BS-410/BS-410E/BS-410S/BS-430/ BS-450/BS-460/BS-470/BS-470E

Chemistry Analyzer

Service Manual

For this Service Manual, the issued date is 2023-01.

Intellectual Property Statement

Responsibility on the Manufacturer Party

Contents of this manual are subject to changes without prior notice.
All information contained in this manual is believed to be correct. Mindray shall not be liable for errors contained herein nor for incidental or consequential damages in connection with the furnishing, performance, or use of this manual.
Mindray is responsible for safety, reliability and performance of this product only in the condition that:

- all installation operations, expansions, changes, modifications and repairs of this product are conducted by Mindray authorized personnel;
- the electrical installation of the relevant room complies with the applicable national and local requirements;
- the product is used in accordance with the instructions for use.

Upon request, Mindray may provide, with compensation, necessary circuit diagrams, calibration illustration list and other information to help qualified technician to maintain and repair some parts, which Mindray may define as user serviceable.

NOTE

- **This equipment is to be operated only by medical professionals trained and authorized by Mindray or Mindray-authorized distributors.**

⚠ WARNING

- **It is important for the hospital or organization that employs this equipment to carry out a reasonable service/maintenance plan. Neglect of this may result in machine breakdown or injury of human health.**

Warranty

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

Exemptions

Mindray's obligation or liability under this warranty does not include any transportation or other charges or liability for direct, indirect or consequential damages or delay resulting from the improper use or application of the product or the use of parts or accessories not approved by Mindray or repairs by people other than Mindray authorized personnel.

This warranty shall not extend to:

- any Mindray product which has been subjected to misuse, negligence or accident;
- any Mindray product from which Mindray's original serial number tag or product identification markings have been altered or removed;
- any product of any other manufacturer.

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Preface

This manual contains the instructions necessary to operate the product safely and in accordance with its function and intended use. Please read this manual thoroughly before using the product. Observance of this manual is a prerequisite for proper performance and correct operation, and it ensures patient and operator safety. All graphics including screens and printouts in this manual are for illustration purpose only and must not be used for any other purposes. The screens and printouts on the actual product should prevail.

Product introduction

This equipment is a computer-controlled fully-automated chemistry analyzer, intended for quantitative determination of clinical chemistries in serum, plasma, urine, cerebrospinal fluid (CSF), and other human body fluids. It can fulfill auto dispensing, reaction, colorimetric measurement, process monitoring, and result calculation. It provides measurement of multiple biochemistries and ISE (ion-selective electrode) tests (Na+, K+ and Cl-), with maximum throughput up to 620 tests per hour. It is one of the necessary tools for laboratory automation.

Conventions

Graphical symbols, formats and abbreviations are used to get better visual effects and readability. To help you understand this manual correctly, this section provides statements of pictures, terms and applicable models used in this manual.

Symbols and formats

The following symbols and formats are used:

Symbol and format	Meaning
	A safety symbol, for alerting you to warnings about safety and system operations. Alerts you to biohazards.
•	Item list.
🕮	Reference content or cross reference.
Bold	Headings or important information.
Italic	Key points.
➢	Start of operating procedure.

Picture

All pictures in this manual are for illustration purpose only and must not be used for any other purposes. The pictures of the actual product should prevail.

Safety Information

This chapter provides you with safety symbols used in this manual and their meanings, summarizes the safety hazards and operating precautions that should be considered seriously when the instrument is being operated, and lists the labels and silkscreen that has been applied to the instrument and their indications.

Safety Symbols

Safety symbols are used in this manual in order to remind you of the instructions necessary to operate the product safely and in accordance with its function and intended use. A safety symbol and text constitutes a notice as shown in the table below:

Symbol	Text	Description
⚠ WARNING	WARNING	Read the statement following the symbol. The statement is alerting you to an operating hazard that can cause personal injury.
	BIOHAZARD	Read the statement following the symbol. The statement is alerting you to a potentially biohazardous condition.
⚠ CAUTION	CAUTION	Read the statement following the symbol. The statement is alerting you to a possibility of system damage or unreliable results.
NOTE	NOTE	Read the statement following the symbol. The statement is alerting you to information that requires your attention.

Summary of Hazards

This section lists hazards of the instrument itself. The hazards of specific operation are included in the warning information of each operation task.

Introduction

Observe the following safety precautions when using the product. Ignoring any of these safety precautions may lead to personal injury or equipment damage.

⚠ WARNING

- **If the product is used in a manner not specified by our company, the protection provided by the product may be impaired.**

Electric Shock Hazards

Observe the following instructions to prevent electric shock.

⚠ WARNING

- **When the MAIN POWER is turned on, users other than the servicing personnel authorized by our company must not open the rear cover or side cover.**
- **Spillage of reagent or sample on the product may cause equipment failure and even electric shock. Do not place sample and reagent on the product. In case of spillage, switch off the power immediately, remove the spillage and contact our Customer Service Department or your local distributor.**

Moving Parts Hazards

Observe the following instructions to prevent personal injury caused by moving parts.

⚠ WARNING

- **Do not touch such moving parts as sample probe, reagent probe, mixers , cuvette wash station, sample carousel, reagent carousel and reaction carousel, when the system is in operation.**
- **Do not put your fingers or hands into any open part when the system is in operation.**

Photometer Lamp Hazards

Observe the following instructions to prevent personal injury caused by photometer lamp.

⚠ WARNING

- **Eye injury could occur from light emission from the photometer lamp. Do not stare into the lamp when the system is in operation.**
- **If you want to replace the photometer lamp, first switch off the MAIN POWER and then wait at least 15 minutes for the lamp to cool down before touching it. Do not touch the lamp before it cools down, or you may get burned.**

Laser Beam Hazards

Observe the following instructions to prevent personal injury caused by laser beam.

⚠ WARNING

- **Light emitted by the bar code reader may cause eye injury. Do not stare into the laser beam radiated from the bar code reader when the system is in operation.**

Sample, Calibrator and Control Hazards

Observe the following instructions to protect against the biohazardous infection by samples, calibrators and control samples.

BIOHAZARD

- **Inappropriately handling samples, controls and calibrators may lead to biohazardous infection. Do not touch samples, mixtures or waste with your bare hands. Wear gloves and lab coat and, if necessary, goggles.**
- **In case your skin contacts the sample, control or calibrator, follow the standard laboratory safety procedure and consult a doctor.**

Reagent and Wash Solution Hazards

Observe the following instructions to protect against the biohazardous infection by reagents and wash solution.

⚠ WARNING

- **Reagents and concentrated wash solution are corrosive to human skins. Exercise caution when using reagents and concentrated wash solution. In case your skin or clothes contact them, wash them off with soap and clean water. If reagents or wash solution spills into your eyes, rinse them with much water and consult an oculist.**

Waste Hazards

Observe the following instructions to prevent environmental pollution and personal injury caused by waste.

BIOHAZARD

- **Some substances contained in reagent, control, concentrated wash solution and waste are subject to regulations of contamination and disposal. Dispose of the waste in accordance with your local or national rule for biohazard waste disposal and consult the manufacturer or distributor of the reagents for details.**
- **Wear gloves and lab coat and, if necessary, goggles.**

System Disposal Hazards

Observe the following instructions to dispose of the waste analyzer.

⚠ WARNING

- **Materials of the analyzer are subject to contamination regulations. Dispose of the waste analyzer in accordance with your local or national rule for waste disposal.**

Fire and Explosion Hazards

Observe the following instructions to prevent fire and explosion.

⚠ WARNING

- **Ethanol is flammable substance. Please exercise caution while using ethanol around the instrument in order to prevent fire and explosion.**

Removal of Analyzer from Use for Repair or Disposal

To minimize or eliminate the hazards involved in repair, transportation, disposal process, please observe the following instruction.

⚠ WARNING

- **When the analyzer is not in use, for example, in repair, transportation or disposal process, please clean and sterilize the parts that may cause biohazdards(sample probe, reagent probe and mixers, etc.) and remind the person who handles the device of the related hazards.**

Cleaning and Decontamination

⚠ CAUTION

- **Appropriate decontamination should be carried out in accordance with laboratory safety regulations if reagent, sample or other liquids are spilled onto the equipment. In case of large-amount liquid ingression, please contact our customer service department or the local distributor.**
- **No decontamination or cleaning agents can be used which could cause a HAZARD as a result of a reaction with parts of the equipment or with material contained in it. Strong acid or alkaline solutions are forbidden to clean the equipment.**
- **If there is any doubt about the compatibility of the decontamination or cleaning agents with parts of the equipment or with material contained in it, please contact our customer service department or the local distributor.**

Precautions on Use

This section lists precautions to be understood during instrument operation. The precautions of specific operation are included in the warning information of each operation task.

Introduction

To use the product safely and efficiently, pay attention to the following operating precautions.

Intended Use

⚠ WARNING

- **The instrument is an automated chemistry analyzer for in vitro diagnostic use in clinical laboratories and designed for in vitro quantitative determination of clinical chemistries in serum, plasma, urine and cerebrospinal fluid samples. Please consult us before you use the instrument for other purposes.**
- **When drawing a clinical conclusion, please also refer to patients' clinical symptoms and other test results.**

Environment Precautions

⚠ CAUTION

- **Evaluate the electromagnetic environment prior to operating the system.**
- **Please install and operate the system in an environment specified by this manual. Installing and operating the system in other environment may lead to unreliable results and even equipment damage.**
- **To relocate the system, please contact our Customer Service Department or your local distributor.**

Installation Precautions

⚠ WARNING

- **The product is switched on and off via a switch or breaker. Before installing the system, ensure that the building in which the system will be located has been equipped with a switch or breaker that complies with IEC 61010-1:2001, is in close proximity to the equipment and within easy reach of you, and is marked as the disconnecting device for the equipment.**

Electromagnetic Noise Precautions

⚠ WARNING

- **The IVD MEDICAL EQUIPMENT complies with the emission and immunity requirements described in this part of IEC 61326.**

- **This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.**
- **This equipment is designed for use in a PROFESSIONAL HEALTHCARE FACILITY ENVIRONMENT. It is likely to perform incorrectly if used in a HOME HEALTHCARE ENVIRONMENT. If it is suspected that performance is affected by electromagnetic interference, correct operation may be restored by increasing the distance between the equipment and the source of the interference.**
- **The electromagnetic environment should be evaluated prior to operation of the device.**
- **Do not use this device in proximity to sources of strong electromagnetic radiation (e.g. unshielded intentional RF sources), as these can interfere with proper operation.**

NOTE

- **It is the manufacturer's responsibility to provide equipment electromagnetic compatibility information to the customer or user.**
- **It is the user's responsibility to ensure that a compatible electromagnetic environment for the equipment can be maintained in order that the device will perform as intended.**
- **The calculation formula to determine the separation distance between an IVD MEDICAL EQUIPMENT and a mobile phone is given by $d = 6/E \cdot \sqrt{P}$, where d is the minimum separation distance in metres, P is the maximum power in watts, and E is the immunity test level in V/m.**

Operating Precautions

⚠ CAUTION

- **Take the clinical symptoms or other test results of the patient into considerations when making a diagnosis based on the measuring results produced by the system.**
- **Operate the system strictly as instructed by this manual. Inappropriate use of the system may lead to unreliable test results or even equipment damage or personal injury.**
- **When using the system for the first time, first run calibrations, and then QC tests to make sure the system is in proper state.**
- **Be sure to run QC tests every time when you use the system, otherwise the result may be unreliable.**
- **Do not uncover the reagent carousel when the system is in operation. Keep the reagent carousel cover closed.**
- **The RS-232 port on the analyzing unit is used for connection with the operation unit only. Do not use it for other connections. Use the cables provided by our company or your local distributor for the connection.**
- **The operation unit is a personal computer with the operating software installed. Installing other software or hardware on the computer may interfere with the system operation. Do not run other software when the system is working.**
- **Computer virus may destroy the operating software or test data. Do not use the computer for other purposes or connect it to the Internet. If the computer is infected by virus, please install anti-virus software to check for and clear virus.**
- **Do not touch the display, mouse or keyboard with wet hands or hands with chemicals.**
- **Do not place the MAIN POWER to ON again within 10 seconds since placing it to OFF; otherwise the system may enter the protection status. If it does so, place the MAIN POWER to OFF and place it to ON again.**

Maintenance and Servicing Precautions

⚠ CAUTION

- **Maintain the system strictly as instructed by this manual. Inappropriate maintenance may lead to unreliable results, equipment damage or personal injury.**

- To wipe off dust from the system surface, use a soft, clean and moistened cloth soaked with soap water rather than organic solvents such as ethanol. After cleaning, wipe the surface dry with dry cloth.
- Shut down and turn off analyzer and disconnect the power plug before cleaning. Take necessary measures to prevent water ingression, otherwise equipment damage or personal injury may be caused.
- Replacement of major parts as photometer lamp, sample probe, reagent probe, mixers and syringe plunger assembly must be followed by re-calibration.
- Replacement of the photometer lamp should be done when the system power has been switched off for at least 15 minutes.
- If the system is failed and needs servicing, contact our Customer Service Department or your local distributor. The system may need to be stopped or transported during servicing, which will probably cause biohazards, electric shock hazards and moving part hazards. Exercise caution when prepare the system for servicing.

NOTE

- Check the safe state of the equipment after repair. Make sure the equipment is safe and then offer it to the customer.

Chemistry Parameter Configuration Precautions

⚠ CAUTION

- To define such parameters as sample volume, reagent volume and wavelength, follow the instructions in this manual and the instructions of reagents.

ISE Module Precautions

⚠ CAUTION

- To prevent ISE electrodes from being damaged due to water scarcity, if the system, when equipped with an ISE module, will be powered off for a long time, perform the electrode storage maintenance.

Sample Precautions

⚠ CAUTION

- Use samples that are completely free of insoluble substances like fibrin or suspended matter; otherwise the sample probe may be clogged.
- Medicines, anticoagulants or preservative in the samples may lead to unreliable results.
- Hemolysis, icterus or lipemia in the samples may lead to unreliable test results; running a sample blank, therefore, is recommended.
- Store the samples properly. Improper storage may change the compositions of samples and lead to unreliable results.
- Sample volatilization may lead to unreliable results. Do not leave the sample open for a long period.
- The system has a specific requirement on the sample volume. Refer to this manual for proper sample volume.
- Load samples to correct positions on the sample carousel before the analysis begins; otherwise reliable results may not be obtained.
- During ISE urine analysis, centrifuge the sample to remove interference from the formed substances, and then dilute the sample as required.

Reagent, Calibrator and Control Precautions

⚠ CAUTION

- **Use proper reagents, calibrators and controls on the system.**
- **Select appropriate reagents according to the performance characteristics of the system. Consult the reagent suppliers, our company or our authorized distributor for details, if you are not sure about your reagent choice.**
- **Store and use the reagents, calibrators and controls strictly as instructed by the suppliers; otherwise, reliable results or best performance of the system may not be obtained. Improper storage of reagents, calibrators and controls may lead to unreliable results and bad performance of the system even in validity period.**
- **Perform calibration after changing the reagents, otherwise reliable results may not be obtained.**
- **Contamination caused by carryover among reagents may lead to unreliable test results. Consult the reagent suppliers for details.**

ISE calibration precautions

BIOHAZARD

- **The calibrators contain preservatives. In case your skin contacts calibrators, wash them off with soap and water. In case the calibrators spill into your eyes, rinse them with water and consult an oculist. If you swallow them by mistake, see a doctor.**

⚠ CAUTION

- **Use the calibrators specified by our company. Use of other reagents or calibrators may result in unreliable results, or damage the Hydropneumatic system, or even shorten the electrodes life span.**
- **Prior to using the calibrators, check if they are within the expiration date.**
- **Place them correctly; otherwise, it may cause unreliable results, or leak, or module damage.**

ISE wash solution biohazards

BIOHAZARD

- **The ISE wash solution is sodium hypochlorite. Use the ISE wash solution carefully to prevent it from contacting your skins or eyes. If your skins or eyes contact the ISE wash solution, rinse them off with fresh water and consult a doctor.**

Data Archiving Precautions

NOTE

- **The system automatically stores the data to the built-in hard disk. Data loss, however, is still possible due to mis-deletion or physical damage of the hard disk. You are recommended to regularly archive the data to such medium as CDs.**
- **To avoid the data loss caused by unexpected power failure, UPS (uninterrupted power supply) is recommended.**

External Equipment Precautions

⚠ WARNING

- **For operating instructions and precautions of the computer and printer, please refer to their**

operation manuals.

- External equipment connected to the analogue and digital interfaces must be authorized and complied with relevant safety and EMC standards (e.g., IEC 60950 Safety of Information Technology Equipment Standard and CISPR 22 EMC of Information Technology Equipment Standard (CLASS B)). Any person, who connects additional equipment to the signal input or output ports and configures an IVD system, is responsible for ensuring that the system works normally and complies with the safety and EMC requirements. If you have any questions, consult the technical services department of your local representative.

External Vacuum Pump Precautions

⚠ WARNING

- Make sure the vacuum pump tubing is connected properly without any twists or sharp angles so that it can work normally.
- Tubing and cables connected to the vacuum pump must be protected to prevent damage and breaks due to human or other causes.
- Set the vacuum pump on a solid flat platform or ground.

Tube and Liquid Container Precautions

⚠ WARNING

- When the tube or the part that contain liquid become aged or damaged, please stop its use immediately and contact our customer service department or your local distributor to check and replace it.

Cleaning and Decontamination

⚠ CAUTION

- Appropriate decontamination should be carried out in accordance with laboratory safety regulations if reagent, sample or other liquids are spilled onto the equipment. In case of large-amount liquid ingression, please contact our customer service department or the local distributor.
- No decontamination or cleaning agents can be used which could cause a HAZARD as a result of a reaction with parts of the equipment or with material contained in it. Strong acid or alkaline solutions are forbidden to clean the equipment.
- If there is any doubt about the compatibility of the decontamination or cleaning agents with parts of the equipment or with material contained in it, please contact our customer service department or the local distributor.

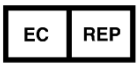
Labels and Silkscreen

Introduction

The following non-warning and warning labels and silkscreen are used on the product for system identification and operating instruction.

For the label marked with  , please consult the related documentations in order to find out the nature of the potential HAZARDS and any actions which have to be taken to avoid them.
Check the labels regularly for cleanliness and integrity. If any of the labels becomes vague or peels off, contact our Customer Service Department or your local distributor for replacement

Labels and Silkscreen

Symbol	Meaning
	Serial Number
	Date of Manufacture
	Manufacturer
	CE marking. The device is fully in conformance with the Council Directive Concerning In Vitro Diagnostic Medical Devices 98/79/EC.
	Authorized Representative in the European Community
	The following definition of the WEEE label applies to EU member states only: The use of this symbol indicates that this product should not be treated as household waste. By ensuring that this product is disposed of correctly, you will help prevent bringing potential negative consequences to the environment and human health. For more detailed information with regard to returning and recycling this product, please consult the distributor from whom you purchased the product.
	In Vitro diagnostic medical device
	Biological risks
	Caution
	Caution: hot surface
	Caution: Laser radiation
	“ON” (Power)
	“OFF” (Power)
	“ON” for a part of equipment
	“OFF” for a part of equipment

Symbol	Meaning
	Serial interface
	Computer Network
	Protective conductor terminal

Warning Labels

Biohazard warning

This label indicating the risk of biohazardous infection is located in the following positions:

- Sample probe
- Waste outlet
- Waste tank

Moving parts warning

This symbol and text indicating the hazardous moving parts is located in the following positions:

- Reagent probe and sample probe;
- Mixers
- Wash station

Laser warning

This symbol and text located near the sample bar code reader and the reagent bar code reader reminds you of not staring into the laser beam.

Photometer lamp warning

This symbol and text located on the lamp housing reminds you of not touching the lamp before it gets cool.

Probe collision warning

This symbol and text located near the sample carousel, reagent carousel and reaction carousel reminds you of not opening the cover to prevent from damaging the probes.

Upper cover

This symbol and text located on the transparent upper cover reminds you of not wipe the upper cover with ethanol or other organic solutions.

ISE module

This symbol and text located in the side cover of the ISE module. Please turn off the main power before opening the side door.

Risk of Electrical Shock

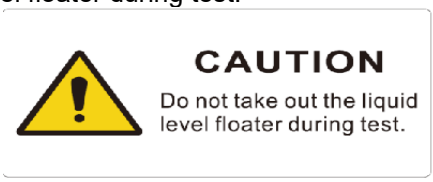
This symbol and text located on the power supply shield, reminds you of not touching or removing the power supply shield while the power is on.

Risk of Chemical Hazards

This symbol and text is located on the diluted wash solution tank. Take cautions to avoid the chemical hazards of the wash solution.

Liquid level floater

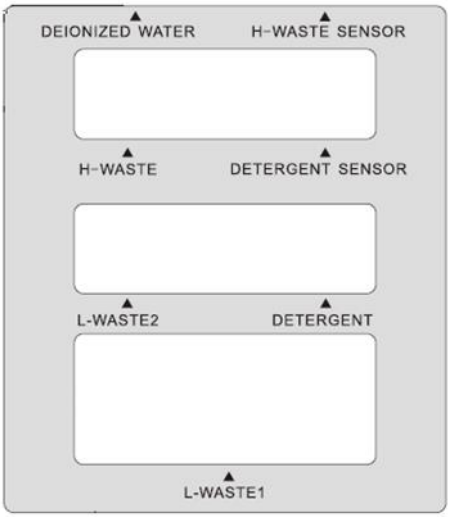
This symbol and text is located near the liquid level floater of the DI water tank and the wash solution tank, Please do not take out the liquid level floater during test.



Non-Warning Labels and Silkscreen

Interfaces for fluid connection

This symbol located on the right panel of the analyzer indicates the connection of fluid tubing.



ISE Reagent Pack

This symbol located below the ISE reagent compartment of the analyzer indicates that the electrodes have been installed before loading the ISE Reagent Pack.

Service User's Permission:

- Engineer username: serviceuser Password: #BS8A#SEU

Note: When logging in as a service user in a client, remember to bring it back to a department user account before log-off

Revision history:

Chapter	History	Version
Preface	1. Added revision history 2. Added description about user permission	V1.0
Chapter 1	1. Rearranged	V1.0
Chapter 2	1. Rearranged 2. Changed FRU	V1.0
Chapter 3	1. Rearranged 2. Changed FRU	V1.0
Chapter 4	1. Rearranged 2. Changed FRU 3. Changed PCB picture 4. Deleted description about replacement of front panel 5. Changed wrong description in 4.5 Power System 6.Changed wiring diagram	V1.0
Chapter 5	1. Rearranged	V1.0
Chapter 6	1. Rearranged 2. Added 6.1.5 3. Added additional information to 6.1.7 4. Added additional information to 6.1.8	V1.0
Chapter 7	1. Rearranged 2. Changed some pictures	V1.0
Chapter 8	1. Rearranged 2. Edited 8.1 3. Edited 8.2 4. Added 8.3	V1.0
Chapter 9	1. Rearranged 2. Changed description about replacement of self-wash connection pipe	V1.0
Chapter 10	1. Added the Troubleshooting chapter 2. Updated fault information table	V1.0
Chapter 11	1. Added the Assembly Exploded View	V1.0
Chapter 12	1. Added the LIS Connection Setting and Troubleshooting chapter	V1.0
Chapter 13	1. Added the Emptying and Relocation chapter	V1.0
Chapter 14	1. Added the Optional Modules chapter	V1.0
Appendices	1. Added the installation acceptance report 2. Added applied training acceptance report 3. Added fault feedback table 4. Added fluidic tube diagram 5. Added hardware connection diagram 6. Added tool list 7. Added active maintenance report	V1.0

Table of Contents

1 System Description

This chapter introduces the instrument in detail from the system architecture and specifications. It mainly includes the following contents:

- System structure
- System specifications

This service manual is for the BS-410/BS-410E/BS-410S/BS-430/BS-450/BS-460/BS-470/BS-470E automatic biochemical analyzer.

1.1 Overview

The BS-410/BS-410E/BS-410S/BS-430/BS-450/BS-460/BS-470/BS-470E is a fully automated and computer-controlled chemistry analyzer designed for the in vitro determination of clinical chemistries in serum, plasma, urine and cerebrospinal fluid (CSF) samples. BS-410/BS-410E/BS-410S/BS-430/BS-450/BS-460/BS-470/BS-470E consists of the analyzing unit and operation unit.

Figure 1-1 BS-410/BS-410E/BS-410S/BS-430/BS-450/BS-460/BS-470/BS-470E chemistry analyzer

- Throughput of biochemistry: 420 tests/hour.
- Throughput of the ISE module:
  312±12 (Max.) tests/hour (Na+, K+, Cl-) for serum and plasma.
  177±6 tests/hour (Na+, K+, Cl-) for urine if Medica ISE module is selected.
  156±6 tests/hour (Na+, K+, Cl-) for urine if Caretium ISE module is selected.
- Maximum throughput with ISE included: 626 tests/hour.

1.2 Components of Analyzing Unit

The fully automated Chemistry Analyzer consists of the analyzing unit (analyzer), operation unit (computer), and output unit (printer).

The **analyzing unit** performs all operations of sample analysis including dispensing sample and reagent, mixing, reaction and measurement, auto washing of cuvettes, ISE analysis, etc.

The **operation unit** is a computer installed with the operating software, which controls operation of the analyzer and processes the test data.

The **printer** is used to print test results.

The operation unit and the analyzing unit are independent structurally and communicate with each other through the serial port. The operation unit sends data and instructions to the analyzing unit and acquires test data and status information from the analyzing unit.

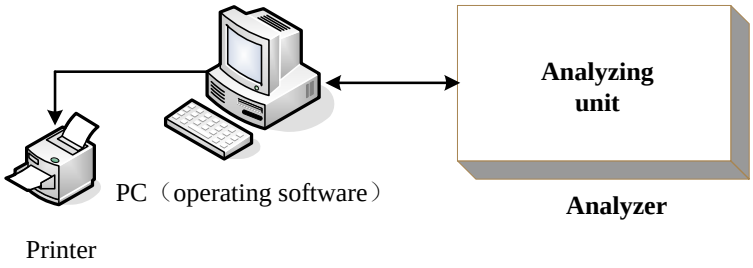
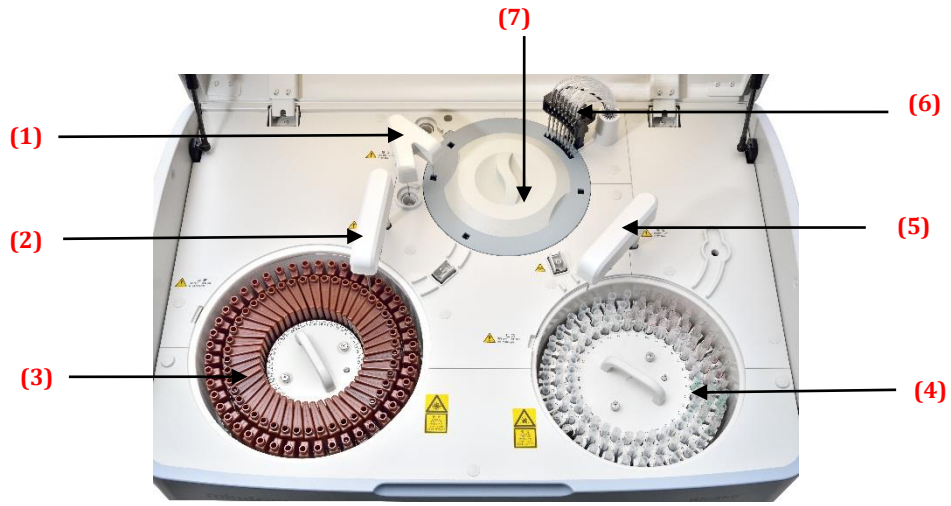


Figure 1-2 System structure

The fully automated chemistry analyzer has a throughput of 420 tests per hour for single- or double- reagent analysis, and its maximum throughput is 626 tests per hour with ISE module. The working period is 8.55seconds.

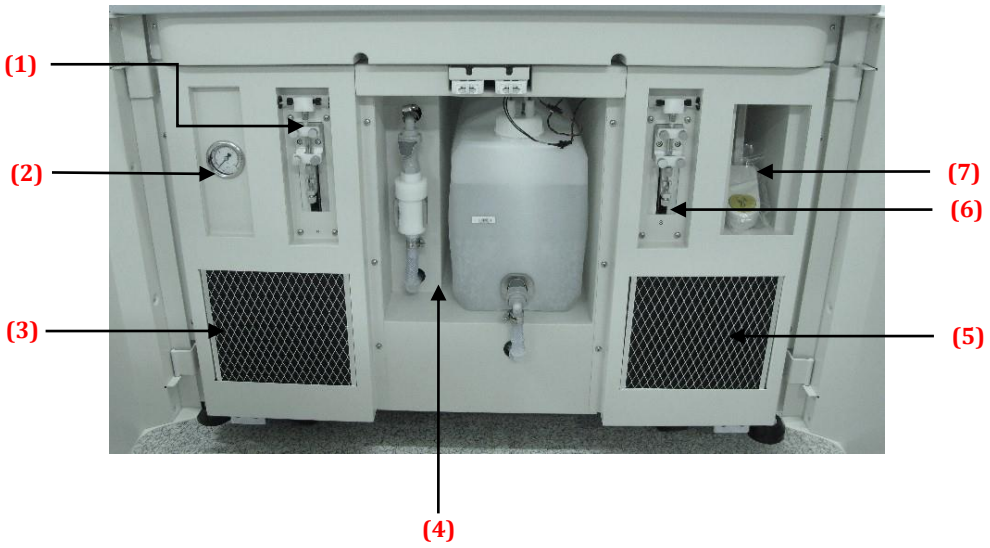
The instrument is composed of the following components: one reaction carousel, one sample carousel, one reagent carousel, two reagent probes, one sample probe, two mixers, one automatic cuvette wash station, one photometric system, one ISE module (optional).

The photometric system, which is composed of gratings and diode array, performs photometric measurement to the reaction cuvettes that hold sample+reagent mixture. After testing, the automatic cuvette wash station performs 8-phase auto wash to the reaction cuvettes.



(1) Mixer assembly
(2) Reagent probe
(3) Reagent carousel
(4) Sample carousel
(5) Sample probe
(6) Cuvette wash unit
(7) Reaction carousel

Figure 1-3 Layout of analyzer's operation panel



(1) Reagent syringe
(2). Pressure gauge
(3) Left dust screen
(4) Deionized water tank
(5) Right dust screen
(6) Sample syringe
(7) ISE reagent pack grid

Figure 1-4 Front cabinet of the analyzer (configured with Medica ISE module, before EIB009)

(1) ISE Reagent Pack (2) ISE Reagent Pack on/off indicator

Figure 1-5 Front cabinet of the analyzer (configured with Caretium ISE module, after EIB009)

1.3 Functions of Analyzing Unit

The working procedure of the system is described as follows:

1) The system resets to initialize all mechanical units and wash the exterior and interior of the sample probe, reagent probe and mixer.
2) Reaction cuvettes are washed through 8 phases, and run water blank test after phase 6.
3) The reagent carousel rotates to the specified position, from which the reagent probe aspirates R1.
4) The reaction cuvettes are carried to the reagent dispense position after the 8-phase washing. And the probe R1 rotates to a cuvette to dispense reagent into it after aspirating R1.
5) R1 is incubated for 10 periods in the cuvette.
6) The sample carousel rotates to the specified position, and the sample probe lowers down to aspirate specified amount of sample.
7) The reaction cuvette with R1 added is carried to the sample dispense position, to which the sample probe rotates to dispense sample after aspirating from the sample carousel.
8) The reaction cuvette with sample added is carried to the sample mixing position for stirring.
9) For double-reagent tests, the reagent carousel rotates to the specified position after a fixed period, and the reagent probe lowers down to aspirate R2.
10) The reaction cuvettes are carried to the reagent dispense position, And the reagent probe with R2 added rotates to the reaction carousel and dispenses R2 into the reaction cuvette.
11) With R2 added, the reaction cuvette rotates to the reagent mixing position for stirring.
12) During each period, the reaction cuvette receives photometric measurement (absorbance reading taking) when passing by the photometric unit;
13) Triple-/quadruple-reagent measurement is similar to single-/double-reagent measurement stated above. (As for triple-/quadruple-reagent tests, the reaction cuvette with R2 dispensed will not be washed when passing by the wash station.)
14) The reaction cuvettes in which reaction is finished will be washed automatically when they pass by the cuvette wash station.

Table 1-1 Main functions of each unit

Unit Name	Descriptions
Sample probe unit	Performs aspiration and dispensing for all biochemistry tests and ISE tests.
Sample carousel unit	Provides 102 positions to hold samples. The outer and middle rings support barcode scanning.
Reagent probe unit	Perform aspiration and dispensing of R1, R2, R3 and R4 for all biochemistry tests.
Reagent carousel unit	92 positions are available for the reagents. All positions support scanning by a built-in reagent bar code reader. The outer ring supports 20ml reagent bottles. The inner ring supports 40ml and 20ml reagent bottles. Reagents can be placed in any positions of the reagent carousel. The reagent carousel provides a refrigerating environment which is constant within 2°C-8°C for 24 hours a day.
Reaction carousel unit	93 positions are available for plastic cuvettes.
Mixer unit	Two mixer heads, driven by step motors.
Photometric unit	Reversed optics with 12 wavelengths: 340nm, 380nm, 412nm, 450nm, 505nm, 546nm, 570nm, 605nm, 660nm, 700nm, 740nm, and 800nm.
Cuvette wash unit	8-phase automatic washing of reaction cuvettes.
ISE unit (optional)	Provides the function of ISE measurement.

1.4 Requirements of External Devices

1.4.1 Operation Unit

- CPU: 3.1 GHz or above;
- Main board: BIOS, supporting network remote boot;
- Hard disc: 500GB or above;
- Memory: 4G or above;
- Network Card: Kilomega network card two or above;
- USB interface: 2.0, 2 or more;
- CD-ROM drive 1;
- Other: built-in speaker;
- Serial port：RS232 serial port, 2 or more;
- **Operating system:** Win10 Professional 1903 (OS Build:18362.175) **Language: English.**

1.4.2 Display Monitor

With resolution of 1280×1024.

1.4.3 Printer

Inkjet printer, laser printer and stylus printer are supported.

1.4.4 Power Supply Equipment

An online UPS with power output no less than 3000VA should be employed.

1.4.5 Water Supply Equipment

- Water quality: meeting the following requirements: the specific resistance should be less than 1MΩ.cm@25℃ (the specific conductance should not be more than 1μS/cm@25℃).
- Water supply pressure: 95-392kPa. Use a water supply module if the water unit does not meet the requirements of water supply pressure.
- Flow: no less than 38L/H for continuous flow, and 2L/M for transient peak flow.
- Water temperature: 5-32°C.

1.5 Major Specifications

1.5.1 General Specifications

- System

Random selection, multiple channels, multiple chemistries, pausing and adding new tests

- System Structure

Analyzing unit + computer + printer (optional)

- Sample type

Serum, urine, plasma, cerebrospinal fluid, whole blood, ect.

- Maximum concurrent tests

45 double-reagent tests/90 single-reagent tests

- Throughput

420 tests/hour; maximum: 626 tests/hour (with ISE module)

- Analytical method

Endpoint, Kinetic and Fixed-time measurements; supporting single-/double-/triple-/quadruple-reagent tests, and single-/double-wavelength tests

- Reaction time

The longest reaction time is 10 minutes for single-reagent measurement and 5 minutes for double-reagent measurement.

- Reaction temperature

37±0.3°C

- Test type

Clinical biochemistries, Immunoturbidimetry, Therapeutic Drug Monitoring (TDM)

- Predilution

Dilution is conducted in reaction cuvette at the ratio of 3~133.

- Operation mode

System and tests are configured via the operating software; test one by one; panels and calculation tests are allowed.

- Calibration math model

Single-point linear, two-point linear, multi-point linear; Logit-Log 4P; Logit-Log 5P; spline curve, exponential function; polynomial expression; parabola.

- QC

Westgard rules, Cumulative sum check, Twin-plot

- Data processing

Store and output various data and diagrams and calculate among different tests.

- Dimensions

Analyzing unit: l×b×h: 990 mm×710 mm×1135 mm;

- Weight

Analyzing unit: 197.5 kg;

- STAT samples

Emergent samples can be analyzed at any time with highest priority.

- Networking

Allowed to connect with LIS (Laboratory Information Management System).

1.5.2 Sample Specifications

- Sample loading

Samples are loaded via sample carousel.

- Sample tube type

Table 1-2 Sample tube volume and dead volume

Sample Container	Specification	Dead Volume
Sample container	Φ14×25mm, 0.5ml (Beckman microtube)	70μl
Sample container	Φ14×25mm, 2ml (Beckman microtube)	150μl
Sample container	Φ12×37mm, 2ml (Hitachi microtube)	100μl
Primary tube or plastic tube	Φ12×68.5 mm	8mm more over the unacceptable sample level height
Primary tube or plastic tube	Φ12×99 mm	8mm more over the unacceptable sample level height
Primary tube or plastic tube	Φ12.7×75 mm	8mm more over the unacceptable sample level height
Primary tube or plastic tube	Φ12.7×100 mm	8mm more over the unacceptable sample level height
Primary tube or plastic tube	Φ13 X 75 mm	8mm more over the unacceptable sample level height
Primary tube or plastic tube	Φ13 X 95 mm	8mm more over the unacceptable sample level height
Primary tube or plastic tube	Φ13 X 100 mm	8mm more over the unacceptable sample level height

- Least sample volume

Hitachi sample container (Φ12×37mm): sample volume ≥ 150μl;
Beckman microtube (Φ14×25mm, 0.5ml): sample volume ≥ 120μl;
Beckman microtube (Φ14×25mm, 2ml), sample volume ≥ 180μl.
For primary tube or plastic tube, sample should be kept 8mm higher than the unacceptable sample level height.

- Sample carousel

Coaxial sample carousel consists of inner, middle and outer rings. The outer and middle rings support barcode scanning.

- Sample positions on sample carousel

34 sample positions on each ring and 102 positions in total. The inner ring provides the routine, control, STAT and wash solution positions.

- STAT samples

Emergent samples can be analyzed at any time with highest priority.

- Sample volume

1.5μl ~ 45μl, with an increment of 0.1μl
ISE: 70μl for serum and 140μl for urine

- Sample probe

One sample probe is available, featuring level detection, horizontal/vertical obstruction detection, clog detection (optional) and level tracking.

- Sample probe cleaning

Wash the exterior and interior of the probe; carryover contamination rate ≤ 0.05%.

- Sample input mode (bar code)

Name	Value
Symbology	Codabar, ITF, code128, code39, UPC/EAN, Code93
Minimum bar code density	0.19mm~0.5mm
Data bits	3~27
Format and content	User-defined
Maximum width	55mm
Maximum height	10mm
Maximum inclination angle	±5°
Print quality	No less than Class C according to the ANSI MH10.8M Print Quality Specification.
Width and narrowness	2.5:1 to 3.0:1

1.5.3 Reagent Specifications

- Reagent loading

Reagents can be set in both the inner ring and outer ring.

- Reagent bar code

Name	Value
Symbology	Codabar, ITF, code128, code39, UPC/EAN, Code93
Minimum bar code density	0.25mm~0.5mm
Data bits	13~30
Format and content	User defined
Maximum width	55mm
Maximum height	10mm
Maximum inclination angle	±5°
Print quality	Class A (ANSI MH10.8M)
Width and narrowness	2.5:1

- Reagent refrigeration

Refrigeration temperature: 2~8°C

- Reagent addition approach

Reagent addition and check of fluid level and remaining volume are performed precisely by syringe.

- Supported reagent types

R1, R2, R3 and R4

- Reagent volume and Diluent volume

Reagent	Reagent volume	Diluent volume	Combined volume of Reagent and Diluent
Non-Concentrated Reagent			
R1	90μl~200μl, with 0.5μL increment.	Empty	90μl~200μl
R2	10μl~200μl, with 0.5μL increment.	Empty	10μl~200μl
R3	10μl~200μl, with 0.5μL increment.	Empty	10μl~200μl
R4	10μl~200μl, with 0.5μL increment.	Empty	10μl~200μl
Concentrated Reagent			
R1	10μl~190μl, with 0.5μL increment.	10μl~190μl, with 0.5μL increment.	90μl~200μl
R2	10μl~190μl, with 0.5μL increment.	10μl~190μl, with 0.5μL increment.	10μl~200μl

Reagent	Reagent volume	Diluent volume	Combined volume of Reagent and Diluent
R3	10μl~190μl, with 0.5μL increment.	10μl~190μl, with 0.5μL increment.	10μl~200μl
R4	10μl~190μl, with 0.5μL increment.	10μl~190μl, with 0.5μL increment.	10μl~200μl

- Reagent carousel

The reagent carousel is coaxial with the inner and outer rings driven together; all the positions support built-in bar code scanning.

- Number and volume of reagent bottle

The reagent positions support Mindray reagent bottles: 20ml for outer ring; 40ml and 20ml for inner ring.

- Reagent probe

One reagent probe is available, featuring level sense, horizontal/vertical bump detection, empty aspiration detection, and level tracking.

- Reagent probe cleaning

Wash the exterior and interior of the probe;

- Reagent inventory

Maximum remaining volume of reagent bottles

- Outer ring 20ml reagent bottle: 1.5ml
- Inner ring 40ml reagent bottle: 2.5ml
- Inner ring 20ml reagent bottle: 1.5ml

- Prevention of cross contamination

User defined; wash the exterior and interior of the reagent probe intensively.

1.5.4 Reaction Specifications

- Optical pathlength of reaction cuvette

5mm

- Specification and material of reaction cuvette

5mm×4mm×29mm; made of plastic

- Number of reaction cuvettes

93

- Mixing procedure

The mixer unit with two mixer heads is equipped with sample and reagent mixers. It starts to work after the sample, R2, R3 and R4 are respectively added.

- Reactant volume

100~300μl

- Photometric system

Reversed optics of holographic concave flat-field gratings; Photodiode detects each wavelength.

- Range of wavelengths

12 wavelengths: 340nm, 380nm, 412nm, 450nm, 505nm, 546nm, 570nm, 605nm, 660nm, 700nm, 740nm, 800nm.

- Light source

12V/20W tungsten-halogen lamp; optical fiber incidence.

- Gratings type

Reversed optics of holographic concave flat-field gratings

- Wavelength accuracy

±2nm

- Photometric measurement method

Photodiode

- Concurrent wavelengths for each test

One or two wavelengths

- Absorbance range

0-3.5A, optical pathlength conversion: 10mm

- Resolution of photometer

0.0001OD

1.6 Test Procedure

This chapter includes the following contents:

- common procedure
- Startup and Shutdown procedure
- Sleep and Wake up procedure

1.6.1 Typical Test Procedure

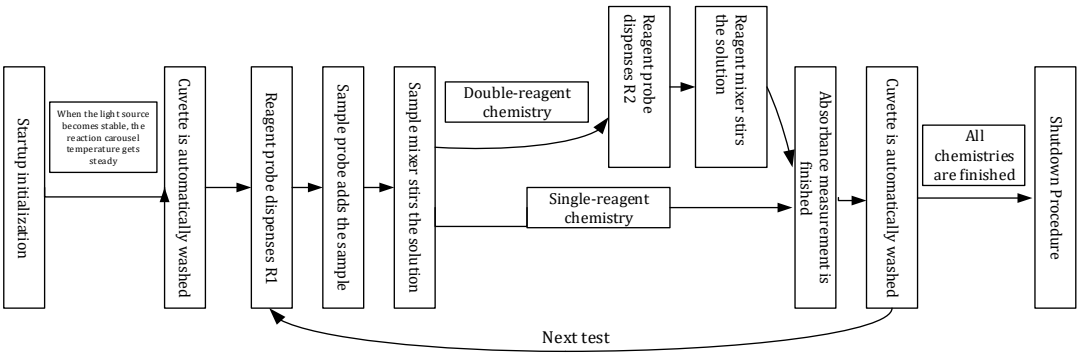
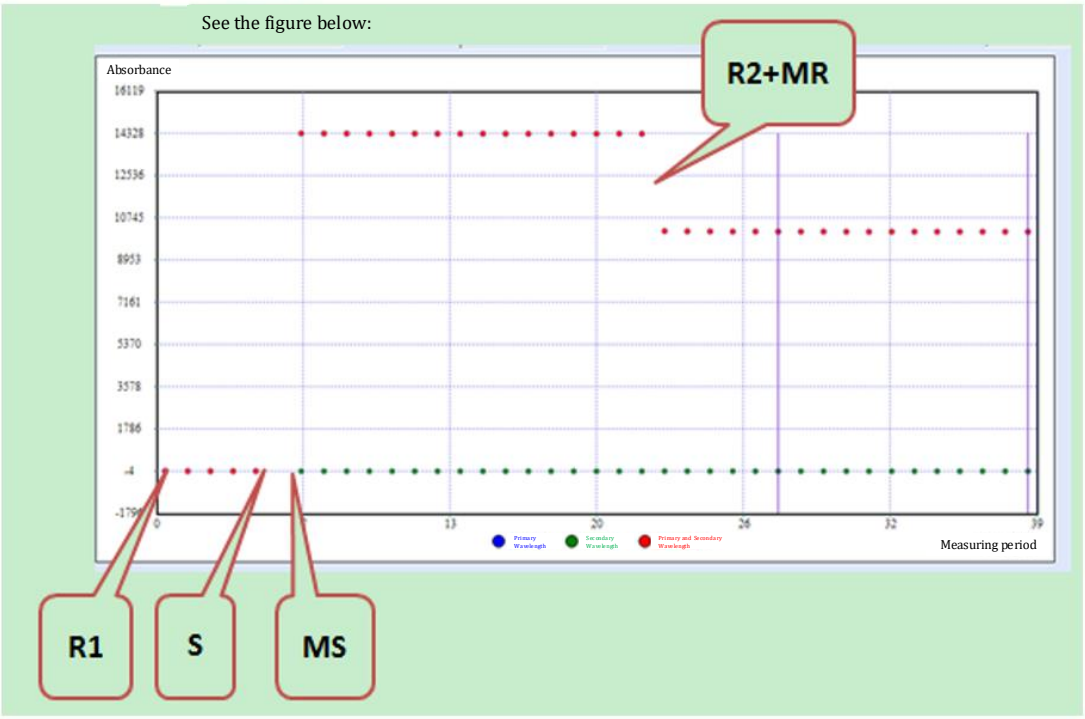


Figure 1-6 Test flowchart

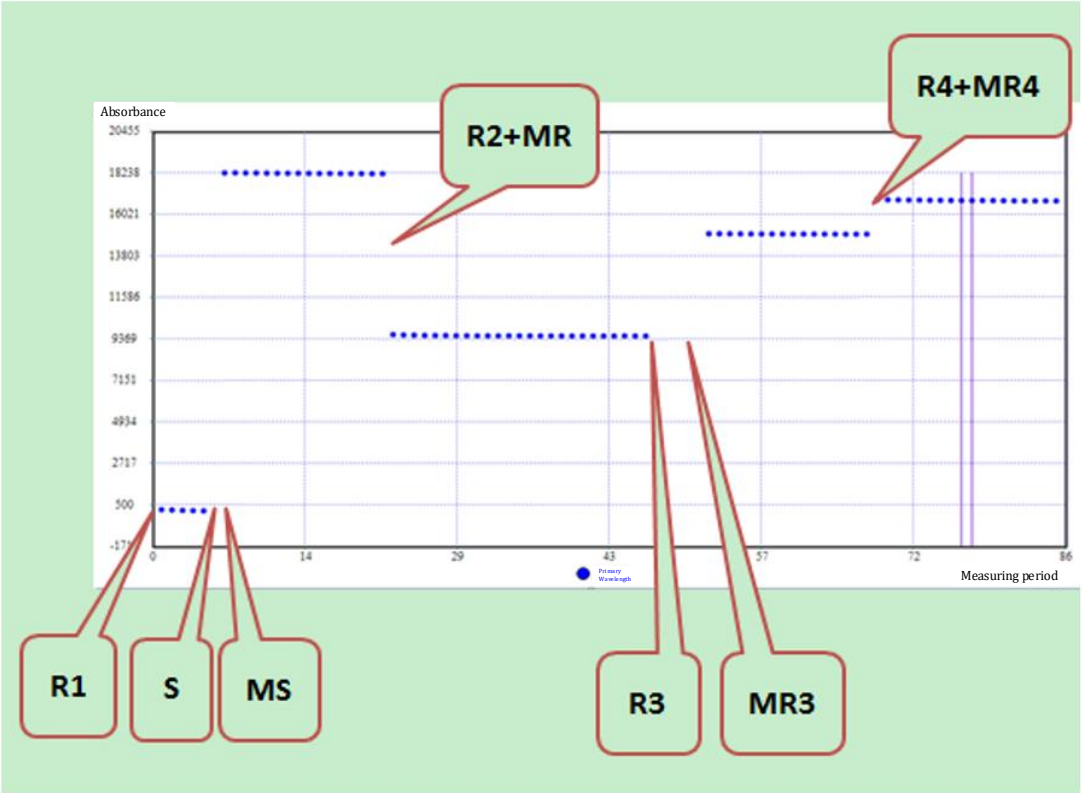
According to the reaction curve of double-reagent, there is a measuring point in every 2 short periods. The first measuring point happens when R1 is dispensed; sample is dispensed after the 5th measuring point and mixed after the 6th one; R1 reacts with sample from the 6th to 22nd measuring point; R2 is dispensed and mixed with R1 after the 22nd measuring point; from the 23rd to 39th measuring point, R1, sample and R2 react with each other.



For the sample that had the diluting test ran, the diluted sample will be aspirated by the sample probe from the corresponding cuvette after 51 periods, and then added to the No. (X+72) cuvette to complete the auto dilution test.

According to the reaction curve of R4, there is a measuring point in every 2 short periods. The first measuring point happens when R1 is dispensed; sample is dispensed after the 5th measuring point and mixed after the 6th one; R1 reacts with sample from the 6th to 22nd measuring point; R2 is dispensed and mixed after the 22nd measuring point; from the 23rd to 47th measuring point, R1, sample and R2 react with each other. R3 is dispensed after the 47th measuring point and mixed after the 52nd one; from the 53rd to 68th measuring point,

R1, sample, R2 and R3 react with each other. R4 is dispensed and mixed after the 68th measuring point; from the 69th to 86th measuring point, R1, sample, R2, R3 and R4 react with each other. See the figure below:



1.6.2 Startup Procedure

1) The analyzer is powered on.
2) The operating software is run and starts checking the running environment.
3) Check the middle-low layer unit's status.
4) The software checks the parameters and status of the analyzer, and inquires the unconfigured and wrong parameters of all units, and checks the status of the fans.
5) The system communicates with the sample bar code reader, if it is configured.
6) The system communicates with the reagent bar code reader, if it is configured.
7) Mechanical reset is performed.
8) The reaction carousel temperature control is turned on.
9) The lamp is turned off and the dark current and maximum luminance value of the reaction carousel lamp are inquired. The lamp is turned on (it takes 5 minutes for the lamp to become steady. When 5 minutes are not reached and the system finishes its home procedure, the system enters incubation status.)
10) The fluidic unit is initialized. Wash solution circulation pump P03 is switched on.
11) The preheating of cuvette wash solution and cleaning water is turned on.
12) The system of the analyzer is reset.
13) The reagent bar code is scanned (when the reagent bar code reader is configured.)
14) ISE module stats its initialization. (performed after the ISE module is configured.)
15) Wash solution circulation pump P03 is switched off.
16) If the conditions for system standby are met, the system enters into Standby status

1.6.3 Shutdown procedure

1) When the system is in Stop, Sleep or Standby status, it can be shut down.
2) The lamp power is turned off.
3) The reaction carousel temperature control and the preheating of cuvette cleaning fluid and wash solution are turned off.
4) The fluidic unit is turned off. The pumps and valves are reset. The DI water pump P03 is switched off.
5) If the analyzer is configured with Medica ISE module, perform ISE MANT for 10 times to discharge the waste in the ISE pipe to the reagent pack. Then, perform PUGA instruction once. (Skip this step if the instrument is stopped, and this step is required only when the Medica ISE module is equipped.) For the analyzer is configured with Caretium ISE module, perform this procedure before powering off the analyzer if the procedure Clean ISE Tubes is not executed.

6) The database is shut down. If the operation fails, the system gives a warning, and continues the shutdown after confirmation.
7) The system exits.

1.6.4 Sleep procedure

1) The lamp is turned off.
2) The bar code reader motors are shutdown if the reagent/sample bar code readers are configured.
3) The hydropneumatic unit is turned off; pumps and valves are reset. The DI water pump P03 is switched off; the waste in the primary vacuum container is discharged.
4) The system enters into Sleep status.

1.6.5 Wake up procedure

1) The lamp is turned on and a 4.5min countdown is started. The following operations continue during the countdown.
2) The bar code reader motors are turned on and laser is turned off, if the reagent/sample bar code readers are configured.
3) The hydropneumatic unit is initialized.
4) The system of the analyzer is reset.
5) Wash solution circulation pump P03 is switched off.
6) The instrument wakes up to enter the Incubation status.
7) If the lamp has been turned on for 4.5 minutes, the system enters the Standby status.

1.6.6 Workflow Descriptions

Sequential actions of sample probe in each period (adding sample for biochemistry test)

Wash ->rotate to sample carousel->lower into sample tube-> aspirate sample -> raise to “home” position vertically -> rotate to reaction carousel -> lower to reaction carousel -> dispense sample -> raise to the specified height for washing -> rotate to wash well -> go to next period

Sequential actions of sample probe in each period (adding sample for ISE test)

Wash ->rotate to sample carousel->lower into sample tube-> aspirate sample -> raise to “home” position vertically -> Rotate to above the ISE sample injection port -> lower into the ISE sample injection port -> dispense sample -> raise to the specified height for washing -> rotate to wash well -> go to next period

Sequential actions of reagent probe in each period

Rotate to reagent carousel -> lower to reagent bottle -> aspirate R1 -> raise to “home” position vertically -> rotate to reaction carousel -> lower into the reaction carousel -> dispense R1 -> raise to the specified height for washing -> rotate to wash well ->wash -> rotate to reagent carousel -> lower to reagent bottle -> aspirate R2 -> raise to “home” position vertically -> rotate to reaction carousel -> lower into the reaction carousel -> dispense R2 -> raise to the specified height for washing -> rotate to wash well -> wash -> go to the next period

Sequential actions of mixer assembly in each period

Rotate the reagent mixer to the position above the sample carousel -> lower into the reaction carousel -> mix the reagent and wash the reagent mixer -> raise to the position above the reaction carousel -> rotate the sample mixer to the position above the sample carousel -> lower into the reaction carousel -> mix the sample and wash the reagent mixer raise to the position above the reaction carousel -> go to the next period

Sequential actions of reaction carousel

The fully-automated chemistry analyzer provides 93 positions for reaction cuvettes; 8.55 seconds for one cycle; one stop after one rotation. In the first clockwise rotation, 25 positions are rotated. During the first stop, R1 is dispensed and sample and reagent are mixed, and 8-phase wash is performed. In the second rotation, 114 positions are rotated, and photometric collection is finished. During the second stop, R2 and the sample are dispensed and mixed.

1.6.7 Measuring Points

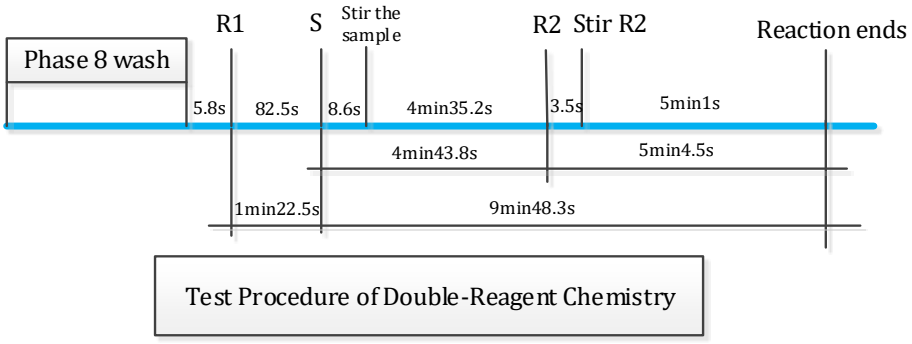


Figure 1-7 Measuring points for single-/double-reagent test

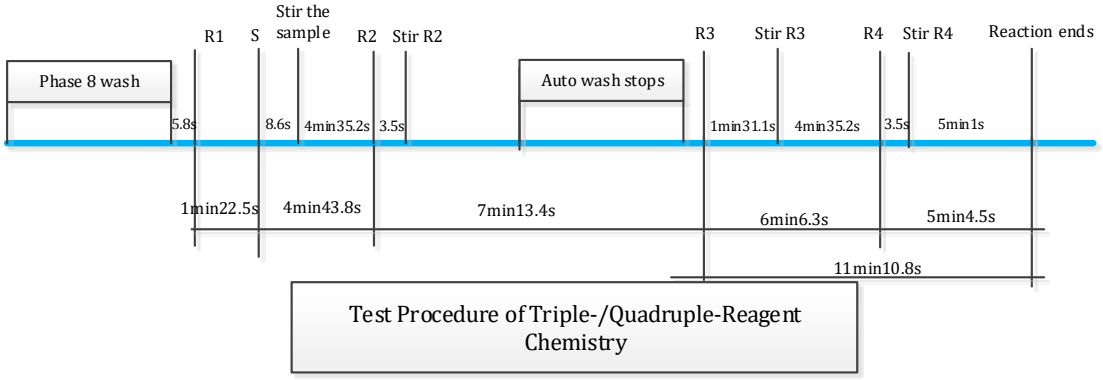


Figure 1-8 Measuring points for triple-/quadruple-reagents test

2 Shells and Frame Assembly

2.1 Shells Assembly

2.1.1 Module Functions

The shells assembly indicates the apparent structures of the whole analyzer and is designed for protecting the internal assemblies. It provides interfaces for each module, and is also a representation of industrial design.

2.1.2 Locations and FRU Details

The shells assembly consists of the shielding cover assembly, panel assembly, left and right plates, doors, rear panel, etc.

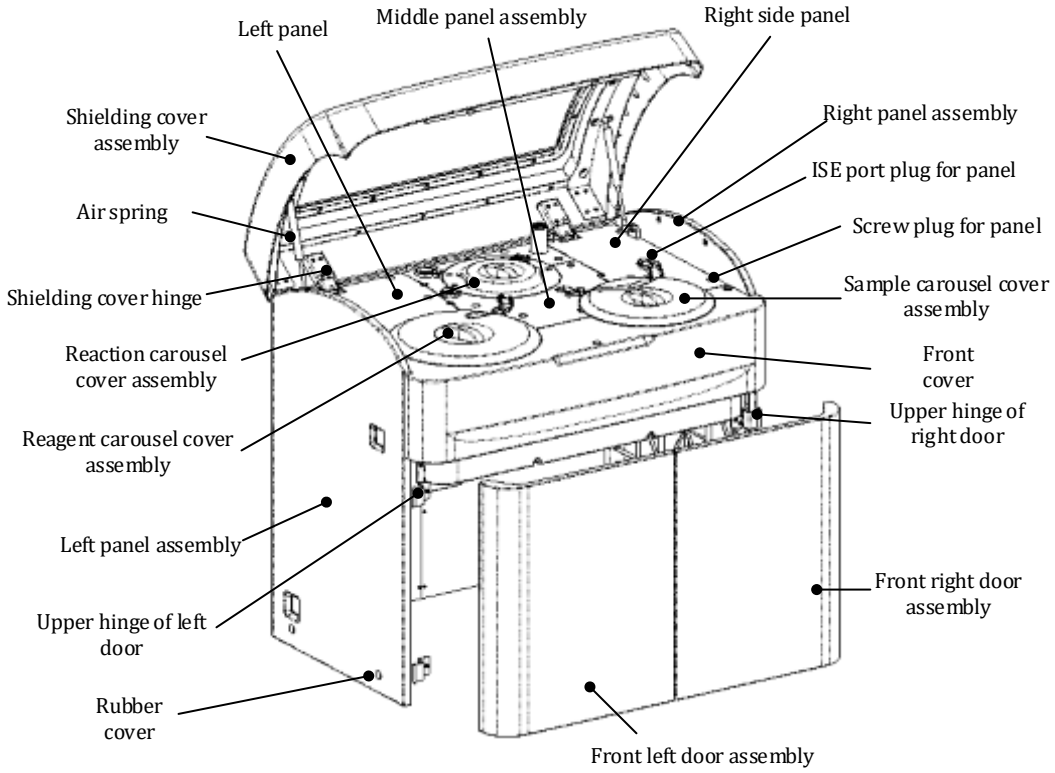


Figure 2-1 Shells assembly-1

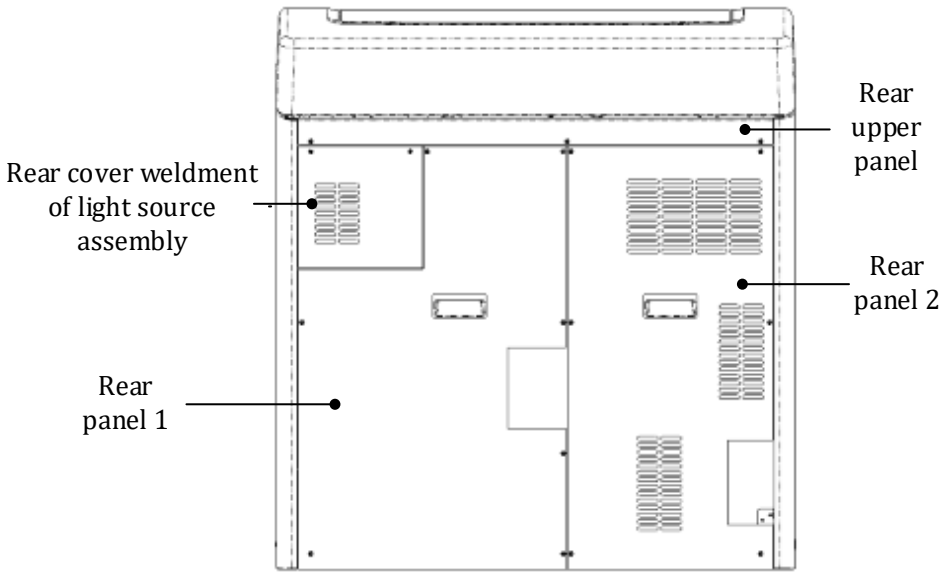


Figure 2-2 Shelled assembly-2

Table 2-1 List of materials

No.	FRU No. or Part No.	Part Name	Remark
1	043-006840-00	Left panel	FRU
2	043-006841-00	Middle panel assembly	FRU
3	043-006842-00	Right side panel	FRU
4	115-037193-00	Left panel assembly	FRU
5	115-037194-00	Right panel assembly	FRU
6	042-017477-00	Rear upper panel	FRU
7	801-BA40-00070-00	Air spring, YQ8/18-90-272 (B-B)-180N	FRU
8	BA38-20-87976	Upper hinge of left door	FRU
9	BA38-20-88237	Upper hinge of right door	FRU
10	BA38-30-88119	Front left door assembly	FRU
11	BA38-30-88120	Front right door assembly	FRU
12	042-017412-00	Rear panel 1	FRU
13	115-022017-00	Rear panel 2	FRU
14	042-004716-00	Light source assembly rear cover weldment	FRU
15	BA40-20-72907	Rubber plug for panel (Mould MR72907)	FRU
16	BA40-20-72908	ISE port plug for panel (Mould MR72908)	FRU
17	BA30-20-06741	Rubber cap (Mould 8692)	FRU
18	BA40-30-61956	Shielding cover hinge	FRU
19	043-007060-00	BS460 front cover	FRU/Optional
20	115-036555-00	Reagent carousel cover assembly (BS-460)	FRU/Optional
21	115-036558-00	Sample carousel cover assembly (BS-460)	FRU/Optional
22	115-036556-00	Reaction carousel cover assembly (BS-460)	FRU/Optional
23	BA38-30-88121	Shielding cover assembly (BS-460)	FRU/Optional
24	043-007089-00	BS430 front cover	FRU/Optional
25	115-036348-00	Reagent carousel cover assembly (BS-430)	FRU/Optional
26	115-036557-00	Sample carousel cover assembly (BS-430)	FRU/Optional
27	115-036349-00	Reaction carousel cover assembly (BS-430)	FRU/Optional
28	115-036553-00	Shielding cover assembly (BS-430)	FRU/Optional
29	043-007061-00	BS450 front cover	FRU/Optional
30	115-036554-00	Shielding cover assembly (BS-450)	FRU/Optional

2.1.3 Removing Shielding Cover Assembly and Replacing The Hinges

When to do

Replace the shielding cover assembly when it is damaged.

Replace the hinges when they are working improperly or cannot work.

Tools

Cross screwdriver and flathead screwdriver

How to do

1) Switch off the main power of the analyzer to ensure all moving assemblies are not in working status.
2) Open the shielding cover, and use a flathead screwdriver to push outwards the cir clip on the air spring head to the degree that it will be dropped.
3) Hold the shielding cover with one hand and remove the air spring with another hand.
4) Use a cross screwdriver to remove the M4×10 powder screws on the hinge of the shielding cover, and

then remove the shielding cover assembly.

5) To replace the hinges, remove the retaining screws after removing the shielding cover assembly, and then replace the hinges.
6) To restore the shielding cover assembly, follow the steps mentioned above in the reversed order.

Alignment and confirmation

After restoring the shielding cover assembly, check the gap with the panels, and if the gap is uneven or the shielding cover interferes with the panels, adjust the hinges.

⚠ WARNING

- **When removing the air spring, hold the shielding cover in case it drops to hurt people and damage the instrument.**

2.1.4 Replacing Air Spring

When to do

Replace the air spring if it loses elasticity or fails.

Tools

Flathead screwdriver

How to do

1) Open the shielding cover, and use a flathead screwdriver to push outwards the cir clip on two ends of the air spring to the degree that it will not be dropped.
2) Hold the shielding cover with one hand and remove the air spring with another hand.
3) Install a new air spring.
4) If the two air springs need replacement, change one first and then change the other.

Alignment and confirmation

No

2.1.5 Removing and Reinstalling Left and Right Panels

When to do

Remove left and right panels if the main unit PCB or the components on two sides of the instrument need maintenance and repairing.

Tools

Cross screwdriver

How to do

1) Remove the rubber caps on the left (right) side panel assembly.
2) Remove the retaining screws on the left (right) side panel assembly.
3) Hold the upper rim of the left (right) side panel assembly and slightly lift the left (right) side panel assembly to remove it.
4) To reinstall the left (right) side panel assembly, follow the steps mentioned above in the reversed order.

Alignment and confirmation

The two screw holes at the bottom of the side plates should be aligned.

2.1.6 Removing and Reinstalling Panels

When to do

Remove panels when they need to be replaced or the parts below them need to be maintained or repaired. (Note: Panels include the left panel, middle panel, and right panel.)

Tools

Cross screwdriver

How to do

1) Remove the right panel assembly.
2) Unscrew the three screws on the rear upper panel and remove the rear upper panel.
3) Remove the rubber plug from the panel.
4) Remove the retaining screws on the panel.
5) Remove the panel carefully and avoid contact with the probe.
6) To reinstall the desk panel, follow the steps mentioned above in a reversed order.

Alignment and confirmation

Do not fasten the screws during panel installation. After the gap is properly adjusted, fasten the screws.

2.1.7 Removing and Reinstalling Front Cover

When to do

Remove the front cover if it is damaged and needs to be replaced, or the components inside the analyzer need maintenance or repairing.

Tools

Cross screwdriver

How to do

1) Remove the rubber plugs of the three screws on the top of the front panel, and loosen the three screws to the degree that they will not be dropped.
2) Open the front door, loosen the four retaining screws in the front of the front desk panel, and then remove the panel.
3) To reinstall the front desk panel, follow the steps mentioned above in the reversed order.

Alignment and confirmation

If the gap between the front desk panel and the desk panel is improper, adjust the three screw holes at the top of the front desk panel.

2.1.8 Replacing Left/Right Front Door Assemblies and Hinges

When to do

Replace the left/right front door assemblies and hinges when they are seriously deformed under abnormal external force.

Tools

Hexagon wrench and cross screwdriver

How to do

1) Open the left (right) front door.
2) Remove the retaining screws on the left (right) front panel assembly, and remove the left (right) front panel assembly.
3) Unscrew the three M4×10 hexagon screws on the lower hinge to remove the lower hinge.
4) Unscrew the three M4×10 hexagon screws on the upper hinge to remove the left (right) front door assembly and the upper hinge.
5) Replace the desired parts, and install the left (right) front door assembly and hinges in the reversed order.

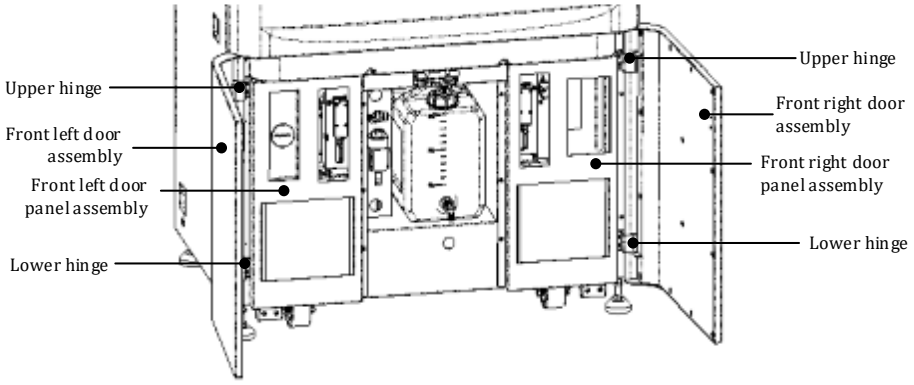


Figure 2-3 Replacing left/right front doors and hinges

Alignment and confirmation

After replacing the left (right) front door assembly or the hinges, check if the gap between the left front door and the right front door is even. If not, adjust the upper hinge and the lower hinge. Open and close the door repeatedly, and check that the door can be locked normally and no bump is heard during the door closing. After alignment, install back the left (right) front panel assembly.

2.1.9 Cleaning Fans

When to do

When much dust is accumulated on the fans, or it has been 1 year since the last maintenance.

Maintenance Tools

Cross screwdriver, suction cleaner or hair brush

Procedure:

1) Switch off the analyzing unit power.
2) If the reagent refrigeration fan needs cleaning, remove rear panel 2.
3) If the lamp fan needs cleaning, remove the light source assembly cover.
4) Manually rotate the fan and remove the dust on it.
5) Install the removed panels.
6) Switch on the analyzing unit power.

Alignment and confirmation

Check if the fans work normally.

2.2 Frame Assembly

2.2.1 Module Functions

The frame assembly is a basic unit used for the installation and support of the components of the analyzer.

2.2.2 Locations and FRU Details

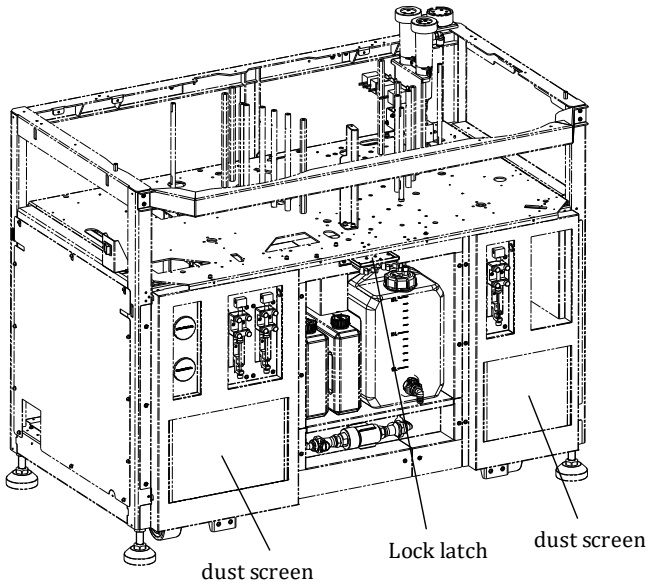


Figure 2-4 Frame assembly

Table 2-2 FRU list

No.	FRU code/PN	Material	Remark
1	801-BA40-00064-00	lock catch	FRU
2	BA40-20-61599	dust screen	FRU

2.2.3 Removing and Reinstalling of Lock Catch

When to do

The lock catch should be replaced if it is damaged.

Tools

Cross screwdriver

How to do

1) Unscrew the three screws to remove the lock catch assembly.
2) Unscrew the retaining screws on the lock catch to remove it.
3) Install a new lock catch.
4) Place the new lock catch to the original position.

Alignment and confirmation

When installing the lock catch, ensure it is aligned completely with the door assembly, and the two doors must be level and not interfere with each other.

2.2.4 Replacement of Left/Right Dust Screen

When to do

The left/right dust screen is damaged or needs maintenance

Tools

None

How to do

1) Push upward the dust screen to remove it.
2) Replace it with a new one.

Alignment and confirmation

Make sure the dust screen can completely cover the air inlet.

3 Modules and Units

This chapter mainly introduces the main unit modules of BS-410/BS-410E/BS-410S/BS-430/BS-450/BS-460/BS-470/BS-470E including the following contents:

- Reaction Carousel Module
- Sample Carousel Module
- reagent Carousel Module
- Sample / Reagent Probe Unit
- Mixer Assembly
- Wash Syringe Assembly
- Photometer Units
- ISE Unit (optional)

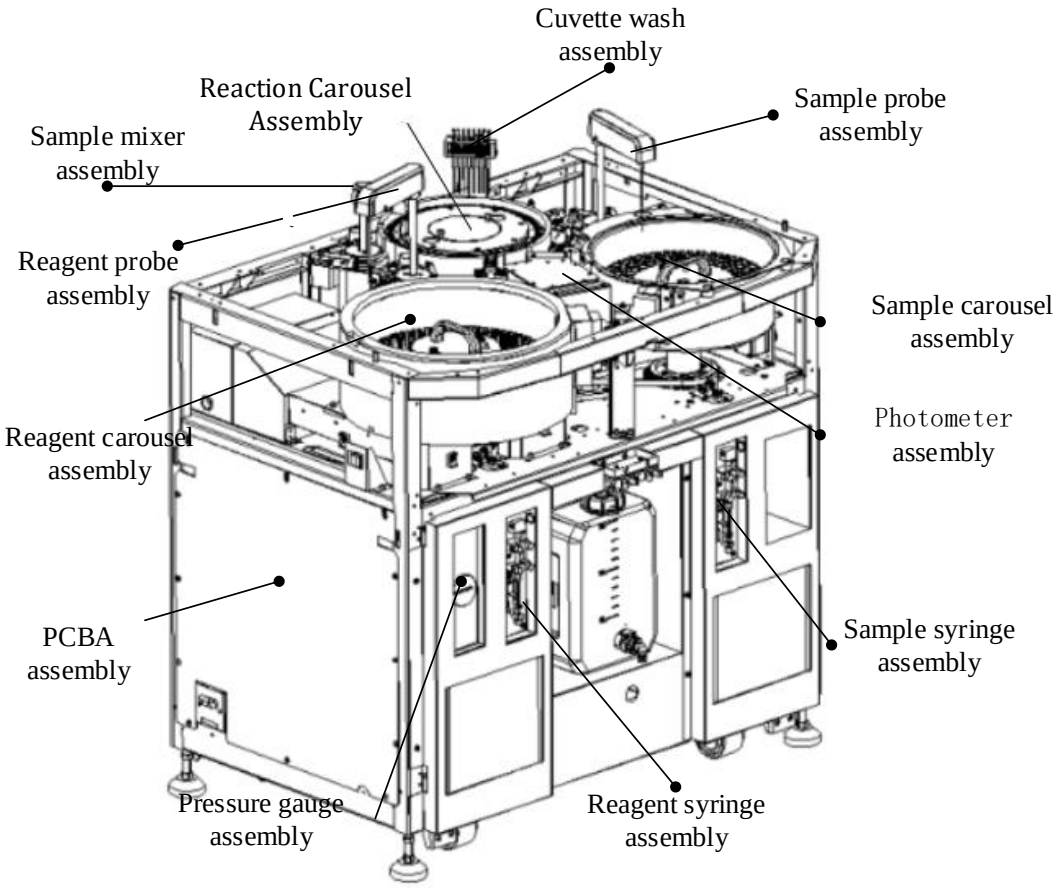


Figure 3-1 Locations of components on the instrument

3.1 Reaction Carousel Assembly

3.1.1 Module Functions

Reaction carousel assembly is situated at the middle and rear of the analyzer, including the reaction carousel body assembly, reaction carousel drive assembly, reaction carousel chamber, reaction carousel sensor, and the reaction carousel motor assembly. It is used to complete various actions, such as carrying and rotating the reaction cuvette to the specified position, adding sample/reagent to the cuvette, mixing and washing, together with the sample probe, reagent probe, mixer and the 8-phase wash probes. It provides a constant temperature for reaction cuvettes, in which sample-reagent reaction takes place.

3.1.2 Locations and FRU Details

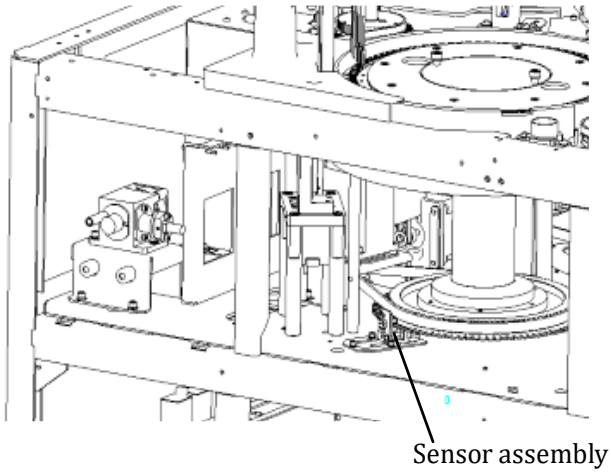


Figure 3-2 Reaction carousel module-1

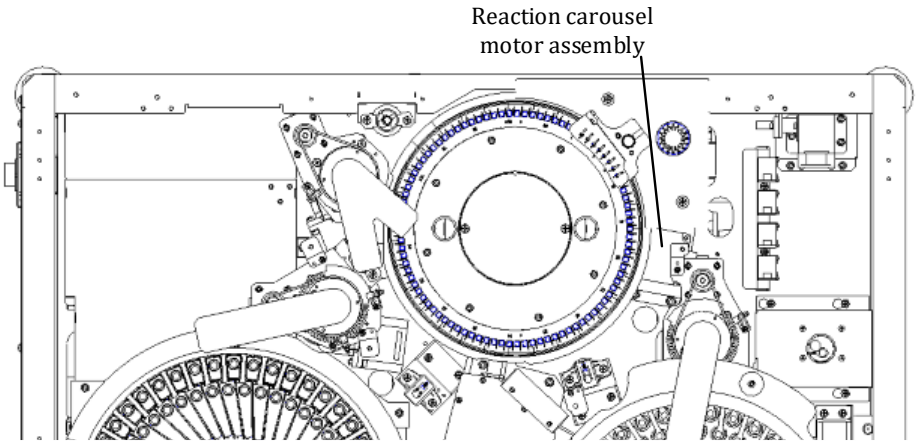


Figure 3-3 Reaction carousel module-2

No.	FRU code and material code	Material name	Remark
1	801-BA38-00024-00	Slip ring	FRU
2	024-000775-00	Silicone heater, 24V 55W, circular	FRU
3	801-BA40-00170-00	Temperature protection switch wire (for reaction carousel)	FRU
4	801-BA38-00035-00	Reaction carousel temperature sensor 1	FRU
5	801-BA38-00036-00	Reaction carousel temperature sensor 2	FRU
6	801-BA38-00037-00	Reaction carousel temperature sensor 3	FRU

7	051-002415-00	Reaction carousel temperature collection board	FRU
8	801-BA38-00013-00	Heater conversion board of reaction carousel	FRU
9	042-017445-00	Metal plate for cuvette	FRU
10	115-029875-00	Reaction carousel motor	FRU
11	M6C-020011---	Synchronous cog belt, TBN260XL037	FRU
12	009-002204-00	Correlative optical coupler wire (S)	FRU Coded disk sensor/Home position sensor

3.1.3 Replacement of Reaction Carousel Body Cables

When to do

The reaction sensors, heater, protection switch or temperature collection board should be replaced if the reaction temperature is abnormal due to their failure.

Tools

Cross screwdriver and hexagon wrench

Exploded view for installation

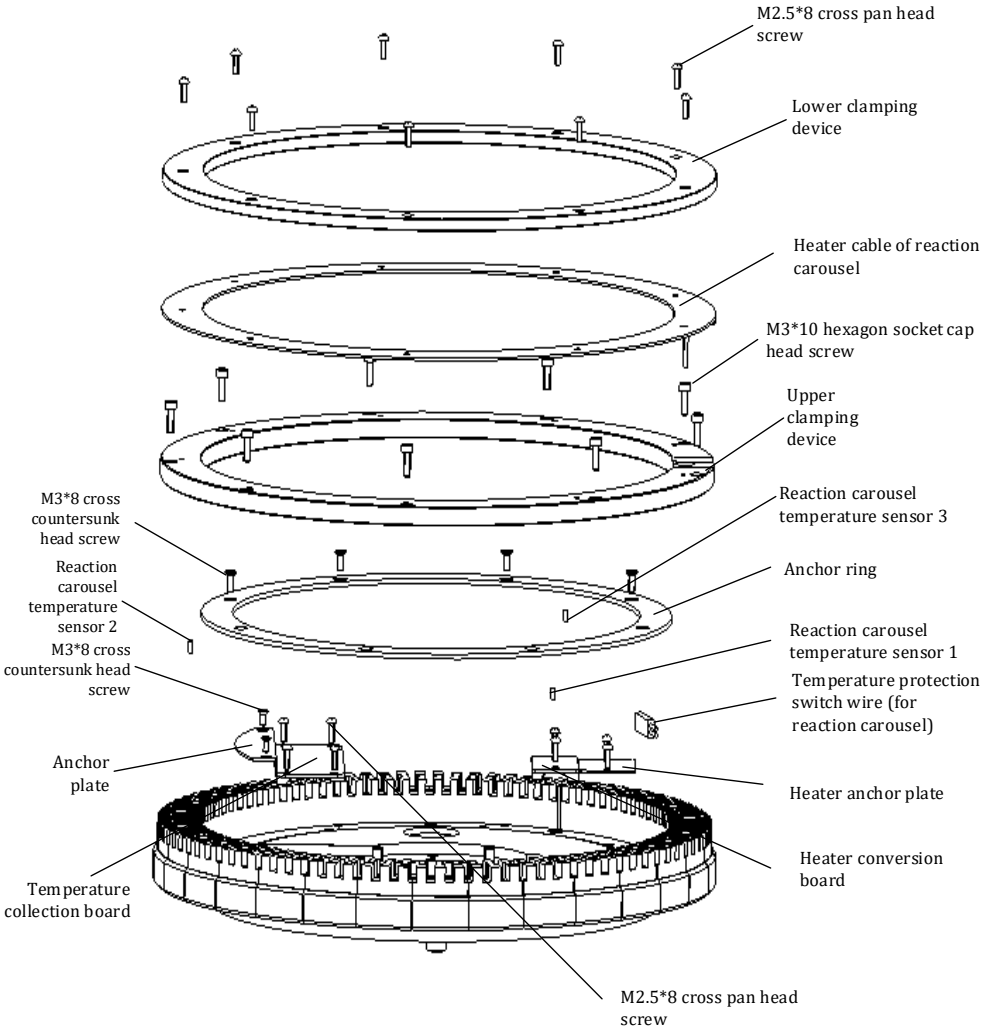


Figure 3-4 Exploded view for replacing reaction carousel body cables

NOTE

- **Please be careful when removing the reaction carousel body to protect the cuvettes and the top of the carousel's rotary shaft.**
- **It is not suggested to remove the upper clamping device. If it is difficult to clean the stains in the cuvette slot, you should remove the parts and clean the interior of the cuvette slot.**
- **Do not pull the cables during the installation; especially pay much attention to protect cables of the three sensors.**
- **The exploded view is based on the minimum decomposition of the reaction carousel assembly, and further decomposition may invalidate the functions of the reaction carousel.**

How to do

1) Switch off the power of the analyzer.
2) Open the front shielding cover and remove the auto wash station, and store them properly to protect the wash probes. Rotate the reagent probe to the reagent aspirate position and rotate the sample probe to the sample aspirate position, the reagent mixer and sample mixer to the wash wells, and then remove the reaction carousel cover assembly.
3) Unscrew the two M3 cross head screws on the reaction carousel's skylight cover to remove it, and unplug the slip ring from the reaction carousel temperature collection board.
4) Unscrew the four M5X12 hexagon socket cap head screws with spring washer on the reaction carousel body to remove it. Please take the carousel carefully in order not to damage the reaction cuvettes.

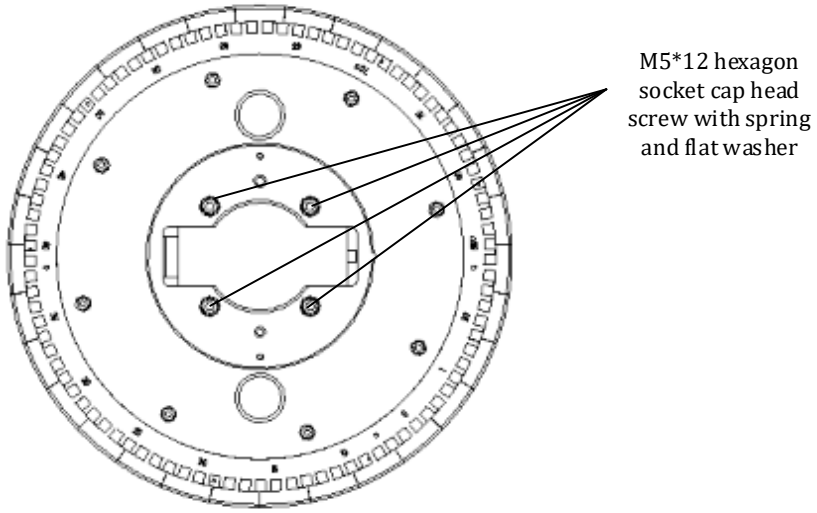


Figure 3-5 Reaction carousel body

5) Remove all reaction cuvettes and store them properly.
6) Place the carousel body with the bottom surface upward and unscrew the two M3×8 cross countersunk head screws on the anchor plate to remove it. Or, remove the two M3×8 cross pan head screws on the heater plate to remove it.
7) Loosen the eight M3×8cross countersunk head screws on the anchor ring and then remove the anchor ring.
8) Loosen the nine M2.5×8 cross pan head screws on the lower clamping device, and then remove the lower clamping device.
9) Unplug the heater connector from the heater conversion board to remove the heater.
10) Unscrew the nine M3×10 hexagon socket cap head screws on the upper clamping device to remove it.
11) Unplug the connectors between the three temperature sensors and the temperature collection board and remove the temperature sensor cable 1, reaction carousel temperature sensor cable 2 and reaction carousel temperature sensor cable 3.
12) Evenly apply proper amount of KP97 thermal paste on the three new temperature sensors and insert them into the holes on the reaction carousel body. Remove the redundant thermal paste around the holes. Ensure that the three temperature sensors are installed in the correct positions, the sensor cables are inside the cable slot on the reaction carousel, and the sensor plugs are inserted properly into the temperature collection board. Write down the serial numbers and the corresponding parameters of the

three sensors which will be used to set the sensor parameters during the alignment.

13) Unplug the temperature protection switch connector from the heater conversion board, and then remove the temperature protection switch.
14) Evenly apply proper amount of KP97 thermal paste on the new temperature protection switch, put the temperature protection switch in the mounting slot, and insert its connector into the heater conversion board.
15) Install the clamping device, and use nine M3×10 hexagon socket screws to fasten it.
16) Apply proper amount of KP97 thermal paste on the root of the new heater cable, and place the heater on the upper clamping device with the cable passing through the slot to the slot on the reaction carousel. Ensure that the heater cable is inside the slot on the reaction carousel. Then insert the cable connector onto the heater conversion board.
17) Put the lower clamping device on the heater and secure the lower clamping device to the upper clamping device with nine M2.5×8 cross pan head screws. When tightening the screws, push the protruding part of the heater towards the inside of the upper and lower clamping devices, and tighten the screws diagonally.
18) Press cables of the heater, the temperature protection switch and the three sensors into the slot of the carousel body, and then install the wire clamping ring onto the carousel body with eight M3×8 cross countersunk head screws.
19) To replace the temperature collection board or the heater conversion board, first perform steps 1-6, and then unplug the connectors on the temperature collection board or the heater conversion board, loosen the M3×8 cross pan head screws, replace the temperature collection board or the heater conversion board with a new one, restore the cable connectors, and fix the temperature collection board or the heater conversion board with M3×8 cross pan head screws.
20) Restore the components in the reversed order.

Alignment and confirmation

Re-configure the related parameters of the sensors after replacing the cables of the sensor, the heater and the temperature protection switch and test the performance of heat-insulating. Refer to ***7.12.1 Sensor Configuration***, ***7.12.2 Observe Temperature Curve***.

3.1.4 Replacement of Metal Plate for Cuvette

When to do

If the metal plate has no elasticity and cannot retain a cuvette, then it should be replaced.

Tools

Tweezers and utility knife

Exploded view for installation

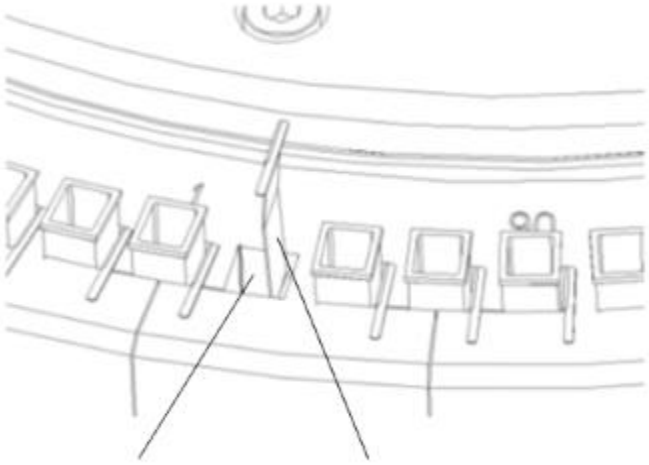


Figure 3-6 Schematic diagram of replacing metal plate for cuvette

NOTE

- **The spring plate should be pressed to the bottom.**
- **Please do not press the spring plate with a sudden force to avoid bending the spring plate.**
- **Edges of the spring plate may have some small burrs. Please be careful when replacing it.**

How to do

1) Switch off the main power of the whole unit.
2) Open the front shielding cover and remove the auto wash station, and store them properly to protect the wash probes. Rotate the reagent probe to the reagent aspiration position and rotate the sample probe to the sample aspiration position. The reagent mixer and sample mixer to the wash wells, and then remove the reaction carousel cover assembly.
3) Unscrew the two M3 cross pan head combination screws on the reaction carousel's skylight cover to remove it. And unplug the slip ring from the reaction carousel temperature collection board.
4) Unscrew the four M5X12 hexagon socket cap head screws on the body of the reaction carousel to remove it. Please take the carousel carefully in order not to damage the reaction cuvettes.
5) Remove the cuvette of which the spring plate needs to be replaced as well as the 3 cuvettes on its left and right sides (2 on each side), and store them properly.
6) Extract the spring plate about 3~5mm with a blade and grip it out with a pair of sharp nose pliers.
7) Press a new spring plate into the cuvette slot in the correct direction.
8) Restore the components in the reversed order.

Alignment and confirmation

Ensure that the cuvettes are pressed to the end.

3.1.5 Replacement of Home Position Sensor and Coder Sensor

When to do

If reaction carousel sensor becomes invalid, please replace the reaction carousel home position sensor or the coder sensor.

Tools

Cross screwdriver, hexagon wrench

Exploded view for installation

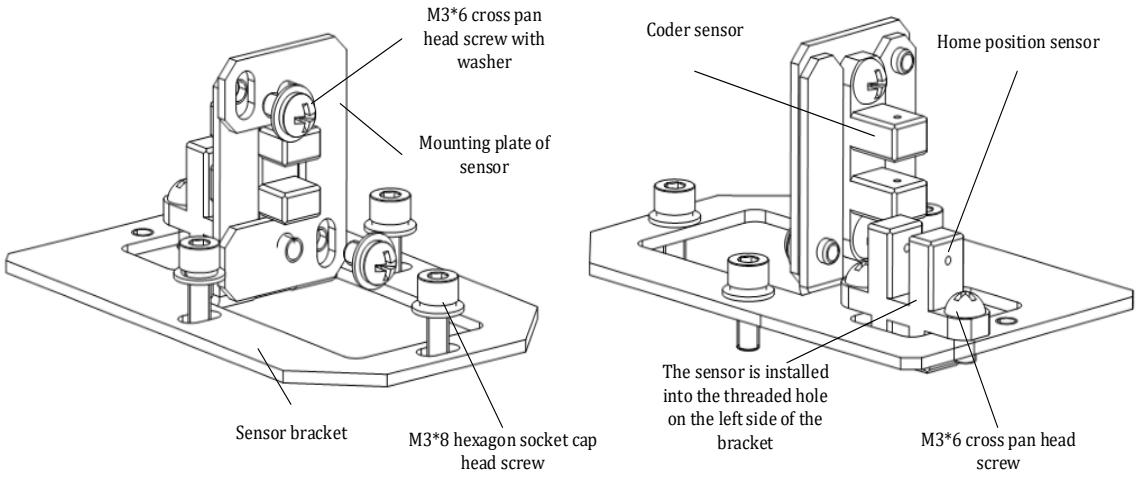


Figure 3-7 Schematic diagram of replacing sensor cables

NOTE

- **Install the sensors according to the identifications on the cable connectors and the instrument connectors: "RCD--PHO-C" for coder sensor and "RCD--PHO-O" for home position sensor.**
- **Do not tighten the sensor screws with excessive torque force, in order to avoid damaging the sensors.**
- **Make sure to install the home position sensor in the correct position.**

How to do

1) Switch off the main power of the whole unit.
2) Loosen the M4×8 cross pan head screws on the rear left panel, and then remove the rear left panel. Manually loosen the two screws to remove the rear cover of the light source assembly.
3) Unplug the connectors of the reaction carousel home position sensor and coder sensor.
4) Loosen the three M3×8 hexagon socket cap head screws with spring and flat washers on the sensor assembly, and then remove the sensor assembly. Pay attention not to drop the screws into the instrument.
5) Unscrew the two M3×6 cross pan head screws with washers on the sensor's mounting plate and remove

the coder sensor cable with the sensor.

6) Loosen the two cross pan head screws on the coder sensor, and remove the coder sensor from the mounting plate.
7) Fix the new coder sensor on the mounting plate using two M3×6 cross pan head screws.
8) Fix the sensor mounting plate to the bracket with two M3×6 cross pan head screws with washer. Do not tighten them.
9) Loosen the two M3×6 cross pan head screws on the home position sensor, and then remove the home position sensor.
10) Fix the new home position sensor onto the sensor bracket using two M3×6 cross pan head screws.
11) Fix the sensor assembly on the big bottom plate using three M3×8 hexagon socket cap head screws with spring and flat washers. Manually rotate the reaction carousel and check that the zero position stopper of the coder does not interfere with the zero position sensor. Adjust the sensor mounting plate to keep the coder in the middle of the coder sensor, and then tighten the screws on the mounting plate.
12) Connect the home position sensor and the coder sensor.
13) After aligning and confirming the sensor assembly, fix the rear left panel to the frame using M4×8 cross pan head screws.

Note:

When replacing only the coder sensor, skip step 9-10.

When replacing only the reaction carousel home position sensor, skip step 5-8.

Alignment and confirmation

After replacing the home sensor of the reaction carousel and the coder sensor cable, refer to ***7.3.2 Signal Collecting Position Adjustment*** to perform the Signal Collecting Position Adjustment and refer to***7.3 -7.9*** to perform circumferential Position alignment of the reaction carousel, sample carousel and reagent carousel and the horizontal position alignment of the sample probe, reagent probe, sample mixer, reagent mixer and cuvette wash station.

3.1.6 Replacement of Reaction Carousel Motor and Synchronous Belt

When to do

The reaction carousel motor and synchronous belt should be replaced if they are damaged.

Tools

Cross screwdriver, hexagon wrench

Exploded view for installation

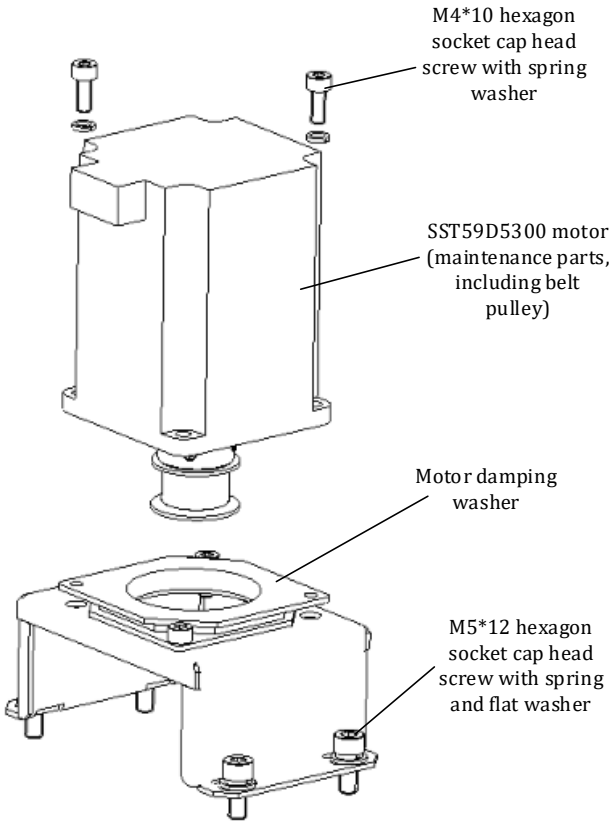


Figure 3-8 Schematic diagram of replacing reaction carousel motor assembly

⚠ WARNING

- **During removing and installation, avoid dropping screws and washers into the analyzer.**
- **Do not remove the two screws on the damping washer.**

How to do

Replace the motor.

1) Switch off the main power of the whole unit.
2) Refer to ***3.1.3 Replacement of Reaction Carousel Body Cables*** to remove the reaction carousel body assembly.
3) Remove the sample and reagent carousel cover assemblies, the front desk panel and the rear left panel.
4) Disconnect the motor cable, loosen the four M4×10 hexagon socket head screws with spring washer on the motor assembly (while keeping the two screws in the waist-shaped hole on the motor mounting plate), remove the motor assembly and avoid dropping screws into the analyzer.
5) Loosen the two M4×10 hexagon socket head screws with spring washer on the motor, and then remove the motor together with the belt wheel.
6) Fix a new 3-carousel motor (with belt wheel) on the damping washer using two M4×10 hexagon socket head screws with spring washer, and ensure that the motor connector and the waist-shaped hole are in the same direction.
7) Fix the motor assembly to the four supporting rods using four M4×10 hexagon socket cap head screws with spring and flat washers. Tighten the synchronous belt and all screws and connect the motor cable.
8) Restore the components in the reversed order.

Change the synchronous belt:

1) Switch off the main power of the whole unit.
2) Refer to ***3.1.3 Replacement of Reaction Carousel Body Cables*** to remove the reaction carousel body assembly.
3) Remove the sample and reagent carousel cover assemblies, the front desk panel, the middle panel assembly, the right panel, the light source assembly rear cover, and the rear left panel.
4) Replace the old synchronous belt with new one.
5) Restore the components in the reversed order.

Alignment and confirmation

N/A.

3.1.7 Replacement of Slip Ring Cables

When to do

The cables of the slip ring should be replaced if they are damaged.

Tools

Cross head screwdriver, hexagon wrench

Exploded view for installation

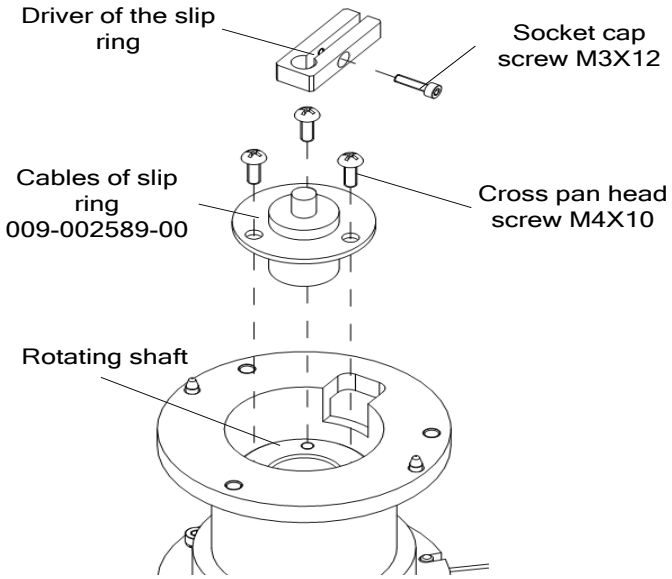


Figure 3-9 Schematic diagram of replacing cables of slip ring

Figure 3-10 Wiring position diagram of the slip ring

⚠ WARNING

- **The slip ring cable connector is underneath the big bottom plate and the reaction carousel assembly.**
- **Do not install the slip ring driver close to the slip ring, but lift it from the A side for about 2mm in order to prevent damaging the slip ring.**
- **Carefully tighten the screws on the slip ring driver. A distorted slip ring driver will damage the slip ring.**

How to do

1) Switch off the main power of the whole unit.
2) Open the front shielding cover and remove the auto wash station, and store them properly to protect the wash probes.
3) Rotate the reagent probe to the reagent aspirate position and the sample probe to the sample aspirate position, and remove the reaction carousel cover and all panels around the reaction carousel assembly and rear panel 1.
4) Unscrew the two M3 screws on the reaction carousel's skylight cover to remove it, and unplug the slip ring from the reaction carousel temperature collection board.
5) Unscrew the three M4X10 cross pan head screws used to fix the Slip ring cable and disconnect the terminal under the bottom plate of the analyzer to remove the cables of the slip ring.
6) Unscrew the one M3X12 hexagon socket cap head screw on the driver of the slip ring to remove it.
7) Install the driver of the slip ring onto the new cables of slip ring using one M3X12 hexagon socket cap head screw. Please lift the driver about 2mm from the cables and then tighten the screw.
8) Fix the cables of the slip ring to the rotating shaft using the three M4X10 cross pan head screws with spring washer, and connect the terminals under the bottom plate of the analyzer.
9) Install the skylight cover, reaction carousel cover assembly, and the rear panel 1 by steps mentioned above in a reverse order.

Alignment and confirmation

N/A.

3.1.8 Replacement of Reaction Cuvette

Refer to ***3.7.6 Replacing Reaction Cuvette***

3.2 Reagent Carousel Assembly

3.2.1 Module Functions

The reagent carousel assembly is situated at the left front of the analyzer, including the reagent carousel body assembly, reagent chamber, drive assembly and the reagent bar code reader. It is used to complete various actions, such as carrying and rotating the reagent bottle to the specified position, add samples together with sample addition assembly. It provides a refrigerating environment, and the reagents stored in such environment can be kept stable with little volatilization.

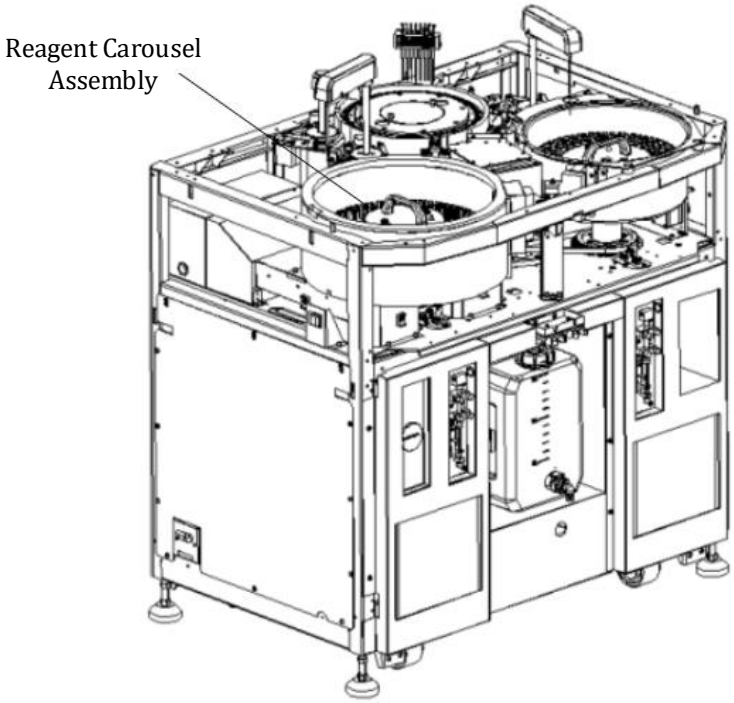


Figure 3-11 Locations of components on the instrument

3.2.2 Locations and FRU Details

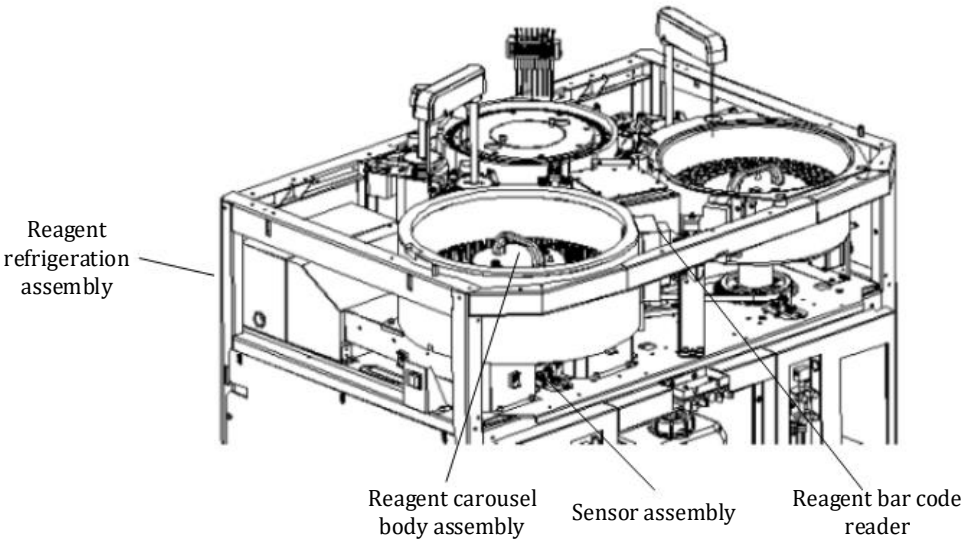


Figure 3-12 Reagent carousel assembly

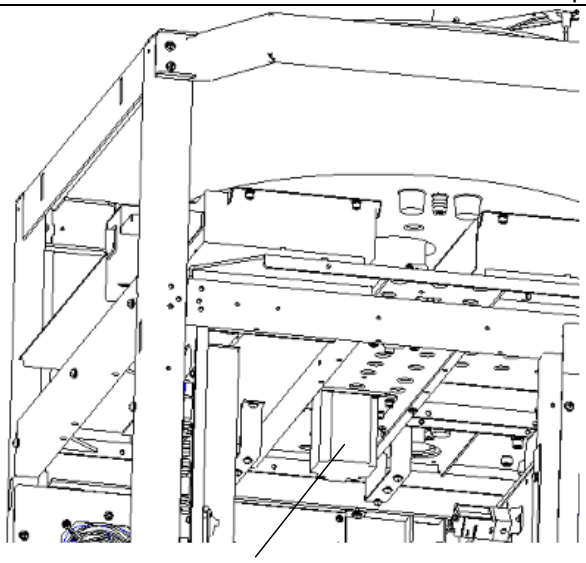


Figure 3-13Carousel motor assembly

Table 3-1 List of materials

No.	FRU code and material code	Material Name	Remark
1	115-036494-00	Reagent refrigeration assembly	FRU
2	009-002204-00	Correlative optical coupler wire (S)	FRU / Home position or coder sensor
3	BA40-21-61655	Semi-conductive Peltier cable	FRU / Peltier
4	801-BA38-00022-00	2-carousel motor assembly	FRU/Reagent carousel motor (with pulley)
5	115-036347-00	Reagent carousel body assembly	FRU
6	801-BA40-00210-00	Fan, 24V 91.8CFM 120×120×38mm 300mm, with alarm	FRU / Refrigerating fan
7	801-BA30-00088-00	Sensor temperature 5Kohm B3470K with threads	FRU / Temperature sensor
8	M6Q-120023---	Fan screen (120mm)	FRU
9	801-BA20-00001-00	Built-in bar code reader (featuring laser diversion)	FRU/Scanner (There are two configurations on the client end, with MS-3 bar code reader replaced by BAL95 bar code reader after EIB007. If reagent scanning fails on the outer ring of the reagent carousel, use BCL95 to fix the problem.)
10	023-002082-00	BCL 95 M0R2 laser built-in bar code reader	

No.	FRU code and material code	Material Name	Remark
11	801-BA40-00199-00	Reagent carousel antifogging heating assembly	FRU

3.2.3 Replacing Reagent Carousel Body Assembly

When to do

Replace the reagent carousel body assembly when it is damaged or cannot meet the operation requirements.

Tools

N/A

Exploded view for installation

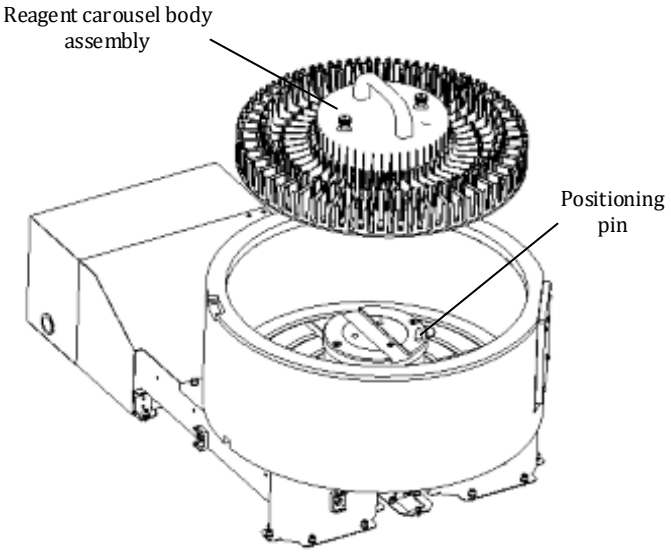


Figure 3-14 Removing/Installation Diagram for Reagent Carousel Body Assembly

How to do

1) Switch off the main power of the whole unit.
2) Rotate the reagent probe to the dispense position, and then remove the reagent carousel cover.
3) Manually loosen the two screws on the reagent carousel body assembly.
4) Lift the handle bar to remove the reagent carousel body assembly.
5) Align the positioning hole of the new reagent carousel body assembly with the stop bolt and install it onto the rotating shaft sleeve of the sample carousel. Tighten the two screws on the reagent carousel body assembly with hands.
6) Restore the components in the reversed order.

Alignment and confirmation

N/A

3.2.4 Replacing Semi-conductive Peltier and Temperature Sensor

When to do

When the reagent refrigeration compartment is seriously rusted or has bad refrigeration effects, or the temperature sensor is damaged

Tools

Cross screwdriver, flathead screwdriver, hexagon wrench, scissors, waterproof glue gun, AC impedance meter, blade, and reagent chamber thermistor fixture (BA40-J09).

Exploded view for installation

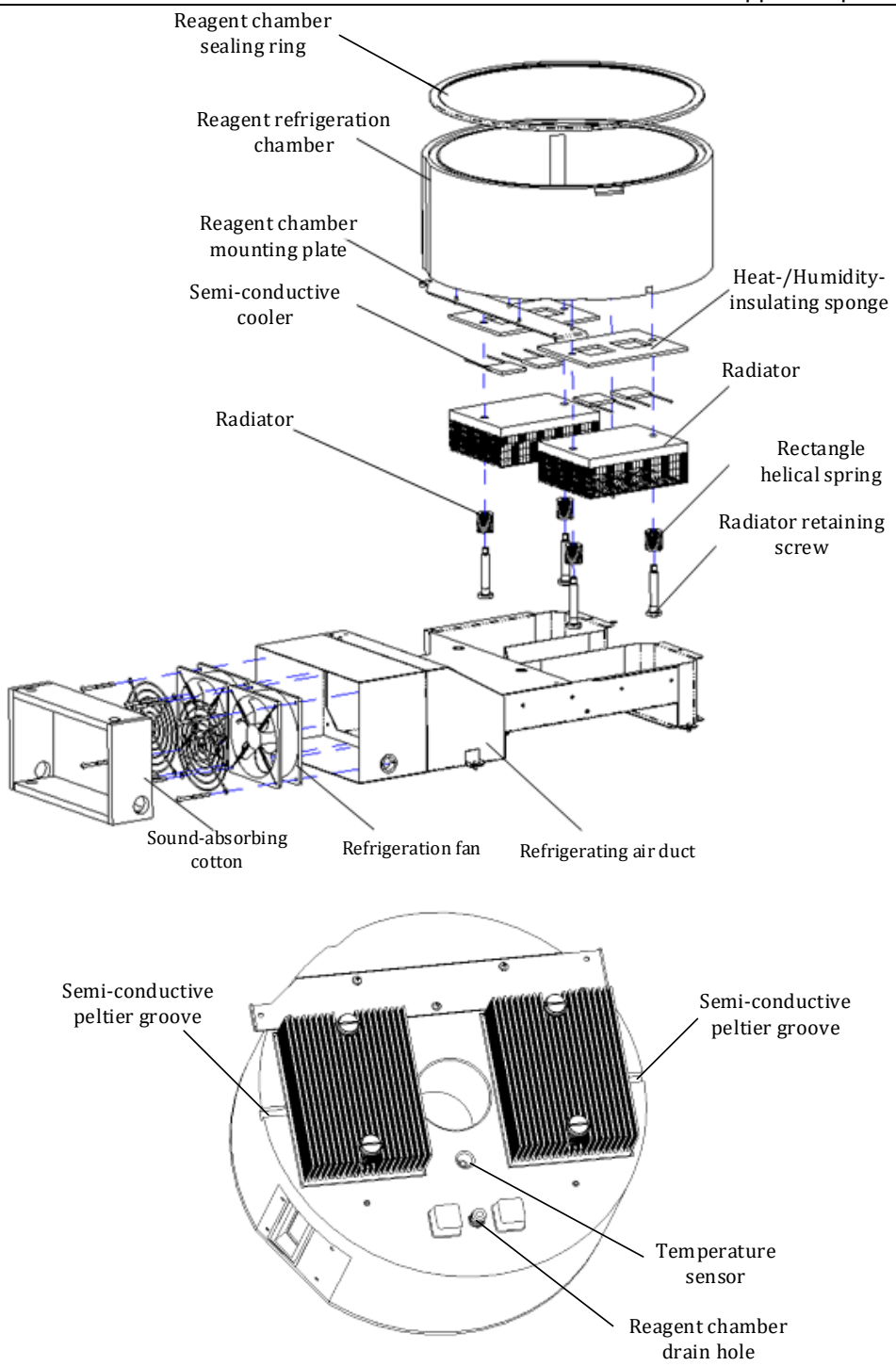


Figure 3-15 Reagent refrigeration assembly

How to do

1) Switch off the main power of the whole unit.
2) Remove the reagent carousel cover assembly, reaction carousel cover assembly and sample carousel cover assembly, and dismantle the desk panels around the reagent refrigeration assembly (front desk panel, left panel, and middle panel), the left side panel assembly and the rear right panel. Protect the sample probe, mixer assembly and reagent probes from being collided during the dismantling.
3) Manually loosen the two screws on the reagent carousel body assembly, and then remove the reagent carousel body assembly.
4) Loosen the three M3×10 hexagon socket cap head screws with spring washer and remove the rotating shaft sleeve of the sample carousel to expose the transmission shaft.
5) Disconnect the drain tube from the reagent refrigeration compartment to the drain hole of the reagent

chamber.

6) Unplug the connectors of the temperature sensor and peltier.
7) Remove the four M4×8 hexagon socket cap head screws with spring and flat washers, and remove the reagent refrigeration assembly from the refrigeration air duct.
8) Remove the reagent refrigeration chamber assembly without touching the reagent probes, wash well and other components. (If a bar code reader is installed, remove it.) Turn the reagent refrigeration assembly over for 180°, and put it on the desktop.
9) Scrape off the sealing glue in the sensor mounting hole of the refrigeration chamber, use the thermistor fixture (BA40-J09) to loosen the temperature sensor, and then remove the temperature sensor.
10) Scrape off the glue in the sensor mounting hole of the refrigeration chamber, install a new temperature sensor (remove the nut and washer that come with it). Then, apply proper amount of KP97 thermal paste on the threads of the temperature sensor and inside the threaded hole of the reagent chamber.
11) Use the reagent chamber thermistor fixture (BA40-J09) to make the temperature sensor through the bottom of the reagent chamber, and tighten the temperature sensor. Then, clean the excessive thermal paste in the chamber. Fill up the mounting hole with TSE382-W waterproof glue until it is flush with the surface of the bottom of the chamber. (After TSE382-W waterproof glue is squeezed into the hole, use a toothpick to smear along the edge of the hole to make the glue closely stick to the hole wall. Then, evenly smear the waterproof glue to ensure seal of the mounting hole.)
12) Scrape off the waterproof glue around the radiator, remove the four radiator retaining screws, remove the radiator and the rectangle helical spring, and remove the semi-conductive peltier.
13) Use an AC impedance meter to measure the AC impedance of the new peltiers, record the values and number each peltier as 1#-2# or 3#-4#. Check that the AC impedance of each peltier is within 2.15Ω±10%. If not, replace the peltier.
14) Clean the thermal paste (KP97) on the projecting part of the panel for the installation of the semi-conductive peltier of the refrigeration chamber. Then, even apply the KP97 thermal paste on the projecting part (thickness of paste: about 0.1 to 0.2mm), put the new peltier on the projecting part, **with the text-side facing downwards**. Carefully attach the peltier, and lead the cable out from the groove. **Note: Pay attention to the installation direction of the peltier. Incorrect installation will lead to refrigeration failure.**
15) Clean the overflow thermal paste around the peltier.
16) Attach a piece of thermal film (phase change heat conductive material) on the no-text side of each peltier. Press with fingers to ensure that the film is properly fixed. Then, remove the protective sheet from the film.
17) Install two radiators respectively into the slot of the chamber (the peltier cable must not press the peltier, and all cables must be led out from the two grooves on sides of the peltier), and install four rectangle helical springs in the hole in sequence.
18) Put four radiator retaining screws through the rectangle spring and radiator onto the chamber. Fasten the screws alternately (do not fasten them one by one, as uneven force on the peltier may damage the peltier).
19) Use an AC impedance meter to measure the AC impedance of the 4 peltiers, and check that it is within 2.15Ω±10%. If not, replace the peltiers.
20) Use a glue gun to apply TSE382-W waterproof glue inside the glue tank around the radiator and the groove of reagent chamber (filling glue in the groove of reagent chamber can fix the peltier cable inside the groove, note that the glue must not exceed the surface of the chamber). Then, remove the excessive glue that is higher than the surface of the bottom of the chamber.
21) When the sealing glue becomes solid completely, use four M4×8 hexagon socket cap head screws with spring and flat washers to fix the reagent refrigeration assembly to the refrigeration air duct.
22) Restore the components in the reversed order.

Note:

When replacing only the temperature sensor, skip steps 12-20.

When replacing only the semi-conductive peltier, skip steps 9-11.

NOTE

- **When replacing the semiconductor Peltiers, store the removed screws properly.**
- **Pay attention to the installation direction of the peltier. Incorrect installation will lead to refrigeration failure.**
- **The surrounding of the radiator and the mounting hole of the temperature sensor must be completely covered by TSE382-W waterproof glue with no air gaps.**
- **Remember to install the thermal film when replacing the radiator.**

Alignment and confirmation

See ***7.12.5*** for alignment of the reagent refrigeration assembly, and see ***7.10.7*** for alignment of the reagent

carousel bar code reader.

3.2.5 Replacing Cooling Fan

When to do

Replace the cooling fan when it is damaged.

Tools

Cross screwdriver

Exploded view for installation

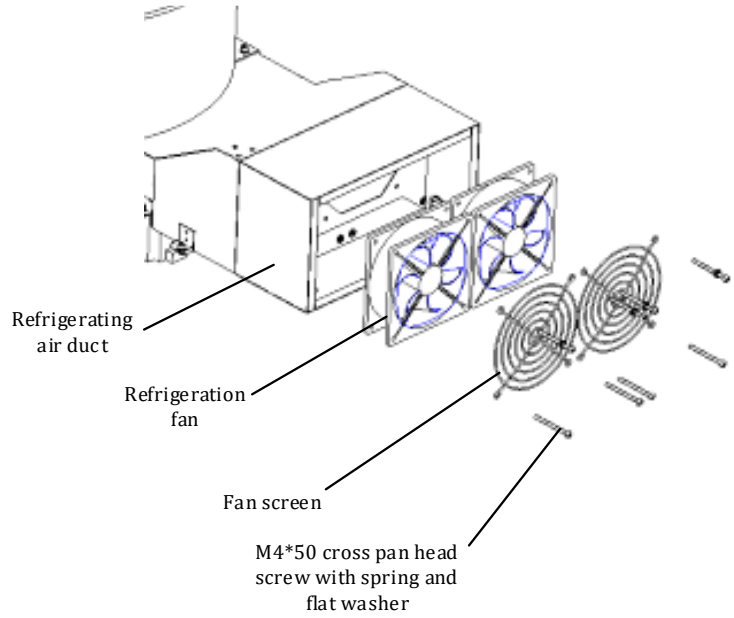


Figure 3-16 Reagent cooling fan

How to do

1) Find the damaged cooling fan.
2) Switch off the main power of the whole unit.
3) Remove the reagent carousel cover assembly and left side panel assembly, the front desk panel, the reagent carousel desk panel and the rear right panel.
4) Unplug the connector of the damaged cooling fan.
5) Loosen the four M4×50 cross pan head screws with spring and flat washers, and remove the damaged fan screen and refrigeration fan.
6) Install a new refrigeration fan with the arrow pointing outwards instead of at the refrigeration compartment. Install the fan screen and fix it with four M4×50 cross pan head screws with spring washer onto the air passage. Note to tighten the screws with proper force.
7) Restore the components in the reversed order.

Alignment and confirmation

After powering on the instrument, check that the cooling fan is blowing wind outwards, To confirm the refrigeration fan status, refer to ***7.12.4 .***

3.2.6 Replacing Reagent Carousel Motor and Synchronous Belt

When to do

Replace the reagent carousel motor or synchronous belt when they are damaged.

Tools

Cross screwdriver and hexagon wrench

Exploded view for installation

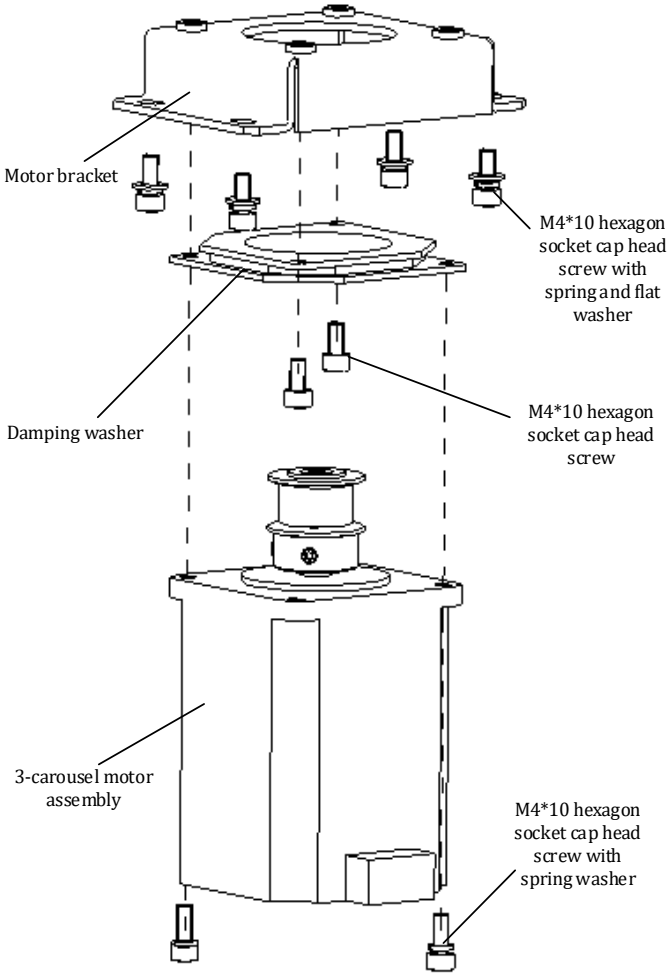


Figure 3-17 Reagent carousel motor and belt

How to do

Replace the motor:

1) Switch off the main power of the whole unit.
2) Remove the reagent refrigeration assembly according to ***3.2.4***.
3) Remove the rear right panel and disconnect the motor cable.
4) Loosen the four M4×10 hexagon socket cap head screws with spring and flat washers on the motor bracket to remove the motor assembly.
5) Loosen the two M4×10 hexagon socket cap head screws with spring and flat washers on the motor to remove the 3-carousel motor assembly.
6) Fix a new motor on the damping board using two M4×10 hexagon socket head cap screw screws with spring washer, and make the motor connector face the back of the analyzer.
7) Sleeve the synchronous belt on the small belt wheel. Fix the motor assembly to the big bottom plate using four M4×10 hexagon socket cap head screws with spring and flat washers. Tighten the synchronous belt and all screws and connect the motor cable.
8) Restore the components in the reversed order.

To replace the synchronous belt:

1) Switch off the main power of the whole unit.
2) Remove the reagent refrigeration assembly according to ***3.2.4***.
3) Remove the rear right panel and disconnect the motor cable.
4) Remove the synchronous belt from the belt pulley. Install the new synchronous belt, and then connect the motor cable.
5) Restore the components in the reversed order.

NOTE

- **Do not remove the belt wheel of the 3-carousel motor assembly.**
- **Do not remove the two screws on the damping washer.**

Alignment and confirmation

N/A

3.2.7 Replacing Reagent Carousel Home Position Sensor and Coder Sensor

When to do

Replace the reagent carousel home position sensor or coder sensor when they fail.

Tools

Cross screwdriver and hexagon wrench

Exploded view for installation

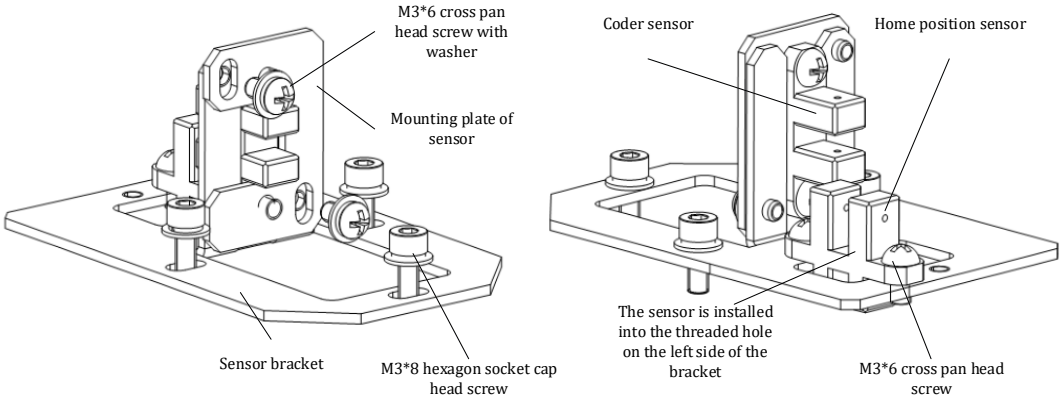


Figure 3-18 Reagent carousel sensor assembly

How to do

1) Switch off the main power of the whole unit.
2) Rotate the reagent probes to the dispense position, remove the reagent carousel cover assembly, and loosen the M4×8 cross pan head screws with washers to remove the front desk panel.
3) Unplug the connectors of the reagent carousel home position sensor and coder sensor.
4) Loosen the three M3×8 hexagon socket cap head screws with spring and flat washers to remove the reagent carousel sensor assembly.
5) Loosen the two M3×6 cross pan head screws with washers on the sensor mounting plate, and then remove the sensor mounting plate together with the coder sensor.
6) Loosen the two M3×6 cross pan head screws on the coder sensor, and remove the coder sensor from the mounting plate.
7) Fix the new coder sensor on the mounting plate using two M3×6 cross pan head screws.
8) Install the mounting plate together with the coder sensor onto the sensor bracket using two M3×6 cross pan head screws with washers. Do not tighten them.
9) Loosen the two M3×6 cross pan head screws to remove the home position sensor from the bracket.
10) Fix the new home position sensor on the bracket using two M3×6 cross pan head screws.
11) Fix the reagent carousel sensor assembly on the big bottom plate using three M3×8 hexagon socket cap head screws. **Note to put the sensor assembly in the middle of the big bottom plate.** Manually rotate the reagent carousel and check that the coder does not interfere with the home position sensor. Adjust the sensor mounting plate to make the coder lie in the middle of the coder sensor, and then tighten the screws on the mounting plate.
12) Plug the connectors of the reagent carousel home position sensor and coder sensor.
13) After aligning the sensor assembly, restore the components in the reversed order.

Note:

When replacing only the coder sensor, skip step 9-10.

When replacing only the reagent carousel home position sensor, skip steps 5-8.

NOTE

- **Install the sensors according to the identifications on the cable connectors and the instrument connectors: "RGD--PHO-C" for coder sensor and "RGD--PHO-O" for home position sensor.**
- **Do not tighten the sensor screws with excessive torque force, in order to avoid damaging the sensors.**
- **Make sure to install the home position sensor in the correct position.**

Alignment and confirmation

Refer to ***7.5 Reagent Carousel Unit*** to check the reagent carousel position, and refer to ***7.7.3*** to check the horizontal positions of reagent probes to the inner and outer rings of reagent carousel.

3.2.8 Removing and Reinstalling Reagent Bar Code Reader (MS-3)

When to do

Replace the reagent bar code reader when it cannot work normally.

Tools

Hexagon wrench

Exploded view for installation

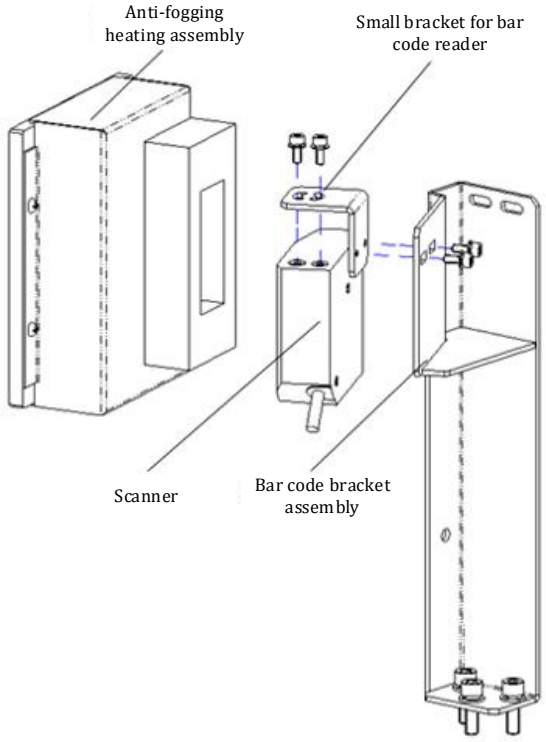


Figure 3-19 Reagent bar code reader

How to do

1) Remove the desk panels around the reagent bar code reader.
2) Loosen the two M3×10 hexagon socket screws on the small bracket, disconnect the reagent bar code reader cable from the instrument, and remove the bar code reader.
3) Install a new bar code reader and connect it in the reversed order of the above steps. Prevent the sponge cushion from blocking the light emitting window of the bar code reader. After attaching the bar code reader closely to the sponge cushion, use a tool to push aside the pressed part of the sponge cushion in order to prevent it from indenting and blocking the scanning window.

Alignment and confirmation

Refer to ***7.10.7*** to check the reagent bar code scanning position.

3.2.9 Removing and Reinstalling Reagent Bar Code Reader (BCLP5)

When to do

Replace the reagent bar code reader when it cannot work normally.

Tools

Hexagon wrench

Exploded view for installation

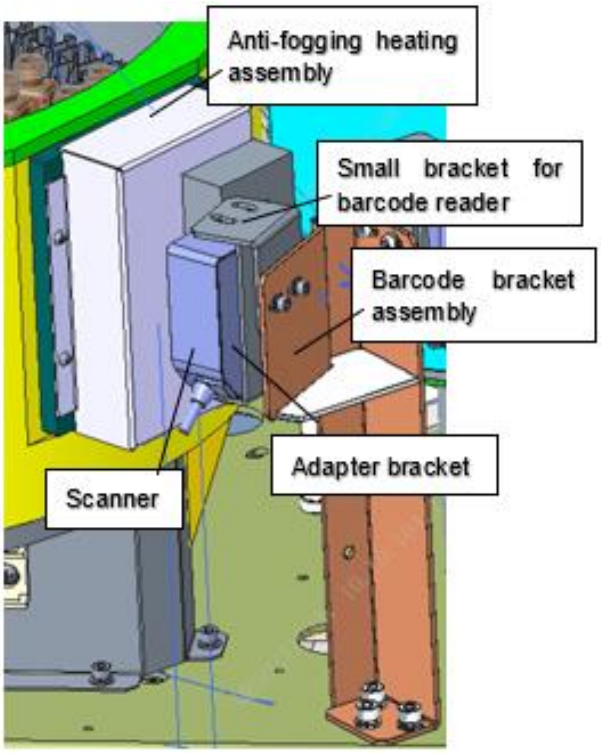


Figure 3-20 Reagent bar code reader

How to do

4) Remove the desk panels around the reagent bar code reader.
5) Loosen the two M3×10 hexagon socket screws on the small bracket and the adapter bracket respectively, disconnect the reagent bar code reader cable from the instrument, and remove the bar code reader.
6) Install a new bar code reader and connect it in the reversed order of the above steps. Prevent the sponge cushion from blocking the light emitting window of the bar code reader. After attaching the bar code reader closely to the sponge cushion, use a tool to push aside the pressed part of the sponge cushion in order to prevent it from indenting and blocking the scanning window.

Alignment and confirmation

Refer to ***7.10.7*** to check the reagent bar code scanning position.

3.2.10 Installing Reagent Anti-Fogging Heater Assembly

When to do

Replace the reagent anti-fogging heater assembly when the glass is damaged or the assembly does not work.

Tools

Hexagon wrench

Removing and reinstalling reagent anti-fogging heater assembly

1) Place a silicone pad in the groove of the anti-fogging device mounting plate, and make the rubber side contact the latter.
2) Place the anti-fogging glass on the silicone pad.
3) Lay the heat-conducting aluminum plate with the groove side facing upwards, and use six M2×8 cross pan head screws to fix it on the mounting plate.
4) Stick a heater to the groove on the aluminum plate.
5) Daub some thermal paste on the bottom side of the overheat protection switch and place the switch on the heater. Use one M3×12 hexagon screw to fix the protection switch with the switch plate.
6) Use four M3×10 pan head or countersunk head screws to fix the anti-fogging device mounting plate on the exterior wall of the reagent chamber.
7) Use four M3×6 pan head screws to fix the dust shield on the mounting plate.

8) Stick a sponge cushion to the dust shield.

Precautions:

1) Align the window of the silicone pad with that of the mounting plate.
2) Ensure that the glass is not cracked or dirty.
3) Lay the cables of the heater and overheat protection switch downwards as shown in the figure below for the purpose of convenient connection.
4) Align the window of the sponge cushion with that of the dust shield in order to ensure that the scanning light comes smoothly. Prevent the sponge cushion from blocking the light emitting window of the bar code reader. After attaching the bar code reader closely to the sponge cushion, use a tool to push aside the pressed part of the sponge cushion in order to prevent it from indenting and blocking the scanning window.

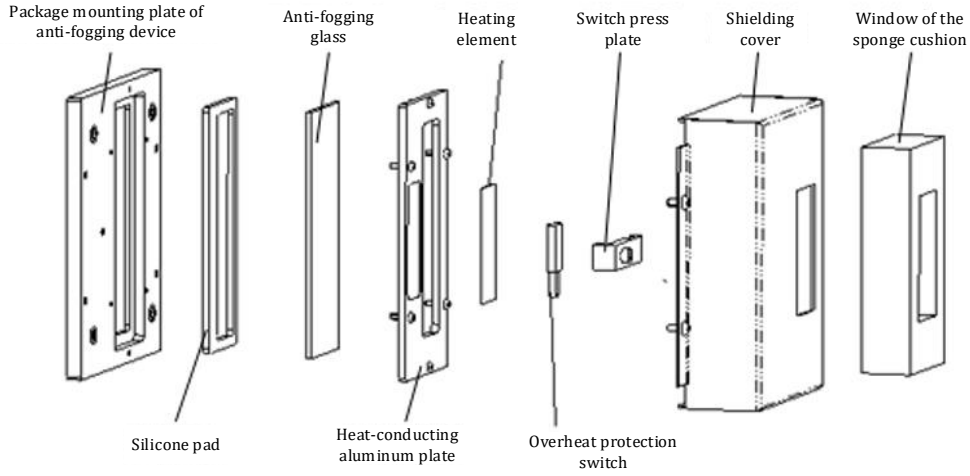


Figure 3-21 Anti-fogging heater module

Replacing reagent anti-fogging glass

1) Loosen the four M3×6 pan head screws to remove the dust shield from the anti-fogging device mounting plate.
2) Loosen the four M3×10 pan head or countersunk head screws on the mounting plate, disconnect the anti-fogging heater cable and temperature protection switch cable, and then remove the anti-fogging device from the reagent chamber.
3) Loosen the six M2×8 pan head screws on the heat-conducting aluminum plate, and then remove the aluminum plate together with the anti-fogging heater and temperature protection switch.
4) Remove the damaged glass from the mounting plate and clear the broken glass on the silicone pad. If necessary, replace the silicone pad. When installing a new silicone pad, make the rubber side contact the mounting plate, and then place the new glass window on the silicone pad. Ensure that the glass is not cracked or dirty.
5) Use six M2×8 cross pan head screws to fix the aluminum plate, anti-fogging heater and temperature protection switch on the mounting plate.
6) Use four M3×10 pan head or countersunk head screws to fix the anti-fogging device mounting plate on the exterior wall of the reagent chamber.
7) Use four M3×6 pan head screws to fix the dust shield on the mounting plate. Prevent the sponge cushion from blocking the light emitting window of the bar code reader. After attaching the bar code reader closely to the sponge cushion, use a tool to push aside the pressed part of the sponge cushion in order to prevent it from indenting and blocking the scanning window.

3.3 Sample Carousel Assembly

3.3.1 Module Functions

The sample carousel assembly, situated in the right front of the analyzer, consists of the carousel body assembly, chamber assembly, drive assembly, sensor assembly, motor assembly, and bar code reader assembly. It holds and carries sample containers to the specified position, and cooperates with the sample probe for sample dispensing etc.

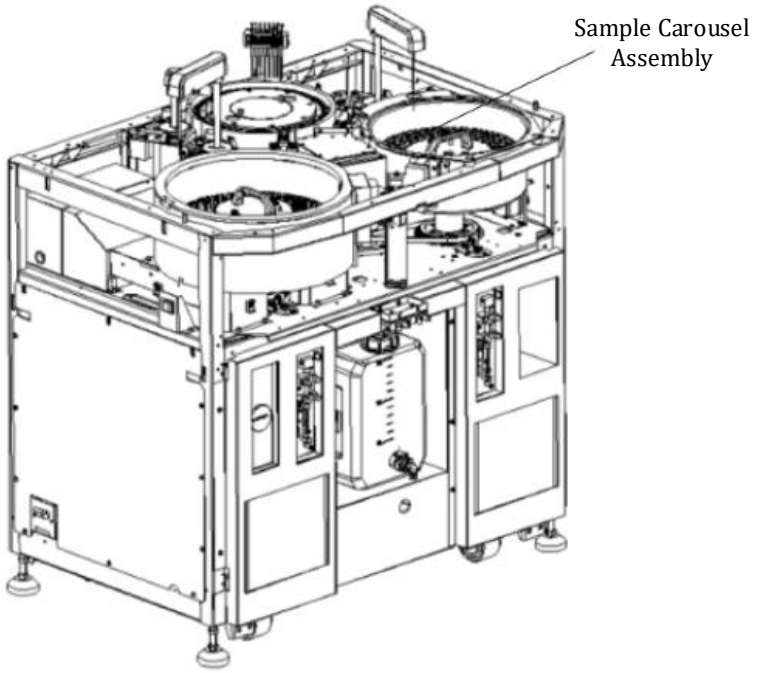


Figure 3-22 Location of sample carousel assembly on the instrument

3.3.2 Component Locations and FRU Details

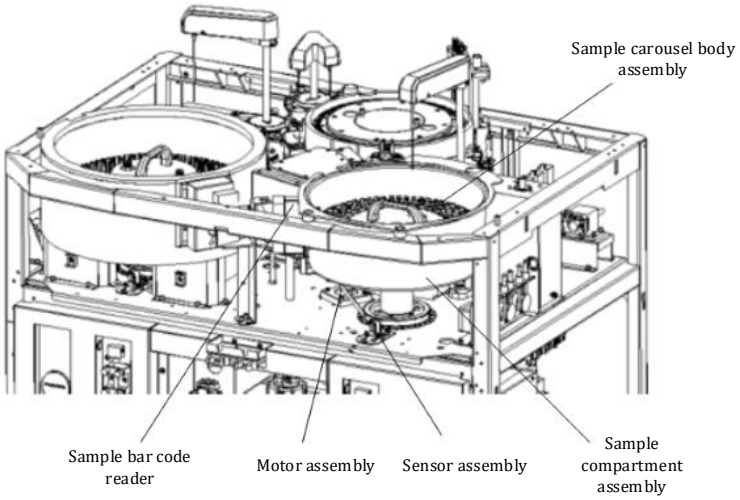


Figure 3-23 Sample carousel assembly

Table 3-2 List of materials

No.	FRU code and material code	Material Name	Remark
1	115-036346-00	Sample carousel body assembly	FRU
2	009-002204-00	Correlative optical coupler wire (S)	FRU / Home position or coder sensor
3	BA38-30-88129	2-carousel motor assembly	FRU/Sample carousel motor assembly
4	115-036993-00	Sample compartment assembly	FRU
5	BA40-20-61458	Tube holder	FRU
6	BA38-21-88063	Sample chamber	FRU
7	801-BA20-00001-00	Built-in bar code reader (featuring laser diversion)	FRU/Bar code reader (There are two configurations on the client end, with MS-3 bar code reader replaced by BAL95 bar code reader after EIB007.)
8	023-002082-00	BCL 95 M0R2 Laser built-in bar code reader	

3.3.3 Replacing Sample Carousel Body Assembly

When to do

Replace the sample carousel body assembly when it is damaged or cannot meet the operation requirements.

Tools

N/A

Exploded view for installation

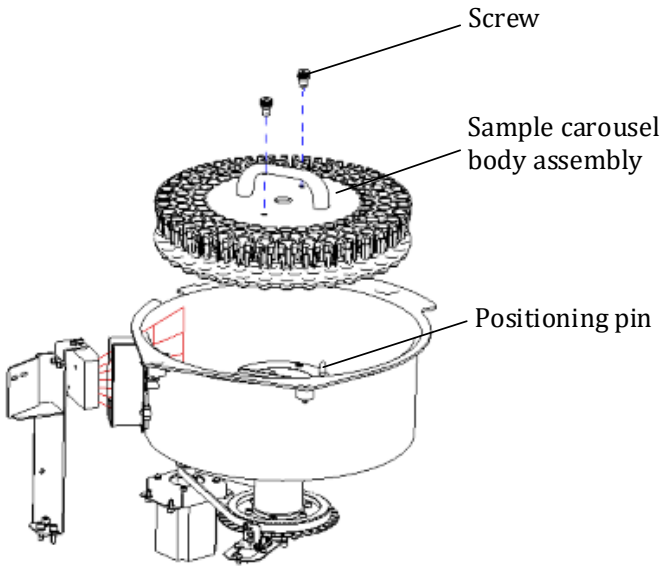


Figure 3-24 Sample carousel body assembly

How to do

1) Switch off the main power of the whole unit.
2) Remove the sample carousel cover.
3) Manually loosen the two screws on the sample carousel body assembly, and then remove the sample carousel body assembly.
4) Align the locating holes on the new sample carousel body with the stop bolts and place it on the rotating shaft sleeve of the sample carousel.
5) Tighten the two screws on the new sample carousel body assembly.

Alignment and confirmation
N/A

3.3.4 Replacement of Sample Carousel Home Sensor and Coder Sensor Cables

When to do
Replace the sample carousel home position sensor or the coder sensor when they fail.
Tools
Cross screwdriver and hexagon wrench
Exploded view for installation

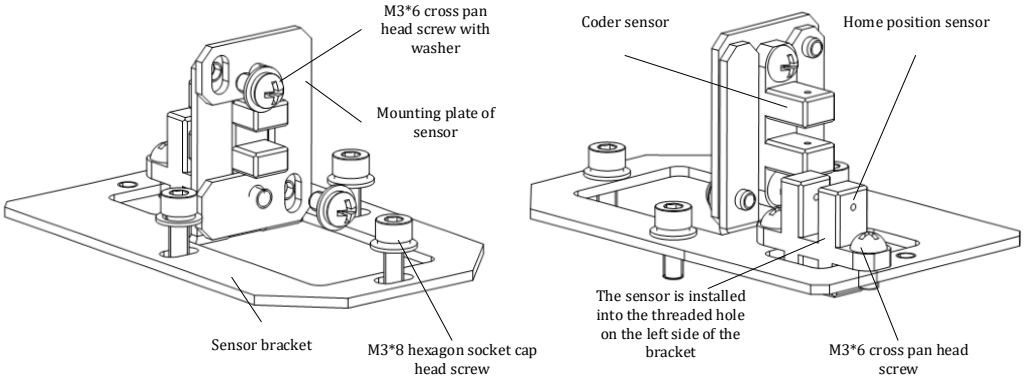


Figure 3-25 Sample carousel sensor assembly

How to do
1) Switch off the main power of the whole unit.
2) Rotate the sample probes to the sample dispense position, remove the sample carousel cover assembly, and loosen the M4×8 cross pan head screws with washers to remove the front desk panel.
3) Disconnect the home position sensor and coder sensor.
4) Loosen the M3×8 hexagon socket cap head screws with spring washers of the sample carousel sensor and remove the sensor assembly.
5) Loosen the two M3×6 cross pan head screws with washers on the sensor mounting plate, and then remove the sensor mounting plate together with the coder sensor.
6) Loosen the two M3×6 cross pan head screws on the coder sensor, and remove the coder sensor from the mounting plate.
7) Fix the new coder sensor on the mounting plate using two M3×6 cross pan head screws.
8) Install the mounting plate together with the coder sensor onto the sensor bracket using two M3×6 cross pan head screws with washers. Do not tighten them.
9) Loosen the two M3×6 cross pan head screws to remove the home position sensor from the bracket.
10) Fix the new home sensor onto the sensor bracket using two M3×6 cross pan head screws.
11) Fix the sample carousel sensor assembly on the big bottom plate using three M3×8 hexagon socket cap head screws with spring washers. **Note to put the sensor assembly in the middle of the big bottom plate.** Manually rotate the sample carousel and check that the coder does not interfere with the home position sensor. Adjust the sensor mounting plate to make the coder lie in the middle of the coder sensor, and then tighten the screws on the mounting plate.
12) Connect the home position sensor and coder sensor.
13) After aligning the sample carousel sensor assembly, restore the components in the reversed order.

NOTE:
To replace only the coder sensor cable, neglect step 9 and 10.
To replace only the home position sensor, neglect step 5 to 8.

NOTE

- **Install the sensors according to the identifications on the cable connectors and the instrument connectors: "RGD--PHO-C" for coder sensor and "RGD--PHO-O" for home**

position sensor.

- **Do not tighten the sensor screws with excessive torque force, in order to avoid damaging the sensors.**
- **Make sure to install the home position sensor in the correct position.**

Alignment and confirmation

Refer to ***7.4 Sample Carousel Unit*** to check the sample carousel position and refer to ***7.6 Sample Probe Unit*** to confirm the horizontal position when the sample probe is aligned with the inner/middle/outer ring of the sample carousel.

3.3.5 Removing and Reinstalling Sample Carousel Motor and Synchronous Belt

When to do

Replace the sample carousel motor and synchronous belt when they are damaged.

Tools

Cross screwdriver and hexagon wrench

Exploded view for installation

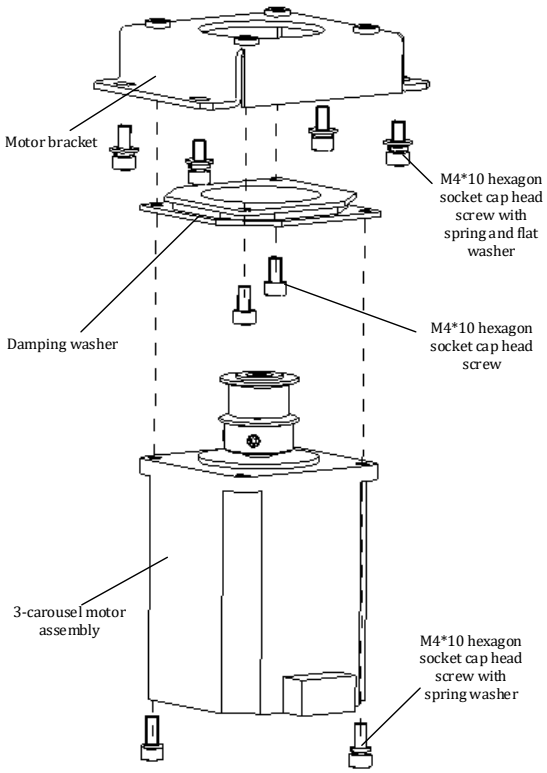


Figure 3-26 Removing/Installation Diagram for Sample Carousel Motor

How to do

Replace the motor:

1) Switch off the main power of the whole unit.
2) Remove the front desk panel and front panel weldment (the water tank and others need to be removed), and unplug the motor cable.
3) Loosen the four M4×10 hexagon socket cap head screws with spring and flat washers on the motor bracket to remove the synchronous belt from the belt pulley. Then, remove the motor assembly.
4) Loosen the two M4×10 hexagon socket cap head screws with spring washers on the motor to remove the 3-carousel motor assembly (with the belt pulley).
5) Fix a new motor with the belt pulley on the damping board using two M4×10 hexagon socket head screws with spring washers, and turn the motor connector back to the sample carousel.
6) Sleeve the synchronous belt on the small belt wheel. Fix the motor assembly to the big bottom plate using four M4×10 hexagon socket cap head screws with spring and flat washers. Tighten the synchronous belt and all screws and connect the motor cable.
7) Restore the components in the reversed order.

To replace the synchronous belt:

1) Switch off the main power of the whole unit.
2) Remove the sample carousel cover and the desk panel and the front desk panel around the sample carousel assembly.
3) Loosen the two screws to remove the sample carousel body assembly.
4) Loosen the three M3×10 hexagon socket cap head screws with spring washers to remove the rotating shaft sleeve of the sample carousel.
5) Loosen the three cross pan head screws to remove the sample chamber.
6) Remove the synchronous belt from the belt pulley. Install the new synchronous belt.
7) Restore the components in the reversed order.

NOTE

- **Do not remove the belt wheel of the 3-carousel motor assembly.**
- **Do not remove the two screws on the damping washer.**

Alignment and confirmation

N/A

3.3.6 Removing Sample Bar Code Reader (MS-3)

When to do

Replace the sample bar code reader when it does not work normally.

Tools

Hexagon wrench

Exploded view for installation

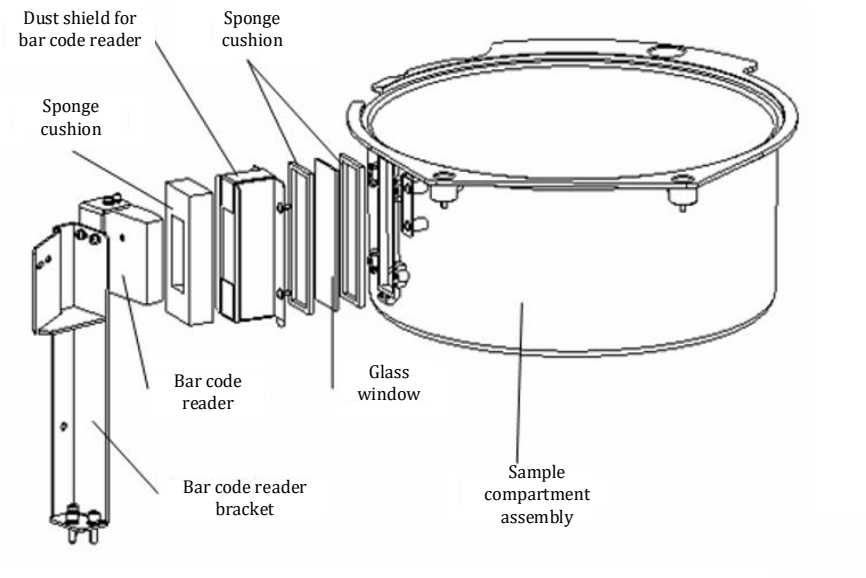


Figure 3-27 Sample bar code reader and sample chamber

How to do

To install the sample bar code assembly:

1) Apply sponge cushion 2 on two sides of the glass window, and note not to contaminate the window surface. The sponge cushion should align with the glass verge. Apply sponge cushion on the dust shield for bar code reader, and note to align its opening with that on the dust shield.
2) Place the glass window in the position of window of the sample carousel chamber. Use four M3×8 pan head screws to fix the bar code reader to the sample chamber.
3) Use two M3×8 hexagon socket screws with spring washer to fix the small bracket of the bar code reader to the square hole on the upper end of the bar code reader bracket.
4) Use two M3×10 hexagon socket screws with spring washer to fix the bar code reader on the small bracket.
5) Use two M5×12 hexagon socket screws with spring washer to fix the bar code reader bracket to the big bottom plate. Tighten the screws and connect the bar code reader cable. Use the strip to fix it to the bracket.

NOTE：

Prevent the sponge cushion from blocking the light emitting window of the bar code reader. After attaching the

bar code reader closely to the sponge cushion, use a tool to push aside the pressed part of the sponge cushion in order to prevent it from indenting and blocking the scanning window.

Replacing Bar Code Reader

1) Remove the sample carousel cover and three rubber plugs on the panel. Unscrew the three screws till they cannot be dropped. Open the front door, unscrew the four retaining screws on the front desk panel, and then remove the front desk panel.
2) Disconnect the bar code reader cable, loosen the wire clamp, unscrew the two M3×10 hexagon socket cap head screws on the bar code reader, and then remove the bar code reader.
3) Install the bar code reader on the small bracket with two M3×10 hexagon socket cap head screws with flat and spring washers, and then connect the bar code reader cable. Prevent the sponge cushion from blocking the light emitting window of the bar code reader. After attaching the bar code reader closely to the sponge cushion, use a tool to push aside the pressed part of the sponge cushion in order to prevent it from indenting and blocking the scanning window.
4) Restore the front desk panel and adjust the gap. Use three M4×10 pan head screws with washer to fix the top and then apply the rubber plugs on the panel. Fix the front with four M4×8 pan head screw with washer and then close the sample carousel cover.

Alignment and confirmation

Align the sample bar code reader according to ***7.10.3*** .

3.3.7 Removing Sample Bar Code Reader (BCL95)

When to do

Replace the sample bar code reader when it does not work normally.

Tools

Hexagon wrench

Exploded view for installation

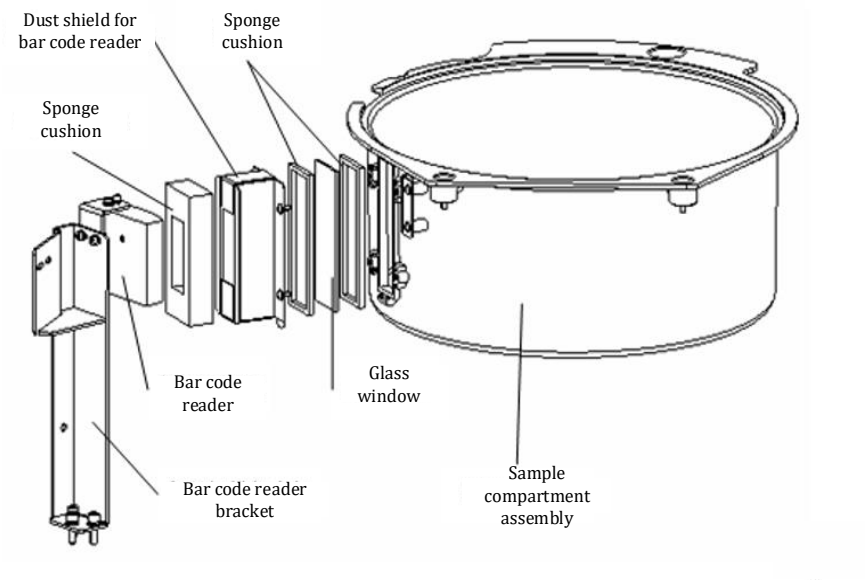
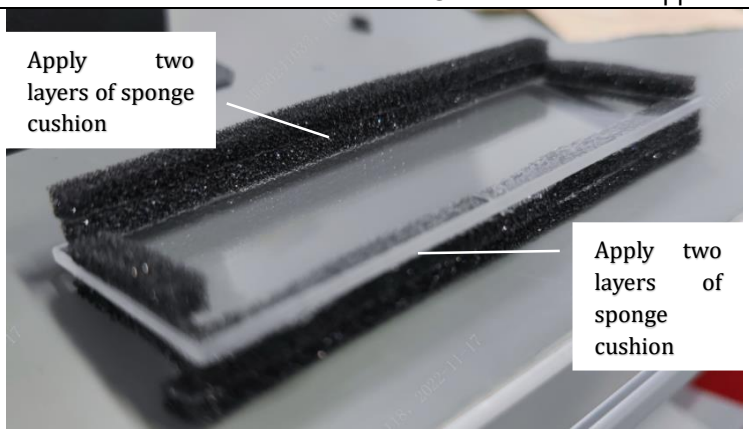


Figure 3-28 Sample bar code reader and sample chamber

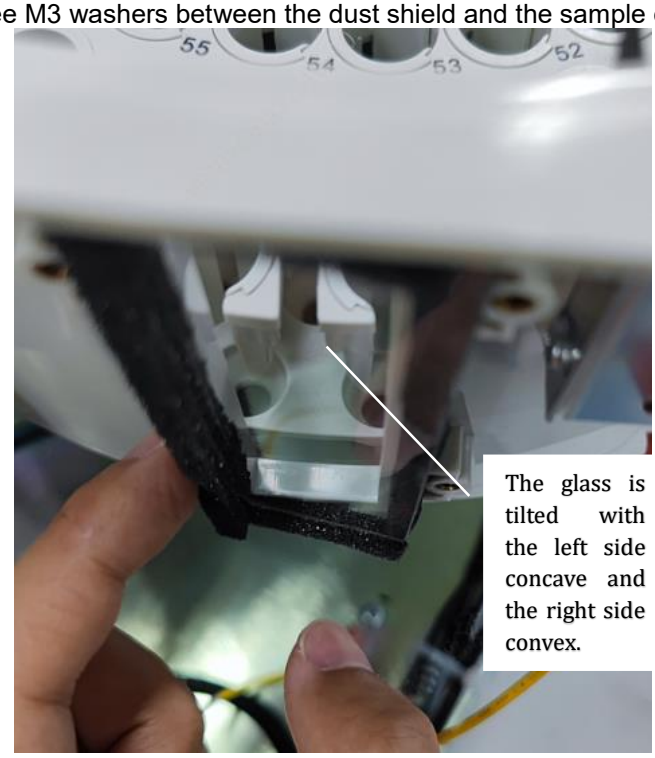
How to do

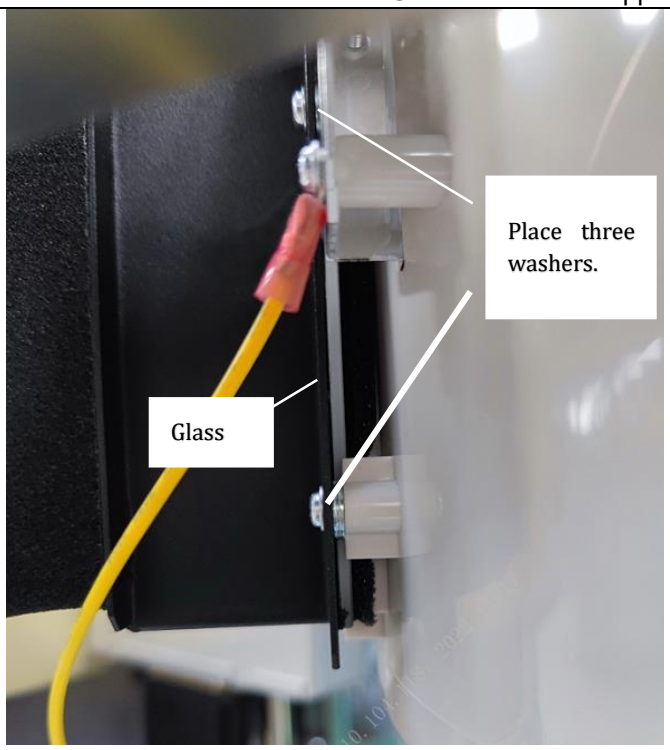
To install the sample bar code assembly:

1) Apply sponge cushion on two sides of the glass window, and note not to contaminate the window surface. The sponge cushion should align with the glass verge. Apply sponge cushion on the dust shield for bar code reader, and note to align its opening with that on the dust shield.

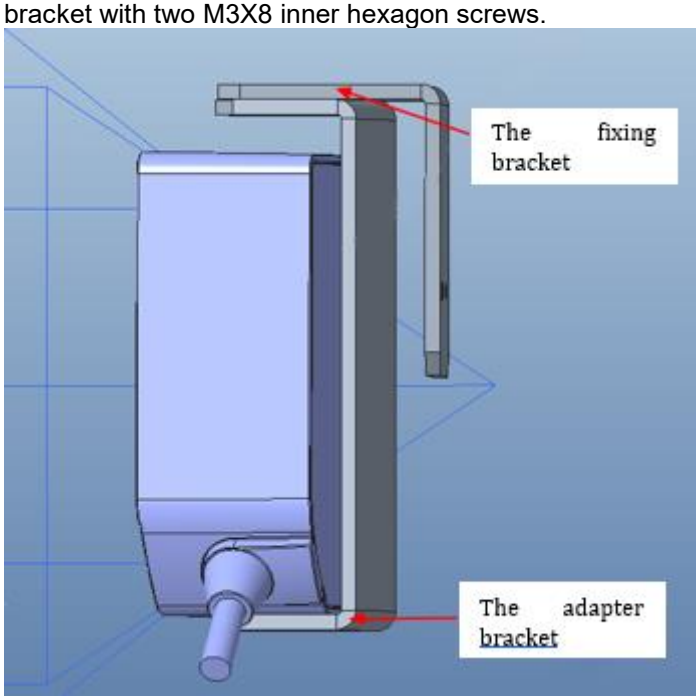


2) Place the glass window at the position of the sample carousel chamber as shown in the figure below. The glass window is tilted at an angle relative to the sample chamber due to one more layer of sponge on the diagonal line. Use four M3X8 pan head screws with washer to fix the bar code reader to the sample chamber. The glass is concave in the left and convex in the right. To avoid crushing the right glass, install the two screws with three M3 washers between the dust shield and the sample chamber.





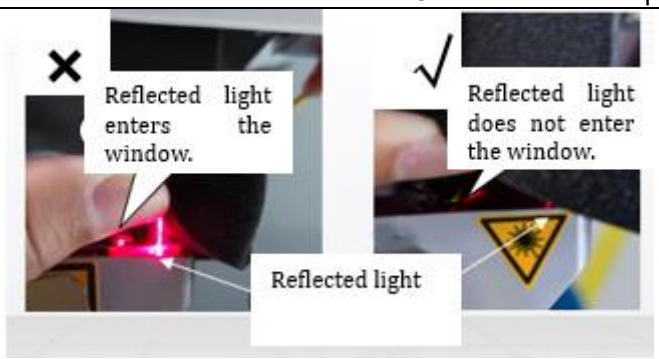
3) Install the scanner onto the adapter bracket with two M3X8 inner hexagon screws, and install the adapter bracket onto the fixing bracket with two M3X8 inner hexagon screws.



4) Use two M3×10 hexagon socket screws with spring washer to fix the bar code reader on the small bracket.
5) Use three M5×12 hexagon socket screws with spring washer to fix the larger bracket to the big bottom plate. Tighten the screws and connect the bar code reader cable. Use the strip to fix it to the bracket.

NOTE：

Tilt the glass at an angle as shown in the figure to prevent the reflected light from entering the receiving window of the bar code reader.



Do not let the sponge cushion shield the light emitting window of the bar code reader. After attaching the bar code reader closely to the sponge cushion, use a tool to push aside the pressed part of the sponge cushion in order to prevent it from indenting and blocking the scanning window.

Replacing Bar Code Reader

1) Remove the sample carousel cover and three rubber plugs on the panel. Unscrew the three screws till they cannot be dropped. Open the front door, unscrew the four retaining screws on the front desk panel, and then remove the front desk panel.
2) Disconnect the bar code reader cable, loosen the wire clamp, unscrew the two M3×10 hexagon socket cap head screws on the bar code reader, and then remove the bar code reader.
3) Install the bar code reader according to the descriptions above, and connect the barcode scanner cable. Do not let the sponge cushion shield the light emitting window of the bar code reader. After attaching the bar code reader closely to the sponge cushion, use a tool to push aside the pressed part of the sponge cushion in order to prevent it from indenting and blocking the scanning window.
4) Restore the front desk panel and adjust the gap. Use three M4×10 pan head screws with washer to fix the top and then apply the rubber plugs on the panel. Fix the front with four M4×8 pan head screw with washer and then close the sample carousel cover.

Alignment and confirmation

Align the sample bar code reader according to ***7.10.3*** .

3.4 Cuvette Wash Station

3.4.1 Module Functions

The cuvette wash unit, located in the rear right of the whole unit, consists of the wash probe assembly and wash probe drive assembly. It provides 8-phase auto wash for non-disposable reaction cuvettes so that they can be used repeatedly without influencing the test effects. The first 6 phases are wash probes that can dispense and aspirate water. The last 2 phases are wipe probes.

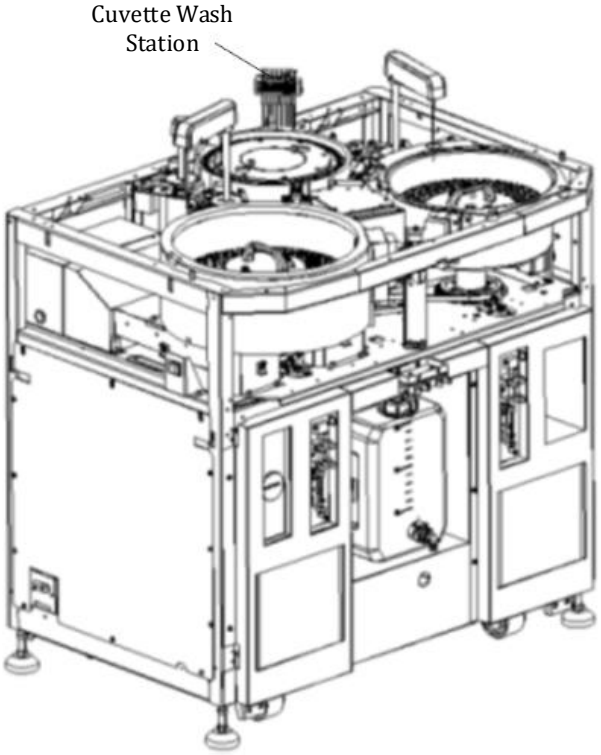


Figure 3-29 Location of the cuvette wash assembly

3.4.2 Component Locations and FRU Details

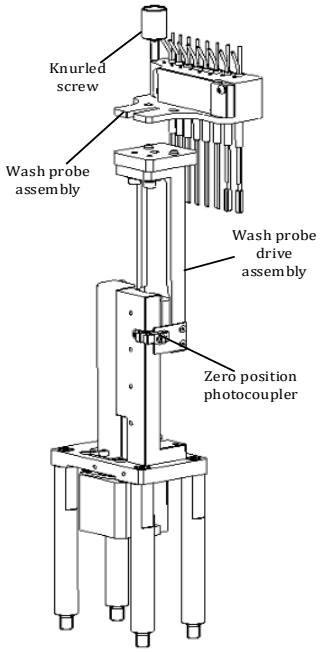


Figure 3-30 Cuvette wash assembly

Table 3-3 List of materials

No.	FRU code and material code	Material Name	Remark
1	115-036498-00	Wash probe assembly	FRU
2	051-001147-00	BA48 wash station photocoupler PCBA	FRU
3	115-013232-00	Wash probe drive assembly	FRU
4	009-002204-00	Correlative optical coupler wire (S)	FRU / Zero position photocoupler
5	041-022457-00	Wipe block	FRU

3.4.3 Replacing Wash Probe Assembly

When to do

Replace the wash probes when they are bent or damaged or the wipe blocks are damaged.

Tools

N/A

Exploded view for installation

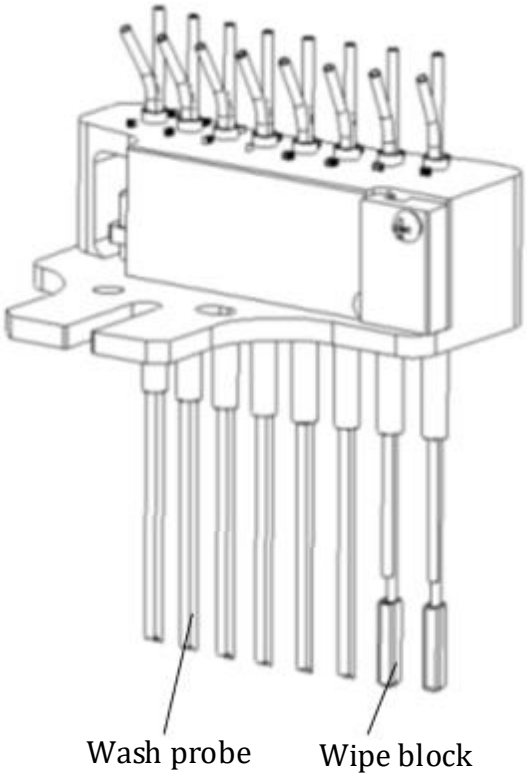


Figure 3-31 Wash probe assembly

How to do

1) Switch off the main power of the whole unit.
2) Open the shielding cover assembly, and manually loosen the two screws to remove the rear panel of light source assembly.
3) Unplug the cable connector of the BA48 wash station photocoupler.
4) Unplug the tubes and cables on the wash probe assembly, and manually loosen the knurled screw to remove the wash probe assembly.
5) Install the new wash probe assembly, manually tighten the knurled screw, and restore the tubes and cables according to their numbers.
6) Restore the components in the reversed order.

NOTE

- **Reinstall the tubes and cables on the wash probe assembly according to the number marking.**

Alignment and confirmation

Check the wash probes' vertical position in reaction cuvettes according to ***7.9 Alignment of Cuvette Wash Unit***

3.4.4 Replacing BA48 Wash Station Photocoupler

When to do

Replace the wash station photocoupler when it is damaged.

Tools

Cross screwdriver

Exploded view for installation

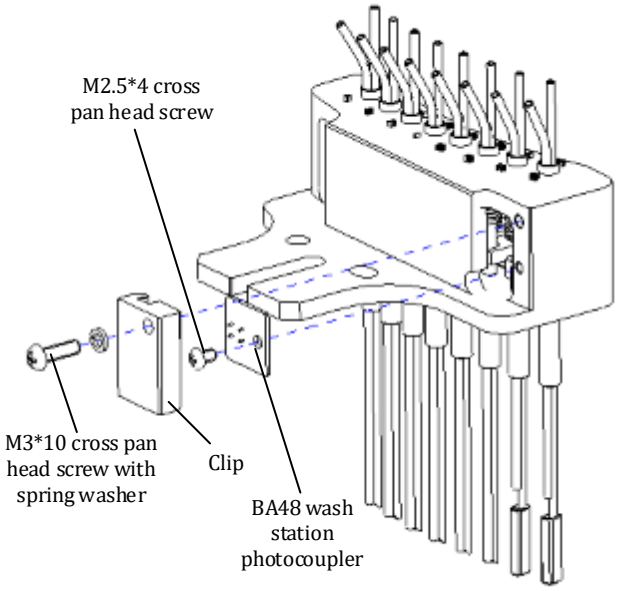


Figure 3-32 Wash station photocoupler

How to do

1) Switch off the main power of the whole unit.
2) Open the shielding cover assembly, and manually loosen the two screws to remove the rear panel of light source assembly.
3) Unplug the cable connector of the BA48 wash station photocoupler.
4) Unplug the tubes and cables on the wash probe assembly.
5) Manually loosen the knurled screw to remove the wash probe assembly.
6) Loosen the one M3×10 cross pan head screw with spring washer to remove the cable clamp.
7) Loosen the one M2.5×4 cross pan head screw to replace the BA48 wash station photocoupler with a new one, and tighten the screw again.
8) Restore the components in the reversed order.

NOTE

- **Reinstall the tubes and cables on the wash probe assembly according to the number marking.**

Alignment and confirmation

N/A

3.4.5 Replacing Wash Probe Drive Assembly

When to do

Replace the wash probe drive assembly when it is damaged.

Tools

Cross screwdriver and hexagon wrench

Exploded view for installation

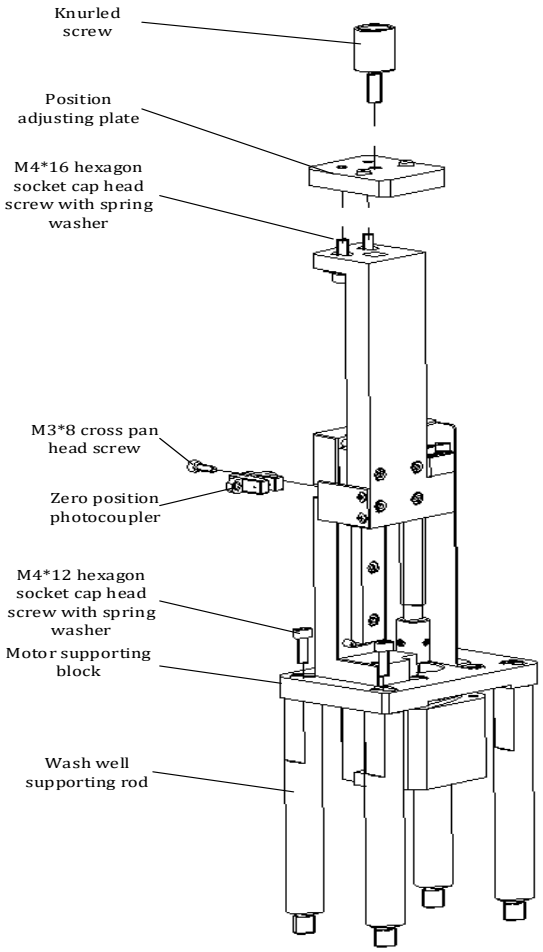


Figure 3-33 Wash probe drive assembly

How to do

1) Switch off the main power of the whole unit.
2) Open the shielding cover assembly, remove the reaction carousel cover, reagent carousel cover and sample carousel cover. Remove the front desk panel, the middle desk panel, the right desk panel, the rear panel of light source assembly and the left rear cover. Loosen and clean the desk panels.
3) Unplug the connectors of the BA48 wash station photocoupler, zero position photocoupler and motor. Manually loosen the knurled screw to remove the wash probe assembly and store it properly.
4) Loosen the four M4×12 hexagon socket cap head screws with spring washers on the motor supporting block, and remove the wash probe drive assembly.
5) Install the new wash probe drive assembly and lock it on the supporting rods with four M4×12 hexagon socket cap head screws with spring washers. Do not tighten the two M4×16 hexagon socket cap head screws with spring washers on the location adjustment plate, till you finish the alignment.
6) After alignment, restore the components in the reversed order.

Alignment and confirmation

Check the wash probes' vertical and horizontal positions in reaction cuvettes according to ***7.9 Alignment of Cuvette Wash Unit***.

3.4.6 Replacing Zero Position Photocoupler

When to do

Replace the zero position photocoupler on the wash probe drive assembly when it is damaged.

Tools

Cross screwdriver

Exploded View for Installation

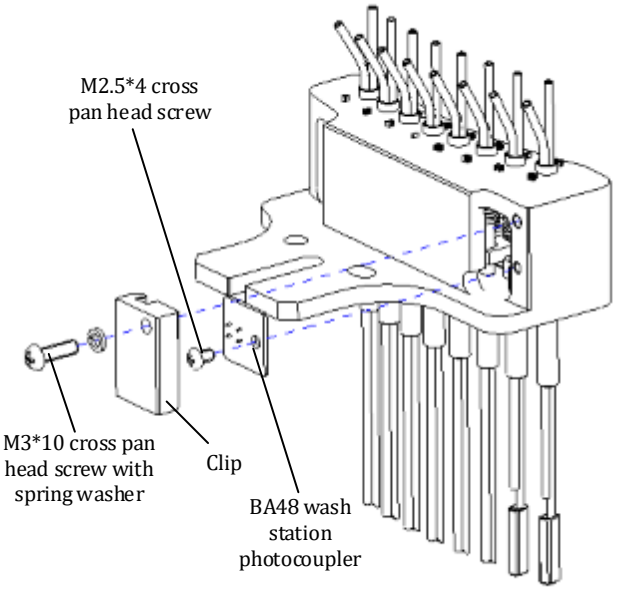


Figure 3-34 Zero Position Photocoupler

How to do

1) Switch off the main power of the whole unit.
2) Manually loosen the two screws to remove the rear panel of light source assembly, and loosen the M4×8 cross pan head screws to remove the rear left panel.
3) Unplug the connector of the zero position photocoupler.
4) Loosen the M3×8 cross pan head screw on the wash probe drive assembly, replace the zero position photocoupler with a new one, and then fix it with the screw.
5) Restore the components in the reversed order.

Alignment and confirmation

Adjust the wash probes' vertical position to reaction cuvettes according to ***7.9 Alignment of Cuvette Wash Unit***.

3.5 Sample/Reagent Probe Unit

3.5.1 Module Functions

The sample/reagent probe assembly includes sample probe movement part and reagent probe movement part. Sample movement part can aspirate the sample from the sample tube and dispense it into the cuvette through the sample probe. Reagent movement assembly can aspirate the reagent from the reagent bottle and dispense it into the cuvette through the reagent probe.

They both have the following functions: featuring level detection, horizontal/vertical bump detection and clog detection. The probe assembly has other functions, such as limiting of mechanical position, self-lock during power interruption, etc.

Sample/reagent probe position:

Sample probe assembly: wash well --> aspirate position on sample carousel --> dispense position on reaction carousel or ISE module.

Reagent probe assembly: wash well --> aspirate position on reagent carousel --> dispense position on reaction carousel.t

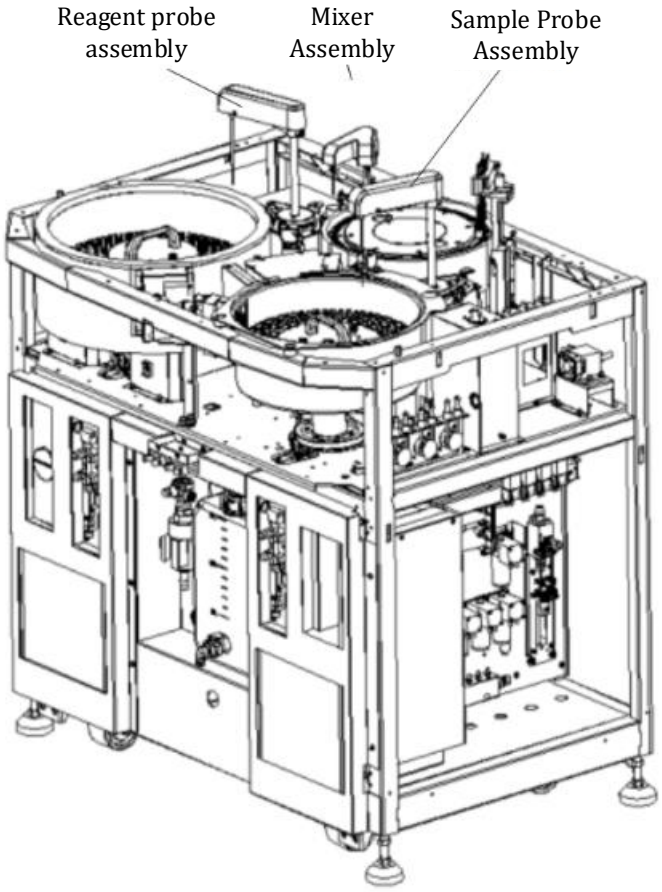


Figure 3-35 Locations of Sample Probes/Reagent Probes/Mixers Units on the Instrument

3.5.2 Component Locations and FRU Details

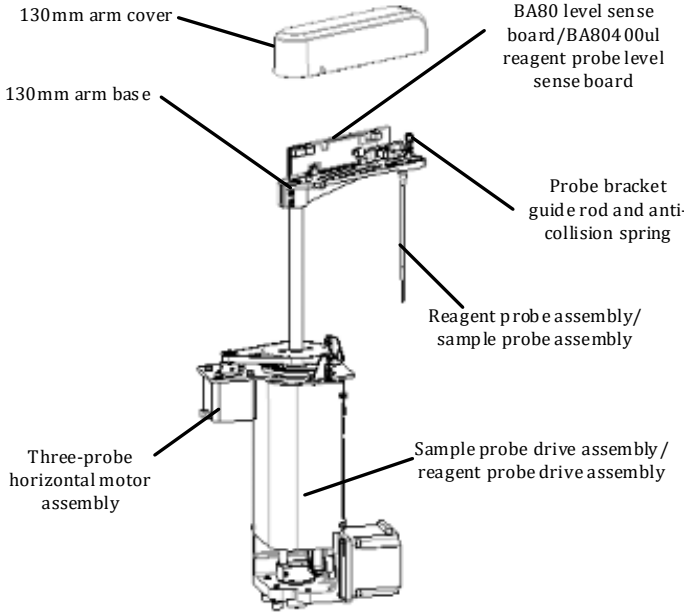


Figure 3-36 Sample/reagent probe assembly

Table 3-4st of materials

No.	FRU code and material code	Material Name	Remark
1	043-002344-00	130mm arm cover	FRU
2	044-000263-00	130mm arm base	FRU
3	115-079103-00	Reagent probe assembly	FRU
4	115-090662-00	Sample Probe Assembly	FRU
5	115-036617-00	Sample probe drive assembly	FRU
6	115-036619-00	Reagent probe drive assembly	FRU
7	115-089474-00	S3M horizontal motor assembly	FRU
8	801-BA80-00036-00	BA80 level detection board PCBA	FRU/Sample probe level sense board
9	801-BA80-00030-00	BA80 400μl reagent probe level sense board PCBA	FRU
10	009-002204-00	Correlative optical coupler wire (S)	FRU
11	043-002345-00	Probe bracket	FRU
12	115-089972-00	Spring guide post & Anti-collision spring	FRU (Applicable for sample probe)
12	041-003368-00	Spring guide post	FRU (Applicable for reagent probe)
13	033-000108-00	Anti-collision spring	FRU
14	041-009179-00	Hardened power screw (M3×6)	FRU
15	0040-10-32307	Valve Washer,10-32,18011Telfon washer	FRU/Sample probe washer
16	0040-10-32303	Kleohn14271 Teflon washer, 14271 washer	FRU/Reagent probe washer (Applicable only to the old reagent 115-007022-01)

3.5.3 Replacing Sample/Reagent Probe Assembly

Note: The replacement of sample probe assembly is the same as that of reagent probe assembly. The following takes the replacement of sample probe assembly as an example.

When to do

When the probe is bent or rusted, or the anti-collision spring is impaired in functioning, or the level sense board goes wrong, replace it.

Tools

Cross screwdriver, flathead screwdriver, hexagon wrench, and cutting pliers

Exploded view for installation

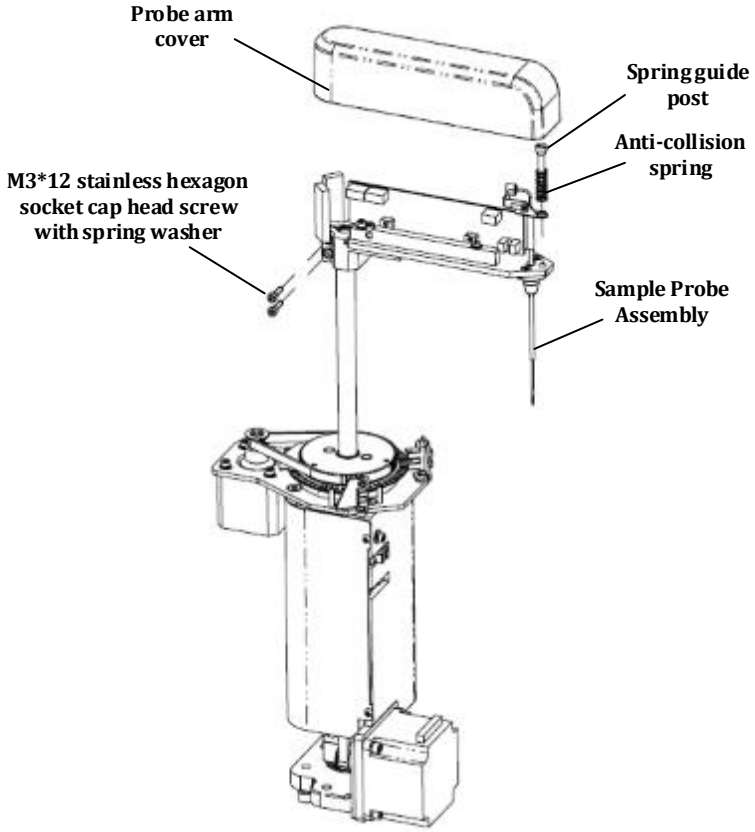


Figure 3-37 Removing/Installation Diagram for Sample/Reagent Probe Assembly

How to do

1) Switch off the main power of the whole unit.
2) Open the shielding cover.
3) Loosen the powder screws on two sides of the probe cover, and lift the cover to remove it.
4) Unplug the cable from the level sense board.
5) Remove the fluidic tube connector.
6) Remove the spring guide post and the anti-collision spring.
7) Remove the sample probe assembly.
8) Loosen the two M3×12 hexagon socket cap head screws with washer on the sample probe arm assembly, and then remove the arm assembly.
9) Fix the new sample probe arm assembly on the precision shaft using two M3×12 hexagon socket cap head screws with spring washer.
10) Lead the new sample probe assembly through the mixer arm and support sleeve.
11) Fix the new anti-collision spring on the probe arm using the spring guide post.
12) Restore the components in the reversed order.

Note:

If only the level sense board needs to be replaced, skip steps 5 to 11.

Alignment and confirmation

Refer to ***7.6 Sample Probe Unit*** and to ***7.6.9 Sample Probe Rotary*** to ISE (Caretium ISE Module Configured)

Alignment index:

The sample probe has its tip above the ISE sample injection port but deviates slightly from the central hole. The probe tip should not contact with the inner wall of the sample inject port.

Alignment methods and procedure:

1) Check if the ISE module has been installed.

2) Select Sample Probe Rotary to ISE.
3) In Step 3, select the down arrow button to lower the sample probe to above the ISE sample injection port. Select the left/right arrow buttons to adjust the sample probe radially till it is 1-2 mm away from the center of the sample injection port or deviating slightly from the central hole.
4) If the sample probe fails by adjusting parameters, loosen the retaining screw on the ISE sample cup and move it till requests are met.
5) The operation in Step 3 is verified in Step 4. If requirements are not met, return to Step 3.
6) Select Continue to save parameters and exit the window.

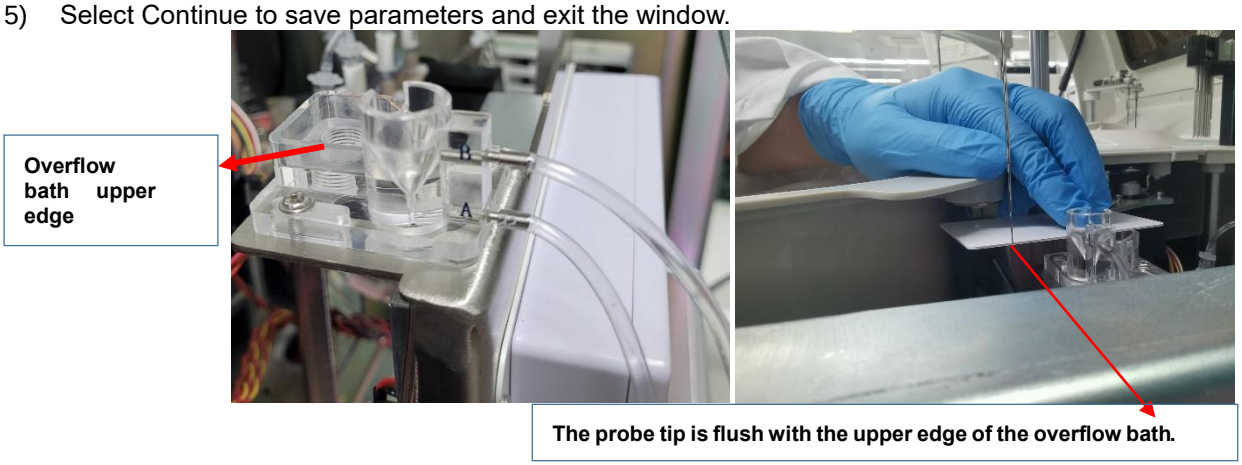
3.5.4 Sample Probe Rotary to ISE Vertical Extreme Height (Caretium ISE Module Configured)

Alignment index:

The sample probe tip should be level with the top edge of the overflow bath and not contact with the interior of the sample injection port.

Alignment methods and procedure:

1) Check if the alignment of Sample Probe Rotary to ISE has been completed.
2) Select Sample Probe Rotary to ISE Vertical Extreme Height.
3) In Step 3, select the up/down arrow buttons to make the probe tip level with the top edge of the overflow bath.
4) The operation in Step 3 is verified in Step 4. If requirements are not met, return to Step 3.
5) Select Continue to save parameters and exit the window.



NOTE

- **Alignment of each position is verified the next step.**
- **Alignment parameters can be saved only after each procedure is complete. Another alignment is required if a procedure is terminated.**
- **If the parameter is not successfully configured or out of range, the parameter range will be displayed by the alarm message and re-perform the alignment.**
- **After adjusting the horizontal and vertical positions, make sure the probe tip does not touch the wall.**
- **To adjust it precisely to the upper edge of the overflow bath, take out a flat card (such as the RFID card or work card in the reagent pack), place it in the overflow bath, and adjust the sample probe to the plane where the card and the upper edge of the overflow bath after returning from step 4 to step 3.**

Reagent Probe Unit perform the alignment related to the sample/reagent probe.

3.5.5 Replacing Reagent Probe Drive Assembly

When to do

Replace the reagent probe drive assembly when the assembly as a whole or one of its components is impaired in functioning or damaged.

Tools

Cross screwdriver, hexagon wrench and cutting **pliers**

Exploded view for installation

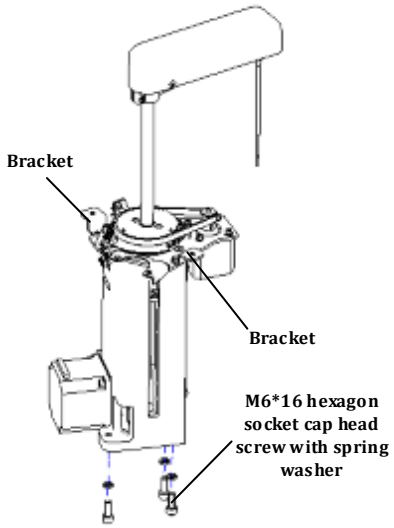
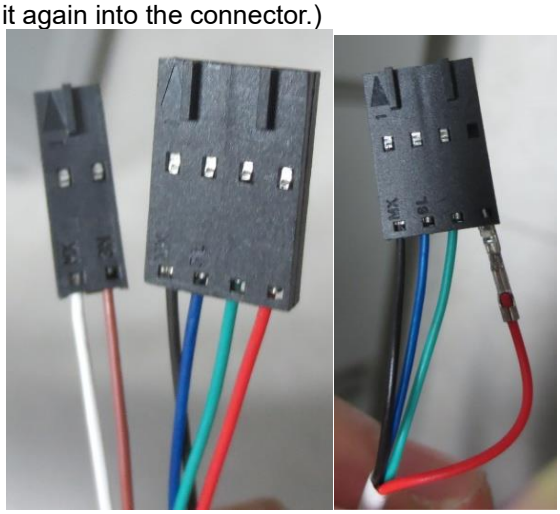


Figure 3-38 Reagent probe drive assembly

How to do

1) Switch off the main power of the whole unit.
2) Open the shielding cover, and remove the desk panels around the sample probe movement part, and the rear right panel, and then remove the mixer wash well.
3) Unplug the reagent probe drive motor cable, sensor cable and wash tube, cut off the connector (beneath the big bottom plate) on the cables passing through the precision shaft, cut off the wash tube connector connecting the syringe, remove the braided hose (about 400mm), and then remove the reagent probe arm assembly. Refer to ***3.5.3*** to remove the sample/reagent probe arm assembly.
4) (Note: Make sure to install the cable connector in place. If the cable can be pulled out from the connector, lift the cable barb and insert it again into the connector.)



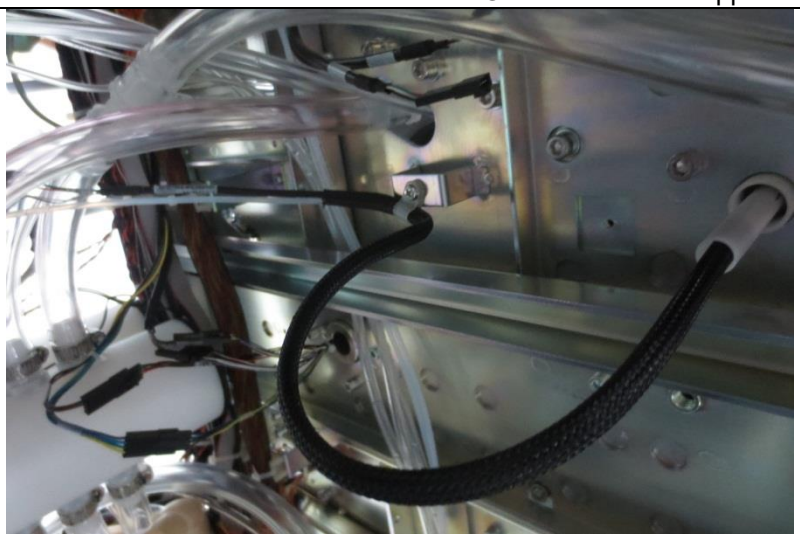


Figure 3-39 Remove the cable connector and install the braided hoses

5) Loosen the three M6×16 hexagon screws with spring washers to remove the sample probe drive assembly from beneath the big bottom plate. Remove the two brackets and install them on the new sample probe drive assembly.
6) Fix the new reagent probe drive assembly on the big bottom plate using three M6×16 hexagon socket cap head screws with spring washer. Make sure to lead the wash tube and sensor cable through the precision shaft prior to the installation.
7) Restore the components in the reversed order.

NOTE:

During installation, put the smaller end of the positioning sleeve under the vertical drive assembly downwards into the large bottom plate, and insert the larger end into the vertical drive assembly to realize positioning.

When installing the sensor of the sample probe drive assembly, lead the cable through the supporting flange, connect the terminal block, insert the braided hose into the protection sleeve for about 20mm deep, raise the arm to the highest position, and tighten the braided hose and cable with a cable tie at 10mm away from the protection sleeve. See the figure below. Align the Teflon tube and cables, lead the braided hose for 10-20mm more than the cable tie position, use a cable clamp UC-1 to pinch the braided hose at the cable tie position, and then use one M4×8 pan head screw with washer to fix the cable clamp on the bottom plate.

Figure 3-40 Install the braided hose

Alignment and confirmation

Align and confirm the reagent probe's positions on the reaction carousel, reagent carousel and wash well, according to***7.6.9 Sample Probe Rotary*** to ISE (Caretium ISE Module Configured)

Alignment index:

The sample probe has its tip above the ISE sample injection port but deviates slightly from the central hole. The probe tip should not contact with the inner wall of the sample inject port.

Alignment methods and procedure:

7) Check if the ISE module has been installed.
8) Select Sample Probe Rotary to ISE.
9) In Step 3, select the down arrow button to lower the sample probe to above the ISE sample injection port. Select the left/right arrow buttons to adjust the sample probe radially till it is 1-2 mm away from the center of the sample injection port or deviating slightly from the central hole.
10) If the sample probe fails by adjusting parameters, loosen the retaining screw on the ISE sample cup and move it till requests are met.
11) The operation in Step 3 is verified in Step 4. If requirements are not met, return to Step 3.
12) Select Continue to save parameters and exit the window.

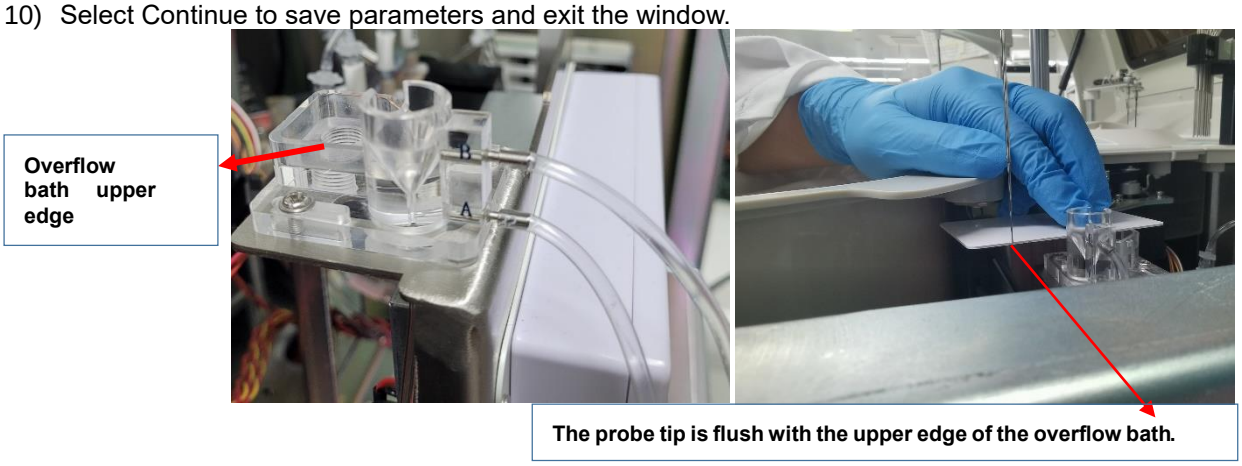
3.5.6 Sample Probe Rotary to ISE Vertical Extreme Height (Caretium ISE Module Configured)

Alignment index:

The sample probe tip should be level with the top edge of the overflow bath and not contact with the interior of the sample injection port.

Alignment methods and procedure:

6) Check if the alignment of Sample Probe Rotary to ISE has been completed.
7) Select Sample Probe Rotary to ISE Vertical Extreme Height.
8) In Step 3, select the up/down arrow buttons to make the probe tip level with the top edge of the overflow bath.
9) The operation in Step 3 is verified in Step 4. If requirements are not met, return to Step 3.
10) Select Continue to save parameters and exit the window.



NOTE

- **Alignment of each position is verified the next step.**
- **Alignment parameters can be saved only after each procedure is complete. Another alignment is required if a procedure is terminated.**
- **If the parameter is not successfully configured or out of range, the parameter range will be displayed by the alarm message and re-perform the alignment.**
- **After adjusting the horizontal and vertical positions, make sure the probe tip does not touch the wall.**
- **To adjust it precisely to the upper edge of the overflow bath, take out a flat card (such as the RFID card or work card in the reagent pack), place it in the overflow bath, and adjust the sample probe to the plane where the card and the upper edge of the overflow bath after returning from step 4 to step 3.**

Reagent Probe Unit.

3.5.7 Replacement of Sample Probe Drive Assembly

When to do

Replace the sample probe drive assembly when the assembly as a whole or one of its components is impaired in functioning or damaged.

Tools

Cross screwdriver, flathead screwdriver, hexagon wrench, and cutting pliers

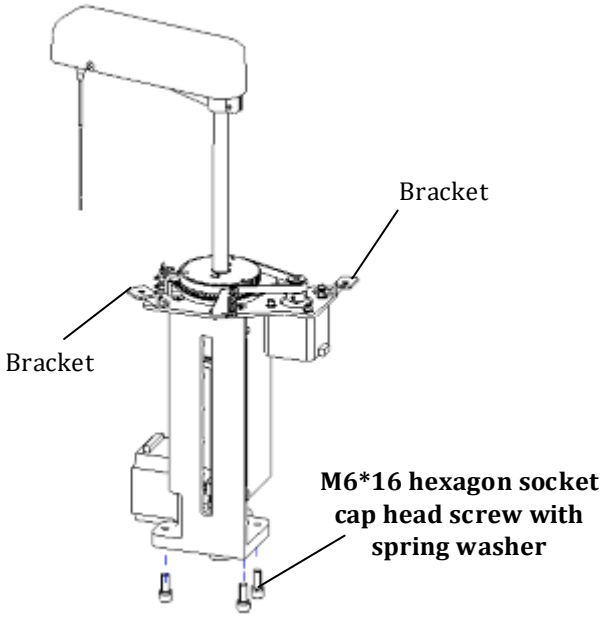
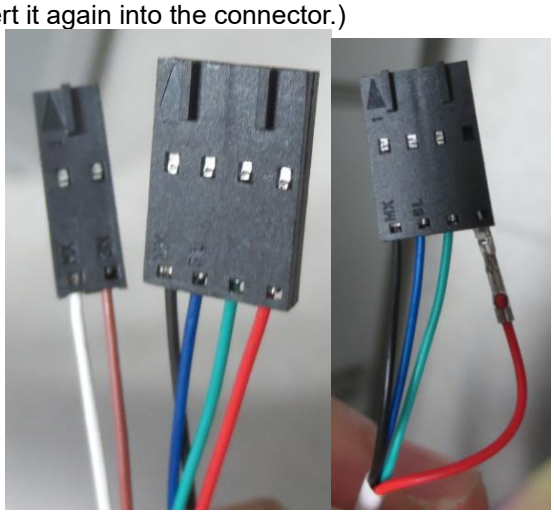


Figure 3-41 sample probe drive assembly

How to do

1) Switch off the main power of the whole unit.
2) Open the shielding cover, and remove the desk panels around the sample probe motion assembly, the right side panel and the rear left panel.
3) Remove the sample carousel body assembly, rotating shaft sleeve, and sample chamber assembly. Make sure to disconnect the earthing wire of the sample chamber assembly from the big bottom plate.
4) Unplug the sample probe drive motor cable, sensor cable and wash tube, cut off the connector (beneath the big bottom plate) on the cables passing through the precision shaft, cut off the wash tube connector connecting the syringe, remove the braided hose (about 400mm). Refer to ***3.5.3*** to remove the sample/reagent probe arm assembly.
5) (Note: Make sure to install the cable connector in place. If the cable can be pulled out from the connector, lift the cable barb and insert it again into the connector.)



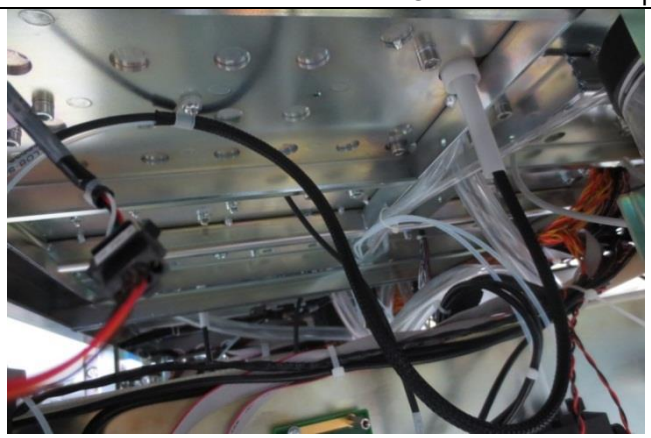


Figure 3-42 Remove the cable connector and install the braided hoses

6) Loosen the three M6×16 hexagon screws with spring washer to remove the sample probe drive assembly from beneath the big bottom plate. Remove the two brackets on it and install them on the new sample probe drive assembly.
7) Fix the new sample probe drive assembly on the big bottom plate using three M6×16 hexagon socket cap head screws with spring washer. Make sure to lead the wash tube and sensor cable through the precision shaft prior to the installation.
8) Restore the components in the reversed order.

NOTE:

During installation, put the smaller end of the positioning sleeve under the vertical drive assembly downwards into the large bottom plate, and insert the larger end into the vertical drive assembly to realize positioning. Connect the sensor cable connector on the sample probe drive assembly after leading the cable through the supporting flange.

Make sure to connect the earthing wire of the sample chamber assembly to the big bottom plate.

Insert the braided hose into the protection sleeve for about 20mm deep, raise the probe arm to the highest position, and tighten the braided hose and cable with a cable tie at 10mm away from the protection sleeve. See the figure below. Align the Teflon tube and cables, lead the braided hose for 10-20mm more than the cable tie position, use a cable clamp UC01 to pinch the braided hose at the cable tie position, and then use an M4×8 pan head screw with washer to fix the cable clamp on the bottom plate.

Figure 3-43 Install the braided hose

Alignment and confirmation

Align and confirm the sample probe' positions on the reaction carousel, sample carousel, wash well, and ISE module according to ***7.6 Sample Probe Unit***.

3.5.8 Replacing 3-probe Horizontal Motor Assembly and Synchronous Belt

When to do

Replace the sample/reagent probe horizontal motor assembly and synchronous belt when they are impaired in functioning or damaged.

Tools

Cross screwdriver and hexagon wrench

Exploded view for installation

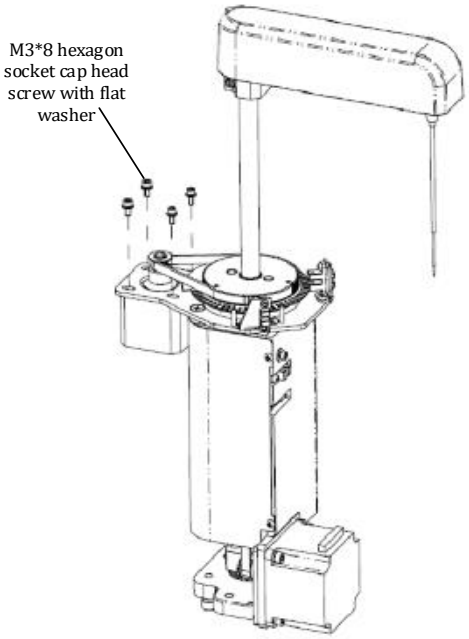


Figure 3-44 3-probe horizontal motor assemble

How to do

1) Switch off the main power of the whole unit.
2) Open the shielding cover and remove the desk panels around the probe/reagent probe unit, the reagent carousel cover and sample carousel cover.
3) Disconnect the 3-probe horizontal motor assembly.
4) Loosen the four M3×8 hexagon socket cap head screws with spring and flat washers on the sample/reagent probe horizontal motor assembly, and then remove the 3-probe horizontal motor assembly and synchronous belt.
5) Fix the new 3-probe horizontal motor assembly onto the horizontal motor bracket using four M3×8 hexagon socket head cap screws with spring and flat washers, and do not tighten the screws. Sleeve the new cog belt on the synchronous belt wheel, tighten the belt wheel, and then tighten the screws on the motor assembly.
6) Restore the components in the reversed order.

Alignment and confirmation

Refer to ***7.6 Sample Probe Unit*** and ***7.6.9 Sample Probe Rotary*** to ISE (Caretium ISE Module Configured)

Alignment index:

The sample probe has its tip above the ISE sample injection port but deviates slightly from the central hole. The probe tip should not contact with the inner wall of the sample inject port.

Alignment methods and procedure:

13) Check if the ISE module has been installed.
14) Select Sample Probe Rotary to ISE.
15) In Step 3, select the down arrow button to lower the sample probe to above the ISE sample injection port. Select the left/right arrow buttons to adjust the sample probe radially till it is 1-2 mm away from the center of the sample injection port or deviating slightly from the central hole.
16) If the sample probe fails by adjusting parameters, loosen the retaining screw on the ISE sample cup and

move it till requests are met.

17) The operation in Step 3 is verified in Step 4. If requirements are not met, return to Step 3.
18) Select Continue to save parameters and exit the window.

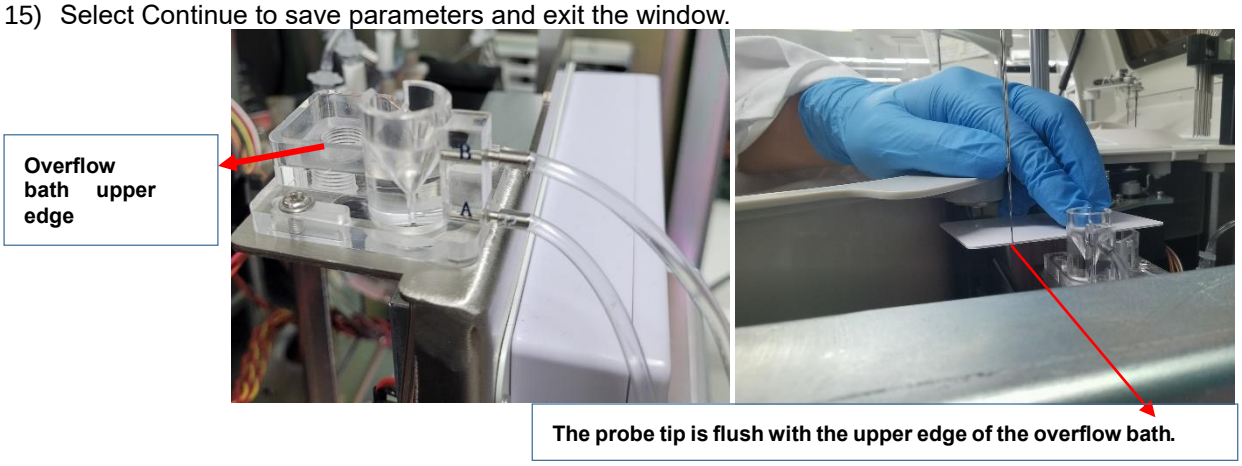
3.5.9 Sample Probe Rotary to ISE Vertical Extreme Height (Caretium ISE Module Configured)

Alignment index:

The sample probe tip should be level with the top edge of the overflow bath and not contact with the interior of the sample injection port.

Alignment methods and procedure:

11) Check if the alignment of Sample Probe Rotary to ISE has been completed.
12) Select Sample Probe Rotary to ISE Vertical Extreme Height.
13) In Step 3, select the up/down arrow buttons to make the probe tip level with the top edge of the overflow bath.
14) The operation in Step 3 is verified in Step 4. If requirements are not met, return to Step 3.
15) Select Continue to save parameters and exit the window.



NOTE

- **Alignment of each position is verified the next step.**
- **Alignment parameters can be saved only after each procedure is complete. Another alignment is required if a procedure is terminated.**
- **If the parameter is not successfully configured or out of range, the parameter range will be displayed by the alarm message and re-perform the alignment.**
- **After adjusting the horizontal and vertical positions, make sure the probe tip does not touch the wall.**
- **To adjust it precisely to the upper edge of the overflow bath, take out a flat card (such as the RFID card or work card in the reagent pack), place it in the overflow bath, and adjust the sample probe to the plane where the card and the upper edge of the overflow bath after returning from step 4 to step 3.**

Reagent Probe Unit to perform the alignment related to the reagent probe.

3.6 Mixer Unit

3.6.1 Module Functions

The mixer unit includes the sample mixer assembly and reagent mixer assembly, which share the same set of vertical drive assembly to mix the reaction liquid after sample and reagent are respectively dispensed. The mixer unit is located in the rear left of the instrument.

3.6.2 Component Locations and FRU Details

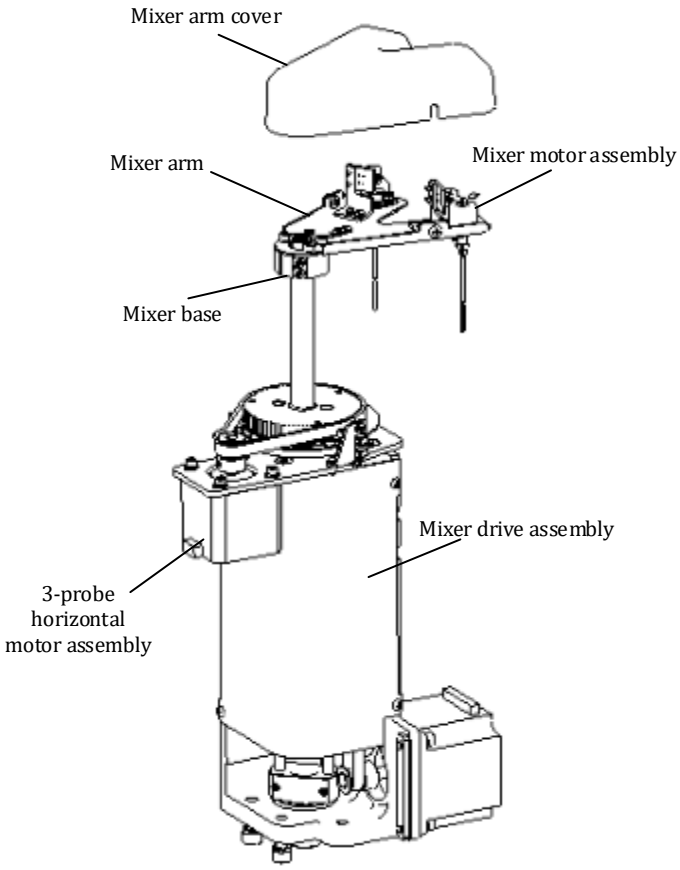


Figure 3-45 Mixer movement assembly

Table 3-5 List of materials

No.	FRU code and material code	Material Name	Remark
1	115-036615-00	Mixer drive assembly	FRU
2	041-047172-00	Mixer	FRU (EIB009)
3	041-020846-00	Retaining nut	FRU
4	115-027877-00	Mixer motor assembly	FRU
5	043-006907-00	Mixer arm cover	FRU
6	042-017010-00	Mixer arm	FRU
7	041-022527-00	Mixer base	FRU
8	115-089474-00	S3M horizontal motor assembly	FRU
9	009-002204-00	Correlative optical coupler wire (S)	FRU
10	051-001620-00	Rotation speed photocoupler conversion board	FRU
11	041-009179-00	Hardened power screw (M3×6)	FRU

3.6.3 Replacing Mixer Arm Assembly

Replacement of the mixer arm assembly includes the replacement of the mixer, mixing motor assembly,

conversion board of rotation speed detection optical coupler, and mixer arm assembly.

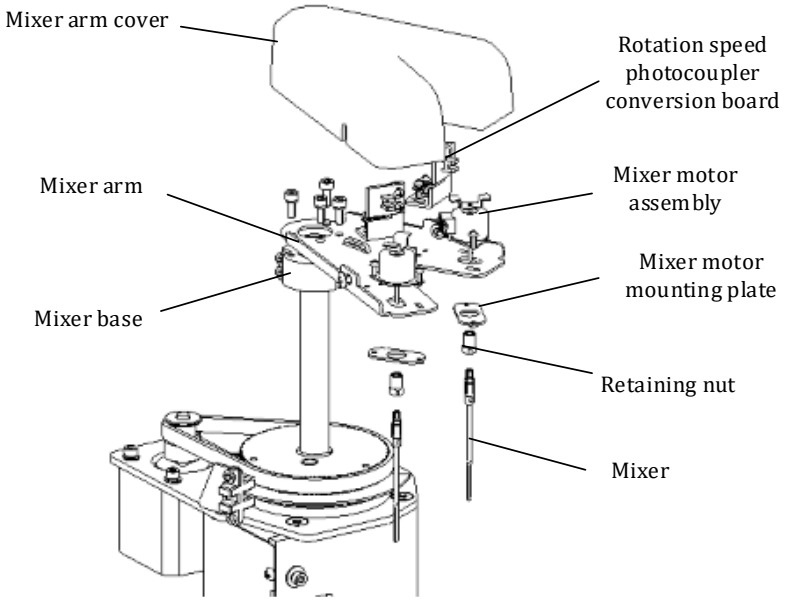


Figure 3-46 Removing/Installation Diagram for Mixer Arm Assembly

Replacing Mixer

When to do
Replace the mixer when it is bent or damaged.
Tools
Two wrench fixtures (BA60-J21)
Exploded view for installation

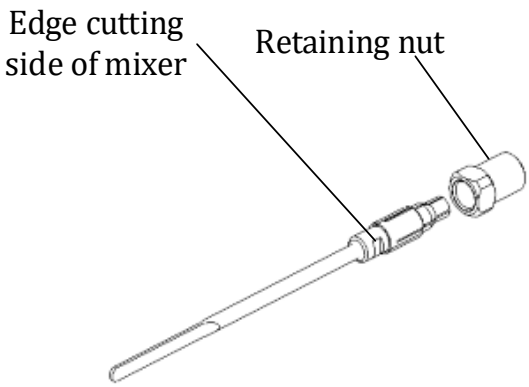


Figure 3-47 Mixer

How to do
1) Switch off the main power of the whole unit.
2) Open the front shielding cover, and pull the mixer arm to the highest point for operation.
3) Use the wrench (BA60-J21) to loosen the mixer, and then grab the mixer with one hand and unscrew the retaining screw counter-clockwise with the other hand to loosen and remove the mixer straight down.
4) Loosen the lock nut on the mixer to the extent that the motor shaft can be easily inserted.
5) Reinstall the new mixer in the reverse order of above steps.

NOTE:
1) When installing the mixer, push it completely along the motor shaft. Force in other directions may damage the motor shaft or the mixer.
2) Stuck the small opening of a wrench at the wrench position of the mixer, stuck the large opening of the

other wrench at the position for nut fastening. Rotate the two wrenches in opposite directions until the nut is fastened (evenly apply force to avoid the motor shaft from being bent). Note: Do not touch the mixer during nut fastening. Otherwise, the mixer may deform.

Diagram of Wrench (BA60-J21)

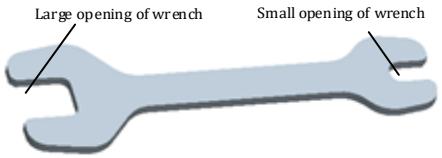


Figure 3-48 Diagram of Wrench (BA60-J21)

Alignment and confirmation

N/A

Replacing Mixing Motor Assembly

When to do

Replace the mixer motor when it fails.

Tools

Cross screwdriver and cutting pliers

How to do

1) Switch off the main power of the whole unit.
2) Open the shielding cover, and gently pull the mixer arm to the highest point. Rotate the mixer assembly to place the mixer at a position ready for operation.
3) Use the wrench (BA60-J21) to loosen the mixer, and then grab the mixer with one hand and unscrew the retaining screw counter-clockwise with the other hand to loosen and remove the mixer straight down.
4) Remove the powder screws on the mixer cover and lift it up to remove it.
5) Disconnect the motor cable and loosen the two M2×6 cross pan head screws to remove the mixer motor assembly.
6) Install a new mixing motor assembly.
7) After alignment of the motor location, restore the components in the reversed order.

NOTE:

When installing the mixer, push it completely along the rotor. Force in other directions may damage the motor shaft or the mixer.

Alignment and confirmation

Refer to ***7.8 Mixer Unit*** to adjust the photocoupler conversion board, the insertion depth of the motor stopper, and the mixer's horizontal position on the reaction carousel.

Replacing Conversion Board of Rotation Speed Detection Optical Coupler

When to do

Conversion board of rotation speed detection optical coupler is faulty.

Tools

Cross screwdriver

How to do

1) Switch off the main power of the whole unit.
2) Open the front shielding cover, and pull the mixer arm to the highest point for operation.
3) Remove the powder screws on the mixer cover and lift it up to remove it.
4) Loosen the two M2×6 cross pan head screws to remove the optical coupler conversion board.
5) Install the new conversion board of rotation speed detection optical coupler.
6) After alignment of the board location, restore the components in the reversed order.

Alignment and confirmation

Refer to ***7.8 Mixer Unit*** to adjust the photocoupler conversion board and the insertion depth of the motor stopper.

Replacing Mixer Arm Assembly

When to do

Replace the mixer arm assembly when the screw holes on the arm base are slipped, or the screw nut is broken, or the arm base is damaged.

Tools

Cross screwdriver, hexagon wrench and cutting pliers

How to do

1) Switch off the main power of the whole unit.
2) Open the front shielding cover, and pull the mixer arm to the highest point for operation.
3) Remove the powder screws on the mixer cover and lift it up to remove it.
4) Unplug the mixer motor cable, loosen the four M3×8 hexagon socket cap head screws with spring washer on the mixer arm assembly, remove the connector from the motor cable, and then remove the mixer arm assembly.
5) Fix the new mixer arm assembly on the mixer base using four M3×8 hexagon socket cap head screws with spring washers.
6) Refer to the above-mentioned steps in the reversed order to install the mixer motor cable and arm cover.

Note:

When aligning the horizontal position of the mixer arm assembly, fasten the screws of the mixer arm and the mixer base in strict accordance with the sequence as shown in the following figure. Otherwise, the mixer may easily get loose after long time of movement.

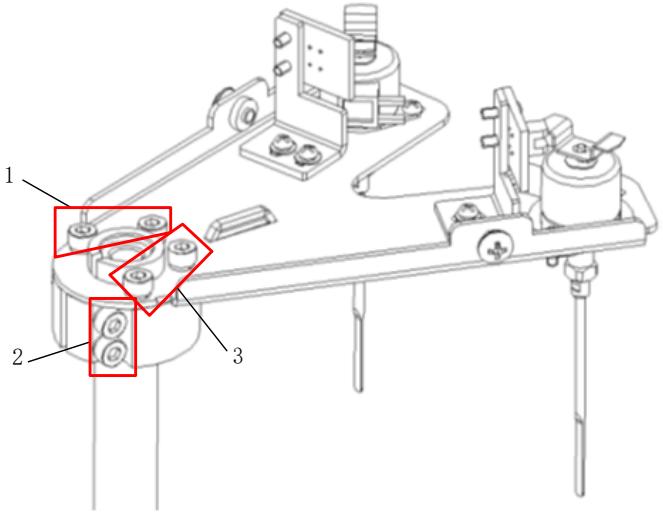


Figure 3-49 Removing/Installation Diagram for Screw Fastening Sequence of Mixer Arm Assembly

Alignment and confirmation

Refer to ***7.8 Mixer Unit*** to adjust the mixer position.

3.6.4 Replacement of Mixer Drive Assembly

When to do

Replace the mixer drive assembly when it is damaged or impaired in functioning.

Tools

Cross screwdriver, hexagon wrench and cutting pliers

Exploded view for installation

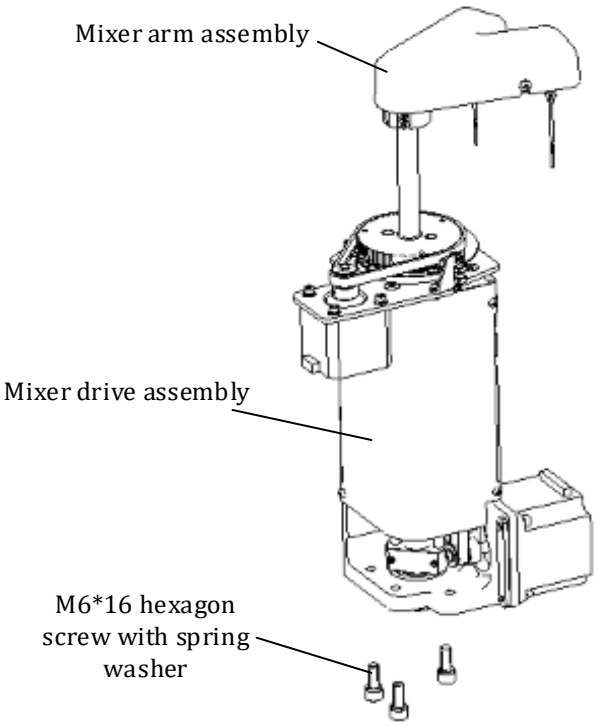


Figure 3-50 Removing/Installation Diagram for Mixer Drive Assembly

How to do

1) Switch off the main power of the whole unit.
2) Open the shielding cover, and remove the desk panels around the mixer drive assembly, the left side panel and the rear right panel.
3) Unplug the cables of the mixer drive motor, mixer motor, and sensor, remove the connectors (below the big bottom plate) from the cables passing through the precision shaft, and then remove the mixer arm assembly. (Note: Make sure to install the cable connector in place. If the cable can be pulled out from the connector, lift the cable barb and insert it again into the connector.)
4) Loosen the three M6×16 hexagon socket head screws with spring washer to remove the mixer drive assembly.
5) Fix the new mixer drive assembly on the big bottom plate using three screws. Make sure to lead the motor cable through the precision shaft prior to the installation.
6) Restore the components in the reversed order.

NOTE:

During installation, put the smaller end of the positioning sleeve under the vertical drive assembly downwards into the large bottom plate, and insert the larger end into the vertical drive assembly to realize positioning.
When aligning the horizontal position of the mixer arm assembly, fasten the screws of the mixer arm and the mixer base in strict accordance with the sequence. Otherwise, the mixer may easily get loose after long time of movement.

Alignment and confirmation

Refer to ***7.8 Mixer Unit*** to adjust the photocoupler conversion board, the insertion depth of the motor stopper, and the mixer's horizontal positions on the reaction carousel and wash well.

3.6.5 Replacing Horizontal Motor Assembly and Synchronous Belt

When to do

Replace the mixer horizontal motor assembly and synchronous cog belt when they are impaired in functioning or damaged.

Tools

Cross screwdriver and hexagon wrench

How to do

The removing and reinstalling methods are similar with those in ***3.5.8*** except for the arm.

Alignment and confirmation

N/A

3.7 Modules and Units — Photoelectric Unit

3.7.1 Functions and Parameters

The BS-410/BS-410E/BS-410S/BS-430/BS-450/BS-460/BS-470/BS-470E has inherited the mature concave gratings light-splitting technology of Mindray analyzers. which can not only simplify the optical design to compact the optical structure, but also eliminate the stray light. A combined light passing through the entrance slit projects on the PDA (Photodiode Array) via the concave flat-field gratings. A certain light-activated element on the array receive the monochromatic light at certain wavelength due to its position. During operation, the photometric system controlled by the computer receives the electric signals produced by the light-activated elements of corresponding wavelength and then converts them into absorbance. In case the spectrum is defined, the absorbance at multiple wavelengths can be calculated quickly.

Technical Parameters

- Optical system: reversed optics of holographic concave flat-field gratings, with each wavelength detected by a Photodiode array.
- Wavelength: 12 wavelengths, 340nm, 380nm, 412nm, 450nm, 505nm, 546nm, 570nm, 605nm, 660nm, 700nm, 740nm, and 800nm
- Wavelength accuracy: ±2nm
- Light source: 12V/20W, tungsten-halogen lamp, transmitting light through fiber bundle
- Minimum reaction volume: 90μl
- Absorbance range: 0-3.5A, 10mm light path conversion
- Light pathlength of cuvette: 5mm
  Number of cuvettes: 93 cuvettes, 4mm×5mm×29mm
- Cuvette material: standard plastic cuvette, compatible with glass cuvettes

Terms of Optics

- AD value: the value converted from photoelectric signal (voltage) through AD converter.
- Water blank: the AD value of a cuvette measured when the wash station dispenses water in phase 6. Water blank is the base point for calculation absorbance, that is, the 0 point of absorbance.
- Cuvette blank out of range: means the water blank of phase 6 is less than the light intensity low limit. This alarm is used to monitor the energy level of the optical system to ensure normal signal-to-noise ratio.
- Cuvette blank out of range (10X): means the relative change of continuous phase-6 water blanks for 10 cuvettes is greater than 3% comparing with the history data. This alarm is used to prevent light fluctuation or erroneous result due to cuvette overflowing and to remind the operator of this phenomenon.

3.7.2 Composition and Structure of Optical Assembly

The BS-410/BS-410E/BS-410S/BS-430/BS-450/BS-460/BS-470/BS-470E applies the holographic concave flat-field gratings and PDA for photometric measurement. See the figure below. The front lens converges the light beam sent from the tungsten-halogen lamp to the reaction cuvette via the fiber bundle. The light beam passes through the reaction cuvette and then converges at the entrance slit via the lens group 2. The gratings divide the light beam from the entrance slit and then converge them to the slit array. Finally, the PDA behind the slit array converts the light signals into electric signals and then outputs them.

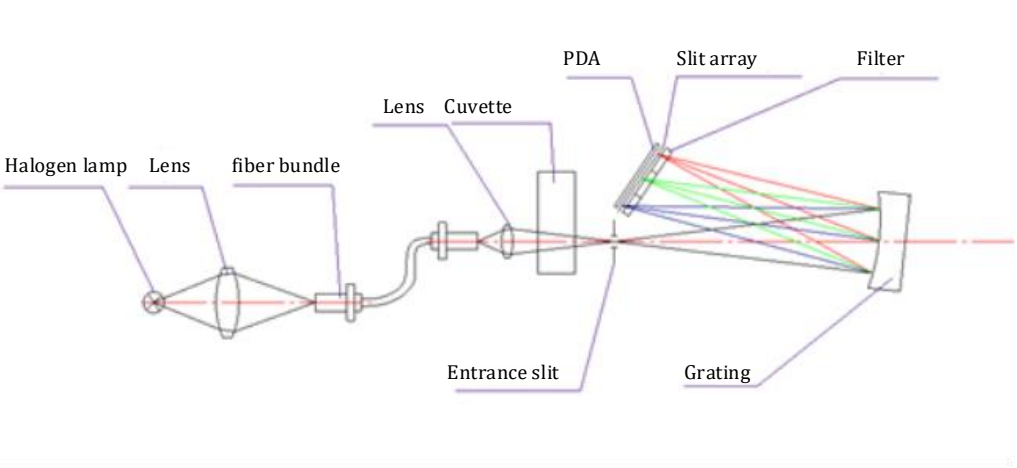


Figure 3-51 Photometer light path

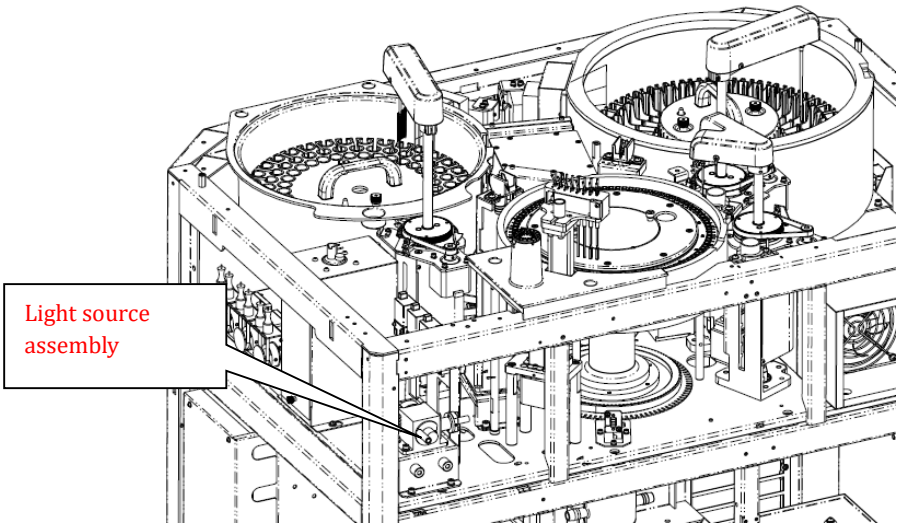


Figure 3-52 Location of light source assembly

The optical measurement assembly consists of the light-splitting assembly and AD housing assembly.

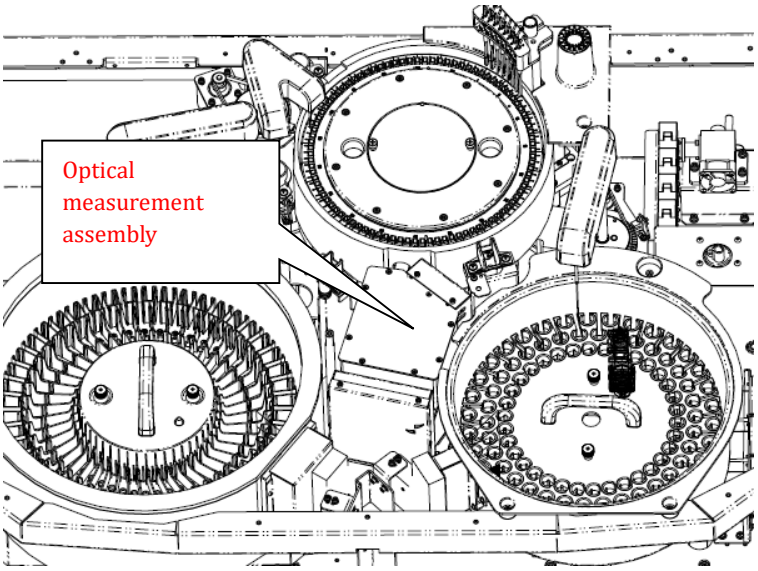


Figure 3-53 Location of optical measurement assembly

Table 3-6 List of materials

No.	FRU code and material code	Material Name	Remark
1	081-000137-00	Lamp assembly (64258/with package)	FRU
2	801-BA40-00167-00	fiber bundle	FRU
3	115-020201-00	Plastic cuvette (with surface processed)	Non-FRU
4	115-022370-00	Light-splitting assembly	FRU
5	115-022371-00	PDA assembly	FRU
6	801-BA80-00136-00	Cable of lamp housing fan	FRU

3.7.3 Replacing Lamp

When to do

Replace the lamp when an alarm is triggered indicating that the lamp has insufficient intensity, or not turned on, or has been used for over 2000 hours, or has cuvette blank out of range (10X).

Tools

N/A

Exploded view for installation

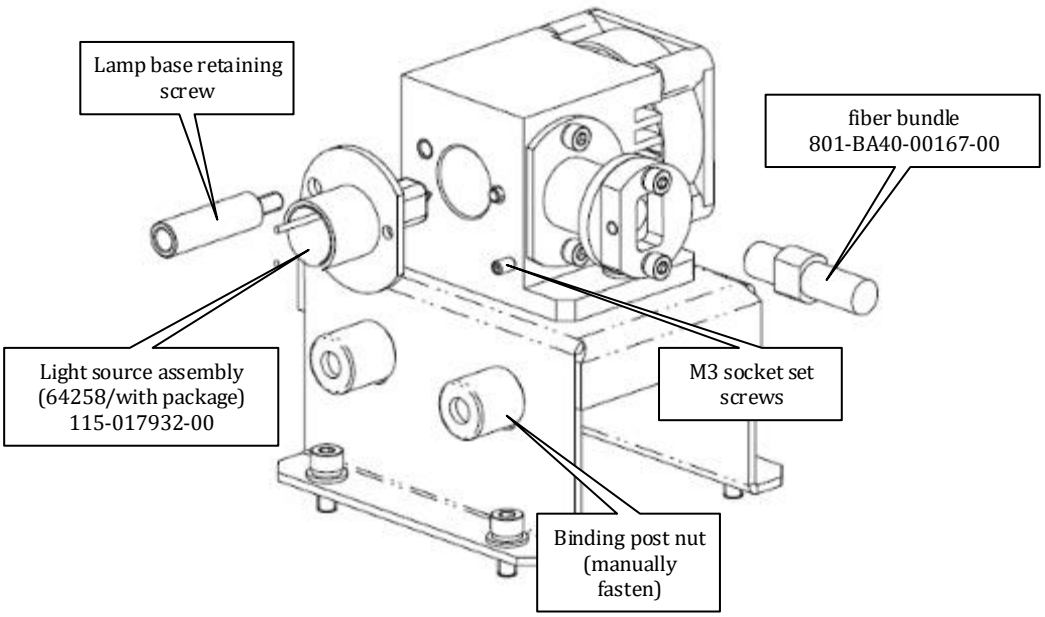


Figure 3-54 Exploded view of lamp and fiber bundle for installation

NOTE

- **Replace the lamp according to the instructions on the screen.**
- **Please wait for at least 5 minutes (if the lamp fan works properly) after turning off the lamp to avoid injury.**
- **Do not touch the bulb when installing the new lamp. In case of touching, please clean the bulb with fiber cloth or ethanol-moistened gauze.**

How to do

1) Select **Utility->Maintenance->Maintenance->Biochemistry Maintenance->Replace Lamp**.
2) Follow the instructions prompted by the software and wait for five minutes until the lamp cools down.
3) Loosen the screws on the back cover of the lamp and remove the lamp rear cover.
4) Unscrew the cable connectors and the lamp base retaining screws with hands, to remove the lamp.
5) Install the lamp and rear panel in a reversed order. Please ensure that the lamp has been installed properly in the right place and there is no space between the lamp and the lamp base before mounting the panel.
6) Select **Continue** and wait for ten minutes to start **Lamp Check** to check if the lamp can work properly.

Alignment and confirmation

Refer to ***7.3 Photometer Unit***.

3.7.4 Replacing Fiber Bundle

When to do

Replace the fiber bundle when it is broken or the light intensity is insufficient.

Tools

Hexagon wrench

How to do

1) Switch off the power supply of the whole unit.
2) Loosen the screws on the back cover of the lamp and remove the lamp rear cover.

3) According to the figure above, use a hexagon wrench to remove the M3 socket set screws with cup point on the light source assembly.
4) Remove the light-splitting assembly by referring to the next section.
5) Use a cross screwdriver to remove the screws that fixing the optical fiber baffle, and remove the optical fiber baffle.
6) Remove the M3 socket set screws with cup point used to fix the optical fiber bundle. Pull out the optical fiber bundle.
7) Install the new fiber bundle, and tighten the screws on the light source assembly and the optical measurement assembly. Note to avoid bending the fiber bundle with radius less than 60mm.

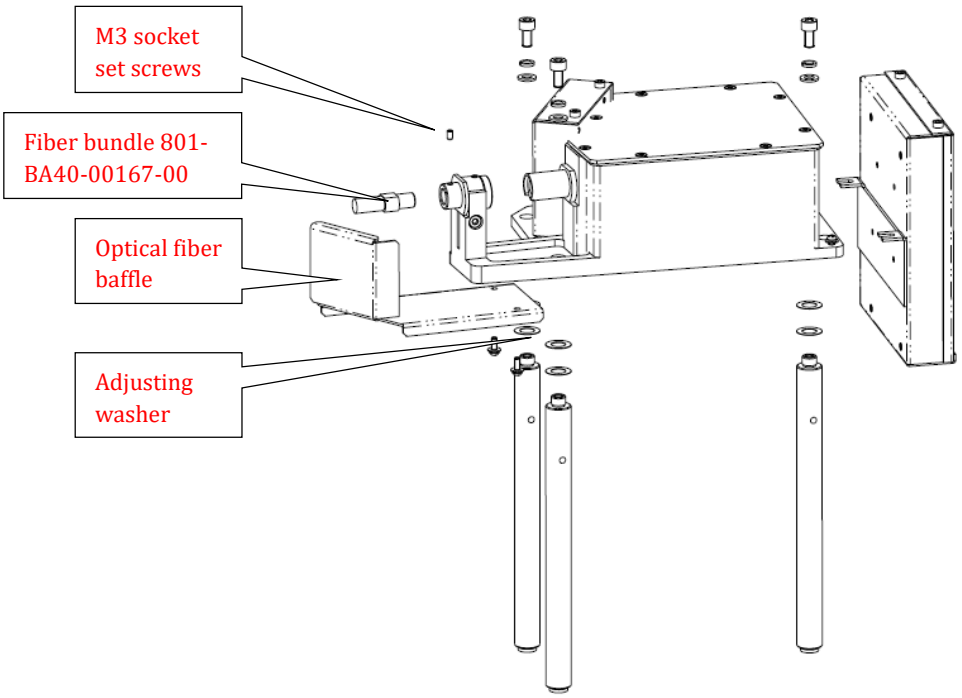


Figure 3-55 Exploded view of fiber bundle on optical measurement assembly for installation

Alignment and confirmation
Refer to ***7.3 Photometer Unit***.

3.7.5 Replacing Light-splitting Assembly

When to do
Replace the light-splitting assembly when it is impaired in functioning or its performance cannot meet the requirements.
Tools
Cross screwdriver and hexagon wrench
How to do
1) Switch off the main power of the whole unit.
2) Loosen the screws on the back cover of the lamp and remove the lamp rear cover.
3) According to ***3.1.3 Replacement of Reaction Carousel Body Cables***, use a hexagon wrench to remove the M3 socket set screws with cup point on the light source assembly.
4) Remove all panels around the reaction carousel and its, and then remove the reaction carousel body assembly.
5) Loosen the drain line of the reaction carousel heat chamber and remove the heat chamber.
6) Loosen the cross pan head screws on the AD housing, and then remove the AD housing assembly.
7) Loosen the three socket cap head screws on the optical measurement assembly to remove it.
8) Install the new optical measurement assembly following the above steps reversely.

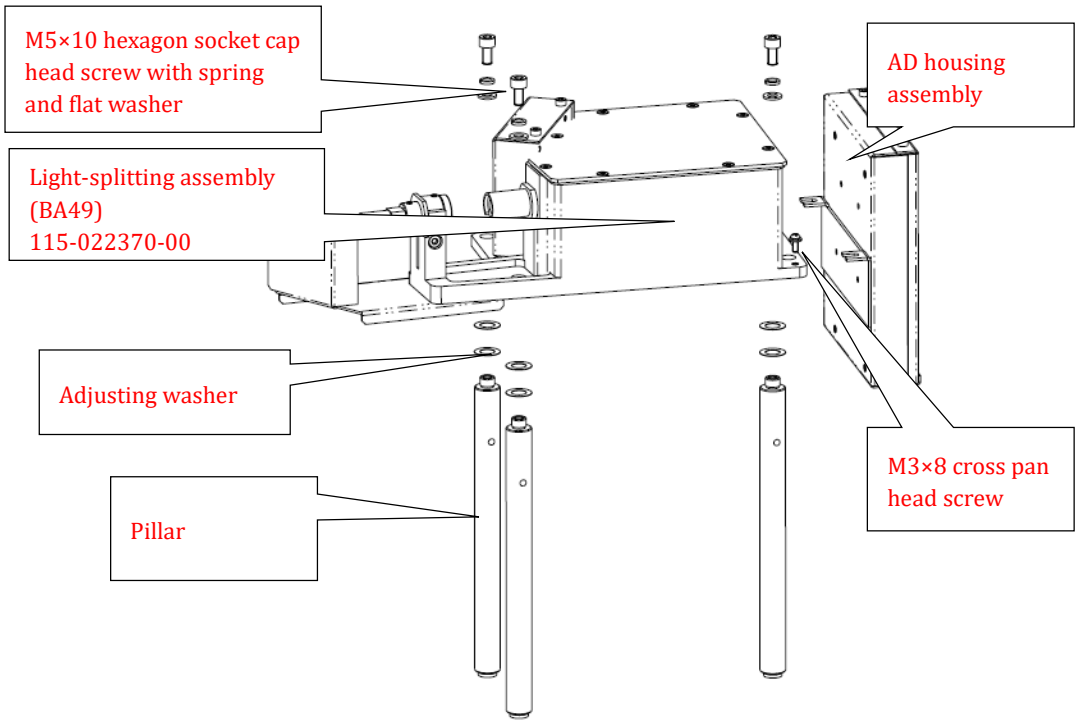


Figure 3-56 Exploded view of optical measurement assembly for installation

NOTE

- **When removing the optical measurement assembly, keep the washers with the supports and ensure the washers are of equal amount on each support.**

Alignment and confirmation

Refer to ***7.3 Photometer Unit***.

3.7.6 Replacing Reaction Cuvette

When to do

Replace a cuvette if,

- It is detected abnormal through the Cuvette Check procedure; or
- Scratches or cracks are found on the optical surface of the cuvette.

⚠ WARNING

- **While installing the reaction cuvettes, exercise caution to avoid scratching them. Do not touch the optical surface of the reaction cuvettes. If the optical surface is polluted, the obtained absorbance may be inaccurate.**
- **While installing the reaction cuvettes, make sure that the optical surface is confronted with the outside of the reaction carousel.**
- **Wear gloves free of fiber and powder to avoid polluting the optical surface of the reaction cuvettes.**

Biohazards

- **Wear gloves and lab coat, and if necessary, goggles during the maintenance process.**

NOTE

- **If a cuvette cannot be removed from the reaction carousel, first remove 1 or 2 cuvettes to its right, use a knife to remove the metal plate next to it, and then use your hands or tweezers to take out the cuvette.**

Tools

Fiber-free gloves, dry cloth or gauze, reaction cuvettes, and concentrated wash solution manufactured by our company

How to do

1) Select Utility -> Maintenance -> Maintenance -> Biochemistry Maintenance.
2) Choose Replace Cuvette.
3) Click Continue to start the maintenance procedure.
4) Remove the reaction carousel cover.
5) Type in the position number of the cuvette you want to replace.
   The input range is 1-93. Only one position number can be entered each time.
6) Select Replace.
7) Use your thumb and forefinger to take out cuvettes, and correspond them to the numbers on the reaction carousel.
8) Place the clean cuvette or the new one into the reaction carousel, and make sure that the cuvette bottom attaches completely to the reaction cuvette.
9) Cover the reaction carousel.
10) Select Done. The system resets mechanically.
11) Perform the Cuvette Check procedure to check if the new cuvettes meet the requirements.
12) Select Utility -> Maintenance -> Maintenance, and then select Scheduled Maintenance -> Other.
13) Mark the Select checkbox in the same row as Replace Cuvettes.
14) Select OK. The maintenance time of each maintenance item is refreshed.
15) Select Log and then record commends and other important information for the procedure.
16) Select OK to save your input information.
17) Select Utility -> Maintenance -> Maintenance -> Biochemistry Maintenance -> Cuvette Check to perform cuvette Check. If Cuvette Check is not performed, the new cuvettes may not be used due to too large water blank or alarm "Water blank out of range (10X)" may be given.

3.7.7 Photometer Lens Maintenance

When to do

The lens of the photometer is contaminated or the maintenance time is over 1 year.

Materials required

Lens cleaning paper, cotton swabs and ethanol

NOTE

- **When moving the sample/reagent probe and mixer, do not bend or collide with them.**
- **Do not leave the cotton tissue on the lens.**

How to do

1) Switch off the analyzing unit power.
2) Loosen the nuts on the wash station, remove it and put in a clear box.
3) Remove the reaction carousel cover gently.
4) Loosen the screws of the reaction carousel and the cable of the slip ring. Remove the reaction carousel.
5) Use cotton swabs dipped with ethanol to wipe the exposed lens of the front and rear lens assembly.

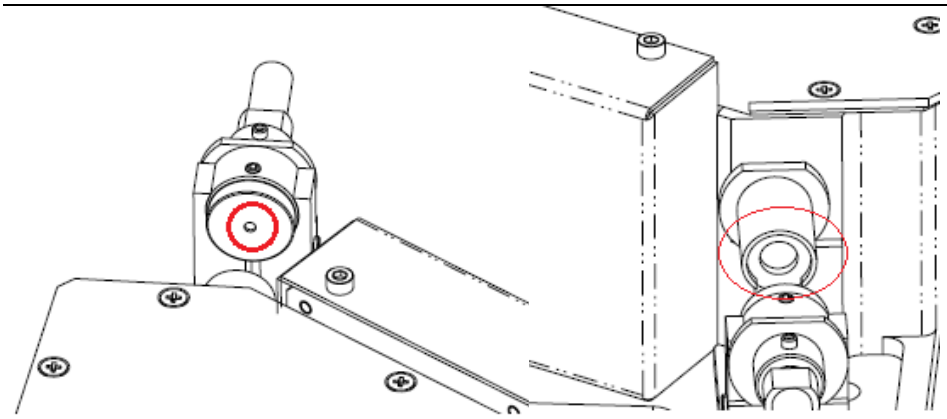


Figure 3-57 Location of lens

6) Install the reaction carousel and insert the cable of the slip ring. Tighten the screws.
7) Cover the reaction carousel.
8) Install back the wash station and tighten the screws.
9) Turn on the analyzing unit.

Alignment and confirmation

Select Utility -> Maintenance -> Maintenance -> Biochemistry Maintenance -> Cuvette Check. If the dirty cuvettes are found, replace them. If Cuvette Check is not performed, water blank may become large after the lens are wiped, which may trigger the alarm "Water blank out of range (10X)".

3.8 ISE Unit (Configured with Medica ISE Module)

3.8.1 Module Functions

The ISE module is an optional module for the fully-automated chemistry analyzer and designed to measure the concentration of K+, Na+ and Cl- in serum, plasma and diluted urine. The sample volume for measurement is: 70μl for serum and plasma, 140μl for urine diluted at the ratio of 1:9 (1 for urine and 9 for diluent).

3.8.2 Structure and FRU List

The ISE unit consists of the ISE module, pump module and reagent module, functions of which are introduced in Table below.

Table 3-7 Components of ISE Unit

No.	FRU code and material code	Material Name	Remark
1	081-000137-00	Lamp assembly (64258/with package)	FRU
2	801-BA40-00167-00	fiber bundle	FRU
3	115-020201-00	Plastic cuvette (with surface processed)	Non-FRU
4	115-022370-00	Light-splitting assembly	FRU
5	115-022371-00	PDA assembly	FRU
6	801-BA80-00136-00	Cable of lamp housing fan	FRU

The figure below shows the composition of the module.

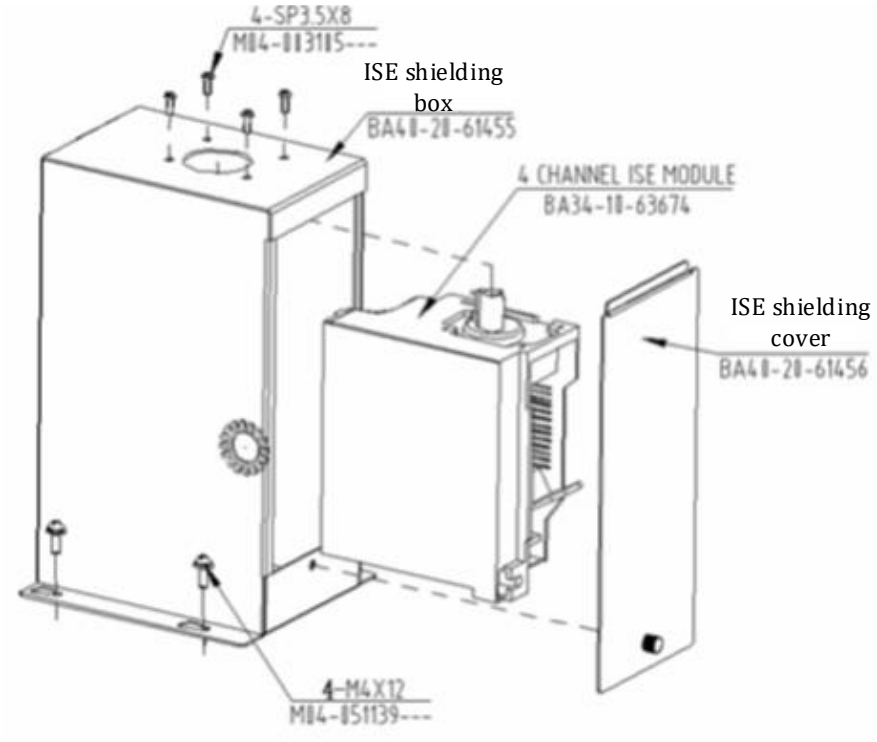


Figure 3-58 Exploded view for installation of Measuring module

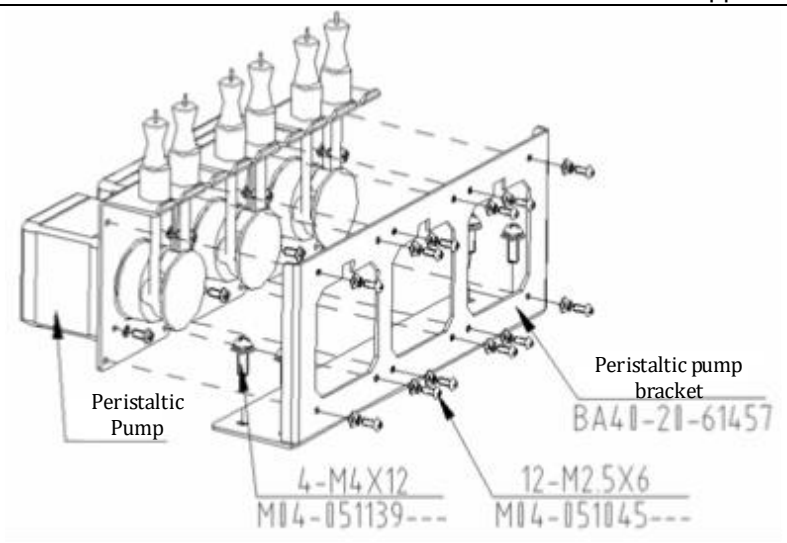


Figure 3-59 Exploded view for installation of pump module

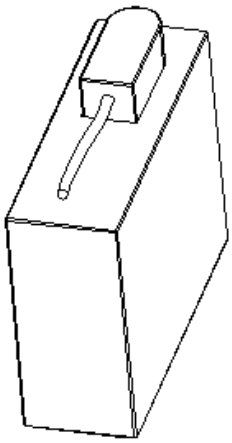


Figure 3-60 Exploded view for installation of reagent module

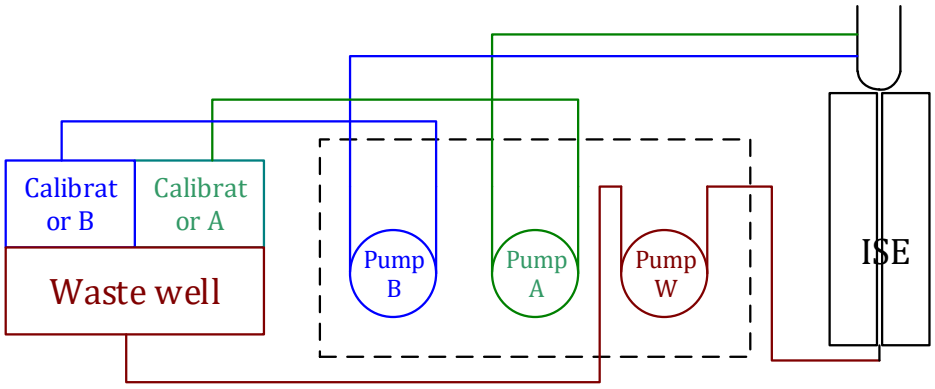


Figure 3-61 ISE measuring system tube connection

Table 1.1 List of materials

No.	FRU code and material code	Material Name	Remark
1	115-004626-00	K electrode	FRU
2	115-004627-00	Na electrode	FRU
3	115-004630-00	Cl electrode	FRU
4	115-004625-00	Reference electrode	FRU
5	115-004628-00	Spacer	FRU
6	BA34-10-63657	Main control board of the ISE module	FRU
7	BA34-10-63659	Pre-amplification board of the ISE module	FRU
8	BA34-10-63658	Compression plate	FRU
9	801-BA34-00104-00	ISE module bubble detector	FRU
10	801-BA34-00103-00	Sample tube of ISE module	FRU
11	BA34-10-63663	O ring of ISE module(3)	FRU
12	BA34-10-63668	O ring of ISE electrode	FRU
13	082-000684-00	Peristaltic Pump	FRU
14	801-BA34-00105-00	The peristaltic pump tube(3 pcs)	FRU
15	BA34-10-63666	ISE waste tube connector	FRU
16	BA34-10-63667	Tube connector of ISE (4)	FRU
17	801-BA34-00106-00	ISE module plastic tube for A ,B and W liquid	FRU
18	BA34-10-63812	ISE module wand	FRU

3.8.3 Unclogging Waste Tubes

When to do

If the sample contains insoluble substances like fibrin or other substances, they can be accumulated in the waste tube after long time use, causing clogging of the waste tube.

Maintenance Tools

Name	PN	Quantity	Remarks
Unclogging tool for ISE	115-023372-00	1	FRU

⚠ WARNING

- **Do not spill liquid on the analyzer. Liquid ingression may cause equipment damage.**

Biohazards

- **Wear gloves and lab coat, and if necessary, goggles during the maintenance process.**

NOTE

- **Excessive bleach and DI water flushed into the ISE reagent pack waste bag may cause waste bag over expansion and clog the Cal A & Cal B reagent flow.**
- **To prevent this problem, connect to an old used-up reagent pack or use the connector of the used-up reagent.**

Procedure:

1) Ensure the analyzer is in idle (standby) status. Open the ISE window on the right side panel of the analyzer.
2) Remove the electrode housing cover. Remove the waste tube fitting from the bottom of the right angle adapter. Remove waste peri-pump tube from the pump bracket.
3) Connect the waste tube fitting to a syringe and unclogging tool with 5mL of undiluted household bleach.
4) Press the wand release button to remove the wand from the current in use ISE reagent pack and keep it in a save place. Engage the wand to an old used-up reagent pack.
5) Inject bleach into the ISE waste tube and soak the tube for 5 minutes. Discharge the waste into the reagent pack.

Note:

When the bleach cannot be injected into the ISE pack, remove the wand and push down to open the waste valve manually with a sharp object, and then inject again. If bleach can go through this time, the waste bag was clogged and cannot be used. If bleach still cannot be injected, replacing the ISE wand is recommended.

6) Repeat this step with 5mL of DI water without the 5 minutes of soaking time.
7) Remove the wand from the old use-up pack and re-install it back to the current in use ISE pack. Re-install the waste tube fitting back to the ISE electrode housing right angle adapter and waste peri-pump tube back to the pump bracket. Re-install the housing cover.

Alignment and confirmation

Perform ISE pump calibration and if it succeeds, the tube has been successfully unclogged.

3.8.4 Replacing Pump Tube

When to do

Replace the pump tube when it is aged or leaking or has not been maintained for a half year.

Maintenance Tools

Cross screwdriver, pump tube.

Precautions

Biohazards

- **Wear gloves and lab coat, and if necessary, goggles during the maintenance process.**

Procedure:

1) Ensure the analyzer is on idle (standby) condition. Open the ISE cover on the right side analyzer panel.
2) Select **Utility -> Maintenance -> Maintenance -> ISE -> Remove Reagent Pack**.
3) Select **Utility -> Maintenance -> Maintenance -> ISE -> Replace Pump Tube and Calibrator Tube**.
4) Select Pump Tube.
5) Replace it with new one. Make sure the connectors and tubes are correctly connected; otherwise ISE module failure may occur.
6) Load the reagent pack and the procedure is completed.
7) Install back the right side panel.
8) Record the maintenance log.

Alignment and confirmation

Perform ISE pump calibration and if it succeeds, the tube has been successfully replaced.

3.8.5 Replacing the ISE Electrode

Since the ISE electrode is a vulnerable component, it has a certain life limit. After a long time and huge sample volume of test, the performance of electrode is likely to be degraded. In this case, it should be considered to replace the electrode.

When to do

Reference electrode: Replace it every six months.

ISE electrode: The test times amounts to 10000, and the performance of electrode is degraded every six months, resulting in failed calibration or abnormal quality control.

Materials required

Reference electrode, ISE electrode

System status

ISE module is in Standby status or the Failure status.

Warnings and precautions

Biohazards

1) Wear gloves, a lab coat, and if necessary, goggles during the maintenance process.

Note

2) After performing this procedure, recalibrate the ISE electrodes prior to starting test.

How to do

a) Remove the electrode:

- Select Utility>Maintenance>ISE Maintenance.
- Click the instruction of changing the electrode, the maintenance window pops up.
- Select the electrode that needs to be changed, and enter the batch number and validity period.
- Click Add, then click OK.
- Click Continue.
- Open the side door of ISE module, take out the cover plate of the ISE shielding box.
- Open the protective package, take out the electrode, remove the tape wound around the inside of the electrode, and wipe the electrode with clean tissue.

  NOTE:

  a) Please take out the inserted things inside the reference electrode, make sure salt built up inside or around the electrode, otherwise, clean it with warm water.
  b) Ensure the red ball inside the reference electrode floats at the top of filled fluid in electrode container, all the O rings on the electrode can't be left.
- Take out all the electrodes installed inside the module, including spacer, Na, K, Cl and reference electrode.

b) Install new electrodes.
- Put the new reference electrode at the lowest part of ISE module to form close contact between the electrode posterior and the container inside.
- Release the platen and make sure the electrode doesn't move easily.
- Reinstall the other electrodes into the original position of the module and make sure all the electrodes installed at the right position.
- They should be placed in the order of Cl, K, Na and spacer from top to bottom:
- If the O ring is lost, please put a new one.
- There are two extra O rings for the packaging box of each electrode.

c) Check whether the electrode is put in the correct position.
- Since the Na, K and Cl electrodes have the same size and shape, please use the connecting probe at the back of the electrodes to ensure the electrodes are installed in the correct position.
- If an electrode is difficult to be installed, check the electrode type and whether it is installed in the wrong position, then repeat the installing steps of the electrode.
- Make sure the five electrodes are inserted correctly in the module and their relative position is in a straight line. Otherwise, it is easy to cause installation failure and the liquid cannot flow smoothly in the electrode tube.

d) Click Continue. The system automatically performs the purification of A and B, and it will prompt that the replacement of electrodes has been done.
e) Select Done.
f) Reinstall the cover plate of the shielding box and close the side door of ISE module.
g) Recalibrate the ISE module.

Note: The new electrode may take some time to stabilize before it can be calibrated successfully.

h) If the calibration fails, perform the following actions:
   1) Carry out the calibration for several times to make the electrode stabilize fast; or
   2) Drip a small amount of serum sample into the hole of electrode tube, and wait for 10~30 minutes till it's activated before calibration.

3.8.6 Remove ISE Reagent Pack

The reagent pack needs to be removed when the analyzer is cut off for a long time, the electrodes are stored away from the machine or the tubes are going to be changed.

When to do

ISE module is powered off for a long time (more than three days), the electrodes are stored away from the machine or the tubes are going to be changed.

System status

ISE module is in Standby status or the Failure status.

How to do

i. Select Utility>Maintenance>ISE Maintenance, click Remove Reagent Pack.
ii. Remove the pump tube on peristaltic pump A, change the position of the two joints and reinstall the pump tube back to pump A.
iii. Peristaltic pump B should be processed in the same way.
iv. Click Continue, the software automatically performs the purification of A and B for 30 times respectively.
v. Restore the previously reversed A and B pump tubes to their original status.
vi. Reinstall the three red caps removed when the reagent pack is installed on the tube connector, then store the reagent pack away from light at room temperature.

vii. Select Done.

3.8.7 Store ISE Electrode Off Machine

After the analyzer has been cut off for a long time or the reagent pack is removed, ISE module cannot keep the electrode moist by periodic prime, and the electrode will be damaged due to dryness, so it's necessary to save the electrode.

Materials required

Packaging box of electrodes, tape

When to do

The reagent pack is removed or the machine is going to be powered off for a long time (more than three days), carry out this maintenance procedure.

If the machine is powered off less than three days, priming should be carried out to protect the electrode.

System status

ISE module is in Standby status or the Failure status.

Warnings and precautions

Biohazards

3) Wear gloves, a lab coat, and if necessary, goggles during the maintenance process.

Note

4) The storage temperature shouldn't exceed 40 degrees, otherwise the electrode will be damaged.

How to do

1) Remove the reagent pack. Refer to *3.8.6Remove* ISE Reagent Pack
2) Open the side door of ISE module, take out the cover plate of the ISE shielding box.
3) Take out all the electrodes successively.
4) Store the reference electrode.
   1. Insert the inserted objects on the previous electrodes into the inside of the reference electrode again to prevent salt from blocking up the inside.
   2. Store the electrode in the electrode box away from light at room temperature.
5) Store Na, K, Cl:
   a) Take out a small amount of calibrator out of the reagent pack, inject it into the inner cavity of the electrode and seal it with tape to ensure a certain amount of calibrator is injected into the cavity of the electrode.
   b) Store the electrode in the electrode box away from light at room temperature.

Reinstall the cover plate of the shielding box and close the side door of ISE module.

3.8.8 Calculation and Strategy of ISE Reagent Pack Allowance

As an integral part of the ISE module, ISE reagent pack should be loaded as required by the manual. In short, load the reagent pack when the analyzer in the Startup status, query the allowance of the reagent pack immediately after loading, and perform the prime of calibrator A and B. If the operation of replacing ISE reagent pack is incorrect, errors will be caused when it comes to calculating the allowance of the reagent pack so that the actual allowance of ISE reagent pack won't be consistent with the allowance displayed on the software interface.

The following operations will make the actual allowance of ISE reagent pack less than the allowance displayed on the software interface.

- The analyzer is in the Startup status and the ISE module is in the Failure status, ISE reagent pack is replaced with a new one, and the ISE failure restore or allowance query for reagent pack aren't performed immediately.

Operation explanation: When the ISE module is in Stopped status, the software will stop writing volume information into the reagent pack chip. However, when the analyzer is in the Startup status, it will automatically execute the Sip action of the ISE module to consume certain amount of reagent. Therefore, after replacing the reagent pack, if the ISE module isn't restored or refreshed to display the allowance, then the software will not calculate the reagent consumption until it reads the information of the new reagent pack. At this time, the real volume of the reagent pack=the volume displayed on the interface-the consumption of Sip action, which means the real volume of the reagent pack is less than the volume displayed on the interface.

- When the analyzer is in the Shutdown status (that is, the analyzer is powered on, but the software exits or the computer is shut down), the ISE reagent pack is replaced with a new one.

Operation explanation: During shutdown, the analyzer will automatically execute the sip action of the ISE module to consume certain amount of reagent. When the analyzer is turned on, if the software detects a new batch of reagent pack, it will automatically zero the amount of reagent consumption that isn't written into the reagent pack chips, and it will display the volume read from the reagent pack chips on the operating interface. At this time, the real volume of the reagent pack=the volume displayed on the interface-the consumption of Sip action, which means the real volume of the reagent pack is less than the volume displayed on the interface.

- When the analyzer is in the Shutdown status (that is, the analyzer is powered on, but the software exits or the computer is shut down), the reagent pack is removed and relocated to another analyzer for use, and it's reinstalled to the original analyzer after being used.

Operation explanation: During shutdown process, the analyzer cannot detect if the reagent pack is normal. If the reagent pack is used in another machine and is taken back to be reload, then when the analyzer is turned on, it will automatically detect that the volume recorded in the reagent pack chips is less than the volume recorded before, so the software will zero the reagent volume consumed by the Sip action in the Shutdown status and will refresh the volume displayed on the interface with the volume read from the reagent pack chips. At this time, the real volume of the reagent pack=the volume displayed on the interface-the consumption of Sip action, which means the real volume of the reagent pack is less than the volume displayed on the interface.

- The optional ISE module is canceled, but the reagent pack isn't removed from the machine.

Operation explanation: Though the ISE module is de-configured, the original reagent pack information is not cleared from the database. During the next configuration, if the reagent pack is the same one, the software will calculate the SIP period of disconfigured ISE into the consumption of reagent pack.

注 意

- When the first operation above mentioned occurs, the ISE failure restore or allowance query for reagent pack should be performed immediately. In this way, the error of calculating ISE reagent pack allowance can be reduced or eliminated.
- When the second and third operations occur, and the operating software hasn't been opened yet to perform startup process, firstly remove the reagent pack that has been replaced in the shutdown status, then open the operation software. After the startup process is completed, install the reagent pack and query the allowance of the reagent pack immediately. In this way, the error of calculating ISE reagent pack allowance can be reduced or eliminated.
- When the fourth operation above mentioned occurs, the reagent pack needs to be removed before cancellation of the optional ISE module.

The following operations will make the actual allowance of ISE reagent pack exceed the allowance displayed on the software interface.

- The analyzer is in the Startup status and the ISE module is in the Failure status, ISE reagent pack is replaced with a new one, allowance query for reagent pack aren't performed immediately.

Operation explanation: The analyzer will automatically refresh the ISE reagent consumption, by subtracting the consumption of calibrator A or B from the known volume (of the original reagent pack) and writing it into the reagent pack chip, when calibrator A or B is consumed for 1%. As the reagent volume information written at this time is based on the calculation of the reagent pack before the replacement, and normally the volume of the used reagent pack is less than that of new reagent pack, the volume written in the replaced reagent pack chips is less than the real volume, that is, the real volume is more than the displayed volume.

- When the analyzer is in the Shutdown status (that is, the analyzer is powered on, but the software exits or the computer is shut down), the ISE reagent pack is removed and stored without being used, and is reloaded before the analyzer is started up.

Operation explanation: During shutdown process, the analyzer cannot detect if the reagent pack is

normal. If the reagent pack is reinstalled before the analyzer is turned on, the volume information of the reagent pack detected during the startup will be the same with the information recorded in the software. However, the software will mistakenly assume that the Sip action in the Shutdown status has consumed the reagent normally (in fact, there's no reagent consumption). Therefore, after the software calculates the reagent consumption, it will write new volume information into the reagent pack chips and will refresh the reagent pack chips to display the volume. At this time, the real volume of the reagent pack=the volume displayed on the interface+the consumption of Sip action during the installation of the reagent pack in the Shutdown status, which means the real volume of the reagent pack is more than the volume displayed on the interface.

- After the operating software exits, the analyzer is powered off, then it is powered on again before the operating software is opened.

Operation explanation: When closed normally, the operating software cannot detect if the ISE module is working. If the analyzer is powered on again before the operating software is opened, the volume information of the reagent pack detected during the startup will be the same with the information recorded in the software. However, the software will mistakenly assume that the Sip action in the Shutdown status has consumed the reagent normally (in fact, there's no reagent consumption because the ISE module doesn't work when it's powered off). Therefore, after the software calculates the reagent consumption, it will write new volume information into the reagent pack chips and will refresh the reagent pack chips to display the volume. At this time, the real volume of the reagent pack=the volume displayed on the interface+the consumption of Sip action during the installation of the reagent pack in the Shutdown status, which means the real volume of the reagent pack is more than the volume displayed on the interface.

注 意

- When the first operation above mentioned occurs, query for reagent pack allowance should be performed immediately. In this way, the error of calculating ISE reagent pack allowance can be reduced or eliminated.
- When the second and third operations occur, and the operating software hasn't been opened yet to perform startup process, firstly remove the reagent pack that has been replaced in the shutdown status, then open the operating software. After the startup process is completed, install the reagent pack and query the allowance of the reagent pack immediately. In this way, the error of calculating ISE reagent pack allowance can be reduced or eliminated.
-

3.8.9 Replacing Calibrator Tube

When to do

Replace the calibrator tube when it is aged or leaking or has not been maintained for over one year.

Maintenance Tools

Cross screwdriver, calibrator tube

Precautions

Biohazards

- **Wear gloves and lab coat, and if necessary, goggles during the maintenance process.**

Procedure:

1) Ensure the analyzer is on idle (standby) condition. Open the ISE cover on the right side analyzer panel.
2) Select **Utility -> Maintenance -> Maintenance -> ISE -> Remove Reagent Pack**.
3) Select **Utility -> Maintenance -> Maintenance -> ISE -> Replace Pump Tube and Calibrator Tube**.
4) Select Calibrator Tube.
5) Replace it with new one. Make sure the connectors and tubes are correctly connected; otherwise ISE module failure may occur.
6) Load the reagent pack and the procedure is completed.
7) Install back the right side panel.

8) Record the maintenance log.

Alignment and confirmation

Perform ISE pump calibration and if it succeeds, the tube has been successfully replaced.

3.8.10 Inventory Calculation of Reagent Pack

Reagent pack as one part of the ISE module should be installed as instructed by this manual. You should install reagent pack while the analyzer is powered off, and then check the reagent inventory and prime the ISE module with Calibrator A and B. If the reagent pack is not properly installed, error may be produced in inventory calculation, and the actual volume may differ from that displayed on the screen.

The following operations may result in the actual inventory of the ISE reagent pack less than the displayed one.

1) When the analyzer is turned on and the ISE module is in failure status, the reagent pack is changed, without recovering the module failure or checking the inventory immediately.

Operation explanation: When the ISE module is in Stopped status, the software will stop writing volume information into the reagent pack chip. However, the analyzer will automatically execute the sip action of the ISE module during startup to consume certain amount of reagent. Therefore, when the reagent pack is replaced, but the ISE module is not restored or the screen display refreshed, the software will not calculate the reagent consumption volume until reading the new reagent pack. At this moment, the actual reagent volume = displayed volume - consumption of Sip after replacing the reagent pack, which means that the actual reagent volume is less than the displayed volume on the screen.

2) When the analyzer is powered on but the software is closed or the computer is shut down, the reagent pack is changed.

Operation explanation: During shutdown, the analyzer will automatically execute the sip action of the ISE module to consume certain amount of reagent. When the analyzer is started up, the software will detect a new reagent pack and zero the consumption that is not written into the reagent pack chip, and then display the volume read from the reagent pack chip. At this moment, the actual reagent volume = displayed volume - consumption of Sip after replacing the reagent pack, which means that the actual reagent volume is less than the displayed volume on the screen.

3) When the analyzer is powered on but the software is closed or the computer is shut down, the reagent pack is switched to another analyzer and then installed back after use.

Operation explanation: During shutdown process, the analyzer cannot detect if the reagent pack is normal. If the reagent pack is installed on the current instrument after being used on another one, the analyzer, when started up, will detect that the recorded reagent volume on the chip is less than the original one, and the software will zero the reagent consumption of Sip during shutdown and display the read volume on the screen. At this moment, the actual reagent volume = displayed volume - consumption of Sip during shutdown (with reagent pack installed), which means that the actual reagent volume is less than the displayed volume on the screen.

4) The ISE module is de-configured, but the reagent pack is still on the instrument.

Operation explanation: Though the ISE module is de-configured, the original reagent pack information is not cleared from the database. When the ISE module is configured again with the same reagent pack, the Sip period without ISE module will be included in calculation of the reagent consumption.

NOTE:

- In condition 1, restore the ISE module and check the reagent inventory immediately to minimize or eliminate the calculation error.
- In condition 2 and 3, before running the operating software to start up the analyzer, remove the reagent pack and then run the operating software. After the startup procedure is complete, re-install the reagent pack and inquire the reagent volume immediately to minimize or eliminate the calculation error.
- In condition 4, remove the reagent pack and then de-configure the ISE module.

The following operations may result in the actual inventory of the ISE reagent pack more than the displayed one.

1) When the analyzer is turned on and the ISE reagent pack is changed, without checking the inventory immediately.

Operation explanation: The analyzer will automatically refresh the ISE reagent consumption, by subtracting the consumption of calibrator A or B from the known volume (of the original reagent pack) and writing it into the reagent pack chip, when calibrator A or B is consumed for 1%. The written volume is based on the original reagent pack before replacement, and the volume of a used reagent pack is often less than that of a new one. So the volume recorded on the chip of the new reagent pack is less than the actual volume, and the actual

volume is greater than the displayed volume on the screen.

2) When the analyzer is powered on but the software is closed or the computer is shut down, the reagent pack is removed for storage, and re-installed before the operating software is run.

Operation explanation: During shutdown process, the analyzer cannot detect if the reagent pack is normal. If the reagent pack is loaded before the analyzer is started up, the analyzer, when started up, will detect that the reagent volume recorded on the chip is same as that recorded by the software, but the software will confirm by mistake the reagent consumption of sip during shutdown. (Actually, no reagent is consumed.) Therefore, after calculating the reagent consumption, the software will write the new volume information onto the chip and display it on the screen. At this moment, the actual reagent volume = displayed volume + consumption of Sip during shutdown (with reagent pack installed), which means that the actual reagent volume is greater than the displayed volume on the screen.

3) The analyzer is powered off after the operating software is closed, and it is powered on again before the operating software is run.

Operation explanation: When closed normally, the operating software cannot detect if the ISE module is working. When powered on before the software is run, the analyzer, when started up, will detect that the reagent volume recorded on the chip is same as that recorded by the software, but the software will confirm by mistake the reagent consumption of sip during shutdown. (Actually, no reagent is consumed because the ISE module is not working while the analyzer is powered off.) Therefore, after calculating the reagent consumption, the software will write the new volume information onto the chip and display it on the screen. At this moment, the actual reagent volume = displayed volume + consumption of Sip during shutdown (with reagent pack installed), which means that the actual reagent volume is greater than the displayed volume on the screen.

NOTE:

- In condition 1, inquire the ISE reagent volume immediately to minimize or eliminate the calculation error.
- In condition 2 and 3, before running the operating software to start up the analyzer, remove the reagent pack and then run the operating software. After the startup procedure is complete, re-install the reagent pack and inquire the reagent volume immediately to minimize or eliminate the calculation error.

3.9 ISE Unit (Configured with Caretium ISE Module)

3.9.1 Module Functions

The ISE module is an optional module for the fully-automated chemistry analyzer and designed to measure the concentration of K+, Na+ and Cl- in serum, plasma and diluted urine. The sample volume for measurement is: 70μl for serum and plasma, 140μl for urine diluted at the ratio of 1:9 (1 for urine and 9 for diluent). Open the right door of the analyzer and observe the ISE reagent compartment on the right of the sample syringe. If an orange indicator is installed under the ISE reagent compartment, the analyzer is configured with the Caretium ISE module. If there is no orange indicator, the analyzer is configured with the Medica ISE module. For details, see the photos in this chapter.

Structure and FRU List

3.9.2 Structure and FRU List

The ISE unit consists of the ISE module, pump module and reagent module.

The figure below shows the composition of the module.

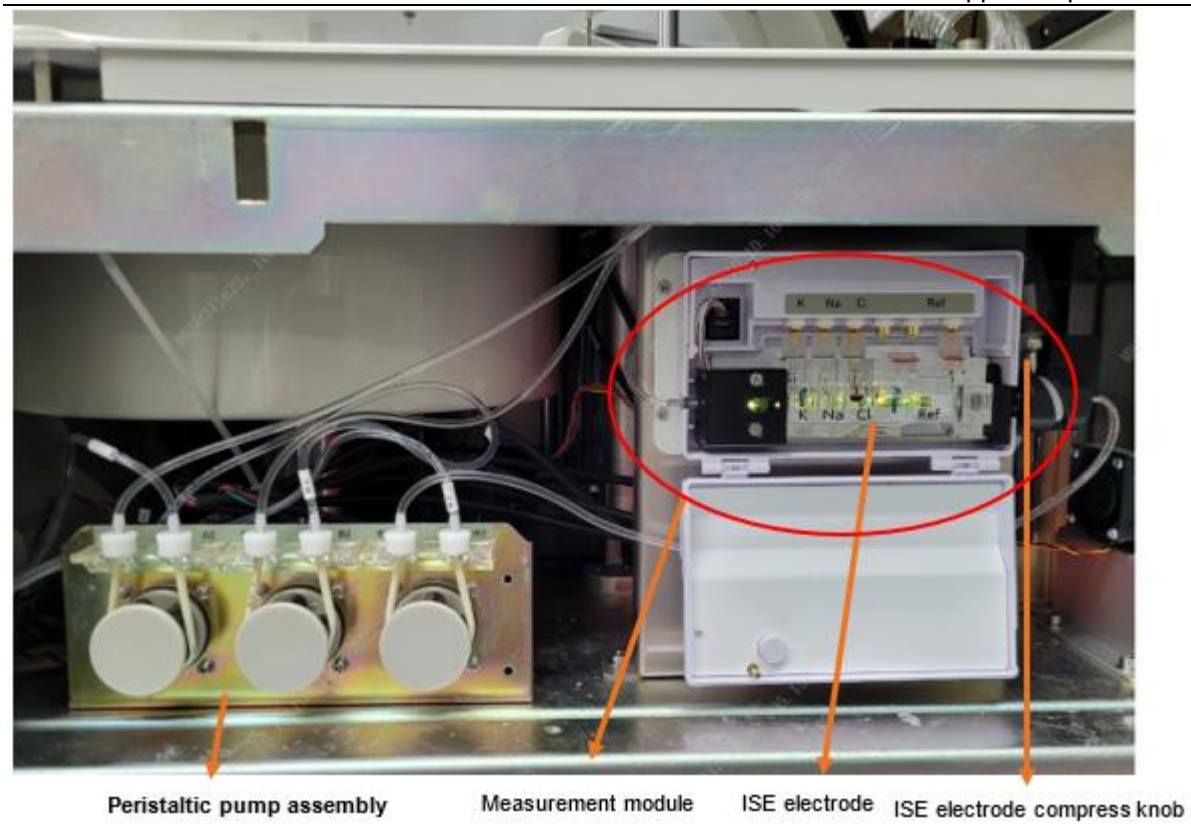


Figure 3-62 Peristaltic pump and measurement module

Figure 3-63 Reagent module installation

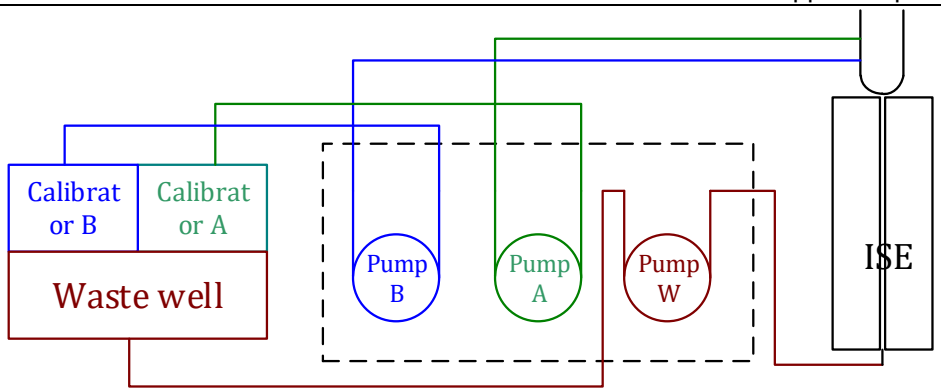


Figure 3-64 ISE measuring system tube connection

Table 1.2 List of materials

No.	FRU code and material code	Material Name	Remark
1	115-084088-00	Reference electrode	FRU
2	115-084090-00	Na electrode	FRU
3	115-084089-00	K electrode	FRU
4	115-084091-00	Cl electrode	FRU
5	040-006869-00	Peristaltic pump tube	FRU
6	040-006870-00	ISE module bubble detector	FRU
7	040-006871-00	ISE module sample cup	FRU
8	040-006872-00	ISE module main control board	FRU
9	040-006874-00	ISE module bus	FRU
10	040-006875-00	Reagent compartment stroke switch	FRU
11	040-006876-00	ISE module tube	FRU
12	040-006873-00	ISE reagent compartment	FRU
13	040-006877-00	Peristaltic Pump	FRU
14	082-004046-00	ISE peristaltic pump (bracket contained)	FRU
15	040-006882-00	Peristaltic pump head	FRU

3.9.3 Emptying Waste Tubes

When to do

The ISE module is powered off for a long time (more than three days) and the electrodes and reagent packets need to be stored.

When the tube is blocked by protein.

⚠ WARNING

- **Do not spill liquid on the analyzer. Liquid ingression may cause equipment damage.**

Biohazards

- **Wear gloves and lab coat, and if necessary, goggles during the maintenance process.**

NOTE

- **Excessive bleach and DI water flushed into the ISE reagent pack waste bag may cause waste bag over expansion and clog the Cal A & Cal B reagent flow.**
- **To prevent this problem, connect to an old used-up reagent pack or use the connector of the used-up reagent.**

Procedure:

1) Select **Utility -> Maintenance** -> **Maintenance** -> **ISE Maintenance** -> Empty Waste Tubes.
2) After the procedure is finished, select OK.

Alignment and confirmation

Perform ISE pump calibration and if it succeeds, the tube has been successfully emptied.

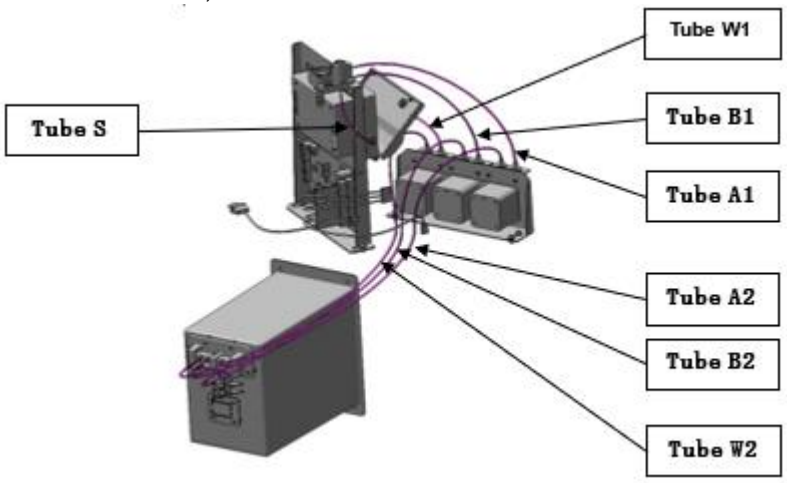
3.9.4 Replacing ISE Tubes

When to do

ISE tubes (including peristaltic pump tubes) are aging or leaking or have been maintained for over 1 year.

Maintenance Tools

Cross screwdriver, ISE module tube.



Precautions

Biohazards

- **Wear gloves and lab coat, and if necessary, goggles during the maintenance process.**

Procedure:

1) Ensure the analyzer is on idle (standby) condition. Open the ISE cover on the right side analyzer panel.
2) Select **Utility -> Maintenance** -> **Maintenance** -> **ISE Maintenance** -> **Replace ISE Tubes**.
3) Check that the reagent packet is on board, click Continue and wait for the tubes to be emptied.
4) Disconnect A1 and B1 tubes from the sample tube rack, remove the W1 and S tubes (connecting the sample tube bottom with the module), and remove the peristaltic pump tube from the pump tube rack.
5) Remove all replaced tubes and replace them with new ones. (Note: When replacing the tube connected to the reagent compartment, ABW should be correctly connected according to the reagent compartment tube label. Do not forget to replace the short tube S at the bottom of the sample cup connected to the module.)
6) Check if all connectors are connected and the tubes are not bent. Record the maintenance log.

Alignment and confirmation

After confirming that the electrodes are installed correctly (uninstalling the reagent pack may cause overflow), insert an adequate reagent package and observe whether the tubes are full. If not, check if the tubes are properly connected. Perform ISE calibration. If the calibration succeeds, the tube replacement succeeds.

3.9.5 Replacing ISE Electrodes

Since the ISE electrode is a vulnerable component, it has a certain life limit. After a long time and huge sample volume of test, the performance of electrode is likely to be degraded. In this case, it should be considered to replace the electrode.

When to do

When 10000 tests are finished or the electrodes are used for 9 months (for Na, K and reference electrodes, the chlorine electrode is used for 6 months), replace the electrodes.

When the slope of an electrode exceeds the lower limit, replace it.

Materials required

Reference electrode, ISE electrode

System status
ISE module is in Standby status or the Failure status.
Warnings and precautions

Biohazards

1) Wear gloves, a lab coat, and if necessary, goggles during the maintenance process.

Note

2) After performing this procedure, recalibrate the ISE electrodes prior to starting test.

How to do

i) Remove the electrode:
- Select Utility>Maintenance>ISE Maintenance.
- Click the instruction of changing the electrode, the maintenance window pops up.
- Enter the serial number of the new electrode and select OK.
- Open the right-side door of ISE module to replace the electrode.
- Unscrew the compressor to remove all electrodes from the ISE module.

NOTE:

a) The O rings on all electrodes must not be lost.
b) Install the new electrode.
   i. Replace the old electrode with the new one and tighten the compressor.
c) Check if the electrode position is correct.
   i. Check if the electrodes are labeled in the correct order.
d) Select Continue.
e) Select Done.
f) Close the right-side door of the ISE module.
g) Perform ISE calibration.

Note: After replacing the electrodes, please remove the front cover of the ISE module. It may take a while for the new electrode to stabilize for successful calibration.
If the calibration fails, perform the following operations:
Perform calibration multiple times to make the electrode status stable.

3.9.6 Storing ISE reagent Pack and Electrodes

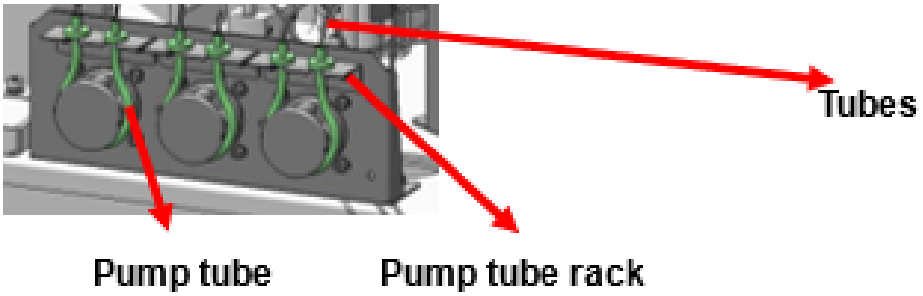
The analyzer is powered off for a long time and the reagent electrode is stored.
When to do
Power off the ISE module for a long time (more than three days) and keep the reagent electrodes away from the system.
Analyzer Status
ISE module status is Standby or Failure.
Procedure
1) Select Utility > Maintenance > ISE Maintenance, and click Empty Waste Tubes.
2) Take out the reagent pack and apply the rubber stopper immediately to prevent leakage and volatilization.
3) Open the right-side door of the ISE module.
4) Open the front cover of the ISE module and loosen the electrode pressing knob.
5) Remove the sealed electrodes and store them in a 2-8 °C refrigerator.

Note

3) After removing the electrodes from storage, please remove the reagent package in time to avoid overflow.

3.9.7 Replacing Pump Tube

When to do
Replace the pump tube when it is aged or leaking.
Materials required
Pump tube



Precautions

Biohazards

- **Wear gloves and lab coat, and if necessary, goggles during the maintenance process.**

Procedure:

1) Select **Utility -> Maintenance -> Maintenance -> ISE Maintenance -> Replace Pump Tubes** (During this procedure, the liquid in A tube, B tube and waste tube will be drained.).
2) Remove the reagent pack.
3) Remove the pump tube from the bracket.
4) Unplug the tube connected to the replaced pump tube
5) Connect the tube to the new pump tube
6) Put the tubes back on the tube bracket. (Note that the tube label should correspond to the indicator label.)
7) Install the cover

Alignment and confirmation

After confirming that the electrodes are installed correctly (uninstalling the reagent pack may cause overflow), insert a reagent pack with sufficient reagent and observe whether the tubes are full. If not, check if the tubes are properly connected. Perform ISE calibration. If calibration succeeds, the pump tube is successfully replaced.

3.9.8 Replacing ISE Bubble Detector

When to do

Air bubble detector of ISE module is damaged.

Materials required

ISE module bubble detector, cross-head screwdriver

ISE module bubble detector

Precautions

 **Biohazards**

- **Wear gloves and lab coat, and if necessary, goggles during the maintenance process.**

Procedure

1) Make sure the analyzer is powered off.
2) Open the right-side cover.
3) Loosen the two cross countersunk head screws that fix the air bubble detector of the ISE module, and remove the air bubble detector of the ISE module.
4) Replace the bubble detector
5) Install the cover

Alignment and confirmation

After confirming that the electrodes are installed correctly (uninstalling the reagent package may cause overflow), insert a reagent pack with sufficient reagent and observe whether the tubes are full. If not, check if the tubes are properly connected. Perform ISE calibration. If the calibration is successful, the air bubble detector of the ISE module is successfully replaced.

3.9.9 Replacing ISE Module Sample Cup

When to do

When sample tube of ISE module is damaged or obviously scratched.

Materials required

ISE module sample cup, cross screwdriver

Precautions

 **Biohazards**

- **Wear gloves and lab coat, and if necessary, goggles during the maintenance process.**

Procedure

1) Make sure the analyzer is powered off.
2) Remove the top cover of ISE module.
3) Remove the tubes connected to the cuvettes and remove the cuvettes.
4) Replace the cuvettes and connect the tubes.
5) Perform the alignment of sample probe rotary to ISE horizontal position and sample probe rotary to ISE vertical position.
6) Install the cover,

Alignment and confirmation

After confirming that the electrodes are installed correctly (uninstalling the reagent package may cause overflow), insert a reagent pack with sufficient reagent, and observe whether the tubes are full. If not, check if the tubes are properly connected. After ISE calibration, measure the serum sample for 20 times and give an alarm if the level is detected before dispensing the sample. If the precision meets the requirement, the replacement is completed. If the level is detected before dispensing the sample, ensure that the dispensing position of the sample probe does not touch the cuvette wall.

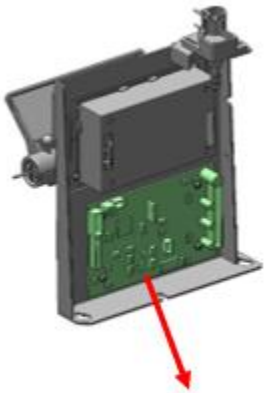
3.9.10 Replacing ISE Module Main Control Board

When to do

ISE main control board failure

Materials required

ISE module main control board, cross-head screwdriver



ISE module main control board

Procedure

1) Switch off the main power of the whole unit.
2) Remove the top cover of ISE module.
3) Remove the tubes and electrical connectors that connect the ISE module.
4) Loosen the three M4X8 cross pan head combination screws used to fix the ISE measurement module, and remove the ISE measurement module;
5) Remove the electric connector and module bus connecting the drive board and the module.
6) Loosen the four M3X6 cross pan head screws with washer fixing the main control board on the ISE measurement module, and remove the main control board.
7) Use cross pan head screws with washers to fix the ISE main control board on the ISE module.
8) Use three M4X8 cross pan head combination screws to fix the grounding wire on the big bottom plate of the frame.
9) Reconnect the ISE tubes, electric plugs and module bus.
10) Install the ISE window cover and close the left and right doors.
11) Perform the alignment of Sample Probe Rotary to ISE and Sample Probe Rotary to ISE.
12) Install the cover.

Alignment and confirmation

After confirming that the electrodes are installed correctly (uninstalling the reagent package may cause overflow), insert the reagent pack with sufficient reagent and observe whether the tubes are full. If not, check if the tubes are properly connected. After ISE calibration is performed, serum samples are analyzed for 20 times. If the calibration succeeds and no ISE related alarm is given during the test, the replacement succeeds.

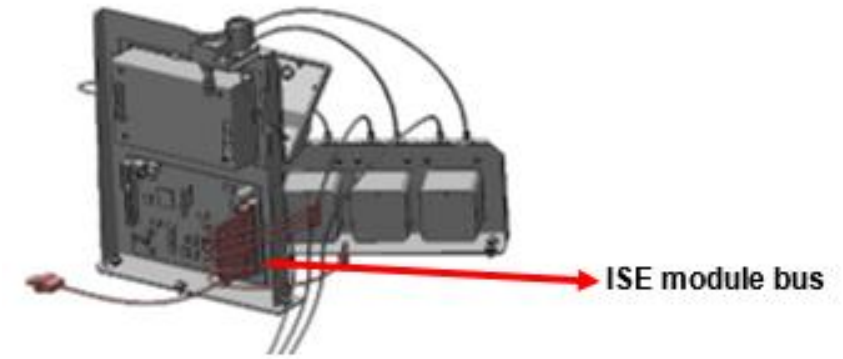
3.9.11 Replacing ISE Module Bus

When to do

When ISE module bus is damaged or in poor contact.

Materials required

ISE module bus, cross-head screwdriver



Precautions

Biohazards

- **Wear gloves and lab coat, and if necessary, goggles during the maintenance process.**

Procedure

1) Switch off the main power of the whole unit.
2) Remove the top cover of ISE module.
3) Use a pair of scissors to cut the cable tie, disconnect the bus and RSs 232, the bus and the analyzer from power supply, the RFID and the bus connectors, the travel switch and the bus connector, and the peristaltic pump motor connector.
4) Remove the bus from the module main board and replace it with a new bus
5) Reconnect the connectors of the electric appliances connected to the bus (RSs 232, power supply connector, peristaltic pump connector, travel switch connector and RFID connector, and then bind the bus (note to connect the connectors reliably to avoid poor contact).
6) Install the cover.

Alignment and confirmation

After confirming that the electrodes are installed correctly (uninstalling the reagent package may cause overflow), insert a reagent pack with sufficient reagent, and observe whether the tubes are full. If not, check if the tubes are properly connected. Perform ISE calibration. If calibration succeeds, the pump tube is successfully replaced.

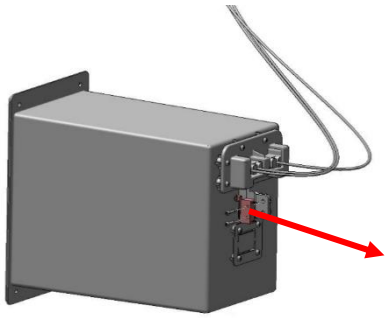
3.9.12 Replacing Reagent Compartment Stroke Switch

When to do

After initialization, the reagent loading cannot be triggered by plugging/unplugging the reagent package or the stroke switch cannot be rebounded.

Tools

Reagent stroke switch, cross screwdriver



Reagent Compartment Stroke Switch

Precautions:

Biohazards

Wear gloves and lab coat, if necessary, goggles.

Procedure

1) Make sure the analyzer is powered off.
2) Open the right side cover.
3) Pull out the electric plug of the stroke switch of the reagent compartment from the bus of the ISE module.
4) Remove and replace the stroke switch.
5) Install the cover.

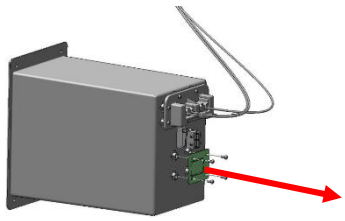
Alignment and Verification

After confirming that the electrodes are installed correctly (failure to install the reagent package may lead to

overflow), insert a sufficient reagent package, and observe whether the tubes are full. If not, check if the tubes are properly connected. After the analyzer is initialized, unplug the reagent package and reagent can be loaded, which means replacement is successful.

3.9.13 Replacing reagent RFID Reader

When to do
RFID reader of reagent compartment is damaged.
Tools
Reagent compartment RFID reader and cross-head screwdriver



RFID reader of reagent compartment

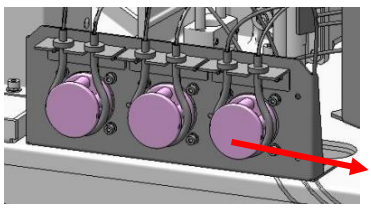
Precautions:

Biohazards
Wear gloves and lab coat, if necessary, goggles.

Procedure
1) Switch off the main power of the whole unit.
2) Open the right cover of the analyzer.
3) Unplug the electrical plug on the RFID reader at the back of the reagent compartment;
4) Loosen the four M2.5X6 cross pan head screws on the RFID reader, and remove the RFID reader.
5) Use four M2.5X6 cross pan head screws to fix the new RFID reader on the back of the reagent compartment.
6) Insert the electrical plug into the new RFID reader;
7) Install the cover.
Alignment and Verification
After confirming that the electrodes are installed correctly (uninstalling the reagent package may overflow the electrodes), insert the reagent sufficient package and observe whether the tubes are full. If not, check if the tubes are properly connected. After the analyzer is initialized, unplug the reagent package and reagent can be loaded, which means replacement is successful.

3.9.14 Replacing Peristaltic Pump Head

When to do
The peristaltic pump can rotate, but the pump head makes loud noise or the pump head roller cannot rotate.
Tools
Pump head



Peristaltic Pump **head**

Precautions:


Biohazards

Wear gloves and lab coat, if necessary, goggles.

Procedure

1) Switch off the main power of the whole unit.
2) Open the right cover of the analyzer.
3) Remove the pump tube on the pump head.
4) Remove the pump head and replace it with a new one.
5) Restore the pump tubes.
6) Install the cover.

Alignment and Verification

After confirming that the electrodes are installed correctly (uninstalling the reagent package may overflow the electrodes), insert the reagent sufficient package and observe whether the tubes are full. If not, check if the tubes are properly connected. After the analyzer is initialized, unplug the reagent package and reagent can be loaded, which means replacement is successful.

4 Hardware Circuits

4.1 Overview

This chapter introduces the functions of PCBA of BS-410/BS-410E/BS-410S/BS-430/BS-450/BS-460/BS-470/BS-470E. The PCBA is the same for three models. Therefore, all models are collectively referred to as BS-460.

4.2 Summary of Hazards

NOTE

- **While the instrument is working, do not touch the hardware circuit boards with your hands or other objects.**
- **To remove a circuit board, you should first disconnect the instrument from the (AC) power supply.**
- **Please wear a pair of anti-static gloves or take other measures to prevent static electricity prior to removing a circuit board.**

4.3 Summary of PCBAs

The table bellows provides a summary of the PCBAs used on the BS-410/BS-410E/BS-410S/BS-430/BS-450/BS-460/BS-470/BS-470E Chemistry Analyzer and briefly describes their functions.

Table 4-1 Sequence number and function description of PCBAs

PCBA (PCB)	Functions	No.
Main control board 051-001801-00 （Please confirm the main control board material code according to the instrument version）	The main control board is the control center of the BS-460. It is mainly used to fulfill the following tasks: communicating with a computer through the RS232 serial port to transmit data and instructions; communicating with the smart modules, including the ISE module, through the extended serial ports to transmit data and instructions; and controlling digital potentiometer adjustment and photoelectric data collection of the AD collection board and receiving the photoelectric data. It provides the BDM/JTAG interface for debugging software and downloading application programs. The application software of the main control board can be updated through the RS232 serial port.	#1
Reaction carousel temperature collection board 051-002415-00	The reaction carousel temperature collection board adjusts the signal of the reaction carousel temperature sensor and controls it for AD conversion. It provides a serial peripheral interface (SPI) and a power supply jack for the reaction carousel heater and connects with the wash solution temperature control board via the slip ring.	#2
3-carousel Drive Board 051-001801-00	The 3-carousel, temperature control and cuvette wash drive board is used to drive and control the sample carousel, reagent carousel, reaction carousel, cuvette wash station, wash syringes, and related components.	#3
3-probe Drive Board 051-002436-00	The 3-probe drive board is used to control and drive the sample probe, reagent probe, sample mixer, reagent mixer, and related components.	#4
Pump/Valve Drive Board 051-000957-00	The pump/valve drive board drives the auto wash pumps and valves, and transmits floater signal.	#5
Reagent refrigeration board 051-000052-00	The reagent refrigeration board is used to drive the reagent refrigeration circuit (including heatsinks) , fans and ISE module.	#6
Sample Probe Level Sense Board 801-BA80-00036-00 Reagent Probe Level Sense Board 801-BA80-00030-00	The two boards respectively sense the level of samples and reagents, and detect/convert the signals of the two vertical obstruct detection sensors.	#7
Clog Detection Board 051-000218-00	The clog detection board detects clogs inside the sample probe by checking the pressure of the fluidic tube when the sample probe aspirates samples.	#8
AD collection board BA40-30-61365 (BA40-20-61364)	The AD collection board adjusts the photoelectric signals output by the pre-amplification board and controls it for AD conversion. It provides an SPI interface for connecting with the main control board.	#9

PCBA (PCB)	Functions	No.
Pre-amplification Board BA40-30-61363 (BA40-20-61362)	The pre-amplification board converts the signals of the discrete photodiode array from analog to digital.	#10
AD collection board 801-BA40-00015-00	The AD collection board adjusts the photoelectric signals output by the preamplifier board and controls it for AD conversion. It provides an SPI interface for connecting with the main control board.	#11
Wash Probe Obstruction Photocoupler Conversion Board 051-001147-00	The wash probe obstruction photocoupler conversion board is used to adapt the wash probe obstruction photocoupler.	#12
Rotation speed photocoupler conversion board 051-001620-00	It adapts the rotation speed photocoupler.	#13
Analog Power Supply Conversion Board 801-BA38-00005-00	The analog power supply conversion board converts the A5V DC/DC digital of the BA40 power supply assembly into +/-12V analog and then provides it for the AC collection board and pre-amplification board.	#14
Power Supply Board of Water Supply Module (Optional) 801-BA40-00053-00	Provides power supply for the water supply module.	#15
Control Board of Drainage Module (Optional) BA40-30-61869	Controls the start and stop of the diaphragm pump of the drainage module.	#16
12V power board 801-BA40-00029-00	These boards are used to power the whole unit, outputting the A12V, A5V digital, D12V/E12V analog, C12V power, B24V power, and the B12V power for partial radiators.	#17
24V power supply board 801-BA40-00030-00		#18
Power supply conversion board 801-BA40-00031-00		#19
022-000428-00 Power supply 100-240VAC 24V 600W	In ECR(EIB009) Replaced with 115-088293-00, which consists of two power modules and a power patching board. It is compatible with the original power assembly. It is used to power the whole unit, outputting the A12V, A5V digital, D12V/E12V analog, C12V power, B24V power, and B12V power for the coolers.	
022-000427-00 Power supply 100-240VAC 12 V600 W		
051-005576-00 Power patching board PCBA		

4.4 Locations of PCBA

The figure below shows the locations of the PCBAs on the whole unit.

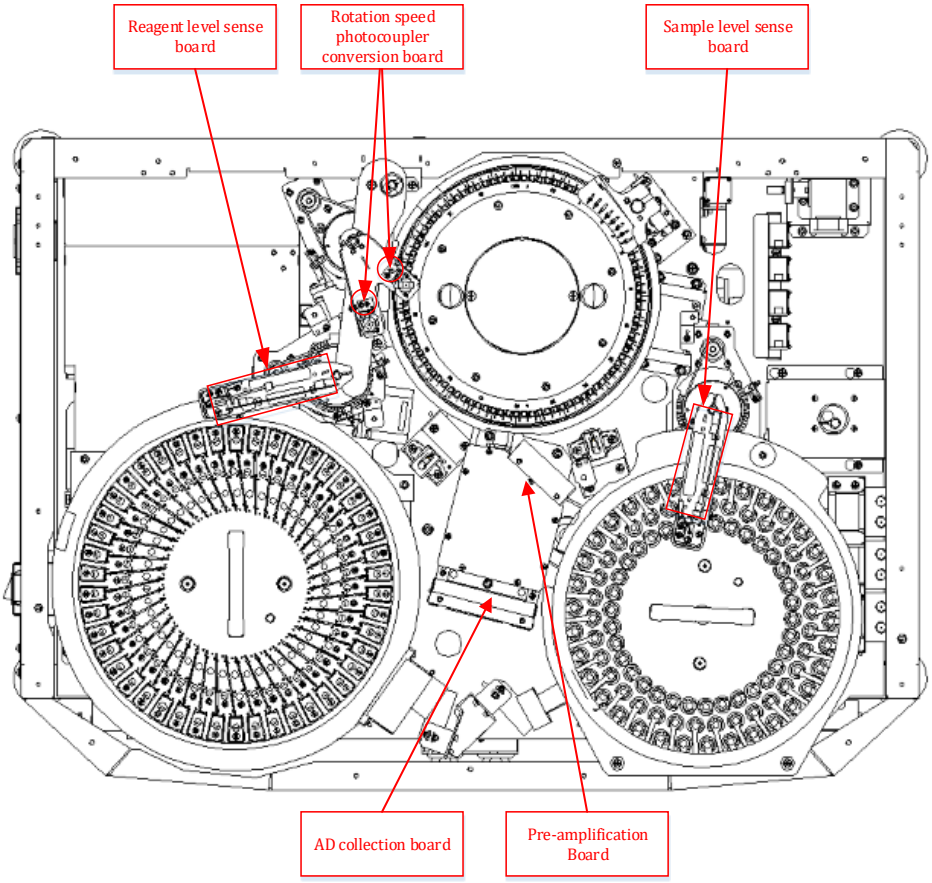


Figure 4-1 Top view of the analyzer

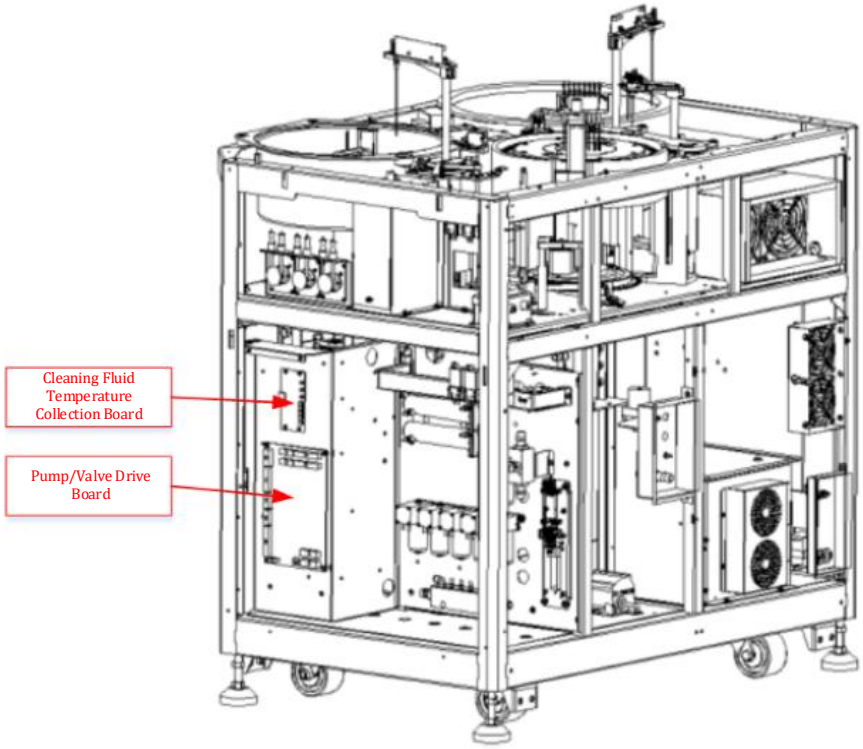


Figure 4-2 Rear right view of the analyzer (Medica configured before EIB009)

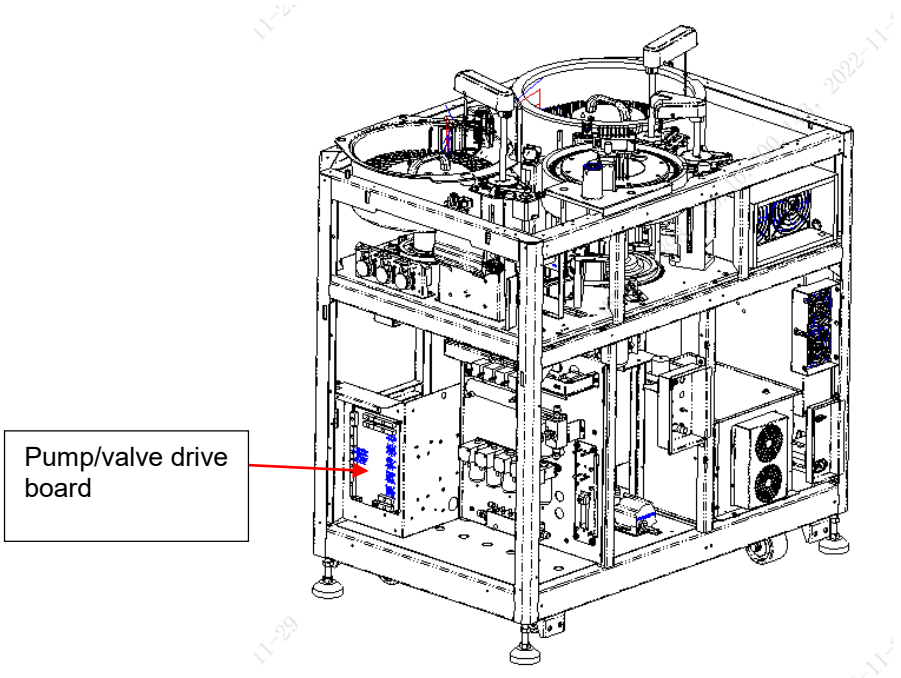


Figure 4-3 Rear right view of the analyzer (Caretium configured after EIB009)

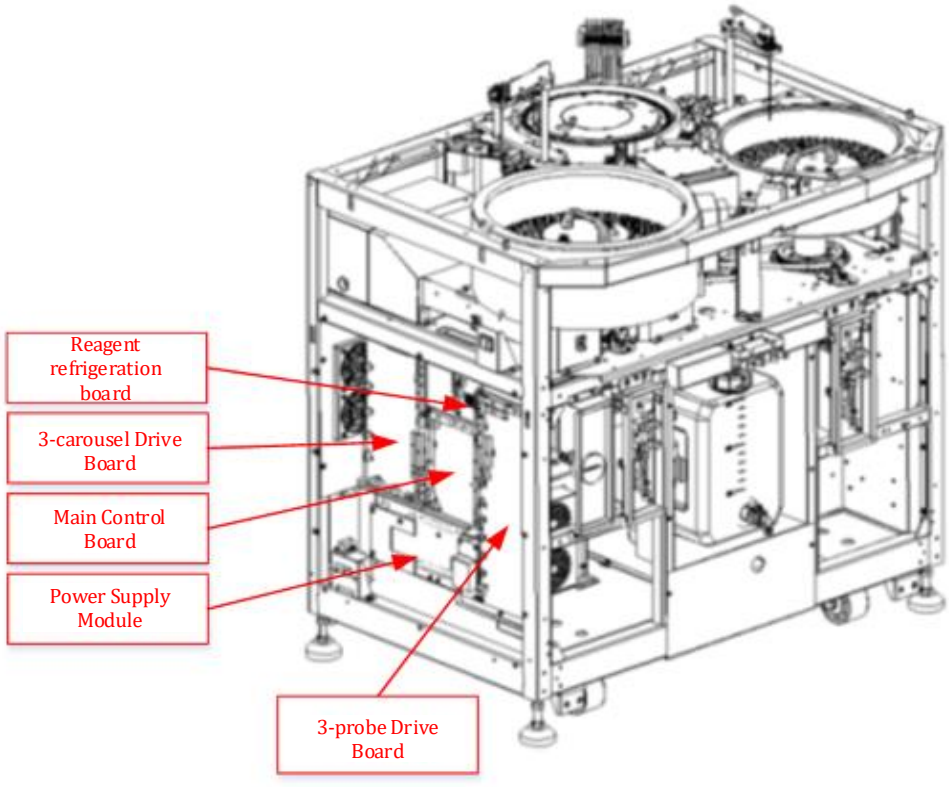


Figure 4-4 Front Left view of the analyzer

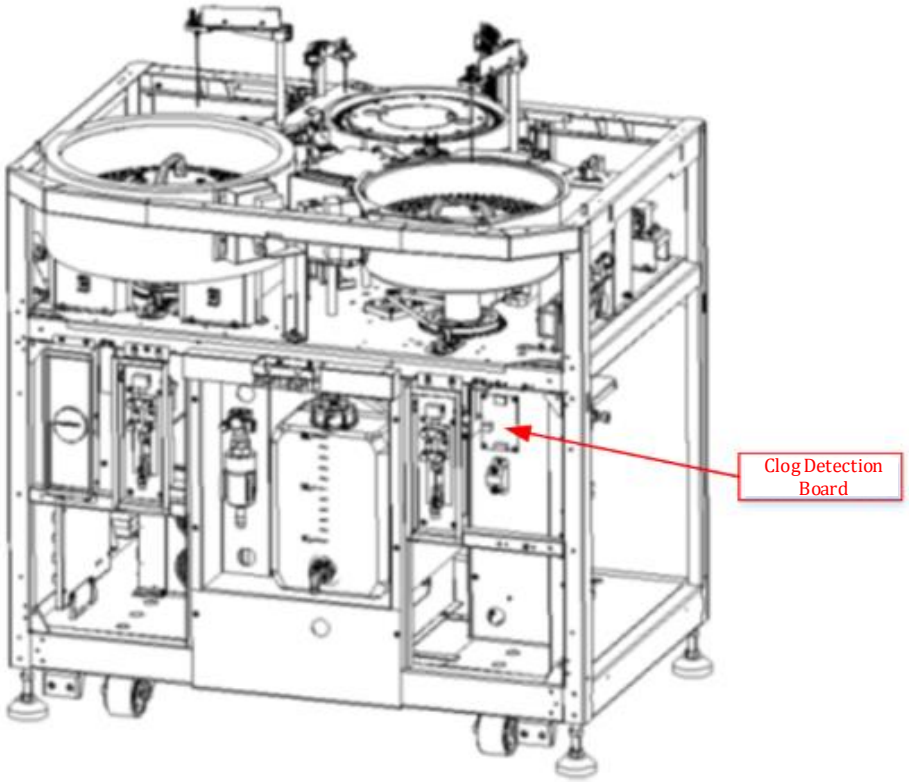


Figure 4-5 Front right view of the analyzer (Medica configured before EIB009)

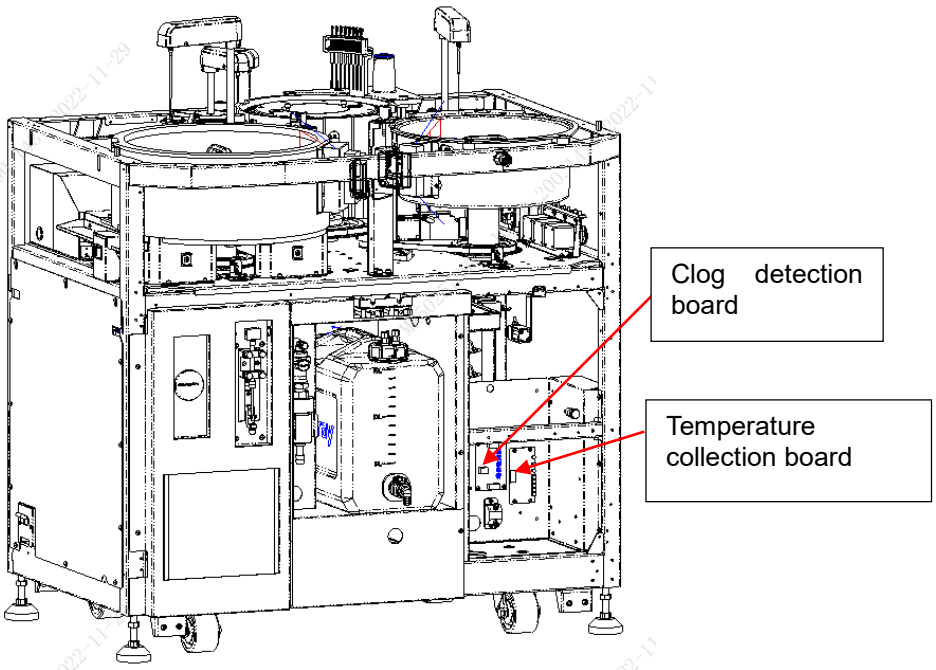


Figure 4-6 Front right view of the analyzer (Caretium configured after EIB009)

4.5 Functions of PCBA

4.5.1 Control Structure

The BS-460 Chemistry Analyzer consists of the analyzing unit (analyzer), operation unit (computer), and output unit (printer).

The analyzing unit (analyzer) is composed of the temperature control system, reaction system (including ISE module), photometric system, sample/reagent handling system, mixer system, and cuvette wash station.

The general control structure of the BS-460 is shown in the figure below.

The hardware system has the following functions:

- **Communicating with a computer through the serial port, and receiving/sending commands, responses, and data.**
- **Controlling data collection of the photometric system.**
- **Controlling movement and status signal collection of execution units.**
- **Controlling working and temperature control signal collection of the temperature control system.**

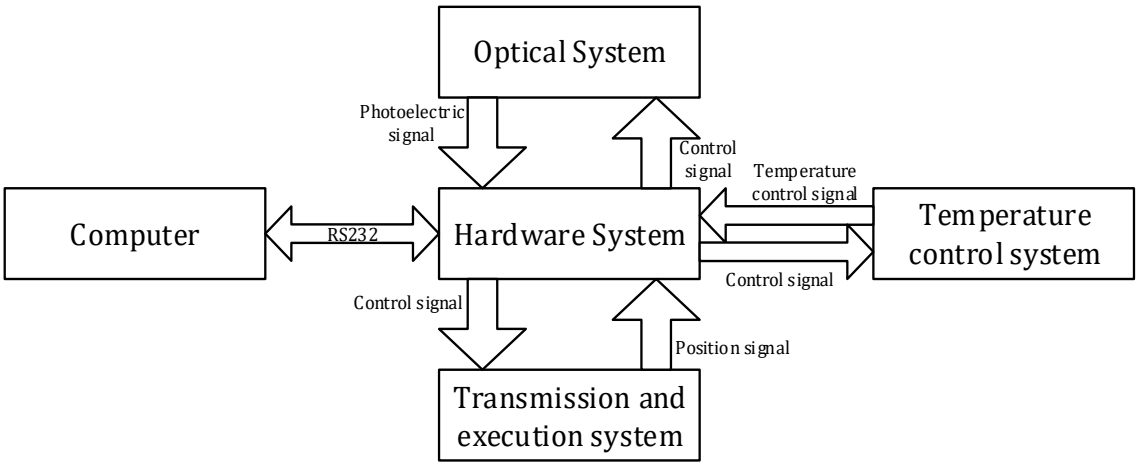


Figure 4-7 Control structure

4.5.2 Main Control Board

Functions and principles

The main control board is used to fulfill the following functions:

- **Communicating with a computer through the serial port to transmit data and instructions and to update the application programs of the PCBA.**
- **Communicating with the smart modules, including the ISE module, through the extended serial ports to transmit data and instructions.**
- **Controlling digital potentiometer adjustment and photoelectric data collection of the AD collection board and receiving the photoelectric data.**
- **Providing the BDM/JTAG interface for debugging software and downloading application programs.**

The figure below shows the relation between the main control board and other PCBAs.

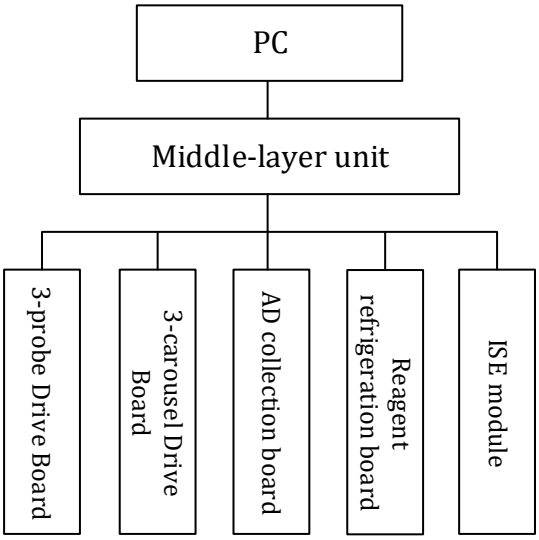


Figure 4-8 Relation between main control board and other PCBAs

The functional diagram of the main control board is as shown below.

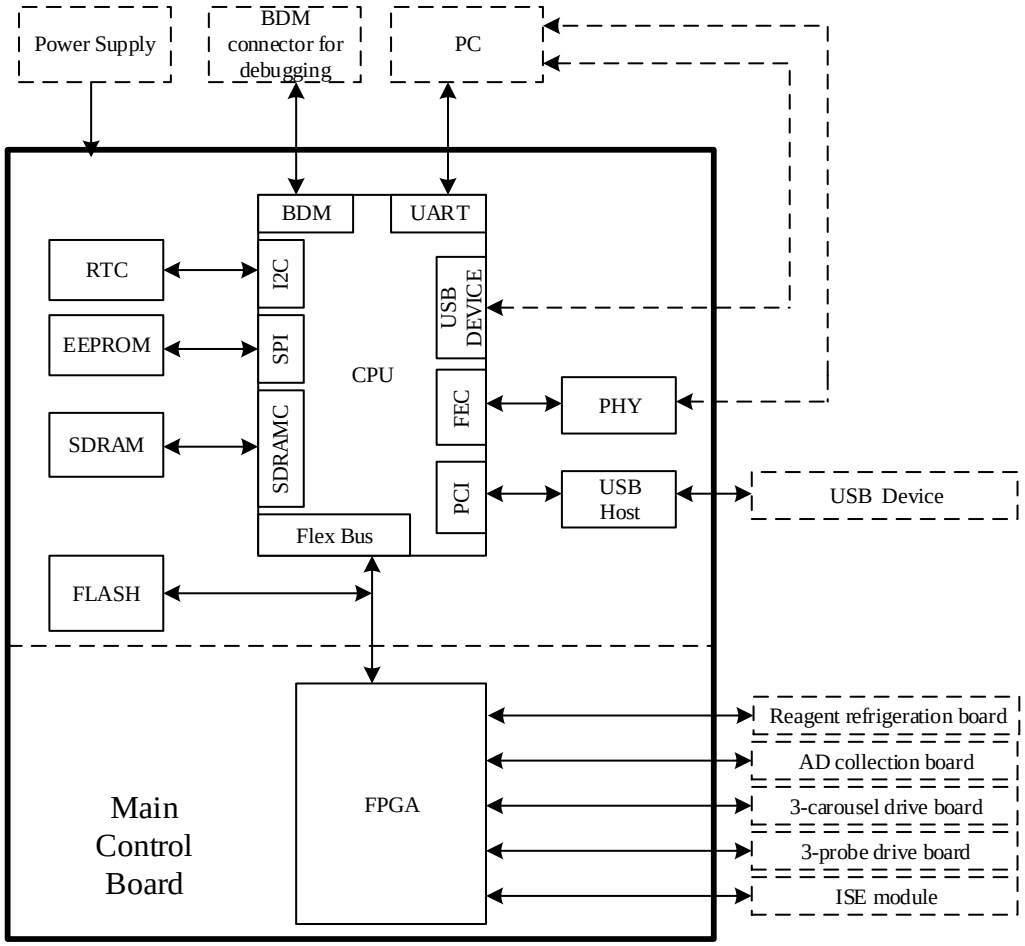


Figure 4-9 Function diagram of control board

Description

PCB layout

The PCB layout of the main control board is as shown below.

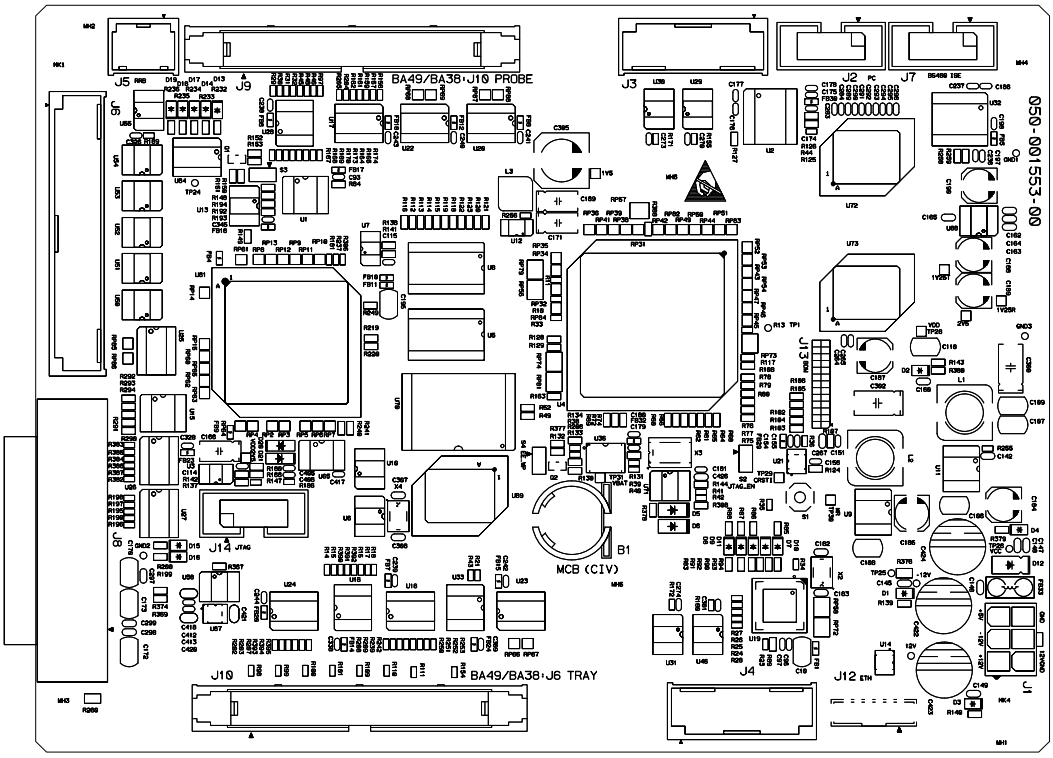


Figure 4-10 Main control board PCB

Connectors

The main control board includes the following connectors.

Power supply:

Power supply input (J1): 6-pin, providing +/-12V analog and +5V digital for PCBAs.

Pin No.	Signal	Reference Value
1	+12V	11.4 ~12.6V
2	-12V	-11.4 ~-12.6V
3	+5V	4.75 ~5.25V
4	12VGND	/
5	12VGND	/
6	GND	/

Connectors for sending/receiving communication signals:

- Serial port (J2) for PC: 10-pin, RS232, used for communication with a computer.
- Connector (J9) for smart module: 34-pin, TTL, used for communication with the three-probe drive board.
- Connector (J6) for smart module: 34-pin, TTL, used for communication with the three-carousel drive board.
- Connector (J8) for AD collection board: DB25, used for communication with the AD collection board and providing power supply for it.
- Connector (J7) for ISE module: 10-pin, RS232, used for communication with the ISE module.
- Connector (J6) for mixer motor: 40-pin, TTL, used for communication with the mixer motor drive board.
- Connector (J5) for reagent refrigeration board: 8-pin, RS422, used for communication with the reagent refrigeration board.

Connectors for debugging:

- BDM connector (J13): 26-pin, used for debugging the CPU software.
- JTAG connector (J1): 10-pin, used for debugging the FPGA.

Switches and jumpers

The main control board contains the following switches and jumpers.

RST key (S1): used to reset the CPU of the PCBA.

Indicators

The main control board contains the following indicators.

- +12V power supply indicator (D3): green. It is lit when the analyzer power switch is turned on, indicating that the +12V power supply has been connected.
- -12V power supply indicator (D1): green. It is lit when the analyzer power switch is turned on, indicating that the -12V power supply has been connected.
- +5V power supply indicator (D4): green. It is lit when the analyzer power switch is turned on, indicating that the +5V power supply has been connected.
- +3.3V power supply indicator (D2): green. It is lit when the analyzer power switch is turned on, indicating that the +3.3V power supply has been connected.
- D13: orange FPGA configuration indicator. On indicates FPGA is successfully configured.
- D14: green FPGA working status indicator. LED is flashing every second, indicating FPGA works normally.
- D17: green Reserved. Constantly lit.
- D18: green When the photoelectric signal collecting is interrupted, the indicator is lit.
- D19: green When communication with the lower layer unit is interrupted, the indicator is lit.

Test points

In the following positions of the main control board can signal tests be performed.

- 12V: +12V power supply input. Normal range: 11.4 - 12.6V.
- -12V: -12V power supply input. Normal range: -11.4 - -12.6V.
- VCC: +5V power supply input. Normal range: 4.75 - 5.25V.
- VDD: +3.3V power supply. It is secondary power supply used to power the major digital circuits of the PCBA. Normal range: 2.97 - 3.63V.
- 2V5: +2.5V power supply. It is secondary power supply used to power the DDR memory. Normal range: 2.25 - 2.75V.
- 1V5: +1.5V power supply. It is secondary power supply used to power the CPU core. Normal range: 1.35 - 1.65V.

Installation methods and precautions

NOTE

- **Prior to removing the PCBA, disconnect the instrument from the power supply and wear a pair of anti-static gloves or wrist straps.**
- **Make sure that the connectors are inserted properly into the PCBA.**
- **Check the connectors with clamps and ensure that the clamps have been locked properly.**
- **Check other connectors and ensure that they are inserted into the end of the slots.**
- **It requires great force to plug/unplug the J3~J4,J10~J11connectors. Hold the PCBA by its edge while plugging/unplugging the connectors to prevent it from being deformed or damaged.**
- **After connecting J7 connector (DB25), tighten the retaining screws on two sides of it.**

4.5.3 Three-probe Drive Board

Functions

- The 3-probe drive board controls and drives the step motors, DC motors and valves, and detects the signal of relevant sensor.
- Receiving instructions from or sending data to the main control board through the relevant interface.
- Controlling and driving the reagent probe, sample probe, sample mixer, reagent mixer, valves, syringes, etc.
- Detecting position sensor signal and horizontal obstruct detection sensor signal.
- Detecting level sense signal and vertical obstruct signal through the interface for the level sense board.
- Setting up level detection sensibility through the serial port for the level sense board.

- Detecting sample probe clog signal through the interface for the sample probe clog detection board, and reading clog pressure through the relevant serial port.

The functional diagram of the three-probe drive board is as shown below.

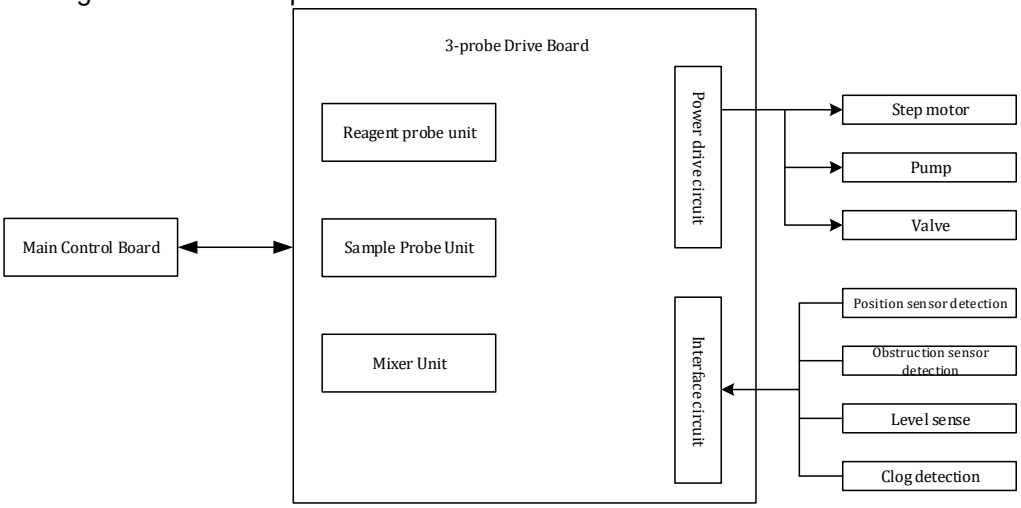


Figure 4-11 Function diagram of three-probe drive board

Description

The PCB layout of the three-probe drive board is as shown below.

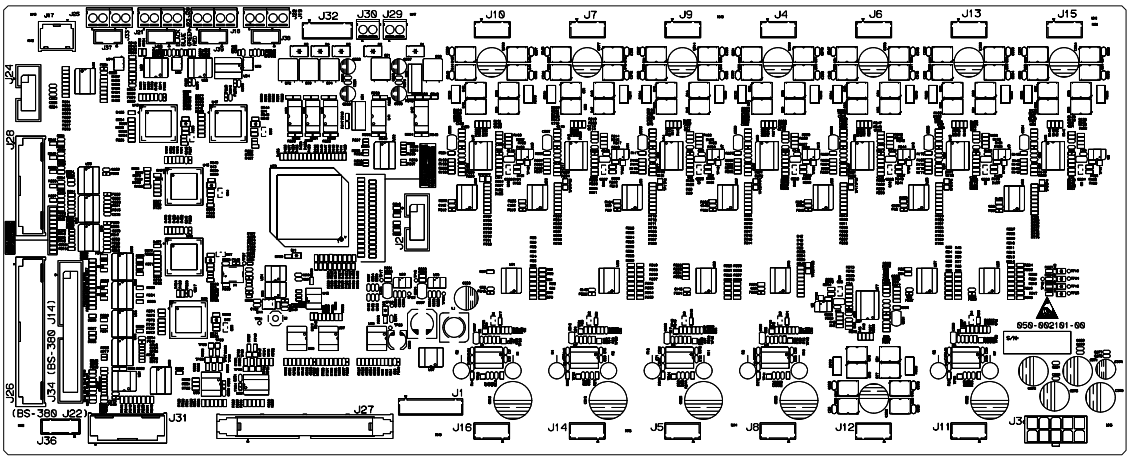


Figure 4-12 Three-drive board PCB

Connectors

The three-probe drive board contains the following connectors.

Power supply:

Power supply input (J3): 10-pin, providing A12V analog, +/-12V, +5V digital, and 24V for the PCBAs.

Table 4-2 Power supply connectors

Pin No.	Signal	Reference Value
1	VCC	4.85 ~5.25V
2	+24V	23.5 ~26V
3	+24V	23.5 ~26V
4	+12V	11.4 ~12.6V
5	-12V	-11.4 ~-12.6V
6	GND	/
7	GND	/
8	GND	/
9	+12VA	11.4 - 12.6

Pin No.	Signal	Reference Value
10	AGND	/

Connectors for sending/receiving communication signals:

- Main control board communication serial port (J27): 34-pin, TTL, used for communicating with the main control board.
- Level sense communication serial port for reagent probe and sample probe (J37): 4-pin, TTL, used for communicating with the reagent and sample level sense boards.
- Clog detection communication serial port (J17): 8-pin, TTL, used for communicating with the clog detection board.

Connectors for debugging:

- JTAG connector (J2): 10-pin, used for debugging the FPGA.

Detection and control connectors:

- Sample level sense signal connector (J40): 4-pin, used for detecting sample probe level sense signal.
- Sample probe vertical obstruct sensor connector (J40): 4-pin, used for detecting sample probe obstruct in vertical direction.
- Reagent level sense signal connector (J39): 4-pin, used for detecting reagent probe level sense signal.
- Reagent probe vertical obstruct sensor connector (J39): 4-pin, used for detecting reagent probe obstruct in vertical direction.
- Clog signal connector (J24): 10-pin, used for detecting clog signal and empty aspirate signal.
- Photocoupler detection connector 1 (J26): 40-pin, used for detecting home position of sample syringe, reagent syringe, mixer assembly, and reagent probe assembly.
- Photocoupler detection connector 2 (J28): 26-pin, used for detecting home position and horizontal obstruct of sample probe assembly and mixer head motor obstruct.
- Probe exterior wash valve connector (J31): 20-pin, used for controlling exterior wash valve of sample probe and reagent probe, reagent and sample mixer wash valve, and probe interior wash pump.
- Probe interior wash drive connector (J32): 6-pin, used for driving interior wash valve of sample probe and reagent probe.
- Reagent horizontal motor drive connector (J4): 4-pin, used for driving the reagent horizontal motor.
- Reagent vertical motor drive connector (J5): 4-pin, used for driving the reagent vertical motor.
- Reagent syringe motor drive connector (J6): 4-pin, used for driving the reagent syringe motor.
- Sample vertical motor drive connector (J10): 4-pin, used for driving the sample vertical motor.
- Sample horizontal motor drive connector (J11): 4-pin, used for driving the sample horizontal motor.
- Sample syringe motor drive connector (J12): 4-pin, used for driving the sample syringe motor.
- Mixer vertical motor drive connector (J13): 4-pin, used for driving the mixer vertical motor.
- Mixer horizontal motor drive connector (J14): 4-pin, used for driving the mixer horizontal motor.
- Mixer head motor drive connector (J16): 4-pin, used for driving the mixer head motor.

Switches and jumpers

The main control board contains the following switches and jumpers.

RST key (S1): used to reset the CPU of the PCBA.

Indicators

The 3-probe drive board contains the following indicators.

Power supply:

- +12V power supply indicator (D8): green. It is lit when the analyzer power switch is turned on, indicating that the +12V power supply has been connected.
- -12V power supply indicator (D7): green. It is lit when the analyzer power switch is turned on, indicating that the -12V power supply has been connected.
- +5V power supply indicator (D9): green. It is lit when the analyzer power switch is turned on, indicating that the +5V power supply has been connected.
- +24V power supply indicator (D10): green It is lit when the analyzer power switch is turned on, indicating that the +24V power supply has been connected.

- FPGA working indicator (D11): green. It is flashing when FPGA works normally.

Test points

In the following positions of the main control board can signal tests be performed.

- J1.1: +12V power supply input. Normal range: 11.4-12.6V.
- J1.2: -12V power supply input. Normal range: -11.4 - -12.6V.
- J1.3: +5V power supply input. Normal range: 4.75 - 5.25V.
- TP20: +3.3V power supply. It is secondary power supply used to power the major digital circuits of the PCBA. Normal range: 2.97 - 3.63V.
- TP17: +2.5V power supply. It is secondary power supply used to download the FPGA. Normal range: 2.25 - 2.75V.
- TP18: +1.5V power supply. It is secondary power supply used to power the FPGA core. Normal range: 1.35 - 1.65V.

Installation methods and precautions

NOTE

- **Prior to removing the PCBA, disconnect the instrument from the power supply and wear a pair of anti-static gloves or wrist straps.**
- **Make sure that the connectors are inserted properly into the PCBA.**
- **Check the connectors with locks and ensure they have been locked properly.**
- **Check other connectors and ensure that they are inserted into the end of the slots.**
- **It requires relatively great force to plug/unplug connectors J3, J26, J28, J31, J35 and J27. Hold the PCBA by its edge while plugging/unplugging these connectors to prevent it from being deformed or damaged.**

4.5.4 Three-carousel Drive Board

Functions

The 3-carousel drive board receives commands from the main control board and then analyzes them; detects position of the three carousels and cuvette wash station, and drives these units; detects the temperature of the temperature sensors and controls the heaters. The major functions of the PCBA include:

- Supporting communication through the serial port. Making the CPUs communicate with the main control board, receiving and analyzing the instructions from it.
- Making the CPUs output control signals to each execution unit.
- Receiving position sensor signals of relevant execution units, auto wash bump prevention signals, and other status signals.
- Detecting the temperature of reaction carousel solid heat, cleaning fluid preheat and the environment, and controlling the heaters.
- Receiving fluid level sensor signals from the hydropneumatic system, and controlling the fluidic valves.

The functional diagram of the 3-carousel drive board is as shown below.

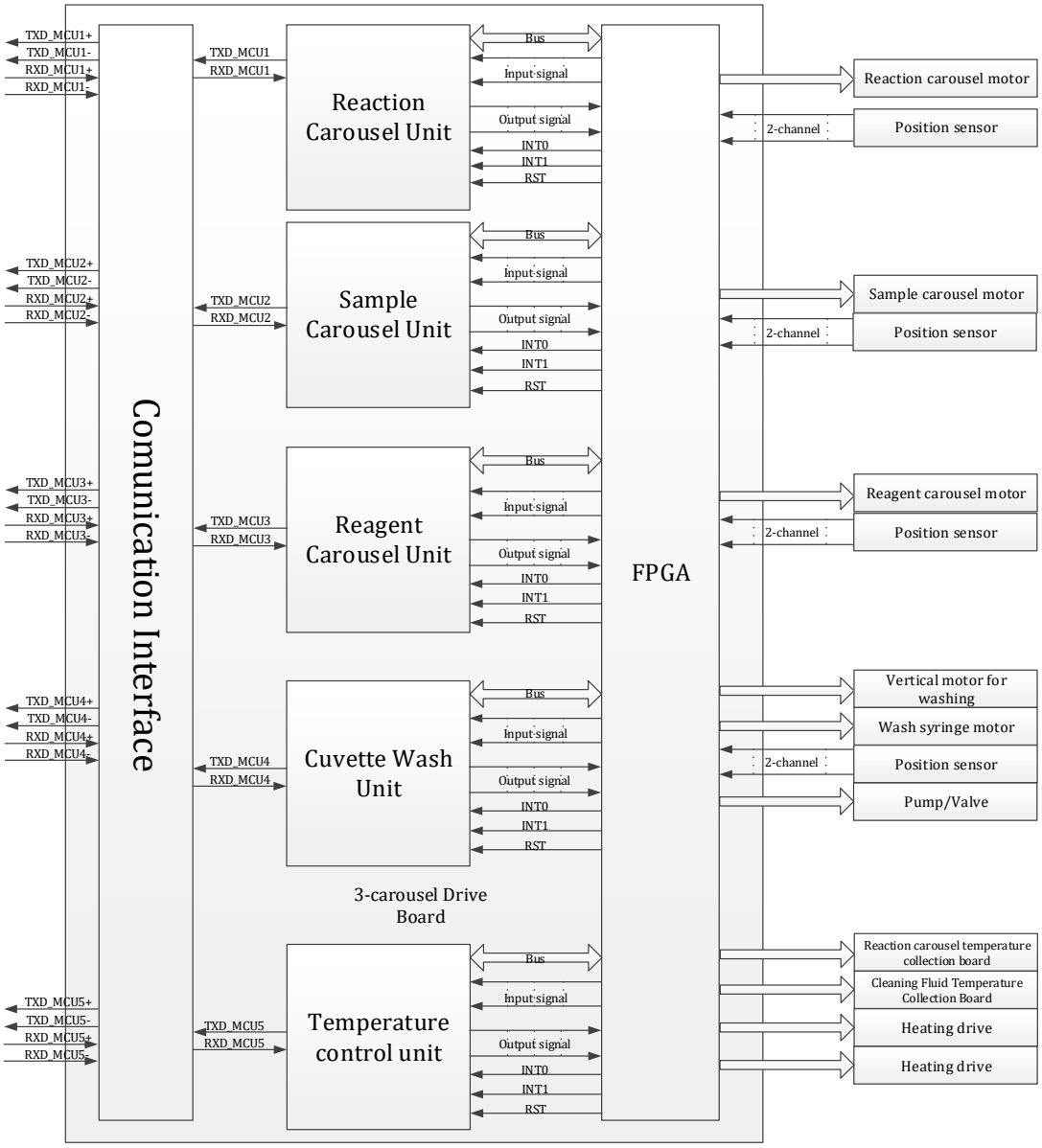


Figure 4-13 Function diagram of three-carousel drive board

Description

The PCB layout of the three-carousel drive board is as shown below.

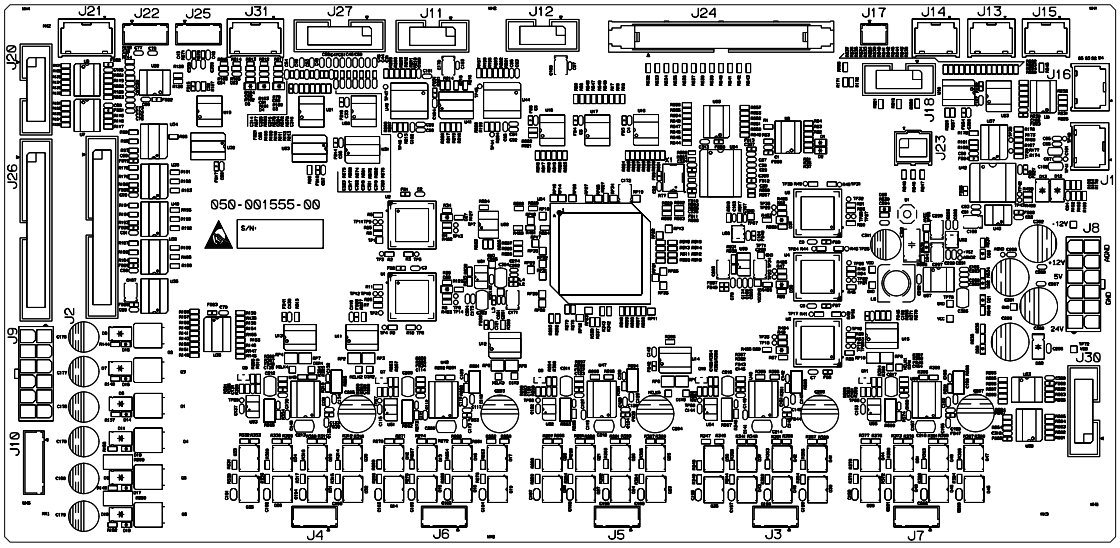


Figure 4-14 Three-carousel drive board PCB

Connectors

The three-carousel drive board contains the following connectors.

Power supply:

Power supply input (J8): 12-pin, providing +/-12V analog, +5V digital, and 24V for the PCBAs.

Table 4-3 Power supply connectors

Pin No.	Signal	Reference Value
1	+24V	23.5 ~26V
2	+24V	23.5 ~26V
3	+24V	23.5 ~26V
4	+VCC	4.85 ~5.25V
5	+12V	11.4 ~12.6V
6	-12V	-11.4 ~-12.6V
7	GND	/
8	GND	/
9	GND	/
10	GND	/
11	AGND	/
12	AGND	/

Connectors for sending/receiving communication signals:

- Main control board communication serial port (J24): 34-pin, TTL, used for communicating with the main control board.
- Reaction carousel temperature collection communication serial port (J21): 8-pin, TTL, used for communicating with the reaction carousel temperature collection board.
- Reagent bar code communication serial port (J12): 10-pin, RS-232, used for communicating with the reagent bar code reader.
- Sample bar code communication serial port (J11): 10-pin, RS-232, used for communicating with the sample bar code reader.
- Cleaning fluid temperature collection communication serial port (J20): 14-pin, SPI, used for communicating with the cleaning fluid temperature collection board.

Connectors for debugging:

- JTAG connector (J18): 10-pin, used for debugging the FPGA.

Detection and control connectors:

- Lamp control signal connector (J1): 8-pin, used for controlling the lamp brightness.

- Cuvette wash syringe photocoupler connector (J15): 9-pin, used for detecting the home position of cuvette wash syringe.
- Floater connector (J27): 14-pin, used for detecting the status of fluidic floaters.
- Vacuum pump and refrigeration fan jam detection interface (J22): 4-pin, used for detecting jams of the refrigeration fans.
- Photocoupler connector (J26): 34-pin, used for detecting the photocouplers of the sample carousel, reagent carousel, reaction carousel, cuvette wash station, and wash syringes.
- Cuvette wash pump/valve control connector (J2): 34-pin, used for controlling the pumps and valves of the cuvette wash unit.
- Cleaning fluid heater drive connector (J9): 12-pin, used for driving the cleaning fluid heater and wash solution heater.
- Reaction carousel heater drive connector (J10): 6-pin, used for driving the reaction carousel heater.
- Reagent carousel motor drive connector (J4): 4-pin, used for driving the reagent carousel motor.
- Sample carousel motor drive connector (J5): 4-pin, used for driving the sample carousel motor.
- Cuvette wash motor drive connector (J6): 4-pin, used for driving the cuvette wash motor.
- Reaction carousel motor drive connector (J3): 4-pin, used for driving the reaction carousel motor.
- Cuvette wash syringe motor drive connector (J7): 4-pin, used for driving the cuvette wash syringe motor.

Switches and jumpers

The main control board contains the following switches and jumpers.

RST key (S5): used to reset the CPU of the PCBA.

Indicators

The 3-carousel board contains the following indicators.

- D19: green It is lit when the analyzer power switch is turned on, indicating that the 3.3V power supply has been connected.
- D20: green It is lit when the analyzer power switch is turned on, indicating that the 5V power supply has been connected.
- D21: green It is lit when the analyzer power switch is turned on, indicating that the +12V power supply has been connected.
- D22: green It is lit when the analyzer power switch is turned on, indicating that the 24V power supply has been connected.
- D23: green It is lit when the analyzer power switch is turned on, indicating that the -12V power supply has been connected.
- D32: green It indicates the working status of cleaning fluid heater 2. It is lit when the heater is turned on.
- D33: green It indicates the working status of cleaning fluid heater 3. It is lit when the heater is turned on.
- D36: green It indicates the working status of reaction carousel heater 1. It is lit when the heater is turned on.
- D38: green It indicates the status of the high-concentration waste tank. It is lit when the waste tank is full.
- D39: green It indicates the status of the waste buffer tank. It is lit when the waste buffer tank is full.
- D2: green It is flashing when FPGA works normally.

Test points

In the following positions of the 3-carousel board can signal tests be performed.

- Lamp control signal connector (J1): 8-pin, used for controlling the lamp brightness.
- Cuvette wash syringe photocoupler connector (J15): 9-pin, used for detecting the home position of cuvette wash syringe.
- Floater connector (J27): 14-pin, used for detecting the status of fluidic floaters.
- Refrigeration fan jam detection interface (J22): 4-pin, used for detecting jams of the refrigeration fans.
- Photocoupler connector (J26): 34-pin, used for detecting the photocouplers of the sample carousel, reagent carousel, reaction carousel, cuvette wash station, and wash syringes.
- Cuvette wash pump/valve control connector (J2): 34-pin, used for controlling the pumps and valves of the cuvette wash unit.
- Cleaning fluid heater drive connector (J9): 12-pin, used for driving the cleaning fluid heater and wash

solution heater.

- Reaction carousel heater drive connector (J10): 6-pin, used for driving the reaction carousel heater.
- Reagent carousel motor drive connector (J4): 4-pin, used for driving the reagent carousel motor.
- Sample carousel motor drive connector (J5): 4-pin, used for driving the sample carousel motor.
- Cuvette wash motor drive connector (J6): 4-pin, used for driving the cuvette wash motor.
- Reaction carousel motor drive connector (J3): 4-pin, used for driving the reaction carousel motor.
- Cuvette wash syringe motor drive connector (J7): 4-pin, used for driving the cuvette wash syringe motor.

Installation methods and precautions

NOTE

- **Prior to removing the PCBA, disconnect the instrument from the power supply and wear a pair of anti-static gloves or wrist straps.**
- **Make sure that the connectors are inserted properly into the PCBA.**
- **Check the connectors with clamps and ensure that the clamps have been locked properly.**
- **Check other connectors and ensure that they are inserted into the end of the slots.**
- **It requires relatively great force to plug/unplug connectors J2, J8, J9, J28, J26, and J27. Hold the PCBA by its edge while plugging/unplugging these connectors to prevent it from being deformed or damaged.**

4.5.5 Pump/Valve Drive Board

Functions

The pump/valve drive board receives pump/valve control signals from the 3-carousel control drive board and 3-probe control drive board, drives BS-460 pumps, and transmits fluidic sensors' signals to the 3-carousel control drive board.
The functional diagram of the pump/valve drive board is as shown below.

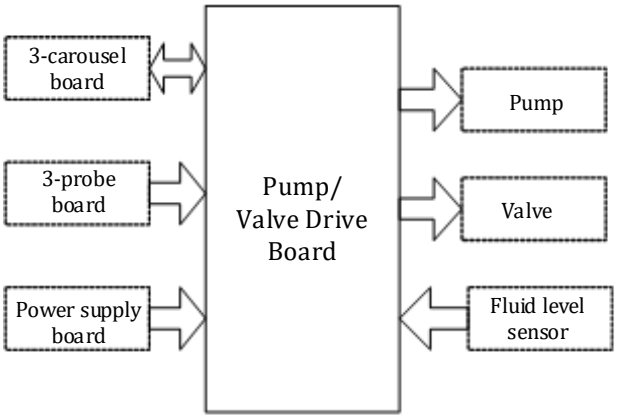


Figure 4-15 Function diagram of pump/valve drive board

Description

The PCB layout of the communication adapter board is as shown below.

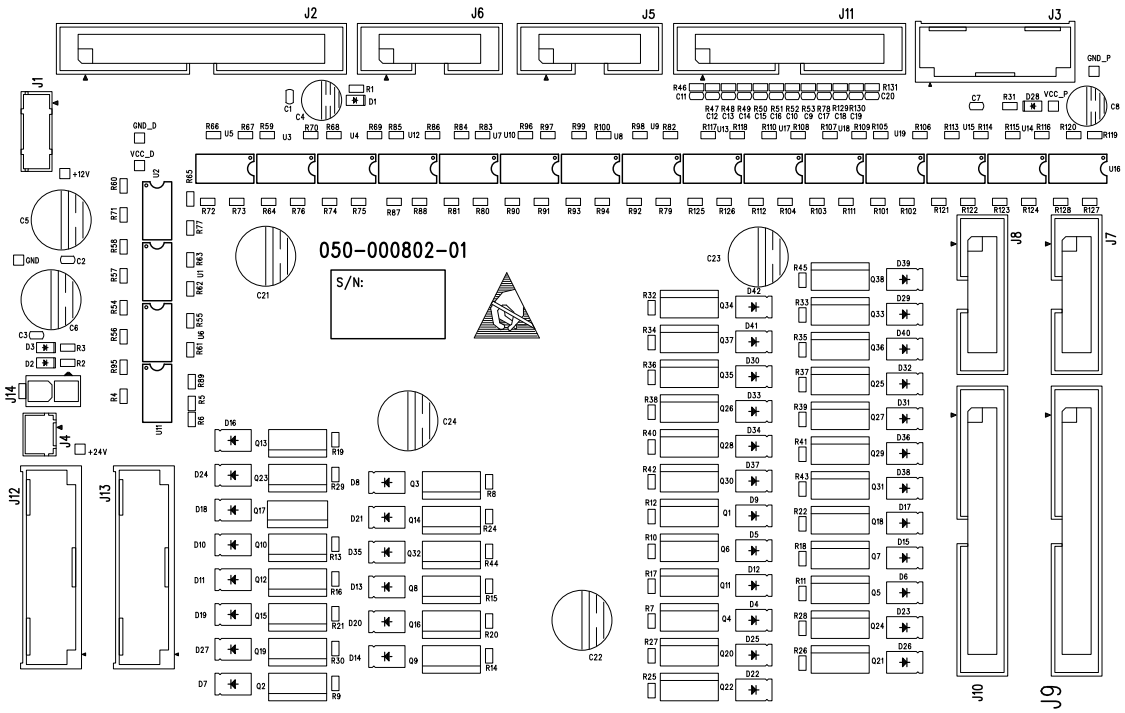


Figure 4-16 Communication conversion board PCB

Connectors

The pump/valve drive board contains the following connectors.

Power supply:

Power supply input (J1): 12-pin, providing +/-12V analog, +5V digital and 24V for the PCBAs.

Table 4-4 Power supply connectors

Pin No.	Signal	Reference Value
1	+12V	11.4 ~12.6V
2	GND	/
3	+12V	11.4 ~12.6V
4	GND	/
5	+12V	11.4 ~12.6V
6	GND	/
7	+12V	11.4 ~12.6V
8	GND	/
9	+24V	23.5 ~26V
10	GND	/
11	+24	23.5 ~26V
12	+24	/

Detection and control connectors:

- Cuvette wash pump/valve control connector (J2): 34-pin, used for controlling the pumps and valves of the cuvette wash unit.
- Floater conversion connector (J5): 14-pin, used for feeding back status of fluidic floaters to the 3-carousel drive board.
- Floater connector (J11): 26-pin, used for detecting the status of fluidic floaters.
- Pump/valve control connector 1 (J3): 20-pin, used for receiving pump/valve control signal transmitted from the 3-probe drive board and 3-carousel drive board and the 24V pump control signal.
- 24V pump drive connector (J7): 16-pin, used for driving the deionized water circulating pump.
- Valve drive connector 1 (J9): 34-pin, used for driving the exterior wash valve of SV08 reagent probe, the exterior wash valve of SV07 sample probe, the SV10 sample mixer wash valve, the SV11 reagent mixer wash valve, the SV01 water inlet valve, the SV16 cuvette 3-phase dispensing valve, the SV17 cuvette 4-

phase dispensing valve, the SV18 cuvette 4-phase dispensing valve, the SV15 cuvette 1/2-phase dispensing valve, and the SV19 cuvette 6-phase dispensing valve.

- Valve drive connector 2 (J12): 26-pin, used for driving the P11 cuvette 1/2-phase waste pump, the P15 cuvette 8-phase waste pump, the P14 cuvette 7-phase waste pump, the P13 cuvette 5/6-phase waste pump, the P04 probe interior wash pump, and the P12 cuvette 3/4-phase waste pump.

Indicators

The pump/valve drive board contains the following indicators.

- D1: green It is lit when the analyzing unit power switch is turned on, indicating that the 5V power supply for 3-carousel drive board has been connected.
- D2: green It is lit when the analyzer power switch is turned on, indicating that the 12V power supply has been connected.
- D3: green It is lit when the analyzer power switch is turned on, indicating that the 24V power supply has been connected.
- D28: green It is lit when the analyzing unit power switch is turned on, indicating that the 5V power supply for 3-probe drive board has been connected.

Test points

In the following positions of the pump/valve drive board can signal tests be performed.

- J1.1: +12V power supply input. Normal range: 11.4-12.6V.
- J1.9: +24V power supply input. Normal range: 23.5 - 26V.

Installation methods and precautions

NOTE

- **Prior to removing the PCBA, disconnect the instrument from the power supply and wear a pair of anti-static gloves or wrist straps.**
- **Make sure that the connectors are inserted properly into the PCBA.**
- **Check the connectors with clamps and ensure that the clamps have been locked properly.**
- **Check other connectors and ensure that they are inserted into the end of the slots.**
- **It requires relatively great force to plug/unplug connectors J2, J3, J5, J9, and J12. Hold the PCBA by its edge while plugging/unplugging these connectors to prevent it from being deformed or damaged.**

4.5.6 Rotation Speed Photocoupler Conversion Board

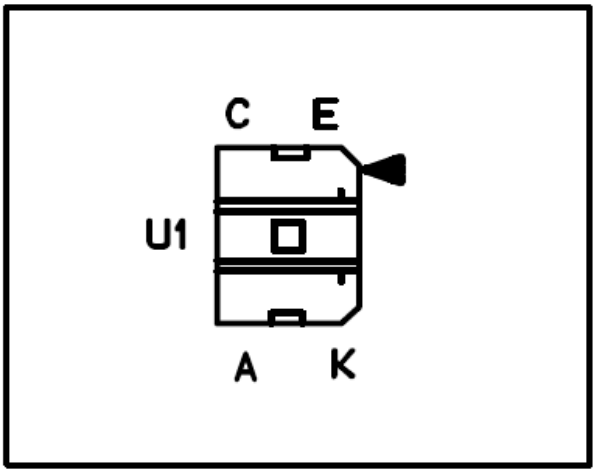
Functions

The Rotation speed optical coupler conversion board is intended for the following functions:

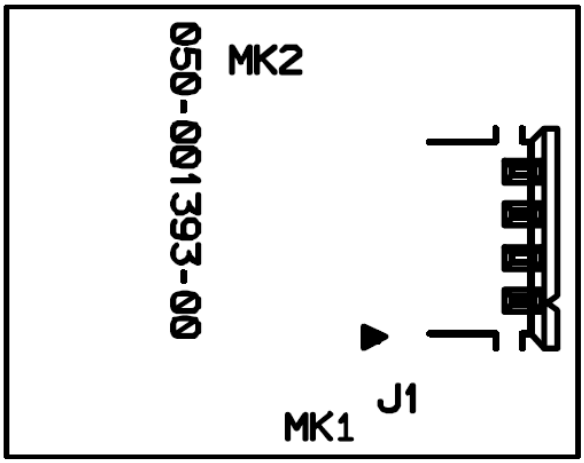
- Use to connect the photocoupler of the mixer rotation speed.
- Providing the signal of the mixer rotation speed and the mixer drive board.

Description

The PCB layout of the Rotation speed optical coupler conversion board is as shown below.
Top view:



Bottom view:



Connectors

- J1: connector for the photocoupler of the mixer rotation speed and mixer drive board.

Indicators

N/A

Installation methods and precautions

NOTE

- **Prior to removing the PCBA, disconnect the instrument from the power supply and wear a pair of anti-static gloves or wrist straps.**

4.5.7 Reaction Carousel Temperature Collection Board

Functions

The BS-460 has one reaction carousel temperature collection board, which is used to:

- Collect/Convert the reaction carouse temperature sensor signals and output them to the wash temperature control board.

The functional diagram of the reaction carousel temperature collection board is as shown below.

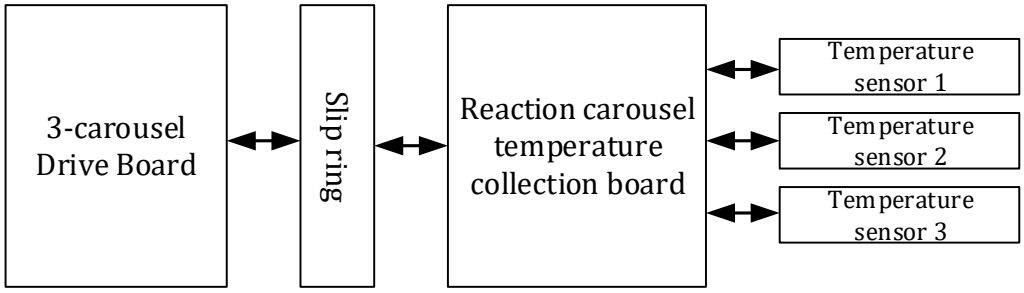


Figure 4-17 Functional diagram of reaction carousel temperature collection board

Description

PCB layout

The PCB layout of the reaction carousel temperature collection board is as shown below.

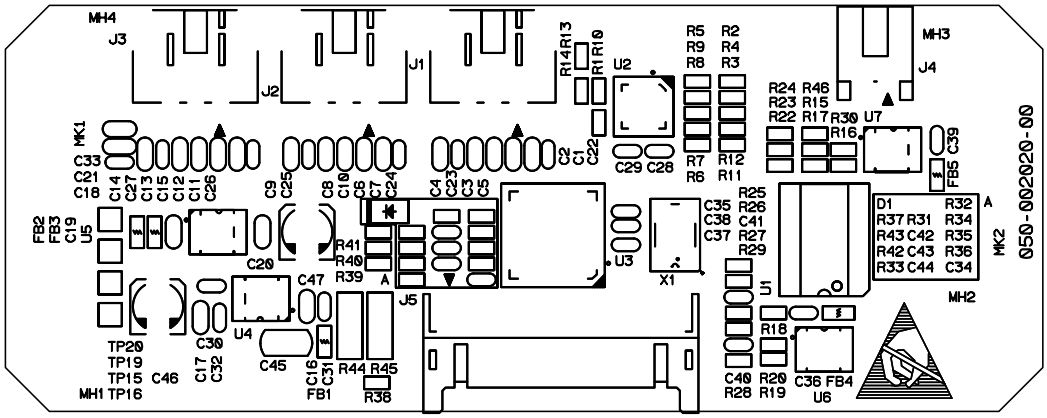


Figure 4-18 Reaction carousel temperature collection board PCB

Connectors

The reaction carousel temperature collection board contains the following connectors.

Connectors 1-3 (J1-J3) for reaction carousel temperature sensor: 3-pin. Used to connect the reaction carousel temperature sensor with the temperature detection circuit.

Table 4-5 Connectors for reaction carousel temperature sensor

Pin No.	Signal Name	I/O	Description	Valid Level and Type
1	SHIELD	/	Shielded wire of sensor	/
2	REF	I	Signal cable of sensor	/
3	PT1000	I	Signal cable of sensor	/

Reaction carousel ground connector (J4): 2-pin, used to connect the carousel to the GND of board, with the other end fixing on the reaction carousel by using M3 pan head screws.

Table 4-6 Reaction carousel ground connector

Pin No.	Signal Name	I/O	Description	Valid Level and Type
1	GND	/	GND	/
2	GND	/	GND	/

Connector for connecting the reaction carousel temperature collection board and the slip ring (J5): 20-pin, used to connect the reaction carousel temperature collection board and the 3-carousel control drive board.

Table 4-7 Connectors for slip ring

Pin No.	Signal Name	I/O	Description	Valid Level and Type
1	SHIELD	/	Shielding ground	/

Pin No.	Signal Name	I/O	Description	Valid Level and Type
2	SHIELD	/	Shielding ground	/
3	/	/	/	/
4	/	/	/	/
5	GND	/	Analog ground	/
6	GND	/	Analog ground	/
7	/	/	/	/
8	/	/	/	/
9	RST	I	RST reset signal	5V TTL
10	TXD	I	Serial port TXD	5V TTL
11	/	I	/	5V TTL
12	RXD	O	Serial port RXD	5V TTL
13	ISP	O	ISP downloading signal	5V TTL
14	GND	/	Analog ground	/
15	GND	/	Analog ground	/
16	GND	I	Control signals of multiplexer switch	5V TTL
17	VPP	I	Control signals of multiplexer switch	5V TTL
18	VPP	/	12V power supply input	/
19	GND	/	Analog ground	/
20	GND	/	Analog ground	5V TTL

Indicators

The reaction carousel temperature collection board contains the following indicators.

- PCB status (D1): green. When the PCB is normal, the indicator will flash at an interval of 1 second.

Test points

In the following positions of the reaction carousel temperature collection board can signal tests be performed.

- TP1: +12V power supply input. Normal range: 12V±5%, that is, 11.4-12.6V.
- TP2: +5V power supply, secondary power supply. Normal range: 5V±5%, that is, 4.75-5.25V.
- TP3: +3.3V power supply, secondary power supply. Normal range: 3.3V±5%, that is, 3.14-3.47V.
- TP5: reaction carousel temperature collection board ground.

Installation methods and precautions

NOTE

- **Prior to removing the PCBA, disconnect the instrument from the power supply and wear a pair of anti-static gloves or wrist straps.**
- **Make sure that the connectors are inserted properly into the end of the slots on the PCBA. Check if the PCBA has been locked tightly.**
- **It requires great force to plug/unplug connectors. Hold the PCBA by its edge while plugging/unplugging the connectors to prevent it from being deformed or damaged.**

4.5.8 Heater Conversion Board of Reaction Carousel

Functions and principles

The BS-460 has one reaction carousel heater conversion board, which is used to:

- Provide the reaction carousel heater and temperature switch connectors, and connect the 3-carousel control drive board via the slip ring to control the heater.

The functional diagram of the reaction carousel heater conversion board is as shown below:

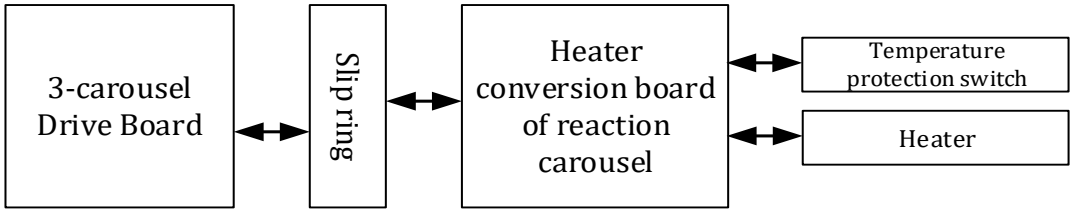


Figure 4-19 Functional diagram of reaction carousel temperature collection board

Description

PCB layout

The PCB layout of the reaction carousel temperature collection board is as shown below.

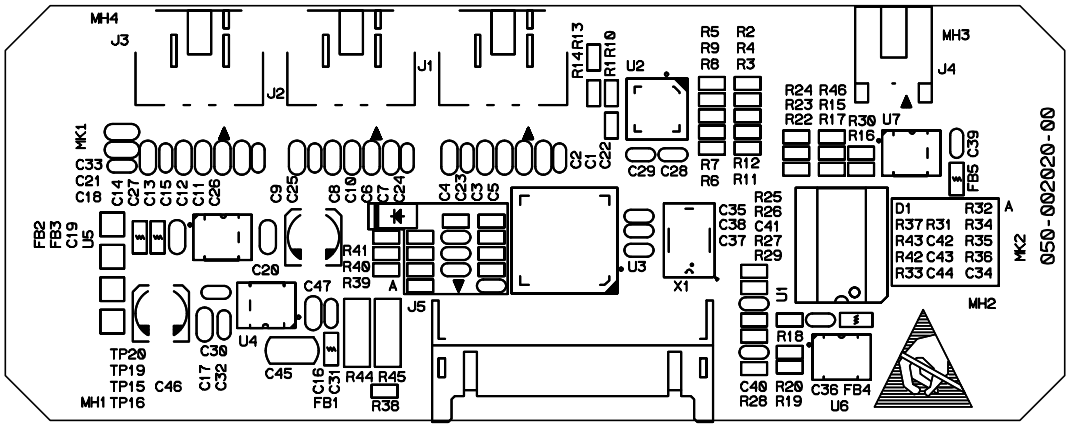


Figure 4-20 Reaction carousel temperature collection board PCB

Connectors

The reaction carousel temperature collection board contains the following connectors.

Connectors 1-3 (J1-J3) for reaction carousel temperature sensor: 3-pin. Used to connect the reaction carousel temperature sensor with the temperature detection circuit.

Table 4-8 Connectors for reaction carousel temperature sensor

Pin No.	Signal Name	I/O	Description	Valid Level and Type
1	SHIELD	/	Shielded wire of sensor	/
2	REF	I	Signal cable of sensor	/
3	PT1000	I	Signal cable of sensor	/

Reaction carousel ground connector (J4): 2-pin, used to connect the carousel to the GND of board, with the other end fixing on the reaction carousel by using M3 pan head screws.

Table 4-9 Reaction carousel ground connector

Pin No.	Signal Name	I/O	Description	Valid Level and Type
1	GND	/	GND	/
2	GND	/	GND	/

Connector for connecting the reaction carousel temperature collection board and the slip ring (J5): 20-pin, used to connect the reaction carousel temperature collection board and the 3-carousel control drive board.

Table 4-10 Connectors for slip ring

Pin No.	Signal Name	I/O	Description	Valid Level and Type
1	SHIELD	/	Shielding ground	/
2	SHIELD	/	Shielding ground	/
3	/	/	/	/

Pin No.	Signal Name	I/O	Description	Valid Level and Type
4	/	/	/	/
5	GND	/	Analog ground	/
6	GND	/	Analog ground	/
7	/	/	/	/
8	/	/	/	/
9	RST	I	RST reset signal	5V TTL
10	TXD	I	Serial port TXD	5V TTL
11	/	I	/	5V TTL
12	RXD	O	Serial port RXD	5V TTL
13	ISP	O	ISP downloading signal	5V TTL
14	GND	/	Analog ground	/
15	GND	/	Analog ground	/
16	GND	I	Control signals of multiplexer switch	5V TTL
17	VPP	I	Control signals of multiplexer switch	5V TTL
18	VPP	/	12V power supply input	/
19	GND	/	Analog ground	/
20	GND	/	Analog ground	5V TTL

Indicators

The reaction carousel temperature collection board contains the following indicators.

- PCB status (D1): green. When the PCB is normal, the indicator will flash at an interval of 1 second.

Test points

In the following positions of the reaction carousel temperature collection board can signal tests be performed.

- TP1: +12V power supply input. Normal range: 12V±5%, that is, 11.4-12.6V.
- TP2: +5V power supply, secondary power supply. Normal range: 5V±5%, that is, 4.75-5.25V.
- TP3: +3.3V power supply, secondary power supply. Normal range: 3.3V±5%, that is, 3.14-3.47V.
- TP5: reaction carousel temperature collection board ground.

Installation methods and precautions

NOTE

- **Prior to removing the PCBA, disconnect the instrument from the power supply and wear a pair of anti-static gloves or wrist straps.**
- **Make sure that the connectors are inserted properly into the end of the slots on the PCBA. Check if the PCBA has been locked tightly.**
- **It requires great force to plug/unplug connectors. Hold the PCBA by its edge while plugging/unplugging the connectors to prevent it from being deformed or damaged.**

4.5.9 Cleaning Fluid Temperature Collection Board

Functions and principles

The BS-460 has one cleaning fluid temperature collection board, which is mainly used to:
Process, collect and AD-convert signals of 1-channel temperature sensor of cleaning fluid and 1-channel temperature sensor of wash solution, and provide SPI access interface. The cleaning fluid temperature collection board is connected with the wash temperature control board.
The functional diagram of the cleaning fluid temperature collection board is as shown below.

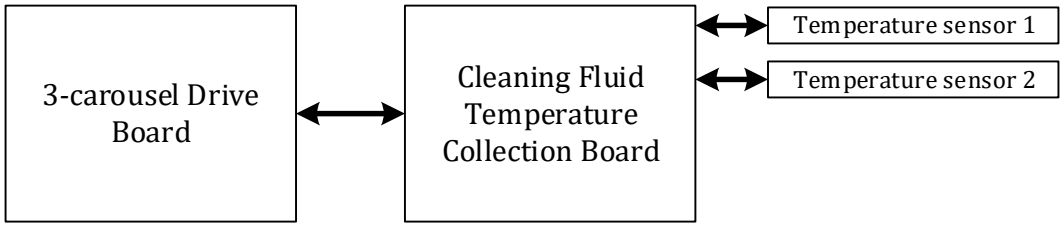


Figure 4-21 Functional diagram of cleaning fluid temperature collection board

Description

The PCB layout of the cleaning fluid temperature collection board is as shown below.

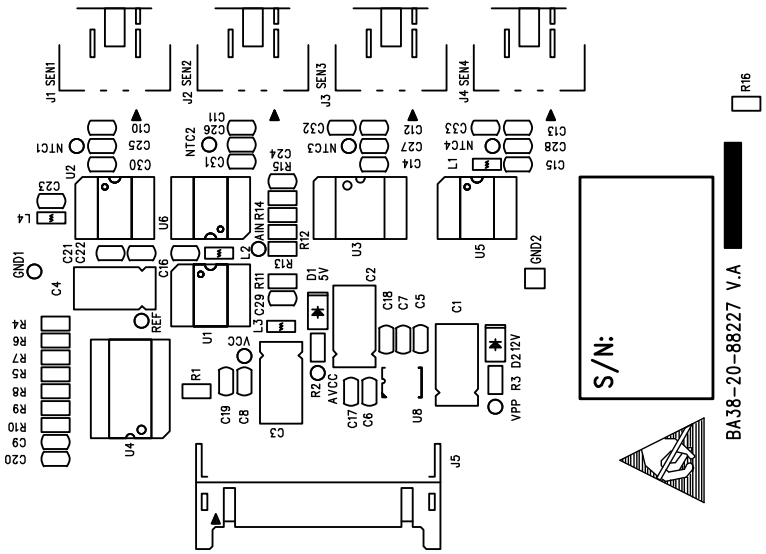


Figure 4-22 Cleaning fluid temperature collection board PCB

Connectors

The cleaning fluid temperature collection board contains the following connectors:

Temperature sensor connectors 1-4 (J1-J4): 3-pin, used to connect the temperature sensor with the temperature detection circuit.

Table 4-11 Connectors for temperature sensor

Pin No.	Signal Name	I/O	Description	Valid Level and Type
1	SHIELD	/	Shielded wire of sensor	/
2	AGND	/	Signal cable of sensor (analog ground)	/
3	NTC	I	Signal cable of sensor	Analog

Connector J5 for wash temperature control board: 20-pin, used to power the PCBA and transmit/control the signals.

Table 4-12 Connectors for wash temperature control board

Pin No.	Signal Name	I/O	Description	Valid Level and Type
1	SGND	/	Enclosure ground	/
2	SGND	/	Enclosure ground	/
3	CS	I	AD chip selection input	TTL, valid in the case of low level.
4	NC	/	NC	/
5	SDO	O	AD chip data output	TTL

Pin No.	Signal Name	I/O	Description	Valid Level and Type
6	SCLK	I	AD chip clock input	TTL
7	NC	/	NC	/
8	NC	/	NC	/
9	NC	/	NC	/
10	MUX_A	I	Channel A	TTL
11	VPP	/	12V power supply input	/
12	MUX_B	I	Channel B	TTL
13	GND	/	Ground	/
14	GND	/	Ground	/
15	GND	/	Ground	/
16	NC	/	NC	/
17	NC	/	NC	/
18	NC	/	NC	/
19	NC	/	NC	/
20	NC	/	NC	/

Indicators

The cleaning fluid temperature collection board contains the following indicators.

- +12V power supply indicator (D2): green. When it is lit, it indicates that the +12V power supply has been connected.
- +5V power supply indicator (D1): green. When it is lit, it indicates that the +5V power supply has been connected.

Test points

- In the following positions of the cleaning fluid temperature collection board can signal tests be performed.
- VPP: +12V power supply input. Normal range: 12V±5%, that is, 11.4-12.6V.
- AVCC: +5V power supply. It is secondary power supply used to power the analog parts of the PCBA. Normal range: 5V±5%, that is, 4.75-5.25V.
- VCC: +5V power supply. It is secondary power supply used to power the digital parts of the PCBA. Normal range: 5V±5%, that is, 4.75-5.25V.
- GND1 and GND2: grounding terminals of the cleaning fluid temperature collection board.
- AIN: AD collection signal test point.
- REF: reference voltage.

Installation methods and precautions

NOTE

- **Prior to removing the PCBA, disconnect the instrument from the power supply and wear a pair of anti-static gloves or wrist straps.**
- **Make sure that the connectors are inserted properly into the end of the slots on the PCBA.**
- **It requires great force to plug/unplug connectors. Hold the PCBA by its edge while plugging/unplugging the connectors to prevent it from being deformed or damaged.**

4.5.10 AD Collection Board

Functions and principles

The AD collection board is intended to implement the following functions:

- Adjusting gains of 12 photoelectric signals via a digital potentiometer.
- Controlling the channel selection switch to switch among 12 channel signals at different time.
- Converting photoelectric analog signals into digital signals via an AD converter and then outputting the signals.

The figure below shows the relation between the AD collection board and other PCBAs.

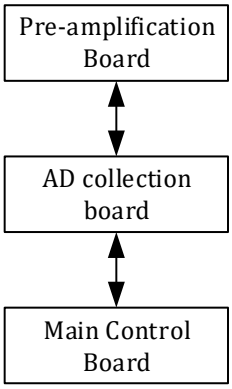


Figure 4-23 Relation between AD collection board and other PCBAs

The functional diagram of the AD collection board is as shown below.

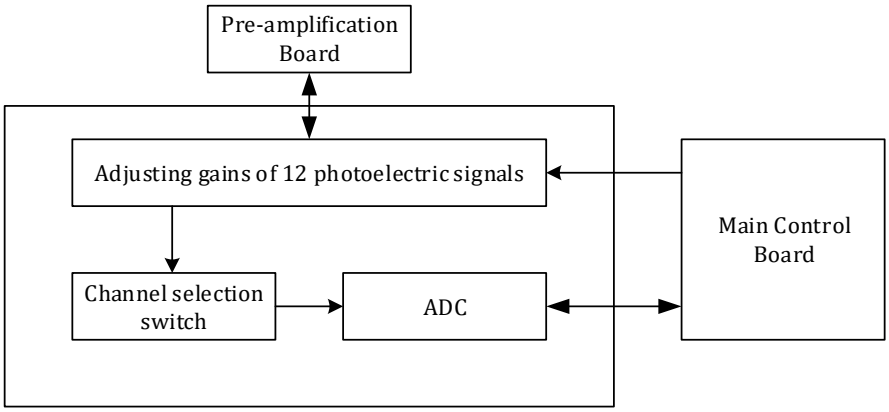


Figure 4-24 Functional diagram of AD collection board

Description

PCB layout

The PCB layout of the AD collection board is as shown below.

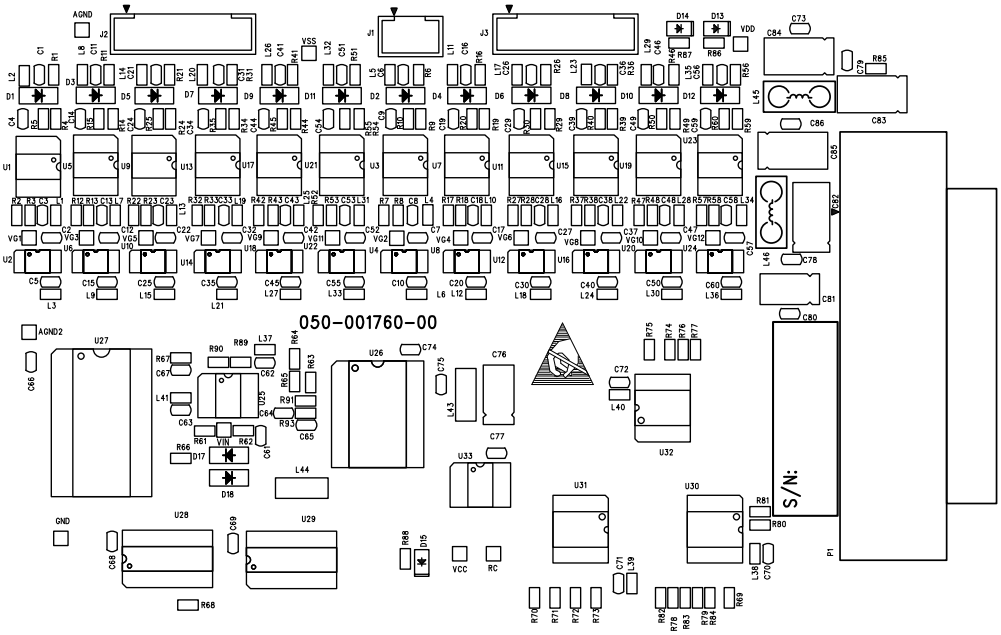


Figure 4-25 AD collection board PCB

Connectors

The AD collection board contains the following connectors.

Power supply:

Power supply output connector (J1): 3-pin, used to provide +12V and -12V power supplies for the pre-amplification board.

Table 4-13 Power supply connectors

Pin No.	Signal Name	Reference Value
1	+12V	11.4 to 12.6V
2	AGND	/
3	-12V	-11.4 to -12.6V

Connectors for sending/receiving communication signals:

Connector (J2) for pre-amplification board signal input: 8-pin, used to receive photoelectric analog signals of six channels.

Table 4-14 Connector (J2) for pre-amplification board signal input

Pin No.	Signal Name	Reference Value
1	AGND	/
2	Signal1	0.25V-2.5V (water blank condition)
3	Signal3	0.25V-2.5V (water blank condition)
4	Signal5	0.25V-2.5V (water blank condition)
5	Signal7	0.25V-2.5V (water blank condition)
6	Signal9	0.25V-2.5V (water blank condition)
7	Signal11	0.25V-2.5V (water blank condition)
8	AGND_SHELD	/

Connector (J3) for pre-amplification board signal input: 8-pin, used to receive photoelectric analog signals of six channels.

Table 4-15 Connector (J3) for pre-amplification board signal input

Pin No.	Signal Name	Reference Value
1	AGND	/
2	Signal1	0.25V-2.5V (water blank condition)
3	Signal3	0.25V-2.5V (water blank condition)
4	Signal5	0.25V-2.5V (water blank condition)
5	Signal7	0.25V-2.5V (water blank condition)
6	Signal9	0.25V-2.5V (water blank condition)
7	Signal11	0.25V-2.5V (water blank condition)
8	AGND_SHELD	/

Main control board connector (P1): 25-pin, used for communication with the main control board.

Switches and jumpers

The AD collection board has no switches or jumpers.

Indicators

The AD collection board contains the following indicators.

Power supply:

- +12V power supply indicator (D13): green. When it is lit, it indicates that the +12V power supply has been connected.
- -12V power supply indicator (D14): green. When it is lit, it indicates that the -12V power supply has been connected.
- +5V power supply indicator (D15): green. When it is lit, it indicates that the +5V power supply has been connected.

Test points

In the following positions of the AD collection board can signal tests be performed.

- VG1: signal output of channel 340nm. Normal range: varies with the signal strength and lies between 0-5V.

- VG2: signal output of channel 380nm. Normal range: varies with the signal strength and lies between 0-5V.
- VG3: signal output of channel 412nm. Normal range: varies with the signal strength and lies between 0-5V.
- VG4: signal output of channel 450nm. Normal range: varies with the signal strength and lies between 0-5V.
- VG5: signal output of channel 505nm. Normal range: varies with the signal strength and lies between 0-5V.
- VG6: signal output of channel 546nm. Normal range: varies with the signal strength and lies between 0-5V.
- VG7: signal output of channel 570nm. Normal range: varies with the signal strength and lies between 0-5V.
- VG8: signal output of channel 605nm. Normal range: varies with the signal strength and lies between 0-5V.
- VG9: signal output of channel 660nm. Normal range: varies with the signal strength and lies between 0-5V.
- VG10: signal output of channel 700nm. Normal range: varies with the signal strength and lies between 0-5V.
- VG11: signal output of channel 740nm. Normal range: varies with the signal strength and lies between 0-5V.
- VG12: signal output of channel 800nm. Normal range: varies with the signal strength and lies between 0-5V.
- VDD: +12V power supply input. Normal range: 12V±5%, that is, 11.4-12.6V.
- VSS: -12V power supply input. Normal range: -12V±5%, that is, -11.4-12.6V.
- VCC: +5V power supply input. Normal range: 5V±5%, that is, 4.75-5.25V.

Installation methods and precautions

NOTE

- **Prior to removing the PCBA, disconnect the instrument from the power supply and wear a pair of anti-static gloves or wrist straps.**
- **Make sure that the connectors are inserted properly into the PCBA.**
- **Check the connectors with locks and ensure they have been locked properly.**
- **Check other connectors and ensure that they are inserted into the end of the slots.**
- **It requires relatively great force to plug/unplug connectors J2 and J3. Hold the PCBA by its edge while plugging/unplugging these connectors to prevent it from being deformed or damaged.**
- **After connecting P1 connector (DB25), tighten the retaining screws on two sides of it.**

4.5.11 Pre-amplification Board

Functions and principles

The pre-amplification board is intended to implement the following functions:

- Converting optical signals into electric signals via a photodiode array.
- With the help of the back circuit, filtering signals and transmitting them to the AD collection board after amplification.

The figure below shows the relation between the pre-amplification board and other PCBAs.

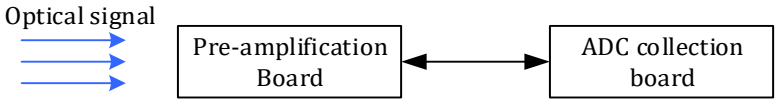


Figure 4-26 Relation between pre-amplification board and other PCBAs

The functional diagram of the pre-amplification board is as shown below.

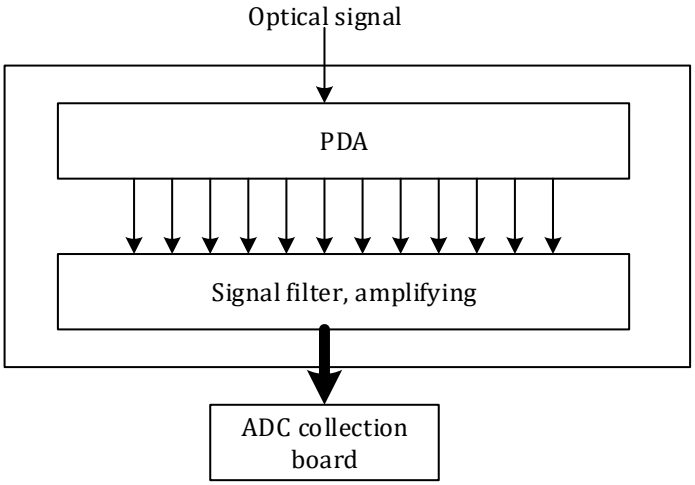


Figure 4-27 Functional diagram of pre-amplification board

Description

PCB layout

The PCB layout of the pre-amplification board is as shown below.

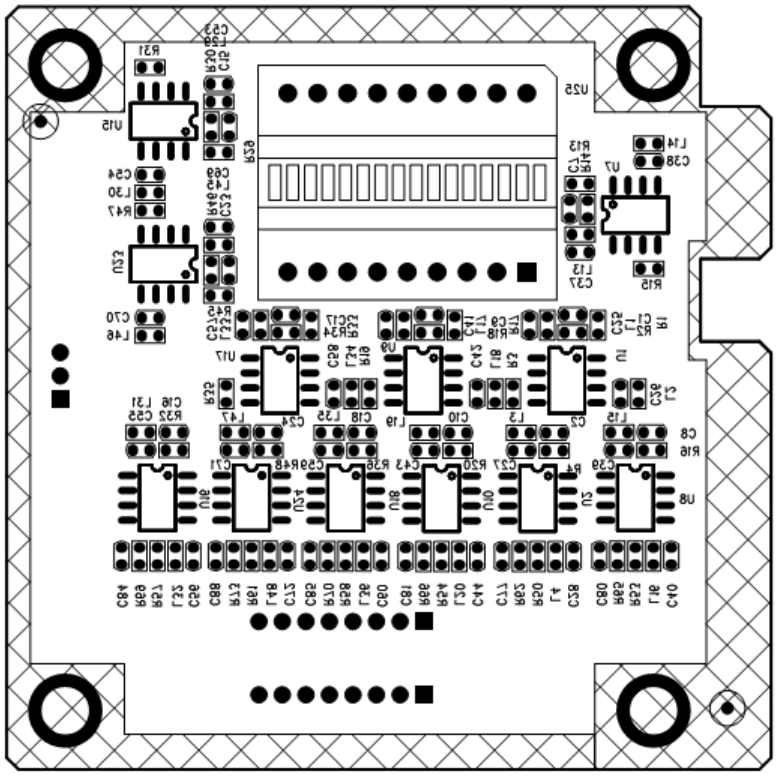


Figure 4-28 Pre-amplification board PCB-1

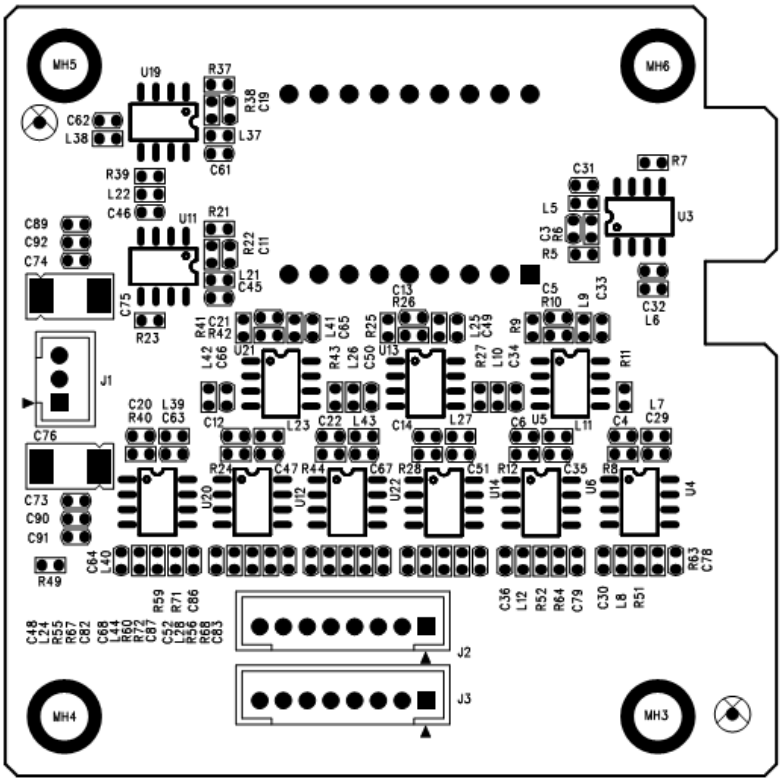


Figure 4-29 Pre-amplification board PCB-2

Connectors

The pre-amplification board includes the following connectors.

Power supply:

Power supply input connector (J1): 3-pin, used to provide +12V and -12V power supplies for the pre-amplification board.

Table 4-16 Power supply connectors

Pin No.	Signal Name	Reference Value
1	+12V	11.4 to 12.6V
2	AGND	/
3	-12V	-11.4 to -12.6V

Connectors for sending/receiving communication signals:

Connector (J2) for preamplifier board signal output: 8-pin, used to receive photoelectric analog signals of six channels.

Table 4-17 Connector (J2) for pre-amplification board signal output

Pin No.	Signal Name	Reference Value
1	AGND	/
2	Signal1	0.25V-2.5V (water blank condition)
3	Signal3	0.25V-2.5V (water blank condition)
4	Signal5	0.25V-2.5V (water blank condition)
5	Signal7	0.25V-2.5V (water blank condition)
6	Signal9	0.25V-2.5V (water blank condition)
7	Signal11	0.25V-2.5V (water blank condition)
8	AGND_SHELD	/

Connector (J3) for pre-amplification board signal output: 8-pin, used to receive photoelectric analog signals of six channels.

Table 4-18 Connector (J3) for pre-amplification board signal output

Pin No.	Signal Name	Reference Value
1	AGND	/
2	Signal1	0.25V-2.5V (water blank condition)
3	Signal3	0.25V-2.5V (water blank condition)
4	Signal5	0.25V-2.5V (water blank condition)
5	Signal7	0.25V-2.5V (water blank condition)
6	Signal9	0.25V-2.5V (water blank condition)
7	Signal11	0.25V-2.5V (water blank condition)
8	AGND_SHELD	/

Switches and jumpers
The pre-amplification board has no switches or jumpers.
Indicators
The pre-amplification board is encapsulated inside the Optical measurement assembly and has no indicators.
Test points
The pre-amplification board is encapsulated inside the Optical measurement assembly and does not need maintenance, and it therefore, has no test points.

Installation methods and precautions

Since encapsulated inside the Optical measurement assembly, the pre-amplification board should be maintained together with the PDA assembly rather than maintained independently.

4.5.12 Level Sense Board

Functions and principles

The BS-460 has three level sense boards, two of them used for detecting reagent level and the other one used for detecting sample level. It fulfills the following functions:

- Sensing the reagent and sample levels. The three boards are identical in circuit structure and interfaces and capable of detecting the fluid level steadily and reliably, especially allowing the sample probe to correctly detecting the fluid level inside reaction cuvettes. ·
- Outputting level sense signals to the control drive board through the probe/mixer conversion board when the probe contacts the fluid level.
- Providing vertical obstruction detection and outputting the detection signals to the control drive board through the five-probe/mixer conversion board.

The functional diagram of the level sense board is as shown below.

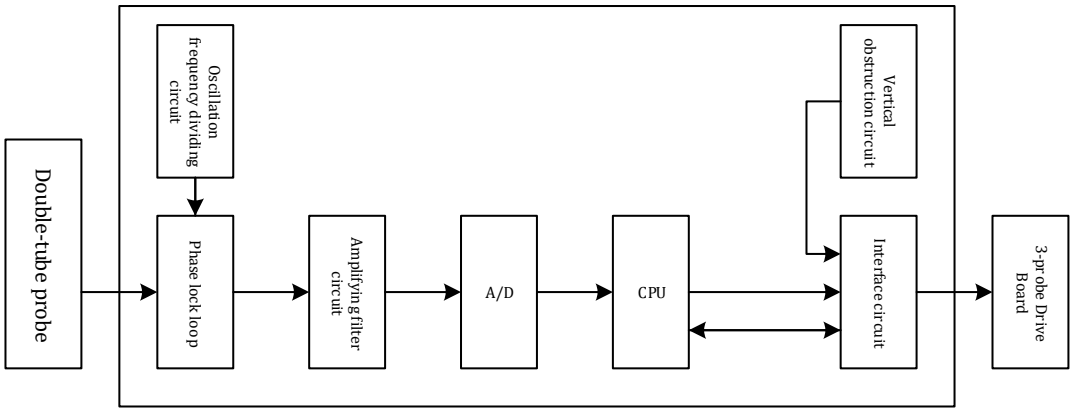


Figure 4-30 Functional diagram of level sense board

Description

PCB layout
The top layer of the level sense board is as shown below.

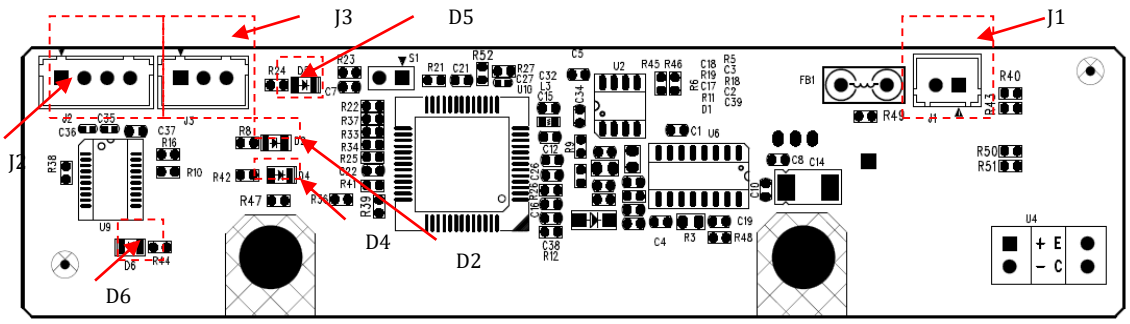


Figure 4-31 Level sense board PCB (TOP layer)

The bottom view of the level sense board is as shown below.

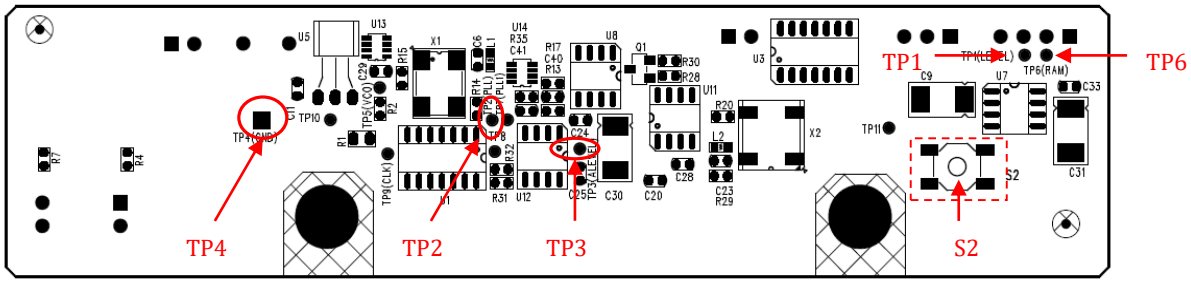


Figure 4-32 level sense board PCB (BOTTOM layer)

Connectors

The level sense board contains the following connectors.

Connector of probes and boards (J1): 2-pin, used for connecting the sample probe or reagent probes with related circuit.

Table 4-19 Connector of probes and boards (J1)

Pin No.	Signal
1	GND
2	Probe capacitor signal input

Power supply and signal output connector (J2): 4-pin, used to provide power supply for the level sense board and output the level sense signal and vertical obstruction signal.

Table 4-20 Power supply and signal output connector for level sense board (J2)

Pin No.	Signal Name	Reference Value
1	GND	/
2	Vertical obstruction signal output	High level (about 4V) is output when no vertical obstruction occurs, and low level (about 0V) is output when vertical obstruction happens.
3	Level sense signal output	Low level (about 0V) is output when the probe fails to detect the fluid level, and high level (about 4V) is output when the probe detects the fluid level.
4	+12V	11.4 to 12.6V

Serial port communication cable connector (J3): 3-pin, used for communication between the level sense board and the control drive board.

Table 4-21 serial port communication cable connector (J3)

Pin No.	Signal
1	RXD

Pin No.	Signal
2	RST
	TXD

Switches and jumpers

The level sense board contains the following switches and jumpers.

- PSEN enable jumper (S1): used for downloading application programs.
- Calibrate key (S2): used for manual self-calibration of fluid level detection.

Jumper S1 must be disconnected in normal conditions.

Indicators

The level sense board contains the following indicators.

- Level sense system calibration indicator (D2): yellow. It is extinguished when the self-calibration of the level sense system fails, and vice versa. If it is lit, it indicates that the calibration is complete and the level sense system is ready for measurement. When the calibration is complete, the indicator will be lit all the time.
- Sensitivity switch indicator (D4): red. It is extinguished when the default sensitivity is being used, and vice versa, which means level sensing is performed in special positions.
- Level sense indicator (D5): green. It is extinguished when the probe fails to detect the fluid level, and vice versa.
- Vertical obstruction indicator (D6): green. It is extinguished when no vertical obstruction occurs, and vice versa.

Test points

In the following positions of the level sense board can signal tests be performed.

- TP1 (LEVEL): level sense signal output. Normal condition: Low level (about 0V) is output when the probe fails to detect the fluid level, and high level (about 4V) is output when the probe detects the fluid level.
- TP2 (PLL): working point voltage of the level sense system. Normal range: 3.8±0.5V.
- TP3 (ALEVEL): analog fluid level. Analog level sense signal, based on which whether the fluid level is detected or not is determined.
- TP4 (GND): grounding terminal of the level sense board.
- TP5 (VCO): reserved.
- TP6 (RAM): vertical obstruction signal output. Normal condition: High level (about 4V) is output when no vertical obstruction occurs, and low level (about 0V) is output when vertical obstruction happens.
- TP7 (PLL1): reserved.
- TP8: voltage monitoring signal for self-calibration of the level sense system.
- TP9 (CLK): reserved.
- TP10: +9V power supply. It is secondary power supply used to power the internal phase-locked loop and some operational amplifiers of the PCBA. Normal range: 9V±5%, that is, 8.55-9.45V.
- TP11: +5V power supply. It is secondary power supply used to power most components inside the PCBA, such as micro control unit (MCU). Normal range: 5V±5%, that is, 4.75-5.25V.

Installation methods and precautions

NOTE

- **Prior to removing the PCBA, disconnect the instrument from the power supply and wear a pair of anti-static gloves or wrist straps.**
- **Make sure that the connectors are inserted properly into the end of the slots on the PCBA.**
- **It requires great force to plug/unplug connectors. Hold the PCBA by its edge while plugging/unplugging the connectors to prevent it from being deformed or damaged.**

4.5.13 Clog Detection Board

Functions and principles

The clog detection board possesses the following functions:

- Collecting pressure by connecting with the pressure sensor.
- Checking for clogs and empty aspirate under the control of the sample control drive board.
- Sending debugging information to the debugging computer.

The figure below shows the location of the clog detection board in the hardware system.

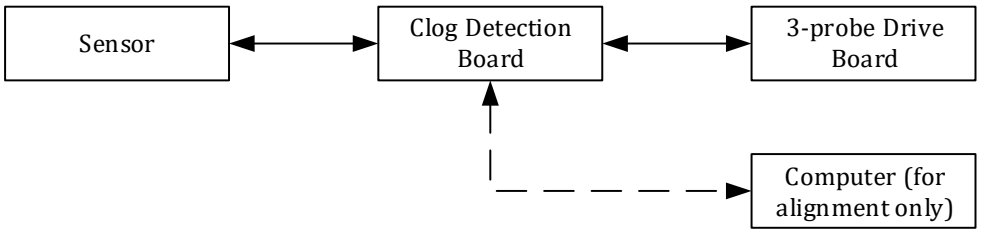


Figure 4-33 location of clog detection board in the hardware system

The circuit diagram of the clog detection board is as shown below.

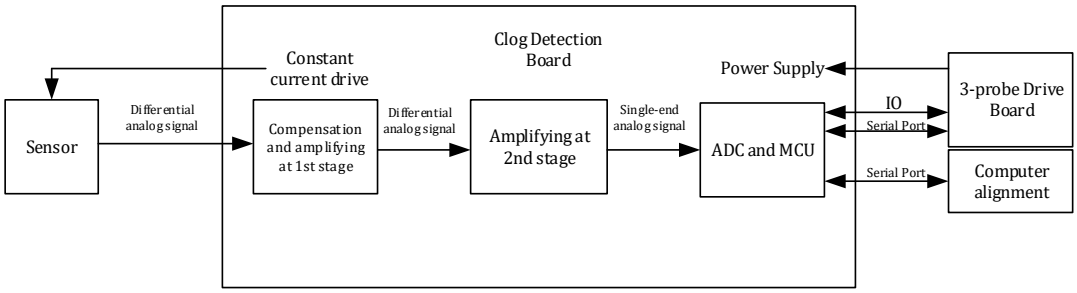


Figure 4-34 Circuit diagram of clog detection boar

Description

PCB layout

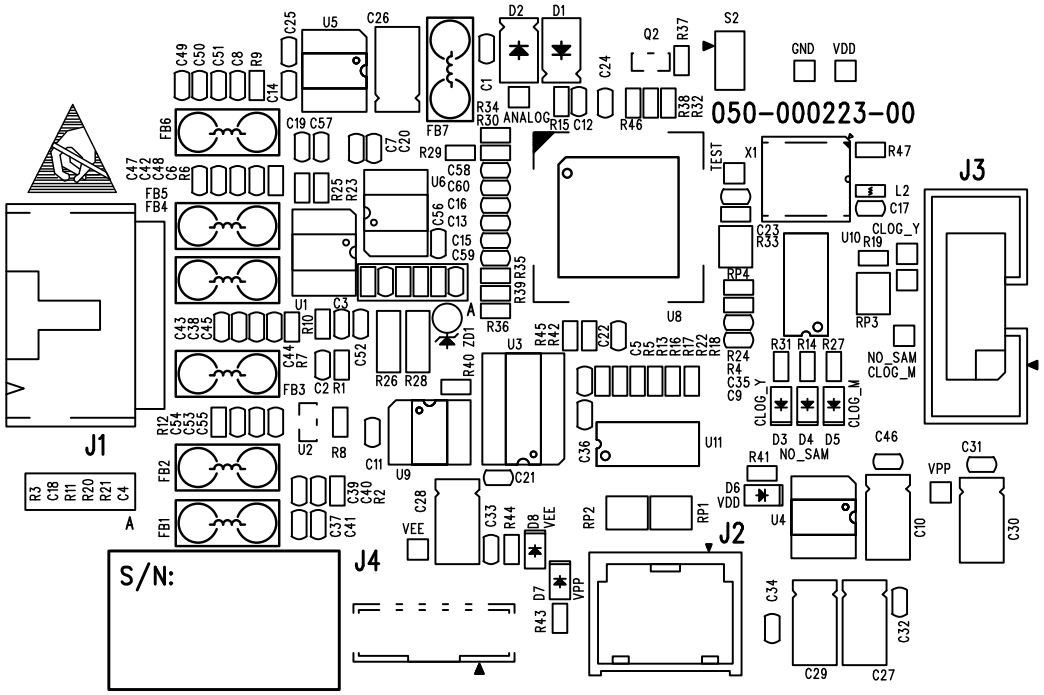


Figure 4-35 Clog detection board PCB

Connectors

Pressure sensor connector (J1): connected with the pressure sensor.

Table 4-22 Pressure sensor connector (J1)

Pin No.	Signal Name	Reference Value
1	Positive end input of pressure sensor	/
2	Positive end of power supply	/
3	Negative end of power supply	/
4	Negative end input of pressure sensor	/
5	Gain adjustment resistance	/
6	Gain adjustment resistance	/

Clog detection board control connector (J2): connected with the sample control drive board and used for communicating control signals during clog detection process.

Table 4-23 Clog detection board control connector (J2)

Pin No.	Description	Test Methods
1	+12V power supply	The voltage lies between 11.4-12.6V when the PCBA is working normally.
2	-12V power supply (reserved)	/
3	Confirmed clog signal	The voltage at this point is less than 0.4V when no clog signal is detected.
4	Possible clog signal (reserved)	/

Pin No.	Description	Test Methods
5	Empty aspirate signal	The voltage at this point is less than 0.4V when no empty aspirate signal is detected.
6	Interruption control signal	The voltage at this point is less than 0.4V when the system status is Standby.
7	Interruption enable signal	The voltage at this point is less than 0.4V when the system status is Standby.
8	Ground	/
9	Reserved input	/
10	Reserved output	/

Clog detection board communication connector (J3): connected with the sample control drive board and used for serial port communication between the clog detection board and the sample probe unit.

Table 4-24 Clog detection board communication connector (J3)

Pin No.	Description	Test Methods
1	+12V power supply	The voltage lies between 11.4-12.6V when the PCBA is working normally.
2	-12V power supply (reserved)	/
3	Serial port input signal	The voltage at this point is greater than 2.4V when the system status is Standby.
4	Serial port output signal	The voltage at this point is greater than 2.4V when the system status is Standby.
5	Online-downloading enable signal	The voltage at this point is less than 0.4V when the system status is Standby.
6	Reset signal	The voltage at this point is greater than 2.4V when the system status is Standby.
7	Ground	/
8	Ground	/

Clog detection board debugging connector (J4): connected with the serial port of a computer and used for debugging the clog detection system. This connector is temporarily not used.

Table 4-25 Clog detection board debugging connector (J4)

Pin No.	Description	Test Methods
1	+12V power supply	/
2	-12V power supply (reserved)	/
3	Serial port input signal	/
4	Serial port output signal	/
5	Ground	/

Switches and jumpers

MCU downloading enable jumper (S2): When it is short-circuited, it indicates that the MCU is downloading something. The jumper must be disconnected when the PCBA is working normally.

Indicators and test points

Indicators

- Clog signal indicator (D3): red. It is lit when the PCBA outputs a clog signal.
- Empty aspirate signal indicator (D4): It is lit when the PCBA outputs an empty aspirate signal. ·
- Possible clog signal indicator (D5): It is lit when the PCBA outputs a possible clog signal.

- +5V power supply indicator (D6): green. It is lit when the +5V power supply is working normally.
- +12V power supply indicator (D7): green. It is lit when the +12V power supply is working normally.

Test points

- +12V power supply (VPP): The voltage at this point lies between 11.4-12.6V when the PCBA is working normally.
- -12V power supply (VEE): reserved test point.
- Ground (GND): This test point is connected with the grounding terminal of the PCBA.
- Pressure sensor output signal (ANALOG): It is an analog signal amplified by the pressure sensor. When the pressure sensor is connected to the air, the voltage at this point lies between 0.8-1.3V.
- Clog signal (CLOG_Y): It is a test point of clog signal output. When the PCBA outputs a clog signal, indicator D3 will be lit and the voltage at this point greater than 2.4V; when the PCBA outputs no clog signal, indicator D3 will be extinguished and the voltage at this point less than 0.4V.
- Empty aspirate signal (NO_SAM): when the PCBA outputs an empty aspirate signal, indicator D4 will be lit and the voltage at this point greater than 2.4V; when the PCBA outputs no empty aspirate signal, indicator D4 will be extinguished and the voltage at this point less than 0.4V.
- Debugging test point (TEST): used for test during debugging.

Installation methods and precautions

NOTE

- **Prior to removing the PCBA, disconnect the instrument from the power supply and wear a pair of anti-static gloves or wrist straps.**
- **Insert connectors J2 and J3 tightly into the PCBA. When inserting connector J1, you will hear a click, which means that the connector is inserted in place into its slot.**

4.5.14 Reagent Refrigeration Board

Functions and principles

The reagent refrigeration board is independent in the hardware system. It controls the coolers' switch, refrigerates reagent, keeps the temperature of the reagent chamber within specified range, provides interface for fans, drives the fans of the entire system, and feeds back the refrigerating fan signal to the three-carousel drive board. It has the following functions:

- Refrigeration Control
- refrigeration temperature indicator control
- fan control and antifogging control
- Power Caretium ISE module (reagent Refrigeration Board J9)

The functional diagram of the reagent refrigeration board is as shown below.

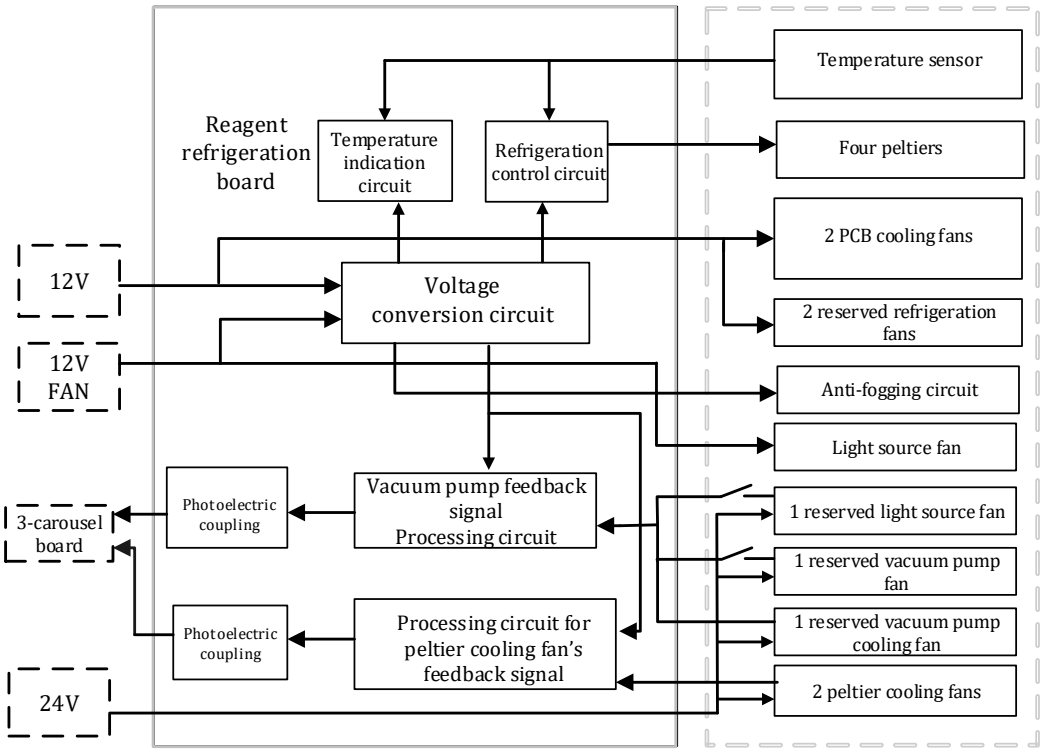


Figure 4-36 Functional diagram of reagent refrigeration boar

Description

PCB layout

The PCB layout of the reagent refrigeration board is as shown below.

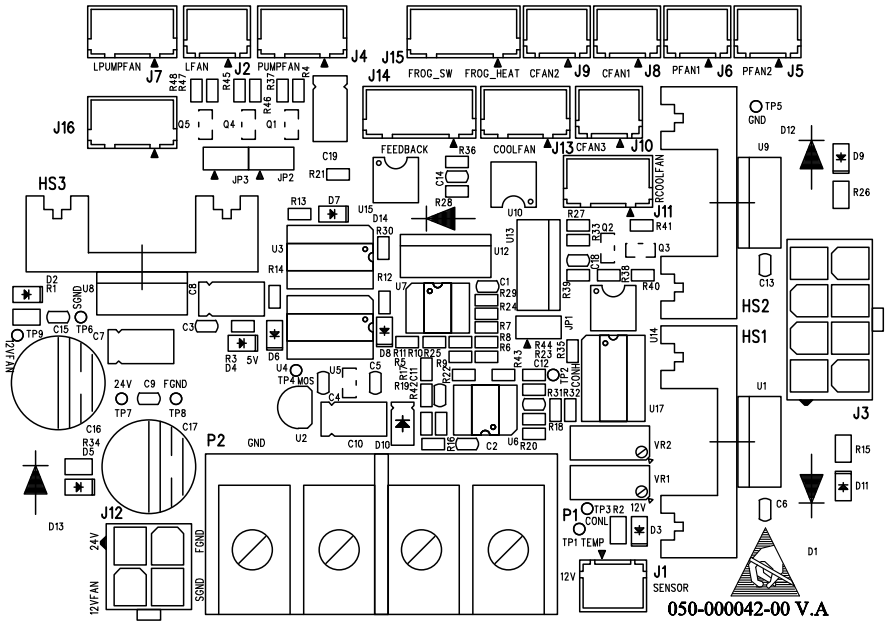


Figure 4-37 Reagent refrigeration board PC

Connectors

The reagent refrigeration board includes the following connectors.

Power supply:

Power supply connector P1 and P2: provides 12V power for the PCB.

Table 4-26 Power supply connector

Pin No.	Signal	Reference Value
P1	12V	11.4 to 12.6V
P2	GND	/

Power supply connector J12: provides 24V and 12V power for fans on the PCB.

Table 4-27 Power supply connector J12

Pin No.	Signal	Reference Value
P1	12V	11.4 to 12.6V
P2	GND	/

Detection and control connectors:

- Reagent refrigeration drive connector (J3): 8-pin, used for driving reagent refrigeration.
- PCB radiating fan connector (J5): 2-pin, used for driving radiating fan of the PCB.
- PCB radiating fan connector (J6): 2-pin, used for driving radiating fan of the PCB.
- Vacuum pump fan connector (J24): 3-pin, used for driving fan of the vacuum pump.
- Vacuum pump and refrigeration fan jam detection interface (J14): 4-pin, used for detecting jams of the vacuum pump and refrigeration fans.
- Demisting heater connector (J15): 4-pin, used for driving the desmisting heater.
- Lamp radiating fan connector (J2): 2-pin, used for driving radiating fan of the lamp.
- Cooler radiating fan connector (J11): 3-pin, used for driving radiating fan of the cooler.
- Reagent carousel temperature sensor connector (J1): 2-pin, used for detecting temperature of the reagent carousel.

Indicators

The main control board contains the following indicators.

- D2: indicates 12V power supply of fan.
- D3: indicates the 12V power supply.
- D4: indicates the 5V power supply (secondary).
- D5: indicates 24V power supply of fan.
- D6: indicates temperature, red. ON: Temperature is higher than the high limit.
- D7: indicates temperature. ON: Temperature is within the normal range.
- D8: indicates temperature, orange. OFF: Temperature is lower than the low limit.
- D9: indicates working status of cooler 2. ON: The cooler is turned on.
- D11: indicates working status of cooler 1. ON: The cooler is turned on.

Installation Methods and Precautions

NOTE

- **Prior to removing the PCBA, disconnect the instrument from the power supply and wear a pair of anti-static gloves or wrist straps.**
- **Make sure that the connectors are inserted properly into the end of the slots on the PCBA.**
- **It requires great force to plug/unplug connectors. Hold the PCBA by its edge while plugging/unplugging the connectors to prevent it from being deformed or damaged.**

4.6 Power Supply System

4.6.1 Power Supply System of Whole Unit

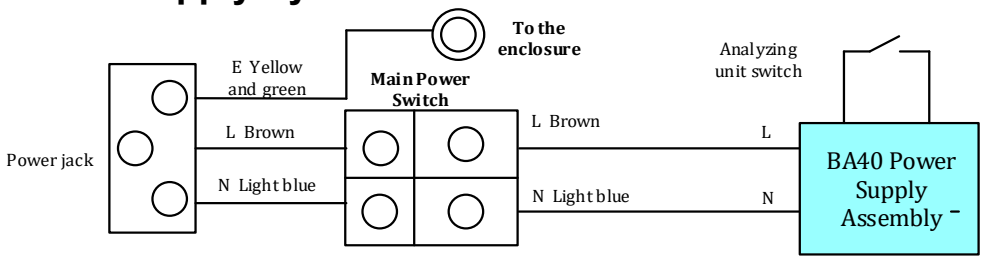


Figure 4-38 Power supply system of the whole unit

BA40 power supply assembly

The BA40 power supply assembly, as the major part of the entire power supply system, consists of three boards, which are 24V power supply board, 12V power supply board and power supply conversion board. It provides power supply for the lamp, DC power supply for major control boards, and power supply for refrigeration modules. After passing through an analog power supply conversion board, the 5V power is converted into +/-12V and then provided for the AD collection board and pre-amplification board. The A5V, C12V, B24V, D12V and E12V power goes through a DC power supply conversion board and then is provided for the wash temperature control board, sample control drive board and reagent control drive board. The B12V and A24V power are input to the reagent refrigeration board for powering the heatsinks and ISE module. Other boards, such as reaction carousel temperature collection board, cleaning fluid temperature collection board, pressure detection board, clog detection board and level sense board, are powered by those boards connected to them. See the figure below.

- The 24V power supply board converts the AC input into A24V and B24V and into 24VFAN for the cooling fans of radiators.
- The 12V power supply board converts the AC input into B12V, A5V, ±14V, and 24VLAMP. The 24VLAMP power supply is transformed to A12V through the power supply conversion board and used for powering the lamp.
- The power supply conversion board is used to shift the AC voltage, control the vacuum pump AC voltage, convert the ±14V power into ±12V, control the C12V power, and shift various output voltages.

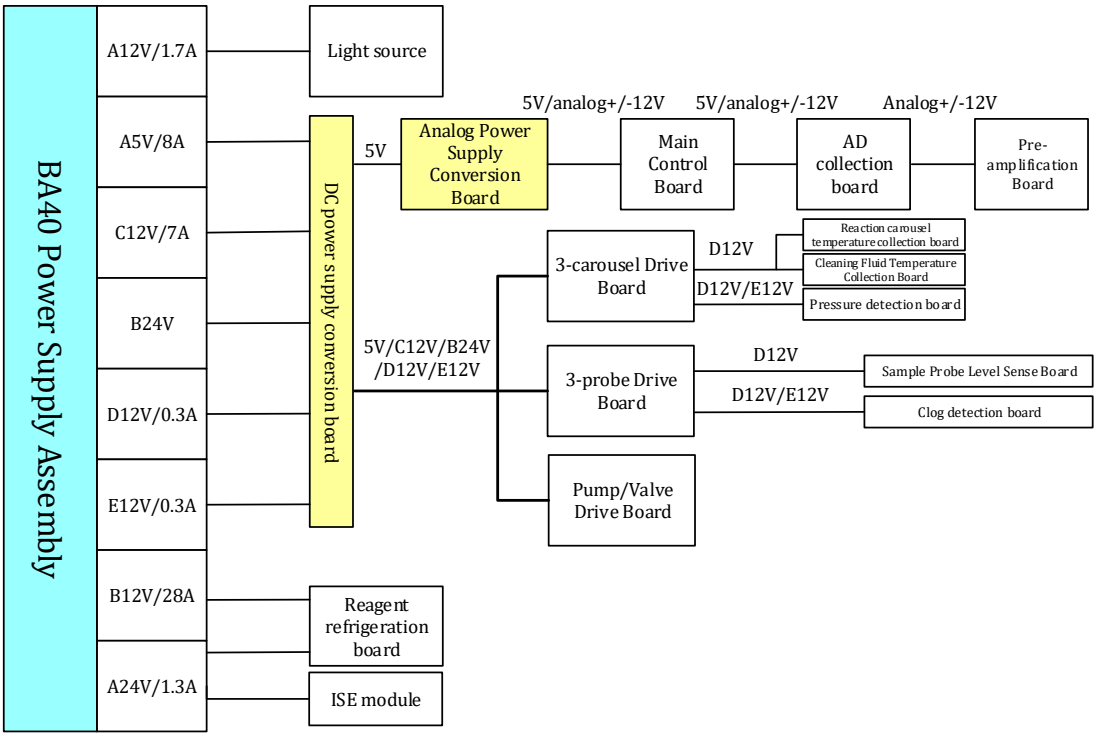


Figure 4-39 BA40 Power supply assembly

4.6.2 Performance Indices

Power supply input

- AC voltage input: 220-240V, 220/230V, and 110/115V.
- AC voltage frequency: 50/60±3Hz
- AC input power: 5KVA

Power supply output

Table 4-28 power supply output

No.	Name	Rated Output	Lower-level PCBA	Usage	Control Description
1	A5V	5V/8A		5V digital	Controlled by analyzer power switch
2	A12V	12V/4.2A		Light source	Controlled by operating software
3	B12V	12V/28A		Reagent refrigeration	Controlled by main power switch
4	C12V	12V/7A		12V drive	Controlled by analyzer power switch
5	D12V	12V/0.3A		+12V analog	
6	E12V	-12V/0.3A		-12V analog	
7	A24V	24V/1.3A		ISE module	Controlled by main power switch
8	B24V	24V/21A		24V drive and heater	Controlled by analyzer power switch
9	24VFAN	24V/1A	/	Reagent refrigeration fan	Controlled by main power switch

Notes:

- Control by operating software means that the lamp voltage is controlled by the operating software while the main power switch and analyzer power switch are turned on.
- Control by analyzer power switch means that the power supply is controlled by the analyzer power switch with the prerequisite that the main power switch is turned on.
- Control by main power switch means that the power supply works normally when the main power switch is turned on, and vice versa.

4.6.3 BA40 Power Supply Assembly(Before EIB009)

The BA40 power supply assembly is composed of the 12V board, 24V board and conversion board. Refer to the functional diagram of the power supply system for the internal structure of the assembly. The functions and principles of the three boards are described on the following pages. If the two radiating fans are placed vertically behind the power supply assembly, the power module is the BA40 power supply assembly before change. If the two power modules with fans are placed horizontally in the rear, it is the BA2K power assembly after change. Refer to the exploded view of power supply assembly in Chapter 11.3.2.

12V power supply board

The functional diagram of the board is as shown below.

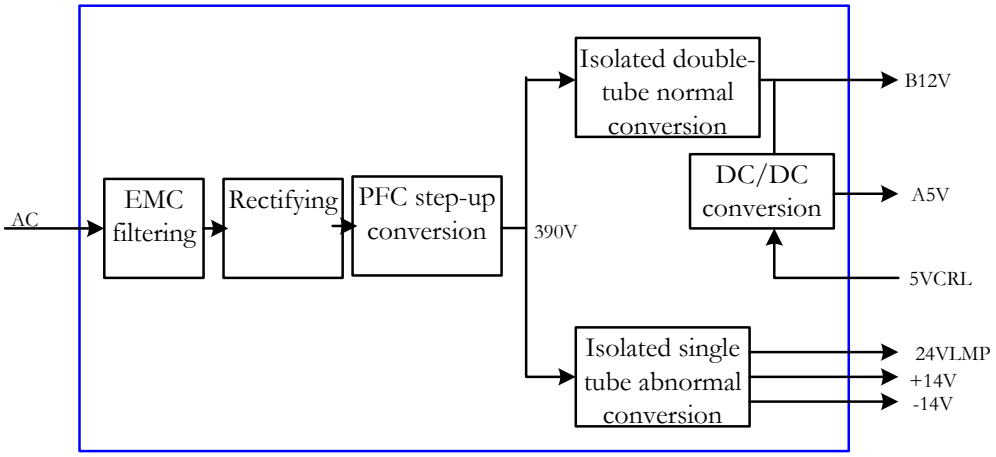


Figure 4-40 Functional diagram of 12V power supply board

The 12V power supply board converts the AC input into the following outputs:

- B12V: used for powering the radiators.
- A5V: used for powering the PCBA and controlled by the analyzer power switch.
- 24VLMP: outputs constant 24V, which is then converted into lamp voltage A12V in the way of DC/DC through the power supply conversion board.
- ±14V: The two outputs are converted into ±12V (D12V and -12V) through the voltage stabilizer on the power supply conversion board and then used for powering analog circuits. The PCB layout of the 12V board is as shown below.

The PCB layout of the 12V power supply board is as shown below.

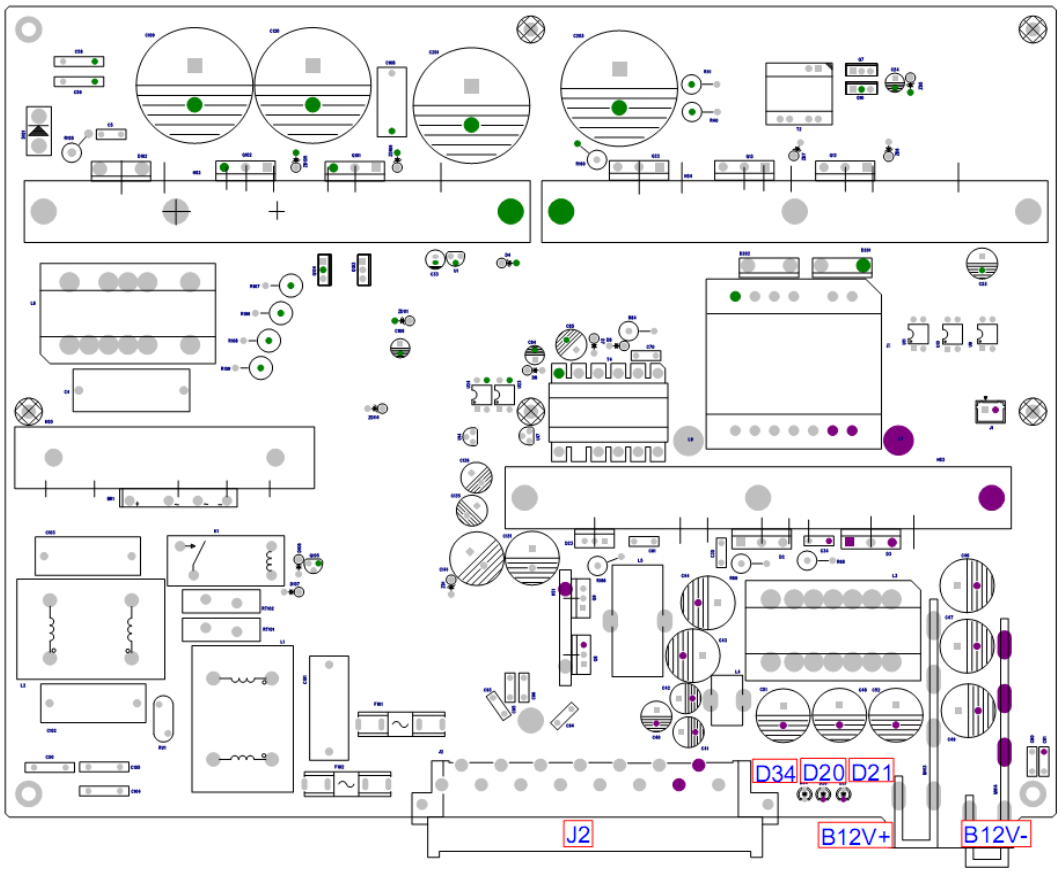


Figure 4-41 12V power supply board PCB

The 12V power supply board is located inside the power supply box. Indicators D20, D21 and D34 indicate voltage output during debugging and repairing of the PCBA and cannot be seen from the outside of the

instrument.
Indication of voltage outputs:

Table 4-29 Indication of voltage outputs corresponding to LED

LED	Output Voltage	Indication Status	Controlled By
D20	A5V	When D20 is lit, it indicates that the PCBA outputs an A5V power.	Controlled by analyzer power switch
D21	B12V	When D21 is lit, it indicates that the PCBA outputs a B12V power.	Controlled by main power switch
D34	A24V	When D34 is lit, it indicates that the PCBA outputs an A24V power.	Controlled by main power switch

Notes:

- Control by operating software means that the lamp voltage is controlled by the operating software while the main power switch and analyzer power switch are turned on.
- Control by analyzer power switch means that the power supply is controlled by the analyzer power switch with the prerequisite that the main power switch is turned on.
- Control by main power switch means that the power supply works normally when the main power switch is turned on, and vice versa.

24V power supply board

The functional diagram of the board is as shown below.

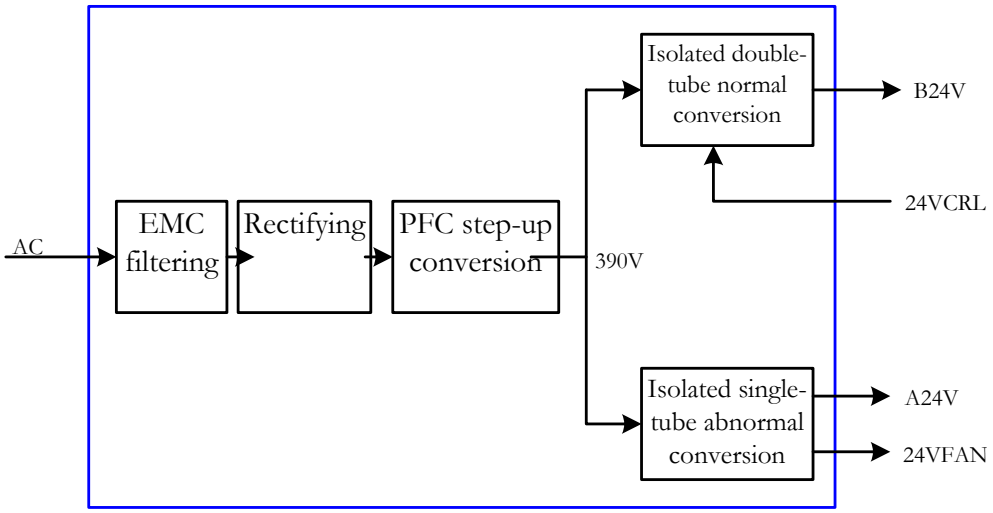


Figure 4-42 Functional diagram of 24V power supply board

The 24V board converts the AC input into the following outputs:

- A24V: used for powering the ISE module.
- 24VFAN: used to power the reagent refrigeration fan.
- B24V: used for powering the moving parts, motors and heaters, and controlled by the analyzer power switch.

The PCB layout of the 24V power supply board is as shown below.

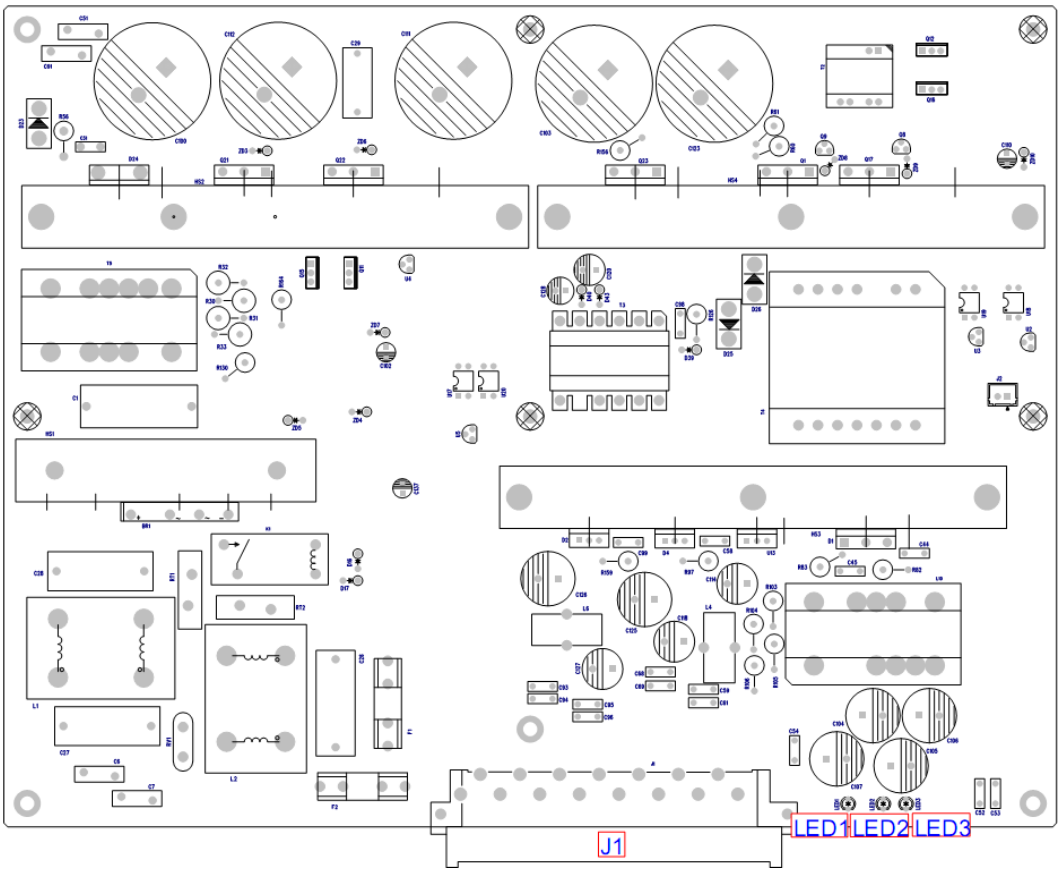


Figure 4-43 24V power supply board PCB

LED1, LED2 and LED3 in the figure above are indicators of the A24V, 24VFAN and B24V outputs. Since located inside the power supply box, the three indicators cannot be seen from the outside of the instrument. They are used to indicate the voltage output during debugging and repairing of the PCBA. There are three indicators on the power supply conversion board, and they are used for indicating the voltage outputs of the 24V board.

Indication of voltage outputs on the 24V board:

Table 4-30

LED	Output Voltage	Indication Status	Controlled By
LED1	A24V	When LED1 is lit, it indicates that the PCBA outputs an A24V power.	Controlled by main power switch
LED2	24VFAN	When LED2 is lit, it indicates that the PCBA outputs a 24VFAN power.	Controlled by main power switch
LED3	B24V	When LED3 is lit, it indicates that the PCBA outputs a B24V power.	Controlled by analyzer power switch

Notes:

- Control by operating software means that the lamp voltage is controlled by the operating software while the main power switch and analyzer power switch are turned on.
- Control by analyzer power switch means that the power supply is controlled by the analyzer power switch with the prerequisite that the main power switch is turned on.
- Control by main power switch means that the power supply works normally when the main power switch is turned on, and vice versa.

Power supply conversion board

The functional diagram of the board is as shown below.

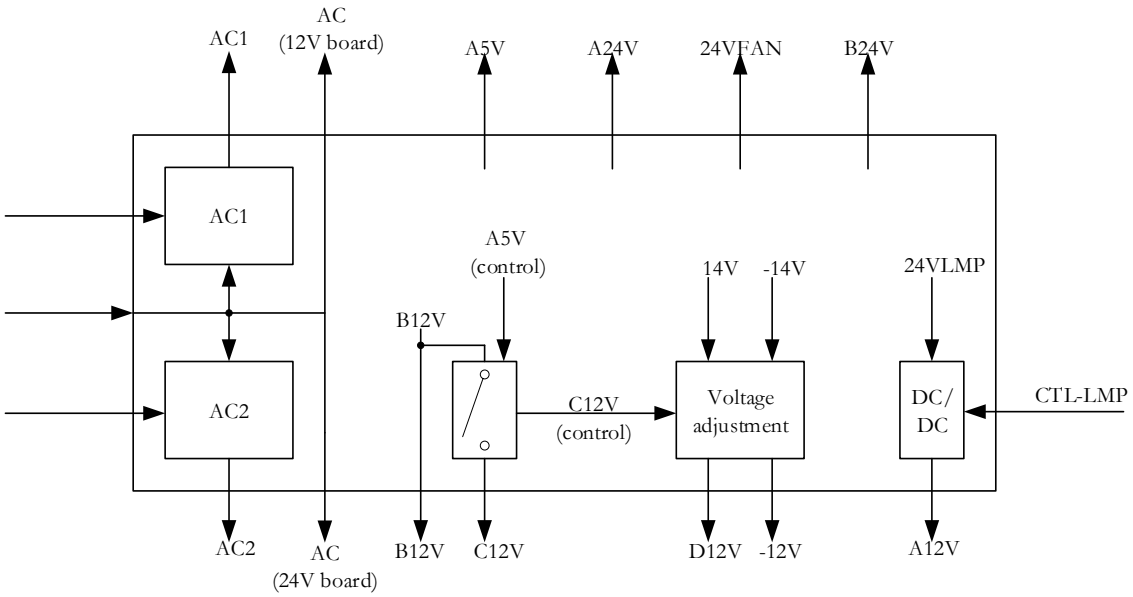
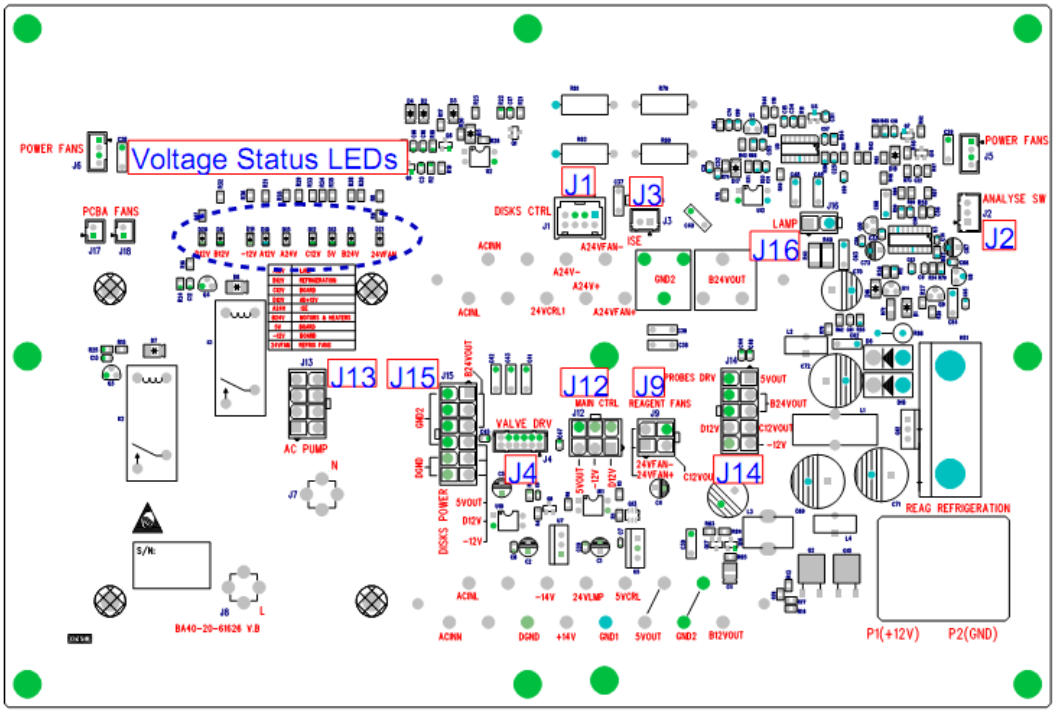


Figure 4-44 Functional diagram of power supply conversion board

This board is used for:

- Providing AC to 12V and 24V power supply board and AC1 and AC2.
- Stabilizing the ±14V output by the 12V board into D12V and -12V.
- Converting the 24VLMP output by the 12V board into controlled lamp voltage A12V.
- Dividing and shifting other DC inputs, and providing power supply interfaces for other PCBAs.

The PCB layout of the power supply conversion board is as shown below.



Indicators

There are 9 voltage indicators on the power supply conversion board indicated by a dotted frame. They are from left to right: D20, D11, D14, D10, D15, D12, D13, D9, and D21, which are used to indicate the following voltage outputs.

Table 4-31 Voltage output of LED indicators

LED	Output Voltage	Indication Status	Controlled By
D20	D12V	When it is lit, it indicates that the PCBA outputs a D12V power.	Controlled by analyzer power switch
D11	B12V	When it is lit, it indicates that the PCBA outputs a B12V power.	Controlled by main power switch
D14	-12V	When it is lit, it indicates that the PCBA outputs a -12V power.	Controlled by analyzer power switch
D10	A12V	When it is lit, it indicates that the PCBA outputs an A12V power.	Controlled by software
D15	A24V	When it is lit, it indicates that the PCBA outputs an A24V power.	Controlled by main power switch
D12	C12V	When it is lit, it indicates that the PCBA outputs a C12V power.	Controlled by analyzer power switch
D13	A5V	When it is lit, it indicates that the PCBA outputs an A5V power.	Controlled by analyzer power switch
D9	B24V	When it is lit, it indicates that the PCBA outputs a B24V power.	Controlled by analyzer power switch
D21	24VFAN	When it is lit, it indicates that the PCBA outputs a 24VFAN power.	Controlled by main power switch

Notes:

- Control by operating software means that the lamp voltage is controlled by the operating software while the main power switch and analyzer power switch are turned on.
- Control by analyzer power switch means that the power supply is controlled by the analyzer power switch with the prerequisite that the main power switch is turned on.
- Control by main power switch means that the power supply works normally when the main power switch is turned on, and vice versa.

The table below shows the status of the indicators when the main power switch and analyzer power switch are turned on or off.

Table 4-32 LED status on the power supply conversion board

LED	Output Voltage	Control Description	Main Power ON Analyzer Power OFF	Main Power ON Analyzer Power ON	Main Power OFF
D11	B12V	When the main power switch is ON, indicators D11, D15 and D21 are lit and only controlled by the main power switch rather than the analyzer power switch.	✓	✓	×
D15	A24V		✓	✓	×
D21	24VFAN		✓	✓	×
D12	C12V	The corresponding indicator is extinguished	×	✓	×
D13	A5V		×	✓	×

LED	Output Voltage	Control Description	Main Power ON Analyzer Power OFF	Main Power ON Analyzer Power ON	Main Power OFF
D14	-12V	only when the main power switch is ON. When the analyzer power switch is ON, the corresponding indicator is lit and controlled by both switches.	×	✓	×
D20	D12V		×	✓	×
D9	B24V		×	✓	×
D10	A12V	Controlled by the main power switch and the operating software	×	×	×
		Turning on/off the lamp can be controlled through the operating software.			

Output connectors:

Table 4-33 Output connectors

No.	Pins	Symbol	Output Description
J3	Pin1	ISE	A24V+
	Pin2		A24V-
J4	Pin1, 3, 5, 7	VALVE DRV	C12V positive output
	Pin9, 11, 12		B24V positive output
	Pin2, 4, 6, 8, 10		B24V and C12V output GND
J7	/	N	AC input N
J8	/	L	AC input L
J9	Pin1	24VFAN+	24VFAN positive output
	Pin2	24VFAN-	24VFAN negative output
	Pin3	C12VOUT	C12V positive output
	Pin4	/	C12V output GND
J12	Pin1	D12V	D12V output
	Pin2	-12V	-12V output
	Pin4, 5	/	D12V and -12V output GND
	Pin3	5VOUT	A5V positive output
	Pin6	/	A5V output GND
J13	Pin1	AC PUMP	AC1 output, not used for BA80
	Pin3		AC2 output, not used for BA80
	Pin6, 8		AC input
J14	Pin1	5VOUT	A5V output
	Pin2, 3	B24VOUT	B24V output
	Pin4	C12VOUT	C12V output
	Pin5	-12V	-12V output
	Pin9	D12V	D12V output
	Pin6, 7, 8	/	A5V, B24V and C12V output GND
	Pin10	/	D12V and -12V output GND
J15	Pin1, 2, 3	B24VOUT	B24V output
	Pin4	5VOUT	A5V output

No.	Pins	Symbol	Output Description
	Pin5	D12V	D12V output
	Pin6	-12V	-12V output
	Pin7, 8, 9, 10	GND2	A5V and B24V output GND
	Pin11, 12	DGND	D12V and -12V output GND
J16	Pin1	LAMP	A12V output for lamp
	Pin2		A12V output GND for lamp

Troubleshooting BA40 power supply assembly

Check the indicators on the power supply conversion board while the main power switch is turned on and the analyzer power switch is off. In normal conditions, indicators D11, D15 and D21 should be lit respectively indicating B12V, A24V and 24VFAN. If D11 is not lit, it indicates that B12V output is abnormal and the 12V power board may go wrong; if D15 and D21 are not lit, it indicates that 24VFAN output is abnormal and the 24V power board may go wrong; If the three indicators are not lit, please check whether the AC voltage of the board is normal or it is possible that both the 12V and 24V power board have gone wrong.

While the main power switch is turned on and the voltage input is normal, turn on the analyzer power switch. In normal conditions, all indicators on the conversion board except for the A12V indicator should be lit. If the B24V indicator is not lit, replug the load line; if the error remains, replace the 24V board and then check if the B24V indicator is lit. If the A5V indicator is not lit, perhaps it is short-circuited or the 12V board goes wrong. If the A5V indicator is lit but C12V or D12V/-12V indicator is extinguished, replug the load line; if the error remains, check the conversion board or replace the power supply board; if the error disappears when a new power supply board is installed, it indicates that the original power supply board needs to be repaired.

If the lamp A12V cannot be enabled through the operating software while the main power switch and analyzer power switch are turned on and working normally, replug the power cord of the lamp; if the error remains, troubleshoot the power supply conversion board by replacing it with a new one.

4.6.4 BA2K Power Supply Assembly(After EIB009)

BA2K power supply assembly (115 -088293-00) consists of the 12 V power supply module, 24 V power supply module and conversion board. The internal connection relationship and functions are as follows: If the two radiating fans are placed vertically behind the power supply assembly, the power module is the BA40 power supply assembly before change. If the two power modules with fans are placed horizontally in the rear, it is the BA2K power assembly after change. Refer to the exploded view of power supply assembly in Chapter 11.3.2.
12 V and 24 V power supply module: Converts the AC into 12 V and 24 V and provides input for the power connection board. Each module is indicated by an LED, but it cannot be viewed directly because it is installed inside the system and can be used for later maintenance analysis.
The figure below shows the connection between the module and the connection board.

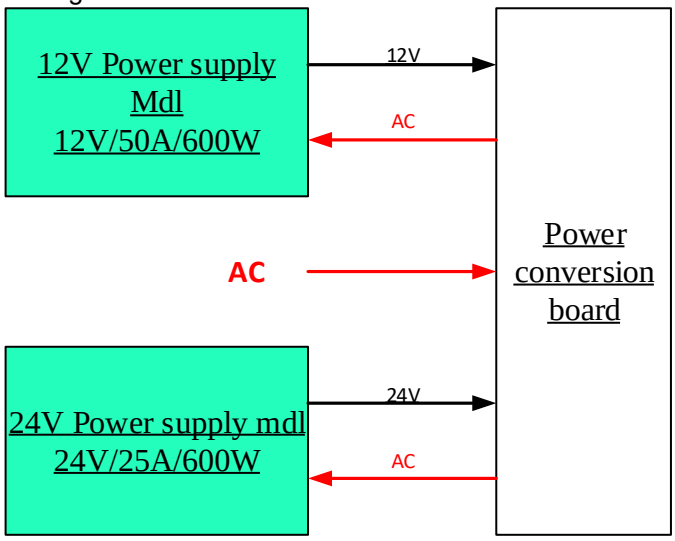


Figure 4-45 power supply module connection diagram

Power conversion board

The functional diagram of this board is as shown below. The functional diagram of the power patching board is as shown below.

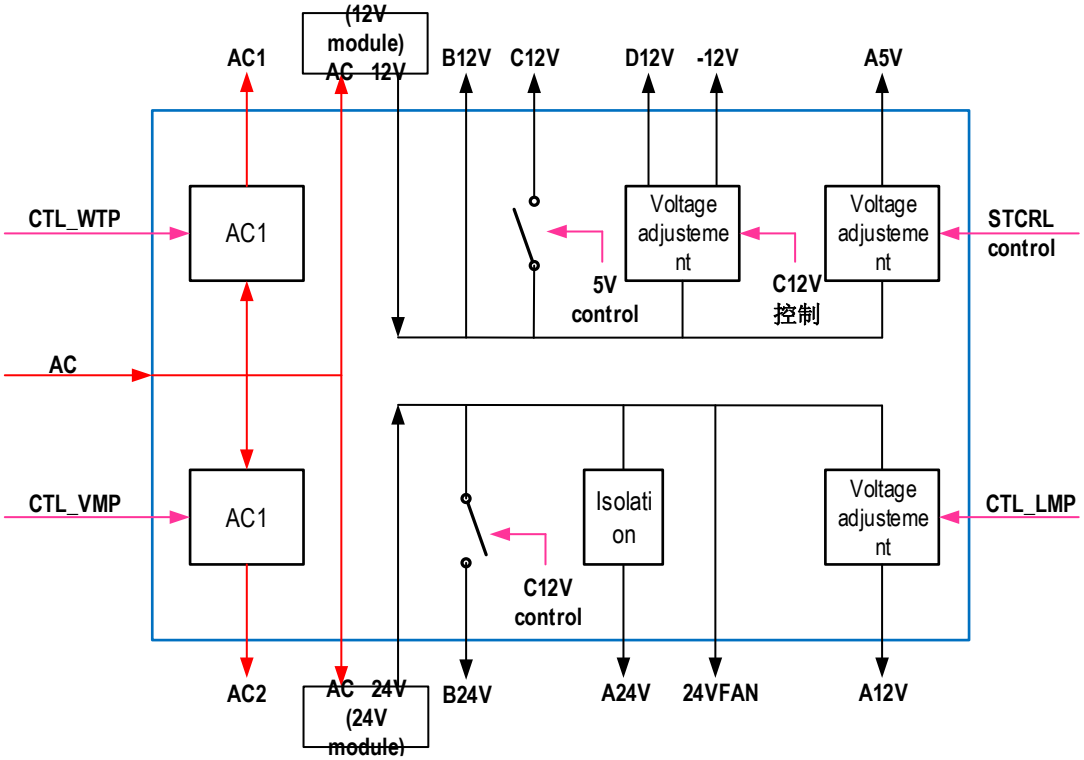


Figure 4-46 power supply module diagram

The board has the following functions:

- distributes the AC input to the 12 V and 24 V power supply module, AC1, and AC2 (the two AC outputs are reserved for the BA2K power supply system and not used on the BA80).
- converts the output of the 12 V power module into signals of D12V, -12 V and A5V.
- converts the output of the 24 V power module into A24V and A12V;
- distributes and transfers the DC voltage of other channels, and provides power interfaces with other boards in the system.

The PCBA layout of the power patching board is as shown below.

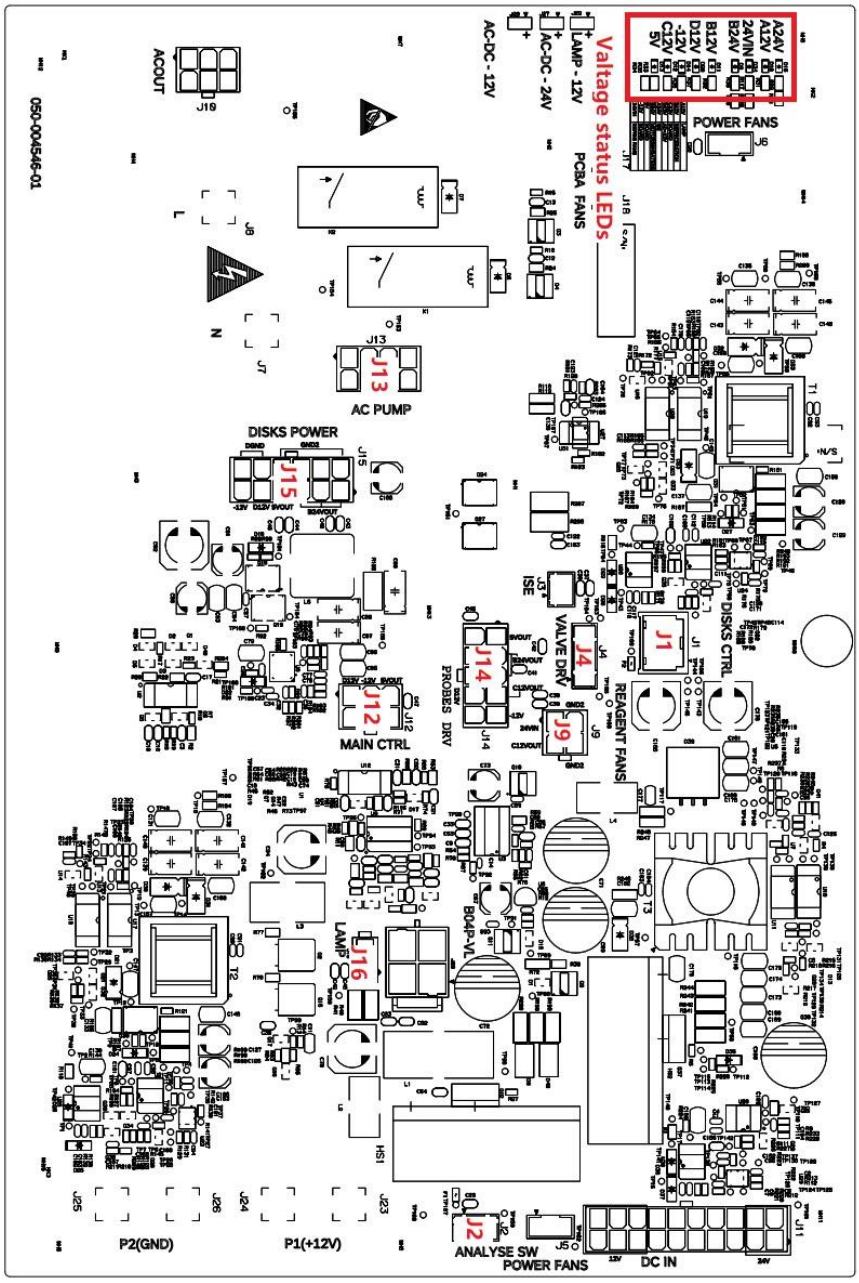


Figure 4-47 power supply conversion board PCB

LED indicator

There are nine voltage indicators on the power supply conversion board indicated by a dotted frame. They are from left to right: D20, D11, D14, D10, D15, D12, D13, D9, and D21, which are used to indicate the following voltage outputs.

LED	Corresponding Output Voltage	Indication Status	Controlled condition
D20	D12V	When it is lit, it indicates that the PCBA outputs a D12V power.	Controlled by analyzer power switch
D11	B12V	When it is lit, it indicates that the PCBA outputs a B12V power.	Controlled by the main power switch
D14	-12V	When it is lit, it indicates that the PCBA outputs a -12 V power.	Controlled by analyzer power switch

LED	Corresponding Output Voltage	Indication Status	Controlled condition
D10	A12V	When it is lit, it indicates that the PCBA outputs a A12V power.	Controlled by analyzer power switch
D15	A24V	When it is lit, it indicates that the PCBA outputs a A24V power.	Controlled by the main power switch
D12	C12V	When it is lit, it indicates that the PCBA outputs a C12V power.	Controlled by analyzer power switch
D13	A5V	When it is lit, it indicates that the PCBA outputs a A5V power.	Controlled by analyzer power switch
D9	B24V	When it is lit, it indicates that the PCBA outputs a B24V power.	Controlled by analyzer power switch
D21	24VFAN	When indicator D21 is lit, 24VFAN signals are output.	Controlled by the main power switch

Remarks:

- The indicator voltage is controlled by the system software while the main power switch and analyzer power switch are turned on.
- It is controlled by the analyzer power switch when the main power switch is turned on.
- It is controlled by the main power switch, which means that the analyzer power switch works normally when it is turned on, and it does not work when it is turned off.

When the analyzer is powered on, the status of each LED on the power supply conversion board is as follows:

Table 4-34 LED Status On The Power Supply Conversion Board For Powering On And Off

<table>
<tr><th>LED</th><th>Output voltage</th><th>Control Description</th><th>Main switch ON Analyzer OFF</th><th>Main switch ON Analyzer ON</th><th>Main power switch OFF</th></tr>
<tr><td>D11</td><td>B12V</td><td rowspan="3">When the main power switch is ON, indicators D11, D15 and D21 are lit and only controlled by the main power switch rather than the ON/OFF status of the analyzer.</td><td>✓</td><td>✓</td><td>×</td></tr>
<tr><td>D15</td><td>A24V</td><td>✓</td><td>✓</td><td>×</td></tr>
<tr><td>D21</td><td>24VFAN</td><td>✓</td><td>✓</td><td>×</td></tr>
<tr><td>D12</td><td>C12V</td><td rowspan="5">When only the main power switch is ON, the corresponding LED on the power supply conversion board is extinguished. Only when the analyzer power switch is ON, the corresponding LED is lit and controlled by both the main power switch and the analyzer power switch.</td><td>×</td><td>✓</td><td>×</td></tr>
<tr><td>D13</td><td>A5V</td><td>×</td><td>✓</td><td>×</td></tr>
<tr><td>D14</td><td>-12V</td><td>×</td><td>✓</td><td>×</td></tr>
<tr><td>D20</td><td>D12V</td><td>×</td><td>✓</td><td>×</td></tr>
<tr><td>D9</td><td>B24V</td><td>×</td><td>✓</td><td>×</td></tr>
<tr><td rowspan="2">D10</td><td rowspan="2">A12V</td><td>Controlled by the main switch and software</td><td>×</td><td>×</td><td>×</td></tr>
<tr><td colspan="4">Turning on/off the indicator can be controlled through the operating software.</td></tr>
</table>

Output connectors:

Item	Pin	Symbol	Output Description
J3	Pin1	ISE	A24V+
	Pin2		A24V-
J4	Pin1, 3,5, and 7	VALVE DRV	C12V positive output
	Pin9, 11,12		B24V positive output
	Pin2, 4,6,8,10		B24V and C12V output GND
J7	/	N	AC input N
J8	/	L	AC input L
J9	Pin1	24VFAN+	24VFAN positive output
	Pin2	24VFAN-	24VFAN negative output
	Pin3	C12VOUT	C12V positive output
	Pin4	/	C12V output GND
J12	Pin1	D12V	D12V output
	Pin2	-12V	-12 V output
	Pin4.	/	D12V and -12 V output GND
	Pin3	5VOUT	A5V positive output
	Pin6	/	A5V output GND
J13	Pin1	AC PUMP	AC AC1 output, BA80 not used
	Pin3		AC AC2 output, not used for BA80
	Pin6.		AC input
J14	Pin1	5VOUT	A5V output
	Pin2.	B24VOUT	B24V output
	Pin4	C12VOUT	C12V output
	Pin5	-12V	-12 V output
	Pin9	D12V	D12V output
	Pin6, 7,8	/	A5V. B24V and C12V output GND
	Pin10	/	D12V and -12 V output GND
J15	Pin1, 2,3	B24VOUT	B24V output
	Pin4	5VOUT	A5V output
	Pin5	D12V	D12V output
	Pin6	-12V	-12 V output
	Pin7, 8,9,10	GND2	A5V and B24V output GND
	Pin11.	DGND	D12V and -12 V output GND
J16	Pin1	INDICATOR	A12V output for indicator
	Pin2		A12V output GND of indicator

BA2K power supply assembly maintenance

Check the indicators on the power supply conversion board while the main power switch is turned on and the analyzer power switch is off. In normal conditions, indicators B12V, A24V and 24VFAN are lit, corresponding to D11, D15 and D21 respectively. If D11 is not lit, it indicates that the B12V output is abnormal and the 12 V power module is faulty. If D15 and D21 are not lit, it indicates that the output of A24V and 24VFAN is abnormal and the 24 V power module is faulty. If the three indicators are off, check whether the AC voltage at the board end is normal and whether the 12 V and 24 V power modules are faulty.

When the main power switch is turned on and the voltage is normal, turn on the analyzer power switch. In normal conditions, all indicators on the conversion board except for the A12V indicator are lit. If the B24V indicator is off, replug the load line; if the problem persists, replace the 24 V power module and then check whether the error disappears. If the A5V indicator is not lit, perhaps it is short-circuited or the power supply conversion board goes wrong. If A5V is lit but C12V or D12V/-12 V is extinguished, replug the load line and power on again; if the error remains, check the conversion

board or replace it. Try replacing the power supply board. If the error disappears, it indicates that the power supply board needs to be repaired.
If the main power switch and analyzer power switch are turned on and working normally, the software cannot control the starting of the indicator A12V. Unplug the power cord of the indicator and power on again to remove the A12V output. Check the power supply conversion board by replacing it.

Power supply change

4.6.5 Analog Power Supply Conversion Board

Functions

The instrument has one analog power supply conversion board, which is mainly used to:
Convert the +5V digital into +/-12V in the way of DC/DC, and then provide it for the main control board to use as analog power for the AD collection board and preamplifier board.

Description

The PCB layout of the analog power supply conversion board is as shown below.

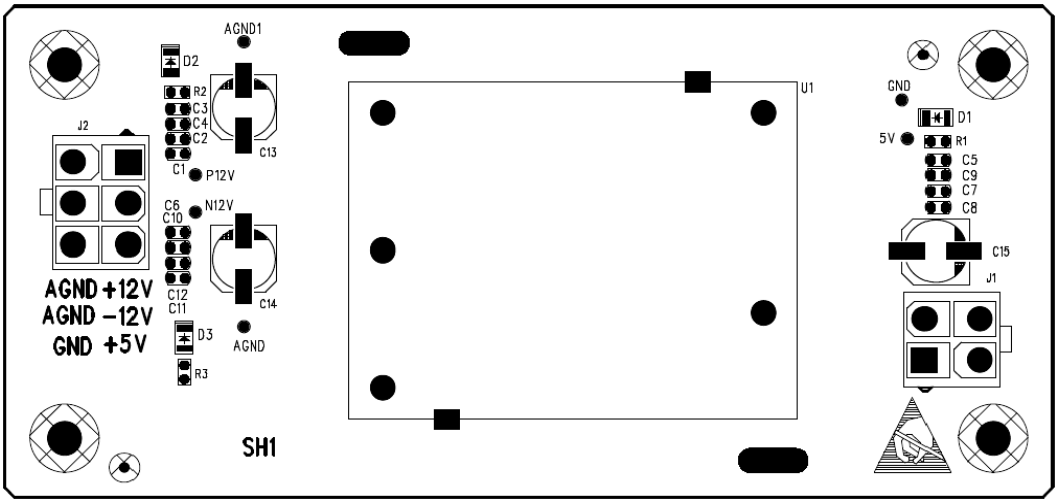


Figure 4-48 Analog power supply conversion board PCB

Connectors
The analog power supply conversion board contains the following connectors:
J1: connector for DC power supply conversion board input.

Table 4-35 Connector for DC power supply conversion board

Pin No.	Signal
1	GND
2	A5V
3	NC
4	NC

J2: connector for main control board power supply output.

Table 4-36 Connector for main control board power supply output

Pin No.	Signal
1	+12V analog
2	-12V analog
3	+5V digital
4, 5	Analog GND
6	Digital GND

Indicators

The analog power supply conversion board contains the following indicators:

- -12V power supply indicator (D3): green. When it is lit, it indicates that the -12V power supply has been connected.
- +12V power supply indicator (D2): green. When it is lit, it indicates that the +12V power supply has been connected.
- +5V power supply indicator (D1): green. When it is lit, it indicates that the +5V power supply has been connected.

Test points

In the following positions of the analog power supply conversion board can signal tests be performed.

- P12V: +12V power supply. Normal range: 12V±5%, that is, 11.4 - 12.6V.
- N12V: -12V power supply. Normal range: -12V±5%, that is, -11.4 - -12.6V.
- +5V: +5V power supply. It is secondary power supply used to power the digital parts of the PCBA. Normal range: 5V±5%, that is, 4.75 - 5.25V.
- GND: digital grounding terminal of the PCBA.
- AGND and AGND1: analog grounding terminals of the PCBA.

Installation methods and precautions

NOTE

- **Prior to removing the PCBA, disconnect the instrument from the power supply and wear a pair of anti-static gloves or wrist straps.**
- **Make sure that the connectors are inserted properly into the end of the slots on the PCBA.**
- **It requires great force to plug/unplug the connectors. Hold the PCBA by its edge while plugging/unplugging the connectors to prevent it from being deformed or damaged.**

4.6.6 Maintenance of Power Supply System

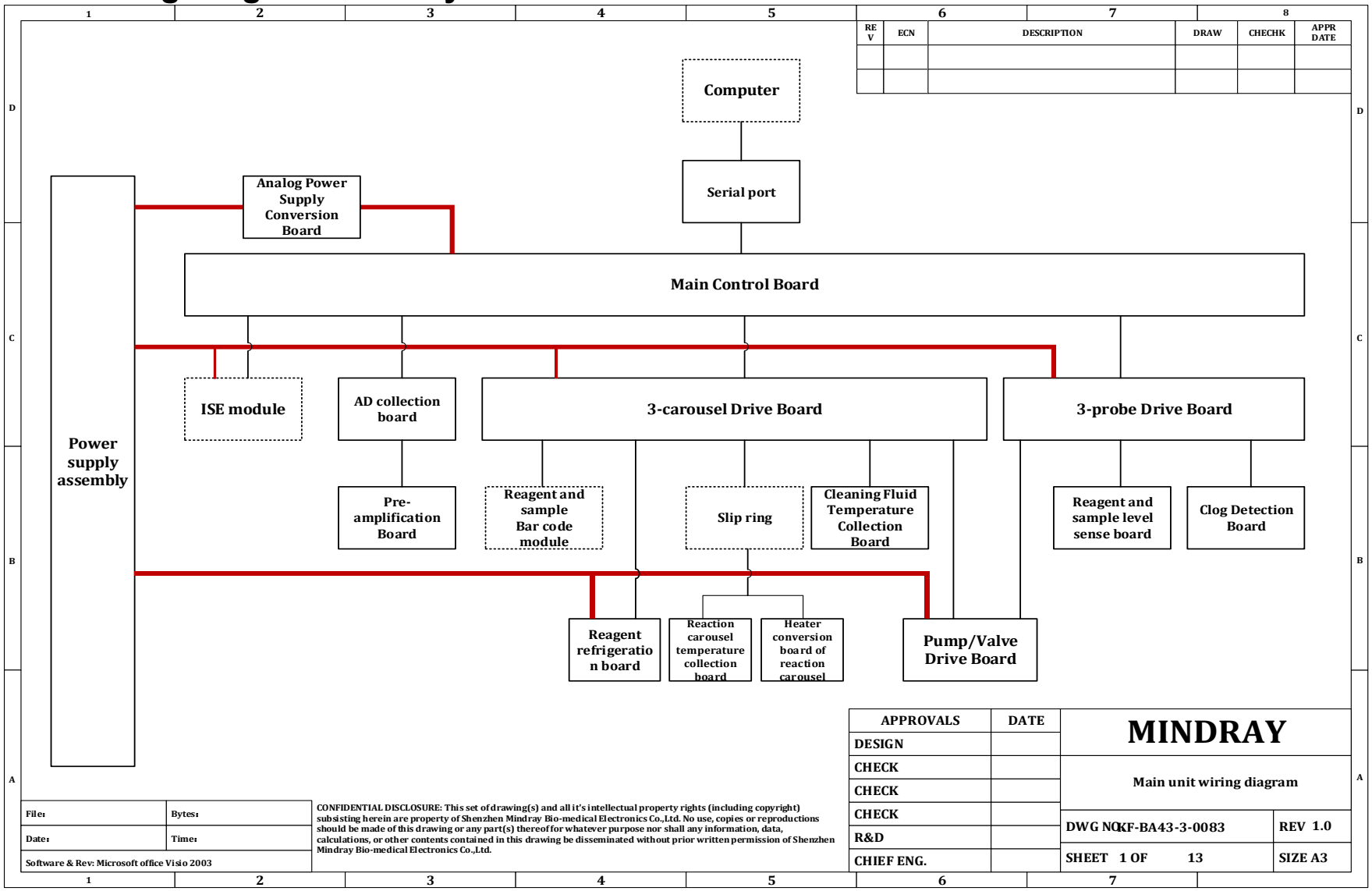
The following summary is about the control relations of the power supply system and provided to help service engineers to troubleshoot various failures.

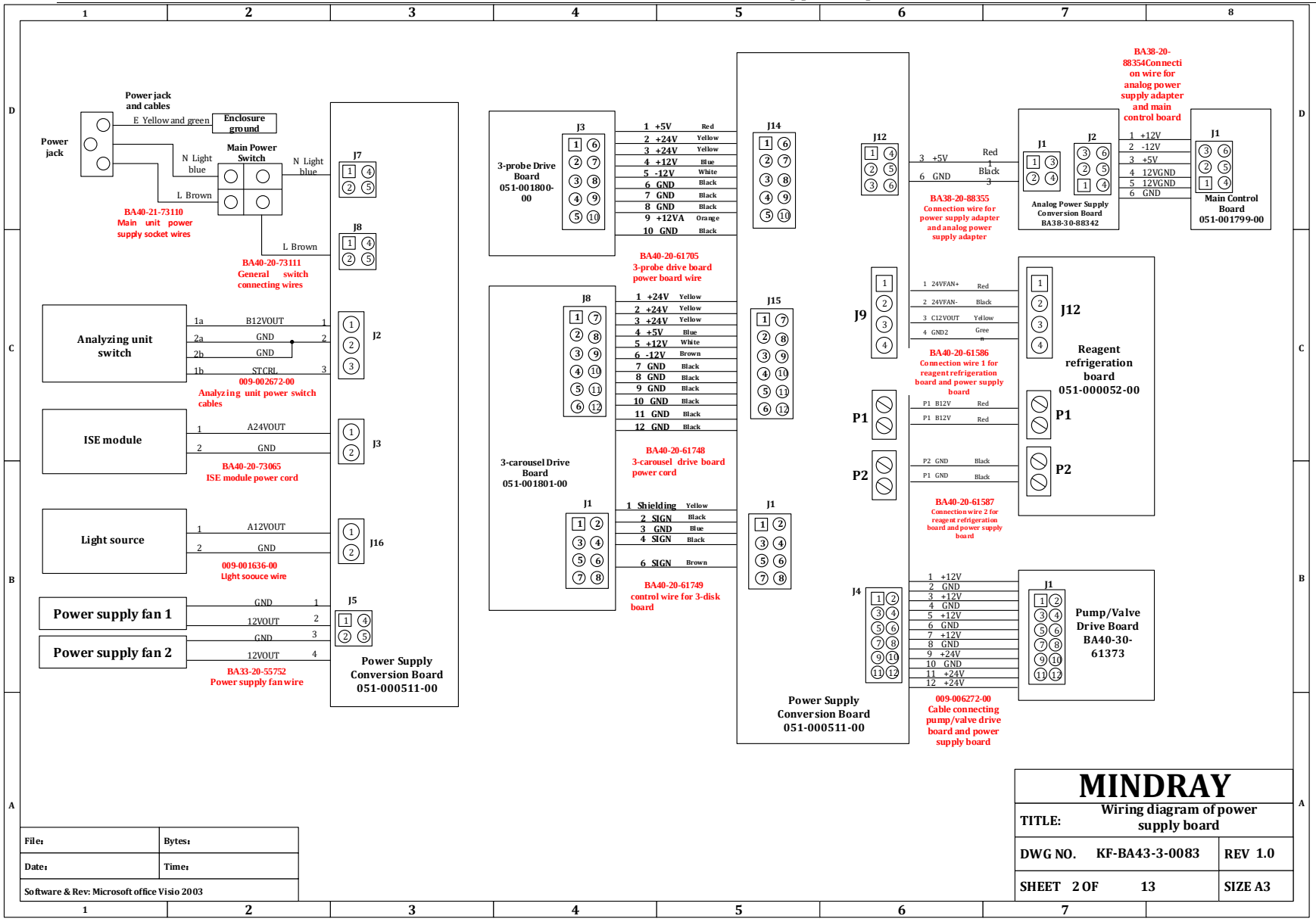
For correspondence between the main power switch/analyzer power switch/hibernating status and the power supply working status, refer to relevant sections on the previous pages.

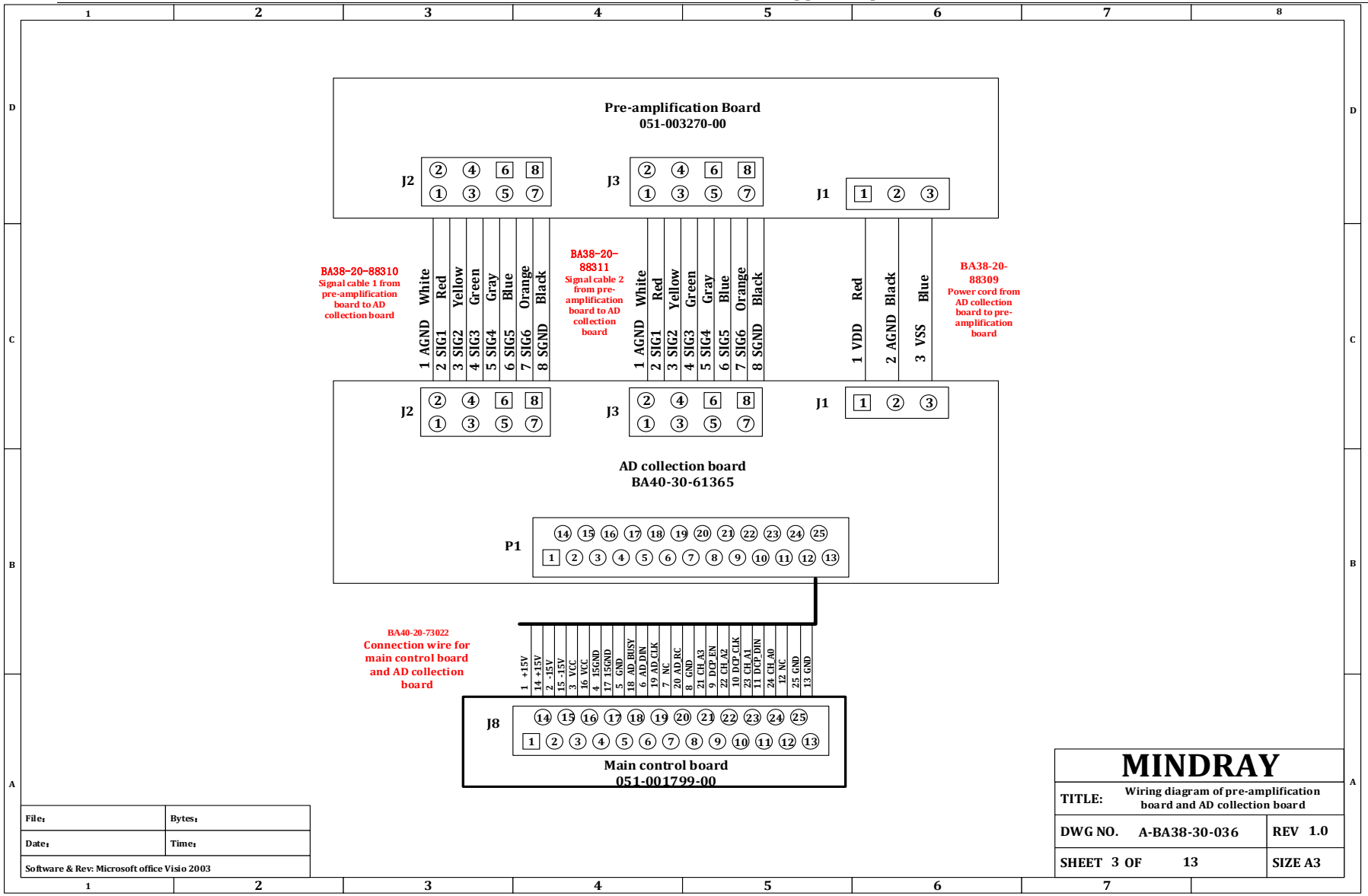
Voltage timing control:

When the analyzer power switch is turned on, the A5V, C12V (D12V/E12V) and B24V are controlled successively in the order of A5V – C12V (D12V/-12V) – B24V. That is, only when the A5V is connected will the C12V (D12V/-12V) be provided, and this is the same for C12V and B24V; if the A5V is not output, the C12V (D12V/-12V) and B24V will not be provided.

4.7 Wiring Diagram of Analyzer




Power jack and cables
E Yellow and green
Enclosure ground
Power jack
N Light blue
Main Power Switch
N Light blue
L Brown
BA40-21-73110
Main unit power supply socket wires
L Brown
BA40-20-73111
General switch connecting wires
J7
J8
Analyzing unit switch
1a B12VOUT 1
2a GND 2
2b GND
1b STCRL 3
J2
009-002672-00
Analyzing unit power switch cables
ISE module
1 A24VOUT
2 GND
J3
BA40-20-73065
ISE module power cord
Light source
1 A12VOUT
2 GND
J16
009-001636-00
Light sooce wire
Power supply fan 1
Power supply fan 2
GND 1
12VOUT 2
GND 3
12VOUT 4
J5
BA33-20-55752
Power supply fan wire
Power Supply Conversion Board 051-000511-00
3-probe Drive Board 051-001800-00
J3
1 +5V Red
2 +24V Yellow
3 +24V Yellow
4 +12V Blue
5 -12V White
6 GND Black
7 GND Black
8 GND Black
9 +12VA Orange
10 GND Black
BA40-20-61705
3-probe drive board power board wire
3-carousel Drive Board 051-001801-00
J8
1 +24V Yellow
2 +24V Yellow
3 +24V Yellow
4 +5V Blue
5 +12V White
6 -12V Brown
7 GND Black
8 GND Black
9 GND Black
10 GND Black
11 GND Black
12 GND Black
BA40-20-61748
3-carousel drive board power cord
J1
1 Shielding Yellow
2 SIGN Black
3 GND Blue
4 SIGN Black
6 SIGN Brown
BA40-20-61749
control wire for 3-disk board
J14
J15
J1
Power Supply Conversion Board 051-000511-00
J12
3 +5V Red
6 GND Black
BA38-20-88355
Connection wire for power supply adapter and analog power supply adapter
J1
J2
Analog Power Supply Conversion Board BA38-30-88342
BA38-20-88354Connection wire for analog power supply adapter and main control board
1 +12V
2 -12V
3 +5V
4 12VGND
5 12VGND
6 GND
J1
Main Control Board 051-001799-00
J9
1 24VFAN+ Red
2 24VFAN- Black
3 C12VOUT Yellow
4 GND2 Green
BA40-20-61586
Connection wire 1 for reagent refrigeration board and power supply board
P1 B12V Red
P1 B12V Red
P2 GND Black
P1 GND Black
BA40-20-61587
Connection wire 2 for reagent refrigeration board and power supply board
J12
Reagent refrigeration board 051-000052-00
P1
P2
J4
1 +12V
2 GND
3 +12V
4 GND
5 +12V
6 GND
7 +12V
8 GND
9 +24V
10 GND
11 +24V
12 +24V
009-006272-00
Cable connecting pump/valve drive board and power supply board
J1
Pump/Valve Drive Board BA40-30-61373
MINDRAY
TITLE: Wiring diagram of power supply board
DWG NO. KF-BA43-3-0083
REV 1.0
SHEET 2 OF 13
SIZE A3
File:
Bytes:
Date:
Time:
Software & Rev: Microsoft office Visio 2003


Pre-amplification Board
051-003270-00
J2
J3
J1
BA38-20-88310
Signal cable 1 from pre-amplification board to AD collection board
1 AGND White
2 SIG1 Red
3 SIG2 Yellow
4 SIG3 Green
5 SIG4 Gray
6 SIG5 Blue
7 SIG6 Orange
8 SGND Black
BA38-20-88311
Signal cable 2 from pre-amplification board to AD collection board
1 AGND White
2 SIG1 Red
3 SIG2 Yellow
4 SIG3 Green
5 SIG4 Gray
6 SIG5 Blue
7 SIG6 Orange
8 SGND Black
1 VDD Red
2 AGND Black
3 VSS Blue
BA38-20-88309
Power cord from AD collection board to pre-amplification board
AD collection board
BA40-30-61365
P1
BA40-20-73022
Connection wire for main control board and AD collection board
1 +15V
14 +15V
2 -15V
15 -15V
3 VCC
16 VCC
4 15GND
17 15GND
5 GND
18 AD_BUSY
6 AD_DIN
19 AD_CLK
7 NC
20 AD_RC
8 GND
21 CH_A3
9 DCP_EN
22 CH_A2
10 DCP_CLK
23 CH_A1
11 DCP_DIN
24 CH_A0
12 NC
25 GND
13 GND
J8
Main control board
051-001799-00
MINDRAY
TITLE: Wiring diagram of pre-amplification board and AD collection board
DWG NO. A-BA38-30-036
REV 1.0
SHEET 3 OF 13
SIZE A3
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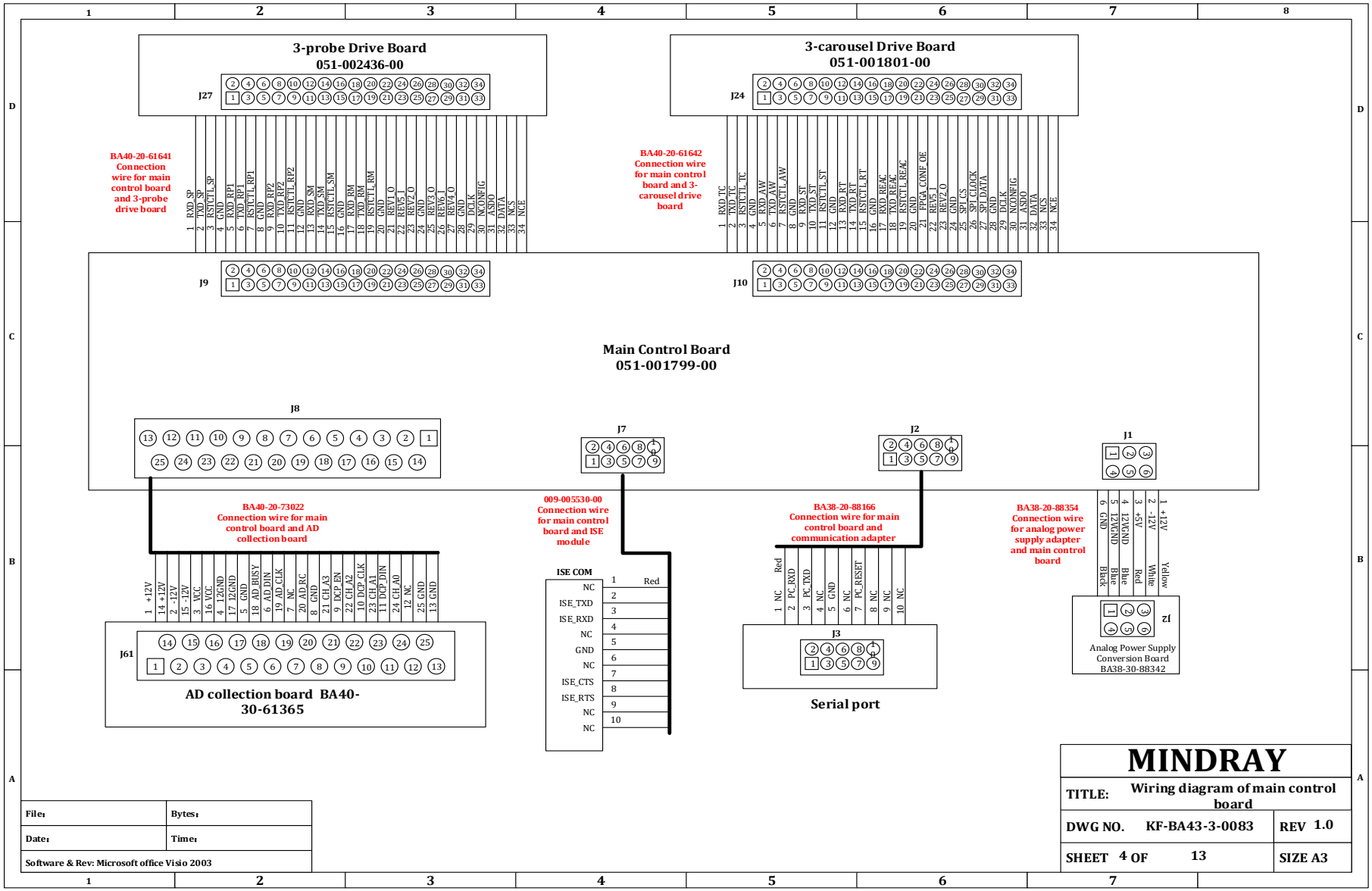
3-probe Drive Board
051-002436-00
J27
BA40-20-61641
Connection wire for main control board and 3-probe drive board
3-carousel Drive Board
051-001801-00
J24
BA40-20-61642
Connection wire for main control board and 3-carousel drive board
J9
J10
Main Control Board
051-001799-00
J8
J7
J2
J1
BA40-20-73022
Connection wire for main control board and AD collection board
009-005530-00
Connection wire for main control board and ISE module
BA38-20-88166
Connection wire for main control board and communication adapter
BA38-20-88354
Connection wire for analog power supply adapter and main control board
ISE COM
J61
AD collection board BA40-30-61365
J3
Serial port
J2
Analog Power Supply Conversion Board BA38-30-88342
MINDRAY
TITLE: Wiring diagram of main control board
DWG NO. KF-BA43-3-0083
REV 1.0
SHEET 4 OF 13
SIZE A3
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Bytes:
Date:
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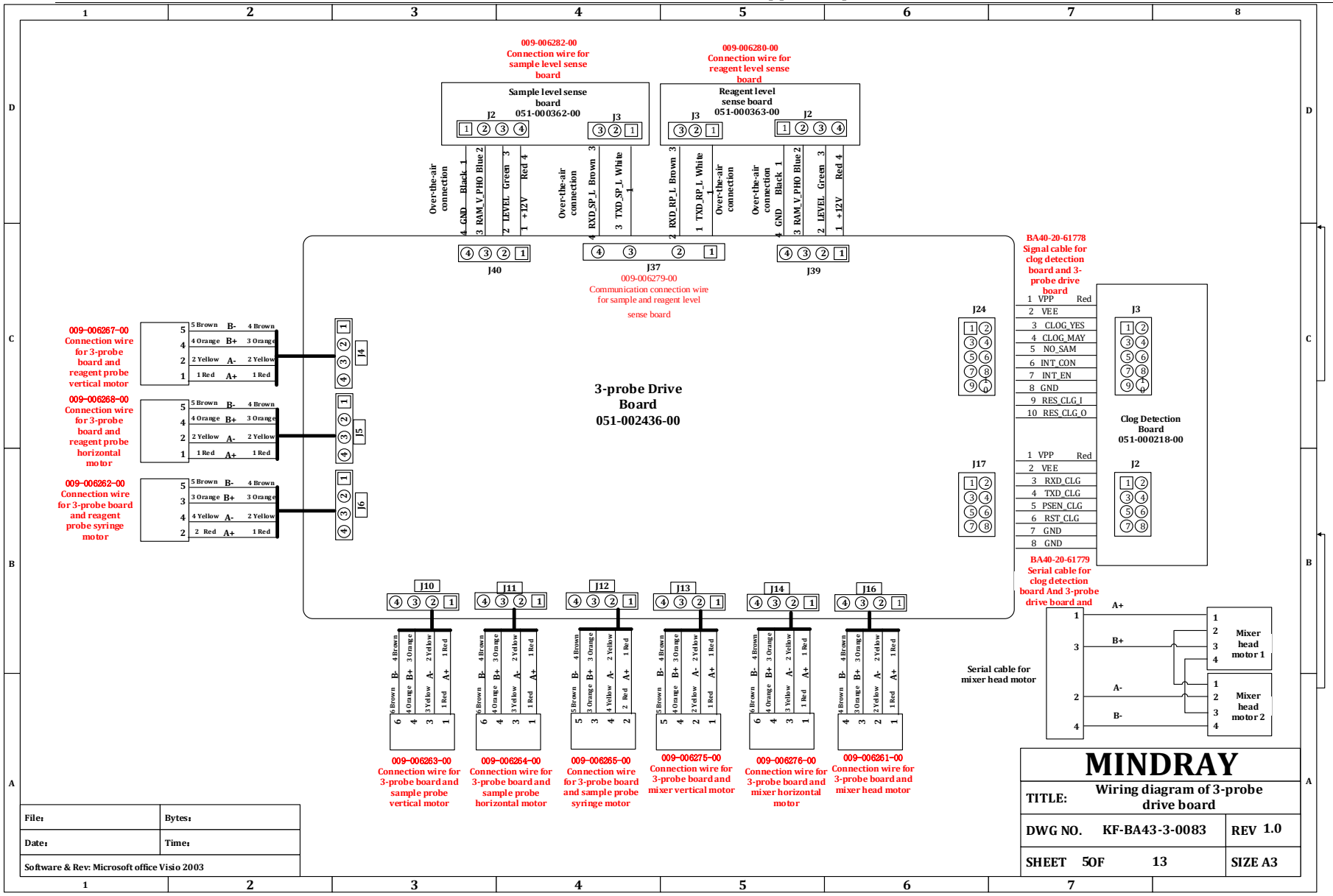
Software & Rev: Microsoft office Visio 2003


009-006282-00
Connection wire for sample level sense board
009-006280-00
Connection wire for reagent level sense board
Sample level sense board
051-000362-00
Reagent level sense board
051-000363-00
J2
J3
Over-the-air connection
GND Black 1
RAM_V_PHO Blue 2
LEVEL Green 3
+12V Red 4
RXD_SP_L Brown 3
TXD_SP_L White 1
RXD_RP_L Brown 3
TXD_RP_L White 1
J40
J37
J39
009-006279-00
Communication connection wire for sample and reagent level sense board
3-probe Drive Board
051-002436-00
009-006267-00
Connection wire for 3-probe board and reagent probe vertical motor
009-006268-00
Connection wire for 3-probe board and reagent probe horizontal motor
009-006262-00
Connection wire for 3-probe board and reagent probe syringe motor
J4
J5
J6
J24
J17
BA40-20-61778
Signal cable for clog detection board and 3-probe drive board
1 VPP Red
2 VEE
3 CLOG_YES
4 CLOG_MAY
5 NO_SAM
6 INT_CON
7 INT_EN
8 GND
9 RES_CLG_I
10 RES_CLG_O
Clog Detection Board
051-000218-00
1 VPP Red
2 VEE
3 RXD_CLG
4 TXD_CLG
5 PSEN_CLG
6 RST_CLG
7 GND
8 GND
BA40-20-61779
Serial cable for clog detection board And 3-probe drive board and
Serial cable for mixer head motor
A+
B+
A-
B-
Mixer head motor 1
Mixer head motor 2
J10
J11
J12
J13
J14
J16
009-006263-00
Connection wire for 3-probe board and sample probe vertical motor
009-006264-00
Connection wire for 3-probe board and sample probe horizontal motor
009-006265-00
Connection wire for 3-probe board and sample probe syringe motor
009-006275-00
Connection wire for 3-probe board and mixer vertical motor
009-006276-00
Connection wire for 3-probe board and mixer horizontal motor
009-006261-00
Connection wire for 3-probe board and mixer head motor
MINDRAY
TITLE: Wiring diagram of 3-probe drive board
DWG NO. KF-BA43-3-0083
REV 1.0
SHEET 5OF 13
SIZE A3
File:
Bytes:
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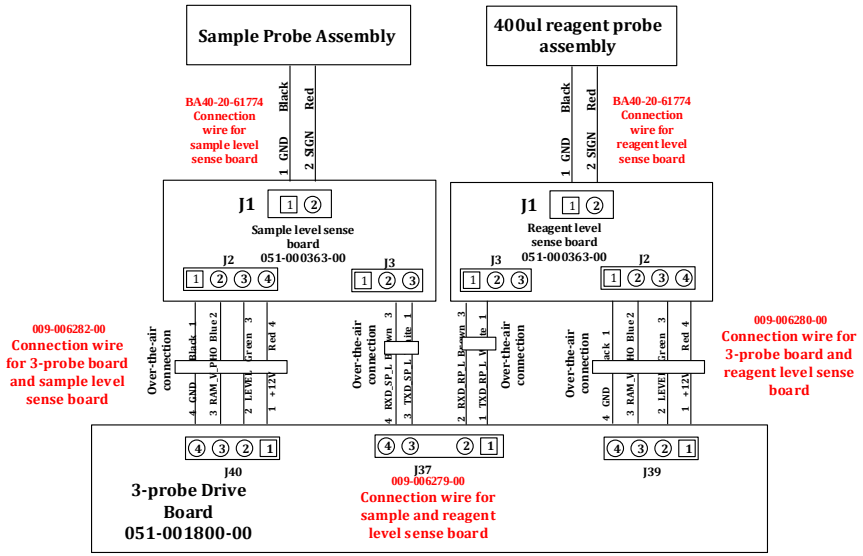
Software & Rev: Microsoft office Visio 2003



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Date:	Time:
Software & Rev: Microsoft office Visio 2003	

MINDRAY

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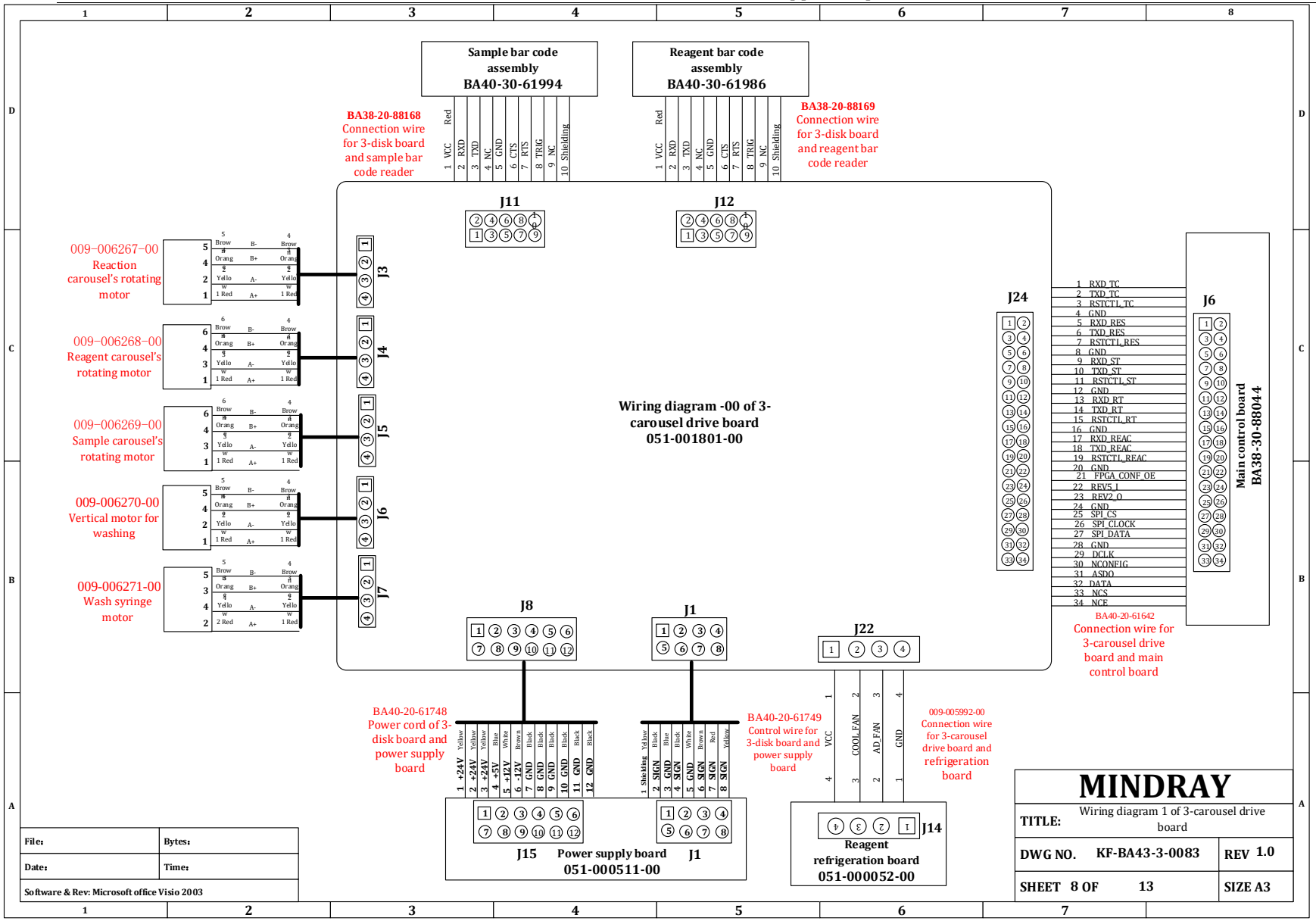
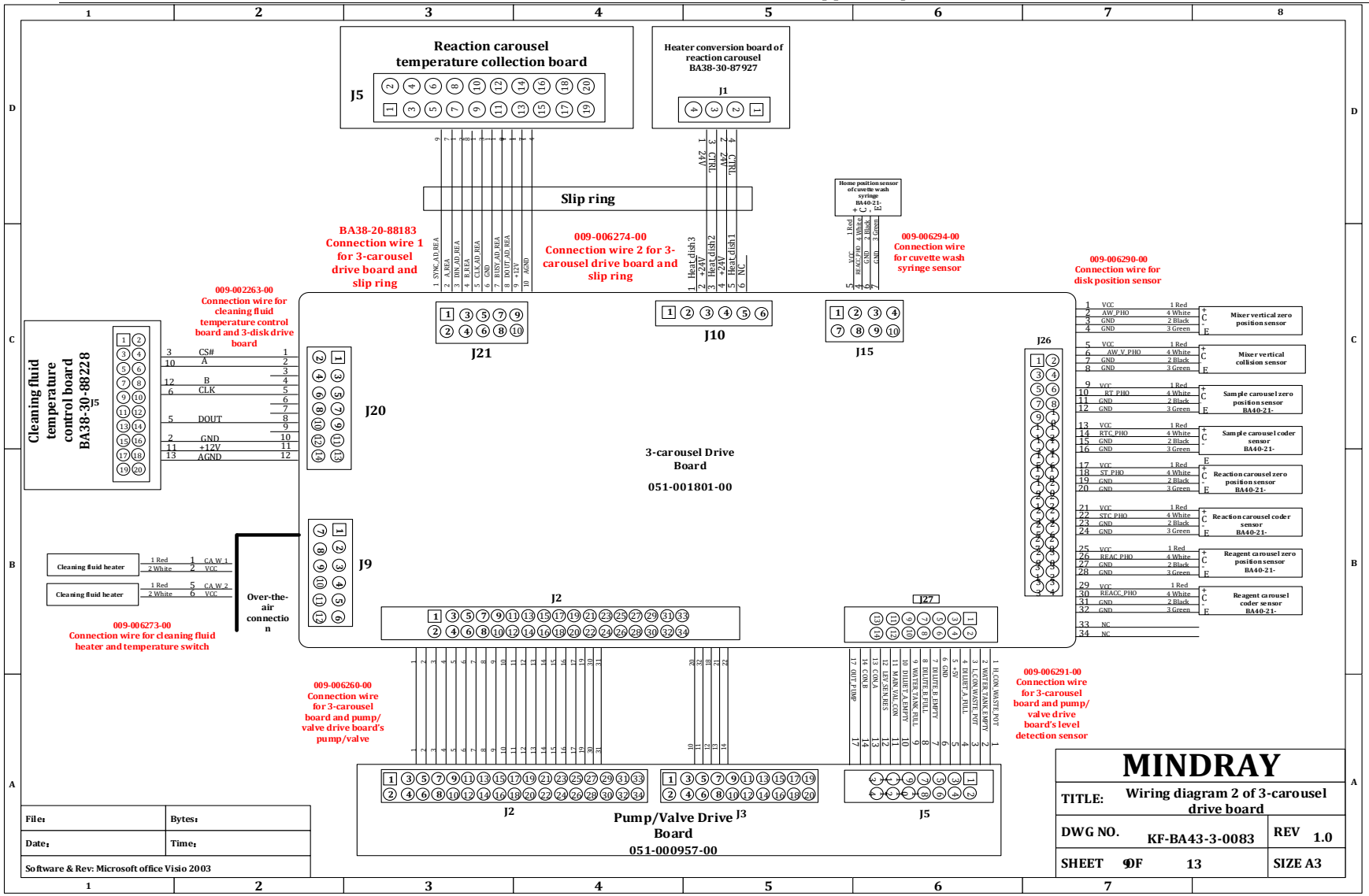
DWG NO.	KF-BA43-3-0083	REV 1.0
SHEET 7 OF 13		SIZE A3


Sample bar code assembly BA40-30-61994
Reagent bar code assembly BA40-30-61986
BA38-20-88168 Connection wire for 3-disk board and sample bar code reader
BA38-20-88169 Connection wire for 3-disk board and reagent bar code reader
1 VCC 2 RXD 3 TXD 4 NC 5 GND 6 CTS 7 RTS 8 TRIG 9 NC 10 Shielding
J11
J12
009-006267-00 Reaction carousel's rotating motor
009-006268-00 Reagent carousel's rotating motor
009-006269-00 Sample carousel's rotating motor
009-006270-00 Vertical motor for washing
009-006271-00 Wash syringe motor
J3
J4
J5
J6
J7
Wiring diagram -00 of 3-carousel drive board 051-001801-00
J24
J6
Main control board BA38-30-88044
1 RXD_TC 2 TXD_TC 3 RSTCTL_TC 4 GND 5 RXD_RES 6 TXD_RES 7 RSTCTL_RES 8 GND 9 RXD_ST 10 TXD_ST 11 RSTCTL_ST 12 GND 13 RXD_RT 14 TXD_RT 15 RSTCTL_RT 16 GND 17 RXD_REAC 18 TXD_REAC 19 RSTCTL_REAC 20 GND 21 FPGA_CONF_OE 22 REV5_I 23 REV2_O 24 GND 25 SPI_CS 26 SPI_CLOCK 27 SPI_DATA 28 GND 29 DCLK 30 NCONFIG 31 ASDO 32 DATA 33 NCS 34 NCE
BA40-20-61642 Connection wire for 3-carousel drive board and main control board
J8
J1
J22
BA40-20-61748 Power cord of 3-disk board and power supply board
1 +24V 2 +24V 3 +24V 4 +5V 5 +12V 6 -12V 7 GND 8 GND 9 GND 10 GND 11 GND 12 GND
1 Shielding 2 SIGN 3 GND 4 SIGN 5 GND 6 SIGN 7 SIGN 8 SIGN
BA40-20-61749 Control wire for 3-disk board and power supply board
1 VCC 2 COOL_FAN 3 AD_FAN 4 GND
009-005992-00 Connection wire for 3-carousel drive board and refrigeration board
J15 Power supply board J1
051-000511-00
J14
Reagent refrigeration board
051-000052-00
MINDRAY
TITLE: Wiring diagram 1 of 3-carousel drive board
DWG NO. KF-BA43-3-0083
REV 1.0
SHEET 8 OF 13
SIZE A3
File: Bytes:
Date: Time:
Software & Rev: Microsoft office Visio 2003



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Software & Rev: Microsoft office Visio 2003	

MINDRAY

TITLE:	Wiring diagram 2 of 3-carousel drive board	
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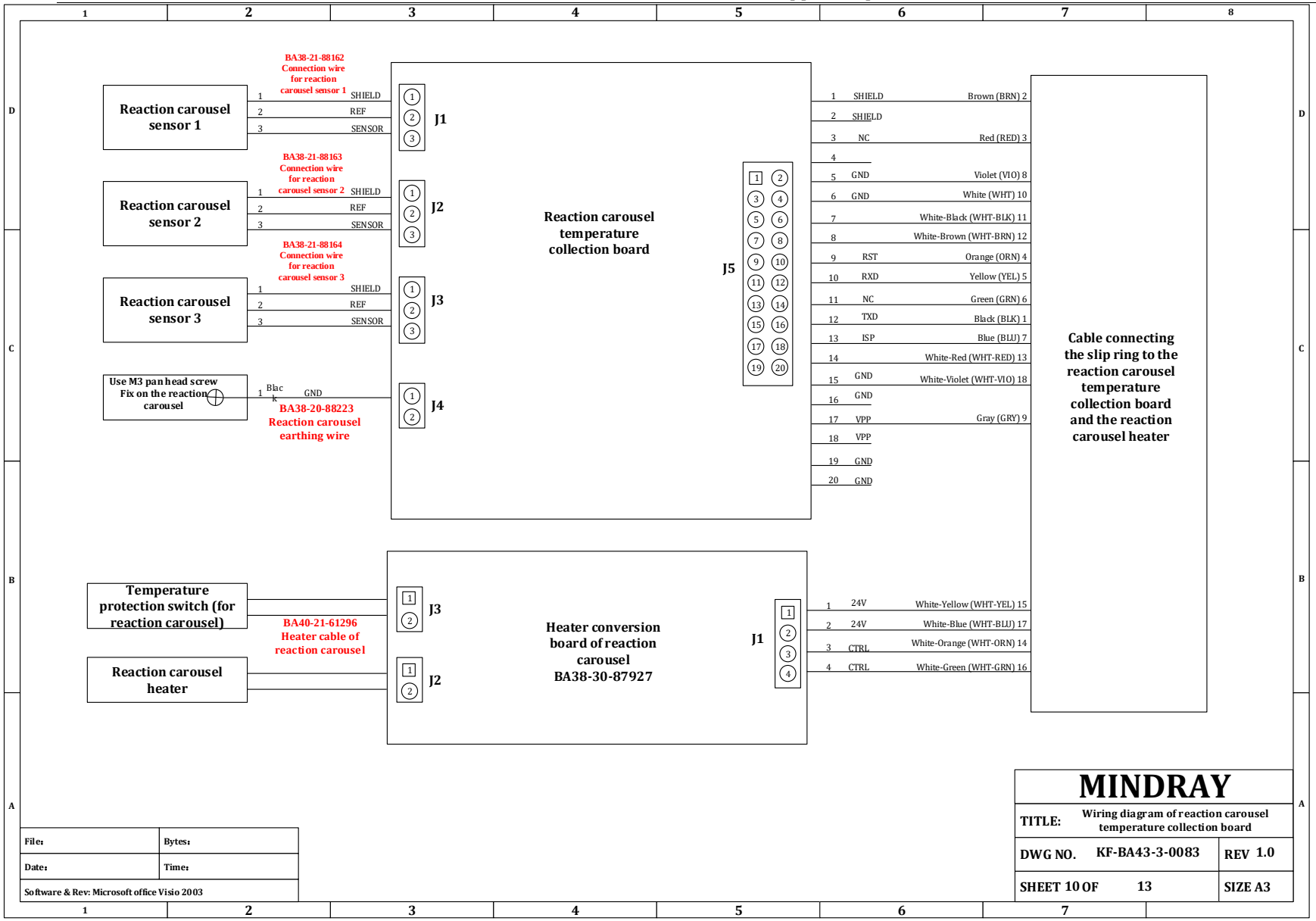
SHEET 9 OF 13		SIZE A3



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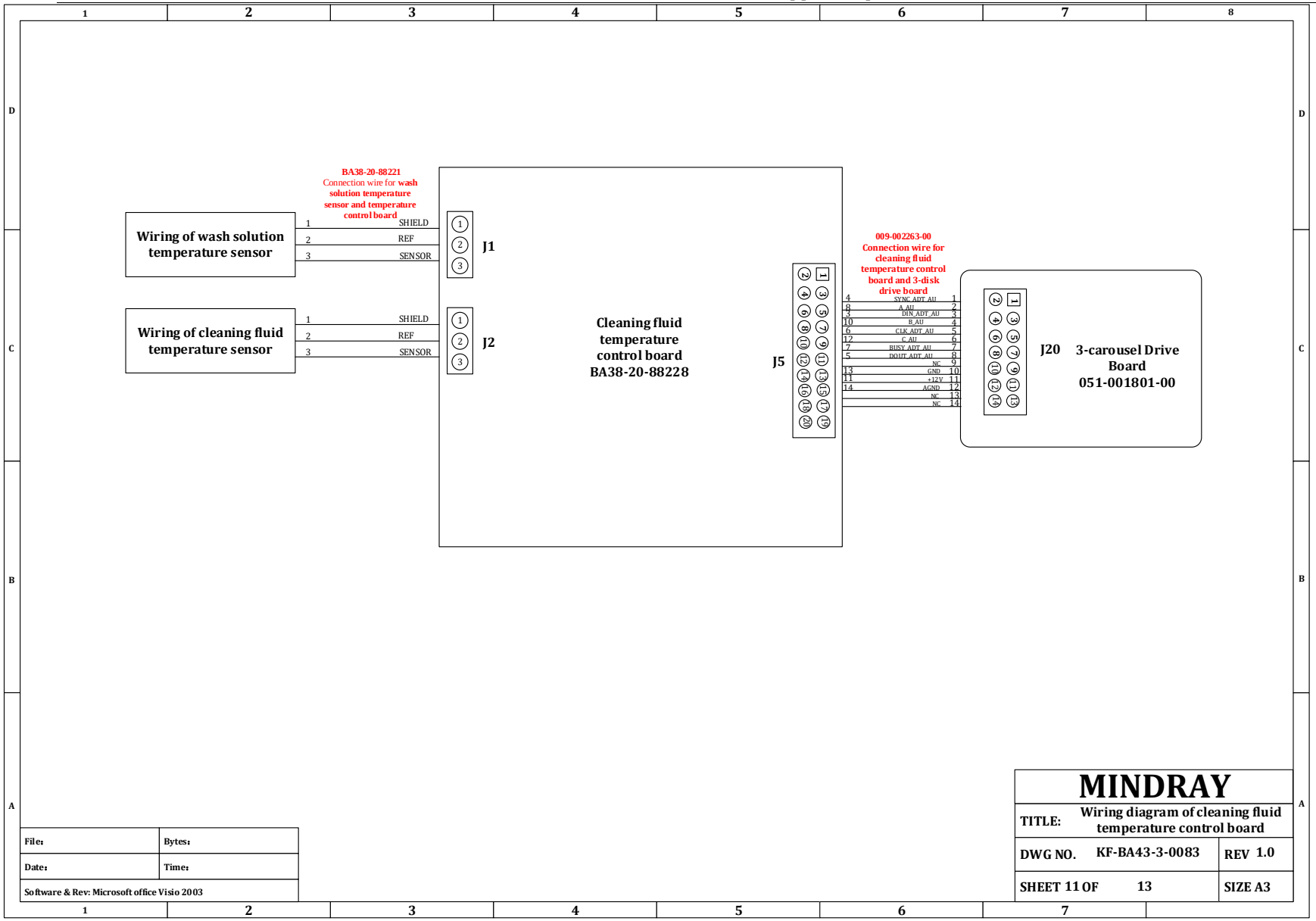
DWG NO.	KF-BA43-3-0083	REV 1.0
SHEET 10 OF	13	SIZE A3


BA38-20-88221
Connection wire for wash solution temperature sensor and temperature control board
Wiring of wash solution temperature sensor
1 SHIELD
2 REF
3 SENSOR
J1
Wiring of cleaning fluid temperature sensor
1 SHIELD
2 REF
3 SENSOR
J2
Cleaning fluid temperature control board BA38-20-88228
J5
009-002263-00
Connection wire for cleaning fluid temperature control board and 3-disk drive board
4 SYNC_ADT_AU 1
8 A_AU 2
3 DIN_ADT_AU 3
10 B_AU 4
6 CLK_ADT_AU 5
12 C_AU 6
7 BUSY_ADT_AU 7
5 DOUT_ADT_AU 8
NC 9
13 GND 10
11 +12V 11
14 AGND 12
NC 13
NC 14
J20 3-carousel Drive Board 051-001801-00
MINDRAY
TITLE: Wiring diagram of cleaning fluid temperature control board
DWG NO. KF-BA43-3-0083
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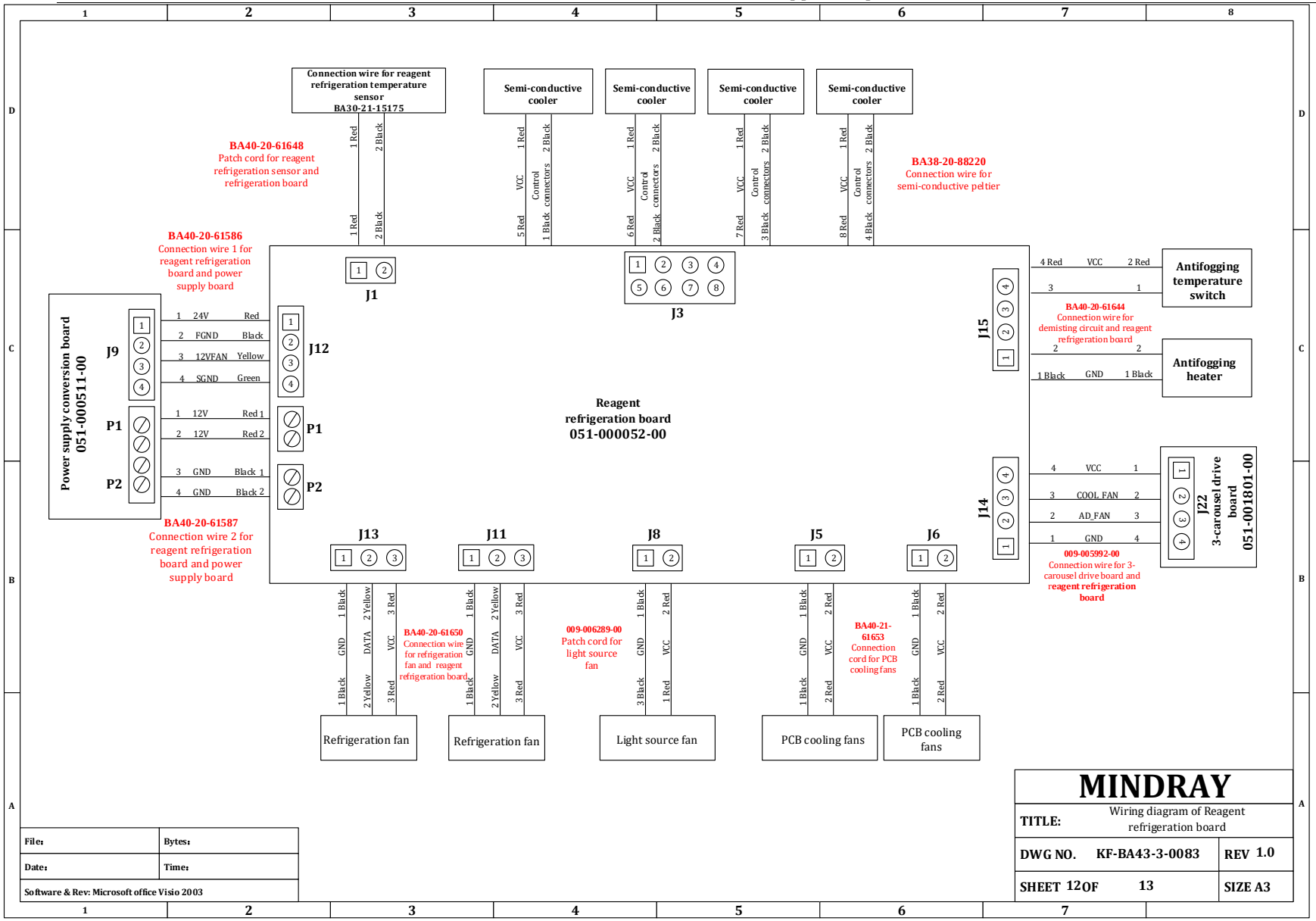
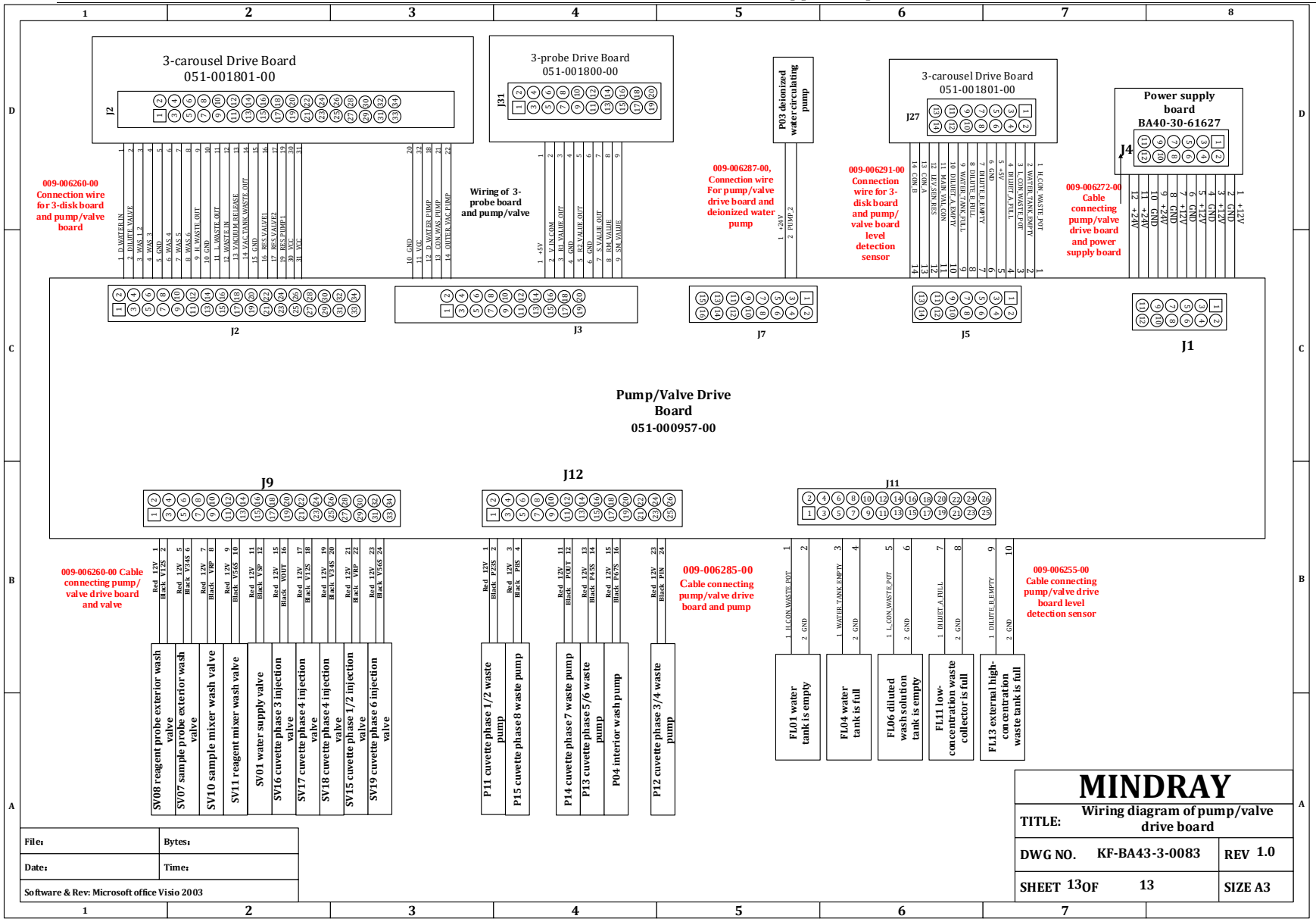

Connection wire for reagent refrigeration temperature sensor BA30-21-15175
Semi-conductive cooler
Semi-conductive cooler
Semi-conductive cooler
Semi-conductive cooler
BA40-20-61648
Patch cord for reagent refrigeration sensor and refrigeration board
BA38-20-88220
Connection wire for semi-conductive peltier
BA40-20-61586
Connection wire 1 for reagent refrigeration board and power supply board
Power supply conversion board
051-000511-00
J9
P1
P2
J12
P1
P2
J1
J3
Reagent refrigeration board
051-000052-00
J15
J14
J13
J11
J8
J5
J6
Antifogging temperature switch
BA40-20-61644
Connection wire for demisting circuit and reagent refrigeration board
Antifogging heater
J22
3-carousel drive board
051-001801-00
009-005992-00
Connection wire for 3-carousel drive board and reagent refrigeration board
BA40-20-61587
Connection wire 2 for reagent refrigeration board and power supply board
BA40-20-61650
Connection wire for refrigeration fan and reagent refrigeration board
009-006289-00
Patch cord for light source fan
BA40-21-61653
Connection cord for PCB cooling fans
Refrigeration fan
Refrigeration fan
Light source fan
PCB cooling fans
PCB cooling fans
MINDRAY
TITLE: Wiring diagram of Reagent refrigeration board
DWG NO. KF-BA43-3-0083
REV 1.0
SHEET 12 OF 13
SIZE A3
File:
Bytes:
Date:
Time:
Software & Rev: Microsoft office Visio 2003



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Date:	Time:
Software & Rev: Microsoft office Visio 2003	

MINDRAY

TITLE:	Wiring diagram of pump/valve drive board	
DWG NO.	KF-BA43-3-0083	REV 1.0
SHEET 13 OF	13	SIZE A3

5 Hydropneumatic System

5.1 Overview

Main functions of the BS-430 hydropneumatic system are as follows:

- To provide deionized water for washing interior/exterior of probes and mixers via the probe wash module.
- To provide deionized water and wash solution for cuvette auto wash module.
- To provide the whole unit with deionized water via the water supply module and to discharge waste liquid via the drainage module.

This chapter describes the working principles and repairing methods of the BS-430's hydropneumatic system.

5.2 Fluidic Diagram

MRSZ/R05N01.291.01（2.0）

REV	ECN	DESCRIPTION	DESIGN
1.0	/	New	Jiang Boshi
2.0	EBJ317	Changed the material code of auto wash syringe SY05	Jiang Boshi

Pipe label

- Deionized water
- Diluted wash solution
- Vacuum
- Concentrated wash solution
- Waste

SV02 SY01 PRE04 SV03 SY02 NR NS MIXS MIXR Reagent Carousel Reaction Carousel P04 SV08 SV07 SV10 SV11 SV19 SV18 SV17 SV16 SI1 SI2 SI3 SI4 SI5 SI6 SI7 SI8 P15 P14 P13 P12 P11 FL11 Low-conc. Waste tank (CAN08) PRE05 MF03 Manifold Throt02 FIL02 FL04 P03 Water supply pump FL01 DI. Water tank (CAN01) SV01 DI water inlet Low-conc. waste outlet 1 DI water preheat Wash solution preheat CAN12 FIL03 Dil Detergent inlet SV15 SY05 Low-conc. waste outlet 2 High-conc. waste outlet

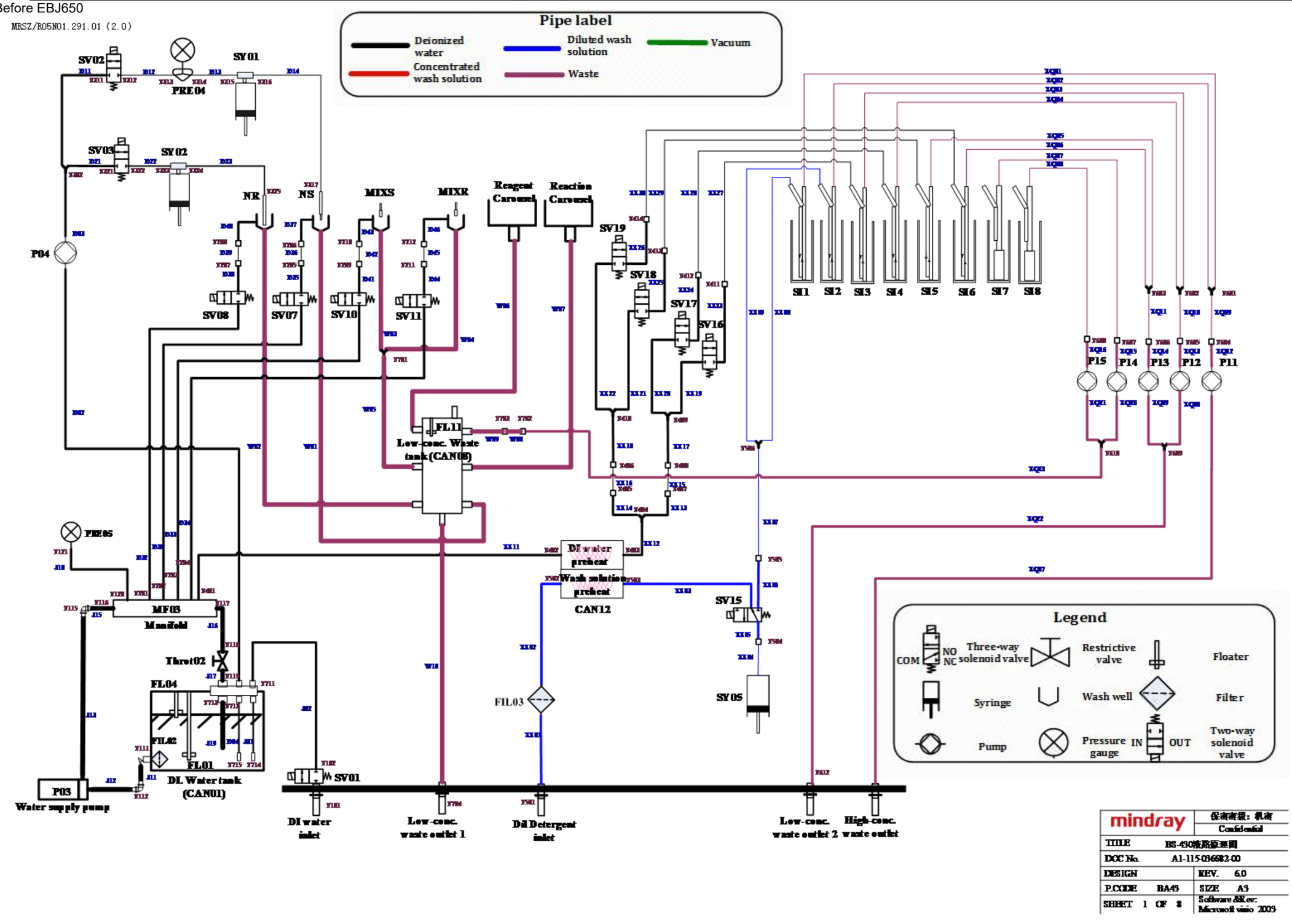
Legend

COM NO NC Three-way solenoid valve; Restrictive valve; Floater; Syringe; Wash well; Filter; Pump; Pressure gauge; IN OUT Two-way solenoid valve

mindray	Security Classification: Confidential
TITLE	Schematic diagram of BS-430
DOC No.	A1-115-036682-00
DESIGN	REV. 2.0
P.CODE BA43	SIZE A3
SHEET 1 OF 8	Software & Rev: Microsoft visio 2003

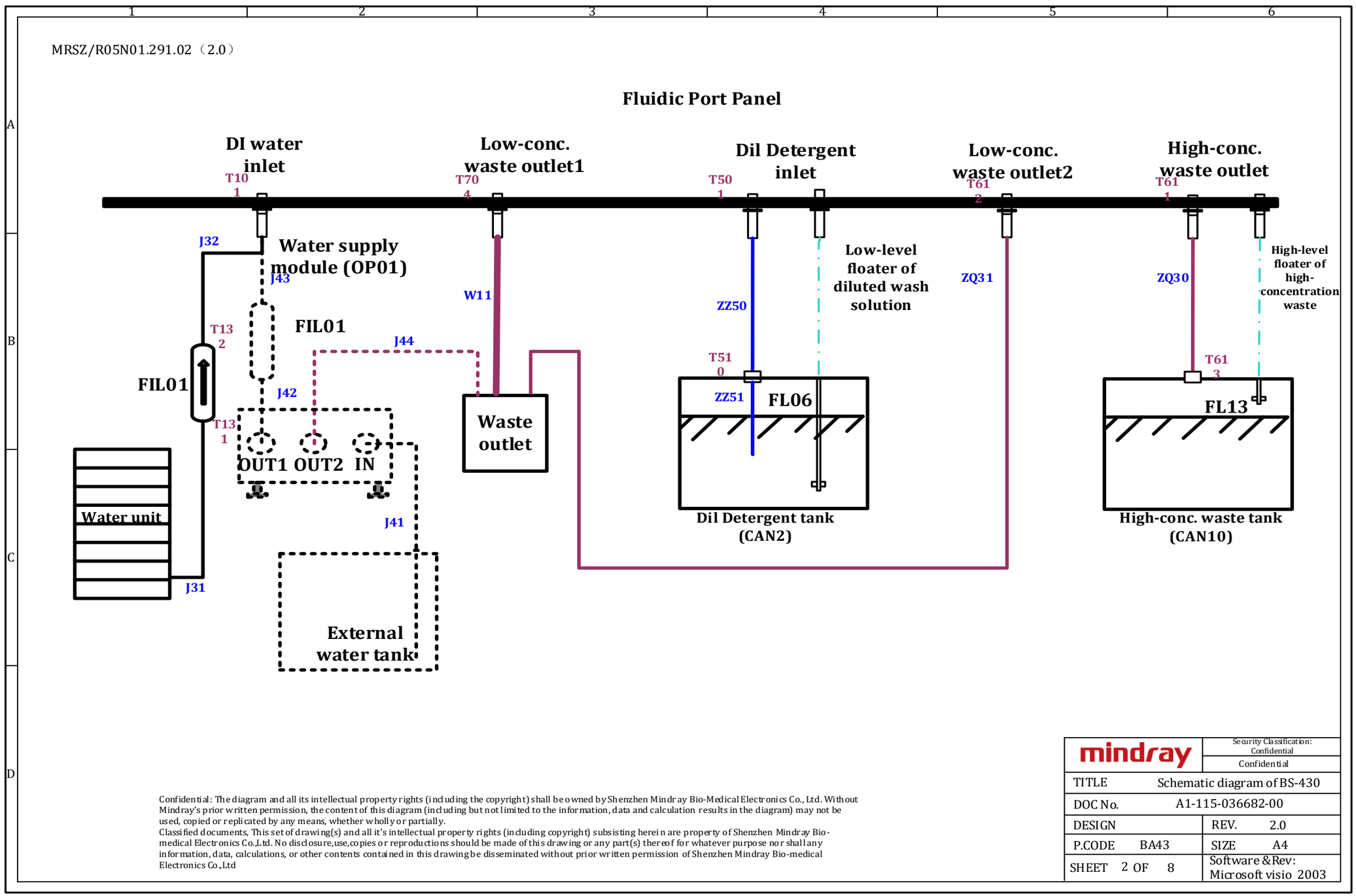
Before EBJ650

MRSZ/R05N01.291.01 (2.0)



mindray	保密等级：机密 Confidential
TITLE	BS-430流路板原理图
DOC No.	A1-115-016682-00
DESIGN	REV. 6.0
P.CODE BA43	SIZE A3
SHEET 1 OF 2	Software &Rev. Microsoft visio 2003

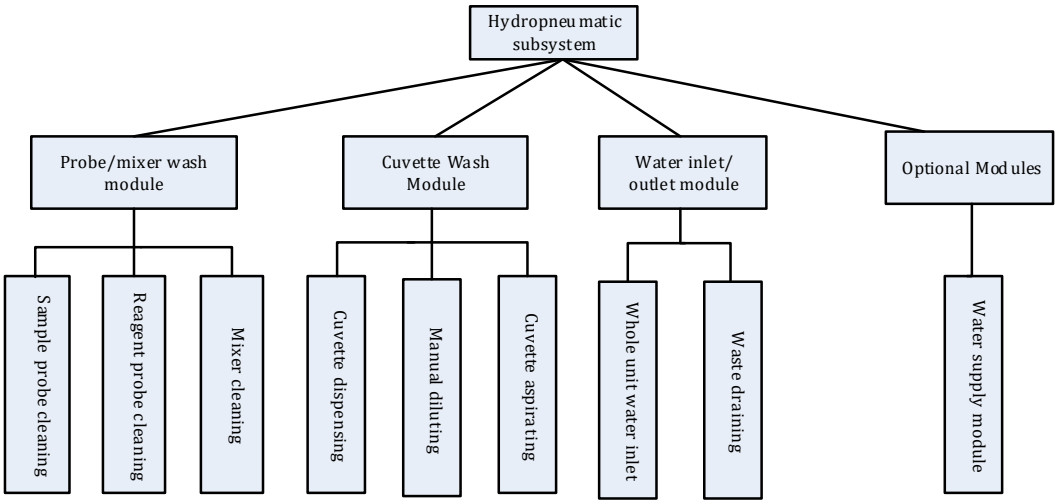
MRSZ/R05N01.291.02（2.0）



mindray	Security Classification: Confidential
	Confidential
TITLE	Schematic diagram of BS-430
DOC No.	A1-115-036682-00
DESIGN	REV. 2.0
P.CODE BA43	SIZE A4
SHEET 2 OF 8	Software &Rev: Microsoft visio 2003

5.3 Principles of Hydropneumatic System

The hydropneumatic system of the BS-430 is composed of the probe wash module, cuvette wash station, and water supply/drainage module. See the figures below:



5.3.1 Probe Wash Module

The probe/mixer wash module consists of one sample probe, one reagent probe, two mixers (collectively known as the four probes), and two syringes. The sample syringe is 250μl, and the reagent syringe is 500μl. This module is used for fixed-quantity sampling and probe/mixer cleaning.

- Fixed-quantity sampling is realized through cooperation of the syringes, sampling valves and probes with the aim of delivering fixed-quantity reagent and sample.
- The washing of the interior of the sample probe and reagent probe is driven by the same probe interior wash pump P04. The washing is completed respectively under the control of the interior wash valve.
- The exterior of the four probes is washed through the deionized water circulating pump P03, which is controlled by the exterior wash solenoid valve and adjusted by the restrictive tube.

The schematic diagram of the probe wash module is as shown below.

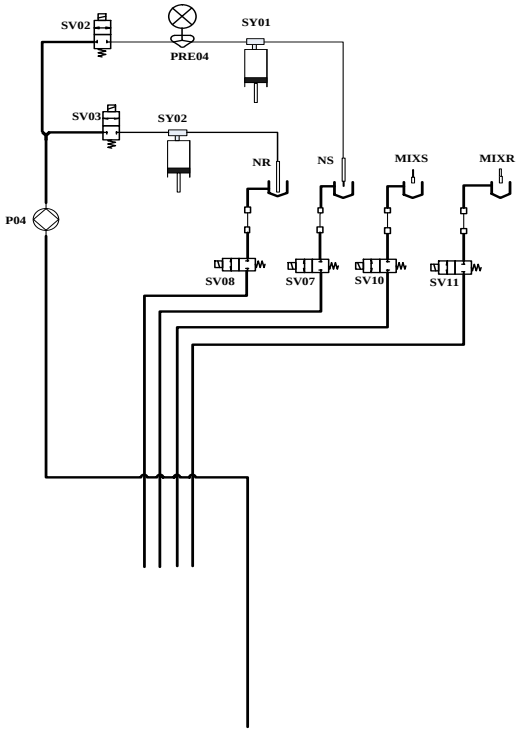


Figure 5-1 Schematic diagram of probe wash module

5.3.2 Cuvette Wash Module

The cuvette wash unit is divided into dispense module and aspirate module, which cooperate with each other to clean the reaction cuvettes for 8 phases, making repeated use of cuvettes possible.

Inlet module:

- In phase 1 and 2, the cuvette wash syringe (10ml) provides diluted wash solution (alkaline); in phase 3 to 6, the deionized water circulating pump provides deionized water; in phase 7 and 8, no liquid is injected.
- The diluted wash solution provided for phase 1 and phase 2 is obtained by diluting the concentrated wash solution with deionized water at the ratio of 1:10 by the users.
- The dispense action in phases 3 to 6 is driven by the deionized water circulating pump, which is controlled by the auto wash solenoid valve and adjusted by the restrictive tube.

Aspirating module

- Five waste pumps are used to discharge the waste fluid and wipe the cuvettes after cleaning. High-concentration waste is generated during phase 1-2 and low-concentration waste during phase 3-8. Wipe blocks are provided to absorb the remaining wash solution inside cuvettes during phase 7-8.
- During cuvette cleaning, when the 8-phase wash probe assembly starts to lower to the cuvette, the waste pumps P11 to P15 are opened to discharge the waste from the cuvette to the outside of the instrument.

The schematic diagram of the module is as shown below.

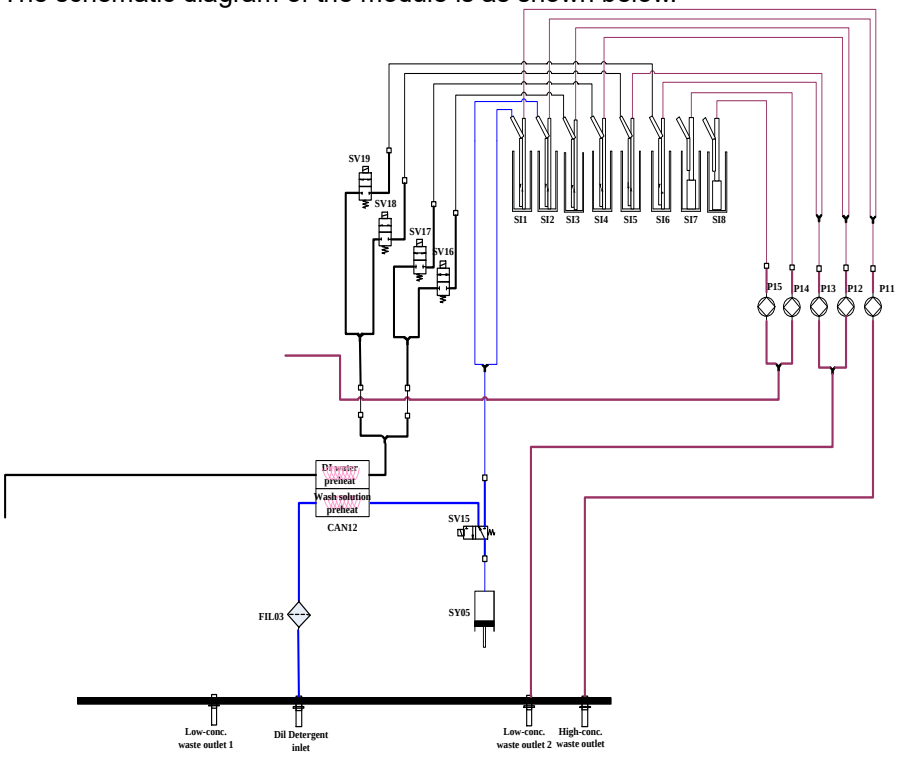


Figure 5-2 Schematic diagram of cuvette wash unit

5.3.3 Water Supply/Drainage Module

The water supply/drainage module includes the water supply part and waste drainage part.

The water supply module delivers water from outside the instrument into the internal water tank, which is then transported by the deionized water pump to other modules. This module has the following features:

- Auto water supply and detection of fluid level are supported.
- The deionized water circulating pump is adopted to supply water for each wash unit, and the restrictive valve is used to adjust the water supply pressure.
- The water supply experiences two filtrations. The first filtration is executed before water is transported from the water supply equipment to the internal water tank, and the second filtration executed before the water is distributed by the deionized water pump to each wash unit.
- A water supply module, used for transporting deionized water to the internal water tank, is provided for optional configuration.

The drainage module allows discharging high-/low-concentration waste separately. The high-concentration waste is directly discharged by the waste pump P11 to the external high-concentration waste tank. The low-concentration waste 1 is collected by gravity to the low-concentration waste tank and then discharged by gravity out of the instrument. The low-concentration waste 2 is directly discharged by the waste pumps P12 and P13 out of the instrument.
The low-concentration waste containers and the external high-concentration waste tank are capable of detecting fluid level.
The high-concentration waste is produced during cuvette cleaning in phase 1-2.
Low-concentration waste 1 comes from the following sources:

- Cleaning interior/exterior of sample probe and reagent probes
- Cleaning exterior of sample mixer and reagent mixer
- Auto cuvette cleaning in phase 7-8
- Condensate water of the reagent carousels
- Overflowed fluid of the reaction carousel

Low-concentration waste 2 comes from the following sources:

- Auto cuvette cleaning in phase 3-6

The fluidic diagram of the module is as shown below.

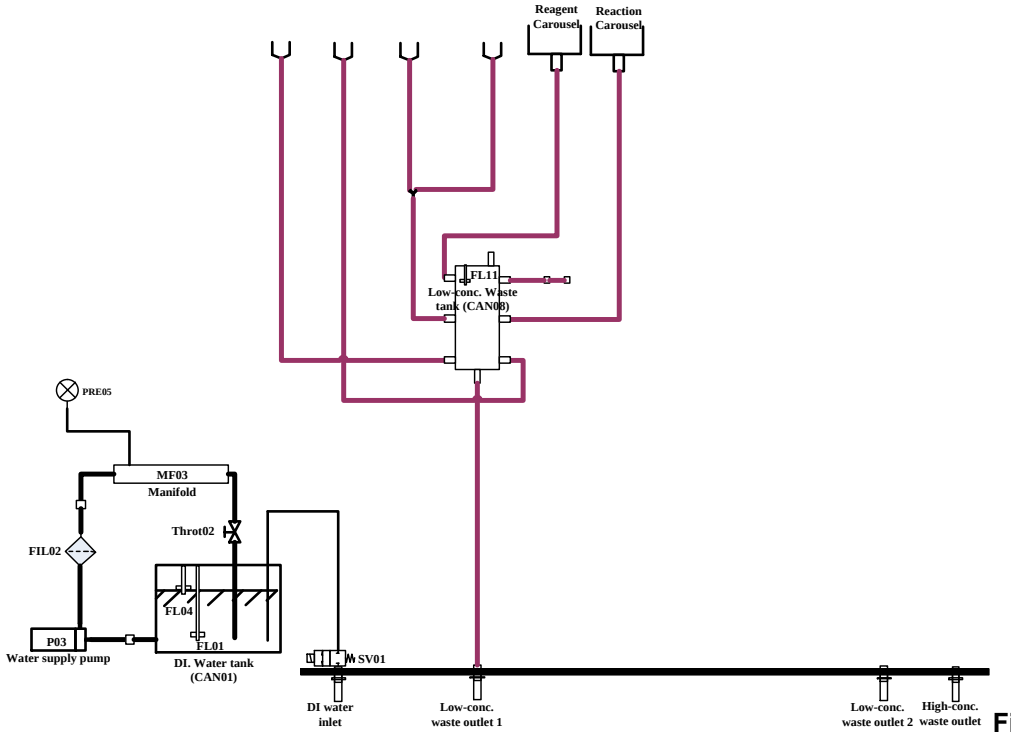


Figure 5-3 Fluidic diagram of water supply/drainage module

5.3.4 Other

The Hydropneumatic system of BS-430 contains five external interfaces, as shown in the figure below. Where,

- Three fluidic outlets. High concentration waste outlet, low concentration waste outlet 1 and low concentration waste outlet 2.
- Two fluidic inlets. Used to connect the DI water tank and diluted wash solution tank.
- Two control cable connectors: Used for connecting the liquid level sensor of high concentration waste and liquid level sensor of diluted wash solution.

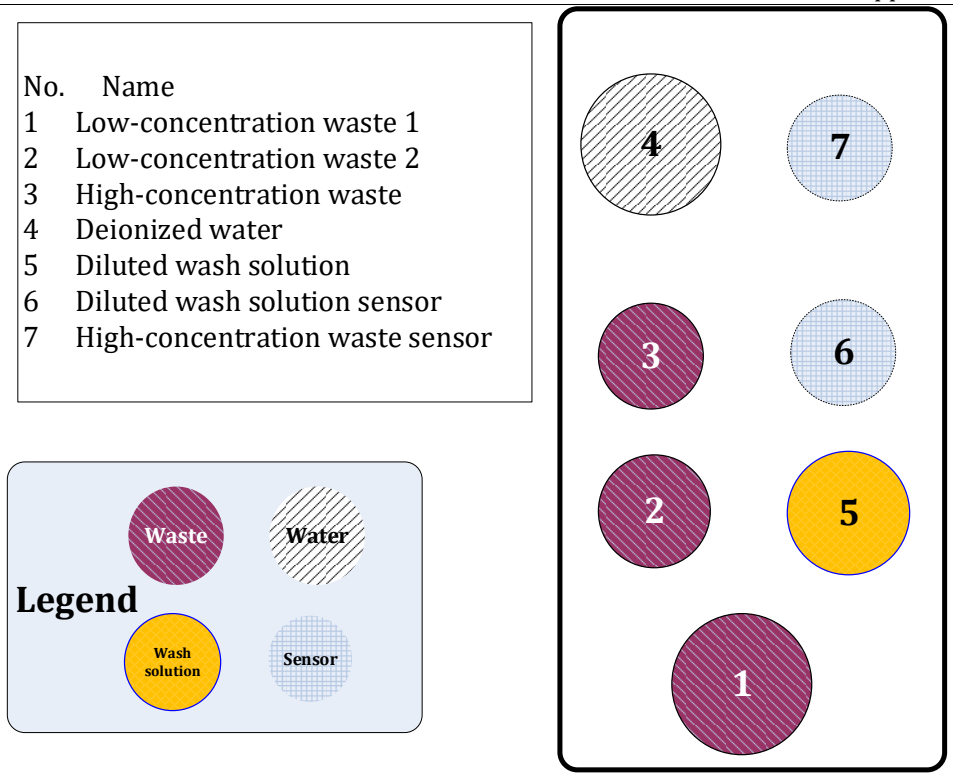


Figure 5-4 External fluidic interfaces of the instrument

5.4 Introduction of Fluidic Actions

5.4.1 Fluidic Initialization

The specific procedure is described below:

1) All pumps and valves are powered off and restored to the initial status.
2) Check the status of the water tank, diluted wash solution tank, low-concentration waste tank, primary vacuum container, external high-concentration waste tank, and floater. If related alarm is removed, the system moves to the next step. If not, the system gives out the alarm and the fluidic initialization fails.
3) Perform the exterior cleaning and priming of the probe and mixer (P03 is not closed after this step is performed).
4) The phase 1-2 auto wash syringes are reset.
5) Prime the wash station for three times to remove air bubbles in the auto wash tube.

Notes:

The fluidic initialization is one part of the startup, system recovery and system wakeup procedure.

5.4.2 Prime Wash Station

The specific procedure is described below:

1) Open auto wash waste pumps P11 to P15.
2) The wash station moves to the bottom of the cuvette.
3) Prime the wash station for three times.
4) After the prime, close the auto wash solenoid valve. The auto wash syringes are reset. The wash station moves to the home position. Close waste pumps P11 to P15

5.5 Removing and Installing Hydropneumatic Components

This section describes removing and installation methods of the Hydropneumatic components, and provides schematic diagrams and pictures of components for service engineers to refer.

5.5.1 Overview

When a software alarm is displayed on the BS-430 fully-automated biochemistry analyzer, service engineers can analyze the instrument status and finally locate the failure source, and if necessary, replace the failed part or component. Generally, service engineers are not recommended to remove the electric devices, such as pumps, solenoid valves, clog detection device, syringes, etc. Only when both hardware and software are confirmed normal but the Hydropneumatic alarm still remains are service engineers suggested to remove the relevant device and then analyze or replace it.

Prior to removing Hydropneumatic components, make sure that all pumps and solenoid valves of the Hydropneumatic system have been turned off, and both the analyzer power switch and main power switch have been placed to the OFF position.

Table 5-1Necessary tools for removing/installing Hydropneumatic components

Name	Requirement	Quantity
Cross screwdriver	/	1
Hexagon screwdriver	/	1
Flathead screwdriver	/	1
Cable tie	/	Several
Diagonal pliers	/	1
Tube cutter	/	1

5.5.2 Probe Wash Module

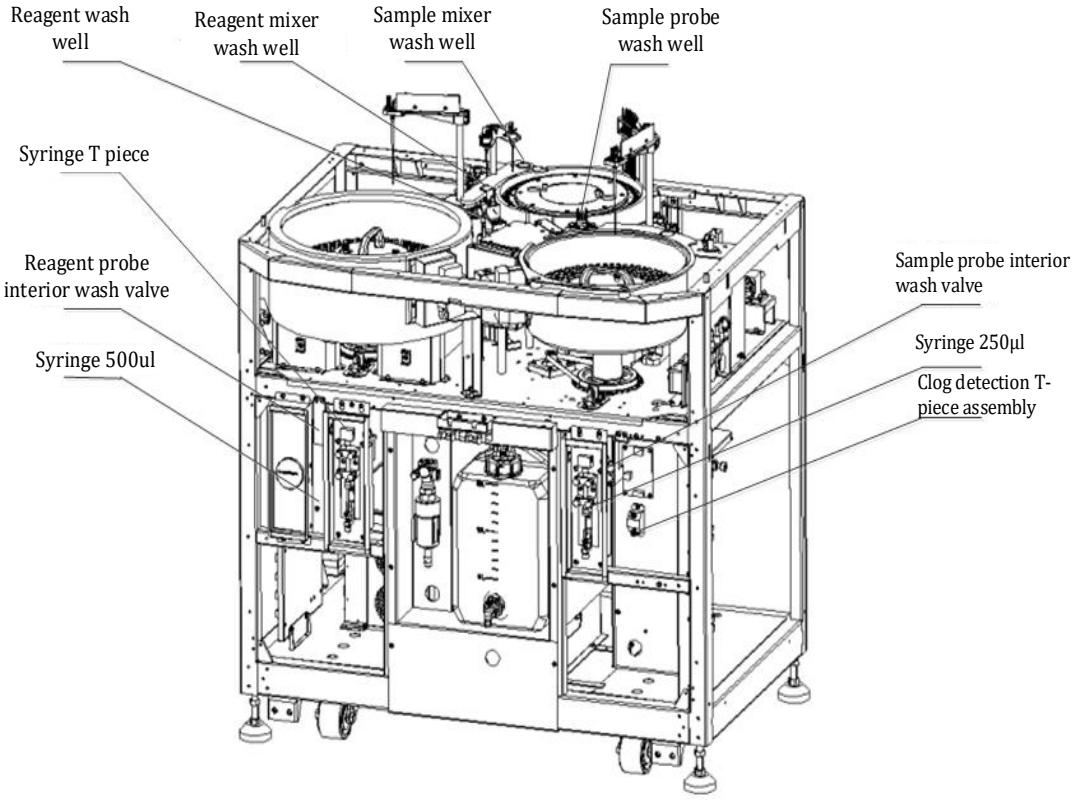


Figure 5-5 Assembly drawing of whole unit -- Probe wash module-front view

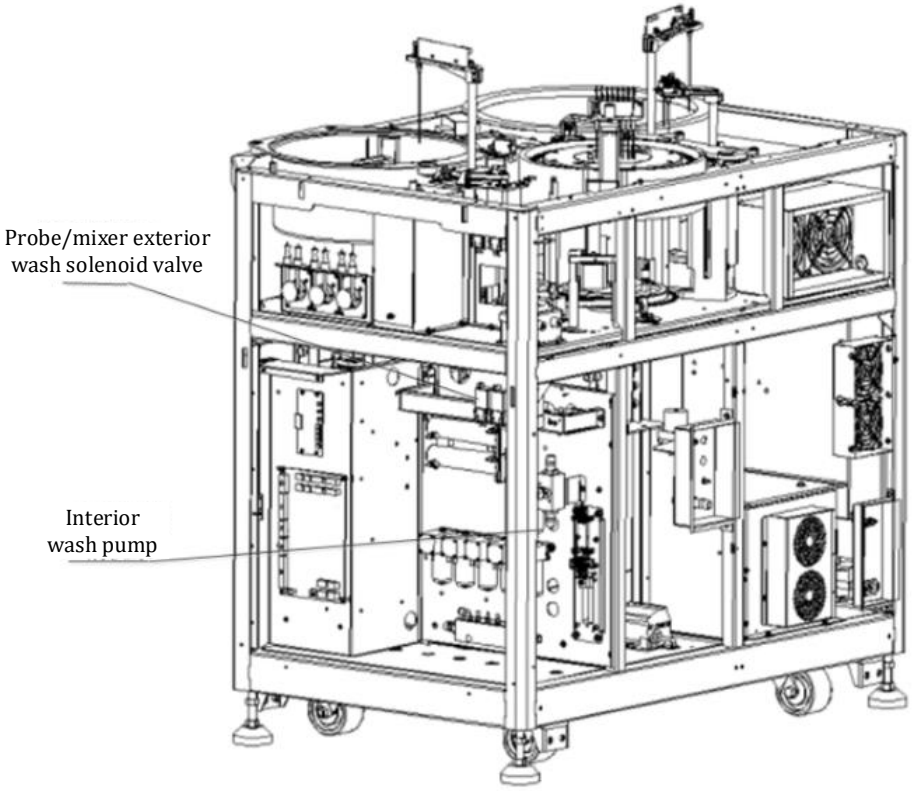


Figure 5-6 Assembly drawing of whole unit -- Probe wash module-rear view

Table 5-2 List of materials

No.	FRU No. or Part No.	Part Name	Remarks
1	115-090464-00	Syringe 500ul (shared with the BS-200)	FRU(EIB compatible change)
2	801-BA38-00040-00	Syringe T-piece (FRU, shared with the BS-200)	FRU
3	115-037053-00	Reagent valve assembly	FRU / Reagent interior wash valve
4	115-090463-00	Syringe 250μl (FRU)	FRU(EIB compatible change)
5	115-022008-00	Clog detection T-piece assembly	FRU
6	115-037054-00	Sample valve assembly	FRU / Sample probe interior wash valve
7	BA30-21-15311	KNF diaphragm pump assembly	FRU/Probe interior wash pump
8	115-022008-00	Clog detection T-piece assembly	FRU
9	082-002273-00	Valve LVMK21-6J cable	FRU/4-probe exterior wash solenoid valve
10	115-037307-00	Sample probe tubing assembly	FRU
11	115-037308-00	Reagent probe tubing assembly	FRU
12	043-006899-00	Wash well shell	FRU
13	801-BA40-00221-00	Wash well (mould MR61463)	FRU

Removing/Installing Fluidic Pump

When to do

1) The pump does not work, that is, there is no flow or pressure.
2) The pump flow and pressure is low.
3) The pump has leaks.
4) Noise is produced when the pump is working.

Removing steps

1) Disconnect the pump's power cord connector.
2) Mark the connection mode of the inlet and outlet tubes and prevent them from being confused.
3) Remove the tubes and apply straps on their openings or place a container under it to prevent liquid from entering the instrument.
4) Loosen the screws fixing the pump and then remove the pump.

Installation procedure

1) Connect the inlet and outlet tubes according to the marks and then tighten the tube clamps.
2) Tighten the retaining screws to fix the pump.
3) Make sure that the power cord is connected correctly.

Verification steps

Refer to ***7.11 Hydropneumatic Unit Alignment***.

NOTE

- **Exercise caution to avoid confusing the inlet tube with the outlet tube.**
- **Make sure that the power cord of the DC pump is connected to the correct positive and negative ends.**

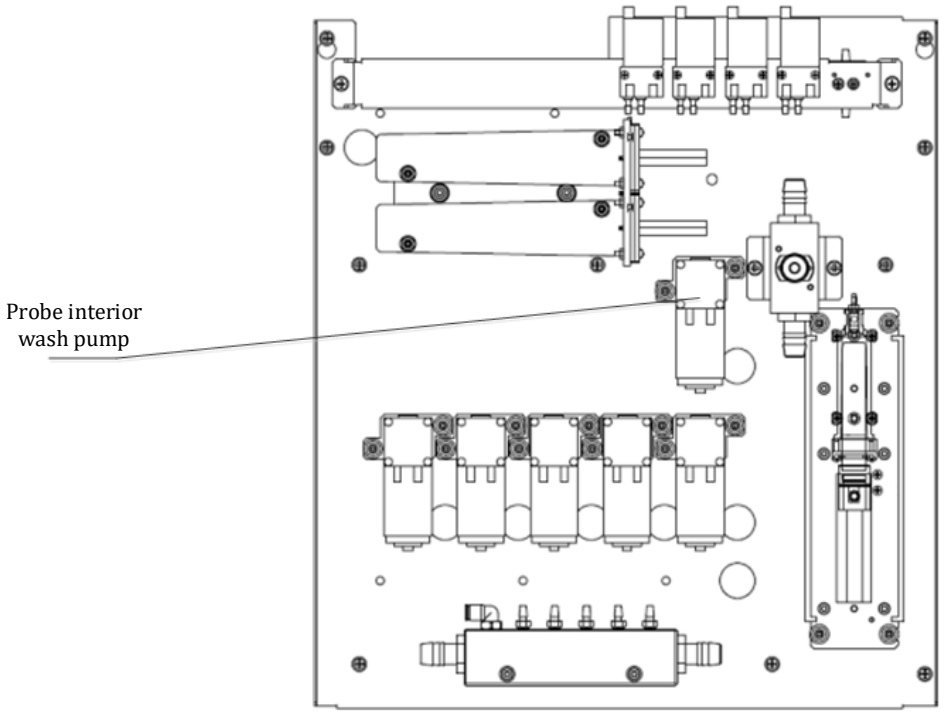


Figure 5-7 Structure of Fluidic Components on the Right Side

Removing/Installing Solenoid Valves

When to do

When a solenoid valve cannot be turned on or has leaks, it needs to be removed and then analyzed or replaced.

Removing steps

1) Disconnect the solenoid valve's power cord connector.
2) Mark the installation direction of the valve and the connection mode of the inlet and outlet tubes to prevent them from being confused.
3) Remove the tubes and apply strap on their openings to prevent liquid spraying.

4) Loosen the screws on the solenoid valve and then remove the solenoid valve.

Installation procedure

1) Check the installation direction according to the marks, connect the inlet and outlet tubes, and then tighten the tube clamps or straps.
2) Tighten the retaining screws to fix the solenoid valve.
3) Make sure that the power cord is connected to the correct positive and negative ends.

Verification steps

Refer to ***7.11 Hydropneumatic Unit Alignment***

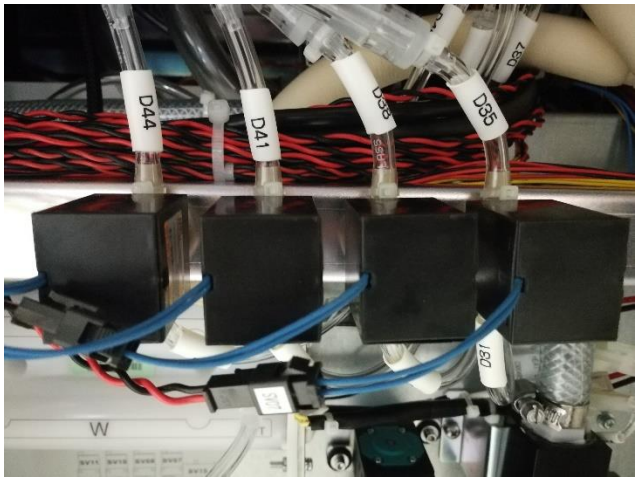


Figure 5-8 Details of wash solenoid valve assembly

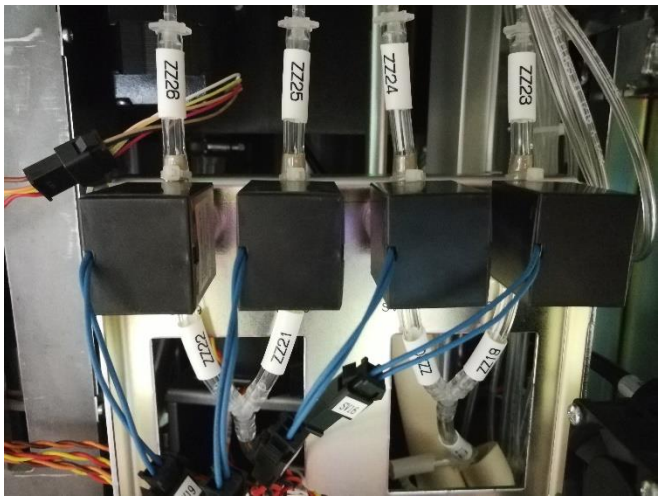


Figure 5-9 Details of cuvette wash solenoid valve assembly

Removing/Installing Restrictor Tube

When to do

Remove the restrictive tube for analysis or replacement if it is clogged with a result of inadequate water flow in probe/mixer exterior wash or phases 3-6 dispense of cuvette wash.

Removing steps

1) Check the connecting position of the restrictive tube, and mark its inlet and outlet to avoid confusion.
2) Remove one end of the restrictive tube and collect the residual water with a container.
3) Unplug the other end of the restrictive tube and remove the tube mark on it.

Installation procedure

1) Cut off a section of restrictive tube (082-001649-00) for the same length as the old one.
2) Sleeve the tube mark and install the restrictive tube in the original position.

Verification steps

Refer to ***7.11.5 Fluidic Prime***.

NOTE

- **While removing or installing the restrictor, exercise caution to prevent the small hole on it from being blocked.**

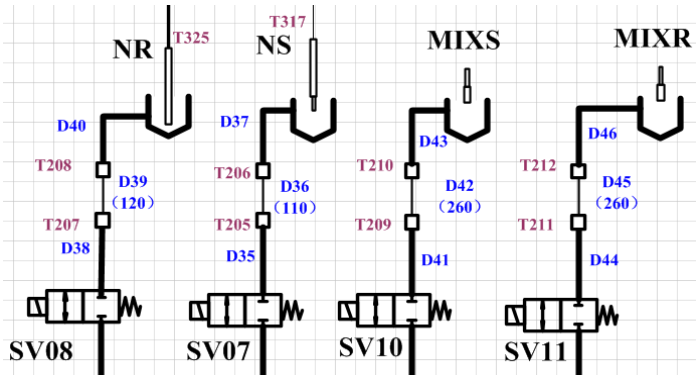


Figure 5-10 Tube connection diagram of restrictor for probe wash

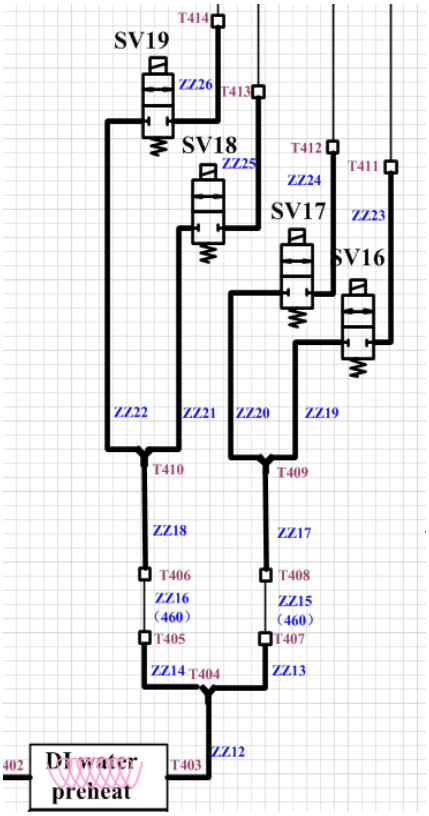


Figure 5-11 Tube connection diagram of flow restrictor auto wash

No.	FRU No. or Part No.	Part Name	Remarks
1	082-001649-00	Tube.1/16"X1/8" ND-100-65(ADF02002),Tygon	FRU/Restrictive tube

5.5.3 Cuvette Wash Module

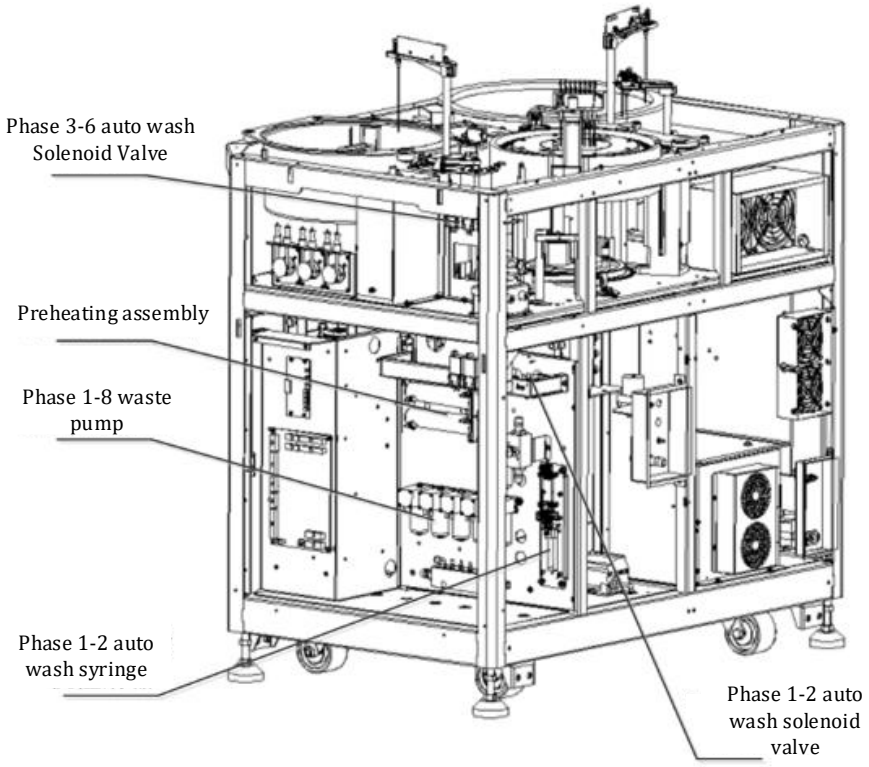


Figure 5-12 Assembly drawing of whole unit -- Cuvette wash module(a) -right rear view

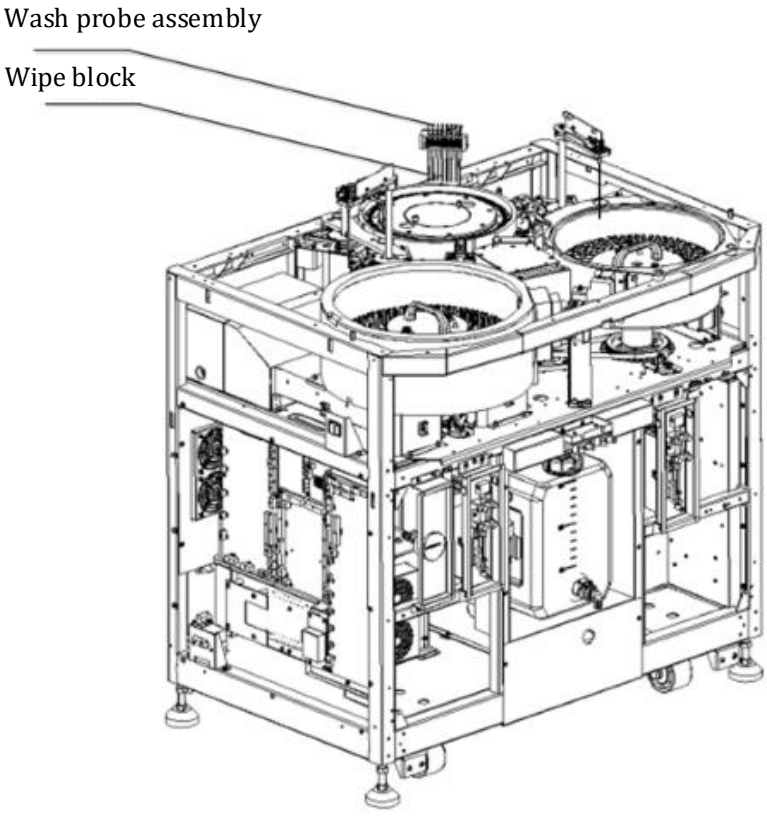


Figure 5-13 Assembly drawing of whole unit -- Cuvette wash module(b) -front view

Table 5-3 List of materials

No.	FRU No. or Part No.	Part Name	Remarks
1	082-002420-00	Rotational diaphragm pump assembly	FRU/Phase 1-8 waste pump
2	082-002273-00	Valve LVMK21-6J cable	FRU/Phase 3-6 auto wash solenoid valve
3	BA38-21-88190	WTB-3R-N4E three-way solenoid valve cables	FRU/Phase 1-2 auto wash solenoid valve
4	115-011901-00	10ml screw lever-driven syringe assembly	FRU/Auto wash syringe assembly
5	115-020528-00	Preheating assembly	FRU
6	043-000422-00	Filter	FRU
7	115-036498-00	Wash probe assembly	FRU(error correction)
8	041-005591-00	Wipe block	FRU
9	BA38-30-88154	Wash phase probe assembly	FRU(phase 3-6)
10	BA40-30-61934	Wipe phase probe assembly	FRU
11	115-091392-00	Wash phase probe assembly	FRU(phase 1-2)

Removing/Reinstalling wash syringe assembly

When to do

Analyze or replace the wash syringe when it has abnormal sound, worse precision, leaking, or other failures.

Removing steps

1) Disconnect the syringe motor cable and sensor cable.
2) Remove the tube from the barbed connector of the syringe.
3) Remove the four M3×12 hexagon socket cap head screws with spring washers and flat washers and remove the syringe.

Installation procedure

1) Install the four M3×12 hexagon socket cap head screws with spring washers and flat washers and do not miss the shock pad.
2) Cut off a little from the tube's end and insert the tube to the barbed connector of the syringe. If a strap has been applied, restore it.
3) Connect the syringe motor cable and sensor cable.
4) Power on the analyzer, log on the software with service user account, and then select Utility -> Maintenance -> Maintenance -> Engineer -> Clear. If the cuvette wash syringe is replaced, select the "Replace Cuvette Wash Syringe" item. Click OK to zero the use count of the relevant syringe.

Verification steps

Refer to ***7.11 Hydropneumatic Unit Alignment***

Replacing waste pump

When to do

- The pump does not work, that is, there is no flow or pressure.
- The pump flow and pressure is low.
- The pump has leaks.
- Noise is produced when the pump is working.

Removing steps

1) Disconnect the pump’s power cord connector.
2) Mark the connection mode of the inlet and outlet tubes and prevent them from being confused.
3) Remove the tubes and apply straps on their openings or place a container under it to prevent liquid from entering the instrument.
4) Loosen the screws fixing the pump and then remove the pump.

Installation procedure

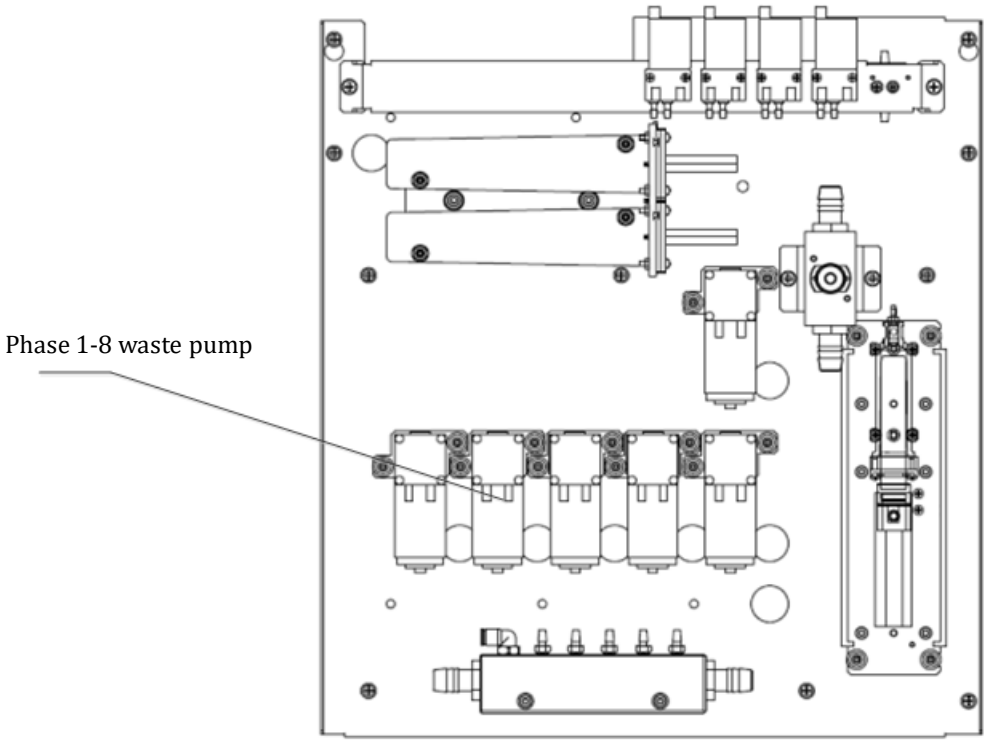
1) Connect the inlet and outlet tubes according to the marks and then tighten the tube clamps.
2) Tighten the retaining screws to fix the pump.
3) Make sure that the power cord is connected correctly.

Verification steps

Refer to***7.11 Hydropneumatic Unit Alignment***.

NOTE

- **Exercise caution to avoid confusing the inlet tube with the outlet tube.**
- **Make sure that the power cord of the DC pump is connected to the correct positive and negative ends.**



Removing/Reinstalling cuvette wash preheating assembly

When to do

- The heater is damaged.
- The temperature sensor is damaged.
- The temperature protection switch is damaged.
- The canister has leaks.
- The connectors are leaking.

Removing steps

1) Switch off the power supply of the whole unit.
2) Open the rear panel.
3) Mark the connection modes of the following parts: inlet/outlet tubes, heaters, sensors and temperature protection switches for wash solution and deionized water.
4) Disconnect the connectors of the heaters, sensors and protection switches.
5) Loosen the two hexagon socket head screws fixing the cuvette wash preheating assembly.
6) Apply straps on the tube openings to prevent liquid from flowing out.
7) Disconnect the inlet and outlet tubes.

Installation procedure

1) Prepare a new cuvette wash preheating assembly.
2) Connect the connectors according to the marks.
3) Connect the tubes according to the marks.

4) Use two M4×8 hexagon socket head screws to fix the preheating assembly.
5) Check if the installation is complete.
6) Restore the instrument.
7) Connect the power supply and perform fluidic prime before starting test.

Verification steps

Refer to ***7.11 Hydropneumatic Unit Alignment*** and ***7.12 Pyrology Unit***

NOTE

- **Operate carefully to prevent liquid from entering the instrument.**
- **Connect the tubes and connectors correctly.**
- **Do not confuse the heater and sensor channel of wash solution with those of cleaning fluid.**

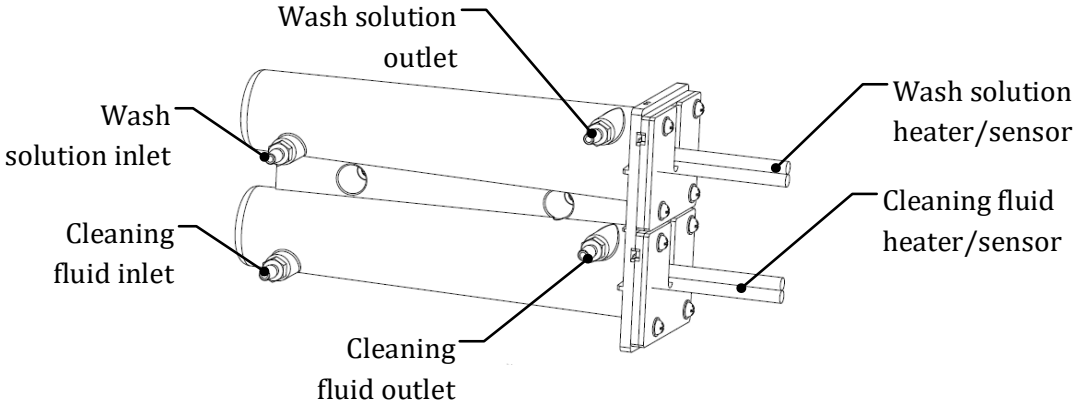


Figure 5-14 Structure of cuvette wash preheating assemble

Removing/Reinstalling filter

When to do

The filter should be maintained regularly.

Removing steps

1) Remove the rear panel of the analyzer. You will see the filter right below the fluidic outlet assembly.
2) Remove the filter tube and the filter, and then apply straps on the tube opening to prevent liquid inside the tube from spraying out.

Installation procedure

1) Install the filter tube and apply a strap.
2) Install back the right panel assembly.

Verification steps

Refer to ***7.11 Hydropneumatic Unit Alignment***

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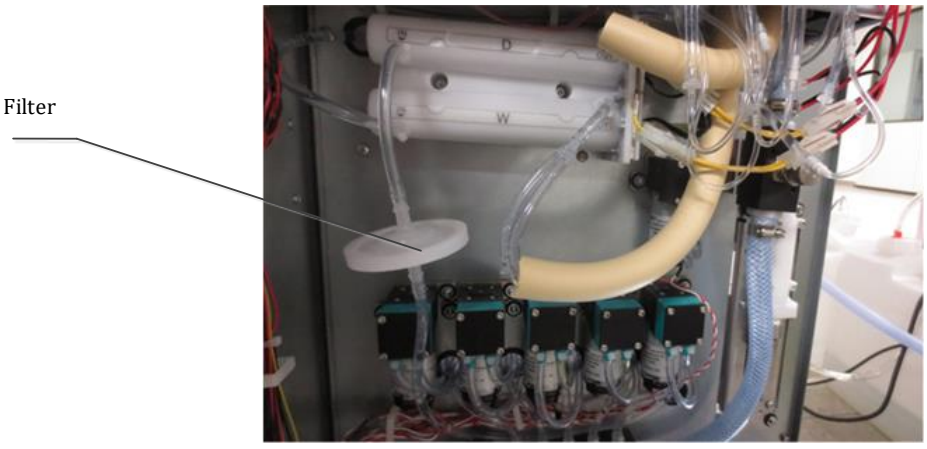


Figure 5-15 Assembly drawing of whole unit -- Acetabular filter

Removing/Reinstalling wash probe assembly

When to do

When fluid overflows the cuvettes or the dispensed cleaning fluid is less than the normal volume, probably a wash probe is clogged and needs to be removed and unclogged.

Removing steps

1) Manually loosen the retaining screws on the wash probe bracket.
2) Remove the wash probe assembly and place it in a container.
3) Turn on the dispense valves and vacuum valves, and then locate the clogged wash probe.
4) Use a cleaning tool to unclog the probe.

Installation procedure

1) Align the locating holes on the wash probe assembly with the stop studs on the bracket, and then slightly tighten the retaining screws.
2) Lower the wash probe assembly, use an alignment tool or eyes to check the phase 7/8 wipe blocks corresponding to the cuvette wall, and then slightly adjust the wash probe assembly to prevent the wash probes from colliding with the cuvettes.
3) After finishing the second step, completely tighten the retaining screws on the wash probe assembly.

Verification steps

Refer to***7.11 Hydropneumatic Unit Alignment***.

NOTE

- **Operate carefully to prevent liquid from dropping into the reaction carousel and cuvettes.**

5.5.4 Water Supply/Drainage Module

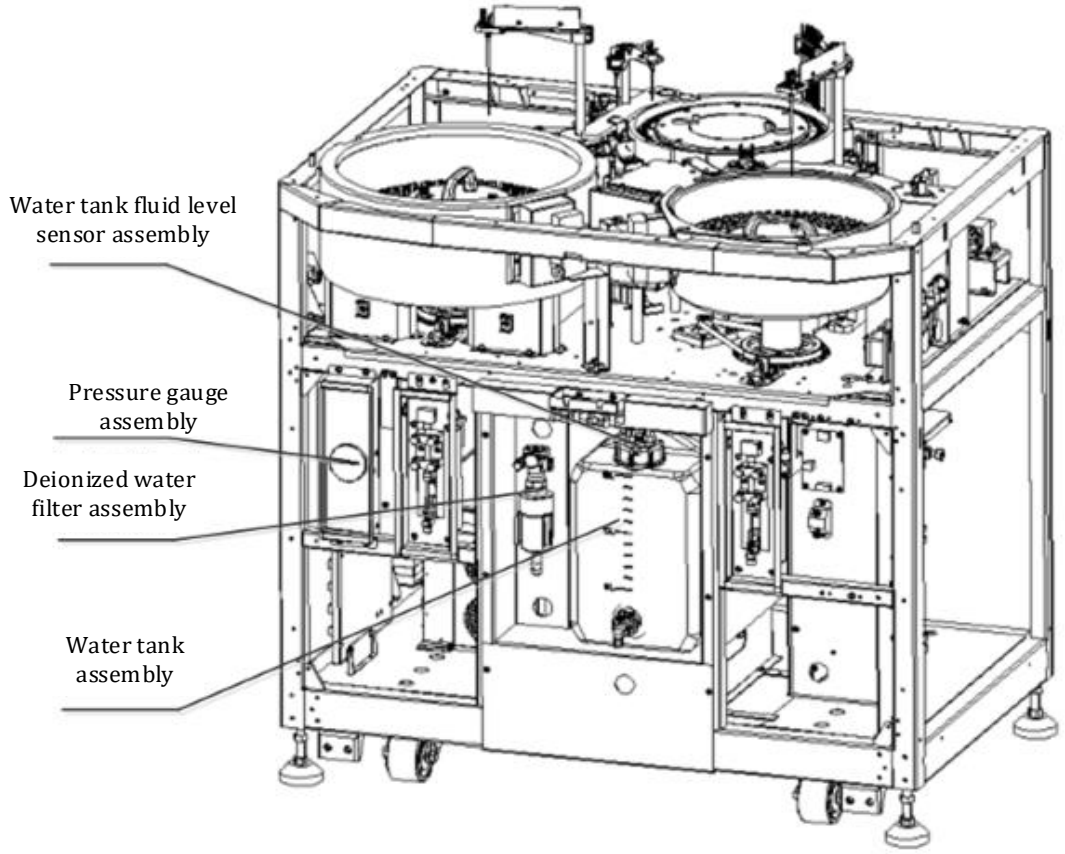


Figure 5-16 Assembly drawing of whole unit -- Water supply/drainage module-front view

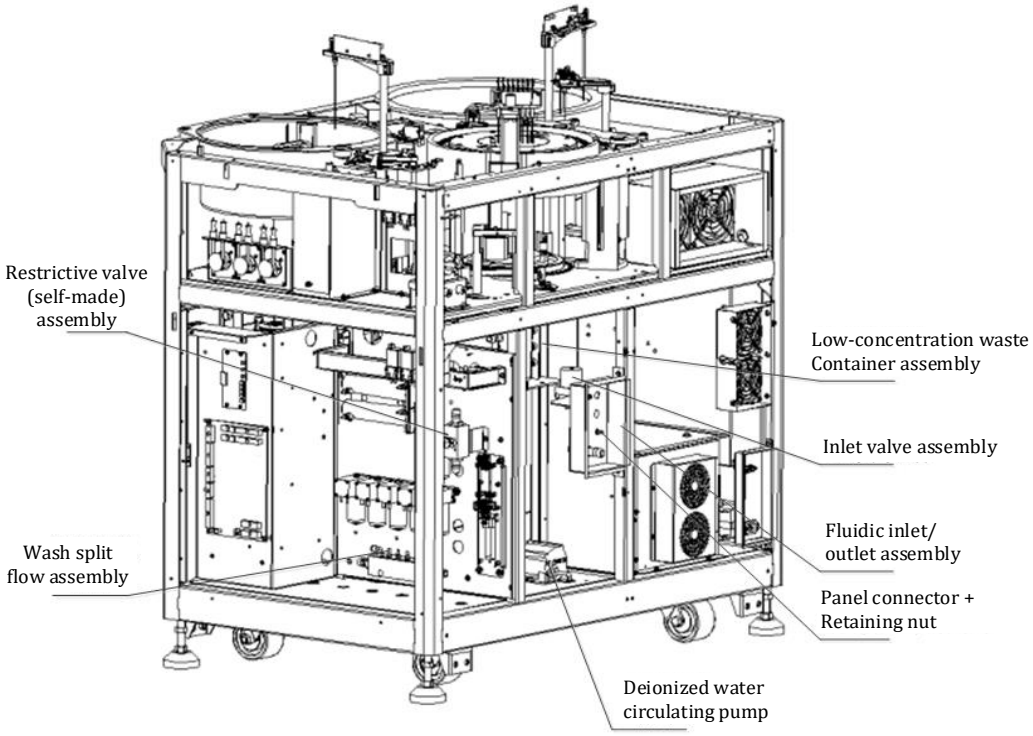


Figure 5-17 Assembly drawing of whole unit -- Water supply/drainage module-right rear view

Table 5-4 List of materials

No.	FRU No. or Part No.	Part Name	Remarks
1	115-036803-00	Pressure gauge assembly (with connector)	/
2	082-002334-00	Connector, quick connector, with one-way valve, 3/8"NPT, PP	Connector (quick-change)
3	082-002335-00	Connector, quick connector, with one-way valve, L-type, 1/2"ID, PP	Connector (quick female joint)
4	082-004132-00	Stainless steel filter .316 L, 100 mesh, 40* 100, female M27-3	After EIB009, used for new water tank.
5	082-000371-00	Stainless filter core, 316L, 100-mesh, refer to drawings for dimensions customization	used before EIB009
6	115-037309-00	Deionized water filter assembly	used before EIB009
7	115-037311-00	Water tank fluid level sensor assembly	used before EIB009
8	115-005419-00	Water tank assembly	used before EIB009
9	115-014501-00	Water tank level sensor assembly	Used after EIB009
10	115-077899-00	Water tank assembly	Used after EIB009
11	115-036407-00	Low-concentration waste container assembly	/
12	115-037056-00	Flow splitting assembly	/

13	115-024226-00	Inlet valve assembly (with connector)	/
14	082-003848-00	Deionized water pump cable	Changed in EBJ619F
15	115-006999-00	Restrictive valve (self-made) assembly	/
16	115-037049-00	Fluidic inlet/outlet assembly	/
17	082-001056-00	Connector. Panel-style 1/4-28UNF,1/8"ID,PP	/
18	M90-100012---	Lock Nut,Panel Mount, 1/4-28UNF,White Nylon	/

Removing/Installing water tank

Open the front door of the analyzer and observe the water tank assembly. If the water tank outlet protrudes from a metal connector, the original water tank assembly is used. If the water tank outlet is integrated with a plastic screw-in cap, it is the water tank assembly after change. See the exploded view of Chapter 11.3.1.

When to do

The water tank should be maintained regularly.

Removing steps

1) Disconnect the quick joint at the lower end of the water tank and drag out the water tank about 1/3 position. Take out the liquid level sensor assembly and do not drag the cable of the floater otherwise the cable may be damaged.
2) Drain about 3/4 water in the tank and remove the tube in the water tank.
3) Apply strap on the tube's opening or place the tube in a container to prevent liquid from entering the instrument.
4) Remove the water tank completely from the instrument and then clean it.

Installation procedure

1) Place the water tank return tube into the water tank and push the water tank internally.
2) When the water tank is pushed into about 2/3 position, put the liquid level sensor of water tank into the water tank, arrange the cables, and then tighten the screw cap. Note: Do not pull the cable and connector forcibly.
3) Arrange the tubes and tighten the screw cap of the water tank return tube.
4) A click will sound when connecting the quick connector at the lower part of the water tank.
5) Power on the instrument and start water supply.

Verification steps

Request a water test and check if the water tank is leaking.

NOTE

- **Do not drag or pull the cable of the liquid level sensor otherwise bad contact may occur.**

Removing/Installing deionized water filter assembly (Before EIB009)

When to do

When the stainless-steel filter core is regularly washed or replaced.

Removing steps

1) Disconnect the quick connector at the end of the deionized water filter assembly to remove the deionized water filter from the bracket.

Figure 5-18 Replace the deionized water filter

2) Open the filter, and then clean it or replace the filter core

Installation Procedure

1) Install the filter and fix it on the mounting bracket.
2) Install the quick connector on the upper end of the deionized water filter assembly.

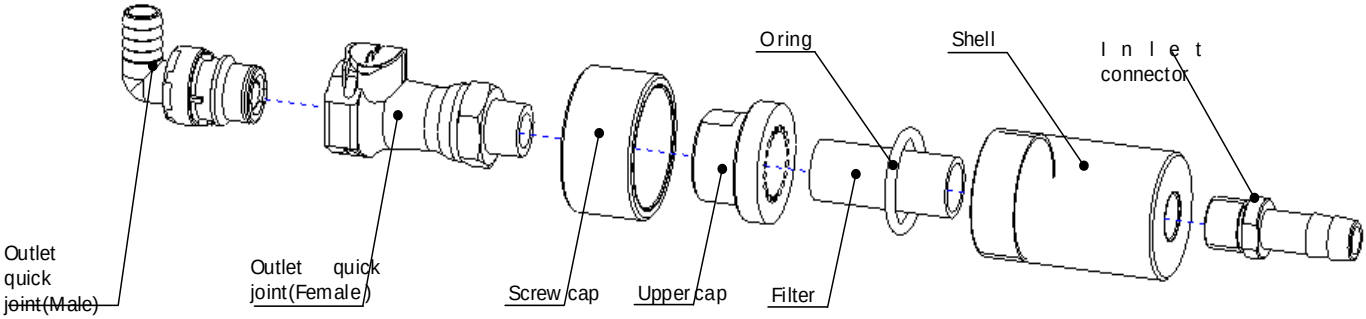


Figure 5-19 Exploded view of deionized water filter

Removing and Reinstalling Deionized Water Filter(EIB009 machine)

When to do

When the filter is maintained or clogged due to leaks, it should be maintained or replaced.

Removing steps

Clean or replace the filter as follows:

1) Power off the analyzer and disconnect the quick connector of the DI water tank.
2) Loosen the cap of the water tank return tube and remove the deionized water tank assembly.
3) Remove the tubes on the back of the container and put them in a clean container.
4) Drain the deionized water tank, unscrew the cap at the bottom of the tank and do not drop the sealing ring.
5) Remove the filter from the cap.

Installation Procedure

1) Install the clean or new filter core, and screw the cap of the water tank back to the bottom of the water tank.
2) Reinsert the water tank return tube and level floater into the water tank.
3) Connect the quick connector of the deionized water tank and the sensor cable.
4) Clean the liquid on the analyzer;
5) Power on the analyzer.

Verification steps

Request a water test and discharge bubbles in the filter and check if the water tank is leaking.

NOTE

- **Do not drag or pull the cable of the liquid level sensor otherwise bad contact may occur.**

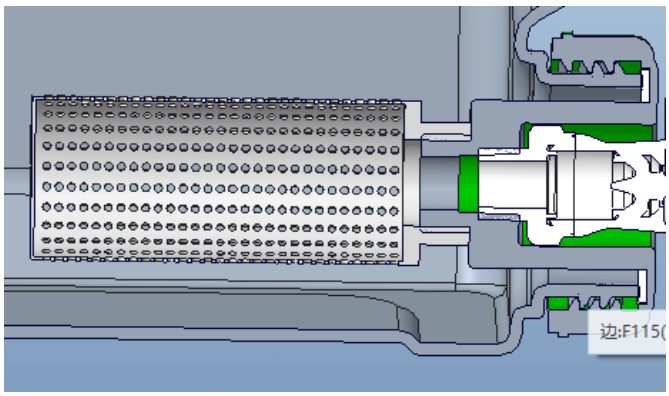


Figure 5-20 Deionized water filter installation

Replacing Waste Container

When to do

When the containers have leaks or floater alarms or need to be maintained regularly.

Removing steps

1) Confirm and record all tubes connected with the container, and distinguish the inlet tube from the outlet tube.
2) Remove the tubes, and then apply straps on the tube openings to prevent liquid inside the tubes from spraying out.
3) Use a screwdriver to remove the container.
4) Replace or maintain the container.

Installation procedure

1) Connect the inlet and outlet tubes according to the recorded connection mode, and then tighten the tube clamps or straps.
2) Fix the container on the instrument.

Verification steps

N/A

5.5.5 External Modules

Water supply module (optional)

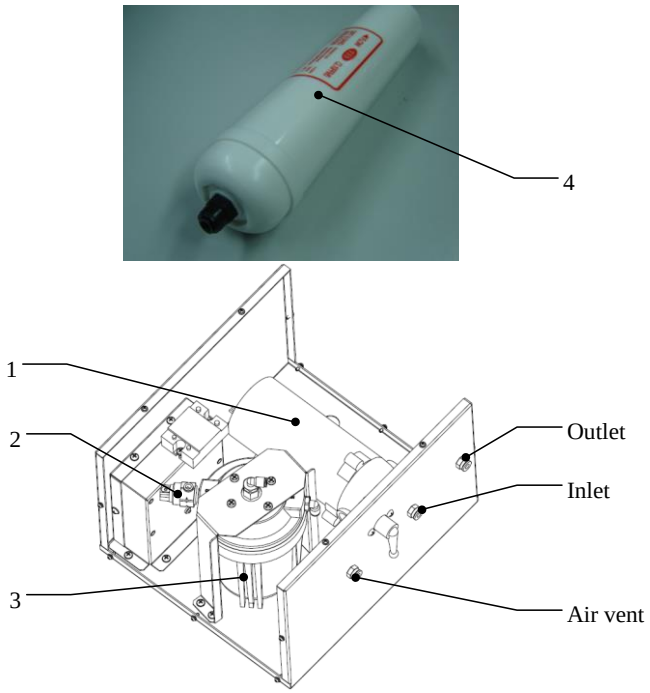


Figure 5-21 Water supply module

The external water supply module contains the following FRUs.

Table 5-5 FRU materials of the water supply module

No.	FRU No. or Part No.	Part Name	Remarks
1	115-038196-00	Diaphragm pump, 10W 24V 0.68MPa	FRU
2	801-BA40-00274-00	Pressure switch material pack	FRU
3	801-BA40-00194-00	5" tank assembly	FRU
4	115-021998-00	Water inlet filter assembly	FRU
5	801-BA40-00244-00	Water supply module	/

5.5.6 External High-concentration Waste Tank Cap Assembly

The external high-concentration waste tank cap assembly contains one FRU.

Table 5-6 High-concentration waste tank cap assembly (FRU)

No.	FRU No. or Part No.	Part Name	Remarks
1	115-037348-00	Cap of the waste tank	FRU

5.5.7 Cap Assembly of the External Diluted Wash Solution Tank

The cap assembly of external diluted wash solution tank contains one FRU.

Table 5-7 High-concentration waste tank assembly (FRU)

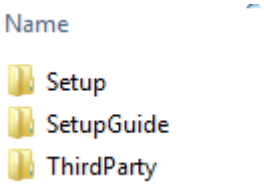
No.	FRU No. or Part No.	Part Name	Remarks
1	115-037347-00	Wash buffer tank cap assembly	FRU

6 Software Introduction

6.1 Software installation

6.1.1 Installation package

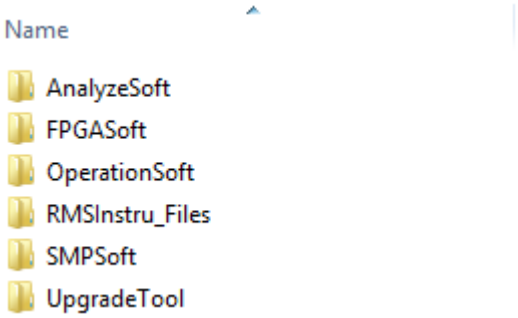
There are three files in the installation package: Setup, SetupGuide, Thirdparty, as shown in the following figure:



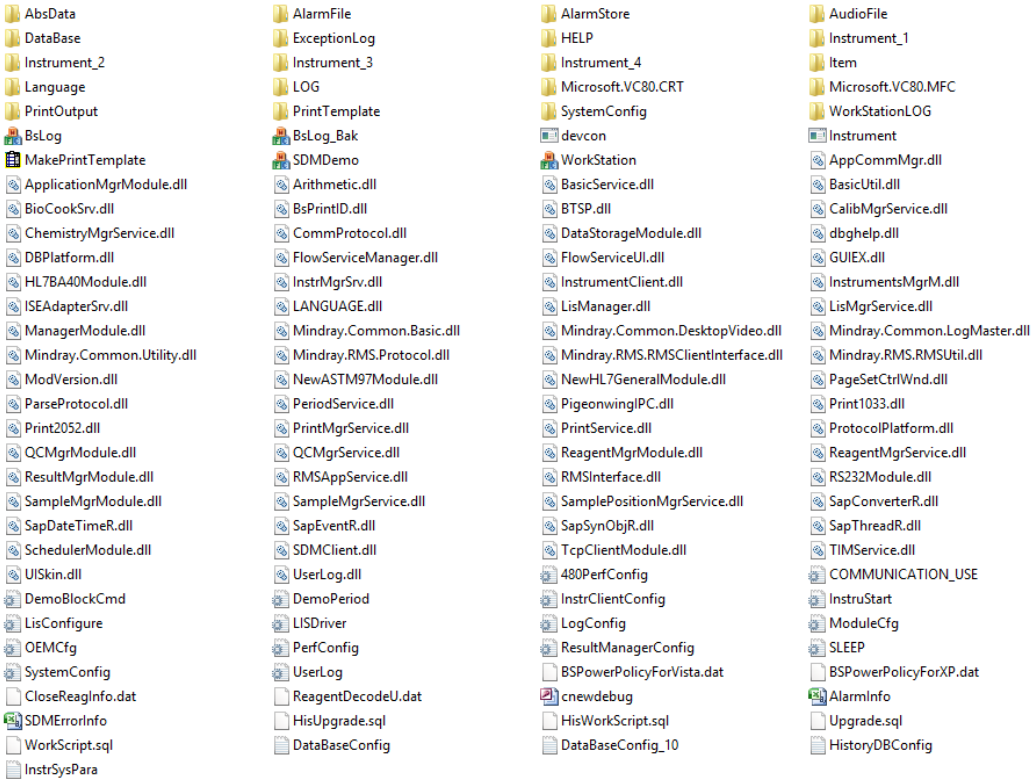
- Setup file: including Setup.exe and Kill blog used to terminate the Bslog program.
- Introduction to Killbog: It is run when the operating software is started, used to record the software log. When the operating software is started, it will check if Killbog is started. If not, the software will give out an alarm and the startup will fail.After the operating software is successfully started, you can terminate the Killblog program and the software log will not be recorded.
- SetupGuide: including software installation guide and upgrade guide.
- Thirdparty: including dotnetfx installation package and SQLExp installation package. The former includes the .net Framework program of Microsoft, which is the SQL running environment and the latter is the database program.

6.1.2 Folder Structure

The default installation directory: D:\Mindray\Workstation.
After installation, the folder structure is as follows:



In which, the rather important folder is OperationSoft as displayed in the following figure:



The following files are displayed after the OperationSoft is unfolded.

- AbsData: used to save the reaction curve data.
- AlarmFile: used to save the alarm log.
- Database: database for all parameters, results, calibration and QC data.
- ExceptionLog: When the software breaks down, it records the abnormal address field to facilitate the troubleshooting (Two in total and one is under Instrument 1 folder.)

- Help: Help file in CHM format.
- Instrument 1: The log file of the analyzing unit.
- Item: Mindray parameter list file.
- LOG: software upgrade information (upgrade record)
- Logs: RMS (Remote Manager System) log.
- Workstation. Exe: BS-430 execution program.

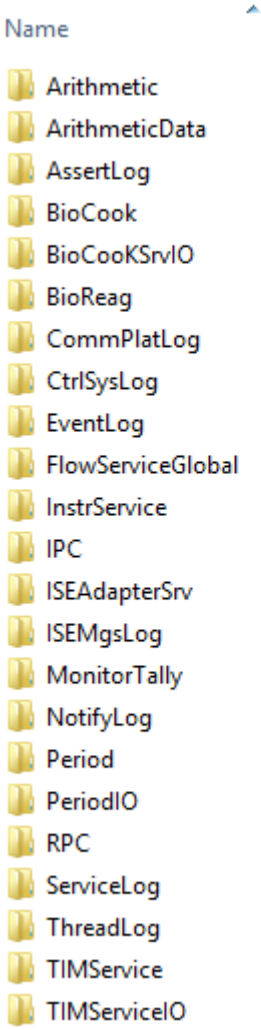
6.1.3 Log File

The BsLog process records in real-time mode the communication and action information of the software and analyzer, which includes but not limited to the following:

- Keyboard input
- Error log, operation log and maintenance log of the software
- Communication instructions between the PC and analyzer
- Action instructions of the analyzer
- Floater and photocoupler statuses of the analyzer (real-time)
- Pump and valve powering statuses of the analyzer (real-time)
- Photoelectric data (real-time)
- ……

Separate log files are produced every day and stored in the following addresses:
1) In the WorkstationLOG folder of D:\Mindray\BA43\OperationSoft.
2) In the InstrumentLOG folder of D:\Mindray\BA43\OperationSoft\Instrument_1.

The folder structure is as follows:



Important folders include:

- InstrService: water blank data
- Lislog: LIS communication data
- RPC: basic control instructions
- ISEAdapterSrv: ISE instructions and test data.

6.1.4 Normal Startup Procedure

The normal startup procedure of the operating software is as follows:

1) The system checks if the Bslog process has been started automatically. If not, the Bslog.exe program is run.
2) Sqlserver is started, and it will exit if an error indicating database initialization failure occurs.
3) The software process is started.
4) Enter the username and password.
5) The software shakes hands with the middle-/lower-layer units. (If handshake fails, an alarm is given prompting the unit is abnormal.)

6.1.5 Analyzer Software Version Information

Before performing the software installation work, please download the latest version of the software on the TDP, TDP path:

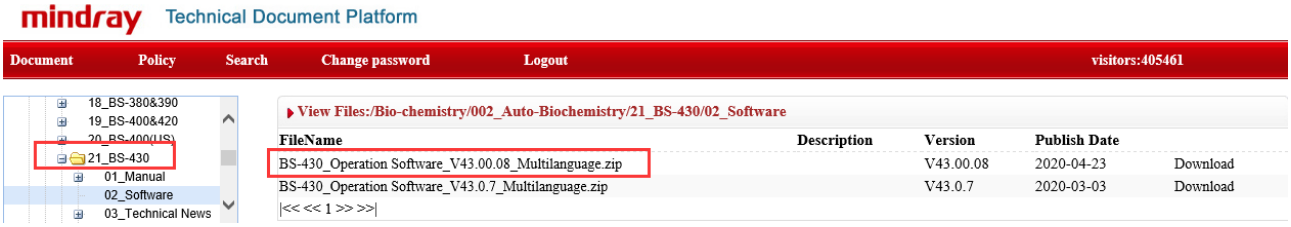


Figure 6-1 Software download address

Enter the current operating software system on the operating computer to confirm the current software version information, as follows:
Enter the main screen of the operating software, select Utility > System Setup > Instrument Setup > Software Version, and confirm the current software version information.

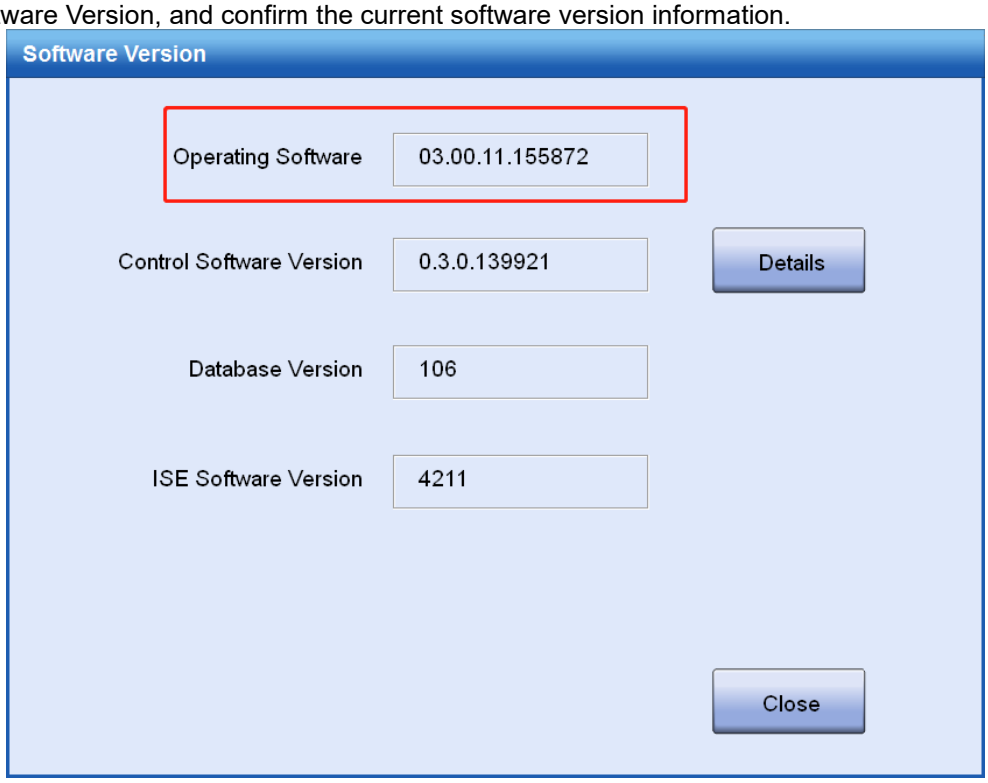


Figure 6-2 Operating software version

6.1.6 LIS Setting Backup

Entry operation software,select **Application** —>**Setting** —>**LIS Setting.** See the figure below

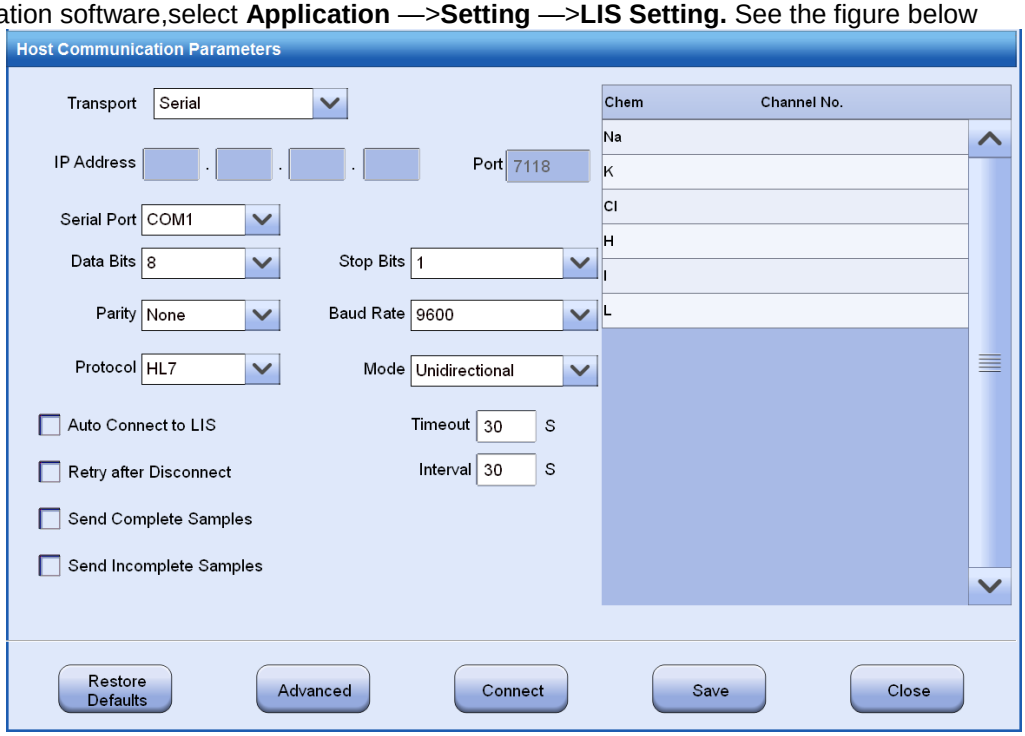


Figure 6-3 Lis setting

NOTE: Take pictures of this LIS setting interface, Channel number content also needs to take full. Make sure no Settings related are lost.

6.1.7 Data Backup

Backing up data:

The database is in the Database folder under the installation directory. You can choose the following two methods:

1) Use the engineer account to quit the operating software and back up the entire Database folder.

2) After quitting the software, re-enter the software and copy the .bak file in the Backup folder under Database.

6.1.8 Backup and Restore The Whole Unit Parameters

Back up the whole unit parameters

1) Run the operating software. Select Utility -> Maintenance -> Parameters, select a unit from the drop down list of "Unit Parameter" to inquire parameters, and then click Save. Repeat this step for other units.

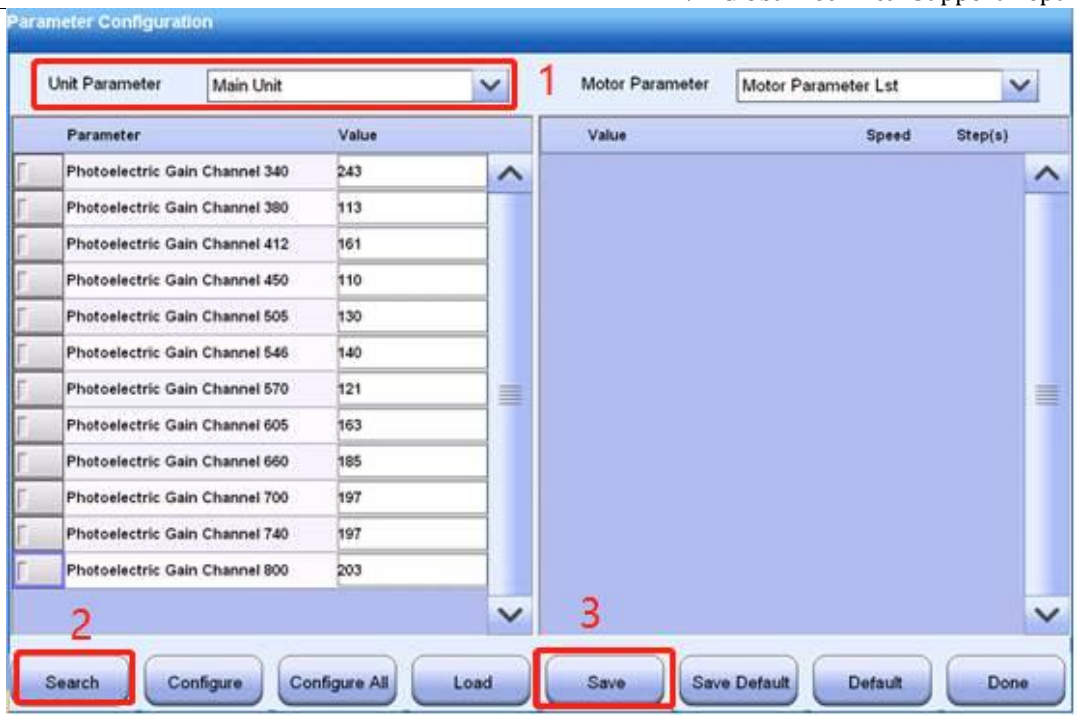


Figure 6-4 Backup the unit parameters

2) The Save as dialog box is displayed. Select a partition, and create a new folder named in the format of "Instrument SN + Non-Motion Parameter Backup", and name the unit to be stored.

Restore the whole unit parameters

To restore parameters, first select the parameter to be restored in Non-motion Para, click Search, click Read, select the saved path parameter file, and then click Configure to complete the restoration of the parameter.as shown in figure below.
Note: You can perform this operation only after logging on the system with the service Engineer username: “ServiceUser” Password:” #BS8A#SEU”

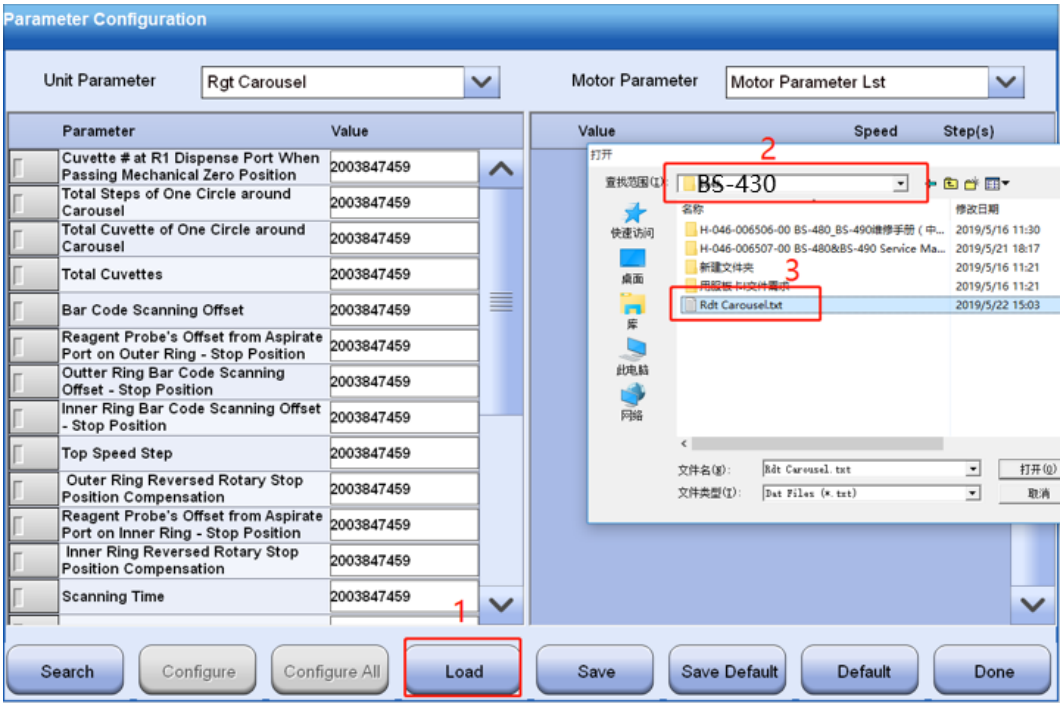


Figure 6-5 Restore the unit parameters

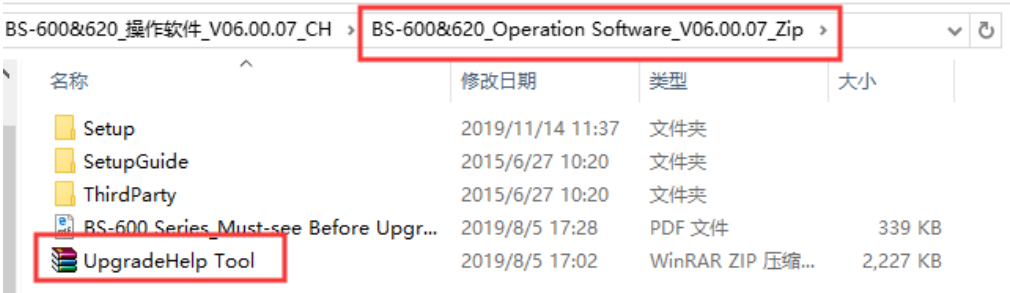
6.1.9 Software Upgrade

Use UpgradeHelp Tool to check if the instrument database has been modified

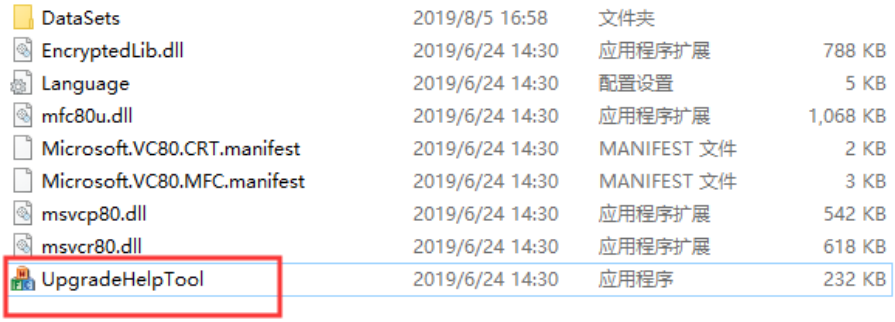
Note: Perform this operation only when upgrading to V43.00.07 and above software.
Before software upgrading, please use the UpgradeHelp Tool to check whether the database has been modified. If the check is not performed but the database has been modified, the instrument will be unusable after upgrading the software to V43.00.07 and above software. The alarm of the software is shown in the figure below.

Steps：

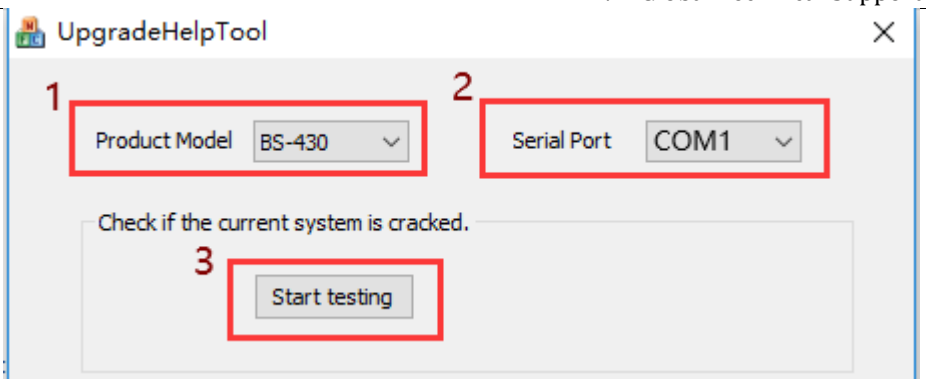
1) Unzip the UpgradeHelp Tool package in the BS-430 software package.



2) Run the UpgradeHelp Tool.exe



3) Select the product model and serial port number (For BS-430, select BS-430, for BS-450, select BS-450, for BS-460, select BS-460……), click “Start testing”, and the pop-up window displays the test result. (The operating software must be closed, and the serial port must not be occupied)



4) If the database has been modified, stop upgrading and contact sales to ask if the customer agrees to use Mindray Reagent, if customer agree, after upgrading the software, you need to use the UpgradeHelp Tool to ***Configure vendor name*** and ***Cancel the open chemistries***.

Confirming that the relevant process has exited

1) Open Task Manager: Right-click on the blank space on the Taskbar, then click Start Task Manager and select the Process tab page, as shown in the following figure.

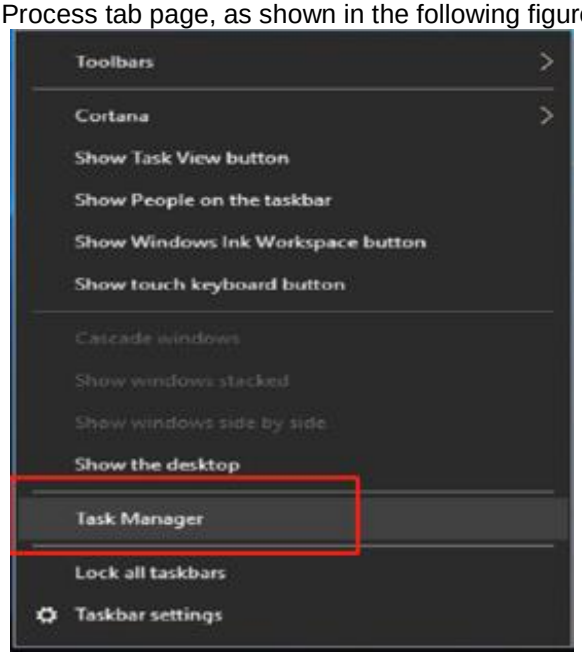


Figure 6-6 Start Task Manager

2) Confirm that the BS-430 related process exits. If there is a process that has not been logged out, select the process that has not been logged out as shown in the following figure. Click the **End Process** button.

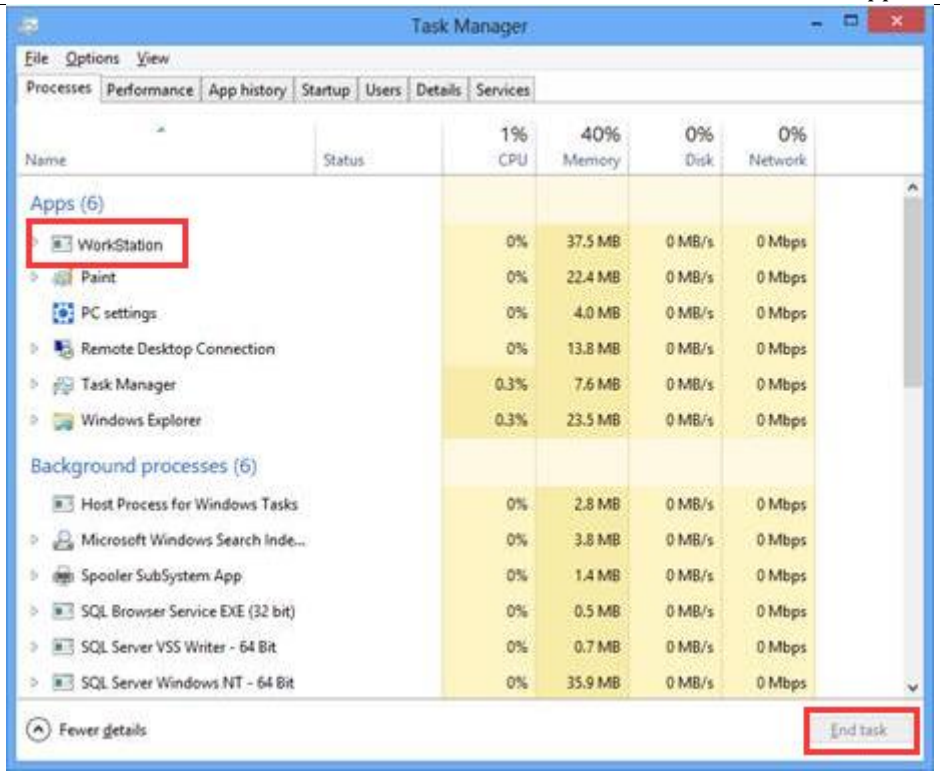


Figure 6-7 Task Manager View Process

3) After **End Process** is clicked, the following dialog box will pop up, click **OK** to close the selected process.

Uninstalling BS-430 operating software

1) Then exit the operating software, enter the Windows computer desktop, click the **Start** menu in the lower left corner of the computer desktop.
2) Click the **Control Panel** to enter the Control Panel screen.
3) Click **Uninstall Program** to enter the Windows **Uninstall Program** screen.
4) Select the **WorkStation** program to be uninstalled, right-click it and execute the
4) uninstalling.

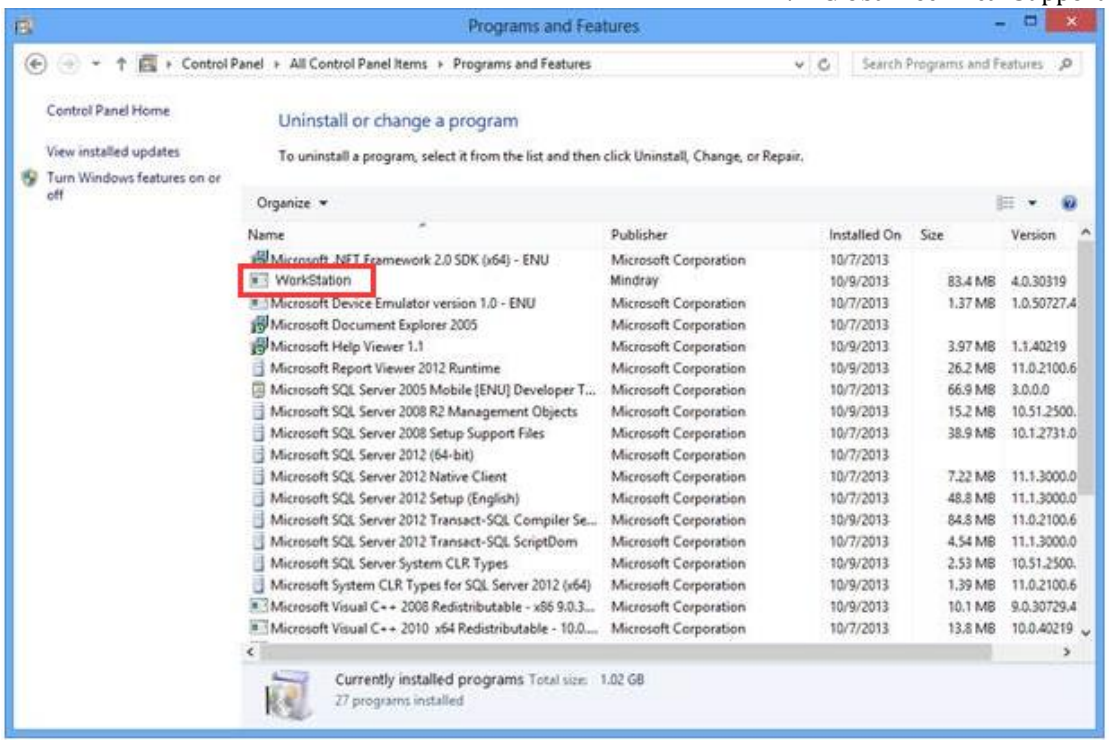


Figure 6-8 Uninstalling BS-600 operating software

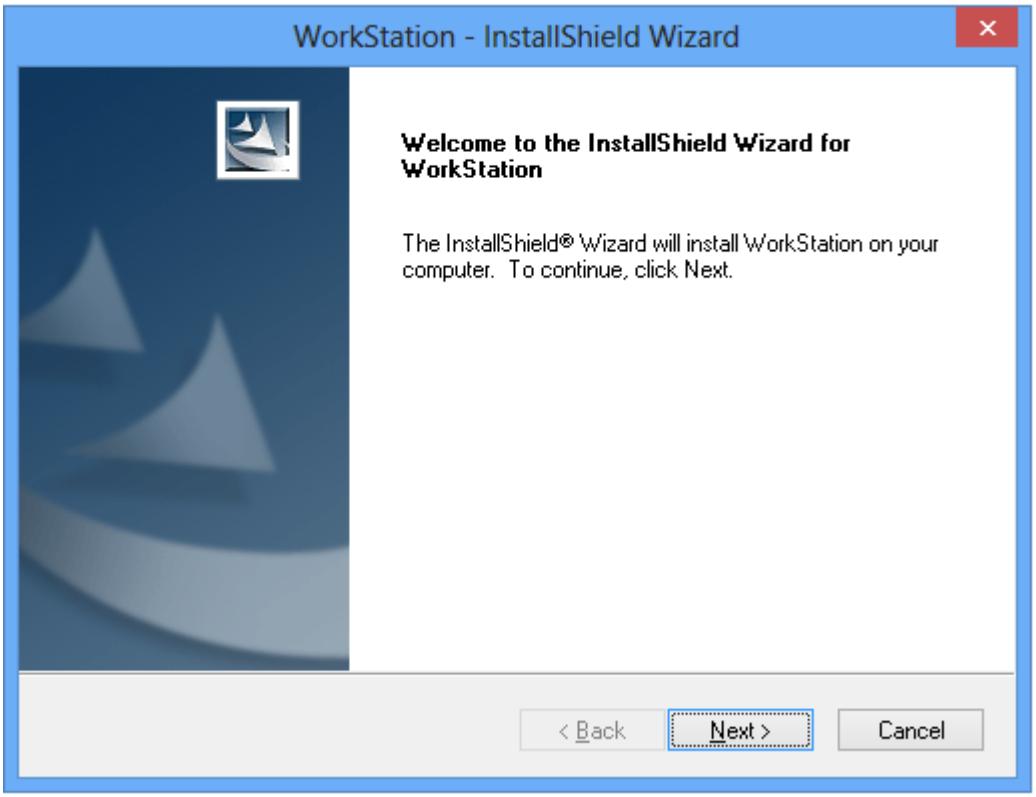
Software Installation Guide

Install the software

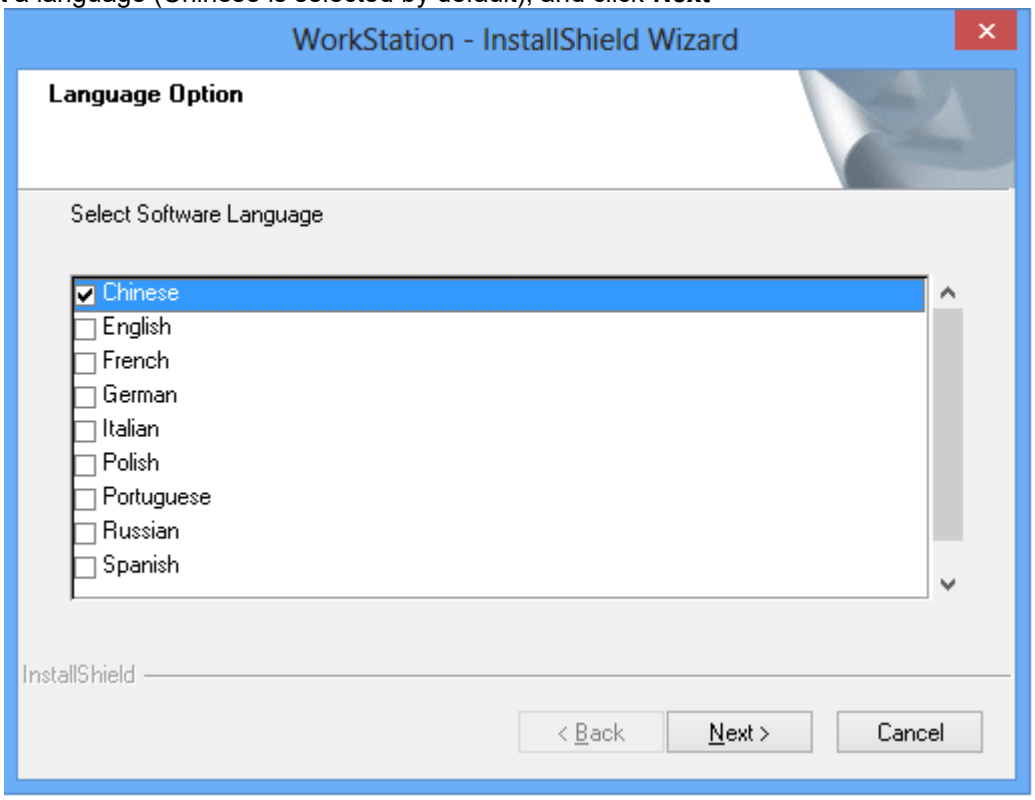
1) Double-click the **setup.exe** file in the **Setup** folder.

Note: In this step, if the BS-430 software has never been installed before, the PC will automatically restart. If the software has been installed and is uninstalled, the PC will not restart.

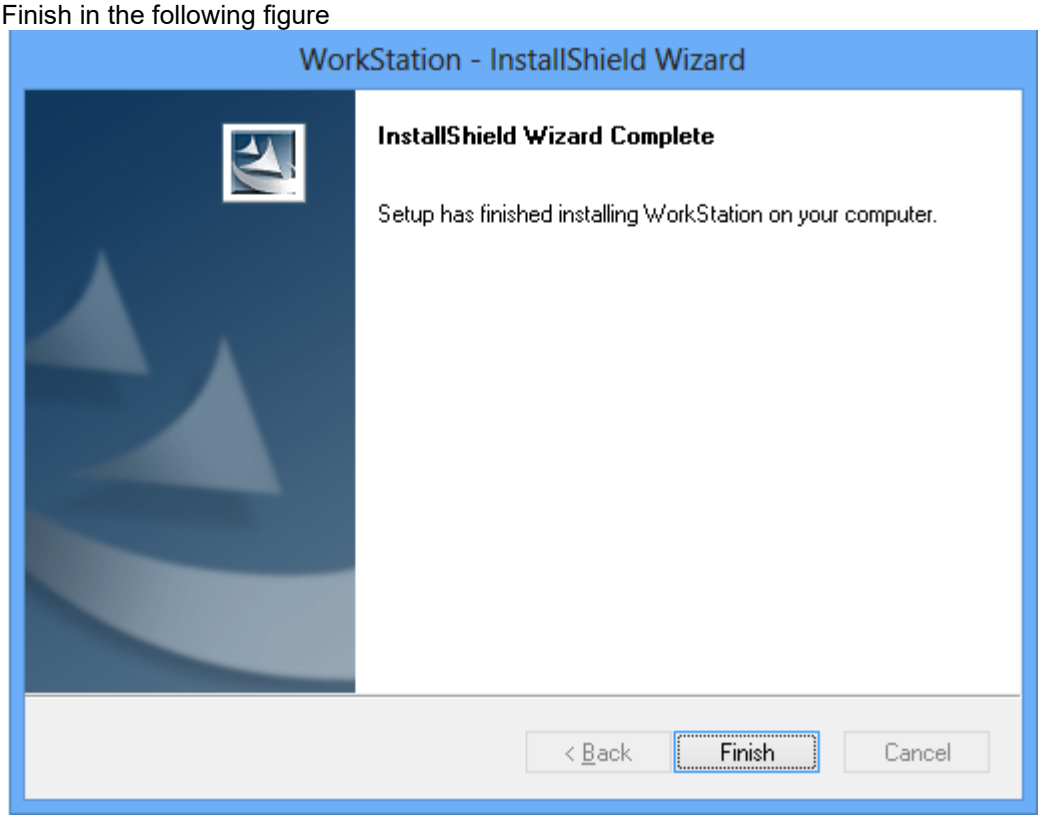
2) Click Next to enter the installation screen.



3) Select a language (Chinese is selected by default), and click **Next**



4) Click Finish in the following figure



Note: After the upgrade installation is completed, the Windows system may play the Program Compatibility Assistant dialog box. then the system has been installed. Please ignore the dialog box.

Checking software parameter configuration

Note:

1) The configuration file is located in the installation directory by default. If the path has been changed during

software installation, find the configuration file in the new directory.

2) The serial port in the configuration file should be set as the one used by the instrument.

- Step 1: Open the configuration file COMMUNICATION_USE.INI in the default directory:

D:\Mindray\WorkStation\OperationSoft\COMMUNICATION_USE.INI

- Step 2: Check if the configurations in the COMMUNICATION_USE.INI file are the same with the following examples. If they are different, change them according to relevant instructions.

```
[INSTRUMENTS]
HasTestInstrumentsNum=1
; Note: Number of Instrument
HasSDM=0
; Note: Is SDM configured
IsUseInstrument1=1
IsUseInstrument2=1
IsUseInstrument3=1
IsUseInstrument4=1
NameOfInstrument1 = 430
NameOfInstrument2 = 430
NameOfInstrument3 = 430
NameOfInstrument4 = 430
[SAMPRACK_COMM_USE]
SAMPRACK_COMM_TYPE=SERIALPORT
SAMPRACK_COMM_NAME=SIM
; Note: Serial port of SDM
[BAUDRATE_SEC]
Baud rate=115200
; Note: Baud rate of SDM
[Demo]
ComPort=COM1
```

- Step 3: Open the configuration file InstrServerConfig.ini in the default directory:

D:\Mindray\WorkStation\OperationSoft\Instrument_1\ InstrServerConfig.ini

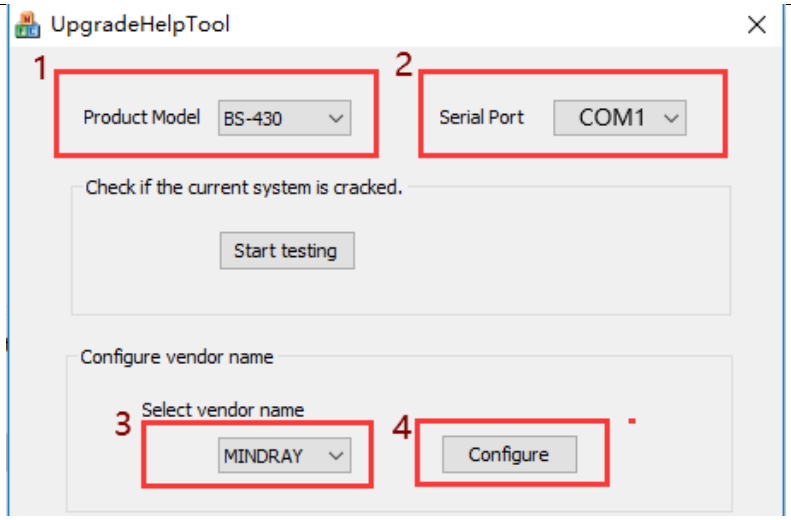
- Step 4: Check if the configurations in the InstrServerConfig.ini file are the same with the following examples. If they are different, change them according to relevant instructions.

```
[INSTR]
INSTRNO=1
SERVER_IP=127.0.0.1
SERVER_PORT=7001
CLIENT_IP=127.0.0.1
CLIENT_PORT=8001
[SERIALPORT]
COMPORT=COM1
; Note: Serial port
BAUDRATE=115200
; Note: Baud rate
```

Configure vendor name

Note: Perform this operation only when upgrading to V43.00.07 and above software

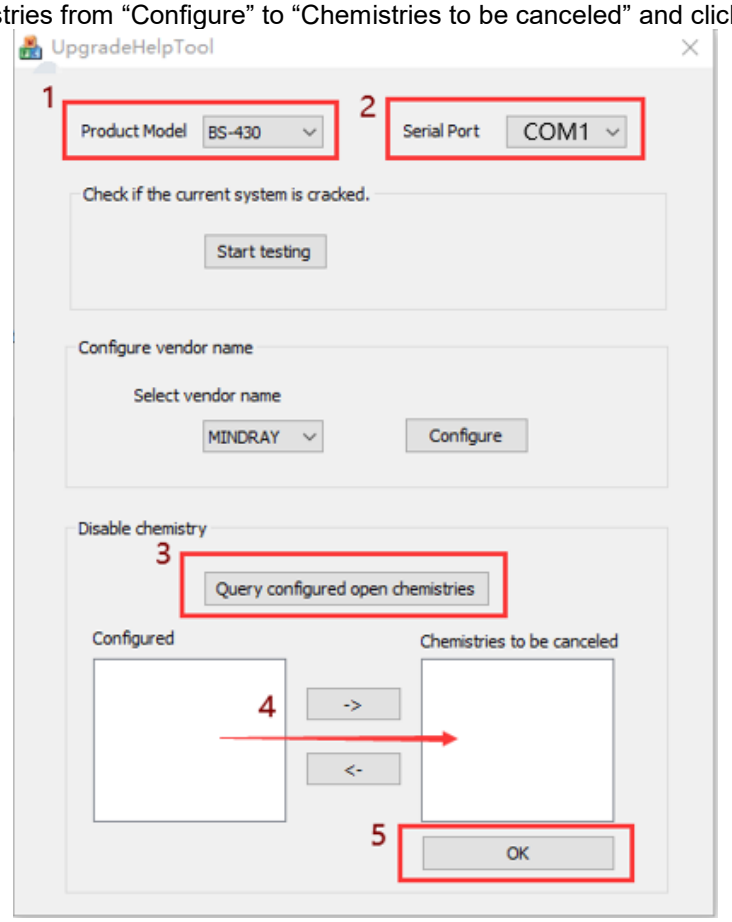
1) Run the UpgradeHelp Tool.exe. (The operating software must be closed, and the serial port must not be occupied)
2) Select the product model and serial port number, vendor name selected in Mindray, click to “Configure”.



Cancel the open chemistries

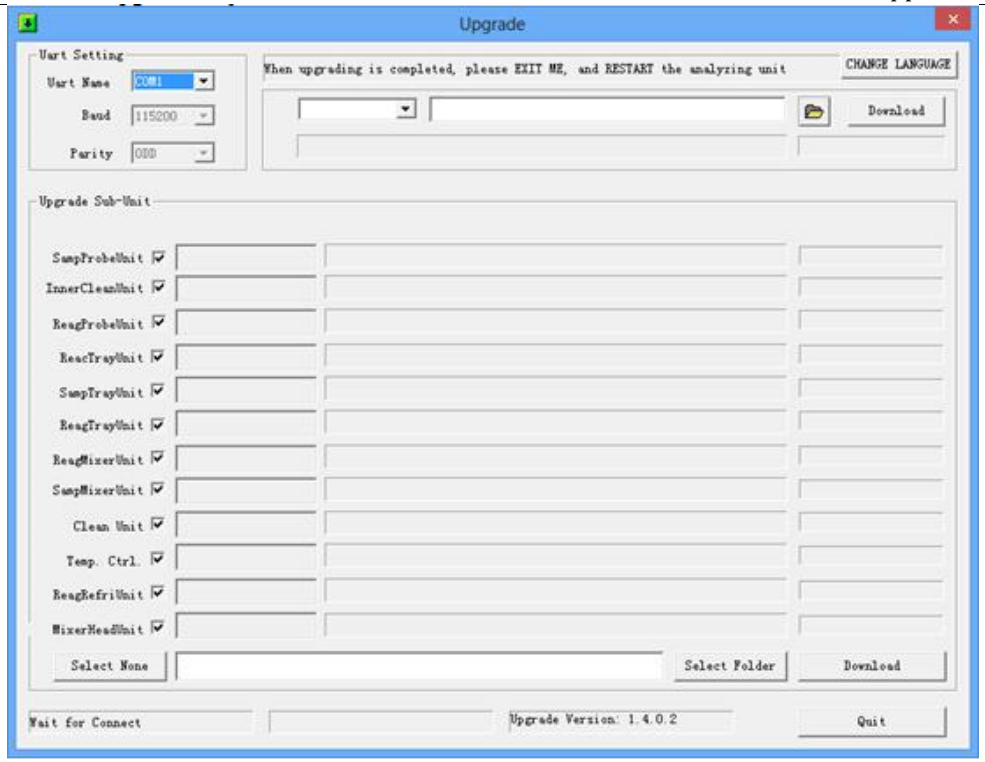
Note: Perform this operation only when upgrading to V06.00.07 and above software, the database has been modified and the customer agrees to use Reagent of Mindray.

1) Run the UpgradeHelp Tool.exe. (The operating software must be closed, and the serial port must not be occupied)
2) Select the product model and serial port number, “Query configure open chemistries”.
3) Move open chemistries from “Configure” to “Chemistries to be canceled” and click to “OK”.

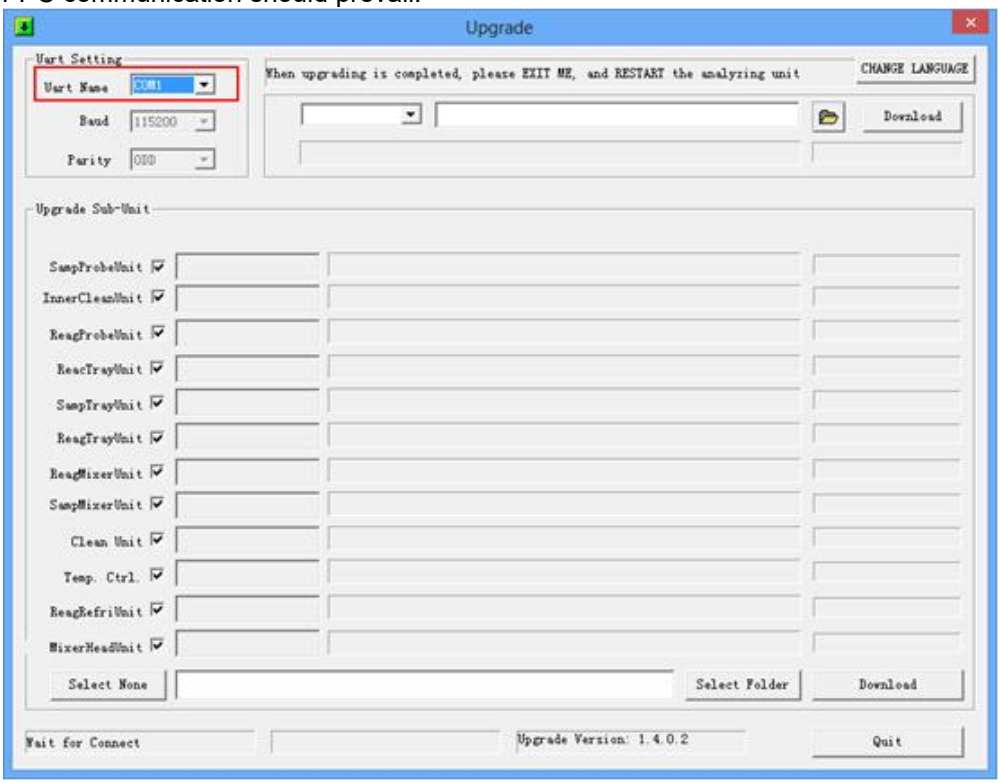


Software Upgrade Guide

1) Open the task manager, and end corresponding process. (Confirming that the relevant process has exited)
2) Confirm that the process of the operating software has been disabled, and start the upgrade tool, as shown in the following figure.

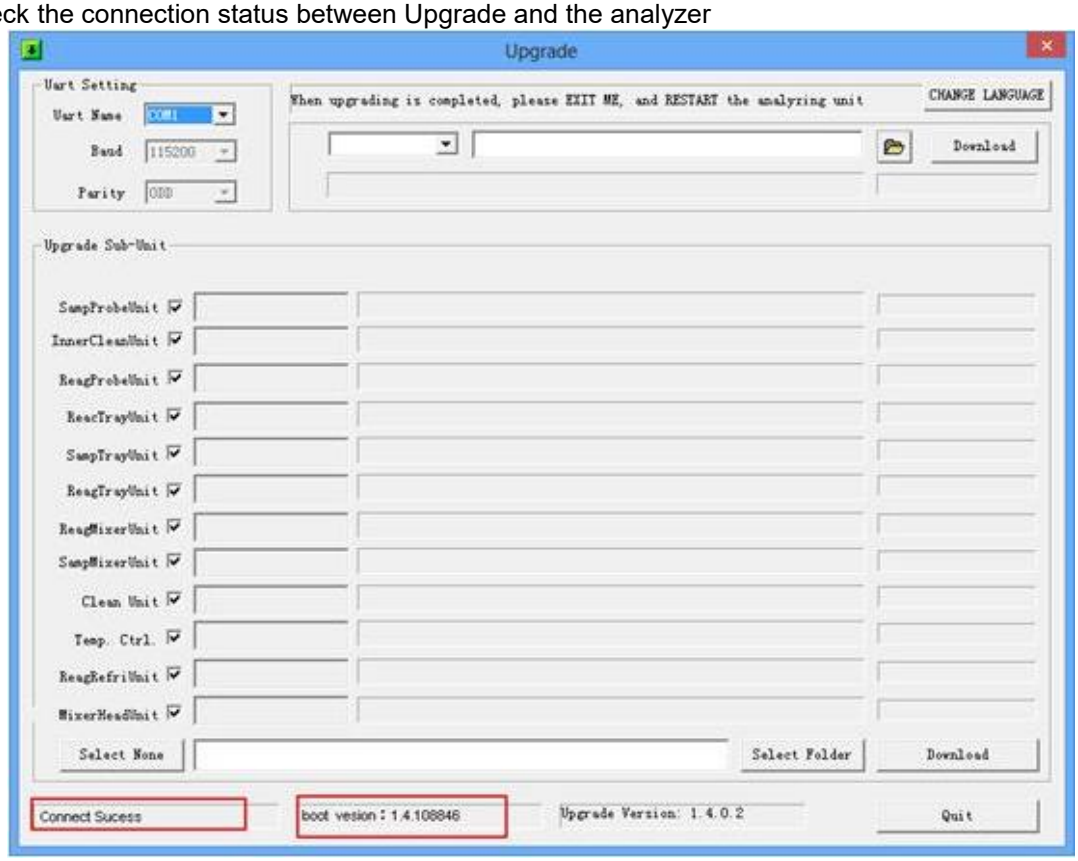


3) **Serial port setting：** Select a serial port used for the analyzer from "Uart name". The default setting is COM1. Note: If the service engineer changes the serial port during instrument installation, the actual one used for PC communication should prevail.



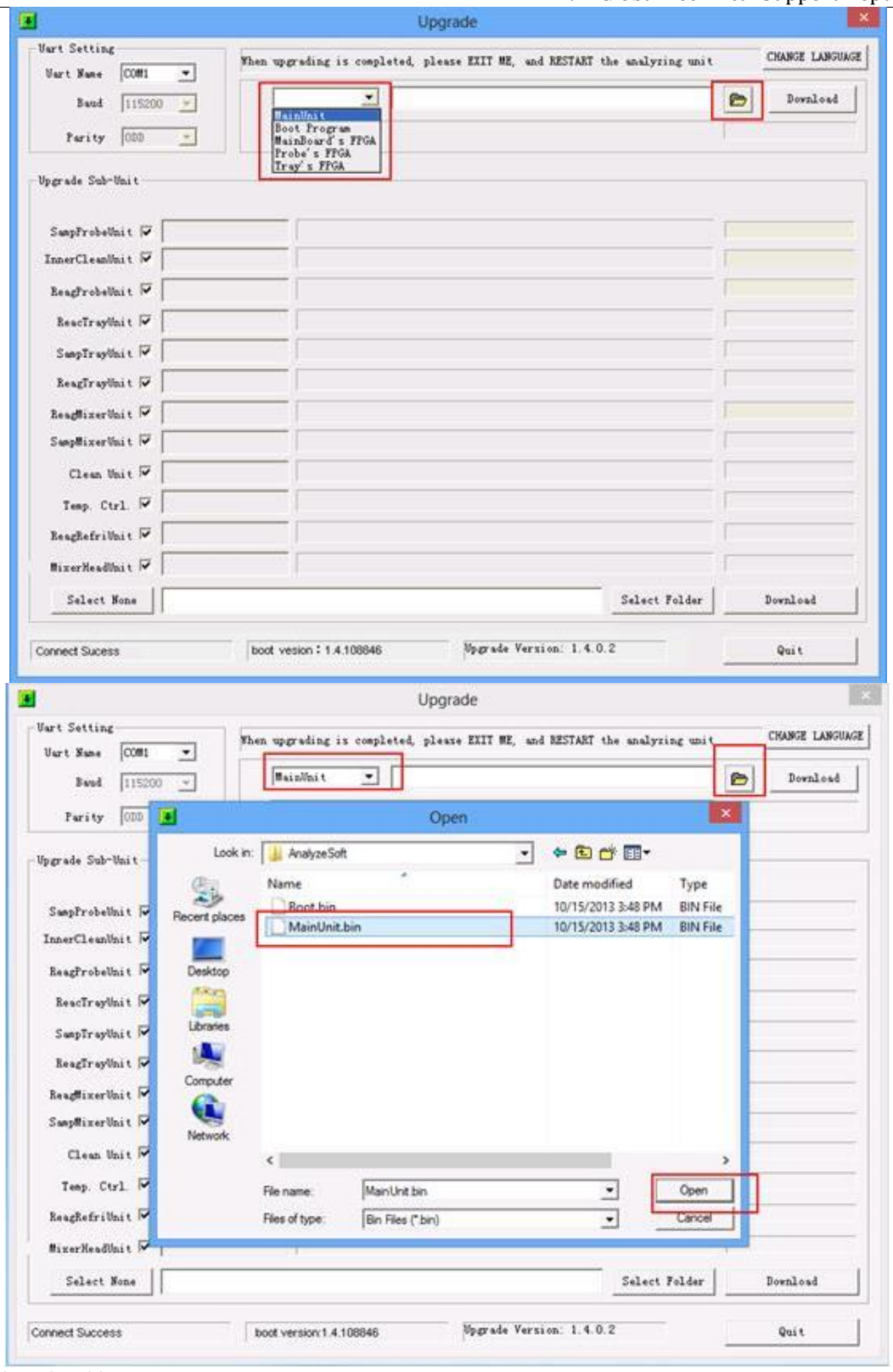
4) Power off the Analyzing unit and power on again. Power off the Analyzing unit, and power it on again after 10 seconds.

5) Check the connection status between Upgrade and the analyzer

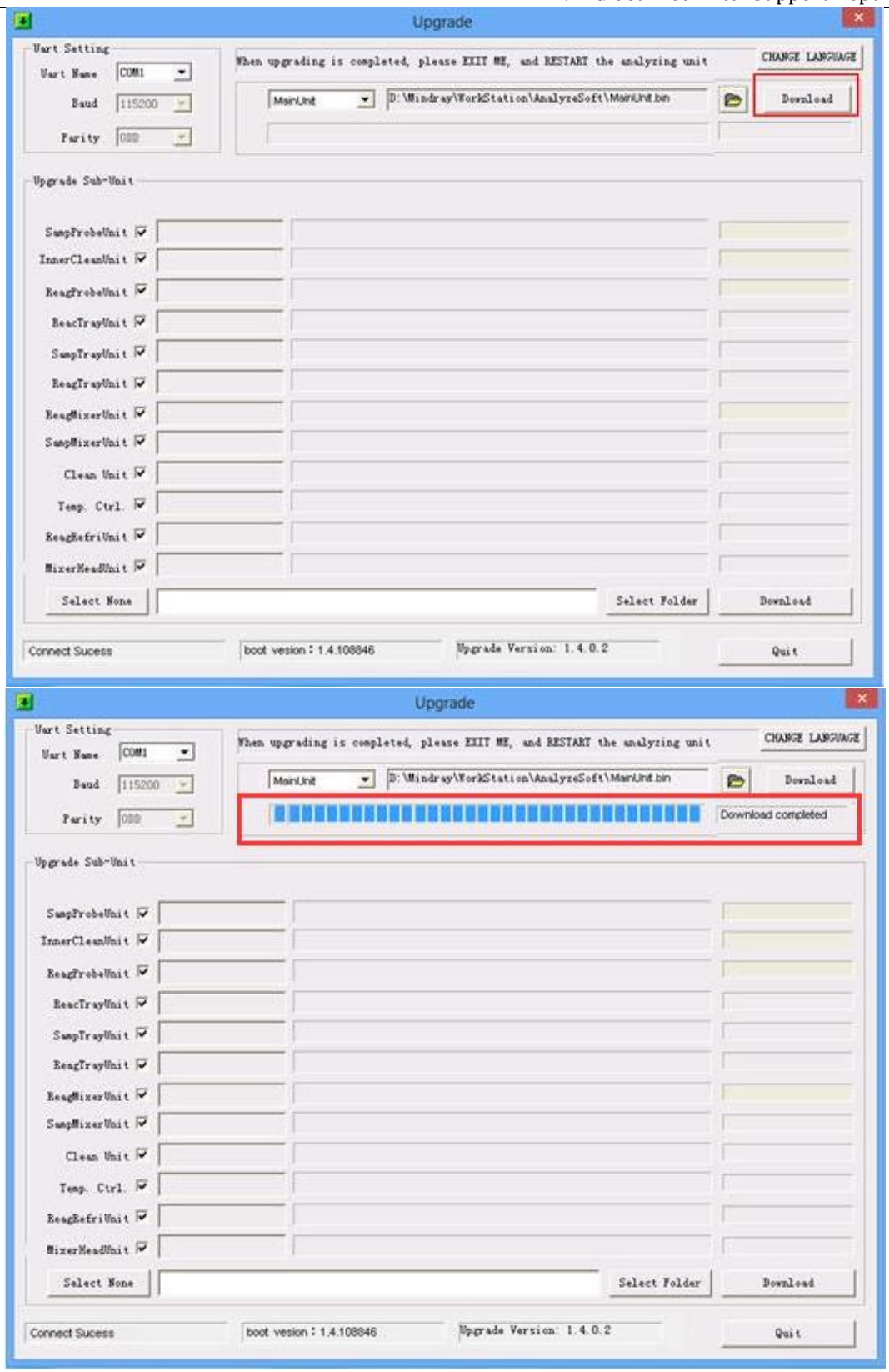


When Upgrade and the analyzer are successfully connected, the connection status=Connect Success, Boot Version=the version used by the analyzer
Note: If the connection status=wait for connect, please check the Uart setting.
Select Boot Program

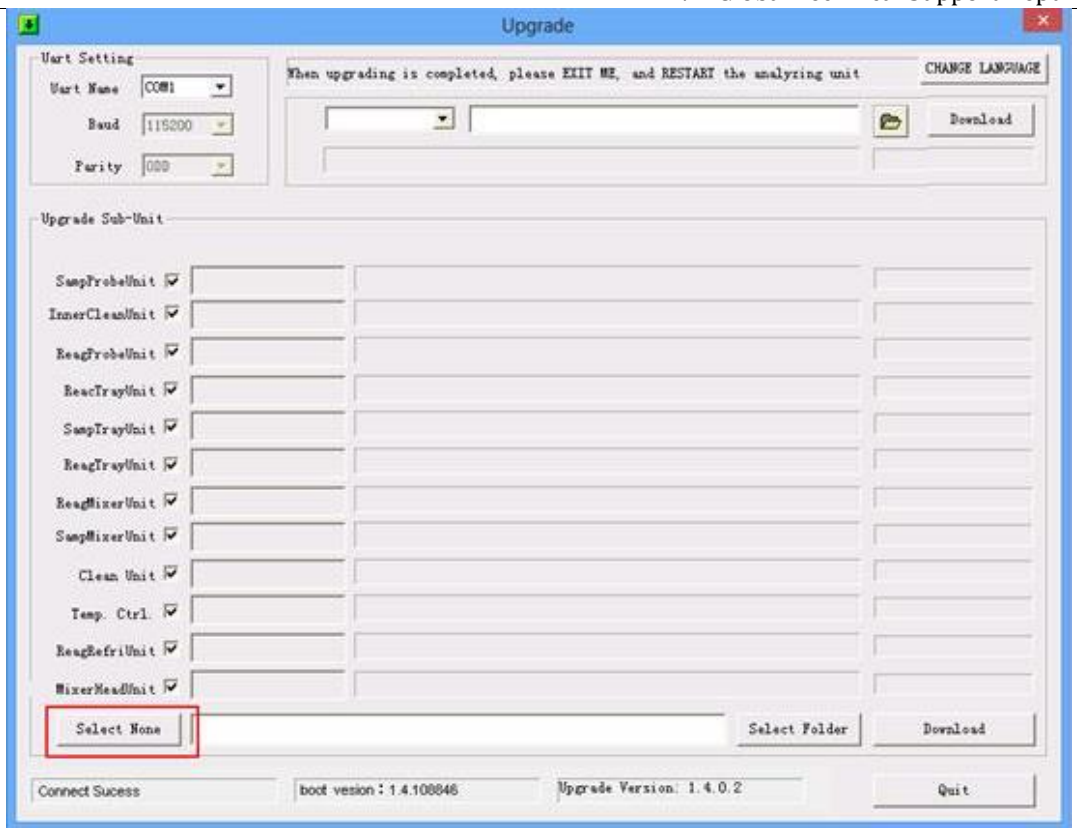
Upgrade Main unit program：Select the MainUnit program. The MainUnit program is under the installation directory and the default installation directory :D:\Mindray\WorkStation\AnalyzeSoft



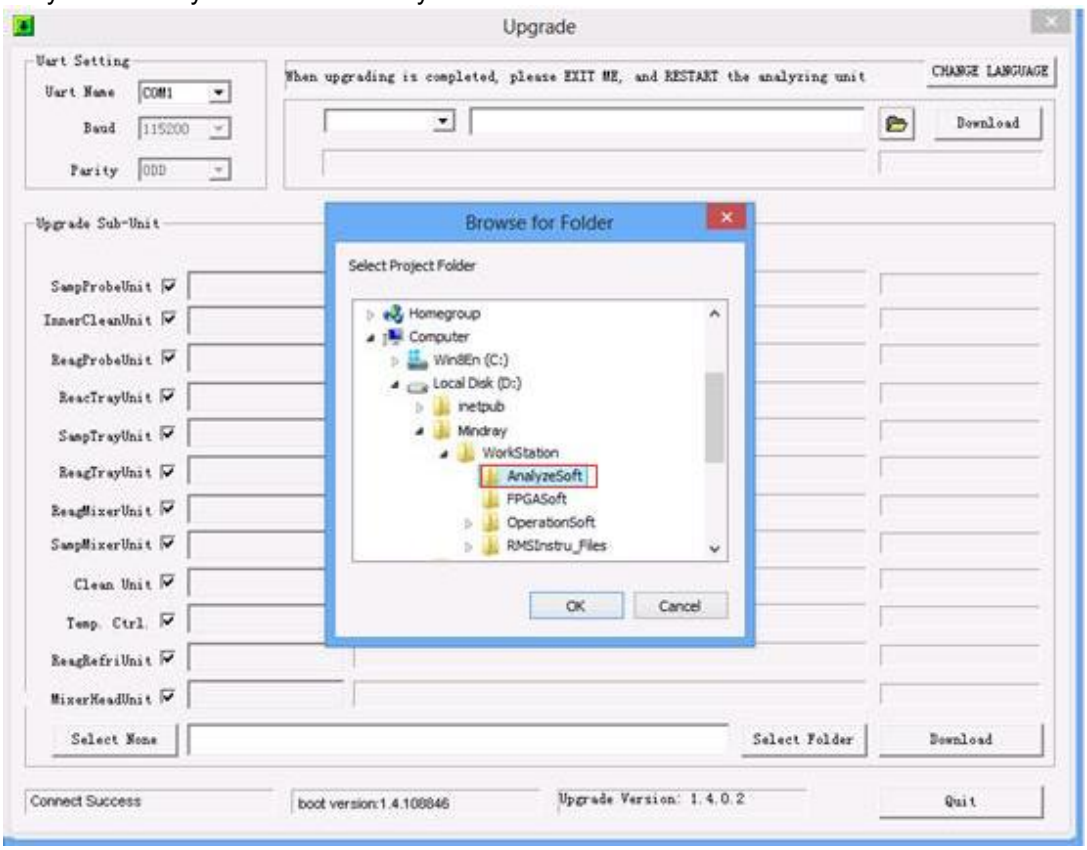
Click the download button

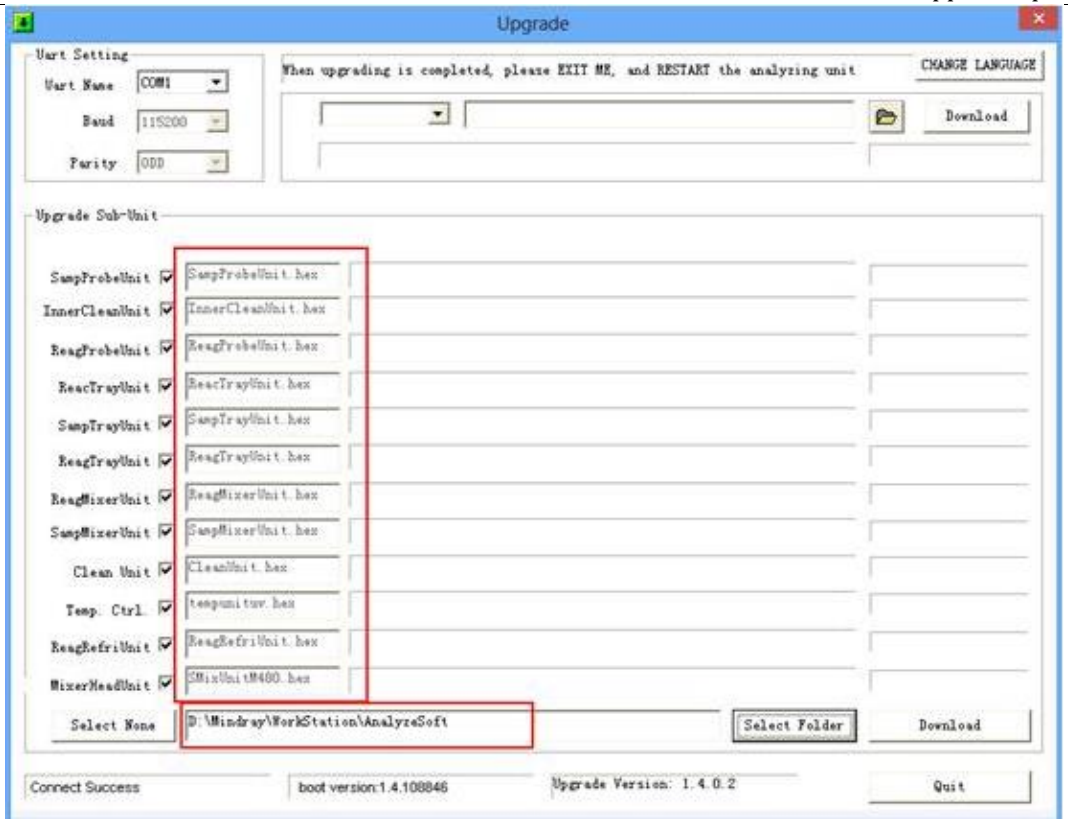


6) **Upgrade Sub- unit program**：Select the target units to write the program.

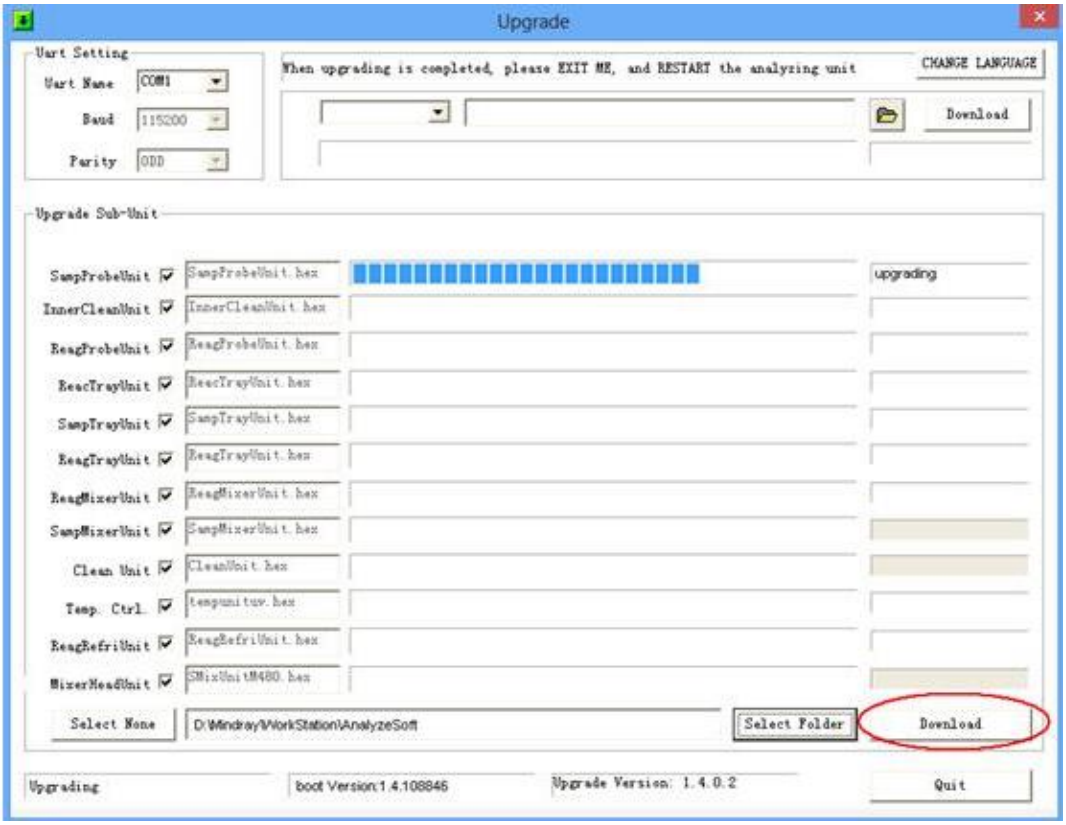


7) **Select the burning files：** The burning file is under the installation directory and the default installation directory :D:\Mindray\WorkStation\AnalyzeSoft

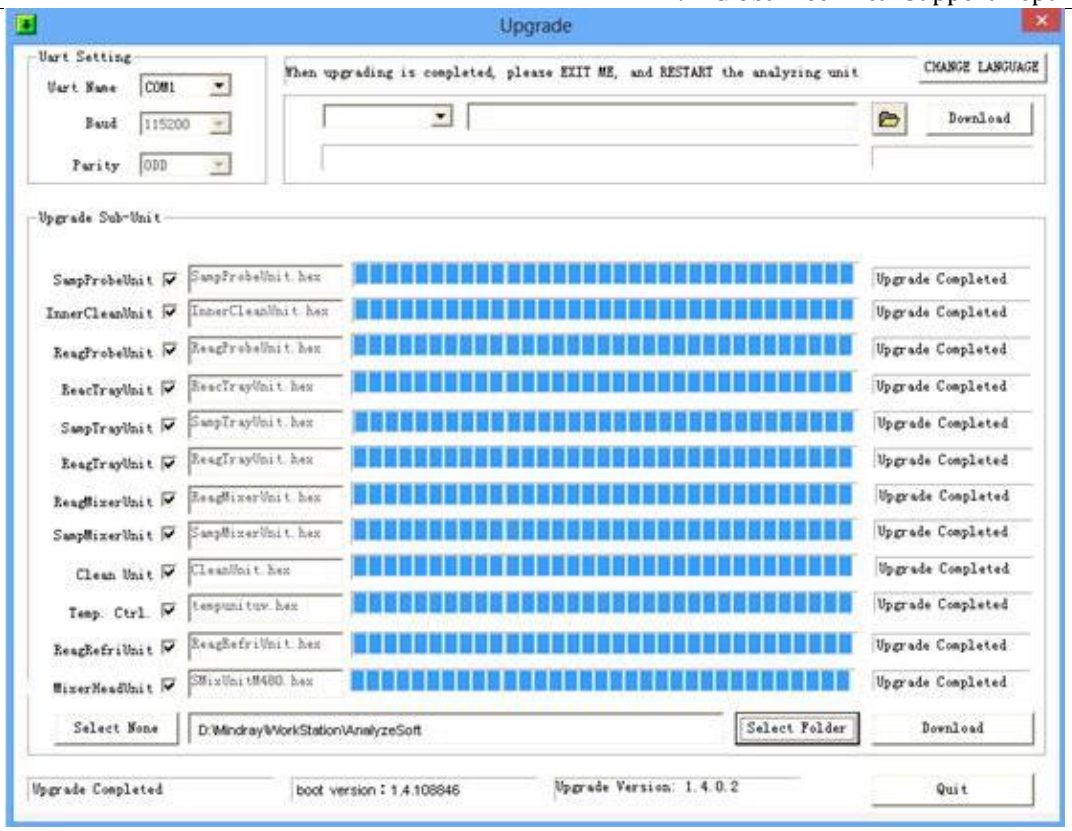




Click the download button



Wait for the prompt: Upgrade completed



8) Power off, and power it on again after 10 seconds.
9) Reboot the computer to run the operating software.

6.2 Microsoft.NET Framework Installation

The Microsoft.NET Framework installer is stored in the Thirdparty in the BS-430 installation package. After opening the Thirdparty file, you can see the dotnetfx installation package and run it.

Note: When the version of the Microsoft.NET Framework configured by the system is lower than 4.0, the database installation may fail, so you are recommended to install the version 4.0 or higher.

6.3 Installing and Uninstalling SQL Database

6.3.1 SQL Database Installation

When the SQL data installation is unsuccessful, the SQL program must be installed separately, which is located in the Thirdparty file of the BS-600 installation package. After opening the Thirdparty file, you can see the SQLExp installation package and execute it to separately execute the SQL database installation.

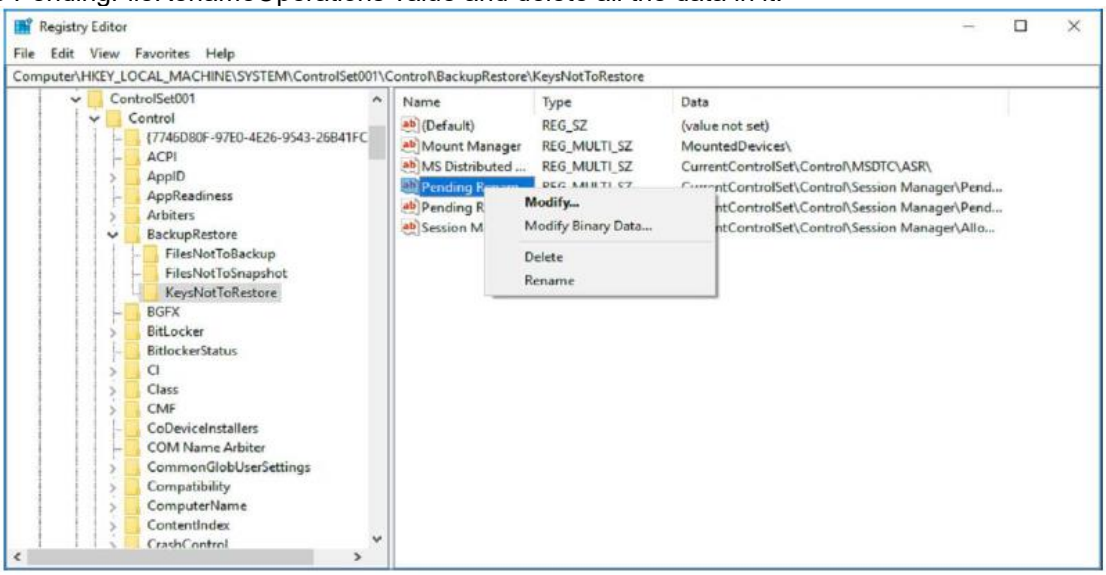
Note: The current SQL database version supported by the operating software is 2012. Install the latest version of the database on site.

6.3.2 SQL Database Uninstalling

1) Select Start menu > Control Panel > Programs > Programs and Functions on the computer desktop, and uninstall SQL Server.

2) Then delete the "Microsoft SQL Server" folder generated during installation, run the registry, enter regedit in Start > Run, enter the registry editor, and delete the following contents in the registry:
HKEY_CURRENT_USER\Software\Microsoft\MicrosoftSQLServeHKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Microsoft SQL Server (note that you must delete the entire Microsoft SQL Server folder).

3) Enter regedit in the bottom left corner of the computer Start > Run, enter the registry editor, and then search HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Session Manager, Find the PendingFileRenameOperations value and delete all the data in it.



4) After the SQL database is uninstalled, the operating software can be executed again. The software automatically installs the SQL data during the installation process.

7 Alignment

7.1 Basic Operation

7.1.1 Utility - Maintenance

Table 7-1 Utility Maintenance

No.	Description
1, 2	Maintenance and Diagnostics: used to maintain and diagnose the system at user end.
3	Alignment: used to align all mechanical positions and the hydropneumatic, pyrology units and ISE.
4	Parameters: used to inquire and configure parameters, and to export parameters of each unit.
5	SPT: provides basic performance tests for the system, including photometer test, precision test (dye), precision test (weight), cuvette residue test, and carryover test.
6	Export parameters: Export alignment parameters of the mechanical positions.

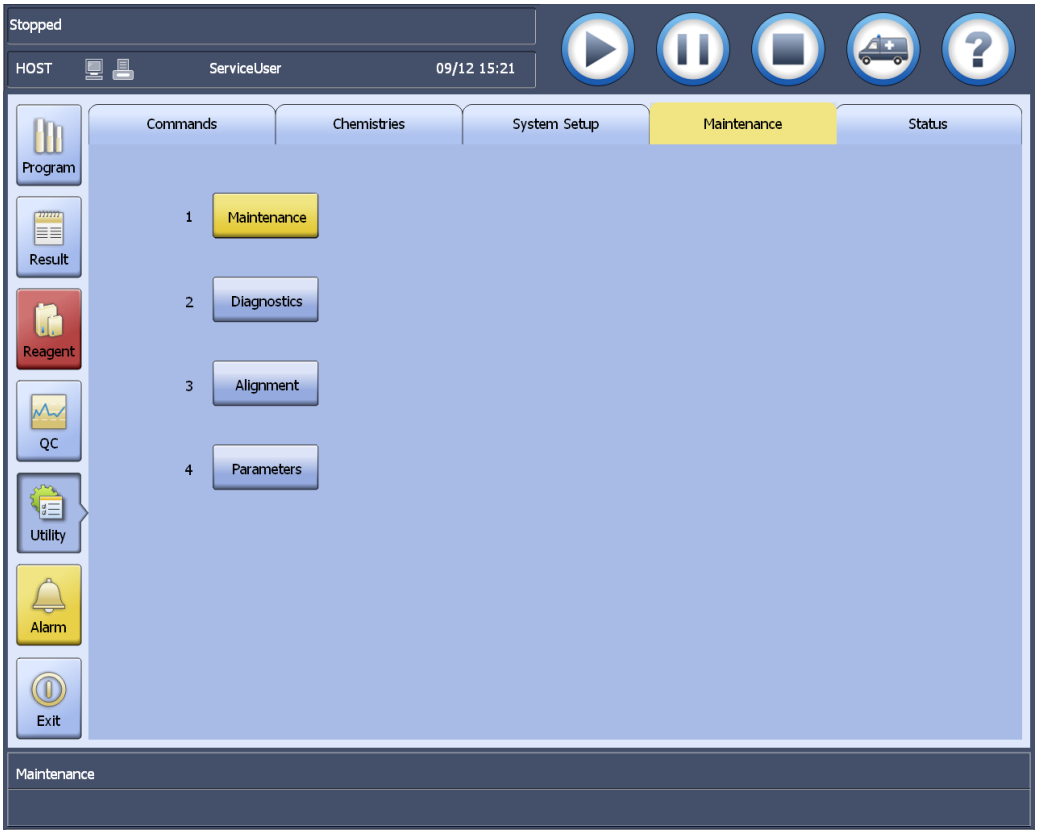


Figure 7-1 Maintenance Screen

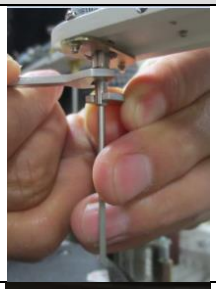
NOTE

- **Before replacing the main control board, you must export the alignment parameters to a local folder on the Parameter Configuration window. After finishing the replacement, import the parameters to the software. Otherwise, the system, when started up, will give an alarm indicating key parameters not configured and cannot be restored. Also change the parameter of fluidic prime status.**

7.1.2 Alignment Fixtures

Table 7-2 Alignment Fixtures

No.	Code	Name	Precision	Quantity
1	BA2K-J12	BA2K cuvette alignment fixture		2
2	043-000644-00	20ml reagent bottle (BA31: brown)		3
	043-002208-00	40ml brown reagent bottle		3
	BA43-J10	Reagent probe aspirate position alignment fixture		6
3	BA48-J10	Sample position alignment tool		9
4	BA60-J07	Pseudo probe		2
5	BA49-J09	Mixer alignment tool		1
6	BA49-J05	Mixer alignment lever		2
7	BA2K-J04-001	BA2K mixer horizontal position alignment cuvette		2
8	BA49-J20	Mixer motor stopper alignment tool		1
9	BA2K-J09	Wash station position alignment cylinder (BA2K-J09-001)		2

No.	Code	Name	Precision	Quantity
10	BA60-J21	Mixer wrench		2
11	BA43-J03	Wash probe position alignment cylinder (open)		1
12	BA48-J12	Sample probe wash well alignment tool		2
13	BA43-J01	Reagent carousel bar code reader alignment tool		1
14	BA43-J02	Reagent carousel alignment tool (T-shaped)		1
15	BA43-J05	Sample carousel bar code reader alignment tool		1
16	115-036803-00	Deionized water pressure gauge assembly (with connector).		1
17	/	Cylinder	5mL	1
18	/	Clearance gauge	0.05mm	1

7.1.3 Mechanical Reset

Alignment methods and Procedure:

1) Install the pseudo probe (BA60-J07), and block the collision sensor with folded thick paper.

2) Access the Alignment window and select Mech Reset to reset the mechanical parts of the system.

7.2 Alignment Procedure

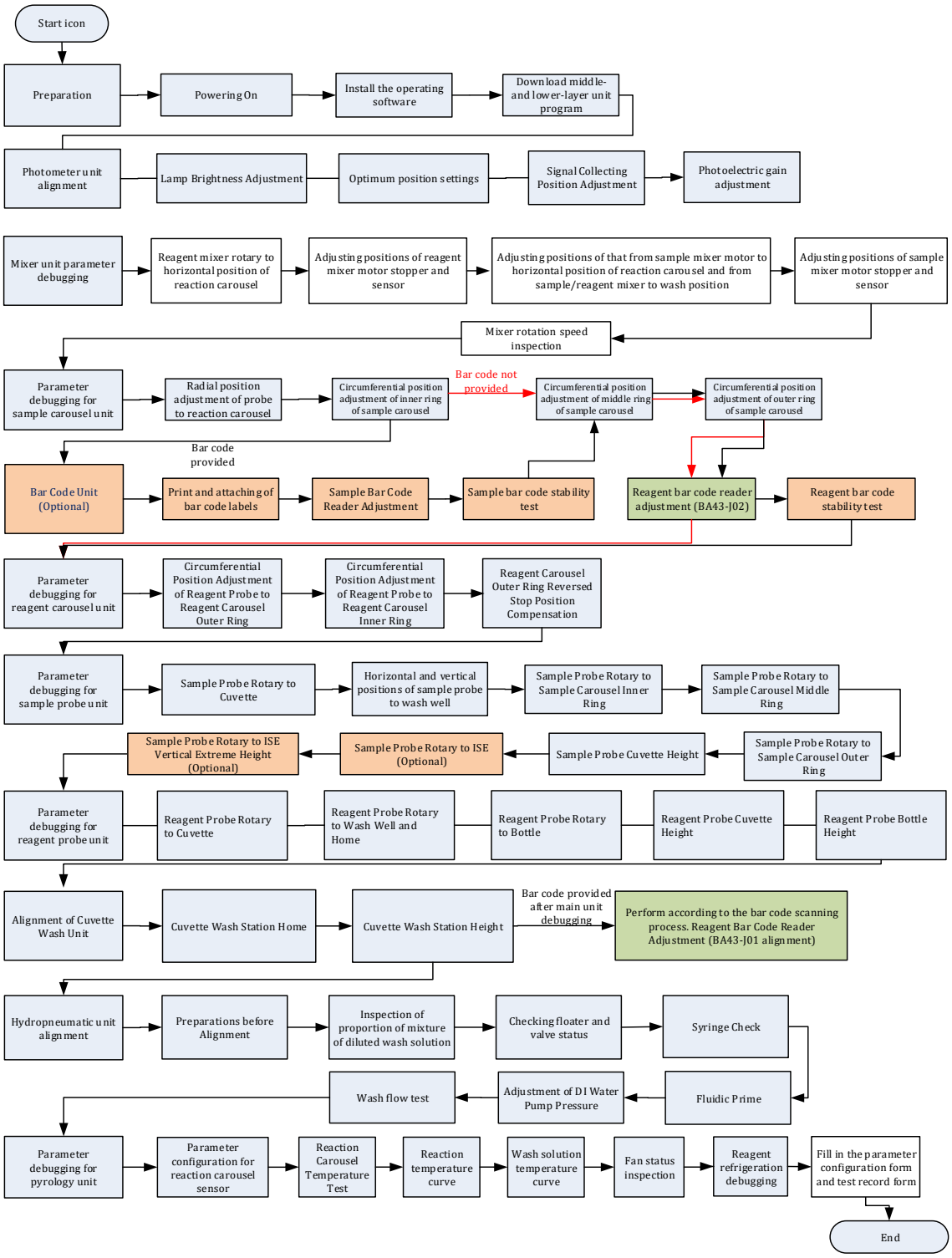
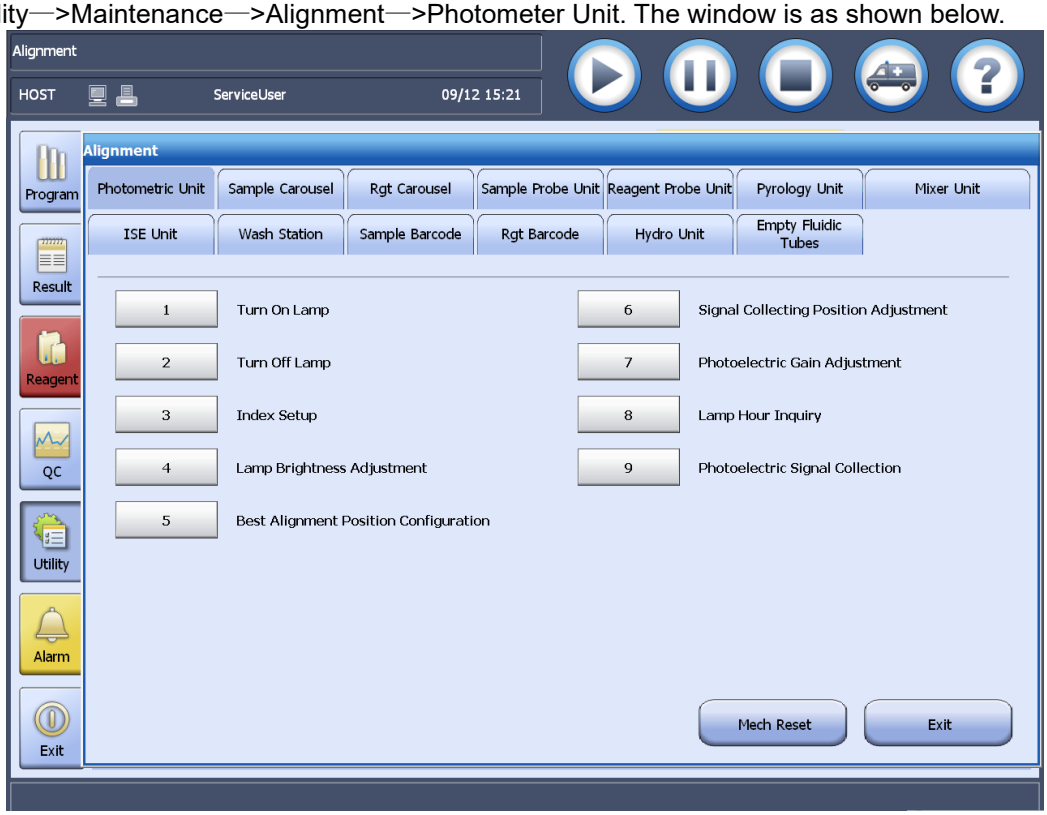


Figure 7-2 Alignment Procedure

7.3 Photometer Unit

Select Utility—>Maintenance—>Alignment—>Photometer Unit. The window is as shown below.



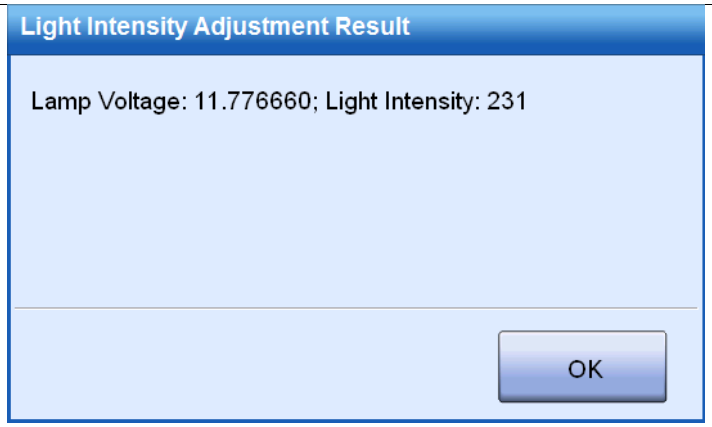
7.3.1 Lamp Brightness Adjustment

Alignment index: The lamp voltage is within the target voltage 11.10V~12.00 V.

Alignment methods and procedure:

1) Select Index Setup to display the Photoelectric Gain Adjustment: Index Setup window. Set the Lamp Voltage as 11.80V. The indices are as shown below:

2) Select Save and then select Exit to close the window.
3) Select Lamp Brightness Adjustment, and then check if the current lamp voltage is within the target voltage range. If yes, select Cancel; otherwise, select Next to adjust the brightness.
4) After finishing the adjustment, a message pops up indicating adjustment succeeded. Select OK.



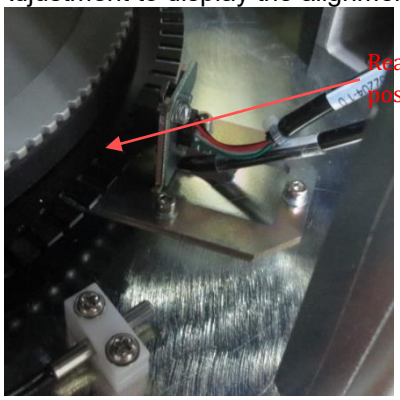
7.3.2 Signal Collecting Position Adjustment

Alignment index:

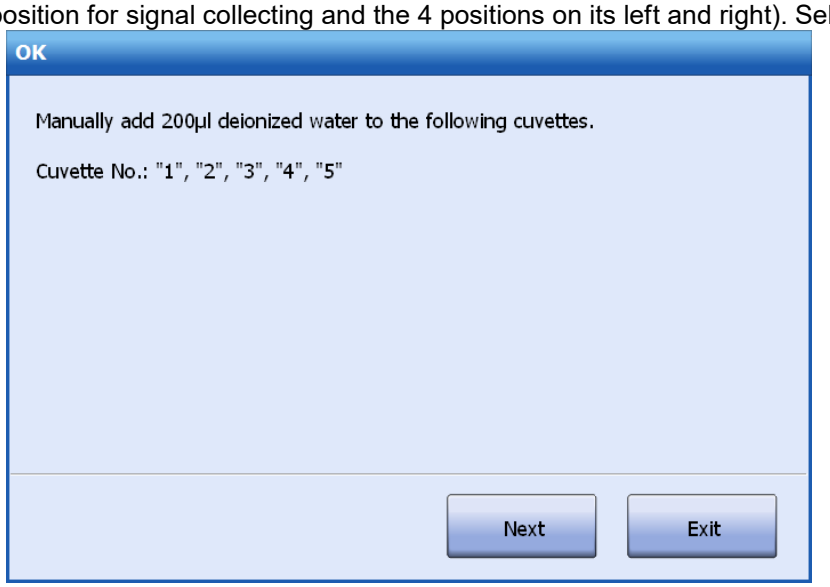
1) The best photoelectric collecting position is in the middle of the two border lines. (Index threshold: The best photoelectric collecting position of 340nm does not exceed the right red line in the lower flat area, and that of 800nm does not exceed the left red line in the upper flat area.)
2) The waveforms of all channels are uniform.

Alignment methods and procedure:

1) Find the position sensor behind the reaction carousel coder, and loosen the three screws with an M3 hexagon wrench. Put the sensor in the middle of the adjustable range, slightly tighten a screw, and then select Signal Collecting Position Adjustment to display the alignment window.



2) Make sure the lamp has been turned on for over 1 minute. If not, wait for 1 minute, and then select Start to proceed to the next step.
3) A window pops up to prompt you to add 200μl DI water with pipette in the designated cuvette (which include the best position for signal collecting and the 4 positions on its left and right). Select Next.



4) Observe the waveforms in the upper part of the window and check if the photoelectric signal meets the

alignment requirement. See the figure below. If not, adjust the photocoupler.

a) To adjust the photocoupler, loosen the three M3 hexagon screws on the bracket, adjust the photocoupler clockwise to move the waveform leftwards or adjust it counterclockwise to move the waveform rightwards. Slightly tighten a screw and select Readjust. The software will test the photoelectric signal again.

b) If the 340nm waveform is vertically beyond the display range, select Done, re-set the AD Range, select Reset, and then select Start to readjust the signal collecting position.

c) If the photocoupler is in a proper position, select Done without any adjustment.

5) After confirming the signal collecting position, select Start at the bottom of the window to test photoelectric signal of all channels.

6) Check that the waveforms of all channels are uniform and then tighten the retaining screws. If not, check if the relevant channel has output and is connected correctly.

7.3.3 Photoelectric Gain Adjustment

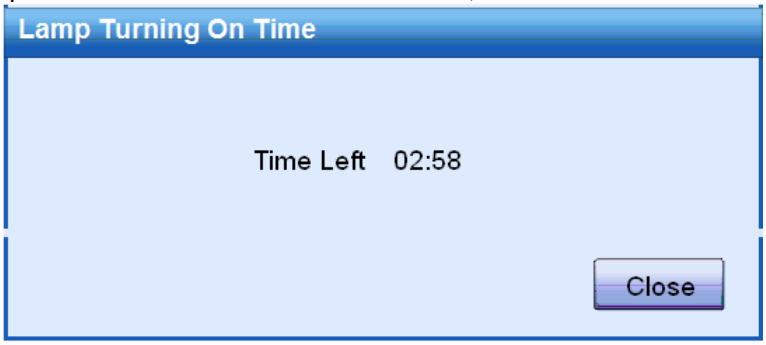
Alignment index:

- The water blank AD value of each channel is within 48000-50000,
- the dark current of all channels is within 1-200;
- The photoelectric gain is no less than 85 for 340nm, and no less than 40 for other channels.

Alignment methods and steps:

1) Select Photoelectric Gain Adjustment.

2) Make sure the lamp has been turned on for over 3 minutes, and then select Done. If not, wait for 3 minutes.



3) Follow step 4 of the software prompt to check if there is deionized water in the cup No. 51~55. If yes, continue.

4) The photoelectric gain is adjusted automatically. When adjustment is complete, select Done.

5) Select Continue to test the dark current and the water blank AD of each channel.

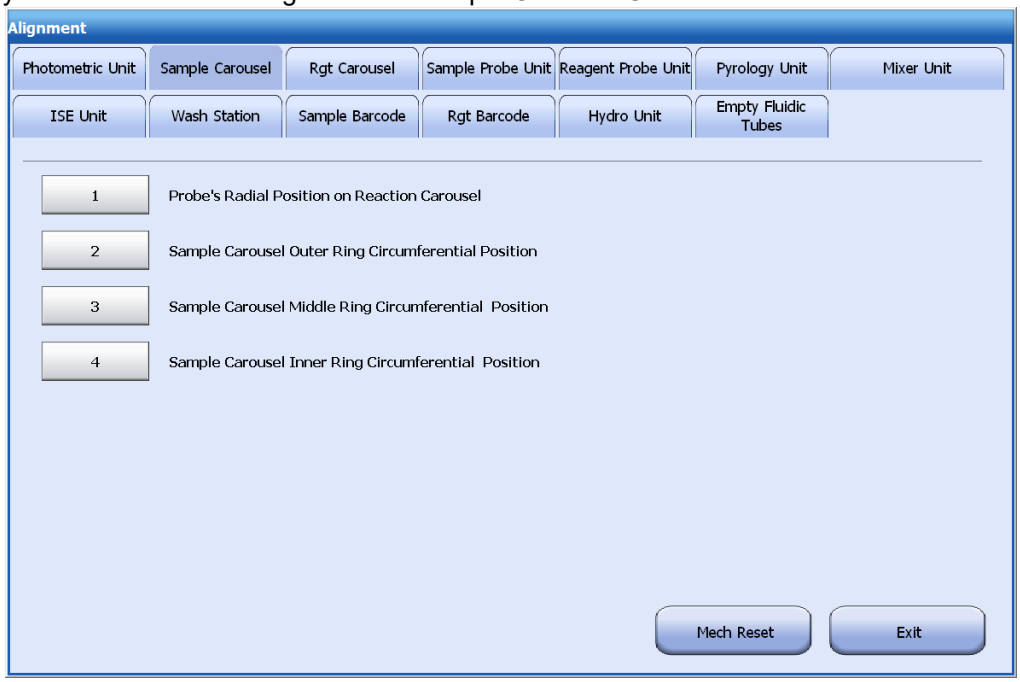
6) If the water blank AD is greater than 54000, decrease the target voltage and readjust the lamp brightness. Decrease the target voltage by 0.1V for each excessive 2000 in the AD value. For instance, the water blank AD of 340nm is 56000, decrease the target voltage from 11.90V to 11.80V. Readjust the photoelectric gain till complying with the indices.
7) The photoelectric gain adjustment is complete.

NOTE

- **Ensure that the screws on the sensor bracket have been tightened.**
- **Alignment parameters can be saved only after each procedure is complete. Another alignment is required if a procedure is terminated. If the parameter is not successfully configured or out of range, the parameter range will be displayed by the alarm message and re-perform the alignment.**

7.4 Sample Carousel Unit

Select Utility—>Maintenance—>Alignment—>Sample Carousel Unit. The window is as shown below.



7.4.1 Radial Position on Reaction Carousel

Alignment index:

The sample probe and reagent probe (pseudo probe BA60-J07) can pass through the through-hole on the cuvette alignment fixture (BA2K-J12).

Operation methods and steps:

1) Select Radial Position Adjustment of Probe to Reaction Carousel and then operate according to the screen prompts.
2) Select Continue to reset all mechanical parts of the whole unit.
3) Follow the screen prompts and the parameter values displayed at the lower left corner, place a cuvette alignment fixture (BA2K-J12) in 35# position and R best alignment position of the reaction carousel.
4) To adjust the sample probe's radial position to the reaction carousel, use an M3 hexagon wrench to loosen the screw on the probe arm, and manually rotate the arm to move the probe to the top of the reaction carousel. Click the up and down arrow buttons to stop the probe at the visually nearest position, rotate the probe arm till the probe tip is circumferentially aligned with the fixture (or adjust parameters to remove the deviation in following operation), and then tighten the arm screw. Tighten the 3 screws of the probe in the radial direction. Click the up and down arrow buttons, and check if the probe tip can pass through the fixture's central hole without interference. If not, loosen the screws and try again.
5) Select Continue. Adjust the R best alignment position of probe in the same way as step 4.
6) Select Continue. The alignment is complete. Select Exit to close the window.

NOTE

- **The alignment tools will be used in following alignment. Leave them aside.**
- **The left arrow button is equivalent to rotating clockwise and the right arrow button rotating counterclockwise.**
- **When selecting Large Step, you can set up the concrete steps according to the reference range.**
- **Once the probe arm length is determined, it must not be adjusted during alignment of probes and carousels.**
- **If the probe arm length is changed, the probe and carousel units should be aligned again.**
- **Alignment parameters can be saved only after each procedure is complete. Another alignment is required if a procedure is terminated. If the parameter is not successfully configured or out of range, the parameter range will be displayed by the alarm message and re-perform the alignment.**

- **After the radial position of the sample probe is determined, you can compare and determine the relative position between the probe radial position and the sample carousel sensor position to avoid repeated alignment. If the sample probe is tilted inside in the radial direction, the position of the sample sensor needs to be adjusted leftwards.**
- **When adjusting the sample carousel position in the circumferential direction, adjust the inner ring first, and then the middle and outer rings.**

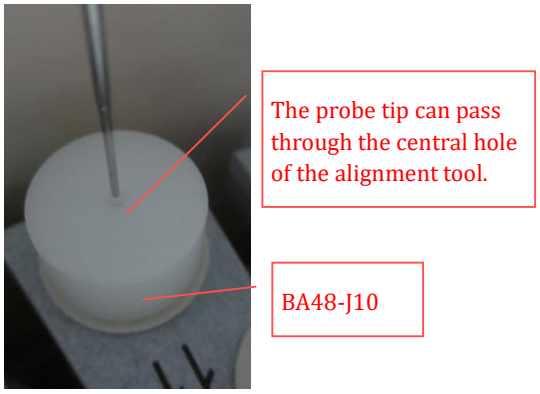
7.4.2 Sample Carousel Outer Ring Circumferential Position

Alignment index:

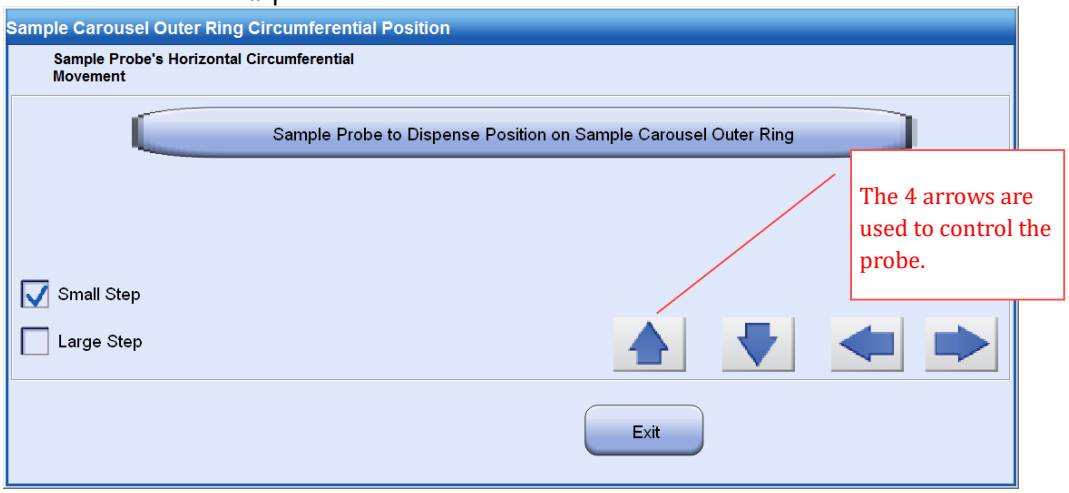
The sample probe (Fixture: BA60-J07 pseudo probe) can pass through the central hole of the sample position alignment tool (BA48-J10) in E1#, S1# and C2# positions of the sample carousel outer ring

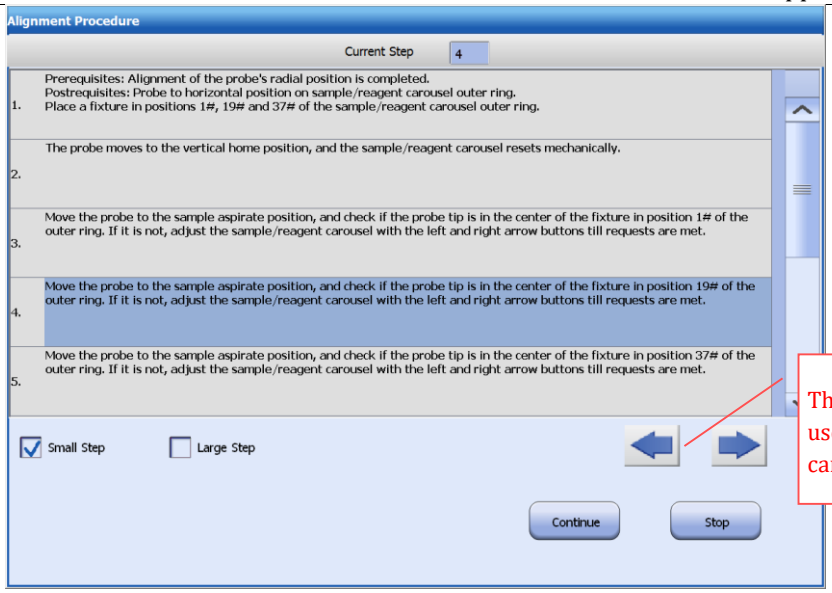
Alignment methods and procedure:

1) Select Sample Carousel Outer Ring Circumferential Position, and then operate according to the screen prompts.
2) Place a sample position alignment tool BA48-J10 in positions #E1, #S1 and #C2 of the sample carousel, and then select Continue.



3) Loosen the arm screw a little so that the probe arm cannot rotate freely but can be rotated by hands. If the arm rotates freely, the adjusted position will be inaccurate. Do not move the motor when rotating the probe arm. If the motor moves, exit the window and access again.
4) Manually rotate the probe arm to E1# position of the sample carousel outer ring, and click the up and down arrow buttons to stop the probe at the visually nearest position above the fixture. Check if the probe tip is aligned with the middle of the through-hole. If it is not, manually rotate the arm to the crossing point in circumferential direction of the sample carousel inner ring, and click the left and right arrow buttons to adjust the probe's circumferential position on the inner ring, so that the probe tip can pass through the central hole of the fixture in E1# position.





5) Adjust the sample probe in S1# and C2# positions of the sample carousel outer ring according to step 3.
6) Select Continue. The alignment is complete. Select Exit to close the window.

7.4.3 Sample Carousel Middle Ring Circumferential Position

Alignment index:

The sample probe (fixture: BA60-J07 pseudo probe) can pass through the central hole of the sample position alignment tool (BA48-J10) in 35#, 46# and 57# positions of the sample carousel middle ring.

Alignment methods and procedure:

1) Select Sample Carousel Middle Ring Circumferential Position.
2) Place a sample position alignment tool BA48-J10 in position #35, #46 and #57 of the sample carousel, and then select Continue.
3) Adjust the sample probe in 35#, 46# and 57# positions of the sample carousel middle ring according to step 4 of Sample Carousel Outer Ring Circumferential Position.
4) Select Continue. The alignment is complete. Select Exit to close the window.

7.4.4 Sample Carousel Inner Ring Circumferential Position

Alignment index:

The sample probe (fixture: BA60-J07 pseudo probe) can pass through the central hole of the sample position alignment tool (BA48-J10) in 1#, 12# and 23# positions of the sample carousel outer ring.

Alignment methods and procedure:

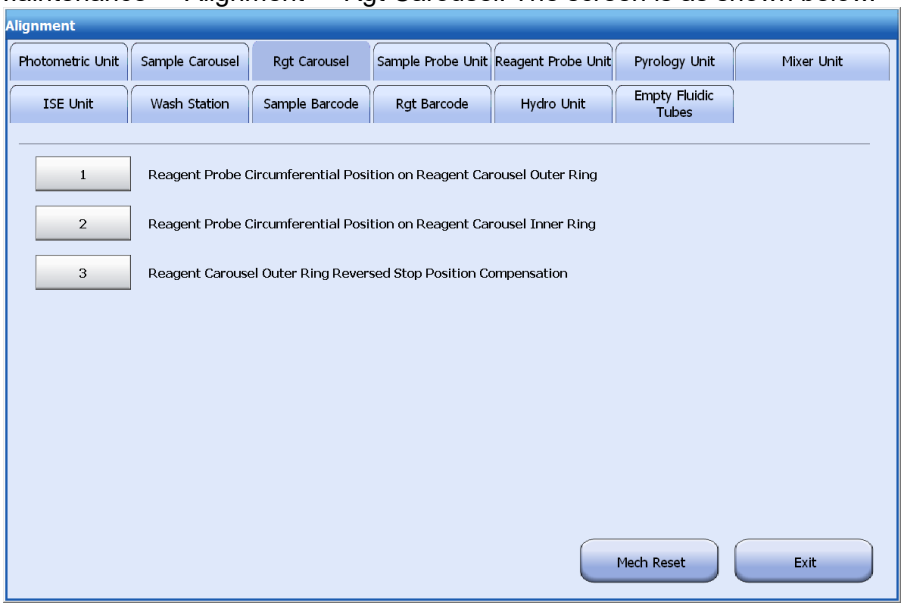
1) Select Sample Carousel Outer Ring Radial Position.
2) Place a sample position alignment tool BA48-J10 in position #1, #12 and #23 of the sample carousel, and then select Continue.
3) Adjust the sample probe in 1#, 12# and 23# positions of the sample carousel outer ring according to step 4 of Sample Carousel Outer Ring Circumferential Position.
4) Select Continue. The alignment is complete. Select Exit to close the window

NOTE

- **When the alignment is complete, there is no need to take out the alignment tool.**
- **Alignment parameters can be saved only after each procedure is complete. Another alignment is required if a procedure is terminated. If the parameter is not successfully configured or out of range, the parameter range will be displayed by the alarm message and re-perform the alignment.**

7.5 Reagent Carousel Unit

Select Utility -> Maintenance -> Alignment -> Rgt Carousel. The screen is as shown below.



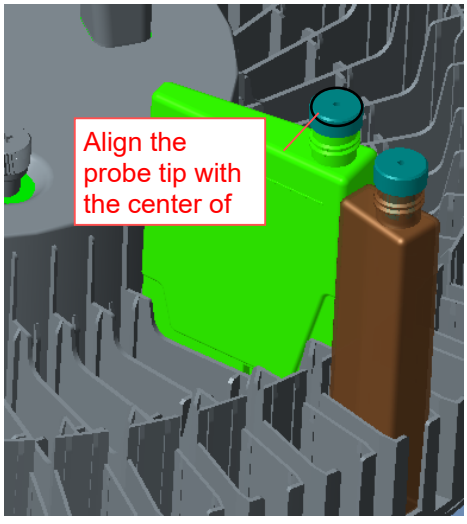
7.5.1 Circumferential Position Adjustment of Reagent Probe to Reagent Carousel Outer Ring

Alignment index:

Probe pseudo probe BA60-J07) can pass through the central hole of the reagent bottle position alignment fixture (BA43-J10) in 1#, 16# and 31# positions of the reagent carousel outer ring.

Alignment methods and procedure:

1) Select Circumferential Position Adjustment of Reagent Probe to Reagent Carousel Outer Ring.
2) Place the alignment fixture with its outer ring hole corresponding to 1#, 16# and 31# positions of the reagent carousel outer ring, and then select Continue.
3) Loosen a little the arm screw of the reagent probe so that the probe arm cannot rotate freely but can be rotated by hands. If the arm rotates freely, the adjusted position will be inaccurate.
4) Manually rotate the reagent probe arm to 1# position of the reagent carousel outer ring, and click the up and down arrow buttons to stop the probe at the visually nearest position above the fixture. Check if the probe tip is aligned with the middle of the outer ring through-hole. If it is not, manually rotate the arm to the crossing point in circumferential direction of the reagent carousel outer ring, and click the left and right arrow buttons to adjust the probe's circumferential position on the outer ring, so that the probe tip can pass through the central hole of the fixture in 1# position.
5) Adjust the reagent probe in 16# and 31# positions of the reagent carousel outer ring according to step 4.
6) Select Continue. The alignment is complete. Select Exit to close the window.



7.5.2 Circumferential Position Adjustment of Reagent Probe to Reagent Carousel Inner Ring

Alignment index:

Probe pseudo probe BA60-J07) can pass through the central hole of the reagent bottle position alignment fixture (BA43-J10) in 47#, 62# and 77# positions of the reagent carousel inner ring.

Alignment methods and procedure:

1) Select Circumferential Position Adjustment of Reagent Probe to Reagent Carousel Inner Ring.
2) Place the alignment fixture with its inner ring hole corresponding to 47#, 62# and 77# positions of the reagent carousel inner ring, and then select Continue.
3) Adjust the reagent probe in 47#, 62# and 77# positions of the reagent carousel inner ring according to step 4 of Probe Circumferential Position on Reagent Carousel Outer Ring.
4) Select Continue. The alignment is complete. Select Exit to close the window.

7.5.3 Reagent Carousel Outer Ring Reversed Stop Position Compensation

Alignment index:

Probe pseudo probe BA60-J07) can pass through the central hole of the reagent bottle position alignment fixture (BA43-J10) in 1#, 16# and 31# positions of the reagent carousel outer ring.

Alignment methods and procedure:

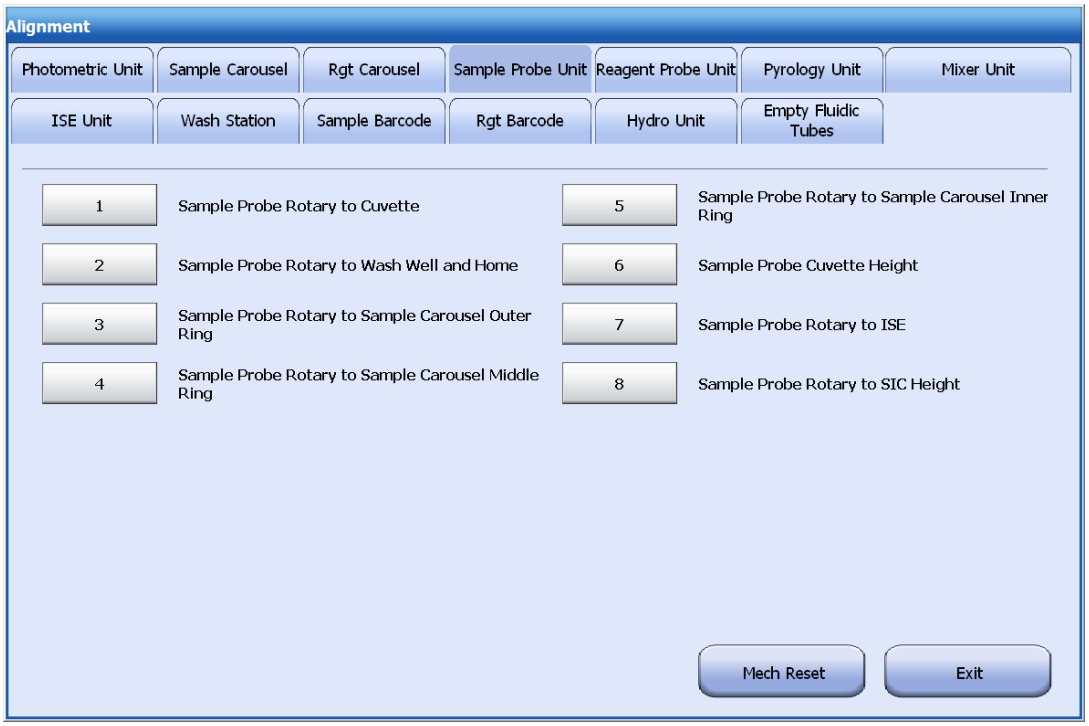
1) Select Reagent Carousel Outer Ring Reversed Stop Position Compensation.
2) Place the alignment fixture with its outer ring hole corresponding to 1#, 14# and 27# positions of the reagent carousel outer ring, and then select Continue.
3) Adjust the reagent probe in 1#, 14# and 27# positions of the reagent carousel outer ring according to step 4 of Probe Circumferential Position on Reagent Carousel Outer Ring.
4) Select Continue. The alignment is complete. Select Exit to close the window.

NOTE

- **Alignment parameters can be saved only after each procedure is complete. Another alignment is required if a procedure is terminated.**
- **If the parameter is not successfully configured or out of range, the parameter range will be displayed by the alarm message and re-perform the alignment. If the parameter is out of range, adjust the position of the sensor. Perform the alignment procedure again.**

7.6 Sample Probe Unit

Select Utility -> Maintenance -> Alignment -> Sample Probe. The screen is as shown below.



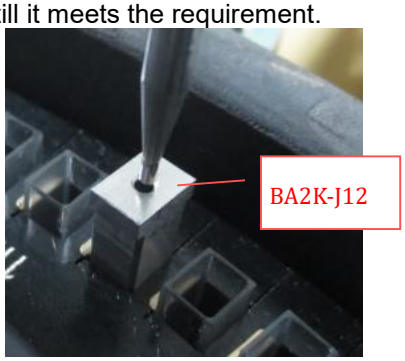
7.6.1 Sample Probe Rotary to Cuvette

Alignment index:

The sample probe (fixture: BA60-J07 pseudo probe) can pass through the through-hole on the cuvette alignment fixture (BA2K-J12).

Alignment methods and procedure:

1) Select Sample Probe Rotary to Cuvette.
2) Place the cuvette alignment fixture (BA2K-J12) in 35# position of the reaction carousel, and then select Continue.
3) Select the down arrow button to lower the sample probe to above the alignment fixture so that it can align with the central hole.
4) Adjust the circumferential position of the probe arm and ensure that the sample probe can enter the central hole on the fixture. Press the probe arm and tighten the screws on it. If error exists, click the left and right arrow buttons to adjust the probe till it meets the requirement.



5) Select Continue and verify the alignment with the up and down arrow buttons. If the index is not satisfied, return to the previous step and try again.
6) Select Continue to save parameters and exit the window.

7.6.2 Sample Probe Rotary to Wash Well and Home

Alignment index:

- Alignment of the horizontal position should satisfy the following two conditions: ① The sample probe tip can enter the central hole on the wash well alignment tool (BA48-J12). ② The gap between the sample probe wash well and the fixture shell is even.

- Vertical position: When reaching the bottom of the central hole on the wash well alignment fixture (BA48-J12), the sample probe is lifted for 0.15mm, which means that the clearance gauge can pass with 0.15mm through the gap between the sensor plate and the arm base and it cannot pass with 0.20mm.

Alignment methods and procedure:

1) Select Sample Probe Rotary to Wash Well and Home.
2) According to Step 2 on the screen, place a wash well alignment tool (BA48-J12) in the sample probe wash well, and then select Continue.
3) Select the up/down and left/right arrow buttons to move the sample probe till it lowers into the center on the alignment fixture. If the sample probe is greatly deviating from the alignment tool, use a big cross screwdriver to loosen the two screws on the wash well, adjust the wash well till the sample probe can enter into the central hole on the alignment tool and the gap between the wash well and the fixture shell is even, and then tighten the screws.

4) Confirm the alignment result. If the requirements are not met, return to Step 3.
5) Adjust the sample probe's vertical position above the wash well by using the up and down arrow buttons. Check that the clearance gauge can pass with 0.15mm and cannot pass with 0.20mm.
6) Check the vertical position. If the requirements are not met, return to Step 5.
7) Remove the alignment tool according to screen prompts.
8) Select Continue to save parameters and exit the window.

7.6.3 Sample Probe Rotary to Sample Carousel Outer Ring

Alignment index:

The sample probe tip can enter the central hole of the alignment fixture (BA48-J10) in 1#, 12# and 23# positions of the sample carousel outer ring.

Alignment methods and procedure:

1) Select Sample Probe Rotary to Sample Carousel Outer Ring.
2) Place a sample position alignment tool (BA48-J10) in position #1, #12 and #23 of the sample carousel, and then select Continue.
3) Select the up/down and left/right arrow buttons to move the sample probe so that it can enter into the central hole on the alignment tool.
4) Select Continue to save parameters and exit the window.

7.6.4 Sample Probe Rotary to Sample Carousel Middle Ring

Alignment index:

The sample probe tip can enter the central hole of the alignment fixture (BA48-J10) in 35#, 46# and 57# positions of the sample carousel inner ring.

Alignment methods and procedure:

1) Select Sample Probe Rotary to Sample Carousel Middle Ring.
2) Place a sample position alignment tool (BA48-J10) in position #35, #46 and #57 of the sample carousel, and then select Continue.
3) Select the up/down and left/right arrow buttons to move the sample probe so that it can enter into the central hole on the alignment tool.
4) Select Continue to save parameters and exit the window.

7.6.5 Sample Probe Rotary to Sample Carousel Inner Ring

Alignment index:

The sample probe tip can enter the central hole of the alignment fixture (BA48-J10) in E1#, S1# and C2# positions of the sample carousel inner ring.

Alignment methods and procedure:

1) Select Sample Probe Rotary to Sample Carousel Inner Ring.
2) Place a sample position alignment tool (BA48-J10) in E1#, #S1 and C2# positions of the sample carousel,

and then select Continue.

3) Select the up/down and left/right arrow buttons to move the sample probe so that it can enter into the central hole on the alignment tool.
4) Select Continue to save parameters and exit the window.

7.6.6 Sample Probe Cuvette Height

Alignment index:

When reaching the cuvette bottom, the sample probe is lifted for 0.15mm, which means that the clearance gauge can pass with 0.15mm through the gap between the sensor plate and the arm base and it cannot pass with 0.20mm.

Alignment methods and procedure:

1) Select Sample Probe Cuvette Height.
2) Check that cuvettes are loaded in 35#, 4# and 66# positions of the reaction carousel.
3) Adjust the sample probe over the 3 cuvette positions, and ensure that the lifting height meets the requirement.
4) Select Continue to save parameters and exit the window.

7.6.7 Sample Probe Rotary to ISE (Medica ISE Module Configured)

Alignment index:

The sample probe has its tip above the ISE sample injection port but deviates slightly from the central hole. The probe tip should not contact with the inwall of the sample inject port.

Alignment methods and procedure:

1) Ensure the ISE has been installed.
2) Select S Probe Rotary to ISE.
3) According to Step 3, select the down arrow button to lower the sample probe to above the ISE sample injection port. Select the left/right arrow buttons to adjust the sample probe radially till it is 1mm away from the center of the sample injection port or deviating slightly from the central hole. The probe tip should not contact with the inwall of sample inject port.
4) If the sample probe fails by adjusting parameters, loose the screws fixing the ISE module on the chassis, and then move it till requests are met.
5) If the problem still remains, use a cross head screwdriver to loosen the screws on the ISE module and move it till requests are met.
6) The operation in Step 3 is verified in Step 4. If requirements are not met, return to Step 3.
7) Select Continue to save parameters and exit the window.

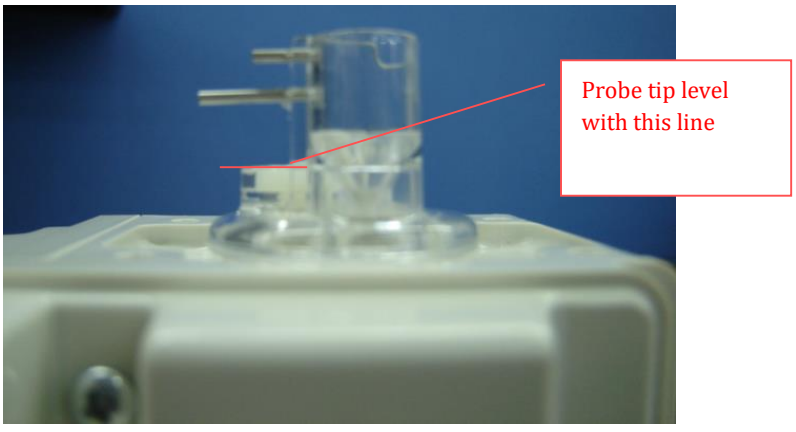
7.6.8 Sample Probe Rotary to ISE Vertical Extreme Height (Medica ISE Module Configured)

Alignment index:

The sample probe has its tip level with the third transition line in the sample injection port.

Alignment methods and procedure:

1) Check if the S Probe Rotary to ISE Horizontal Position alignment has been completed.
2) Select S Probe Rotary to ISE Vertical Height
3) According to Step 3 on the screen, select the up/down arrow buttons to make the probe tip level with the third transition line inside the sample injection port. (You can see three transition lines, and the probe tip shall be level with the one at the bottom, as shown in the figure below.)
4) The operation in Step 3 is verified in Step 4. If requirements are not met, return to Step 3.
5) Select Continue to save parameters and exit the window.



NOTE

- **Alignment of each position is verified the next step.**
- **Alignment parameters can be saved only after each procedure is complete. Another alignment is required if a procedure is terminated.**
- **If the parameter is not successfully configured or out of range, the parameter range will be displayed by the alarm message and re-perform the alignment.**

7.6.9 Sample Probe Rotary to ISE (Caretium ISE Module Configured)

Alignment index:

The sample probe has its tip above the ISE sample injection port but deviates slightly from the central hole. The probe tip should not contact with the inner wall of the sample inject port.

Alignment methods and procedure:

19) Check if the ISE module has been installed.
20) Select Sample Probe Rotary to ISE.
21) In Step 3, select the down arrow button to lower the sample probe to above the ISE sample injection port. Select the left/right arrow buttons to adjust the sample probe radially till it is 1-2 mm away from the center of the sample injection port or deviating slightly from the central hole.
22) If the sample probe fails by adjusting parameters, loosen the retaining screw on the ISE sample cup and move it till requests are met.
23) The operation in Step 3 is verified in Step 4. If requirements are not met, return to Step 3.
24) Select Continue to save parameters and exit the window.

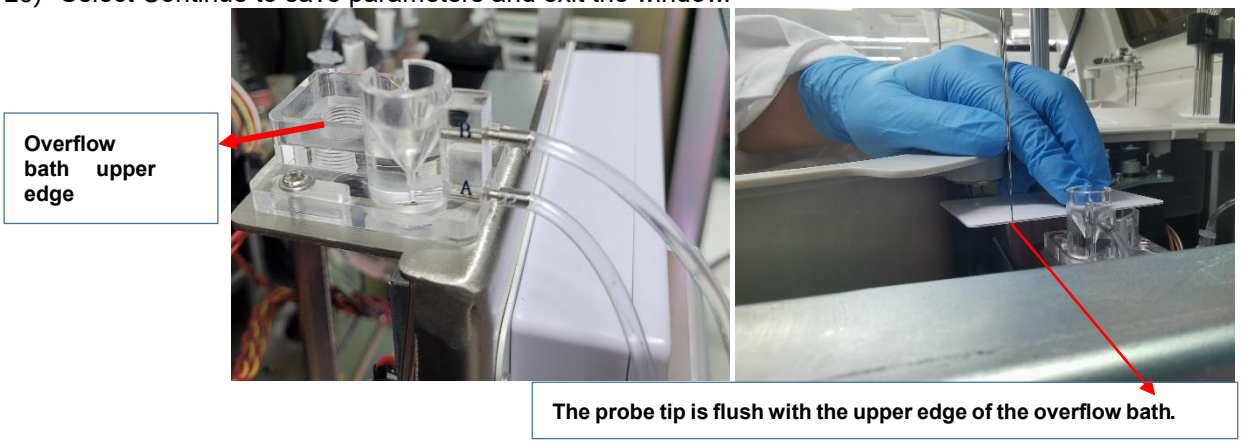
7.6.10 Sample Probe Rotary to ISE Vertical Extreme Height (Caretium ISE Module Configured)

Alignment index:

The sample probe tip should be level with the top edge of the overflow bath and not contact with the interior of the sample injection port.

Alignment methods and procedure:

16) Check if the alignment of Sample Probe Rotary to ISE has been completed.
17) Select Sample Probe Rotary to ISE Vertical Extreme Height.
18) In Step 3, select the up/down arrow buttons to make the probe tip level with the top edge of the overflow bath.
19) The operation in Step 3 is verified in Step 4. If requirements are not met, return to Step 3.
20) Select Continue to save parameters and exit the window.

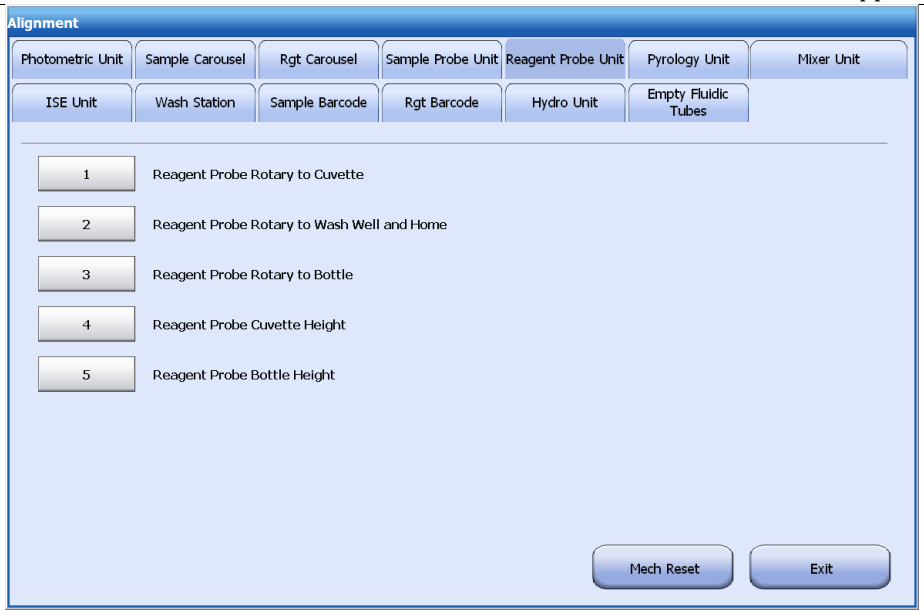


NOTE

- **Alignment of each position is verified the next step.**
- **Alignment parameters can be saved only after each procedure is complete. Another alignment is required if a procedure is terminated.**
- **If the parameter is not successfully configured or out of range, the parameter range will be displayed by the alarm message and re-perform the alignment.**
- **After adjusting the horizontal and vertical positions, make sure the probe tip does not touch the wall.**
- **To adjust it precisely to the upper edge of the overflow bath, take out a flat card (such as the RFID card or work card in the reagent pack), place it in the overflow bath, and adjust the sample probe to the plane where the card and the upper edge of the overflow bath after returning from step 4 to step 3.**

7.7 Reagent Probe Unit

Select Utility—>Maintenance—>Alignment—>Reagent Probe Unit. The screen is as shown below.



7.7.1 Reagent Probe Rotary to Cuvette

Alignment index:

The reagent probe (fixture: BA60-J07 pseudo probe) can pass through the through hole of the cuvette alignment fixture (BA2K-J12) in the reagent probe best alignment position, without interfering with the cuvette wall in the forward and reversed maximum deviating positions.

Alignment methods and procedure:

1) Select Reagent Probe Rotary to Horizontal Position of Reagent Carousel.
2) Place the cuvette alignment fixture (BA2K-J12) in the best alignment cuvette position of the reaction carousel, and then select Continue.
3) Select the down arrow button to lower the reagent probe to above the alignment fixture so that it can align with the central hole.
4) Adjust the probe arm circumferentially till the probe can enter the central hole on the alignment tool. Press the probe arm and tighten the screws on it. If there is deviation when the screws are tightened, select the left/right arrow buttons to adjust the parameter till requirements are met.
5) Check the alignment result. If the requirements are not met, return to the previous step and adjust again.
6) Ensure that the forward and reversed maximum deviating positions displayed on the screen are holding cuvettes. Check that the probe does not interfere with the cuvette wall when it moves to the center of the forward maximum deviating cuvette position. Select Continue to go to the next step.
7) When the probe moves to the reversed maximum deviating cuvette position, check that it does not interfere with the cuvette wall. Select Continue to go to the next step.
8) Select Continue to save parameters and exit the window.

7.7.2 Reagent Probe Rotary to Wash Well and Home

Alignment index:

- Alignment of the horizontal position should satisfy the following two conditions: ① The reagent probe can enter the central hole on the wash well alignment tool (BA48-J12). ② The gap between the reagent probe wash well and the fixture shell is even.
- Vertical position: When reaching the bottom of the central hole on the wash well alignment fixture (BA48-J12), the reagent probe is lifted for 0.15mm, which means that the clearance gauge can pass with 0.15mm through the gap between the sensor plate and the arm base and it cannot pass with 0.20mm.

Alignment methods and procedure:

1) Select Reagent Probe Rotary to Wash Well and Home.
2) According to Step 2 on the screen, place a wash well alignment tool (BA48-J12) in the reagent probe wash well, and then select Continue.
3) According to Step 3 on the screen, select the up/down and left/right arrow buttons to move the reagent probe so that it can lower into the center on the alignment tool. If the reagent probe is greatly deviating from the alignment tool, use a big cross screwdriver to loosen the two screws on the wash well, adjust the wash well till the reagent probe can enter into the central hole on the alignment tool and the gap between the wash well and the fixture shell is even, and then tighten the screws.

4) The operation in Step 3 is verified in Step 4. If requirements are not met, return to Step 3.
5) According to Step 5, adjust the reagent probe's vertical position above the wash well by using the up and down arrow buttons. Check that the clearance gauge can pass with 0.15mm and cannot pass with 0.20mm.
6) The alignment is verified in Step 6. If requirements are not met, return to Step 5.
7) Select Continue to save parameters and exit the window.

7.7.3 Reagent Probe Rotary to Bottle

Alignment index:

Probe (pseudo probe BA60-J07) can pass through the central hole of the reagent bottle position alignment fixture (BA43-J10) in 1#, 16# and 31# positions of the reagent carousel outer ring, and 47#, 62# and 77# positions of the reagent carousel inner ring.

Alignment methods and procedure:

1) Select Reagent Probe Rotary to Bottle.
2) Place the alignment fixture with its outer ring hole corresponding to 1#, 16# and 31# positions of the reagent carousel outer ring, and then select Continue.
3) Follow the software prompts to adjust the reagent probe's position in 1#, 16# and 31# positions of the reagent carousel outer ring. Select the down arrow button to lower the reagent probe to the top of the fixture so that it can align with the hole. Select the left/right arrow buttons to adjust the reagent probe circumferentially till it can enter the central hole of the fixture.
4) After adjusting the reagent probe's position on the reagent carousel outer ring, place the fixture with its inner ring hole corresponding to 47#, 62# and 77# positions of the reagent carousel inner ring. Then, adjust the reagent probe's position on inner ring according to step 3.
5) Select Continue. The alignment is complete. Select Exit to close the window.

7.7.4 Reagent Probe Cuvette Height

Alignment index:

When reaching the cuvette bottom, the reagent probe is lifted for 0.15mm, which means that the clearance gauge can pass with 0.15mm through the gap between the sensor plate and the arm base and it cannot pass with 0.20mm.

Alignment methods and procedure:

1) Select R Probe Cuvette Height.
2) According to Step 3, select the up/down arrow buttons to adjust the reagent probe's lifting height till a 0.15mm clearance gauge can pass through and a 0.2mm cannot.
3) In Steps 4 and 5, adjust the vertical extreme position of the probe in the remaining two positions according to Step 3.
4) Select Continue to save parameters and exit the window.

7.7.5 Reagent Probe Bottle Height

Alignment index:

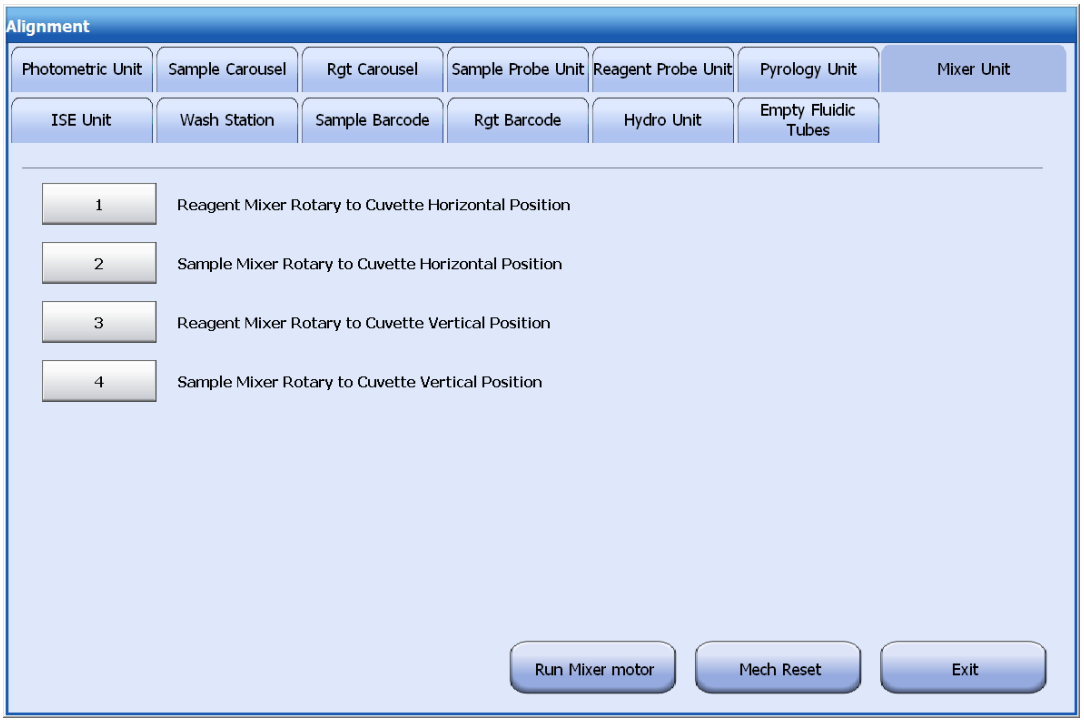
When reaching the bottle bottom, the reagent probe is lifted for 0.15mm, which means that the clearance gauge can pass with 0.15mm through the gap between the sensor plate and the arm base and it cannot pass with 0.20mm.

Alignment methods and procedure:

1) Select Reagent Probe Bottle Height. The reagent probe resets mechanically.
2) According to Step 2, place empty reagent bottles in #1, #16 and #31 positions of the reagent carousel outer ring.
3) According to Step 3, select the up/down arrow buttons to adjust the reagent probe's lifting height till a 0.15mm clearance gauge can pass through and a 0.20mm cannot.
4) Adjust the vertical extreme position of the probe in the remaining two positions according to Step 3.
5) Select Continue to save parameters and exit the window.

7.8 Mixer Unit

Select Utility—>Maintenance—>Alignment—>Mixer Unit. The screen is as shown below.



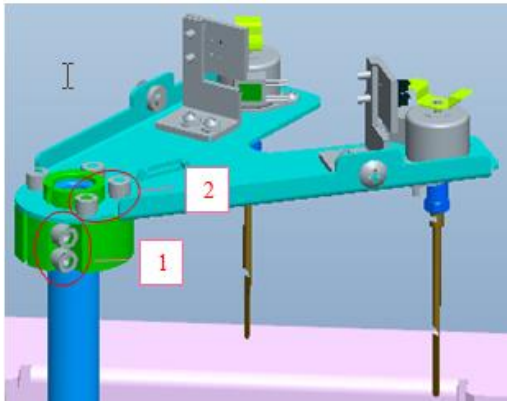
7.8.1 Reagent Mixer Rotary to Horizontal Position of Reaction Carousel

Alignment index:

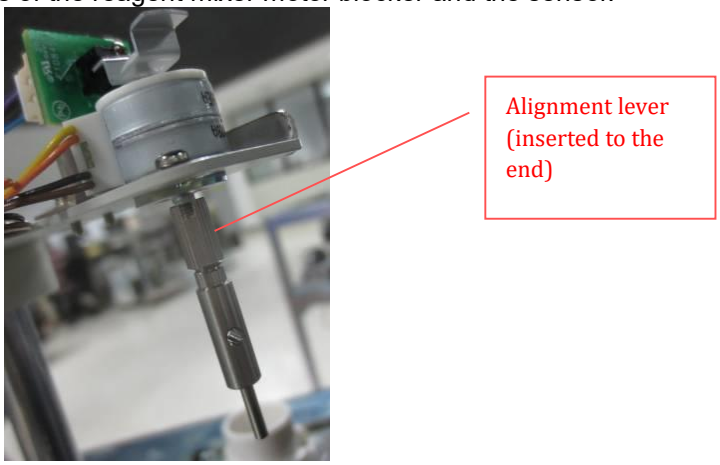
- The reagent mixer (mixer alignment lever BA49-J05) can pass the through hole of the mixer horizontal position alignment cuvette (BA2K-J04-001) in position 90# of the reaction carousel.
- When the mixer motor stopper contacts with the inner side of the alignment tool (BA49-J20), it does not interfere with the alignment tool to jam as you rotate it manually. (No fixture is needed on the other side of the stopper.) When you remove the fixture and rotate the stopper, the stopper does not interfere with the photocoupler on its two sides.

Alignment methods and procedure:

1) Install the reagent and sample mixer alignment fixture BA49-J05, and then select Mixer to Horizontal Position on Reaction Carousel.
2) Place the mixer horizontal position alignment fixture (BA2K-J04-001) in position 90# of the reaction carousel body.
3) In Step 3, select the up/down arrow buttons to lower the alignment lever (BA49-J05) to the top of the mixer horizontal position alignment fixture (BA2K-J04-001). Use an M3 hexagon wrench to loosen the retaining screw as shown in the following figure, align the lever with the center of the alignment tool, and then slightly press the arm to tighten it in the sequence as shown in the following figure. If the lever is not radially enough, use a cross head screwdriver to adjust the motor till the lever align with the alignment tool.



4) If the lever is not correct horizontally, select the left/right arrow buttons in Step 4 to adjust so that it can align with the alignment tool.
5) The operation in Step 4 is verified in Step 5. If requirements are not met, return to Step 4.
6) Select Continue, remove the fixture and store it properly.
7) As shown in 8.2, adjust the positions of the reagent mixer motor blocker and the sensor.



7.8.2 Adjusting Positions of Mixer Motor Stopper and Sensor

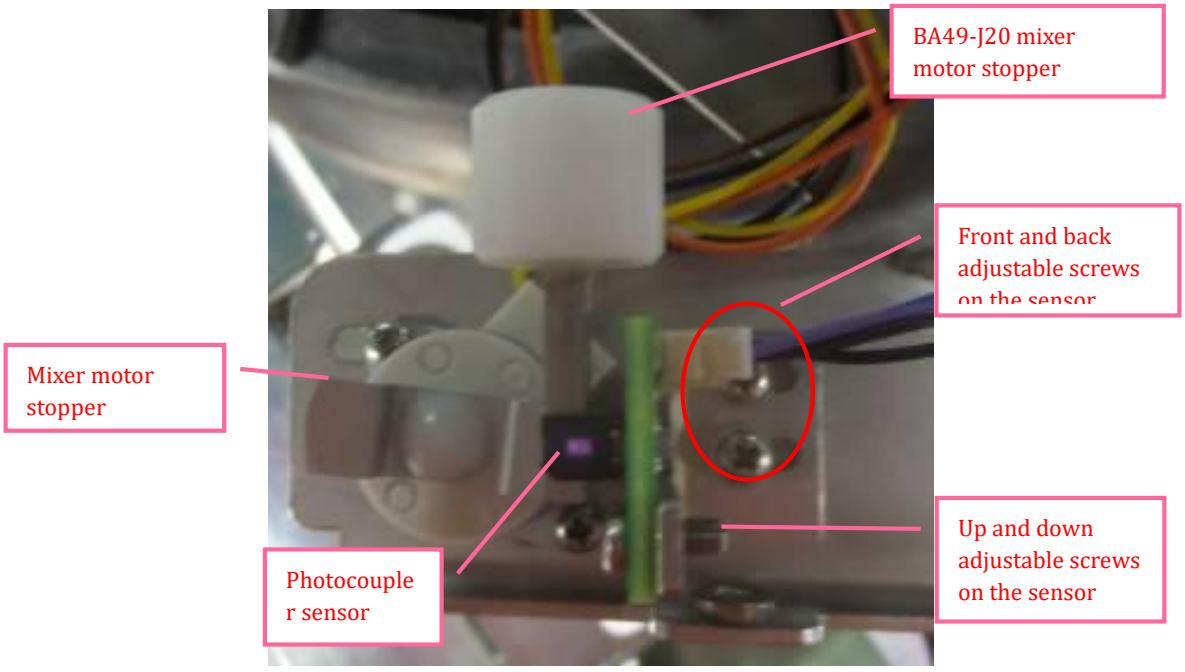
Alignment index:

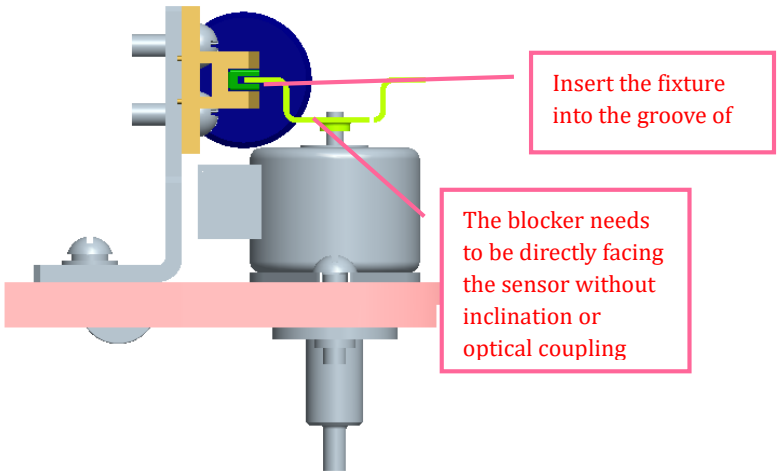
When the mixer motor stopper contacts with the inner side of the alignment tool (BA49-J20), it does not interfere with the alignment tool to jam as you rotate it manually. (No fixture is needed on the other side of the stopper.) When you remove the fixture and rotate the stopper, the stopper does not interfere with the photocoupler on its two sides.

Alignment methods and procedure:

Tip: This procedure should be performed after the alignment of Mixer Rotary to Cuvette is done. If the motor position has been adjusted, perform this procedure.

1) Insert the alignment tool into the slot of the sensor and the slot of the tool faces outward.
2) Manually rotate the motor stopper to the groove on the alignment fixture. The stopper should contact the groove when being opposite to the sensor, and it should not interfere with the fixture to jam as you rotate it manually. If not, adjust the screws on the sensor bracket till the requirements are met. (When adjusting the stopper on the other side, do not use the alignment fixture but rotate it to avoid interfering with the photocoupler.)
3) After alignment, remove the alignment tool and check that the stopper can be rotated opposite to the sensor without deviation or interference. If not, adjust again until the requirements are met.





7.8.3 Sample Mixer Rotary to Horizontal Position of Reaction Carousel

Alignment criteria: The mixer (mixer alignment lever BA49-J05) can enter the through hole of the mixer horizontal position alignment cuvette (BA2K-J04-001) in position 81# of the reaction carousel.

Alignment methods and procedure:

1) Make sure that the mixer alignment fixture BA49-J05 is installed, and then select Mixer to Horizontal Position on Reaction Carousel.
2) Place the mixer horizontal position alignment fixture (BA2K-J04-001) in position 81# of the reaction carousel body.
3) In Step 3, select the up/down arrow buttons to lower the alignment lever (BA49-J05) to the top of the mixer horizontal position alignment fixture (BA2K-J04-001). Use a cross head screwdriver to adjust the motor till the lever align with the alignment tool in radial direction.
4) If the lever is not correct horizontally, select the left/right arrow buttons in Step 4 to adjust so that it can align with the alignment tool in circumferential direction. Also make sure that the reagent mixer does not interfere with the wash well.
5) The operation in Step 4 is verified in Step 5. If requirements are not met, return to Step 4.
6) Select Continue. Make sure that the sample mixer does not interfere with the wash well. Then, remove the fixture from the sample mixer position.
7) Select Continue, and properly place the reaction carousel.
8) As shown in 8.8.2, adjust the positions of the sample mixer motor blocker and the sensor.

7.8.4 Run Mixer Motor

Alignment index: When the mixer motor is running, no abnormal rotation alarm is given and the motor stopper should not interfere with the photocoupler.

Alignment methods and procedure:

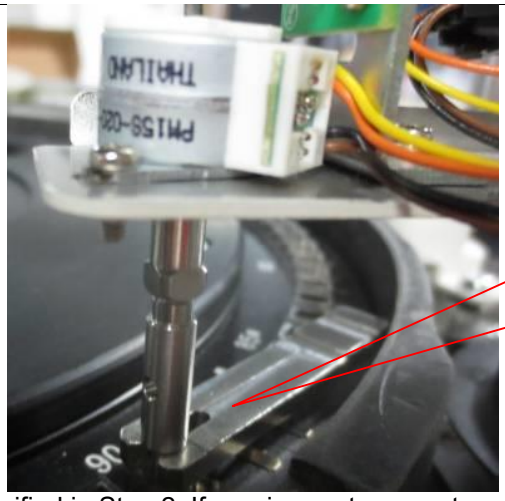
Select Run mixer motor, and check that the reagent and sample mixers can rotate normally without alarms.

7.8.5 Reagent Mixer Height

Alignment index: The lever lowers into the cuvette, the gap between which the go gauge of the mixer alignment tool (BA49-J09) can pass and the no-go gauge cannot.

Alignment methods and procedure:

1) Select Reagent Mixer Height. Make sure the reagent mixing position is holding a cuvette instead of alignment tool.
2) Select Continue. After the system resets mechanically, the reagent mixer moves into the cuvette.
3) Select the up/down arrow buttons, and insert the alignment tool (BA49-J09) between the mixer's straight-knurled column and cuvette edge. Gently push the alignment tool to observe if the Go Gauge can easily pass while the No-go Gauge cannot.



4) The operation in Step 3 is verified in Step 2. If requirements are not met, return to Step 2.
5) Select Continue to save parameters and exit the window.

7.8.6 Sample Mixer Height

Alignment index: The lever lowers into the cuvette, the gap between which the go gauge of the mixer alignment tool (BA49-J09) can pass and the no-go gauge cannot.

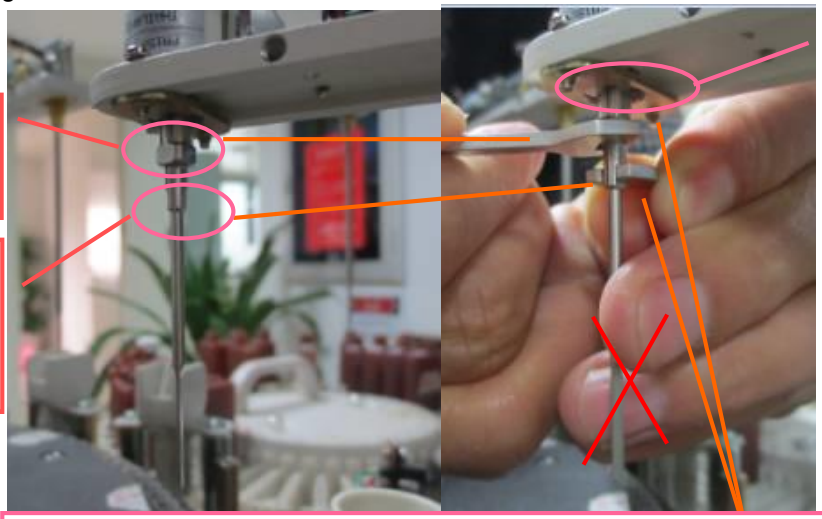
Alignment methods and procedure:

1) Select Sample Mixer Height. Make sure the sample mixing position is holding a cuvette instead of alignment tool.
2) Select Continue. After the system resets mechanically, the sample mixer moves into the cuvette.
3) Select the up/down arrow buttons, and insert the alignment tool (BA49-J09) between the mixer's straight-knurled column and cuvette edge. Gently push the alignment tool to observe if the Go Gauge can easily pass while the No-go Gauge cannot (see the preceding figure).
4) The operation in Step 3 is verified in Step 2. If requirements are not met, return to Step 2.
5) Select Continue to save parameters and exit the window.

7.8.7 Replacing Mixer

Methods and procedure:

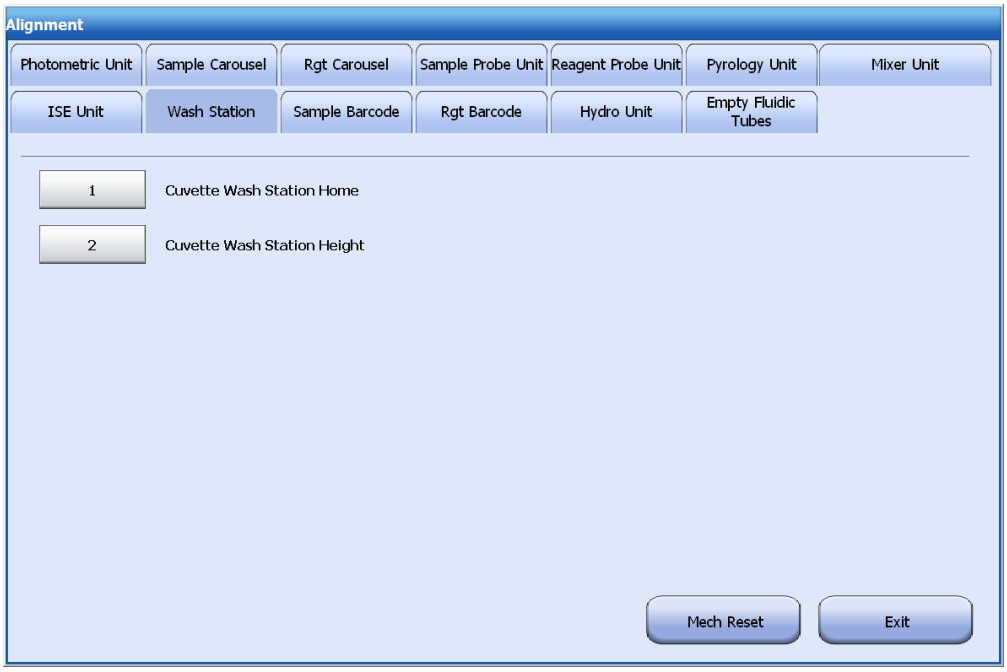
1 Replace the alignment tool mixer with the actual mixer, and use two BA60-J21 tools to fix it properly.



Two BA60-J21 tools:
1. Manually screw the mixer onto the motor shaft. Make sure the mixer is inserted to the bottom properly.
2. Stuck the small opening of a wrench at the wrench position of the mixer, stuck the large opening of the other wrench at the position for nut fastening. Rotate the two wrenches in opposite directions until the nut is fastened (evenly apply force to avoid the motor shaft from being bent). Note: Do not touch the mixer during nut fastening. Otherwise, the mixer may deform.

7.9 Alignment of Cuvette Wash Unit

Select Utility -> Maintenance -> Alignment -> Cuvette Wash Station. The screen is as shown below.



7.9.1 Cuvette Wash Station Home

Alignment index:

The wipe blocks can move smoothly in the hole of the wash station position alignment rod (BA2K-J09-001), phase-1 wash probe can enter into the hole on the wash probe position alignment cylinder (open) (BA43-J03), and wash probes of other phases are in the center of the cuvettes.

Alignment methods and procedure:

1) Select Cuvette Wash Station Home.
2) Remove cuvettes under the wash probes of phases 1, 7 and 8, and place alignment tools instead, including two alignment rods (BA2K-J09-001) and one auxiliary alignment tool (BA43-J03). Make sure the alignment tool under phase-1 wash probe faces the probe with its opening. Select Continue.
3) According to Step 3 on the screen, use an M4 hexagon wrench to loosen the two screws on the wash probe conversion board, adjust the wash probes till the wipe blocks can move vertically in the hole of the alignment rod, and the wash probes of other phases are in the center of the cuvettes. When requests are met, tighten the two screws gradually. Exercise caution to prevent deforming the probes. Then remove the phase 1 probe and align it with the alignment tool. Place the cuvette properly and move the wash station with your hand. Ensure the wipe block of the wash station align with the center of the tool and other wipe blocks align with the center of the cuvettes. The wipe blocks can move vertically in the hole of the alignment tool and no interference is found. If the wipe block interferes with the alignment tool, realign till the requirement is met. Click Continue.
4) The operation in Step 3 is verified in Step 4. If requirements are not met, return to Step 3.
5) In Step 5, the reaction carousel rotates to the forward maximum deviating cuvette position. Click the up and down arrow buttons to move the wash station so that the wipe blocks and wash probes are in the center of the cuvettes and can move smoothly.
6) In Step 6, the reaction carousel rotates to the reversed maximum deviating cuvette position. Click the up and down arrow buttons to move the wash station so that the wipe blocks and wash probes are in the center of the cuvettes and can move smoothly.
7) Select Continue to save parameters and exit the window.
8) Remove the alignment tools and restore cuvettes.

7.9.2 Cuvette Wash Station Height

Alignment criteria: When the wash station lowers to the vertical washing position, the wash probes bounce for 0.6 to 0.8mm, which means that the clearance gauge can pass with 0.6mm through the gap between the anti-collision blocks and the wash station bracket and it cannot pass with 0.8mm.

Alignment methods and procedure:

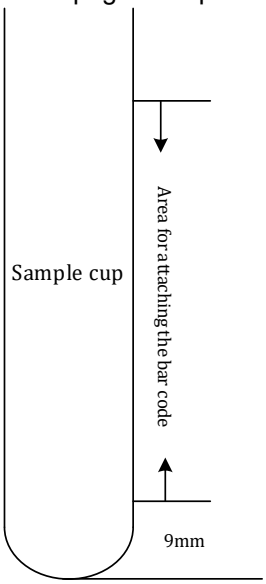
1) Select Cuvette Wash Station Height.
2) Check if the wipe blocks can insert into the center of each cuvette. Select Continue.

3) When the wash probes move vertically to the bottom of the cuvettes, make them contact the cuvette bottom. Select Small Step or Large Step and click the up/down arrow buttons to adjust the probes, and measure the lifting height with a 0.6mm and 0.8mm clearance gauge. Make sure the gap between the anti-collision blocks and the wash station bracket can let go the 0.6mm clearance gauge and cannot let go the 0.8mm one.
4) Verify Step 3. If requests are not met, return to Step 3, and select the up/down arrow buttons to adjust the mixer till requests are met.
5) Select Continue to save parameters and exit the window.

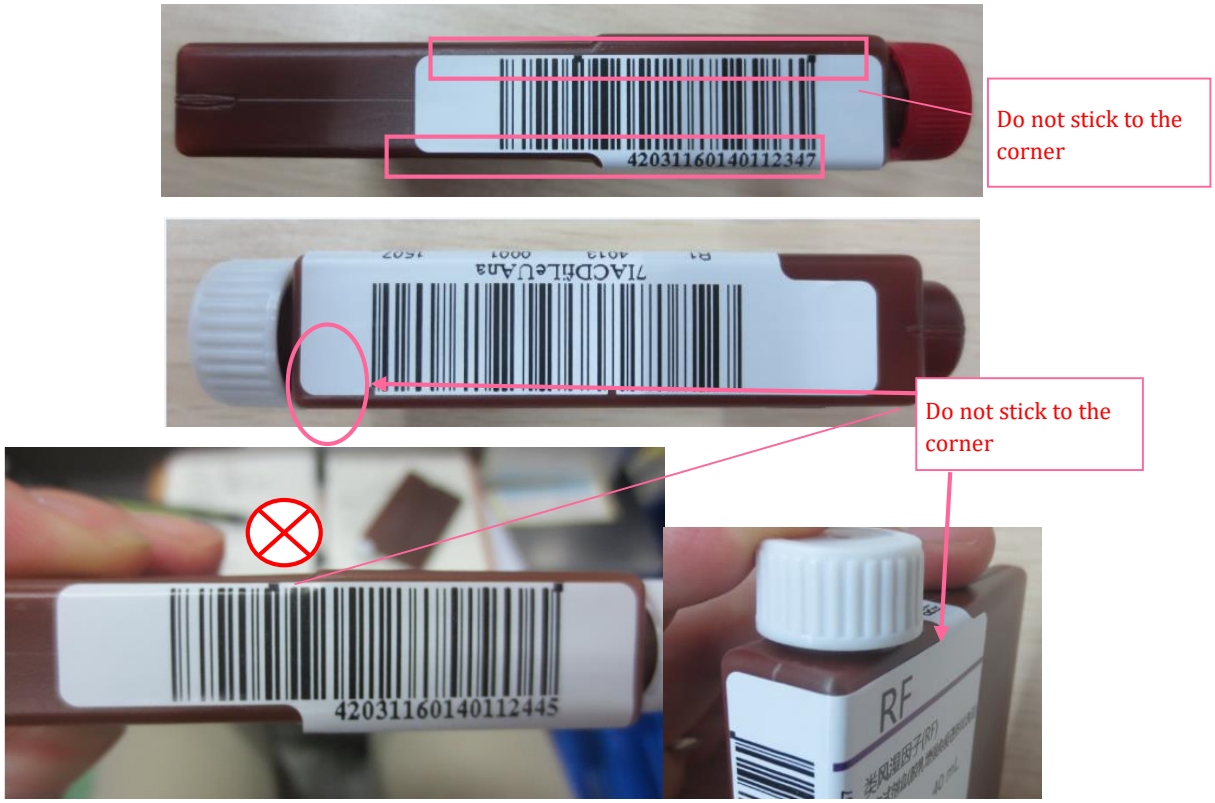
7.10 Bar Code Unit (Optional)

7.10.1 Bar Code Sticking Requirements

1) The bar code label should be clear, and not vague, dirty or scratched.
2) The sample bar code label should be stuck upright and plane and 9mm away from the tube bottom.

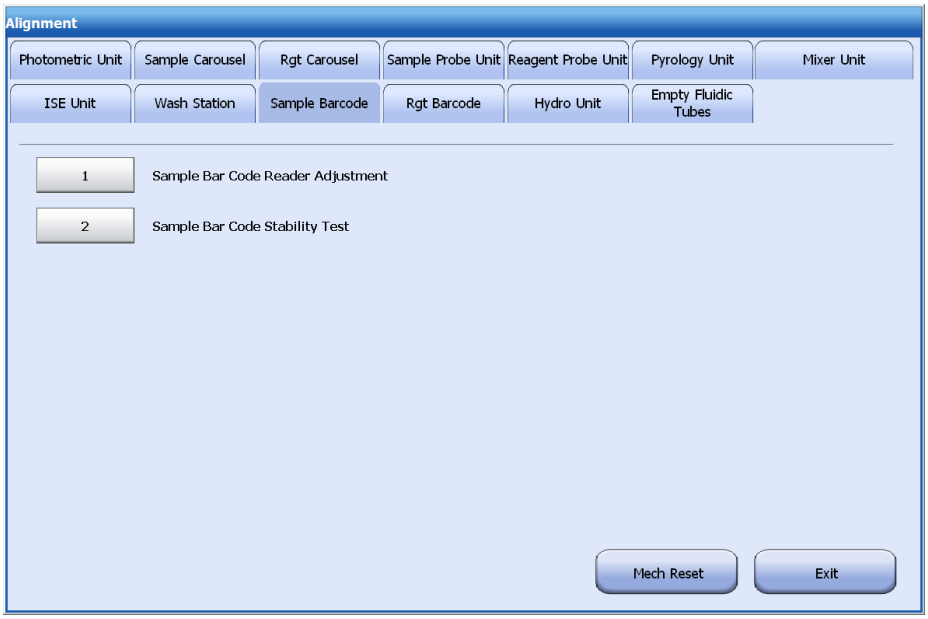


3) The reagent bar code label should be stuck in the front side below the bottle opening, and in the middle of the vertical and horizontal directions.



7.10.2 Sample Barcode Unit

Select Utility -> Maintenance -> Alignment -> Sample Barcode.



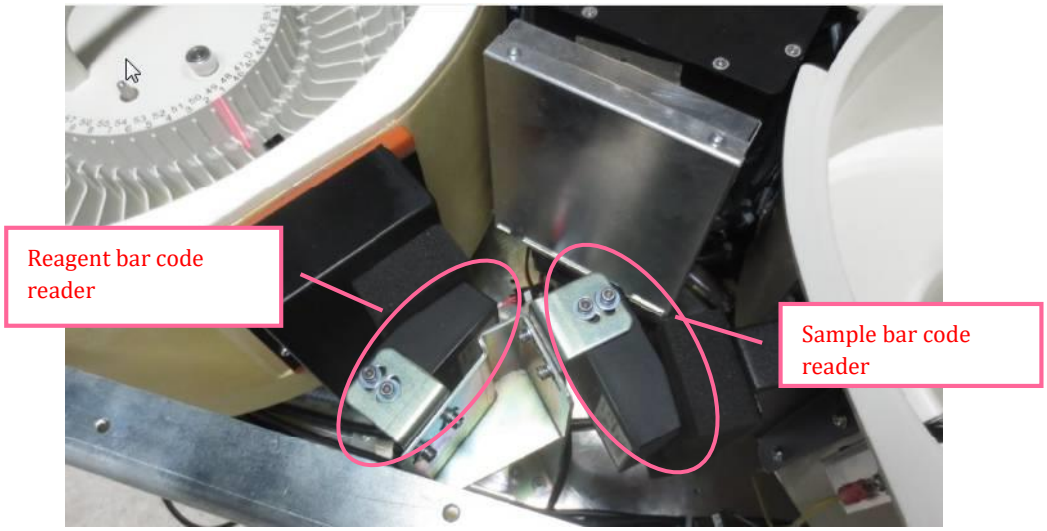
7.10.3 Sample Bar Code Reader Adjustment(MS-3)

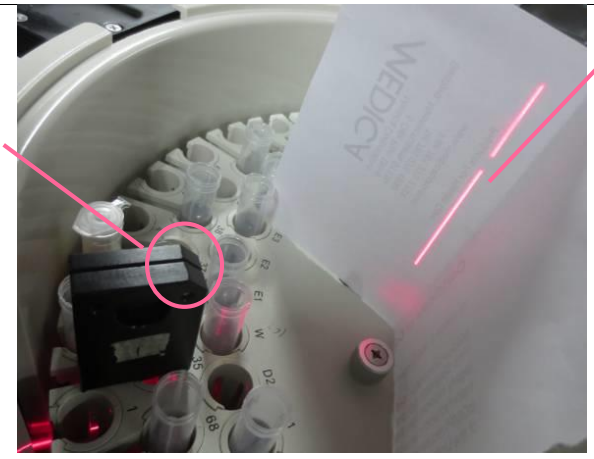
Alignment index:

- The light beam transmitted from the bar code reader can pass through the slit on the bar code reader alignment tool (BA43-J05) of the sample carousel.
- 2 The bar code in 1- 5# and 35 - 39# positions of the sample carousel can be identified correctly and completely and displayed on the screen.

Alignment methods and procedure:

1) Select Sample Bar Code Reader Adjustment.
2) Place a sample bar code reader alignment tool (BA43-J05) in position 35# of the sample carousel middle ring, and then select Continue.
3) If the light does not go through the fixture slit, loosen the two screws on the bar code reader to adjust the incident angle. If the light beam is wider than the fixture slit, adjust the bar code reader to allow the left of the light beam (counter-clockwise) to go through the slit. If the light beam is not vertical, adjust the two screws on the small bracket till requests are met. Tighten the screws.





4) In Step 3, if the light is slightly deviating in circumferential direction, use the left/right arrow buttons to rotate the sample carousel till requests are met.
5) Remove the alignment tool in position 35#, and place bar-coded sample tubes in position 1-5 and 35-39. (The bar code label must be clean without dirt or scratches, and 13mm away from the tube bottom with inclination angle less than 5º.) When scanning is finished, check if the identified bar code is correct. If some bar code cannot be read, replace the relevant tube with another one having complete bar code. Repeat this step.
6) If all bar code cannot be read, check if the light direction meets the requirement and the bar code reader works normally.
7) Select Continue to save parameters and exit the window.

7.10.4 Sample Bar Code Reader Adjustment(BCL95)

Alignment Index

 The light beam transmitted from the bar code reader can pass through the slit on the bar code reader alignment tool (BA43-J01).

The 1~5# and 47~51# barcodes of the reagent carousel can be identified completely and displayed on the screen, and the barcodes are correct without error or omission, and the displayed position jumps.

Alignment methods and steps:

1) Select reagent Bar Code Reader Alignment.
2) Click the left and right arrow to adjust reagent carousel position until the alignment tool (BA43-J02) can be easily inserted into the groove between outer rings 2# and 3# of the reagent carousel. Before fine tuning the parameters, ensure that the alignment tool has been removed, otherwise the reagent carousel may be damaged. Check if the reagent carousel alignment tool can easily insert into the slot and then remove it. Note: If proper position can not be adjusted to by the adjustment of parameters, tighten the reagent coder sensor and try to fix it in the middle.

3) Place the bar code reader adjustment fixture (BA43-J01) in the gap between positions 2#~3# on the outer ring of the reagent carousel. If the light does not go through the fixture slot in parallel and fully, loosen the two screws fixing the scanner to adjust the incident angle. If the light beam is wider than the

fixture slot, adjust the bar code reader to allow the left of the light beam (counter-clockwise) to go through the slot and fall in the laser receiving area. If the light beam is not vertical, adjust the two screws on the small bracket till requests are met. Tighten the retaining screws repeatedly until the requirements are met or approximate requirements.

4) In Step 3, if the light is slightly deviating in radial direction, use the left/right arrow buttons to rotate the reagent carousel till requests are met.
5) Remove the alignment tool, place bar-coded reagent bottles at position 1-5# and 47-51#, scan the bar codes, and check whether all the bar codes are correct. If some bar code cannot be read, replace the tube with another one having complete bar code. Repeat this step.
6) If all bar code cannot be read, check if the light direction meets the requirement and the bar code reader works normally.
7) Select Continue to save parameters and exit the window.

NOTE

- **Make sure the sponge of the window seals the bar code reader completely and does not block the scanning light. Otherwise, readjust the bar code reader's position.**

7.10.5 Sample Bar Code Stability Test

Alignment index:

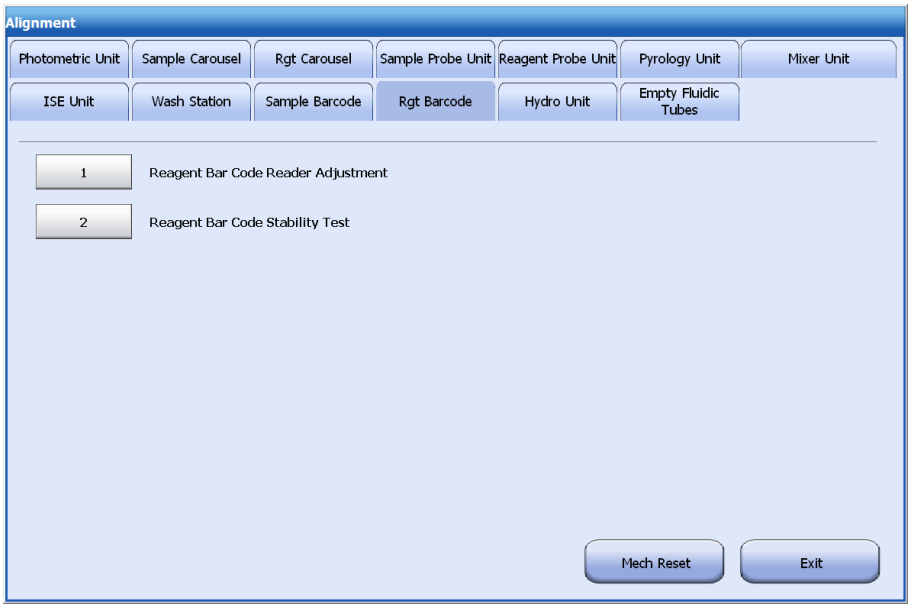
- When the sample carousel rotates for several circles, the bar code identified in the same position should be the same.
- The bar code in 1-68# positions of the sample carousel can be identified correctly and completely and displayed on the screen.

Alignment methods and procedure:

1) Place bar-coded sample tubes in 1# to 34# positions on the outer ring and in 35# to 68# positions on the middle ring of the sample carousel.
2) Select Sample Bar Code Stability Test, set the scan circle as 10, and select Start.
3) After scanning, check if the identified bar code meets the requirement. If different bar code is read in the same position, the position will be indicated in red.
4) If the stability test fails, find the reasons and take actions according to the following probabilities:
   a) Check if the failed bar code meets the printing standard, the bar code label is not tilting, dirty or damaged and has been applied in correct position.
   b) Check if the glass scanning window is clean without contamination.
   c) The scanning window is not blocked by the sponge cushion.
   d) If none of the above happens, replace the bar code reader, adjust it properly and do the test again.
   e) Generally, the three methods above are enough to troubleshoot the problem.
5) When the test is finished, select Close.

7.10.6 Reagent Barcode Unit

Select Utility -> Maintenance -> Alignment -> Rgt Barcode.



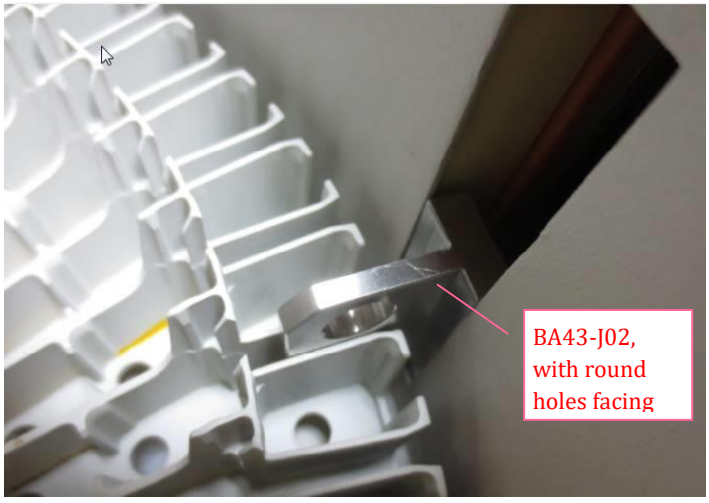
7.10.7 Reagent Bar Code Reader Adjustment (MS-3)

Alignment index:

- The light beam transmitted from the bar code reader can pass through the slit on the bar code reader alignment tool (BA43-J01) of the reagent carousel.
- The bar code in 1-5# and 47-51# positions of the reagent carousel can be identified correctly and completely and displayed on the screen.

Alignment methods and procedure:

1) Select Reagent Bar Code Reader Adjustment.
2) Click the left and right arrow to adjust reagent carousel position until the alignment tool(BA43-J02) can easily insert the groove between the 2# and 3# position on the outer ring of the reagent carousel. Before fine tuning the parameter, ensue the alignment tool has been removed, otherwise the reagent carousel may be damaged. Check if the reagent carousel alignment tool can easily insert into the slot and remove it. Note: If proper position can not be adjusted through the adjustment of parameters. Please re-fix the reagent carousel coder sensor in the middle position.



3) Place a bar code alignment tool (BA43-J01) of reagent carousel in the slot between position 2# and position 3# on the outer ring of the reagent carousel. If the light does not go through the fixture slit, loosen the two screws on the bar code reader to adjust the incident angle. If the light beam is wider than the fixture slit, adjust the bar code reader to allow the left of the light beam (counter-clockwise) to go through the slot and fall in the laser receiving area. If the light beam is not vertical, adjust the two screws on the

small bracket till requests are met. Tighten the screws.

4) In Step 3, if the light is slightly deviating in circumferential direction, use the left/right arrow buttons to rotate the reagent carousel till requests are met.
5) Remove the alignment tool, and place bar-coded reagent bottles in positions 1#-5# and 47#-51#. When scanning is finished, check if the identified bar code is correct. If some bar code cannot be read, replace the relevant tube with another one having complete bar code. Repeat this step.
6) If all bar code cannot be read, check if the light direction meets the requirement and the bar code reader works normally.
7) Select Continue to save parameters and exit the window.

NOTE

- **Check that the sponge cushion seals the bar code reader completely without blocking the scanning light. Otherwise, adjust the bar code reader again.**

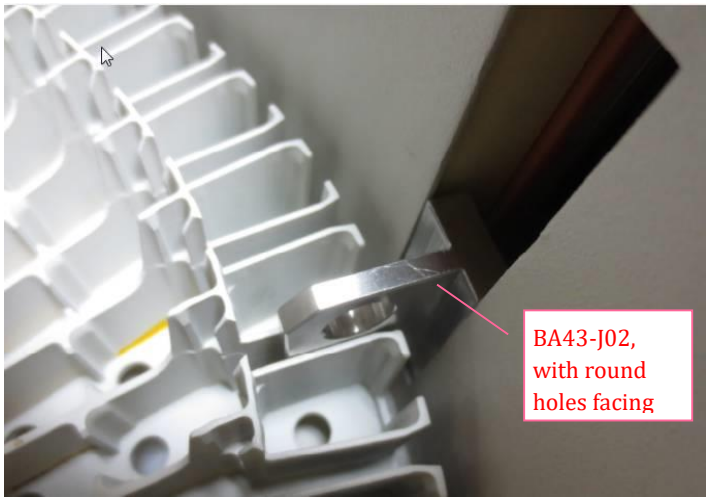
7.10.8 Reagent Bar Code Reader Adjustment (BCL95)

Alignment index:

- The light beam transmitted from the bar code reader can pass through the slit on the bar code reader alignment tool (BA43-J01) of the reagent carousel.
- The bar code in 1-5# and 47-51# positions of the reagent carousel can be identified correctly and completely and displayed on the screen.

Alignment methods and procedure:

8) Select Reagent Bar Code Reader Adjustment.
9) Click the left and right arrow to adjust reagent carousel position until the alignment tool(BA43-J02) can easily insert the groove between the 2# and 3# position on the outer ring of the reagent carousel. Before fine tuning the parameter, ensue the alignment tool has been removed, otherwise the reagent carousel may be damaged. Check if the reagent carousel alignment tool can easily insert into the slot and remove it. Note: If proper position can not be adjusted through the adjustment of parameters. Please re-fix the reagent carousel coder sensor in the middle position.



10) Place a bar code alignment tool (BA43-J01) of reagent carousel in the slot between position 2# and position 3# on the outer ring of the reagent carousel. If the light does not go through the fixture slit, loosen the two screws on the bar code reader to adjust the incident angle. If the light beam is wider than the fixture slit, adjust the bar code reader to allow the left of the light beam (counter-clockwise) to go through the slot and fall in the laser receiving area. If the light beam is not vertical, adjust the two screws on the small bracket till requests are met. Tighten the screws.

During alignment, place a piece of white paper at the back of the scanner. Adjust the scanner position and let the light pass through the gap of the tool. If the light on the white paper is a vertical red line, the alignment is successful. (The position of white paper shown in the figure is for reference only.)

11) In Step 3, if the light is slightly deviating in circumferential direction, use the left/right arrow buttons to rotate the reagent carousel till requests are met.
12) Remove the alignment tool, and place bar-coded reagent bottles in positions 1#-5# and 47#-51#. When scanning is finished, check if the identified bar code is correct. If some bar code cannot be read, replace the relevant tube with another one having complete bar code. Repeat this step.
13) If all bar code cannot be read, check if the light direction meets the requirement and the bar code reader works normally.
14) Select Continue to save parameters and exit the window.

NOTE

- **Check that the sponge cushion seals the bar code reader completely without blocking the scanning light. Otherwise, adjust the bar code reader again.**

7.10.9 Reagent Bar Code Stability Test

Alignment index:

- When the reagent carousel rotates for several circles, the bar code identified in the same position should be the same.
- The bar code in all positions of the reagent carousel can be identified correctly and completely and displayed on the screen. Randomly choose 3 bar codes on the outer ring and inner ring, and check that the bar code displayed on the screen is same as that on the bar code label.

Alignment methods and procedure:

1) Place bar-coded reagent bottles in positions 1#-46# on the outer ring and in positions 47#-92# on the inner ring of the reagent carousel.
2) Select Reagent Bar Code Stability Test, set the scan circle as 10, and select Start.
3) After scanning, check if the identified bar code meets the requirement. If different bar code is read in the same position, the position will be indicated in red.
4) If the stability test fails, find the reasons and take actions according to the following probabilities:
   - Check if the failed bar code meets the printing standard, the bar code label is not tilting, dirty or damaged and has been applied in correct position.
   - Check if the glass scanning window is clean without contamination.
   - The scanning window is not blocked by the sponge cushion.
   - If none of the above happens, replace the bar code reader, adjust it properly and do the test again.

Generally, the three methods above are enough to troubleshoot the problem.

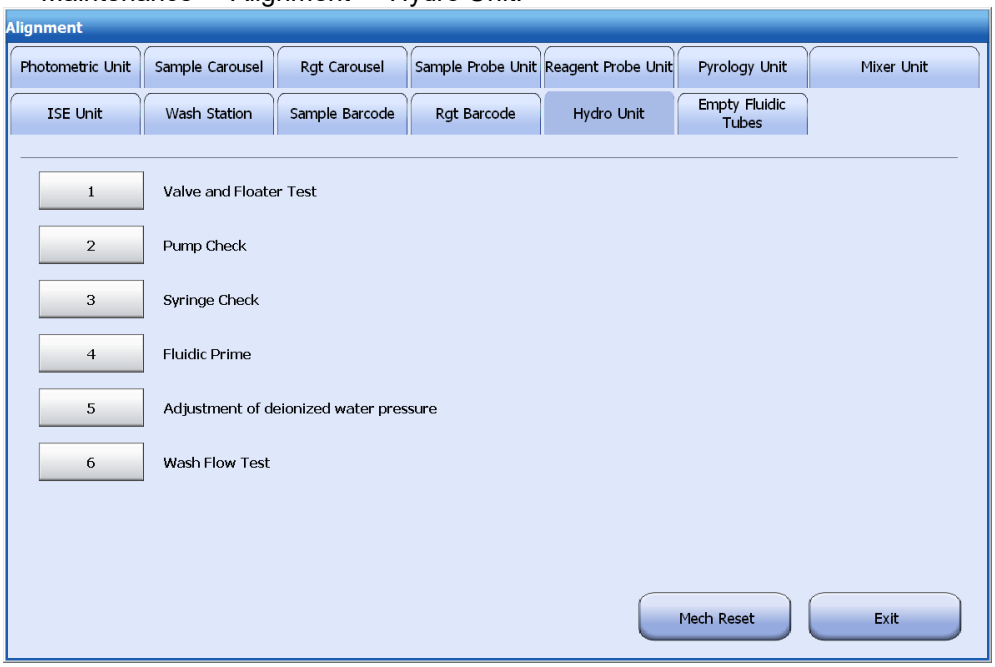
5) When the test is finished, select Close.

NOTE

- **Check that the sponge cushion seals the bar code reader completely without blocking the scanning light. Otherwise, adjust the bar code reader again.**
- **After alignment, check if the screws on the bar code reader and conversion board have been tightened.**

7.11 Hydropneumatic Unit Alignment

Select Utility -> Maintenance -> Alignment -> Hydro Unit.



7.11.1 Preparations Before Alignment

1) Check if all tubes have been connected correctly.
2) Check if the wash tubes on the 8-phase wash probes assembly have been connected properly. If not, first connect the 8-phase aspirating tubes. Visually check that the 8-phase aspirating tubes are inserted with the same depth and not twisted, and all tubes are smooth without crossover or protrusion.
3) Check if the solenoid valves have been connected to the correct cables.
4) The diluted wash solution tank holds sufficient diluted wash solution.

Cuvette Type	Dilution ratio of diluted wash solution 1
Plastic Cuvette	10:1 (water: concentrated wash solution)
Glass Cuvette	50:1 (water:concentrated wash solution)

5) Fill the water tank with sufficient water.
6) Connect the water supply module to the water tank and analyzer, and connect the high-/low-concentration waste tanks.
7) Check if the inlet filter assembly has been installed.
8) Remove the 3 pseudo probes from the sample probe arm and reagent probe arms, and install the real probes instead.

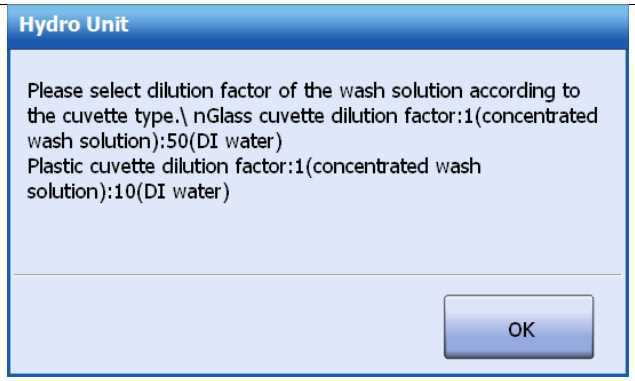
Installation requirements:

a) Gap between the probe plate and the arm surface is not allowed. Otherwise, check the retaining bolt and tube, because the tube's elasticity will also affect the probe's bouncing;
b) Install the earthing wire of the reagent probes;
c) A washer has been applied on the retaining bolt, and the nut has been tightened;
d) After fixing the probe with bolt and spring, manually lift the probe and release it, and check that the probe can bounce back freely through the spring;
e) Adjust the level sense board and the relative positions of the probe plate and photocoupler so that the probe plate is in the middle of the photocoupler.

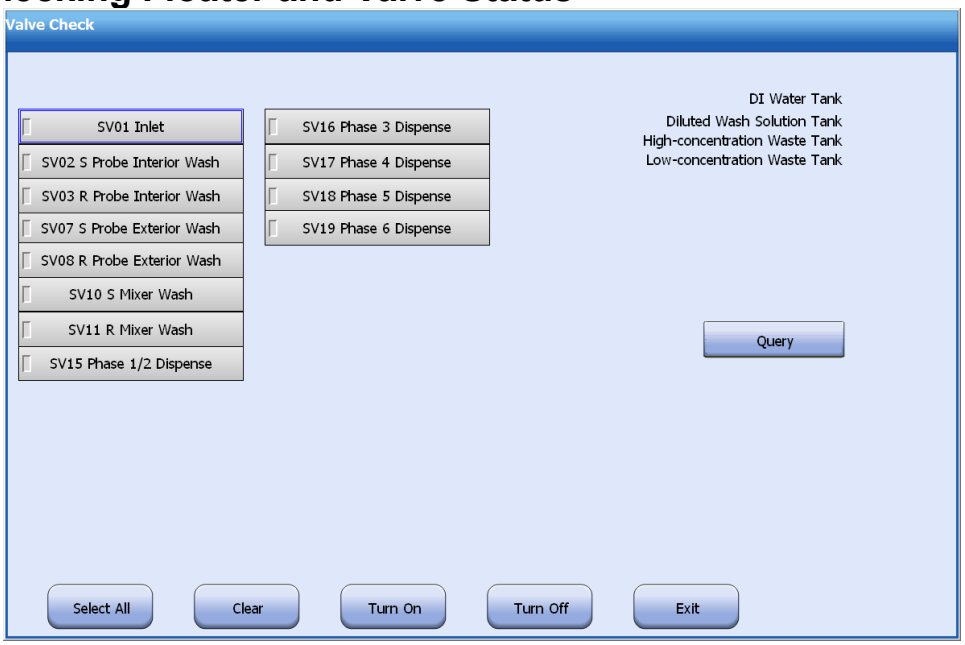
7.11.2 Confirming Diluted Wash Solution

Alignment methods and procedure:

Select Hydro Unit. In the displayed dialog box, check whether the portion of diluted wash solution is consistent with the prompt. If yes, select OK.



7.11.3 Checking Floater and Valve Status

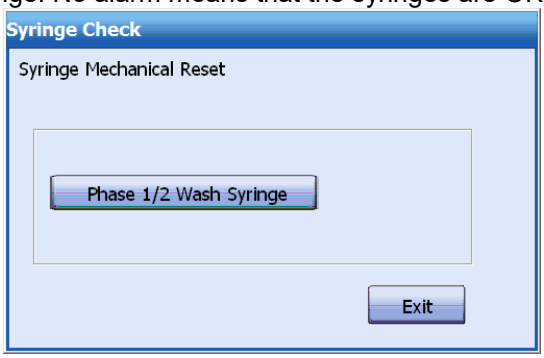


Manually switch the floater status one by one according to the table below, and then select Query to refresh the floater status. Check if the actual fluid level of each container is the same as the status displayed on the screen.

Tank Name	Floater Status	Screen Display
Deionized water tank	Low-level floater (high level) High-level floater triggered (high level)	Full
Deionized water tank	Low-level floater triggered (high level) High-level floater not triggered (low level)	Not empty
Deionized water tank	Low-level floater not triggered (low level) High-level floater not triggered (low level)	Empty
Deionized water tank	Low-level floater not triggered (low level) High-level floater not triggered (high level)	Error
Diluted wash solution tank	Floater triggered (high level)	Not empty
Diluted wash solution tank	Floater not triggered (low level)	Empty
High-concentration waste tank	Floater triggered (high level)	Full
High-concentration waste tank	Floater not triggered (low level)	Not Full

7.11.4 Syringe Check

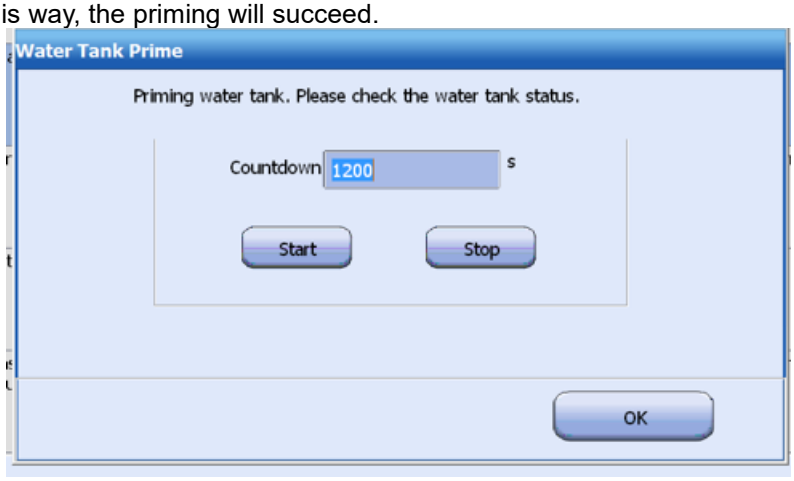
1) Select Syringe Check.
2) Click Phase 1/2 Wash syringe. No alarm means that the syringes are OK.



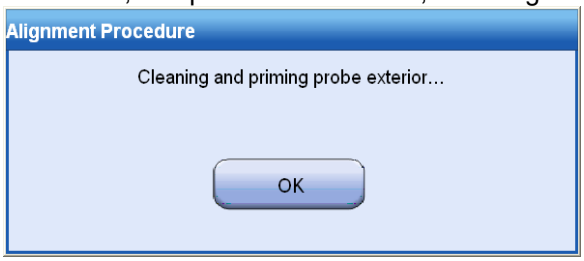
7.11.5 Fluidic Prime

1 Fill the water tank with deionized water for half.

1) Select Fluidic Prime.
2) In Step 2, select Continue. After water tank priming, select OK. Wait for 60 seconds to discharge the air from the DI water circulating pipeline and fill the DI water circulating pump P03 with the DI water in the water tank. In this way, the priming will succeed.



3) Run Step 3. Select Continue to prime the probe exterior and check if the cleaning liquid is sprayed out continuously for 30 seconds without bubbles from the four wash wells. Select OK and Continue to go to the next step. Note: After priming, close the water in the four wash wells in the sequence of sample probe wash well, reagent probe wash well, sample mixer wash well, and reagent mixer wash well.



If the low-concentration waste tank becomes full during the priming, the following message will appear. Check if the low-concentration waste tube is unobstructed. Wait for 3 minutes and then select OK to repeat this step.

4) According to the screen prompts, remove the wash station and put it in an appropriate open container for collecting the residual liquid.
5) Select Start to prime the phase 1-2 wash probes for 100 times, and check the water-spraying of the wash probes. If they can spray out water continuously without bubbles, select Stop to end the priming. Then select OK.
6) Note: Before priming, make sure that the water inlet tube of phase 1-2 is immersed under the liquid in the diluted wash solution tank. Otherwise, the priming efficiency will be affected.
7) Select Continue to prime the phase 3-6 wash probes. A countdown dialog box will display before the priming starts. Check the dispense probes of phase 3-6 till they spray clear water continuously without

bubbles. When the priming is over, observe if the phase 3 to 6 wash probes are stopped in order. If yes, select OK; otherwise, select OK and then select Stop at the lower-right corner. Troubleshoot the error and prime the probes again.

8) Lift the 8-phase wash probe above the liquid level. Select Continue. The waste pump of the 8-phase wash probe will open. Touch the 8-phase wash probe to feel the suction force. If the suction force can be felt, it is acceptable. Keep that for 10 seconds.
9) Restore the 8-phase wash probe back.
10) Select Continue to perform probe interior wash. Observe the water flow. When water continuously flows out from the sample probe and the reagent probe, select OK. Check whether the prime is closed in the sequence of "sample probe interior→reagent probe interior". If yes, go to the next stop. If no, exit the priming process, check the pipe connection, and perform priming again.
11) When performing probe interior wash, you need to manually remove the probe and reagent syringes, pull and push the sample syringe plunger back and forth until there is no air bubbles in the syringe and T pieces. After bubbles are removed from the two syringes, stop probe interior wash, and install back the syringes in sequence. Note to make the V-shaped slot level align to scale 7.5 of the sample syringe, and scale 15 of the reagent syringe. Select OK to go to the next step.

Note: When manually draining the air, keep the instruction for probe interior wash running. Do not install the syringe when the instruction is running.

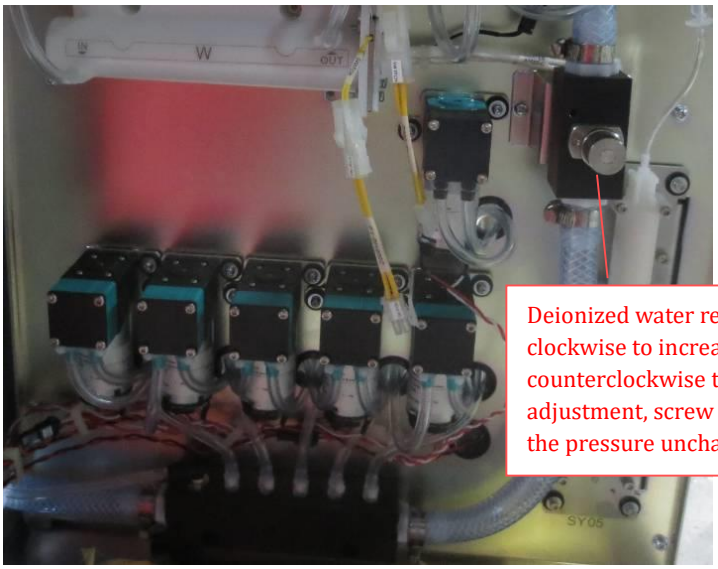
12) Select Continue to reset the mechanical parts for 3 times. Check that the mechanical parts are moving normally.
13) Select Continue.
14) Select Exit to finish the alignment procedure. Select Maintenance -> Parameters -> Wash Station to check if the value of Fluidic Prime Complete is 1. If yes, the prime is successful.

7.11.6 Adjustment of Deionized Water Pressure

Alignment index:

Adjust the deionized water pump pressure to be within 17.5 - 21.5kPa. (Try to keep the pressure at around 19.5kPa for the following flow test.)

Alignment methods and procedure:



1) Select Adjustment of Deionized Water Pressure. Select Continue. Spin the regulating valve knob in the back of the analyzer to make the reading on the DI water pressure gauge within the index range. When the pressure is correct, tighten the knob and ensure the pressure remains unchanged during the process. Select OK. (Note: Try to adjust the pressure to the middle of the index range.)
2) Check the deionized water pressure reading according to the screen prompts.
3) Select Continue to exit the procedure.

NOTE

- **After adjusting the deionized water pressure regulating valve, you must perform a flow test as instructed in the next section.**

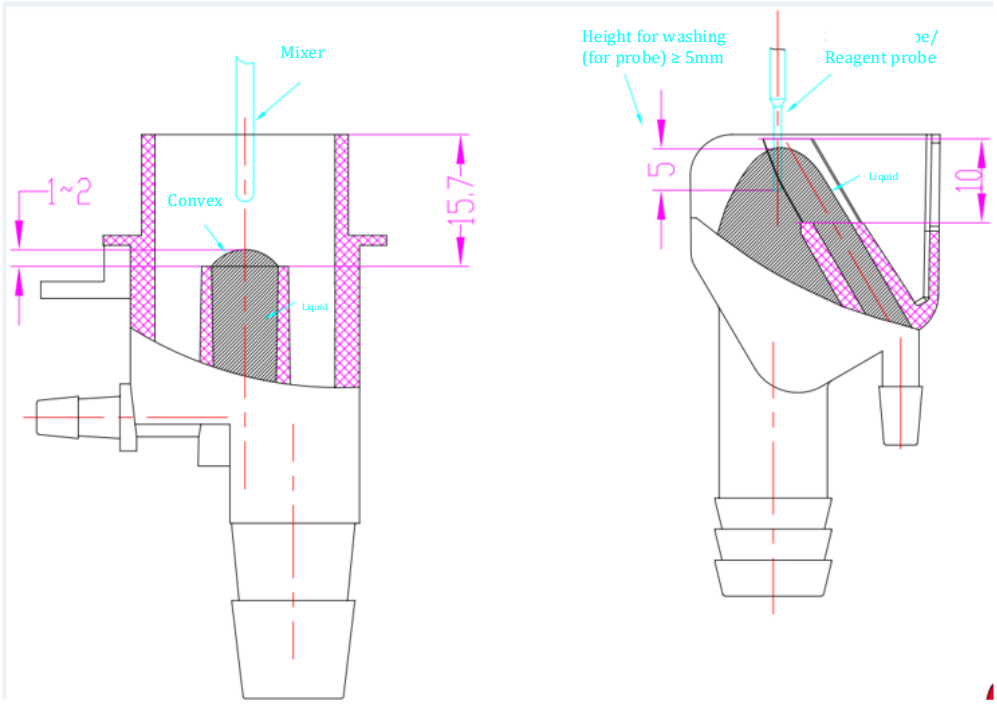
7.11.7 Deionized Water Flow Test

Test index: (If the deionized water pressure is changed, measure the following 3 flows.)

- Exterior wash flow of sample probe and reagent probe: 250-280ml/min
- Phases 3-4 auto wash flow: 77.4 - 94.8 ml/min
- Phases 5-6 auto wash flow: 71.2 - 91.2 ml/min

Test methods and procedure:

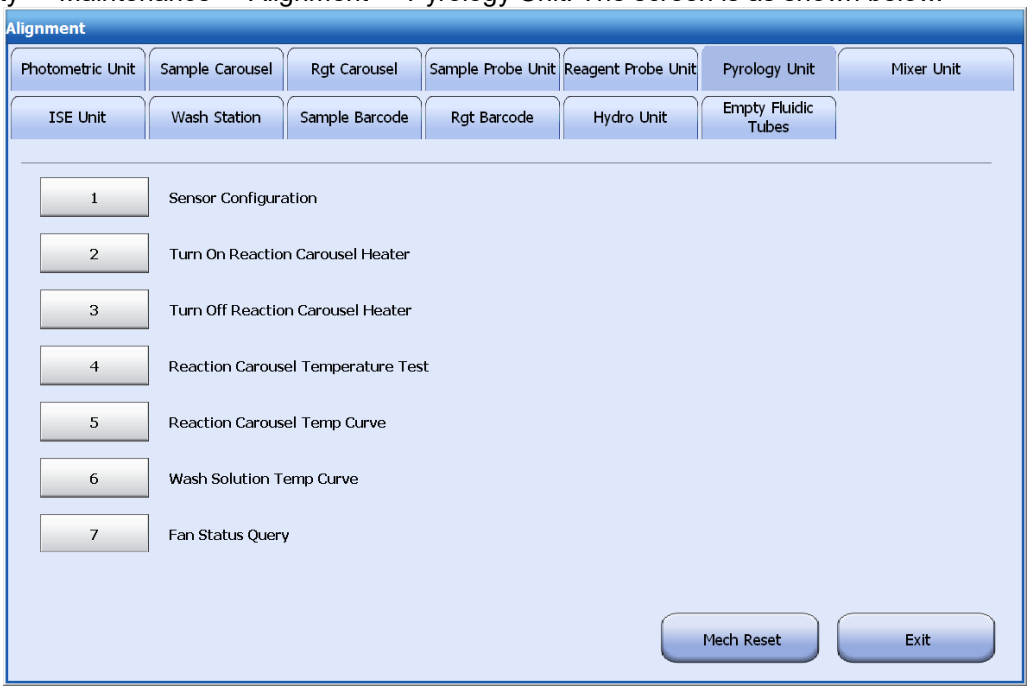
1) Select Wash Flow Test.
2) Operate according to the screen prompts, and observe the water flow of the two probe wash wells and the two mixer wash wells according to the exterior wash order. Check that the probe wash wells are neither spilling and overflowing water nor blocked, the probe wash height is ≥ 6mm, and the reagent wash height is ≥ 5mm; check that the mixer wash wells spray out water through the middle hole with an 1-2mm convex.



3) Select Exit.

7.12 Pyrology Unit

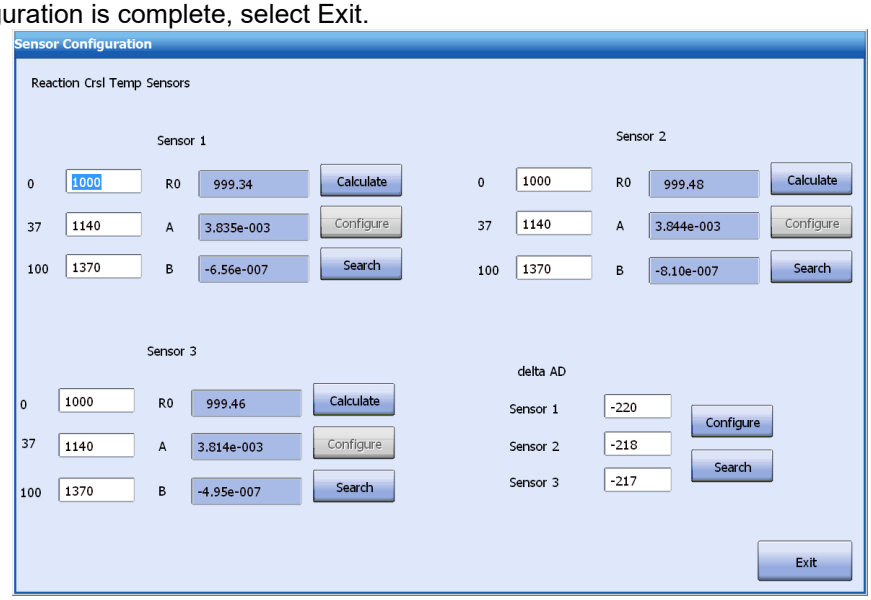
Select Utility -> Maintenance -> Alignment -> Pyrology Unit. The screen is as shown below.



7.12.1 Sensor Configuration

Alignment methods and procedure:

1) Select Sensor Configuration.
2) According to the sequence number on the temperature sensor, contact the headquarters to find the resistance of rated temperature points (0, 37 and 100), select sensor 1 and input the resistance for each temperature point, and then select Calculate.
3) When a dialog box pops up indicating qualified sensor, select Configure to configure the parameters to the relevant sensor. Configure sensor 2 and 3 in the same way as sensor 1.
4) Observe the△AD value of PCB, and input it in the edit boxes at lower-right corner of the window for sensor 1, 2 and 3. Select Configure, and then select Search to verify them.
5) When configuration is complete, select Exit.



7.12.2 Observe Temperature Curve

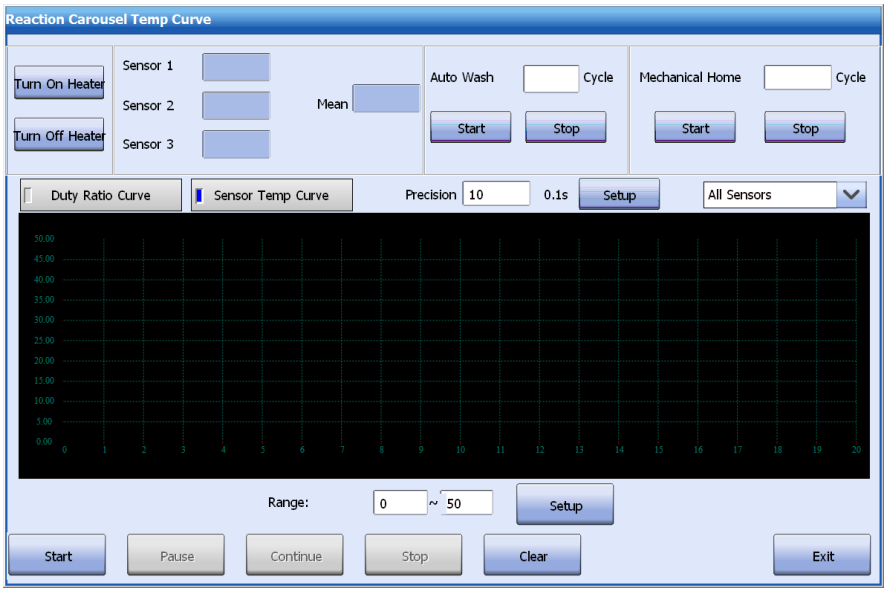
Alignment index:

Reaction carousel temperature curve is within 36.7℃-37.3℃.

Alignment methods and procedure:

1) Select Reaction Carousel Temperature Curve.

2) Select Turn On Heater.
3) Select Sensor Temp Curve, and then select Start. Observe the reaction carousel temperature curve and check if the curve of each sensor is straight and stable with average value within 37.0±0.3℃.
4) Select Stop. Select Exit to close the window.



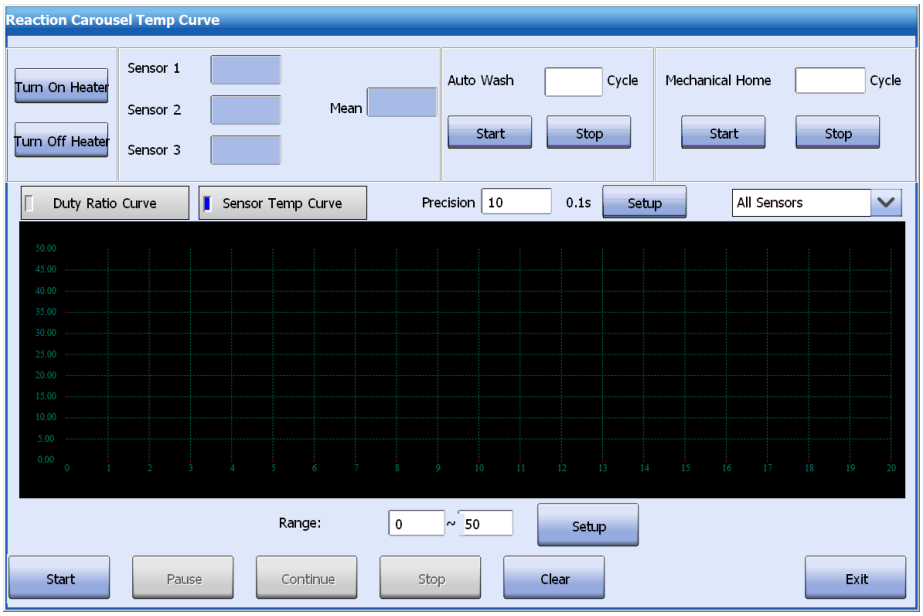
7.12.3 Wash Solution Temperature Control

Alignment index:

The temperature of cleaning fluid and wash solution is within 43℃-45℃.

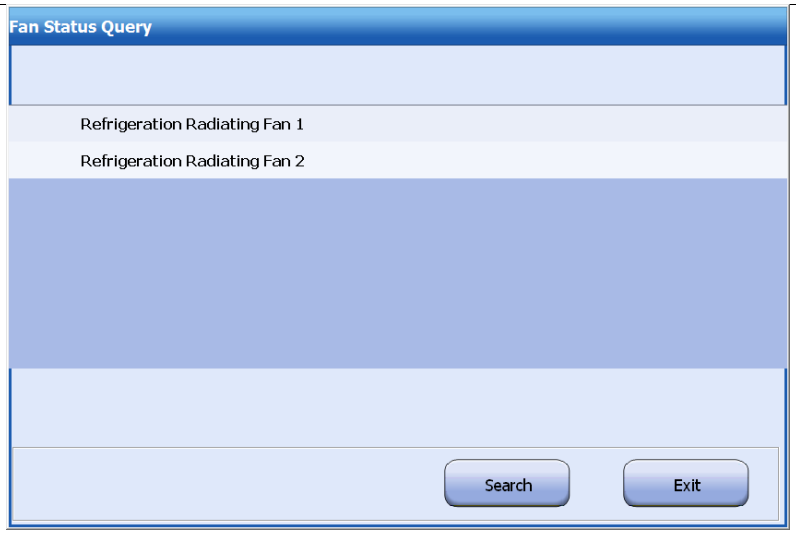
Alignment methods and procedure:

1) Select Wash Station on the Parameter Configuration window, and check that the value of Fluidic Prime Complete is 1. Select Utility -> Maintenance -> Alignment -> Pyrology Unit -> Wash Solution Temp Curve.
2) Select Deionized Water Heater and Wash Solution Heater, and then select Turn On.
3) Select Start in the temperature curve area, and then observe if the temperature curves of cleaning fluid and wash solution are straight and steady (for 5 minutes according to the computer time). Check that the average temperature of cleaning fluid and wash solution is within 43℃-45℃.
4) Select Stop. Select Exit to close the window.



7.12.4 Fan Status Query

The Fan Status Query option is used to inquire the current status of each fan.



7.12.5 Reagent Refrigeration Alignment

Methods and procedure:

Check whether the heatsinks are functional. Make sure that the machine has been started for at least 30 minutes. Touch the heatsinks in the reagent carousel to feel whether the refrigeration is normal. If not, check the circuit by referring to the following table.

Classification	LED Network Identifier	LED Indicator Color	Function Descriptions	Classification
			On	Off
Power supply working status	12V	Green	12V power supply is working	12V power supply is not working
	12VFAN_LED	Green	12V fan power supply is working	12V fan power supply is not working
	5V	Green	5V power supply is working	5V power supply is not working
	24V	Green	24V power supply is working	24V power supply is not working
Heatsink working status	D9, D11	Green	Heatsink is working	Heatsink is not working
Refrigeration temperature range	GREEN_LED	Green	Refrigeration is normal	Refrigeration is faulty/not connected
	YELLOW_LED	Yellow	Refrigeration temperature is too low	Refrigeration temperature is not too low/not connected
	RED_LED	Red	Refrigeration temperature is too high	Refrigeration temperature is not too high/not connected

8 Installation

8.1 Check before Installation

8.1.1 Installation Environment

- Altitude: -400m to +2,000m.
- The system is for indoor use only.
- The bearing platform (or ground) should be level (with gradient less than 1/200).
- The bearing platform (or ground) should be able to support at least 450Kg weight.
- The installation site should be well ventilated.
- The installation site should be free of dust.
- The installation side should not be in direct sun.
- The installation site should be kept away from a heat or draft source.
- The installation site should be free of corrosive gas and flammable gas.
- The bearing platform (or ground) should be free of vibration.
- The installation site should be kept away from big noise and power supply interference.
- Keep the system away from brush-type motors and electrical contact device that is frequently switched on and off.
- Do not use such devices as mobile phones and radio transmitter near the system.
- Operating temperature: 15°C-30°C with fluctuation < 2°C/H.
- Relative humidity: 35%-85%, without condensation.
- Provide air conditioning equipment if the room temperature does not meet the requirements.
- Install the equipment near a sewer for convenient discharging of waste liquid.
- Dimensions before packing: 990mm(length)×710mm(depth)×1135mm(height)
- Dimensions after packing: 1330mm(length)×935mm(depth)×1360mm(height)

8.1.2 System Configuration

- Fully-automated chemistry analyzer
- Packing list of accessory kit
- Packing list of ISE accessory kit (for ISE module only)
- Optional modules (water supply module, for international customers)

8.2 Installation Requirements

8.2.1 Space and Accessibility Requirements

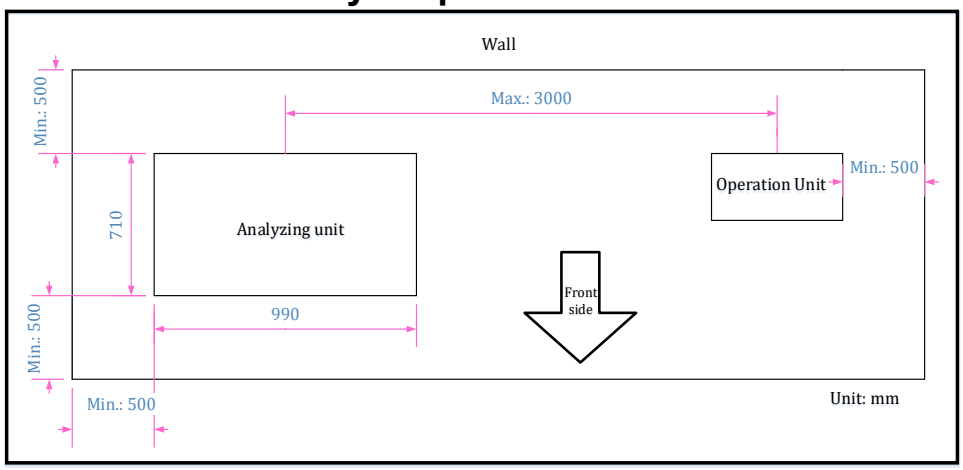


Figure 8-1 System Clearance

- Power supply: 220V: 220-240V- 50Hz, 220/230V- 60Hz; 110V: 110/115V- 60Hz. Voltage fluctuation: +/-10%. Line frequency: +/-3Hz. Three-wire power cord with good grounding performance (ground voltage ≤ 5V).
- The instrument (exclusive of analyzer, external vacuum pump, water supply module, and water drainage module) should be powered by a properly-grounded power supply no less than 3000VA, and the mains socket used to connect the instrument should have its load no less than 10A.
- Keep the instrument away from the mains socket within 2.5m.
- If you are going to use a UPS to power the instrument, make sure that the UPS can provide power supply greater than or equal to 3000VA/2100W.

⚠ WARNING

- **Make sure the power socket is grounded correctly. Improper grounding may lead to electric shock or equipment damage.**
- **Measurement of ground voltage:**
- **Set the multimeter to the AC 250V scale, connect the black probe to the earth wire and the red probe to the live wire and neutral wire. If grounding is proper, the voltage between earth wire and neutral wire should be less than 5V, and the voltage between earth wire and live wire should be similar to that of live wire and neutral wire.**
- **Check if the power socket outputs voltage meeting the specified requirements and has a proper fuse installed.**

8.2.2 Water Supply and Drainage

- Water quality: meeting requirements of CLSI type II with specific resistance no less than 1 (MΩ.cm@25°C) and silicate less than 0.1mg/L.
- Water supply pressure: 100-392kPa. Use a water supply module if the water unit does not meet the requirements of water supply pressure.
- Flow: no less than 42L/H for continuous flow, and 2L/M for transient peak flow.
- Water temperature: 5-32°C.
- When the instrument uses water supplied by a water unit,
  - Make sure that the tube connecting the water unit outlet with the instrument inlet is no longer than 10m.
  - The water tube provided by the instrument is ID4mm OD6mm PU tube, which should be installed by the water unit supplier.
- When the instrument uses water supplied by a water supply module(optional),
  - Lay the water supply module between the deionized water tank (with cap) and the instrument.

- Make sure that the tube between the deionized water tank (with cap) and the instrument inlet is no longer than 10m.
- Choose a deionized water tank (with cap) with capacity of 80-120L.
- Lay the water supply module on the ground.
- To discharge low-concentration waste to the sewer:
- Low-concentration waste tube is shorter than 5m.
- The low-concentration waste outlet should be no less than 50mm wide.
- Make sure that the low-concentration waste outlet is no higher than 100mm.

BIOHAZARD

- **Dispose of waste liquid according to the local regulations.**

⚠ CAUTION

- **The supplied water must meet the requirements of CLSI type II; otherwise insufficiently-purified water may result in misleading test results.**
- **The drainage module must be placed on the ground; otherwise low-concentration waste may overflow.**

8.3 Computer Configuration (for International Customers)

8.3.1 CPU

At least Intel Dual Core, 3.1GHz

8.3.2 Memory

At least 4GB for each RAM

8.3.3 Network Adapter

The computer is connected to the analyzer through a network adapter. If you are going to connect the computer with the LIS or Internet, you should prepare another network adapter (Intel gigabit network adapter)

8.3.4 Serial Port

The computer should provide an RS232 serial port, which is used to connect it with the analyzer.

8.3.5 Hard Disk Defragment

Install the operating system in the C drive and the operating software of the instrument in the D drive. Make sure that the C drive is over 100G and E drive over 50G, and the remaining space is for the D drive, and the disk file system is of NTFS format. Deselect the two options at the bottom of the disk properties window: “Compress drive to save disk space” and “Allow Indexing Service to index this disk for fast file searching”.

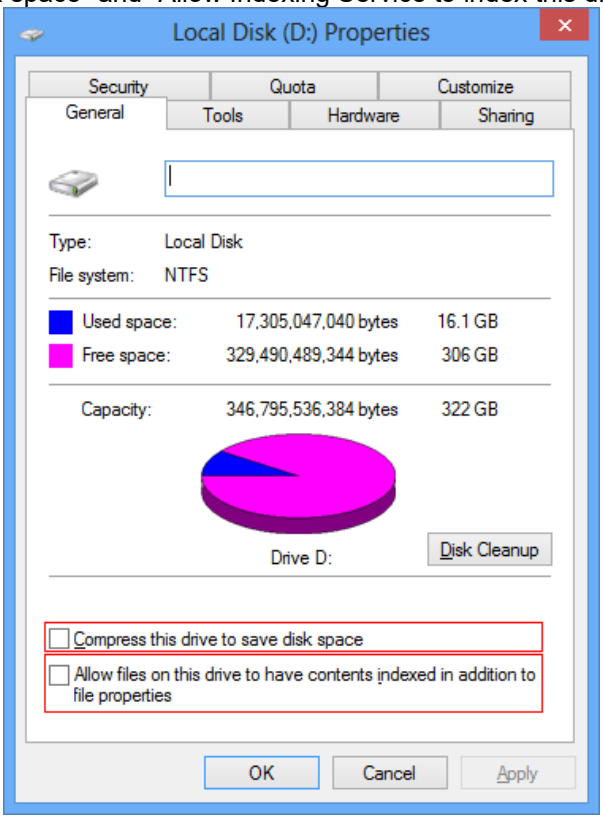


Figure 8-2 Requirements for hard drive partition

Operating system

The operating software supports Win10 Professional 1903 (OS Build:18362.175).

The default login user of the computer must belong to the Administrator group and has permissions for administrator.

Application Software

Except for the operating system, other application software must not be installed or reserved on the computer. If anti-virus application has been installed, remove the automatic scheduled scanning and add BS480 and BSLOG to the trust list.

8.3.6 Remove Screen Saver and System Standby

To remove the screen saver and system standby, click the right mouse button on the desktop, select Properties

to display the Display Properties window. Select None in the Screen saver pull-down list box, and then select the Power button to go to the Power Options Properties window. Perform the settings as shown in the figures below.

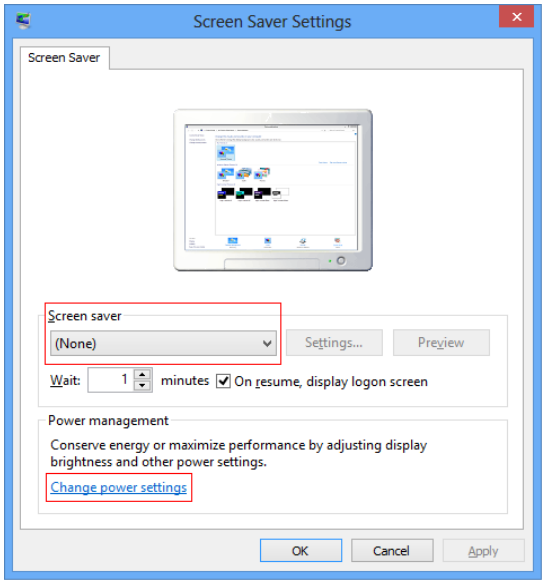


Figure 8-3 Remove screen saver

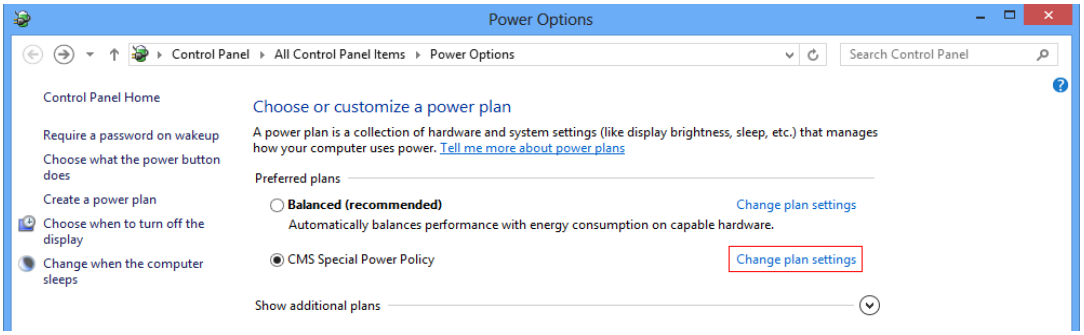


Figure 8-4 Standby settings -1

Select the Hibernate page, and then deselect the Enable hibernation checkbox.

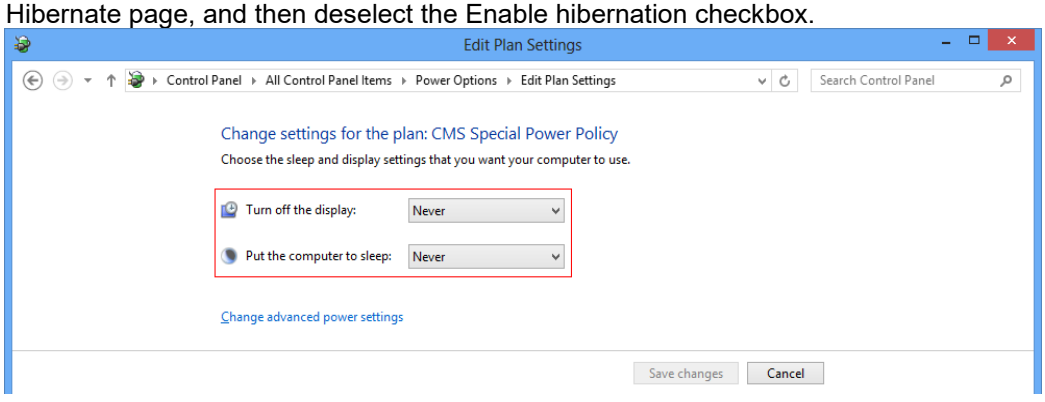


Figure 8-5 Standby settings -2

8.3.7 Screen Display Properties

Set the screen resolution as 1280*1024 pixels and color quality as Highest

Disable Automatic Synchronization with Internet Time Server

Double click the time icon on the lower-right corner of the task bar. The Date and Time Properties window is displayed.

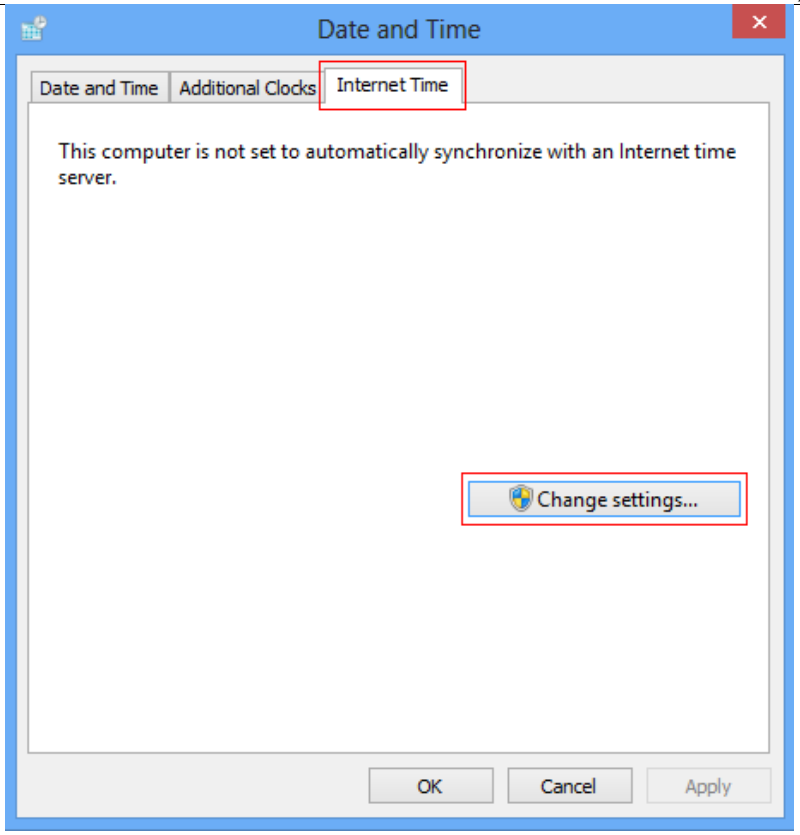


Figure 8-6 Disable automatic synchronization with internet time server -1

Select the Internet Time tab, and then deselect the checkbox in front of Automatically synchronize with an Internet time server.

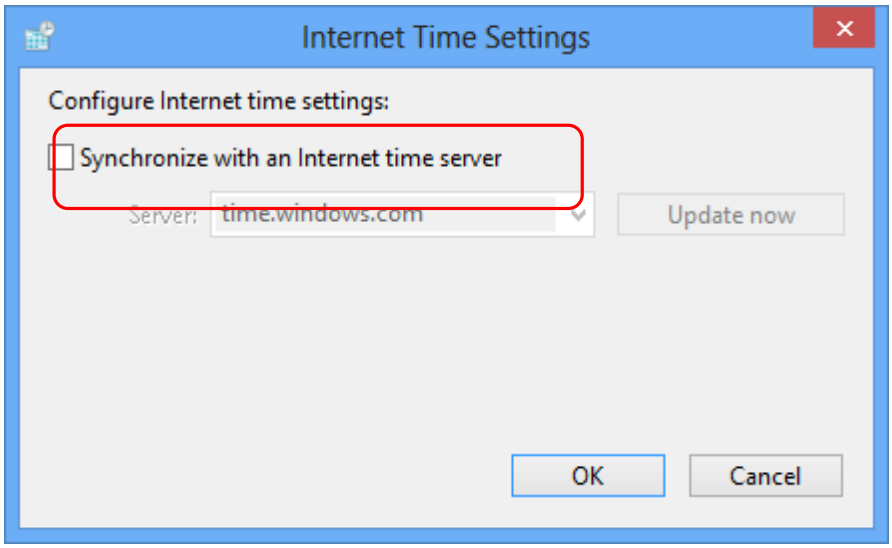


Figure 8-7 Disable automatic synchronization with internet time server -2

Turn off Automatic Updates

Turn off the automatic updates on the Automatic Updates window.

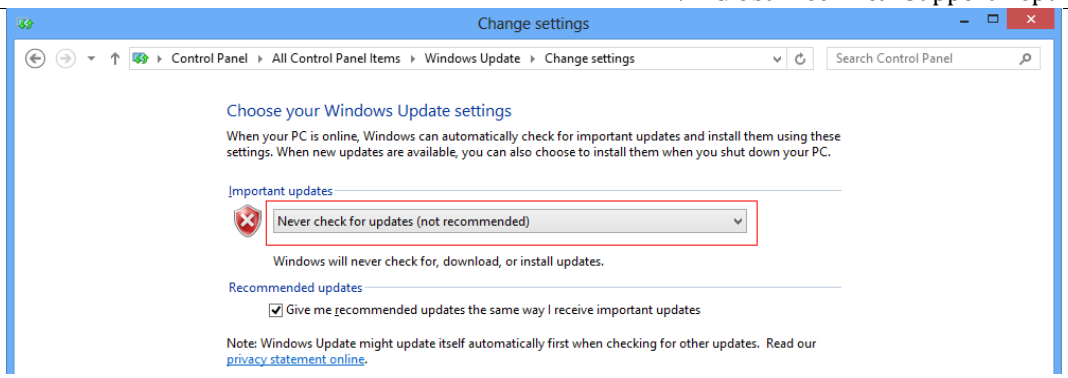


Figure 8-8 Turn off automatic updates

8.4 Installation Procedure

8.4.1 Unpacking

1) Before unpacking, check the packing list and see if the following items are included: chemistry analyzer, accessory kit, high-concentration waste tank, wash solution, ISE module (accessory kit, optional), water supply module (optional), drainage module (optional).
2) The chemistry analyzer is about 364kg. Unload it from the truck with a forklift.
3) Use an adjustable wrench to loosen the retaining screws on the upper cover and slope cover of the package, remove the two covers and keep 2.5m space in front of the slope cover (1.3m for the slope cover and 1.2m for the instrument).

Figure 8-9 Remove screws on the upper cover and slope cover of the package

Figure 8-10 Remove a side cover from the package

4) Unscrew the anchors, and ensure the four roller wheels are not contacting the mounting plates. Use an adjustable wrench to remove the four stationary barriers of the analyzer and all screws on the steel angles, and then remove the steel angles and screw up the anchors.

Figure 8-11 Screw down the anchors and tighten them to support the analyze

Figure 8-12 Remove the mounting plate, and then screw up the anchors carefully.

5) A slope cover is fixed on the side cover. Loosen the two screws on the slope cover to remove it.

Figure 8-13 Remove the slope cover

6) Fix the slope cover in proper direction on the bottom cover, and push the analyzer along the slope cover to the ground. Store all of the wooden boards and retaining screws properly so that they can be used when the instrument is transported.

Figure 8-14 Align the slope cover with the analyzer

7) After removing the analyzer from the package, screw down the four anchor screws, lift the roller wheels slightly from the ground and make sure all the four anchors steadily support the analyzer.

8.4.2 Installation of Probes and Mixers

Remove the packaging material and plastics on the analyzer panels. Take out the sample probe and reagent probe from the accessory kit and insert them into the corresponding metal connectors. Note not to forget the white washers in the package.

Figure 8-15 Install white washer

Installation of Probes

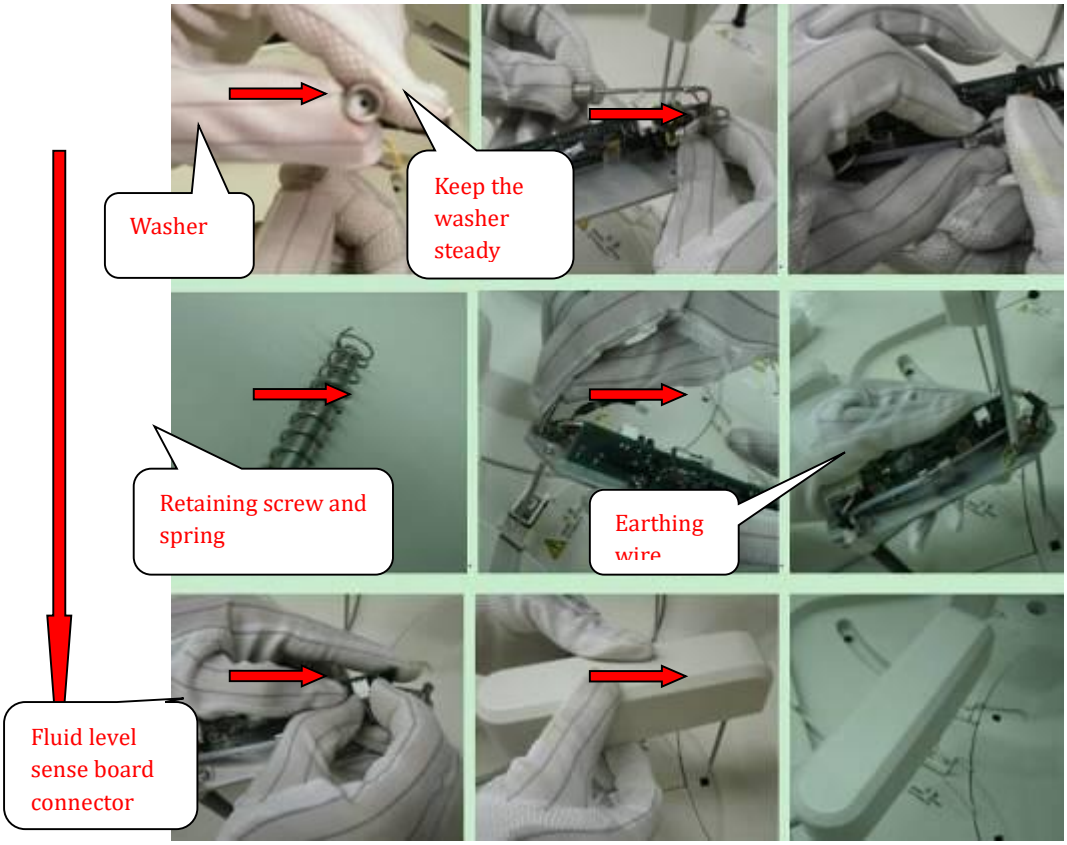


Figure 8-16 Installation procedure of probes

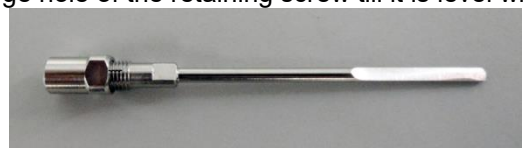
1) Before installing the probe, remove the probe arm cover, loosen the screws on the probe arm cover, and lift the probe upwards.
2) Insert the probe downwards into the hole on the probe arm while aligning the screw hole on the probe plate to the rod inside the arm.
3) Install the washer in the tube connector. To replace the washer, remove the old one from the tube connector and install the new one. Connect the tube connector to the probe and then tighten it.
4) Fix the earthing wire of the probe to the earthing terminal inside the arm; connect the probe connector to the liquid level detection board.
5) Sleeve the spring on the rod and tighten the retaining screw. Pay attention to the spring direction and make the thread opening face downwards.

6) Pinch the probe by the part near the probe arm. Push the probe upwards and then release it to check if the spring works well. If it does, proceed to the next step. If not, check if the spring is clamped or fixed too tightly.
7) After installation, power on the analyzer, and check if the No.D2 LED indicator on the circuit board inside the probe arm is lit. If it is, it indicates that the level detection system works normally.
8) Install the arm cover, and tighten the screws on it.
9) Pinch the probe by the part near the probe arm. Push the probe upwards and then release it to check if the spring works well. If it does, proceed to the next step. It not, it indicates that the arm cover is not installed correctly. Reinstall the arm cover and check the spring until it can move freely

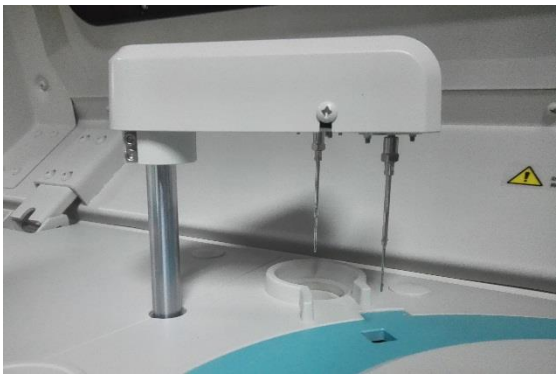
Installation of Mixers

1) Take out the mixer from the accessory kit and lift the mixer arm to the vertical extreme position.

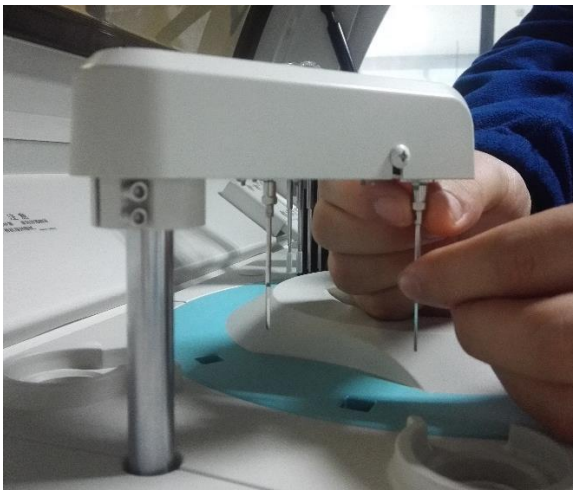
2) Screw the mixer into the large hole of the retaining screw till it is level with the small hole end.



3) Insert the mixer motor shaft into the mounting hole and make sure they contact closely and there is no gap in the vertical direction.



4) Tighten the retaining screw of the mixer clockwise and check whether the mixer is perpendicular. If not, reinstall the mixer.



5) Tighten the mixer by using the mixer wrenches in the accessory kit. Use even force to avoid bending the mixer motor shaft.

8.4.3 Fluidic Connection

Connect BS-600 with water unit

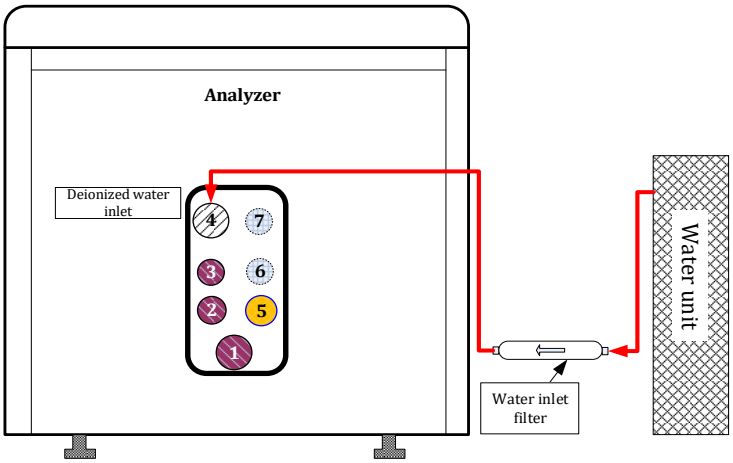


Figure 8-17 Connect BS-430 with water unit

The water tube provided with the instrument is ID4mm OD6mm PU tube, which should be installed by the water unit supplier as shown in the above figure.

Requirements for connecting the analyzer and the water unit:

1) Use the PU tube in the accessory kit to connect the analyzer with the water unit. Install the water inlet filter between the water unit outlet and the analyzer inlet and make sure that the filter will not be influenced by external force and is convenient for replacement.
2) Make sure that the arrow on the filter shell that indicates the water flow points at the analyzer inlet.
3) Ensure that the water inlet tube between the water unit and the analyzer is less than 10m long. When installing the tube, prevent it from being bent, twisted, or pressed, and keep it away from any sharp-edged objects or others that may scratch the tube.
4) If the tube is not installed correctly, remove it, cut off the part that has contacted the connectors, and then reinstall the tube properly.

Connect Analyzer with Water Supply Module (optional)

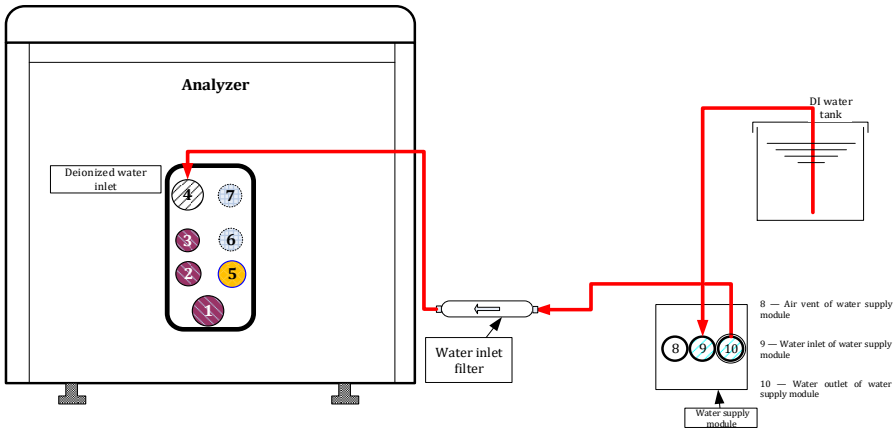


Figure 8-18 Connect BS-430 with water supply module

Requirements for connecting the analyzer and the water supply module:

1) Use the PU tube in the accessory kit to connect the analyzer with the water supply module. Install the water supply module between the deionized water tank and the analyzer inlet. Install the water inlet filter between the water supply module outlet and the analyzer inlet, and make sure that the filter will not be influenced by external force and is convenient for replacement.
2) Install the water supply module filter at the end of the inlet tube and then place the tube at the bottom of the deionized water tank.
3) Make sure that the arrow on the filter shell that indicates the water flow points at the analyzer inlet.
4) Ensure that the water inlet tube between the deionized water tank and the analyzer inlet is less than 10m long. When installing the tube, prevent it from being bent, twisted, or pressed, and keep it away from any sharp-edged objects or others that may scratch the tube.
5) Connect the air vent of the water supply module to the sewer and keep the tube less than 10m long.
6) If the tube is not installed correctly, remove it, cut off the part that has contacted the connectors, and then reinstall the tube properly.

Connecting analyzer with wash solution facilities

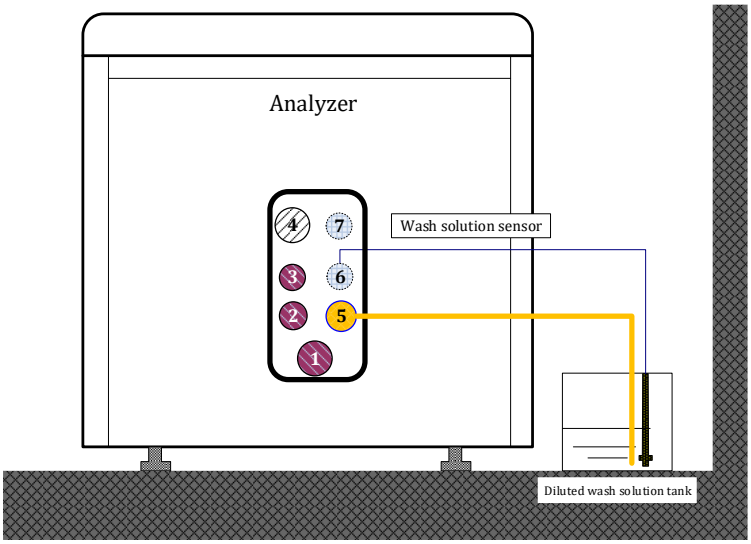


Figure 8-19 Wash solution facilities connection of BS-430

Requirements for connecting wash solution facilities of the BS-430:

1) To prevent leaks, fix all tubes and connectors properly with the tube clamps in the accessory kit.
2) When installing the tubes, prevent them from being bent, twisted, or pressed, and keep them away from any sharp-edged objects or others that may scratch the tubes.
3) Ensure that all electric connectors are higher than and away from fluidic parts and prevent fluidic

connectors from facing electric components.

Connecting analyzer with waste drainage facilities

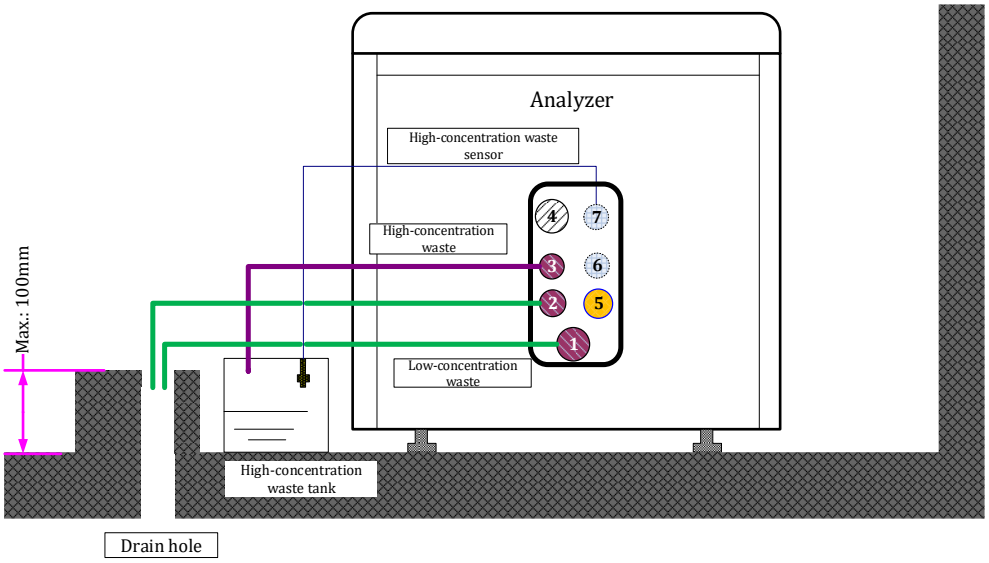


Figure 8-20 Connect BS-430 with waste drainage facilities

Requirements for connecting waste drainage facilities of the BS-430:

1) Lay the high-/low-concentration waste tubes separately.
2) Connect the high-concentration waste tube and sensor (high-concentration waste tank cap assembly) to the high-concentration waste tank.
3) Insert the low-concentration waste tube into the sewer, and make sure that the tube is less than 5m long.
4) Make sure that the low-concentration waste outlet is no less than 50mm wide and less than 100mm high.
5) To prevent leaks, fix all tubes and connectors properly with the tube clamps in the accessory kit.
6) When installing the tubes, prevent them from being bent, twisted, or pressed, and keep them away from any sharp-edged objects or others that may scratch the tubes.
7) Ensure that all electric connectors are higher than and away from fluidic parts and prevent fluidic connectors from facing electric components.

8.4.4 Connection of Analyzer

1) Dilute the concentrated wash solution 10 times and fill the wash solution tank with the diluted wash solution.
2) If you are using an UPS, install it and make it properly grounded.
3) Connect the analyzer, computer, printer, monitor, water unit (or water supply module), power cord and data cable. Do not switch on the power before finishing all connections.
4) Connect the computer with the analyzer through the serial port (choose the port COM1 for the computer).

8.4.5 Starting Up the System

1) Turn on the power switch of the water unit or the water supply module (optional) and the water drainage module (optional).
2) Turn on the analyzing unit power switch and the main power switch. The water inlet valve in the back of the analyzer is turned on automatically to supply water for the water tank. In normal conditions, the water tank can be filled full in 20-30 minutes.
3) Start the computer. The BS-480 operating software is run automatically when the Windows is started. You are also allowed to run the operating software by selecting the shortcut icon on the desktop or in the **Start** menu. See the figure below. The system skips the initialization procedure when detecting that the fluidic prime is not performed. Enter the username “ServiceUser” and password “#BS8A#SEU” in the login window.

Figure 8-21 Startup screen

Figure 8-22 Login screen

4) When the main screen is shown, select **Utility** -> **System Setup** -> **Factory F2**. Select **1 Optional Modules**, enable/disable ISE module, sample bar code and reagent bar code, and then select **OK**. See the figure below:

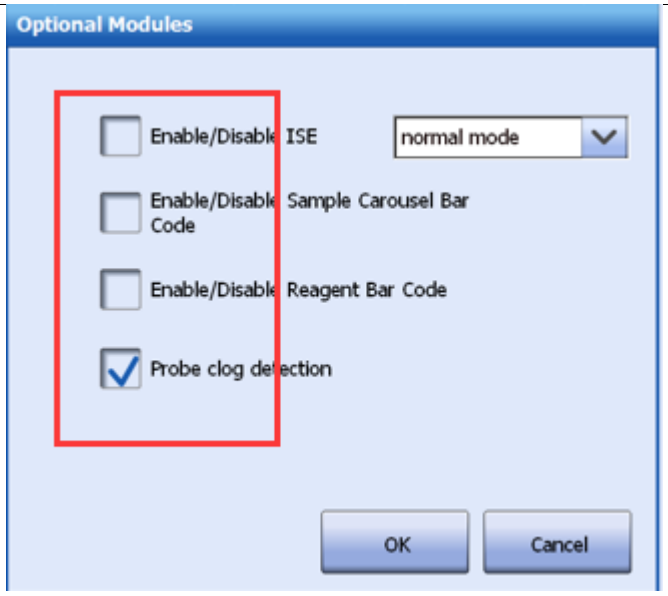


Figure 8-23 Optional window

5) Perform the Fluidic Prime procedure in ***8.4.6 Fluidic Prime.***

8.4.6 Fluidic Prime

1) Select **Utility -> Maintenance -> Alignment -> Hydro Unit**. The screen is displayed as follows.

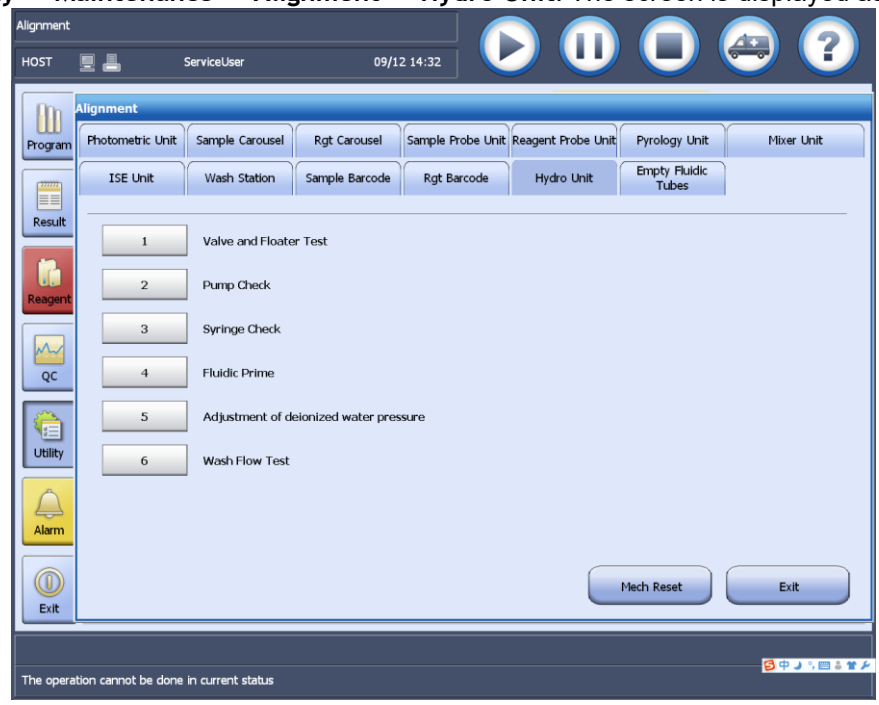


Figure 8-24 Hydro unit screen

2) Select **4 Fluidic Prime** to display the following window. The check of solenoid valves, **fluid** level floaters, pumps, and syringes has been finished by default. Select Continue to proceed to the next step.

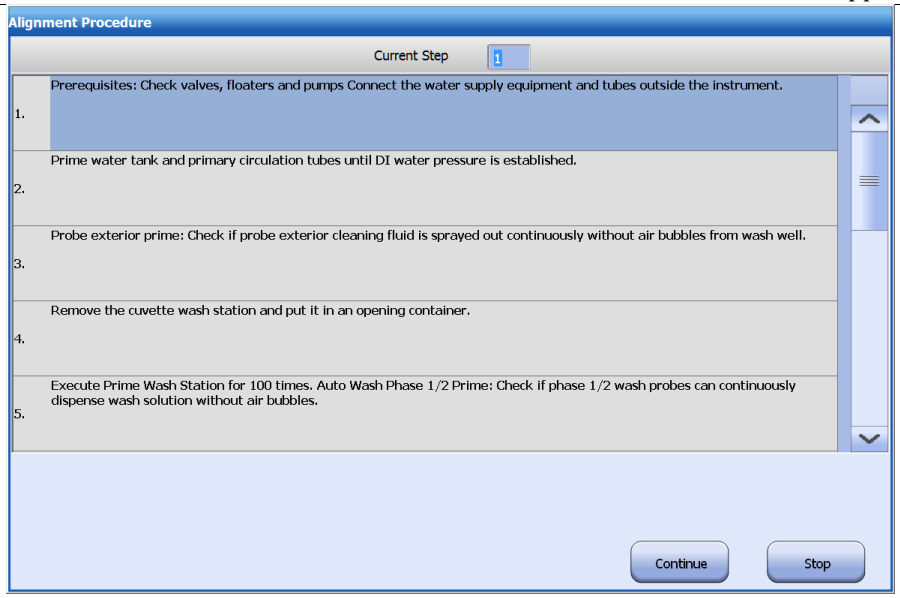


Figure 8-25 Fluidic prime alignment procedure

3) Select **Continue** and then select Start to prime the water tank. When the priming is finished, select OK.

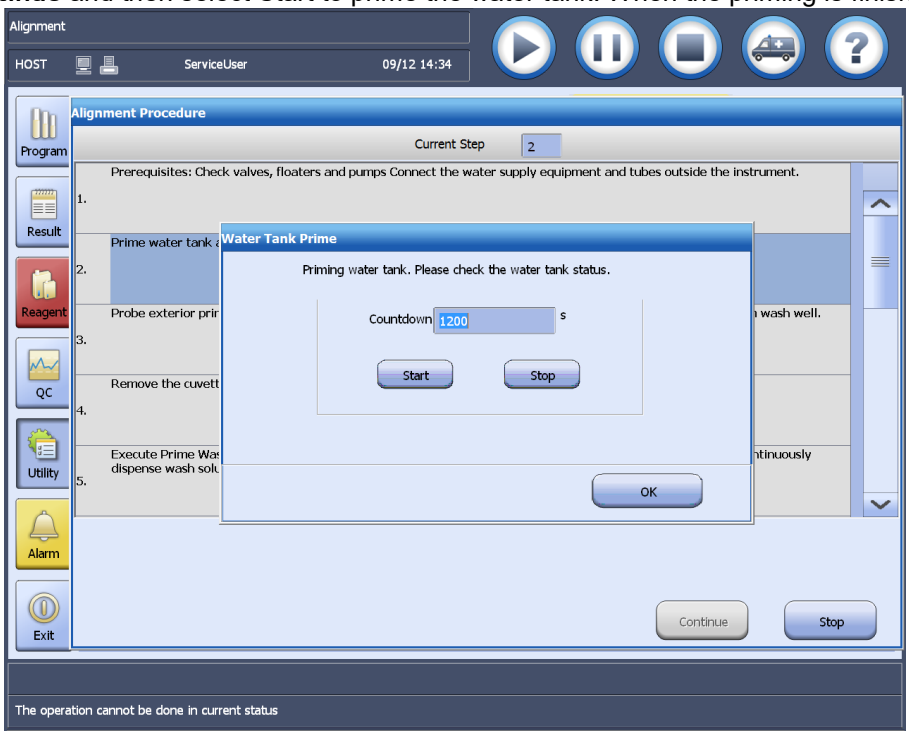


Figure 8-26 Water tank prime window

4) Select Continue to perform the Clean and Prime Probe Exterior procedure. The DI water pump P03 is turned on during the process. Observe the water pressure gauge and make sure that the water supply pressure is within 15-24kPa. Check if cleaning fluid can spray out continuously from the wash wells without air bubbles. Select OK and then select Continue to go to the next step.

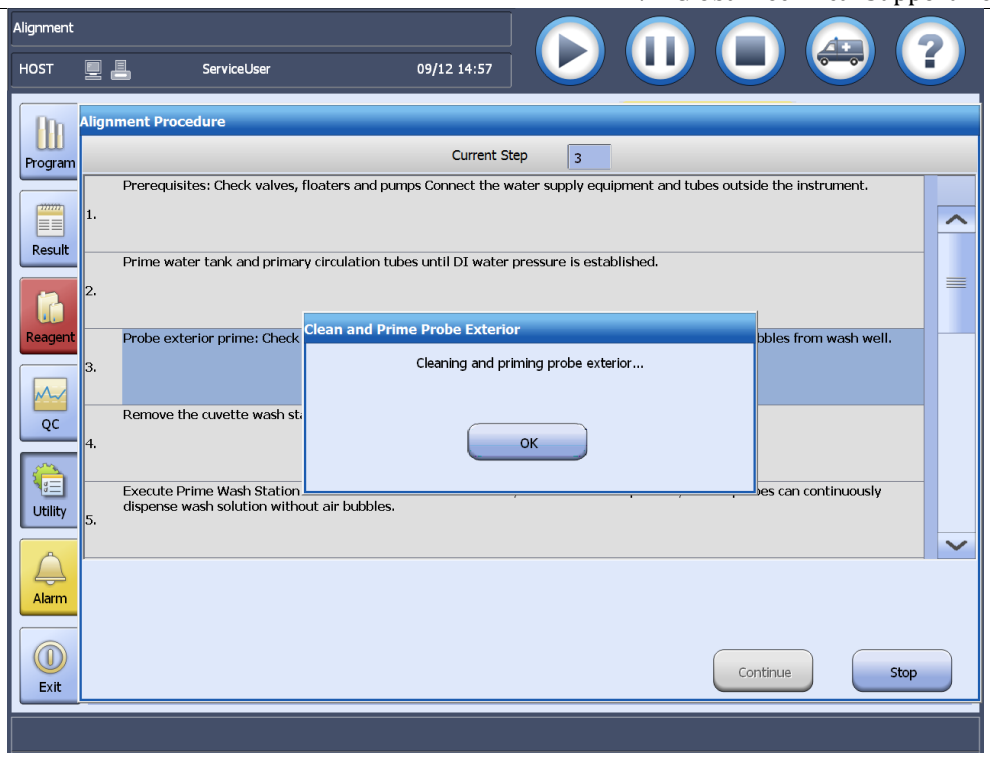


Figure 8-27 Clean and prime probe exterior

5) Follow the screen instructions, remove the cuvette wash station and put it in an opening container. (This step is important, otherwise cuvette 5 may overflow.) Select Continue and Start to perform the phase 1-2 probe priming. When the wash probes for Phase 1-2 can spray out wash solution continuously without air bubbles, select Stop to exit.

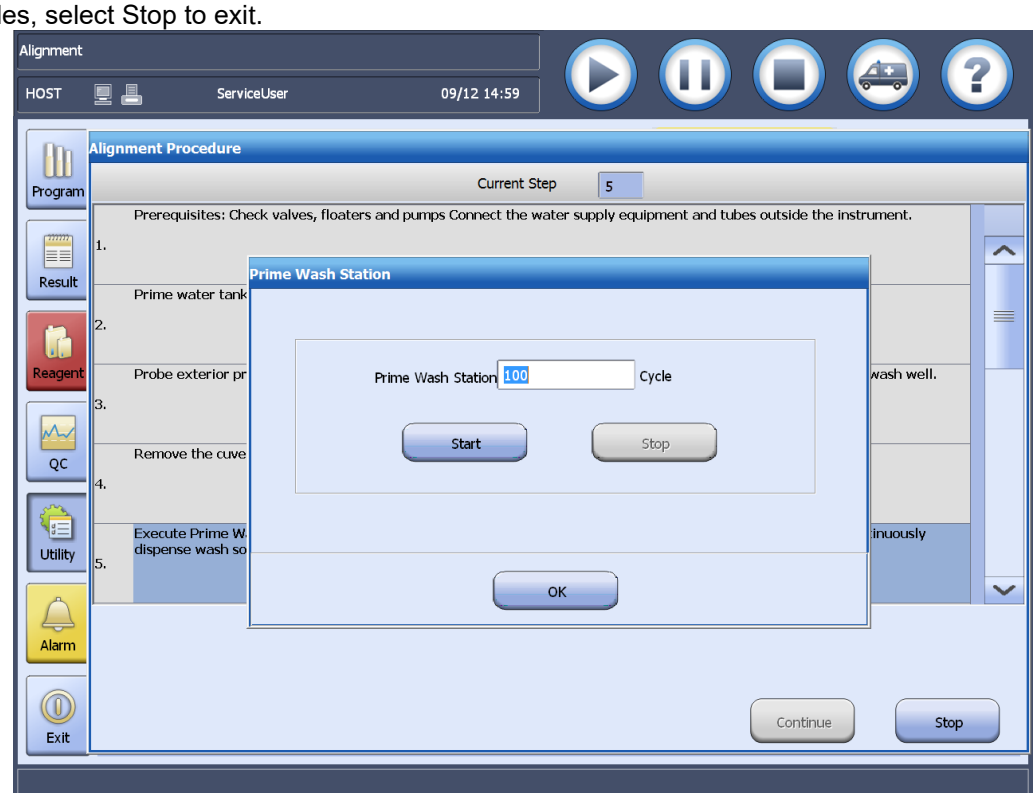


Figure 8-28 Prime wash station

6) Select Continue to prime the wash probes of phase 3, 4, 5 and 6 under the 60s countdown. Check the dispense probes of phase 3, 4, 5 and 6 till they spray clear water continuously without bubbles. After 60s,

check if they stop spraying water in sequence. Select Continue to go to the next step.

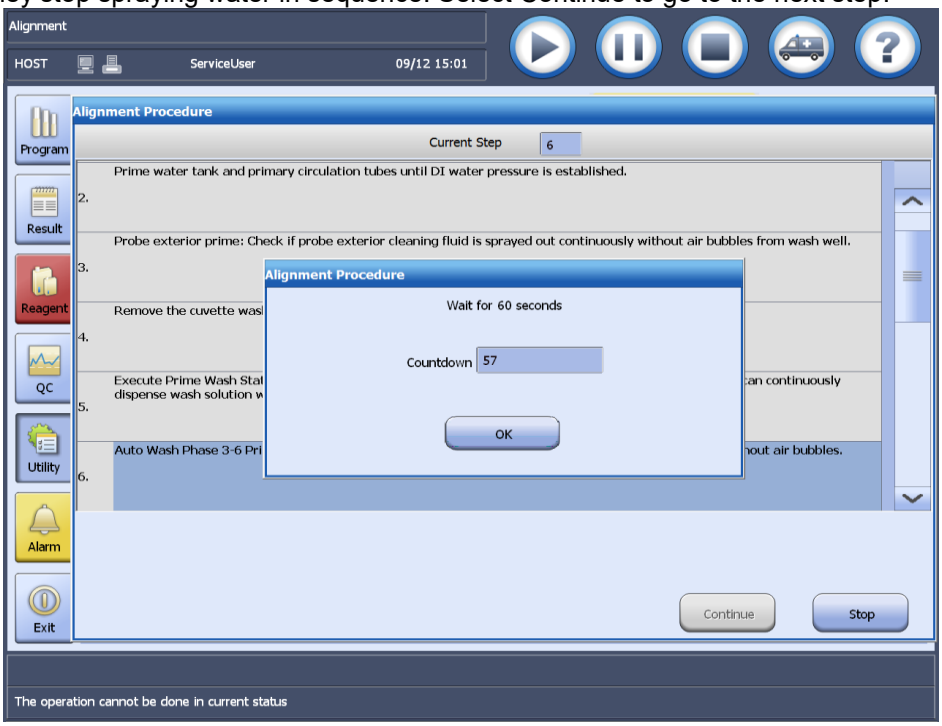


Figure 8-29 Countdown for priming wash station

7) Follow the screen instructions to lift the wash probes from the fluid level. Select Continue, and touch the wash probes to feel suction force.

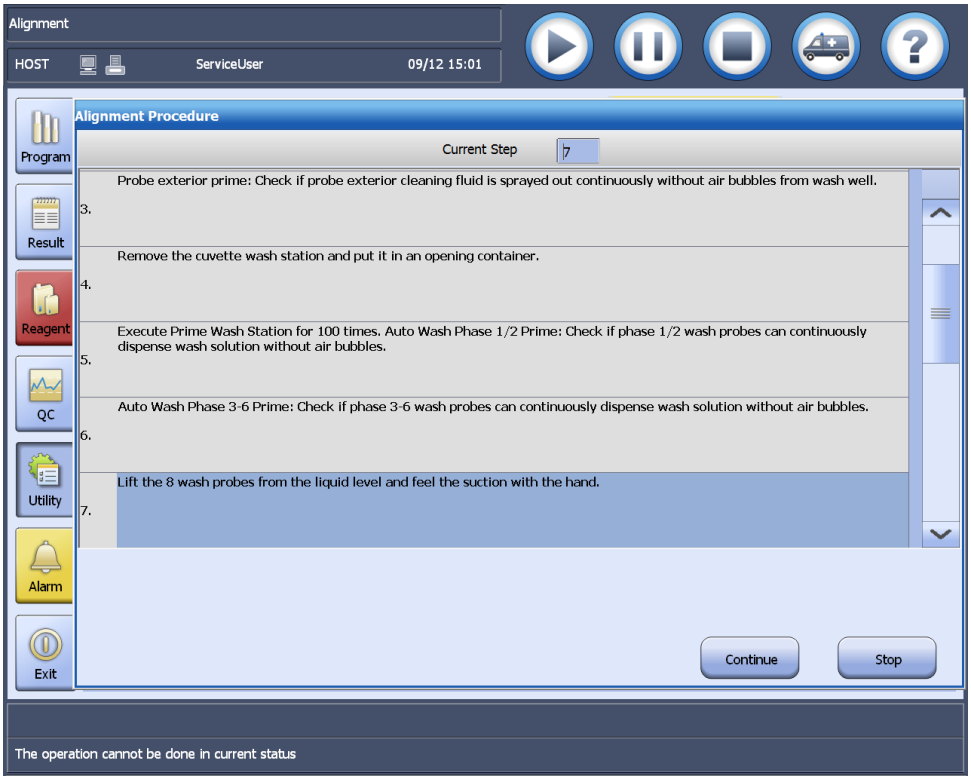


Figure 8-30 Determination of cuvette wash station suction force

8) Reinstall the cuvette wash station in step 8.
9) Loosen the retaining screws and sample/reagent syringes. Select Continue to prime the probe interior. Check if the cleaning liquid is sprayed out straightly from the probes. Pull and push the 2 syringe plungers until there are no air bubbles in the syringe and T pieces. Install the sample syringe and make the V-shape

slot level to scale 7.5. In the same way, remove air from the reagent syringes, install the reagent syringes and make the V-shape slot level to scale 15. Select OK to exit.

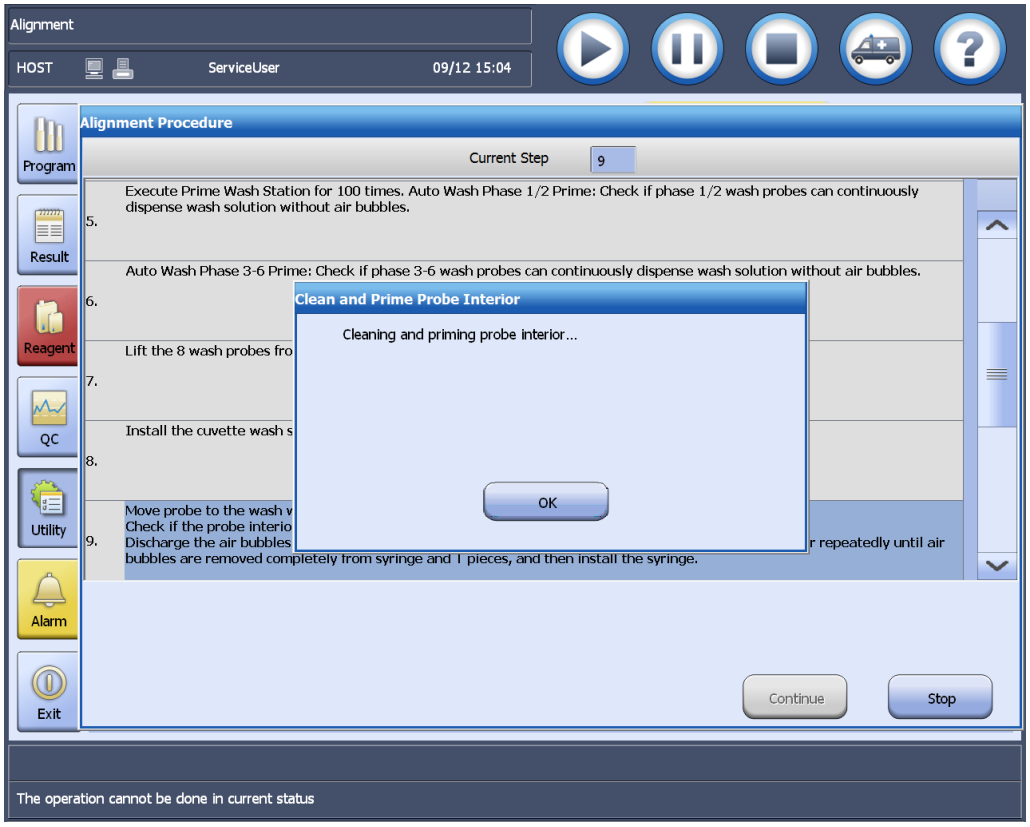


Figure 8-31 Probe wash priming

10) The system is homed for 3 times in Step 10. There should be no failure alarms, and the containers and pressure gauges in correct status as indicated in the following figure.

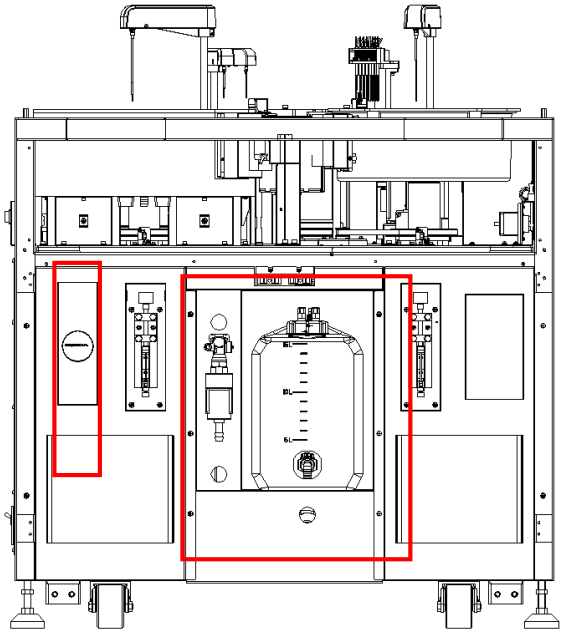


Figure 8-32 Container status and pressure gauges

11) The fluidic prime is finished.

8.4.7 Initial Maintenance Record

Exit the Alignment screen and enter the Maintenance screen. Confirm all scheduled maintenance procedures and set up start time for them. The maintenance frequencies include Daily, Weekly, Monthly, Three-Month, Six-Month, and Other. Select the Select All button on each maintenance frequency tab page, and then select OK. The current date and time appears in the Date Performed column of each maintenance procedure as shown in the figure below

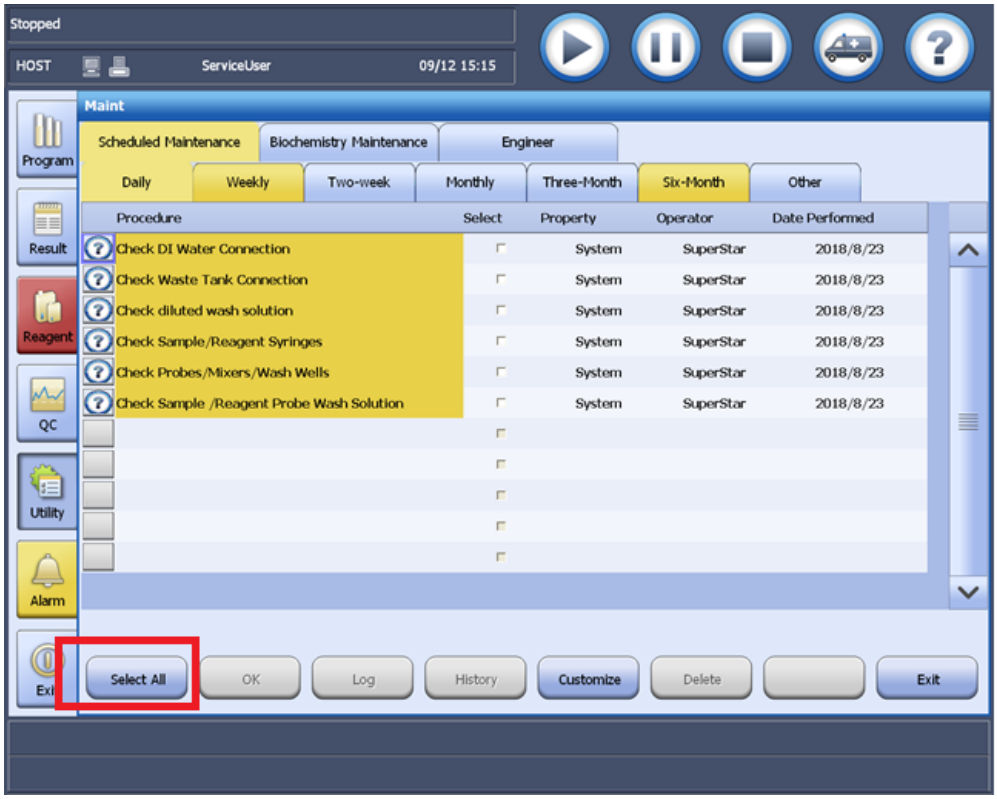


Figure 8-33 Scheduled maintenance screen

8.4.8 Startup Initialization

After priming, exit the operating software and restart the computer. Then, open the operating software again to check the version related information. Enter the username (Admin) and password (Admin) to log in to the system and start the initialization procedure, as shown in the following figure.

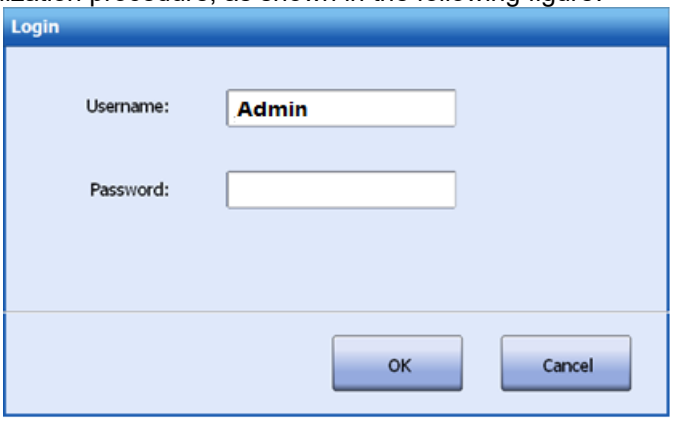


Figure 8-34 Login screen

When the main screen is shown, select Reagent -> Reagent/Calibration, and then load diluted wash solution and ISE buffer by selecting the Load button. Make sure the electrodes are installed before loading reagent.

Figure 8-35 ISE Reagent/Calibration screen

If the optional Caretium ISE module is configured, please perform the ISE Electrode Replacement procedure in ISE Maintenance while the analyzer is in Standby status and the ISE module is in Standby or Stopped status. Refer to the following figure for the electrode serial number.

To load the Caretium module reagent, simply push the reagent package into the bottom of the reagent compartment while the electrode is on board. When the reagent package indicator is off, it indicates that the installation is in place, and the module automatically performs reagent prime.

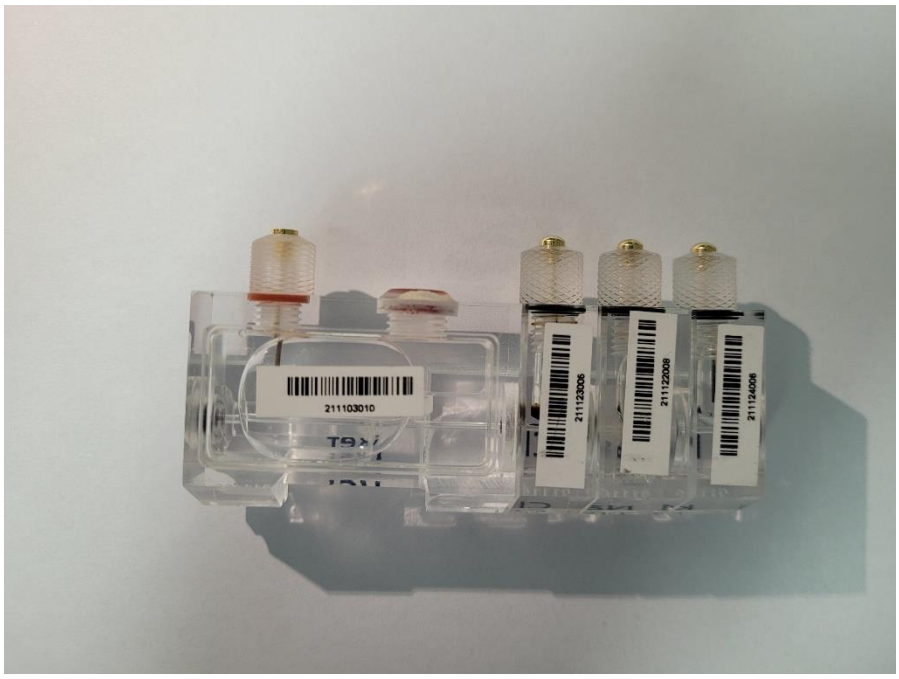


Figure 8-36 ISE Serial Number

8.4.9 Importing and Configuring Chemistry Parameters of Mindray Reagent

1) Select **Utility** -> **Chemistries** -> **Config**, and select **Options** to display the **Option** window. Select import to display the Import window.

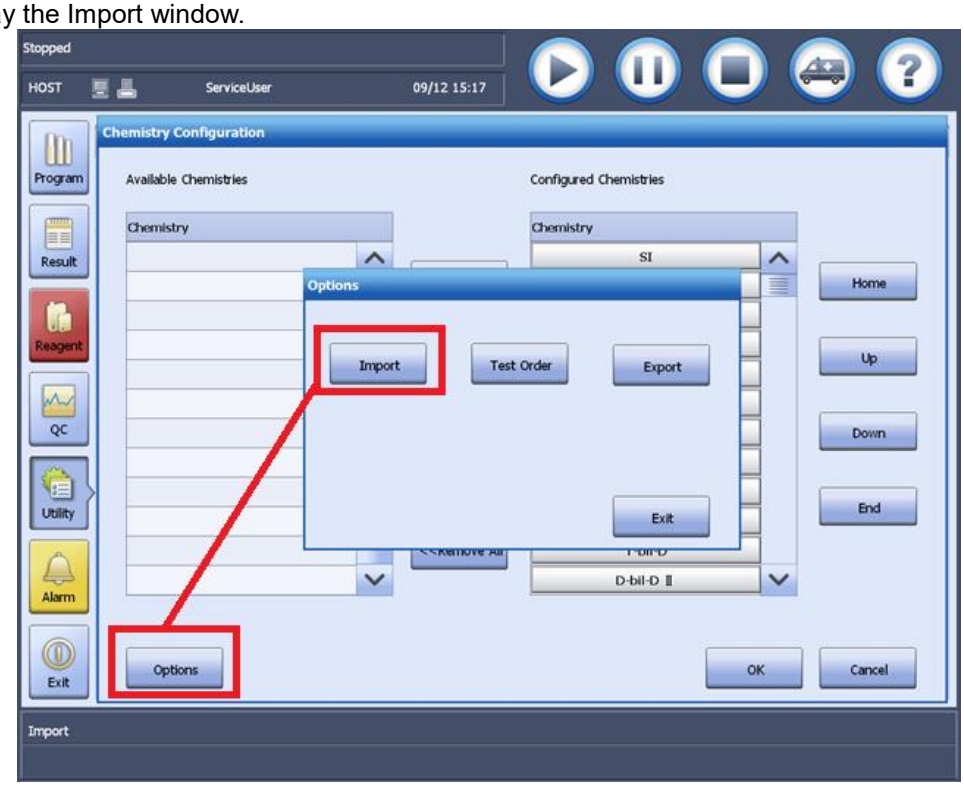


Figure 8-37 Entering the import screen

2) Select Load Default to display all Mindray reagent chemistries in the left column. Select Add All to add all chemistries to the right column. Select Exit to close the window.

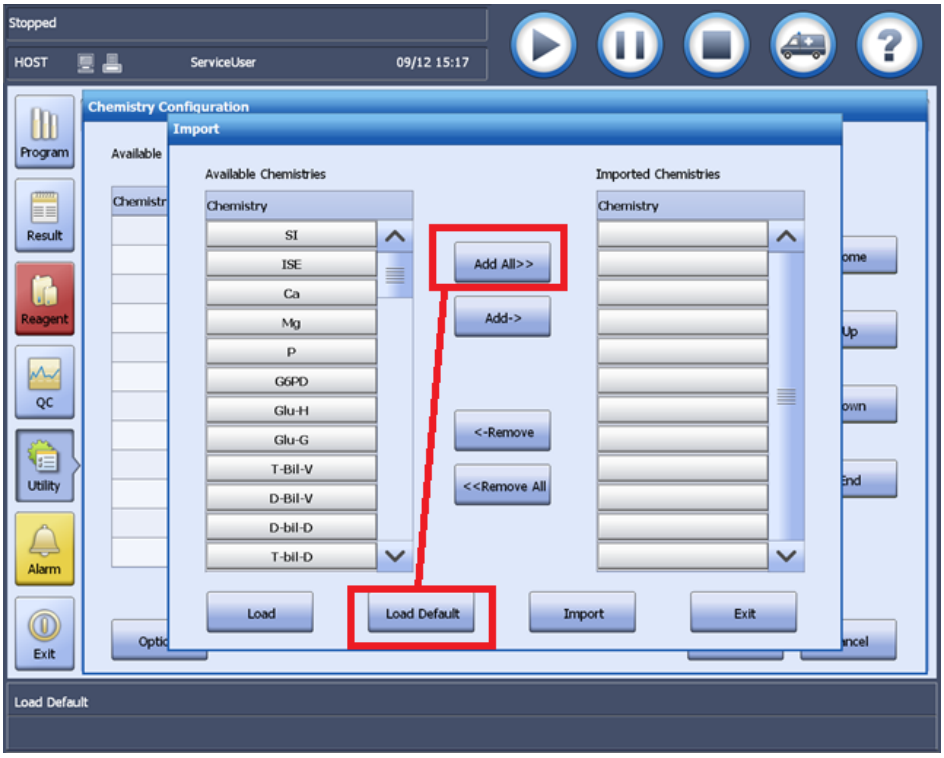


Figure 8-38 Import screen

3) All Mindray reagent chemistries are displayed in the Available Chemistries column. You can delete chemistries that will not be used in your laboratory.
4) Select OK to complete the chemistry configuration.

Figure 8-39 Complete chemistry configuration

8.4.10 System Performance Test

Water test

Before test:

1) Perform following checks during water test:
   - All components' mechanical movement is correct without abnormal alarms (of optics, temperature control, mechanics, communication, etc.).
   - Probes are washed normally without hanging liquid.
   - When lowering to cuvette bottom, the wash station is lifted (except for the phase-6 probe).
   - The reaction curve of all samples has no periodical fluctuation or sharp jumps, and the absolute value of test results is no greater than 10.
2) Define a chemistry.
   Define a double-reagent chemistry “Water” with the following parameters: Kinetic, increased reaction, primary wave 340nm, secondary wave 412nm, unit U/L, decimal 0.01, reaction time 24-33, sample volume 5, R1 100 and R2 10.
3) On the Calibration Setup window, select the chemistry "Water", specify the K factor math model with K factor 10000, select Save and exit the window.
4) Load the reagent.
5) Preparation for analysis is as follows:
   - Load deionized water as R1 and R2 (each more than 15ml).
   - Place deionized water as two samples (each more than 2ml).
   - Place concentrated wash solution in position D of the reagent carousel and in position D2 of the sample carousel.

NOTE

- **Wear gloves when loading the wash solution.**

5) Start testing.

Program two samples with the chemistry "Water", each with 65 replicates. Start the test and observe the

working status of the parts. If an alarm is given, troubleshoot the error.

Other Tests

Repeatability Test:
While referring to the requirements in BS-600/BS-620 Installation Acceptance Report, perform a repeatability test for all listed chemistries by using the accompanying reagents of Mindray and the default chemistry parameters. If neither accompanying reagents nor Mindray reagents are available, skip this test, or if necessary, also skip the following tests. Fill the test results in the result record table. In the event of failed items, troubleshoot them immediately.

Quality Control:
Run QC tests using the accompanying reagents provided by Mindray. In the event of out of-control chemistries, contact a clinical engineer to troubleshoot the error.

Result Records

Fill in the BS-600/BS-620 Installation Acceptance Report in the accessory kit.

9 Maintenance Guide

9.1 Overview

Proactive maintenance is a preventive measure taken by service personnel of Mindray or authorized by Mindray with the aim of eliminating hidden troubles to ensure system reliability and achieve best performance during operation. The proactive maintenance cycle for the chemistry analyzer is one year and for ISE module, half a year. The maintenance includes changing, cleaning or checking the parts as shown in the table below.

Table 9-1 Maintenance items to be performed by service personnel

Category	Procedure	When to do
Replacement Item	Replace Cuvette Wash Connection Tube	More than 1 year
	Replace Online Filter	More than 1 year
	Replace Filter Core	More than 3 months
	Replace Sample Syringe	over 100,000 times
	Replace Reagent Syringe	over 300,000 times
	Replace Calibrator Tube (Medica ISE configured)	More than 1 year
	Replace Pump Tube (Medica ISE configured)	More than half year
	Replace tube (Caretium ISE configured)	More than 0.5 year
	Replace Probe Washer	More than 1 year
Clean Item	Photometer Lens Maintenance	When needed
	Cleaning the dust screen	When needed
	De-dust cooling fan	When needed
	Cleaning the wash wells	When needed
	Clean Cuvette Wash Station	When needed
	Clean ISE Injection Port (ISE Configured)	When needed
	Clean ISE Sample Cup (Caretium ISE configured)	When needed
	Clean DI Water Tank	When needed
	Clean Sample/Reagent Compartment	When needed
	Clean Analyzer Panels	When needed
	Special Wash	When needed
	Clean Sample/Reagent Probes Exterior	When needed
	Clean Mixers	When needed
Check Item	Pump Calibration (Medica ISE Configured)	When needed
	Air Bubble Detector Calibration (Medica configured)	When needed
	Check the clog of overflow tube at the bottom of the ISE sample cup	When needed
	Cuvette Check	When needed
	Photometer Check	When needed
	Check auto wash syringe	More than 1 year

9.2 Maintenance Tools

Table 9-2 Maintenance tools

Too Name	Applicable Maintenance
Philips-head screwdriver φ3.3×100	Removing the system enclosure and the cooling fans
Philips-head screwdriver φ4.7×100	Installing and removing the probes and lamp
Slot-head screwdriver φ4.7×100	Removing probe and pipe hoop
Round-head needle, 0.25+/-0.01mm*125mm round tip	Unclogging the probes
Hair brush	Cleaning filter core and dust screens
Gauze	clean probe/mixer exterior and sample/reagent compartment

Cotton swabs	Clean Wash Wells
Suction cleaner	Cleaning fans and dust screens
Tweezers	Removing/Installing probes and syringe washers
Beaker	Maintaining wash station
Pipette	clean ISE sample injection port
Ethanol	Cleaning photometer, probes, mixers and wash station
NaClO (0.5% sodium hypochlorite solution)	Clean Wash Wells

9.3 Maintenance Procedure

Among the proactive maintenance items of BS-430, some of them are performed with the main power switched off, while the other are performed through the maintenance window on the operating software, where maintenance logs are recorded. To improve the efficiency and shorten the field maintenance time, you are recommended to follow the procedure below:

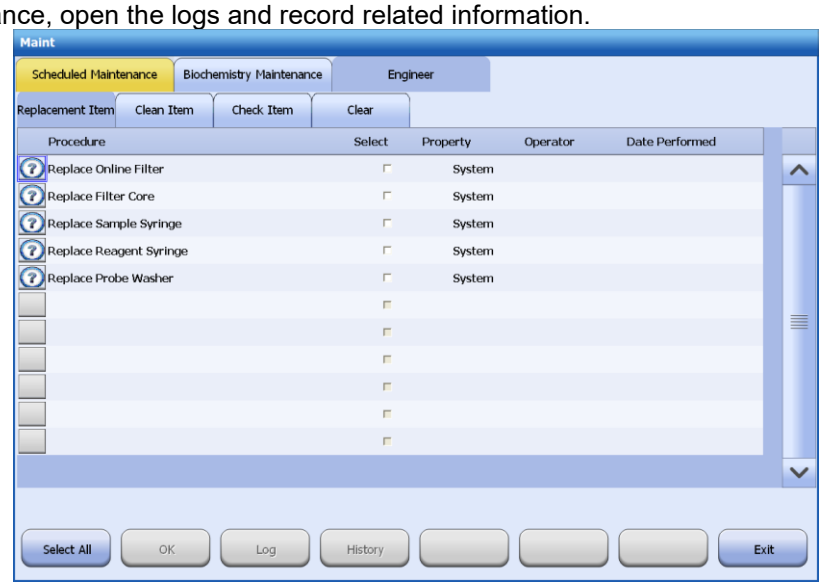
No.	Procedure	Maintenance tools	Operations
1	Clean Analyzer Panels	Ethanol and gauze	Wipe
2	Cleaning the dust screen	Hair brush, suction cleaner	Remove dust
3	De-dust cooling fan	Hair brush, suction cleaner	Remove dust
4	Photometer Lens Maintenance	Ethanol and tissue for wiping lens	Wipe
5	Replace Online Filter	Filter	Replace
6	Replace Filter Core	Filter core	Replace
7	Clean DI Water Tank	/	Washing
8	Replace sample/reagent syringe	Sample/reagent syringes	Replace
9	Replace Probe Washer	Washer	Replace
10	Check auto wash syringe	/	Execute
11	Replace Cuvette Wash Connection Tube	Tube	Replace
12	Replace Pump Tube(Medica ISE configured)	Pump Tube	Replace
13	Replace Calibrator Tube(Medica ISE configured)	Calibrator Tube	Replace
14	Clean Sample/Reagent Probes Exterior	Ethanol and gauze	Wipe
15	Clean Mixers	Ethanol and gauze	Wipe
16	Cleaning the wash wells	NaClO solution and cotton swabs	Wipe
17	Clean Cuvette Wash Station	Ethanol and cotton swab	Wipe
18	Clean Sample/Reagent Compartment	Ethanol, gauze, cotton swab	Disassemble and wipe
19	Clean ISE Injection Port (Medica ISE Configured)	Ethanol and cotton swab	Wipe
20	Pump Calibration (Medica ISE Configured)	/	Execute
21	Air Bubble Detector Calibration(Medica ISE configured)	/	Execute
22	Check clog of ISE overflow tube (Caretium ISE configured)	/	Check
23	Clean ISE sample injection port(Caretium ISE configured)	/	Execute
24	Replace ISE tube(Caretium ISE configured)	/	Execute
25	Special Wash	Concentrated wash solution	Execute
26	Cuvette Check	/	Execute
27	Photometer Check	/	Execute

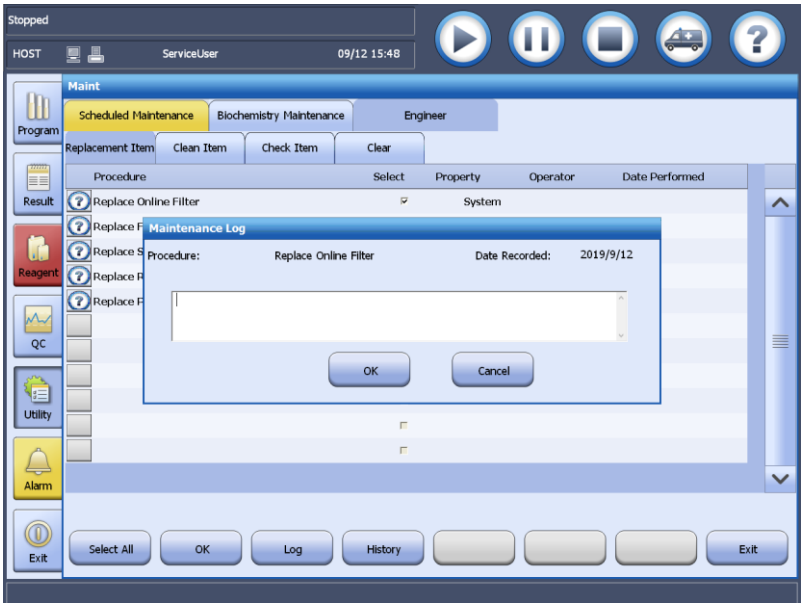
9.3.1 Steps

Clean Analyzer Panels

1) Open the upper protective shield of the analyzer.
2) Use clean gauze moistened with ethanol to clean the analyzer panels and carousel covers.

3) Use wash solution to clean the monitor screen and keyboard.
4) Restore the upper protective shield.
5) After maintenance, open the logs and record related information.





Clean Dust Screens

1) Switch off the analyzer power.
2) Open the front door of the analyzer.
3) Remove the dust screen. For the removing steps, refer to ***2.2.4 Replacement of Left/Right Dust Screen***
4) Tidy and clean the dust screens.
5) Dry the dust screens in air.
6) Restore the dust screens.
7) Close the front door of the analyzer.
8) After maintenance, open the logs and record related information.

Clean the dust of the cooling fan

1) Refer to chapter***2.1.9 Cleaning Fans*** for cleaning dust of the fans.
2) After maintenance, open the logs and record related information.

Photometer Lens Maintenance

1) Refer to chapter ***3.7.7 Photometer Lens Maintenance*** for Photometer Lens Maintenance.

2) After maintenance, open the logs and record related information.

Replace Online Filter

1) Check the maintenance log and when the online filter maintenance interval is more than 1 year, change it.
2) Refer to ***Removing/Reinstalling filter***
3) After maintenance, open the logs and record related information.

Replace Filter Core

1) Check the maintenance log. It is recommended to replace the filter core for every 3 months.
2) Refer to ***Removing/Installing deionized water filter assembly***
3) After maintenance, open the logs and record related information.

Clean DI Water Tank

1) Refer to ***Removing/Installing water tank***
2) After maintenance, open the logs and record related information.

Replace Sample/Reagent Syringes

1) Check the using count of the syringe on the status screen. When the sample syringe has been used for 300,000times, change it. When the reagent syringe has been used for 300,000times, change it.
2) Prepare a new syringe plunger assembly and washer, put the plunger head in the deionized water beaker to remove air from the syringe, and then moisten the washer in the deionized water.
3) Place the analyzing unit power to the OFF position.
4) Open the front door of the analyzer. You will see two syringes. The left one is reagent syringe and the right one is sample syringe as shown in the figure below

5) Loosen counterclockwise the four retaining screws on top of the syringe, and then remove the screws and the fixing blocks.
6) Loosen counterclockwise the retaining screw at the bottom of the syringe and then remove it.
7) Hold the T piece with one hand and the syringe connector with the other hand. Loosen the syringe counterclockwise and then remove the washer.
8) Loosen the plunger guide cap counterclockwise, hold the plunger head and pull it slightly to remove the plunger assembly from the syringe.
9) Insert the plunger head of the new plunger assembly into the bottom of the syringe, and then tighten the retaining screw to fix the plunger head. Tighten the plunger nut clockwise.
10) Soak the new syringe connector in the deionized water beak, pull the plunger head to aspirate half syringe of deionized water, and then push the plunger head to remove the air.
11) If no washer is found in the T piece, put the new washer in the T piece. Hold the T piece with one hand and the syringe connector with the other hand, and then screw the T piece clockwise.
12) Install the syringe on the bracket.
13) Install the fixing blocks and 4 retaining screws while having the retaining screws not tightened.
14) Align the plunger head to the retaining screw at the bottom of the syringe, and then tighten clockwise the retaining screw.

15) Pinch the plunger guide cap to adjust the syringe height. For the sample syringe, make the syringe head over the upper fixing block for 7.5 scales; for the reagent syringes, make the syringe head over the upper fixing block for 15 scales.
16) Tighten the four retaining screws on the fixing blocks.
17) After finishing replacement, switch on the analyzer power.
18) Perform the Home maintenance procedure. Check the new syringe for leak and bubbles. If leak occurs, check the syringe and the connector.
19) Close the front door of the analyzer.
20) The procedure is completed. Write the maintenance log and input the maintenance information and clear the using count of the syringe.

Replace Probe Washer

No action is required when the new reagent probe material (115 -079103-00) is used.

1) Check the maintenance log. When the sample/reagent probe washer has been used for 1 year and change it.
2) Remove the sample/reagent probe and remove the washer.
3) Install the washer and install back the sample/reagent probe.
4) Run the operating software, and select Utility-Maintenance-Maintenance- Biochemistry Maintenance and then select Probe interior clean and prime.
5) After maintenance, open the logs and record related information.

Auto wash syringe check

1) Check the maintenance log. When auto wash syringe has been used for over one year, check the auto wash syringe.
2) Ensure the analyzer is on idle (standby) condition. Open the ISE cover on the right side analyzer panel.
3) Run the operating software, and select Utility -> Maintenance -> Maintenance -> Biochemistry Maintenance, and then select Auto Wash Prime to prime the diluted wash solution.
4) During priming, check for abnormal sound and leakage of the auto wash syringe.
5) Install back the right side panel.
6) After maintenance, open the logs and record related information.

Replace Cuvette Wash Connection Tube

1) Check the maintenance log. When Cuvette wash connection tube has been used for 1 year and change it.
2) The analyzing unit should be powered off, or in failure mode or in standby status.
3) Open the upper protective shield of the analyzer. Loosen the installation button of the wash station, and then remove the wash station.
4) Remove the connecting tube that needs replacing.
5) Install the cleaning connection sleeve in place, pay attention to the different connection apertures, do not press in the wrong direction.
6) Reinstall the wash station.
7) Execute Prime Wash Station on the Biochemistry Maintenance window. Deionized water flows through the tube, removing air bubbles from it.
8) Restore the upper protective shield of the analyzer.
9) After maintenance, open the logs and record related information.

Replace Pump Tube (Medica ISE configured)

1) Check the maintenance log. When Pump Tube has been used for half year, change it.
2) Refer to ***3.8.4 Replacing Pump Tube*** for replace Pump Tube.
3) After maintenance, open the logs and record related information.

Replace Calibrator Tube (Medica ISE configured)

1) View the maintenance log. When the Calibrator Tube has been used for more than 1 year, change it.
2) Refer to ***03.8.9 Replacing Calibrator*** Tube for Replace Calibrator Tube.
3) After maintenance, open the logs and record related information.

Clean Sample/Reagent Probes Exterior

1) Place the analyzing unit power to the OFF position.
2) Lift gently the probe to the utmost height and move it to the position convenient for maintenance.。
3) Use gauze soaked with ethanol to gently wipe the probe exterior. Clean the probe tip until it becomes clear without stain. Use gauze moistened with deionized water to clear the ethanol on the probe. Do not pull the probe vertically to prevent probe damage.
4) After the procedure, restore the upper protective shield of the analyzer. Power on the analyzing unit and select Home.
5) After maintenance, open the logs and record related information.

Clean Mixers

1) Place the analyzing unit power to the OFF position.
2) Lift gently the mixer to the utmost height and move it to the position convenient for maintenance.。
3) Use gauze soaked with ethanol to gently wipe the mixer exterior. Clean it until it becomes clear without stain. Use gauze moistened with deionized water to clear the ethanol on the mixer. Do not pull the mixer vertically to prevent probe damage.
4) After the procedure, restore the upper protective shield of the analyzer. Power on the analyzing unit and select Home.
5) After maintenance, open the logs and record related information.

Clean Wash Wells

1) Place the analyzing unit power to the OFF position.
2) Move the probe and mixer away from the wash well for the convenience of maintenance.
3) Use clean cotton swabs moistened with NaClO to clean the wash wells.
4) After the procedure switch on the analyzer power.
5) Execute Home command or Check Probes/Mixers/Wash Wells maintenance command. Check if the wash wells have a normal water flow.
6) After maintenance, open the logs and record related information.

Clean Wash Station

1) The analyzing unit should be powered off, or in failure mode or in standby or incubation status.
2) Open the upper protective shield of the analyzer. Remove the wash station, and use gauze moistened with ethanol to clean the nozzles and wipe blocks.
3) Use the gauze soaked with DI water to clear the ethanol left on the nozzles.
4) Install back the wash station and close the upper shielding cover of the analyzer.
5) Execute the Prime Wash Station maintenance command.
6) After maintenance, open the logs and record related information.

Clean Sample/Reagent Compartment

1) The analyzing unit should be powered off, or in failure mode or in standby or incubation status.
2) Remove the carousel cover and carousel, and then store them properly.
3) Use clean gauze soaked with deionized water or ethanol to clean the interior of the compartment. If necessary, you can use gauze moistened with neutral wash solution.。
4) Use clean gauze soaked with deionized water or ethanol to clean the carousel body, and then use cotton swabs dipped with ethanol to clean the sample or reagent positions.
5) Install the carousel and the carousel cover.
6) After maintenance, open the logs and record related information.

Clean ISE injection port (Medica ISE configured)

1) Make sure that the system status is Incubation or Standby.
2) Enter ISE maintenance screen and select Clean ISE injection port.
3) Open the upper protective shield of the analyzer.
4) Open the cover of the ISE module on the analyzer's front panel.
5) Use clean cotton swab soaked with ethanol to wipe the sample injection port (interior of the sample injection port of the ISE module) until it is clean; then use a clean cotton swab soaked with DI water to

wipe the interior and periphery of the sample injection port .
6) Enter the ISE Maintenance window and execute purge A and purge B for three times each.
7) Restore the cover of the ISE module on the analyzer's front panel. Restore the upper protective shield of the analyzer.
8) After maintenance, open the logs and record related information.

Check if ISE overflow tube is clogged (Caretium ISE configured)

1) Open the right side panel and check if there is dirt under the ISE overflow tube. If so, use gauze moistened with deionized water.
2) Open the upper protective shield of the analyzer.
3) Open the cover of the ISE module on the analyzer's front panel.
4) Visually check whether the connected tube under the sample injection port overflow bath is blocked. If yes, remove the tube together with the sample injection port.
5) Install back the sample injection port.(Note: After installing the sample cuvette, perform the Sample Probe Rotary to ISE procedure.)

Clean ISE sample injection port (Caretium ISE configured)

1) Make sure that the system status is Incubation or Standby, and the ISE module status is Standby (on the reagent packet).
2) Select Clean ISE Sample injection port on the ISE Maintenance window.
3) Use cotton swabs soaked with ethanol to wipe the sample injection port (interior of the sample injection port of the ISE module) until it is clean. Use cotton swabs soaked with DI water to wipe the interior and periphery of the sample injection port.

Replace Tubes (Caretium ISE configured)

See ISE Tube Replacement.

Pump Calibration (ISE configured)

1) Make sure that the system status is Incubation or Standby.
2) Enter ISE maintenance screen and click Pump Calibration.
3) Fill sample cup with 500 μl DI water, place it in the W position on the sample carousel.
4) Continue the procedure until it is completed.
5) After the procedure is completed, the calibration results are displayed. If calibration is successful, the procedure is completed. If not, ISE enters error status.
6) After maintenance, open the logs and record related information.

Air Bubble Detector Calibration (ISE configured)

1) Ensure ISE is standby.
2) Enter ISE maintenance screen, and select Air Bubble Detector Calibration. The procedure is performed automatically.
3) After the procedure is completed, the calibration results are displayed. If calibration is successful, the procedure is completed. If not, ISE enters error status.
4) After maintenance, open the logs and record related information.

Special wash

1) Open the upper protective shield of the analyzer.
2) Load over 40ml concentrated wash solution in position D on the reagent carousel and over 5ml concentrated wash solution in position D3 on the sample carousel.
3) Select Utility-Maintenance-Maintenance- Biochemistry Maintenance and select special wash.
4) Confirm if cuvette check is needed after the concentrated wash. If it is, mark the checkbox in front of Check Cuvettes.
5) Select Continue. The system starts cleaning the sample probe, reagent probes, mixers, cuvettes and wash station. When special wash is finished, the system performs cuvette check automatically.
6) Select Done.
7) Restore the upper protective shield of the analyzer.
8) After maintenance, open the logs and record related information.

Cuvette Check

1) Select Utility-Maintenance-Maintenance- Biochemistry Maintenance and then select Cuvette check.
2) After check, check the cuvette check results for yellow indication. Record the cuvettes highlighted in yellow and perform the Clean Cuvettes or Replace Cuvettes procedure.
3) After maintenance, open the logs and record related information.

Photometer Check

Select Utility-Maintenance-Maintenance- Biochemistry Maintenance and then select Photometer Check
If the result is Normal, the system will give no alarms; otherwise the following alarm will be given.

- If the alarm indicates the lamp is off, check if the lamp has been turn on.
- If the alarm light too strong is given, please perform photometric unit alignment or check if the photometric unit is normal.
- If the alarm indicates light intensity too weak, replace the lamp.

Phase 5-8 aspirate tube check

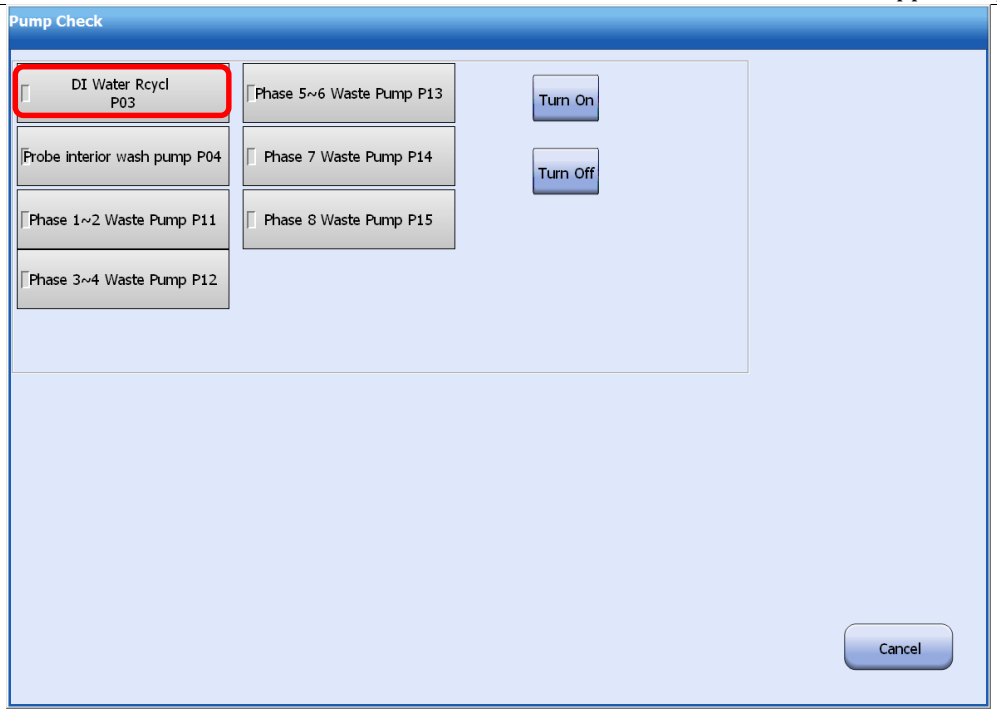
1) Make sure the system is powered off. Remove the wash probe assembly from the cuvette wash station.
2) Check if the phase 5-8 Teflon tubes with white wipe block are discolored or blocked. If not, move to the next step. If so, cut new Teflon tubes to replace old ones. The tube length should be same as the that of the old ones. Replace the band at the same place on the tubes. Install the tubes. Note do not install the phase 5-8 tubes in the wrong order.
3) Observe the probes and wipe blocks of the wash station. If they are blocked, use the cleaning tool to unclog them.
4) Use ethanol-moistened gauze to wipe the wash probes and wipe block. Use gauze moistened with deionized water to clear the ethanol on the wash probes and wipe block.
5) Restore the cuvette wash station.

Waste tube check

1) Make sure the analyzer is powered off. Remove the back panel and observe the high and low concentration waste tubes and check if they are clogged or waste are accumulated in the tubes. Pay special attention to the high/low-concentration waste collector, High/low concentration waste discharge valve and waste pump outlet.
2) Use beaker or cylinder to hold 50-100ml DI water to pour gently into the sample wash well, reagent wash well and mixer wash well respectively and check if there is obvious liquid accumulation in the waste tube especially the tube between the wash well and waste collector.
3) If the waste tube is clogged or obstructed, fill a beaker or a measuring cylinder with 50-100ml wash solution, pour it slowly into the sample probe wash well, reagent probe wash wells and mixer wash wells and leave it in the waste tube for 30-40 minutes. Then fill the beaker or measuring cylinder with 50-100ml deionized water and pour it slowly into the above-mentioned wash wells. Check if the clogging or obstruction is removed. Repeat the above steps for 1-2 times, and if the clogging or obstruction still remains, replace the waste tube.

Pump check

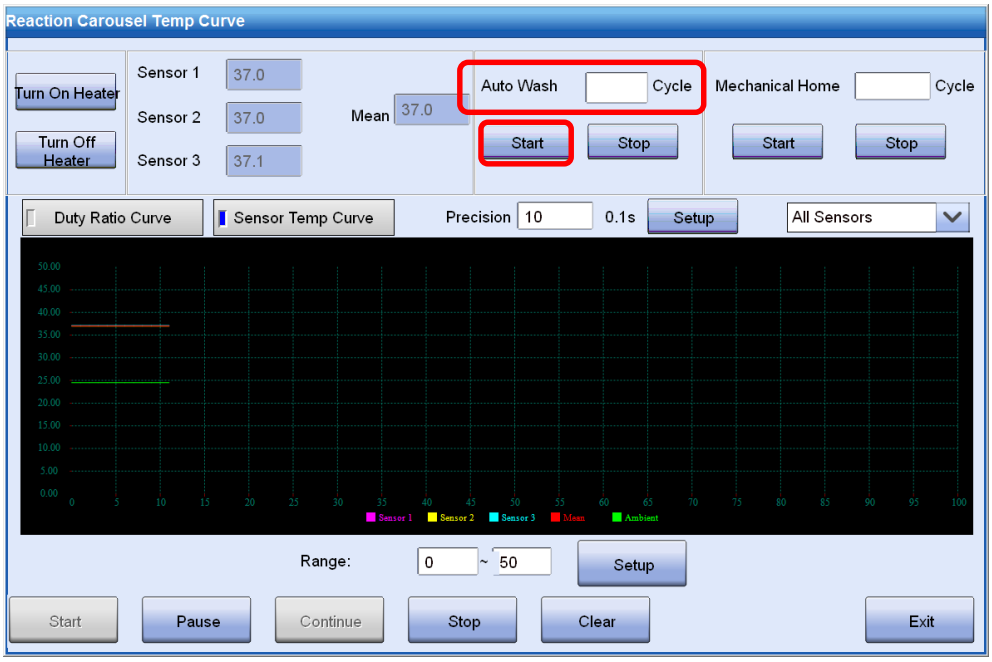
1) Run the operating software. Select Maintenance -> Alignment -> Hydro Unit and select Pump Check as shown below.



2) Select P03 and turn on.
3) Check Pump P03 in the front of the analyzer to see if the pressure is within 32-40kpa. If the pressure is abnormal, the pump may go wrong or other causes lead to this error. Check the system again.
4) Check Pump P03 in the front of the analyzer to see if the pressure is within 15-24kpa. If the pressure is abnormal, the pump may go wrong or other causes lead to this error. Check the system again.
5) For deionized water pressure adjustment, refer to 7.11.6 Adjustment of Deionized Water Pressure.

Check fluid level in cuvette

1) Remove the cover of the reaction carousel. Make sure there is no liquid in the cuvettes.
2) Enter alignment and select Pyrology Unit-Reaction Carousel Temperature Curve as shown below. Enter 6 cycles for auto wash and click start.



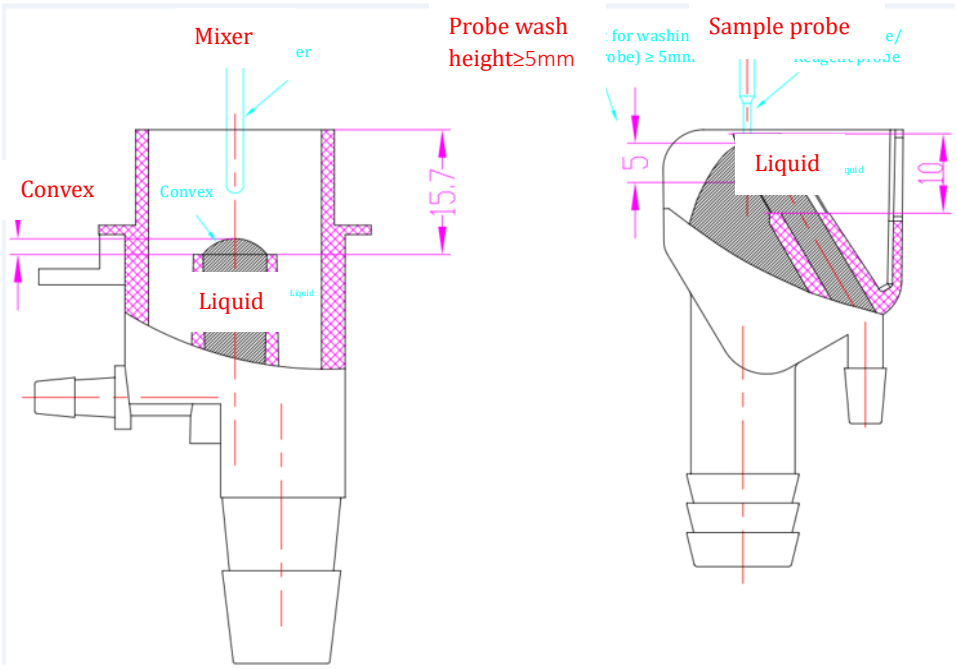
3) The system starts auto wash for 6 times and stops.
4) Find the 6 cuvettes with liquid in them and use the tweezers to remove them on the clean table top.
5) Find the 6 cuvettes with liquid in them and use the tweezers to remove them on the clean table top.
6) Use the ruler to measure the liquid height in the 1 to 6 phases cuvettes and the height is about 20mm. In

normal condition, it should not be less than 20mm. If the liquid height is obviously low, the dispense tubes or restrictive tubes may be blocked. Check the tubes and confirm the liquid height again.

7) Exit the alignment screen.
8) Install back the cuvettes and the reaction carousel cover.
9) Home the system and execute special wash cuvette to dry the liquid in the cuvettes.

Check probes/mixers exterior wash flow

1) Open the upper cover of the analyzer and home the system.
2) Select Utility -> Maintenance -> Maintenance, then select Biochemistry Maintenance.
3) Select Probes/Mixers Exterior, and then select Continue.
4) Liquid flows out of the probe and mixer wash wells automatically. Observe the water flow of the 3 probe wash wells and the 2 mixer wash wells according to the exterior wash order. Check that the probe wash wells are neither spilling and overflowing water nor blocked, and the probe wash height is ⩾ 5mm; check that the mixer wash wells spray out water through the middle hole with an 1-2mm convex.



5) Repeat the above steps for more than 3 times to check if the probe/mixer flow is normal. If not, check the exterior wash tubes. (First check if the restrictive tube at the exterior wash valve's outlet is clogged.) Check the flow again after solving the problem.
6) Select Done.
7) Close the maintenance window.

10 Troubleshooting

This chapter provides methods to locate and troubleshoot the errors and problems. Read this chapter thoroughly to achieve the best performance of the instrument.

10.1 Classification of Logs

The logs provided by the system are divided into:

- Error log
- Edit log

10.1.1 Error Logs

Error logs record all types of failures occurring on the system components. The table below shows all failures divided by component:

Table 10-1 Classification of failure based on component

No.	Failure by component	No.	Failure by component
1	Operating system	13	Reagent mixer unit
2	System communication	14	Reaction carousel unit
3	Database	15	Sample carousel unit
4	Result calculation	16	Reagent carousel unit
5	Sample bar code	17	Wash station
6	Reagent bar code	18	Temperature unit
7	Host communication	19	ISE unit
8	Command execution	20	Light source
9	Sample probe unit	21	Cuvette wash station
10	Probe R1 unit	22	Reagent refrigeration unit
11	Reagent probe unit	23	Other
12	Sample mixer unit	24	Home process

Error code

Each error has a unit code used for identification and locating probable causes and solutions. An error code consists of 6 letters and numbers, such as "**C01001**", in which "**C**" indicates that the error occurs on the operation unit, "**01**" is the error description of instrument connection, and "**001**" is the serial number of the error. Therefore, "**C01001**" is described as "the first error of instrument connection on the operation unit".
The following tables provide a summary of error codes for the operation unit and analyzing unit.

Table 10-2 Error code of the operation unit

Error Code	Description
C	Indicates that the error occurs on the operation unit.
00-99	Indicates the specific component on which the error occurs. 00-Operating system 01- System communication 02-Database 03-Result calculation 04-Sample bar code 05-Reagent bar code

	06-LIS host communication 07-Other
000-999	Serial number of the error.

Table 10-3 Error code of the analyzing unit

Error Code	Description
A	Indicates that the error occurs on the analyzing unit.
00-99	Indicates the specific component on which the error occurs. 00-Command execution 01-Sample probe unit 02-Probe R1 unit 03-Reagent probe unit 04-Sample mixer 05-Reagent mixer 06-Reaction carousel unit 07-Sample carousel unit (including sample bar code module) 09-Reagent carousel unit (including reagent bar code module) 11-Wash unit 12-Temperature unit 14-Reagent refrigeration unit 15-Other 21-Probe interior wash unit 22-Home process or ISE unit
000-999	Serial number of the error.

Help

Every error log is provided with online help information. Select the  icon in front of an error log. The descriptions, possible causes and solutions of the error are displayed.

10.1.2 Edit Logs

Edit logs record all deletions and part of editing actions performed by the user.

- The deleting logs record all deleting actions other than the error deletion.
- The editing logs include editing of sample results and calibration factors.

10.2 Viewing and Handling Logs

All error logs and edit logs can be recalled, searched, refreshed, deleted and printed.

10.2.1 Description of Error Log Screen

Select **Alarm** in the function buttons area of the main screen. The **Error Log** screen is displayed by default and shows all errors occurring on the current day.

Figure 10-1 Error Log screen

Every error log contains the event ID, date/time, error description (by processing method), event class (by subsystem) and symptom.

Choose the following buttons as needed:

- **Search F1**: to search for error logs by date, event ID, symptom, or event class.
- **Refresh F2**: to refresh the error logs based on the current search conditions.
- **Delete F3**: to remove specified error logs on the screen.
- **Print F7**: to print all error logs currently displayed on the screen.

10.2.2 Description of Edit Log Screen

Select **Alarm > Edit Log**. The **Edit Log** screen is displayed and shows all editing actions occurring on the current day.

Figure 10-2 Edit Log screen

Every edit log contains the serial number, date/time, operator, event type and description.
Choose the following buttons as needed:

- **Search F1**: to search for edit logs based on the occurring date.
- **Refresh F2**: to refresh the edit logs based on the current search conditions.
- **Delete F3**: to remove specified edit logs on the screen.
- **Print F7**: to print all edit logs currently displayed on the screen.

10.2.3 Recalling Logs

Error logs and edit logs can be recalled by all users in any system status. Error logs can be recalled by date, event ID, symptom and event class, while edit logs can only be recalled by occurring date.
Perform the following steps to recall desired event logs:

1) Select Alarm > Error Log or Edit Log.
2) Select Search F1.
3) Enter one or more of the following conditions:

- Date
- Event ID (available for error logs only)
- Symptom (available for error logs only)
- Event class (available for error logs only)

4) Select **OK**. The event logs satisfying the conditions are displayed on the screen.

5) Choose the following buttons as needed:

- **Refresh F2**: to refresh the logs based on the current search conditions.
- **Delete F3**: to remove specified logs on the screen.
- **Print F7**: to print all logs currently displayed on the screen.

10.2.4 Refreshing Logs

To refresh the event logs, perform the following procedure:

1) Select Alarm > Error Log or Edit Log.
2) Select Refresh F2.
3) The system refreshes the logs based on the previous search conditions.

- New error logs are displayed chronologically and highlighted by different colors. Yellow indicates a warning, and red indicates a serious error.
- New edit logs are displayed chronologically on the front-most of the log list.

4) Choose the following buttons as needed:

- **Delete F3**: to remove specified logs on the screen.
- **Print F7**: to print all logs currently displayed on the screen.

10.2.5 Clearing **Logs**

Since the system has a limited storage capacity, you should clear and manage the event logs regularly to ensure that the most-recent and important logs are kept. Only users with sufficient permissions are allowed to delete event logs.

Perform the following steps to clear event logs:

1) Select Alarm > Error Log or Edit Log.
2) Select event logs you desire to delete.
3) Select Delete F3.
4) Select OK. To abort the deleting, select Cancel.

When you confirm the deleting, the system removes the selected event logs from the screen.

10.2.6 Printing Logs

After searching for desired logs on the **Error Log** or **Edit Log** screen, select **Print F7**. The event logs currently displayed are printed out in the same format as shown on the screen.

Printing logs will take a long time and requires a great number of papers. Think twice before printing logs.

To terminate the printing, select **Utility > Commands > Stop Print**.

10.3 Troubleshooting Methods

When an error occurs, it will be indicated in many ways. The following pages describe how to troubleshoot errors and help you determine solutions to such errors.

Generally, troubleshooting is divided into the following steps:

1) An error occurs and is indicated in various ways.
2) Check the error logs and component status.
3) Identify the error and determine relevant solutions.

4) Implement the solutions.
5) Check and evaluate the implementation of the solutions.

10.3.1 Error Indications

Errors may occur on hardware, software and the entire system. When an error occurs, it will be indicated in many ways to help identify it and determine the possible causes and solutions. Errors can be indicated by alarm tone, alarm message, color, alarm message box, result flag and error log, through which you will obtain detailed information about errors and find the relevant solutions.

Alarm tone

When an error occurs, the buzzer gives alarm tone reminding you to notice the error and take corrective actions. Alarm tone can be adjusted manually or silenced.
Perform the following steps to adjust the alarm tone:
1) Select Utility > System Setup.
2) Adjust the alarm tone in the Alarm Volume field.
3) Test the alarm tone until it is satisfied.
4) To silence the alarm tone, drag the slider to the leftmost position of the scale.
5) Select Save F8 to save the adjustment.

Alarm message

When an error occurs, the system gives an alarm and displays the alarm message in the second line of the prompt message area.

Color highlight

An error will be indicated by highlighting relevant buttons and screen texts with different colors. Yellow indicates a warning, and red indicates a serious warning or error.

- **Reagent** button
- **Utility** button
- **Alarm** button

Select a button to access relevant function page, check for abnormities and take corrective actions. When the problem is solved, the alarm indication disappears.

Alarm message box

An error can also be shown in an alarm message box, which contains the date/time, event ID, time(s) and help icon.
Errors that are indicated through an alarm message box are divided into the following types:

- Common error: including those that are indicated by warning the user, and by invalidating tests, reagents and samples. When such error occurs, the alarm message box shows with the title bar highlighted in yellow.
- Serious error: including those except for the common error. When such error occurs, the alarm message box shows with the title bar highlighted in red, and you are only allowed to reboot or exit the system.

When an alarm message box appears, select the **Alarm** button to view the new error logs, analyze the possible causes and determine relevant corrective actions.

Flag

Flag is also called data alarm. When calibration error or failure, or sample result error occurs due to the sample, reagent or system failure, a flag will appear near the corresponding calibration result or sample results.

Error log

All alarms are recorded in the error logs. By recalling the error logs you are enabled to master the current status of the system and troubleshoot errors.

10.3.2 Identifying Errors

To identify errors, understand the error indication thoroughly, check the error logs and system status, and then determine relevant solutions.

The table below shows the error types that may occur on the system. Find relevant corrective actions according to the description.

Table 10-4 Error types

Error Type	Description
Instrument failure and error	Instrument failure and error may be detected on all subsystems and processed in different ways. Such errors are shown in the Error messages and corrective actions table, and can be identified through the event ID.
Data alarm	Data alarm is a flag indicating biochemistry or ISE chemistry result error. The flags are included in the Result flags table, and can be identified through the flag symbol.

10.4 Common Troubleshooting

10.4.1 Database Initializing Failed

Error phenomenon: Database initializing failed.

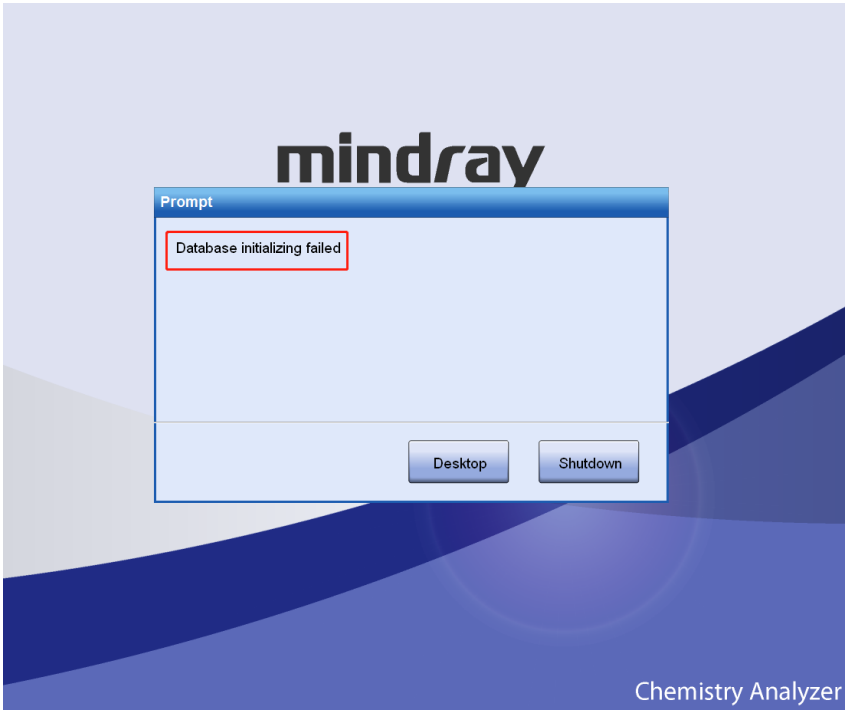


Figure 10-3 Database initializing failed

Error triggering rules: This error is reported when the instrument fails in initializing the database upon startup.

Solution:

1) Check and ensure that the current account is administrator.
2) Ensure that **Compatibility Mode** is not selected on the property bar of the software startup program.

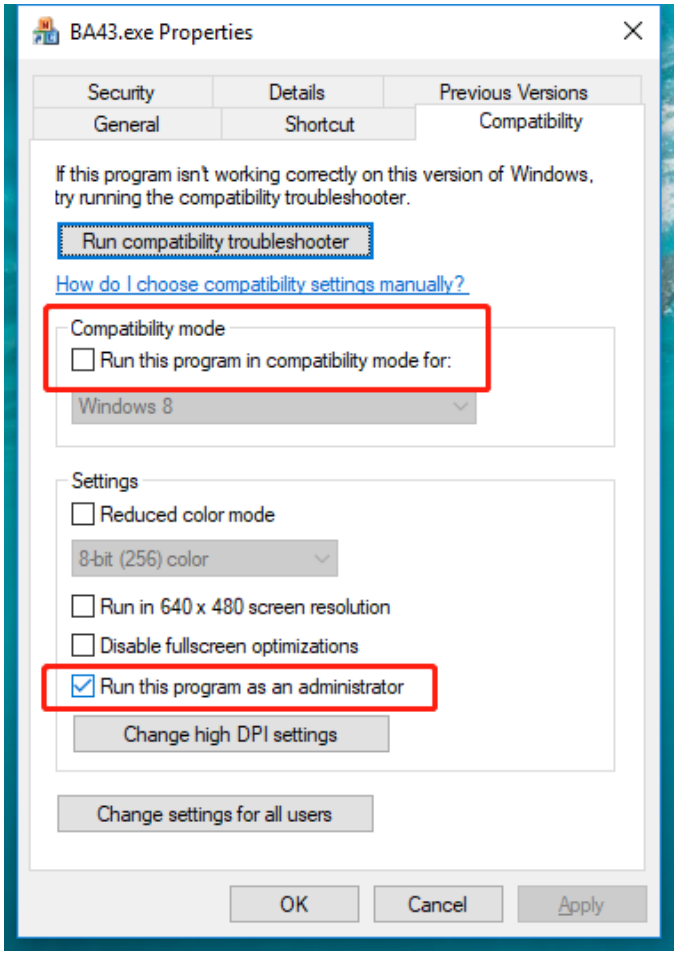


Figure 10-4 Properties Window

3) Back up the Database folder. Leave the Backup file in this folder and delete the rest files. Enter the software. If you can normally enter the software, it indicates that an error occurs to the current database file. If you cannot normally enter the software, go to next step.
4) Unload the SQL database and reinstall it. Check whether you can enter the software. If you cannot enter the software, go to the next step.
5) Reinstall the operating system and software. If you still cannot enter the software, format the disk where the software installation directory resides. Reinstall the software again.

10.4.2 Database Backup Failed

Error phenomenon: Database backup failed.
Error triggering rules: This error is reported when the instrument fails in backing up the database upon startup and shutdown.

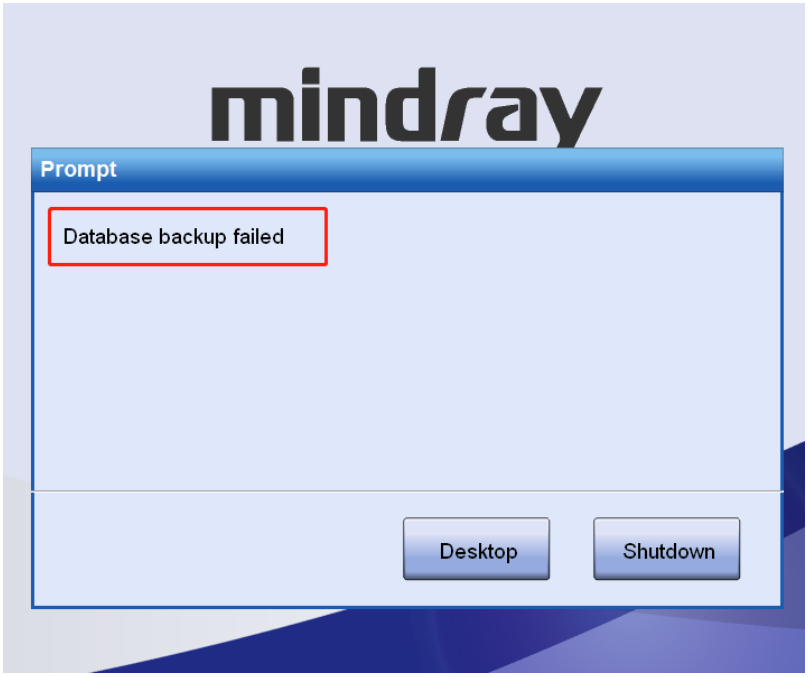


Figure 10-5 Database backup failed

Solution: Delete the BackUp file in the Database folder. Restart the instrument.

10.4.3 Database Version Is Higher Than The Software Version

Error phenomenon: Database version is higher than the software version.

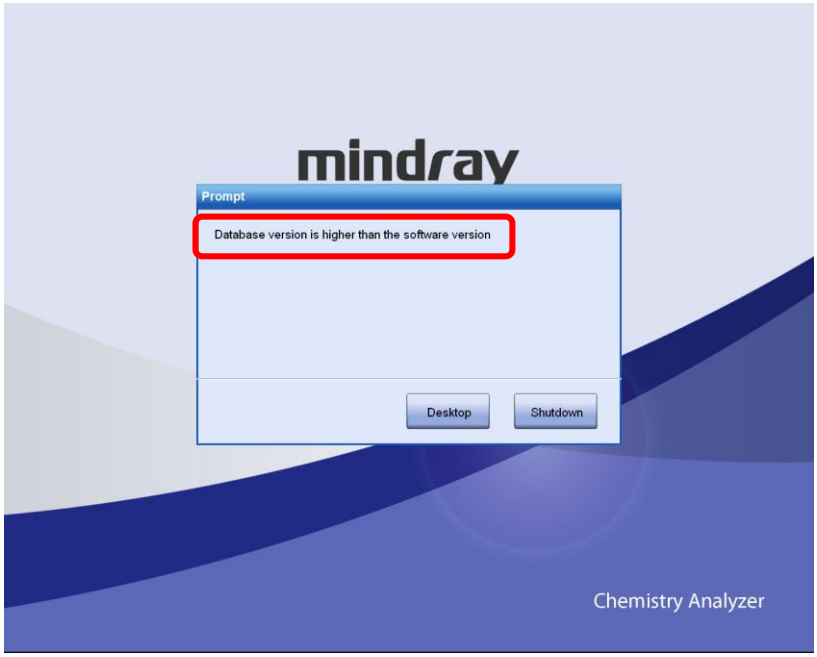


Figure 10-6 Database version is higher than the software version

Error triggering rules: This error is reported when the SQL database software version mismatches with the database file version of the software.

Solution:

1) Locate the Databaseconfig file in the software installation directory. Open this file by using Notepad and find the last section of characters.
<Property name="DBVer">99</Property></SessionFactory></DBConfigure>
2) Change 99 into a digit greater than that marked with 5, namely, 97 in this example. Save the file. (Note: This figure is the screenshot when the instrument is normal. If the instrument is abnormal, 99 may be another digit.)
3) Restart the software.

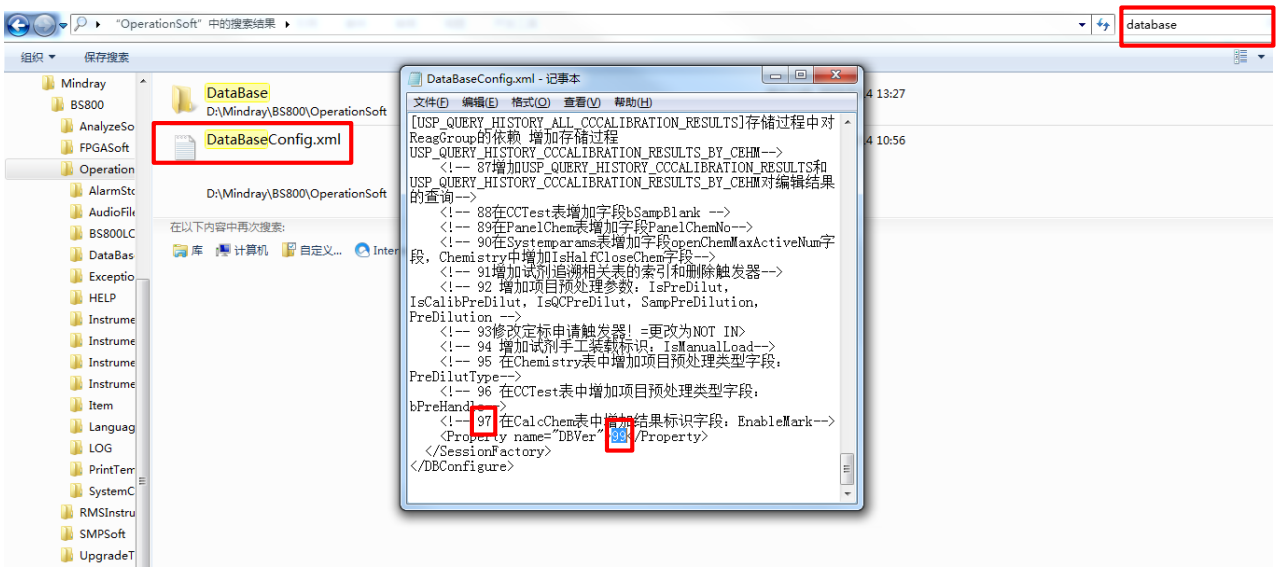


Figure 10-7 How to rectify the error "Database version is higher than the software version"

10.4.4 Unmatched Operating Software Version

Event ID: A22039

Error phenomenon: Software version does not match during home procedure.

Error triggering rules: This error is reported when the operating software version mismatches with the control software version.

Solution: Upgrade the operating software, and then the control software. Ensure that the program for upgrading the control software is the latest. Follow the instructions to upgrade the control software.

10.4.5 Operating Software Freeze

Error phenomenon: Operating software freeze and slow response

Solution:

1) Two causes for too large database file:
   a) The instrument is used for a long term, resulting in too large BackUp file in the Database folder. In this case, ask the R&D personnel to help optimize the database.
   b) The BackUp file is too large. For example, its size exceeds 20 GB. In this case, delete it, and restart the instrument.
2) The PC is infected with viruses.
3) A third-party software is installed on the PC. An input method may also be installed.
4) The instrument is not powered down for a long term (exceeding 1 month).
5) A function key on the instrument keyboard is stuck.

10.4.6 Configuring Key Parameters Failed

Error phenomenon: Configuring key parameters failed.

Error triggering rules: This error is reported when the non-motion parameters and related assembly are not properly configured.

Solution:

1) Choose **Alignment** > **Component Version Config**. Set the corresponding version. If the error still exists, go to next step.
2) Choose **Alignment** > **Parameters**. Configure non-motion parameters of all the units again.

10.4.7 Equipment Cannot Be Connected

Error phenomenon: The operating software reports the failure in connecting with the instrument.

Error triggering rules: This error is reported when the instrument cannot be connected.

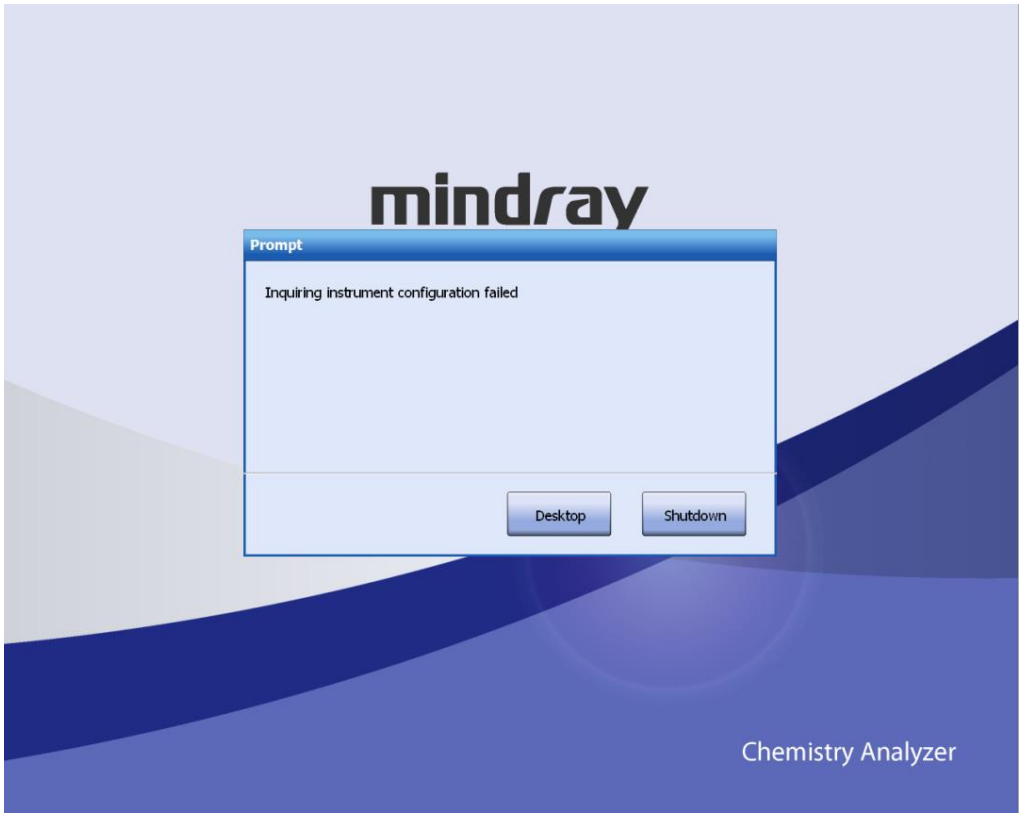


Figure 10-8 Equipment cannot be connected

Error analysis: Analyze and rectify this error according to the following figure.

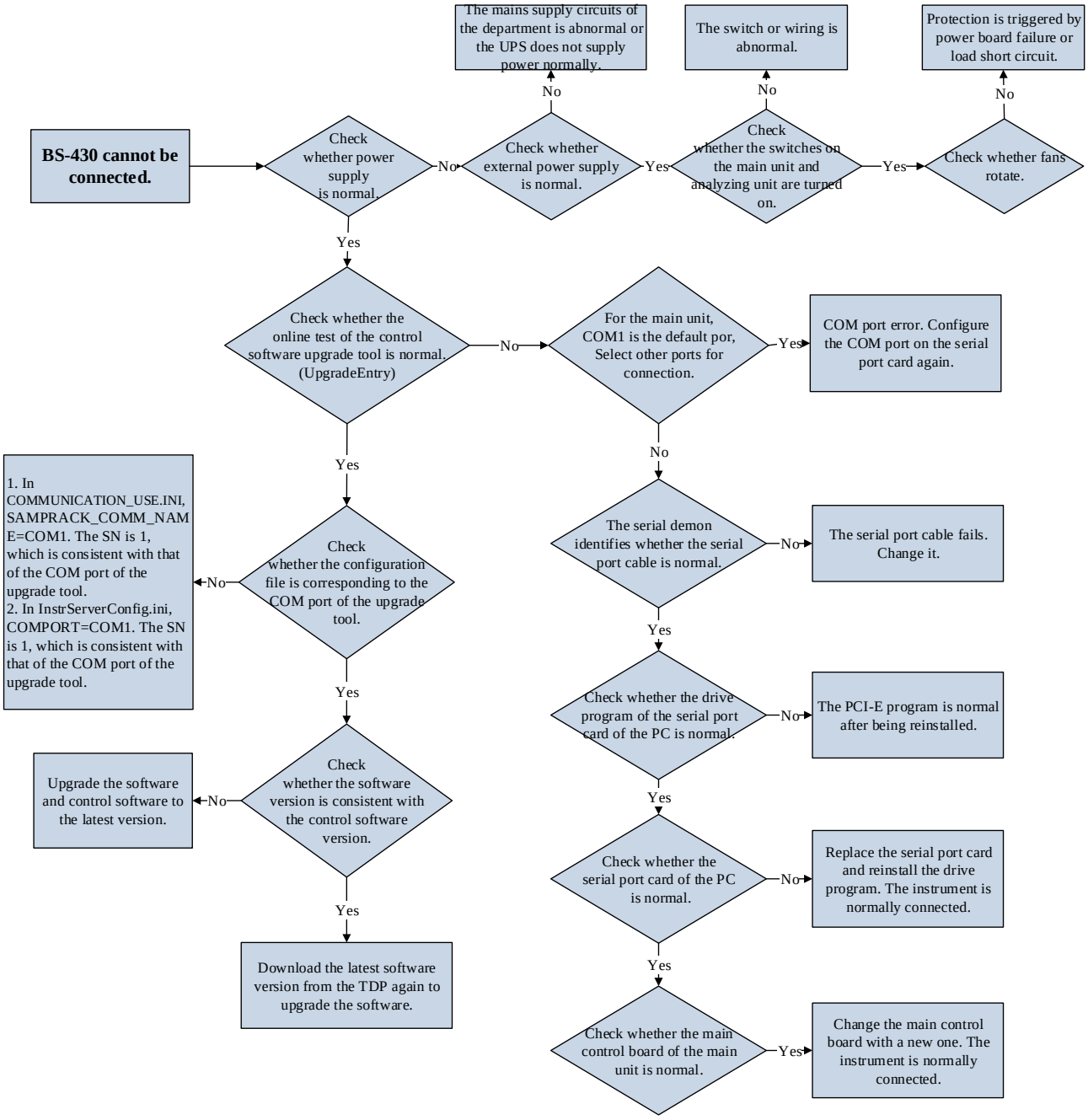


Figure 10-9 Troubleshooting procedure

10.4.8 Water Residues Exist in the Cuvette A02027

Error Code: A02027

Fault Information: water residues exist in the cuvette or Probe level detection failed

Fault Scenario: this alarm occurs during the analyzer test.

Fault Mechanism: the residual water is detected in the cuvette when the probe adds the R1 reagent to the reaction carousel.

Possible Cause:

- Horizontal and vertical positions of the probe to the reaction carousel not correct
- Damaged probe

- Fluidics leakage of the probe
- Overflow of the reaction carousel
- Ground interference
- Level detection signal processing problem

Procedure:

1) Open the reaction carousel cover and check if there is any residual water in the cuvette corresponding to the alarm. If there is, proceed to step 5, if not, proceed to the next step.
2) Check if the horizontal and vertical positions of the probe to the reaction carousel are correct. If they are not correct. please refer to the alignment guide, if the positions are correct, please proceed to the next step.
3) Check the verticality of the probe, visually measure it, or use a vertical reference for comparison. If the probe is not straight, please replace the probe.
4) Check if the analyzer is falsely alarmed due to interference:
   a) Confirm that the analyzer has a grounding wire and the zero ground voltage is <5V. The measuring method is: set the multimeter to AC 250V voltage, and connect the black test lead to the ground wire jack, and the red test lead to the live wire/zero wire jack, respectively. When the grounding is good, the voltage between the ground wire and the zero wire is less than 5V, and the voltage between the ground wire and the live wire is similar to the voltage between the live wire and the zero wire.
   b) Check whether the connection line of the level detection board is damaged, or is tied too tightly by the cable tie. Check if the board connector is loose. The specific operation method is
   c) If other level detection alarms appear at the same time, the level detection board 051-002479-00 is suspected and should be replaced.
5) Check the residual water source of the cuvette. There are two general conditions for the overflow of the wash station: one is that the liquid absorption is not smooth, and the other is excessive liquid dispensing. The first case is more common, please refer to the section 10.2.9 for specific steps*3) in section 10.2.9*..

10.4.9 Cuvette Blank out of Range C07004

Event ID: C07004

Description: Cuvette blank out of range

Error triggering rules: During testing, when the AD (water blank) value of any wavelength channel of any reaction cuvette is less than the alarm threshold, the instrument skips this cuvette and reports an error: Cuvette blank out of range.

Possible causes:

- The cuvette is contaminated.
- The lamp is aging.
- The lamp is not installed correctly.
- The wash station sucks and dispenses liquid incorrectly.
- The optical lens is dirty.
- The light splitter lens assembly is abnormal.
- The light splitter component is abnormal.

Solution:

1) The reaction cuvette may be dirty. Foreign matters may fall into the reaction cuvette. The reaction cuvette position in the reaction carousel is incorrect after you manually wash the reaction cuvette. It is recommended that you should check the reaction cuvette. On the **Biochemistry Maintenance** tab page, click **Special Wash**, which can be performed by the user. Ask the user to check whether liquid overflows from the wash station. If the reaction cuvette cannot be cleaned, and a scratch exists on the cuvette surface, change the reaction cuvette.
2) The lamp is aging or the new lamp is not installed in position. Ask the user about the use time of the lamp. If the lamp has been used for more than 2,000 hours, recommend changing the lamp.
3) The water at the client and the tubes of the wash station are dirty, resulting in low water blank AD value; or the dispense probe of the wash station is blocked, resulting in that the dispense volume is less than a half of the reaction cuvette height.
4) If liquid overflows from the wash station, foreign matters may exist in the reaction cuvette, which blocks the waste discharge probe of the wash station; or drain waste valve cannot be opened, resulting in abnormal waste drainage; or the drain waste pump is abnormal, resulting in abnormal waste drainage.
5) The optical path is dusty and the front optical assembly is aging. Clear the dust on the optical path and adjust gain.
6) The power supply circuit component of the lamp is aging, resulting in the power supply voltage attenuation of the lamp. Adjust the lamp voltage. The arrange voltage of the lamp is 10.5V~11.8V.
7) The optical assembly is abnormal, which shall be replaced.

10.4.10 Light Intensity Is Too Weak C07003

Event ID: C07003

Description: Light intensity is too weak.

Error triggering rules: During testing, when the AD (water blank) value of any wavelength channel of four reaction cuvettes is less than the alarm threshold, the instrument stops testing and reports an error: Light intensity is too weak.

Possible cause: This error is reported when error of Cuvette blank out of range occurs for 4 times. For the troubleshooting, see *10.3.9 "Cuvette Blank out of Range C07004"*.

Troubleshooting: See "Cuvette Blank out of Range C07004".

10.4.11 Water Blank out of Range (10X)

Event ID: C07009

Description: Water blank out of range (10X)

Error triggering rules: If the current water blank AD value of the 340 nm channel of a cuvette is 3% more than the last value, the system skips this cuvette. If the current water blank AD values of the 340 nm channel of ten cuvettes are 3% more than the last values, this error is reported.

Possible causes:

- Fluctuation of light source.
- Wash station overflow.
- Insufficient dispense volume of the sixth phase.
- Air bubbles exist when the sixth phase is washed.
- The water for washing is dirty.

- The cuvette is contaminated and cannot be completely cleaned.
- Human factors:

a) Do not follow the maintenance software procedure to replace the lamp. If the lamp is replaced according to the procedure, the water blank base value is automatically cleared.
b) Do not follow the maintenance software procedure to replace the cuvette. If the cuvette is replaced according to the procedure, the water blank base value will be automatically cleared.
c) Change the light brightness on the parameter configuration screen. Direct change may trigger this error.
d) Change the photoelectric gain on the parameter configuration screen. Follow the alignment procedure to adjust photoelectric gain regardless of directly changing it.
e) If water blank base value is not cleared after the signal collecting position is adjusted, replace the lamp again to clear the water blank base value.

Solution:

1) The reaction cuvette may be dirty. Foreign matters may fall into the reaction cuvette. The reaction cuvette position in the reaction carousel is incorrect after you manually wash the reaction cuvette. It is recommended that you should check the reaction cuvette. On the **Biochemistry Maintenance** tab page, click **Special Wash**, which can be performed by the user. Ask the user to check whether liquid overflows from the wash station. If the reaction cuvette cannot be cleaned, and a scratch exists on the cuvette surface, change the reaction cuvette.
2) The lamp is aging or the new lamp is not installed in position. Ask the user about the use time of the lamp. If the lamp has been used for more than 2,000 hours, recommend changing the lamp.
3) Do not follow the related procedures to change the lamp or cuvette. Follow the procedures of changing the lamp or cuvette.
4) The water at the client and the tubes of the wash station are dirty, and the stainless steel filter core is blocked, resulting in low water blank AD value; or the dispense probe of the wash station is blocked, resulting in that the dispense volume is less than a half of the reaction cuvette height.
5) If liquid overflows from the wash station, foreign matters may exist in the reaction cuvette, which blocks the waste discharge probe of the wash station; or drain waste valve cannot be opened, resulting in abnormal waste drainage; or the drain waste pump is abnormal, resulting in abnormal waste drainage.
6) The power supply circuit component of the lamp is aging, resulting in unstable power supply voltage of the lamp (not always 12 V).
7) The optical assembly is abnormal, which shall be changed.
8) The A/D collecting board or main control board is abnormal.

10.4.12 Lamp Is not Turned On C07005

Event ID: C07005

Description: Lamp is not turned on.

Error triggering rules: During testing, when the AD (water blank) values of 340 nm channel of three reaction cuvettes are less than 1,000, the instrument stops testing and reports an error: Lamp is not turned on.

Possible causes:

- The lamp is damaged.
- The lamp cable is not connected properly.
- The power board of the lamp is not connected properly.

- The power supply of the analyzing unit is disconnected.
- Wash station overflows.
- The light splitter lens assembly is abnormal.
- Optical assembly fails.

Solution:

1) The lamp is damaged or the new lamp is not installed in position. When the instrument is started up, ask the user to open the reaction carousel cover. Check whether yellow light penetrates into the reaction cuvette. (Stand in front of the instrument. If the lamp is turned on, check whether yellow light penetrates into the reaction cuvette in the middle close to you.) If the lamp is normal, the penetrating yellow light is bright. If the penetrating yellow light is dimmed, it indicates that the lamp is aging.)
2) Foreign matters fall into the reaction cuvette. Recommend that the user should check the cuvette.
3) If liquid overflows from the wash station, foreign matters may exist in the reaction cuvette, which blocks the waste discharge probe of the wash station; or the level 2 drain vacuum waste valve cannot be opened, resulting in abnormal waste drainage; or the vacuum release valve or suck valve is abnormal, resulting in abnormal waste drainage.
4) The power cable of the lamp is not properly connected or the power board do not output 12 V power.
5) The optical assembly is abnormal, which shall be changed.
6) The A/D collecting board or main control board is abnormal.

10.4.13 Light Intensity Is Too Strong C07006

Event ID: C07006

Description: Light intensity is too strong.

Error triggering rules: During testing, when the absorbance value of any wavelength channel of a reaction cuvette is less than 4000.

Possible causes:

- The light source voltage fluctuates.
- The lamp fails.
- Photoelectric gain adjustment is abnormal.
- Reaction carousel overflows.
- The lens is abnormal.
- The optical assembly is abnormal.

Solution:

1) The lamp is used for more than 2,000 hours or 6 months; or a bulb not produced by the original factory is used. Change the lamp. For details, see 3.9.3 “Replacing Lamp”.
2) Check whether the reaction cuvette is installed and whether the wash station overflows. For details, see step 3 in section 10.4.14.
3) Choose **Utility** > **Maintenance** > **Parameters**. Select **Reaction Carousel**.
4) The photoelectric gain of each channel of wavelength is between 31 and 255. The greater the photoelectric gain, the smaller the AD value and the higher the absorbance value.

There are two methods of changing the photoelectric gain. The first method is recommended.

a) Adjust photoelectric gain according to section 7.3.3 “Photoelectric Gain Adjustment”. After adjustment,

the photoelectric gain changes.

b) Set the gain again according to section 6.7.4 “Parameter Configuration”.

5) If the error still exists after you change the gain into 255, try to replace the lamp.
6) If the error still exists, change the optical assembly.

10.4.14 Cuvette Overflow

Error phenomenon: Wash solution overflows when the reaction cuvette is washed. Obvious water stain exists on the surface of the cuvette or 8-phase wash probe obviously drops liquid. The instrument frequently reports “Cuvette blank out of range”, “Lamp is not turned on”, and “Water blank out of range (10X)”. The instrument stops testing.

Possible causes:

- The 8-phase wash probe, aspirate probe, or aspirate tube is blocked by foreign matters, resulting in the failure in aspirating waste in the reaction cuvette. (Human factor)
- Dispense volume is not evenly distributed or wash valve is not completely closed (V15 to V19), or a valve fails.
- Aspirating liquid abnormal (P11~P13).

Solution:

1) For the human factor, check whether the aspirate probe and tubes are blocked. The outstanding feature of the overflow caused by blocked aspirate probe or tube is that a single probe drops liquid or liquid overflows at a position. In this case, unclog the probe or tube.
2) A dispense valve of auto wash station, such as V15, V16/V17, V18/V19, may be blocked, resulting in too great dispense volume of the adjacent valve; or a valve fails and thus drops/dispenses liquid all the time.
3) During cuvette cleaning, when the 8-phase wash probe assembly starts to lower to the cuvette, the waste pumps P11 to P15 are opened to discharge the waste from the cuvette to the outside of the instrument. If one of these pumps was broke, the waste liquid should not be discharged on time.

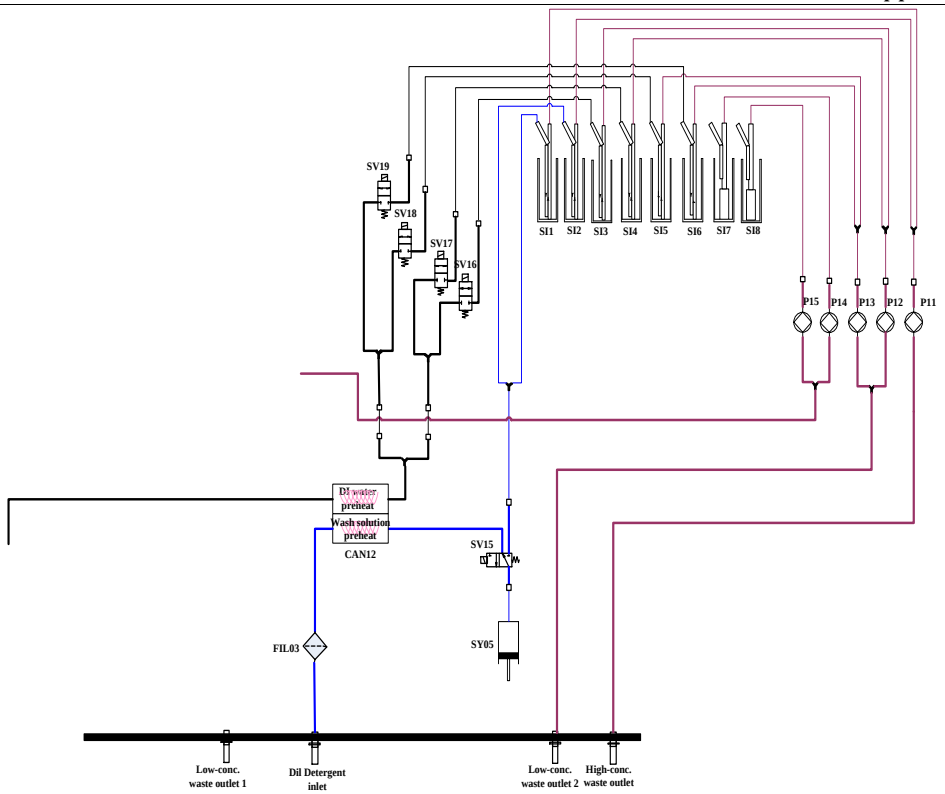


Figure 10-10 Schematic diagram of cuvette wash unit

10.4.15 Reaction Carousel Temperature Is out of Range A12005

Event ID: A12005

Description: Reagent refrigeration temperature is out of range.

Error triggering rules: This error is reported when the reagent refrigeration temperature is beyond the range of 2℃ and 8℃.

Possible causes:

- The ambient temperature is out of range.
- The reagent carousel temperature sensor goes wrong.
- The temperature protection switch goes wrong. (component error, cable error)
- The reagent cooler goes wrong.
- Reagent refrigeration board goes wrong.
- Electromagnetic interference exists.

Solution:

1) Peltier cooler goes wrong. Due to poor airtightness of the reagent refrigeration module, condensing water enters the Peltier cooler area, resulting in damaging Peltier cooler and increasing current, or even damaging the reagent cooler or 12V power board.
2) The temperature sensor reagent refrigeration compartment fails. The sensor is a negative temperature coefficient: 5 kΩ at -25℃, and 11 kΩ at -4℃.

3) Refrigerant loss occurs due to long-term operating, resulting in poor refrigeration effects. Inject refrigerant again.
4) The loading capability of the 12V30A power plate is weakened, resulting in abnormal working of the reagent cooler. Some Peltier coolers cannot run normally.
5) The ambient temperature is excessively high, affecting refrigeration effect of the reagent carousel.

10.4.16 Sample Probe Vertical (Horizontal) Movement Error A01006

Event ID: A01006
Description: M1: Sample probe vertical movement error
Error triggering rules: This error is reported when the vertical movement zero position sensor of the sample probe does not receive reset signals within the specified time.
Possible causes:

- The sensor does not work properly.
- Belt or belt wheel is loose.
- Drive assembly is blocked.
- Sensor signal cable or motor cables fail.
- Three-probe drive board fails.
- Drive board of the sample probe fails.

Solution:
1) The belt wheel is loose or dirty, resulting in abnormal movement.
2) The sensor is dirty or abnormal.
3) The block on the drive assembly is not installed in position or deviates from its specified position. Therefore, movement is abnormal.
4) The drive assembly is dirty, resulting in blocked upward and downward movement. Use a gauze to remove dust and coat the rotor with lubricating grease.
5) Control drive board error: The three-probe drive board or sample control drive board is abnormal.
6) The drive motor fails and liquid drops into the motor interior.

10.4.17 Reagent Bar Code Scanning Failed

Error phenomenon: After the reagent carousel cap is closed, the reagent carousel does not rotate and reagent scanning is not performed. All the reagents cannot be scanned. The reagent at a position cannot be scanned. A specified item cannot be scanned.
Possible causes:
There are many causes for the failure in reagent scanning. From the perspective of previous error modes, major causes are as follows:

- The carousel cap is not installed properly. The magnetic sensor is not triggered or condensing water exists on the scanning window or reagent bar code scanning position deviates. All of these may result in the reagent scanning failure.
- The reagent bottle base is loose. The reagent bottle shakes during scanning, resulting in scanning failure.
- Parameter configuration of reagent items are incorrect, resulting in bar code matching failure.
- Stain or condensing water exists on the reagent bottle bar code or bar code is incorrect.

Solution:

Check whether all the reagents cannot be scanned or some items cannot be scanned or some positions cannot be scanned.

1) Assume that all the reagents cannot be scanned:
   a) Check whether reagent bottles are rotated and scanned after the carousel cap is closed. (Reagent scanning will make “Ga Ga” sound.) If reagent bottles are not rotated for scanning, short connect the magnetic sensor (after short connection, simulate the scenario that the carousel cap is closed). If the reagent carousel does not rotate or is not scanned after short connection, the sensor may be damaged. If the reagent carousel is scanned after short connection, it indicates that the carousel cap does not align with the specified position. In this case, reinstall the cap.
   b) Condensing water exists on the scanning window. Use a clean duster cloth to wipe water spray on the glass window. Normally, water spray may exist on the glass window exterior. The user shall remove it. If water spray exists on glass window interior, check whether the demisting heater is normal.
   c) If the reagent bottle base is loose or bar code on the reagent bottle is dirty or damaged, change the reagent bottle base or reagent bottle.
2) Assume that reagent bottles can be rotated and scanned, but most of reagents cannot be read.
   a) If this error is not caused by bar code contamination or heating window, it may be caused by scanning light bias, because instrument vibration will result in slight deviation of reagent bottle positions.
   b) On the alignment screen, check whether bar code scanning light of reagents is beyond the valid scanning range.

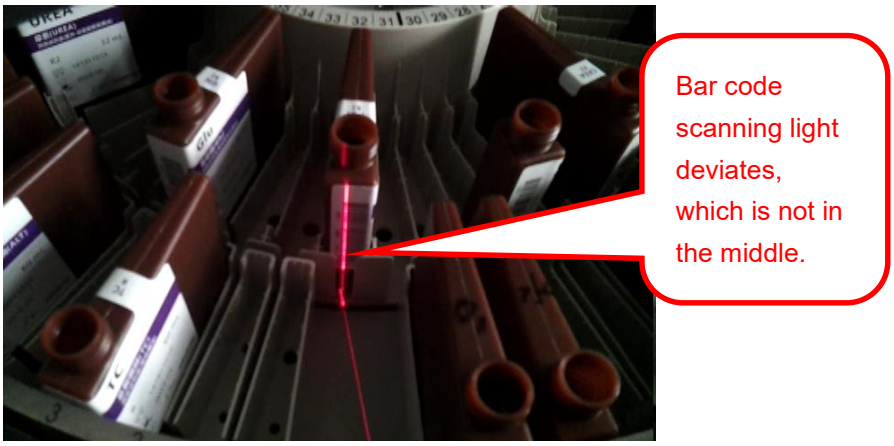


Figure 10-11 Checking bar code scanning light

Figure 10-12 Scanning light going through the fixture slot

c) Reagent parameters are not properly configured. Some items are involved with diversified specifications of the BS-430. Although item names are the same, but reagent bar codes differ. If parameters are not properly configured, reagent bar codes cannot be read. Therefore, reagents must match with the parameter table.

Locate the causes for bar code scanning failure according to the following figure:

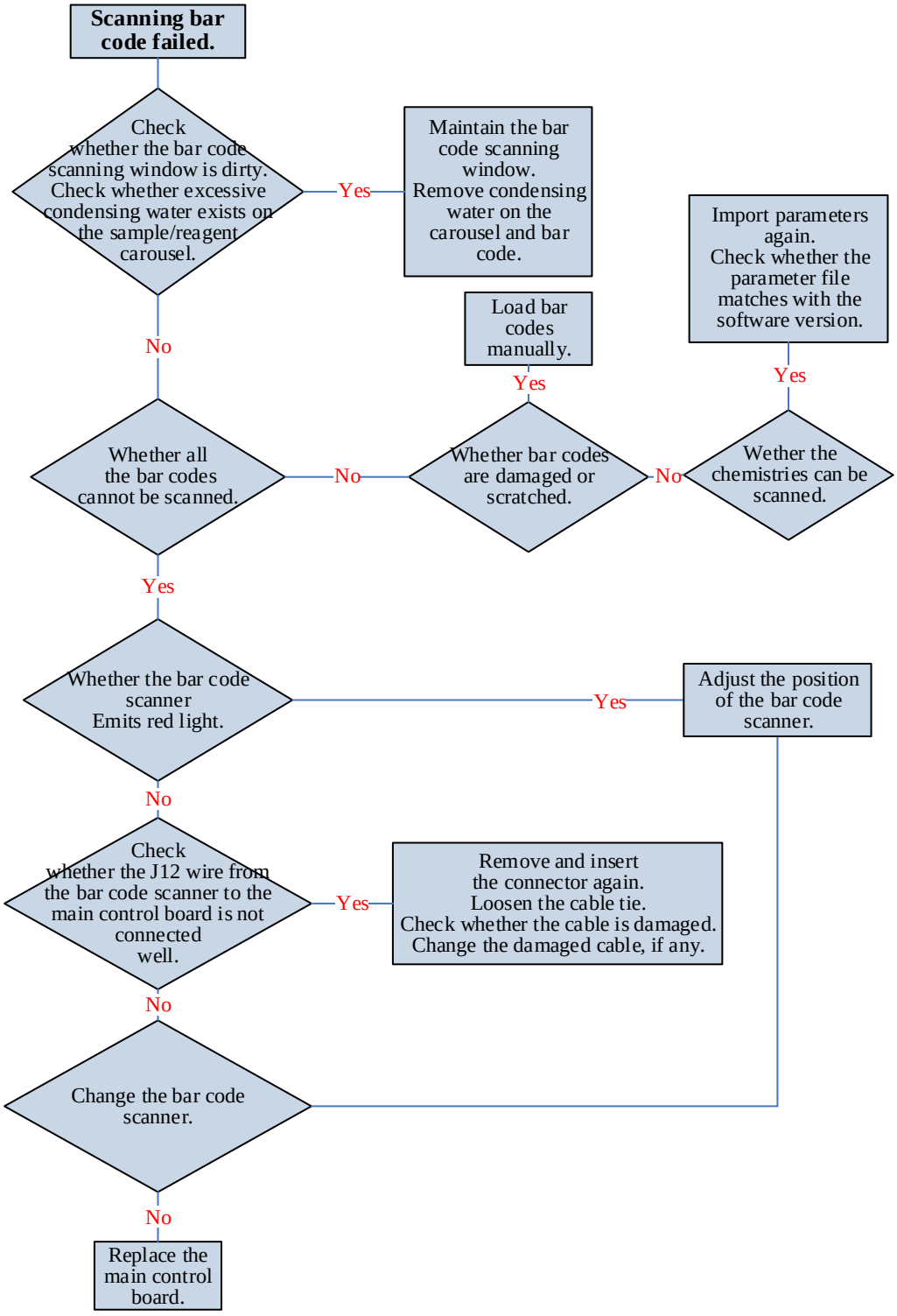


Figure 10-13 Procedure for locating the causes for reagent bar code scanning failure

10.4.18 Clinical Result Problems

Troubleshoot as follows:

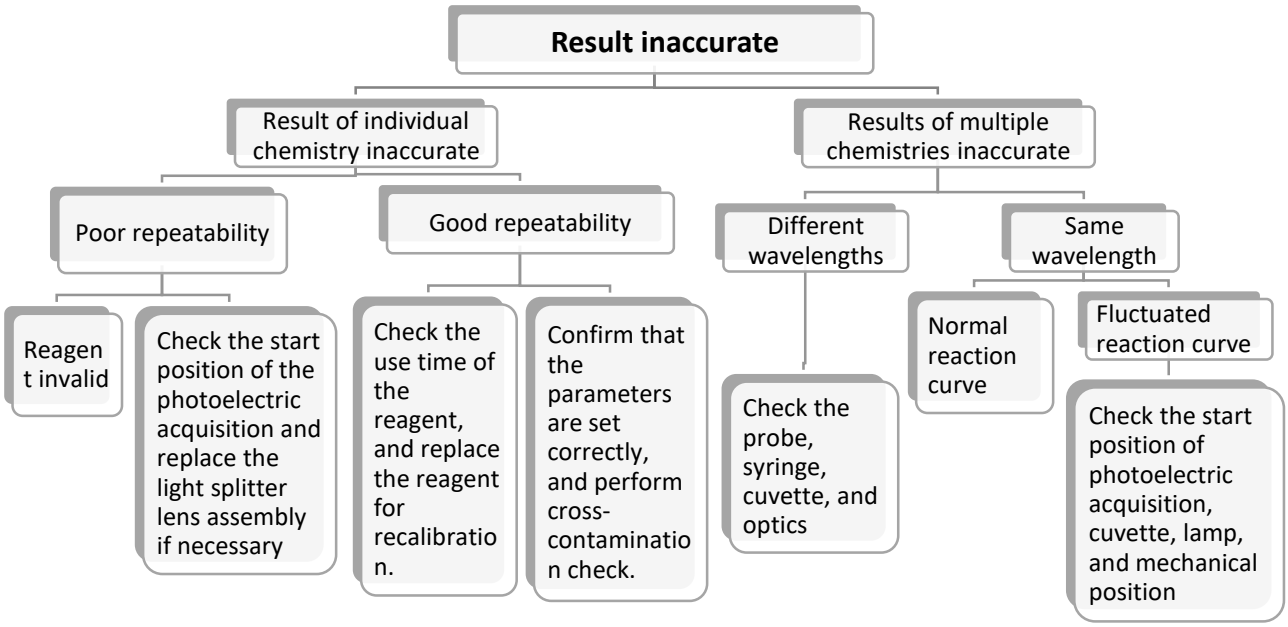


Figure 10-14 Troubleshooting clinical result problem

Client FAQ:

1) Common errors in parameters

- The parameter is set incorrectly, or the increment and decrement are set to the parameter.
- The 2nd generation reagents are used, but the parameters input are the 1st generation ones.

2) Calibration setup error

- The concentration value of the calibrator is set incorrectly, or a wrong calibrator is taken.
- The calibration rule is set incorrectly, and the wrong calibration rule is selected.
- The number of calibration repetitions is set incorrectly or may be set to only once, which usually should be 2 to 4 times by default.
- The calibrator displayed by the software expired and was not modified in time, and could not be calibrated.
- In the calibration rule, the calibrator is incorrectly selected, and there may be multiple calibrators for one chemistry.

3) QC setup error

- The control target value and SD value are set incorrectly, or the wrong control is taken.
- The QC rule is set incorrectly, and the correct control is not selected.
- The control displayed by the software expired and was not modified in time, and the QC could not be applied.

4) Redissolution error

- Dry powder calibrator and QC solution should be redissolved before use. An error occurs when redissolution with water, for example, only 3 ml of water is required, but 5 ml is added.
- The redissolved water is used incorrectly, for example, use the distilled water placed for a long time, or directly use the mineral water for redissolution. For redissolution, the distilled water for injection is recommended.
- Pipettes are recommended for redissolution when syringe or an uncalibrated sample gun is used.
- After redissolution, the storage is incorrect. After normal redissolution, the solution should be split charged and stored frozen, and the freezing and thawing cannot be repeated. The storage is recommended not to exceed 1 month.

5) Reagent problem

- Reagent is expired
- Reagent is not placed in the refrigerator
- Air bubbles in the reagent pack.
- Rgt load error
- Reagent tilt

6) Calibrator and control problem

- Matching calibrator and control are not used
- Calibrator and control used is not assigned

7) Analyzer problem

- Micro-blocking of the probe may result in an assignment or a low result
- The sample syringe leaks, which may result in poor repeatability
- The Teflon tubing from the probe to the sample syringe is folded or damaged, which may lead to poor repeatability of the results.
- If the lamp life exceeds 2000 hours or 6 months, the stability of the results may be poor, and the reaction curve may fluctuate. In particular, the enzymatic chemistry will frequently send an alarm of linearity limit out of range.
- If the photoelectric acquisition position is wrong, all the results will be unstable.
- If the cuvette is contaminated, the result will be unstable.
- If the mixer is dirty, the result will be unstable.
- Position shift will affect loading and mixing, resulting in unstable results.

8) Water quality problem

- Poor water quality will affect the results of chemistries such as ions.
- The TBA chemistry is affected by the pH value of water
- The water quality will affect the cleaning effect. There will be cleaning residue, affecting the results

9) Sample problem

- Sample centrifugation problem. The sample containing fibrinogen may block the probe.
- Sample trait problems, hemolysis, jaundice, chyle blood, etc.
- Blood collection tube problems. Separation of glue, etc. may be easy to result in probe blockage.
- Some patients have taken certain drugs and caused abnormal detection in some chemistries.

10.5 Data Alarms and Corrective Actions

10.5.1 Data Alarms

Data alarm is a result flag indicating that an error or abnormity occurs to a result. By identifying results flags can evaluate if the results are reliable and acceptable. Data alarm is not necessarily an error but will definitely influence the result and should be considered carefully.

The system provides monitoring of biochemistry results and ISE chemistry results. When calibration error or failure, or sample result error occurs due to the sample, reagent or system failure, a flag will appear near the corresponding calibration result or sample results. The following pages summary the result flags of the system.

10.5.2 Data Alarms and Corrective Actions

Table 10-5 Data alarms and corrective actions

Flag	Alarm Type	Description	Probable Causes	Corrective Actions
<	Result related	Exceeds linearity range low	The result exceeds the low limit of the linearity range.	Take no actions, or rerun the test for confirmation.
<	ISE result related	Exceeds measurement range low	Sample or control result exceeds the low limit of the measurement range.	Take no actions, or rerun the test for confirmation.
>	Result related	Exceeds linearity range high	The result exceeds the high limit of the linearity range.	Rerun the test with sample diluted or decreased.
>	ISE result related	Exceeds measurement range high	Sample or control result exceeds the high limit of the measurement range.	Rerun the test with sample diluted or decreased.
▲	Result related	Sample volume is Increased one	Sample volume is Increased one	No actions are required.
▼	Result related	Sample volume is decreased one	Sample volume is decreased one	No actions are required.
^	Result related	Exceeds reference range high	The result exceeds the high limit of the reference range.	No actions are required.
^!	Result related	Exceeds critical range	The result exceeds the high limit of the critical	No actions are required.

Flag	Alarm Type	Description	Probable Causes	Corrective Actions
		high	range.	
v	Result related	Exceeds reference range low	The result exceeds the low limit of the reference range.	No actions are required.
v!	Result related	Exceeds critical range low	The result exceeds the low limit of the critical range.	No actions are required.
10-x	Result related	10-x	Results of five runs (10 results), or 10 continuous results of a control are on the same side.	Check if the reagent is qualified, control sample is normal, and the instrument is working correctly.
1-2s	Result related	1-2s	The current QC result is between ±2 and ±3 standard deviations from the assigned mean concentration.	No actions are required.
1-3s	Result related	1-3s	The current QC result is greater than ±3 standard deviations from the assigned mean concentration.	Check if the reagent is qualified, control sample is normal, and the instrument is working correctly.
2-2s	Result related	2-2s	Results of two controls in the same run or two continuous results of a control are on the same side and greater than ±2 standard deviations from the assigned mean concentration.	Check if the reagent is qualified, control sample is normal, and the instrument is working correctly.
4-1s	Result related	4-1s	Results of two runs (4 results), or 4 continuous results of a control are on the same side and greater than ±1 standard deviation from the assigned mean concentration.	Check if the reagent is qualified, control sample is normal, and the instrument is working correctly.
ABS	Result related	Absorbance out of range	The absorbance of primary or secondary wavelength used for calculating results is greater than 3.4A.	Check the sample for foreign matters or interferents; check if the reagent is qualified and placed in the correct position; check the cuvette is clean; check if the photometric system is working normally.
BLK	Calibration	Blank response out of	The reagent goes wrong; insufficient reagent is	Check if the cuvette is not overflowed, the

Flag	Alarm Type	Description	Probable Causes	Corrective Actions
	related	range	dispensed; the cuvette contains air bubbles; the light drifts; or the cuvette is overflowed.	reagent is sufficient without air bubbles, the light does not drift and the chemistry parameters are reasonable. If yes, replace the reagent and then rerun the test.
BOE	Result related	Substrate depletion	The sample concentration is too high, and substrate depletion occurs during fixed-time measurements.	Check the reaction curve and the substrate depletion limit. Rerun the test with diluted sample.
CALCE	Result related	Chemistries of the special calculation exceeding the linear range.	Chemistries of the special calculation exceeding the linear range.	Check if the sample contains foreign matters such as clot and if sample probe is clogged. Check if the reagent is expired. If there are no above mentioned problem, please rerun the test or run the HbA1c test by manually pre-treating the sample
CALE	Result related	Edited calibration factor	The calibration factors are edited.	No actions are required.
CALF	Result related	Calibration failed.(for biochemistries)	The calibration fails.	Recalibrate.
CALF	Result related	No fluid in tubing	1. Waste pump tube is aging, blocked, or broken； 2. Sample injection port and fluidic path are blocked or leaking. 3. Air bubble detector failed.	1. Replace the reagent pack with a new one 2. Perform purge B to remove bubbles 3. /4. Replace the pump tube 5. Clean the sample injection port and reinstall electrodes. 6. Replace the bubble detector. 1. Place sufficient ISE wash solution. 2. Replace the pump tube 3. Clean the sample injection port and reinstall electrodes. 4. Replace the bubble detector.
CALF	Calibration	No fluid in tubing	1. Waste pump tube is aging, blocked, or	1. Replace the reagent pack with a new one

Flag	Alarm Type	Description	Probable Causes	Corrective Actions
	related		broken； 2. Sample injection port and fluidic path are blocked or leaking. 3. Air bubble detector failed.	2. Perform purge B to remove bubbles 3. /4. Replace the pump tube 5. Clean the sample injection port and reinstall electrodes. 6. Replace the bubble detector. 1. Place sufficient ISE wash solution. 2. Replace the pump tube 3. Clean the sample injection port and reinstall electrodes. 4. Replace the bubble detector.
CALJ	Calibration related	Rejected calibration factor	The calibration factors are rejected.	No actions are required.
CALM	Result related	Air in segment	1. Waste pump tube is aging, blocked, or broken； 2. Sample injection port and fluidic path are blocked or leaking. 3. Air bubble detector failed.	1. Replace the pump tube 2. Clean the sample injection port and reinstall electrodes. 3. Replace the bubble detector.
CALM	Calibration related	Air in segment	1. Waste pump tube is aging, blocked, or broken； 2. Sample injection port and fluidic path are blocked or leaking. 3. Air bubble detector failed.	1. Replace the pump tube 2. Clean the sample injection port and reinstall electrodes. 3. Replace the bubble detector.
CALR	Result related	Recalculated calibration factor	The calibration factors are recalculated.	No actions are required.
COV	Calibration related	Calibration curve not convergent	For nonlinear calibration, a satisfying base cannot be calculated and no calibration curve is drawn.	Check that the reagent and calibrator are normal, and then recalibrate. If the error remains, contact our customer service department.

Flag	Alarm Type	Description	Probable Causes	Corrective Actions
CSD	Calibration related	Calibration curve standard deviation out of range	The calculated standard deviation of the calibration curve exceeds the specified limit.	Check if the acceptance limit is reasonable and the reagent and calibrator are normal, and then recalibrate.
DEL	Calibration related	Deleted QC result	The QC result has been deleted.	No actions are required.
DET	Calibration related	Calibration determination coefficient out of range	The calculated determination coefficient of the calibration curve exceeds the specified limit.	Check if the acceptance limit is reasonable and the reagent and calibrator are normal, and then recalibrate.
DEP	Calibration related	Saving calibration result error	1. ISE communication cable failure. 2. Communication interface or pins failure 3. Main control board of the ISE module goes wrong. 4. Software error.	1. Replace the ISE communication cable. 2. Replace the interface or pins. 3. Replace the main control board of the ISE module. 4. Upgrade the operating software or reinstall it.
DTGL	Result related	Insufficient probe wash solution	The probe wash solution is insufficient during measurement.	Fill more probe wash solution.
DUP	Calibration related	Calibration repeatability error	The difference between the maximum and minimum response of the calibrator exceeds the specified limit.	Check if the acceptance limit is reasonable, troubleshoot the error, and then recalibrate.
EDT	Result related	Edited result	The result has been edited.	No actions are required.
EDT	Calibration related	Edited calibration factor	The calibration factors have been edited.	No actions are required.
ENC	Result related	No calculation interval	The sample concentration is too high, and substrate depletion occurs within the lag time of rate check measurements.	Check the reaction curve and the substrate depletion limit. Rerun the test with diluted sample.
EXP	Result related	Enzyme linearity range extension	The high-concentration sample leads to substrate depletion during the reaction time, and the result is calculated by using measuring points within the	Rerun the test with diluted sample.

Flag	Alarm Type	Description	Probable Causes	Corrective Actions
			lag time.	
EXT	Result related	Extended calibration factor	The result is obtained by extending the calibration time.	Take no actions, or recalibrate.
FAC	Calibration related	Calibration slope difference out of range	The slope difference is applicable to linear calibration only and refers to the K factor (slope) difference between two adjacent calibrations. It exceeds the specified limit.	Check if the acceptance limit is reasonable and the reagent and calibrator are normal, and then recalibrate.
ICA	Result related	The response is normal, but results cannot be calculated.	The chemistry has not been calibrated.	Rerun it after calibration.
L!	Result related	Water blank fluctuation is out of range.	1. The cuvette is overflowing. 2. The lamp has been replaced incorrectly. 3. Cuvette check is not performed after maintenance. 4. The cable connectors are not tightened. 5. The retaining screw is not tightened. 6. Cleaning liquid inside the cuvette is little. 7. The lamp is aged. 8. The photometer goes wrong.	1. Check if the cuvette is overflowing. 2. Check if the **Replace Lamp** command is executed during lamp replacement. 3. Check if the cable connectors and retaining screw of the lamp have been tightened. 4. Check if the cleaning liquid inside the cuvette is no less than half of the cuvette. 5. Check if the reaction curve fluctuates irregularly. If yes, replace the lamp. 6. If the error remains, contact our customer service department.
LIN	Result related	Non-linear	The measuring points for result calculation are nonlinear, because the sample concentration is too high, or the substrate depletion limit is not specified or unreasonable. The lamp is aged.	Check the reaction curve and the substrate depletion limit. Rerun the test with diluted sample. If the alarm occurs for more than one chemistry, and the reaction curve fluctuates irregularly, replace the lamp.
LOW	Result related	Response less than that of the minimum-	The sample concentration is lower than the sensitivity indicated on the reagent pack, making	For ascending calibration curve, rerun the test with standard or increased sample volume; for

Flag	Alarm Type	Description	Probable Causes	Corrective Actions
		concentration calibrator	response less than that of the lowest-concentration calibrator.	descending calibration curve, rerun the test with diluted sample.
MBK	Calibration related	Mixed blank absorbance out of range	The reagent goes wrong; the cuvette is not clear; the reaction cuvette is overflowed; or insufficient reagent is dispensed.	Check if the cuvette is clear and not overflowed, the reagent is sufficient without air bubbles, and the chemistry parameters are reasonable. If yes, replace the reagent and then rerun the test.
MON	Calibration related	Calibration curve not monotonic	The calibration data and calibration curve are not monotonic.	Check if the calibrator is defined and placed correctly, and then recalibrate.
NLN	Result related	No linear interval	The high-concentration sample leads to less than 3 valid measuring points within the reaction time of rate check measurements.	Rerun the test with diluted sample.
NOIS	Result related	Electrode voltage noise	1. Electrode failure. 2. Environment interference. 3. ISE main control board failure. 4. Salt buildup around electrodes or tubes due to fluidic leaks.	1. Replace the electrode. 2. Relocate the instrument. 3. Replace the main control board of the ISE module. 4. Clean the tubes and electrodes.
NOIS	Calibration related	Electrode voltage noise	1. Electrode failure. 2. Environment interference. 3. ISE main control board failure. 4. Salt buildup around electrodes or tubes due to fluidic leaks.	1. Replace the electrode. 2. Relocate the instrument. 3. Replace the main control board of the ISE module. 4. Clean the tubes and electrodes.
OVE	Result related	Overridden calibration factor	The result is obtained by overriding a failed calibration.	Take no actions, or recalibrate.
PUGA	Result related	Air in calibrator A	1. Calibrator A is exhausted. 2. Bubbles exist in calibrator tube A 3. Pump tube A is aging, blocked, or broken. 4. Waste pump tube is aging, blocked, or	1. Replace the reagent pack with a new one 2. Perform purge B to remove bubbles 3. /4. Replace the pump tube 5. Clean the sample injection port and reinstall

Flag	Alarm Type	Description	Probable Causes	Corrective Actions
			broken； 5. Sample injection port and fluidic path are blocked or leaking. 6. Air bubble detector failed.	electrodes. 6. Replace the bubble detector.
PUGA	Calibration related	Air in calibrator A	1. Calibrator A is exhausted. 2. Bubbles exist in calibrator tube A 3. Pump tube A is aging, blocked, or broken. 4. Waste pump tube is aging, blocked, or broken； 5. Sample injection port and fluidic path are blocked or leaking. 6. Air bubble detector failed.	1. Replace the reagent pack with a new one 2. Perform purge B to remove bubbles 3. /4. Replace the pump tube 5. Clean the sample injection port and reinstall electrodes. 6. Replace the bubble detector.
PUGB	Result related	Air in calibrator B	1. Calibrator B is exhausted. 2. Bubbles exist in calibrator tube B 3. Pump tube A is aging, blocked, or broken. 4. Waste pump tube is aging, blocked, or broken； 5. Sample injection port and fluidic path are blocked or leaking. 6. Air bubble detector failed.	1. Replace the reagent pack with a new one 2. Perform purge B to remove bubbles 3. /4. Replace the pump tube 5. Clean the sample injection port and reinstall electrodes. 6. Replace the bubble detector.
PUGB	Calibration related	Air in calibrator B	1. Calibrator B is exhausted. 2. Bubbles exist in calibrator tube B 3. Pump tube A is aging, blocked, or broken. 4. Waste pump tube is aging, blocked, or broken； 5. Sample injection port and fluidic path are blocked or leaking. 6. Air bubble detector failed.	1. Replace the reagent pack with a new one 2. Perform purge B to remove bubbles 3. /4. Replace the pump tube 5. Clean the sample injection port and reinstall electrodes. 6. Replace the bubble detector.

Flag	Alarm Type	Description	Probable Causes	Corrective Actions
PRO	Result related	Prozone check error	Antibody excess occurs due to too high sample concentration.	Check the reaction curve and the prozone check parameters. Rerun the test with diluted sample.
R	Result related	Rerun result	The result is obtained by rerunning the test.	No actions are required.
R4S	Result related	R4S	One result of a run is greater than +2 standard deviations from the assigned mean and the other greater than -2SDs.	Check if the reagent is qualified, control sample is normal, and the instrument is working correctly.
RBK	Result related	R1 blank absorbance out of range	The reagent goes wrong; the cuvette is not clear; the reaction cuvette is overflowed; or insufficient reagent is dispensed.	Check if the cuvette is clear and not overflowed, the reagent is sufficient without air bubbles, and the chemistry parameters are reasonable. If yes, replace the reagent and then rerun the test.
RCE	Result related	Response calculation error	Absorbance data for calculation is incomplete, or the dividend is 0.	Rerun the test. If the error remains, contact our customer service department.
REC	Result related	Recalculated result	The sample result is recalculated manually with the latest calibration factors.	/
REE	Result related	The sample result is compensated.	The sample result is compensated.	/
RESP	Result related	ISE response check code error Command format or execution error	1. ISE communication cable failure. 2. Communication interface or pins failure 3. Main control board of the ISE module goes wrong. 4. Software error.	1. Replace the ISE communication cable 2. Replace the interface or pins. 3. Replace the main control board of the ISE module. 4. Upgrade the operating software or reinstall it.
RESP	Calibration related	ISE response check code error Command format or execution error	1. ISE communication cable failure. 2. Communication interface or pins failure 3. Main control board of the ISE module goes wrong.	1. Replace the ISE communication cable. 2. Replace the interface or pins. 3. Replace the main control board of the ISE module.

Flag	Alarm Type	Description	Probable Causes	Corrective Actions
			4. Software error.	4. Upgrade the operating software or reinstall it
RGTE	Result related	Expired reagent	The result is based on an expired reagent.	Replace the reagent.
RGTL	Result related	Insufficient reagent	The result is based on insufficient reagent.	Replace the reagent.
RGTL	Calibration related	Insufficient reagent	The calibration result is based on insufficient reagent.	Replace the reagent.
RRN	Result related	Response greater than that of the maximum-concentration calibrator	The sample concentration exceeds the high limit of the calibrator concentration.	Rerun the test with diluted sample.
SEN	Calibration related	Calibration sensitivity error	The difference of final response of the maximum and minimum concentration calibrators exceeds the specified limit.	Check if the acceptance limit is reasonable and the reagent and calibrator are normal, and then recalibrate.
SJAM	Result related	Sample probe is clogged	Probe clogging is detected during sampling or the sample probe is clogged during sampling.	Sample treatment.
SLDR	Calibration related	Electrode slope drift	1. Electrode or reagent pack fails. 2. Electrode is unsteady. 3. New reagent pack is unsteady. 4. Reference electrode has been used for over 66 months. 5. ISE main control board failure. 6. Ambient temperature fluctuates drastically	1. Replace the problematic electrode and reagent pack. 2. New electrode will become steady after 15 minutes since installed. 3. Run a couple of calibrations after installing new reagent pack. 4. Replace the reference electrode. 5. Replace the ISE main control board. 6. Control the ambient temperature to make the fluctuation within +/-4℃.
SLEX	Calibration related	Slope out of range	1. Electrode is not installed correctly. 2. Calibrator expired. 3. Electrode degenerated 4. Bubbles in reference electrode 5. Reference electrode has been used for a long	1. Reinstall the electrode 2. Replace the calibrator. 3. Replace the problematic electrode and rerun. 4. Remove the electrode and clap on it to

Flag	Alarm Type	Description	Probable Causes	Corrective Actions
			time 6. Electrodes interfered. 7. Module or tubing temperature above 32℃.	eliminate bubbles. Reinstall the electrode and run calibration. 5. Replace reference electrode and rerun. 6. Troubleshoot the electrodes by replacing them in different groups. 7. Monitor temperature, if too high, relocate equipment.
SLP	Result related	Corrected result	The result is adjusted with calculation factors.	No actions are required.
SLP	Result related	The results are produced when the calibration factors instead of the default ones are configured for the second time calibration.	Calibration factors instead of the default ones are configured for the second time calibration.	No actions are required.
SMPA	Result related	Air in sample	1. Sample is insufficient or contains many bubbles after dispensing. 2. No or insufficient sample has been dispensed into the sample injection port. 3. The electrodes are not properly installed, causing leakage. 4. The waste pump tube is aging or broken.	1. Increase the sample volume. At least 90 μl sample should be prepared. 2. Electrode is not installed correctly. Reinstall it. 3. Check the waste tube, and if necessary, replace it.
SMPE	Result related	Expired sample	The sample is expired.	Replace the sample.
SMPL	Result related	Insufficient sample	The sample is insufficient during analysis.	Refill the sample.
SMPL	Calibration related	Insufficient sample	The sample is insufficient during analysis.	Refill the sample.
VDRF	Result related	Electrode voltage drift	1. Electrode or reagent pack fails. 2. Electrode is unsteady.	1. Replace the problematic electrode and reagent pack.

Flag	Alarm Type	Description	Probable Causes	Corrective Actions
			3. New reagent pack is unsteady. 4. Reference electrode has been used for over 66 months. 5. ISE main control board failure. 6. Ambient temperature fluctuates drastically.	2. New electrode will become steady after 15 minutes since installed. 3. Run a couple of calibrations after installing new reagent pack. 4. Replace the reference electrode. 5. Replace the ISE main control board. 6. Control the ambient temperature to make the fluctuation within +/-4℃
VOUT	Result related	Electrode Voltage Overflow	1. Electrode or reagent pack fails. 2. Electrode is unsteady. 3. New reagent pack is unsteady. 4. Reference electrode has been used for over 66 months. 5. ISE main control board failure.	1. Replace the problematic electrode and reagent pack. 2. New electrode will become steady after 15 minutes since installed. 3. Run a couple of calibrations after installing new reagent pack. 4. Replace the reference electrode. 5. Replace the ISE main control board.
VOUT	Calibration related	Electrode Voltage Overflow	1. Electrode or reagent pack fails. 2. Electrode is unsteady. 3. New reagent pack is unsteady. 4. Reference electrode has been used for over 66 months. 5. ISE main control board failure.	1. Replace the problematic electrode and reagent pack. 2. New electrode will become steady after 15 minutes since installed. 3. Run a couple of calibrations after installing new reagent pack. 4. Replace the reference electrode. 5. Replace the ISE main control board.
T1	Result related	Reaction disk temperature error	1. The ambient temperature is out of range. 2. The temperature sensor goes wrong. (component error and cable error) 3. The temperature protection switch goes wrong.	1. Check if the error is accidental. 2. If not, contact our customer service department.

Flag	Alarm Type	Description	Probable Causes	Corrective Actions
			(component error and cable error) 4. The heater goes wrong. (component error and cable error) 5. PCB error 6. Parameters are lost. 7. Electromagnetic interference exists.	

10.6 Information of Alarms

Table 10-6 Error Messages and Corrective Actions

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
A00006	Instrument instructions cannot be executed.	Error	Main control unit E2PROM reading or writing error.	/	E2PROM read/write error.	Switch off the analyzing unit power and switch on it again. Recover failure by performing the Home maintenance procedure. If this message appears for 3 times, contact our customer service department or your local distributor.
A01006	Sample Probe Unit	Error	Sample probe vertical movement error 1. Sensor status is incorrect. 2. Failed to find the zero position. 3. Collision occurs during operation other than aspirating. 4. Collision error remains. 5. Moving vertically is not allowed in current horizontal position. 6. Losing steps when passing the zero position vertically Sample probe horizontal movement error 1. Sensor status is incorrect. 2. Failed to find the zero position. 3. Collision occurs during horizontal movement. 4. Moving horizontally is not allowed in current vertical position. 5. Losing steps when passing the zero position horizontally Sample syringe movement error 1. Sensor status is incorrect. 2. Failed to find the zero position. 3. Syringe losing steps when passing the zero position	/	Sample probe vertical movement error 1. Sensor status error. Belt or belt pulley is loose. 2. Failed to find the zero position. 1) Assembly is jammed; 2) Driving circuit error; 3) Vertical motor error; 4) Vertical sensor error; 5) Belt pulley is loose; 3. Collision occurs during operation other than aspirating. 1) Collision sensor or circuit or cable failure; 2) Collision sensor is not blocked when assembling the sample probe; 3) Incorrect sample probe positioning; 4) Incorrect sample carousel positioning. 4. Collision error remains. 1) Collision sensor or circuit or cable failure; 2) Collision sensor is not blocked when assembling the sample probe; 3) Collision sensor is not blocked due to deformation of blocking plate's driving spring. 5. Vertical movement is not allowed in current horizontal position. Software error. 6. Losing steps when passing the zero position vertically: 1) The zero position sensor is loose or faulty. 2) The moving part collide with other parts or is blocked. Sample probe horizontal movement error 1. Sensor status error. Belt or belt pulley is loose. 2. Failed to find the zero position.	Sample probe vertical movement error 1. Sensor status error. Check if belt or belt wheel is loose, tighten them if so; 2. Failed to find the zero position. 1) Remove obstacle or replace with a new assembly; 2) Replace PCB; 3) Replace motor; 4) Replace sensor; 5) Tighten properly; 3. Collision occurs during operation other than aspirating. 1) Replace sensor or PCB or cable; 2) Reassemble; 3) Rotate the positioning sensor to remove dust or adjust the probe to be vertical; if problem remains, adjust the positioning parameters; 4) Adjust sample carousel positioning parameters. 4. Collision error remains. 1) Replace sensor or PCB or cable; 2) Reassemble; 3) Mount the spring of blocking plate again; 5. Vertical movement is not allowed in current horizontal position. Reset the whole unit or the sample probe unit. 6. Losing steps when passing the zero position vertically: 1) Check whether there is dust deposit on the sensor and whether the sensor is loose. If yes, clean the dust and fasten the sensor. 2) Remove obstacle or replace with a new assembly. Sample probe horizontal movement error 1. Sensor status error. Check if belt or belt wheel is loose, tighten them if so; 2. Failed to find the zero position. 1) Replace PCB; 2) Replace motor; 3) Replace sensor; 4) Tighten properly. 3. Collision occurs during horizontal movement. 1) Replace PCB; 2) Replace motor; 3) Replace sensor;

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
					1) Driving circuit error; 2) Motor error; 3) Home position sensor error; 4) Belt pulley is loose; 3. Collision occurs during horizontal movement. 1) Driving circuit error; 2) Motor error; 3) Home position sensor error; 4) Belt pulley is loose; 4. Horizontal movement is not allowed in current vertical position. Software error. 5. Losing steps when passing the zero position horizontally: 1) The zero position sensor is loose or faulty. 2) The moving part collide with other parts or is blocked. Sample syringe movement error 1. Sensor status error. Belt or belt pulley is loose. 2. Failed to find the zero position. 1) Assembly is jammed; 2) Driving circuit error; 3) Motor error; 4) Sensor error; 5) Belt pulley is loose; 3. Syringe losing steps when passing the zero position: 1) The zero position sensor is loose or faulty. 2) The moving part collide with other parts or is blocked.	4) Tighten properly; 4. Horizontal movement is not allowed in current vertical position. Reset the whole unit or the sample probe unit. 5. Losing steps when passing the zero position horizontally: 1) Check whether there is dust deposit on the sensor and whether the sensor is loose. If yes, clean the dust and fasten the sensor. 2) Remove obstacle or replace with a new assembly. Sample syringe movement error 1. Sensor status error. Check if belt or belt wheel is loose, tighten them if so; 2. Failed to find the zero position. 1) Remove obstacle or replace with a new assembly; 2) Replace PCB; 3) Replace motor; 4) Replace sensor; 5) Tighten properly; 3. Syringe losing steps when passing the zero position: 1) Check whether there is dust deposit on the sensor and whether the sensor is loose. If yes, clean the dust and fasten the sensor. 2) Remove obstacle or replace with a new assembly.
A01007	Sample Probe Unit	Warning	Sample probe vertical movement error 1. Collision occurs during aspirating.	/	Sample probe vertical movement error 1. Collision occurs during aspirating. 1) Collision sensor or circuit or cable failure; 2) Collision sensor is not blocked when assembling the sample probe; 3) Incorrect sample probe positioning; 4) Incorrect sample carousel positioning.	Sample probe vertical movement error 1. Collision occurs during aspirating. 1) Replace sensor or PCB or cable; 2) Reassemble; 3) Rotate the positioning sensor to remove dust or adjust the probe to be vertical; if problem remains, adjust the positioning parameters; 4) Adjust sample carousel positioning parameters.
A01021	Sample Probe Unit	Error	Clog detection board communication error	/	Check if connection between clog detection board and wash control is normal; 2. Clog detection board malfunction	1. Check relevant cable for any signs of fray or loose cable, or disconnection, or short circuit; 2. Check if the power indication light for clog detection board is on properly; check if clog detection board is

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
						working correctly. 3. Replace clog detection board if malfunction has been identified.
A01024	Sample Probe Unit	Warning	Sample probe fails to detect liquid level when aspirating 1. The sample probe fails to detect liquid level on sample carousel when aspirating. 2. The sample probe fails to detect liquid level on reaction carousel when aspirating.	/	1. No sample is loaded on the designated position. 2. Insufficient sample. 3. Sample probe level detection error.	1. Check if there is sufficient sample, and run the test again; 2. If there are level detection error, check sample probe, level detection board and connecting cable; replace if any abnormity is identified.
A01027	Sample Probe Unit	Error	Sample probe aspirates nothing. 1. Sample probe aspirates nothing on the sample carousel. 2. Sample probe aspirates nothing on the reaction carousel.	/	1. No sample is loaded on the designated position. 2. Insufficient sample. 3. Sample probe level detection error. Clog detection error.	1. Check if there is sufficient sample, and run the test again; If level detection error is identified, check sample probe, level detection board and connecting cable; replace if any abnormity is identified. If clog detection error is identified, check if there is loose connection or liquid leakage in sample probe hydro system.
A01028	Sample Probe Unit	Error	Sample probe fails to detect liquid level during cleaning 1. Reagent probe does not detect liquid level in wash well when reset. 2. Reagent probe does not detect liquid level in wash well during cleaning.	/	1. No DI water or hydro error; 2. Sample probe level detection error.	Check if hydro is normal; troubleshoot if there is any abnormity; If level detection error is identified, check sample probe, level detection board and connecting cable; replace if any abnormity is identified.
A01029	Sample Probe Unit	Warning	Sample probe is clogged when aspirating	/	Sample contains clots or insufficient sample; Sample probe hydro error. Clog detection system error.	1. Check if the sample has been pre-processed properly, or contains foreign matters such as clot, or is too viscous, or is sufficient. 2. Clean the sample probe with special wash solution. If the problem remains, remove the sample probe and unclog it. 3. Check if the fluidics are normal, especially if there is any air bubbles in clog detection pressure sensor. Check clog detection board and clog detection pressure sensor, if previous two possible causes have been eliminated.
A01030	Sample Probe Unit	Error	Sample probe is clogged during cleaning	/	Sample probe is clogged; Sample probe hydro error.	1. Clean the sample probe with special wash solution. Remove the sample probe and unclog it. 2. Check if sample probe tubing, pump and valve for interior wash is normal; 3. Check clog detection board and clog detection pressure sensor.
A01033	Sample Probe Unit	Warning	Sample probe fails to detect liquid level on reaction carousel when dispensing.	/	1. There is no reagent or insufficient reagent in the cuvette; 2. Incorrect vertical extreme position parameter for sample probe on reaction carousel; 3. Sample probe level detection error.	1. Check if R1 volume is sufficient and the reagent bottle is free of air bubbles, and then try again; 2. Check if the vertical extreme position parameter for sample probe on reaction carousel is correct; 3. If there are level detection error, check sample probe, level detection board and connecting cable; replace if any abnormity is identified.
A01036	Sample Probe Unit	Error	Sample probe level detection board data receiving error	/	1. Cable error for communication between level detection board and	Check relevant cable for any signs of fray or loose cable, or disconnection, or short circuit.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
					smart modules	
A01037	Sample Probe Unit	Error	Sample probe level detection board self calibrating failed	/	1. Cable error for communication between level detection board and smart modules; 2. Sample probe error, or connection error between sample probe and level detection board; 3 Sample probe level detection board error.	1. Check relevant cable for any signs of fray or loose cable, or disconnection, or short circuit; 2. Check if sample probe is installed correctly; check if sample probe is bent, cracked or loose; 3. Check if level detection board is normal; replace it if not.
A01038	Sample Probe Unit	Error	Sample probe interior wash is abnormal.	/	The sample probe interior pressure is low. 1. SV02 is not turned on or goes wrong. 2. SV03is not turned off completely. 3. The sample wash tube and connector are leaking. 4. The pressure detection board goes wrong.	1. Check if the solenoid valve cable is disconnected and the voltage is normal. Replace the valve if necessary. 2. Check the pipe connection. Replace the pipe if necessary. 3. Check if the clog detection board is normal. If not, replace it.
A02006	Reagent probe unit	Error	Reagent probe vertical movement error 1. Sensor status is incorrect. 2. Failed to find the zero position. 3. Collision occurs during operation other than aspirating. 4. Collision error remains. 5. Moving vertically is not allowed in current horizontal position. 6. Losing steps when passing the zero position vertically Reagent probe horizontal movement error 1. Sensor status is incorrect. 2. Failed to find the zero position. 3. Collision occurs during horizontal movement. 4. Moving horizontally is not allowed in current vertical position. 5. Losing steps when passing the zero position horizontally Reagent syringe movement error 1. Sensor status is incorrect. 2. Failed to find the zero position. 3. Syringe losing steps when passing the zero position	/	Reagent probe vertical movement error 1. Sensor status error. Belt or belt pulley is loose. 2. Failed to find the zero position. 1) Assembly is jammed; 2) Driving circuit error; 3) Vertical motor error; 4) Vertical sensor error; 5) Belt pulley is loose; 3. Collision occurs during operation other than aspirating. 1) Collision sensor or circuit or cable failure; 2) Collision sensor is not blocked when assembling the reagent probe; 3) Incorrect reagent probe positioning; 4) Incorrect reagent carousel positioning. 4. Collision error remains. 1) Collision sensor or circuit or cable failure; 2) Collision sensor is not blocked when assembling the reagent probe; 3) Collision sensor is not blocked due to deformation of blocking plate's driving spring; 5. Vertical movement is not allowed in current horizontal position. Software error	Reagent probe vertical movement error 1. Sensor status error. Check if belt or belt wheel is loose, tighten them if so; 2. Failed to find the zero position. 1) Remove obstacle or replace with a new assembly; 2) Replace PCB; 3) Replace motor; 4) Replace sensor; 5) Tighten properly; 3. Collision occurs during operation other than aspirating. 1) Replace sensor or PCB or cable; 2) Reassemble; 3) Rotate the positioning sensor to remove dust or adjust the probe to be vertical; if problem remains, adjust the positioning parameters; 4) Adjust reagent carousel positioning parameters 4. Collision error remains. 1) Replace sensor or PCB or cable; 2) Reassemble; 3) Mount the spring of blocking plate again; 5. Vertical movement is not allowed in current horizontal position. Reset the whole unit or the reagent probe unit. Reagent probe horizontal movement error 6. Losing steps when passing the zero position vertically: 1) Check whether there is dust deposit on the sensor and whether the sensor is loose. If yes, clean the dust and fasten the sensor. 2) Remove obstacle or replace with a new assembly. Reagent probe vertical movement error

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
					6. Losing steps when passing the zero position vertically: 1) The zero position sensor is loose or faulty. 2) The moving part collide with other parts or is blocked. Reagent probe horizontal movement error 1. Sensor status error. Belt or belt pulley is loose. 2. Failed to find the zero position. 1) Driving circuit error; 2) Motor error; 3) Home position sensor error; 4) Belt pulley is loose; 3. Collision occurs during horizontal movement. 1) Driving circuit error; 2) Motor error; 3) Home position sensor error; 4) Belt pulley is loose; 4. Horizontal movement is not allowed in current vertical position. Software error 5. Losing steps when passing the zero position horizontally: 1) The zero position sensor is loose or faulty. 2) The moving part collide with other parts or is blocked. Reagent syringe movement error 1. Sensor status error. Belt or belt pulley is loose. 2. Failed to find the zero position. 1) Assembly is jammed; 2) Driving circuit error; 3) Motor error; 4) Sensor error; 5) Belt pulley is loose; 3. Syringe losing steps when passing the zero position: 1) The zero position sensor is loose or faulty. 2) The moving part collide with other parts or is blocked.	1. Sensor status error. Check if belt or belt wheel is loose, tighten them if so; 2. Failed to find the zero position. 1) Replace PCB; 2) Replace motor; 3) Replace sensor; 4) Tighten properly; 3. Collision occurs during horizontal movement. 1) Replace PCB; 2) Replace motor; 3) Replace sensor; 4) Tighten properly; 4. Horizontal movement is not allowed in current vertical position. Reset the whole unit or the reagent probe unit. 5. Losing steps when passing the zero position horizontally: 1) Check whether there is dust deposit on the sensor and whether the sensor is loose. If yes, clean the dust and fasten the sensor. 2) Remove obstacle or replace with a new assembly. Reagent syringe movement error 1. Sensor status error. Check if belt or belt wheel is loose, tighten them if so; 2. Failed to find the zero position. 1) Remove obstacle or replace with a new assembly; 2) Replace PCB; 3) Replace motor; 4) Replace sensor; 5) Tighten properly; 3. Syringe losing steps when passing the zero position: 1) Check whether there is dust deposit on the sensor and whether the sensor is loose. If yes, clean the dust and fasten the sensor. 2) Remove obstacle or replace with a new assembly.
A02007	Reagent probe unit	Warning	Reagent probe vertical movement error 1. Collision occurs during aspirating.	/	Reagent probe vertical movement error	Reagent probe vertical movement error 1. Collision occurs during aspirating.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
					1. Collision occurs during aspirating. 1) Collision sensor or circuit or cable failure; 2) Collision sensor is not blocked when assembling the reagent probe; 3) Incorrect reagent probe positioning; 4) Incorrect reagent carousel positioning.	1) Replace sensor or PCB or cable; 2) Reassemble; 3) Rotate the positioning sensor to remove dust or adjust the probe to be vertical; if problem remains, adjust the positioning parameters; 4) Adjust reagent carousel positioning parameters
A02023	Reagent probe unit	Warning	Reagent probe fails to detect liquid level on reagent carousel	/	1. There is no reagent or insufficient reagent on the reagent position. 2. Reagent probe level detection error.	1. Check if the reagent is sufficient, and then try again. 2. If level detection error is identified, check the reagent probe, level detection board and connecting cable; replace if any abnormity is identified.
A02026	Reagent probe unit	Error	The liquid level is not detected during reagent probe cleaning.	/	1. No DI water or hydro error; 2. Reagent probe level detection error.	1. Check if tubing, pump and valve for exterior wash of the reagent probe is normal.. 2. If level detection error is identified, check if the reagent probe, level detection board and connecting cable are normal; replace if any abnormity is identified.
A02027	Reagent probe unit	Warning	Water residues exist in the cuvette	/	DI water residual exists in cuvette.	Check if the aspirating tubing, solenoid valve, and waste pump of wash station is normal.
A02030	Reagent probe unit	Error	Reagent probe level detection board data receiving error	/	1. Cable error for communication between level detection board and smart modules	Check relevant cable for any signs of fray or loose cable, or disconnection, or short circuit.
A02031	Reagent probe unit	Error	Reagent probe level detection board self calibrating failed.	/	1. Cable error for communication between level detection board and smart modules; 2. Reagent probe error or level detection board connection error; 3. Reagent probe level detection error.	1. Check relevant cable for any signs of fray or loose cable, or disconnection, or short circuit; 2. Check if the reagent probe is installed correctly; check if the reagent probe is bent, cracked or loose. 3. Check if level detection board is normal; replace it if not.
A02032	Reagent probe unit	Warning	Reagent probe aspirates no reagent on the reagent carousel.	/	Air bubbles exist in the reagent bottle.	1. Check if the reagent bottle contains air bubbles, and then try again. 2. Check if the reagent bottle meets requirements.
A02033	Reagent probe unit	Warning	The liquid level cannot be detected after reagent probe dispensing.	/	1. The reagent is insufficient, or air bubbles exist in the reagent bottle. 2. Reagent probe level detection error.	1. Check if the reagent is sufficient and the reagent bottle contains air bubbles, and then try again. 2. If level detection error is identified, check the reagent probe, level detection board and connecting cable; replace if any abnormity is identified.
A04006	Mixer Unit	Error	Sample mixer vertical movement error 1. Sensor status is incorrect. 2. Failed to find the zero position. 3. Moving vertically is not allowed in current horizontal position. 4. Losing steps when passing the zero position vertically Sample mixer horizontal movement error 1. Sensor status is incorrect. 2. Failed to find the zero position. 3. Moving horizontally is not allowed in	/	Sample mixer vertical movement error 1. Sensor status error Belt or belt pulley is loose. 2. Failed to find the zero position. 1) Assembly is jammed; 2) Driving circuit error; 3) Vertical motor error; 4) Vertical sensor error; 5) Belt pulley is loose; 3. Vertical movement is not allowed in current horizontal position. Software error	Sample mixer vertical movement error 1. Sensor status error Check if belt or belt wheel is loose, tighten them if so; 2. Failed to find the zero position. 1) Remove obstacle or replace with a new assembly; 2) Replace PCB; 3) Replace motor; 4) Replace sensor; 5) Tighten properly; 3. Vertical movement is not allowed in current horizontal position. Reset the whole unit or the relevant unit.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
			current vertical position. 4. Losing steps when passing the zero position horizontally		4. Losing steps when passing the zero position vertically: 1) The zero position sensor is loose or faulty. 2) The moving part collide with other parts or is blocked. Sample mixer horizontal movement error 1. Sensor status error Belt or belt pulley is loose. 2. Failed to find the zero position. 1) Driving circuit error; 2) Motor error; 3) Home position sensor error; 4) Belt pulley is loose; 3. Horizontal movement is not allowed in current vertical position. Software error 4. Losing steps when passing the zero position horizontally: 1) The zero position sensor is loose or faulty. 2) The moving part collide with other parts or is blocked.	4. Losing steps when passing the zero position vertically: 1) Check whether there is dust deposit on the sensor and whether the sensor is loose. If yes, clean the dust and fasten the sensor. 2) Remove obstacle or replace with a new assembly. Sample mixer horizontal movement error 1. Sensor status error Check if belt or belt wheel is loose, tighten them if so; 2. Failed to find the zero position. 1) Replace PCB; 2) Replace motor; 3) Replace sensor; 4) Tighten properly; 3. Horizontal movement is not allowed in current vertical position. Reset the whole unit or the relevant unit. 4. Losing steps when passing the zero position horizontally: 1) Check whether there is dust deposit on the sensor and whether the sensor is loose. If yes, clean the dust and fasten the sensor. 2) Remove obstacle or replace with a new assembly.
A04007	Mixer Unit	Error	Sample mixer rotation error	/	The mixer is blocked or the rotational speed sensor of the mixer goes wrong.	1. Replace the motor, or relevant cable, or circuit. 2. Adjust the mixer or replace the assembly. 3. Replace the sensor, or relevant cable, or circuit.
A04008	Mixer Unit	Error	Reagent mixer rotation error	/	The mixer is blocked or the rotational speed sensor of the mixer goes wrong.	1. Replace the motor, or relevant cable, or circuit. 2. Adjust the mixer or replace the assembly. 3. Replace the sensor, or relevant cable, or circuit.
A04009	Mixer Unit	Error	Abnormal rotation speed of sample mixer or reagent mixer	/	The mixer motor, relevant cable or drive circuit is faulty.	1. Replace the motor, or relevant cable, or circuit. 2. Adjust the mixer or replace the assembly. 3. Replace the sensor, or relevant cable, or circuit.
A06006	Reaction Carousel Unit	Error	Reaction carousel movement error 1. Failed to find the home position 2. The coder missed steps. 3. The reagent carousel inner ring missed steps when moving to the home position.	/	Reaction carousel movement error 1. Failed to find the home position Home position sensor error 2. The coder missed steps. 1) Assembly is jammed; 2) Driving circuit error; 3) Motor error; 4) Sensor error; 5) Belt pulley is loose; 3. The reagent carousel inner ring missed steps when moving to the home position. Home position sensor error	Reaction carousel movement error 1. Failed to find the home position Replace sensor or cable 2. The coder missed steps. 1) Remove obstacle or replace with a new assembly; 2) Replace PCB; 3) Replace motor; 4) Replace sensor or cable; 5) Replace belt pulley and motor assembly; 3. The reagent carousel inner ring missed steps when moving to the home position. Replace sensor or cable
A07006	Sample Carousel Unit	Error	Sample carousel movement error 1. Failed to find the home position 2. The coder missed steps.	/	Outer sample carousel movement error 1. Failed to find the home position	Outer sample carousel movement error 1. Failed to find the home position Replace sensor or cable

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
			3. The reagent carousel inner ring missed steps when moving to the home position.		Home position sensor error 2. The coder missed steps. 1) Assembly is jammed; 2) Driving circuit error; 3) Motor error; 4) Sensor error; 5) Belt pulley is loose; 3. The reagent carousel inner ring missed steps when moving to the home position. Home position sensor error	2. The coder missed steps. 1) Remove obstacle or replace with a new assembly; 2) Replace PCB; 3) Replace motor; 4) Replace sensor or cable; 5) Replace belt pulley and motor assembly; 3. The reagent carousel inner ring missed steps when moving to the home position. Replace sensor or cable
A07009	Sample Carousel Unit	Error	Sample bar code reader does not work normally	/	Due to the system error, the sample bar code reader can not work normally. If the error repeats and cannot be removed, then the bar code reader has not performed the initialization normally or the communication cables are disconnected. If bar code reader is not available, please try again.	Recover the failure. If the error remains, initialize the sample bar code reader. If initialization cannot be performed, check if bar code reader is connected properly. If the error remains, then replace the bar code reader or the control drive board.
A07010	Sample Carousel Unit	Warning	Received bar code contains no ending character.	/	Sample bar code reader does not work normally due to communication error.	Initialize the sample bar code reader and try again. If the problem still remains, check the cable of the bar code reader or replace the bar code reader or the control drive board.
A07011	Sample Carousel Unit	Error	Bar code sending buffer is full.	/	Sample bar code sending buffer is full due to communication error.	Recover the failure or reboot the analyzing unit.
A09006	Reagent Carousel Unit	Error	Reagent carousel fails to find home position Reagent carousel movement error 1. Failed to find the home position 2. The coder missed steps. 3. The reagent carousel inner ring missed steps when moving to the home position.	/	Reagent carousel outer ring movement error 1. Failed to find the home position Home position sensor error 2. The coder missed steps. 1) Assembly is jammed; 2) Driving circuit error; 3) Motor error; 4) Sensor error; 5) Belt pulley is loose; 3. The reagent carousel inner ring missed steps when moving to the home position. Home position sensor error	Reagent carousel outer ring movement error 1. Failed to find the home position Replace sensor or cable 2. The coder missed steps. 1) Remove obstacle or replace with a new assembly; 2) Replace PCB; 3) Replace motor; 4) Replace sensor or cable; 5) Replace belt pulley and motor assembly; 3. The reagent carousel inner ring missed steps when moving to the home position. Replace sensor or cable
A09011	Reagent Carousel Unit	Error	Bar code reader does not work normally.	/	Reagent bar code reader connection error due to system failure. If the error repeats and cannot be removed, then the bar code reader has not performed the initialization normally or the communication cables are disconnected. If bar code reader is not available, please try again.	Recover the failure. If the error remains, initialize the sample bar code reader. If initialization cannot be performed, check if bar code reader is connected properly. If the error remains, then replace the bar code reader or the control drive board.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
A09012	Reagent Carousel Unit	Warning	Received bar code contains no ending character.	/	Communication error. Reagent bar code instruction buffer is full.	Initialize the sample bar code reader and try again. If the problem still remains, check the cable of the bar code reader or replace the bar code reader or the control drive board.
A09014	Reagent Carousel Unit	Error	Bar code sending buffer is full.	/	Reagent bar code reader does not work normally due to communication error.	Recover the failure or reboot the analyzing unit.
A11005	Wash unit	Error	Wash station movement error 0. Home position is not found. 1. Sensor status is incorrect. 2. The wash station collides with an obstacle when moving. 3. Movement is forbidden in current status. 4. Losing steps when passing the zero position vertically	/	Wash station movement error 1. Sensor status error Belt pulley is loose; 2. Home position is not found. 1) Driving circuit error; 2) Motor error; 3) Home position sensor error; 4) Belt pulley is loose; 3. The wash station collides with an obstacle when moving. 1) Wash probes are not vertical; 2) Reaction carousel positioning is deviated; 3) Collision sensor or circuit error 4. Losing steps when passing the zero position vertically: 1) The zero position sensor is loose or faulty. 2) The moving part collide with other parts or is blocked.	Wash station movement error 1. Sensor status error Check if belt or belt wheel is loose, tighten them if so; 2. Home position is not found. 1) Replace PCB; 2) Replace motor; 3) Replace sensor; 4) Tighten properly; 3. The wash station collides with an obstacle when moving. 1) Align wash probes; 2) Align reaction carousel positioning; 3) Replace sensor, cable or PCB 4. Losing steps when passing the zero position vertically: 1) Check whether there is dust deposit on the sensor and whether the sensor is loose. If yes, clean the dust and fasten the sensor. 2) Remove obstacle or replace with a new assembly.
A11012	Wash unit	Warning	Water supplying is too slow	/	The water unit goes wrong. The water supply valve goes wrong. The water supply ball valve is not opened. (The handle is horizontal when it is opened) The water supply ball valve goes wrong. 5. The low-level floater of the water tank goes wrong. 6. The water supply tube is bent. 7. The outlet filter of the water supply tube is clogged.	1. Check the water unit. Check if the water supply ball valve is opened and the handle is horizontal. Check if the water supply ball valve is blocked. 4. Check if water supply valve can be turned on and off normally. 5. Check if low-level floater signal is correct. 6. Check if the water supply tube is smooth. 7. Check if outlet filter of water supply tube is clogged.
A11013	Wash unit	Error	Water tank is empty	/	The water unit goes wrong. The water supply valve goes wrong. 3. The low-level floater of the water tank goes wrong. 4. The water supply tube is bent. 5. The outlet filter of the water supply tube is clogged.	1. Check the water unit. 2. Check if water supply valve can be turned on and off normally. 3. Check if low-level floater signal is correct. 4. Check if the water supply tube is smooth. 5. Check if outlet filter of water supply tube is clogged.
A11015	Wash unit	Error	Insufficient diluted wash solution	/	1. The diluted wash solution is to be exhausted. 2. The low-level floater of the diluted	1. Check if the diluted wash solution is exhausted and the floater status is Empty. If yes, fill more diluted wash solution.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
					wash solution tank goes wrong.	2. Check diluted wash solution low-level floater.
A11019	Wash unit	Error	Low concentration waste collector is full	/	1. The low-concentration waste drain tube is bent. 2. The low-concentration waste outlet is too high.	1. Check if the low-concentration waste drain tube is smooth. 2. Check if the low-concentration waste outlet is of normal height.
A11020	Wash unit	Error	High concentration waste tank is full	/	The high concentration waste tank is full The floater of the high concentration waste tank goes wrong.	Check the high-concentration waste tank. If the tank is full, replace it. Cover the full tank and dispose of the waste properly. Check if high-concentration waste goes wrong.
A11028	Wash unit	Error	Water tank floater logic failure	/	1. The high-/low-level floaters of the water tank go wrong.	1. Check if the high-/low-level floater signal of the water tank is correct.
A11034	Wash unit	Error	Cuvette wash syringe movement error. 1. Sensor status is incorrect. 2. Failed to find the mechanical zero position. 3. Losing steps when passing the zero position	/	Cuvette wash syringe movement error. 1. Sensor status error Sensor is not connected or is damaged. 2. Home position is not found. 1) Driving circuit error; 2) Motor error; 3) Home position sensor error; 4) Component jam. 3. Syringe losing steps when passing the zero position: 1) The zero position sensor is loose or faulty. 2) The moving part collide with other parts or is blocked.	Wash station movement error 1. Sensor status error If the problem remains after resetting, check the sensor connection or replace it. 2. Home position is not found. Check if the component resistance is too high. If it is, replace the component. 1) Remove obstacle or replace with a new assembly. 2) Replace PCB; 3) Replace motor; 4) Replace sensor; 5) Tighten properly. 3. Syringe losing steps when passing the zero position: 1) Check whether there is dust deposit on the sensor and whether the sensor is loose. If yes, clean the dust and fasten the sensor. 2) Remove obstacle or replace with a new assembly.
A12005	Temperature control unit	Warning	Reaction carousel temperature is out of range	T1	1. The ambient temperature is out of range. 2. The temperature sensor goes wrong. (component error, cable error) 3. The temperature protection switch goes wrong. (component error, cable error) 4. The heater goes wrong. (component error, cable error) 5. PCB error 6. Parameters are lost. 7. Electromagnetic interference exists.	1. Reproduce failure. 2. Check whether the ambient temperature is out of range. 3. Temperature sensor error: check for any signs of short circuit or broken circuit; check if connections are secure. 4. Temperature protection switch error: check if protection switch is shut and connections are secure. 5. Heater error: check if resistance under normal temperature is correct, and connections are secure. 6. PCB error 7. Parameters are lost: check if temperature control parameters are correct. 8. Electromagnetic interference
A12006	Temperature control unit	Warning	Temperature of wash solution for cleaning cuvettes is out of range	/	1. The ambient temperature is out of range. 2. The temperature sensor goes wrong. (component error, cable error) 3. The temperature protection switch goes wrong. (component error, cable error) 4. The heater goes wrong. (component error, cable error)	1. Reproduce failure. 2. Check whether the temperature is out of range. 3. Temperature sensor error: check for any signs of short circuit or broken circuit; check if connections are secure. 4. Temperature protection switch error: check if protection switch is shut and connections are secure. 5. Heater error: check if resistance under normal temperature is correct, and connections are secure. 6. PCB error

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
					5. PCB error 6. Parameters are lost. 7. Electromagnetic interference exists.	7. Parameters are lost: check if temperature control parameters are correct. 8. Electromagnetic interference
A12007	Temperature control unit	Warning	Temperature of fluid for cleaning cuvettes is out of range	/	1. The ambient temperature is out of range. 2. The temperature sensor goes wrong. (component error, cable error) 3. The temperature protection switch goes wrong. (component error, cable error) 4. The heater goes wrong. (component error, cable error) 5. PCB error 6. Parameters are lost. 7. Electromagnetic interference exists.	1. Reproduce failure. 2. Check whether the temperature is out of range. 3. Temperature sensor error: check for any signs of short circuit or broken circuit; check if connections are secure. 4. Temperature protection switch error: check if protection switch is shut and connections are secure. 5. Heater error: check if resistance under normal temperature is correct, and connections are secure. 6. PCB error 7. Parameters are lost: check if temperature control parameters are correct. 8. Electromagnetic interference
A14011	Temperature control unit	Warning	Reagent refrigerating fan is abnormal	/	1. The fan is blocked. 2. The fan is damaged. 3. The power supply goes wrong.	1. Reproduce failure. 2. Pull off and plug in fan socket. 3. Check if power supply for fan is normal. 4. Clean dust off the fan. 5. Replace fan.
A22001	ISE module	Error	1. Slope of Na electrode is out of range. 2. Slope of K electrode is out of range. 3. Slope of Cl electrode is out of range. 4. Slopes of Na and Li electrodes are out of range. 5. Slopes of K and Li electrodes are out of range. 6. Slopes of K and Na electrodes are out of range. 7. Slopes of Cl and Li electrodes are out of range. 8. Slopes of Cl and Na electrodes are out of range. 9. Slopes of Cl and K electrodes are out of range. 10. Slopes of K, Na and Li electrodes are out of range. 11. Slopes of Cl, Na and Li electrodes are out of range. 12. Slopes of Cl, K and Li electrodes are out of range. 13. Slopes of Cl, K and Na electrodes are out of range. 14. Slopes of Cl, K, Na and Li electrodes are out of range.		1. Electrode is not installed correctly. 2. Calibration is invalid. 3. Electrode is degenerated. 4. Bubbles exist inside reference electrode. 5. Reference electrode has been used for a long time. 6. Electrodes interfere with each other. 7. Module or fluidic temperature exceeds 32℃.	1. Remove and reinstall the electrode. 2. Replace the calibrator. 3. Replace the failed electrode and run tests again. 4. Remove the electrode, clap it to remove the bubbles, reinstall it, and then run calibration. 5. Replace the reference electrode and run tests again. 6. Replace electrode by different combinations to troubleshoot the failed one. 7. Monitor the temperature. If the ambient temperature is too high, move the instrument to another position.
A22002	ISE module	Error	Sample probe cannot detect fluid level on the sample carousel due to insufficient sample, or sample is detected containing bubbles in the electrode channel.		1. Sample is insufficient, or contains bubbles after being dispensed. 2. No or insufficient sample is dispensed to the injection port.	1. and 2. Increase the sample volume. Place enough sample in the tube, at least 90μl for ISE measurement. 3. Electrode is not installed correctly. Reinstall it. 4. Check the waste tube, and if necessary, replace it.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
					3. Leaks exist due to improper installation of electrode. 4. Waste pump tube is aging or broken.	
A22004	ISE module	Error	Communicating with the ISE module failed.	/	1. Power supply of ISE module goes wrong. 2. Communication cable between ISE module and middle-layer unit goes wrong. 3. Communication interface or pins go wrong. 4. Main control board of the ISE module goes wrong.	1. Replace the 24V power supply board of the ISE module. 2. Replace the communication cable. 3. Replace the interface or pins. 4. Replace the main control board of the ISE module.
A22005	ISE module	Error	ISE unit communication response error	/	1. Communication cable between ISE module and middle-layer unit goes wrong. 2. Communication interface or pins go wrong. 3. Main control board of the ISE module goes wrong. 4. Software error.	1. Replace the communication cable. 2. Replace the interface or pins. 3. Replace the main control board of the ISE module. 4. Upgrade or reinstall the software.
A22006	ISE module	Error	Pure A/B failed according to the returned data of last purge A and purge B.	/	1. Leaks exist due to improper installation of electrode or O ring's missing. 2. Sample injection port of electrode inside is blocked. 3. Calibrator in the reagent pack is exhausted. 4. Purge cycle is not enough. 5. Peristaltic pump tube is aging, blocked or broken. 6. Calibrator cannot be output due to the blocked wand tube.	1. Reinstall the electrode and check for the O ring. 2. Use warm water to rinse the sample injection port, and unclog the electrode tube. Check the inside of the reference electrode for salt buildup. 3. Replace the reagent pack. 4. Increase the prime cycle. 5. Replace the pump tube. 6. Use warm water to unclog the wand tube.
A22007	ISE module	Warning	Inventory of ISE reagent pack is 0.	/	Calibrator is exhausted.	Replace the reagent pack with a new one.
A22008	ISE module	Error	Voltage of Na electrode is out of range during B calibration or sample measurement. Voltage of K electrode is out of range during B calibration or sample measurement. Voltage of Cl electrode is out of range during B calibration or sample measurement. Voltage of Na electrode is out of range during B calibration or sample measurement. Voltage of K electrode is out of range during B calibration or sample measurement.		1. Electrode or reagent pack is invalid. 2. Electrode is unstable. 3. New reagent pack is unstable. 4. Reference electrode has been used for over 6 months. 5. Main control board of the ISE module goes wrong.	1. Replace the failed electrode or reagent pack. 2. New electrode can become stable only after 15 minutes since installation. 3. Multiple calibrations are required after installing new reagent pack. 4. Replace the reference electrode. 5. Replace the main control board.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
			Voltages of K and Na electrodes are out of range during B calibration or sample measurement. Voltage of Cl electrode is out of range during B calibration or sample measurement. Voltages of Cl and Na electrodes are out of range during B calibration or sample measurement. Voltages of Cl and K electrodes are out of range during B calibration or sample measurement. Voltages of K and Na electrodes are out of range during B calibration or sample measurement. Voltages of Cl and Na electrodes are out of range during B calibration or sample measurement. Voltages of Cl and K electrodes are out of range during B calibration or sample measurement. Voltages of Cl, K and Na electrodes are out of range during B calibration or sample measurement. Voltages of Cl, K and Na electrodes are out of range during B calibration or sample measurement. Voltage of Na electrode is out of range for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltage of K electrode is out of range for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltage of Cl electrode is out of range for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltage of Na electrode is out of range for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltage of K electrode is out of range for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltages of K and Na electrodes are out of range for calibration A in two-point			

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
			calibration or serum mode, or for calibration B in urine mode. Voltage of Cl electrode is out of range for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltages of Cl and Na electrodes are out of range for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltages of Cl and K electrodes are out of range for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltages of K and Na electrodes are out of range for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltages of Cl and Na electrodes are out of range for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltages of Cl and K electrodes are out of range for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltages of Cl, K and Na electrodes are out of range for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltages of Cl, K and Na electrodes are out of range for calibration A in two-point calibration or serum mode, or for calibration B in urine mode.			
A22009	ISE module	Error	Na electrode's voltage drift for calibration A or slope drift for two-point calibration in urine mode. K electrode's voltage drift for calibration A or slope drift for two-point calibration in urine mode. Cl electrode's voltage drift for calibration A or slope drift for two-point calibration in urine mode. Na electrode's voltage drift for calibration A or slope drift for two-point calibration in urine mode. K electrode's voltage drift for calibration A or slope drift for two-point calibration in urine mode.	/	1. Electrode or reagent pack is invalid. 2. Electrode is unstable. 3. New reagent pack is unstable. 4. Reference electrode has been used for over 6 months. 5. Main control board of the ISE module goes wrong. 6. The ambient temperature is fluctuating greatly.	1. Replace the failed electrode or reagent pack. 2. New electrode can become stable only after 15 minutes since installation. 3. Multiple calibrations are required after installing new reagent pack. 4. Replace the reference electrode. 5. Replace the main control board. 6. Monitor the ambient temperature and ensure the fluctuation is within +/-4.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
			K and Na electrodes' voltage drift for calibration A or slope drift for two-point calibration in urine mode. Cl electrode's voltage drift for calibration A or slope drift for two-point calibration in urine mode. Cl and Na electrodes' voltage drift for calibration A or slope drift for two-point calibration in urine mode. Cl and K electrodes' voltage drift for calibration A or slope drift for two-point calibration in urine mode. K and Na electrodes' voltage drift for calibration A or slope drift for two-point calibration in urine mode. Cl and Na electrodes' voltage drift for calibration A or slope drift for two-point calibration in urine mode. Cl and K electrodes' voltage drift for calibration A or slope drift for two-point calibration in urine mode. Cl, K and Na electrodes' voltage drift for calibration A or slope drift for two-point calibration in urine mode. Cl, K and Na electrodes' voltage drift for calibration A or slope drift for two-point calibration in urine mode.			
A22010	ISE module	Error	Voltage of Na electrode has noise during B calibration or sample measurement. Voltage of K electrode has noise during B calibration or sample measurement. Voltage of Cl electrode has noise during B calibration or sample measurement. Voltage of Na electrode has noise during B calibration or sample measurement. Voltage of K electrode has noise during B calibration or sample measurement. Voltages of K and Na electrodes have noise during B calibration or sample measurement. Voltage of Cl electrode has noise during B calibration or sample measurement. Voltages of Cl and Na electrodes have noise during B calibration or sample measurement. Voltages of Cl and K electrodes have noise during B calibration or sample measurement. Voltages of K and Na electrodes have noise	/	1. Electrode is invalid. 2. Temperature interference. 3. Main control board of the ISE module goes wrong. 4. Fluidic leaks exist, resulting in salt buildup around the electrode or tube.	1. Replace the electrode. 2. Relocate the instrument. 3. Replace the main control board of the ISE module. 4. Clean the tube and electrode.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
			during B calibration or sample measurement. Voltages of Cl and Na electrodes have noise during B calibration or sample measurement. Voltages of Cl and K electrodes have noise during B calibration or sample measurement. Voltages of Cl, K and Na electrodes have noise during B calibration or sample measurement. Voltages of Cl, K and Na electrodes have noise during B calibration or sample measurement. Voltage of Na electrode has noise for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltage of K electrode has noise for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltage of Cl electrode has noise for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltage of Na electrode has noise for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltage of K electrode has noise for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltage of K and Na electrodes has noise for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltage of Cl electrode has noise for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltages of Cl and Na electrodes have noise for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltages of Cl and K electrodes have noise for calibration A in two-point calibration or serum mode, or for calibration B in urine			

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
			mode. Voltages of K and Na electrodes have noise for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltages of Cl and Na electrodes have noise for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltages of Cl and K electrodes have noise for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltages of Cl, K and Na electrodes have noise for calibration A in two-point calibration or serum mode, or for calibration B in urine mode. Voltages of Cl, K and Na electrodes have noise for calibration A in two-point calibration or serum mode, or for calibration B in urine mode.			
A22011	ISE module	Error	Calibrator B is detected containing bubbles in the electrode channel, or is exhausted.	/	1. Calibrator B is exhausted. 2. Calibrator B tube contains many air bubbles. 3. Peristaltic pump B tube is aging, clogged and broken. 4. Waste pump tube is aging, clogged and broken. 5. The sample injection port and fluidic tube is blocked or leaking. 6. The air bubble detector is invalid.	1. Replace the reagent pack with a new one. 2. Perform purge B to remove air bubbles. 3. and 4. Replace the peristaltic pump tube. 5. Clean the sample injection port, or reinstall the electrode. 6. Replace the air bubble detector.
A22012	ISE module	Error	Calibrator A is detected containing bubbles in the electrode channel, or is exhausted.	/	1. Calibrator A is exhausted. 2. Calibrator A tube contains many air bubbles. 3. Peristaltic pump A tube is aging, clogged and broken. 4. Waste pump tube is aging, clogged and broken. 5. The sample injection port and fluidic tube is blocked or leaking. 6. The air bubble detector is invalid.	1. Replace the reagent pack with a new one. 2. Perform purge B to remove air bubbles. 3. and 4. Replace the peristaltic pump tube. 5. Clean the sample injection port, or reinstall the electrode. 6. Replace the air bubble detector.
A22013	ISE module	Error	Pump calibration result error	/	1. Peristaltic pump tube is aging. 2. Aspiration and dispensing of sample probe goes wrong.	1. Replace the pump tube. 2. Replace the sample probe.
A22014	ISE module	Error	Air bubble detector error	/	1. Air bubble detector board is eroded due to the leaks at the joint of sample injection port and bubble detector. 2. The air bubble detector is invalid.	Replace the air bubble detector.
A22015	ISE module	Error	Reading reagent pack chip information	/	Reagent pack information cannot be	1. Install the reagent pack.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
			error		read, or the read volume of calibrator A or B is less than that recorded in the database.	2. Install the reagent pack wand.
A22016	ISE module	Error	Writing reagent pack chip information error	/	1. Reagent pack is not installed. 2. Reagent pack wand is failed.	1. Install the reagent pack. 2. Install the reagent pack wand.
A22017	ISE module	Error	Wash solution is detected containing bubbles in the electrode channel, or has not been loaded to correct position on the sample carousel.	/	1. ISE wash solution is insufficient. 2. Waste pump tube is aging, clogged and broken. 3. The sample injection port and fluidic tube is blocked or leaking. 4. The air bubble detector is invalid.	1. Place sufficient ISE wash solution. 2. Replace the peristaltic pump tube. 3. Clean the sample injection port, or reinstall the electrode. 4. Replace the air bubble detector.
A22018	ISE module	Error	The ISE tube has no liquid or has leaks.	/	1. Waste pump tube is aging, clogged and broken. 2. The sample injection port and fluidic tube is blocked or leaking. 3. The air bubble detector is invalid.	1. Replace the peristaltic pump tube. 2. Clean the sample injection port, or reinstall the electrode. 3. Replace the air bubble detector.
A22019	ISE module	Error	Stored calibration value error.	/	1. Communication cable between ISE module and middle-layer unit goes wrong. 2. Communication interface or pins go wrong. 3. Main control board of the ISE module goes wrong. 4. Software error.	1. Replace the communication cable. 2. Replace the interface or pins. 3. Replace the main control board of the ISE module. 4. Upgrade or reinstall the software.
A22021	ISE module	Error	Command format or execution error	/	1. Communication cable between ISE module and middle-layer unit goes wrong. 2. Communication interface or pins go wrong. 3. Main control board of the ISE module goes wrong. 5. Software error.	1. Replace the communication cable. 2. Replace the interface or pins. 3. Replace the main control board of the ISE module. 5. Upgrade or reinstall the software.
A22022	ISE module	Error	Air exists in segment	/	1. Waste pump tube is aging, clogged and broken. 2. The sample injection port and fluidic tube is blocked or leaking. 3. The air bubble detector is invalid.	1. Waste pump tube is aging, clogged and broken. 2. The sample injection port and fluidic tube is blocked or leaking. 3. The air bubble detector is invalid.
A22023	ISE module	Error	Reagent module not loaded	/	1. Reagent pack is not installed. 2. Reagent pack wand is failed.	1. Install the reagent pack. 2. Install the reagent pack wand.
A22024	ISE module	Error	Check digit in error code returned by ISE module is incorrect.	/	1. Communication cable between ISE module and middle-layer unit goes wrong. 2. Communication interface or pins go wrong. 3. Main control board of the ISE module goes wrong. 5. Software error.	1. Replace the communication cable. 2. Replace the interface or pins. 3. Replace the main control board of the ISE module. 5. Upgrade or reinstall the software.
A22025	System communication	Error	Communication with middle-/lower-layer units failed in home procedure.	/	The serial cable is not connected; or the analyzer power is switched off.	Check the serial port connection. Replug the cable. Check if the analyzing unit and rack feeder system are powered

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
						on. Start the initialization again. Restart the computer and analyzing unit. If three continuous attempts are failed, contact our customer service department or your local distributor.
A22026	System communication	Error	Key parameters are not configured during home procedure.	/	Key parameters are not configured.	Switch off the analyzing unit power and switch on it again. If this message appears for 3 times, contact our customer service department or your local distributor.
A22027	System communication	Error	Fluidic prime is not performed during home procedure.	/	Fluidic prime is not performed.	Switch off the analyzing unit power and switch on it again. If this message appears for 3 times, contact our customer service department or your local distributor.
A22028	System communication	Error	Downloading key parameters failed during home procedure.	/	Downloading key parameters failed, or reading parameters from E2PROM failed, or configuring parameters of low-layer unit failed.	Switch off the analyzing unit power and switch on it again. If this message appears for 3 times, contact our customer service department or your local distributor.
A22029	System communication	Error	Collecting dark current failed during home procedure.	/	Collecting dark current failed.	Switch off the analyzing unit power and switch on it again. If this message appears for 3 times, contact our customer service department or your local distributor.
A22032	System communication	Error	Floaters are found abnormal during fluidic initialization of home procedure.	/	Water tank low-level floater is full. Or Low level floater of the diluted wash solution tank is empty. Or Low-concentration waste collector floater is empty. Or External high-concentration waste tank floater is full.	1. Check if the water unit and inlet tube are normal. 2. Check if the low-concentration waste tube is normal. 3. Check floaters of the water tank, diluted wash solution tank, low-concentration waste container, and external high-concentration waste tank.
A22034	System communication	Error	Resetting cuvette wash syringe failed during fluidic initialization of home procedure.	/	Resetting cuvette wash syringe failed.	Switch off the analyzing unit power and switch on it again. If this message appears for 3 times, contact our customer service department or your local distributor.
A22036	System communication	Error	Initializing sample bar code reader failed during home procedure.	/	Initializing sample bar code reader failed.	Switch off the analyzing unit power and switch on it again. If this message appears for 3 times, contact our customer service department or your local distributor.
A22037	System communication	Error	Initializing reagent bar code reader failed during home procedure.	/	Initializing reagent bar code reader failed.	Switch off the analyzing unit power and switch on it again. If this message appears for 3 times, contact our customer service department or your local distributor.
A22038	System communication	Error	Executing reagent bar code scanning failed during home procedure.	/	Scanning reagent bar code failed.	Switch off the analyzing unit power and switch on it again. If this message appears for 3 times, contact our customer service department or your local distributor.
A22039	System communication	Error	Software version does not match during home procedure.	/	1. Executing version query instruction failed. 2. Returned control software version and that stored in the operating software does not match.	Switch off the analyzing unit power and switch on it again. If this message appears for 3 times, contact our customer service department or your local distributor.
A22041	Sample Probe Unit	Sample probe special wash failure	Sample probe special wash failure during home procedure	/	1. Sample probe vertical movement assembly fails 2. Drain tubes of sample probe wash well are bent or have foreign objects inside	1. Troubleshoot possible movement-related problems by referring to the solutions to sample probe movement errors. 2. Arrange the drain tubes of sample probe wash well and remove foreign objects.
C00007	Operating system	Error	CPU error	/	The CPU is too busy.	Restart the computer and operating software. Check for viruses or other software, or if anti-virus software trusts the BS-430 operating software.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
C00011	Operating system	Error	The operating software has not been closed normally.	/	The operating software is abnormal or the analyzer is powered off accidentally.	After rebooting the software, perform the special wash procedure.
C00012	Operating system	Warning	Sound card failure	/	No sound card is installed. Sound card failure. Incorrect sound card driver.	Reinstall the sound card or the sound card driver.
C01001	System communication	Error	Instrument cannot be connected	/	The serial cable is not connected; or the analyzer power is switched off. The track is powered off.	Check the serial port connection. Replug the cable. Check if the analyzing unit and rack feeder system are powered on. Start the initialization again. Restart the computer and analyzing unit. If three continuous attempts are failed, contact our customer service department or your local distributor.
C02001	Database	Error	Database initializing failed	/	Database software is not installed; database is not established; database system or database file is damaged or lost; database is opened exclusively	Install database software; re-establish database; if problem remains, contact our R&D department
C02002	Database	Error	Database upgrade failed	/	Database is severely damaged; database does not exist; database is not private for BS-600; database is opened exclusively	Install database software; re-establish database; if problem remains, contact our R&D department
C02004	Database	Warning	Data backup failed	/	Database record is being used. Database is locked.	Back up database again; if problem remains, contact our R&D department
C02005	Database	Warning	Reading/Writing database failed	/	Cannot read or write necessary information from or into database	Check if database has been damaged; contact our R&D department
C03001	Result calculation	Warning	Response calculation error	RCE	Absorbance data for calculation is incomplete, or the dividend is 0.	Investigate the cause of photoelectric data loss; contact our R&D department
C03002	Result calculation	Warning	Absorbance out of range	ABS	The absorbance measured at the primary and secondary wavelength is greater than 3.3A.	Check the sample for foreign matters or interferents; check if the reagent is qualified and placed in the correct position; check the cuvette is clean; check if the photometric system is working normally.
C03003	Result calculation	Warning	R1 blank absorbance out of range	RBK	The reagent goes wrong; the cuvette is not clear; the reaction cuvette is overflowed; or insufficient reagent is dispensed.	Check if cuvette is clean or overflowed; check if reagent is sufficient, without air bubbles; check if chemistry parameters are reasonable; if previous problems do not exist, replace reagent and rerun the test.
C03004	Result calculation	Warning	Substrate depletion	BOE	The sample concentration is too high, and substrate depletion occurs during fixed-time measurements.	Check the reaction curve and the substrate depletion limit. Rerun the test with diluted sample.
C03005	Result calculation	Warning	No calculation interval	ENC	The sample concentration is too high, and substrate depletion occurs within the lag time of rate check measurements.	Check the reaction curve and the substrate depletion limit. Rerun the test with diluted sample.
C03006	Result calculation	Warning	Non-linear	LIN	The measuring points for result calculation are nonlinear, because the sample concentration is too high, or the substrate depletion limit is not specified or unreasonable.	Check the reaction curve and the substrate depletion limit. Rerun the test with diluted sample.
C03007	Result calculation	Warning	Prozone check error	PRO	Antigen excess occurs due to too high sample concentration.	Check the reaction curve and the prozone check parameters. Rerun the test with diluted sample.
C03008	Result calculation	Warning	Response greater than that of the maximum-concentration calibrator	RRN	The sample concentration exceeds the high limit of the calibrator	Rerun the test with diluted sample.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
					concentration.	
C03009	Result calculation	Warning	Mixed blank absorbance out of range	MBK	The reagent goes wrong; the cuvette is not clear; the reaction cuvette is overflowed; or insufficient reagent is dispensed.	Check if the cuvette is clear and not overflowed, the reagent is sufficient without air bubbles, and the chemistry parameters are reasonable. If yes, replace the reagent and then rerun the test.
C03010	Result calculation	Warning	Blank response out of range	BLK	The reagent goes wrong; insufficient reagent is dispensed; the cuvette contains air bubbles; the light drifts; or the cuvette is overflowed.	Check if the cuvette is not overflowed, the reagent is sufficient without air bubbles, the light does not drift and the chemistry parameters are reasonable. If yes, replace the reagent and then rerun the test.
C03011	Result calculation	Warning	Calibration repeatability error.	DUP	The difference between the maximum and minimum response of the calibrator exceeds the specified limit.	Check if the acceptance limit is reasonable, troubleshoot the error, and then recalibrate.
C03012	Result calculation	Warning	Calibration sensitivity error.	SEN	The difference of final response of the maximum and minimum concentration calibrators exceeds the specified limit.	Check if the acceptance limit is reasonable and the reagent and calibrator are normal, and then recalibrate.
C03013	Result calculation	Warning	Calibration curve standard deviation out of range.	CSD	The calculated standard deviation of the calibration curve exceeds the specified limit.	Check if the acceptance limit is reasonable and the reagent and calibrator are normal, and then recalibrate.
C03014	Result calculation	Warning	Calibration determination coefficient out of range	DET	The calculated fit of the calibration curve exceeds the specified limit.	Check if the acceptance limit is reasonable and the reagent and calibrator are normal, and then recalibrate.
C03015	Result calculation	Warning	Calibration coefficient differential limit exceeds limit.	FAC	The slope difference is applicable to linear calibration only and refers to the K factor (slope) difference between two adjacent calibrations. It exceeds the specified limit.	Check if the acceptance limit is reasonable and the reagent and calibrator are normal, and then recalibrate.
C03016	Result calculation	Warning	Calibration curve not monotonic.	MON	The calibration data and calibration curve are not monotonic.	Check if the calibrator is defined and placed correctly, and then recalibrate.
C03017	Result calculation	Warning	Calibration curve is not convergent.	COV	For nonlinear calibration, a satisfying base cannot be calculated and no calibration curve is drawn.	Check that the reagent and calibrator are normal, and then recalibrate. If troubleshooting fails, choose other calibration rules and recalibrate.
C03018	Result calculation	Warning	12S	12S	The current QC result is between ±2 and ±3 standard deviations from the assigned mean concentration.	No actions are required.
C03019	Result calculation	Warning	13s	13s	The current QC result is greater than ±3 standard deviations from the assigned mean concentration.	Check if the reagent is qualified, control sample is normal, and the instrument is working correctly.
C03020	Result calculation	Warning	22s	22s	Results of two controls or two results of one control within a run are simultaneously greater than +2 or -2 standard deviations from the assigned mean.	Check if the reagent is qualified, control sample is normal, and the instrument is working correctly.
C03021	Result calculation	Warning	R4S	R4S	One result of a run is greater than +2 standard deviations (SD) from the assigned mean and the other greater than -2SD.	Check if the reagent is qualified, control sample is normal, and the instrument is working correctly.
C03022	Result calculation	Warning	41s	41s	Results of two runs (4 results), or 4 continuous results of a control are on the same side and greater than ±1 standard deviation from the assigned	Check if the reagent is qualified, control sample is normal, and the instrument is working correctly.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
					mean concentration.	
C03023	Result calculation	Warning	10x	10x	Results of five runs (10 results), or 10 continuous results of a control are on the same side.	Check if the reagent is qualified, control sample is normal, and the instrument is working correctly.
C03024	Result calculation	Error	CC test period time out. Cannot continue	/	Software error Operating system error	Rerun the tests; check the serial cable connection of the main unit; restart the software; switch on the analyzing unit power again; check the Task Manager for abnormal processes; or contact the R&D department of Mindray.
C03026	Result calculation	Warning	Photoelectric data is lost	/	Communication error.	If the error persists, contact our R&D department.
C03027	Result calculation	Warning	1.0-2.7 out of control	2.7s	The cumsum of control is greater than ±2.7 standard deviations from the average.	Check if the reagent is qualified, control sample is normal, and the instrument is working correctly.
C03028	Result calculation	Warning	1.0-3.0 out of control	3.0s	The cumsum of control is greater than ±3.0 standard deviations from the average.	Check if the reagent is qualified, control sample is normal, and the instrument is working correctly.
C03029	Result calculation	Warning	0.5-5.1 out of control	5.1s	The cumsum of control is greater than ±2.7 standard deviations from the average.	Check if the reagent is qualified, control sample is normal, and the instrument is working correctly.
C03030	Result calculation	Error	Photoelectric measurement period is out of range	/	Software error	1. Rerun the operating software. 2. Restart the analyzing unit. If problem remains, contact our R&D department.
C03031	Result calculation	Error	Multiple photoelectric measurements are time out	/	Software error	1. Rerun the operating software. 2. Restart the analyzing unit. If problem remains, contact our R&D department.
C04001	Sample bar code	Warning	Duplicate sample bar code.	/	Duplicate bar code is used on the current day.	Replace the duplicate sample bar code label.
C04002	Sample bar code	Warning	Bar code has no corresponding programming.	/	The sample of the bar code has not been programmed.	Program the sample of the bar code.
C04006	Sample bar code	Warning	Sample is expired.	/	The sample is loaded after its shelf life is exceeded.	The sample is expired. Replace the sample and program it again. Reject the expired sample. If the sample shelf life is too short, change it to a reasonable one.
C04008	Sample bar code	Warning	Sample bar code too long.	/	The bar code length is greater than the maximum value of 27 digits.	Redefine the bar code with no more than 27 digits.
C40009	Sample bar code	Warning	Sample bar code is less than 3 digits.	/	The bar code length is less than the minimum value of 3 digits.	Redefine the bar code with no less than 3 digits.
C04012	Sample bar code	Warning	Sample bar code analyzing failed during sample programming.	/	Bar code data does not accord with the defined format.	Reset the bar code format, or reprint and scan the bar code.
C05001	Reagent bar code	Warning	Reagent of this bar code has already been loaded.	/	Incorrect reagent or reagent bar code is being used, or an invalid reagent bar code is being used in a closed-reagent system. Closed-reagent bar code is aligned with closed reagents, and cannot be used again for new reagent when a reagent is exhausted.	Reprint the reagent bar code, or replace the reagent bottle with an invalid bar code.
C05002	Reagent bar code	Warning	Reagent bar code information error.	/	Incorrect reagent bar code is being used, or reagent bar code is not configured reasonably. The reagent bar code contains incomplete or	Print the new reagent bar code with correct settings and check the bar code against the settings. In the case of a closed-reagent system, replace the reagent bottle, or contact the reagent supplier.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
					incorrect reagent information, such as expiration date, reagent volume, etc. The reagent is placed in a wrong position, for example, a 40ml square bottle on the inner ring and a 40ml long bottle on the outer ring.	Check if the reagent bottle type and the position match.
C05003	Reagent bar code	Warning	Reagent bar code is incorrect and does not meet the requirements.	/	Incorrect reagent bar code is being used, or reagent bar code settings are incorrect. Non-closed reagent bar code is being used in a closed-reagent system. The system fails to extract reagent information from the bar code.	Check the reagent bar code settings, or reprint the reagent bar code against the settings. In the case of a closed-reagent system, contact the reagent supplier.
C05006	Reagent bar code	Error	Other reagents are placed in the fixed reagent position.	/	Reagent rather than wash solution is placed in the fixed wash solution position on reagent carousel 1.	Reposition the reagent, or remove it from the fixed wash solution position.
C05008	Reagent bar code	Error	Other reagents are placed in the fixed reagent position.	/	Reagent rather than physiological saline is placed in the fixed physiological saline position on reagent carousel 1.	Reposition the reagent, or remove it from the fixed wash solution position.
C06001	Host communication	Error	LIS initialization error	/	Host file is damaged or does not exist.	Reboot operating software; initialize LIS module
C06002	Host communication	Error	LIS communication parameter error	/	Host parameters error	Check system configuration parameters; re-connect LIS
C06003	Host communication	Error	LIS communication error	/	Communication failure	If the error occurs accidentally, send or receive the instruction again. If the error occurs for several times, contact LIS vendor. If problem remain, contact our R&D department.
C06004	Host communication	Error	LIS host cannot be connected	/	Abnormal network connection, or the LIS host is not started.	Check if LIS host and LIS station is started normally.
C06005	Host communication	Warning	Sending sample results failed.	/	Communication failure	If the error occurs accidentally, send or receive the instruction again. If the error occurs for several times, contact LIS vendor. If problem remain, contact our R&D department.
C06006	Host communication	Warning	Sending sample information failed.	/	Communication failure	If the error occurs accidentally, send or receive the instruction again. If the error occurs for several times, contact LIS vendor. If problem remain, contact our R&D department.
C06007	Host communication	Warning	Inquiring sample information failed	/	LIS host failure.	If the error occurs accidentally, neglect it. Neglect the error. If the error occurs for several times, contact LIS vendor. If the problem remains, contact our customer service department or your local distributor.
C06008	Host communication	Warning	Downloading sample failed.	/	Incorrect channel settings; or insufficient or redundant chemistries on the LIS host.	Check and re-set the chemistry correspondence between the operating software and the LIS host.
C07003	Light Source	Error	Light intensity is too weak.	/	1. The lamp is not installed correctly. 2. The cuvette is contaminated. 3. The lamp is aging. 4. The wash station dispenses liquid incorrectly.	1. Open the lamp replacement door and check if the lamp is installed correctly. 2. Perform the special wash procedure and then the lamp check procedure. 3. Replace the lamp.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
					5. The AD collection board goes wrong.	4. Check if the wash station dispenses liquid with correct volume to reaction cuvettes. 5. Check if the cables on the AD collection board are installed correctly. 6. Replace the AD collection board. 7. If the problem remains, contact the R&D department of Mindray.
C07004	Light Source	Warning	Cuvette blank out of range	/	1. The cuvette is contaminated. 2. The lamp is aging. 3. The lamp is not installed correctly. 4. The wash station dispenses liquid incorrectly. 5. The photoelectric collection board goes wrong.	1. Replace or clean the failed cuvette. 2. Open the lamp replacement door and check if the lamp is installed correctly. 3. Perform the diluted wash procedure and then the cuvette check procedure. 5. Replace the lamp. 6. Check if the wash station dispenses liquid with correct volume to reaction cuvettes. 6. Check if the cables on the AD collection board are installed correctly. 7. Replace the AD collection board. 8. If the problem remains, contact the R&D department of Mindray.
C07005	Light Source	Error	Lamp is not turned on	/	1. The lamp is damaged. 2. The lamp cable is not connected properly. 3. The power board of the lamp is not connected properly. 4. The power supply of the analyzing unit is disconnected. 5. The photoelectric collection board goes wrong.	1. Open the reaction carousel and check if the lamp is turned on. If it is not, rerun the operating software. 2. Check if the lamp cable is tightened. 3. Replace the lamp. 4. Check if the connect of the lamp power board is loose, and if necessary, reinsert the connector. 5. Check if the cables on the AD collection board are installed correctly. 6. Replace the AD collection board. 7. If the problem remains, contact the R&D department of Mindray.
C07006	Light Source	Error	Light intensity is too strong.	/	1. A cuvette position has no cuvette installed. 2. The circuit gain is too high and beyond the measurement range.	1. Check if all cuvette positions have cuvettes installed. 2. Readjust the gain or(/and) lamp voltage. 3. If the problem remains, contact the R&D department of Mindray.
C07007	Light Source	Error	Dark current is high.	/	1. The circuit gain is too high and beyond the measurement range. 2. The power board of the lamp is not connected properly. 3. The photoelectric collection board goes wrong.	1. Perform dark current fluctuation test to identify failure. 2. Check if the abnormal channel has something to do with the channel gain. If it does, adjust the channel gain. 3. Check if the cables on the AD collection board are installed correctly. 4. Unplug the cables from the AD collection board and pre-amplification board and perform the dark current fluctuation test again. Check if the failure is related to the pre-amplification board. If yes, replace the optical measurement assembly. 5. Replace the AD collection board. 6. If the problem remains, contact the R&D department of Mindray.
C07008	Light Source	Warning	The lamp has been used over its lift span.	/	1. The lamp has been used for over	1. Replace the lamp.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
					2,000 hours. 2. The lamp has been replaced incorrectly.	2. Perform the Replace Lamp maintenance procedure.
C07009	Light Source	Error	Water blank out of range (10X).	/	1. Overflow. 2. The lamp has been replaced incorrectly. 3. Cuvette Check is not performed after cuvette maintenance. 4. Wash solution inside the cuvette is little. 5. The cable connector or retaining screw of the lamp are not tightened. 6. The lamp is aging. 7. The photometer goes wrong.	1. Check if the cuvette is overflowing. 2. Check if the Replace Lamp command is executed during lamp replacement. 3. Check if the Cuvette Check command is executed after cuvette maintenance. 4. Check if the cleaning liquid inside the cuvette is no less than half of the cuvette. 5. Check if the cable connectors and retaining screw of the lamp have been tightened. 6. Check if the reaction curve fluctuates irregularly. If yes, replace the lamp. 7. If the problem remains, contact the R&D department of Mindray.
C07010	Light Source	Warning	Reagent blank is abnormal 10X.	RG!	1. Overflow or water intrusion on reaction carousel is not processed. 2. Bubbles are dispensed together with reagent. 3. Foreign matters exist in cuvette. 4. Reagent volume is insufficient.	1. If the alarm only occurs on certain cuvette, it may be caused by foreign matters or bubbles. Check the cuvette for foreign matters. If there are surely no bubbles in cuvette, ignore it. 2. If overflow or water intrusion happens, remove the reaction carousel and clear it and the temperature bath. 3. Check the height and vertical extreme position of the reagent probe.
C07012	Other failure in the operating unit	Warning	Storage device error; Cannot import data	/	No floppy disk or U disk is inserted. No file is found in the floppy disk or U disk, or file error, or file is damaged. The floppy disk or U disk is locked or damaged.	Check if a USB drive or floppy disk is inserted or full. Check if the storage device is damaged.
C07013	Other failure in the operating unit	Warning	Storage device error. Cannot export data	/	No floppy disk or U disk is inserted. Insufficient disk space. The floppy disk or U disk is locked or damaged.	Check if a USB drive or floppy disk is inserted or full. Check if the storage device is damaged.
C07014	Other failure in the operating unit	Warning	Biochemistry reagent exhausted	/	All reagents of the reagent type for the chemistry are less than the minimum limit. All reagents of the type are too little to be detected.	Refill or replace the reagent.
C07016	Other failure in the operating unit	Warning	Insufficient reagent probe wash solution.	/	Insufficient wash solution on the reagent carousel.	Refill the wash solution on the reagent carousel.
C07017	Other failure in the operating unit	Warning	Reagent probe wash solution is exhausted.	/	The wash solution on the reagent carousel is exhausted.	Refill the wash solution on the reagent carousel.
C07022	Other failure in the operating unit	Warning	Less than %s tests are left in biochemistry reagent Chemistry: %s Position: %s	/	All reagents of the reagent type for the chemistry are less than the minimum limit. All reagents of the type are too little to be detected.	Refill or replace the reagent.
C07023	Other failure in the operating unit	Warning	Calibration factors of one or more chemistries are to be expired.	/	The calibration factors are about to be expired.	Recalibrate the chemistry.

Error Code	Component	Event Class	Problem Description	Flag	Probable Causes	Corrective Actions
C07027	Other failure in the operating unit	Warning	Calibrator %s has been expired	/	The calibrator is expired.	Replace the calibrator.
C07028	Other failure in the operating unit	Warning	Chemistry: %s, lot number: %s, position: %s, has been expired	/	Expired reagent	Replace the reagent.
C07029	Other failure in the operating unit	Warning	Chemistry: %s, lot number: %s, position: %s, has exceeded the uncapping time	/	The uncapping time of the reagent pack is too long.	Replace the reagent.
C07034	Other failure in the operating unit	Warning	Insufficient physiological saline on reagent carousel	/	Insufficient physiological saline on reagent carousel	Refill the physiological saline on the reagent carousel.
C07035	Other failure in the operating unit	Warning	Physiological saline on reagent carousel is exhausted	/	Physiological saline is exhausted	Refill the physiological saline on the reagent carousel.
C07036	Other failure in the operating unit	Warning	Chemistry: %s. Calibration factors are expired	/	The calibration factors have been expired.	Recalibrate the chemistry.
C07037	Other failure in the operating unit	Warning	Reagent bottle number of %s chemistry is changed. Please recalibrate	/	Serial number of the reagent is changed.	Reagent serial number of the chemistry is changed. Please recalibrate
C07038	Other failure in the operating unit	Warning	Reagent lot number of %s chemistry is changed. Please recalibrate	/	Lot number of the reagent is changed.	Reagent lot number of the chemistry is changed. Please recalibrate
C07039	Other failure in the operating unit	Warning	The calibration factors are expired.	/	The calibration factors are expired.	The calibration factors are expired.
C07040	Other failure in the operating unit	Warning	Biochemistry reagent exhausted	/	Reagent is exhausted. Reagent level cannot be detected.	Refill or replace the reagent.
C07041	Other failure in the operating unit	Error	Less than X% tests are left in ISE chemistry reagent. (X can be defined)	/	Inventory of the ISE reagent is lower than the alarm limit.	Check the inventory, and refill ISE reagent if necessary.
C07042	Other failure in the operating unit	Warning	Solutions are expired. (special reagents)	/	The non-reagent solution or the reagent is expired.	Replace the expired solution or the reagent.

11 Assembly Exploded View

Overview

This section shows the diagram and part number for each assembly. Such information can help engineer order and change the parts.

NOTE

- **All the part numbers in tables below are intended for engineer to query order number. When you order spare parts, please use the order number in spare parts list from Mindray.**
- **If part number is shown as /, that means the parts cannot be ordered as a spare part. It is intended to help reader understand the machine.**
- **Tube or connectors are not mention in this section. Please refer to the liquid system section**

11.1 Exploded View of the Host Panel

11.1.1 Exploded View of Front Panel

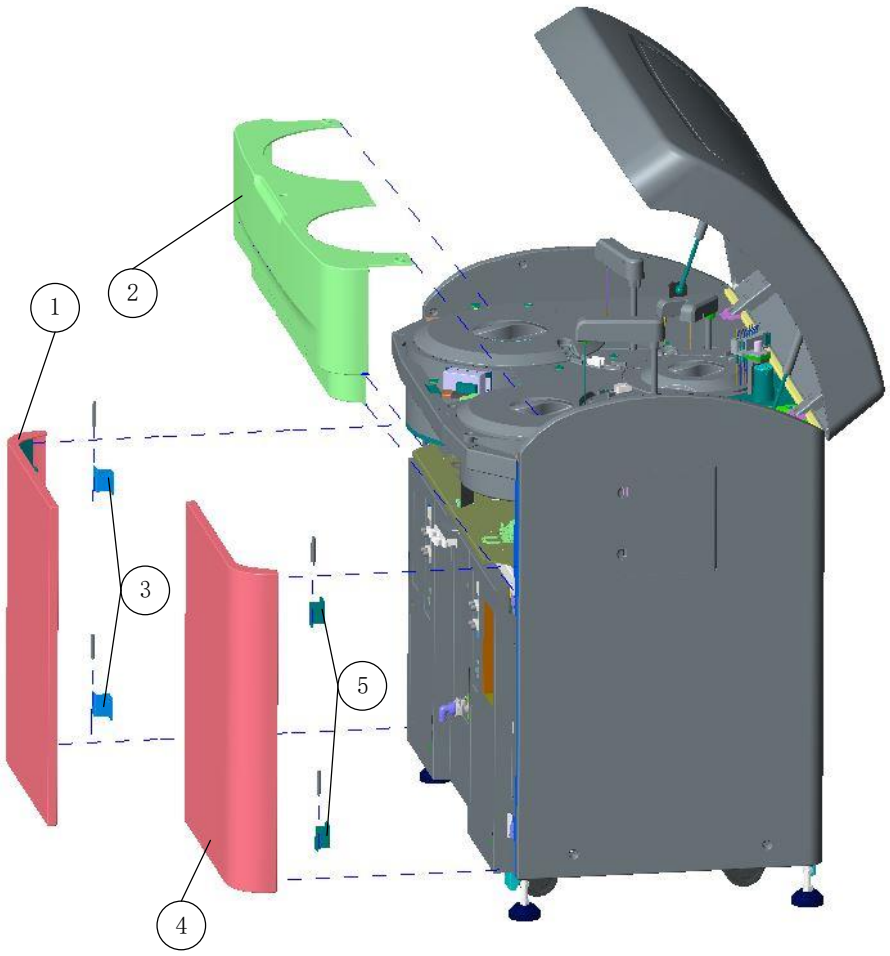


Figure 11-1 Exploded view of front panel

Parts list:

NO	Part Number	Part name	Quantity	Remark
1	BA38-30-88119	Left Front Door Assembly	1	/
2	043-007089-00	BS-430 front shell	1	/
3	/	Hinge of Left Door	2	/
4	BA38-30-88120	Right Front Door Assembly	1	
5	/	Hinge of Right Door	2	/

11.1.2 Exploded View of Back Panel

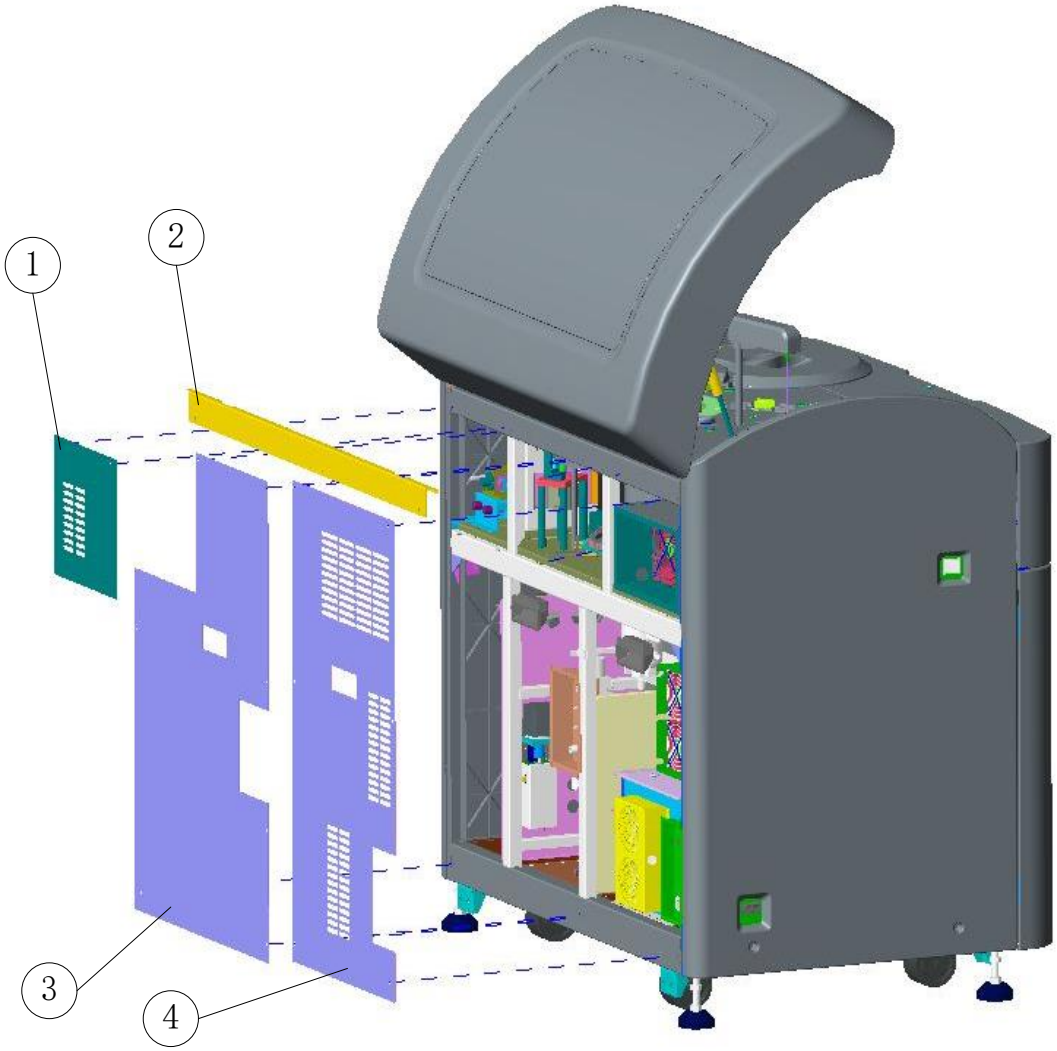


Figure 11-2 Exploded view of back panel

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	042-004716-00	the jointing of light shell	1	/
2	/	back top plate	1	/
3	042-017412-00	back plate 1	1	/
4	042-017413-00	back plate 2	1	/

11.1.3 Exploded View of Left Panel

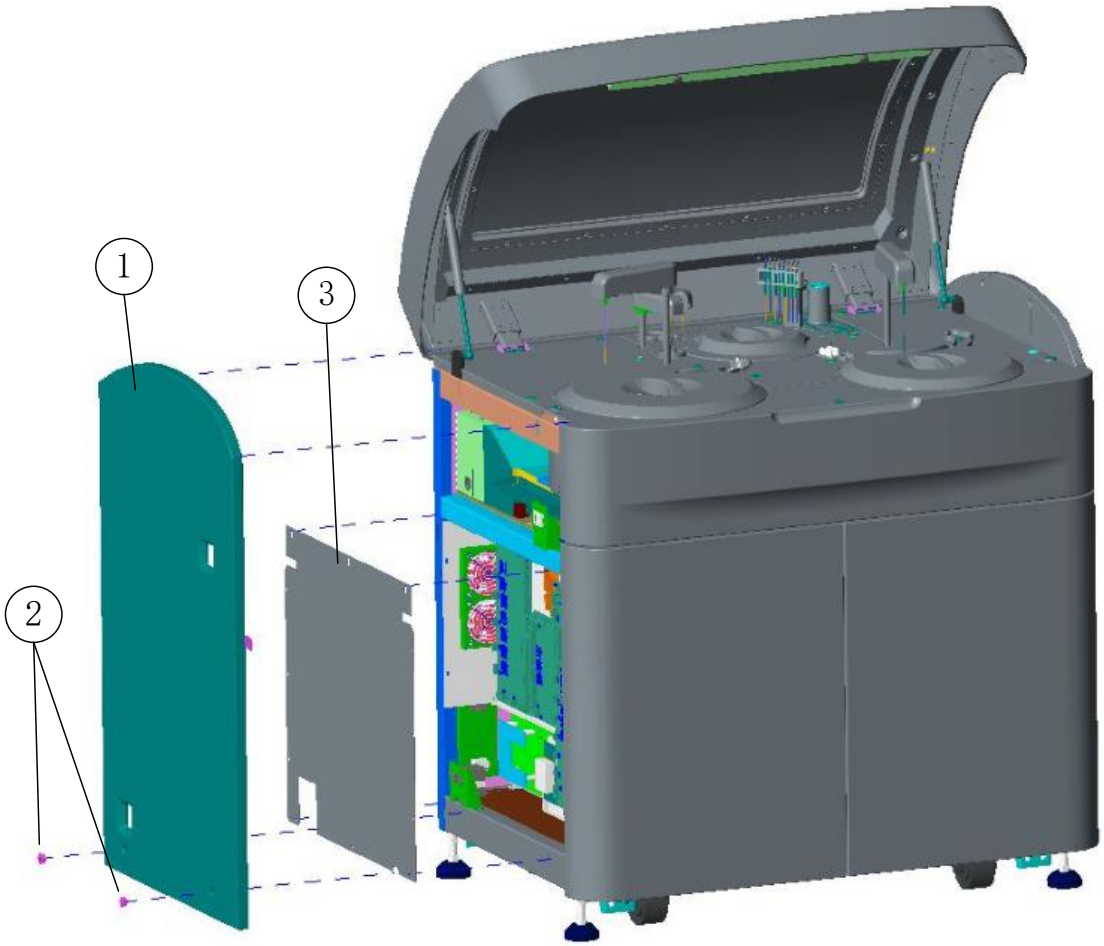


Figure 11-3 Exploded view of left panel

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	115-037193-00	left cover plate assembly	1	/
2	BA30-20-06741	Rubber cap	4	/
3	/	Board shield	1	/

11.1.4 Exploded View of Right Panel

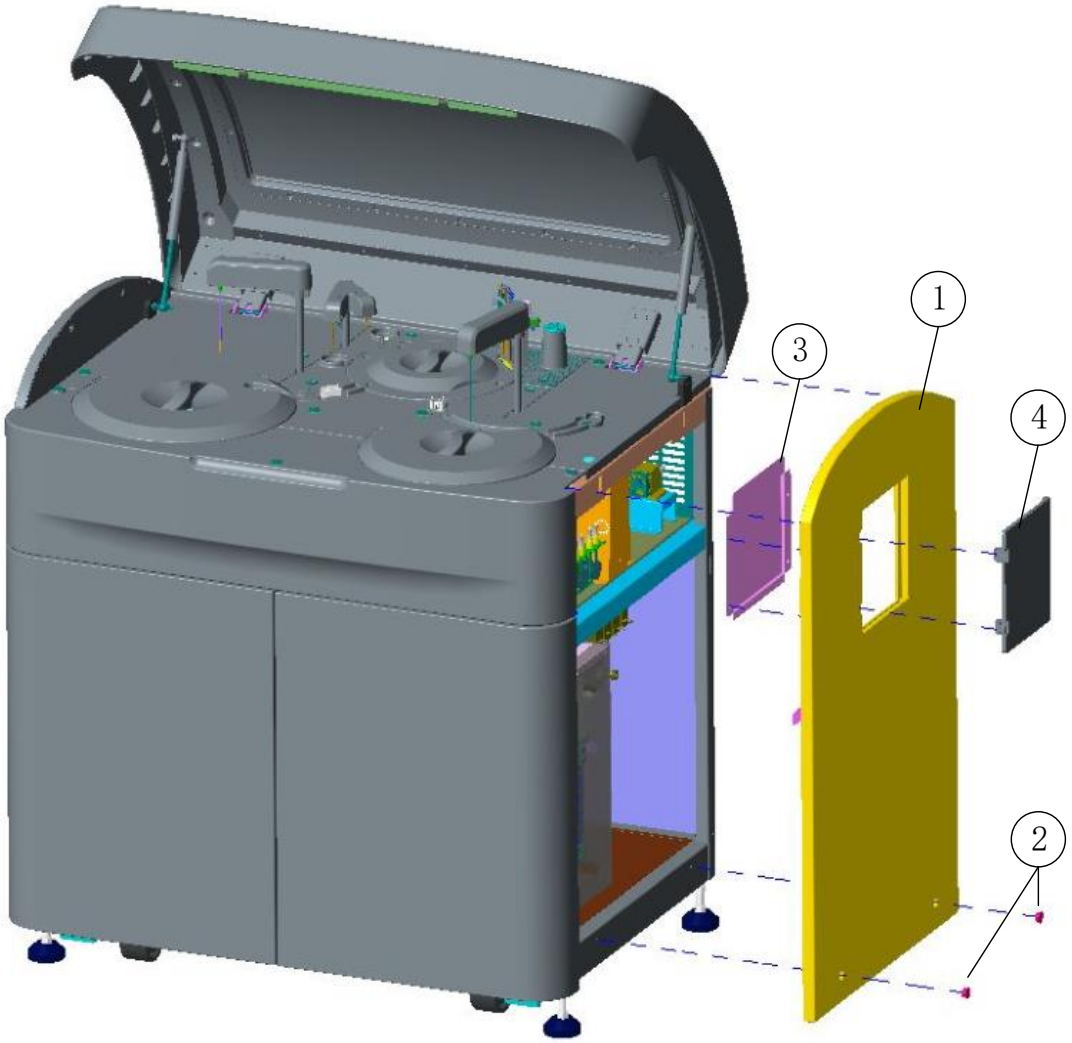


Figure 11-4 Exploded view of right panel

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	115-037194-00	right cover plate assembly	1	/
2	BA30-20-06741	Rubber cap	4	/
3	/	ISE door baffle	1	/
4	/	ISE Cover	1	/

11.1.5 Exploded View of Top Panel

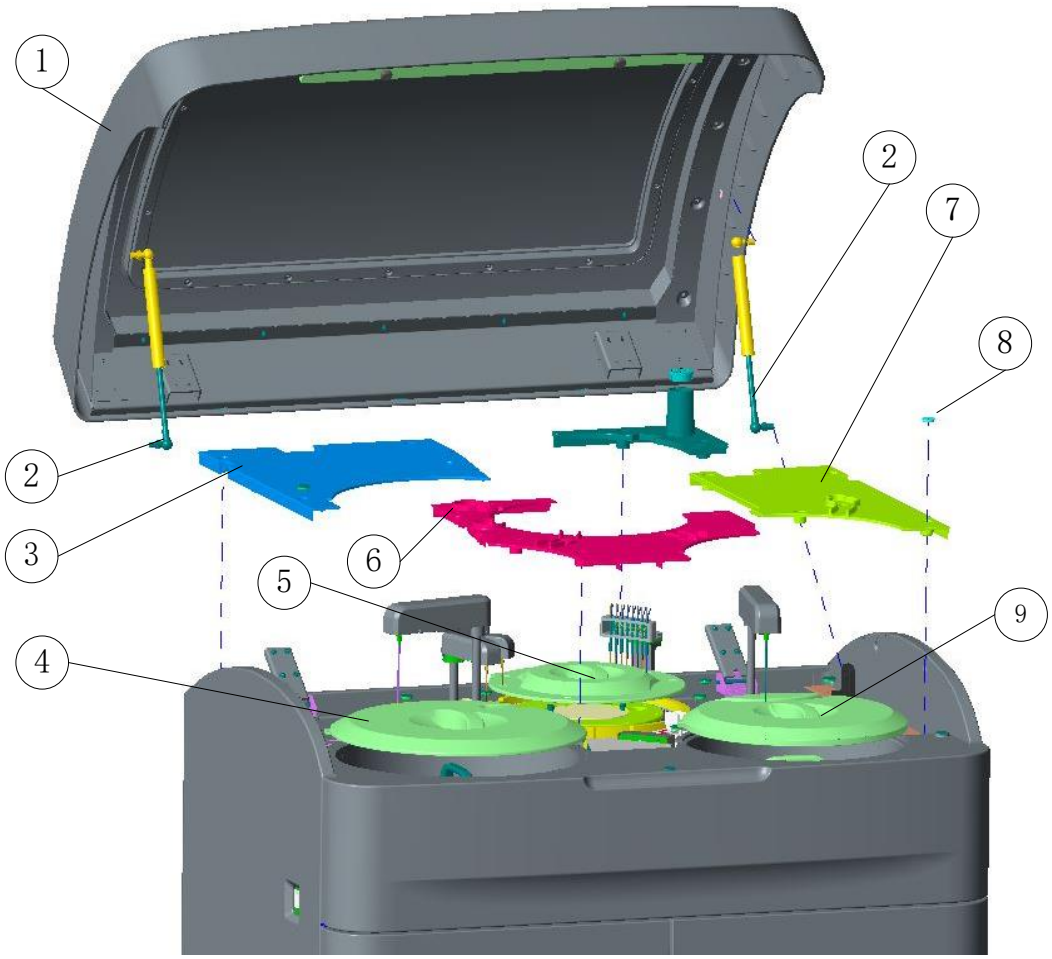


Figure 11-5 Exploded view of top panel

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	115-036553-00	protect cover assembly	1	For BS-430
2	M6T-010001---	Air Spring	2	/
3	043-006840-00	left plate	1	/
4	115-036348-00	reagent disk cover assembly	1	For BS-430
5	115-036349-00	reaction disk cover assembly	1	For BS-430
6	043-006841-00	middle plate	1	/
7	043-006842-00	right plate	1	/
8	BA40-20-72907	Screw cap	/	/
9	115-036557-00	sample disk cover assembly	1	For BS-430

11.2 Reaction Carousel Assembly

Figure 11-6 Reaction carousel assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Reaction Plate Assembly	1	/

11.2.1 Exploded View of Reaction Carousel Assembly

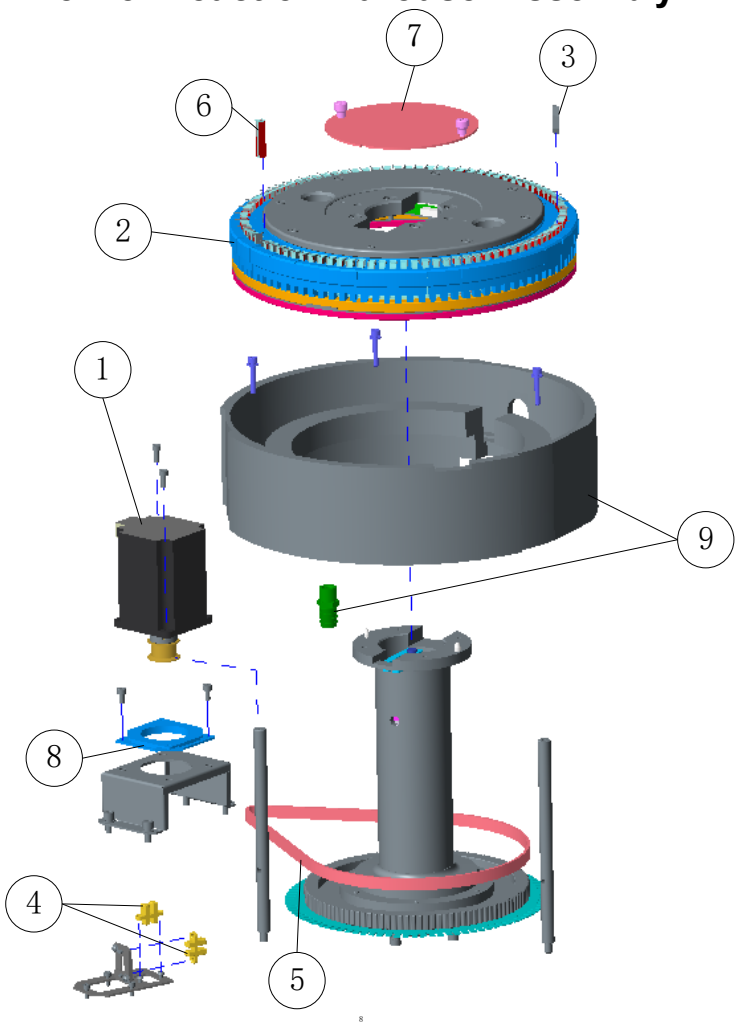


Figure 11-7 Exploded view of Reaction Carousel Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	115-029875-00	Three disk motor assembly	1	Motor with belt for Reaction disk .
2	115-036488-00	Reaction Plate Body Assembly	1	/
3	042-017445-00	Cuvette Spring	90	/
4	009-002204-00	wire of Optical Switch(s)	8	/
5	M6C-020011---	Belt	1	/
6	/	plastic cuvette	90	Not a repair material
7	/	Reaction Disk Cover	1	/
8	/	Shock Relief Pad	3	/
9	045-000558-00	reaction vessel	1	/

11.2.2 Exploded View of Reaction Carousel Drive Shaft Assembly

Figure 11-8 Exploded view of reaction carousel drive shaft assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	BA38-21-88189	Slip Ring	1	/
2	/	Reaction Coder Disk	1	/

11.2.3 Exploded View of Reaction Carousel Body Assembly

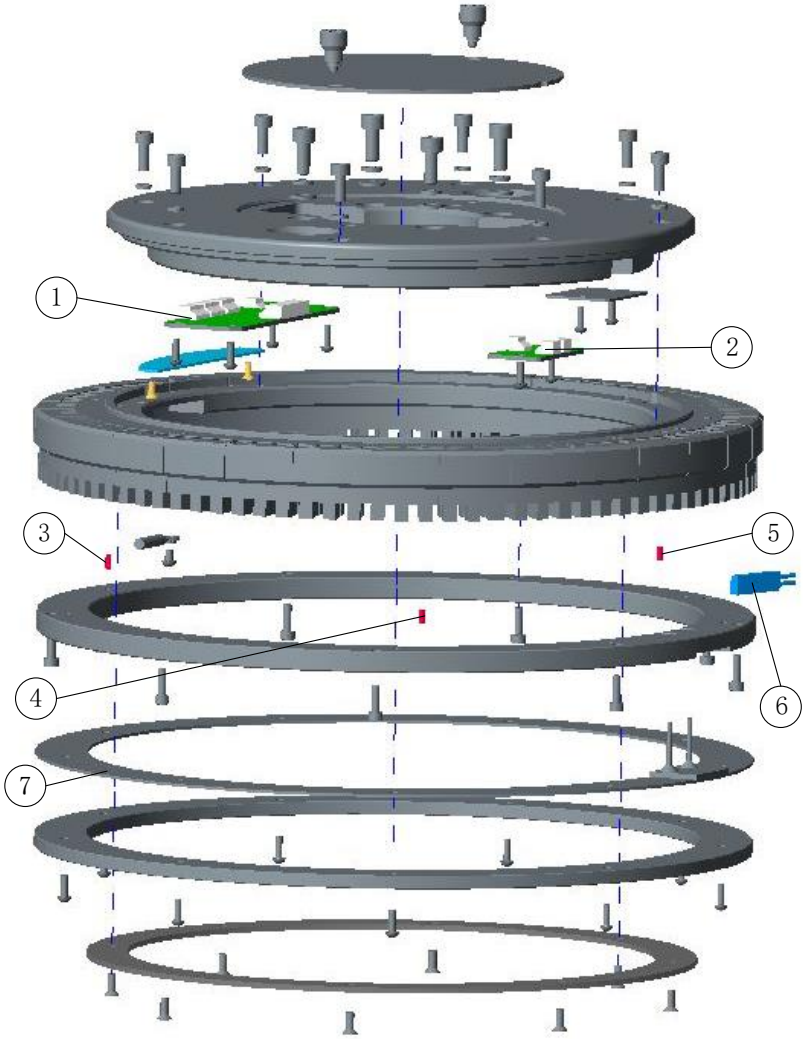


Figure 11-9 Exploded view of Reaction Carousel Body Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	051-002415-00	BA43 Reaction Temper Collection PCBA	1	/
2	BA38-30-87925	Reaction Disk Heater Connection Board	1	/
3	BA38-21-88163	Reaction Disk Temperature Sensor 2	1	/
4	BA38-21-88164	Reaction Disk Temperature Sensor 3	1	/
5	BA38-21-88162	Reaction Disk Temperature Sensor 1	1	/
6	BA40-21-61296	Reaction Disk Over-heat Protector	1	/
7	024-000775-00	Silicone rubber heater, 24V 55W	1	Heater for reaction disk.

11.3 Reagent Carousel Assembly

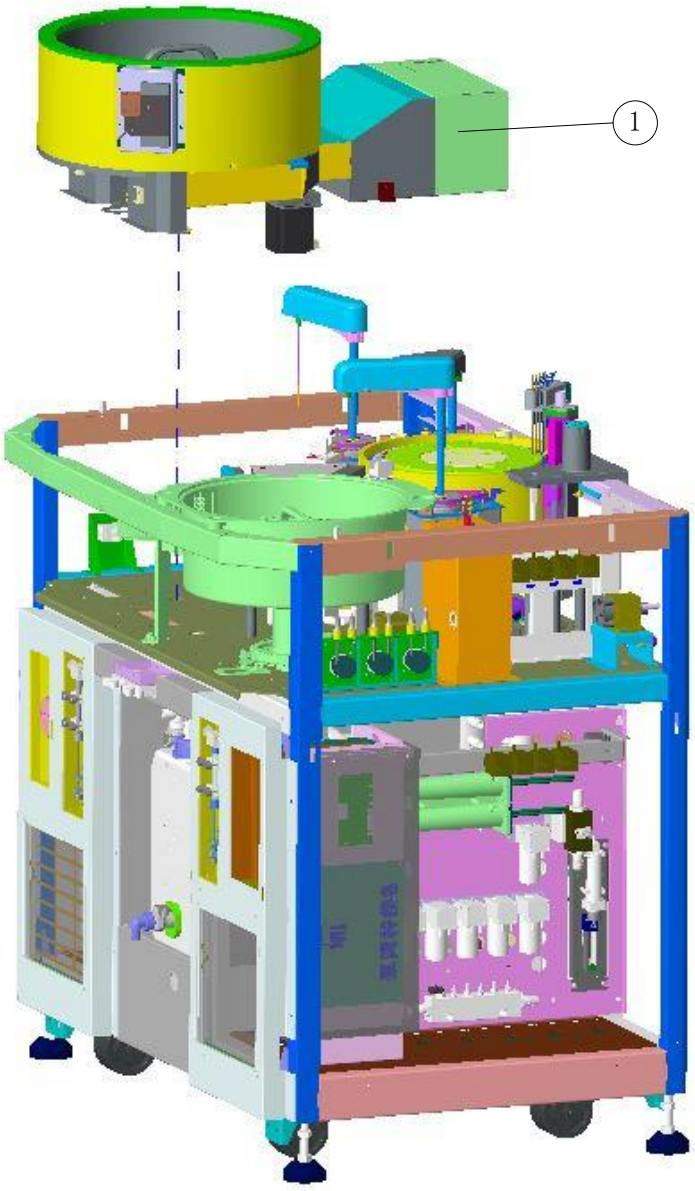


Figure 11-10 Reagent Carousel Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Reagent Plate Assembly	1	/

11.3.1 Exploded View of Reagent Carousel Assembly

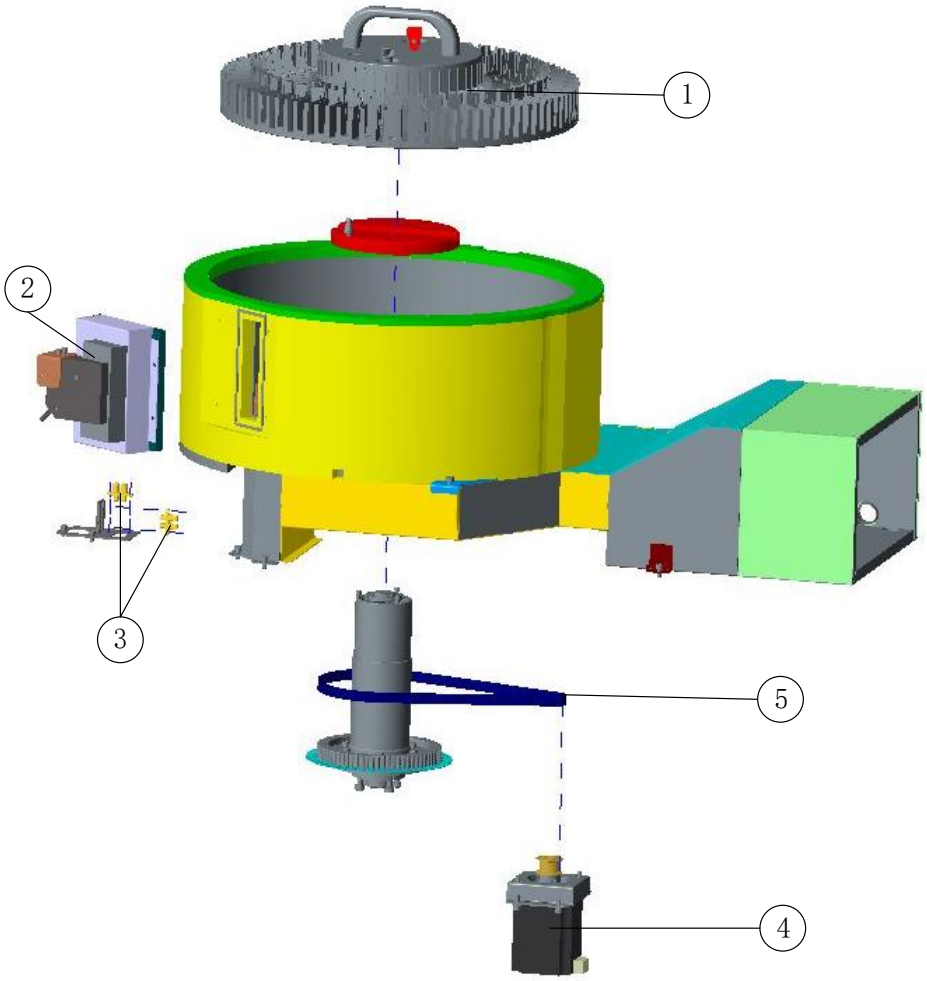


Figure 11-11 Exploded view of Reagent Plate Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	115-036347-00	Reagent carousel assembly	1	/
2	115-087288-00	Reagent Bar Code Assembly	1	There are two configurations on the client, which change from MS-3 scanner to BCL95 scanner after EIB007. When all bar codes of the reagent carousel outer ring can not be identified, the BCL95 assembly can be used for replacement.
3	009-002204-00	wire of Optical Switch(s)	8	Code disk sensor, three-disk initial position sensor
4	024-000151-00	Step Motor SST59D5300	2	Sample disk, reagent disk motor plus belt wheel

5	BA30-10-15041	Synchronous belt. 220XL037 width of 9.5	2	Synchronous belt connecting two motors and code discs

11.3.2 Exploded View of Reagent Bar Code Assembly

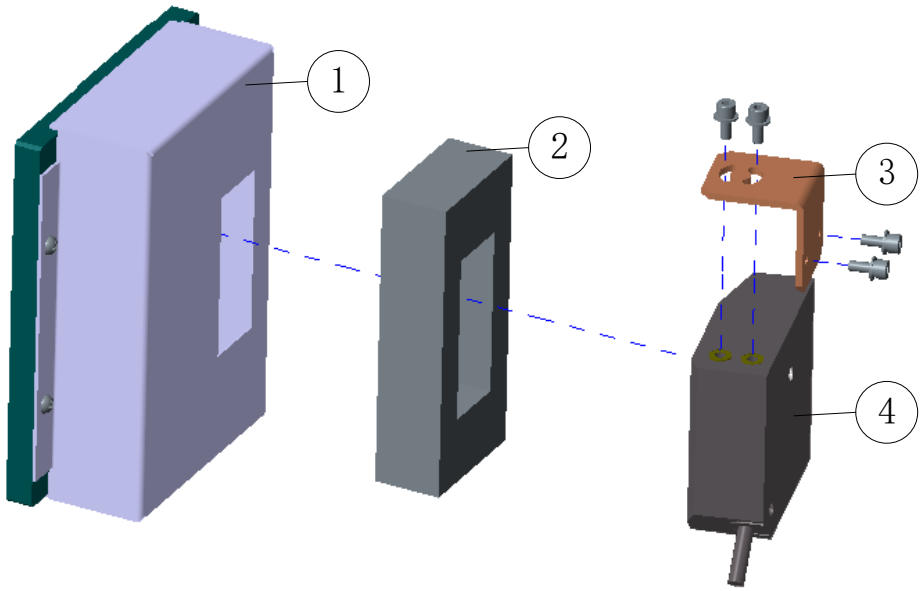


Figure 11-12 Exploded view of reagent bar code assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	BA40-30-61987	Antifogging Assembly	1	Components include sponge adjustment pads
2	/	Sponge cushion	3	/
3	/	Small bracket for bar code reader	2	/
4	0000-10-11078	Bar Code Scanner	1	/

11.3.3 Exploded View of Antifogging Assembly

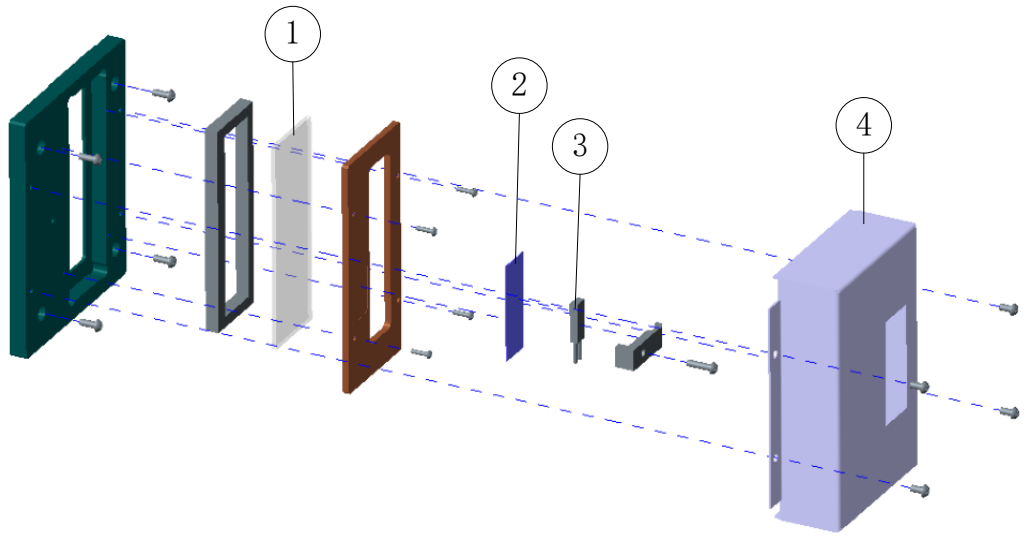


Figure 11-13 Exploded view of Antifogging Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Glass window	1	/
2	/	Antifogging Heater	1	/
3	/	Thermal Protector 70C	1	/
4	/	scan cover	1	/

11.3.4 Exploded View of Reagent Refrigeration Assembly

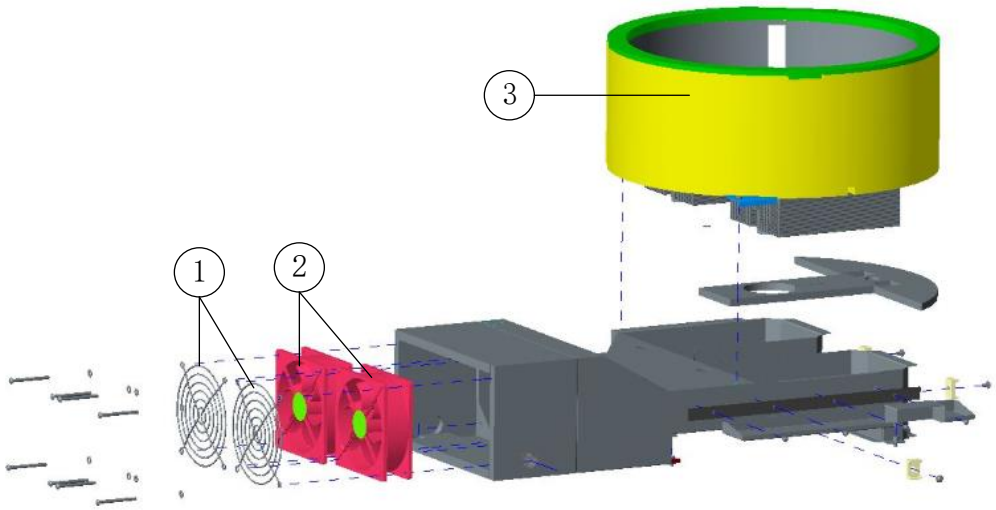


Figure 11-14 Exploded view of Reagent Refrigeration Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	M6Q-120023---	Fan grille	2	Reagent fan cooling fan grille
2	M90-000179---	FAN 24V with Signal Feedback Cable	2	Reagent tray cooling fan
3	BA38-30-88151	Reagent Chamber Assembly	1	/

11.3.5 Exploded View of Reagent Chamber Assembly

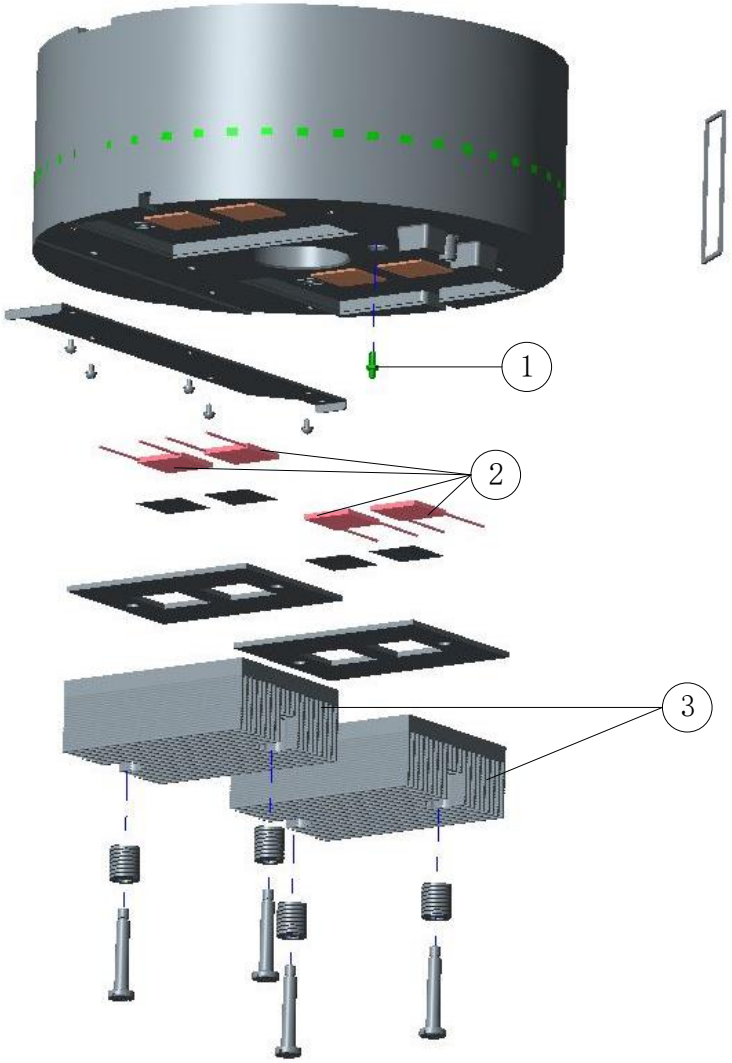


Figure 11-15 Exploded view of reagent chamber assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	024-000110-00	Reagent Temperature Sensor	1	Temperature sensor for reagent disk.
2	BA40-21-61655	Peltier	4	Peltier Cooler
3	/	heat sink	2	/

11.4 Sample Carousel Assembly

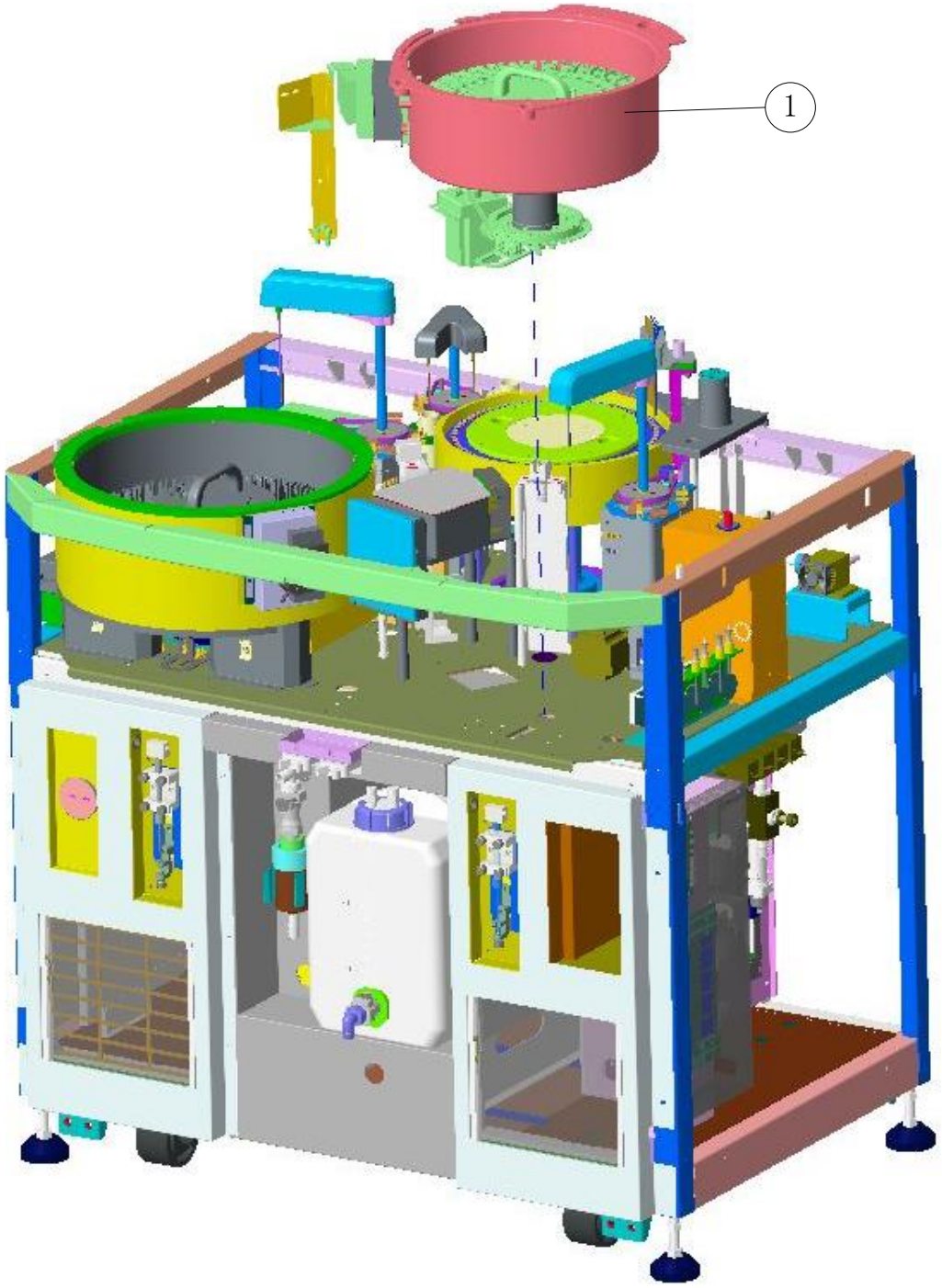


Figure 11-16 Sample carousel assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Sample Plate Assembly	1	/

11.4.1 Exploded View of Sample Carousel Assembly

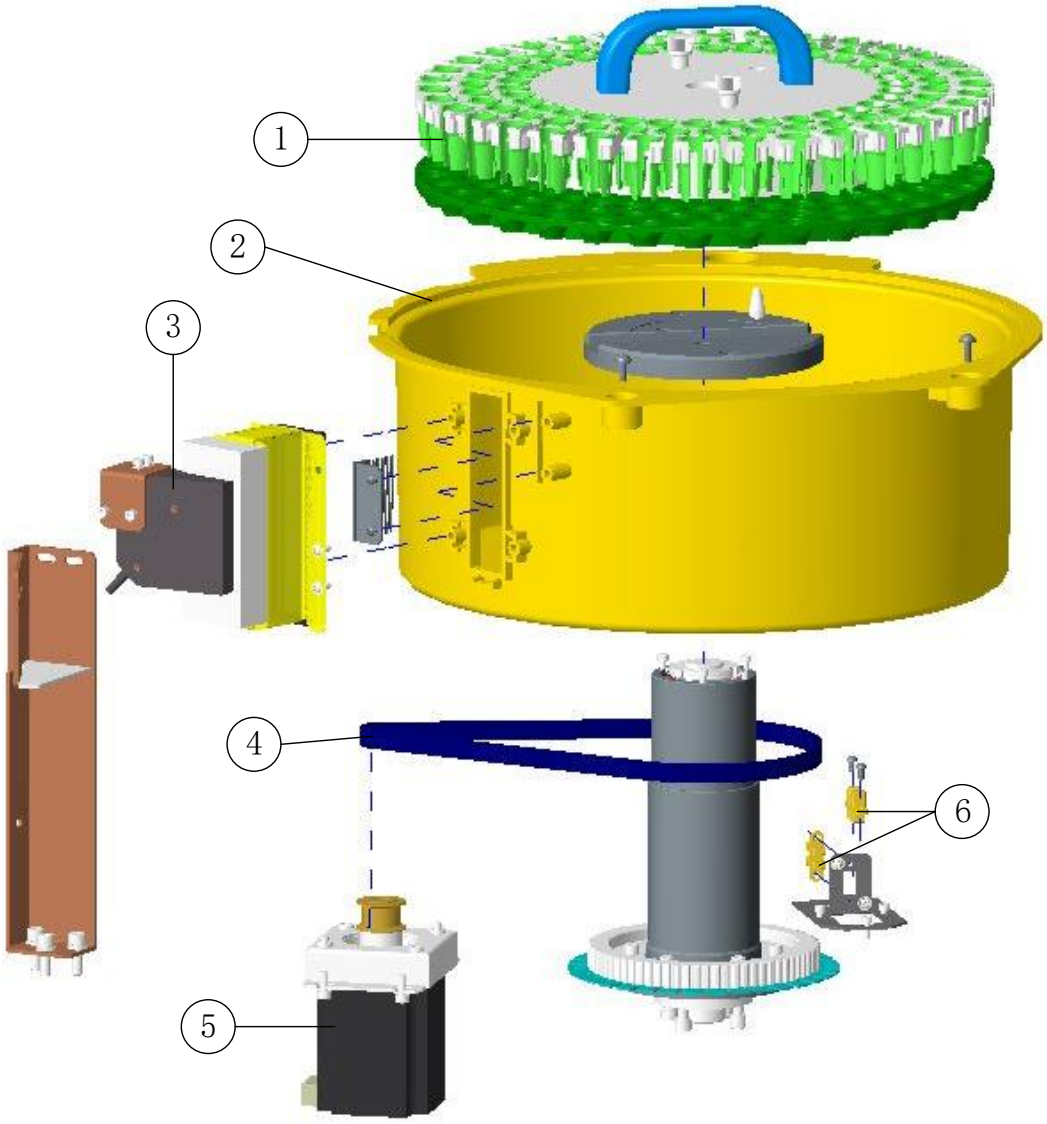


Figure 11-17 Exploded view of sample carousel assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	115-036346-00	sample disk assembly	1	/
2	BA38-21-88063	Sample pot	1	/
3	115-087291-00	Sample Bar Code Assembly	1	There are two configurations on the client, which change from MS-3 scanner to BCL95 scanner after EIB007. When all bar codes of the reagent carousel outer ring can not be identified, the BCL95 assembly can be used for

				replacement.
4	BA30-10-15041	Synchronous belt. 220XL037 width of 9.5	2	Synchronous belt for disk motors.
5	024-000151-00	Step Motor SST59D5300	2	Motor with belt for Sample/Reagent disk.
6	009-002204-00	wire of Optical Switch(s)	8	sensor for disks

11.4.2 Exploded View of Sample Bar Code Assembly

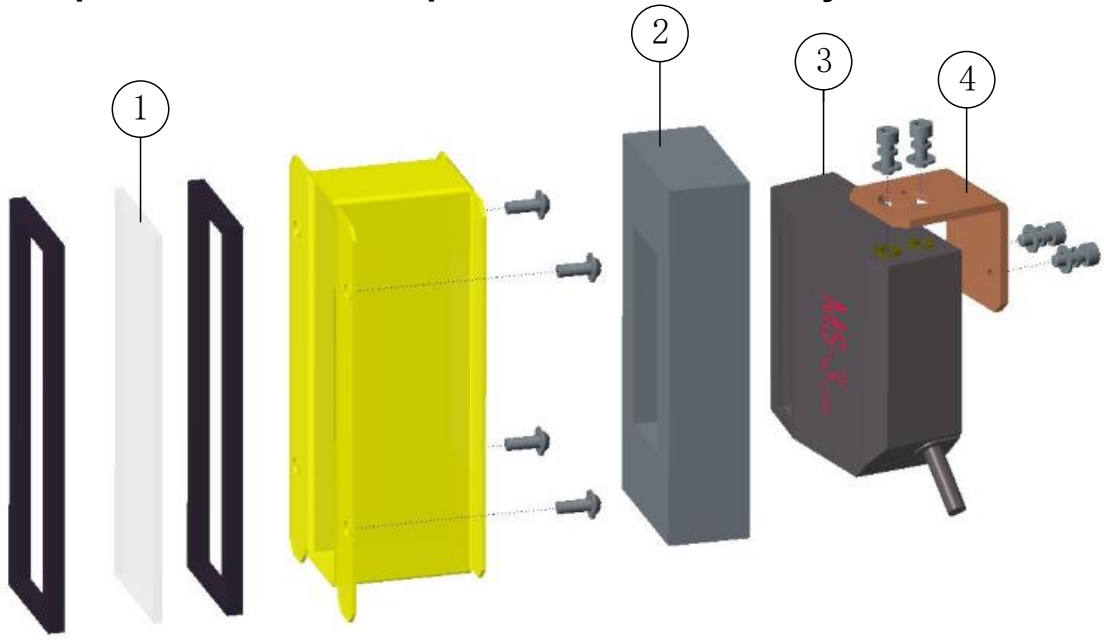


Figure 11-18 Exploded view of Sample Bar Code Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Glass window	2	/
2	/	Sponge cushion	2	/
3	023-002082-00	BCL 95 M0R2 Bar Code Scanner	2	There are two configurations on the client, which change from MS-3 scanner to BCL95 scanner after EIB007. When all bar codes of the reagent carousel outer ring can not be identified, the BCL95 assembly can be used for replacement.
4	/	Small bracket for bar code reader	2	/

11.5 Optical Components

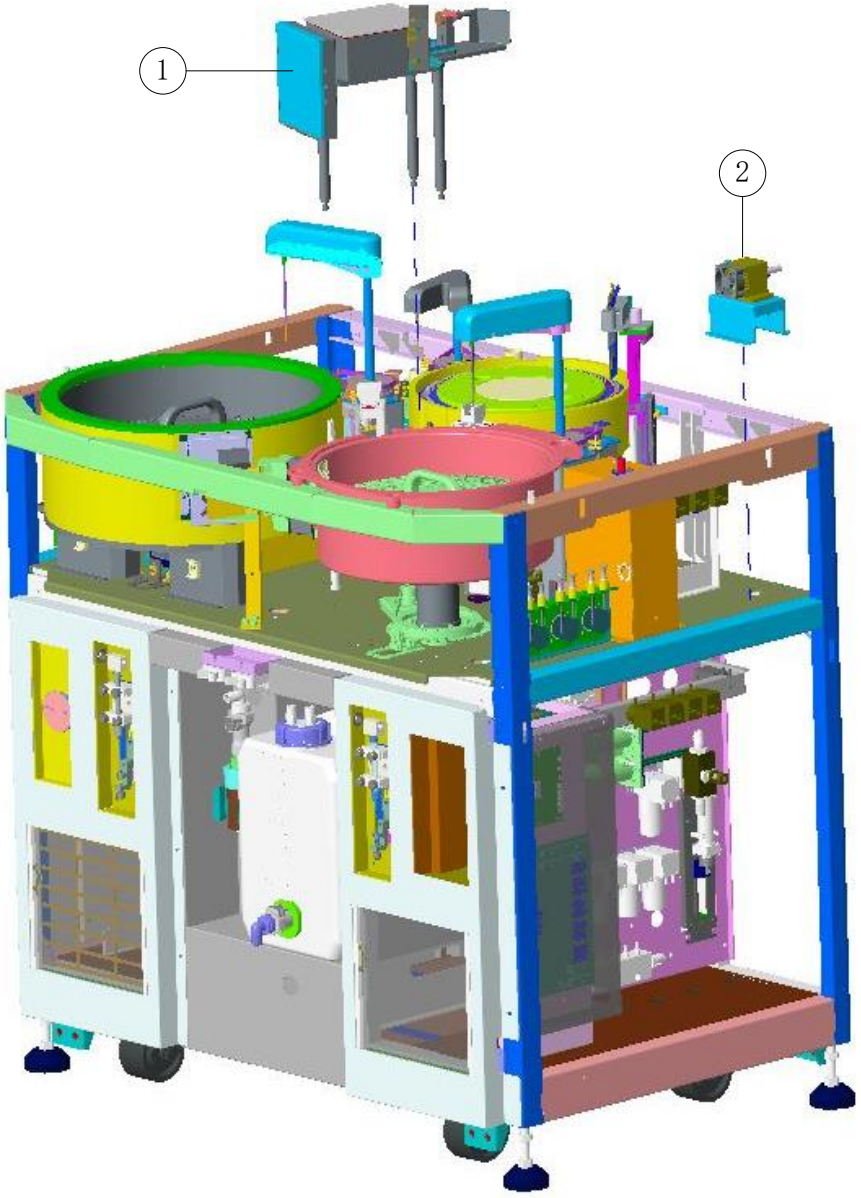


Figure 11-19 Optical component

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Optical Measurement Assembly(BA43)	1	/
2	/	Lamp Assembly(BA43)	1	/

11.5.1 Exploded View of Lamp Assembly

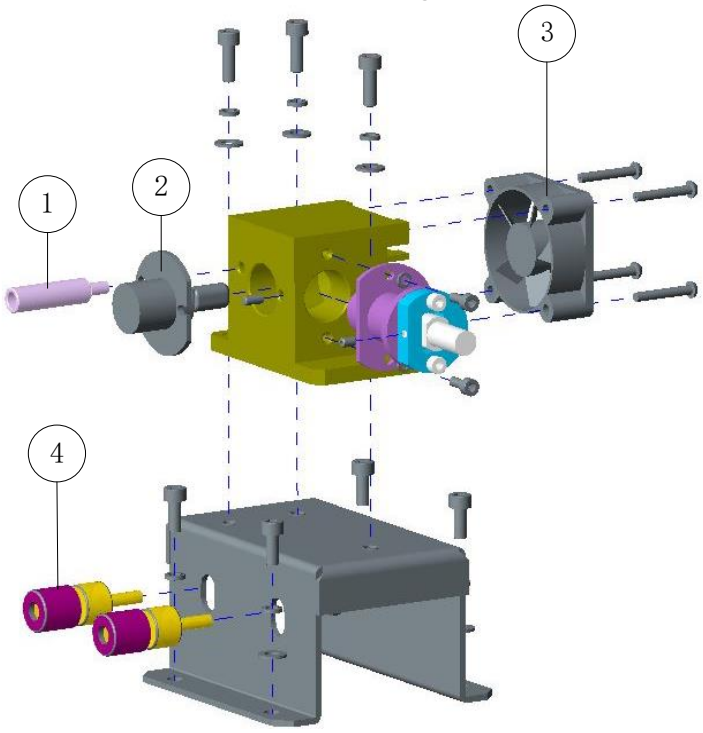


Figure 11-20 Exploded view of Lamp Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	041-001143-00	Lamp base retaining screw	1	/
2	081-000137-00	Lamp(12V,20W)	1	/
3	BA10-20-78211	Fan for optical part	1	Cooling fan for Lamp
4	008-000207-00	Terminal	2	/

11.5.2 Exploded View of Optical Measurement Assembly

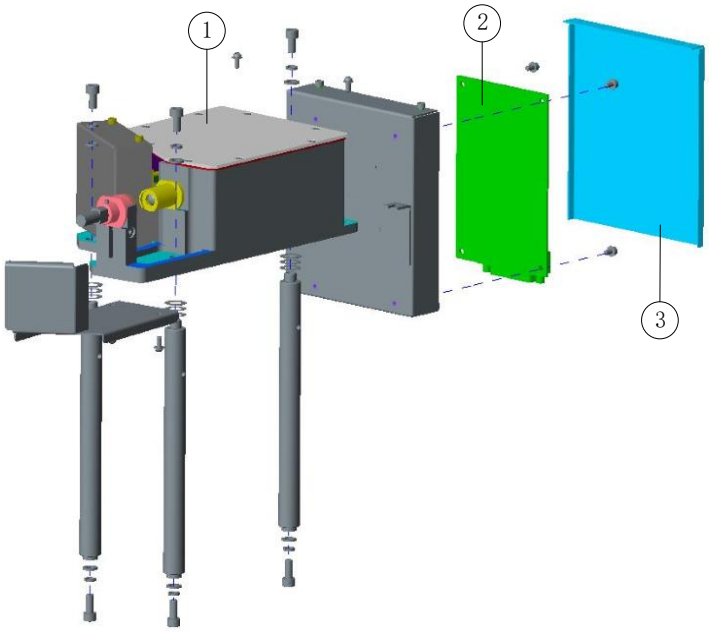


Figure 11-21 Exploded view of Optical Measurement Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	115-039004-00	Optical Assembly	1	/
2	BA40-30-61365	A/D Conversion Board	1	/
3	/	AD box cover	1	/

11.6 Mix Motion Assembly

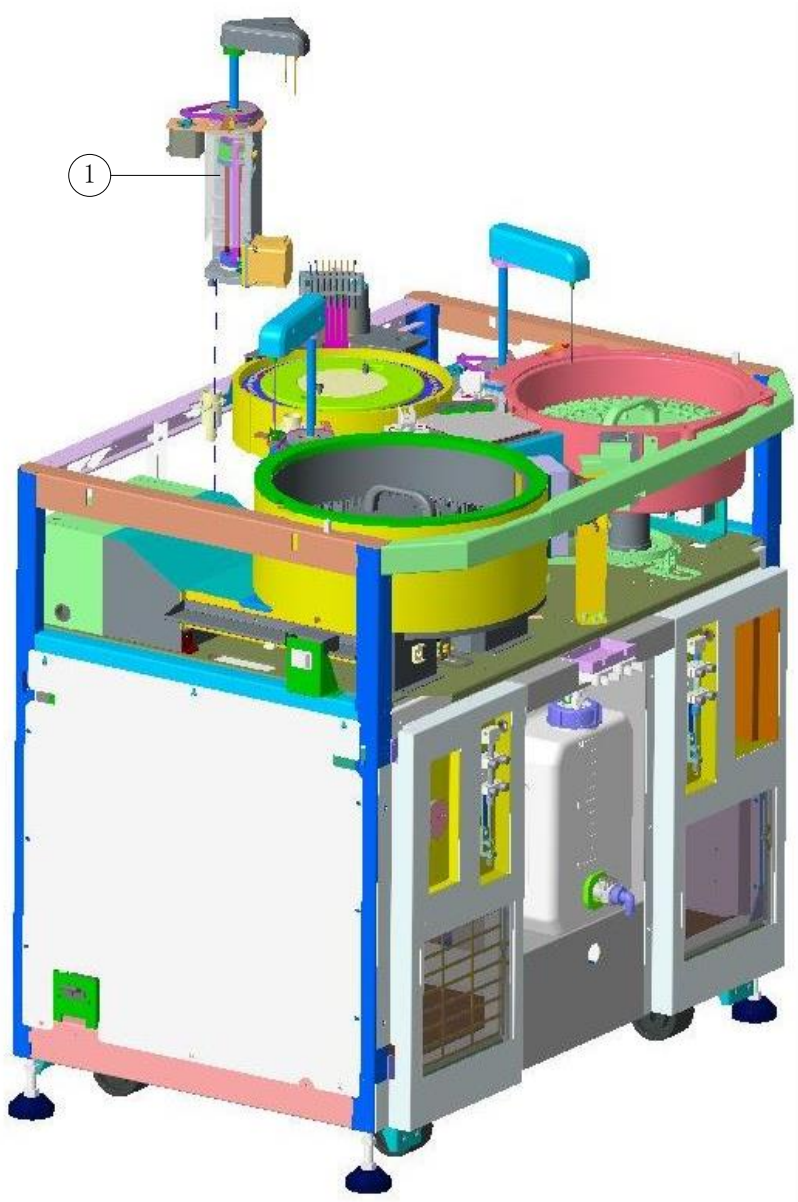


Figure 11-22 Mix Motion Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Mix Motion Assembly	1	/

11.6.1 Exploded View of Mix Motion Assembly

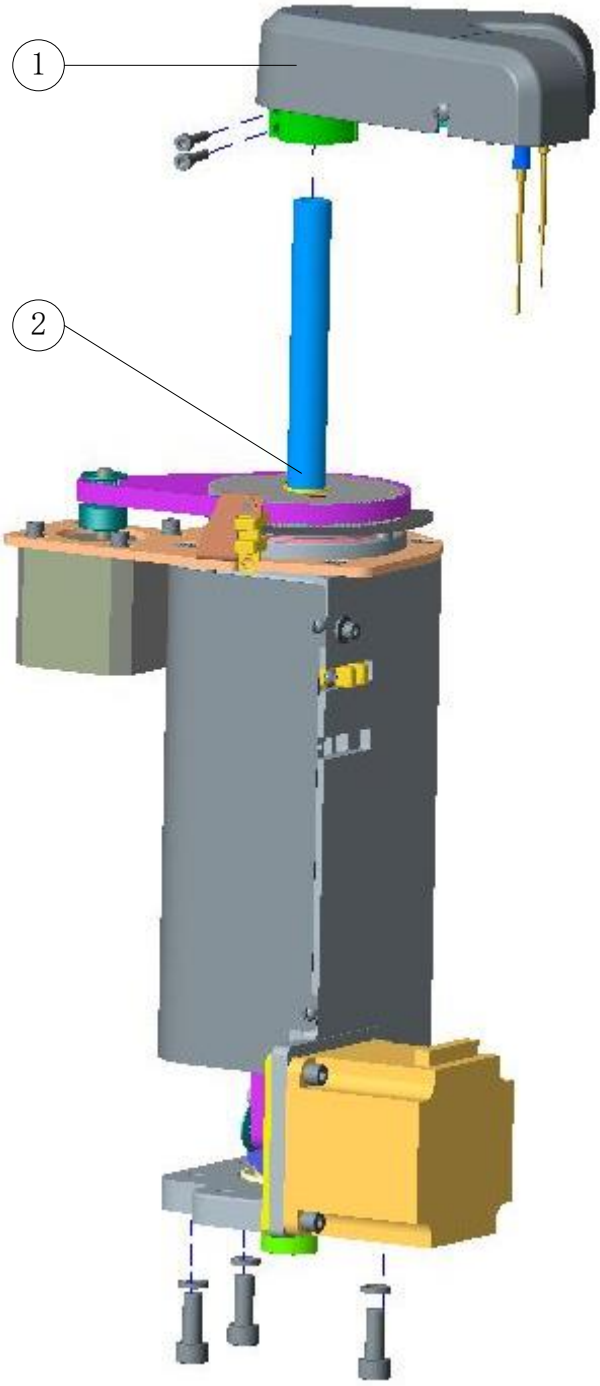


Figure 11-23 Exploded view of Mix Motion Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Mixer Rocker	1	/
2	115-036615-00	Mix Driver Assembly	1	/

11.6.2 Exploded View of Mixer Rocker

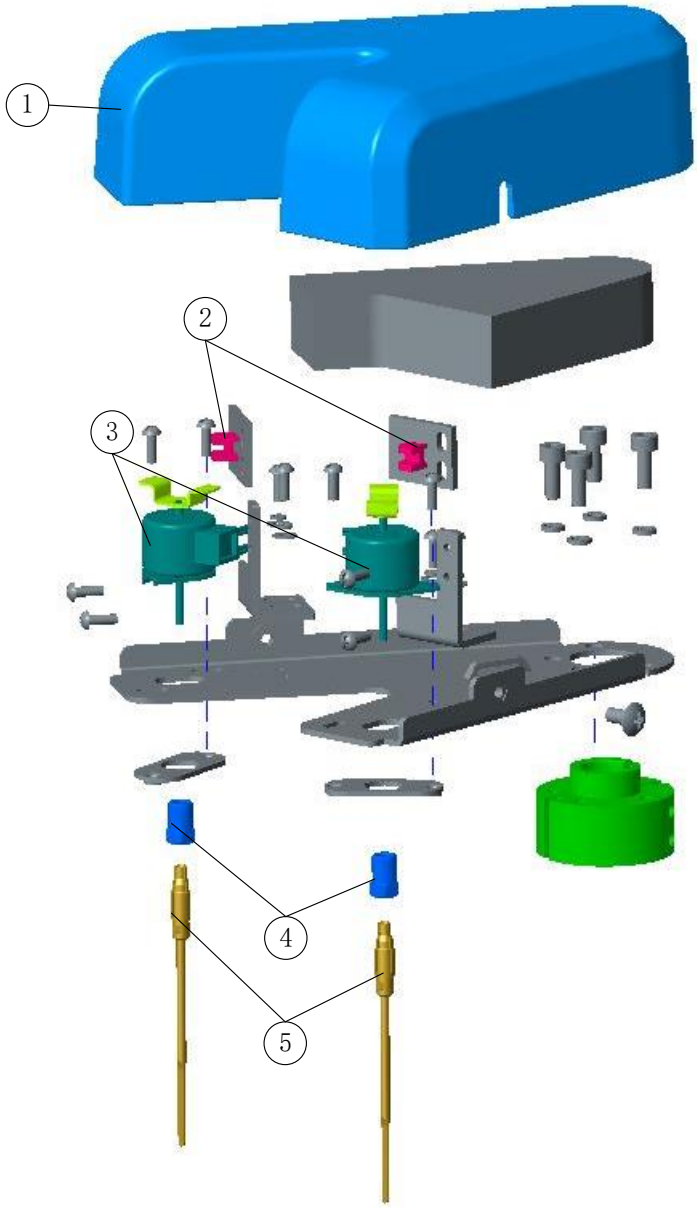


Figure 11-24 Exploded view of Mixer Rocker

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	043-006907-00	mixed cover	1	/
2	051-001620-00	mixing speed detecting pho board PCBA	2	/
3	115-027877-00	mixer motor assembly	2	/
4	041-020846-00	Retaining Nut (for mixing bar)	2	/
5	041-047172-00	Mixer	2	/

11.6.3 Exploded View of Mix Driver Assembly

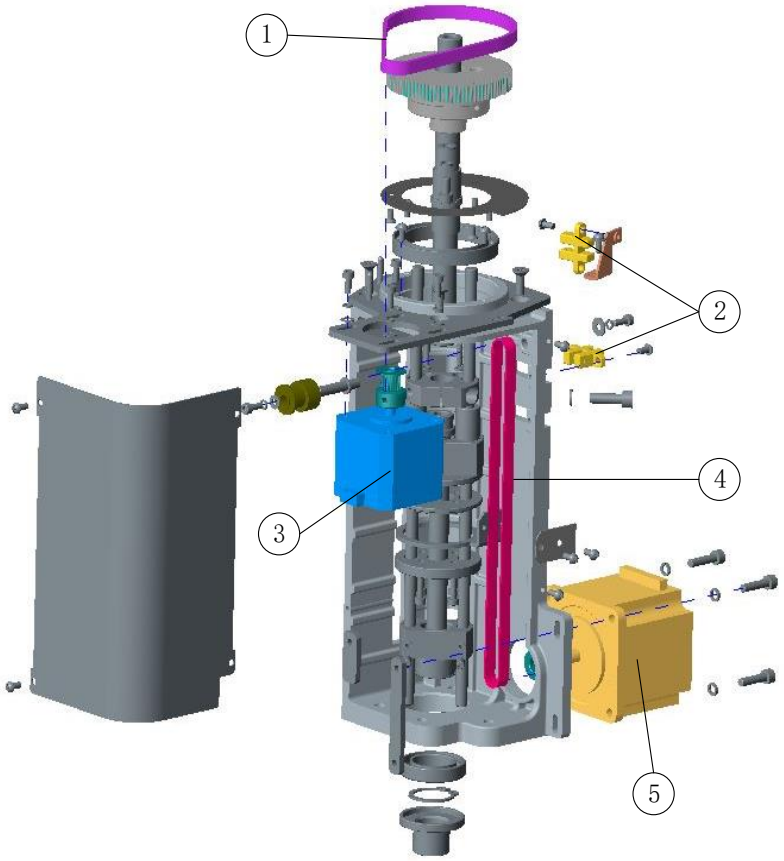


Figure 11-25 Exploded view of Mix Driver Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	031-000250-00	Synchronous tooth shape HTBN363S3M-60	3	/
2	009-002204-00	wire of Optical Switch(s)	8	/
3	115-089474-00	S3M horizontal motor assembly(BA43)	3	/
4	/	Belt (B175MXL6.4)	3	/
5	/	vertical motor assembly	2	/

11.7 Washing Well

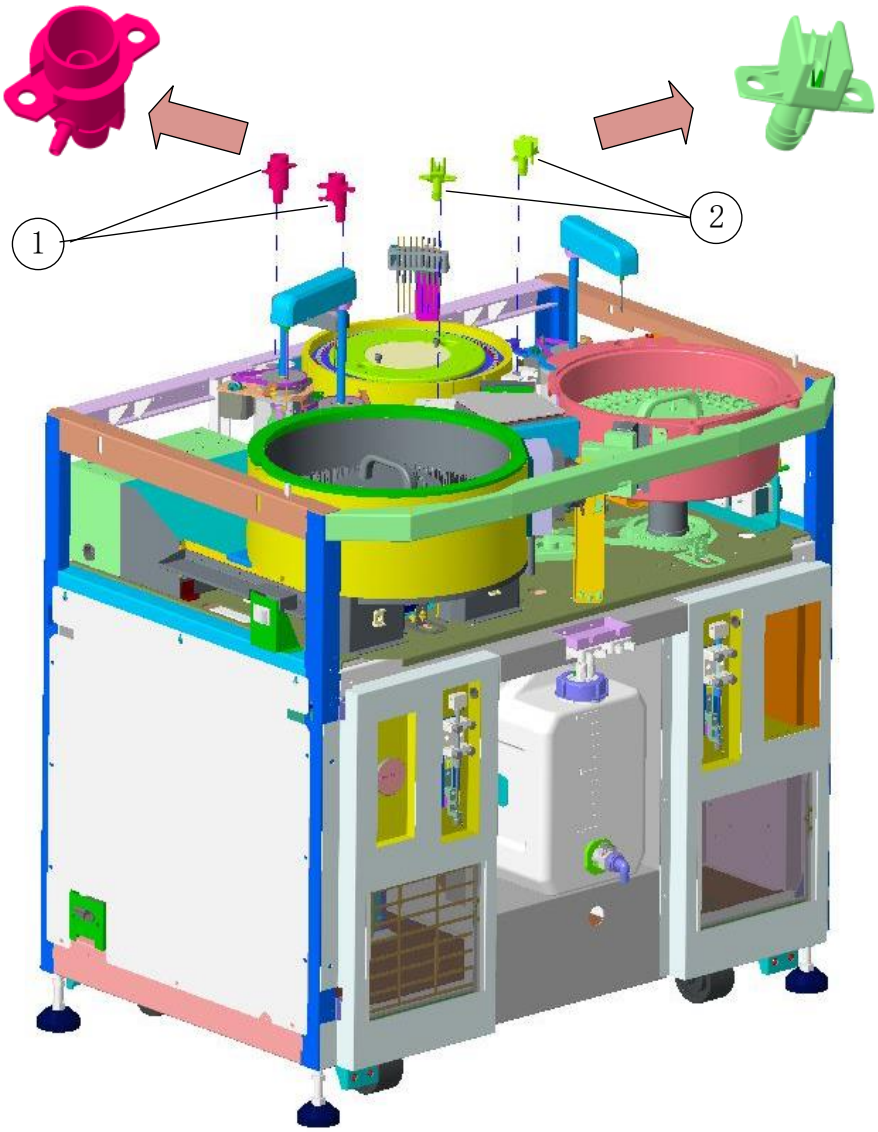


Figure 11-26 Washing Pool

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	BA40-20-61463	Washing Well	2	Stirring rod cleaning pool
2	/	wash well shell	2	/

11.8 Auto-Washing Assembly

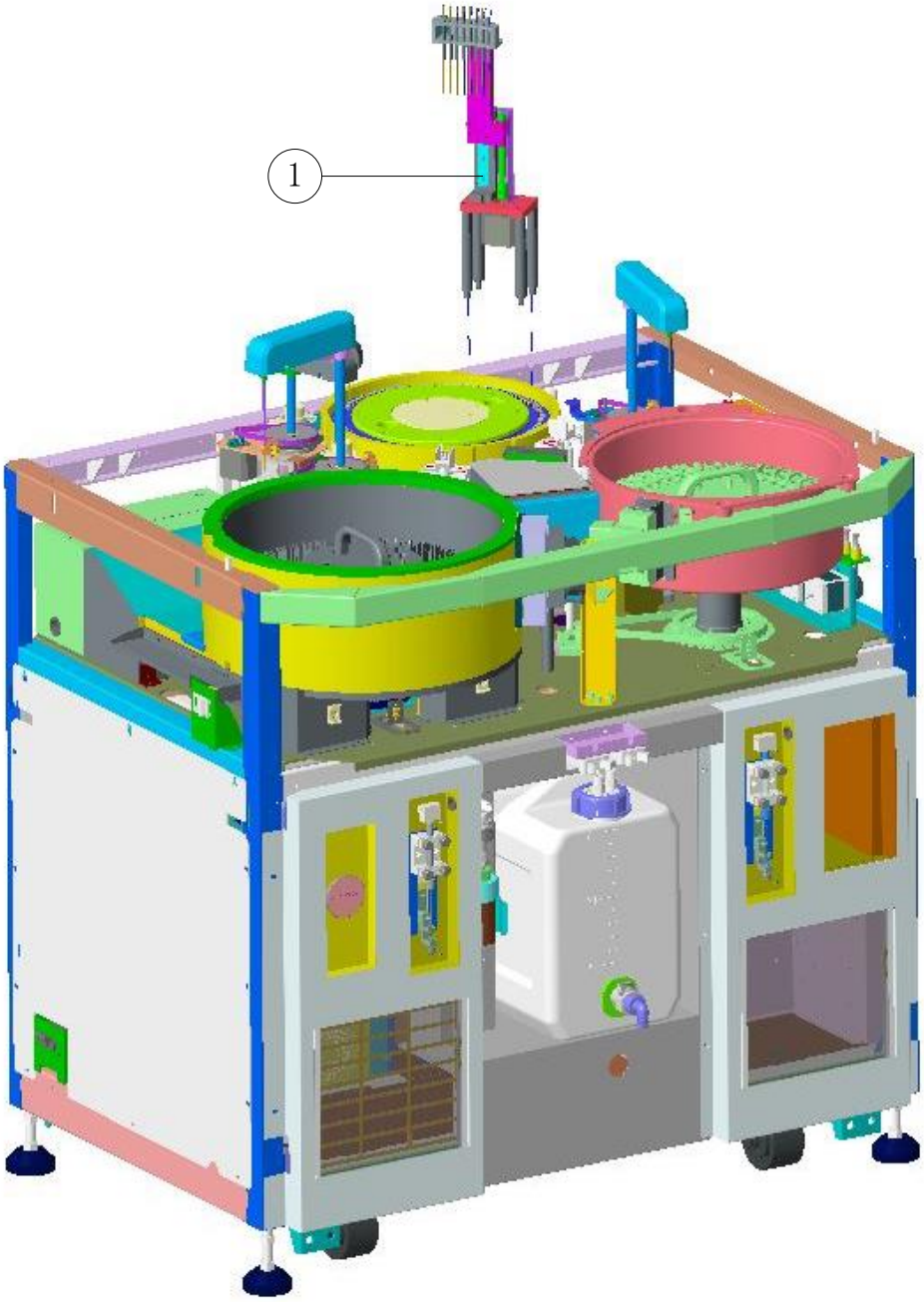


Figure 11-27 Auto-Washing Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Auto-Washing Assembly	1	/

11.8.1 Exploded View of Auto-Washing Assembly

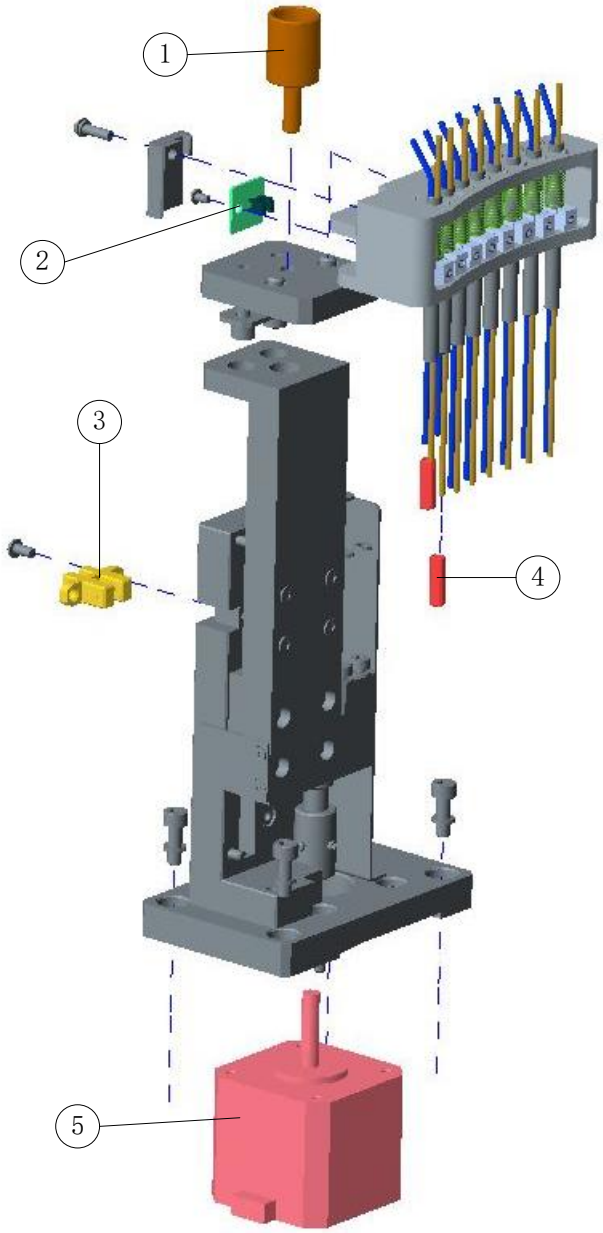


Figure 11-28 Exploded view of Auto-Washing Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Knurled screw	1	/
2	051-001147-00	BA48 Wash Photo Connector PCBA	1	/
3	009-002204-00	wire of Optical Switch(s)	8	/
4	041-022457-00	The Point Of Washing	2	wiper
5	024-000149-00	Step Motor(42mm C)	1	Driving motor for wash station.

11.9 Reagent Probe Motion Assembly

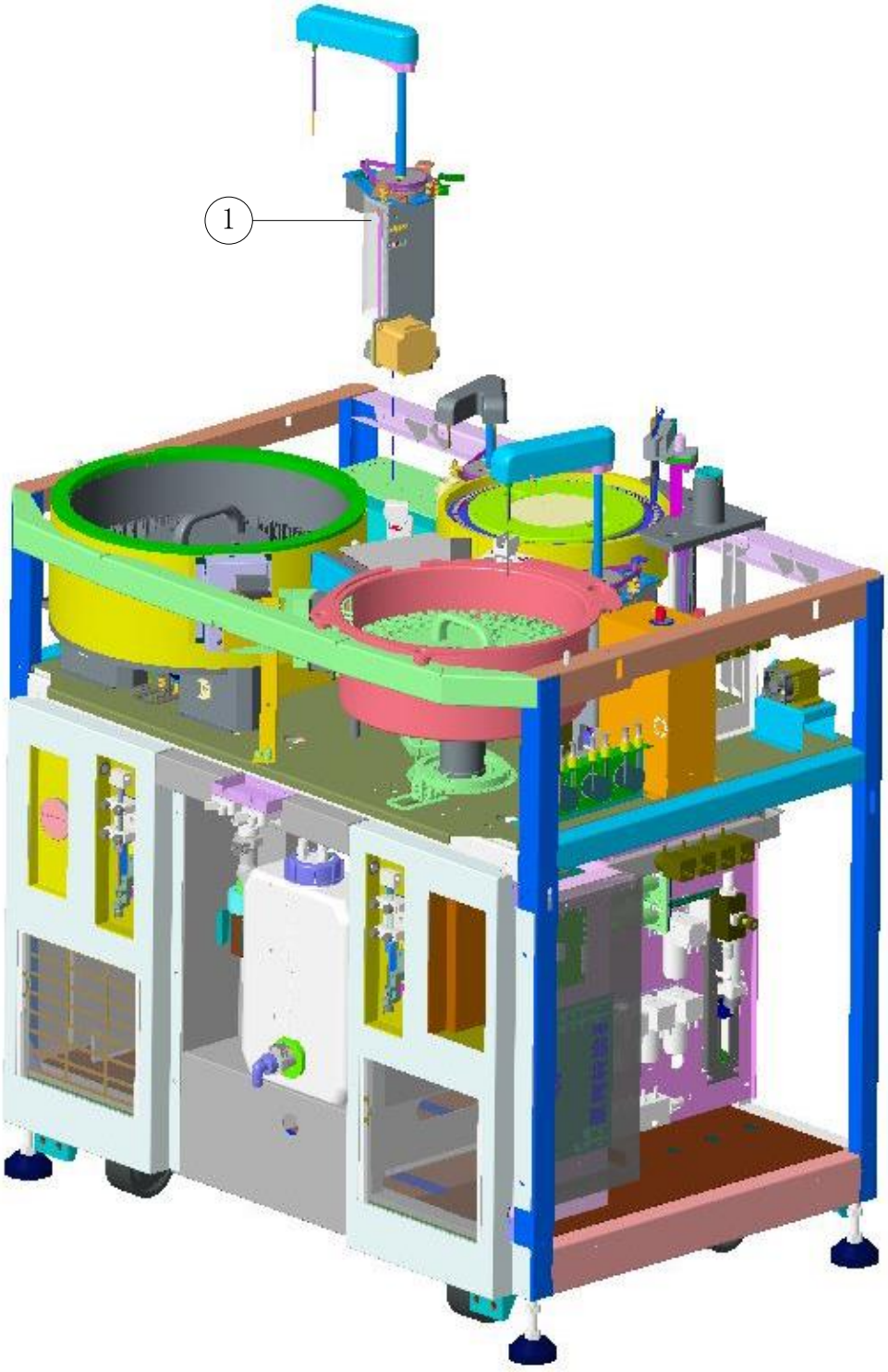


Figure 11-29 Reagent probe motion assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	reagent probe motion assembly	1	/

11.9.1 Exploded View of Reagent Probe Motion Assembly

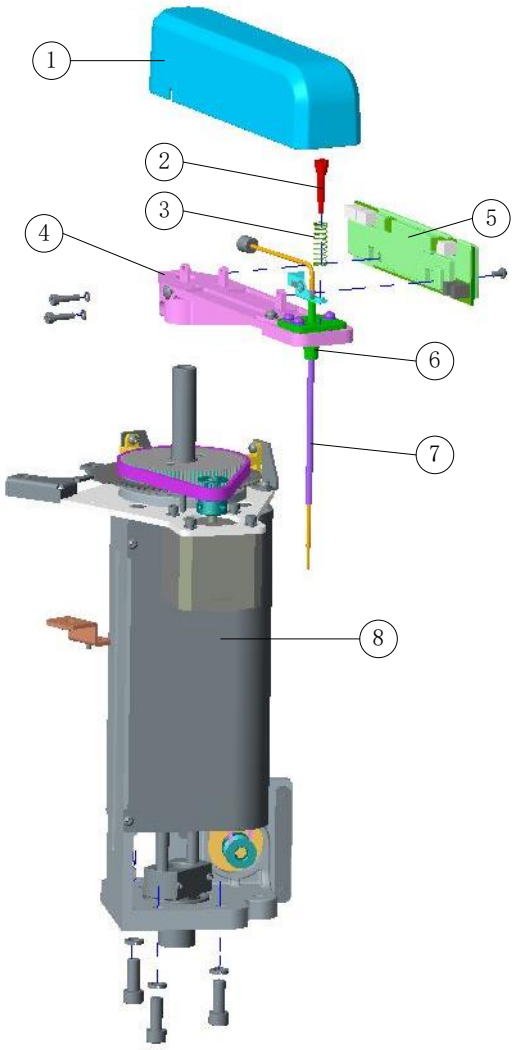


Figure 11-30 Exploded view of reagent probe motion assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	043-002344-00	130mm rocker arm cover	2	Sample probe rocker arm cover
2	041-003368-00	guide finger for spring	2	/
3	033-000108-00	spring avoiding strike	2	/
4	044-000263-00	130mm rocker arm	2	Sample probe rocker arm
5	051-000363-00	Reagent Probe Liquid Level Detection Board PCBA	1	/
6	043-002345-00	support boss	2	/
7	115-079103-00	BS-2800M Reagent Probe Assembly	1	/
8	115-036619-00	Reagent probe drive assembly	1	/

11.9.2 Exploded View of Reagent Probe Drive Assembly

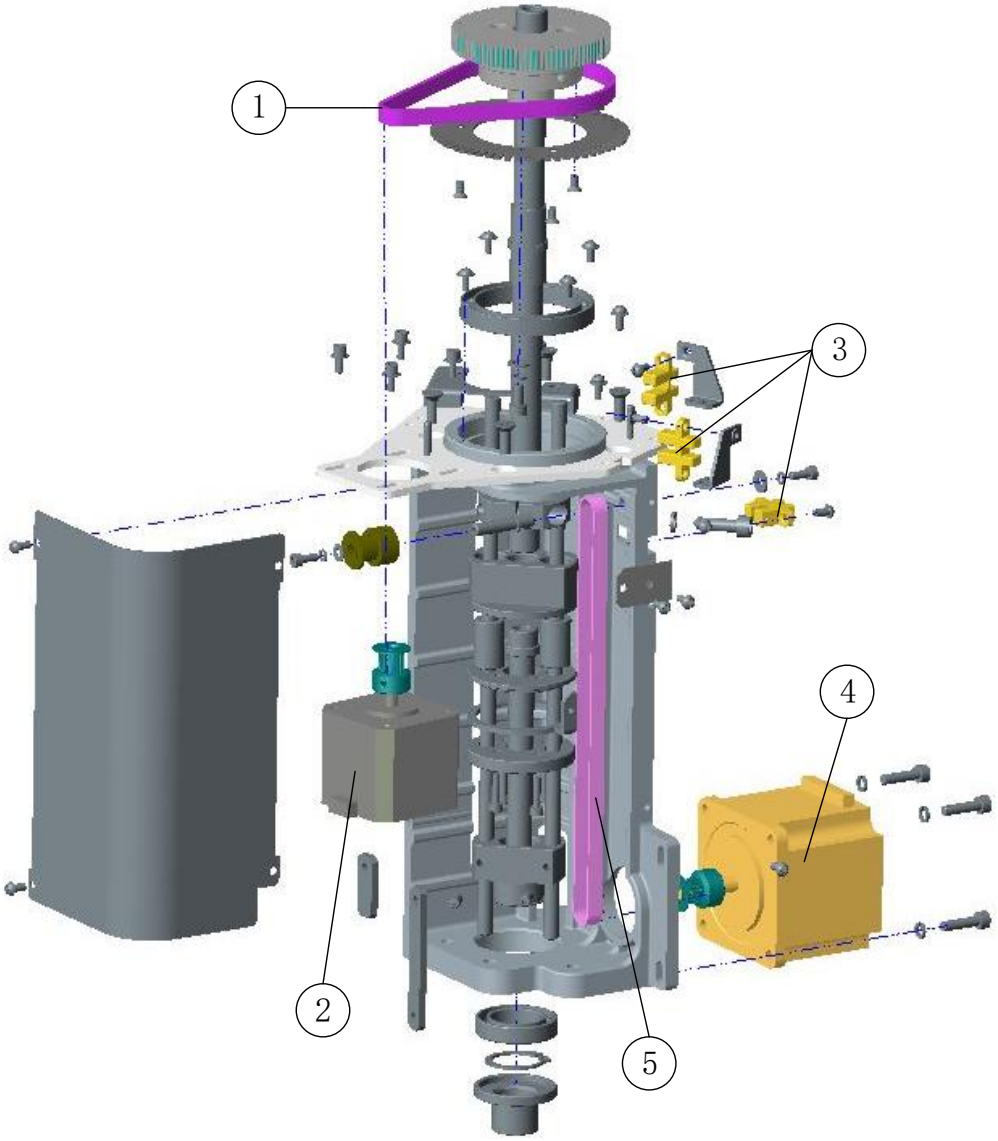


Figure 11-31 Exploded view of Reagent probe drive assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	031-000250-00	Synchronous cog belt HTBN363S3M-60	3	/
2	115-089474-00	S3M horizontal motor assembly(BA43)	3	/
3	009-002204-00	wire of Optical Switch(s)	8	sensor for disks
4	/	vertical motor assembly	2	/
5	/	Belt (B175MXL6.4)	3	/

11.10 Sample Probe Motion Assembly

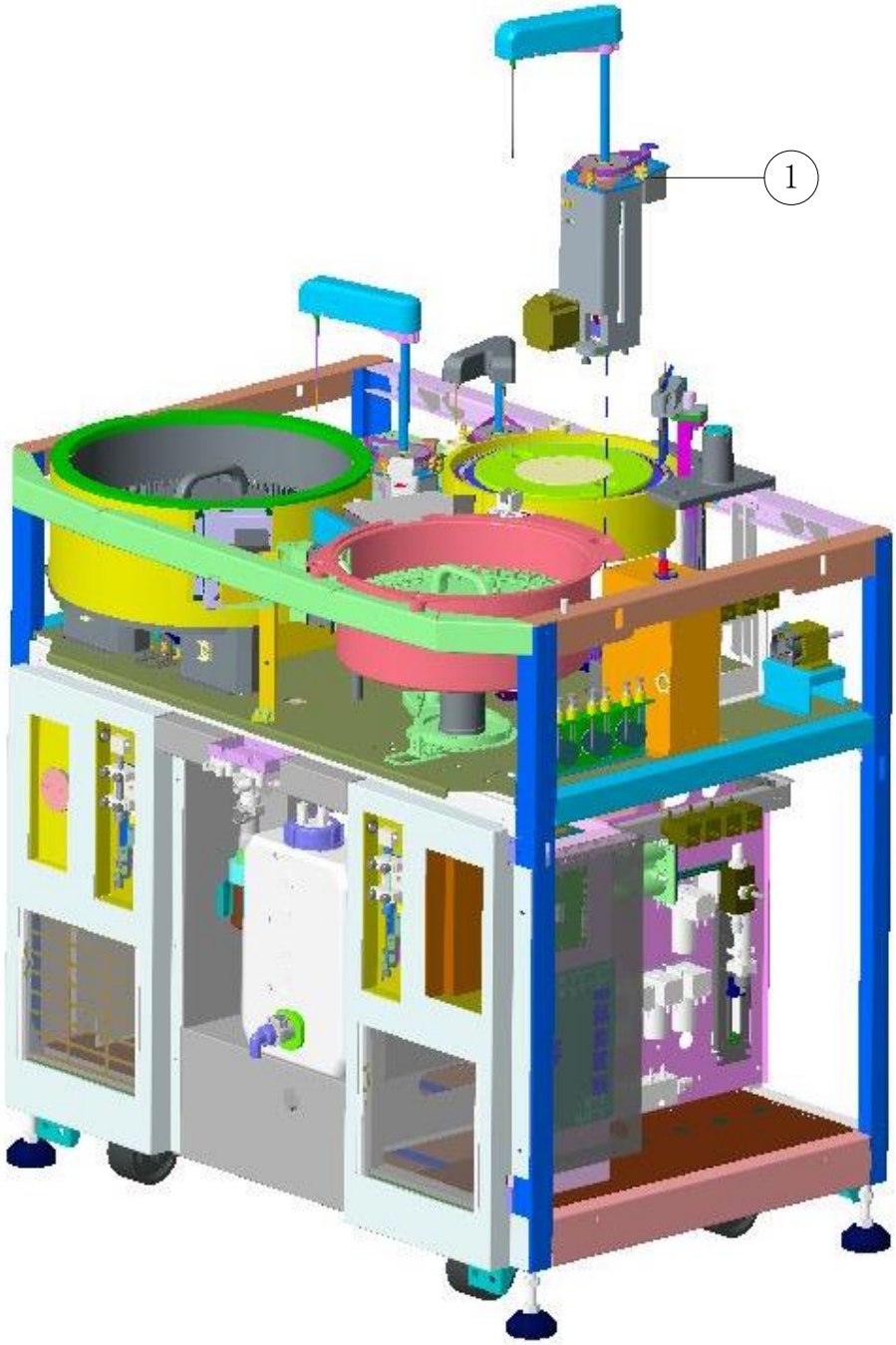


Figure 11-32 Sample Probe Motion Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	sample probe motion assembly	1	/

11.10.1 Exploded View of Sample Probe Motion Assembly

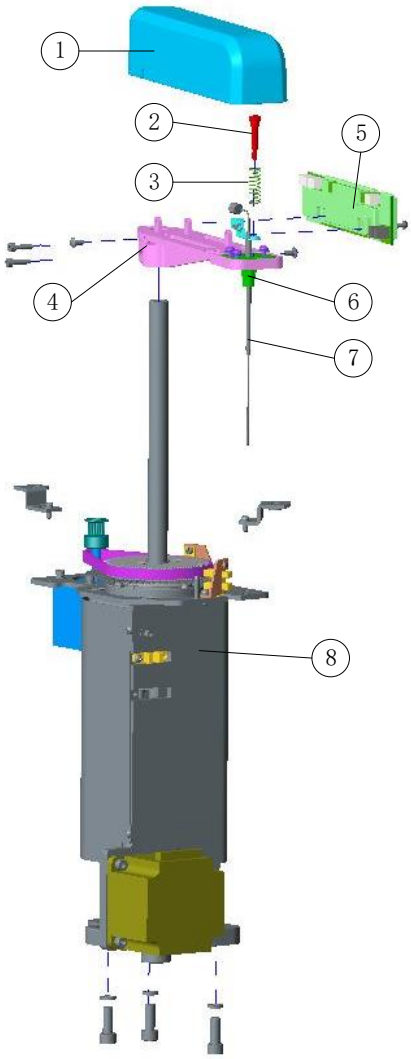


Figure 11-33 Exploded view of Sample Probe Motion Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	043-002344-00	130mm rocker arm cover	2	Sample probe rockerarm cover
2	041-003368-00	guide finger for spring	2	/
3	033-000108-00	Anti-collison spring	2	/
	033-001414-00	Anti-collison spring	1	Applicable to the new sample probe assembly 115 -090336-00
4	044-000263-00	130mm rockerarm	2	Sample probe rockerarm
5	051-000362-00	Liquid level detection board PCBA	1	/

6	043-002345-00	support boss	2	/
7	115-037086-00	Sample probe assembly	1	/
	115-090336-00	Sample probe assembly(Passivated glycation)		After EIB009
8	115-036617-00	Sample probe drive assembly	1	/

11.10.2 Exploded View of Sample Probe Drive Assembly

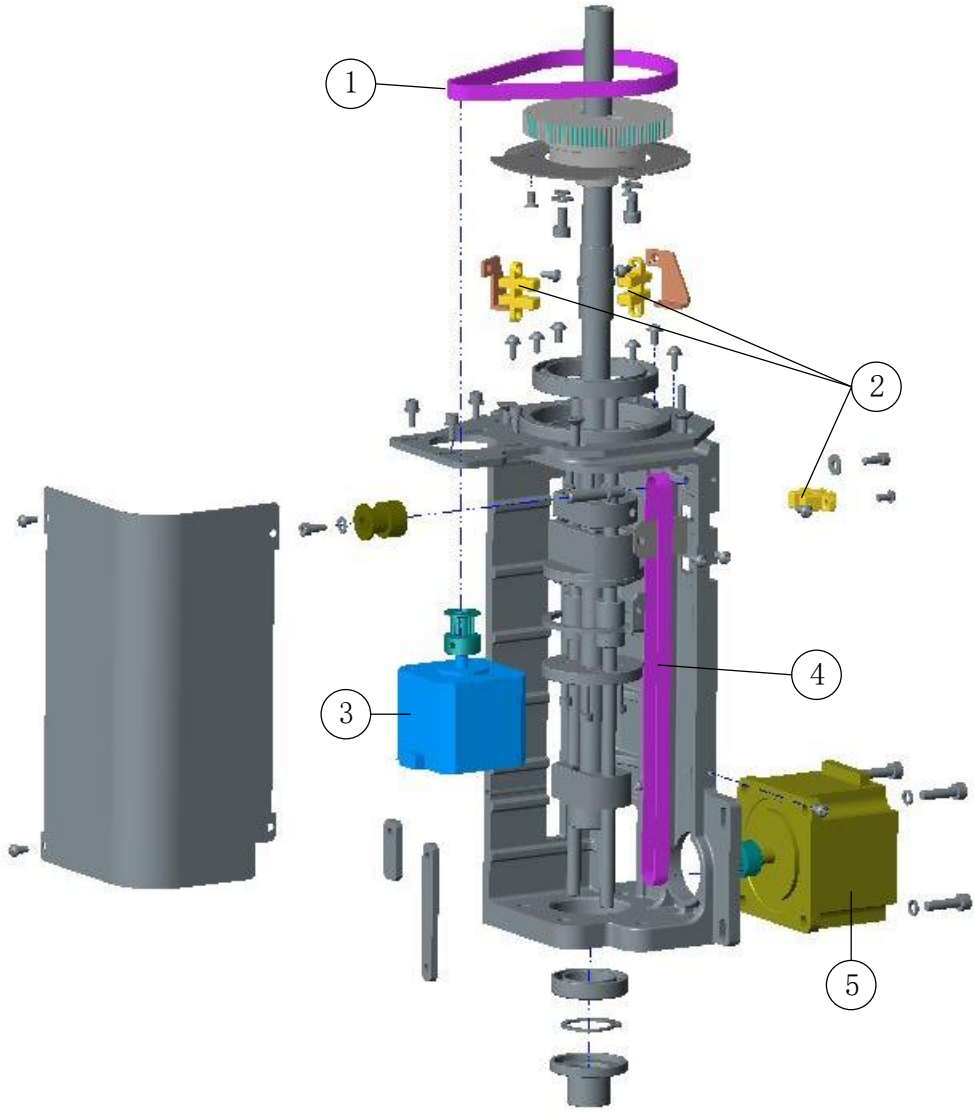


Figure 11-34 Exploded view of Sample probe drive assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	031-000250-00	Synchronous cog belt HTBN363S3M-60	3	/
2	009-002204-00	wire of Optical Switch(s)	8	Code disk sensor, three-disk initial position sensor
3	115-089474-00	S3M horizontal motor assembly (BA43)	3	/

4	/	Belt (B175MXL6.4)	3	/
5	/	vertical motor assembly		/

11.11 Medica ISE Module

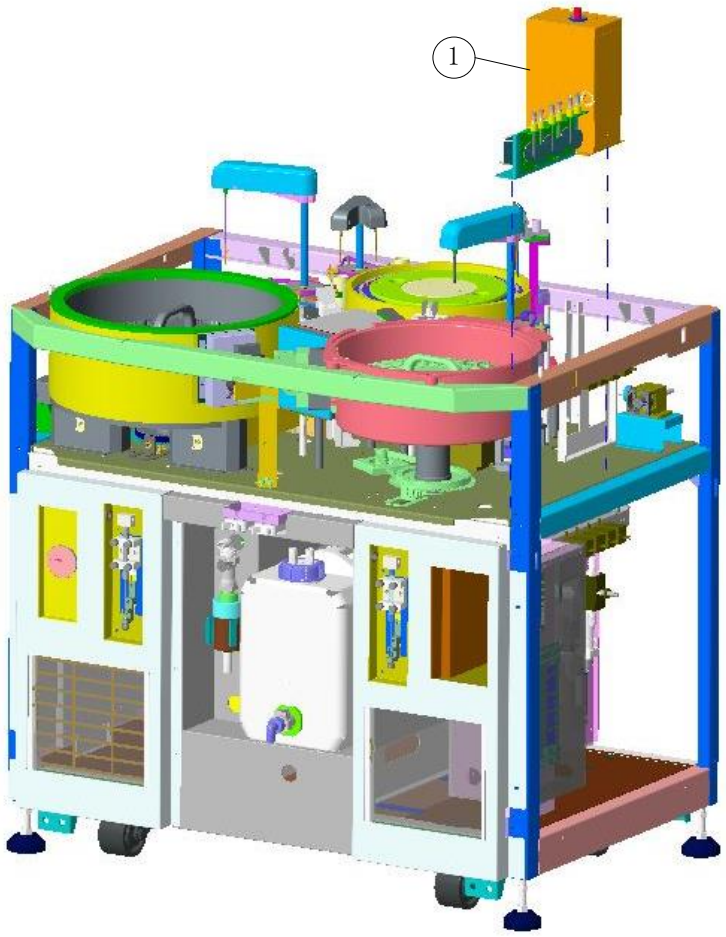


Figure 11-35 ISE Module

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	ISE module	1	/

11.11.1 Exploded View of ISE Module

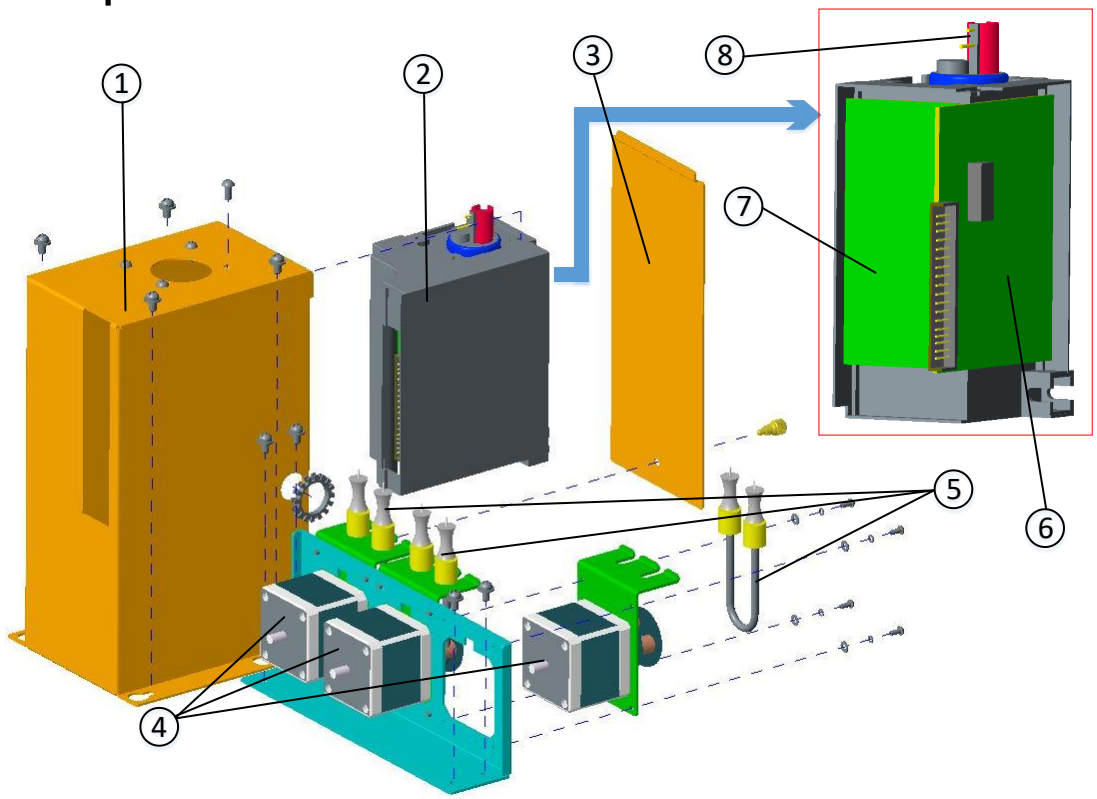


Figure 11-36 Exploded view of ISE Module

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	ISE shielding shell	1	/
2	BA34-10-63674	ISE MODULE,4 CHANNEL	1	/
3	/	ISE shield cover	1	/
4	082-000684-00	Bump.006390-001	3	/
5	BA34-10-63664	ISE Pump Tube Kit	3	3 pump tubes included
6	BA34-10-63657	ISE Main Control Board	1	/
7	BA34-10-63659	ISE Pre-amplification Board	1	/
8	BA34-10-63661	ISE Sample Cup	1	/

11.12 Caretium ISE Module

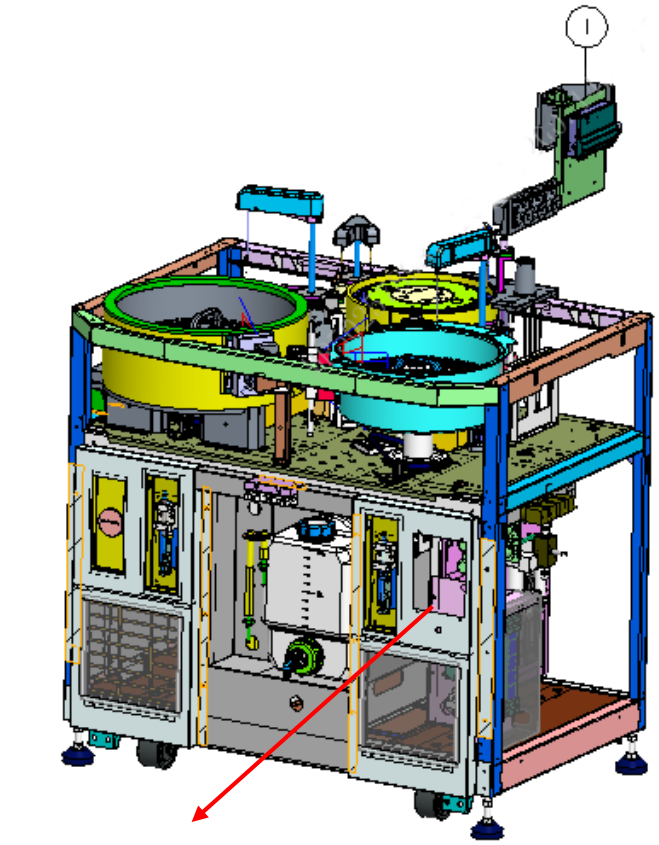


Figure 11-37 ISE Module location

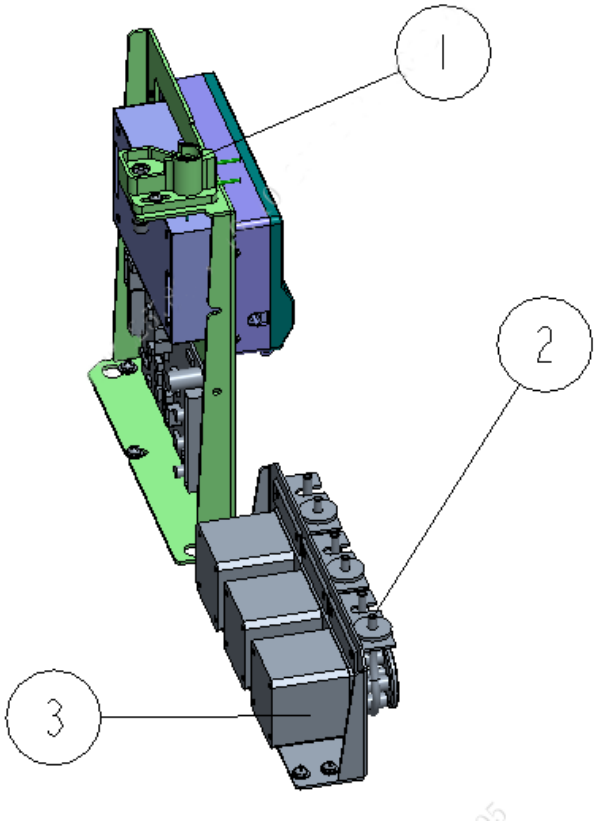


Figure 11-38 ISE assembly exploded view

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	040-006752-00	ISE module	1	/
2	040-006869-00	Pump tube	1	/
3	082-004046-00	ISE peristaltic pump (bracket included)	1	/

11.13 Front of The Rack (Facing the instrument)

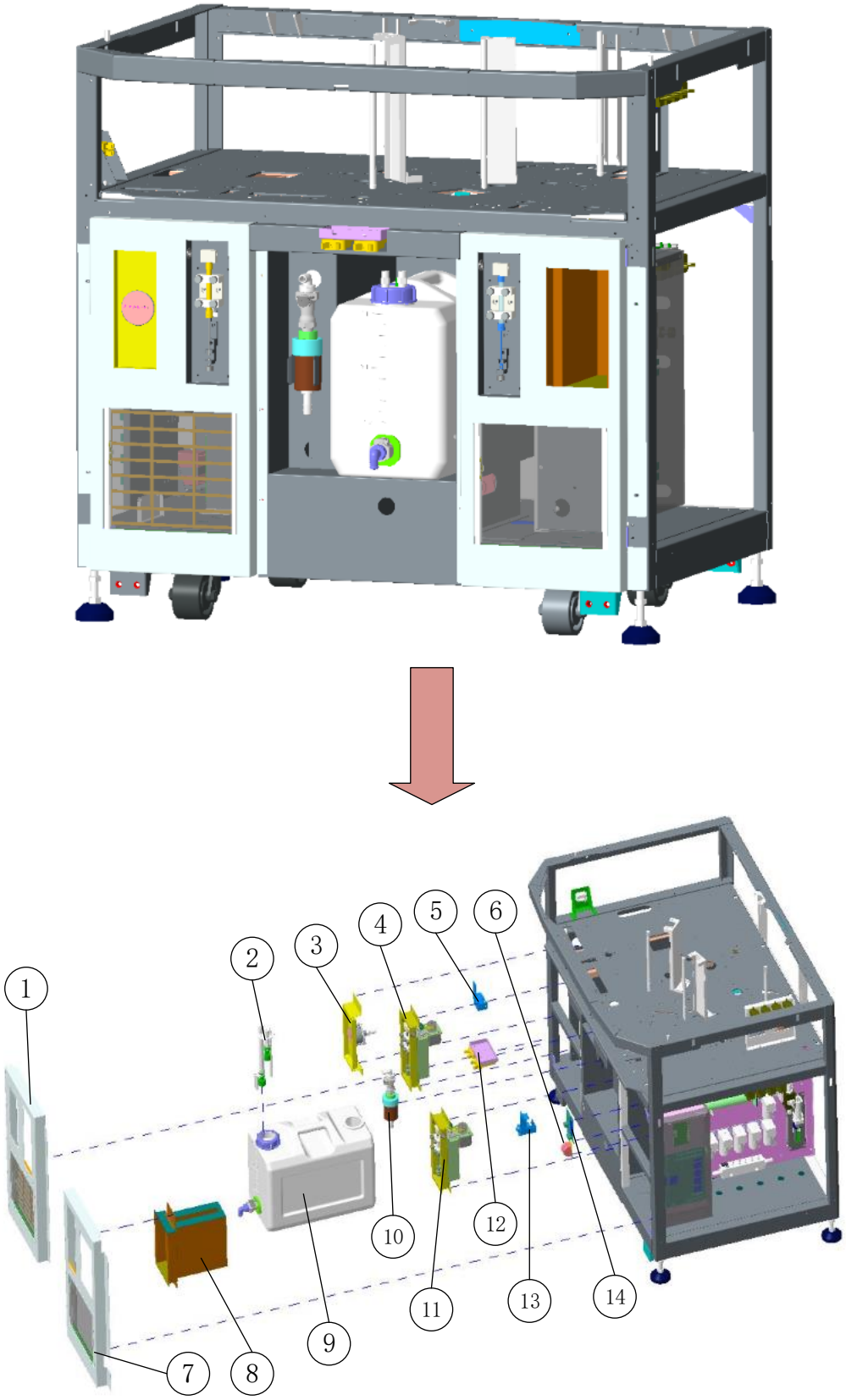


Figure 11-39 front of the rack (facing the instrument)

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	left front board assembly	1	/
2	115-037311-00	Water tank level sensor assembly	1	/
3	/	pressure meter assembly	1	/
4	/	reagent injector assembly	1	/
5	115-037053-00	reagent valve assembly	1	SV03
6	115-022008-00	Sample Probe Clogging Detector	1	/
7	/	right front board assembly	1	Does not include air filter
8	/	ISE frame assembly	1	/
9	115-005419-00	Water tank assembly(FRU)	1	Before EBJ650
	115-077899-00	Water tank assembly(FRU)	1	After EBJ650
10	115-013119-00	filter assembly	1	Before EBJ650
	082-004132-00	Stainless steel filter		After EBJ650
11	/	sample injector assembly	1	/
12	/	Door lock assembly	1	Includes stand
13	115-037054-00	sample valve assembly	1	SV02
14	051-000218-00	Sample Probe Clogging Detection Board	1	/

11.13.1 Exploded View of Water Tank Assembly

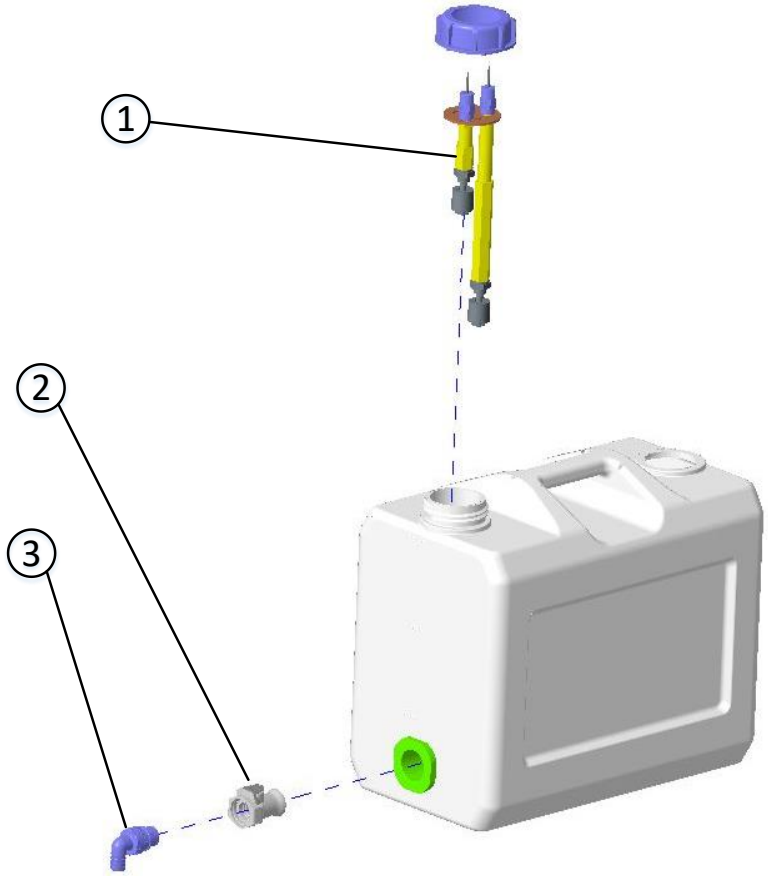


Figure 11-40 Exploded view of Water tank assembly(Before EBJ650)

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	115-005420-01	Water tank level sensor assembly(Version B)	1	
2	082-000306-00	Connector(Fast female socket)	2	Water tank quick connector
3	082-000307-00	Connector(Quick plug)	2	Water tank quick connector

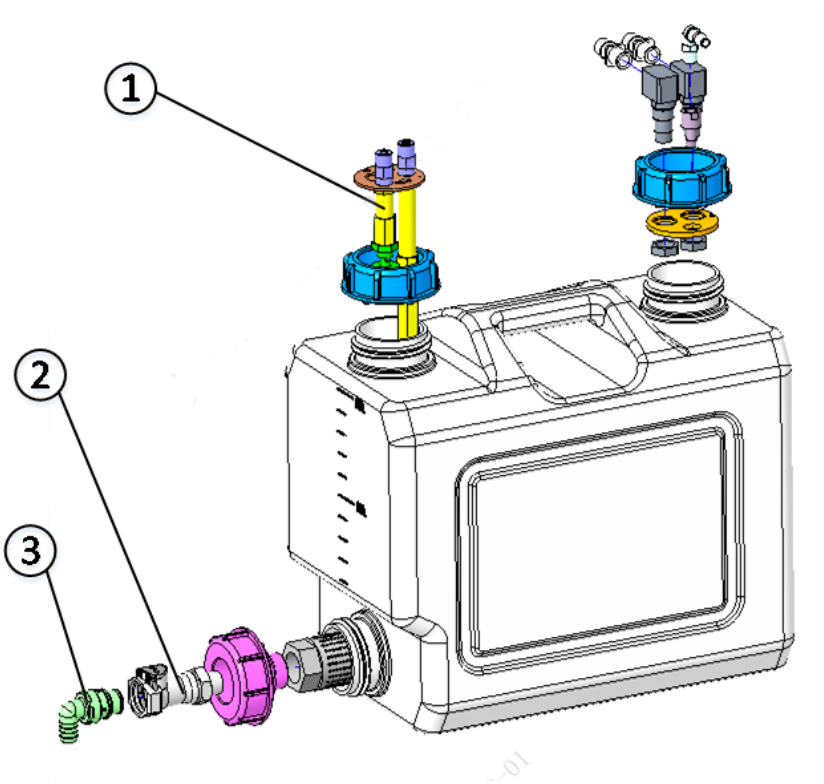
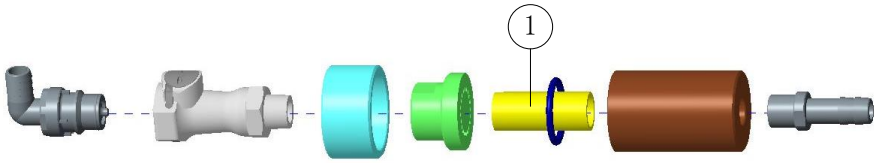


Figure 11-41 Exploded view of Water tank assembly(After EBJ650)

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	**115-005420-01**	Water tank level sensor assembly(Version B)	**1**	
2	**082-000306-00**	Connector(Fast female socket)	**2**	Water tank quick connector
3	**082-000307-00**	Connector(Quick plug)	**2**	Water tank quick connector

11.13.2 Exploded view of deionized water filter assembly (Configurations Before EBJ 650)



Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	082-000371-00	Water tank level sensor assembly (Version B)	**1**	**316 L, 100 mesh stainless steel filter core. For customized size, see the drawing.**

This part is canceled after EBJ650

11.13.3 Exploded View of Door Lock Assembly

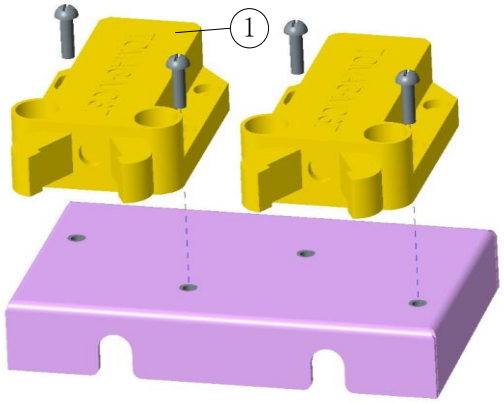


Figure 11-42 Exploded view of Door lock assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Lock Catch (White)	2	/

11.13.4 Exploded View of Pressure Meter Assembly

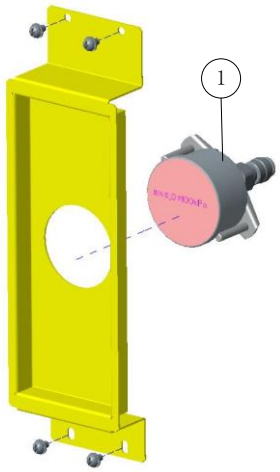


Figure 11-43 Exploded view of pressure meter assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	115-036803-00	Pressure Gauge Assembly	1	/

11.13.5 Exploded View of Left Front Board Assembly

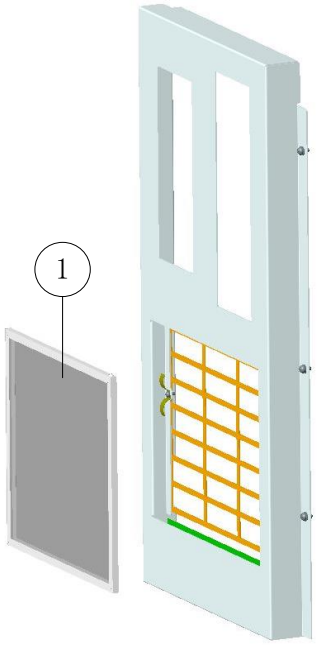


Figure 11-44 Exploded view of Left front board assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	BA40-20-61599	Right Dust Proof Net	2	Dust proof screen.

11.13.6 Exploded View of Right Front Board Assembly

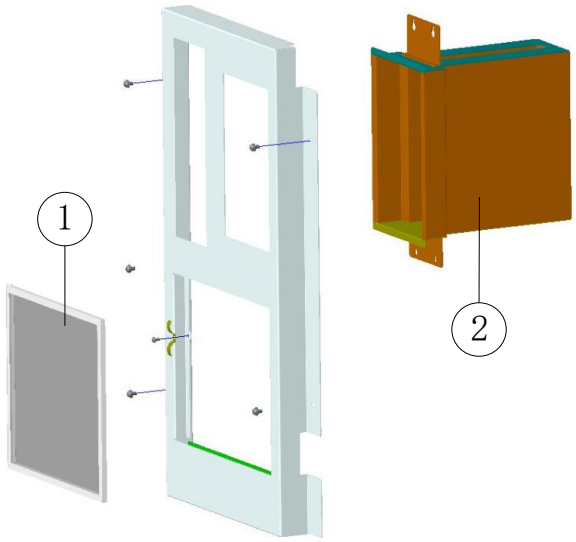


Figure 11-45 Exploded view of right front board assembly (Medica ISE configured)

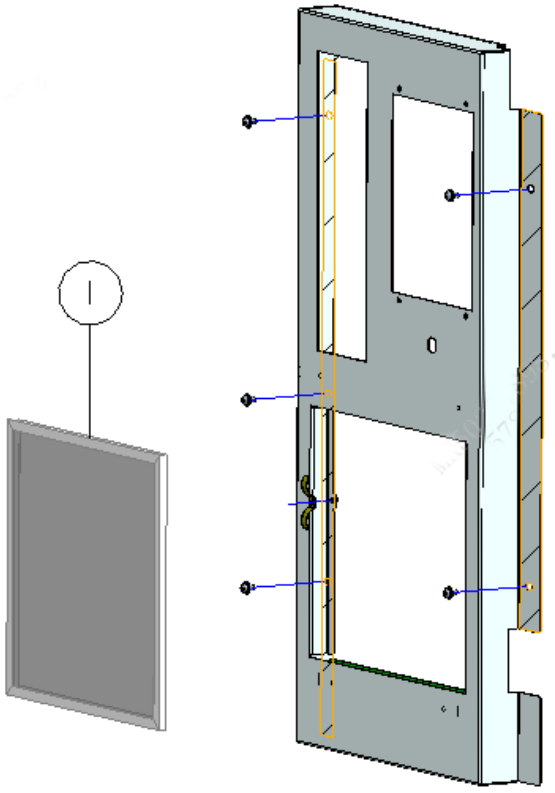


Figure 11-46 Exploded view of right front board assembly (Caretium ISE configured)

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	BA40-20-61599	Right Dust Proof Net	2	Dust proof screen.
2	/	ISE frame assembly	1	/

11.13.7 Exploded view of sample/reagent syringe

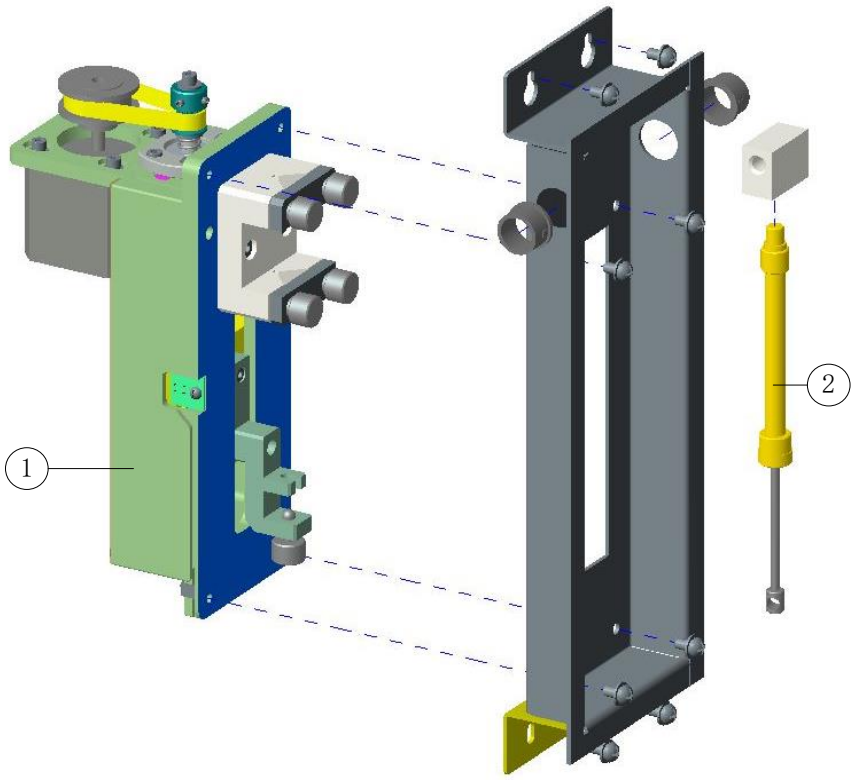


Figure 11-47 Exploded view of reagent injector assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	115-038263-00	Reagent Syringe Drive Assembly	1	/
2	115-090464-00	Reagent Syringe(500ul)	1	/

11.13.8 Exploded view of Reagent Syringe Drive Assembly

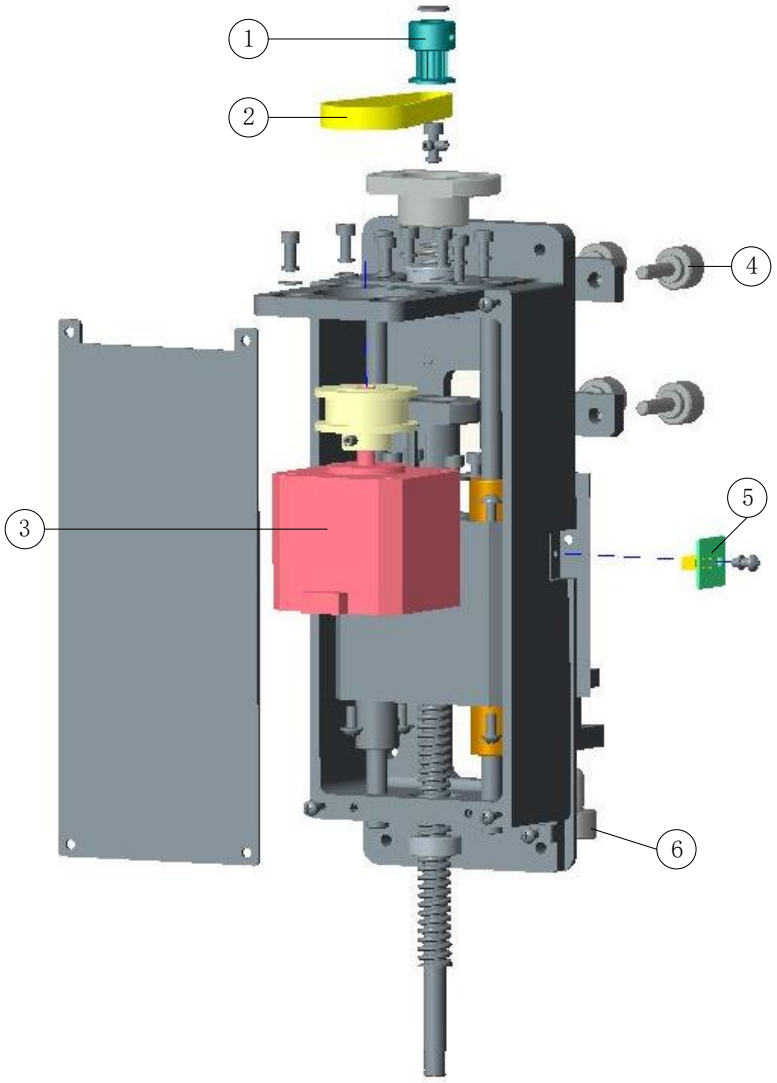


Figure 11-48 Exploded view of Reagent Syringe Drive Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Pulley (15MXL)	2	/
2	/	Synchronous belt B63MXL6.4	2	/
3	/	subassembly	2	/
4	/	Fixing Screw	8	/
5	BA31-30-41501	Initial Position Sensor of Syringe	2	/
6	/	Piston lock screw	2	/

11.13.9 Exploded View of Sample Syringe Assembly

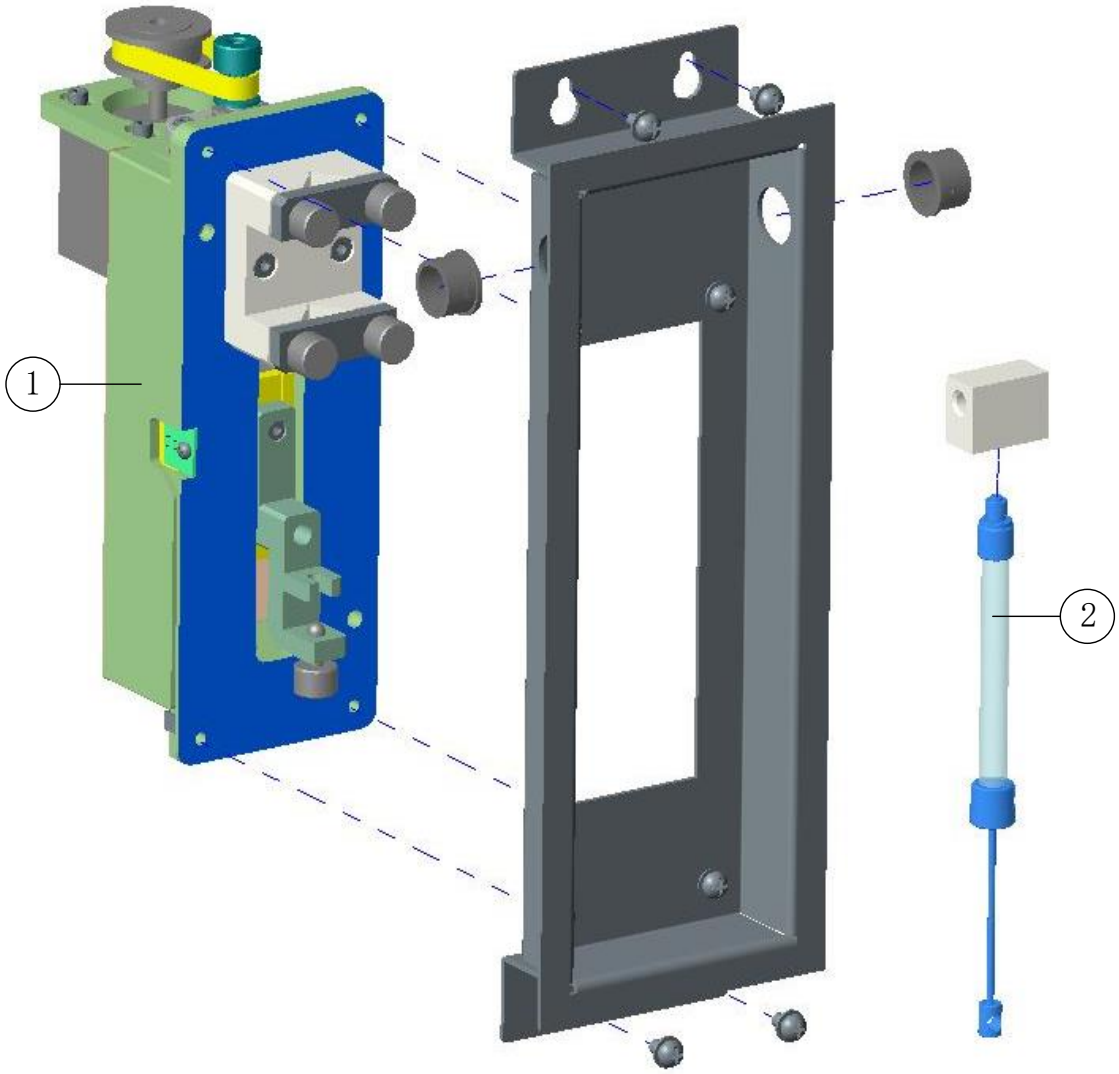


Figure 11-49 Exploded view of sample injector assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	115-006442-00	Sample Syringe Drive Assembly (FRU)	1	/
2	115-090463-00	250ul syringe	1	Sample syringe

11.13.10 Sample Syringe Drive Assembly

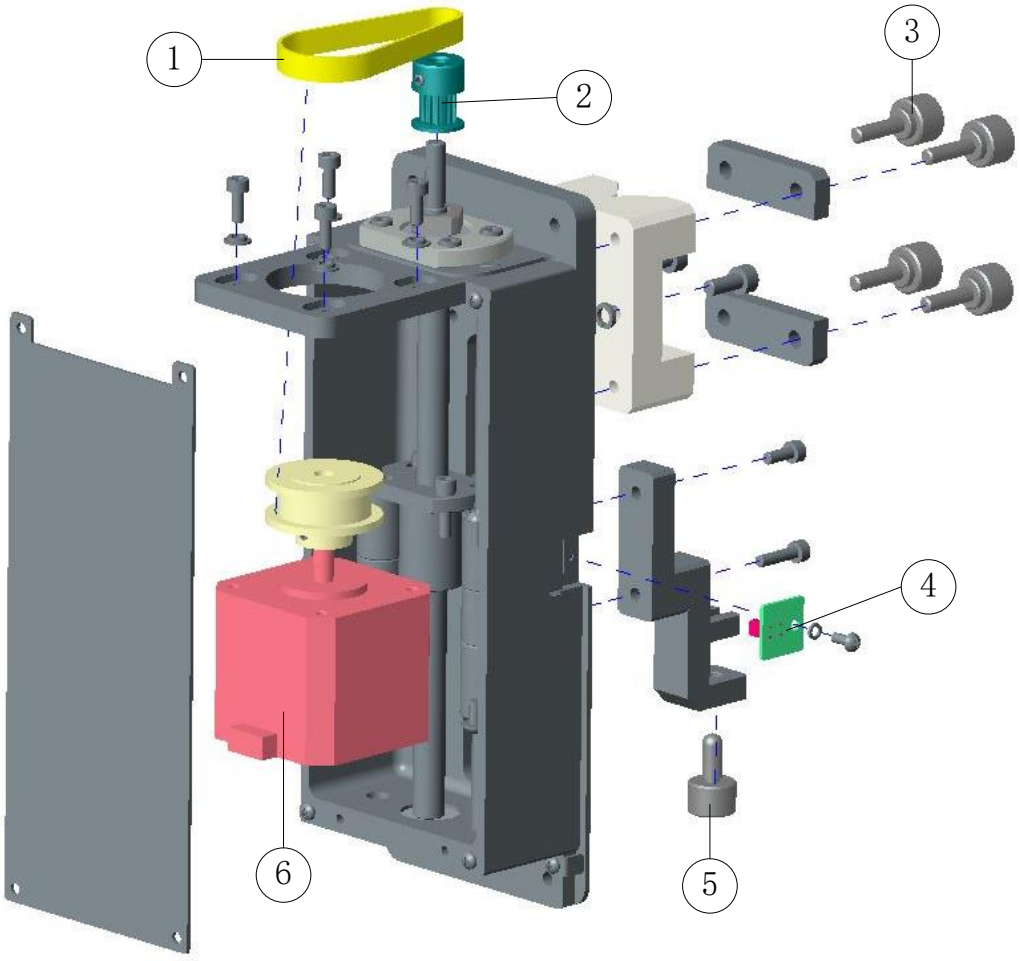


Figure 11-50 Sample syringe drive assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Synchronous belt B63MXL6.4	2	/
2	/	Pulley (15MXL)	2	/
3	/	Fixing Screw	8	/
4	BA31-30-41501	Initial Position Sensor of Syringe	2	/
5	/	Piston lock screw	2	/
6	/	subassembly	2	/

11.14 Back of The Rack (Facing the instrument)

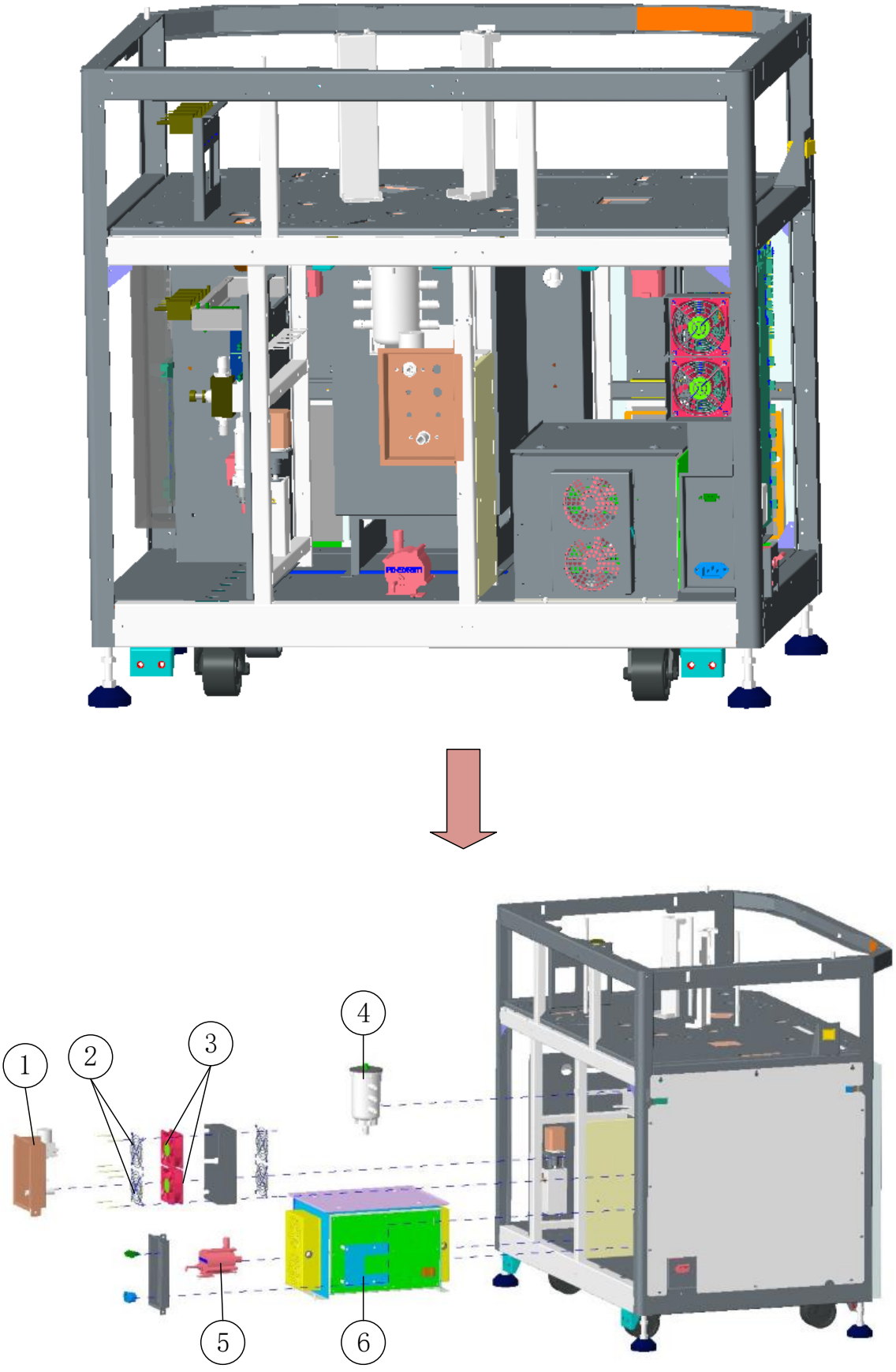


Figure 11-51 Back of the rack (facing the instrument)

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	liquid exit assembly	1	/
2	/	2100-10-08212	2	/
3	/	Fan for PCBs	2	/
4	115-036407-00	diluted waste container assembly	1	/
5	009-002590-00	WATER PUMP WIRE	1	Deionized water circulation pump，P03
6	/	Power supply assembly	1	/

11.14.1 Exploded View of Liquid Exit Assembly

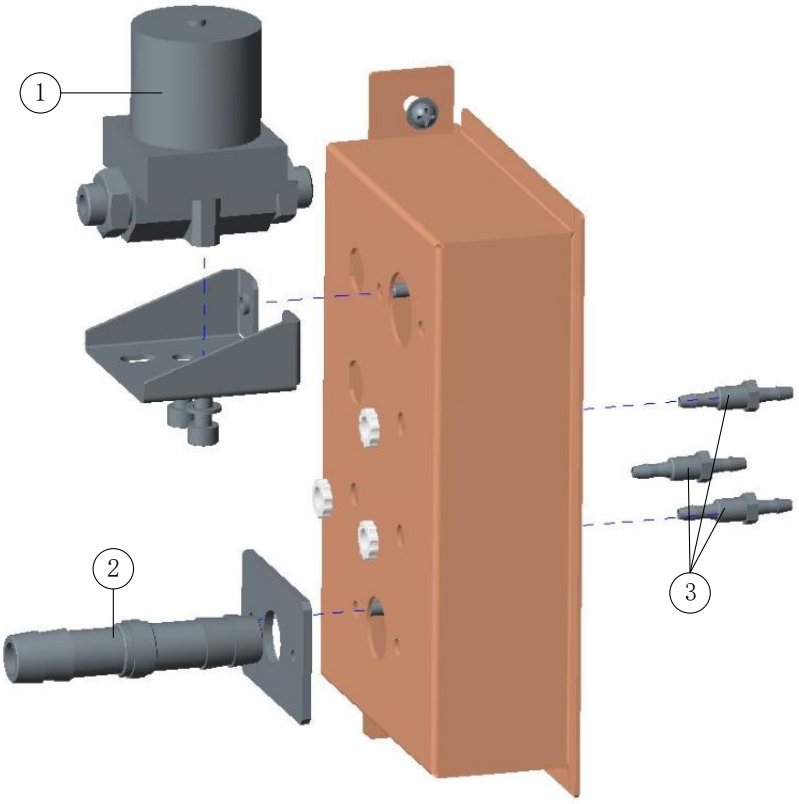


Figure 11-52 Exploded view of liquid exit assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	115-024226-00	Water Inlet Valve(Joint)	1	SV01
2	042-002313-00	liquid waste connector	1	/
3	082-001056-00	connector.1/4-28UNF,1/8"ID,PP	3	/

11.14.2 Exploded View of Power Supply Assembly

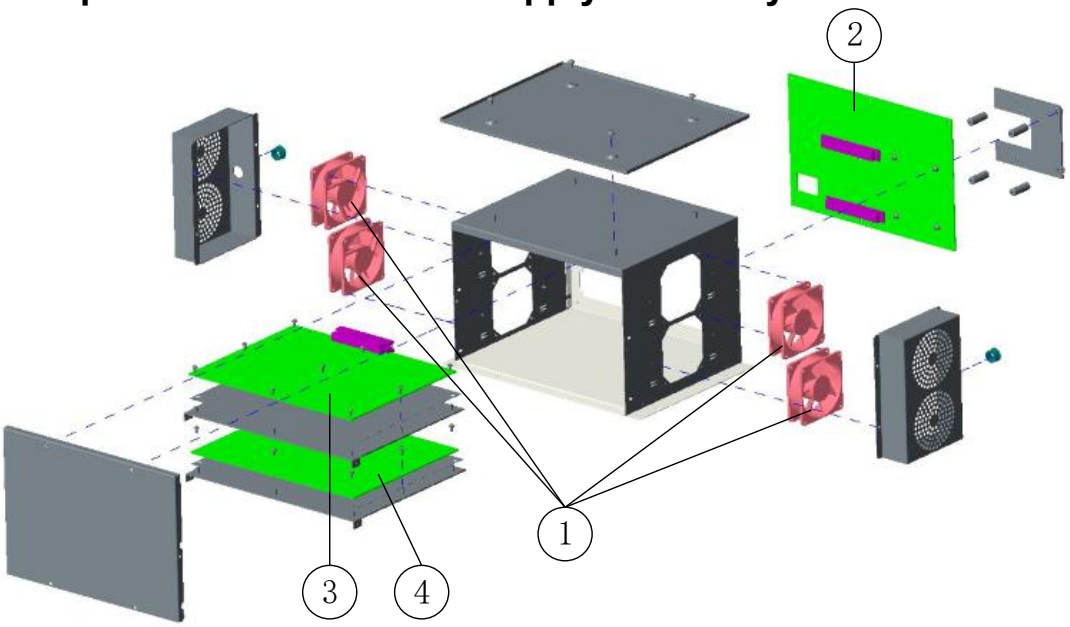


Figure 11-53 Exploded view of Power supply assembly (

Before EIB009)

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Fan 0.21A	4	/
2	051-000511-00	Power Connection Board	1	/
3	051-000510-00	24V Power Supply Board	1	/
4	051-000509-00	12V Power Supply Board	1	/

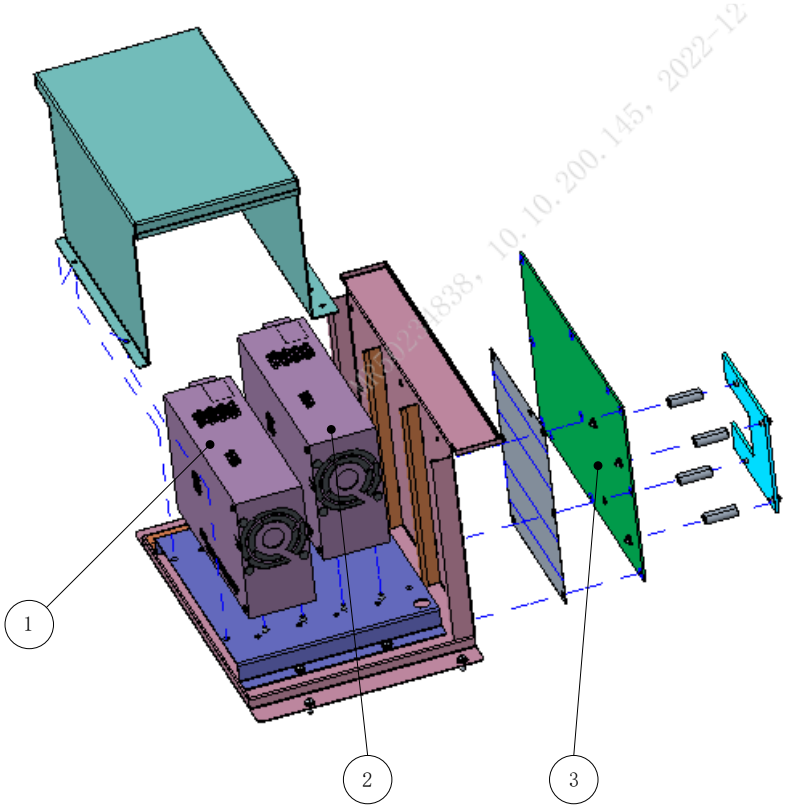


Figure 11-54 Exploded view of Power supply assembly(

After EIB009)

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	**022-000428-00**	Power supply 100 -240VAC 24 V 600 W	1	/
2	**022-000427-00**	Power supply 100 -240VAC 12 V 600 W	1	/
3	**051-005576-00**	Power patching board PCBA	1	/

11.15 Left Side of The Rack (Facing the instrument)

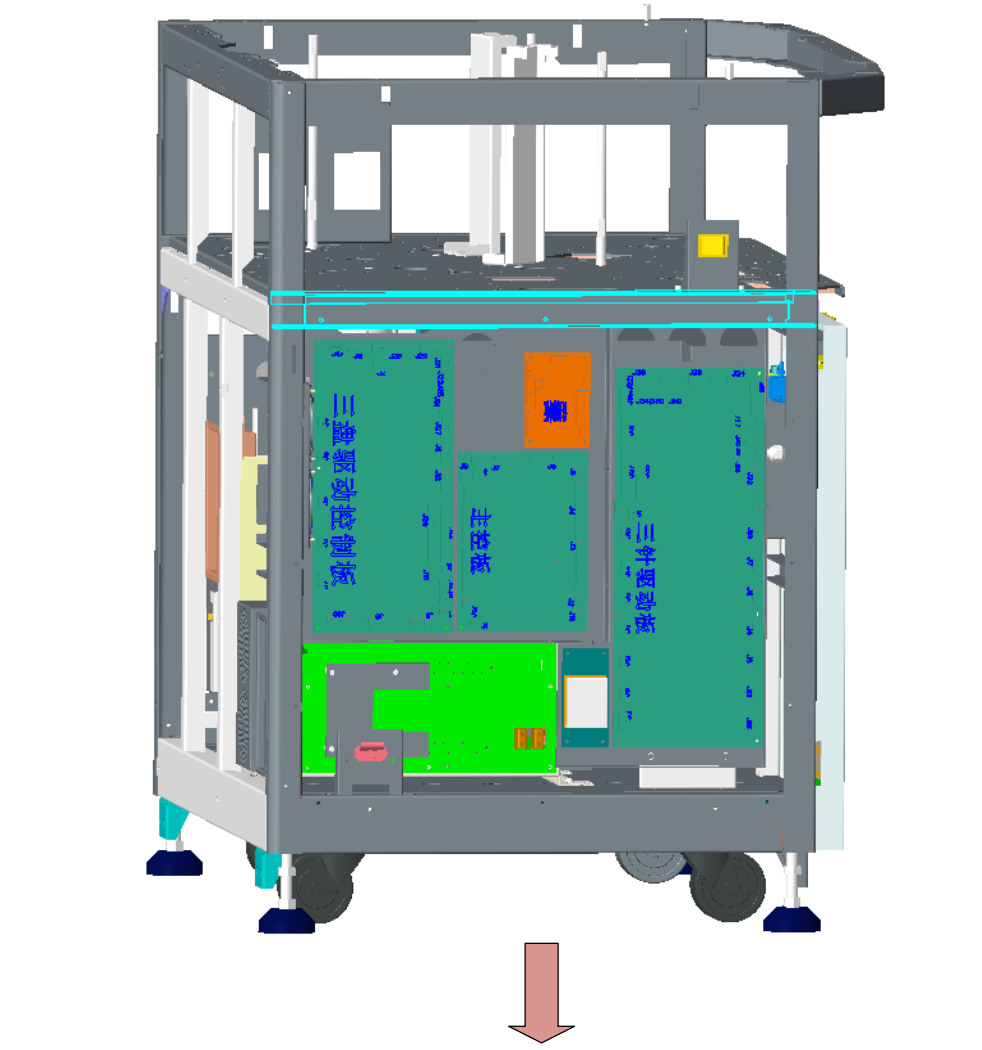


Figure 11-55 left Side of the Rack (Facing the instrument)

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	051-001801-00	BA4A Three Disk Driver Board PCBA	1	/
2	051-000052-00	Reagent Refrigeration Board(New version)	1	/
3	BA40-30-61937	Analyzing Unit Switch	1	Analyzing Unit Switch with Rack
4	M07-00100S---	SWITCH breaker 250V 13A	1	Main Switch
5	115-038783-00	Main board(open system)	1	/
	115-038784-00	Main board(Close System 3 User-defined)	1	/
	115-038785-00	Main board(Close System 5 User-defined)	1	/
	115-038786-00	Main board(Close System 0 User-defined)	1	/
6	051-002436-00	Three Probe Driver Board PCBA	1	/
7	BA38-30-88342	Analog Power Connection Board	1	/

11.16 Right Side of The Back (Facing the instrument)

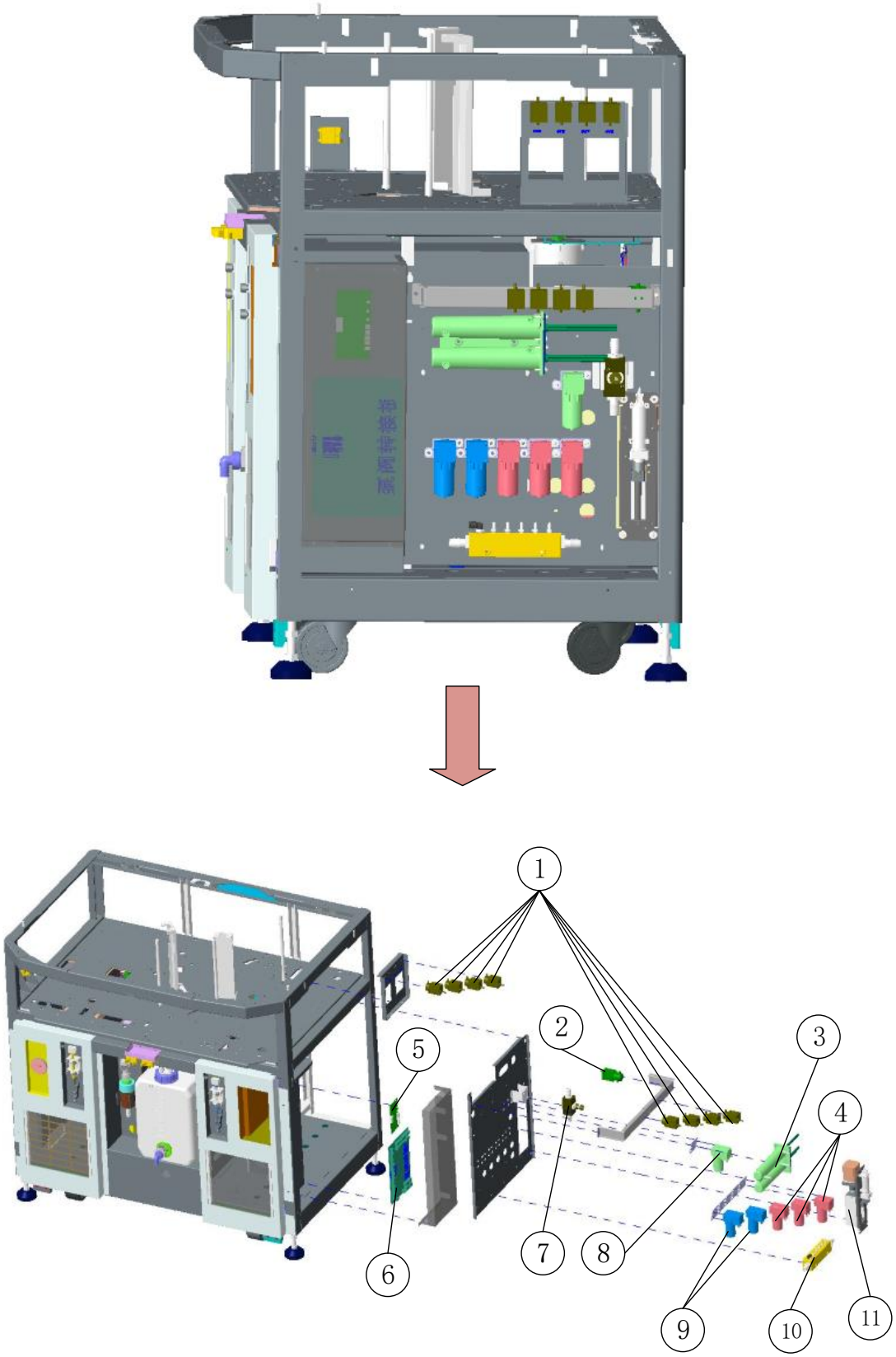


Figure 11-56 Right Side of The Back (Facing the instrument)

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	BA40-21-61680	2-Way EM Valve	8	Valves SV07\SV08\SV10\SV11\SV16-SV19
2	BA38-21-88190	EM Valve	1	Valve SV15
3	115-038565-00	automatic washing heat assembly(BA43)	1	/
4	082-002426-00	diaphragm pump of NMP830	3	Waste pumps P13-P15
5	BA38-30-88228	Wash Solution Temperature Control Board	1	/
6	051-000957-00	BS480 Pump Valve Driver Board PCBA	1	/
7	115-006999-00	Throttle Valve(homemade)	1	Throt02
8	BA30-21-15311	Probe Interior-washing Pump	1	P04
9	/	Probe Exterior-washing Pump	2	/
10	/	separate flow block assembly	1	/
11	115-011901-00	10ml syringe module	1	Syringe for wash station.

11.16.1 Exploded View of 10ml Syringe Module

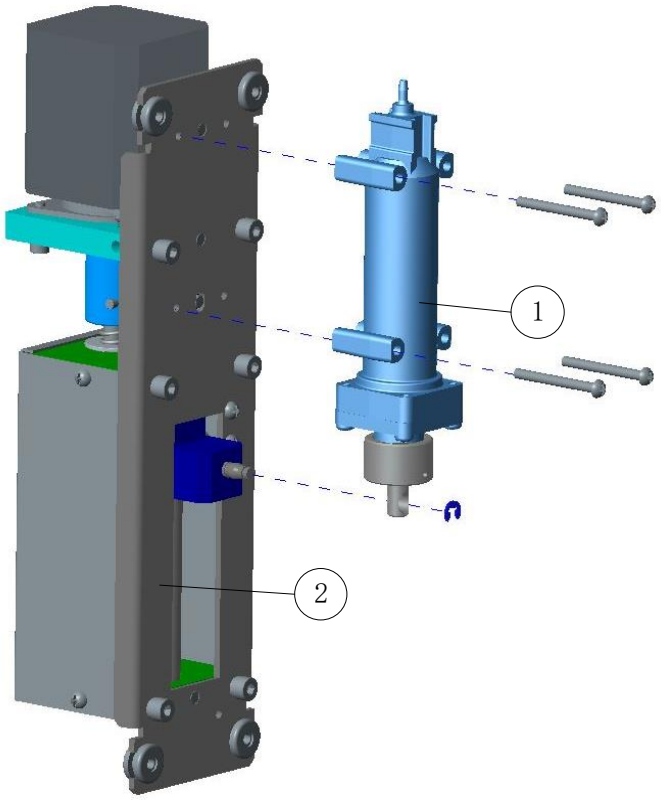


Figure 11-57 exploded view of 10ml syringe module

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	115-011902-00	10ml syringe	1	Self-cleaning cleaning agent syringe
2	/	wash injector drive assembly	1	/

11.17 Exploded View of Wash Injector Drive Assembly

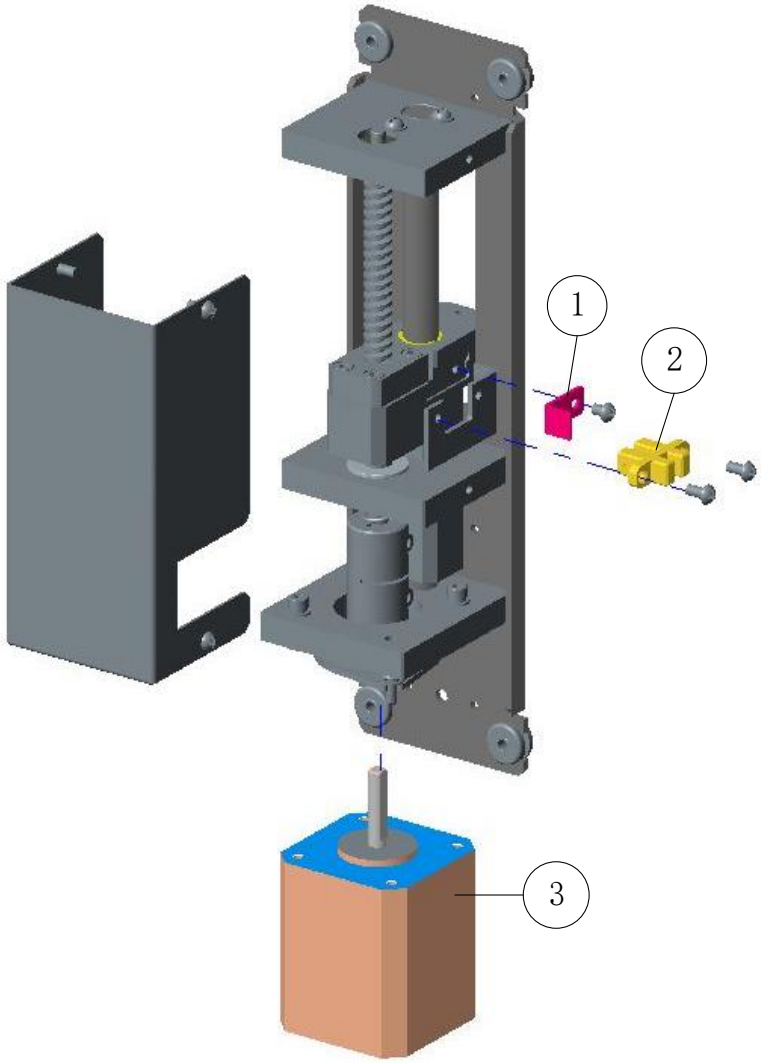


Figure 11-58 Exploded View of Wash Injector Drive Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	/	Optical Sensor block of injector	1	/
2	009-002204-00	wire of Optical Switch(s)	8	Code disk sensor, three-disk initial position sensor
3	024-000366-00	Stepping motor	1	Driving motor for Auto-wash syringe.

11.18 Optional Module

11.18.1 Water Supply Unit（BA40-30-61697）

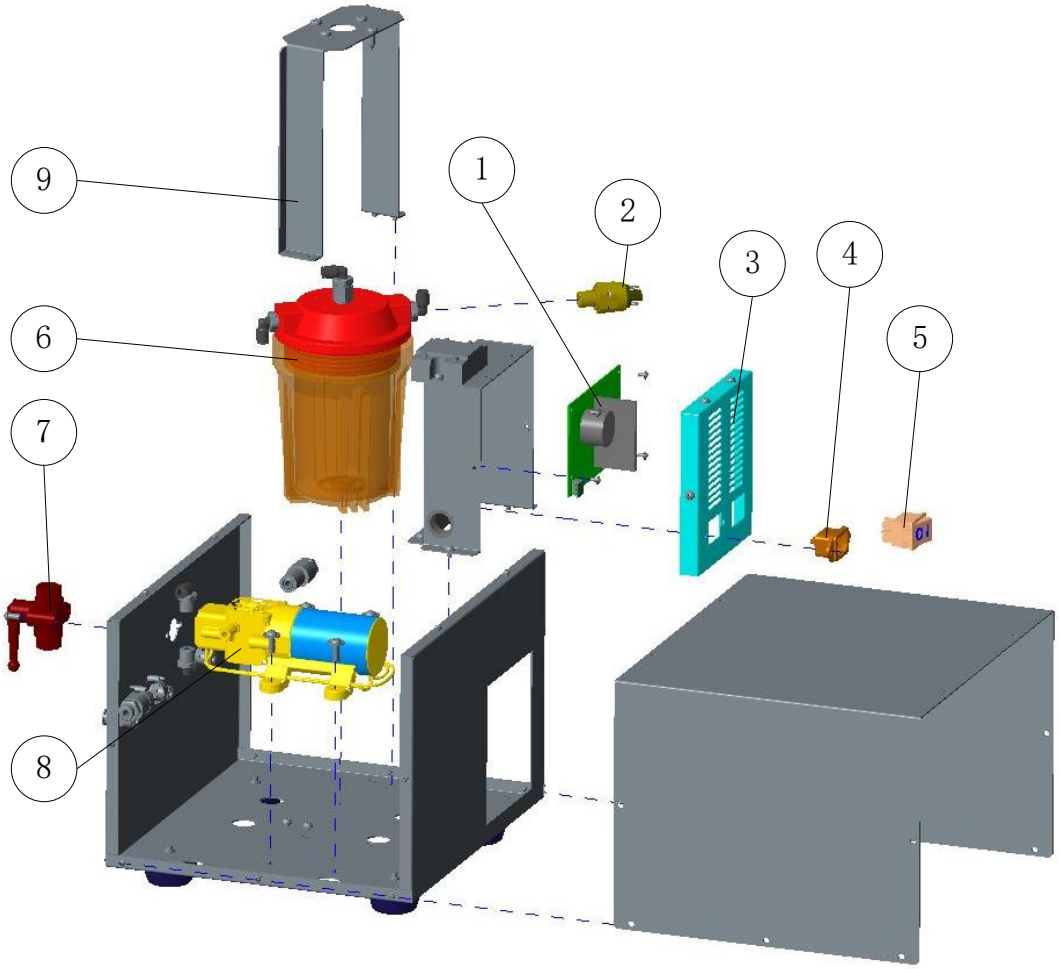


Figure 11-59 Water Supply Unit

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	BA40-30-72955	Power Supply Board of WIM	2	/
2	/	Pressure Switch	1	/
3	/	Inlet pump power cover	1	/
4	/	Water inlet module power socket wiring	3	/
5	010-000310-00	Power Switch	3	/
6	BA40-30-61692	Water Buffer Tank Assembly of WIM	1	Includes pressure switch
7	M6Q-020027---	Ball Valve	1	/
8	082-001263-00	diaphragm pump 2.6L/min 24VDC	1	/
9	/	Inlet pump filter housing bracket	1	/

11.18.2 Drainage Unit（BA40-30-61346）

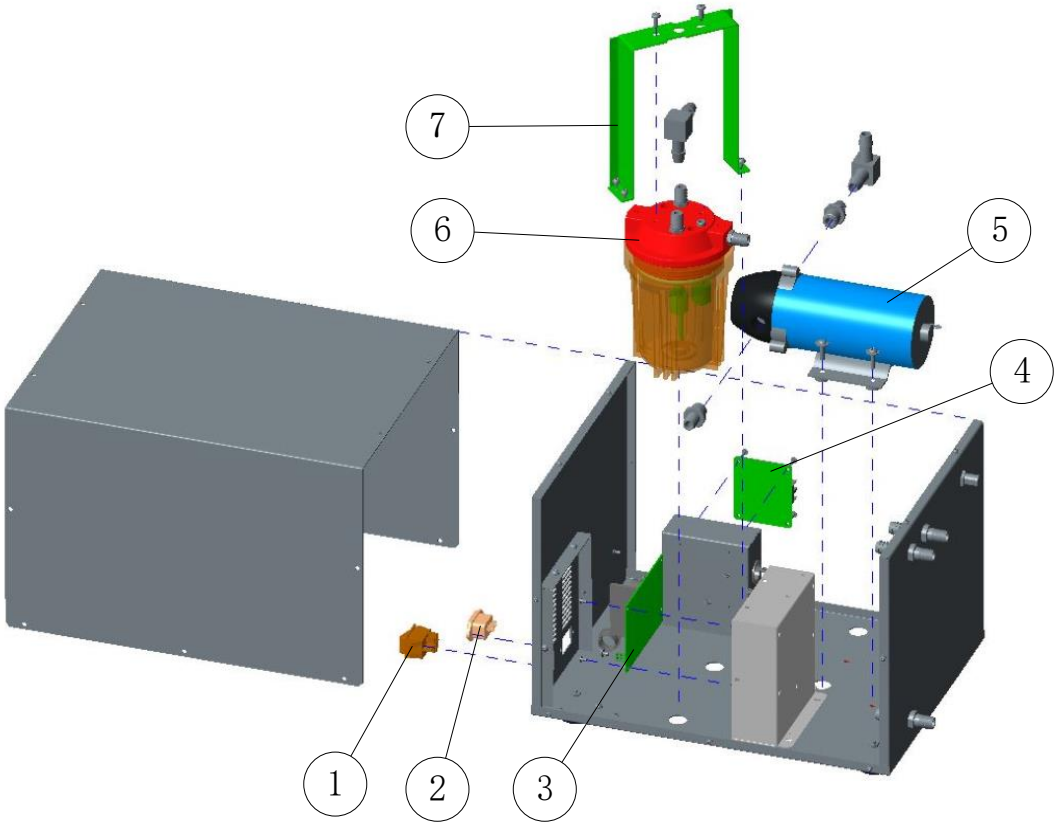


Figure 11-60 Drainage Unit

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	010-000310-00	Power Switch	3	/
2	/	Water inlet module power socket wiring	3	/
3	BA40-30-72955	Power Supply Board of WIM	2	/
4	/	Mainboard of Drain Module	1	/
5	BA40-10-62020	Water Pump of WIM	1	/
6	BA40-30-61690	Waste Liquid Buffer Tank Assembly of DM	1	/
7	/	Waste buffer bottle holder	1	/

11.18.3 External Air Pump Assembly（115-005404-00）

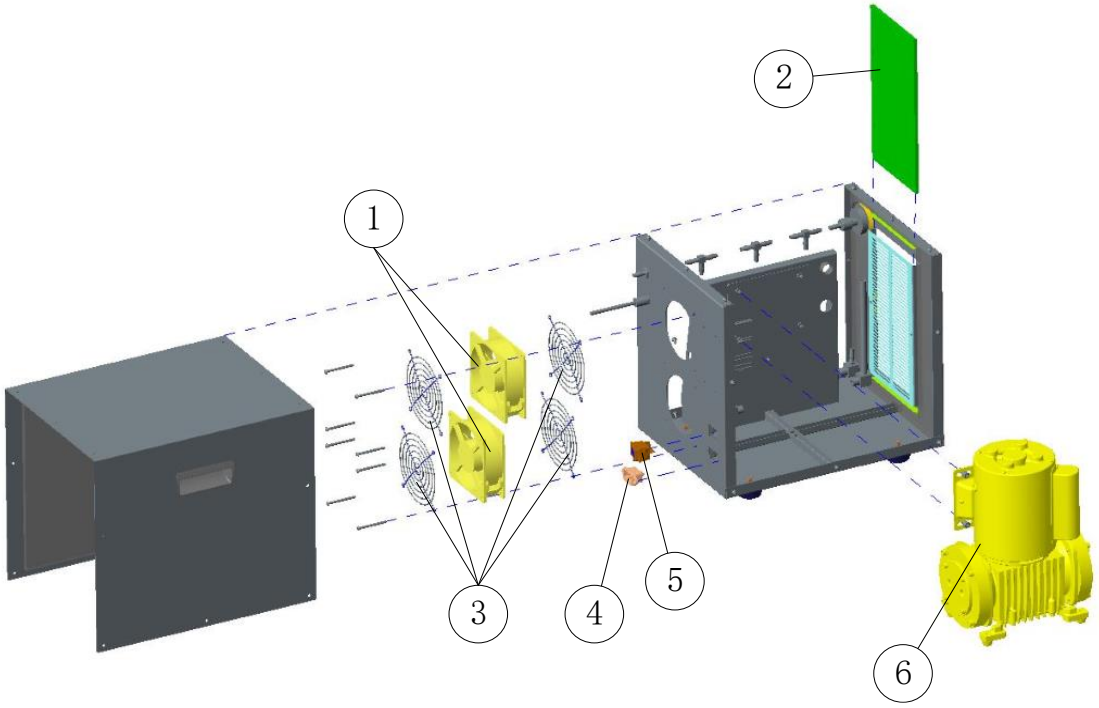


Figure 11-61 External Air Pump Assembly

Parts list:

NO.	Part Number	Part name	Quantity	Remark
1	024-000075-00	FAN 220Vac 120*120*38mm 60CFM 40dB	2	Cooling fan
2	/	Air filter	1	/
3	/	Fan grille. 120mm	4	/
4	/	Water inlet module power socket wiring	3	/
5	010-000310-00	Power Switch	3	/
6	082-000354-00	pump	1	/

12 LIS Connection Setting and Troubleshooting

12.1 Overview of LIS

The LIS system is abbreviated from Laboratory Information System (Laboratory) and an important part of the hospital information management. The LIS system has the main features including but not limited to specimen check and acceptance, report processing, report review and specimen transfer. The stability of the LIS system will significantly affect the normal operation of the laboratory department and even the diagnosis of clinicians. The LIS system is also an important part for 15189 review process of the laboratory department. Medical organizations pay more and more attention to medical information technology, including establishment of the LIS system. The LIS system is also closely related to other systems in a hospital, including HIS system and electronic medical records system. When an operator reviews a report in the LIS system, the self-service report printer, out-patient medical workstation, in-patient medical workstation, including WeChat official account and Alipay can receive the test result from the LIS system in real time. The LIS system has more and more data interactions with other HIS subsystems.

For a equipment manufacturer, the equipment is normally connected to the LIS system which will print the lab report. This is one of the most important sign indicating whether the equipment is enabled. To allow an engineer to effectively coordinate the debugging operation of the LIS interface, the following sections focus on basic knowledge and common problems concerning LIS connection.

12.2 LIS Networking

The communication between a computer (hereinafter referred to as workstation) and the LIS system is based on TCP/IP protocol and data is transmitted via serial port or Ethernet port (cable transmission). The stability of the network is very critical to the communication of the LIS system. The workstation configured for the equipment shall have 2 or more network cards, and the workstation resides in the same network as that of the equipment and LIS computer.

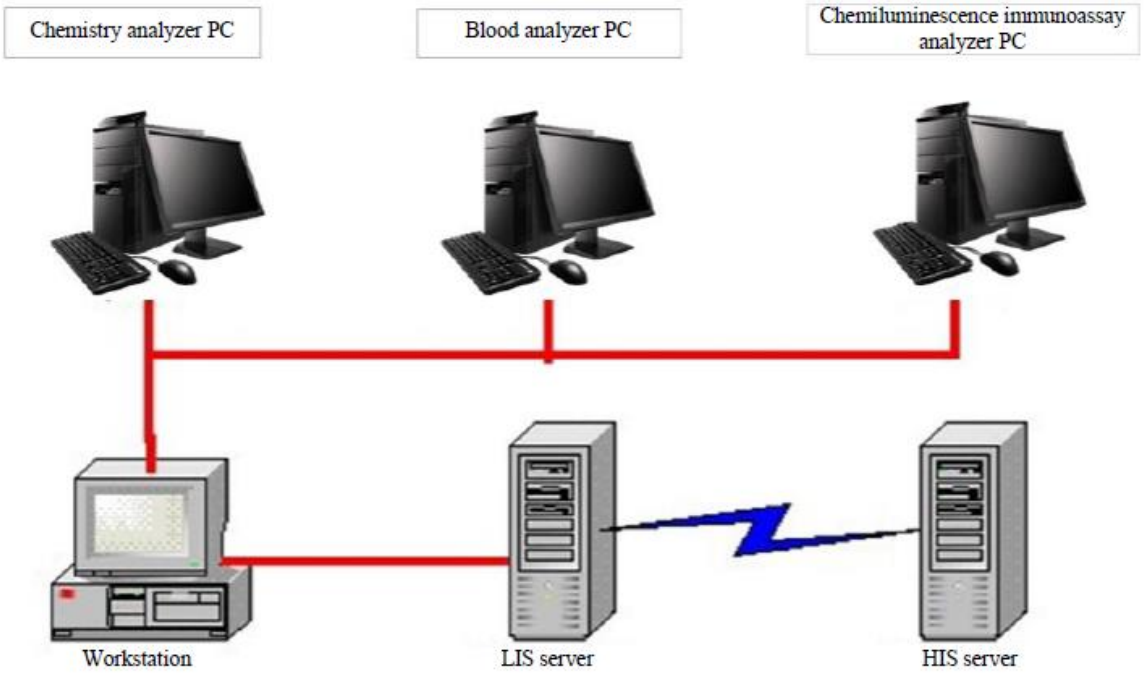


Figure 12-1 LIS connection diagram

12.2.1 Querying State of RS232 Serial Port Card and Network Card

Identifying the installation state of RS232 serial port and network card driver is an important part for detecting the network state. If the driver is not installed, or any exception occurs to the installed driver, even if the hardware including serial cable or network cable works normally, the network communication may be faulty.

Select [Computer] - [Property] - [Device Manager] - [Port] to check the installation of serial port card driver to check the state of the serial port.

Select [Computer] - [Property] - [Device Manager] - [Network Adapter] to check the installation of network card driver to check the state of the network card. Open Network and Sharing Center -> Control Panel\Network & Internet\Network Connection to check network connection.

12.2.2 Checking Network Status

One of the network cards configured to the workstation is used to communicate with the LIS computer. Use a network cable to connect the workstation to the LIS computer and use the "ping" command to check the connectivity of the network.

ping is also a communication protocol as a part of TCP/IP protocol. The "ping" command can be used to check the connectivity of the network and helpful in analyzing and identifying network failure. It is applied in the following format: ping (a space) IP address.

Use the following steps to set the IP address of one of network works in the workstation computer to the same network segment as that of the LIS system:

1) Click the "Network Connections" icon on the computer, open "Network and Sharing Center" and then click "Local Connection".
2) Click "Details" to check IP address, subnet mask, default gateway and DNS server.
3) Open Network and Sharing Center -> check Active Network -> click and select Network Connections - Connection - Properties (select Internet protocol version 4).

Set IP address and other information on this interface. The network between workstation computer and LIS system is set according to the network architecture of a hospital.

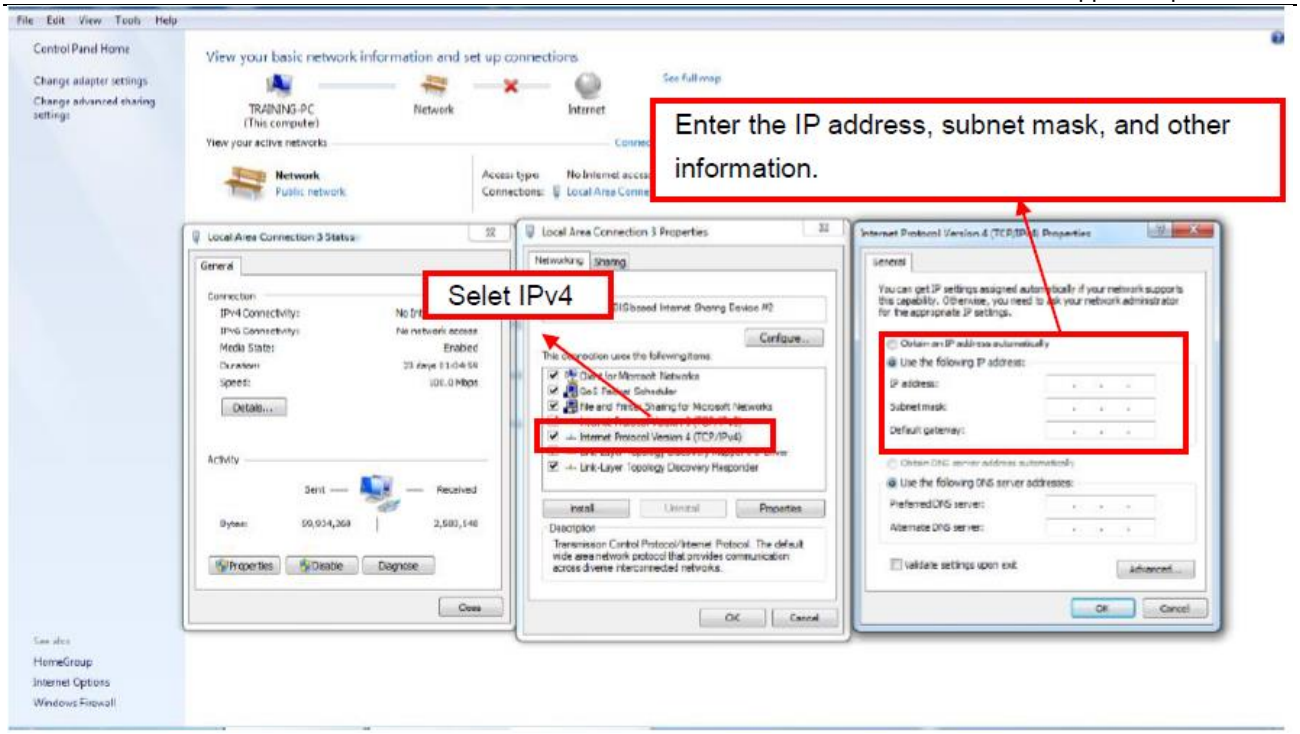


Figure 12-2 Input IP address

IP setting of workstation computer in a hospital

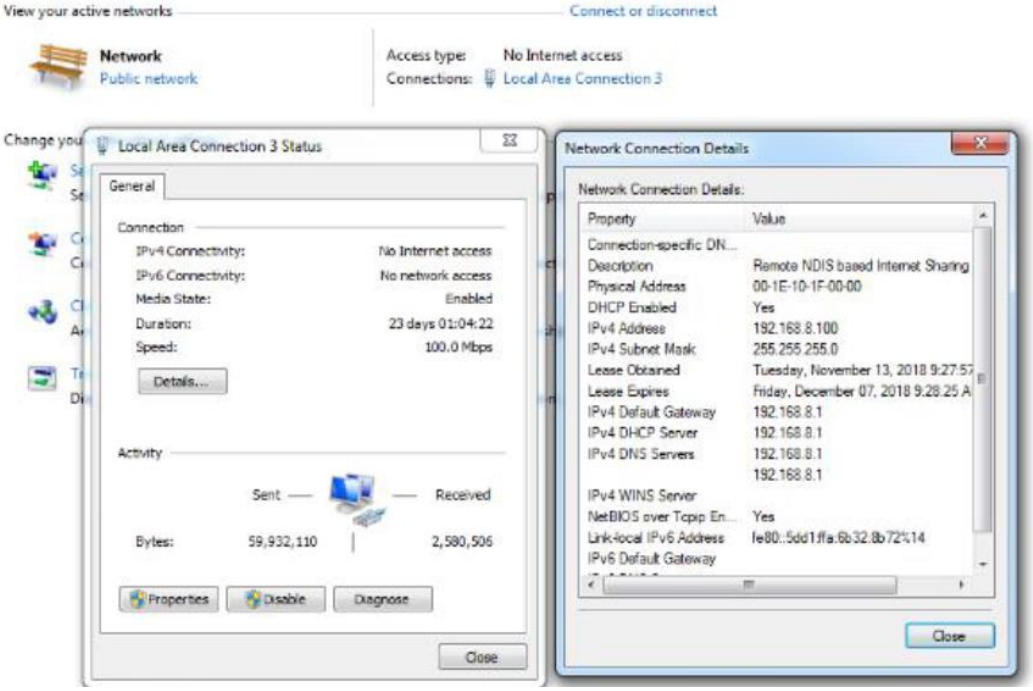


Figure 12-3 IP setting of workstation computer in a hospital

The IP address of the workstation computer shall be in the same network segment as that of LIS computer.

4) On the workstation, use the Win + R combination key and input CMD into the Run input box to enter the command console:

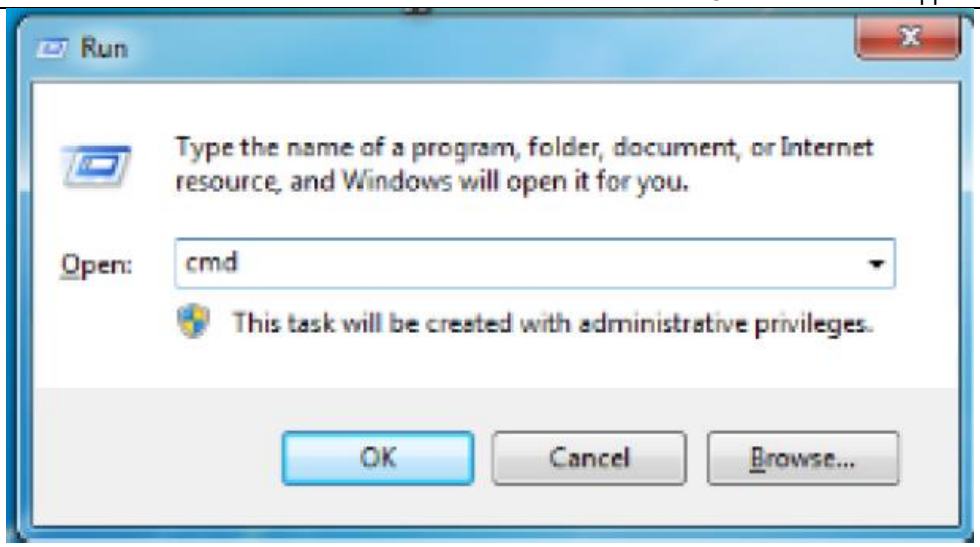


Figure 12-4 Run screen

5) Input ping + IP of the LIS computer. If you are actually returned with bytes, the network is connected.

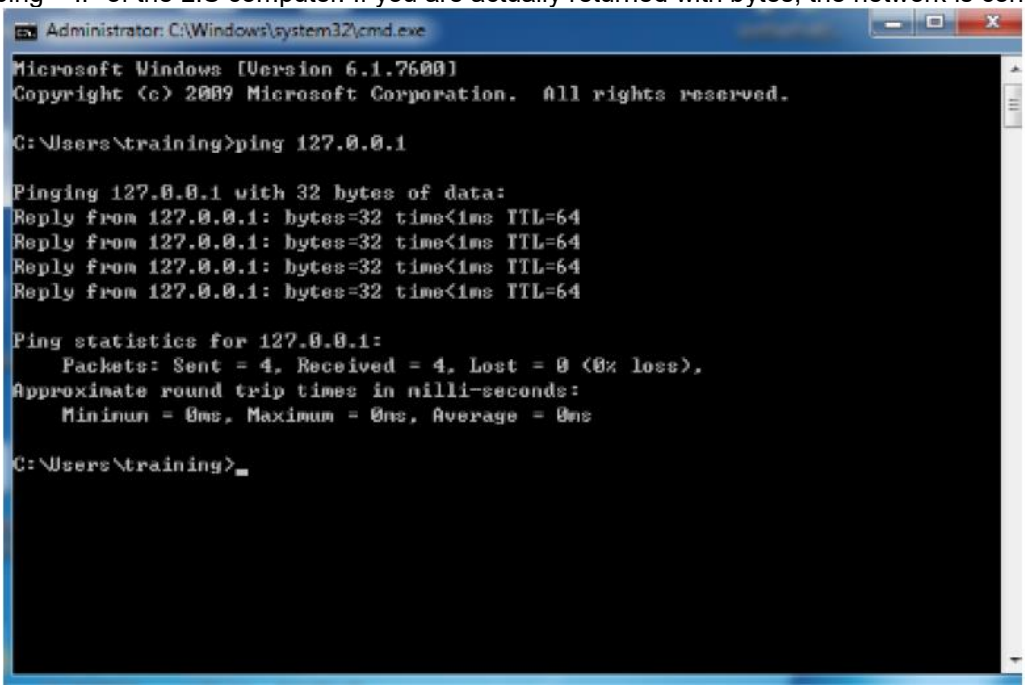


Figure 12-5Network connected

Request timeout, data lost.

Figure 12-6 Network disconnected

6) Perform step 5 on the LIS computer to check if the network is connected

12.3 LIS Parameter Setup

12.3.1 Introduction to Protocols

Mindray devices strictly follow HL7 protocol and ASTM protocol. LIS manufacturers, at their discretion, decide to use what protocol to implement LIS interface connection, i.e. via Ethernet port or serial port.

There are detailed descriptions about field and domain for message headers and separator domains defined in HL7 protocol and ASTM protocol. LIS interface engineers shall strictly follow the examples given in the communication protocol to develop LIS interfaces. This User Manual further explains the communication protocol so that LIS engineers can be directed more effectively to develop interfaces.

The ASTM protocol is not specific to serial port. It is also applicable to Ethernet port. ASTM and HL7 protocols define the message transfer format while serial port and Ethernet port are means for transferring data.

Note:

Serial port or Ethernet port is only a means for transferring data. The cross serial port cable used in data transfer shall meet RS232C specifications.

12.3.2 Parameter Setup on a Workstation Computer

[Apply] - [System Setup] - [LIS Setup]

If Auto Connect to LIS is checked, the machine will be automatically connected to the LIS interface. A port is set by the LIS system. The port on the workstation shall be set the same as that of the LIS system. Do not set the port number to 80/8080.

After Retry after Disconnect is checked, the machine will automatically connect to the LIS system if LIS disconnection is detected.

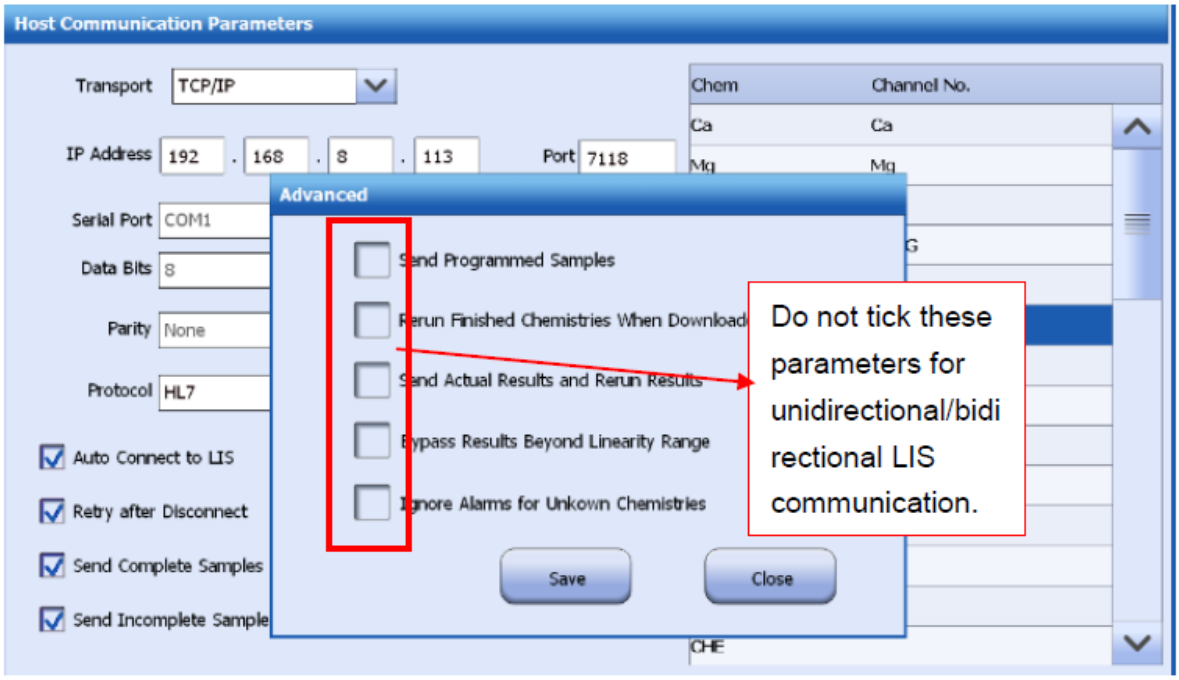


Figure 12-7 Transport setup

BS-480 allows interaction with the LIS system via serial port or Ethernet port. ASTM and HL7 standards are only protocols and not related to transport medium. Both HL7 protocol and ASTM protocol allow transfer of test data via serial port or Ethernet port.

12.3.3 Basic Concept of Unidirectional/Bidirectional LIS Communication

Unidirectional LIS communication:

The machine only sends the test result to the LIS system and receives no any instruction from the LIS system. The machine, after test, will automatically send related data to the LIS system which will then analyze the received test result.

Bidirectional LIS communication:

The machine not only sends the test data to the LIS system but also receives an instruction from the LIS system.

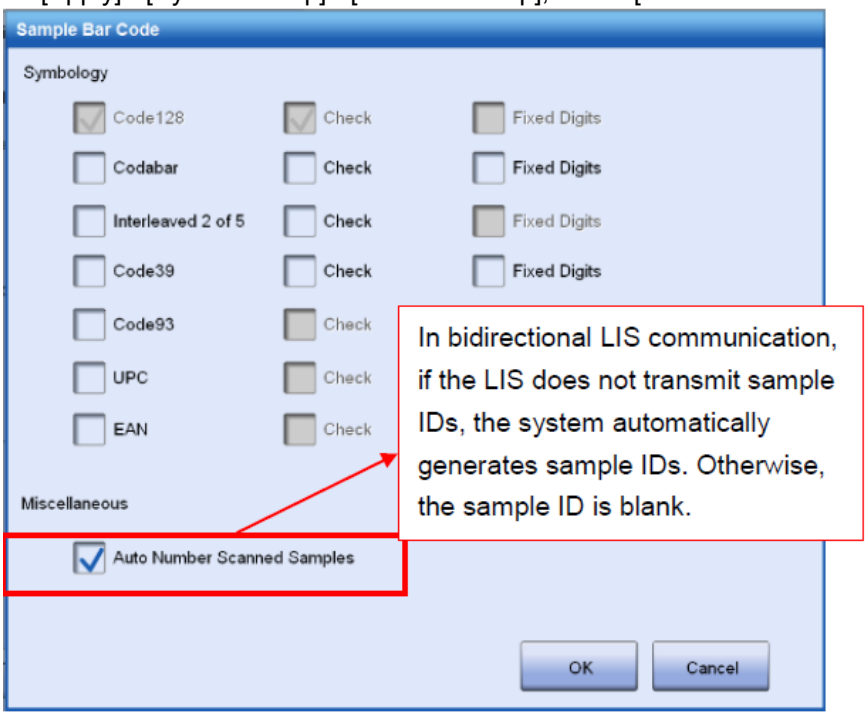
After recognizing the barcode containing sample information, the machine will send the "Inquiring sample information" instruction to the LIS system which will then retrieve the matching information about test items therefrom according to received sample information. If the information about test items are retrieved, the LIS

system shall return messages in a fixed format to the machine within the specified period of time.
The uniqueness of a sample is identified by a bar code. Once a barcode for a sample is generated, it is unique and cannot be changed.

Note: Regardless of bidirectional LIS communication or unidirectional LIS communication, the LIS shall always make response to the information sent from the machine.
The unidirectional and bidirectional LIS communications have the basically same settings on LIS Setup -> Transport Setup, with the only difference in

Bidirectional LIS setup:

1) From [Apply] - [System Setup] - [LIS Setup], select Bidirectional for the communication mode.
2) From [Apply] - [System Setup] - [Barcode Setup], select [Auto Number Scanned Samples].



12.3.4 Channel ID Setup

Purpose of channel ID (item code): A channel ID plays an important role in LIS communication. In unidirectional LIS communication, if there is a test item without setting a channel ID (item code), the result will not be sent to the LIS system. Missing of test results is often resulted from failure to set a channel ID.
When a sample shall be diluted before testing, a channel ID is divided into a general channel ID and a dilution channel ID which have the same setting method. However, a general channel ID shall not be the same as a dilution channel ID, and do not carry out the original content test and dilution test for the same specimen at the same time. The LIS system can process the general testing and dilution testing separately, but only one channel ID is active when the machine is communicating with the LIS system.
The role of a channel ID is more important in bidirectional LIS communication. Without setting a channel ID, or when the channel ID (item code) of the machine does not match that of the LIS system, when the machine identifies the sample barcode and then sends the "Inquiring sample information" instruction to the LIS system, the LIS system will not match correct information about sample items from the background according to the barcode. To correctly transfer information about sample items, use the channel ID set in the LIS system. If the LIS system sends a channel ID not set in the machine or a wrong channel ID, the machine will receive the information with an alarm and reject to process it.

Steps to set a channel ID:

1) Disconnect the LIS system before maintaining a channel ID
2) Double click the blank area after an item and input the pre-defined channel ID (it is determined by the LIS engineer).

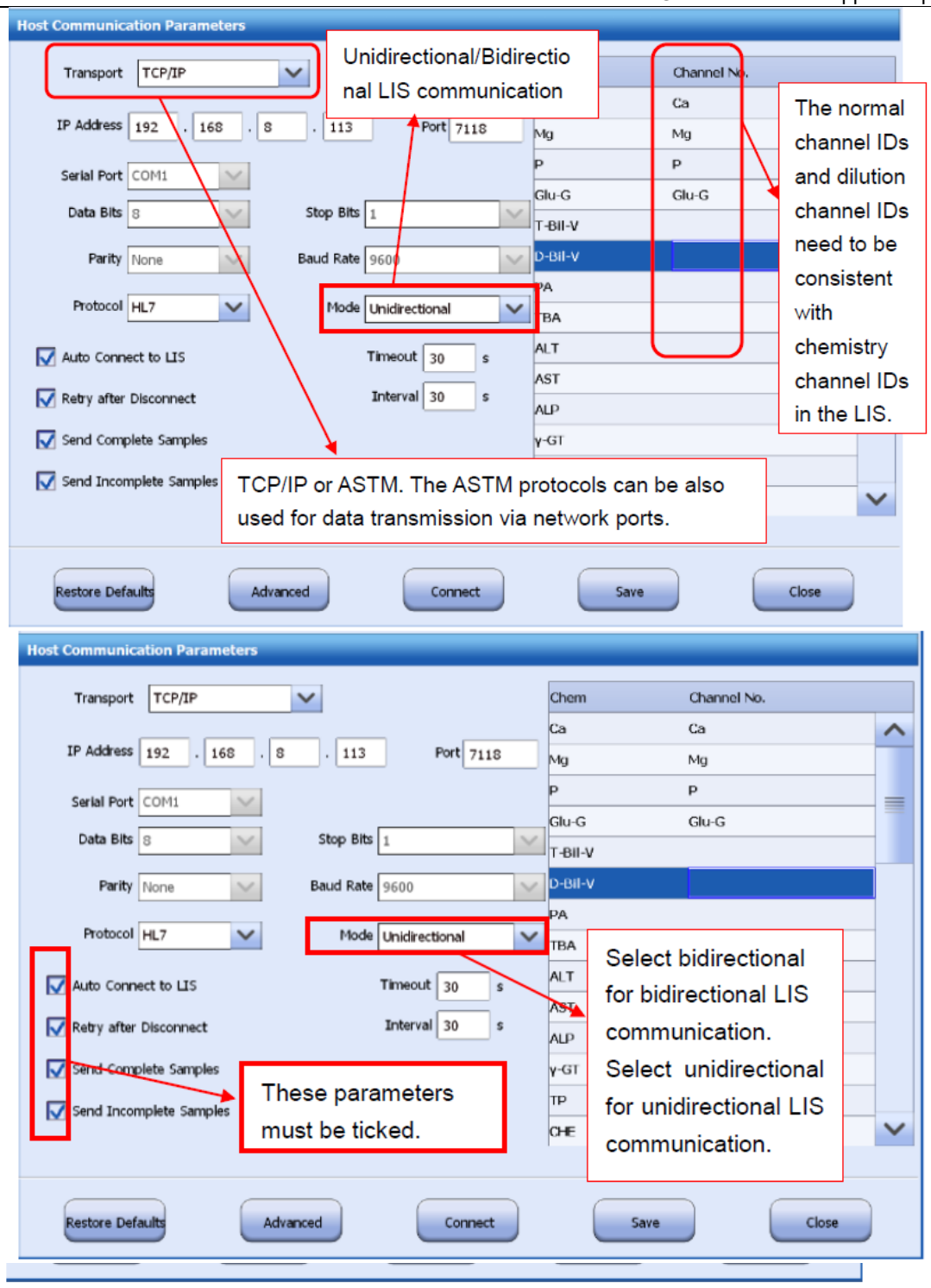


Figure 12-8 Channel ID setup

Note: In general, only the LIS system administrator has permission to set a channel ID in the LIS system. Any other persons are not authorized to edit a channel ID.
The channel ID maintained on the workstation computer shall be the same as that on the LIS system.
For example, the channel ID setup interface of the LIS system.

12.4 Operation Guidance of Test Tool

Please download the LIS test tool from the TDP platform

View Files:/Bio-chemistry/LIS/LIS Tool

Role of test tool: The tool is mainly intended for testing the LIS communication function of the machine (the capability of sending the test result after specimen testing)

The LIS communication function is one of the most basic functions of the software. Methods to process raw data may be different, depending on LIS manufacturers. When a test result is missed or part of results goes wrong during transfer, you can use a data reception tool to check the cause. If it is checked that data sent from the machine is completely consistent with that displayed in the workstation log, you can simply locate the LIS interface to address the problem with raw data. Therefore, you can simply use the test tool to find out the reason for an LIS problem. This tool mainly helps an engineer to check raw data sent from the machine.

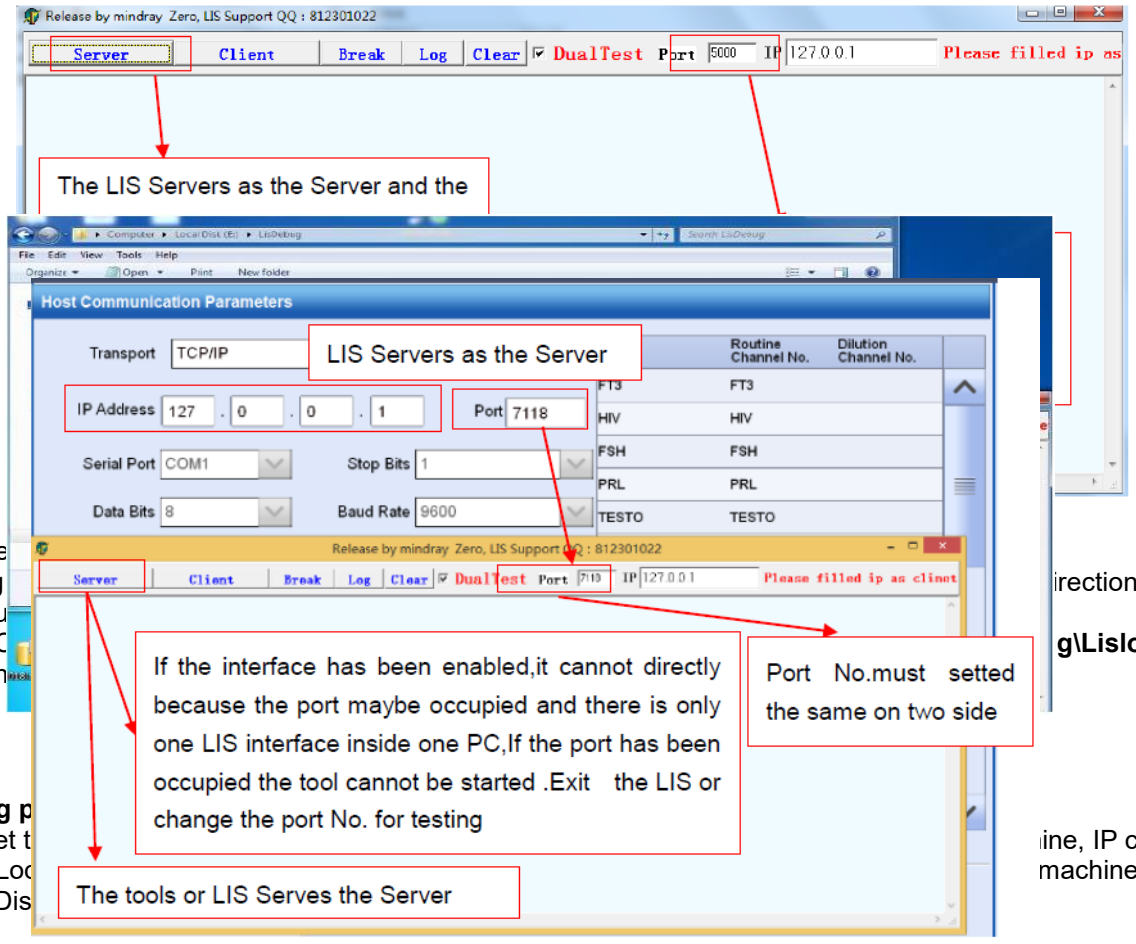
The machine and LIS system cannot be used as the client or server side at the same time. Instead, there can be the case where one is the client and the other is the server side. Note that port numbers are consistent. If the 2 conditions above are met, the basic communication conditions are established. As a client, the machine has the function to automatically connect to the LIS system.

12.4.1 Operation Procedure of Test Tool

1) Double click the "Mindray.exe" app

Note: The bi-direction test checkbox is checked by default. The server side mode is used by default.

Copy the Mindray.exe test tool to the workstation computer. Open **Mindray.exe** and exit the LIS system. Set the port number and IP address in LIS setup on the workstation computer the same as that on the test tool, and use the test tool as the client.



2) Se

Setting irectional LIS commu

Note: C g\Lislog.txt.

Click th

Setting p

IP is set t ine, IP can be set to Loc machine, IP is set to Dis

Figure 12-11 LIS tool

3) Simulating bidirectional LIS communication

When simulating bidirectional LIS communication, this tool can visualize the communication between the test tool and the machine and generate a communication log which can be used to describe how to implement bidirectional LIS communication to be used for simulation by an engineer. This can be an important guidance for LIS engineers to develop bidirectional LIS interfaces.

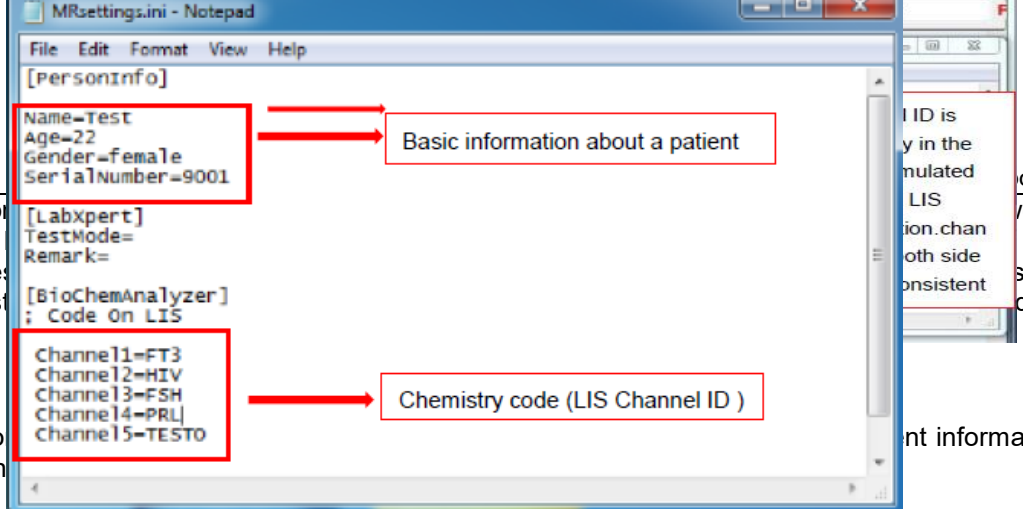


Figure 12-13 LIS channel ID

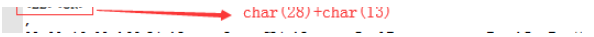
Note: By default, the Mindray.exe tool assigns default values to basic patient information during programming. A channel ID shall be manually entered in MRsettings.ini.

LIS Engineer's Need-to-Know

- Start character: char(11) Ox0B
- Carriage return character: char(13) Ox0B
- Stop character: char(13)+char(28) Ox0D+Ox1C
- ASCII (American Standard Code for Information Interchange) is a computer encoding system based on Latin alphabet and mainly used for displaying Modern English and other Western-European languages. It is now the most common single-byte coding system https://baike.baidu.com/item/编码/80092. In interactions of LIS communication information, part of codes in the ASCII chart are used as control characters. Therefore, LIS engineers shall identify the start character and stop character when developing LIS interfaces. If all conditions are met, data is valid, with the start character being single-byte char(11) Ox0B and stop character being multi-byte char(13)+char(28) Ox0D+Ox1C.

08,00:46:09:140,LinkLayer
Log: =><SB>MSH|^~\&|||||20180708004609||QRY^Q02|2487|P|2.3.1||||||ASCII|||<CR>
QRD|20180708004609|R|D|1169|||RD|120000116538|OTH|||T|<CR>
QRF||||||RCT|COR|ALL||<CR>
<EB><CR>

,



Messages in LIS communication use fixed format. Each sample message contains control characters which are invisible to the naked eye but they have to exist. The machine will convert the start character to <SB> and stop character to <EB><CR> in order to completely express received messages.

Regardless of receiving the sample application information or response message from the LIS system, the machine will always detect both the start and stop characters in the message frame. An LIS engineer shall not treat the start character and stop character as a character in the LIS interface, nor add or delete control characters.

12.5 Common Problems and Corrective Measures

12.5.1 LIS Cannot Be Connected

First, check whether the port number set on the workstation computer matches that of the LIS interface. Do not use port number 80/8080. Next, check whether the IP address of the workstation matches that of the LIS host and check that the workstation is properly connected to the LIS host.
The machine is used as the client and the LIS is used as the server side by default. The machine can be automatically connected to the LIS.

12.5.2 LIS Communication Interrupted Suddenly

- LIS sudden interruption: The "Transmission (TX)" button of the LIS is grayed out. The button is black in normal state.
- The HOST status bar flashes always. It is blue in normal state. (In the condition that the LIS interface is active)
- The machine software displays that the LIS is connected, but the "TX" button is grayed out (in the condition that the LIS interface is active)
- The machine software displays that the LIS is not connected, and the "TX" button is grayed out (in the condition that the LIS interface is active)
- The Connect icon is on and then grayed out (In the condition that the LIS interface is active)

For Mindray machines, the administrator permission is required for LIS communication to normally transmit test results and implement information interaction. Change administrator permissions as below:

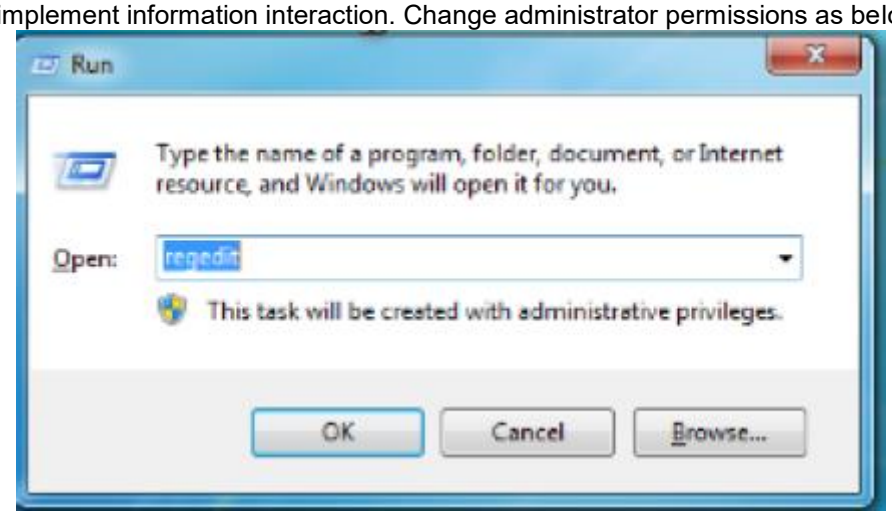


Figure 12-14 Run regedit

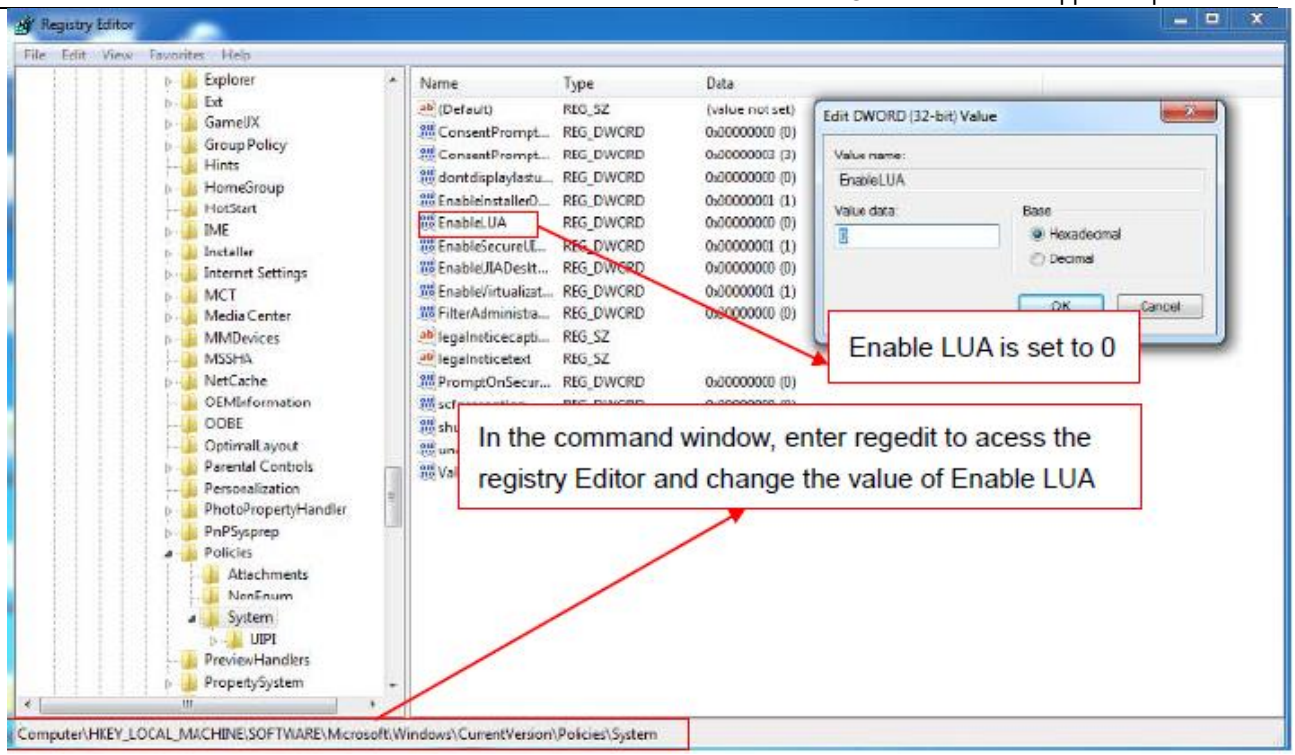


Figure 12-15 Registry

The EnableUA value is normally 0: from the Registry, change the EnableUA value to 0
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Policies\System

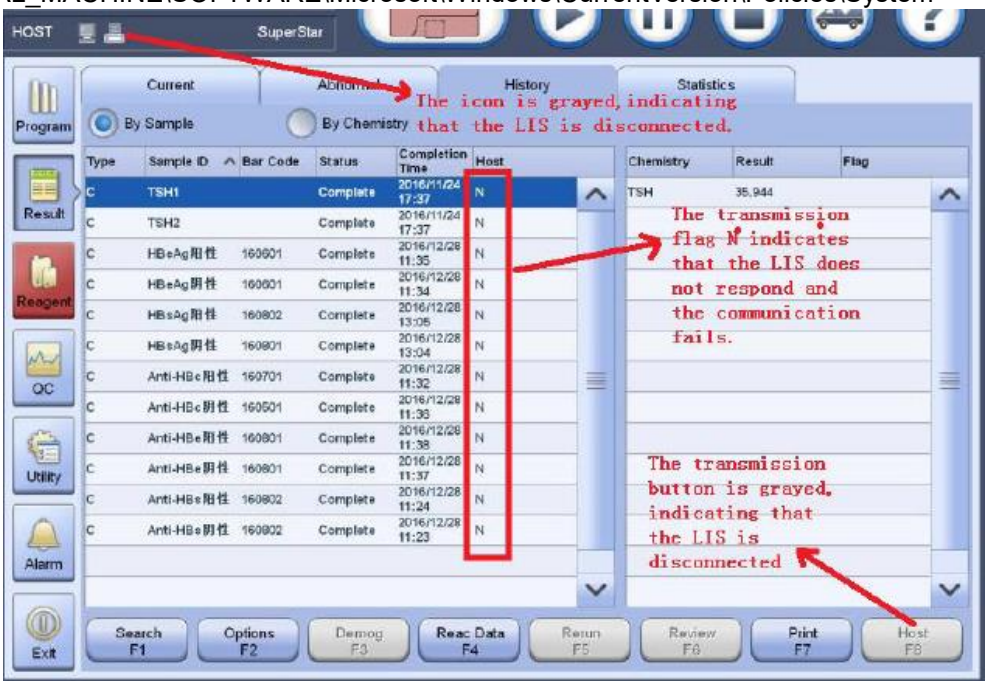


Figure 12-16 LIS state

12.5.3 Issues With Firewall

Firewall settings will also affect the LIS communication. Check the firewall settings in both the machine and LIS system sides.

Firewall policy: For the sake of security, some labs will customize some policies to allow only the port number specified by the LIS system for communication. This is wrong. Although the port number used for LIS

communication is fixed, data communication inside the machine is randomly assigned with a port number. Therefore, a port number shall not be fixed or limited to a certain range.

Windows system is a copy: Some computer systems are not an authorized edition, especially for non-authorized edition with the desktop displayed as black ground that will affect the LIS communication. In this case, please install an authorized edition and then deploy the LIS environment again.

12.5.4 Invalid LIS Response

During LIS communication, especially when transmitting test results, the workstation can continue communication only when a correct response message is received from the LIS system; otherwise, the communication is blocked.

Error C06005 Sending sample results failed

Main cause: After sending the sample results, the machine does not receive the valid ACK message from the LIS system.

The machine will identify this as sending failure.

Error C06007 Inquiring sample information failed

Main cause: The machine issues the "Inquiring sample information" instruction to the LIS system. That is, the machine scans the barcode and then sends the barcode information to the LIS system. However the LIS system fails to return the information about what is test item on the barcode in the specified period of time or correct format, and an alarm is generated. For an example of this, see below.

22,10:28:59:523,LinkLayer
Log: =><SB>MSH|^~\&|||||20190222102859||QRY^Q02|10|P|2.3.1||||||ASCII|||<CR>
QRD|20190222102859|R|D|9|||RD|1902224828|OTH|||T|<CR>
QRF||||||RCT|COR|ALL||<CR>
<EB><CR>
22,10:28:59:668,LinkLayer
Log: <=<SB>MSH|^~\&|||||20190222102859||QCK^Q02|10|P|2.3.1||||||ASCII||<CR>
MSA|AA|10|Message accepted|||0|<CR>
ERR|0|<CR>
QAK|SR|OK|<CR>
<EB><CR>
22,10:28:59:669,MSH segment field count < 19 error[Count = 18].,
22,10:28:59:669, Parse segment[1] of message error[Ret = -2147090430]. ,
22,10:28:59:669,LinkLayer Log: CLinkLayer::DealFrame create FetchRcvFrm(),

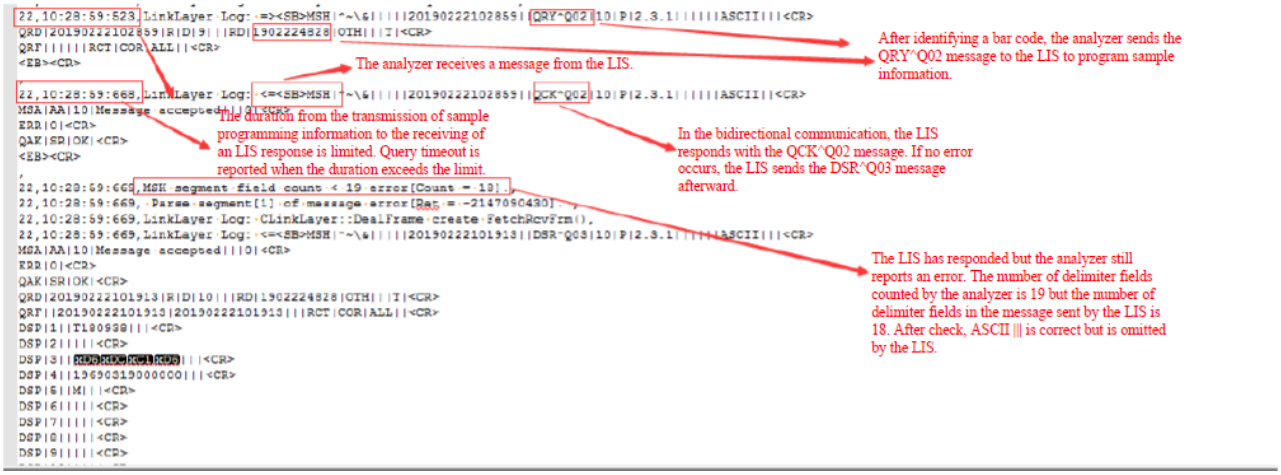


Figure 12-17 LIS code

If there is a problem with message ACK, then an error will occur when item information is transmitted to the machine later.

Figure 12-18 LIS item information

12.5.5 ISE Response Time Out

27,11:33:07:185,LinkLayer
Log: =><SB>MSH|^~\&|||||20180727113307||ORU^R01|3583|P|2.3.1||||0||ASCII|||
27,11:33:37:194,AppLayer Log: Application Layer Timeout !!!,
:
:
:
27,11:33:37:198, sending sample results failed. Sample ID/bar code: 3032, position: N0016-2,

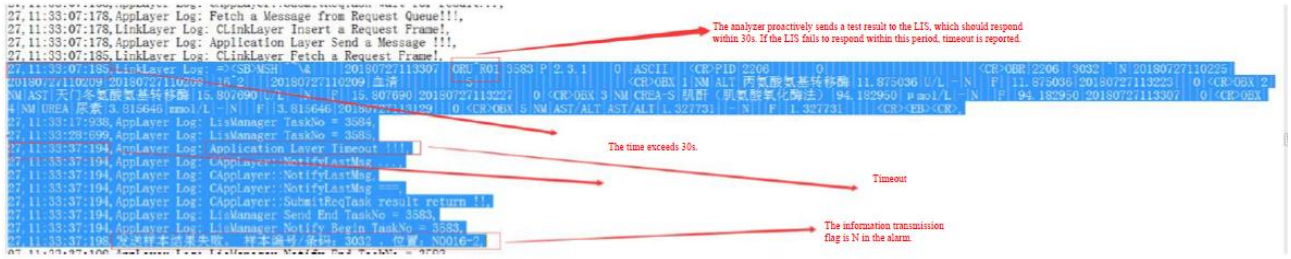


Figure 12-19 LIS sample result

When the "Sending sample results failed" error occurs, check whether a response message is developed for the LIS interface.
The response time can be set to 10 s, 20 s or 30 s in LIS setup.
When the workstation sends sample results, the LIS system shall make response. If the response is given for more than 10 s, the machine will alert response timeout. An alarm will be also generated when the response format is wrong. An LIS engineer shall pay special attention to start character, stop character and message ID when processing response messages. Message ID is a variable. Not all message IDs sent each time are 1.
<SB>MSH|^~\&|LIS-Server|NanShan
Hospital|Mindray|BS-400|20090216201111||ACK^R01|64|P|2.3.1||||0||ASCII|||<CR>
MSA|AA|64|Message accepted|||0|<CR>
<EB><CR>,
Problems with bidirectional LIS communication due to problems with channel ID

12.5.6 LIS Communication Result Slowly Transmitted

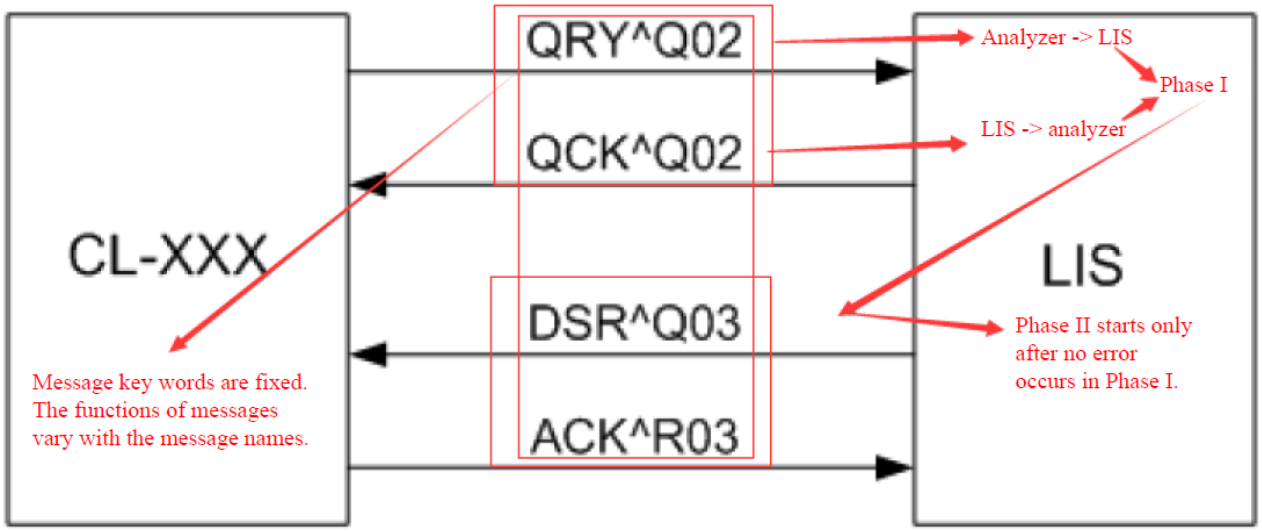
The machine has a mechanism to check response. That is, the machine will continue communication only when it receives a valid response from the LIS system after a sample result is sent out. Otherwise, it will wait for a valid response. Sending the test result from the machine to the LIS system may take a very short time. If an engineer finds that transmitting a test result takes several minutes or longer, there is a high probability that the LIS system has no response or gives wrong response.
In this case, an LIS engineer is recommended to check the response format of the LIS interface.
Note:
Message ID in a response message is a variable but not a constant. Message ID uses that given in the sample

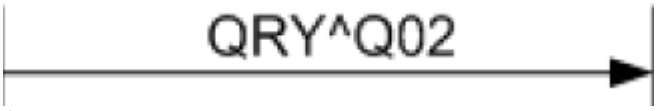
result.
Response message:
<SB>MSH|^~\&|LIS-Server|NanShan Hospital|Mindray|BS-400|20090216201111||ACK^R01|64|P|2.3.1||||0||ASCII|||<CR>
MSA|AA|64|Message accepted|||0|<CR>
<EB><CR>,

12.5.7 Part of Item Results Missed During LIS Communication

If part of item results are missed when transmission to the LIS system, check the channel ID, especially checking whether this is a calculation item.

12.6 Bidirectional LIS Communication interaction Log





11,09:57:56:467,LinkLayer Log:=>
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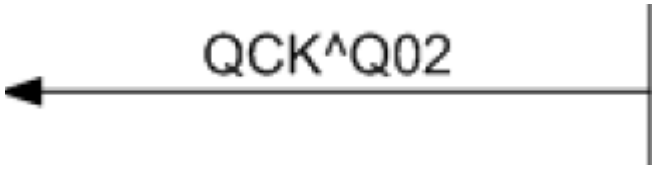
QRD|20180811095756|R|D|1|||RD|00210041808023005O|OTH|||T|<CR>
QRF||||||RCT|COR|ALL||<CR>
<EB><CR>



11,09:57:56:558,LinkLayerLog: <=<SB>MSH|^~\&|||||20180811095756||QCK^Q02|1|P|2.3.1||||||ASCII|||<CR>
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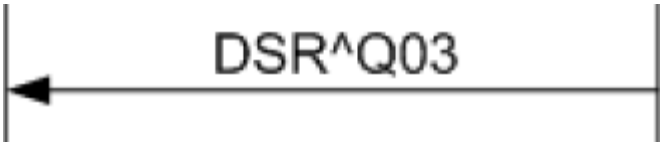
ERR|0|<CR>
QAK|SR|OK|<CR>
<EB><CR>



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ERR|0|<CR>
QAK|SR|OK|<CR>
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DSP|1|||||<CR>
DSP|2|||||<CR>
DSP|3|||||<CR>
DSP|4|||||<CR>
DSP|5|||||<CR>
DSP|6|||||<CR>
DSP|7|||||<CR>
DSP|8|||||<CR>
DSP|9|||||<CR>
DSP|10|||||<CR>
DSP|11|||||<CR>

DSP|12|||||<CR>
DSP|13|||||<CR>
DSP|14|||||<CR>
DSP|15|||||<CR>
DSP|16|||||<CR>
DSP|17|||||<CR>
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DSP|23||20180811095756|||<CR>
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DSP|25|||||<CR>
DSP|26||serum|||<CR>
DSP|27|||||<CR>
DSP|28|||||<CR>
DSP|29||2^^^|||<CR>
DSP|30||13^^^|||<CR>
DSP|31||6^^^|||<CR>
DSP|32||7^^^|||<CR>
DSP|33||8^^^|||<CR>
DSP|34||9^^^|||<CR>
DSP|35||10^^^|||<CR>
DSP|36||11^^^|||<CR>
DSP|37||12^^^|||<CR>
DSP|38||1^^^|||<CR>
DSC||<CR>
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11,09:57:56:732,LinkLayer
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ERR|0|<CR>
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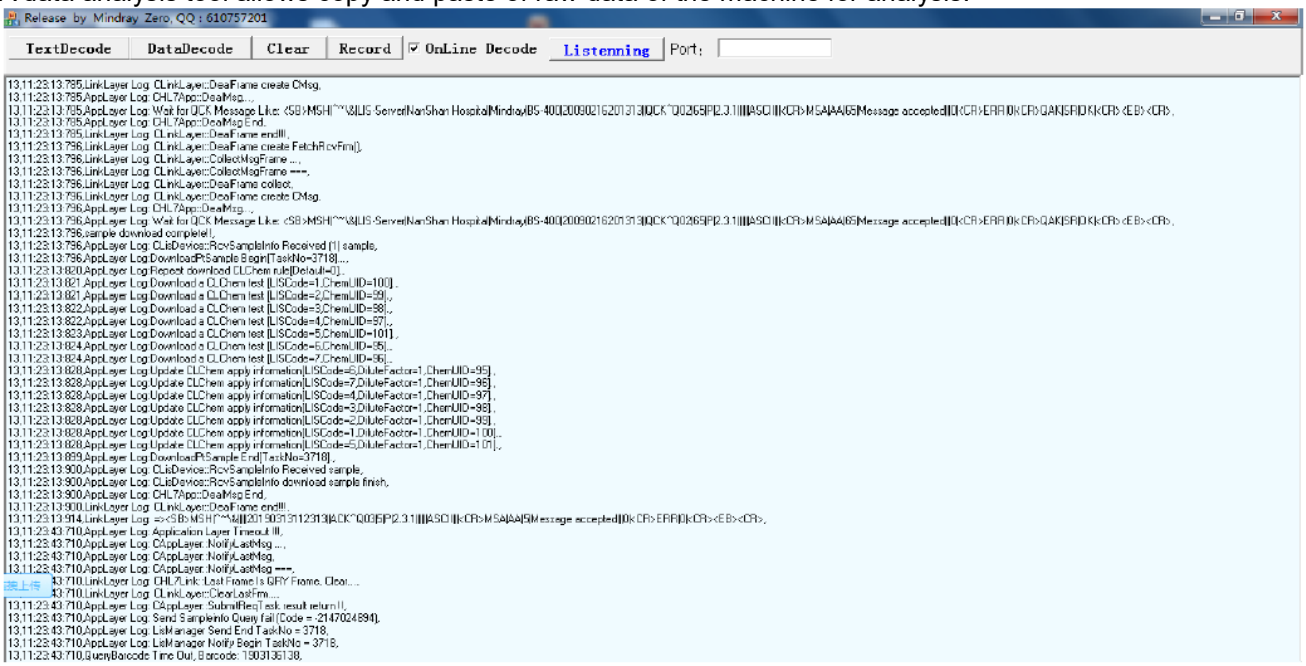
12.7 Role of Analysis Tool

A data analysis tool allows copy and paste of raw data of the machine for analysis.



08,23:03:18:947,LinkLayer
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OBR|1472||9015|^|N|20180708224731|20180708224703|20180708224703||1^1|||||20180708224703|serum|||
|||||||5|||||||||||||||||||||<CR>
OBX|1|NM|4|calcium|2.252133|mmol/L|-|N|||F||2.252133|20180708225609|||0|<CR>
OBX|2|NM|5|magnesium|0.569389|mmol/L|-|N|||F||0.569389|20180708225829|||0|<CR>
OBX|3|NM|6|inorganic phosphorus|1.578690|mmol/L|-|N|||F||1.578690|20180708230304|||0|<CR>
OBX|4|NM|10|total bilirubin (vanadate oxidation method)|8.779144|μmol/L|-
|N|||F||8.779144|20180708230315|||0|<CR>
OBX|5|NM|11|direct bilirubin (vanadate oxidation method)|3.441980|μmol/L|-
|N|||F||3.441980|20180708230318|||0|<CR>
OBX|6|NM|16|adenosine deaminase|7.739112|U/L|-|N|||F||7.739112|20180708230311|||0|<CR>
OBX|7|NM|17|prealbumin|230.296762|mg/L|-|N|||F||230.296762|20180708230300|||0|<CR>
OBX|8|NM|18|total bile acid|1.787443|μmol/L|-|N|||F||1.787443|20180708230130|||0|<CR>
OBX|9|NM|19|alanine aminotransferase|19.820950|U/L|-|N|||F||19.820950|20180708230134|||0|<CR>
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OBX|11|NM|21|alkaline phosphatase|130.115058|U/L|-|N|||F||130.115058|20180708230130|||0|<CR>
OBX|12|NM|22|γ-glutamyltransferase|67.893341|U/L|-|N|||F||67.893341|20180708230134|||0|<CR>
OBX|13|NM|23|lipoprotein (a)|71.263917|mg/L|-|N|||F||71.263917|20180708230217|||0|<CR>
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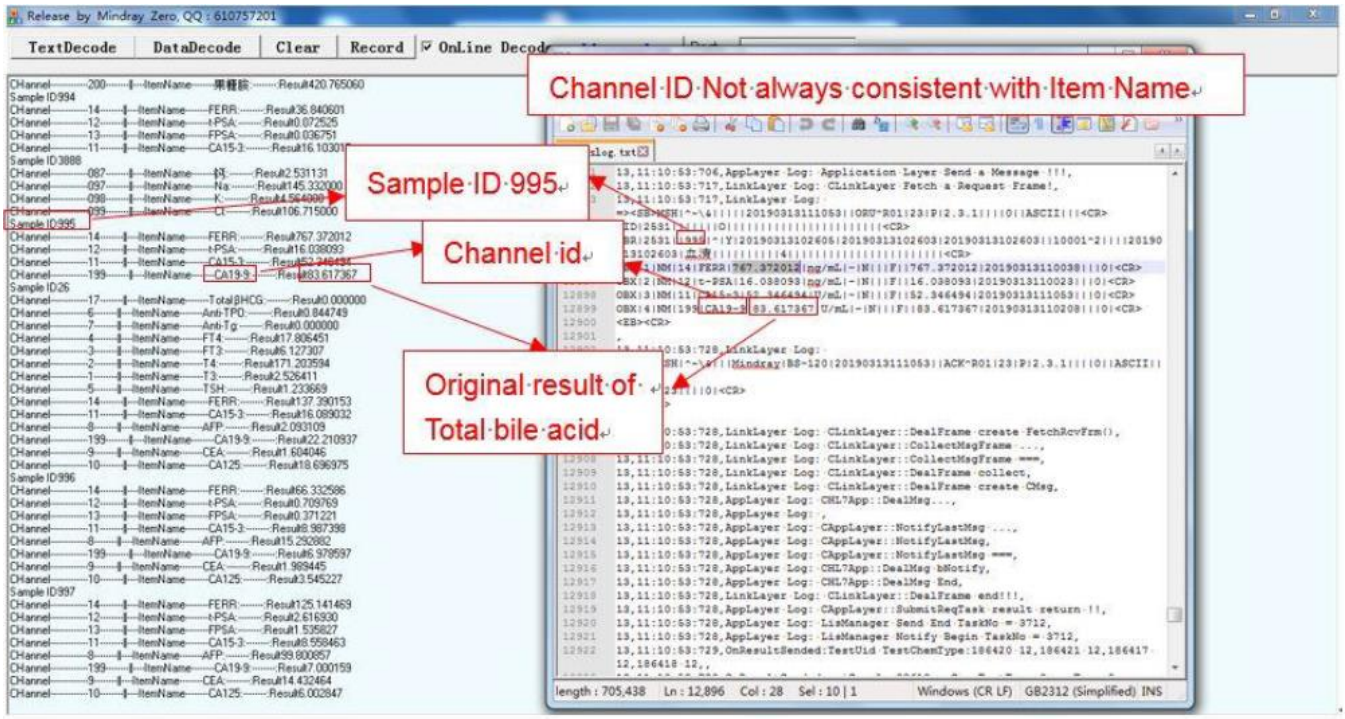
OBX|17|NM|27|lipase|10.279494|U/L|-|N|||F||10.279494|20180708230130|||0|<CR>
OBX|18|NM|28|α-amylase|63.568402|U/L|-|N|||F||63.568402|20180708230039|||0|<CR>
OBX|19|NM|29|apolipoprotein A1|1.740667|g/L|-|N|||F||1.740667|20180708230217|||0|<CR>
OBX|20|NM|30|apolipoprotein B|1.241503|g/L|-|N|||F||1.241503|20180708230231|||0|<CR>
OBX|21|NM|31|triglyceride|5.302102|mmol/L|-|N|||F||5.302102|20180708230235|||0|<CR>
OBX|22|NM|33|low density lipoprotein cholesterin|2.838998|mmol/L|-
|N|||F||2.838998|20180708230231|||0|<CR>
OBX|23|NM|34|high density lipoprotein cholesterin|1.156541|mmol/L|-
|N|||F||1.156541|20180708230235|||0|<CR>
OBX|24|NM|35|total cholesterol|5.675223|mmol/L|-|N|||F||5.675223|20180708225732|||0|<CR>
OBX|25|NM|36|creatinine (sarcosine oxidase method)|61.837352|μmol/L|-
|N|||F||61.837352|20180708230239|||0|<CR>
OBX|26|NM|38|uric acid|436.774956|μmol/L|-|N|||F||436.774956|20180708230242|||0|<CR>

OBX|27|NM|40|cystatin C|1.232627|mg/L|-|N|||F||1.232627|20180708230246|||0|<CR>
OBX|28|NM|41|urea|3.750785|mmol/L|-|N|||F||3.750785|20180708230116|||0|<CR>
OBX|29|NM|43|creatine kinase MB isoenzyme|32.245208|U/L|-|N|||F||32.245208|20180708230242|||0|<CR>
OBX|30|NM|44|creatine kinase|62.994467|U/L|-|N|||F||62.994467|20180708230249|||0|<CR>
OBX|31|NM|45|lactic dehydrogenase |324.101538|U/L|-|N|||F||324.101538|20180708230217|||0|<CR>
OBX|32|NM|46|α-hydroxybutyrate dehydrogenase|243.997631|U/L|-|N|||F||243.997631|20180708230213|||0|<CR>
OBX|33|NM|58|C reactive protein|36.545503|mg/L|-|N|||F||36.545503|20180708230257|||0|<CR>
OBX|34|NM|61|β2-microglobulin|2.708314|mg/L|-|N|||F||2.708314|20180708230300|||0|<CR>
OBX|35|NM|62|α-L-fucosidase |53.824504|U/L|-|N|||F||53.824504|20180708230123|||0|<CR>
OBX|36|NM|63|Fe|10.033768|μmol/L|-|N|||F||10.033768|20180708230257|||0|<CR>
OBX|37|NM|65|homocysteine (enzymatic cycling methods)|13.780098|μmol/L|-|N|||F||13.780098|20180708230304|||0|<CR>
OBX|38|NM|1|Na|136.355000|mmol/L|-|N|||F||136.355000|20180708225006|||0|<CR>
OBX|39|NM|2|K|4.220000|mmol/L|-|N|||F||4.220000|20180708225006|||0|<CR>
OBX|40|NM|3|Cl|101.729000|mmol/L|-|N|||F||101.729000|20180708225006|||0|<CR>
OBX|41|NM|135|Glo|19.400000|g/L|-|N|||F||19.400000|||||<CR>
OBX|42|NM|136|A/G|1.515464||-|N|||F||1.515464|||||<CR>
OBX|43|NM|137|AST/ALT|1.972250||-|N|||F||1.972250|||||<CR>
OBX|44|NM|138|IBIL-V|5.340000|μmol/L|-|N|||F||5.340000|||||<CR>
<EB><CR>



This tool can display how the LIS interface process raw data from the machine and how the raw data from the machine is analyzed and extracted, and generates a log in a specified format

```
CHannel-------------4--------||----ItemName--------FT4:--------:Result10.255664
CHannel-------------3--------||----ItemName--------FT3:--------:Result5.025971
CHannel-------------2--------||----ItemName--------T4:--------:Result78.267857
CHannel-------------1--------||----ItemName--------T3:--------:Result1.225975
CHannel-------------5--------||----ItemName--------TSH:--------:Result1.125121
Sample ID
CHannel-------------8--------||----ItemName--------AFP:--------:Result2.841179
CHannel-------------9--------||----ItemName--------CEA:--------:Result1.823549
CHannel-------------10--------||----ItemName--------CA125:--------:Result15.061476
Sample ID9987
CHannel-------------17--------||----ItemName--------Total βHCG:--------:Result3.099655
CHannel-------------14--------||----ItemName--------FERR:--------:Result16.586064
CHannel-------------11--------||----ItemName--------CA15-3:--------:Result4.495621
CHannel-------------8--------||----ItemName--------AFP:--------:Result2.632388
CHannel-------------199--------||----ItemName--------CA19-9:--------:Result30.721326
CHannel-------------9--------||----ItemName--------CEA:--------:Result13.529757
CHannel-------------10--------||----ItemName--------CA125:--------:Result14.327042
Sample ID4
CHannel-------------6--------||----ItemName--------Anti-TPO:--------:Result0.296162
CHannel-------------7--------||----ItemName--------Anti-Tg:--------:Result0.138800
CHannel-------------4--------||----ItemName--------FT4:--------:Result17.255520
CHannel-------------3--------||----ItemName--------FT3:--------:Result4.424873
CHannel-------------2--------||----ItemName--------T4:--------:Result150.711796
CHannel-------------1--------||----ItemName--------T3:--------:Result1.040784
CHannel-------------5--------||----ItemName--------TSH:--------:Result0.724696
Sample ID9987
CHannel-------------097--------||----ItemName--------Na:--------:Result143.411000
CHannel-------------098--------||----ItemName--------K:--------:Result4.087000
Sample ID5
CHannel-------------6--------||----ItemName--------Anti-TPO:--------:Result1.087935
CHannel-------------7--------||----ItemName--------Anti-Tg:--------:Result0.091842
CHannel-------------4--------||----ItemName--------FT4:--------:Result10.097226
CHannel-------------3--------||----ItemName--------FT3:--------:Result4.315436
CHannel-------------2--------||----ItemName--------T4:--------:Result92.305991
CHannel-------------1--------||----ItemName--------T3:--------:Result1.421357
CHannel-------------5--------||----ItemName--------TSH:--------:Result1.319109
Sample ID8
```

Sample ID 9015
Channel ID -------------4--------|| item name --------calcium:--------:result 2.252133
Channel ID -------------5--------|| item name --------magnesium:--------:result 0.569389
Channel ID -------------6--------|| item name --------inorganic phosphorus:--------:result 1.578690
Channel ID-------------10--------||item name--------total bilirubin (vanadate oxidation method):--------:result 8.779144
Channel ID-------------11--------||item name--------direct bilirubin (vanadate oxidation method):--------:result 3.441980
Channel ID -------------16--------|| item name --------adenosine deaminase:--------:result 7.739112
Channel ID -------------17--------|| item name --------prealbumin:--------:result 230.296762
Channel ID -------------18--------|| item name --------total bile acid:--------:result 1.787443
Channel ID -------------19--------|| item name --------alanine aminotransferase:--------:result 19.820950
Channel ID -------------20--------|| item name --------aspartate amino transferase:--------:result 39.088345
Channel ID -------------21--------|| item name --------alkaline phosphatase:--------:result 130.115058
Channel ID -------------22--------|| item name --------γ-glutamyltransferase:--------:result 67.893341
Channel ID -------------23--------|| item name --------lipoprotein (a):--------:result 71.263917
Channel ID -------------24--------|| item name --------total protein:--------:result 48.843538
Channel ID -------------25--------|| item name --------cholinesterase:--------:result 4114.479156
Channel ID -------------26--------|| item name --------albumin:--------:result 29.379028
Channel ID -------------27--------|| item name --------lipase:--------:result 10.279494
Channel ID -------------28--------|| item name --------α-amylase:--------:result 63.568402
Channel ID -------------29--------|| item name --------apolipoprotein A1:--------:result 1.740667
Channel ID -------------30--------|| item name --------apolipoprotein B:--------:result 1.241503
Channel ID -------------31--------|| item name --------triglyceride:--------:result 5.302102
Channel ID -------------33--------|| item name --------low density lipoprotein cholesterin:--------:result 2.838998
Channel ID -------------34--------|| item name --------high density lipoprotein cholesterin:--------:result 1.156541
Channel ID -------------35--------|| item name --------total cholesterol:--------:result 5.675223
Channel ID -------------36--------|| item name --------creatinine (sarcosine oxidase method):--------:result

61.837352
Channel ID ----------38--------|| item name --------uric acid:--------:result 436.774956
Channel ID ----------40--------|| item name --------cystatin C:--------:result 1.232627
Channel ID ----------41--------|| item name --------urea:--------:result 3.750785
Channel ID ----------43--------|| item name --------creatine kinase MB isoenzyme:--------:result 32.245208
Channel ID ----------44--------|| item name --------creatine kinase:--------:result 62.994467
Channel ID ----------45--------|| item name --------lactic dehydrogenase:--------:result 324.101538
Channel ID ----------46--------|| item name --------α-hydroxybutyrate dehydrogenase:--------:result 243.997631
Channel ID ----------58--------|| item name --------C-reactive protein:--------:result 36.545503
Channel ID ----------61--------|| item name --------β2-microglobulin:--------:result 2.708314
Channel ID ----------62--------|| item name --------α-L-fucosidase:--------:result 53.824504
Channel ID ----------63--------|| item name --------Fe:--------:result 10.033768
Channel ID----------65--------||item name--------homocysteine (enzymatic cycling methods):--------:result 13.780098
Channel ID ----------1--------|| item name --------Na:--------:result 136.355000
Channel ID ----------2--------|| item name --------K:--------:result 4.220000
Channel ID ----------3--------|| item name --------Cl:--------:result 101.729000
Channel ID ----------135--------|| item name --------Glo:--------:result 19.400000
Channel ID ----------136--------|| item name --------A/G:--------:result 1.515464
Channel ID ----------137--------|| item name --------AST/ALT:--------:result 1.972250
Channel ID ----------138--------|| item name --------IBIL-V:--------:result 5.340000

13 Emptying and Relocation

13.1 Overview

When the machine is shut down or needs to be moved to another working environment, it needs to be handled as follows.

13.1.1 Short-term Shutdown

If the machine is shut down for a short term (within three days), the following actions needs to be performed on it:

1) On the software, execute the tube empty process.

2) Empty Main Units.
3) Remove all the reagent and detergent on the machine.
4) If the ISE module is configured, select Empty ISE Tube to empty the ISE tubes according to the software prompts. Remove the ISE electrodes and inject proper amount of Calibrator A into the Na, K and Cl electrodes with a pipettor, and use tape to seal the electrodes before storing them. As regards the reference electrode, insert a soft tube into it.
5) Exit the operating software, shut down the computer and power off the analyzer.
6) If the analyzer is to be stored in another place, disconnect the data cables and power cords among the analyzing unit, computer, monitor, and disconnect the tubes at the back of the analyzer.

13.1.2 Long-term Shutdown

If the machine is shut down for a long term (more than days or even several years), the following actions needs to be performed on it:

- On the software, execute the tube empty process. Refer to ***13.2Empty Main Units***
- Remove all the reagent and detergent on the machine.
- If the ISE module is configured, select Empty ISE Tube to empty the ISE tubes according to the software prompts. Remove the ISE electrodes and inject proper amount of Calibrator A into the Na, K and Cl electrodes with a pipettor, and use tape to seal the electrodes before storing them. As regards the reference electrode, insert a soft tube into it.
- Exit the operating software, turn off the computer and also the analyzing unit.
- Pack the machine according to the packing procedure.

13.1.3 Relocation

In the daily business of clinical laboratory department, the following situations may be encountered, in which the machine needs to be relocated.

Relocation outside a lab

- The department is moved with the hospital or the machine is relocated to the branch hospital:
- The machine is donated to the lower clinics for use.

Relocation within a lab

1) It is applicable to the renovation of the department. In this case, the machine should be relocated to the temporary department before the renovation.
2) It is applicable to transfer between labs, for example, changing to a new lab, a new building.

Purpose of the relocation: Relocation may affect the normal operation and even the performance of the machine. The purpose of relocation is to ensure compliance of performance with service requirements through subsequent debugging and verification of an engineer after the relocation.

Relocation procedure:

1) On the software, execute the tube empty process. Refer to ***13.2 Empty Main Units***.
2) Remove all the reagent and detergent on the machine.
3) Exit the operating software, turn off the computer and also the analyzing unit.
4) Pack the machine according to the packing procedure.
5) Transport to the destination.
6) Reinstall it according to the installation procedure.

13.2 Empty Main Units

13.2.1 Preparation:

Procedure:

- Empty the ISE tubes (optional);
- Empty the wash solution tube;
- Empty DI Water Tube;
- Empty Interior Wash Tube;
- Empty auto wash tube;
- Empty waste tubing;
- Check Parameter for "Is Fluidic Prime Finished".
- Empty water supply module (optional);

Units of Fluidic Tubes

Select Utility -> Maintenance -> Alignment -> Empty Fluidic Tubes:

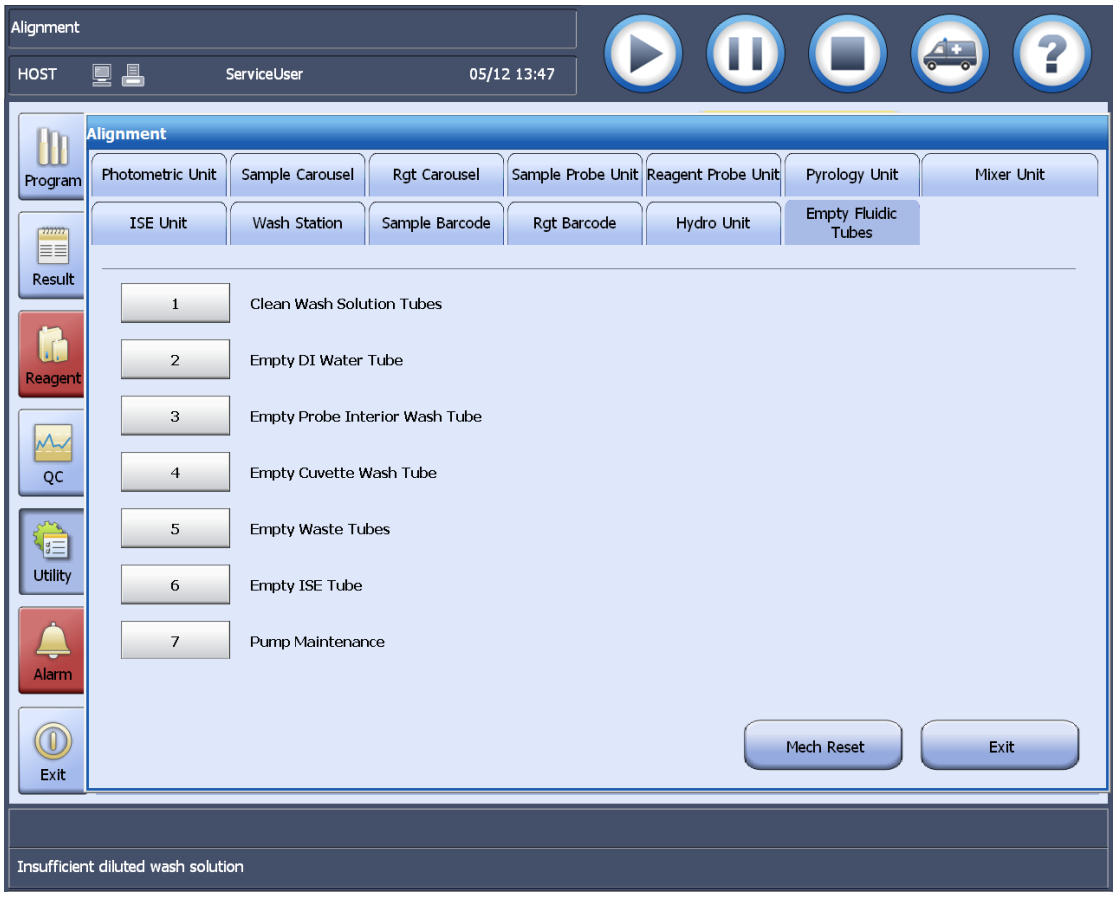


Figure 13-1 Empty Fluidic Tubes

13.2.2 Empty the ISE tubes (ISE Module Configured)

Emptying indicator:

1) After emptying ISE tubes, no water flows from the connected ISE reagent pack;
2) All electrodes have been removed, and also the pump tubes.

Emptying methods and steps:

- Prepare a pipettor, click Empty ISE Tube as shown in the picture below;
- Use the pipettor to aspirate 200μl of calibrator A from the sample injection port for future use.
- Place sufficient ISE wash solution in the D1# position of the sample carousel; click Continue to execute the wash instruction and wait until the wash process is complete, and then click Continue.

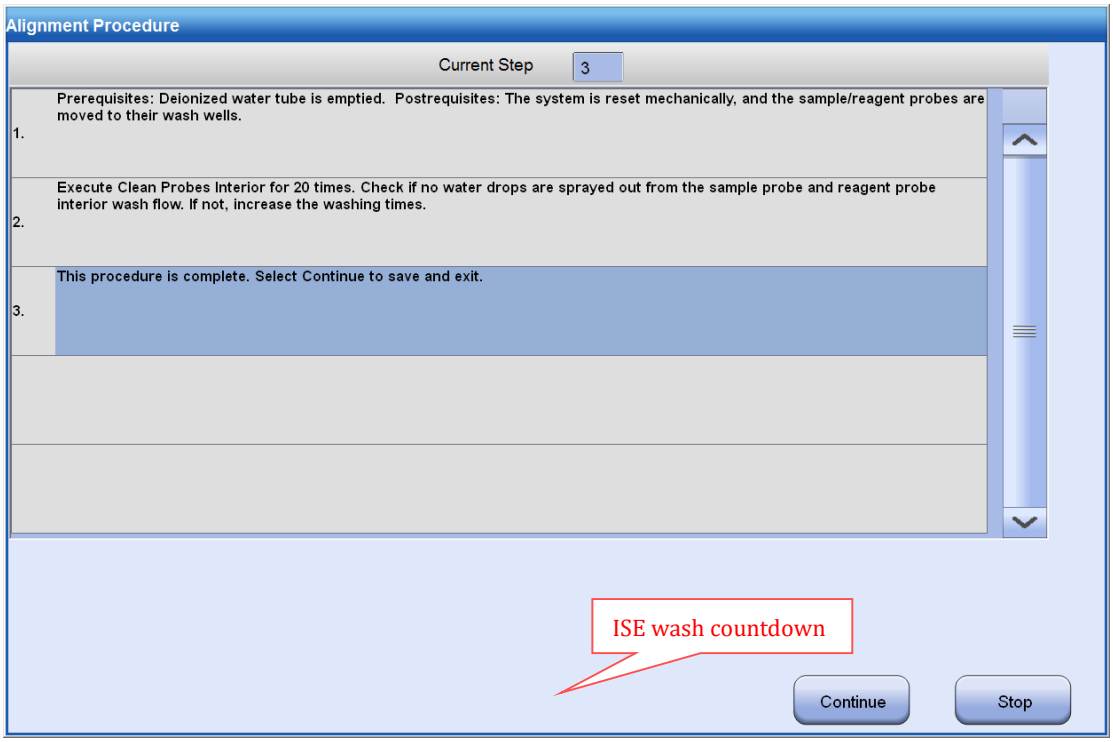


Figure 13-2 Empty ISE Tube

- Remove all electrodes except the reference electrode. Inject the aspirated calibrator A into electrodes K+, Cl- and Na+, and use adhesive tape to seal the two ends of the electrodes;
- Install 4 spacers, use an emptying device to connect the A/B ports on the wand to deionized water, and then execute Purge A/B for 40 times in a cycle manner.
- Disconnect deionized water from A/B ports and continue with the priming.

Note: Number of priming operations can be set according to emptying requirements until all residual deionized water in the A and B tubes are removed and no fluid flows out from the waste outlet.

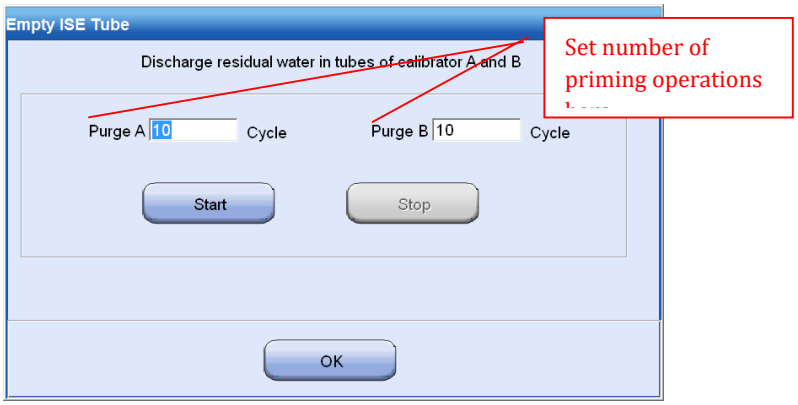


Figure 13-3 operations of emptying calibrator A and B

- Remove all electrodes; remove the emptying device; place the wand in the reagent pack; remove the pump tube on the peristaltic pump; install the shielding box door, and tighten the screws on the shielding box..

Figure 13-4Installing Peristaltic Pump Tube

13.2.3 Empty the wash solution tubes (Medica ISE module configured)

Emptying indicator:

1) Dilute cleaning agent bottle is cleaned, no water flows out of the dilution line;
2) The cuvette is cleaned, no residual water;
3) Check the waste liquid outlet, there should be no red waste liquid flowing out.

Prerequisites:

The machine can work normally.

Emptying methods and steps:

1) As shown in Figure 13-2, enter the "Empty Wash Solution Tubes" process interface;
2) Follow the instructions on the software interface: Disconnect the water inlet tube and check if the waste tube has been connected to the waste tank. Check that P03 pump and preheating assembly are turned off.
3) After the operation is completed, click "Continue" to advance to the next step.
4) Follow the software prompts to complete the operation: Manually remove the diluted wash solution bottle, empty and clean it, fill it half with deionized water, and then restore it to the original level.
5) After following the prompts on the interface, there is no visible detergent foam in the cleaned bottle, and then click "Continue", a dialog box like the left pops up, click "Start" on the dialog box, the machine starts the cleaning agent pipeline and cuvette in the cleaning process, check the waste liquid outlet during the cleaning process. Visually observe that there should be no red waste liquid remaining. After cleaning, click "OK" to enter the next step.
6) If there is still red waste liquid in the waste liquid port until the end of cleaning, set the number of cleaning times and re-clean.
7) After cleaning is completed, click "Continue" to save and exit this step of debugging.

13.1.1 Empty ISE tube (Caretium ISE module configured)

Drainage indicator:

1) After emptying the ISE tubes, there is no liquid in them.
2) The reagent pack has been removed, all electrodes removed, and the peristaltic pump tubes removed.

Emptying method and procedure:

- For dispensing , please perform Clean ISE Tubes and Clean ISE SIC (Sample Injection Port).

- After cleaning, select Replace Tube. If only ISE tubes need to be emptied, do not replace them. Make sure the reagent pack is on board. If the whole tube is not emptied after one tube replacement, repeat Replace Tube.
- After emptying, remove the reagent pack, electrodes and pump tubes.

13.2.4 Empty DI Water Tube

Emptying indicator:

- No water flows out of DI Water Tubes;
- No visible spout in 8-phase wash probes assembly;

Prerequisites:

Circulating washing and emptying the reaction cuvettes.

Emptying methods and steps:

a) As shown in Figure 13-2, enter the "Empty DI Water " process interface;

b) Place the water reflux tube and water inlet tube of water tank in a clean empty container with their ends connected with the air.

c) After confirming that the prerequisites have been met, then follow the prompts on the interface, click "Continue", a dialog box pops up, after confirming that the contents of the dialog box are consistent with the real thing, click "OK", wait for 2 minutes, after the water runs out of the exterior wash tubes, the software will enter the next step.

d) Remove 8-phase wash probes assembly and place it in a clean container.

e) Unplug water inlet tube of the fluidic outlet assembly.

f) Follow the prompts on the interface, click "Continue", a dialog box pops up, after confirming that the contents of the dialog box are consistent with the real thing, click "OK" to enter the next step.

g) Follow the prompts on the interface, click "Continue", a dialog box pops up, after confirming that the contents of the dialog box are consistent with the real thing, click "OK" to enter the next step.

h) Open SV16/SV17/SV19/SV18 respectively, blow the residual water in the tubes; if no water drops are observed to be sprayed out from inlet and outlet tubes of the valves, the emptying is finished.

i) Click "Continue", a dialog box pops up, then follow the prompts on the interface, after confirming no water droplets are sprayed out of the 3~6 phase probe mouth, turn off the solenoid valve, click "Exit" to enter the next step.

j) Follow the prompts on the interface, click "Continue", a dialog box pops up, after confirming that the contents of the dialog box are consistent with the real thing, click "OK" to enter the next step.

   1) Reassemble the 8-phase wash probes assembly on wash station;

   2) Place the water tank in its original position, and place the water inlet tube and water reflux tube into the water tank.

   3) Check whether there's residual water in the diluted bottle.

k) After cleaning is completed, click "Continue" to save and exit this step of debugging.

13.2.5 Empty Interior Wash Tube

Emptying indicator:

After executing the emptying process of interior wash tube, no water droplets are sprayed out of the sample probe and reagent probes.

Prerequisites:

Empty DI Water Tube;

Emptying methods and steps:

1) As shown in Figure 13-2, enter the "Empty Wash Solution Tubes" process interface;
2) After confirming that the prerequisites have been met, click “Continue” to check that the sample probe and reagent probe have been moved above the wash tank.
3) Execute probe interior wash and priming. Check whether water drops are sprayed out from the sample probe interior wall.
4) Click "Continue", a dialog box pops up, click “Start”, after observing no water droplets are sprayed from the probes, click “Stop”, then click “OK” to enter the next step.
5) Click "Continue" to save and exit this step of debugging.

13.2.6 Empty Auto Wash Tubes

Emptying indicator:

After executing the emptying process of auto wash tube, no water droplets are sprayed out of the 1-2 phase auto wash tube.

Prerequisites:

Empty DI Water Tube;

Emptying methods and steps:

- As shown in Figure 13-2, enter the "Empty Auto wash tube " process interface;
- Follow the prompts on the interface, click "Continue", a dialog box pops up, after confirming that the contents of the dialog box are consistent with the real thing, click "OK” to enter the next step.
- Remove 8-phase wash probes assembly and place it in a clean container.

Note: Do not place the container with the eight-phase needle on the reaction plate, and keep it away from the moving parts to avoid collision.

- Clean the diluted wash solution bottle, and putting it in the original position after emptying.
- Click "Continue", a dialog box pops up, execute the "Automatic Cleaning and Pouring" instruction 30 times. Click "Start" until no water droplets are ejected from the automatic cleaning needle 1st and 2nd phase, then click "Stop" and click "OK" to enter the next step, otherwise increase the times of perfusion and empty again.

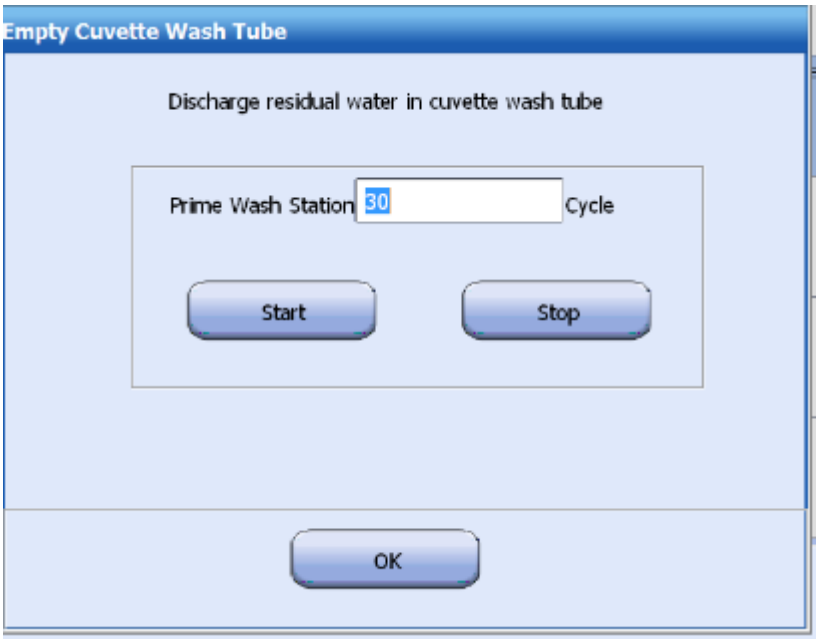


Figure13-5 The Debugging Interface for “Empty Auto Wash Tubes”

- Click "Continue", a dialog box pops up, confirm that the Eight-phase probe assembly is reassembled on the wash station, click "OK" to enter the next step.
- Click "Continue" to save and exit this step of debugging.

13.2.7 Empty Waste Tube

Emptying indicator:

1) No water flows out from low-concentration waste connector of the fluidic outlet assembly.
2) Wipe the water droplets in the reagent chamber and sample carousel**.**

Prerequisites:

Circulating washing and emptying the reaction cuvettes.

Emptying methods and steps:

- Enter the "Empty Waste Tube " process interface;
- After confirming that the prerequisites have been met, block the outlets for low concentration liquid wastes with plugs at the back of the machine, so as to ensure no waste flows out from the waste tank. Follow the prompts on the interface, click "Continue", a dialog box pops up, after confirming that the contents of the dialog box are consistent with the real thing, click "OK", a dialog box like this pops up.
- Click "Start", after observing no water flows out of the waste tubes at the back of the machine, click "Stop" and click "OK" to enter the next step.
- Following the prompts on the interface, spray high-pressure air on all the exterior wash wells. When spraying a wash well with the air blow gun, block all the other wash wells with plugs. Click "Continue" to proceed to the next step.
- Click Continue to proceed to the next step.

1) After the machine is powered off, remove the reagent carousel and use the rag to wipe clean the condensate water in the reagent chamber and then reinstall the reagent carousel;
2) After the machine is powered off, remove the sample carousel and use the rag to wipe clean the scattered sample in the sample pot and then reinstall the sample carousel;

- Following the prompts on the interface, remove the tubes from the waste liquid outlet, and block the outlets for low/high concentration liquid wastes with plugs. Click "Continue" to proceed to the next step.
- Click "Continue" , save the operations and exit the debugging process.

13.2.8 Check the Parameter for "Is Fluidic Prime Finished"

Proceed to "Parameter configuration and search" interface, select "Cuvette Wash Station", find the parameter for "Is Fluidic Prime Finished" and check whether the parameter is "0". If not, change the parameter into "0", then click "Search" to check whether the parameter is successfully configured.

13.2.9 Empty water supply module (optional)

Invert the water supply module, turn off ball valve, and connect the water outlet and inlet to deionized water tank, turn on the power switch till there's no water flowing out.

14 Optional Modules

14.1 Overview

Optional modules include ISE module and barcode scanning module.
When a client needs the features above, carry out upgrade, installation and debugging procedure as described in the following section to ensure that modules function well.

14.2 Upgrade of ISE Module

14.2.1 Overview of ISE Module

Please refer to***3.8 ISE Unit (Configured*** with Medica ISE Module).
Upgrade of the ISE module requires ISE service pack 115-031788-00 and ISE accessory pack (with package) 115-003320-00

14.2.2 Installation of ISE Module

Taking off Panels

1) Turn of the mains power switch and take off the right top panel, left panel, right panel and rear panel;

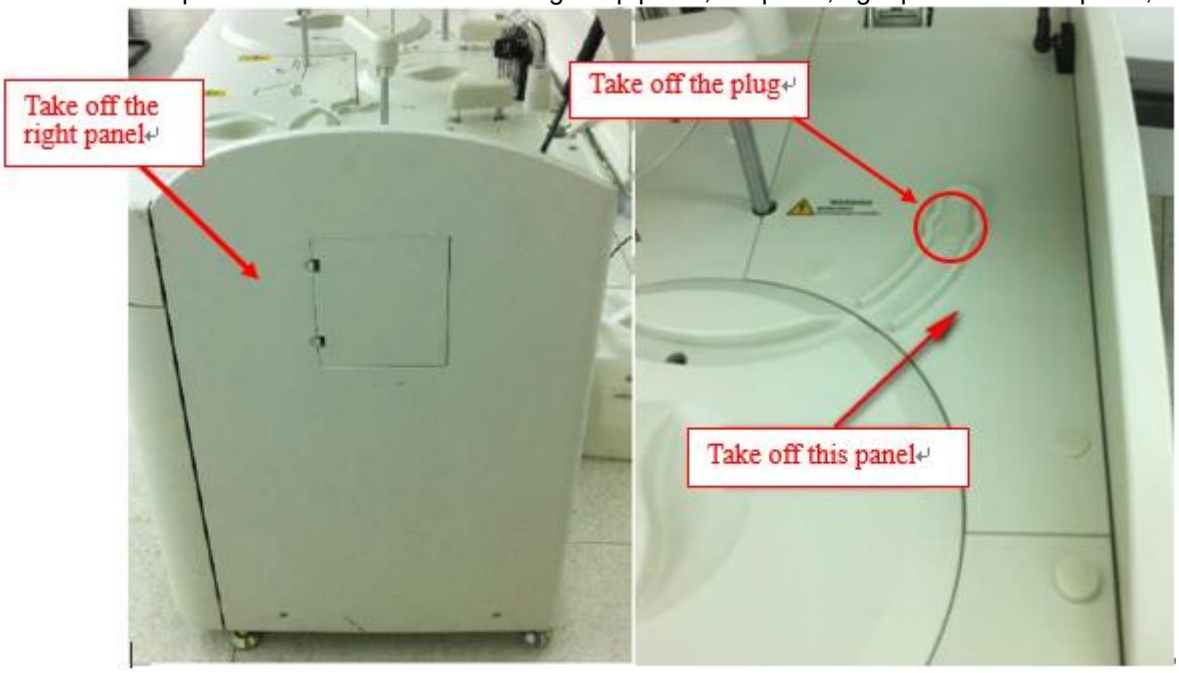


Figure 14-1 Take off the right and top panels

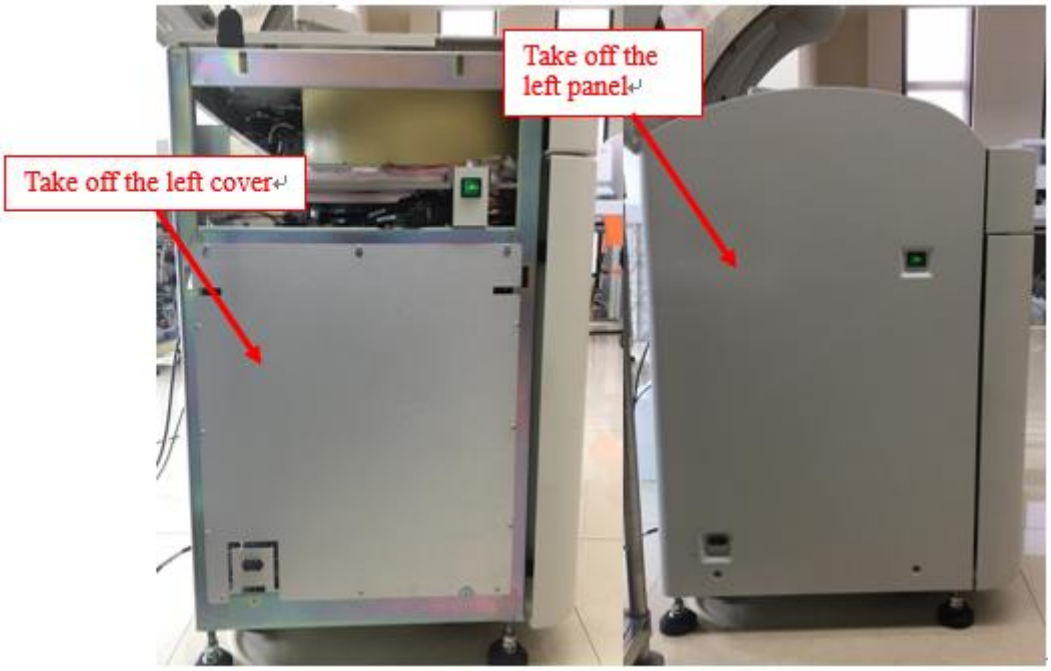


Figure 14-2 Take off the left panel and its baffle

Figure 14-3 Take off the rear panel

2) Take off the ISE baffle on the right panel;

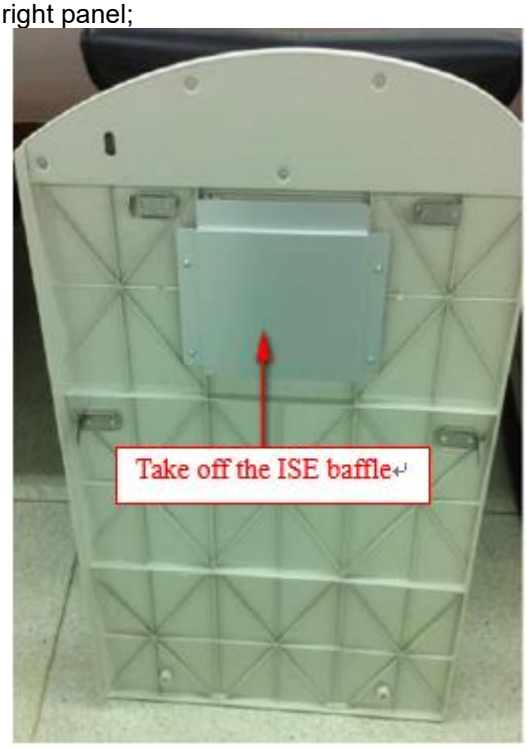


Figure 14-4 Take off the ISE baffle

Installation of ISE Components

1) Attach the ISE patch cord to the ISE module;

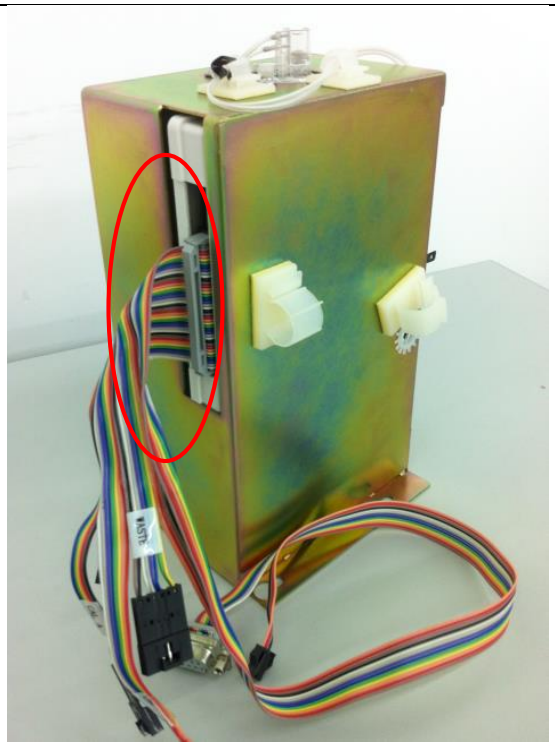


Figure 14-5 Connect the ISE module to the patch cord

2) Fix the connected ISE module and peristaltic pump assembly to the bottom plate of the machine;

Note:

When installing the ISE module to the bottom plate, temporarily install the fixing screws. Rotate the sample probe arm to the dispensing port of the ISE module and adjust the location of the ISE module so that the probe tip is located in the center of the dispensing port of the ISE module, and then tighten the fixing screws of the ISE module.

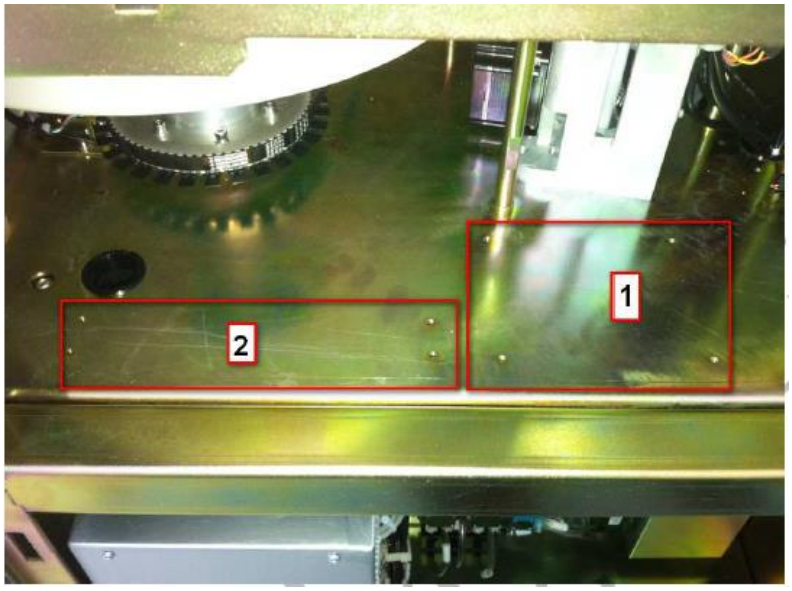


Figure 14-6 Fix the ISE module and peristaltic pump assembly-1

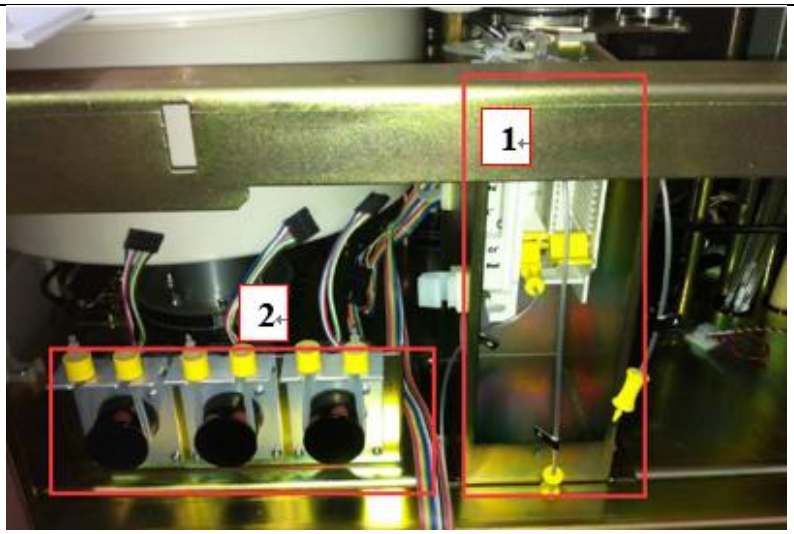


Figure 14-7 Fix the ISE module and peristaltic pump assembly-2

Connection of ISE Fluidic Tube

1) Use the rubber hose supplied with the ISE module to connect to the injection tube for calibrators A and B, cut it to the desired length as shown in the figure and connect it to pumps A and B.

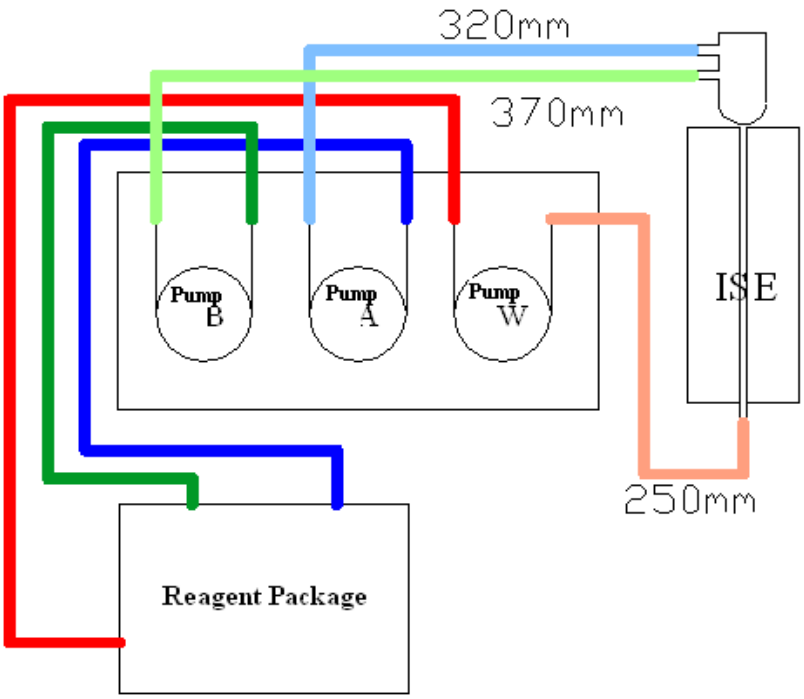
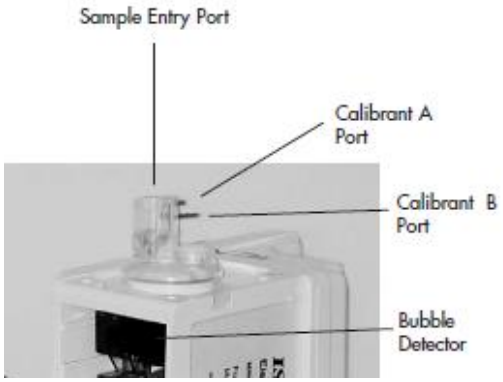


Figure 14-8 Fluidic tube connection diagram-1

Note:

a) Insert the pump tubes A and B to the dispensing port of the ISE module as shown in the figure below.

b) The connector and rubber hose shall be inserted in place. Use hot water to heat the hose head if necessary for easy insertion. The hose shall be inserted not less than 3.5 mm;



2) Pass the reagent pack wand tube through the wiring hole on the bottom place from the bottom up and then connect it to the peristaltic pump;
Connect the tubes in the following orders:
   a) Connect "cal A" to the calibrator A peristaltic pump
   b) Connect "cal B" to the calibrator B peristaltic pump
   c) Connect "W" to the waste liquid peristaltic pump
   d) Connect "D" to the ISE patch cord

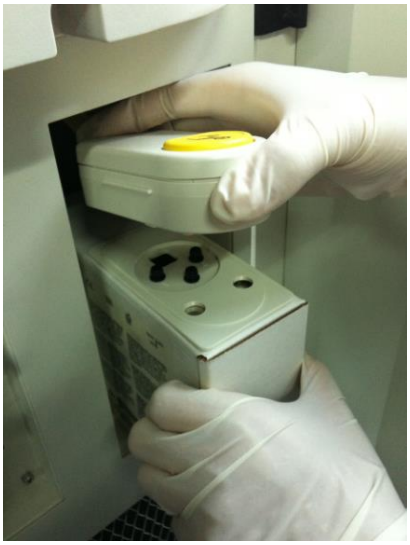


Figure 14-9 ISE reagent pack wand

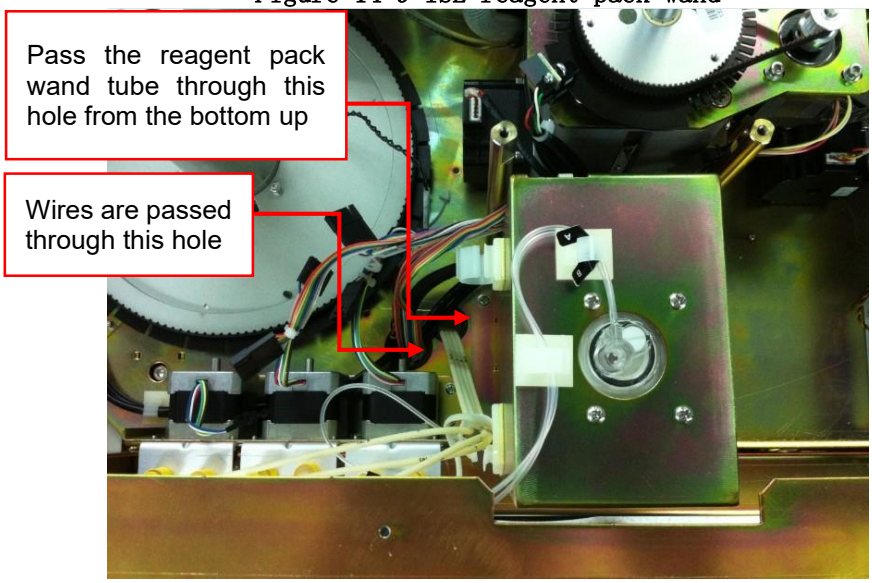


Figure 14-10 Wiring diagram

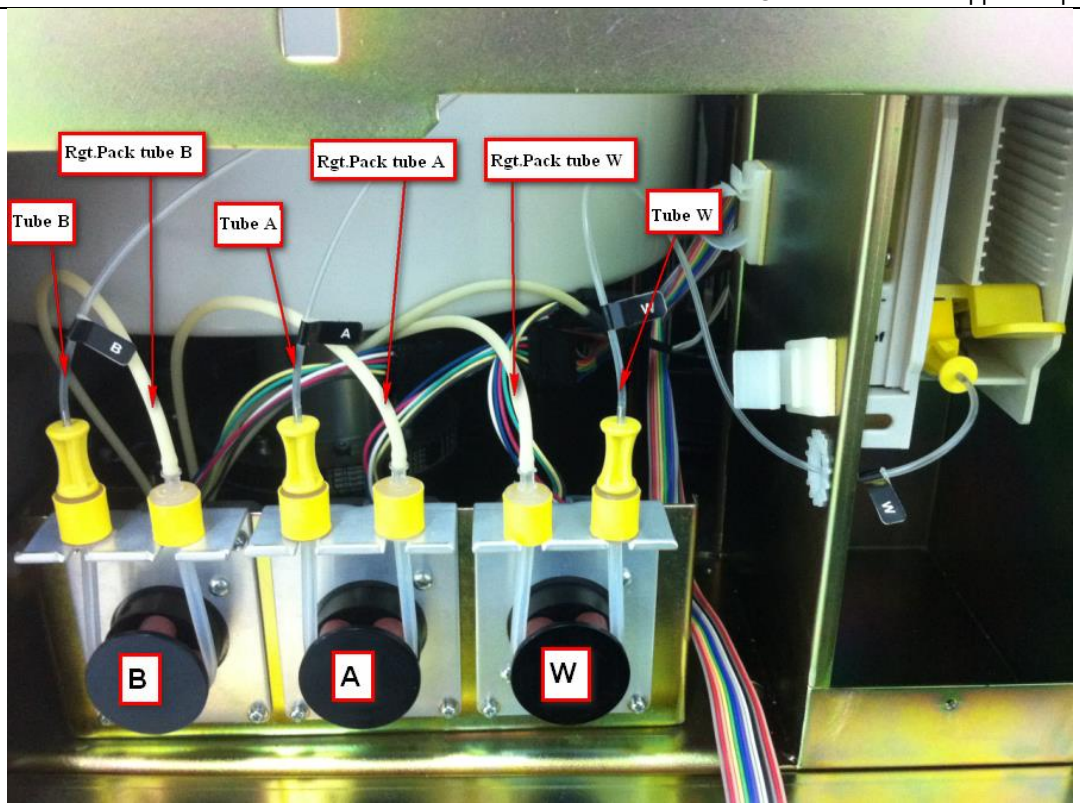


Figure 14-11 Connection of peristaltic pump liquid tubes

Connection of ISE Cables

1) Pass the ISE power cord and main control board communication cable through the right side of the machine to the left side;

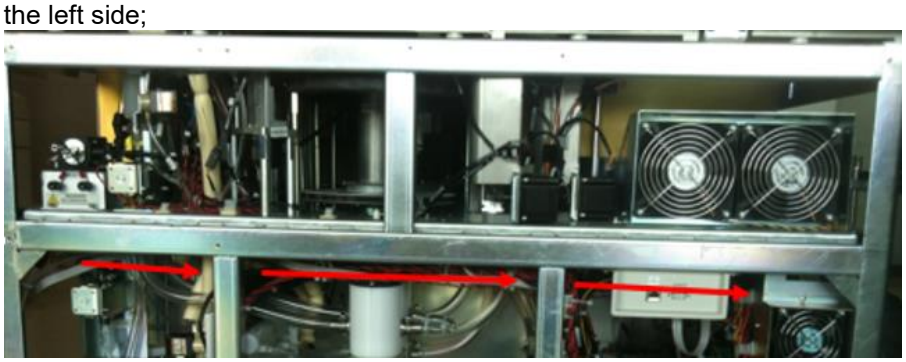


Figure 14-12 Cable connection

2) Connect the main control board communication cable to the J4 jack on the main control board and the ISE power cord to the J3 jack on the power board.

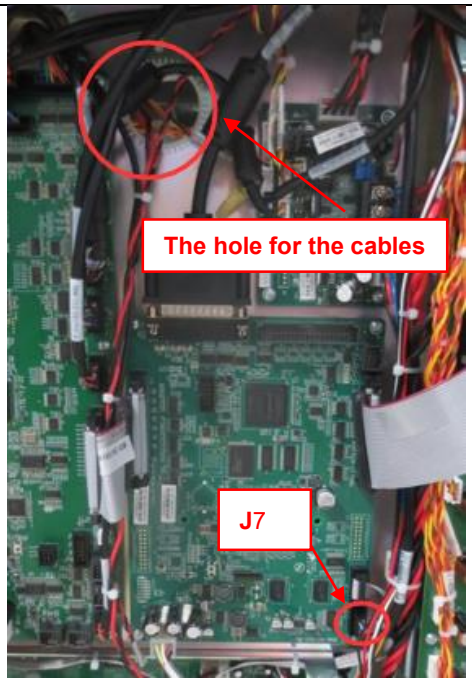


Figure 14-13 Main control board communication cable

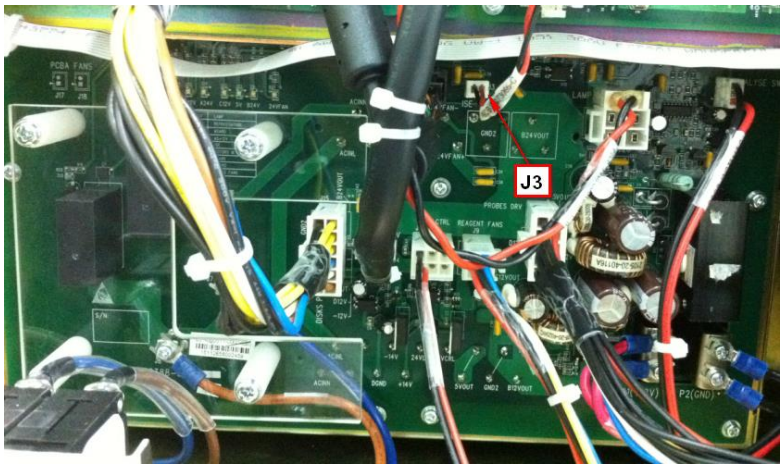


Figure 14-14 ISE power cord

Optional Module

1) Use service username and password to open the operating software and click "Apply" → "System Setup" → "Factory".

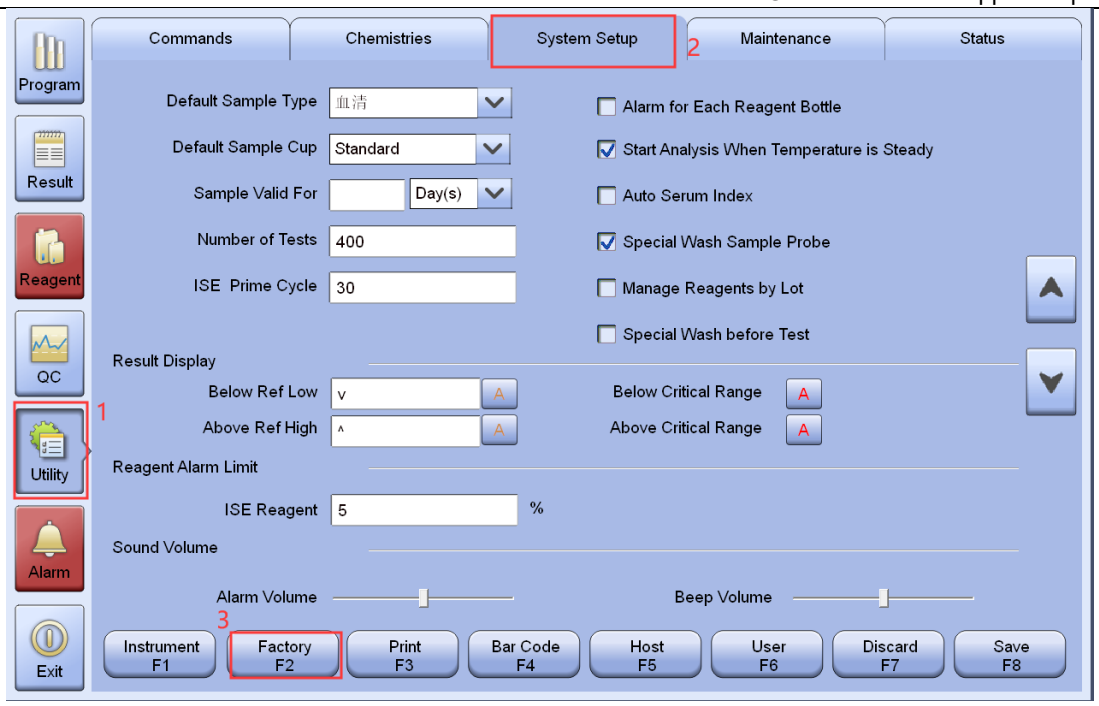


Figure 14-15 Factory Settings

2) Click "Optional Modules".

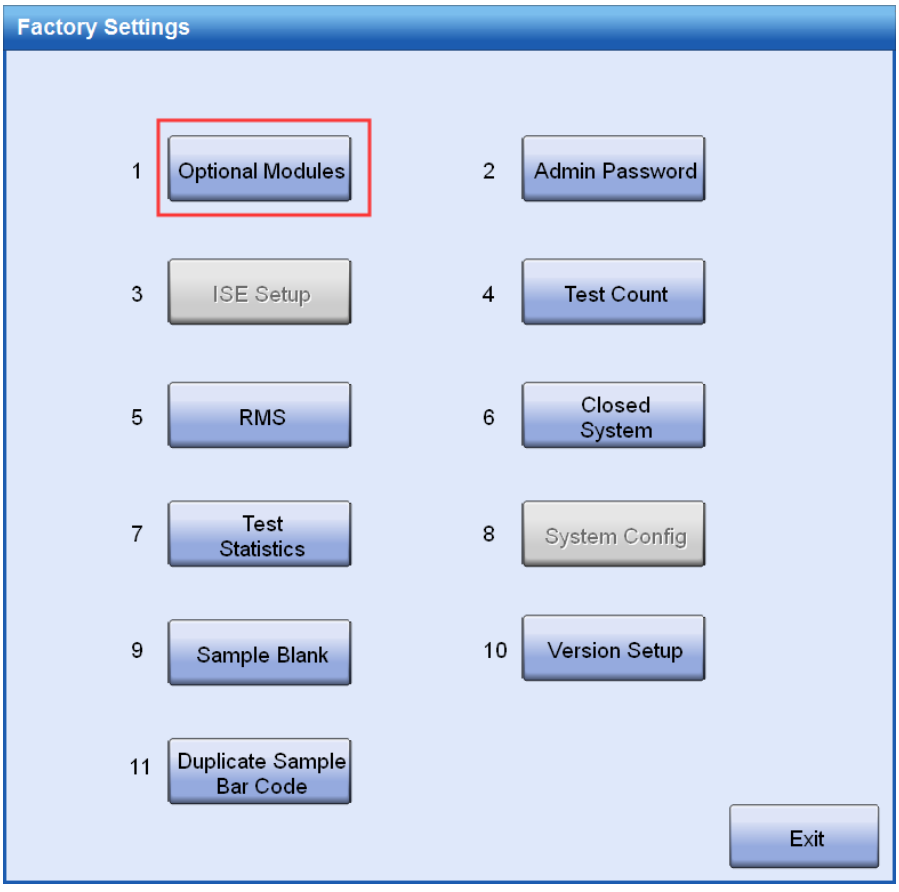


Figure 14-16 Optional Modules

3) Check the "ISE Optional" checkbox and click "Save".

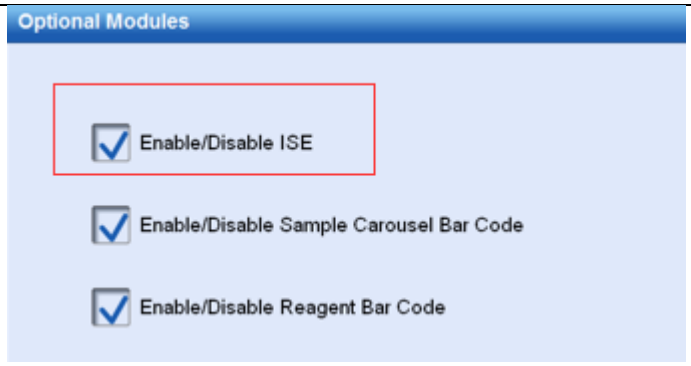


Figure 14-17 ISE optional

14.2.3 Debugging of ISE Module

Preparation before Debugging

1) From "Apply" → "Maintenance" →"Machine Debugging" → "ISE Unit", enter the ISE unit debugging;
   - ***a)*** Adjust the sample probe to ISE horizontal position. Refer to ***7.6.7 Sample Probe Rotary to ISE (Medica*** ISE Module Configured)
   - ***b)*** Adjust the sample probe to ISE vertical position. Refer to ***7.6.8 Sample Probe Rotary to ISE Vertical Extreme Height (Medica*** ISE Module Configured)
2) Check whether all parts are installed completely and securely, tubes are properly connected and three peristaltic pumps are correctly located. Attach the electrodes Ref, Cl-, K+, Na+ and null to the ISE module from the bottom up, and connect the reagent pack to the tube. Then, check that the reagent module is installed and then prepare the 100μl of wash solution specific to the ISE module;

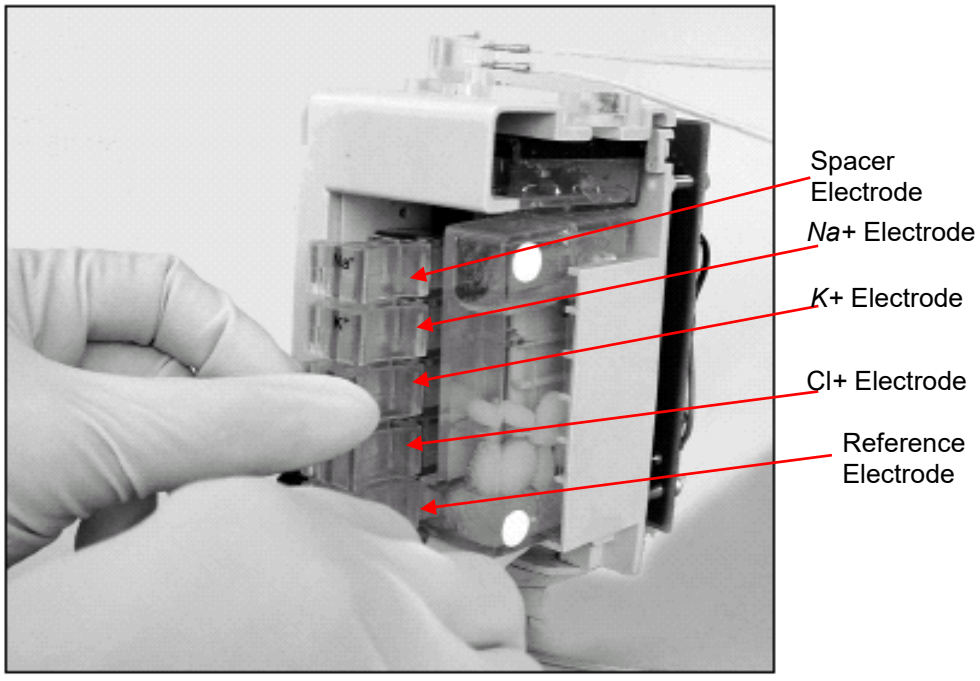


Figure 14-18 Installation of ISE module electrodes

3) Connect the reagent pack to the reagent pack wand: as shown in the figure below, install the reagent pack wand in place until you hear a "click" sound. Therefore, the "ISE communication error" appears.

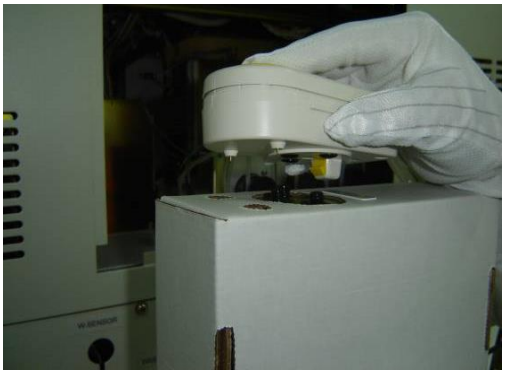


Figure 14-19 Install the reagent pack wand

Module Initialization

Handshake:

When the ISE module shakes hand with the system, click "Start". When data returns "<ISE!>", the data is displayed on the display bar and the next line displays "Handshake successful" indicating that the module is normally communicated with the system, as shown in the figure below.

Purger A:

a) On the Purge A interface, define the parameters as below, interval time: 5S, cycle count: 30 times.
b) Click "Start" and wait until "<ISE!>" returns on the current data display area, indicating that a calibrator A purging cycle is completed. During this, pump A and waste liquid pump rotate clockwise and pump liquid out. Repeat the operation above for several times and you can see that calibrator A tube is gradually filled with liquid and drained to the dispensing port.
c) In this case, click "Stop". The software will stop purging after the current calibrator A purging cycle is completed.
d) If no liquid flow is detected or liquid flow is slow after several executions, check whether the hose connector is properly and reliably connected and whether the peristaltic pump works normally.

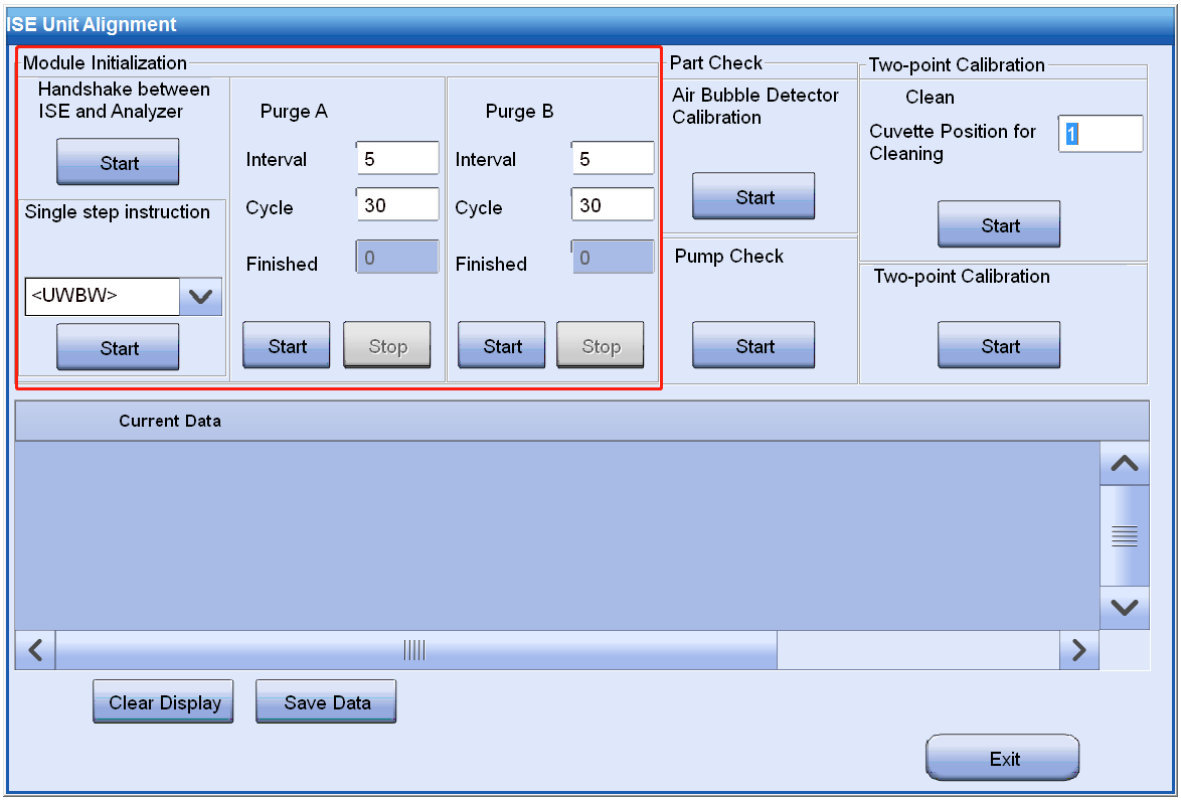


Figure 14-20 ISE unit debugging interface

Purge B:

The operator for "Purge B" is the same as that for "Purge A".

Air Bubble Detector Calibration:

a) Click "Start" under Part Check - Pump Check.
b) After calibration, wait until the current data display area returns calibrated data (data format: <BBC A xxx M xxx L xxx>). The next line displays "Air bubble detector calibrated", indicating the debugging is successful.
c) If the current data display area displays calibrated data as <ERC BBC x000000>, the next line displays "specific error" (marked with red text) according to the returned error code. For error codes, see ***Table 0.1 ISE Error Codes***

Pump Check:

a) Place a test tube filled with deionized water in the W position of the sample carousel;
b) Click "Start" under Part Check - Pump Check.
c) Operate as instructed on the screen. After calibration is complete, wait until the current data display area returns data as <PMC A xxxx B xxxx W xxxx> (each value shall fall in between 1500 and 3000), and the next line displays "Pump Check Correctly", indicating that the debugging is successful.
d) If the current data display area returns calibrated data as <ERC PMC x000000>. For x, see Appendix. The next line displays "specific error" (marked with red text). For error codes, see ***Table 0.1 ISE Error Codes***.

Wash:

Prepare sufficient wash solution in the sample carousel (usage in each wash operation is 100 ul), and then input the level of the wash solution in the cuvette in "Set liquid level in cuvette", and click "Clean". Wait until the data area returns <ISE!> (wait for about 160 s). The next line displays "Clean completed", including the wash is complete.

Two-point calibration:

a) Click "Start" in the "Two-point calibration" area to display the confirmation dialog for fluidic tube wash. If it is possible to check that the last wash operation has been waited for more than 15 min, directly click OK; otherwise, wait until the countdown time ends.
b) After the countdown time ends, automatically execute the two-point calibration testing. After the testing is complete, the current data display area returns the calibration result "< Na xx.xx K xx.xx Cl xx.xx xxxxxxxx>". ;
c) If an error code displays during calibration, repeat several times of two-point calibration. If the problem persists, replace the corresponding electrode reporting error as instructed by error message. For error codes, see ***Table 0.1 ISE Error Codes***

Note: After the ISE module is installed, do not cut off the mains power (the power switch for the analyzing unit can be cut off). If the mains power must be cut off and the downtime is more than 2 hours, empty the ISE and remove the electrodes.. To remove electrodes, the ISE module shall be cleaned and emptied as well.

14.2.4 Precautions for ISE

- **After electrodes are installed, the reagent pack shall be installed as well and at the same time, the mains power for the analyzer shall be turned on to ensure that the ISE is continuously powered on.**
- **Carry out the calibration before ISE testing and the calibration result is normal. Otherwise, the accuracy of the test result cannot be ensured.**
- **Clean it with MEDICA-specific wash solution at the end of daily operation (for details, refer to user manual);**
- **If testing for samples is carried out continuously for more than 8 hours or more than 50 consecutive samples are tested, clean it and carry out calibration again.**
- **To remove electrodes, execute maintenance instructions and remove electrodes, along with the reagent pack. Then, execute the ISE emptying procedure.**

14.2.5 Appendix - ISE Error Codes

Note: Error codes will be affixed to result strings. An error code is in format of 7 ASCII characters, such as <1234567>. Each digit represents a specific meaning, as shown below:

Table 0.1 ISE Error Codes

	Digit #1	Digit #2	Digit #3	Digit #4	Digit #5	Digit #6	Digit #7
Error Type	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Air bubble included in the sample	S	0	0	0	0	0	0
Air bubble included in the calibrator A	A	0	0	0	0	0	0
Air bubble included in the calibrator B	B	0	0	0	0	0	0
Air bubble included in the wash solution	C	0	0	0	0	0	0
Air in Segment	M	0	0	0	0	0	0
Pump calibration error	P	0	0	0	0	0	0
No fluid in electrode pipes	F	0	0	0	0	0	0
Air bubble monitoring error	D	0	0	0	0	0	0
Chip reading error	R	0	0	0	0	0	0
Chip writing error	W	0	0	0	0	0	0
Saving calibration result error	Q	0	0	0	0	0	0
Command error	T	0	0	0	0	0	0
No error	0	0	0	0	0	0	0
Na+	0	1	1	1	1	1	1
K+	0	2	2	2	2	2	2
Na+，K+	0	3	3	3	3	3	3
Cl-	0	8	8	8	8	8	8
Cl-,Na+	0	9	9	9	9	9	9
Cl-,K+	0	A	A	A	A	A	A
Cl-,K+,Na+	0	C	C	C	C	C	C

The error types in the table above are described as below:

1) - Air bubble/hardware;

2) - Electrode voltage overflowed during calibrator B calibration or blood measurement;
3) - Electrode voltage overflowed during two-point calibration or calibrator A calibration in blood measurement mode, or
4) calibrator B calibration in urine measurement mode;
5) - Electrode voltage noise during calibrator B calibration or blood measurement;
6) - Electrode voltage noise during two-point calibration or calibrator A calibration in blood measurement mode, or
7) calibrator B calibration in urine measurement mode;
8) - Voltage drift during calibrator A calibration in blood measurement mode, or slope drift
9) during two-point calibration;
10) - Exceeds the slope or module measurement range;

14.3 Upgrade of Barcode Scanner

14.3.1 Overview of Barcode Scanner Module

Auto enter reagent/sample information: use the barcode scanner module to automatically enter reagent/sample information

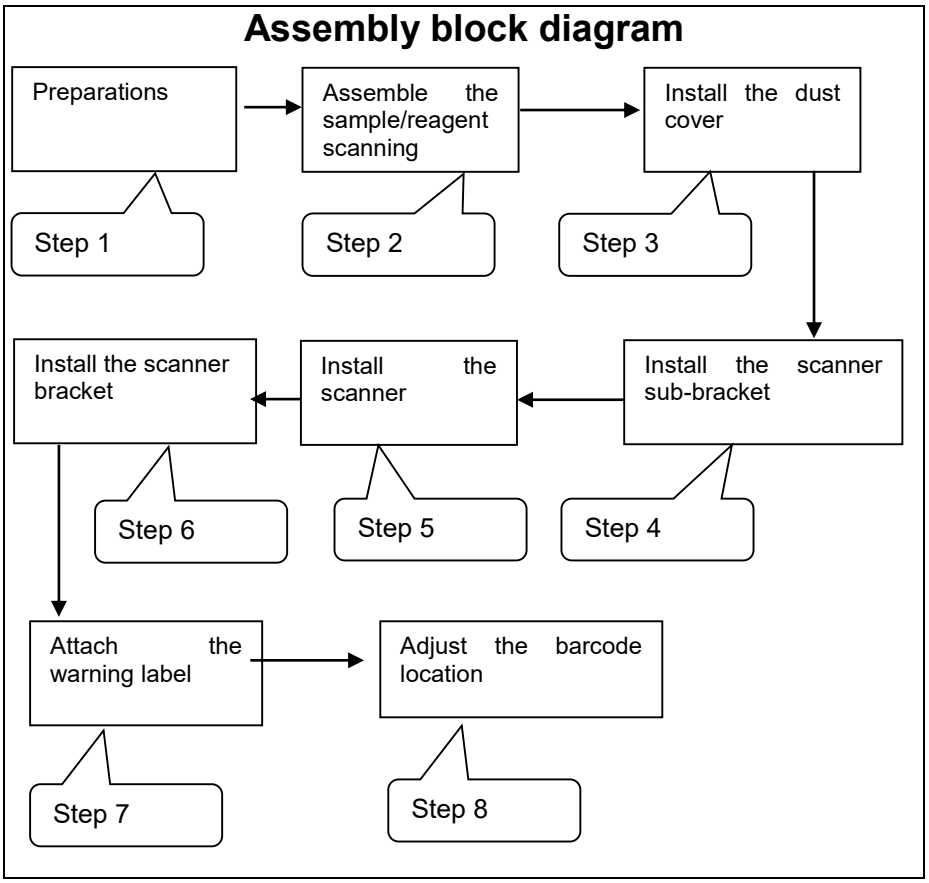
For specifications of sample barcode, please refer to ***1.5.2 Sample Specifications.***

For specifications of reagent barcode, please refer to ***1.5.3 Reagent Specifications***.

Upgrade of the reagent barcode scanner module requires the barcode module service pack 115-026890-00

14.3.2 Upgrade and Installation of Barcode Scanner

Upgrade procedure:



1) Preparing for upgrading:

Upgrade of the sample barcode scanner module requires the service pack 115-026888-00 (Chinese)

Upgrade of the reagent barcode scanner module requires the service pack 115-026890-00 (Chinese)

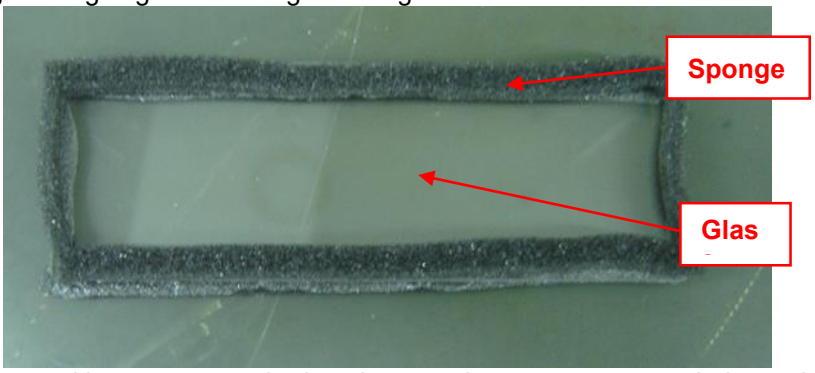
Adjustment fixture for the sample carousel barcode scanner (BA40-J21)

Adjustment fixture for the reagent carousel barcode scanner (BA40-J19) (BA40-J20)

2) Installing the scanning window unit

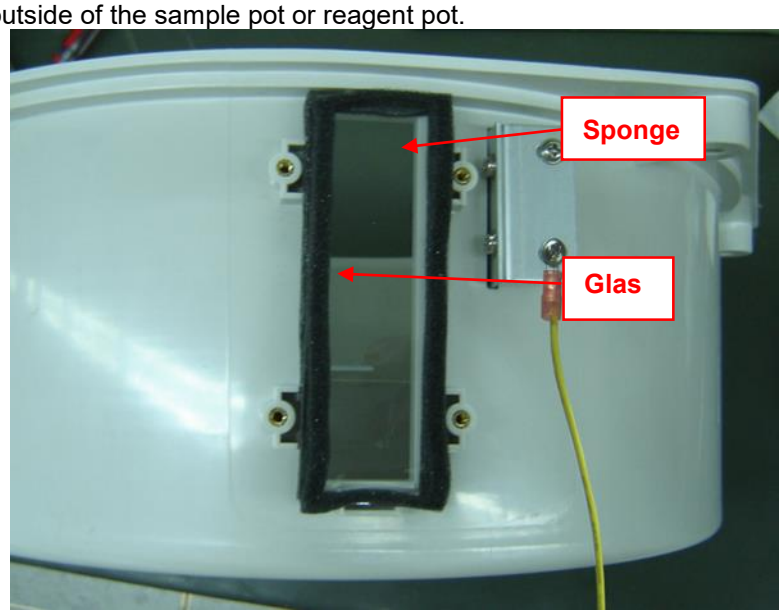
a) Remove the cover of the scanning window of the sample carousel or reagent carousel;

b) Attach sponge fills (BA34-20-63677) to two faces of the glass (BA34-20-63593), with the edge of the sponge fill aligning with the edge of the glass.



c) Place the glass with sponge attached to the sample pot or reagent window, with the sponge

facing the outside of the sample pot or reagent pot.

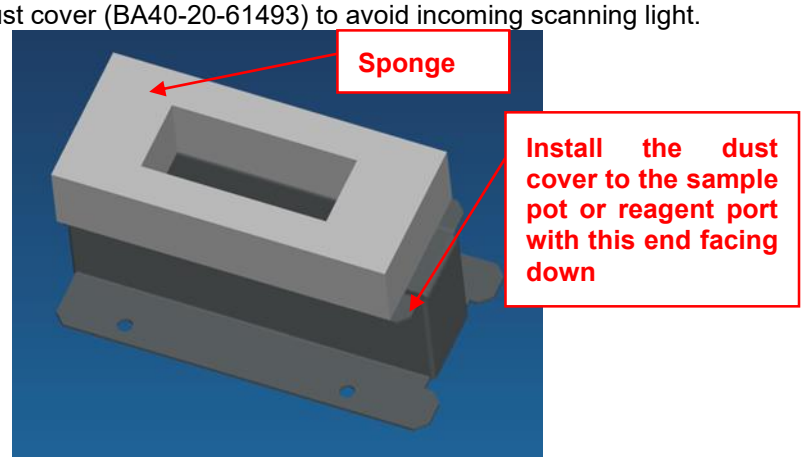


Note:

a) Keep the cover and fixing screw of the scanning window for future use;
b) Keep the glass surface clean.

3) Install the dust cover

a) Attach a sponge fill (BA40-20-61518) on the dust cover, with the window of the sponge fill aligning that of the dust cover (BA40-20-61493) to avoid incoming scanning light.



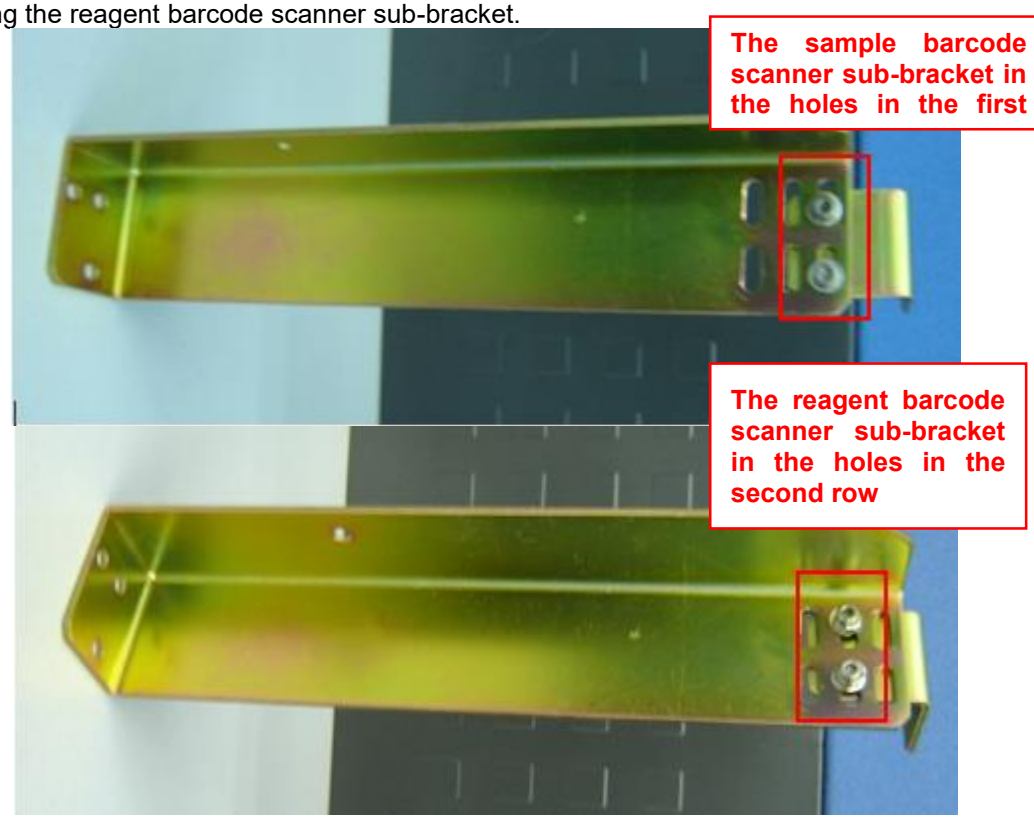
b) Fix the dust cover to the sample pot or reagent pot with four M3X8 cross recessed pan head screws with washer and tighten the screws to the specified torque: 3.2-4.5kgf.cm;

Note:

a) The window of the sponge fill shall be align with that of the dust cover.
b) Do not install the dust cover reversely.

4) Installing the scanner sub-bracket

Fix the scanner sub-bracket to the scanner bracket with two M3X8 (M04-051096---) socket cap screws with flat washer (M04-000802---), spring washer (M04-000104---). Attach the screws to the holes in the first row when installing the sample barcode scanner sub-bracket. Attach the screws to the holes in the second row when installing the reagent barcode scanner sub-bracket.



Note:

a) The sample barcode scanner sub-bracket has the installation location different from the reagent barcode scanner sub-bracket;
b) Temporarily attach screws and tighten them after debugging.

5) Install the scanner

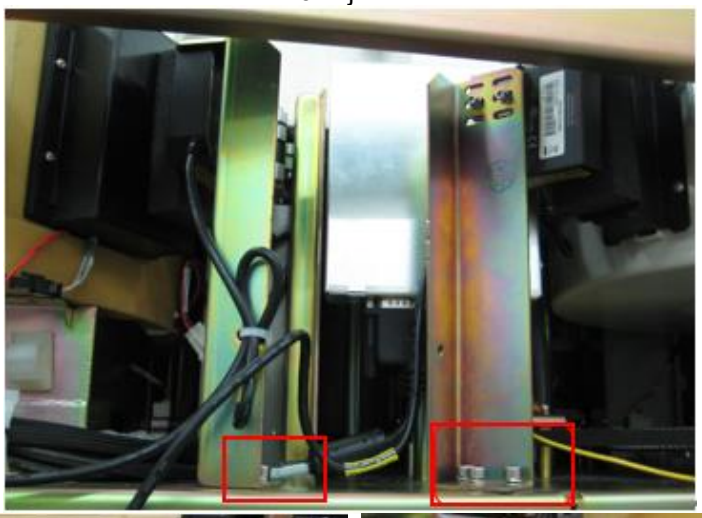
Fix the scanner to the scanner sub-bracket with two M3X10 (M04-051026---) socket cap screws with flat washer (M04-000802---), spring washer (M04-000104---).

Note:

a) Do not contaminate the scanner glass surface during installation to avoid effect on scanning performance.
b) Temporarily attach screws when installing the scanner and tighten them after debugging.

c) The sample scanner has the installation height different from the reagent scanner.
d) Note the installation direction of the scanner.

6) Install the scanner bracket
   a) Connect the scanner bracket to the bottom plate with three M5X16 (M04-051062---) stainless steel hexagon socket cap screws with flat washer (M04-021011---) and spring washer (M04-021007---);
   b) Use the cable (BA40-20-61772) from the three-disc board to the sample carousel barcode to connect the barcode scanner to the J11 jack of the three-disc drive board.



Note:

a) The scanner shall face against the scanning window;
b) Temporarily attach screws when installing the scanner and tighten them after debugging.
c) The scanner shall have the height same as that of the scanning window.

7) Attach the warning label

Attach a laser warning label on the top of the scanning window

Note:

a) The warning label shall be flat and smooth;
b) The warning label is visible to an operator.

8) Debugging of barcode scanning assembly

For sample barcode scanning adjustment, refer to ***7.10.3 Sample Bar Code Reader Adjustment*** and ***7.10.5 Sample Bar Code Stability Test***

For reagent barcode scanning adjustment, refer to ***7.10.7 Reagent Bar Code Reader Adjustment*** and ***7.10.8 Reagent Bar Code Reader Adjustment*** (BCL95)

Alignment index:

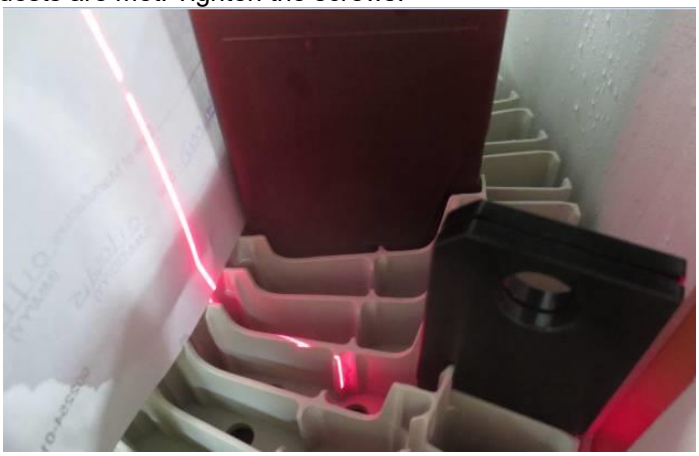
- The light beam transmitted from the bar code reader can pass through the slit on the bar code reader alignment tool (BA43-J01) of the reagent carousel.
- The bar code in 1-5# and 47-51# positions of the reagent carousel can be identified correctly and completely and displayed on the screen.

Alignment methods and procedure:

15) Select Reagent Bar Code Reader Adjustment.
16) Click the left and right arrow to adjust reagent carousel position until the alignment tool(BA43-J02) can easily insert the groove between the 2# and 3# position on the outer ring of the reagent carousel. Before fine tuning the parameter, ensue the alignment tool has been removed, otherwise the reagent carousel may be damaged. Check if the reagent carousel alignment tool can easily insert into the slot and remove it. Note: If proper position can not be adjusted through the adjustment of parameters. Please re-fix the reagent carousel coder sensor in the middle position.

17) Place a bar code alignment tool (BA43-J01) of reagent carousel in the slot between position 2# and position 3# on the outer ring of the reagent carousel. If the light does not go through the fixture slit, loosen the two screws on the bar code reader to adjust the incident angle. If the light beam is wider than the

fixture slit, adjust the bar code reader to allow the left of the light beam (counter-clockwise) to go through the slot and fall in the laser receiving area. If the light beam is not vertical, adjust the two screws on the small bracket till requests are met. Tighten the screws.



18) In Step 3, if the light is slightly deviating in circumferential direction, use the left/right arrow buttons to rotate the reagent carousel till requests are met.
19) Remove the alignment tool, and place bar-coded reagent bottles in positions 1#-5# and 47#-51#. When scanning is finished, check if the identified bar code is correct. If some bar code cannot be read, replace the relevant tube with another one having complete bar code. Repeat this step.
20) If all bar code cannot be read, check if the light direction meets the requirement and the bar code reader works normally.
21) Select Continue to save parameters and exit the window.

NOTE

- **Check that the sponge cushion seals the bar code reader completely without blocking the scanning light. Otherwise, adjust the bar code reader again.**

Reagent Bar Code Stability Test

Appendices

A.1 Installation Acceptance Report

BS-410&410E&4
10S&430&450&4

A.2 Error Information Feedback Form

BS-410&410E&4
10S&430&450&4

A.3 Liquid Diagram

BS-430 Liquid Diagram.pdf

A.4 Hardware Diagram

BS-430 Hardware Diagram.pdf

A.5 Tool List

Tool List_EN.xlsx

P/N: 046-019214-00 (5.0)