BeneSphera™ Brand

3-PART DIFFERENTIAL

Hematology Analyzer H32

Service Manual

BeneSphera™

Part of AVANTOR™ PERFORMANCE MATERIALS

BeneSphera™ Brand
3-Part Differential Hematology Analyzer Service Manual

Rev: 1.0

How to Use This Manual

For the best results, you should familiarize yourself with this analyzer and its performance before conducting clinical tests. This manual provides guidelines for using the BeneSphera™ Brand 3-Part Differential Hematology Analyzer, including instructions on installation, daily tests, daily maintenance and Quality Control (QC).

The functionality of instruments with different software versions or configurations may be different than what is described in this manual. In addition, the content of this user manual may differ from the actual instrument because of upgrades. If you have any questions, please contact the distributor. We recommend retaining all packaging materials in the event that the unit needs to be stored, transported or returned to the distributor for maintenance.

Declaration and Notice of Liability Limitation

Avantor Performance Materials, Inc. ("Avantor") warrants the proper functioning of this unit for a period of one (1) year from the date of sale, and will repair or replace this unit (at Avantor's option) if the unit fails to function properly due to defects in parts or workmanship. Avantor assumes no liability of any type or kind, including for bodily injury (including death),or for property damage, or for the accuracy of the results obtained using this product. Avantor's responsibility is limited to repair or replacement of this product in the event of product failure to the extent due to a defect in parts or workmanship.

AVANTOR DOES NOT PROVIDE ANY OTHER WARRANTIES WITH RESPECT TO THIS PRODUCT, INCLUDING THE WARRANTIES OF FITNESS FOR ANY PARTICULAR PURPOSE OR USE, OR MERCHANTABILITY.

Further, while Avantor has undertaken reasonable efforts to ensure the accuracy of the information in this manual, Avantor provides no warranty that all of the information in this manual is accurate or up to date. The figures in the manual are only for demonstration, and may be different from the actual display.

Warnings and Directions

All warnings and directions must be followed strictly to minimize the risk of injury, and to ensure the normal performance of the instrument and the accuracy of test results

	**WARNING:** Flags a procedure that if not followed properly, can prove to be extremely hazardous to either the operator or the environment or both.
	**CAUTION:** Emphasizes operating procedures that must be followed to avoid possible damage to or destruction of the instrument, or loss of important data.
	**BIOLOGICAL RISKS:** Consider all specimens, reagents, calibrators, controls, etc. that contain human blood or serum as potentially infectious! Use established, good laboratory working practices when handling specimens.
	**ELECTRICAL RISKS:** Avoid contact with interior electrical circuits. Contact with interior electrical circuits presents a risk of electrical shock, bodily injury, and death.

IMPORTANT NOTES:

- Emphasizes operating procedures that must be followed to avoid erroneous results.
- Emphasizes the important information especially helpful to the operator before, during or after a specific operational function.

WARNINGS AND PRECAUTIONS

The instrument must be connected to a power outlet of correct voltage. Turn the power to this instrument off whenever it is being serviced or if it will not be used for an extended period of time.

Proper maintenance is essential. If the instrument is not maintained properly or repaired as needed, abnormal or inaccurate results may occur and the instrument itself may sustain damage.

This instrument must be operated under the stated conditions. If not, abnormal or inaccurate results may occur and the instrument itself may sustain damage.

This instrument is an automated hematology analyzer and is intended only for *in vitro* diagnostic use in clinical laboratories. The warnings below are required to be strictly followed.

If you experience smoke, a peculiar smell or sound while using this device, the power supply must be immediately switched off and the distributor or seller advised. If the instrument continues to be used under these circumstances, serious injury, death and/or property damage could result from fire or other instrument malfunction.

Keep blood samples, reagents and metal pieces, such as tools, away from the interior of the instrument to avoid causing a short circuits or other electrical malfunction. If any blood samples, reagents or metal pieces come into contact with the interior of the instrument, immediately switch

off the power supply and disconnect the plug from the power socket.

Avoid contact with interior electrical circuits. Contact with interior electrical circuits presents a risk of electrical shock and death.

Use of protective clothing and gloves is strongly recommended when operating or maintaining this instrument. After completion of work, wash hands with soap, water and appropriate disinfectants.

Consider all specimens, reagents, calibrators, controls, etc., that contain or come into contact with human blood or serum as potentially infectious. Wear protective clothing and gloves and follow all bio-safety practices. Should blood or serum come into contact with an open wound, mucous membrane or get into the eyes, rinse the area well and seek immediate medical advice.

Use of Reagents

Avoid direct contact with reagents. Reagents can cause irritation of the eyes, skin and mucous membranes. Should you come in contact with reagents, rinse immediately with plenty of water and seek immediate medical advice.

Do not swallow the reagents. If swallowed, follow the instructions on the Material Safety Data Sheet (MSDS) and contact your local poison control center.

Disposal procedures for residual reagents, detergent and other waste must meet the requirements of all applicable local regulations. The appropriate biological precautions must be taken.

Voltage, Connection and Grounding of Power Supply

The instrument must be connected to a power outlet of correct voltage and must be properly grounded. The power switch and input voltage supply connection should always be accessible.

	**ELECTRICAL RISKS:** Risk of Electrical Shock and Death. Avoid damaging the power cable. Do not place any appliances on the same circuit. Do not pull the power cable. When the peripherals are connected, the power supply must first be powered off, or a short circuit or open circuit might be caused.

	**ELECTRICAL RISKS:** Risk of Electrical Shock and Death. Do not open the side or rear covers or upper panel while the instrument is running.

CONTENTS

1. Instrument Introduction

1.1 Product Introduction

1.1.1 Product name: Auto Hematology Analyzer

1.1.2 Model: BeneSphera™ 3-Part Differential

1.1.3 Test items

This analyzer uses the impedance principle (colorimetric for hemoglobin measurement) to categorize and count blood cells in blood. All test parameters are shown in Table 1-1.

Table 1-1

System Parameters	Abbreviation	Unit (Default)
White Blood Cell count	WBC	10^9/L
Lymphocyte count	LYM#	10^9/L
MID Cell count	MID#	10^9/L
Granulocyte count	GRA#	10^9/L
Lymphocyte percentage	LYM%	%
MID Cell percentage	MID%	%
Granulocyte percentage	GRA%	%
Red Blood Cell count	RBC	10^{12}/L
Hemoglobin concentration	HGB	g/L
Hematocrit	HCT	%
Mean corpuscular volume	MCV	fL
Mean corpuscular hemoglobin	MCH	pg
Mean corpuscular hemoglobin concentration	MCHC	g/L
Red Cell Distribution Width SD	RDW-SD	fL
Red Cell Distribution Width CV	RDW-CV	%
Platelet count	PLT	10^9/L
Mean Platelet Volume	MPV	fL
Platelet Distribution Width	PDW	%
Plateletcrit	PCT	%
Platelet–large cell ratio	P-LCR	%
White Blood Cell histogram	WBC Histogram	
Red Blood Cell histogram	RBC Histogram	
Platelet histogram	PLT Histogram	

1.2 Product Technical Parameters

Test principle	:	WBC/RBC/PLT: Impedance method; HGB: colorimetric
Aspiration volume	:	9.8μL (Whole Blood), 9.8μL (Anticoagulant Peripheral Blood), 20μL (Pre-diluted Peripheral Blood)
Test rate	:	About 1 min/ea.
Working environment	:	15°C～35°C, relative humidity 10%～90%
Storage environment	:	0°C～40°C, relative humidity ⩽ 80%
Power supply	:	a.c.110V～220V, 50/60Hz
Input power	:	96VA

1.3 Instrument Design and Structure

The analyzer is composed of counting chambers, flow tubing system, computer control system and software.

1.3.1 Front View

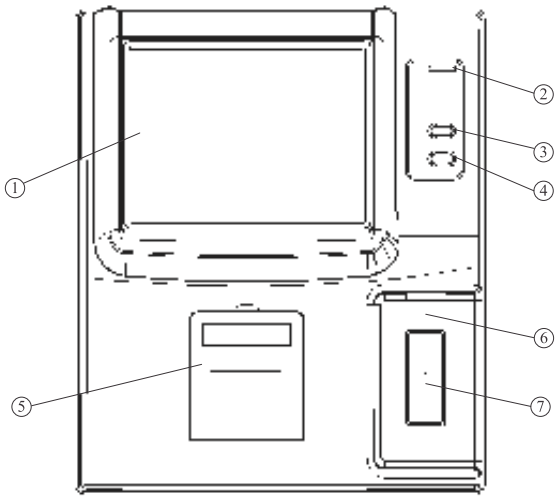


Fig.1-1 Front view

1. Display screen: displays the software interface.
2. Indicator light: yellow at startup, turns red when starting sample test and turns green when sample test is finished.
3. Feed key: built-in printer releases the paper outward.
4. Test key: the instrument will aspirate sample when this key is pressed in analysis mode.
5. Printer cover: paper installation position for built-in printer.
6. Sampling needle: use sampling needle to aspirate blood sample.
7. Aspiration key: the instrument will aspirate sample when this key is pressed in analysis mode. This has the same function as the Test key.

1.3.2 Rear View

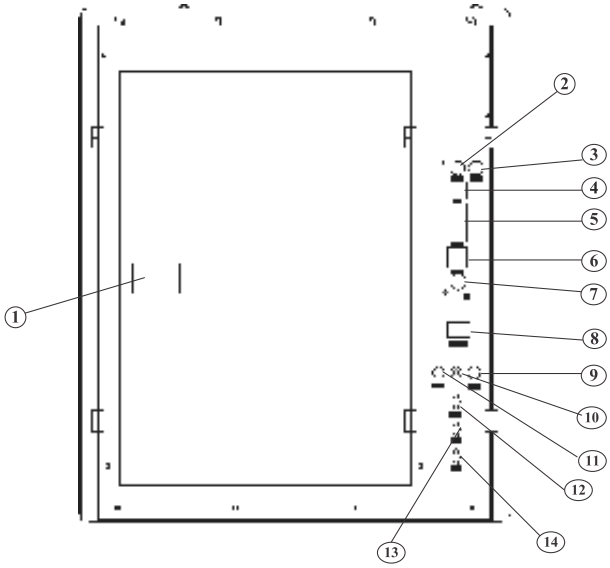


Fig.1-2 Rear view

1. Rear cover lock switch: unlock this switch to open the rear cover to replace reagent.
2. Keyboard interface: PS/2 keyboard interface
3. Mouse interface: PS/2 mouse interface
4. USB port
5. RS-232 serial port: to connect with data receiving devices
6. Network interface
7. Power interface: to connect with external power supply
8. Power switch: switch instrument power
9. Diluent sensor
10. Grounding hole: used for instrument grounding
11. Cleanser sensor
12. Cleanser port
13. Diluent port
14. Waste port

2. Installation

2.1 Unpacking the Instrument

1. Unpack the instrument from its packing and remove the material used for transportation. Please keep the original packing carton and packing material, in case you need to repack the instrument in the future.

2. Remove the instrument from plastic package.

3. In accordance with the packing list, make sure the packing carton includes:

- BeneSphera™ Brand 3-Part Differential Hematology Analyzer
- User manual
- Packing list
- Agent warranty certificate
- Power adapter
- Product COA

NOTE: please remember to review the packing list that came with this product. In case of a discrepancy, please contact the distributor.

2.2 Installation Environment

In order to ensure proper instrument functionality, please consider the following working conditions for the BeneSphera™ Brand 3-Part Differential Hematology Analyzer:

- Avoid direct sunlight
- Avoid a dusty environment
- Avoid electromagnetic radiations and fields
- Ensure sufficient working space around the instrument

NOTE: for the best performance, this product should be operated in an environment with a temperature between 15°C and 35°C and relative humidity of 10% to 90%.

CAUTION: FAILURE TO OBSERVE THE ABOVE WORKING CONDITIONS AND ENVIRONMENTAL FACTORS CAN RESULT IN INSTRUMENT MALFUNCTION AND INACCURATE RESULTS.

2.3 Power Requirement

- a.c.110V～220V
- 50/60Hz
- l96VA

WARNINGS:

(1) AC power must be properly grounded.

(2) AC power must be stable; avoid using other instruments that consume large amounts of power on the same power group.

(3) If there is smoke, smell or noise coming from the instrument, immediately shut off the power, disconnect the power cable and contact your distributor.

(4) When (un)plugging the power connector, hold the connector by the plug itself, instead of by the power cord.

FAILURE TO FOLLOW THE ABOVE REQUIREMENTS AND INSTRUCTIONS CREATES A RISK OF ELECTRICAL SHOCK, INJURY AND DEATH.

2.4 Reagents

The instrument uses lyse, cleanser and diluent for measurement and maintenance. Failure to use the reagents shipped with the instrument or reagents recommended by the distributor can affect the accuracy of test results and can void the manufacturer's warranty.

2.4.1 Connection of Lyse

1. From the reagent packing carton, take out lyse and cleanser bottles respectively, open the door at the rear panel of the instrument and place the lyse bottle in the lyse compartment.

2. Open the bottle lid and insert the lyse reagent adapter into the lyse bottle and tighten the bottle cap.

2.4.2 Connection of Cleanser

1. Take out the cleanser reagent adapter from the accessories bag.
2. Connect the cleanser reagent adapter tube to the "Cleanser" connector on rear panel of instrument.
3. Insert the other end of the reagent adapter into cleanser bottle, and tighten the bottle cap.

2.4.3 Connection of Diluent

1. Take out the diluent reagent adapter from the accessories bag.
2. Connect the diluent reagent adapter end to the "Diluent" connector on rear panel of instrument.
3. Insert the other end of catheter into diluent bottle and tighten the bottle cap.

2.4.4 Connection of Waste

1. Take out the waste tubing from accessories bag.
2. Connect the waste tubing end to the "Waste" connector on the rear panel of instrument.
3. Rotate the bottle cap clockwise on the waste tubing to tighten it on the waste bottle.

CAUTION:

(1) The reagent tubings must not be twisted, folded or blocked.

(2) Please do not use expired reagents.

(3) Use only the reagents provided with the instrument or recommended by Avantor or a licensed distributor.

BIOLOGICAL RISKS:

(1) The waste must be treated in accordance with country and local regulations.

(2) Wear rubber gloves and appropriate protective clothing during waste disposal.

2.5 Connection of Keyboard, Mouse

1. Carefully take out the keyboard and mouse from the packing carton.
2. Carefully insert keyboard cable plug into the socket marked "Keyboard" on the instrument's rear panel.
3. Carefully insert the mouse cable plug into socket marked "Mouse" on instrument rear panel.

2.6 Connection of External Printer

1. Make sure both the printer and instrument have been shut down.
2. Insert one end of USB cable into printer USB interface socket.
3. Insert the other end of USB cable into instrument USB interface.
4. Connect printer to AC power supply with the power connector supplied with printer.

3. Electronic Boards Description

The BeneSphera™ Brand 3-Part Differential Hematology Analyzer electrical circuit system is composed by the following electronic boards:

1. Analogue board (integrated with front CPU board and analog signal board)
2. Main board (Working as controlling computer)
3. Power supply interface board
4. Printer driving board (integrated in the printer module)
5. Stepper motor driving board
6. Keypad board
7. Touch panel driving board
8. LCD converter board
9. Interface board

CAUTION: DO NOT change any settings, voltages, jumpers on any of the electronic boards unless properly trained by Avantor or authorized 3rd parties. Improper settings can result in inaccurate test results.

ELECTRICAL RISKS: Risk of electrical shock and death. Keep fingers and other body parts, and any conductive materials, away from any electronic parts during troubleshooting.

3.1 Analogue Board

The Analogue board includes two boards: Front CPU board and Analogue Signal board. Functional description:

1. The front CPU board sends the commands to each part of the instrument, and executes procedures after receiving feedback signals, until the end of the sample test. It also gives out warnings when receiving error signals or incorrect timing commands.
2. It connects to the main board via a serial port, receiving the high-level control commands from the main board.
3. The Analogue Signal board is composed of motor controller C8051F020. It controls the movements of each part by MCS 51: X-axis motor; Z-axis motor; syringe motor; negative pressure syringe motor and 11 valves. It also performs the home position detection of the mechanical parts.
4. It performs the acquisition and processing of different analog signals, including the pulse signal from WBC and RBC counting baths, and analog signals from the HGB photoelectric and pressure sensor. It converts the pulse signals into digital signals and classifies them to WBC, RBC and HGB. Then it saves the signals and transfers them to the main board.
5. Though, the heart of the instrument's controlling program is the main board, which adjusts the 5024 digital potentiometers on the analog board, to perform electronically signal gaining adjustments.
6. It is used for the output voltage transfer; DC 24V input transfers into +12V and -12V for analog circuit; DC 5V for front CPU and its circuit).

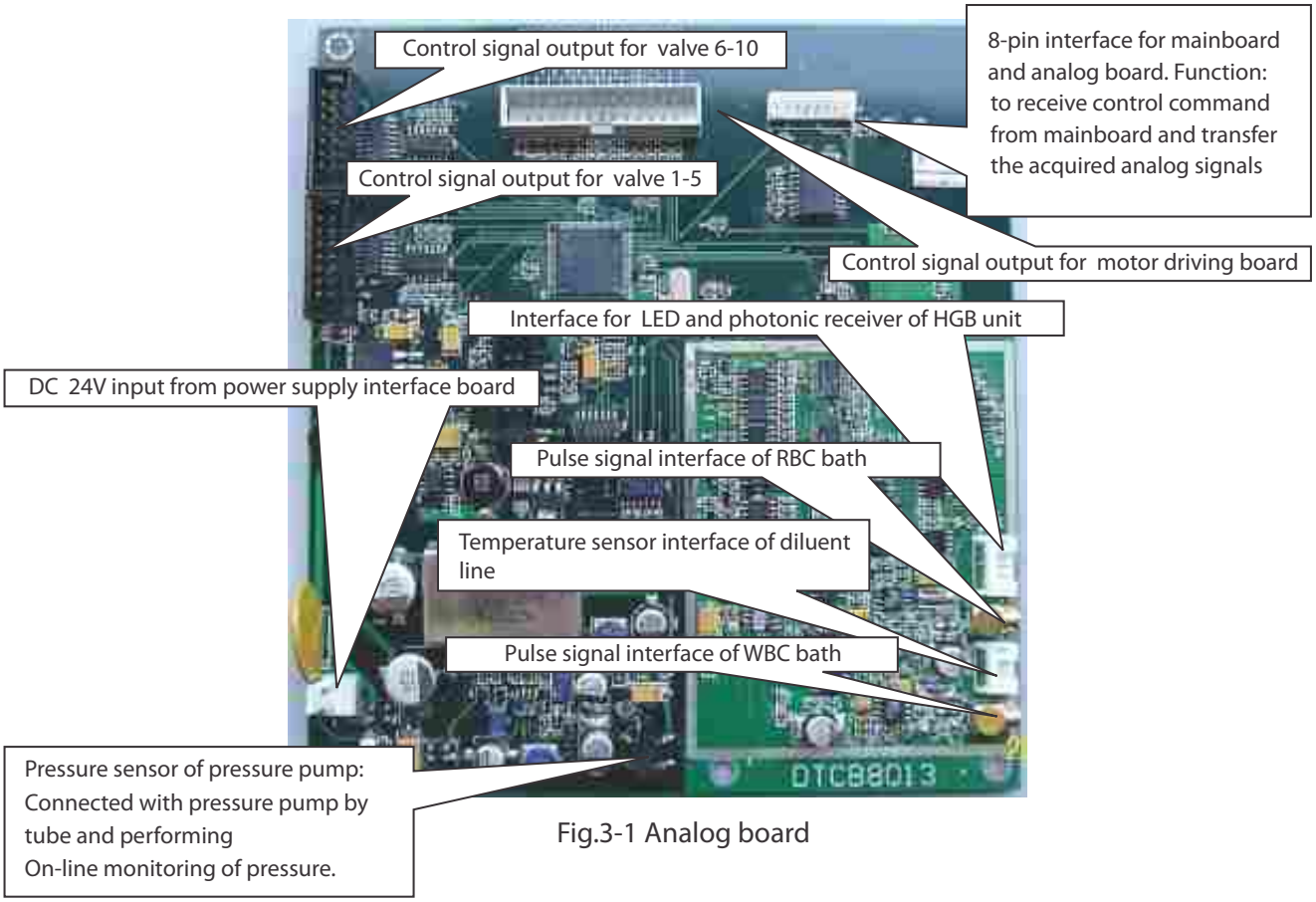


Fig.3-1 Analog board

3.2 Mainboard

3.2.1 Functional Description

Mainboard EMB-3680 is a low power consumption board, powered by +5V/+24V single power supply and features:

1. Geode™ LX 700/800+AMD Geode CS5536 chip. It supports: AMD Geode™ LX 700@0.8W or Geode™ LX 800@0.9W CPU.
2. 200 pin DDR SO-DIMM memory (ECC not supported, 333/400MHZ DDR supported, max 1G Bytes).
3. Integrated Realtek RTL 8100 network cards.
4. VGA, LVDS, and TTL display output mode (VGA, LVDS, TTL support two individual displays, LVDS and TTL can't be used at the same time).
5. For external storage usage, there is one Mini IDE channel providing 2 hard disk interfaces, 1 socket for COMPACT FLASH card, and 4 USB 2.0 interfaces.

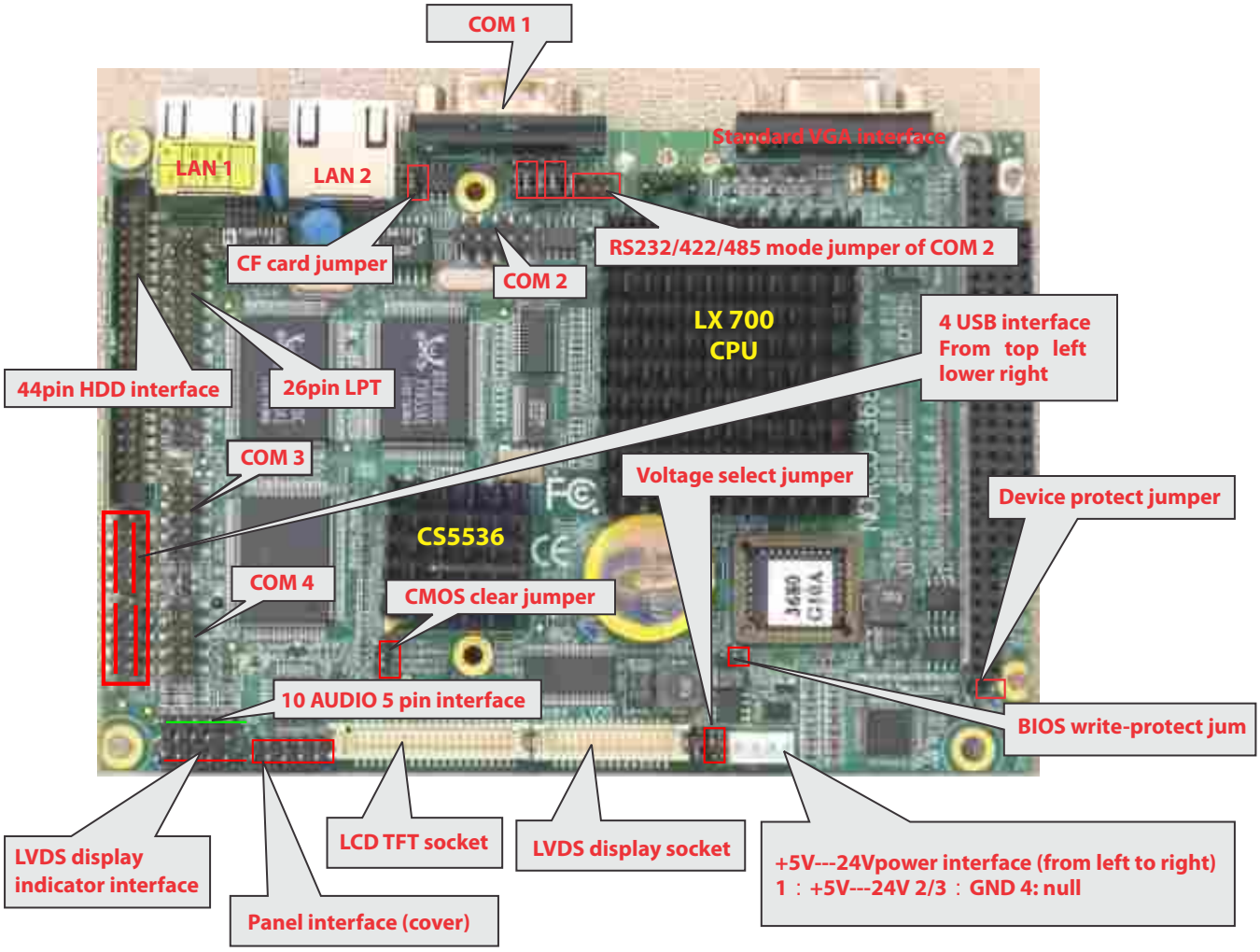


Fig.3-2 Mainboard

Definitions of BeneSphera™ Brand 3-Part Differential Hematology Analyzer interfaces:

COM 4: Connected to analogue board

COM 3: Connected to printer

COM 2: Connected to touch panel

COM 1: Connected to interfaces

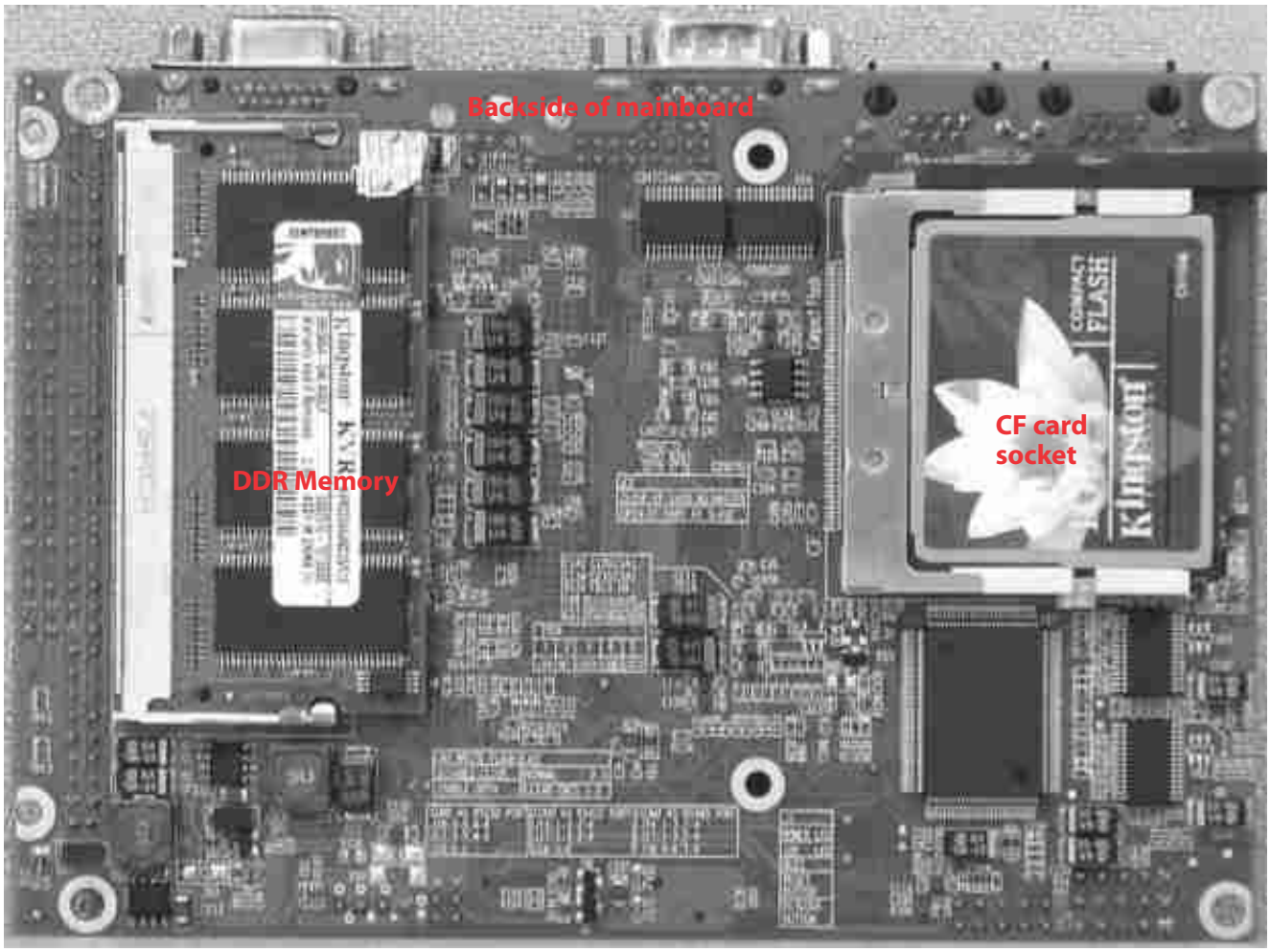


Fig.3-3 Backside of mainboard

3.2.2 Definition of Jumpers

3.2.2.1 Jumper to Clear CMOS Configuration (JCC)

From top to bottom is pin 1, 2 and 3. When you want to clear the CMOS configuration, first switch off the power supply of the instrument (or you can just switch off +5V---24V power supply), use the jumper to connect pin 1 and 2, then take off the jumper and connect pin 2 and 3 again, connect the instrument with the power supply and start the instrument. The CMOS configuration will be reset to default value.

JCC:	
1-2	CLEAR CMOS
2-3	NORMAL

CAUTION: To prevent damages to the mainboard, you must NOT perform the cleaning of CMOS configuration when system is working.

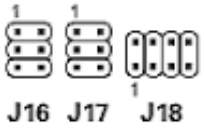
3.2.2.2 Write-protect Jumper for Anti-virus

When you want to modify BIOS configuration, please keep this jumper open. At normal conditions during your daily operation, please keep this jumper closed to prevent BIOS data affected by viruses.

JAV: WRITE FLASH	
CLOSE	DISABLE
OPEN	ENABLE

3.2.2.3 RS232/422/485 Mode Jumper for COM 2

This jumper is used to set RS232/422/485 transfer mode for COM 2, default mode is RS232. For settings, please refer to following table:



COM2	RS232		COM2	RS422		COM2	RS485	
J16	3-5	4-6	J16	1-3	2-4	J16	1-3	2-4
J17	3-5	4-6	J17	1-3	2-4	J17	1-3	2-4
J18	1-2		J18	3-4		J18	5-6	7-8

3.2.2.4 CF Card Jumper (JCF)

This jumper is used to set CF card and IDE2 devices (such as hard disk) as master or slave device.

JCF	
OPEN	Set CF card as slave device
CLOSE	Set CF card as master device

If you want to set CF card as the master startup device, please set JCF jumper as CLOSE.

If you want to set CF card as the slave startup device, please set JCF jumper as OPEN.

Because the BeneSphera™ Brand 3-Part Differential Hematology Analyzer uses a CF card as a master external storage device, the JCF jumper is set to CLOSE.

3.2.2.5 Voltage Select Jumper

Voltage settings		
J3	1-2	5V
	2-3	3V
J2	1-2	5V
	2-3	12V

3.2.2.6 Device Protect Jumper

This jumper is used to protect the PC104 device and the display device. When the power supply Voltages are higher than +12V, this jumper is set to CLOSE.

J6	
VCC>12V	CLOSE
VCC<12V	OPEN

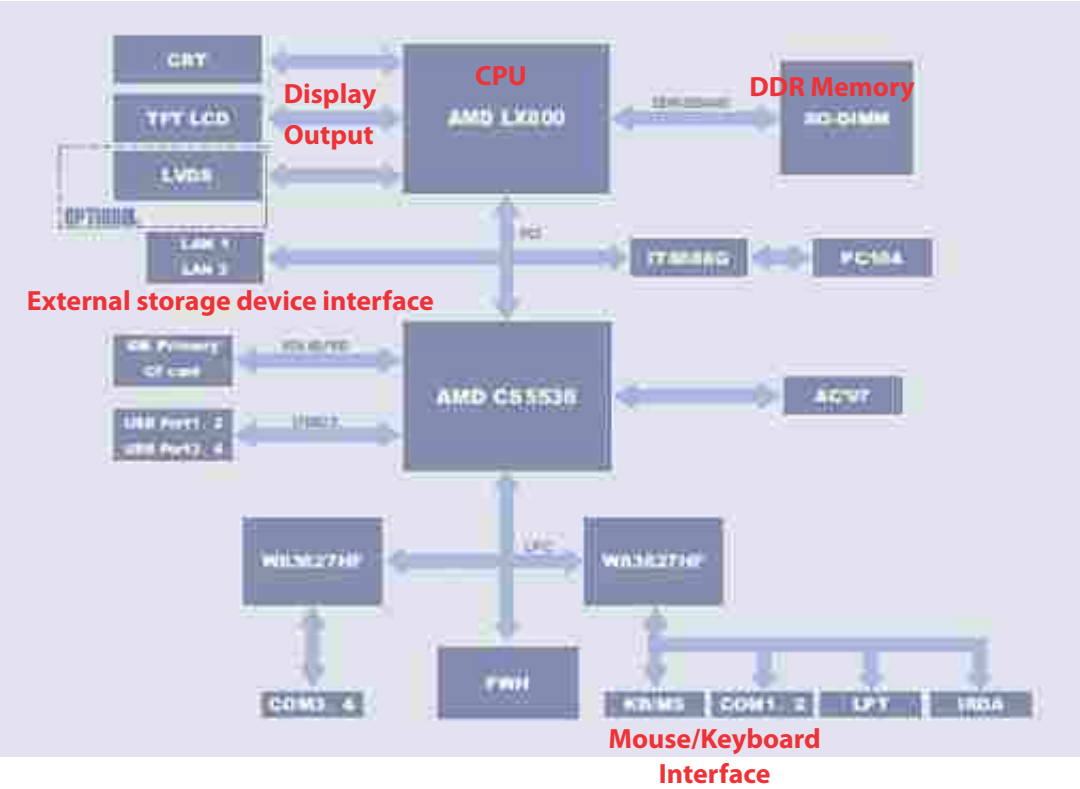


Fig.3-4 Block diagrams of communication connections

3.3 Power Supply Interface Board

This board connects different parts and provides power supply to them. It uses a power supply chip to complete the DC/DC conversion, provides +12V, two way +5V output for the Mainboard, touch panel and printer.

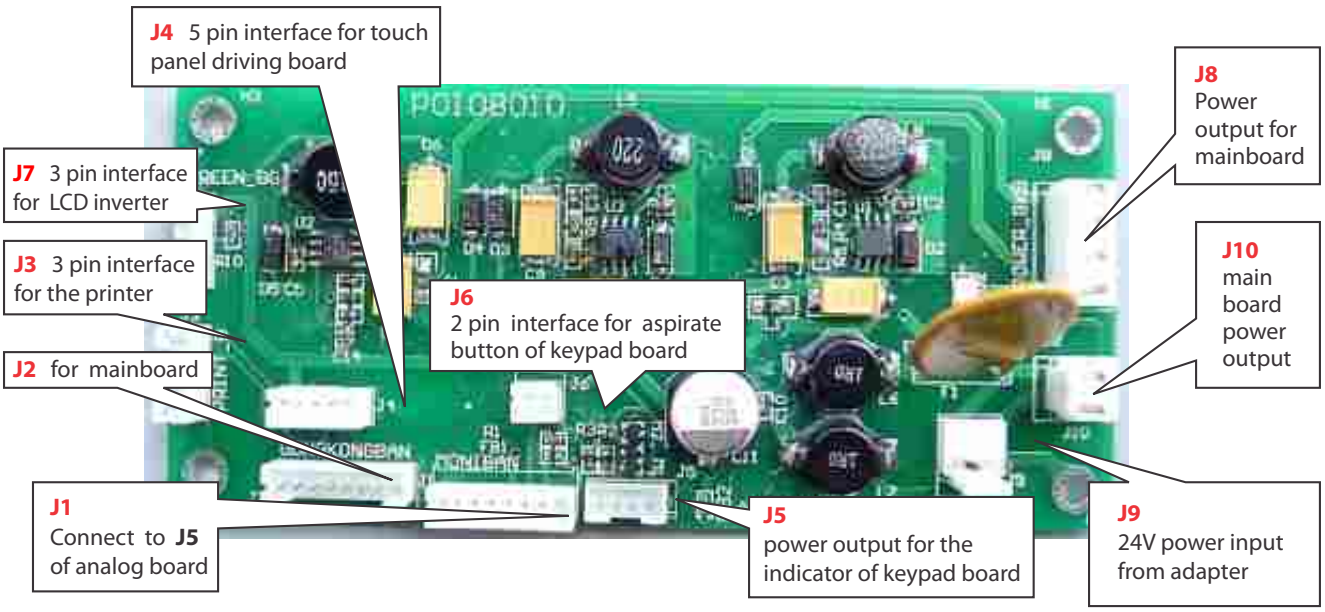


Fig.3-5 Power supply interface board

3.4 Motor Driver Board

This board controls and detects movement of various parts. It uses L297 and L298 chips to drive different motors and transfers the home position signals to the front CPU board.

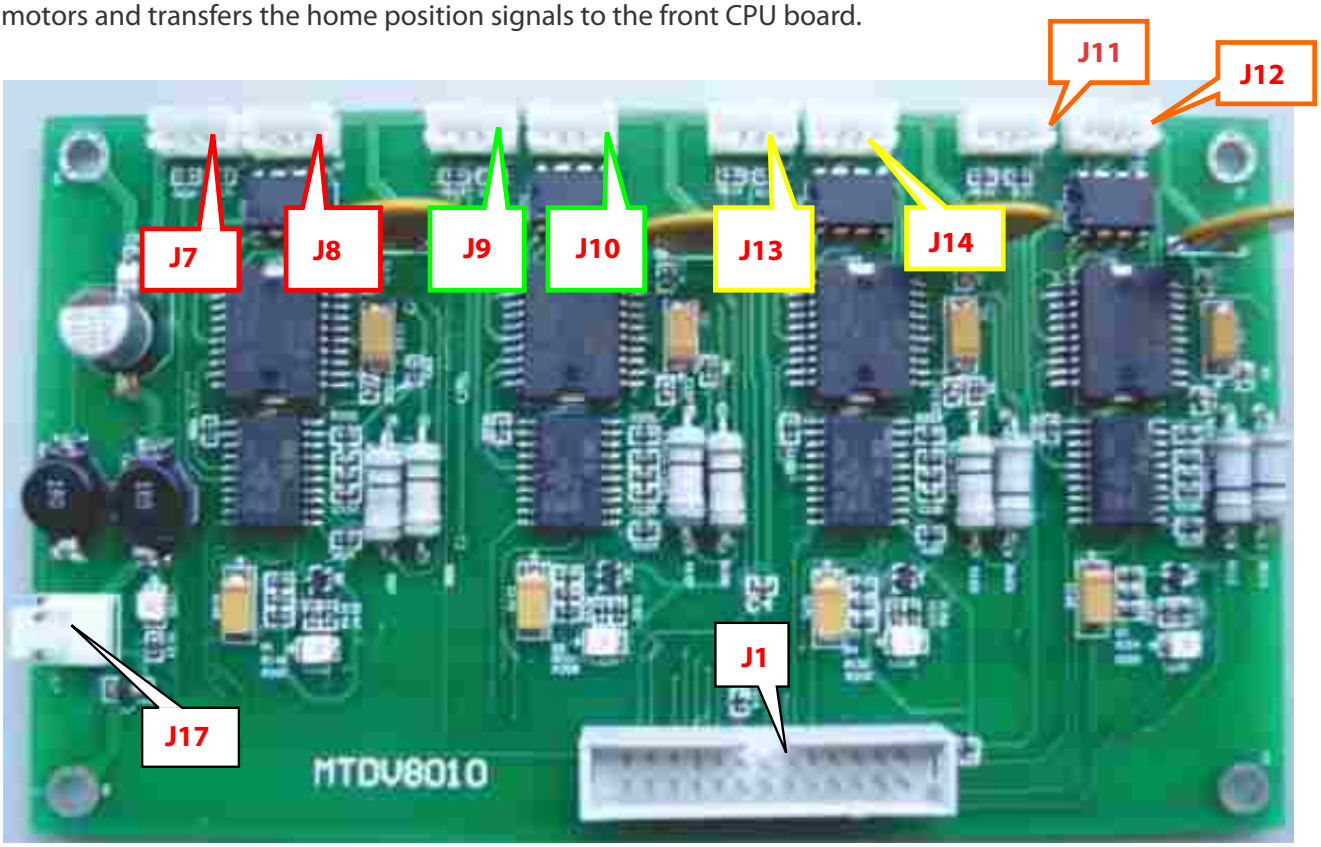


Fig.3-6 Motor driver board

J1: Four-channel stepper motor driving signal input from analog board (connect to J7 of analog board)

J7: 4-pin interface for the home position detector of pressure syringe.

J8: 4-pin interface for the stepper motor of pressure syringe.

J9: 4-pin interface for the home position detector of reagent dispensing pump.

J10: 4-pin interface for the stepper motor of reagent dispensing pump.

J11: 4-pin interface for home position detector of horizontal movements of sampling needle carrier.

J12: 4-pin interface for the stepper motor which controls the horizontal movements of sampling needle carrier.

J13: 4-pin interface for home position detector of vertical movements of sampling needle carrier.

J14: 4-pin interface for the stepper motor which controls the vertical movements of sampling needle carrier.

J17: 24V input from power adapter.

⚠	**CAUTION:** Be careful when (re)connecting any connectors. Any wrong connection may cause damage to the different motors, sampling needle and counting baths, and may result in instrument malfunction and inaccuracy.

3.5 Keypad Board

The two indicators indicate the actual status of the instrument and the two buttons are the paper feed and sample aspiration buttons.

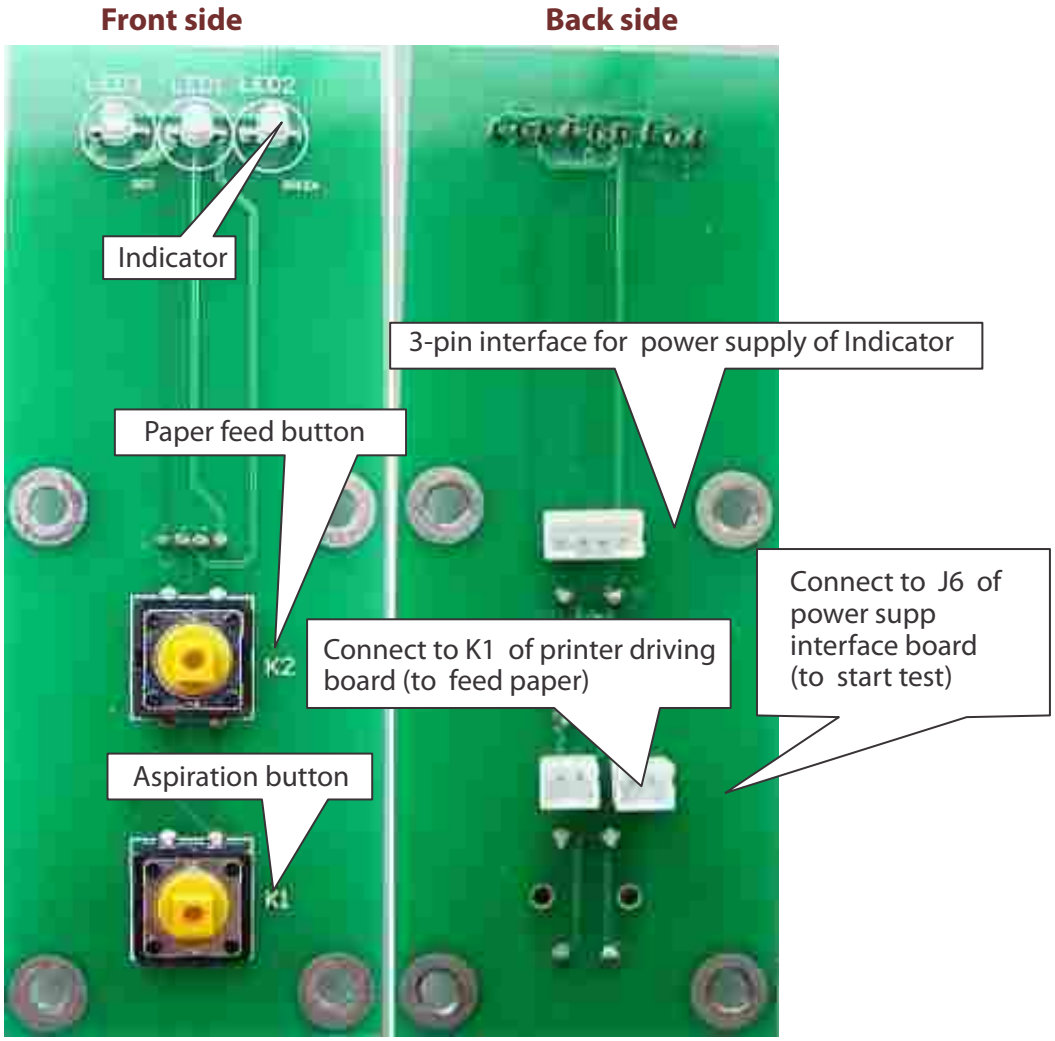


Fig.3-7 Keypad board

The aspiration button is connected in series with the aspiration key at the position of the sampling needle. Together, their function is to start the instrument for sample testing.

The Indicator shows the status of instrument:

1. Red indicates that the instrument is busy; the keys are not functional when the indicator is red.
2. Green means that the instrument is in a ready status, and the instrument is ready to start any operation.

4. Fluidic System

4.1 Fluidic Diagram

Fig. 4-1 shows the Fluidic diagram of the instrument:

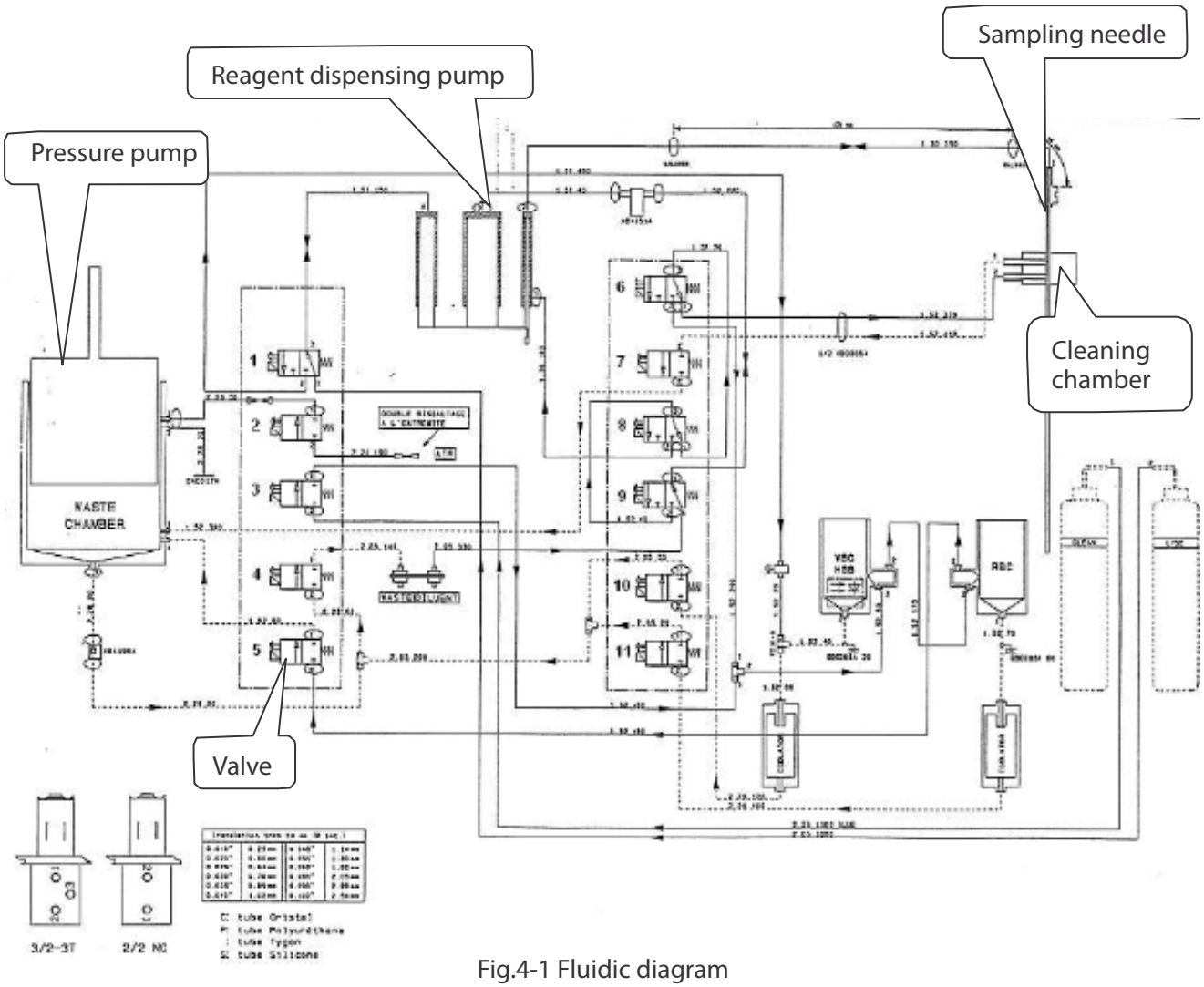


Fig.4-1 Fluidic diagram

4.2 Composition of Fluidic System

The fluidic system of BeneSphera™ Brand 3-Part Differential Hematology Analyzer is composed of: 4 three-way valves; 7 two-way valves; WBC counting bath; RBC counting bath; two buffering isolation chambers; sampling needle; cleaning chamber; reagent dispensing pump; pressure syringe; three reagents (Lyse, Diluent, Cleanser); waste bottle; temperature sensor and devices to eliminate static electricity.

4.3 Functions of Valves

As shown in fig. 4-1, there are 11 valves, which functions are as follows:

Valve 1 : Controls the dispensing of LYSE.

Valve 2 : Releases pressure from the pressure syringe; aspirate air (venting).

Valve 3 : Add CLEANSER to WBC counting bath.

Valve 4 : Drains waste from the waste chamber of pressure syringe to the waste bottle.

Valve 5 : It is activated when the WBC/RBC counting bath is counting and controls the negative pressure.

Valve 6 : Add DILUENT into WBC counting bath.

Valve 7 : Drains the waste from the wash block when washing the sampling needle.

Valve 8 : Add DILUENT into sampling needle wash block.

Valve 9 : Controls the dispensing of DILUENT.

Valve 10 : Drains WBC counting bath.

Valve 11 : Drains RBC counting bath.

4.4 Introduction of the Solenoid Valves

4.4.1 Working Principle of Solenoid Valves

Please refer to below Fig. 4-2 which shows the working principle of solenoid valves. At the left side the status is shown when it is not energized. The right side shows the status when it is energized. The direction of the magnetic force is to the right.

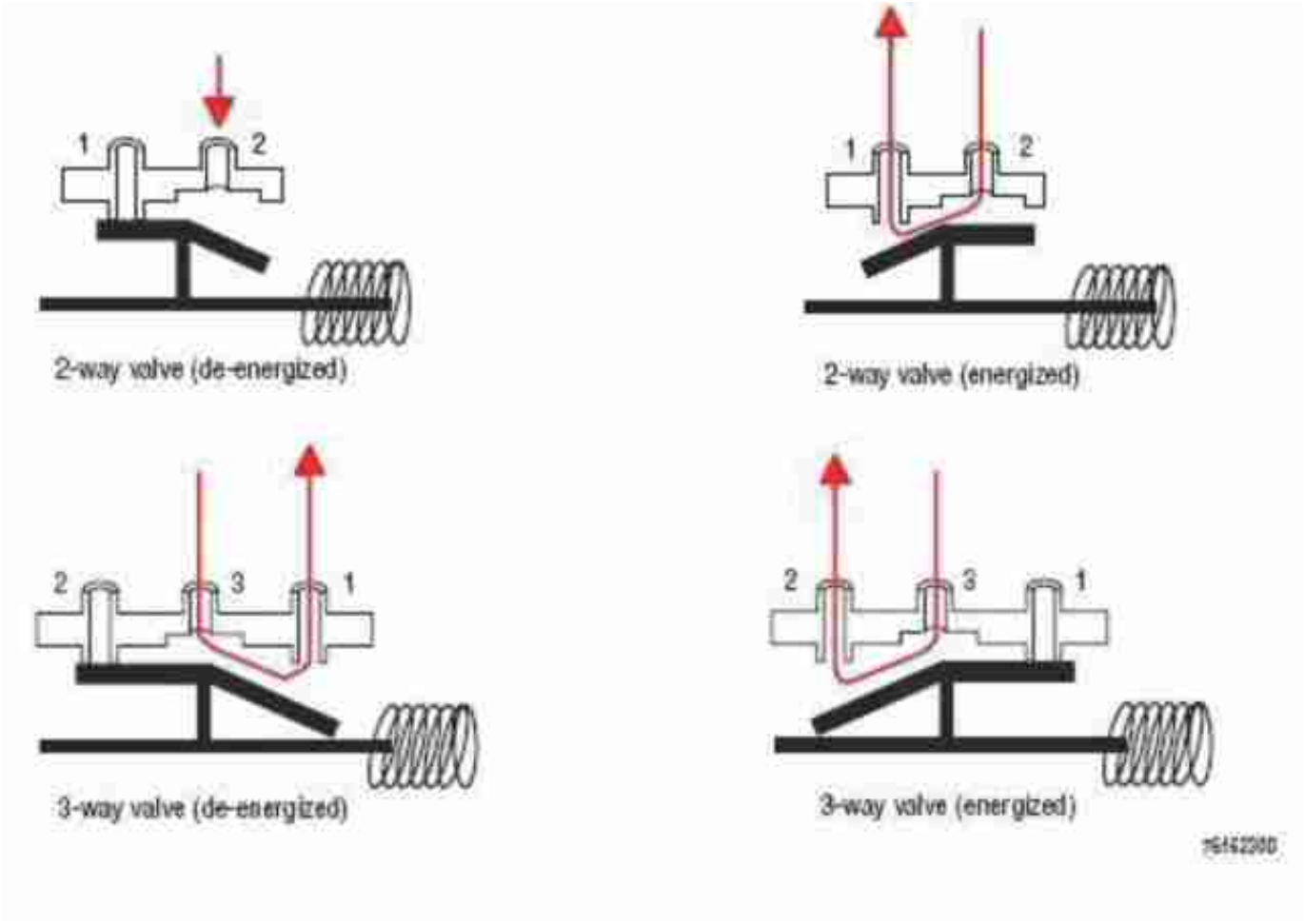
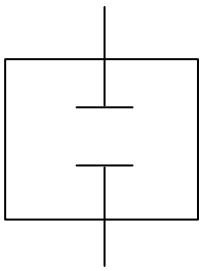


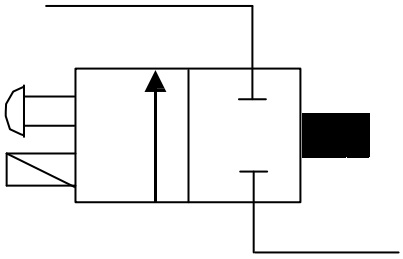
Fig.4-2 Working principle of solenoid valve

4.4.2 Symbol of Solenoid Valve in the Fluidic Diagram

2-Way valve

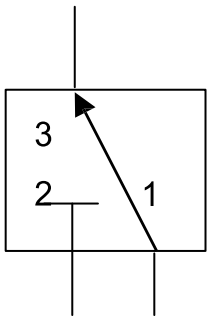


This symbol indicates that it is a 2-way solenoid valve which is normally closed. It is closed when not energized at normal conditions.

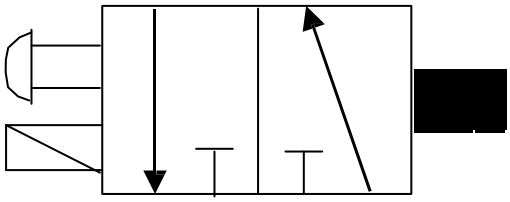


The above shows the fig. of a 2-way solenoid valve in the fluidic diagram. There are two parts of this fig. The right side indicates the status when the valve is not energized, you can see that it is closed. The left side indicates the status when the valve is energized and open; the arrow head indicates the flow direction of liquid.

3-Way valve



This symbol indicates that it is a 3-way solenoid valve. When it is not energized, common ends 3 and 1 are connected, the direction of liquid flowing is from end 1 to 3. Common ends 3 and 2 are not connected.



The above fig. shows the 3-way solenoid valve in the fluidic diagram. There are two parts of this fig. The right side indicates the flow direction of the liquid when the valve is not energized. The left side indicates the flow direction of the liquid when the valve is energized.

At 3-way solenoid valve, we usually use COM as symbol of the common ends, abbreviated as C. NC indicates that this end is closed at normal conditions, NO indicates that it is open at normal conditions. When the valve is not energized, NO is connected with end C and NC is not connected.

4.5 Fluidic System Cycle Diagrams

Introduction to the fluidic system cycle diagrams:

1. Every cycle that is explained has been marked with a different color.
2. 2-way valves which are not related to the cycle are considered as closed; for the 3 way valves ports 1-3 are considered to be connected.
3. At the left side from top to bottom are valves 1-5. At the right side from top to bottom are valves 6-11 (reference Fig. 4.1).

4.5.1 Pressure Releasing Cycle

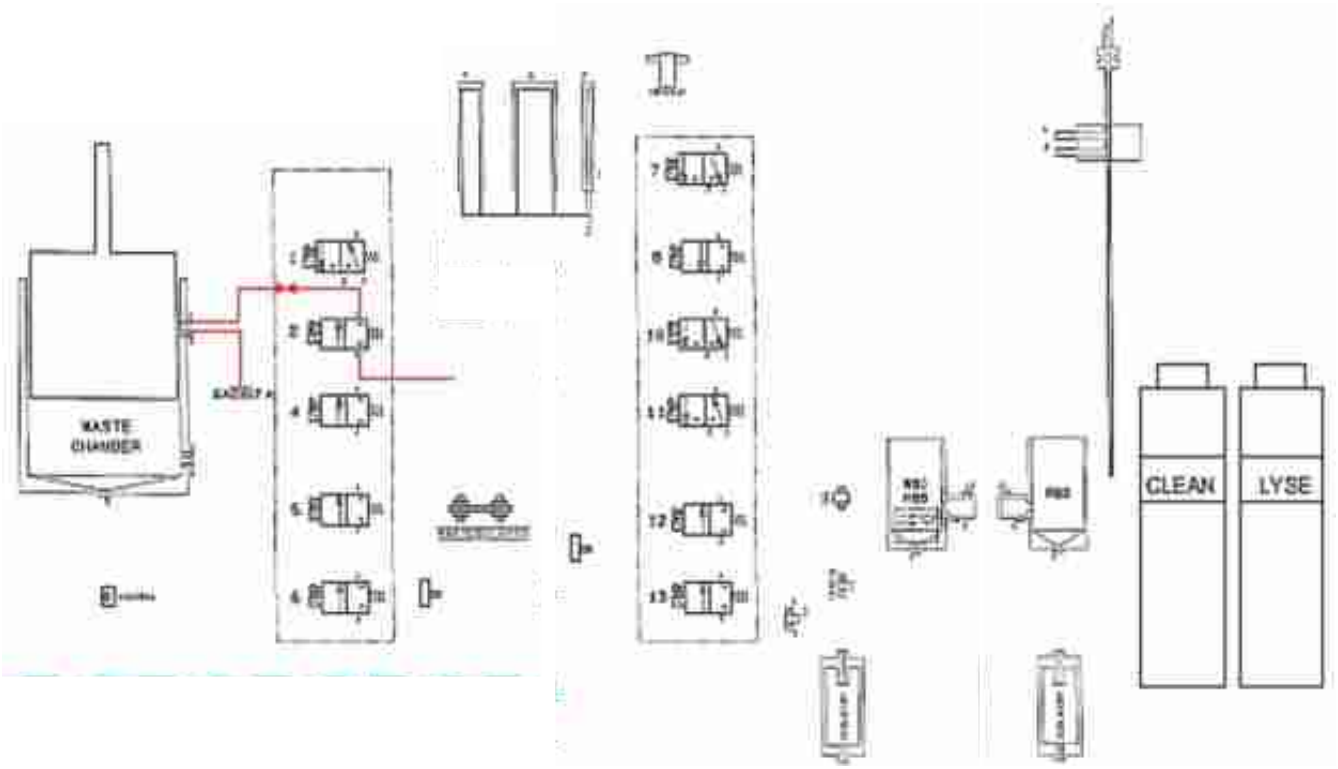


Fig.4-3 Pressure releasing cycle

Create negative pressure: Valve 2 closes and the main piston is pulled back (pressure sensor monitors the pressure). The piston stops when the target value is reached.

Create positive pressure: Valve 2 closes and the main piston is pushed down (pressure sensor monitors the pressure). The piston stops when the target value is reached.

Pressure release: Valve 2 opens

4.5.2 Diluent Cycle

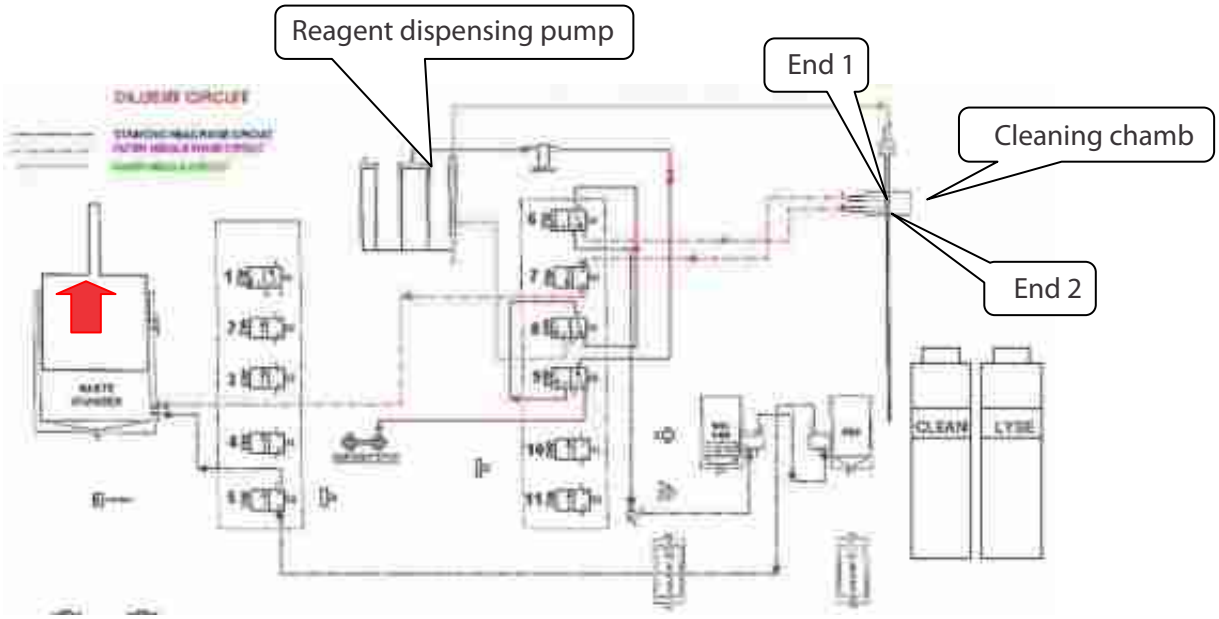


Fig.4-4 Diluent cycle

Step 1: Aspirate liquid:

Valve 9 is not energized (pins 1 and 3 are connected). The piston of reagent dispensing pump is pulled down and aspirates the Diluent.

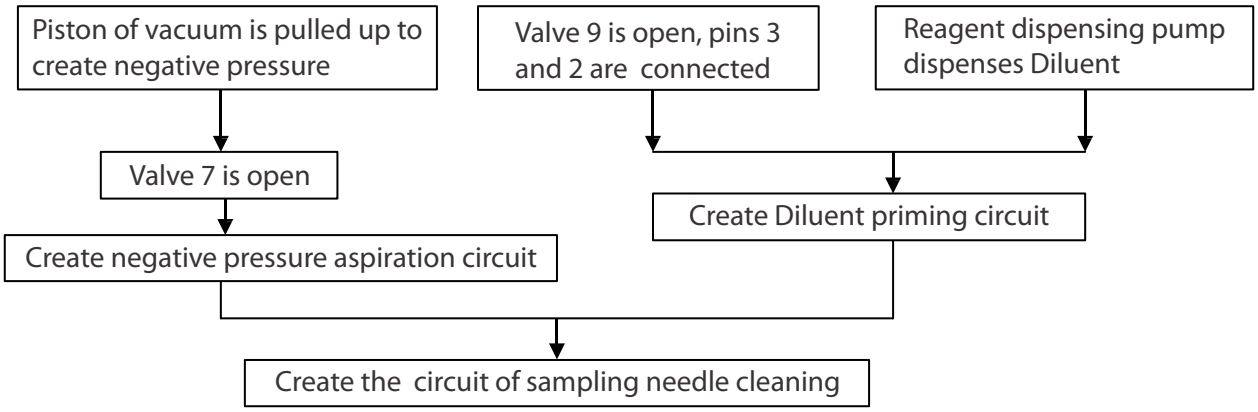
Step 2: Rinse the outside surface of the sampling needle:

A. Diluent priming cycle:

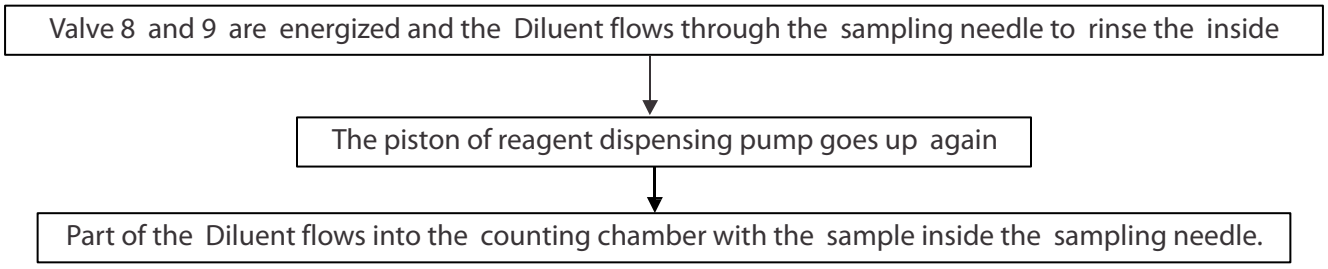
The Diluent from the reagent dispensing pump passes through pins 3 and 2 of valve 9, pins 3 and 1 of valve 8, pins 3 and 1 of valve 6, and reaches pin 2 of the cleaning chamber.

B. Create negative pressure aspiration cycle:

After valve 7 opens, the piston of pressure syringe is pulled up to create negative pressure. The Diluent is aspirated from pin 1 of the cleaning chamber.



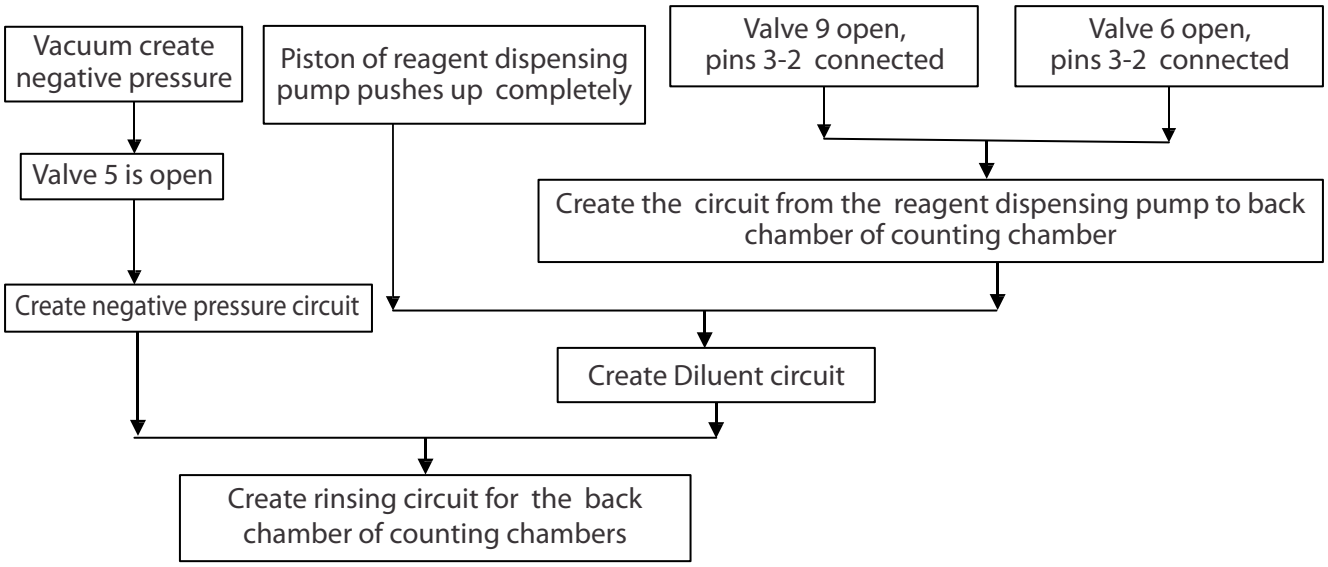
Step 3: Rinse the inside of the sampling needle



4.5.3 Rinsing Cycle of the Back Bath of the Counting Chambers

First the Diluent priming cycle is created. The Diluent comes from the reagent dispensing pump and passes through pins 3 and 2 of valve 9, pins 3 and 1 of valve 8, pins 3 and 2 of valve 6, and reaches the back bath of the counting chambers.

Then negative pressure is created. Valve 5 is opened and the negative pressure aspirates Diluent through both back baths of the counting chambers to rinse them.



4.5.4. Rinsing Cycle of Cleanser

The pressure syringe creates negative pressure; valve 3 is open and thus connected to Cleanser, valve 5 opens and vacuum is applied for the flow of Cleanser.

Direction of Cleanser: Cleanser bottle → Valve 3 → Back bath of WBC → Back bath of RBC → Valve 5 → Pressure syringe

Note: During this procedure, there is no liquid in the counting bath, air bubbles pass through the aperture and are used in the rinsing cycle. They are mixed with the Cleanser to improve the cleaning effect.

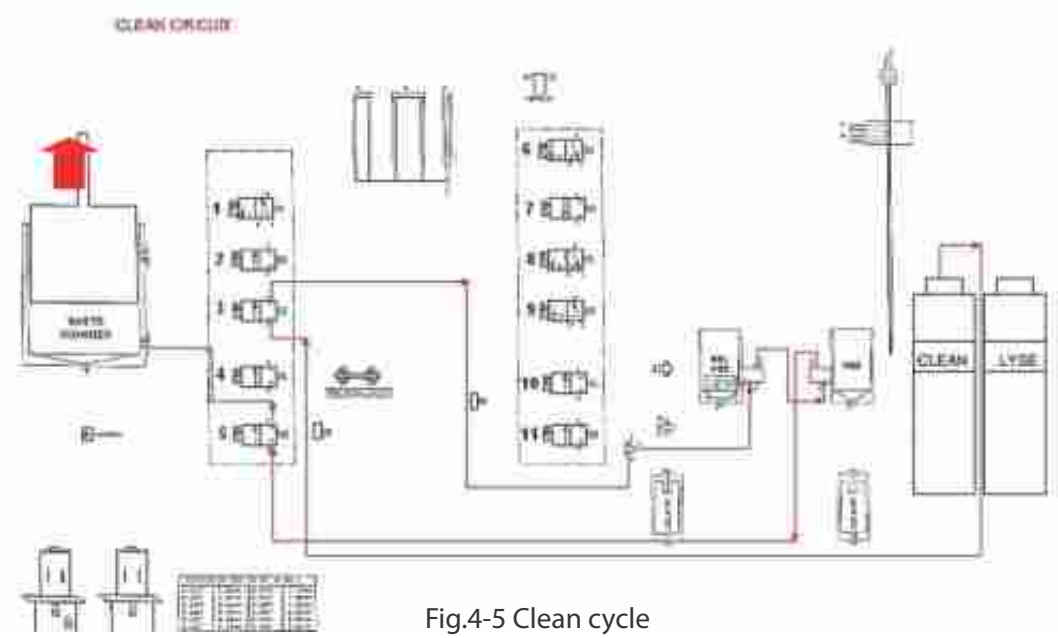


Fig.4-5 Clean cycle

4.5.5. Lyse cycle

There are two main steps in the Lyse cycle: step 1 is to aspirate Lyse and step 2 is to add Lyse to the WBC counting bath.

Aspirate Lyse: Valve 1 is closed (The reagent dispensing pump is connected with the Lyse bottle) and the piston of reagent dispensing pump is pulled down and aspirates Lyse from the bottle.

Add Lyse to the WBC counting bath: Valve 1 is open (The reagent dispensing pump is connected with WBC counting bath) and the piston of reagent dispensing pump is pushed up and adds Lyse into the WBC counting bath.

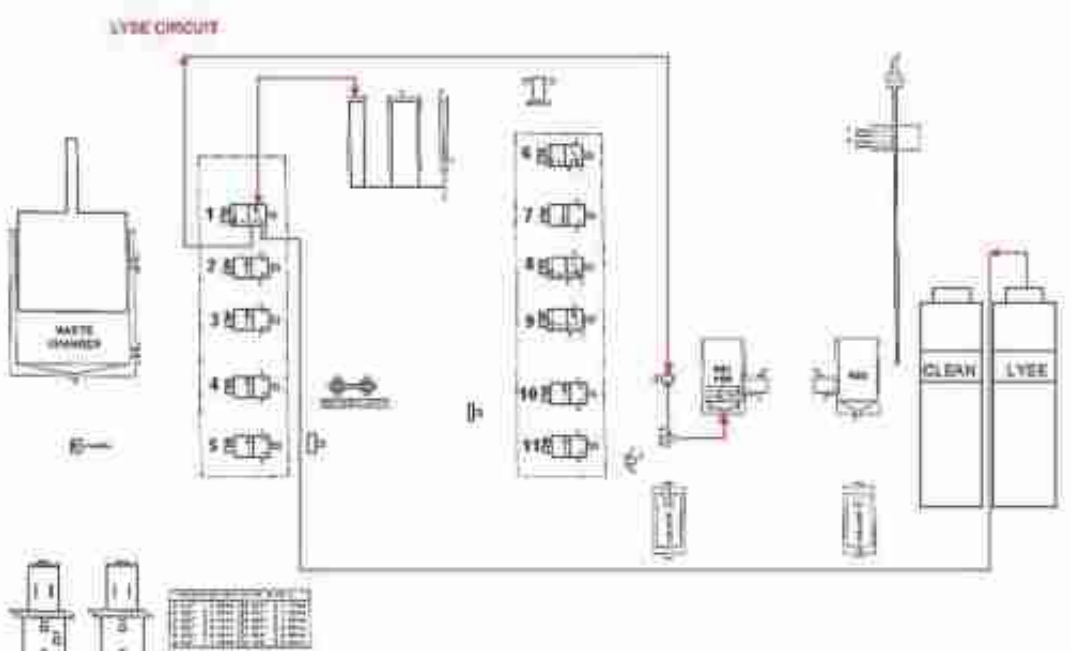
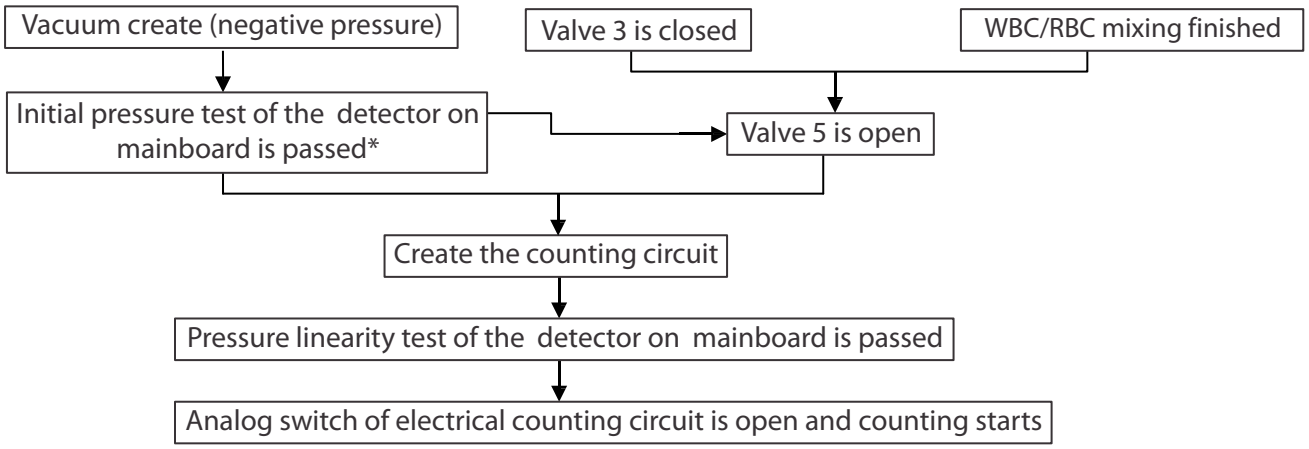


Fig.4-6 Lyse cycle

4.5.6. WBC/RBC Counting Cycle

After dilution of RBC and WBC, Lyse is added to the WBC bath. Air bubble mixing will mix the diluted samples and the counting sequence for RBC and WBC starts.



* Principle of pressure test:

1. It tests the time it takes to increase the pressure to a certain level.
2. If the time is less than expected, it will sound an alarm for "Air bubbles" (air leakage). This means that there is an air leakage somewhere in the fluidic lines to the counting circuit.
3. If the time is more than expected, it will sound an alarm for "Aperture jam". This means that there might be a blockage in the counting circuit.

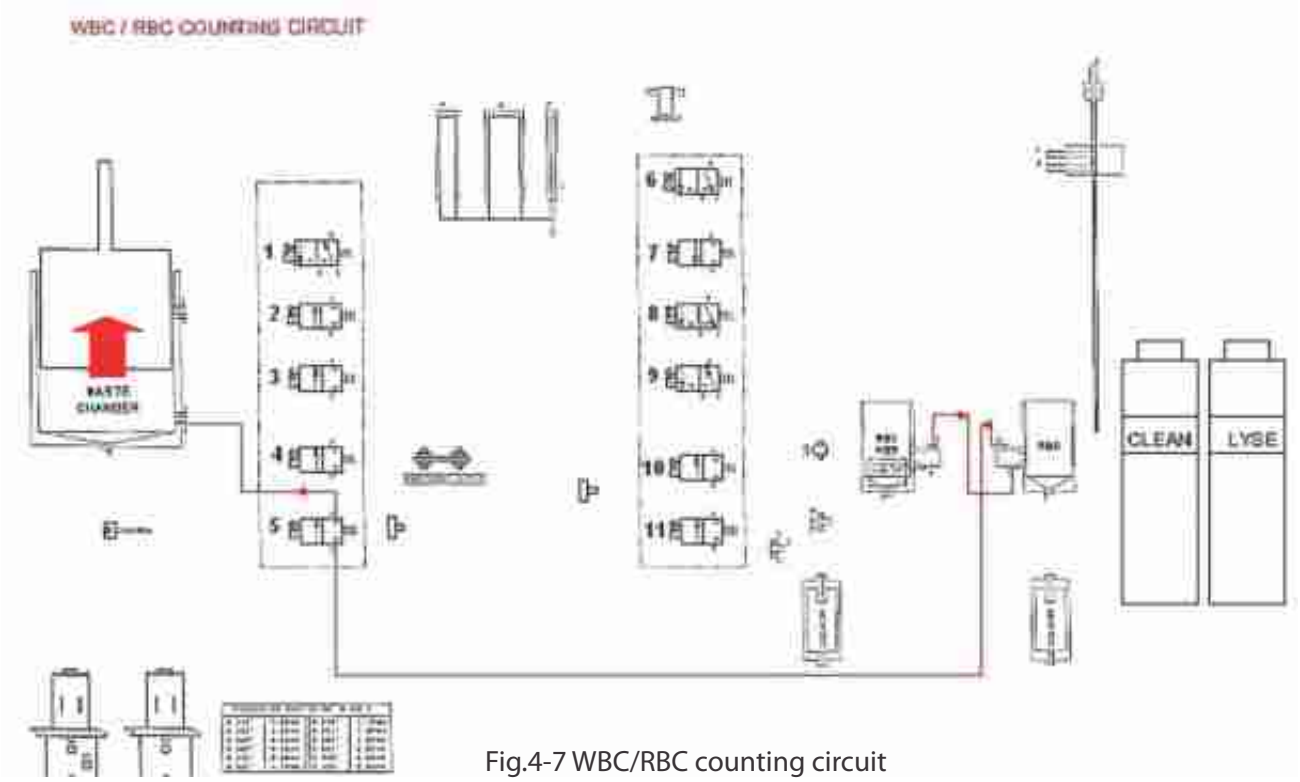
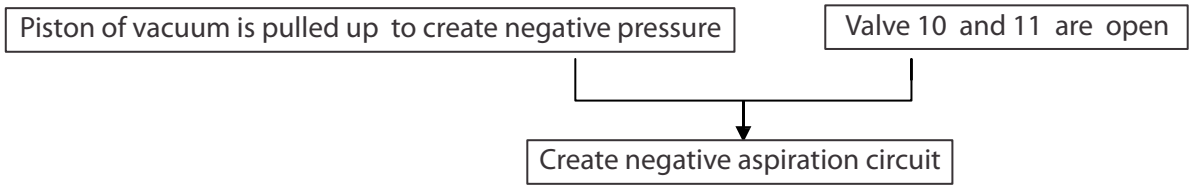


Fig.4-7 WBC/RBC counting circuit

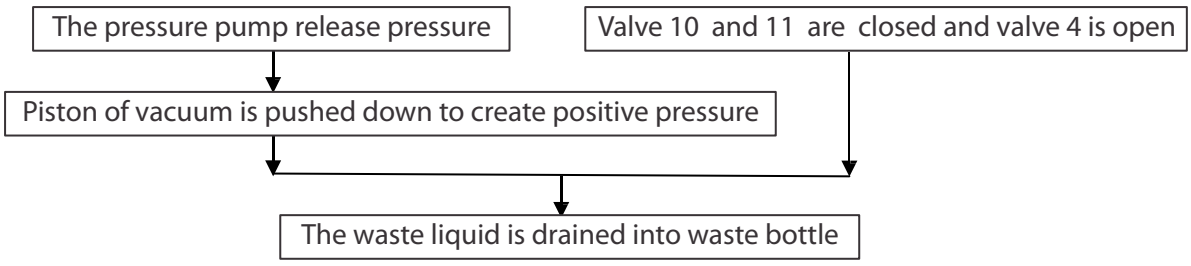
4.5.7. Drain the Waste from Counting Bath

The pressure syringe aspirates the waste liquid into the pump and drains it into the waste bottle by switching between positive and negative pressure.

1. Aspirate the waste liquid from the counting bath



2. Drain the waste liquid from counting bath



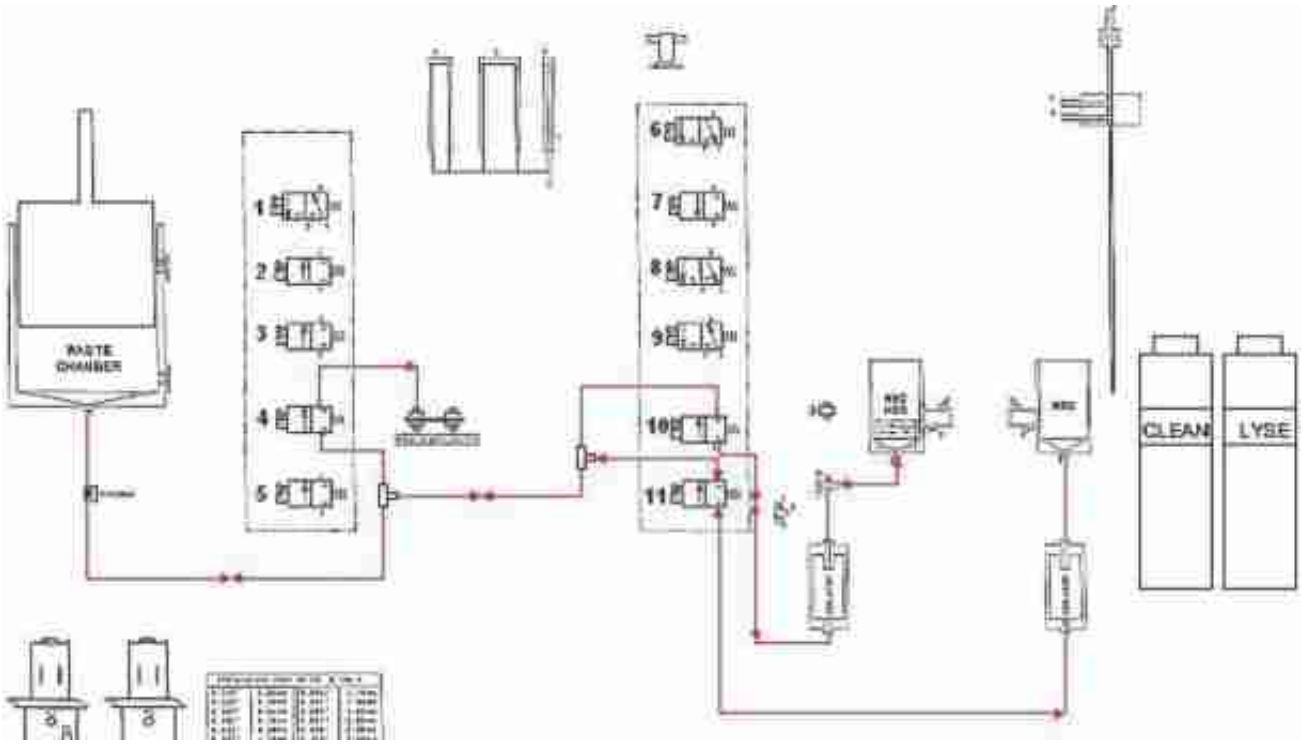


Fig.4-8 Waste liquid circuit

5. Maintenance / Service

This instrument is a precise automated hematology analyzer. To ensure that the instrument continues to work effectively, it is essential that the periodic and daily maintenance described below be performed.

Failure to perform the required maintenance can result in instrument failure and inaccurate results.

	**CAUTION:** Please perform the maintenance operation according to user's manual and service manual; otherwise, damage to the instrument may occur.

	**BIOLOGICAL RISKS:** Consider all specimens, reagents, calibrators, controls, etc. that contain human blood or serum as potentially infectious! Use established, good laboratory working practices when handling specimens.

	**CAUTION:** Do not use any solvents, fatty or corrosive substances to clean the instrument covers.

5.1 User Maintenance Schedule

A. Daily

1. Before shutting down the instrument, take a soft cloth or clean paper wetted with aconcentrated cleanser, to clean the sampling needle. Run the cloth or paper from the top of the needle to the bottom, and also clean the 2cm area which is above the needlepoint. After cleaning, go to the "Menu" function of the unit and perform the "Back Flush" operation, followed by the "Remove Blockage" and "Cleaning" operations one time.
2. If there are liquid spills on the plate which is on the bottom inside the instrument, please wipe it with a clean wet cloth.
3. If you find abnormal test results, please perform blank test and check if the blank values are too high. If these values remain high, please refer to the troubleshooting section 6.3.
4. If the shielded cover of the counting baths is dirty, you must take off the cover and clean it with a clean wet cloth. This is to prevent dirt from entering the counting baths, that can block the aperture.
5. If needed, clean the LCD with a soft cloth.

B. Weekly

1. You should perform the operation of "Concentrated cleanser soaking" at least twice a week. Add 2ml of concentrated cleanser into the counting bath. You can also increase the time of cleaning according to your sample volume in the Settings Menu.
2. If the instrument will not be used for more than a week, you should perform the operation of "Drain chamber" and "Drain pipeline" after the last usage of the instrument.

C. Every Two weeks

If the instrument will not be used for more than two weeks, you should perform the operation of "Stop use" in the maintenance menu to clean and drain counting baths and the fluidic system.

5.2 Maintenance / Service Menu

In the main menu screen, click the "Service" button to open the Service Menu:

Fig.5-1 Service Menu

5.2.1 Prime

The system will prime the fluidic system automatically during sample test. If you have performed the drain operation or replaced the reagent, you have to perform priming.

1. All reagents: -Diluent, Lyse and Cleanser - will be primed into the fluidic system.
2. Diluent: diluent will be primed into the fluidic system.
3. Lyse solution: lyse solution will be primed into the fluidic system.
4. Cleanser: cleanser will be primed into the fluidic system.

5.2.2 Drain Chambers

Function to drain and empty the liquid from both the WBC and RBC chambers.

5.2.3 Clean Chambers

If the chamber has been contaminated or polluted or the blank test returns unacceptable results, use this function.

5.2.4 Drain Pipeline

Function to drain all fluids from the fluidic system and reagent lines.

5.2.5 Back Flush

Function to back flush the aperture holes, to remove any blockages or dirt from opening.

5.2.6 High Voltage Pulse

This burn function is to clean the aperture opening, by putting a high voltage over it.

ELECTRICAL RISKS: Risk of electrical shock and death. Keep fingers and other body parts, and any conductive materials, away from the aperture when using this function.

5.2.7 Remove Blockage

Extended procedure to eliminate any blockage from the aperture opening.

5.2.8 Machine Reset

Function to home-position all motors from the instrument.

5.2.9 Concentrated Cleanser Soaking

Concentrated cleanser is an alkalescent wash solution. It is used for cleaning the Fluidic System and counting chambers. When you select "Concentrated cleanser soaking" in the Service menu, the system alerts you to add cleanser manually into the chambers. You must perform this operation every three days or when high backgrounds occur.

5.2.10 Replace Reagent

The system will monitor the usage of reagents during usage of the instrument. When you are replacing the reagent, input the correct volume of the reagent. The system will record this volume and monitors the usage of reagents. When the remaining volume is not enough, the system will provide a notification.

5.2.11 Stop Use

If the instrument will not be used for more than two weeks or it needs to be prepared for shipping, please perform the next steps:

1. In "Service" Menu, select "Stop Use" and complete all operations according to the instructions given by system. When the screen indicates that the instrument is ready to shut down, power off the instrument.
2. Close the remaining Diluent, Cleanser and lyse bottles and store as per reagent instructions.

3. When the instrument is prepared for shipping: clean the reagents adapters and place them in the accessory bag; place instrument in the plastic bag and place it in the packing carton box; include mouse and keyboard.

5.2.12 Check Mechanics

From the Service menu, click "Check Mechanics" button to open the mechanical test menu:

Fig.5-2 Mechanical test

⚠	**WARNING:** Keep fingers and other body parts away from moving parts.

Click "Needle", "Carriage", "Liquid Syringe" or "Pressure Syringe" to test working condition of these components. The test results will be shown in the corresponding box on the right.

While the component is moving, carefully watch whether the component movement is smooth and uniform. If there is still an abnormality after repeated test, please contact your distributor or vendor.

Click the "Valves" button to open the individual solenoid valve test screen:

Fig.5-3 Solenoid valve test

The instrument has a total of 11 solenoid valves. You can test individual valves, or click the "All Valves" button to test them. Click the "Exit" button to return mechanical check screen. The function of each solenoid valve is as follows:

Valve 1 : Controls the dispensing of Lyse.

Valve 2 : Releases pressure from the pressure syringe; aspirate air (venting).

Valve 3 : Add Cleanser to WBC counting bath.

Valve 4 : Drains waste from the waste chamber of pressure syringe to the waste bottle.

Valve 5 : Activated when the WBC/RBC counting bath is counting; this controls the negative pressure.

Valve 6 : Adds Diluent into WBC counting bath.

Valve 7 : Drains the waste from the wash block when washing the sampling needle.

Valve 8 : Adds Diluent into sampling needle wash block.

Valve 9 : Controls the dispensing of DILUENT.

Valve 10 : Drains WBC counting bath.

Valve 11 : Drains RBC counting bath.

5.2.13 Debug

This menu is only accessible if you have logged in as an Engineer. He is used to debug, test and check the hardware settings of the instrument.

5.2.14 Engineering Adjust

This menu is only accessible if you have logged in as an Engineer and contains important hardware system parameters. Changing these settings can have direct impact on test results, or functionality of the system.

⚠	**CAUTION:** DO NOT change any settings, voltages, jumpers on any of the electronic boards unless properly trained by Avantor or authorized 3rd parties. Improper settings can result in inaccurate test results.

6. Replacement of Spare Parts

6.1 Disassembling the Instrument

The BeneSphera™ Brand 3-Part Hematology Analyzer is an instrument with high precision; there are almost no parts that can be repaired by users. When technical problems occur which can't be solved by the user, you must engage a professional service engineer to repair the instrument.

6.2 Replacement of Aperture, LED and Photocell

if you still can not eliminate the problem of aperture blockage after several times of back flushing and soaking with concentrated Cleanser, you should clean or replace the aperture following the below steps strictly.

1. Shutdown the analyzer and power off the unit by unplugging it.
2. Open the right door and remove the two screws which fix the bath cover, and the screw at backside, and remove the side covers. Loosen the two screws which fix the shielding cover of the counting bath, and then lift the shielding cover and remove it to reveal the WBC/RBC counting bath assembly, as shown in fig. 5-1:

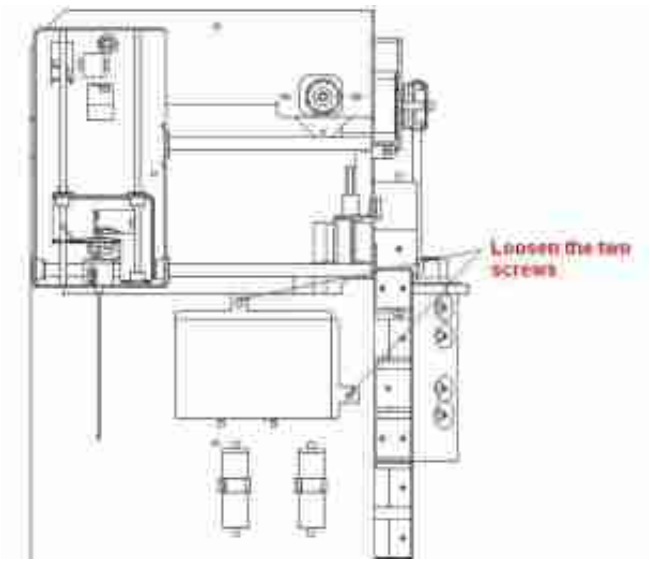


Fig.6-1 Counting Bath Assembly

3. First, take off the signal cable attached to the counting bath from the PCB, pull out the counting bath slowly from the bracket. Take the counting bath out of the instrument and disassemble it as shown in the following figure:

Fig.6-2 Disassembly of the Counting Bath

Please be careful when you are disassembling the aperture. After removal of the bath, place the aperture face up, remove the two fixing screws, and take out the washers carefully. Pay attention to the aperture; don't take it out together with the washers. Hold the body of the counting bath with the aperture face down, blow air into the bath to make the aperture fall out on a clean tissue. Clean the aperture with absolute alcohol or enzymatic cleanser. If possible check the aperture under a microscope to see if it has been cleaned properly. After cleaning the aperture, re-install it in reverse order into the counting bath again. Please pay attention that the aperture is installed between the two washers. Do not fix the screws too tight, to prevent breakage of the aperture!

When you want to replace the Hgb LED and photocell, just take out the fixing block with LED or photocell from the WBC counting bath. Clean it or replace it with a new one, then install it again in reverse order.

⚠	**CAUTION:** Do not remove the aperture using tools, because it can be damaged. You should use your forefinger, as follows: Dip you finger in clean water, and then use your forefinger to take the aperture and install it into the bath.

6.3 Replacement of Airproof Washers (O-type)

6.3.1 Replace the Airproof Washers of Pressure Syringe

If there is air leakage in the pressure syringe (this can be detected by pressure detector), you should replace the airproof washer (O-type) of the pressure syringe. Please follow below procedures to perform the replacement.

1. After powering Off the instrument, pull the piston of the pressure syringe to the extreme lowest position, then loosen the three screws that fix the syringe, and disassemble the body of the pressure syringe from the inside plate, as in fig. 6-3:

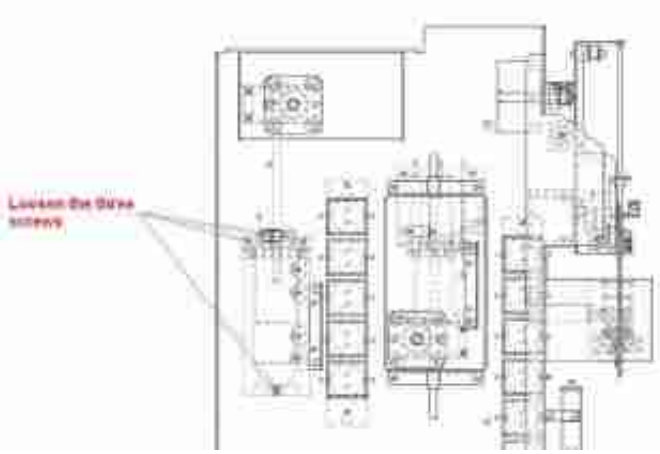


Fig.6-3 Disassembly of the pressure syringe

2. Loosen the 4 screws on the installation plate of the pressure syringe, remove the leaking or broken airproof washer (O-type), install a new washer (smear the inside and outside of the washer with airproof lubricating grease) to the original position and reinstall the plate, as shown in fig. 6-4.
3. Re-Install the pressure syringe in the instrument.

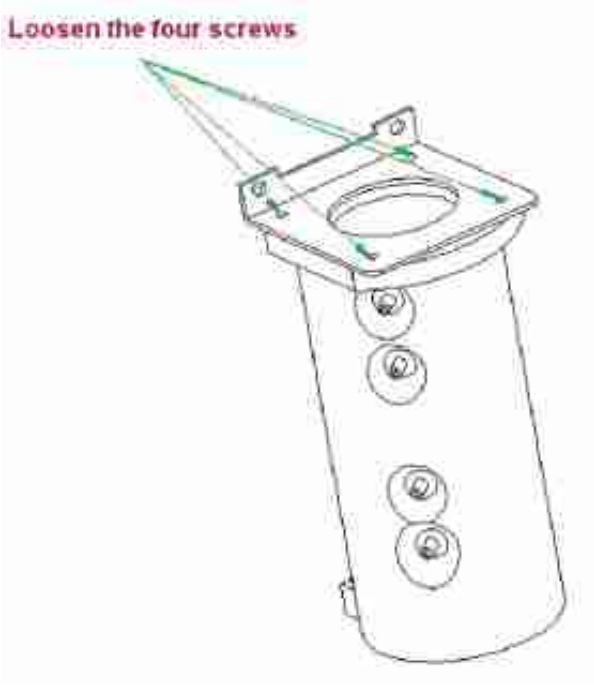


Fig.6-4
Disassembly of the pressure syringe washer

6.3.2 Replacement of Washers for Reagent Dispensing Syringes

The washers (O-type) for the reagent dispensing syringes need to be replaced on a regular basis.

Please follow the below procedure for replacement of the washers:

1. Power off the instrument and disconnect the tubings on top of the syringes. Watch out for liquid spills. Loosen the 4 screws which fix the reagent dispensing syringe assembly and remove the assembly carefully from the instrument, as shown in fig. 6-5:

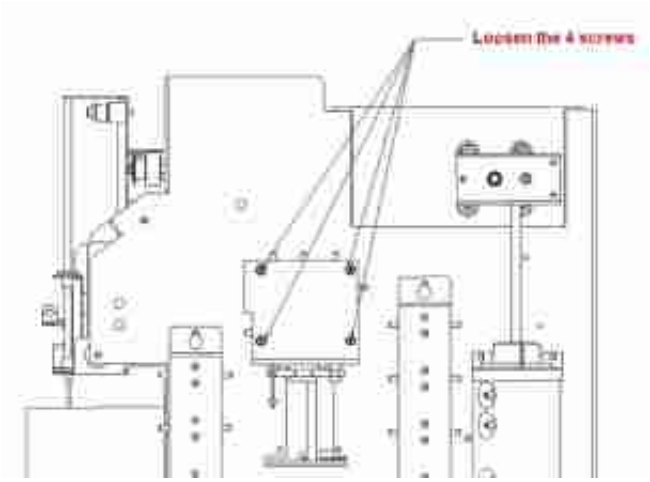


Fig.6-5
Disassembly the reagent dispensing syringe

2. Loosen the 6 screws at the bottom of reagent dispensing syringe assembly and pull out the 3 pistons from the syringes body, as shown in fig 6-6:

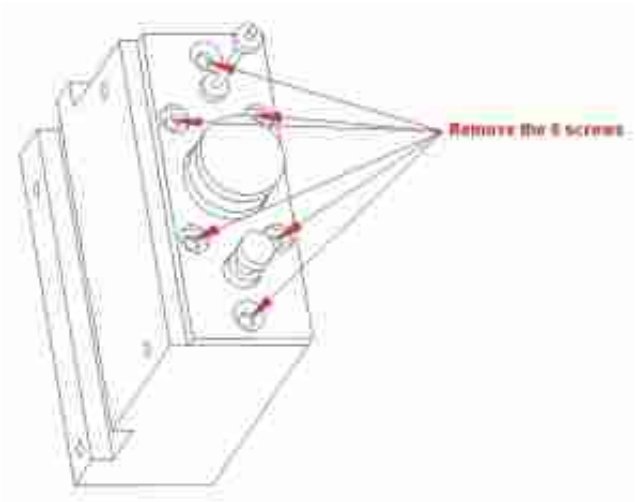


Fig.6-6 Piston screw removal

3. Take off the leaking or broken washers and replace them with a new washer for each piston (smear the inside and outside of the washers with airproof lubricating grease) and reinstall the syringes and the holding plate again, As shown in fig 6-7:

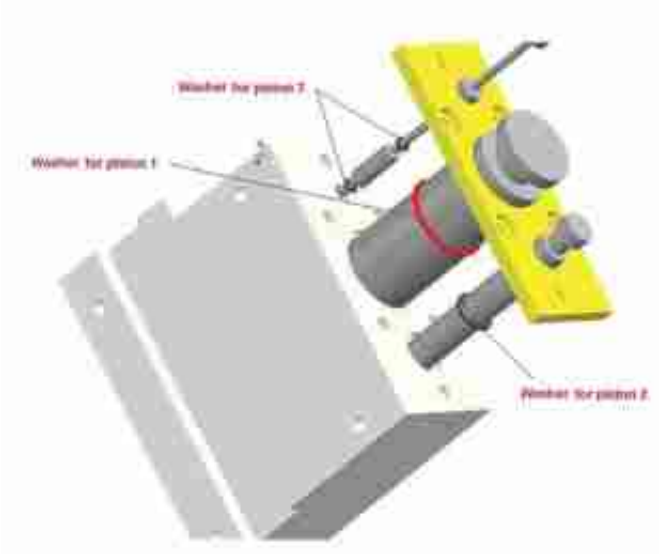


Fig.6-7 Piston washer locations

6.3.3 Replace the Airproof Washer from the Sampling Needle Wash Block

To replace the airproof washer (O-type) from the sampling needle wash block, follow below procedure, as shown in fig 6-8:

1. Power off the instrument and remove the tubing on top of the sampling needle (watch out for liquid spills). Loosen the 2 screws which fix the sampling needle, then loosen the 2 screws which fix the wash block assembly.

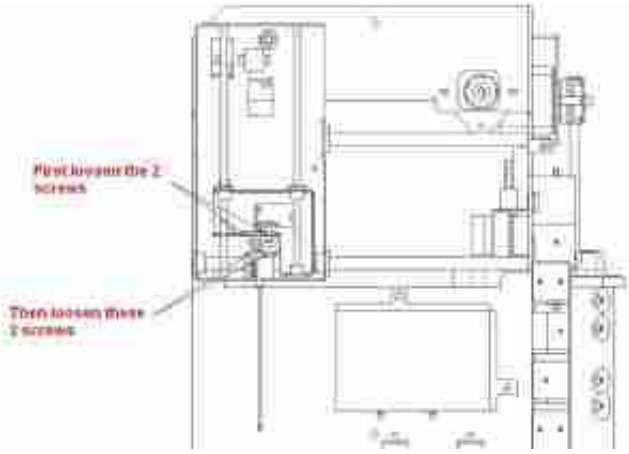


Fig.6-8
Disassembly of the sampling needle wash block

2. Remove the sampling needle and wash block from the carrier, then take the wash block cover and sampling needle out of the wash block assembly. Remove the airproof washer and replace it with a new one. Please remember to smear the inside and outside of the washers with airproof lubricating grease and fix the cleaning chamber assembly again in reverse order (don't forget to re-install the tubing on top of the needle), as shown in fig. 6-9:

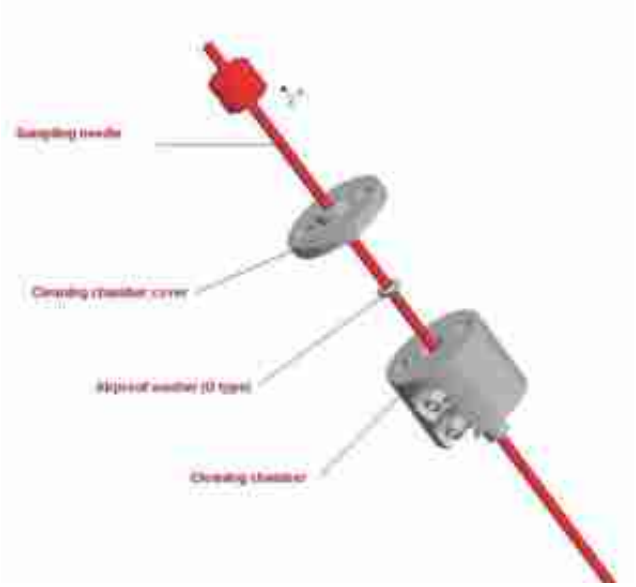


Fig.6-9
Replace the airproof washer from the wash block

6.4. Replacement of Sampling Needle

The procedures for replacing the sampling needle is similar to the procedures for replacing the airproof washer for the sampling needle. First, power off the instrument. Then loosen the 4 screws as shown in fig. 6-8. Take out the sampling needle and wash block assembly and remove the tubing connected to the sampling needle. Take the sampling needle out of the wash block. Remove the wash block cover and airproof washer from the sampling needle, and replace with a new needle and re-install the wash block again.

7. Troubleshooting

This chapter describes common faults of instrument and their solutions. If these tips do not help eliminate the issues, or more detailed instructions are required please contact the Avantor Performance Materials Customer Service department.

	**BIOLOGICAL RISKS:** Consider all specimens, reagents, calibrators, controls, etc. that contain human blood or serum as potentially infectious! Use established, good laboratory working practices when handling specimens.

	**WARNING:** keep fingers and other body parts away from any moving parts.

	**ELECTRICAL RISKS:** Risk of electrical shock. Keep fingers and other body parts, and any conductive materials, away from electronic parts during troubleshooting.

Problem	Possible Solutions
1. Instrument cannot start	Check the power supply of instrument. Check if the power cord has been properly connected. Check the voltage from power supply. Turn off the instrument, restore power and turn on the instrument again.
2. No Diluent	Change diluent; perform the operation of Prime->Diluent in "Maintenance" menu.
3. No Cleanser	Change cleanser; perform the operation of Prime->Cleanser in the "Maintenance" menu.
4. No Lyse	Change lyse; perform the operation of Prime->Lyse in the "Maintenance" menu.
5. Waste bottle full	Empty the waste bottle
6. Temperature abnormal	Click "System Info" -> "System status" at main menu of software, check the environment temperature, if it is not in the range of 15C ~35C, adjust the environment temperature to this range
7. Blank value remains high	Check if the reagent has run out. Check if the reagent is contaminated and replace accordingly. Perform the operation of "Back Flush" at the maintenance menu. If this does not solve the problem, perform the "Concentrated cleanser soaking" procedure and repeat the Blank tests.
8. Blockage in Aperture	Perform the operation of "Remove Blockage" in the maintenance menu. If needed perform the operation of "Concentrated cleanser soaking". If this does not solve the problem, perform the operation "Burn" from the maintenance menu.
9. Air bubbles	Perform the operation of "Cleaning" in the maintenance menu. Check if the solenoids are working well. Check if the reagent tubings are well connected and check for any leakages inside the instrument.
10. Printer does not print	Check if there is paper in the printer. Check if the printer and instrument are well connected. Check the printer settings in the "Settings" menu.
11. Abnormal noise in the instrument	Open the two side doors of the instrument, check if an unexpected object is blocking the movement parts. If yes, remove that object. Check if the piston of the pressure syringe is out of the pump body. If so, restore the piston towards the pump body and push it back to the original position. If the problem persists, arrange for a service visit

8. Calibration (Service Mode)

Before delivery, all instruments have been tested according strict testing and calibration protocols. But after transportation or usage, test results may drift because of different reasons. In order to guarantee instrument test accuracy and stable and reliable test results, instrument must be calibrated in the following cases:

1. First installation for use and reinstallation at other place.
2. Instrument has been repaired.
3. Deviations in QC results.

8.1 Preparation before Calibration in Service Mode

Commercial controls, calibrators or a reference hematology instrument can be used to calibrate this instrument. All mathematic calculations related with calibration can be done by instrument automatically, calibration coefficient is automatically saved. The BeneSphera™ Brand 3-Part Differential Hematology Analyzer has three sets of calibration coefficients: anti-coagulating whole blood; anti-coagulating peripheral blood and pre-diluted peripheral blood.
Anti-coagulating whole blood and peripheral blood and pre-diluted peripheral blood are calibrated separately.

Prior to instrument calibration, you must check the performance of the instrument:

1. Check reagent status and be sure that instrument is in normal status.
2. Make blank tests and be sure that the blank test meets the specification.
3. In the counting screen, use a median blood sample to check the reproducibility and make sure that instrument reproduces according the specifications.

8.1.1 Engineering Login

In the USER Mode, only 5 CBC parameters can be calibrated. But when logged in Service Mode, more parameters can be calibrated manually or by auto-calibration.

In the main menu screen, click "Settings" to go to the System Setting menu:

Fig.8-1 System setting

By clicking the "Other" button, the next menu is shown:

Fig.8-2 Other Settings

The system has different levels of users: common user, system administrator, advanced user. Default is the common user where some settings are disabled to change. To enable these settings, please click the "Log on" button to open the logon dialog box:

Fig.8-3 Logon dialog box

Select Engineer, enter password "1001" and then click the "OK" button. Press Exit in the Other Settings to return to the Main Menu.

8.2 Manual Calibration

In the Main Menu screen, select Calibration and then Manual Calibration. The system goes to the manual calibration screen as shown below, where additional CBC parameters can be calibrated:

Fig.8-4 Manual calibration

CAUTION: Calibration Coefficients WBC, RBC, HGB, MCV and PLT in User mode and Engineering Mode are different! In USER Mode only WBC, RBC, HGB, MCV and PLT can be changed.

Manual calibration procedure is as follows:

1. Obtain reference values from the Calibrator, Control or human blood samples measured on a reference hematology instrument.
2. In Sample Test menu, use calibration sample to test several times (at least three).
3. Record the tested data and compare with the reference values.
4. Calculate new calibration coefficient
   Calculate new calibration coefficient as per formula below:

$$New\ Calibration\ Coefficient = \frac{Current\ Calibration\ Coefficient\ X\ Mean\ of\ Reference\ Values)}{Mean\ of\ Test\ Values}$$

5. Input in the manual calibration screen the new calibration coefficient for every single parameter that needs calibration. Insert the calibration date manually.
6. Click "Save" button to save current calibration result. When the "Exit" button is used, the system will not save the newly calculated coefficients but will return directly to the main menu screen.

8.3 Automatic Calibration

When automatic calibration is selected, the instrument automatically calculates new calibration coefficient, when the calibration samples are measured (only CBC parameters WBC, RBC,HGB, MCV, PLT).

In the Main Menu screen, select Calibration and then Auto Calibration. The system goes to the auto calibration screen as shown below in Fig. 8-5:

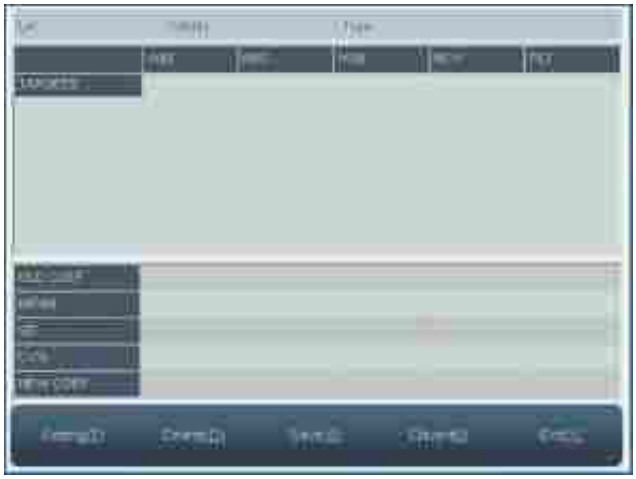


Fig.8-5 Auto-calibration

At first, the calibration sample has to be set up. Click "Setting (T)" button to open auto-calibration setting menu, see Fig. 8-6.

Fig.8-6 Auto-calibration setting

- Lot No.: Lot number or ID of calibration sample. When you input a number and save it, you can select from dropdown list don next logon.
- Expiry: Validity period of calibration sample. When the validity period is lower than current system date, the instrument will give an alarm to use another calibration sample to calibrate.
- Sample Type: blood type of calibration sample.
- Targets: Reference value of each parameter of calibration sample.
- Items: Parameters to calibrate.

The "Delete" button is used to delete the current calibration sample settings. Click "OK" or "Save" to save current lot number data and exit. Click "Exit" button to return directly to the Auto-calibration running screen.

After setup you will return to the Auto-Calibration screen as shown in Fig.5-2. The process to start the Auto Calibration is as follows:

1. Prepare the calibration sample and press Aspiration key to start test.
2. After testing, the calibration result will be shown in the current test number column.
3. Repeat test at least three times (the instrument allows a maximum of 20 runs).
4. Statistic results and the new calibration coefficients will be shown in the table below the parameter results automatically.
5. Unsatisfactory or incomplete test data rows can be deleted at any time.

If the new calibration coefficients are OK, click "Save" button and the system will save the new calibration coefficients.

APPENDIX A: Spare Parts List

PART NO.	DESCRIPTION
5-035-001-00	Sampling Injector Assembly (include pistons, O-rings)
1-2-035-024-10	Diluent Piston 1
1-2-035-025-10	Lyse Piston 1
1-2-035-026-11	Sample Piston 1
1-8-035-045-10	Diluent O Ring
1-8-035-046-10	Lyse O Ring
1-8-035-047-10	Sample O Ring
1-2-035-036-10	Sample Injector Bottom Board
1-2-035-007-10	Negative Pressure Injector Piston
5-035-002-00	Negative Pressure Injector Assembly (include pistons, O rings)
1-4-035-024-10	Negative Pressure Injector Fixed Board
1-8-035-044-10	Negative Pressure Injector O Ring
1-8-035-020-00	Solenoid Valve (two position three-port with connector)
1-8-035-078-10	Solenoid Valve (two position two-port with connector)
1-8-035-072-00	Step Motor
1-8-035-016-00	Y Axis Belt
1-8-035-017-00	X Axis Belt
5-035-003-00	RBC Counting Cell Assembly (include electrode, aperture)
5-035-004-00	WBC Counting Cell Assembly (include electrode, aperture)
5-035-005-00	RBC Buffer Cell Assembly (include buffer filter)
5-035-006-00	WBC Buffer Cell assembly (include buffer filter)
1-3-035-001-10	Counting Cell Bracket
1-3-035-002-10	Buffer Cell Bracket
2-035-002-00	Solenoid Transfer Board
2-035-006-00	Optical Coupler Board
1-5-035-015-11	Optical Coupler Cable
1-5-035-041-11	Optical Coupler Cable (for sampling needle)
1-2-035-035-10	Sampling Needle
1-8-035-048-10	Sampling Needle O Ring
5-035-007-00	Sampling Needle Rinsing Set Assembly (include O ring and cover)
5-035-008-00	Main Board Assembly (include memory bank, but without CF card)
1-8-035-069-00	4G CF Card (software will be loaded depending on SN)
2-035-008-16	High Voltage Board
2-035-001-00	Key-press Board

PART NO.	DESCRIPTION
1-8-010-013-00	Printer Head
1-8-010-005-11	Printer Driving Board
5-035-009-00	LCD Assembly with Touch Panel (800X600) - BeneSphera™ brand 3-Part Differential Hematology Analyzer (include metal cover)
5-035-010-00	LCD Assembly with Touch Panel (640X480)- BeneSphera™ brand 3-Part Differential Hematology Analyzer (include metal cover)
1-8-035-005-10	Touch Screen
1-8-035-006-00	Touch Screen Control Board
2-035-003-24	Front End Board-V2.4
2-035-004-12	Motor Driver Board-V1.2
2-035-004-00	Motor Driver Board-V1.1
1-6-035-055-00	PS2 Mouse
1-6-035-054-00	PS2 Keyboard
1-6-002-003-00	Touch Pen
1-6-035-007-10	Dustproof Cover
1-8-035-075-00	Power Supply Adapter
93001350	Barometer

PART NO.	DESCRIPTION
92000120	Printer Paper
92000109	Probe Vertical Alignment Tool
92000111	Probe Horizontal Alignment Tool
1-3-035-020-10	Main Cover
11900242	Display Interface Board-BS3
2-035-005-00	Power Supply Interface Board-BS3
2-035-007-00	Interface Board for all Ports
5-035-013-00	Lyse Bottle Lid Assembly (for 500mL bottle including connector, tube and aspiration head)
5-035-012-00	Lyse Bottle Lid Sensor Assembly (500mL)- BeneSphera™ brand 3-Part Differential Hematology Analyzer (include sensor, sensor cable, tube, aspiration head)
5-035-015-00	Lyse Bottle Lid Assembly (for 1L bottle including connector, tube and aspiration head)
5-035-018-00	Diluent Liquid Lid Assembly
5-035-019-00	Cleanser Liquid lid Assembly(1L)
5-035-014-00	Lyse Bottle Lid Sensor Assembly (1L)- BeneSphera™ brand 3-Part Differential Hematology Analyzer (include sensor, sensor cable, tube, aspiration head)
5-035-016-00	Dilution Bottle Lid Sensor Assembly- BeneSphera™ brand 3-Part Differential Hematology Analyzer (include sensor, sensor cable, tube, aspiration head)
5-035-017-00	Cleanser Bottle Lid Sensor Assembly (1L)- BeneSphera™ brand 3-Part Differential Hematology Analyzer (include sensor, sensor cable, tube, aspiration head)
1-5-035-044-11	Cleanser Liquid Level Sensor Cable- BeneSphera™ brand 3-Part Differential Hematology Analyzer 3
1-5-035-045-11	Diluent Liquid Level Sensor Cable- BeneSphera™ brand 3-Part Differential Hematology Analyzer
1-5-035-047-10	Lyse Liquid Level Sensor Cable (port of board)
5-035-020-00	USB Disk assembly (include the win-xp system and instructions)
11900021	Push Switch
1-8-035-022-00	1.30mm Tube (L=38cm)
1-8-035-024-00	2.06mm Tube (L=38cm)
1-8-035-025-001	2.29mm Tube (L=38cm)
1-8-035-023-00	1.52mm Tube (L=76cm)
1-8-035-026-00	Waste Liquid Tube L=150cm)

PART NO.	DESCRIPTION
1-8-035-025-003	Diluent Liquid Tube (L=80cm)
1-8-035-025-002	Clean Liquid Tube (L=80cm)
1-8-003-025-00	MTLL013-5 (male luer blue)-Waster Connector
1-8-001-002-00	MTLL220-1 (male luer white)-Diluent Connector
1-8-035-029-00	MTLL220-4 (male luer green)-Cleanser Connector
1-8-035-028-00	MTLL220-3 (male luer red)-Lyse Connector
1-8-035-025-005	Tube in Diluent Bottle (L=29/34cm)
1-8-035-025-004	Tube in Clean Bottle (L=24/19cm)
1-8-035-025-006	Tube in Lyse Bottle (L=10cm)
5-035-011-00	Spare Parts Package(include O ring and tube)
1-8-035-014-10	Aperture 1 (for RBC counting cell)
1-8-035-074-10	Aperture 3 (for WBC counting cell)
11220553	LED Lamp
1-8-035-008-00	Photodiode
1-8-035-050-10	Washer of Aperture

Phillipsburg, NJ 9001:2008 & 14001:2004
Paris, KY 9001:2008
Mexico City, Mexico 9001:2008
Deventer, the Netherlands 9001:2008, 14001:2004 & 13485:2003
Gliwice, Poland 9001:2008 & 17025:2005
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