RT-7100
Auto Hematology Analyzer
Service Manual

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Content

Chapter I Instrument Description

1.1 Product Introduction

- Windows user interface, easy to operate.
- With three kinds of test modes which are whole blood, anticoagulation peripheral blood and pre-diluted peripheral blood.
- RT-7100 3-part differential auto hematology analyzer features:

  1) Minimum blood consumption (only 9.8μL);

  Easy for blood sampling, especially suitable for children, infants, the older and the patients requiring radiotherapy and chemotherapy

  2) No power panel inside the machine, with an external DC power supply block;

  Completely solved the electromagnetic interference on the test results caused by alternating current, it is featured with electricity saving, safety and environmental protection.

  3) The intelligent high-pressure bounce-back block-removing, effectively avoid bore blocking;
- Specified reagents are recommended for the instrument.

1.2 Product Performance Structure and Composition

The analyzer is composed of cell counting chambers, piping system, computer control system and the related software.

1.3 Product applicability

The product is suitable for the clinical testing of whole blood counting, White Blood Cells 3-part differential counting, as well as the determination of hemoglobin concentration, and it can provide 20 parameters and 3 histograms of blood. Such as the determination of White Blood Cells (WBC), Red Blood Cells (RBC), Platelet (PLT), Hematocrit (HCT) and Hemoglobin (HGB), as well as the White Blood Cells 3-part differential counting.

1.4 Instrument technical parameter

This instrument is mainly used for the accurate measurement of the 20 parameters and 3 histograms of blood as shown in table 1-1.

English name	Abbreviation	Default Unit
The number of White Blood Cells	WBC	10^9/L
The number of lymphocytes	LYM#	10^9/L
The number of intermediate cells	MID#	10^9/L
The number of granulocytes	GRA#	10^9/L
The percentage of lymphocytes	LYM%	%
The percentage of intermediate cells	MID%	%
The percentage of granulocytes	GRA%	%
The number of Red Blood Cells	RBC	10^{12}/L
Hemoglobin	HGB	g/L
Hematocrit	HCT	%
Mean corpuscular volume	MCV	fL
Mean corpuscular hemoglobin	MCH	pg
Mean corpuscular hemoglobin concentration	MCHC	g/L
RDW SD	RDW-SD	fL
RDW CV	RDW-CV	%
Platelet number	PLT	10^9/L
Mean platelet volume	MPV	fL
Platelet Distribution Width	PDW	%
Plateletcrit	PCT	%
Platelet larger cell ratio	P-LCR	%
White Blood Cell histogram	WBC Histogram	
Red Blood Cell histogram	RBC Histogram	
Platelet histogram	PLT Histogram	

Table 1-1

Chapter II Instrument Installation

2.1 Instrument unsealing

1、Unpack the package of the instrument and remove the materials for transport. Save the packing box and the packaging materials well, for your convenience in the future of re-packaging the instrument.

2、Take out the instrument from the box.

3、Take away the packaging materials, and take out the instrument from the plastic packaging bag.

4、Check the items in the box and confirm that the following items are within the box:

- RT-7100 Auto hematology analyzer mainframe
- User's Manual
- Packing List
- Dealer warranty certificate
- Power adapter
- Certification of inspection

2.2 Select the appropriate placement location

To ensure the instrument working properly, select a workplace that can meet the following requirements for placing RT-7100 Auto hematology analyzer:

- A worktable without direct sunlight;
- The surface of the worktable should be flat, with enough space, no big shock (such as a place where a centrifuge is placed);
- No electromagnetic devices which may cause magnetic field in the vicinity;
- No extreme temperature changes;
- No large amount of dust;
- Grounding well;

Note: The instrument working environment temperature is 15 ℃ ~ 35 ℃, relative humidity ≤ 80%.

In order to ensure the normal operation of the instrument, placing the instrument in the following places is prohibited:

- A place of large temperature difference
- A place beyond the operating temperature range

- A place of a large number of dusts
- A place close to the magnetic field of electromagnetic devices

2.3 Power Requirements

- a.c.110V - 220V
- 50/60Hz
- 96WATTS

2.4 Structure

Front view

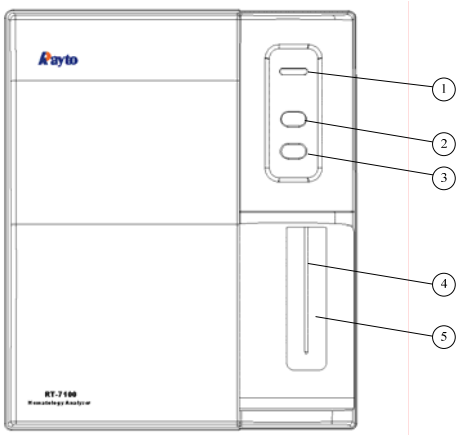


Figure 2-1 Front view

①Indicator ④Sampling needle

②Reset key ⑤Sampling key

③Sampling key

Back View

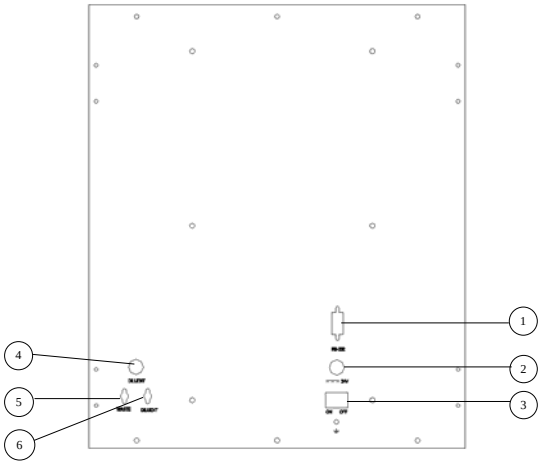


Figure 2-2 Back View

① RS-232 serial port:: Connect PC

② Power interface: to connect with external power supply

③ Power switch: switch instrument power

④ Diluent sensor interface

⑤ Waste port

⑥ Diluent port

2.5 Check the mechanical motion unit

1) Unscrew the screws to fix the extra-lateral plate, and open the extra-lateral plate, as well as open the front shell.

2) Cut the bandage to fix the motion frame and the mounting plate, and take out the bandage after cutting, check to confirm whether the Sampling needle is bent, or screws to fix the guide rail on the motion frame unit is loosened or not.

3) Unscrew the two screws to fix the shielding shell on the counting chamber component, raise up the shielding shell, and take out the shielding shell, to check whether the counting chamber and the bear frame is on the right position or not.

4) After testing, reinstall the counting chamber shielding shell, face piece and the extra-lateral plate well.

2.6 Connect the instrument to the power supply

1) Plug one end of the power cord into the power outlet of the instrument.

2) Plug the other end of the power cord into an AC power outlet.

Warning

（1）The AC power supply must be well grounded (zero ground voltage <5V).

（2）The AC power must be stable, it is prohibited to share power supply with the appliances of high power, and it is better to configure a stabilized voltage power supply.

（3）If the instrument is found to have smoke, smell or abnormal sounds, immediately turn off the power, and contact the maintenance service center immediately.

（4）When unplugging the power cord, please seize the plug itself, rather than the power cord.

2.7 Reagents Connection

2.7.1 Lyse and Cleanser connection

1) Take out the hemolytic agent and the multifunctional enzyme cleaning solution from the reagent box, open the cover of the bottle, and place it into the reagent room horizontally.

2) Plug the plastic tube marked with multifunctional enzyme cleaning solution into the multifunctional enzyme cleaning solution bottle, and tightens the bottle cover.

2.7.2 Diluent connection

1) Take the diluent catheter with white connector from the annex box.

2) Connect the white connector of the diluent catheter with the liquid path connector of the same color on the backboard of the instrument.

3) Plug the other end of the catheter into the diluent bottle, and tighten the diluent bottle cap.

2.7.3 Waste liquid Connection

1) Take out the waste liquid catheter with blue connector from the annex box

2) Connect the blue connector of the waste liquid catheter with the “waste liquid” fluid path connector on the backboard of the instrument.

3) Connect the other end of catheter into waste liquid bottle.

Warning:

1. Reagent pipeline can not be forcibly distorted, folded, and rotated.

2. Reagent and instrument must be matched, otherwise easily lead to inaccurate test results.

3. Do not use expired reagents.

4. Must handle the waste liquid in accordance with national laws and regulations, when handling the waste liquid, please wear rubber gloves.

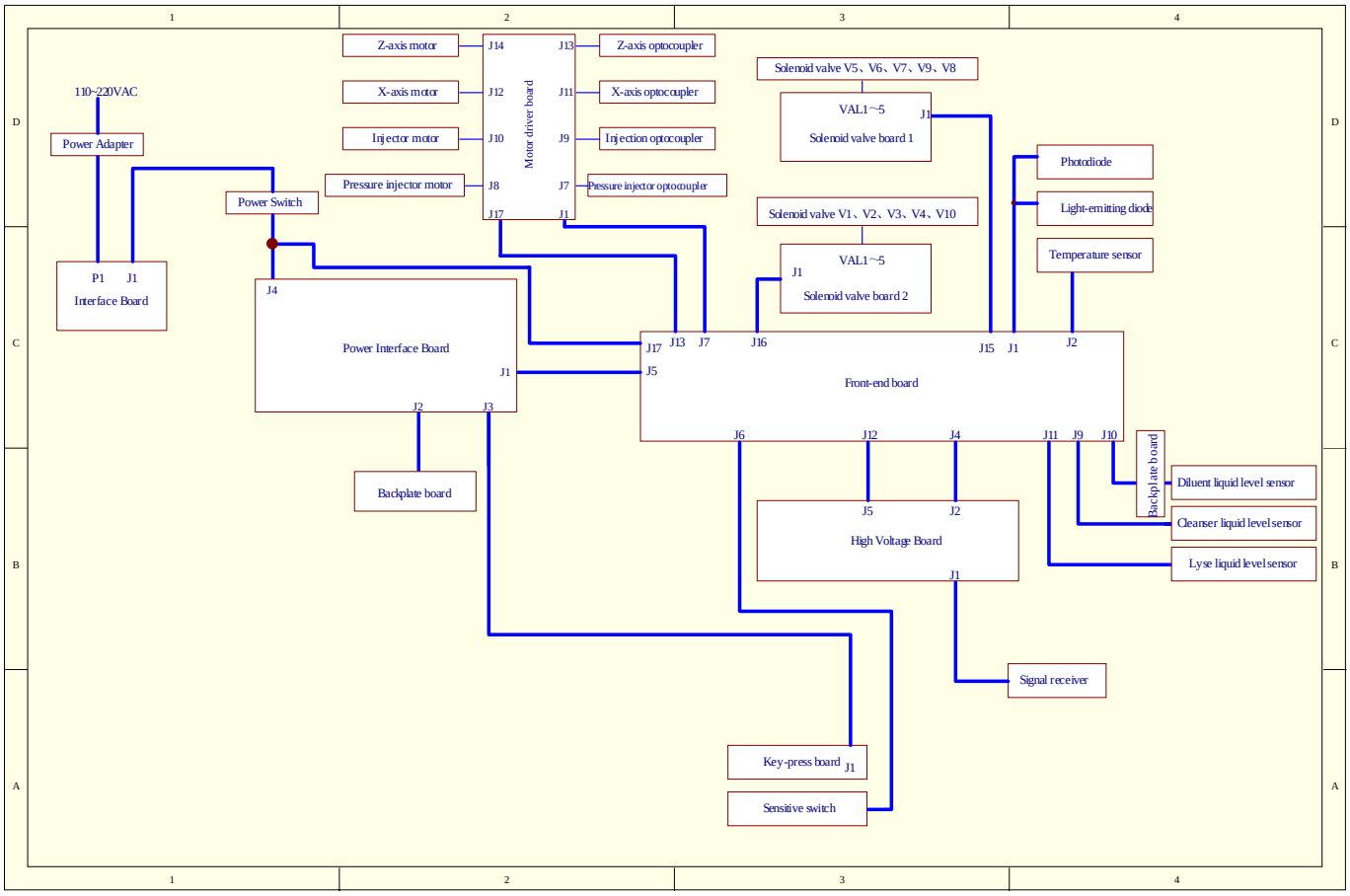
2.8 Connection of instrument and PC

1) Take out RS-232 cable from packing carton.
2) Insert one end of RS-232 cable into PC RS-232 interface socket.
3) Insert another end of RS-232 cable into instrument RS-232 interface.

Chapter III Functional Description

3.1 Whole machine PCB interconnecting diagram

1.



Wiring Harness Connection:

RT811.35.05-1.0-HGB connector: The front-panel J1-photo-diode, light-emitting diode;

RT871.35.02-1.0-Lamp connector: The Power Interface Board J3- Key-press board J1,

RT801.35.03-1.1-solenoid valve connecting line (L): The front-panel J16-solenoid valve plate 2, J1

RT801.35.03-1.1-solenoid valve connecting line (L): The front-panel J15-Solenoid Valve Plate 1, J1

RT801.35.06-1.1-optocoupler connection line: Motor drive board J7, J9, J11-negative pressure syringe, X-axis, syringe optocoupler;

RT801.35.59-1.0-Z-axis optocoupler connection line: Motor drive board J13-Z axis Optocoupler;

RT801.35.08-1.1-temperature sensor connector: Front-panel J2-temperature sensor;

RT801.35.13-1.1-switch connection line: Interface board J5-power switch;

RT811.35.06-1.1-Total Power Line: Front plate J17-Power Switch - Power Interface Board J9;

RT801.35.16-1.1-motor drive cable: The front-panel J7-motor drive board J1;

RT801.35.20-1.1-hemolysin pipe grounding line: Hemolytic metal pipe joints-wbc connection block;

RT811.35.08-1.1-signal-receiving line: Signal reception head - high voltage switchboard J1;

RT801.35.23-1.1-driver board power line: The front plate J13-motor drive plate J17;

RT801.35.24-1.1-key-press serial bulb line: Power interface board J1- front-panel J5;

RT801.35.25-1.0-adapter power line: 110-220VAC-power adapter;

RT801.35.30-1.1- high voltage control line: The front-panel J12 high-pressure plate J5;

RT801.35.31-1.1-RBC signal switch wiring: The front-panel J4 high-pressure plate J2;

RT801.35.34-1.0- Sensitive Switch Connector: The front panel J6-sensitive switch;

RT811.35.10-1.0-Lyse,cleanser liquid level sensor wire: Front end board 01J11-Lyse/01J9-cleanser;

RT801.35.55-1.0-Diluent liquid level sensor wire (inner): Front end board J10-diluent BNC;

RT801.35.56-1.0-liquid level sensor wire (outer): Diluent-rear board;

RT871.35.01-1.2-Output serial port: Power interface board J2- rear board

3.2 The front-end CPU board

The front-end CPU board is the control center of the machine, connect with the main board through the serial port, to achieve the back-end control commands; the smallest subsystem is composed of C8051F020; to control the action of each component by 51 microcomputers, including the x-axis motor, z-axis motor, syringe motor, negative pressure syringe motor and so on, the components of these mechanical pieces are required to conduct the corresponding null detection, while achieving the acquisition and processing of a variety of analog signals.

3.3 Power Interface Board

Power interface board is mainly responsible for the generation of power for each part, as well as the connections between different components. Complete the DC/DC power conversion with the power supply chip, and can generate +16.5V, two-way +5V outputs, to provide power to the industrial control boards and printer.

3.4 Motor Driver Board

The motor drive board is mainly responsible for the control and inspection of each moving parts, to drive each motor with the combination of L297 + L298, and feedback the zero bit signals of the corresponding moving parts back to the front panel.

3.5 Key-press board

Key-press board includes status indicator and two keys. The status indicator will indicate the running state of the machine, and the other two keys are the device reset key and the sampling key.

3.6 Optocoupler board

Optocoupler board includes only one slot optocoupler and a connection terminal, primarily for the convenience of the mechanical zero bit signal output.

3.7 Electromagnetic valve board

Electromagnetic valve board includes only a number of connection terminals, to connect the solenoid valve to the system.

3.8 Interface Board

Interface board includes the power supply input terminal.

3.9 High voltage board

The high voltage board is primarily designed to generate a high-voltage, which can conduct block-removing on the liquid path by igniting.

Chapter IV Parts Replacement

4.1 Instrument reassembly method

RT-7100 is a high-sophisticated instrument, there is no internal part can be repaired by user. Non-professionals should not arbitrarily open the machine, when the instrument has something wrong, and it can not be resolved in accordance with the method regulated in this manual, it should be repaired by professionals.

4.2 The replacement of seal ring

4.2.1 The replacement of the negative pressure syringe seal ring

If there is leak phenomenon on the negative pressure syringe (which can be detected by the pressure sensor), the negative pressure syringe seal ring should be replaced. Please replace the negative-pressure syringe O-ring in strict accordance with the following steps.

1) Pull the piston of the negative pressure syringe to the highest position, and then unscrew the three screws to fix the negative-pressure syringe components, and remove the syringe main body from the inner board. As shown in Figure 4-2-1.

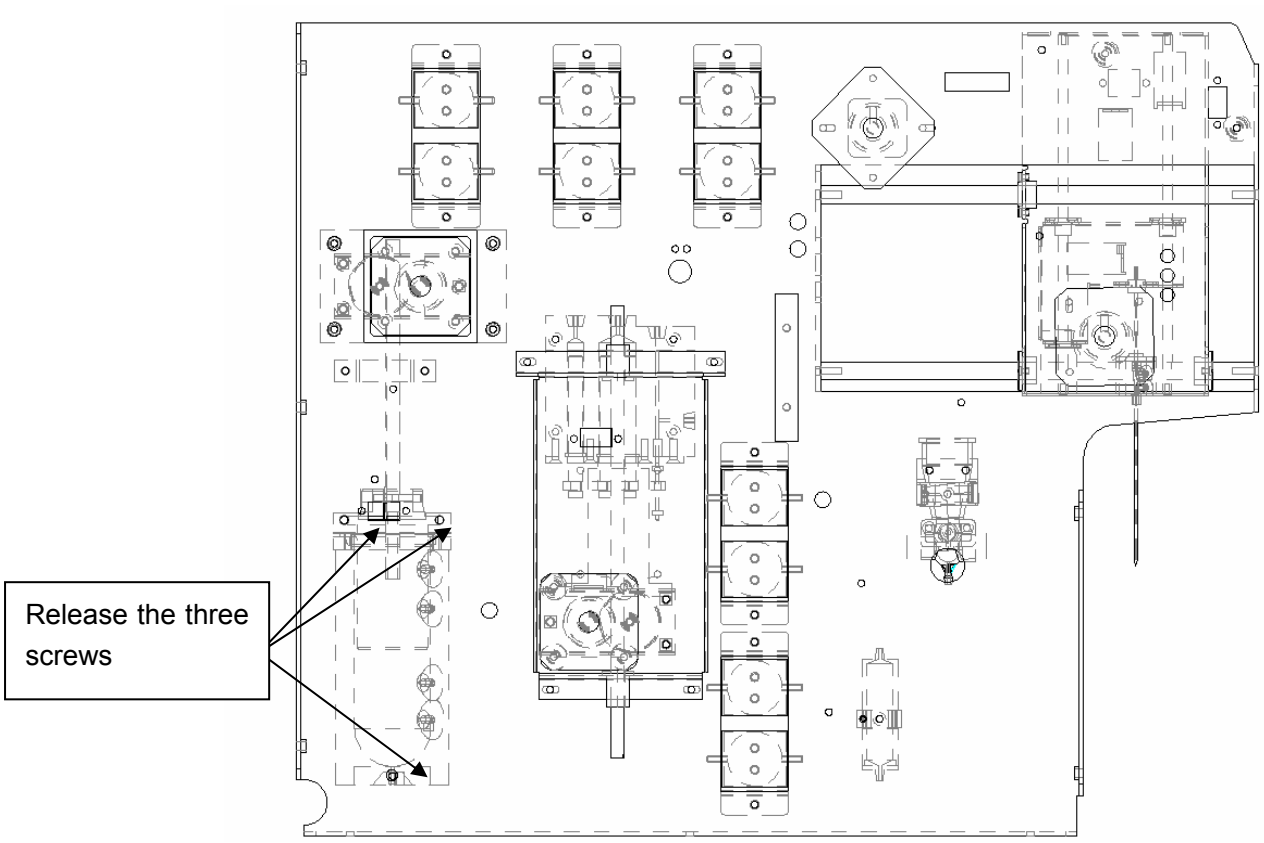


Figure 4-2-1

2) Release the four screws on the negative pressure syringe mounting plate, take out the worn O-ring, and put a new O-ring (coat the instrument specified lubrication sealed grease inside and outside the O-ring) onto the position to mount the original O-ring. As shown in Figure 4-2-2.

3) After all the processes have been completed; it should be reassembled back with the reverse order.

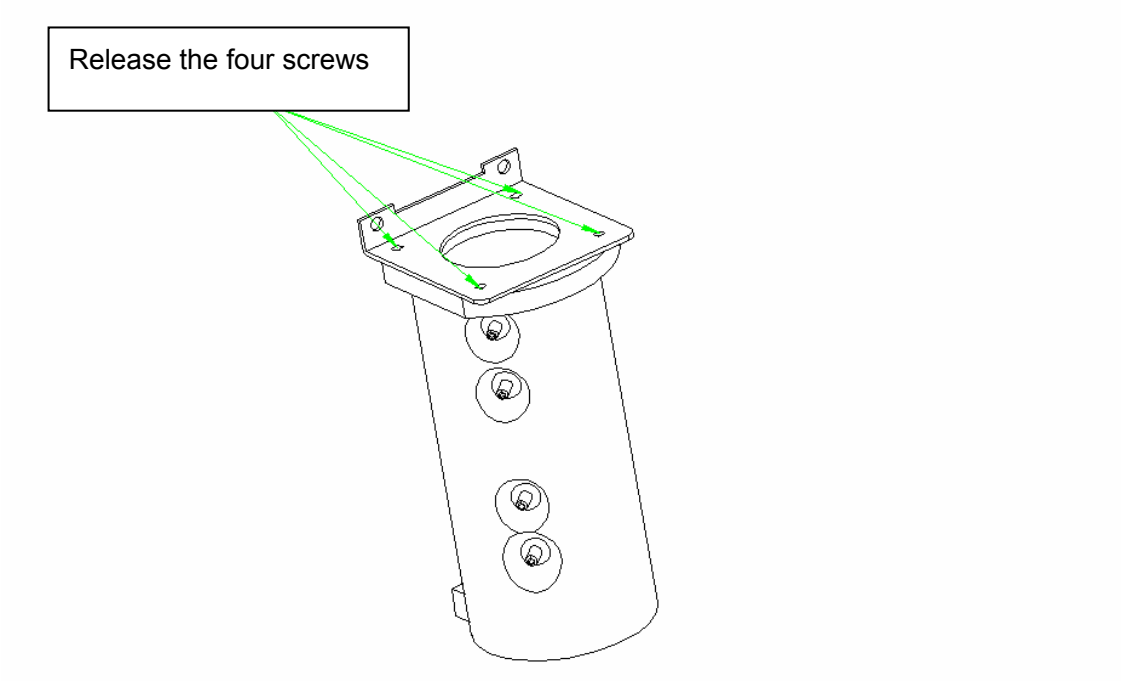


Figure 4-2-2

4.2.2 The replacement of the sampling injector seal ring

The O-ring of the sampling injector must be changed regularly, and the replacement of the O-ring of the sampling syringe should be operated in strict accordance with the following steps:

1) Release the four screws to fix the sampling syringe components, disassemble the sampling syringe components from the inner board, as shown in Figure 4-2-3:

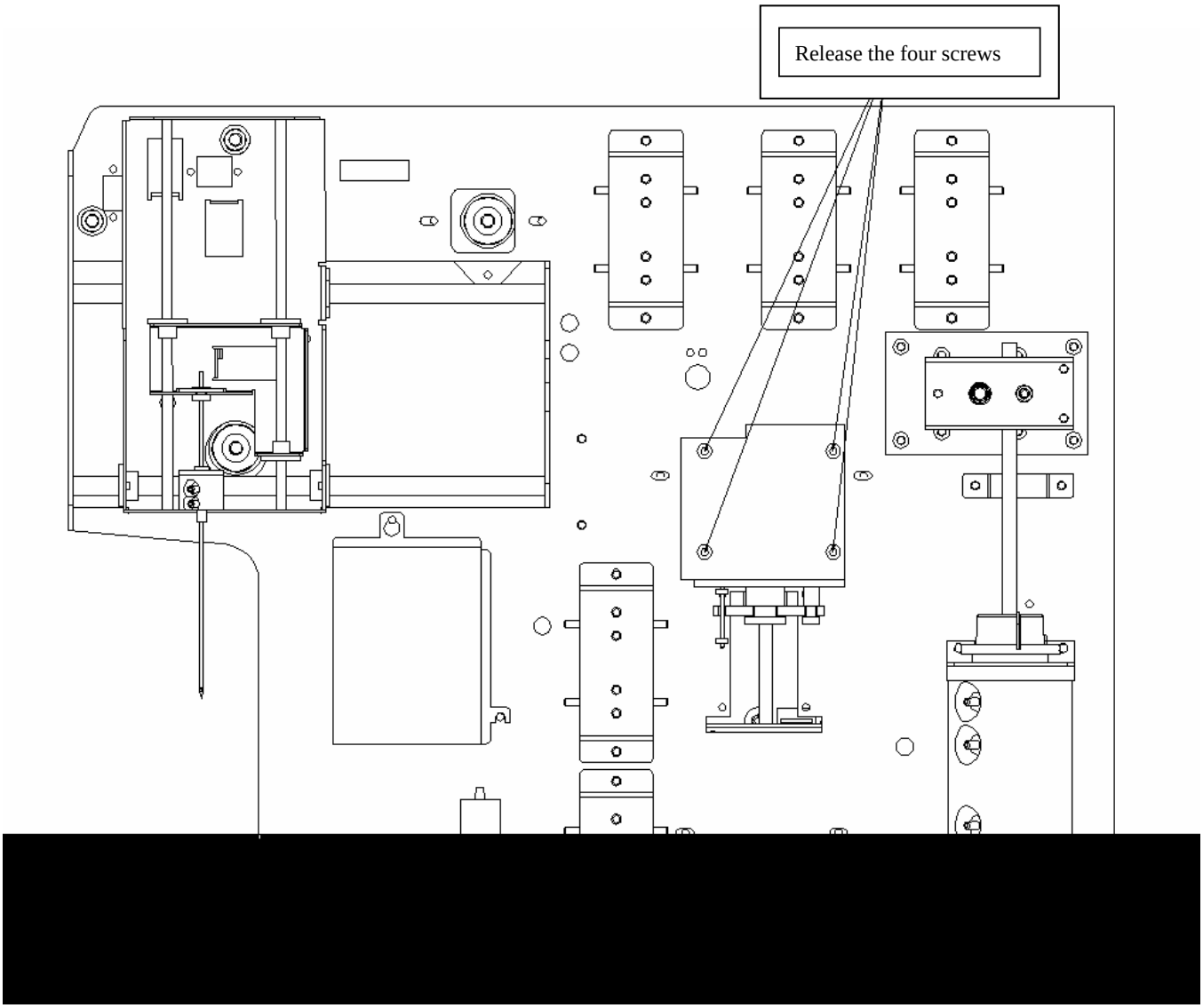


Figure 4-2-3

2) Release the four screws to fix the syringe base-board on the bottom of the syringe components, and you can pull the three pistons from the main body of the sampling syringe, as shown in Figure 4-2-4:

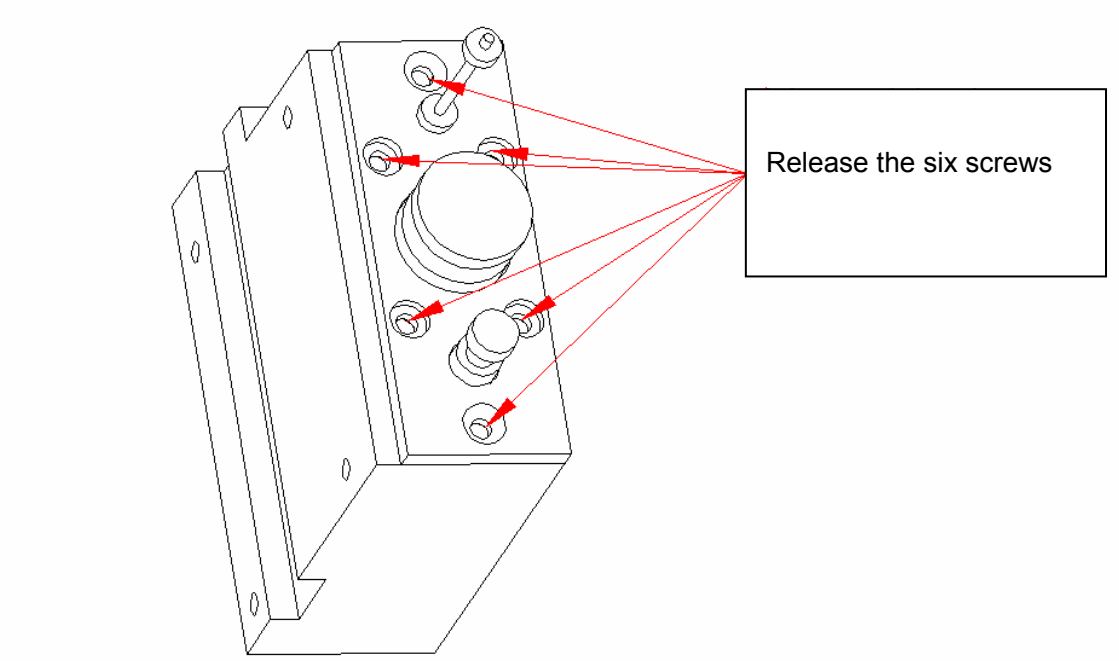


Figure 4-2-4

3) Take out the worn O-ring from the piston, and replace the corresponding new O-ring, coat the instrument specified lubrication sealed grease outside the O-ring, and reassemble it with the reverse order. As shown in Figure 4-2-5:

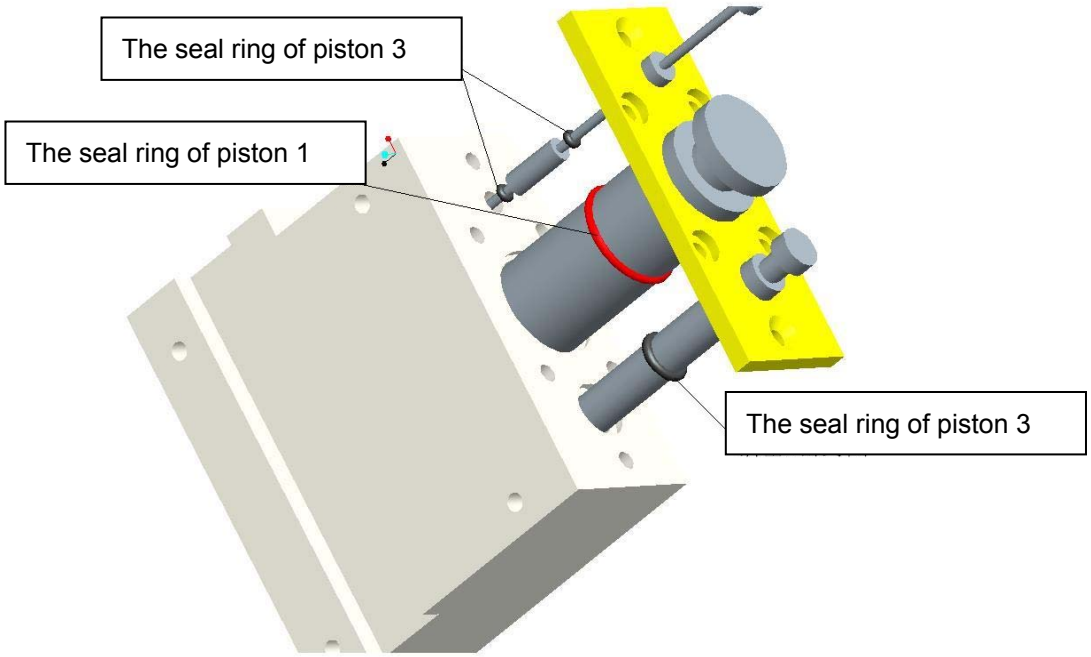


Figure 4-2-5

4.2.3 The replacement of the sampling needle cleaning head seal ring

If the sealing performance of the sampling needle has something wrong, the sampling needle cleaning head O-ring should be replaced, when replacing, please operate in strict accordance with the following steps, as Figure 4-3-6 shown below:

1) Loosen the two screws to fix the sampling needle on the sampling mounting plate, and then loosen the two screws to fix the cleaning head component on the motion rack;

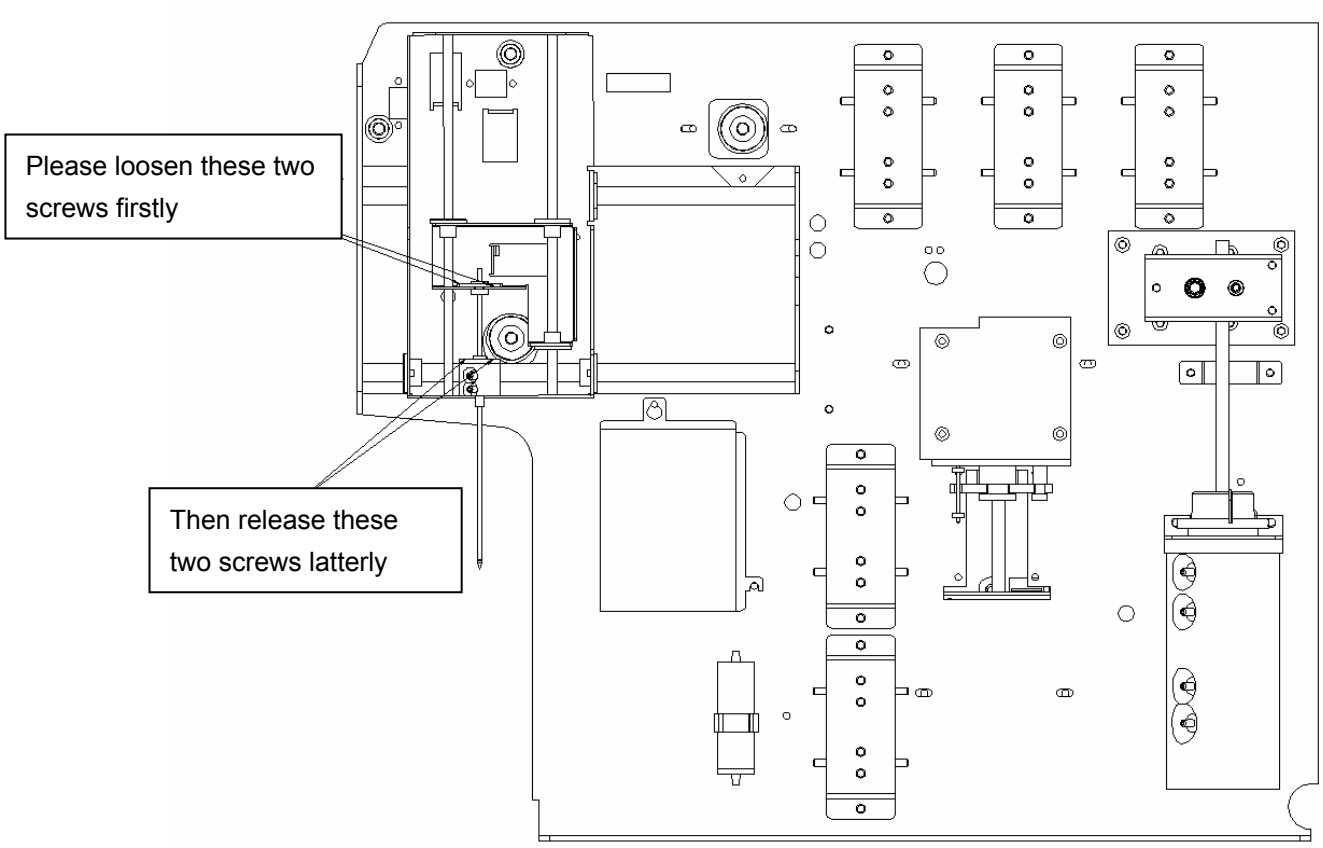


Figure 4-2-6

2) Remove the sampling needle and the sampling needle cleaning head components from the motion rack component, and then pull out the cleaning head cover and the sampling needle together from the sampling cleaning head, you can remove the worn O-ring from the sampling needle, and replace it with a new O-ring of the same specification, pay attention to coat the instrument specified lubrication sealed grease outside the O-ring, and reassemble it with the reverse order. As shown in Figure 4-2-7

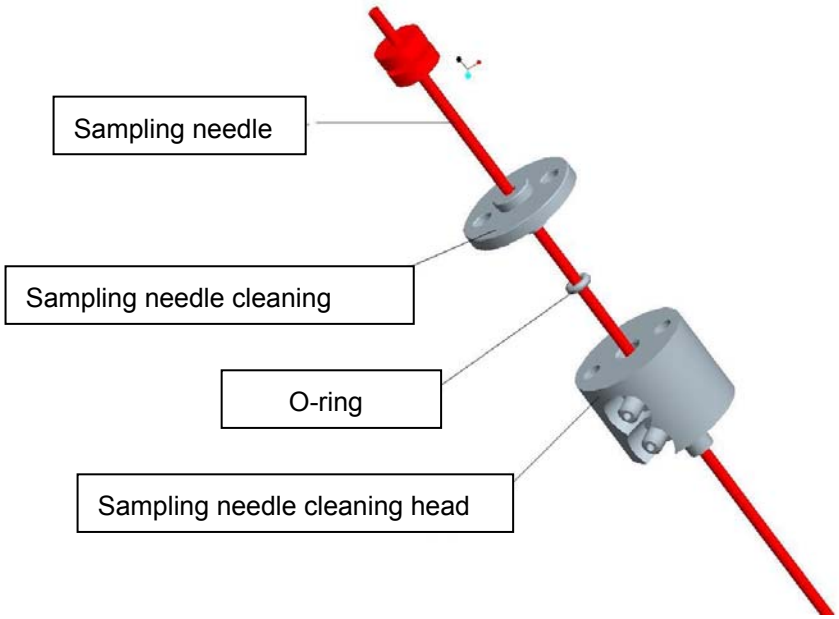


Figure 4-2-7

Warning: After the replacement of the seal ring, must coat the instrument specified lubrication sealed grease in strict accordance to the related requirements.

4.3 The replacement of sampling needle

The steps to replace the sampling needle is basically the same with the steps to replace the seal ring, firstly just as shown in Figure 4-2-6, loosen the four screws by the order of the figure, remove the sampling needle and the cleaning head components from the motion rack component; and then pull out the PVC pipe on the sampling needle; and finally as shown in Figure 4-2-7, remove the sampling needle from the cleaning head, and remove the sampling needle cleaning head cover and the seal ring from the sampling needle, at last replace a new sampling needle and reassemble it with the reverse order.

Chapter V Care & Maintenance

RT-7100 is a sophisticated clinical 3-part differential auto hematology analyzer, to maintain the instrument in a good condition, you must do the routine maintenance work well. The maintenance of RT-7200 is very simple, but it must be conducted carefully.

5.1 Cleaning the surface of the instrument

● Maintain the instrument working environment clean.

●The cleaning of the instrument surface must be conducted with some neutral detergents and damp cloth.

● LCD display must be cleaned with a soft cloth.

● If the drip pan within the instrument has some liquid, please clean the liquid to dry with a clean rag

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Warning: Do not allow any solvents, fats and oils, or corrosive substances contact with the instrument.

5.2 Rinsing the counting chamber

The counting chamber must be maintained clean, in order to ensure accurate and reliable measurement results.

1. Counting chamber external cleaning

If the external surface of the counting chamber shielded enclosure is dirty, please remove the shielded enclosure and clean it with a clean damp cloth to prevent any debris falling into the counting chamber cause Ruby bore blocking, resulting in that the instrument can not work properly.

2. Counting via internal cleansing

a. As for the daily maintenance, the entire pipeline must be washed before shut-down, in the non-normal shutdown (such as power failure during testing, etc.), should pay attention to the timely follow-up washing, otherwise easily lead to ruby bore blocking.

b. If there is some dirt within the counting chamber, resulting in ruby bore blocking and it can not be resolved after repeatedly block-removing, please remove the ruby and clean it.

5.3 Cleaning the sampling needle

If the outer wall of the sampling needle has some residue which can not be washed away, please wipe it lightly with a soft cloth soaked with anhydrous alcohol.

Warning: If do not use the instrument for a long period of time (more than one week), please empty the liquid within the counting cell.

Chapter VI Simple fault handling

Phenomenon	Solutions
1) The instrument can not be started	- Check whether the instrument is powered - Check whether the power plug is loosened - Check voltage
2) Automatic power off	- Check whether the instrument power supply is connected - Check whether the power cable is loosened - The internal fuse within the instrument breaks down for protection, turn off the power, and re-boot
3) No diluent	- Replace the diluent, then enter SERVICE menu and select Diluent to prime.
4) No cleanser	- Replace the multifunctional enzyme cleaning solution, then enter SERVICE menu and select “Cleanser” to prime.
5) No lyse	- Replace the hemolytic agent, then enter SERVICE menu and select “Lyse” to prime.
6) The waste liquid bottle is full	- Dump the waste liquid
7) Abnormal temperature	- Software main menu, click on “System information”- “System state”, view the ambient temperature, if the temperature is not within the range of 15°C~35°C return the ambient temperature of the instrument back to this range
8) The repeatable blank count value is too high	- Whether the reagent is used up - Whether the reagent is deteriorated or contaminated - Check whether the temperature or pressure is normal
9) Parameter testing is not accurate	- Calibrate the instrument - Check whether the position of the sampling needle is normal or not - Check whether there are air bubbles inside the liquid syringe, whether the piston movement is smooth. If there are bubbles,

	please confirm that the reagent pipeline connection is normal - Check whether the solenoid valve is working properly
10)The printer can not print	- Check whether the printer is out of paper - Check whether the connection is normal - Check the printer settings within the system settings
11) The quality control is not within the target value	- Check the validities of the reagents - Check whether the settings are correct, whether the parameters need to be modified or not. - Confirm the quality control is not contaminated - Re-test

Note: If the user meet an error can not be solved in the course of operating, or a recurring error, please contact the supplier.

Note:

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