BC-3000 Plus Auto Hematology Analyzer

Service Manual

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Mindray is responsible for safety, reliability and performance of this equipment only in the condition that:

- all installation, expansion, change, modification and repair of this equipment are conducted by Mindray qualified personnel;
- applied electrical appliance is in compliance with relevant National Standards;
- the instrument is operated under strict observance of this manual.

⚠ **Note** ⚠

This equipment is not intended for family usage.

This equipment must be operated by skilled/trained clinical personnel.

⚠ **Warning** ⚠

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

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.

Warranty

Workmanship & Materials

Mindray guarantees new equipment other than accessories to be free from defects in workmanship and materials for a period of one year from date of shipment under normal use and service. Mindray's obligation under this warranty is limited to repairing, at Mindray’s option, any part which upon Mindray's examination proves defective.

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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 substitution upon it of parts or accessories not approved by Mindray or repaired by anyone other than a Mindray authorized representative.

This warranty shall not extend to any instrument which has been subjected to misuse, negligence or accident; any instrument from which Mindray's original serial number tag or product identification markings have been altered or removed, or any product of any other manufacturer.

Safety, Reliability and Performance

Mindray is not responsible for the effects on safety, reliability and performance of the BC-3000plus Hematology Analyzer if:

- assembly operations, extensions, re-adjusts, modifications or repairs are carried out by persons other than those authorized by Mindray.
- Personnel unauthorized by Mindray repairs or modifies the instrument.

Return Policy

Return Procedure

In the event that it becomes necessary to return a unit to Mindray, the following procedure should be followed:

1. Obtain return authorization. Contact the Mindray Service Department and obtain a Customer Service Authorization (Mindray) number. The Mindray number must appear on the outside of the shipping container. Return shipments will not be accepted if the Mindray number is not clearly visible. Please provide the model number, serial number, and a brief description of the reason for return.

2. Freight policy. The customer is responsible for freight charges when equipment is shipped to Mindray for service (this includes customs charges).

Company Contact

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Conventions Used in This Manual and Instrument

Warnings, Cautions and Notes

Warnings, cautions and notes are used in this manual to alert or signal the reader to specific information.

⚠ WARNING ⚠

Warning alerts the user to the possible injury or death associated with the use or misuse of the instrument.

⚠ CAUTION ⚠

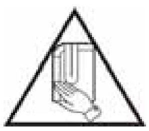
Caution alerts the user to possible injury or problems with the instrument associated with its use or problem such as instrument malfunction, instrument failure, damage to the instrument.

⚠ NOTE ⚠

Note provides specific information, in the form of recommendations, pre-requirements, alternative goods or supplemental information.

⚠ WARNING ⚠

Potential biohazard



⚠ WARNING ⚠

Avoid contacting with the sample probe.

Content

Chapter 1 General

1.1 Introduction

CAUTION

To maintain the instrument in normal condition, the user must perform the periodic maintenance. Refer to the user manual.

This service manual provides useful information to help service personnel to understand, troubleshoot, service, maintain and repair the Hematology Analyzer.

All replaceable parts or units of this instrument and its optional units are clearly list with exploded illustration to help you locate the parts quickly.

The maintenance must be periodically performed because the instrument has fluid paths and precision parts. Accordingly, the user is responsible for performing the periodic maintenance. The “maintenance” chapter in this service manual describes the maintenance that should be performed by the qualified service personnel. The “maintenance” chapter in the user manual describes the maintenance that can be performed by the user.

NOTE

If the instrument has a problem and there has been no periodic maintenance, the instrument will usually be normal again by cleaning the fluid paths or replacing a consumable with a new one.

The information in the user manual is primarily for the user. However, it is important for service personnel to thoroughly read the user manual and service manual before starting to troubleshoot, service, maintain or repair this instrument. This is because service personnel needs to understand the operation of the instrument in order to effectively use the instrument in order to effectively use the information in the service manual.

1.2 Service Policy

⚠CAUTION⚠

Be careful not to directly touch any place where blood is or may spread to.
Wear rubber gloves to protect yourself from infection before doing maintenance.

Our company's basic policy for technical service is to replace faulty units, printed circuit boards or parts. We do not support component-level repair of boards and units outside the factory.

⚠NOTE⚠

When ordering parts or accessories from your nearest distributor, please quote the part number and part name which is listed in the service manual, and the name or model of the unit in which the required part is located. This will help us to promptly attend to your needs.
Always use parts and accessories recommended or supplied by our company to assure maximum performance from your instrument.

1.3 Specification

Hemoglobin Analysis

Wavelength 525nm

Sampling Features

Volumes Required for Each Analysis：

Whole Blood Mode (vein blood) 13uL

Prediluted Mode (capillary blood) 20uL

Aspirated volumes：

500uL of lyse first dilution per cycle for WBC measurement

300uL of second dilution per cycle for RBC and PLT measurement

Dilution Ratios	Whole Blood	Prediluted
WBC/HGB	1: 308	1:407
RBC/PLT	1:44833	1: 44274

Cell Counting Aperture Size：

WBC 100um

RBC 70um

Throughput more than 60 samples/hour

Check Diluent, Rinse and Lyse

The applied volume of each reagent is:

	Diluent	Rinse	Lyse	E-Z
Normal Startup	42ml	10ml		
Prepare a sample (whole blood)	25.4ml	6ml	0.5ml	
Prepare a sample (prediluted)	25.1ml	6ml	0.26ml	
Normal Shutdown	32ml	10ml		1.6ml

Performance Specifications

Imprecision

Imprecision is based on replicate determinations of the same sample**.** The first result is not used in the calculation.

Imprecision Specifications

Parameter	Level	Units	CV%
WBC	7.0-15.0	10^9/L	≤ 2.5
RBC	3.5-6.0	10^{12}/L	≤ 2
HGB	110 – 180	g/L	≤ 1.5
MCV	80.0 – 110.0	fL	≤ 0.5
PLT	200 – 500	10^9/L	≤ 5

Operating Range

Parameter	Range	Units
WBC	0.0-999.9	10^9/L
RBC	0.00-9.99	10^{12}/L
HGB	0-300	g/L
MCV	0-250	fL
PLT	0-3000	10^9/L

Linearity

Parameter	Linearity Range	Units	Difference (whichever is greater)
WBC	0.3-99.9	10^9/L	±0.3 or ±5%
RBC	0.20-9.99	10^{12}/L	±0.05 or ±5%
HGB	0-300	g/L	±2 or ±3%
PLT	10-999	10^9/L	±10 or ±10%

Display

Liquid Crystal Display（LCD），resolution: 640×480

Input/Output

Two RS232/C serial ports

One printer port

One keyboard interface

Built-in Thermal Recorder

Printer (optional)

EPSON LX-300, EPSON LX-300+

Scanner(optional)

TYSSO CCD-82

Reagents Required

DILUENT	M-30D	DILUENT
RINSE	M-30R	RINSE
LYSE	M-30L	LYSE
E-Z CLEANSER（Enzyme cleanser）	M-30E	CLEANSER
PROBE CLEANSER	M-30P	CLEANSER

Power

Input:	AC 220V±10%	AC 110V±10%
	50/60±1 Hz	50/60±1 Hz
Consumption:	180 VA	180 VA
Fuse:	2A	4A

Ambient Temperature and Humidity

Temperature:

15℃～35℃ (59°F～95°F)

Humidity:

10%～85% without condensation

Dimensions

Height	Width	Depth
46cm	39cm	40cm

Weight

25KG

Recommended Anticoagulant

A salt of K_2EDTA with the proper proportion of blood to anticoagulant, as specified by the tube manufacturer.

Sample Identification

An 8-digit identification number is mandatory sample identification.

Results Output

The system can transmit sample and control data to an external computer.

Sample results screen shows sample identification number, sample mode, sample results and any sample result flags.

The system provides a printout of all data.

1.4 Panel Description

1.4.1 Front Panel and Keys

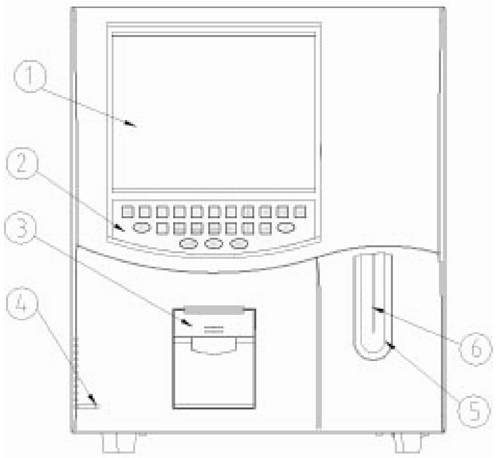


Figure 1-1

No.	Name	Description
1	Display Screen	Display various messages, measured data and histograms
2	Keypad	Touch key (all of the description refer to under lists), 23 buttons
3	Recorder	Print out measured result
4	Power Light	Show hematology analyzer work status
5	[Start] key	Press to aspirate the sample and start counting
6	Sample Probe	Aspirate the sample Dispenses the diluent when in capillary blood mode.

Keypad

1	**[START]**	In Count screen, QC Count screen and Auto Calibration screen, press it to count. In the status of Adding Diluent, press it to add Diluent.
2	**[MENU]**	Press this key to switch between window operation and menu operation
3	**[PRINT]**	Press this key to print using either recorder or printer
4	**[FEED]**	Press this key to feed paper of the recorder. Release it to stop the operation.
5	**[MUTE]**	Mute the alarm and clear some of the error messages.
6	**[DEL]**	Delete the selected data in Review screen. Delete error message in Error Message screen. Delete reference data and running control data in QC Edit screen. Call default value in Normal Range screen.
7	**[0]...[9]**	Enter numbers

8	**[↑][↓][←][→]**	Move the cursor in the window area or menu area.
9	**[ID]**	Enter the ID number of the sample
10	**[DILUENT]**	In the Count screen of Prediluted mode, press this key to enter the Adding Diluent status.
11	**[PgUp][PgDn]**	Scroll the screen up or down page by page.
12	**[ENTER]**	Confirm
13	**[STARTUP]**	Clean the tubing, baths and sample probe then check the background.
14	**[FLUSH]**	Press the key to execute the Flush operation to remove the clogs

1.4.2 Rear Panel

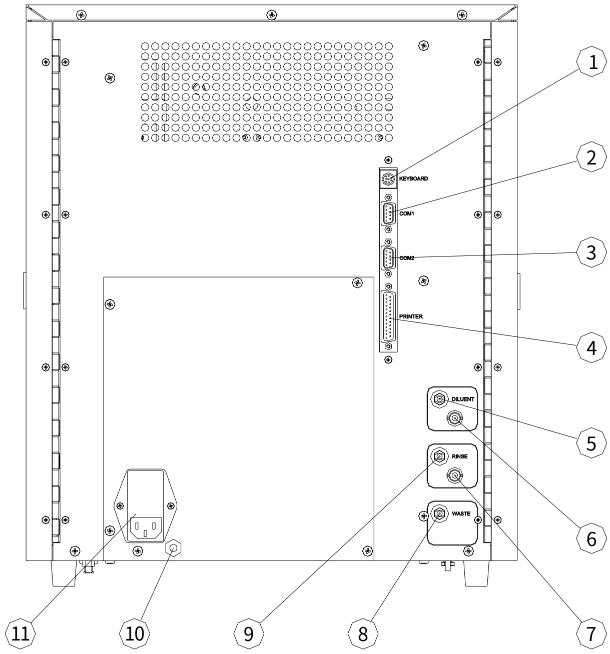


Figure 1-2

No.	Name	Description
1	Keyboard Interface	Connect the standard keyboard
2	RS-232C Serial Port 1	Connect computer and transfer data to computer **CAUTION** **In order to avoid any safety hazard, only coonect personal computer which are approved to IEC950** **The instrument should only be connected to an external instrument which complies with the CISPR 11 Second Edition 1990-09, Group 1 and Class B standard**
3	RS-232C Serial Port 2	Connect a bar code scanner
4	Printer Interface	Connect the external printer LX-300+ (LX-300)
5	DILUENT Tubing Connector	Inlet for diluent. Connect one end of the tube (standard accessory) to the diluent inlet and attach the other end of the tube to the diluent
6	BNC socket for DILUENT sensor	connector for diluent. Connect one end of the connector of the cable.
7	BNC socket for RINSE sensor	connector for rinse. Connect one end of the connector of the cable.

8	WASTE Tubing Connector	Inlet for waste. Connect one end of the tube (standard accessory) to the waste inlet and attach the other end of the tube to the waste
9	RINSE Tubing Connector	Inlet for rinse. Connect one end of the tube (standard accessory) to the rinse inlet and attach the other end of the tube to the rinse
10	Equipotential ground terminal	Connects the ground lead to the Equipotential ground terminal on the wall for earth grounding
11	Power switch AC source Fuse holder	Turns power on or off Connects the AC power cord to supply the AC power to the instrument Contains the time lag fuse (T 2A for 220V or T 4A for 110v) ⚠**CAUTION**⚠ **Fuses cut the power off when an abnormality occurs in the hematology analyzer. Remove the malfunction before replacing the fuse.** **Before replacing a fuse, turn the power off anf disconnect the AC power cord from the instrument.** **Fuse replacement should be done by a qualified person.**

1.4.3 Front review without front panel

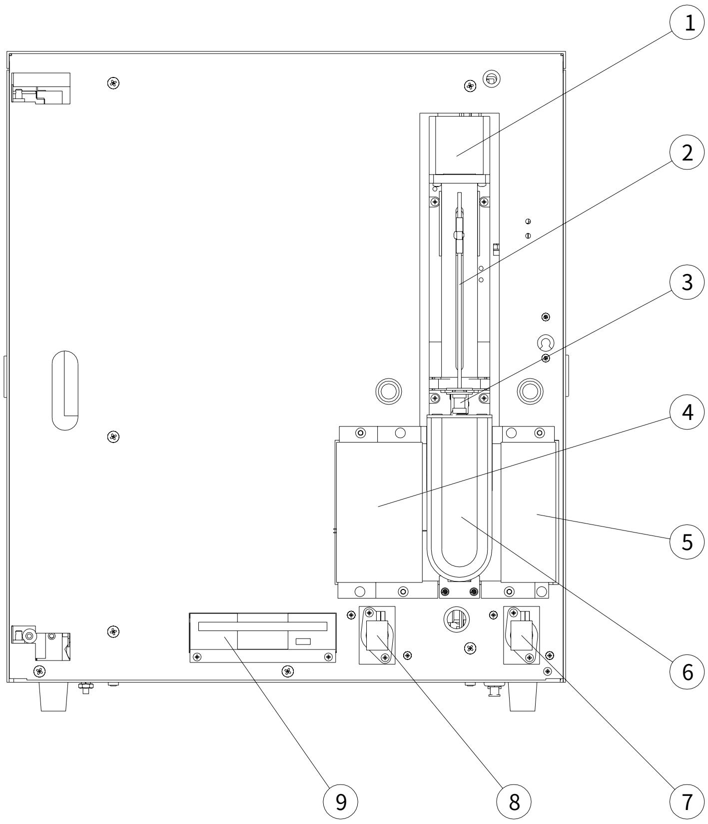


Figure 1-3

1--- Fluctuating Motor

2--- Sample Probe

3--- Sample Probe Wipe Block

4--- WBC unit shield

5--- RBC/PLT unit shield

6--- [Start] key

7---Valve 11

8--- Valve 12

9---Floppy Disk Driver

1.4.4 Right-side view without the door

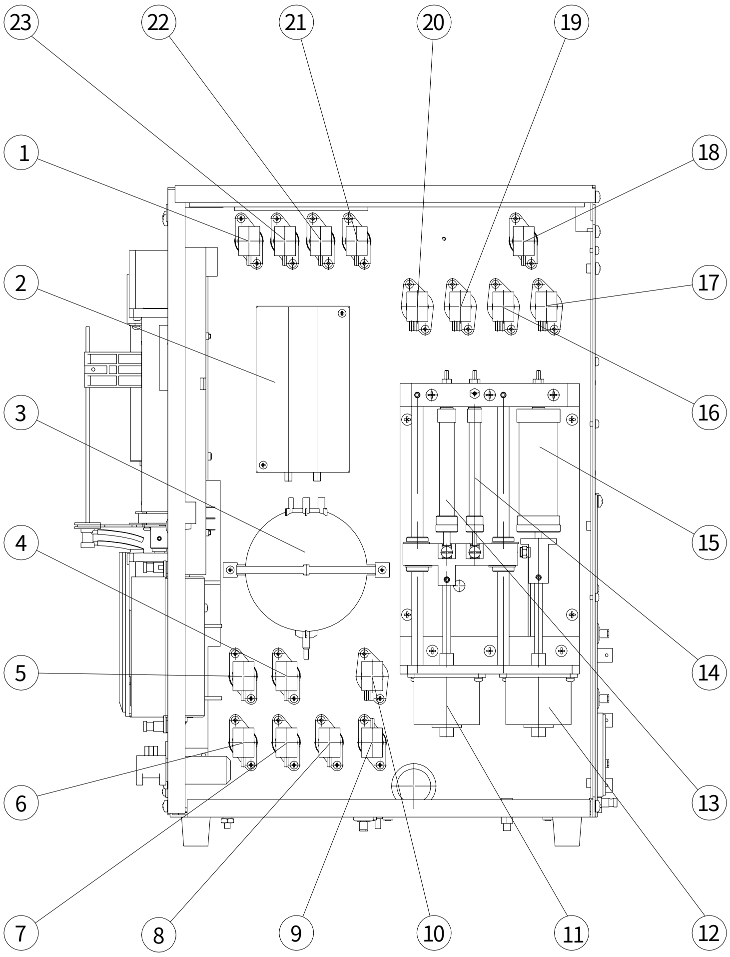


Figure 1-4

1--- valve 8	2---volumetric unit
3---vacuum chamber	4---valve 15
5---valve 16	6---valve 14
7---valve 13	8---valve 10
9---valve 2	10--- valve 9
11---2.5ml and 50ul motor	12---10ml motor
13---2.5ml syringe	14---50ul syringe
15---10ml syringe	16---valve 4
17---valve 3	18---valve 1
19---valve 6	20---valve 5
21---valve 17	22---valve 7
23---valve 18	

1.4.5 Left-side view without the door

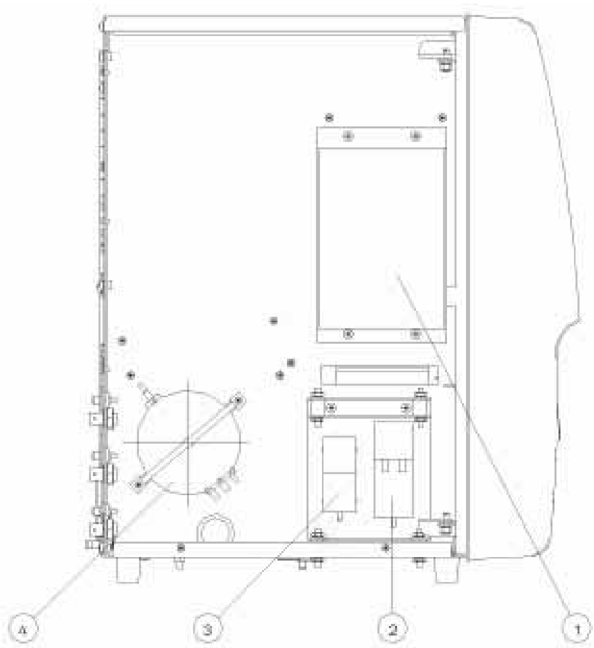


Figure 1-5

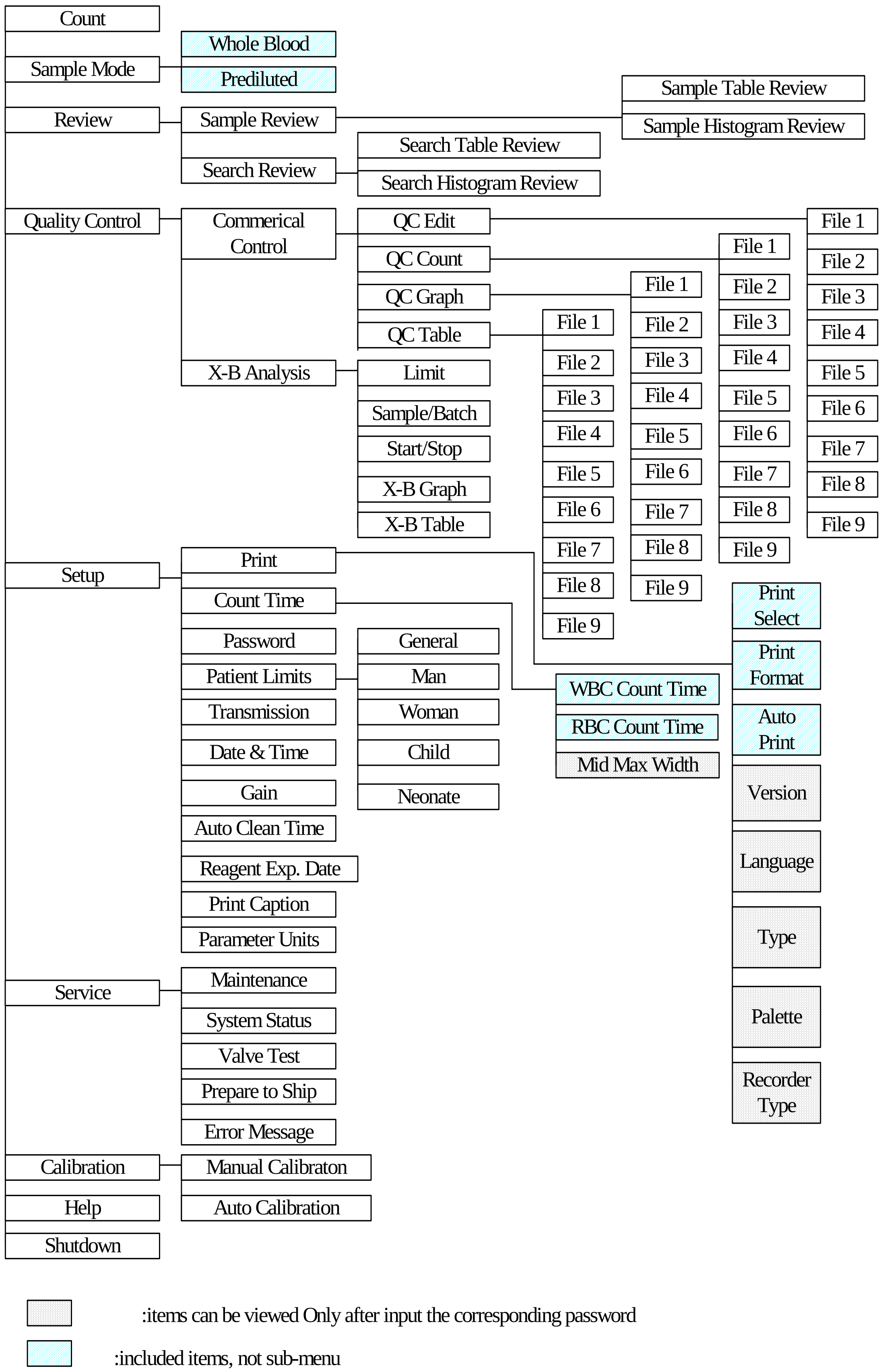
1---hard disk (Module on disk)

2---vacuum pump

3---pressure pump

4---pressure chamber

1.5 Menu Structure Chart



Chapter 2 Troubleshooting

2.1 Check Procedure

Check the instrument according to the check procedure below.

Measurement operation check
Was the quantity of each reagent sufficient for measurement?
Were the correct or recommended reagents used?
Was the operating temperature proper?
Was the supplied main power voltage correct?

→ Refer to "Check Items before Instrument Check"

↓

After turning on the instrument.
Did the instrument fail to generate an alarm?
NO DILUENT
HARDWARE FAIL

→ Refer to "Troubleshooting and Alarm"

↓

Background noise measurement.
Did the instrument fail to generate an alarm?
Was the result within the specification?

↓

Control measurement
Did the instrument fail to generate an alarm?
Was the result reproducibility good for:
HGB? RBC?
WBC? PLT?
HCT?
(Was the obtained data within the range?)

↓

END

2.2 Check Items before Instrument Check

Check items before Instrument check

Use the instrument and diluent under the following operating conditions:

Around instrument | Diluent
- temperature: 15 to 35℃ | temperature: 15 to 30℃
- humidity: 10 to 85%
- atmospheric pressure: 860 to 1060hPa （Working）

If the temperature is less than 15℃, it slows the reaction rate from hemoglobin to cyanmethemoglobin. This may result in increase of the hemoglobin data. It may also result in increase of the WBC count because the RBCs are not sufficiently hemolysed due to the lower temperature. Insufficiently hemolyzed RBCs will be included in the WBC count as RBC ghosts.

Sampled Whole Blood Handling Check

Storage for Blood Sample

Measure all required parameters soon after sampling the whole blood from a patient. As time elapses after blood sampling, the blood cells' volume and density change. The ratios of the volume and density variations depend on the environmental conditions and patient. If the blood sample isleft in an air conditioned room for a long time, the volume of the red blood cell increases and the MCV, RDW and MPV will be affected, and moreover, the PLT will be easily aggregated.

WBC part differential

To get high reliability on the acquired data, measure the blood samples within 6 hours after sampling the whole blood. If the blood sample is left in an air conditioned room for a long time, geerally, the WBC membrane's resistance against hemolysing reagent is decreased. Therefore the WBC histogram of the correct shape cannot be obtained.

Blood Sample from a Patient with Specified Conditions

To measure a blood from a patient who has hepatopathy, certain special treatments, or is a neonate, it may be necessary to use a method other than the hematology. Analyzer. This is because the RBC membrane's resistance against hemolysing reagent is increased (insufficient hemolysing) and it will cause an increase of the WBC count when the blood is measured with the hematology analyzer.

Furthermore, the bilirubin and WBC in the blood may affect the hemoglobin concentration in the measurement.

Capillary Blood Handing Check

⚠CAUTION⚠

In the capillary blood mode, the instrument aspirates the diluted sample of 20uL. In this mode, if the venous blood is incorrectly aspirated instead of capillary blood, there is a high possibility that the fluid path is clogged or the background noise is not easily decreased.

Most causes of data error using capillary blood are due to incorrect technique for the capillary blood sampling and diluting. Therefore, take care the following notes and make a capillary blood sample.

⚠NOTE⚠

Dilute the sampled capillary blood correctly the first time, because it is difficult to sample the blood twice from the capillary.

2.3 How to Check Sample Data

Background Noise Check

This check is used to make sure that the counted and calculated data of a diluent sample is not affected by background noise. If the background checking value exceeds the tolerable dilute data shown in the table below, the diluent data counted and calculated before background noise is reduced erroneous. In the table below, each diluent data is defined as follows:

Recommended diluent data

This data is best for acquiring accurate data of the sample.

Acceptable dilunt data

This data is the minimum value for acquiring accurate data of the sample.

Recommended diluent Data		Acceptable diluent Data	
WBC	0.0	WBC	0.3x$10^{9/L}$
RBC	0.00	RBC	0.03x$10^{12/L}$
HGB	0	HGB	1g/L or 0.1g/dL
HCT	0.0	HCT	0.5%
PLT	3	PLT	10x$10^{9/L}$

Refer to "Troubleshooting Erroneous Data" of this chapter for the possible causes of background noise and how to reduce it.

Check Procedure

1. Press the start key to count and calculate the diluent. There is no need to aspirate the diluent from the sampling probe.
2. Make sure the counted and calculated data is less than or equal to the acceptable diluent data as shown upper. If they are out of range, decrease the background noise.

Parameter Data Check with Diluent

Check that the background values are less than or equal to the data in the previous table. Discard the other parameter values because they are not affected by noise.

Especially check the data for the PLT parameters. When the diluent includes the particles of dust smaller than WBC and RBC parameters, the data of them is not affected by the dust but the data for the PLT parameter increases because the volume for the PLT parameter is smaller than the WBC and RBC parameters. I f the data for the PLT parameter exceeds $10X10^9/L$, do the action described below to reduce the background noise.

Reducing Background Noise

To reduce the background noise when the background check value exceeds the acceptable diluent data shown in the previous table, perform the following.

1. Make sure connecting grounding well.
2. Execute the “clean Bath” program which in the service menu. If this does not reduce the background noise, perform the following steps.
3. Execute the “E-Z cleanser cleaning” and “Diuent Prime” program.
4. Perform the background check to make sure that the background noise is reduced.

If the data of the background check is still outside the acceptable diluent data values shown in the previous table, replace the diluent with diluent from a new, sealed container.

⚠**NOTE**⚠

When the instrument is used every day and the background noise rarely exceeds the lower limit for the diluent data, the instrument is not severely contaminated. However, this contamination builds up in the instrument and cannot be easily removed if the instrument is not cleaned periodically.

Reproducibility Check

This check is used to check reproducibility of the instrument, using pintout data value of a diluted sample from the same hematology control. When the values are out the specification range, the reproducibility of the instrument is poor. If the reproducibility is found to be poor, this printed result is used to troubleshoot the instrument as described in "Troubleshooting Erroneous Data" of this chapter.

Check Procedure

1. Reduce the background noise. Refer to "Background Noise Check" of this chapter.
2. Access "Quality Control" → normal level Controls→ QC Edit→ File "X" to set a new control file and input each parameter's specification.
3. Access "Quality Control" → Commercial Controls→ QC Count→ Count a diluted sample from the same sufficiently mixed hematology control 10 times.
4. Access "Quality Control" → Commercial Controls→ QC Graph→ File "X" to review the result and CV value.
5. If you want to print out the displayed values with an built-in thermo-printer unit, press the print key which on the keypad directly in the graph screen or table screen.

Data Check with Hematology Control

The CV (Coefficient of Variation) indicates the data reproducibility on each parameter. A lower CV value for a parameter indicates better reproducibility for the parameter (i.e. each sample data for the parameter deviates less).

Check the CV value for each parameter by comparing it with the CV specifications (as shown in the next page) described in the brochure. You get the CV value by counting a normal concentration hematology control 10 times consecutively.

If the acquired CV values are out of the CV specifications, the reproducibility of the instrument is poor. To troubleshoot the instrument, refer to "Troubleshooting Erroneous Data" of this chapter.

<Data example and CV specifications>

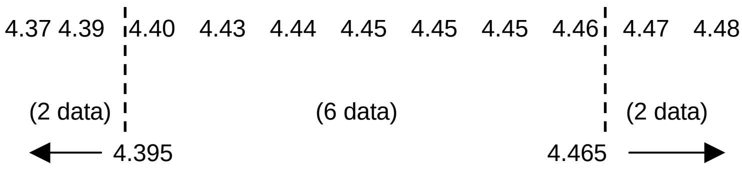
	N	X	CV%	CV Specification
WBC	10	10.0	1.05	2.5% or less
RBC	10	4.23	1.22	2% or less
HGB	10	130	0.77	1.5% or less
PLT	10	201	3.25	5% or less
Lymph#	10	4.0	1.47	
Lymph%	10	41.0	1.28	
Gran#	10	4.9	1.77	
Gran%	10	48.2	1.15	
HCT	10	36.1	1.28	
MCV	10	86.9	0.24	0.5% or less
MCH	10	31.6	1.02	
MCHC	10	353	1.08	

N: Number of samples for each parameter
X: Mean of sample data for each parameter
CV: Standard deviation divided by mean X

Note
Normally, the hematology analyzer counts approx $4.0X10^4$ blood cells for 16 seconds per one RBC counting. The reproducibility for the hematology analyzer is statistically determined by the number of blood cells aspirated through the aperture. The reproducibility is better as the number of counted blood cells increases; the reproducibility is worse as the number of counted blood cells decreases. That is, the acquired data has more deviation when a blood sample of lower concentration is counted.

The following explanation and diagram show what the CV values mean for data of each parameter.

For example, when noting the RBC data on the printout (see the previous table), the mean of the RBC data is 4.43 and CV is 0.8%. 0.8% of 4.43 is 0.035. Therefore the range is 4.395 to 4.465 (4.43±0.035). This means that six of the ten acquired RBC data are within the range.



Accuracy Check

This check is used to check the accuracy of the measurement by comparing the actually measured data of the hematology control with expected value on the assay sheet of the hematology control. If there is a large difference between them, calibrate the instrument by resetting the calibration coefficient for each parameter.

Check Procedure

1. Gently take the hematology control out of the refrigerator and place it in a normal temperature environment for a while to raise it to room temperature. The hematology control must be within the expiration data.
2. Confirm that the hematology control is not hemolysed. Normally the hematology control is separated into blood plasma and blood serum of the hematology control may be mixed. Also, if the hematology control is frozen, it is hemolysed.
3. Measure each parameter with the hematology control.
4. Check that the obtained sample data for each parameter is within the range between the lower and upper expected values on the assay sheet. Run the control again, replace a new control to try again if the results are out of range. After that, if the result are still unacceptable, recalibrate the instrument with the following procedures.
5. When the condition temperaare range is out of (20 to 26℃), control results maybe out of limits.

Parameter Data Check with Hematology Control

Check that the obtained sample data for each parameter is within the range of the assay values on the assay sheet.

⚠NOTES⚠

If the data for any parameter is out of range, calibrate the instrument according to "Calibration" of the operator's manual.
To calibrate the instrument for more accuracy, refer to the following "Procedure for Instrument Fine Calibration" of this chapter.

Procedure for Instrument Fine Calibration

The instrument allows the user to input the factors manually with the range between 75% and 125%.

The procedures of manual are:

1. Confirm the sample mode.
2. Run the calibrator in Count screen for at least five times. The reproducibility of WBC, RBC, HGB, MCV and PLT must satisfy following limits.

Parameter	CV
WBC	≤2.5
RBC	≤2.0
HGB	≤1.5
MCV	≤0.5
PLT	≤5

3. Calculate the new calibration factors.
4. Enter the new calibration factors.

Calculate the New Calibration Factors

Use the below formula to calculate the new calibration factors

$$new\ \ factor = \frac{old\ \ factor \times reference\ value}{average\ of\ \ test\ value}$$

Example:

Reference value of WBC = 8.4

In whole blood mode, three running values of WBC are 8.1, 8.0, 8.1, 8.1 and 8.3. The mean value of WBC is 8.12. Old calibration factor in the whole blood mode is 98.9%.

$$Mean = \frac{\sum_{i=1}^{n} x_i}{n} = 8.12$$

CV < 2%

$$new\ factor = \frac{old\ \ factor \times reference\ value}{average\ of\ \ test\ value} = \frac{98.9\% \times 8.4}{8.12} = 102.3\%$$

Enter the Calibration Factors

In the menu operation, move the cursor to the "Calibration/Manual Calibration" and press [ENTER] to access the manual calibration screen as shown in below figure.

Press [ENTER] to access the Edit Parameter state.

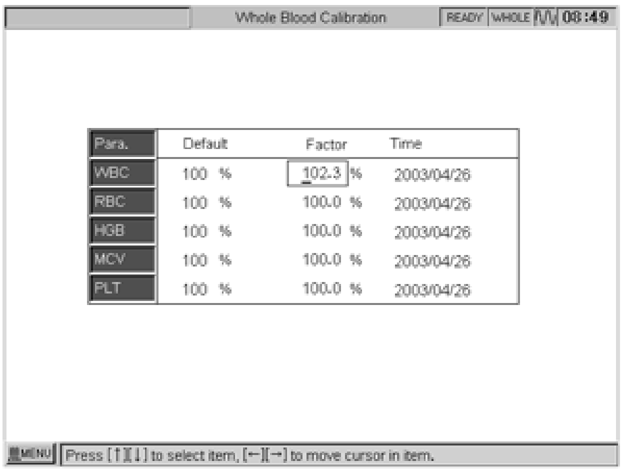


Figure 2-1

Press [↑][↓] to select the item and [←][→] to move the cursor within the item.

Press [0] – [9] to enter numbers.

The "fixed decimal" format is adopted so that the user need not enter the decimal point.

The factor should be within the range of 75% -- 125%.

Confirm the New Calibration Factors

After entering the new factors, press [MENU] key to return to menu operation, then the dialog box pops up as shown in below figure.

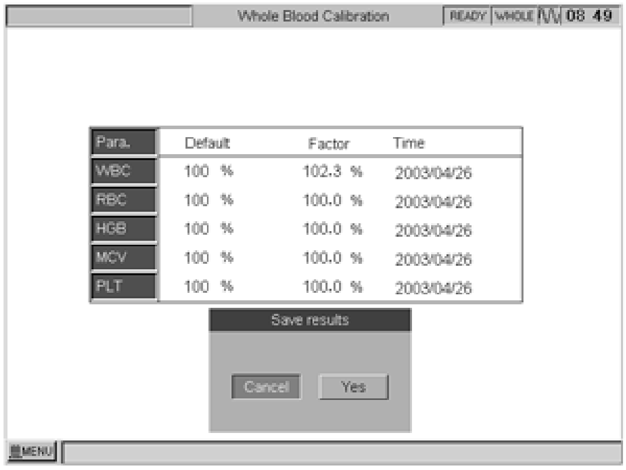


Figure 2-2

Select "Yes", store the new factors.

Select "Cancel", reserve the old factors.

Verification

After entering the new factors, run the calibrator in Count screen. Verify that the results are within the specified range.

•The Automatic Calibration procedures are:

1. Set up the sample mode to Whole Blood or Prediluted.
2. Enter the reference value of the calibrator.
3. Run the calibrator.
4. Confirm the calibration factors.

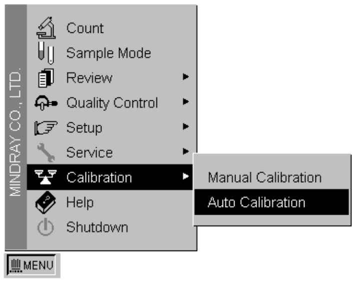


Figure 2-3

In menu operation, move the cursor to "Calibration/Auto Calibration", press [ENTER] key to access Auto Calibration screen.

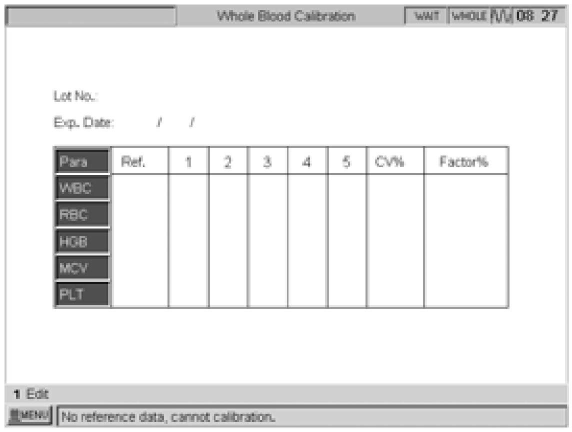


Figure 2-4

Edit the reference:

Press [1] to access "Edit Reference" status. Enter the reference values of the calibrator.

Press [↑][↓] to select the item and [←][→] to move the cursor within the item.

Press [0] – [9] to enter numbers.

The "fixed decimal format" is adopted so that the user need not enter the decimal point.

Press [ENTER] to exit edit status and access the Count status.

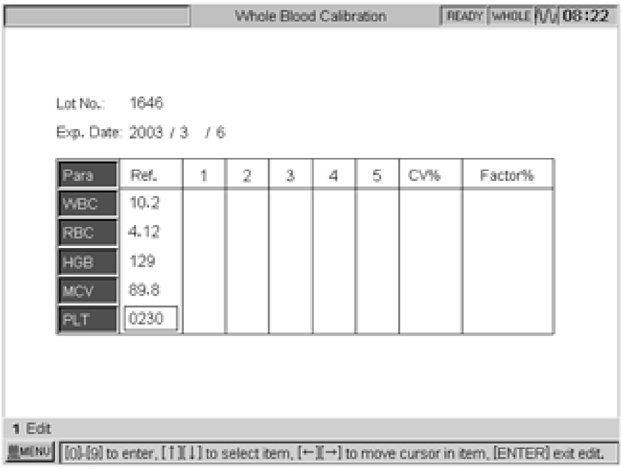
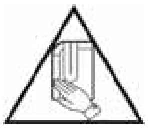


Figure 2-5

Run Calibrator Procedure

⚠ **WARNING** ⚠

Potential biohazard



⚠ **WARNING** ⚠

Avoid contacting with the sample probe.

1. Place the well-mixed calibrator to the probe so that the tip is well into the tube, and press the [START] to run. The process of run is the same as that of count. After running, the screen displays as shown in below figure.

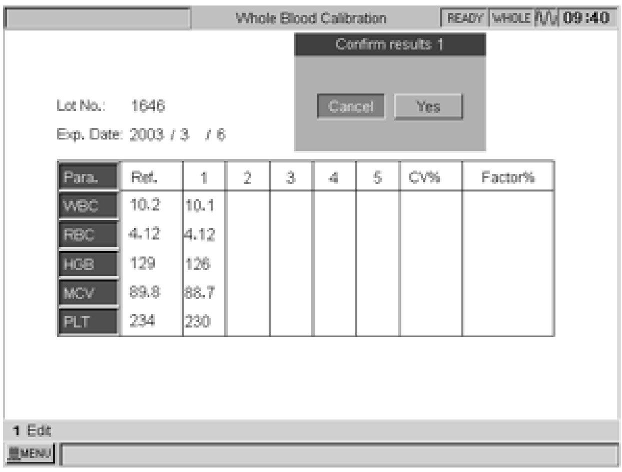
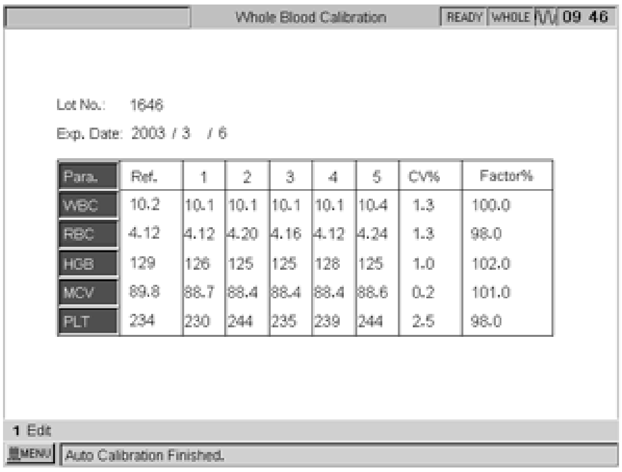


Figure 2-6

Select “Yes” to validate the results.

Select “Cancel” to invalidate the results.

The below figure shows an example of the results after five times of running.



Para.	Ref.	1	2	3	4	5	CV%	Factor%
WBC	10.2	10.1	10.1	10.1	10.1	10.4	1.3	100.0
RBC	4.12	4.12	4.20	4.16	4.12	4.24	1.3	98.0
HGB	129	126	125	125	128	125	1.0	102.0
MCV	89.8	88.7	88.4	88.4	88.4	88.6	0.2	101.0
PLT	234	230	244	235	239	244	2.5	98.0

Figure 2-7

The average value of calibration and the new calibration factors automatically calculated by the system are displayed in the right side of the screen.

“***” refers to invalid results, which means that the average value of the parameter and the calibration factor are invalid.

Maximum 5 samples can be counted for auto calibration. The auto calibration result will be displayed only after 3 samples are counted. If the calibration factor of a parameter is out the range of 75% ~ 125%, it will not be displayed, find the reason. If necessary, contact the Mindray Customer Service Department or the distributor.

Confirm the New Calibration Factors

Press [MENU] to return to the menu operation. The dialog box pops up as shown in below figure.

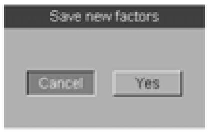


Figure 2-8

Select “Yes”, save the new calibration factors.

Select “Cancel”, keep the original calibration factors.

Verification

When the new calibration factors are adopted, count the calibrator in the Count screen and verify that the result is within the specified range.

2.4 Troubleshooting Erroneous Data

Background Noise

When the count data of a container filled with diluent just exceeds the tolerable value of the parameter shown in the table in "Background Noise Check" of this chapter, the seven possible causes of error are:

(1) Dirty diluent
(2) Dirty diluent container
(3) Dirty baths
(4) Dirty valves

⚠NOTE⚠

Before storing the instrument for a long time, clean and empty all fluid tubings in the instrument with distilled water. Otherwise, the diluent salt adheres to the baths and cannot be removed easily.

(5) Electronic noise affecting the counting/calculation circuit:
AC line, backlight converter, peripheral equipment such as microwave treatment machine, motors in the instrument
(6) Mechanical noise affecting the counting/calculation circuit:
Vibration from motor in or around the instrument, such as a centrifuge
(7) Tubing noise affecting the counting/calculation circuit:
Liquid flow with some remained electric charges

As a countermeasure to the above 7 causes, take the following actions.

Cause (1) or (2)
– Replace the diluent with diluent from a sealed container.

Cause (3) or (4)
– Clean the baths with E-Z cleanser
– Clean the baths with probe cleanser

– Clean valves with distilled water
– Exchange the other same model valves to try

Cause (5)
–Securely ground the instrument, including any optional units such as external printer.
Cause (6)
– Keep the instrument away from the vibration source.

Cause (7)
– Securely ground the tubing.

For Reproducibility

This subsection describes the cases when the reproducibility for the following measuring parameter or calculated parameter is poor.

– PLT

– HGB

– WBC

– RBC

– Data other than red cell indexes (MCV, MCH and MCHC)

– RBC and PLT coefficient related parameters

– HCT and MCV

Poor Reproducibility for PLT

Possible Cause	Countermeasure
The background data on PLT is high	Refer to "Background Noise Check" of this chapter
Dirty RBC aperture	Clean the aperture.
Dirty RBC bath	Clean the bath. Refer to the "Maintenance" of the operator's manual.
Dirty measuring tube	Clean the tube below the RBC bath
Dirty wipe block	Clean the wipe block Replace a new wipe block
The sample probe position is not correct	Adjust the probe position using localizer
The 3-way valve (SV11) is dirty	Clean the valves Replace this valve
The 3-way valve (SV11) cannot drain liquid empty.	Replace the 3-way valve (SV11).
The diuent syringe exists bubbles	Remove the bubbles from the syringe
Faulty circuit	Replace the ANALOG board

Poor Reproducibility for HGB

Possible Cause	Countermeasure
Dirty WBC measurement bath	Clean the WBC bath with E-Z cleanser or probe cleanser
The voltage output from the HGB sensor is not optimal	Adjust the HGB voltage. Refer to "Adjust Gain" of this manual. Adjust the adjustable resistance VR3 & VR4 to adjust the output voltage of HGB to 4.4v-4.6v
The 3-way valve (SV12) cannot drain liquid empty.	Replace the 3-way valve (SV12).
The 3-way valve (SV12) is dirty	Clean or replace the valves
The specified diluent and hemolysing reagent were not used	Use the correct reagent
Cyanide in the hemolysing reagent has been dissolved by sunlight or heat	Replace the hemolysing reagent with a new reagent and tighten the cap of the reagent bottle.
The HGB 2.5 mL syringe exists bubbles	Remove the bubbles from the syringe
The light axis of the HGB LED is deviated	Adjust the light position Replace the light

The light of HGB is aging	Replace the HGB unit
The diuent syringe exists bubbles	Remove the bubbles from the syringe
Faulty the Analog board	Replace the analog board

Poor Reproducibility for WBC

Possible Cause	Countermeasure
The background data on WBC is high	Refer to “Background Noise Check“ of this chapter
Dirty WBC measurement bath	Clean the WBC bath with E-Z cleanser or probe cleanser
Dirty measuring tube	Clean the tube below the WBC bath
Dirty wipe block	Clean the wipe block Replace a new wipe block
The sample probe position is not correct	Adjust the probe position using localizer
The 3-way valve (SV12) cannot drain liquid empty.	Replace the 3-way valve (SV12).
The 3-way valve (SV12) is dirty	Clean the valves Replace this valve
The lyse reagent has been dissolved by sunlight or heat	Replace the lyse reagent with a new reagent and tighten the cap of the reagent bottle.
The constant current is not stable	Change the transformer or analog board
The diuent syringe exists bubbles	Remove the bubbles from the syringe
Faulty the Analog board	Replace the analog board

Poor Reproducibility for RBC

Possible Cause	Countermeasure
The background data on RBC is high	Refer to “Background Noise Check“ of this chapter
Dirty RBC measurement bath	Clean the RBC bath with E-Z cleanser or probe cleanser
Dirty measuring tube	Clean the tube below the RBC bath
Dirty wipe block	Clean the wipe block Replace a new wipe block
The sample probe position is not correct	Adjust the probe position using localizer
The 3-way valve (SV11) cannot drain liquid empty.	Replace the 3-way valve (SV11).

The 3-way valve (SV11) is dirty	Clean the valves Replace this valve
The constant current is not stable	Change the transformer or analog board
The diuent syringe exists bubbles	Remove the bubbles from the syringe
Faulty the Analog board	Replace the analog board

2.5 Troubleshooting

B

Burn fuse when power on unit	AC input power is not stable Power supply board is short circuit	Using a manostat (voltage regulator) Replace the power supply board
Bubbles	Bubbles in the sample Regents are not enough Setting count time is long The aperture is broken Counting channel is leakage	Remove the bubbles Re-prime the regents Re-set the count time Change a new aperture Replace the leakage parts
Background testing is abnormal	Regents are dirty Electronic noise Dirty bath Dirty valves	Change new regents Connect ground well Clean the bath Clean the valves

C

Counting time is sometimes too short and sometimes normal	The CPU board has some problem	Replace the CPU board
Clog	Big cells or debris in the sample Setting count time is short The aperture is blocked Diluent is not enough Volumetric board is broken	Remove the debris from the sample Re-set the count time Clean the aperture Check the diluent syringe and diluent Replace the volumetric board

D

Diluent injection time becomes longer, and make WBC bath full	SV3 valve doesn't close properly	Replace the SV3 valve
Display is not clear	Backlight is too bright or too dark LCD screen is old	Adjust the unique resistor on the CPU board Replace the LCD screen

F

Fluctuating and rotatory motor error	The environment temperature is low Tubing which on the sample	Increase environment TEMP and add UPS Loose the tubing

	probe assembly is too tight The detectors are broken	Replace the two detectors

H

Hang during initiation (Initiation stop)	Software has some problem Power supply board is broken	Re-install the software or replace a new Moduleondisk Replace power supply board
HGB always alarm	WBC bath is dirty	Clean WBC bath
HGB error and WBC clog	The 10ml syringe's piston falls off	Re-fix the piston
Hematology analyzer leakage and vacuum is abnormal	The tubing of waste assembly is kink	Release the tubing and empty the liquid
HGB background voltage is abnormal, no chance to make it down	WBC bath is dirty or HBG gain is not correct	Dip in the WBC bath and adjust HGB gain
HGB error	HGB background voltage is abnormal (0-3.2v or 4.9-5.0v), it's out of acceptable range	Adjust the HGB gain or the resistor (VR3 &VR4 which on the analog board) to 4.2V-4.6V
HGB adjust error	HGB background voltage is abnormal (3.2-3.4v or 4.8-4.9v), it's out of acceptable range	Adjust the HGB gain or the resistor (VR3 &VR4 which on the analog board) to 4.2V-4.6V

I

Initiation time is too long	disk on module is broken	Replace hard disk (disk on module)

K

Keyboard, some buttons no response	CPU board or keyboard is broken	Replace the CPU board or keyboard

L

LCD screen, there is a line on the screen	CPU board is broken if the line is a dot line and the position is fixed LCD screen is faulty if the line is a continuous black or light line	Replace the CPU board Replace the LCD screen

LCD screen is dark	The color palette setting is not correct The backlight is too dark	Re-set the color palette to 8-color Adjust the unique resistor on the CPU board
Leakage	Vacuum chamber is broken, waste liquid tubing is kink, tubing leakage Analog board is broken The air filters are dirty	Change the vacuum chamber Loose the waste liquid tubing Check the default point Replace a new analog board Replace this two fiters

M

mid-size cell's percent is sometime too high and sometime normal	Put the sample to long time Add too much anti-coagulant	Count the sample in 30mins Reduce the value of anti-coagulant

N

No diluent injected	Diluent is empty The piston falls off	Change a new bottle of diluent Re-fix the piston
No sample inspired and no diluent injected	SV4 valve doesn't work	Replace the SV4 valve
No initialization, but exist backlight and a moment it becomes black, the indicators flash like saver	The CPU board is broken	Replace the CPU board
No rinse (diluent, lyse) alarm	The rinse (diluent, lyse) sensor is broken or plastic washer falls off	Replace the rinse (diluent, lyse) sensor or re-fix the washer
No backlight	The inverter is broken	Replace the inverter

P

PLT/RBC's result shows "**.*"	Test the RBC aperture voltage is not stability, the range is 4.5-11.0V	Replace the RBC bath
PLT result is always over 1000	The RBC bath is dirty	Clean or replace the RBC bath
Power-on is normal, but the screen is black suddenly after	Power supply board and CPU board are broken	Replace the power supply board and CPU

initiation		board
Power-on is normal, but no display, no initiation, no response	The CPU board is broken	Replace the CPU board
PLT background is abnormal	Connecting ground is not proper, or with high voltage	Reconnect ground wire
Pressure error	Pressure pump leakage or tubing broken Pressure filters are blocked	Replace pump or tubing Replace new filters

R

Rotatory motor error	The tubing connecting sample probe is loose, and liquid enters the motor to make the resistance higher	Replace the proble mosule
RBC bath full and liquid overflows	The V11 valve doesn't work or dirty or doesn't work well	Clean or replace the V11 valve
RBC/PLT's result shows "**.*"	Test the RBC aperture voltage is not stability, the range is 4.5-11.0V	Replace the RBC bath
RBC always clog	1. RBC bath is dirty 2. The count time is a little longer than the setting time 3. One of the sensor which on the MTB board is broken	1. Clean the bath using E-Z cleanser or probe cleanser 2. Re-set the count time 3. Replace the MTB board
RBC bath is leakage	RBC bath is broken with cranny	Replace the RBC bath
RBC background and value is too high	RBC bath is broken with cranny	Replace the RBC bath
RBC no result	Analog board is broken	Replace the analog board

S

Stability is bad, and PLT over 1000 sometime	There are some bubbles in Diluent syringe and make the injected diluent not enough	Replace the SV3 valve
Sample probe leakage	SV4 valve is leakage	Replace the SV4 valve
Show "8002 error code"	The disk on module is broken	Replace the disk on module
Show "48V is low"	The transformer or analog	Replace transformer

	board is broken	or analog board

T

TEMP is low	The environment temperature is low	Increase the environment TEMP

V

Vacuum is low	Air filters are so dirty Waste liquid tube is kink Tube is leakage Vacuum pump is leakage Vacuum chamber is leakage	Replace the filters Loose the tube Replace one new tube Replace a new pump Replace a new chamber

W

WBC always clog	1. WBC bath is dirty 2. The count time is a little longer than the setting time 3. One of the sensor which on the MTB board is broken	1. Clean the bath using E-Z cleanser or probe cleanser 2. Re-set the count time 3. Replace the MTB board
WBC bath leakage	WBC bath is broken with cranny	Replace the WBC bath
WBC background and value is too high	WBC bath is broken with cranny	Replace the WBC bath
WBC bath full and liquid overflows	The V12 valve doesn't work or dirty or doesn't work well	Clean or replace the V12 valve
WBC result is not stable	WBC bath is broken with cranny	Replace the WBC bath
Wipe-block is leakage	Wipe-block is old	Replace wipe-block
WBC value is too high and RBC is zero or "***"	Mis-use the Rinse and diluent	Exchange the two reagents
WBC clog, no count time	WBC aperture clog	Clean the aperture using probe cleanser
WBC differential part is abnormal, and it's end point at 200fl	WBC channel gain is not correct	Adjust WBC channel gain
WBC bubbles during counting	SV8 valve is leakage	Replace the SV8 valve
WBC no result	Analog board is broken	Replace the analog board

2.6 Alarm

Error Message	Possible Cause
Com Error	1. The transmission settings between BC-3000PLUS and the external computer are different.
2.5ml & 50ul Motor Error	1. The position optical coupler is abnormal. 2. The driving motor is abnormal. 3. The communication wire of the motor is bad connected. 4. The 2.5ml syringe or/and 50ul syringe is damaged or the resistance of it has increased. 5. The 2.5ml syringe or/and 50ul syringe is not mounted to the right position.
10ml Motor Error	1. The position optical coupler is abnormal. 2. The driving motor is abnormal. 3. The communication wire of the motor is bad connected. 4. The 10ml syringe is damaged or the resistance of it has increased. 5. The 10ml syringe is not mounted to the right position.
Rotatory Motor Error	1. The position optical coupler is abnormal. 2. The driving motor is abnormal. 3. The communication wire of the motor is bad connected. 4. The motor components loosen or mounted to the wrong position. 5. The pin clip loosens, if the tubing connecting the sample probe moves randomly or touches the wall when the motor operates. 6. The tubing connecting the wipe block is over tightly fastened.
Fluctuating Motor Error	1. The position of the optical coupler is abnormal. 2. The driving motor is abnormal. 3. The communication wire of the motor is bad connected. 4. The motor components loosen or mounted to the wrong position. 5. The screw lever is not enough smooth.
DC/DC Error	1. The DC/DC component is abnormal. 2. The analog signal board is abnormal.
12V Power Error	1. The power supply board is abnormal. 2. The analog signal board is abnormal.
48V Power Error	1. The power supply part is abnormal. 2. The analog signal board is abnormal.
WBC A/D Error	1. The CPU board is abnormal.
RBC A/D Error	1. The CPU board is abnormal.
PLT A/D Error	1. The CPU board is abnormal.
WBC Interrupt Error	1. The CPU board is abnormal.

RBC Interrupt Error	1. The CPU board is abnormal.
PLT Interrupt Error	1. The CPU board is abnormal.
HGB Error	1. The HGB LED loosens. 2. The HGB unit is bedabbled. 3. The HGB LED is damaged. 4. WBC bath is dirty. 5. Diluent is polluted or exceeds its Exp. date.
HGB Adjust	1. The HGB LED loosens. 2. The HGB unit is bedabbled. 3. Light intensity of the HGB LED is set incorrectly. 4. WBC bath is dirty. 5. Diluent is polluted or exceeds its Exp. date.
Vacuum Filter Error	1. The filter is clogged by dirt.
Vacuum Low	1. Vacuum pump is damaged. 2. Tubing or vacuum chamber has leaks. 3. Tubing connecting vacuum chamber to sensor loosens or falls off. 4. The valve connecting the vacuum chamber is damaged. 5. The waste container is placed over normal position, or the waste tubing is too thin or too long, or the waste tubing cannot drain the liquid smoothly.
Envir. Temp. Abnormal	1. The environment temperature is over the range 15℃～35℃ 2. The temperature sensor is abnormal.
Background Abnormal	1. The count baths or apertures are dirty. 2. There are bubbles in the tubing system. 3. The reagents are polluted or exceed their Exp. date. 4. There is clog or bubbles error when test the background.
WBC Clog	1. The WBC aperture is clog or dirty. 2. Foreign object has clogged the WBC bath. 3. WBC reference count time is set up improperly. 4. Optical couplers on the volumetric metering board are damaged or the values of potentiometers are set improperly. 5. The liquid cannot flow in the tubing smoothly (pressed, bends or clogged by foreign object). 6. Inadequate reagent. 7. Can not form stable surface in WBC metering glass tube. 8. The tubing has leaks or the vacuum system has problem. 9. The sample has problem, such as the type and proportion of anticoagulant is selected improperly or

	there is blood clots.
WBC Bubbles	1. WBC reference count time is set up improperly. 2. Optical couplers on the volumetric metering board are damaged or the values of potentiometers are set improperly. 3. Inadequate reagent. 4. not form stable surface in WBC metering glass tube. 5. tubing has leaks or the vacuum system has problem.
RBC Clog	1. The RBC aperture is clog or dirty. 2. Foreign object has clogged the RBC bath. 3. RBC reference count time is set up improperly. 4. Optical couplers on the volumetric metering board are damaged or the values of potentiometers are improperly set. 5. The liquid cannot flow in the tubing smoothly (pressed, bends or clogged by foreign object). 6. Inadequate reagent. 7. Can not form stable surface in RBC metering glass tube. 8. The tubing has leaks or the vacuum system has problem. 9. The sample has problem, such as the type and proportion of anticoagulant is selected improperly or there is blood clots.
RBC Bubbles	1. RBC reference count time is set up improperly. 2. Optical couplers on the volumetric metering board are damaged or the values of potentiometers are improperly set. 3. Inadequate reagent. 4. Can not form stable surface in RBC metering glass tube. 5. The tubing has leaks or the vacuum system has problem.
Diluent Empty	1. There are no diluent in the diluent container. 2. The liquid sensor is not connected correctly. 3. The liquid sensor is damaged.
Rinse Empty	1. There is no rinse in the rinse container. 2. The liquid sensor is not connected correctly. 3. The liquid sensor is damaged.
Lyse Empty	6. There are no lyse in the lyse container. 7. The liquid sensor is not connected correctly. 8. The liquid sensor is damaged.
Pressure1 Low	9. Pressure pump has fault. 10. Tubing, vacuum chamber has leaks.

	11. Tubing connecting vacuum chamber to sensor loosens or falls off. 12. The valve connecting the vacuum chamber is damaged.
Pressure2 Low	13. Pressure pump has fault. 14. Tubing, pressure chamber has leaks. 15. Tubing connecting pressure chamber to sensor loosens or falls off. 16. The valve connecting the pressure chamber is damaged.
Recorder Out of Paper	1. There are no papers in the recorder box. 2. The sensor is abnormal.
Recorder Too Hot	1. The thermal head is too hot. 2. The sensor is abnormal.
File Error	1. The system software is destroyed. 2. The DiskOnModule disk has bad pars.
Bar Code Invalid	1. The format of bar code inputted is invalid for BC-3000PLUS.
Bar Code Com Error	1. There are some errors when the bar code scanner communicates with BC-3000PLUS host.
Printer Error	1. The printer is not connected correctly. 2. There are no papers in the printer. 3. Wrong type printer which BC-3000PLUS does not support.
Diluent Expiry	1. Diluent exceeds its Exp. date. 2. The diluent Exp.data inputted is incorrect.
Rinse Expiry	1. Rinse exceeds its Exp. date. 2. The rinse Exp.data inputted is incorrect.
Lyse Expiry	1. Lyse exceeds its Exp. date. 2. The Lyse Exp.data inputted is incorrect.

Trouble	Possible Cause
Poor repeatability	1. Operation is not normalized, sample is not completely mixed up. 2. Sample is heavily polluted. 3. Sample is improperly selected (such as the sample has blood clots). 4. Wipe block is inaccurately positioned. 5. Instrument has interference. 6. Reagents are polluted or exceed their Exp. date.
Severe interference	1. Shielding box of sample bath is not well mounted. 2. Shielding wire of analog signal board is not connected correctly.

	3. Valve V11 or V12 connecting count bath is not well closed or has dirt. 4. The gain is set incorrectly. 5. The input power is unstable.
Power-off during running	1. Unstable input power, it exceeds the protective range.

Chapter 3 Hardware

The instrument has the following hardware:

CPU Board
Power Drive Board
Analog Signal Board
Keypad
Recorder Board
Volumetric Metering Board
Power Supply Board
Display Screen
Linear Transformer

3.1 CPU Board

Function and Modules

The board consists of three modules:

- **Computer System Module**

  With CPU as the core, the computer system module also includes some peripheral circuits like RTC, WDT, SDRAM, Flash, and Super I/O. The super I/O circuit uses Super I/O chip as the core and includes other sub-circuits like keyboard, serial port, parallel port, floppy disk drive interface and IDE interface.

  CPU, SDRAM and Flash construct the basic computer system and the basic environment for the operation of software.

  RTC provides calendar and clock.

  WDT is designed to protect the system in case the software fails to function. It will generate reset signal once the software fails to function.

  Super I/O provides external interfaces, including one parallel port, two serial ports, one keyboard interface and one floppy disk drive interface.

- **A/D&I/O Module**

  A/D&I/O module use FPGA and CPLD as the core and include other peripheral circuits like FIFO, ADC and I/O.

  The A/D circuit can convert the analog signal pre-processed by the analog signal board and then send it to CPU via FIFO.

  CPU uses I/O interfaces to manage interrupts, control valves and pumps, control the gain of analog signal board, and zap function and HGB light.

- **Display Module**

  The display module uses FPGA as the core and includes other peripheral circuits like SRAM, display interface I/O.

  Display module is designed to display the information on the LCD screen.

Block Diagram of CPU Board

Figure 3-1 shows the block diagram of CPU board.

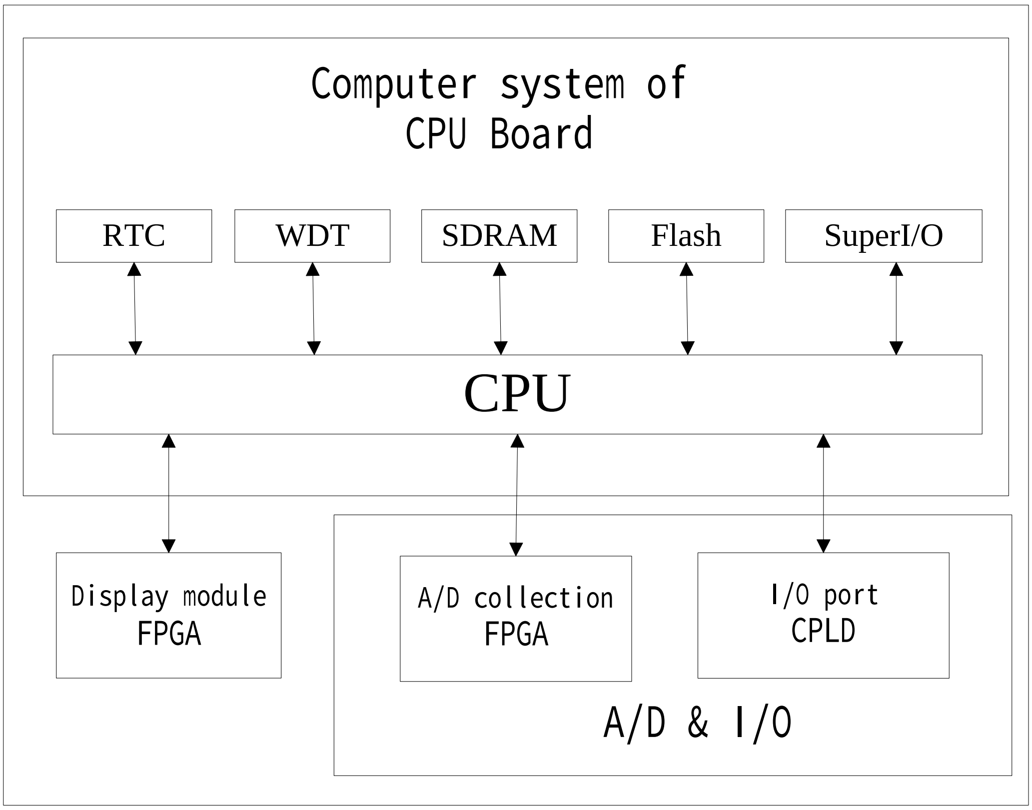


Figure3-1

- **Computer System**

Computer system includes CPU (U33), SDRAM (U1, U2), Flash (U3), RTC (U7), WDT (U6) and Super I/O (U30).

CPU, SDRAM and Flash make up of the basic computer system. Flash serves to store BIOS and FPGA configuration data. During initialization, CPU can read the FPGA configuration data from the Flash in order to set up FPGA. By executing the startup program in BIOS, CPU can transfer the main program on the DiskOnModule disk into SDRAM and accordingly run the program.

RTC and WDT together use I^2C bus. CPU may get the current time by accessing RTC. RTC has backup battery, therefore it can run normally even in the shutdown state. WDT is adopted to provide protective function. It can forcibly reset CPU when software fails to function.

Super I/O provides external interfaces. The parallel port is for connecting printer. Serial port 1 may connect bar code scanner. Serial port 2 may realize the communication with external computer. The keyboard interface is designed to connect standard keyboard.

- **A/D & I/O**

Circuit of this part includes A/D collection and I/O.

A/D sample: this board has three pieces of A/D chips. U37 is a 12-bit A/D to sample voltages of WBC, HGB and WBC apertures as well as RBC aperture, vacuum, pressure, 5V supply, +12V, -12V and +48V supplies of analog signal board, and 12V supply of power board. CPU select channel by using the analog switch on the analog signal board and saves the data sampled by U37 into U40 and U41. U35 and U36 are 8-bit A/D, used respectively to detect PLT and RBC. The sampled data are separately saved into U39 and U38. U38~U41 are 8-bit and 2K FIFO. When FIFO is half-full, it sends interrupt to CPU. CPU can read the data from FIFO via FPGA (U42). Besides, U42 is used to control the analog signal board, including gain control, zap control, HGB light and constant-current source control.

- **Display Module**

The display circuit is made up of FPGA (U43) and VRAM (U47~U49). CPU writes the display data into VRAM via FPGA. FPGA can generate LCD driving timing. CPU reads data from VRAM in terms of the driving timing and displays them on LCD.

■ PCB Layout of CPU Board

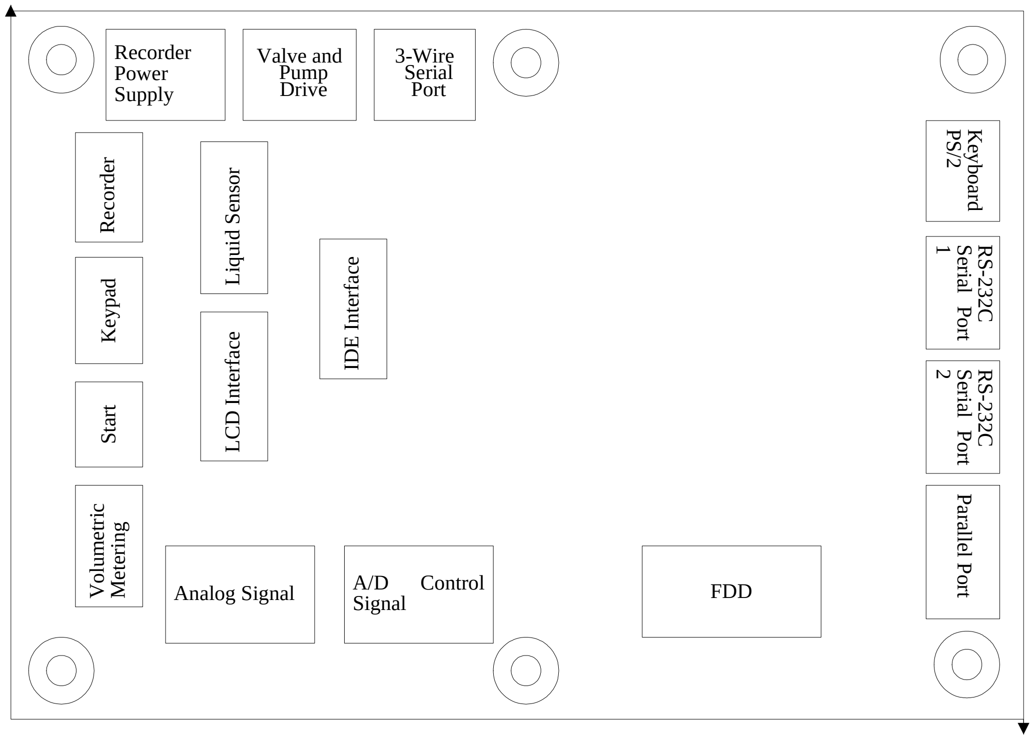

Recorder Power Supply
Valve and Pump Drive
3-Wire Serial Port
Keyboard PS/2
Recorder
Liquid Sensor
Keypad
IDE Interface
RS-232C Serial Port 1
LCD Interface
Start
RS-232C Serial Port 2
Volumetric Metering
Analog Signal
A/D Control Signal
FDD
Parallel Port

Figure 3-2

3.2 Analog Signal Board

Functions and Modules

The main functions of the analog signal board are

1. Process the original signal into the situation matching the requirement of A/D conversion;
2. Amplify the weak signal of WBC and RBC/PLT channels to the value between 0.2V-5V;
3. Amplify HGB signal;
4. Monitor the environmental temperature;
5. Monitor the pressure and vacuum in chambers;
6. Monitor the accessorial power supplies.

The analog signal board includes the following modules:

1. RBC/PLT and WBC amplification circuit: blood cells count channel, including WBC unit and RBC/PLT unit. This circuit can amplify the WBC and RBC/PLT signals by using multistage AMP and band-pass filters. Every channel in this circuit uses digital potentiometer to adjust the AMP multiple. There is voltage-limited protective output at the end stage of output circuit;

2. HGB measuring circuit: amplify HGB signal via using current-voltage conversion and voltage AMP circuit. At the same time, it acts as the constant-current driver circuit for the LED when measuring HGB. The output current of this circuit is adjustable between 5-25mA. ON/OFF of the constant-current source is controlled by optical coupler. This circuit uses digital potentiometer to adjust the AMP multiple;

3. Pressure measuring circuit: This circuit can transfer the changes of vacuum and pressure into voltage signal by pressure sensor, then amplify this signal and send it to A/D converter on CPU board to acquire digital signal. The AMP circuit uses AD620. The adjustable resistors are placed at the output and the feedback loop of the AMP circuit to adjust the zero point and full-scale output range of pressure measurement;

4. Temperature measuring circuit: use thermistor to monitor the environmental temperature. The changes of the thermal-sensitive resistor is amplified by AD620 and then output to CPU board;

5. Power supply circuit: provide +48V DC, 120V AC and ±12V supplies. The ±12V supply is realized by using the DC-DC module with +5V input. The +48V circuit provides constant-current source necessary for RBC/PLT measurement. The 120V AC circuit provides the necessary voltage to zap the apertures;

6. Multiplexer circuit: supply the function that multiple-way signals can be transmit through the same A/D channel. Use multiplexer to control the sequence of multiple-way output signals to CPU board. The signal controlling the analog switch comes from CPU board.

7. Supply monitoring circuit: monitor +48V and ±12V voltages. Obtain the desired amplitude of the output signal by using resistor to divide voltages.

Block Diagram of Analog Signal Board

The block diagram of analog signal board is shown in figure 3-3.

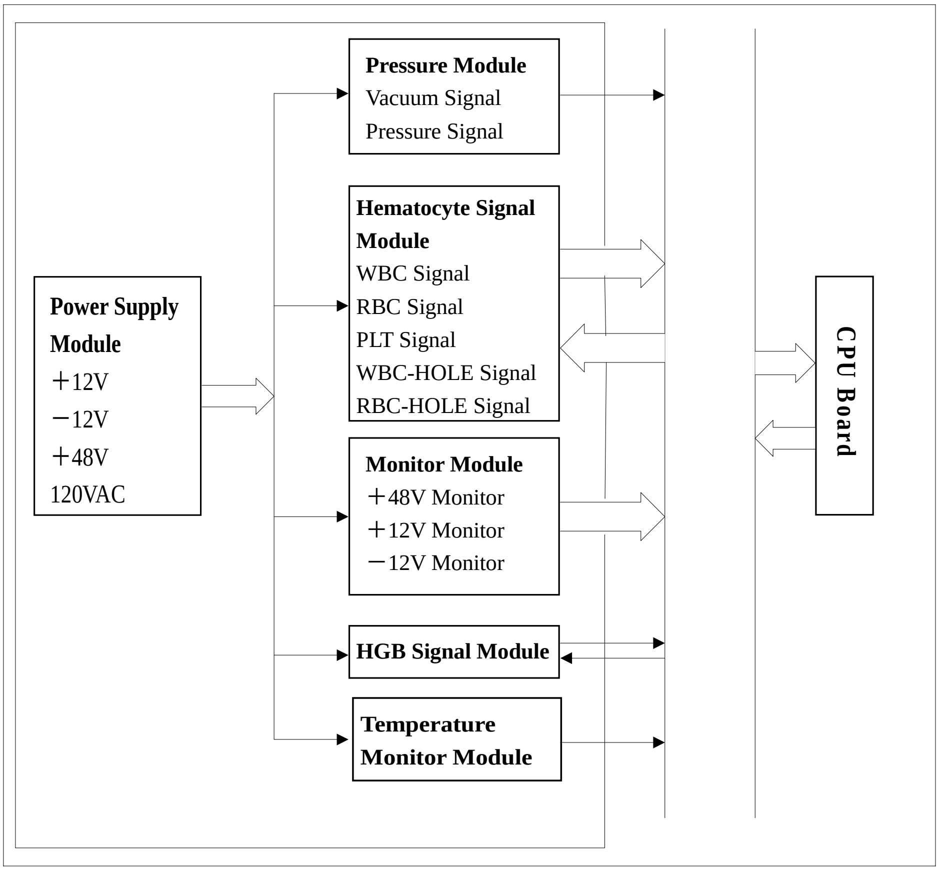


Figure 3-3

- **WBC and RBC/PLT AMP Module**

The circuits of three AMP channels WBC, RBC and PLT are basically the same except difference on small points. RBC and PLT channel uses the first two stages of AMP circuit and is separated from each other since the third stage. The following description uses WBC channel as the example.

The input signal is AC signal from uV to mV grade. Therefore using capacitors to filter direct current signal and connect the AMP channel at the preliminary stage. The preliminary stage AMP uses U14 to amplify the signal. At the end of this stage, passive RC circuit is applied to realize high-pass filter. The second stage AMP uses U15. Its feedback loop is the same as the first stage. It uses parallel-connected capacitors to realize low-pass filter. The third stage AMP uses U10. Its feedback loop adopts electronic potentiometer U19, which is controlled by CPU board so that circuit of this stage can provide different AMP multiples and realize the adjustable program-controlled gain. Besides, a voltage regulating tube is connected to the circuit of this stage to protect U19 from being damaged due to too high voltage. A passive RC circuit is connected at the end of this stage to finish high-pass filter. After amplifying the signal to the value within the required range, use U11 to realize active RC filter circuit in order to realize low-pass filter as well as limit the band width of the signal within the required range. At last the circuit outputs the signal that has passing circuit of removing negative pulse and buffer circuit.

- **HGB Measuring Module**

The input signal of HGB circuit is current signal. Before amplifying the signal, the current signal shall be first converted into voltage signal. OP AMP U27 is adopted to construct this circuit. The circuit uses classical current-voltage converting circuit. Resistor is connected into the feedback loop in order to convert current signal into voltage signal. A capacitor is parallel connected into the feedback loop to realize low-pass filter. After converting the current signal into voltage signal, input the voltage signal into the voltage AMP stage. U28 is used to realize the AMP circuit. Adjustable resistor is connected into the feedback loop in order to adjust the AMP multiple. Besides, a zero adjusting circuit is connected to the input end via an add circuit in order to ensure that when the input is zero the input signal of the circuit has positive voltage. An adjustable resistor is used to control the output of zero point.

- **Pressure Monitor Module and Temperature Monitor Module**

Both pressure measuring and temperature measuring circuits use instrumentation amplifier to amplify the signal. The circuits for measuring pressure and temperature are basically the same. The following description uses pressure measuring circuit as the example.

The circuit uses U25 to construct the constant current source to power the pressure sensor. The pressure sensor has bridge circuit. Its output signal is transmitted into U20 by means of difference. U20 can adjust the AMP multiple via the adjustable resistor at its R_g pin so as to amplify and output the signal. Additionally, an adjustable resistor is connected to the output of the pressure measuring circuit to adjust the zero output of the pressure sensor.

- **Power Supply Monitor**

The ±12V voltage powering the analog circuit is converted from +5V voltage. This part is realized by using DC-DC module U30. Add a LC filter circuit at the end output of the power supply to reduce its ripple.

On this board, relay is used to control ON/OFF of the 120V AC so as to zap the apertures.

+48V voltage is converted from the 53V AC voltage. This part first uses DB104 to implement DC conversion, then use U29 to obtain the +48V DC voltage. Optical coupler is used to control ON/OFF of the supply.

The monitor circuit adopts the form of voltage-division with resistor. Its output is transmitted to the CPU board by a follower. The power supplies to be monitored are +48V and ±12V.

3.3 Power Drive Board

Functions and Modules

The power drive board is designed to control the rotatory motor, fluctuating motor and syringe motors. Besides, it also receives the switch signal from the host to control the pump and valve. The power board has three modules: ON/OFF control module, motor control module and power supply module.

The ON/OFF control module consists of optical coupler isolation circuit, valve driving circuit and pump driving circuit.

Optical coupler isolation circuit: isolate the parallel ON/OFF signal coming from the host; eliminate the interference of large current signal to the front-end control circuit.

Valve driver circuit: realize power driving function for 18-way valves; the driving current is 1.5A and the driving voltage is 12V.

Pump driver circuit: realize power driving function for 4-way pumps, the driving current of three ways is 1.5A and the driving current of the other way is 3A. The driving voltage is 12V.

Motor control circuit: it consists of serial port communication circuit, program control circuit, current-limiting circuit, motor driving circuit and protective circuit.

Serial port communication circuit: realize serial port communication with the host, the signal level is compliable with RS232 serial port. According to the requirement for isolation, the communication between the host and the module is isolated by using optical coupler. Besides communication management circuit is used to realize multi-machine communication management.

Program control circuit: control the rotatory motor, fluctuating motor, and 10ml syringe motor and 2.5ml&50μl syringe motor according to the command from the host. Three 53-series CPUs are used to realize the control. At the same time, receives information of received command and returns the executed results to the host.

Current-limiting circuit: use constant current to control the syringe motor and the fluctuating motor in order to obtain good results.

Motor driver circuit: drive the step motor. The driving current of each phase should be 1A. Protective circuit: Because the motor is inductive load, protective circuit should supply continuous current for it.

Power supply module: provide +7.2V and +5V supplies to respectively power of the recorder and the power board.

Block Diagram of Power Drive Board

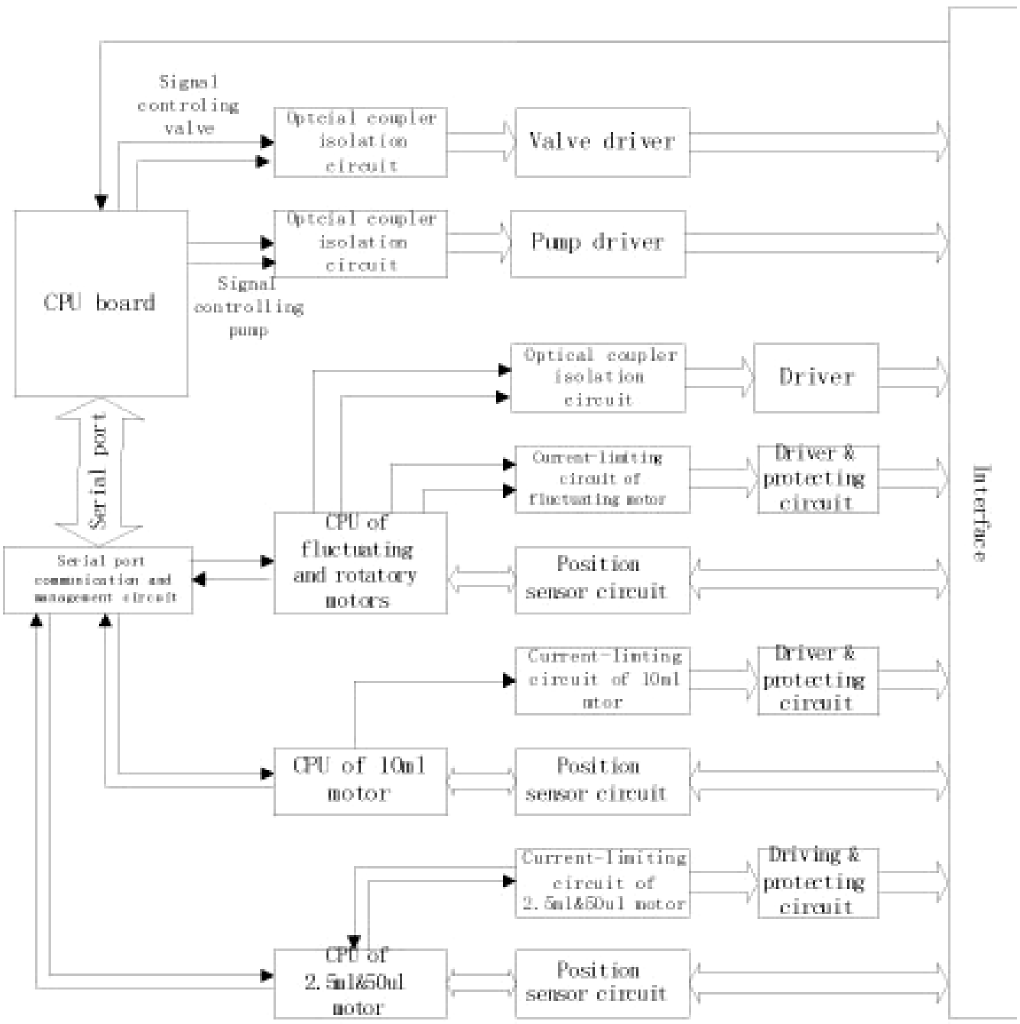


Figure 3-4

- **Switch Control Module**

The control signals of 18 ways valves and 4 ways pumps are transmit to the power board through parallel port. 7 optical couplers are used to isolate the digital supply from the driving supply in order to avoid the interference of big current on the front-end circuit. The circuit driving the valve uses ULN2068B as the driver chip. Its driving voltage is 12V. The maximum driving current of each valve is 1.5A.

Similar to the circuit driving the valve, the circuit driving the pump also uses ULN2068B as the driver chip. Their difference lies in that a pump with big power consumption uses transistor Q1 to amply the current in order to obtain 3A driver current.
The control logic level is TTL, which is valid at low level. It means when the input signal is “0”, the corresponding pump or valve is connected through.

- **Motor Control Module**

Receive the command from the host via serial port under the control of serial port communication and management circuit. For serial port communication circuit, the optical coupler isolation OP7 and OP8 as well as level transition U10 are adopted to realize isolation and level transition. Besides, U28 is applied to manage the communication circuit so as to realize multi-machine communication.

The 4-step motors are controlled by three modules which U21 controls the rotatory and fluctuating motor in order to control the sample probe assembly. The rotatory motor uses constant-voltage full step driver way while the fluctuating motor adopts constant-current half-step driver way. In addition, U26 and U27 are used to control the motors of 10ml syringe and 2.5ml&50µl syringe by means of constant-current half-step drive.

The driving circuit of rotatory motor uses optical coupler isolation and is driven by U9. U15 acts to drive the fluctuating motor and syringe motors. Its output can be 2A per phase.

Current-limiting circuit and voltage protective circuit are realized respectively by L6506D and UC3610. The setup limit current is 1A. The driving voltage of motor shouldn’t exceed 50V.

- **Power Supply**

Provide +5V for power board. U29 is used to realize the constant-voltage output and Q2 for amplifying the current. The maximum current that can be provided is 4.5A. The internal control supply of the power board is realized by LM7805.

3.4 Keypad

Functions and Modules

The keypad circuit may not only support the input via man-machine interface but also control the buzzer and LCD backlight. The main circuit modules are:

1. Key matrix: the key matrix circuit I0～I6, O0～O3 make up of 7×4 key matrix. There are totally 23 keys on the keypad. When single key is pressed, only a unique pair between I0~I6 and O0~O3 are connected through to identify the key function.

2. Circuit for controlling LCD backlight: this circuit first uses a piece of 7805 to obtain the constant 5V supply. Then it can acquire the voltage used to control the backlight brightness through using 2 resistors with fixed resistance and an adjustable resistor. The voltage-division range is between 1V ~ 3V. LCDBCTL signal is used to control the existence of backlight.

3. Buzzer: use control signal I7 and a dynatron to control the buzzer.

Block Diagram of Keypad

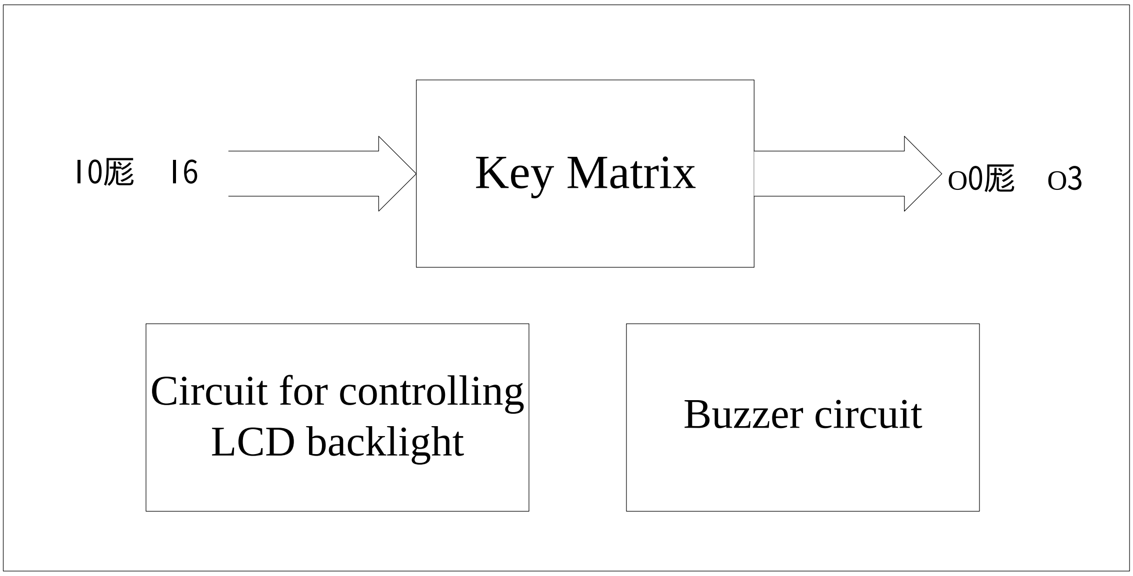


Figure 3-5

3.5 Recorder Board

Functions and Modules

The main function of the recorder board is to receive the data from the CPU board via serial port, process them and send them to the thermal head. At the same time, it drives the motor of the thermal head to feed paper so that the received data can be printed out in the form of characters or graphs.

Block Diagram of Recorder Board

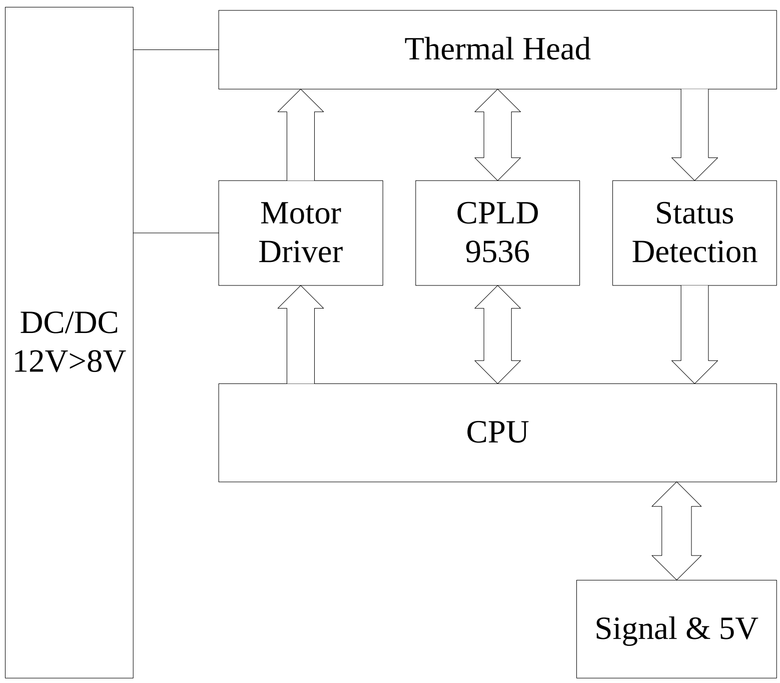


Figure 3-6

- **Thermal head**

The thermal head, the core component in the recorder, is the PTMBL1306A thermal head, manufactured by the ALPS company.

- **CPU system**

The CPU system is the core of the drive board. Its task is to receive the data from the host and generate lattice messages after calculation using a specified algorithm. These messages are then sent to the thermal head to be printed out. The CPU system can simultaneously collect data from both thermal head and drive board and display data sent to the host.

- **Power conversion**

The recorder requires the system to provide two voltages: 12 V and 5 V. The 5 V is directly driven by the logic and analog circuit of the drive board and the thermal head. Its current is less than 150 mA. The 12 V is converted into 8 V (by the DC/DC on the board) to drive the thermal head and he motor. The current required is determined by the printing content and ranges from 0.5 A to 2 A.

- **Motor drive**

A small motor is used to control the paper movement at the thermal head. The processor on the drive board uses two motor drives IC LB1843 V to control and drive the motor. These two IC's use constant current to control and drive the motor.

- **Status detection**

To correctly and safely control and drive the thermal head and the motor, the drive board must use the sensor inside the thermal head to detect the following signals: the position of the chart paper, if the paper is installed and if the temperature of the thermal head has exceeded the limit.

- **Key Test Points**

NO.	NAME	LOCATION	FUNCTION
1	12 V	JP3.1	Power input, range: 10~18 V
2	GND	JP3.2	Power and signal ground
3	VPP	U7.8	Power supply for heating thermal head and drive motor: 7.8 V~8.4 V
4	VCC	U1.14	+5 V supply: 4.75~5.25 V
5	RESET	U3.10	CPU reset signal. At high level(>2.4 V) after power-on

3.6 Volumetric Metering Board

Functions and Modules

The volumetric metering board can calculate liquid volume with the help of volumetric tube and optical coupler. It is used to ensure the accuracy of WBC and RBC/PLT count. The volumetric metering board has two channels: WBC channel and RBC/PLT channel. Each channel consists of one volumetric tube and two optical couplers. When the system starts counting, the liquid starts flowing in the volumetric tube. When the liquid is passing through the first optical coupler, the comparator outputs signal of starting count. After the liquid is passing through the second optical coupler, the comparator outputs the signal of stopping count. In this way we can know the time when the system starts and stops counting process.

The circuit has four parts:

1. Circuit for driving optical coupler: provide driving current for the four optical couplers. Besides, its activity is controlled by CPU board in order to decide whether the optical coupler works.
2. Circuit for detecting signal of optical couplers: this circuit collects the signal of voltage variation when the liquid is flowing through the optical coupler and then transmit the signal to the subsequent circuit.
3. Circuit for generating comparative level: generate the comparative threshold level of the comparator.
4. Circuit for outputting comparative signal: compare the voltage output from the circuit for detecting signal of optical coupler with the comparative threshold and accordingly output start count or stop count signal.

Block Diagram of Volumetric Metering Board

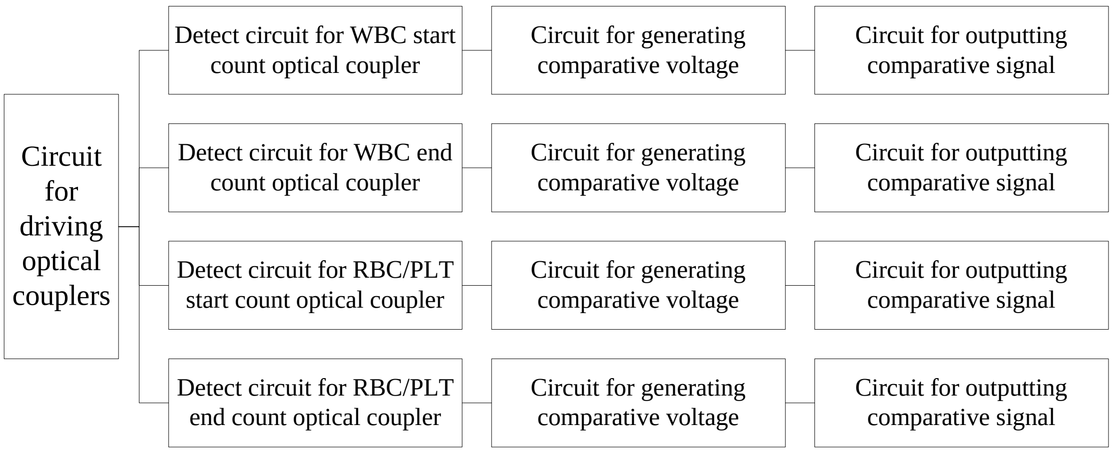


Figure 3-7

- **Circuit for Driving Optical Couplers**

To obtain the same light intensity of the four optical couplers, we need to use uniform constant-current sources. The source is made up of U3 and resistor with the output range of 5～25mA. CPU board generates signal to control the optical couplers. This signal is isolated from Q1 by an optical coupler.

- **Circuit for Detecting Signal of Optical Couplers**

The detecting signal is output from the receive terminal of the optical coupler. Use potentiometer to adjust the output voltage so that the output voltage of the detecting signal of the optical coupler can be 2.5V.

- **Circuit for Outputting Comparative Signal**

Connect U11 with the comparator to form hysteresis comparator with the hysteresis difference set to 0.25V. Moreover, a LED is added into this part to serve as the indicator. LED lighting on means the optical coupler has detected liquid.

3.7 Power Supply Board

General

This power supply is designed for use only on BC-3000PLUS hematology analyzer.

There are two types of power supply board, one input power is AC220V±20% and another input power is AC110V±20%.The outputs of rating load are +5V& 3Amax, +12V&3Amax and +32V&1A. The outputs of maximum load are +5V& 7Amax, +12V&6.5Amax and +32V&3A peak. The outputs of the three ways are isolated from each other in order to reduce the noise interference.

Working Principle

The two types power supply boards have the same working principle. The power supply board filters and rectifies the input AC supply in order to obtain a smooth DC voltage with the amplitude about 1.2 times of the input AC voltage. At the same time, the input AC supply provides a startup voltage for U2 control chip to control the supply converter. U2 controls the on/off of the main switch through monitoring the voltage and current of the +12.5V and +5V feedback circuits in order to stabilize the output of +12.8V and +5V. In addition, the turn ratio of the transformer is used to stabilize the +30V output.

At the same time, this power supply has over-voltage and under-voltage protecting functions for +12.8V, +5V and +30V. On the primary side, after the power supply becomes stable, the transformer will provide the VCC necessary for U2.

Block Diagram of Power Supply Board

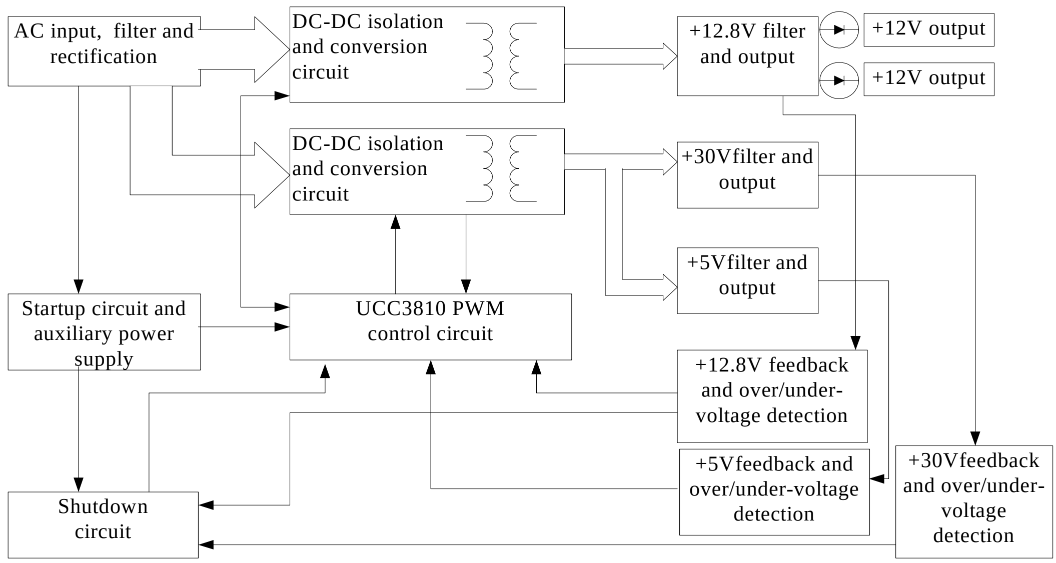


Figure 3-8

Difference Between Two Types Power Supply Board

The difference between the two types power board is the rectification circuit. The figure 3-9 is the 220V input rectification circuit and the figure 3-10 is the 110V input rectification circuit. The difference on PCB layout is if there is a connection wire between BD1 and the joint of C5 and C6 as shown in figure 3-10.

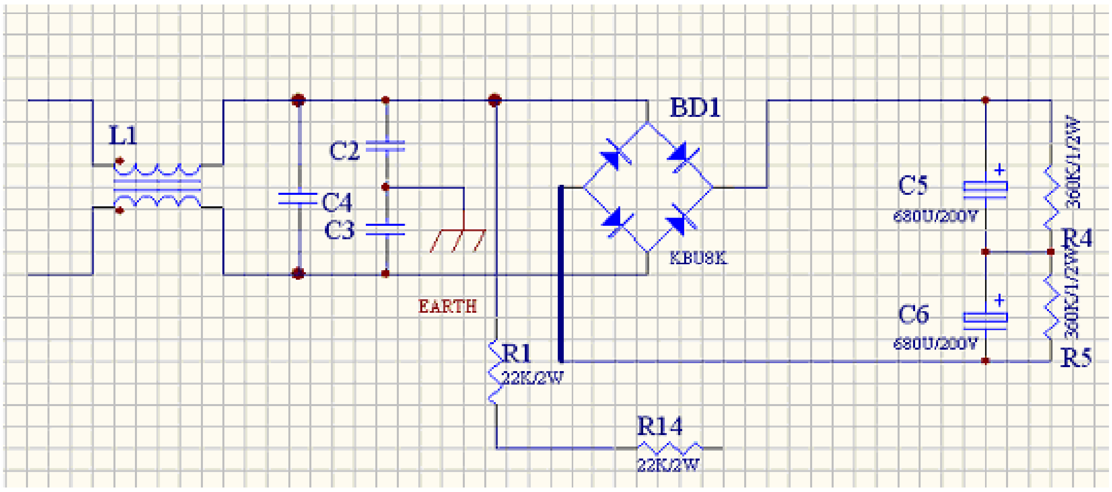


Figure 3-9

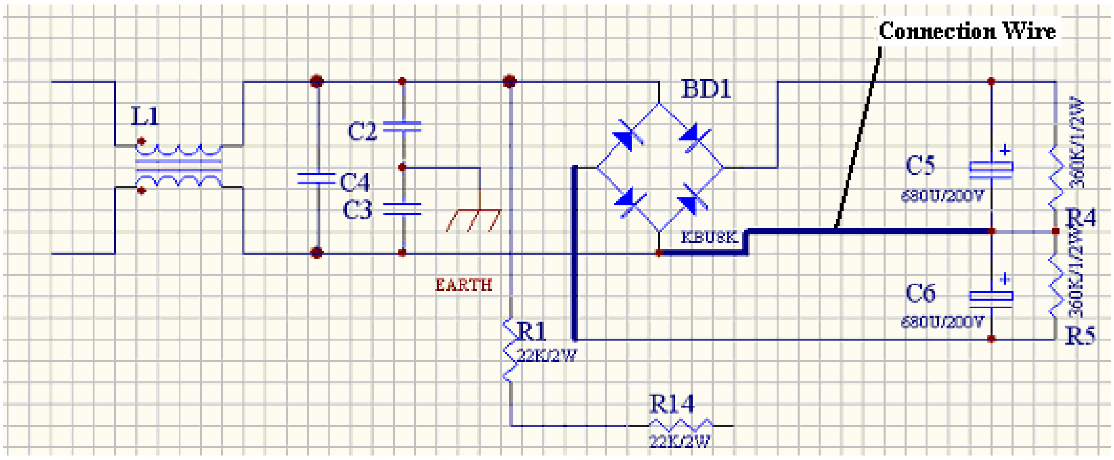


Figure 3-10

Do not confuse the type of the power supply board otherwise lead to the instrument damage or body hazard.

Chapter 4 Hydraulic System

4.1 Hydraulic System Block Diagram

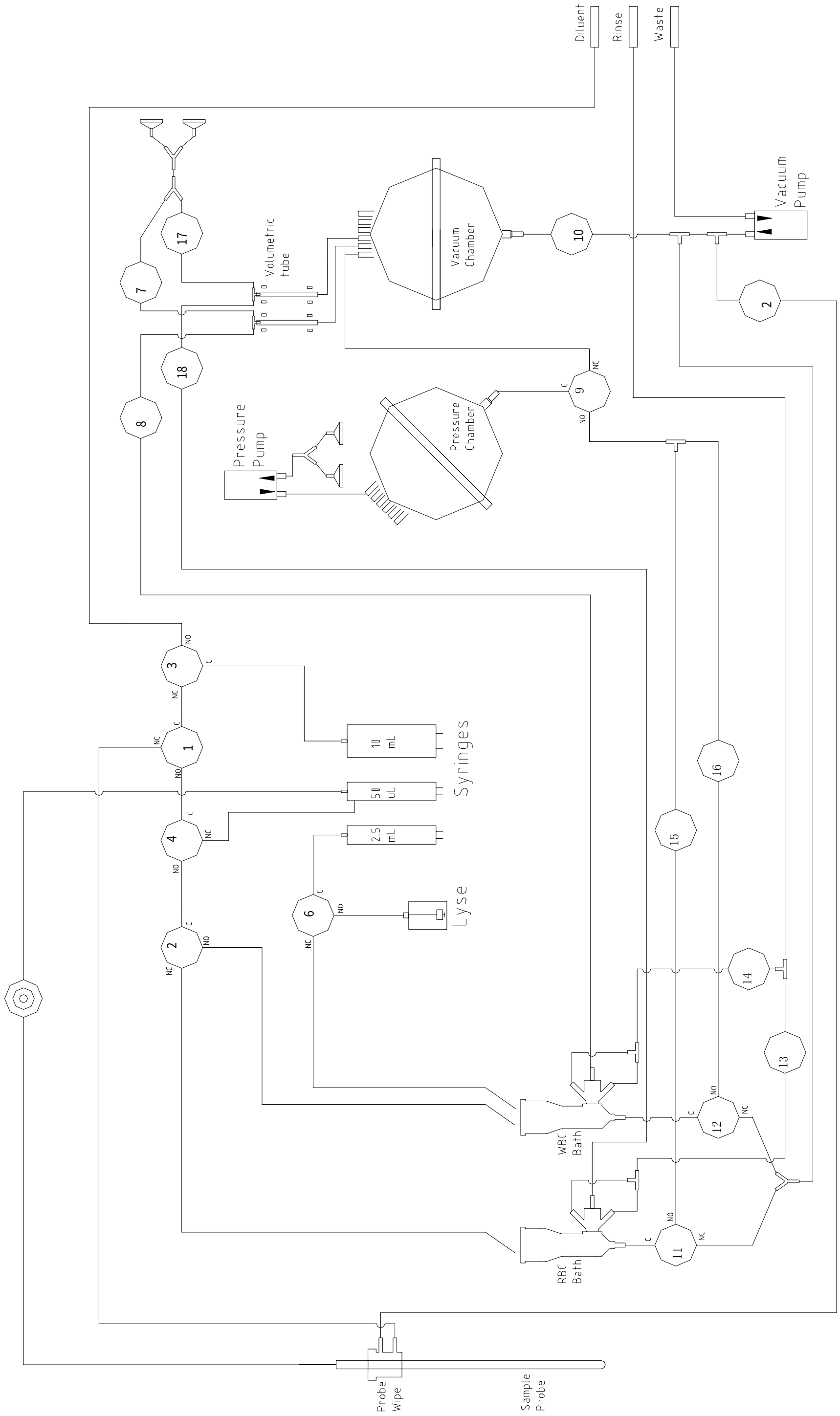


Figure 4-1 Hydraulic System Block Diagram

4.2 Units of Hydraulic System

- **Sensor Unit**

This part is made up of front bath, aperture, rear bath, electrodes and seal washer. This part is the most important for the whole instrument. Simply speaking this part is a sensor. Most measuring results are generated by this part.

- **HGB Unit**

This part is used to measure the hemoglobin concentration.

- **Dilute Unit**

This part consists of 4 step motors (rotatory motor, fluctuating motor and two syringe driving motors), 2 syringes (10ml and 50ul), wipe block and sample probe. It is used to aspirate and dilute the sample and clean the system.

- **Volumetric Unit**

This part implements the function of measuring the volume; we can calculate the concentration of blood cells with the number of pulses and the value of volume. This part is mainly made up of glass tubes and optical couplers.

- **Vacuum Unit**

Vacuum is the impetus to drive the counting process of hematology analyzer. It is made up of vacuum chamber, valves and vacuum pump.

- **Pressure Unit**

The pressure of this part is provided by pressure pump.
It has the function of mix-up dilution.

- **Auxiliary Unit**

This part mainly refers to the connecting tube, connectors and valves which are mainly used for connection

4.3 Whole Blood Count Cycle

In whole blood mode, press the “Start” key, the system transmits “Start Count” request to CPU, which will feedback the response signal.

1. The 50ul syringe aspirates 13ul of EDTA-K2 anticoagulant whole blood into the probe. The instrument reads HGB blank. The WBC bath rinses and drains. The 10ml syringe dispenses diluent into the WBC bath to prefill it.

2. The probe moves to the WBC bath and the 10ml and 50ul syringes dispense the sample (13ul) and diluent into the WBC bath, making a 1:269 dilution.

3. The 50ul syringe aspirates 15.6ul of the 1:269 dilution into the probe for the RBC/PLT dilution. The RBC bath rinses and drains. The 10ml syringe dispenses diluent into the RBC bath to prefill it.

4. The 2.5ml syringe sends 0.5ml lyse reagent to the WBC bath for a final 1:308 dilution, while the 10ml and 50ul syringes dispense 15.6ul of the 1:269 dilution and additional diluent into the RBC bath for a final RBC/PLT dilution of 1:44833.

5. Mixing bubbles enter the baths to mix the bath contents. The vacuum chamber drains.

6. Both dilutions (WBC and RBC/PLT) are drawn through the apertures via regulated vacuum.

7. The instrument counts 500ul dilution for WBCs and counts 300ul dilution for RBCs and PLTs. After counting finishes, the flow ends.

8. The system takes an HGB sample reading.

9. The system analyzes the data while the WBC and RBC baths drains and rinses.

10. The system zaps the apertures and the probe moves to the aspirating position. The system displays results on the screen.

11. The system is ready for the next sample.

4.4 Flow Charts of Main Procedures

4.4.1 Power on

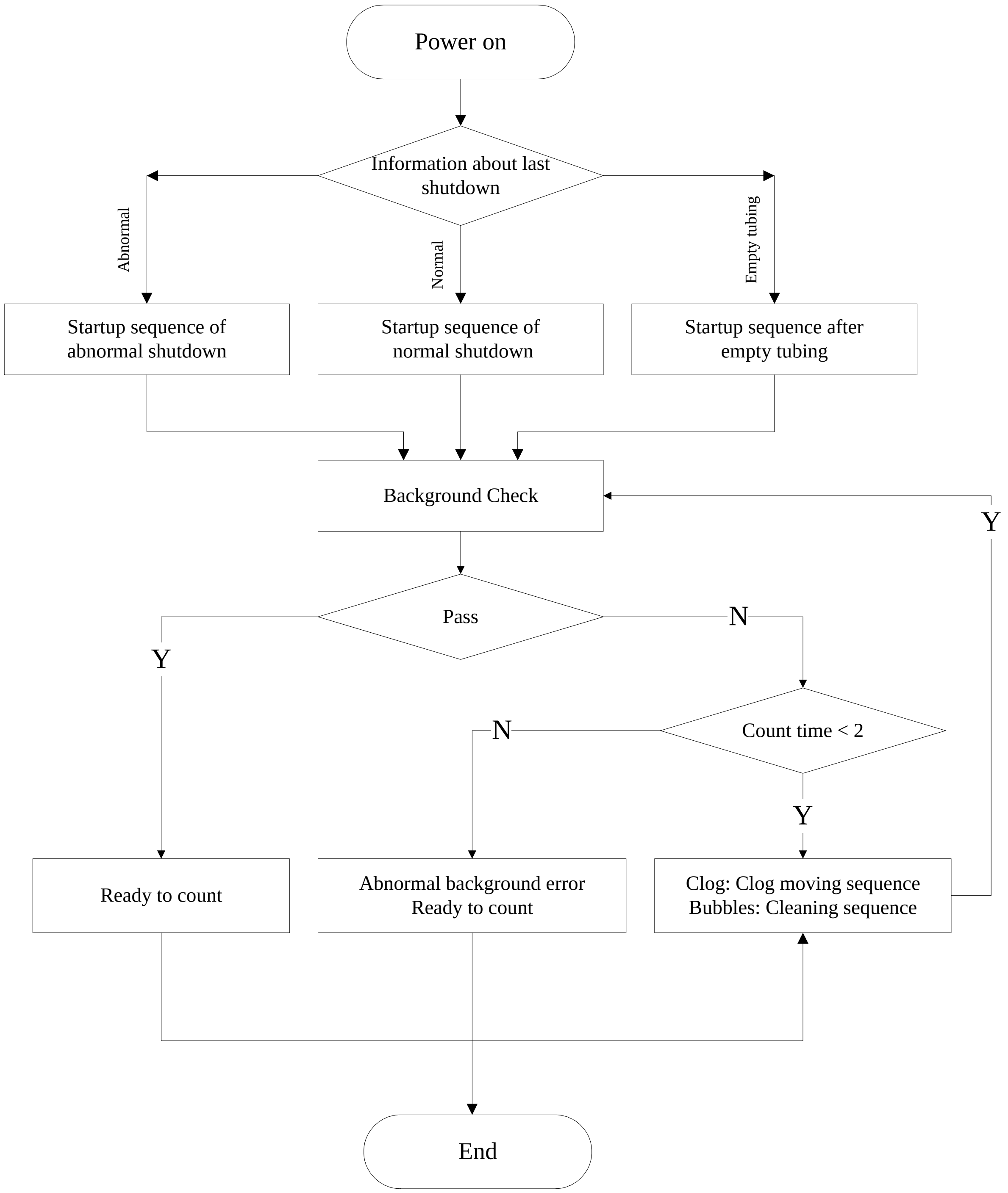


Figure 4-2 Power On

4.4.2 Whole Blood Count

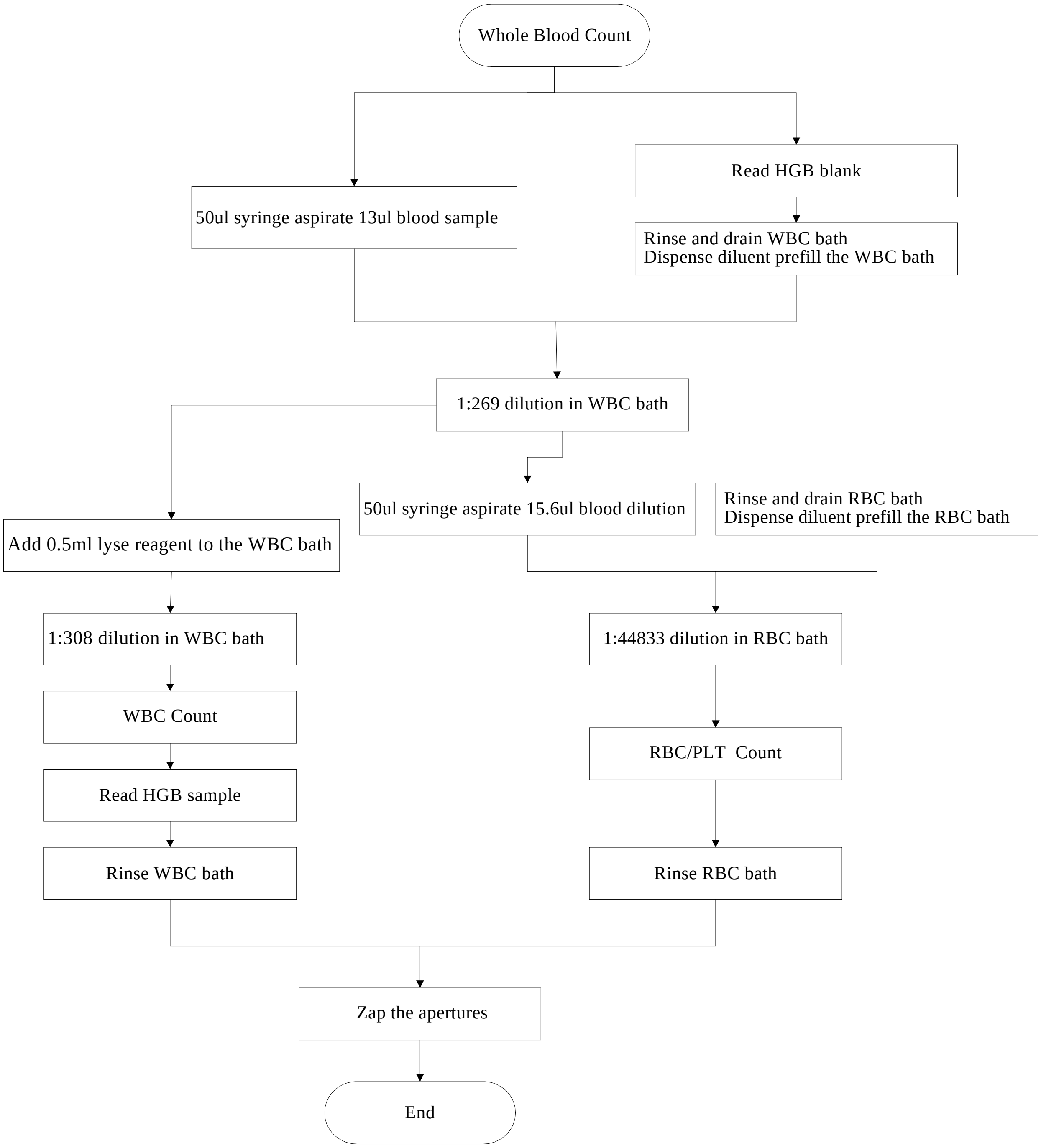


Figure 4-3 Whole Blood Count

4.4.3 Prediluted Count

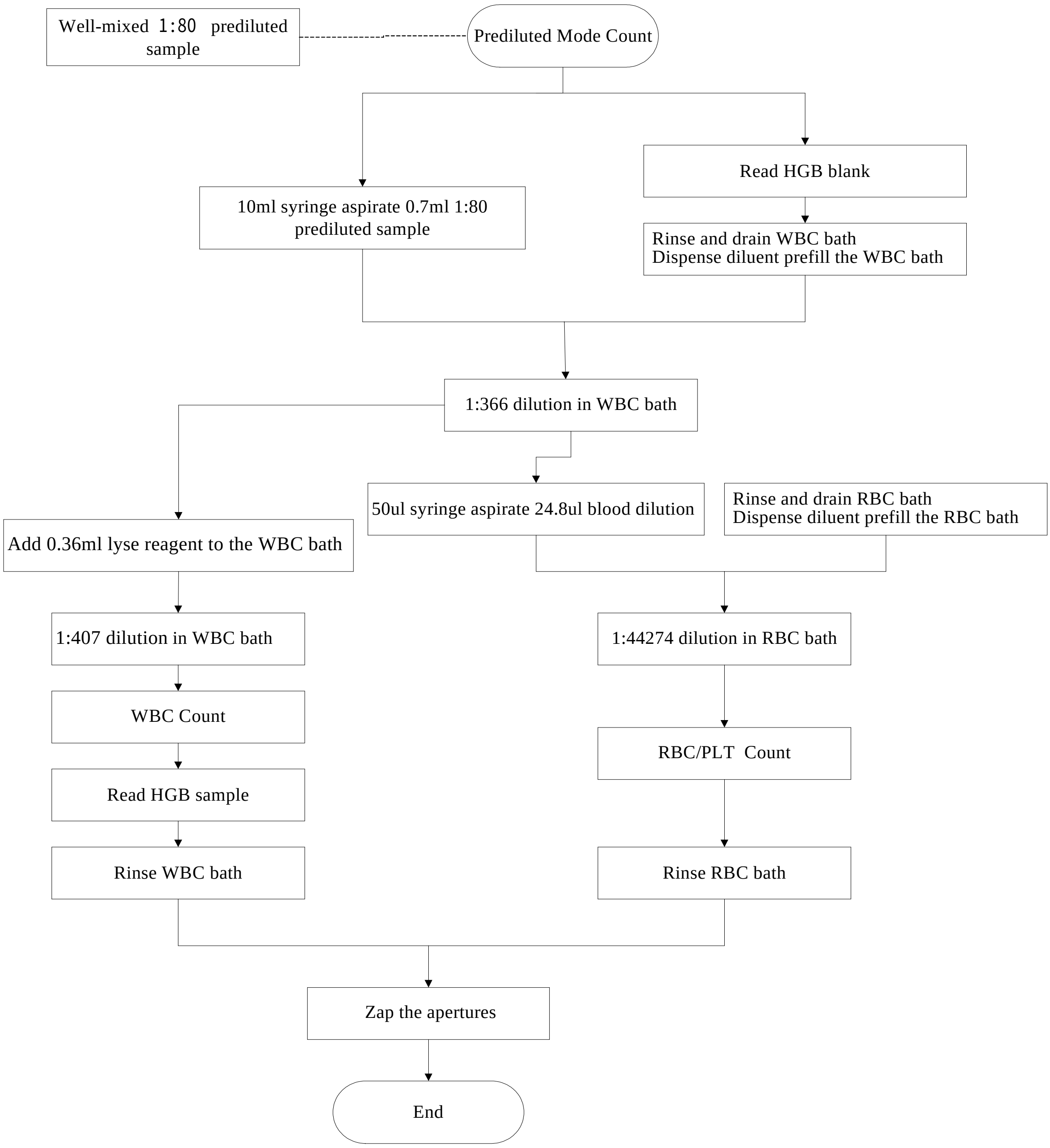


Figure 4-4 Prediluted Count

4.4.4 Startup

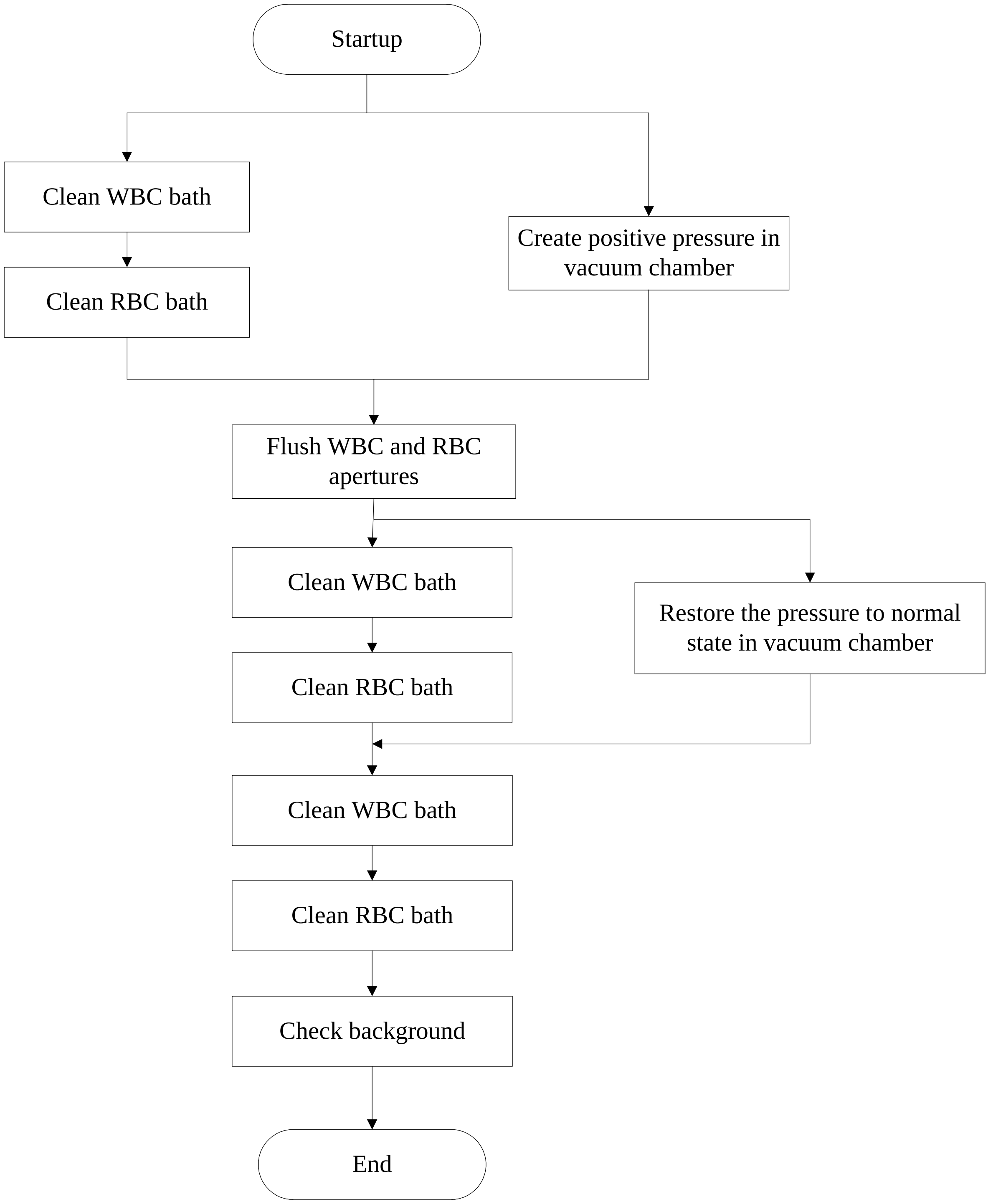


Figure 4-5 Startup

4.4.5 Flush Apertures

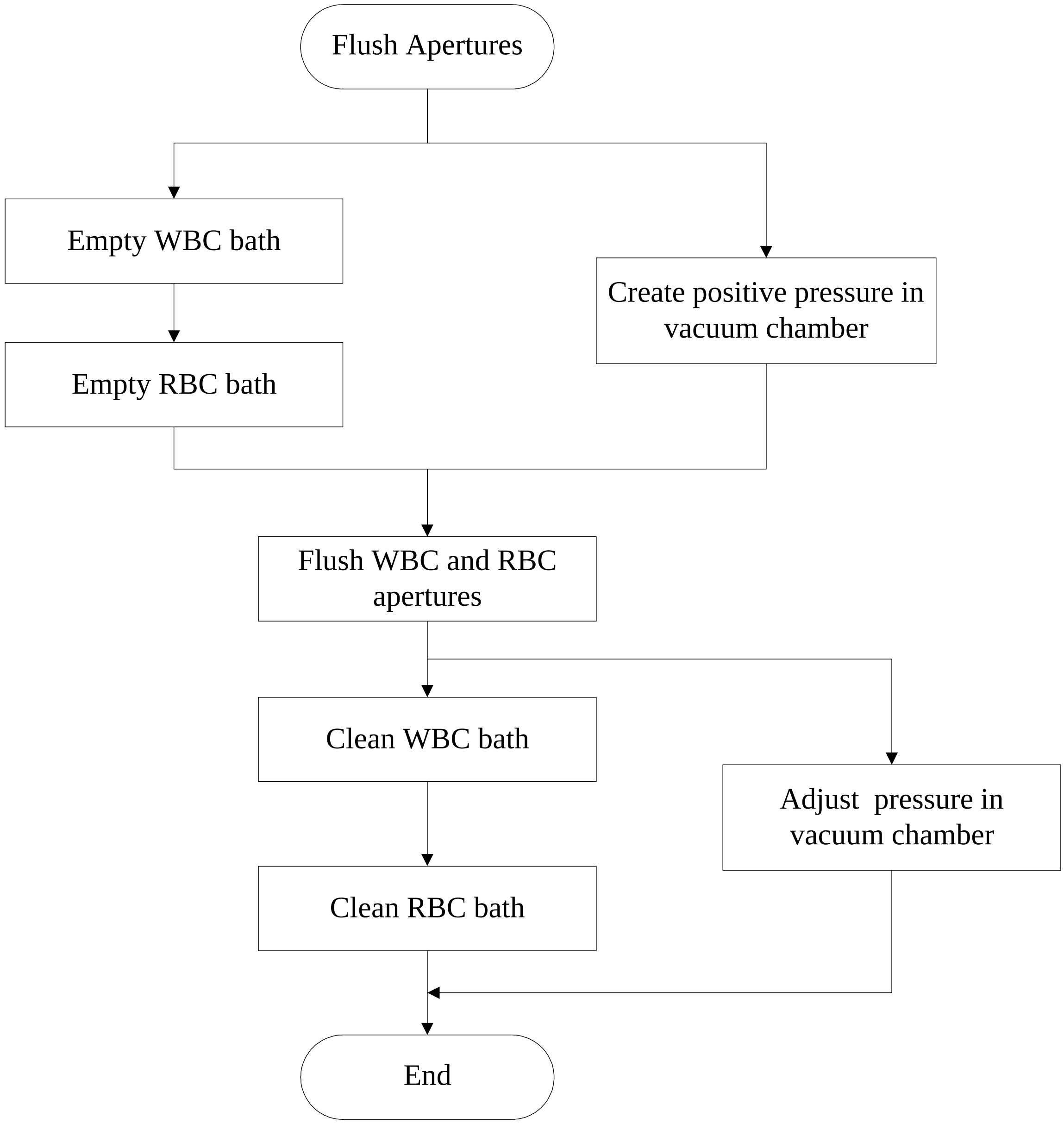


Figure 4-6 Flush Aperture

4.4.6 Dispense Diluent

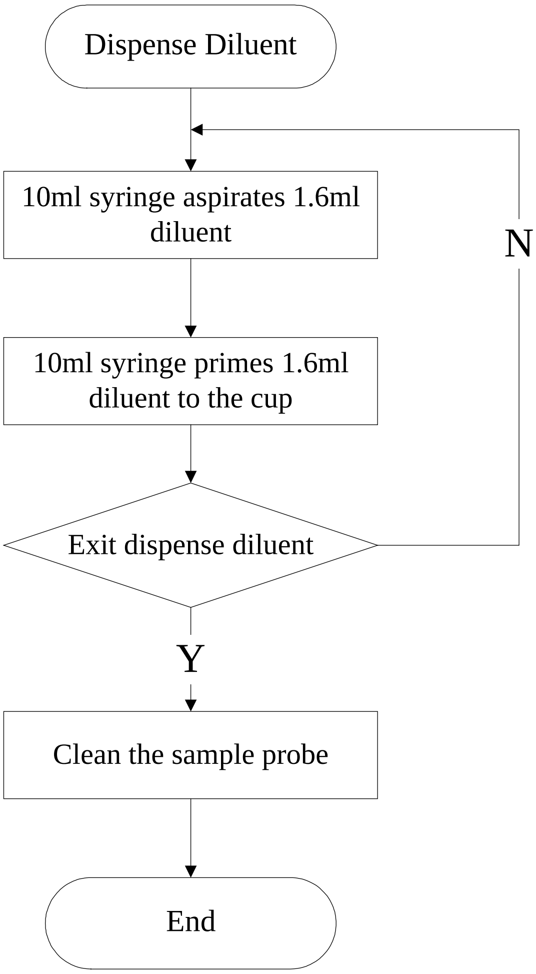


Figure 4-7 Dispense Diluent

4.4.7 Shut Down

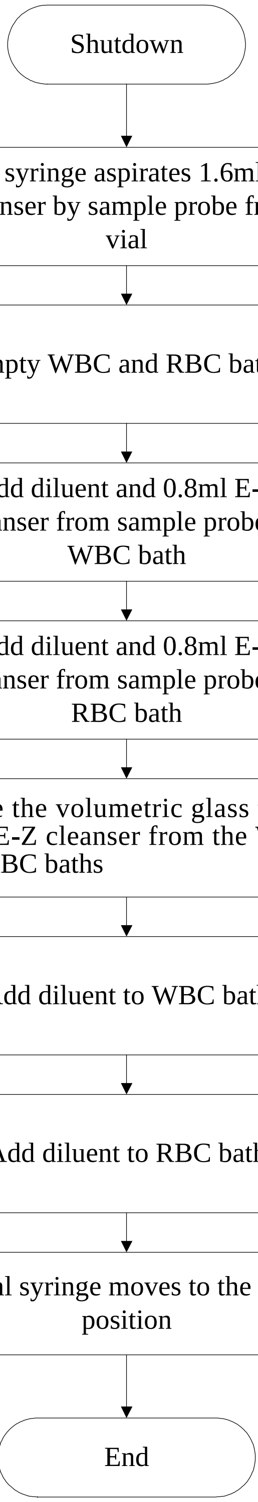


Figure 4-8 Shut Down

4.5 Hydraulic System Flow Diagram

4.5.1 Inspire Sample and Diluent (Whole Blood Mode)

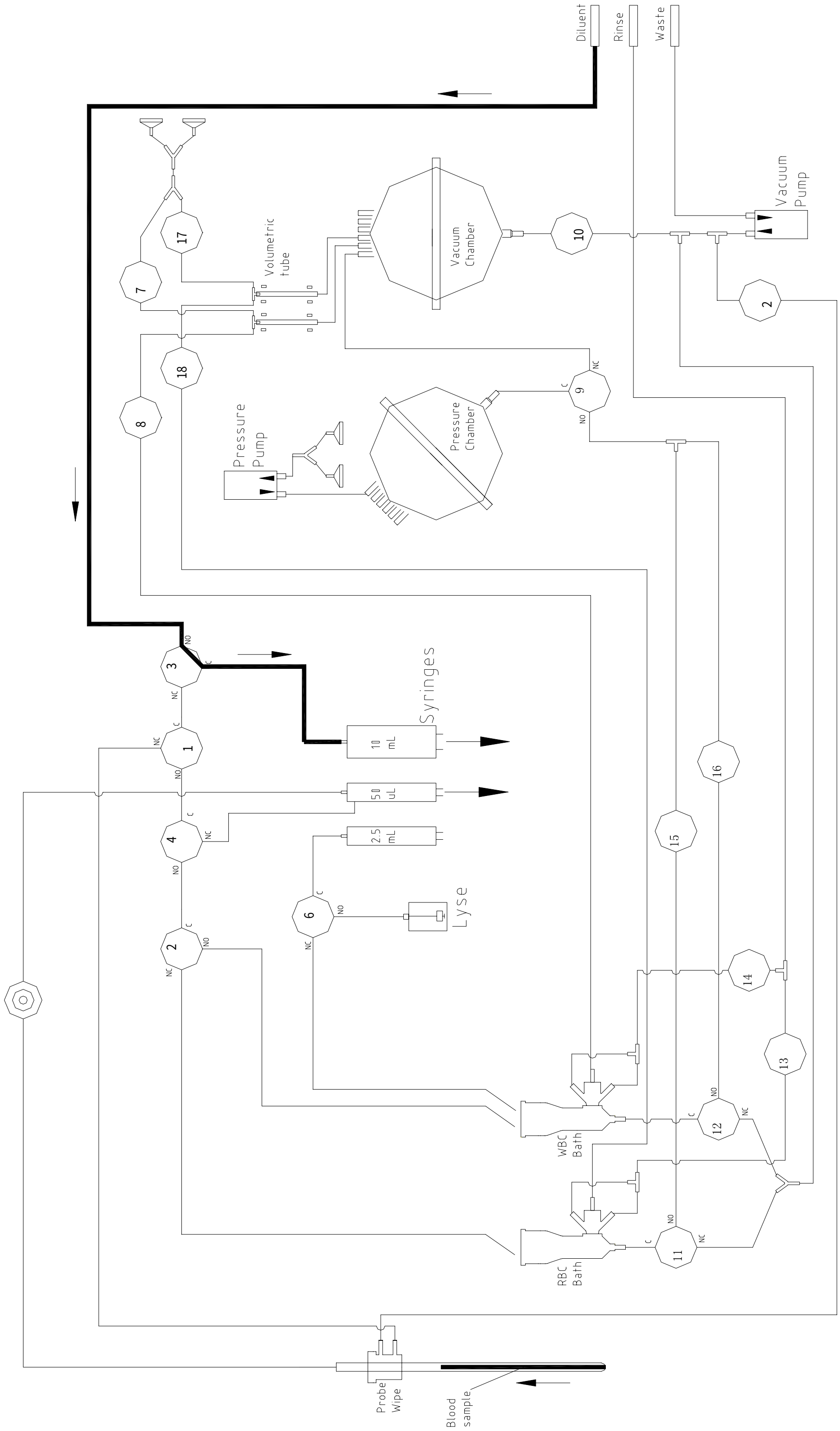


Figure 4-9 Inspire Sample and Diluent (Whole Blood Mode)

4.5.2 Inspire Sample and Diluent (Prediluted Mode)

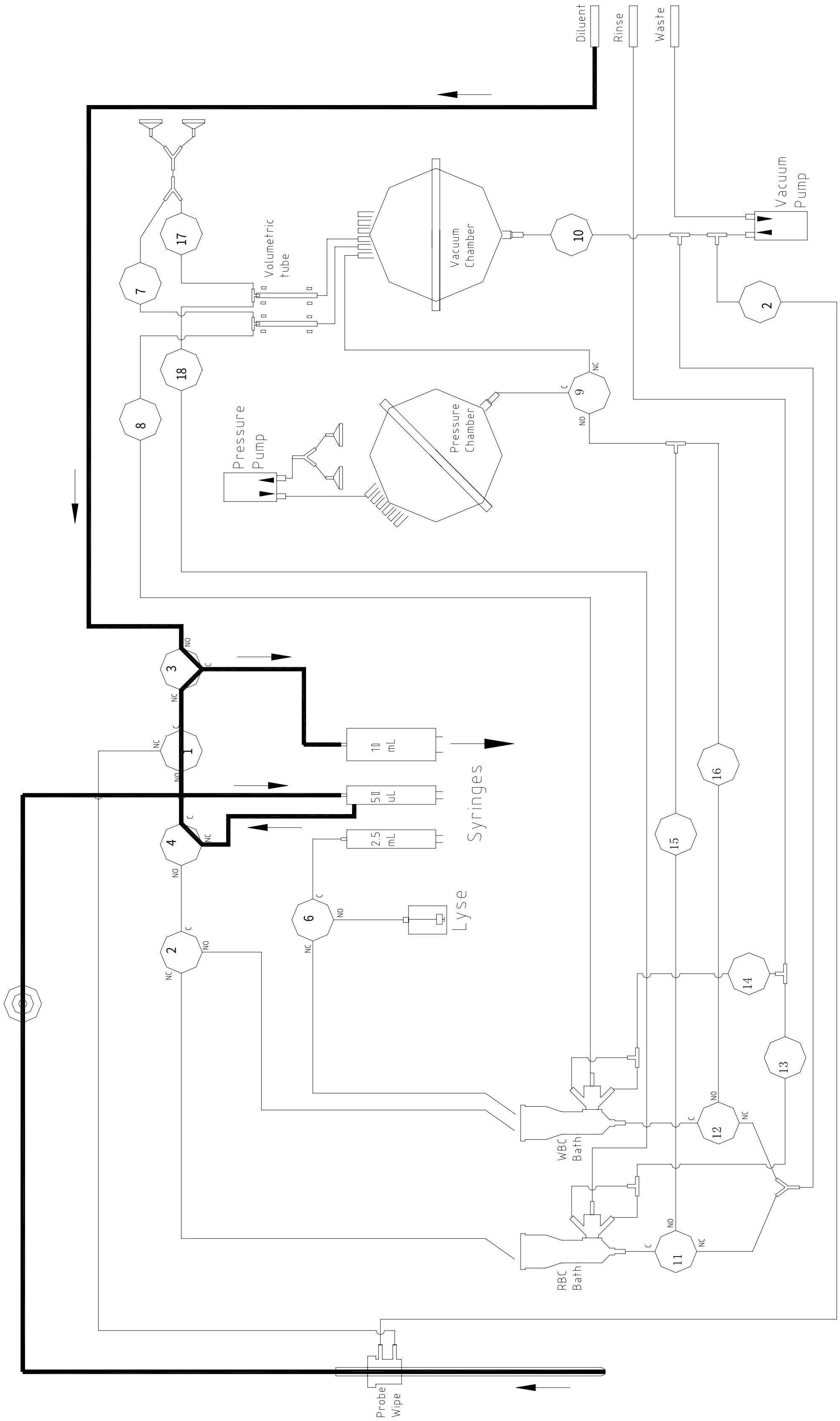


Figure 4-10 Inspire Sample and Diluent (Prediluted Mode)

4.5.3 WBC Injection & Lyse Preparation

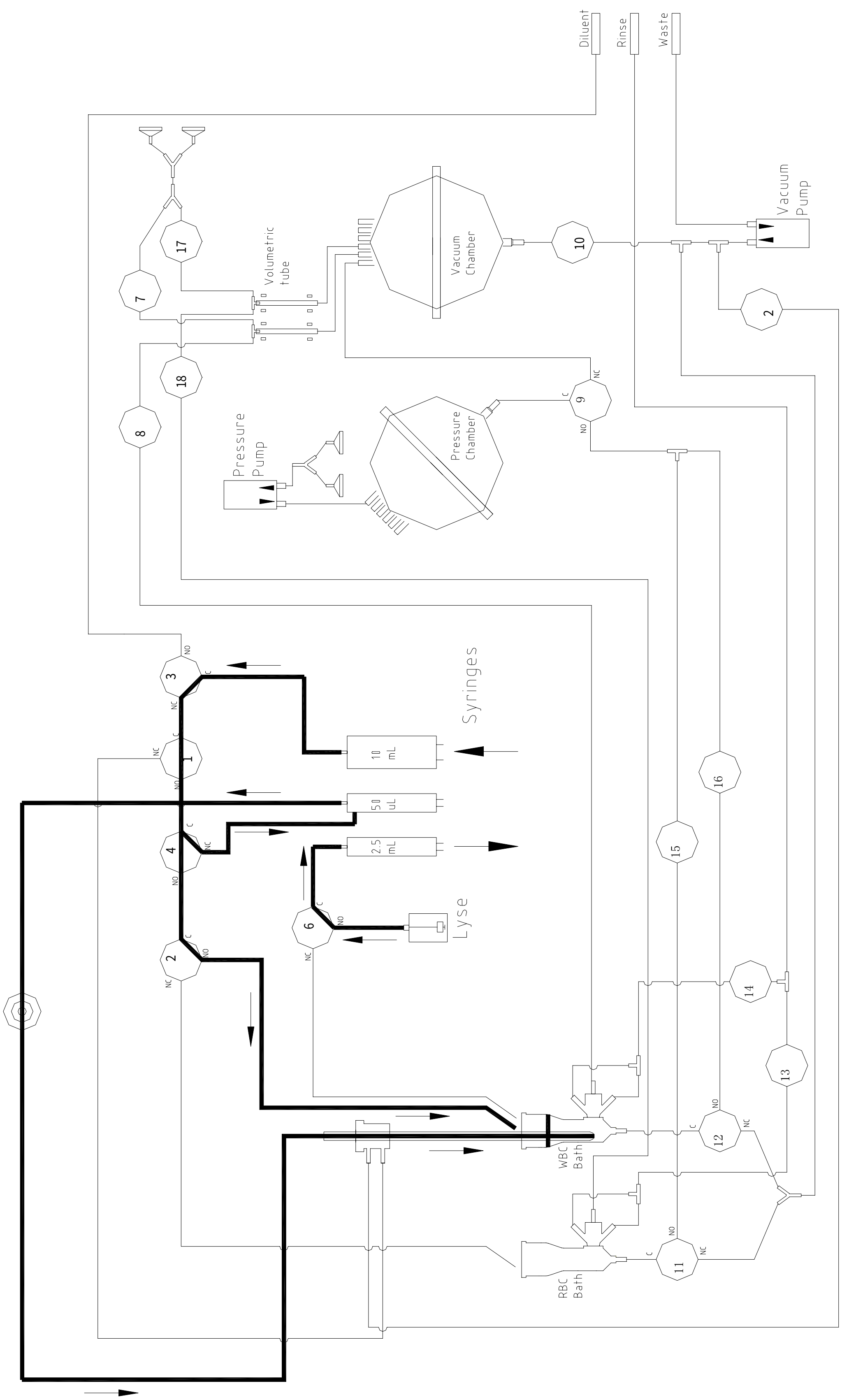


Figure 4-11 WBC Injection & Lyse Preparation

4.5.4 RBC & Lyse Injection

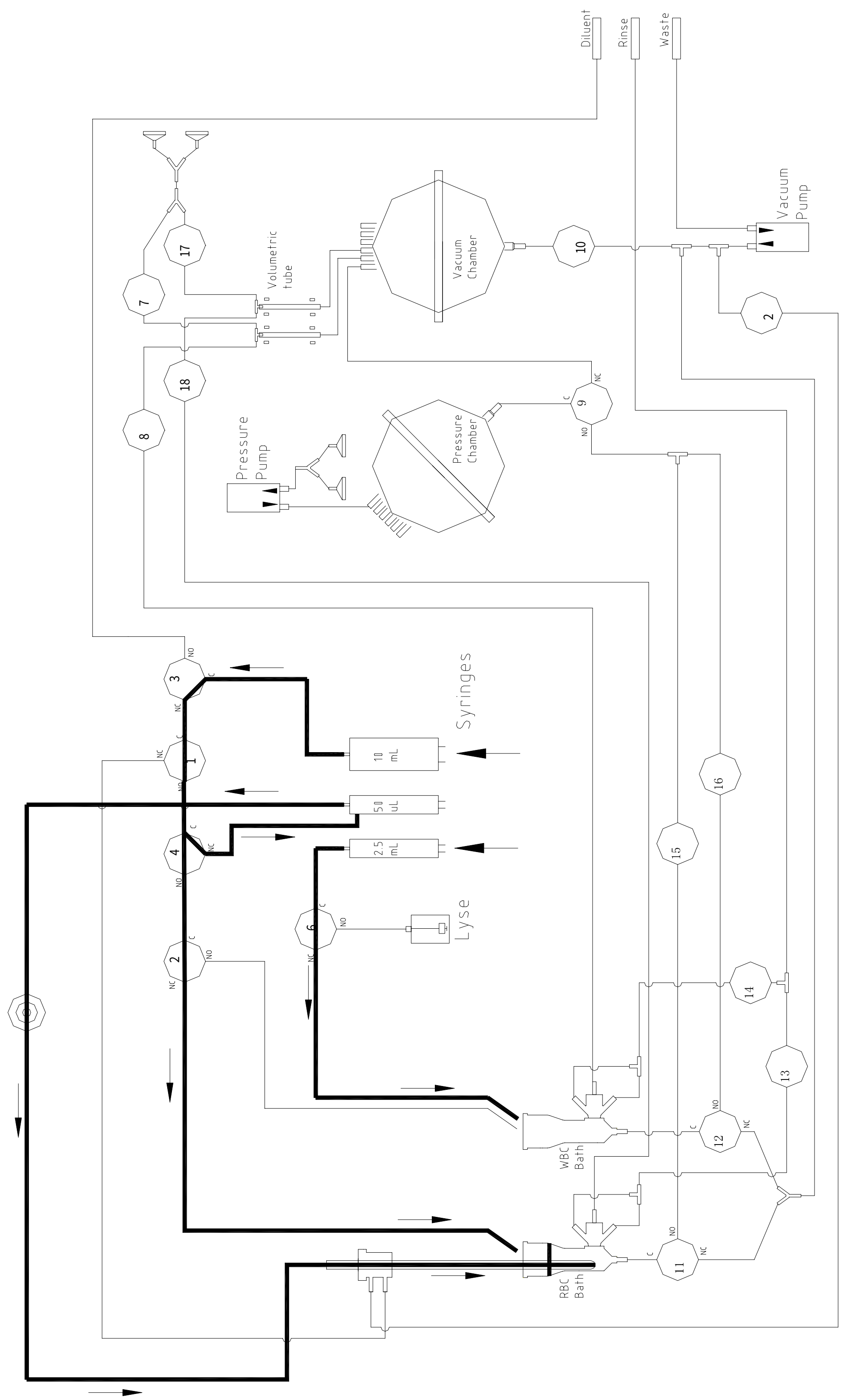


Figure 4-12 RBC & Lyse Injection

4.5.5 Mixture

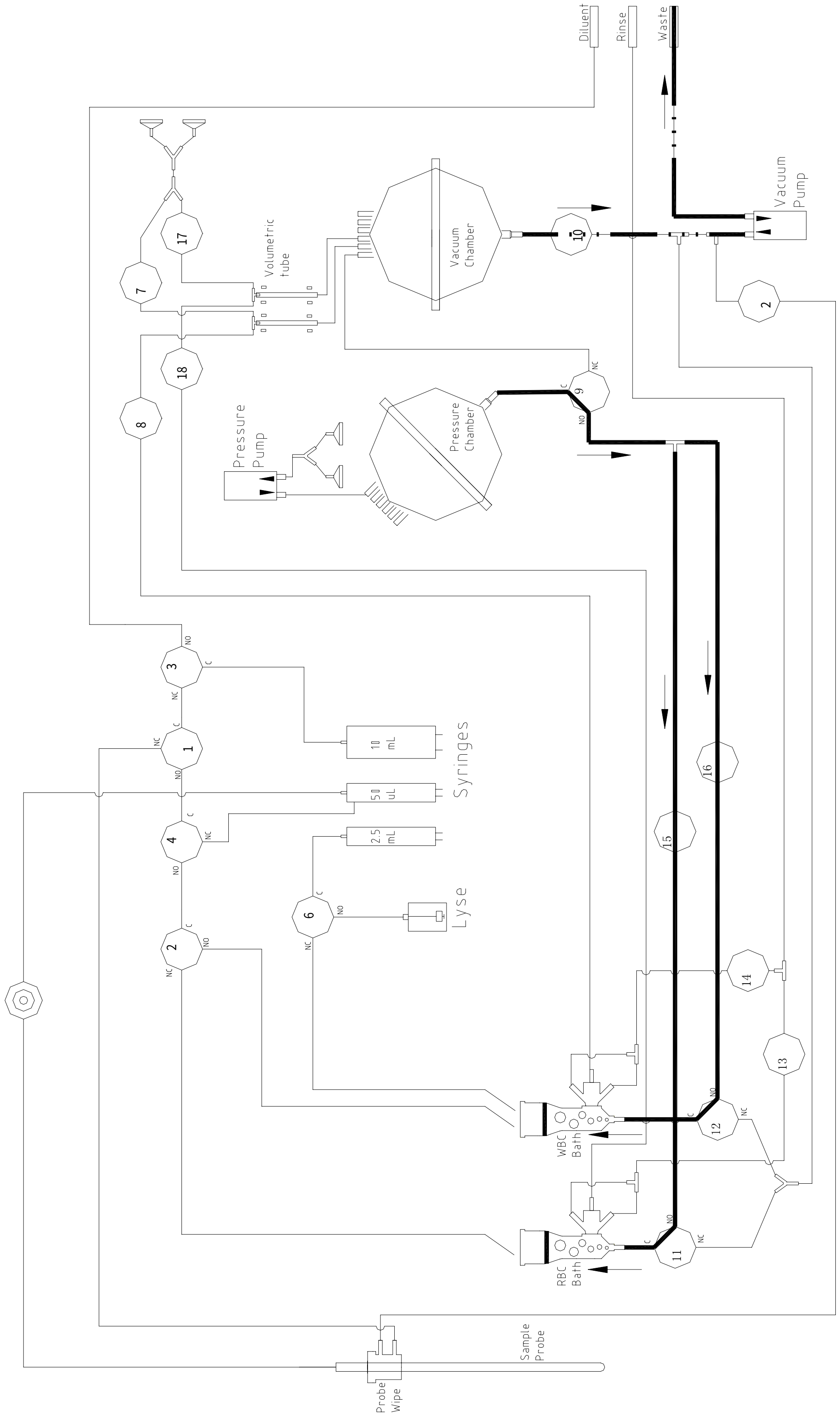


Figure 4-13 Mixture

4.5.6 Count Cycle

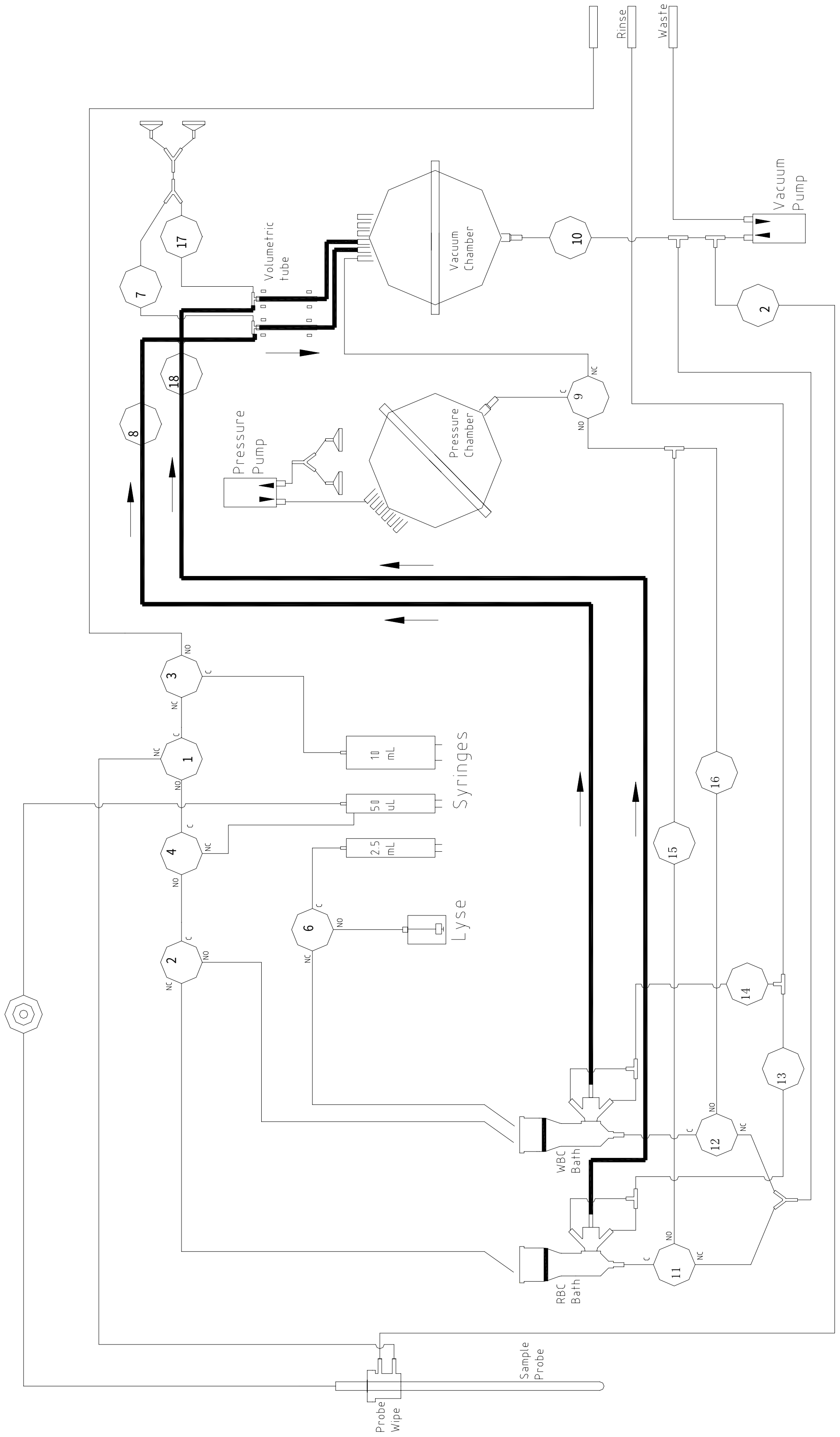


Figure 4-14 Count Cycle

4.5.7 Cleaning

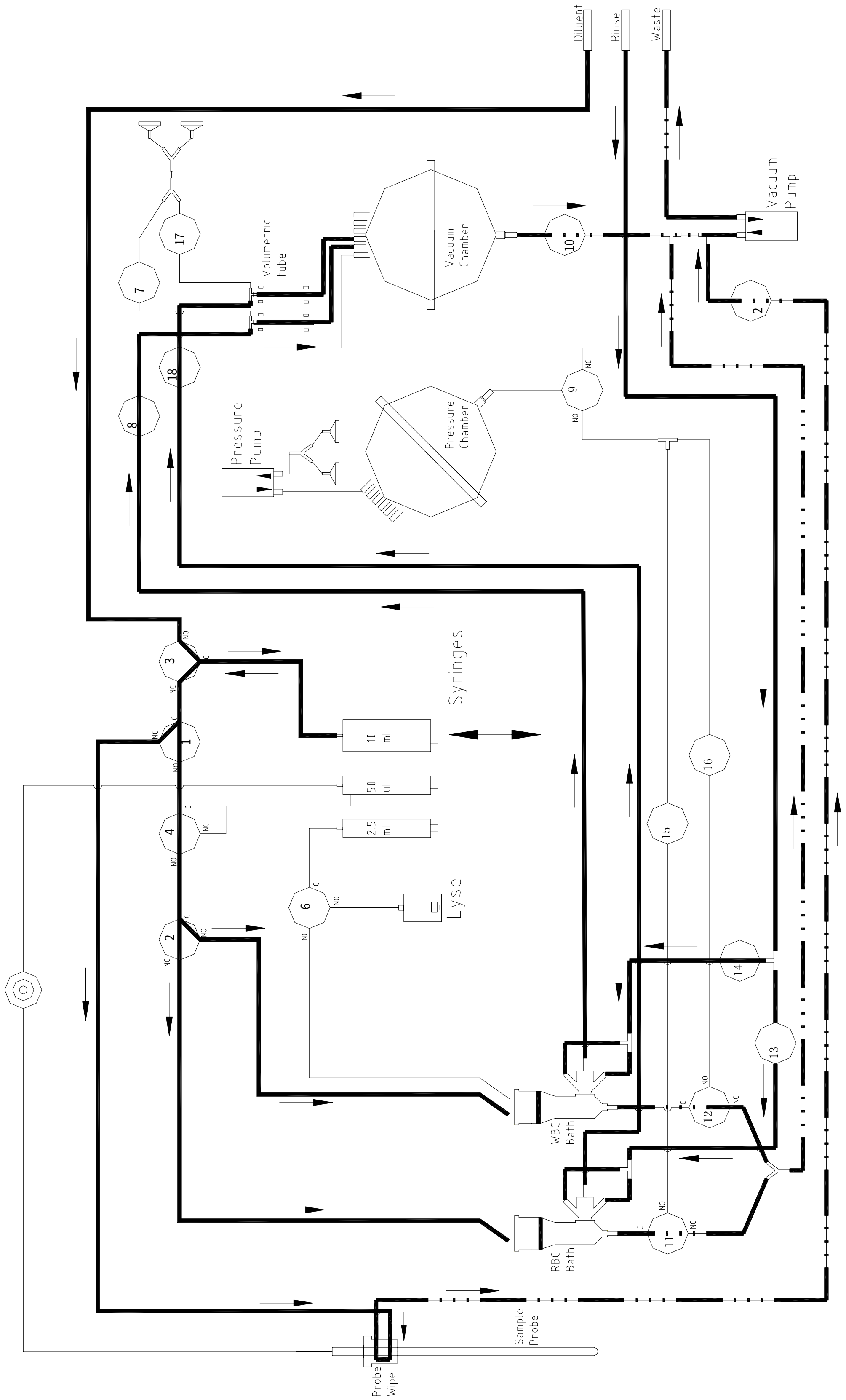


Figure 4-15 Cleaning

4.5.8 Flush

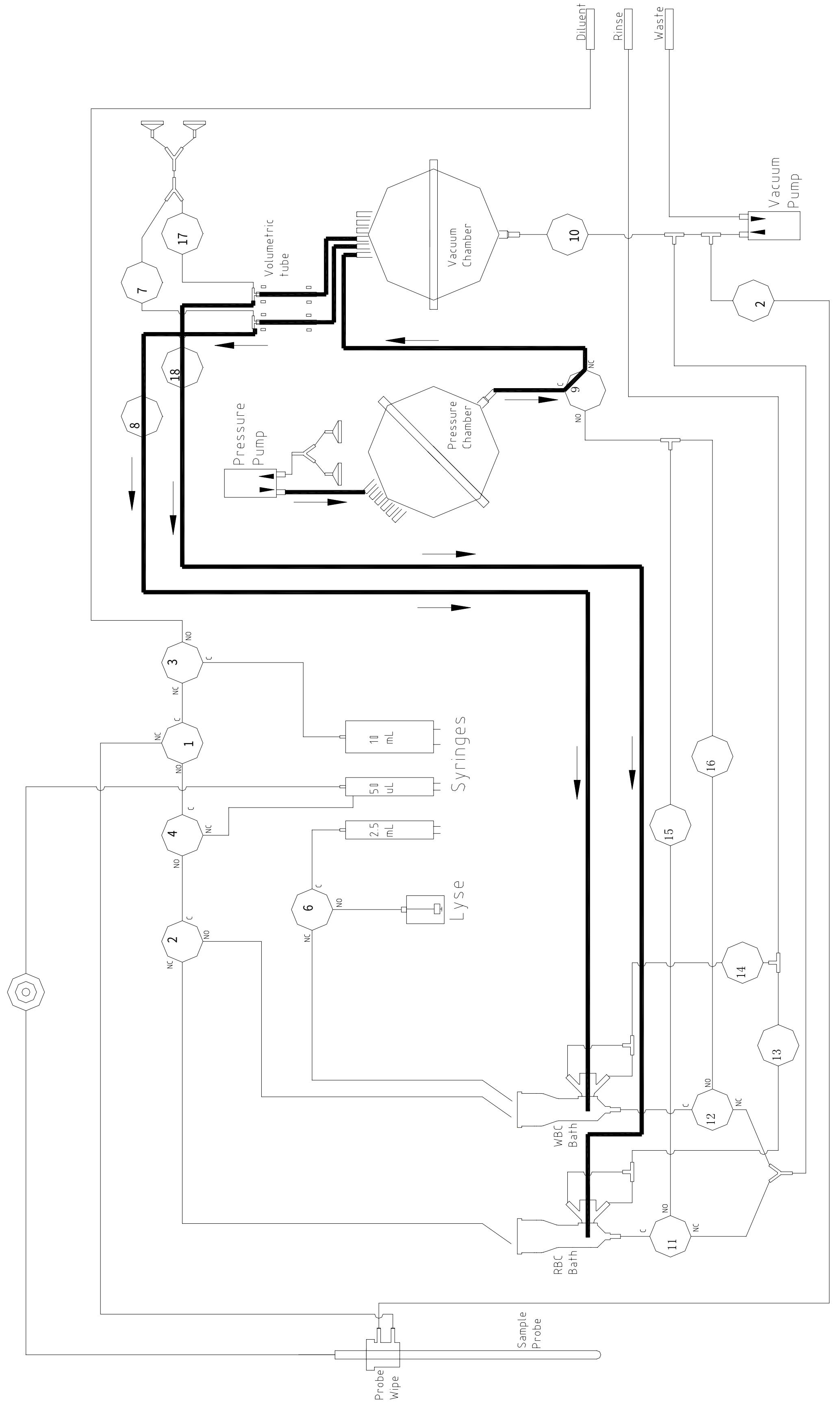


Figure 4-16 Flush

4.5.9 Empty Tube

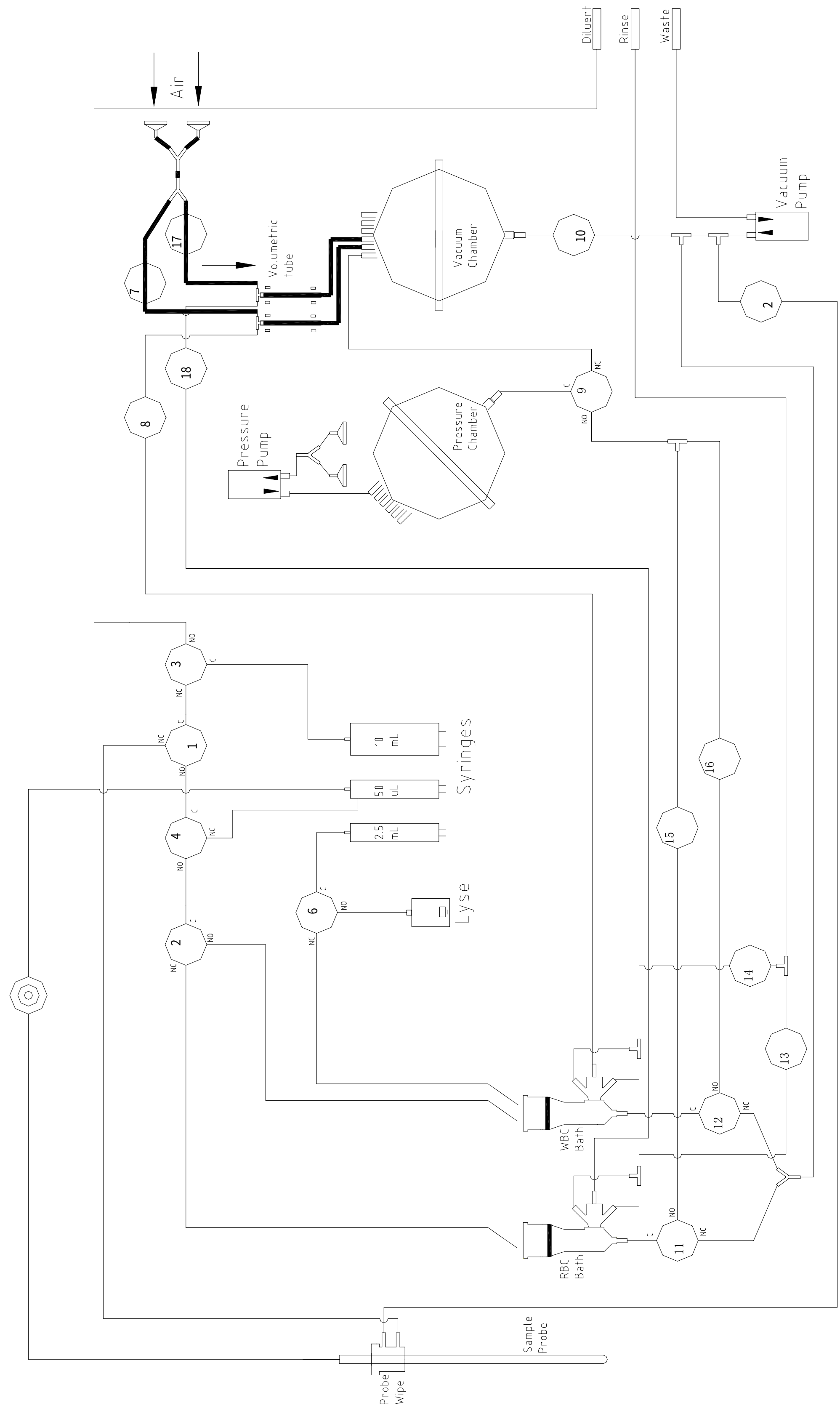


Figure 4-17 Empty Tube

Chapter 5 System Structure

5.1 Disassemble/Replace Parts and Components

5.1.1 Disassemble Syringe and Replace Piston

⚠ **WARNING**⚠

Potential biohazard

It is unnecessary to remove the syringe assembly from the instrument.

Push the switch as shown in figure 5-1 and open the right side door of the machine.

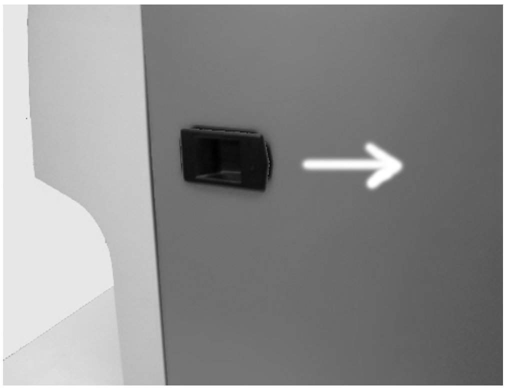


Figure 5-1

Figures 5-2 through 5-8 show how to remove the 10ml syringe and replace the piston.

1. Take out the screw on the baffle.

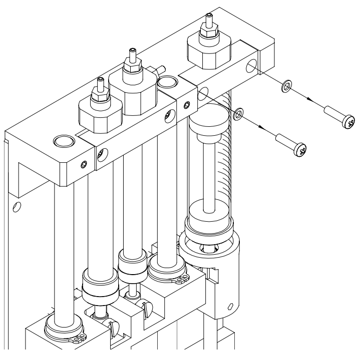


Figure 5-2

2. Remove the baffle.

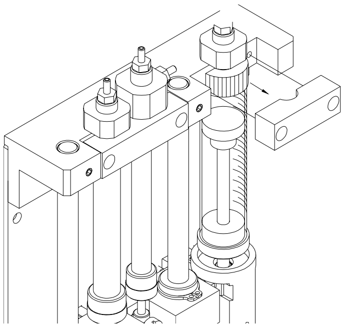


Figure 5-3

3. Take out the fixing screw between the 10ml motor lever and white metal connector.

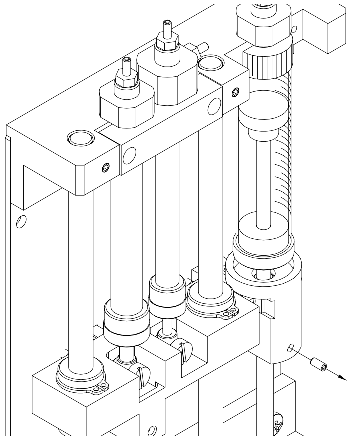


Figure 5-4

4. Rotate the step motor lever out from the metal connector.

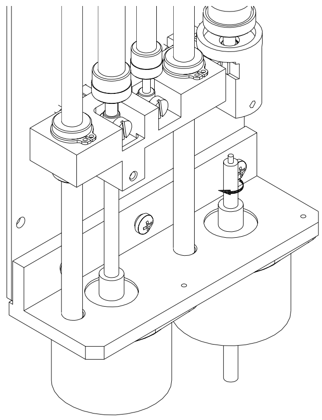


Figure 5-5

5. Remove the syringe and metal connector.

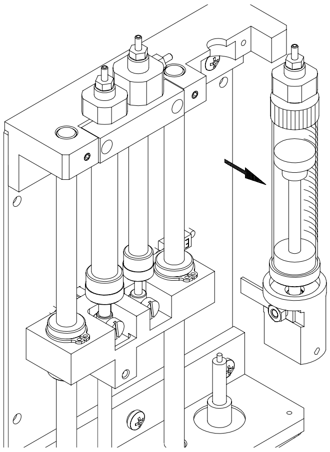


Figure 5-6

6. Remove the bottom of the syringe.

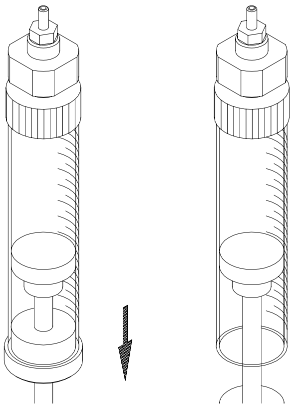


Figure 5-7

7. Replace the piston.

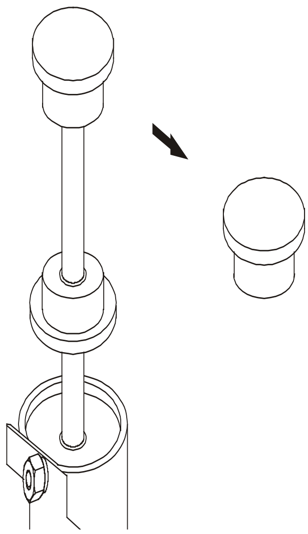


Figure 5-8

Install the syringe by following the above steps in reserve order.

(If to replace the syringe, you need to rotate the original syringe out from the metal connector.)

Figures 5-9 through 5-13 show how to remove the 2.5ml syringe and replace the piston.

1. Take out the screw on the baffle.

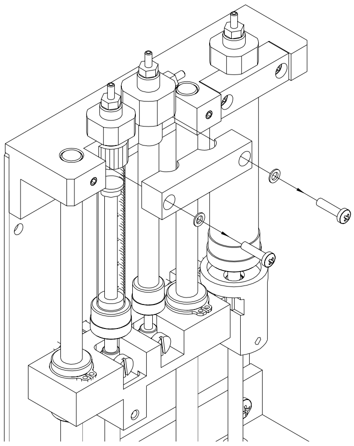


Figure 5-9

2. Then take out the fixing screw.

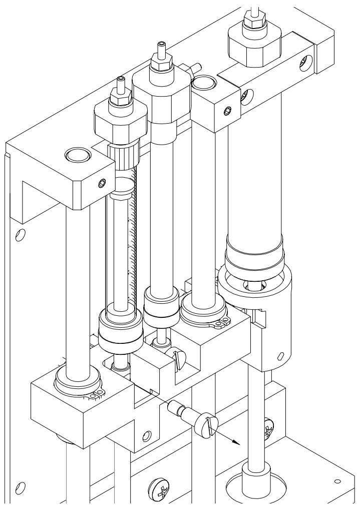


Figure 5-10

3. Remove the syringe.

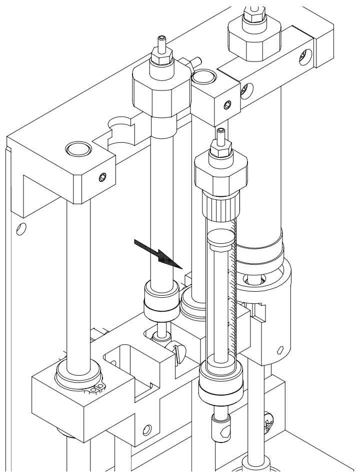


Figure 5-11

4. Remove the bottom of the syringe.

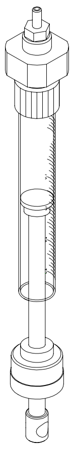


Figure 5-12

5. Replace the piston.

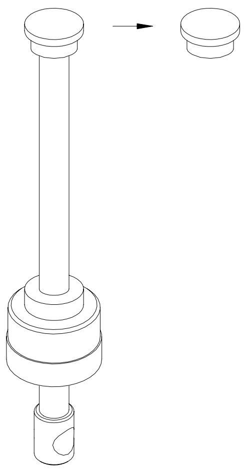


Figure 5-13

Install the syringe by following the above steps in reserve order.

Replace the piston of 50ul syringe in the same way as that for replacing the piston of 2.5ml syringe.

5.1.2 Replace Sample Probe

1. Push the switch and open the right side door of the machine.

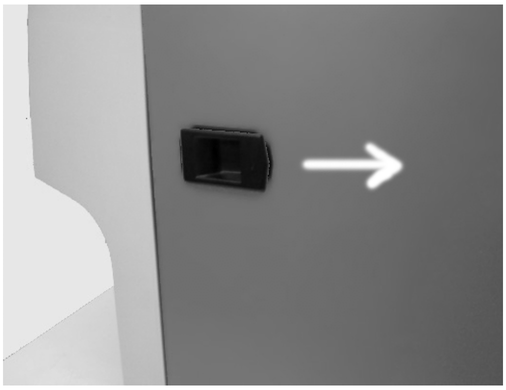


Figure 5-14

2. Lift up the switch and open the front panel.

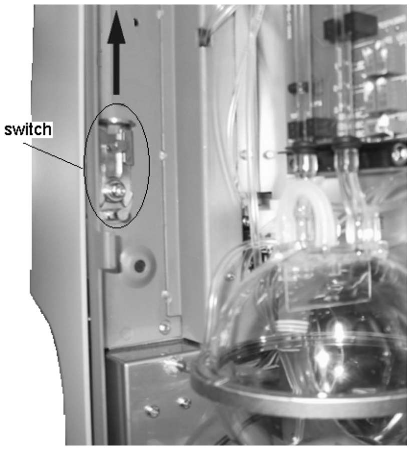


Figure 5-15

3. Figure 5-16 shows the machine with the front panel opened.

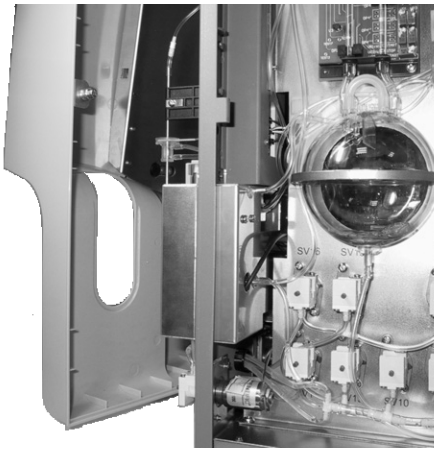


Figure 5-16

4. In “Setup/Password” screen, enter the password “3000”.

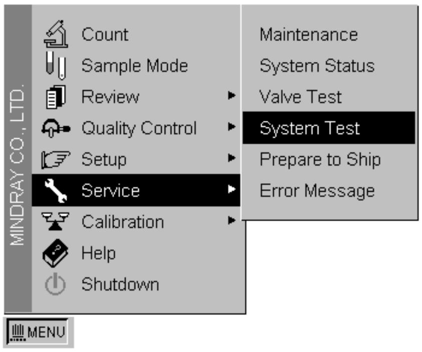


Figure 5-17

In menu operation, move the cursor to “Service/System Test” item and press [ENTER] to access the System Test screen.

Press [↑] [↓] [←] [→] to move the cursor to “Fluctuating Motor”.

Press [ENTER] to pop up the dialog box.

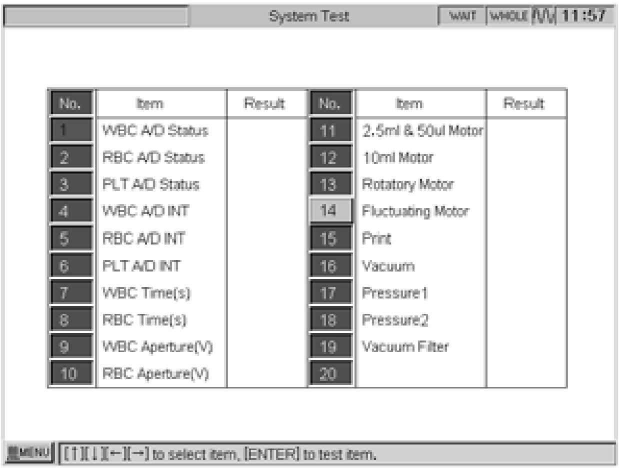


Figure 5-18

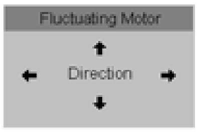


Figure 5-19

5. Press [↑] to move the sample probe to the upper position.

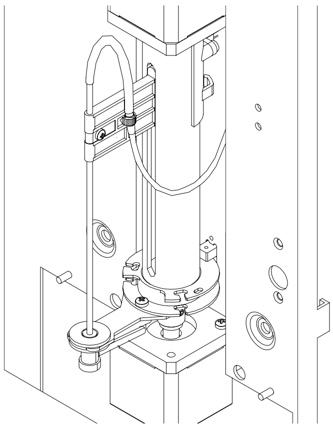


Figure 5-20

6. Loosen the nut of the fixing screw of fixing the sample probe.

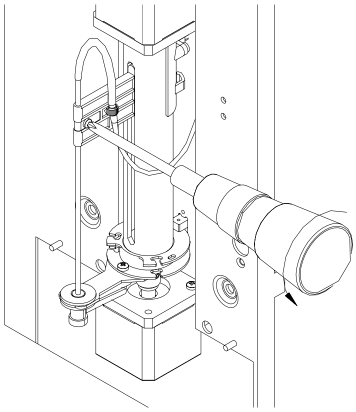


Figure 5-21

7. Pull off the tubing connected to the top end of the sample probe. Pull the sample probe out. Replace the sample probe.

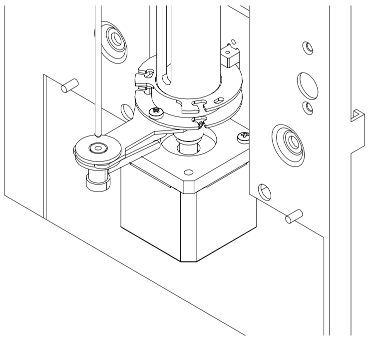


Figure 5-22

8. When installing the sample probe, first connect the tubing and install the sample probe as 5-23. Insert the localizer of the sampler probe from the bottom end of the sample probe wipe block. Hold the localizer to make it cling closely to the sample probe wipe block until the bottom end of the sample probe contacts the localizer.

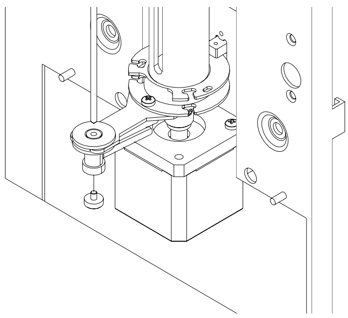


Figure 5-23

9. Fasten the fixing screw of the sample probe.

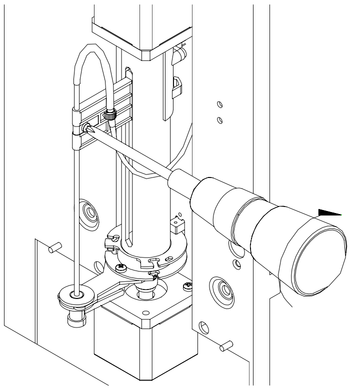


Figure 5-24

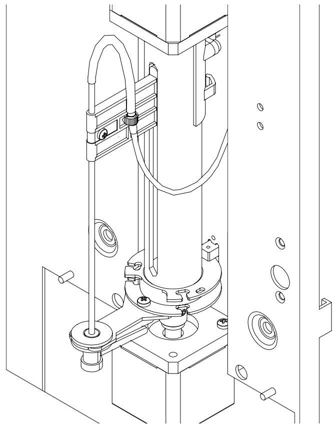
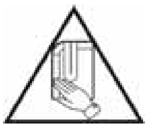


Figure 5-25

10. Press [ENTER] to close dialog and sample probe returns to ready position.

5.1.3 Replace Sample Probe Wipe Block



Avoid directly contacting with the patient blood samples.

1. Push the switch and open the right side door of the machine.

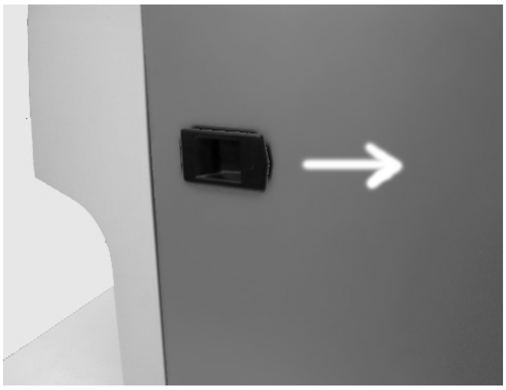


Figure 5-26

2. Lift up the switch and open the front panel.

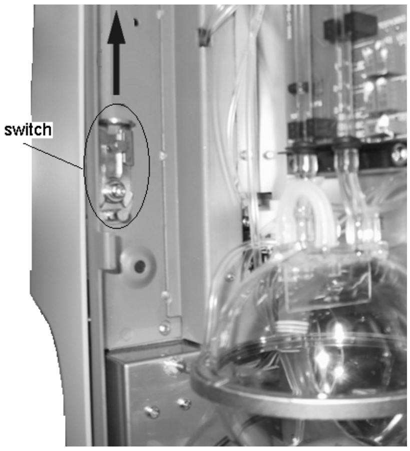


Figure 5-27

3. Figure 5-28 shows the machine with the front panel opened.

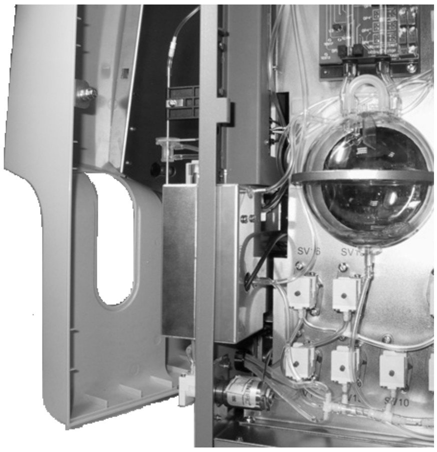


Figure 5-28

4. In “Setup/Password” screen, enter the password “3000”.

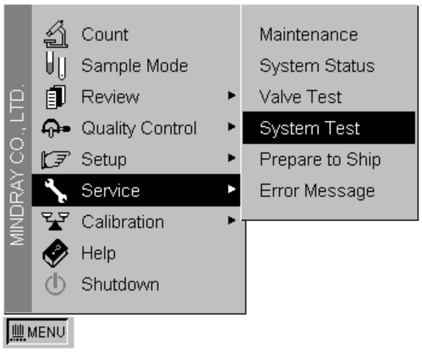


Figure 5-29

In menu operation, move the cursor to “Service/System Test” item and press [ENTER] to access the System Test screen.

Press [↑] [↓] [←] [→] to move the cursor to “Fluctuating Motor”.

Press [ENTER] key to pop up the dialog box.

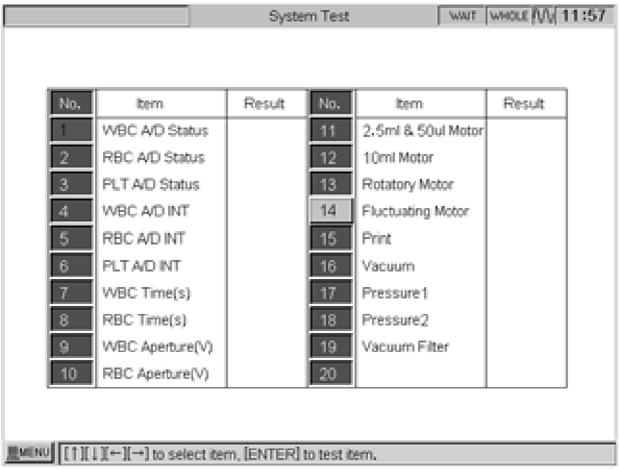


Figure 5-30

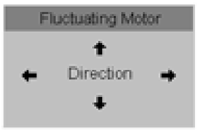


Figure 5-31

5. Press [↑] to move the sample probe to the upper position.

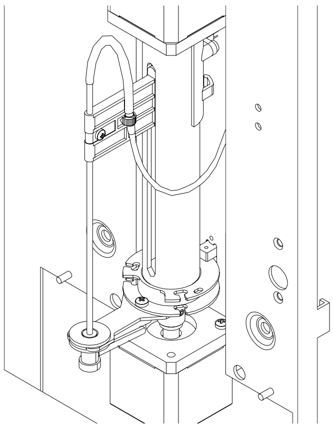


Figure 5-32

6. Loosen the nut of the fixing screw of fixing the sample probe.

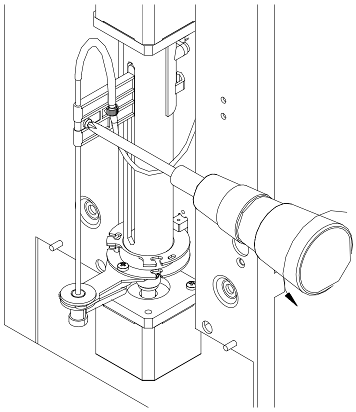


Figure 5-33

7. Pull up the sample probe until it leaves the sample probe wipe block (see figure 5-34).

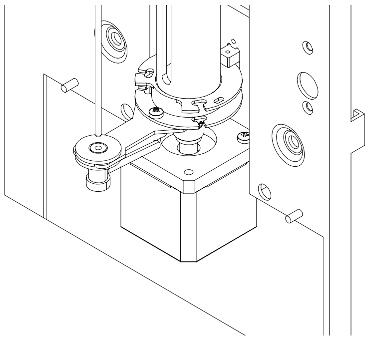


Figure 5-34

8. Then pull off the two inlet tubing of the sample probe wipe block, take out the sample probe wipe block and replace it with a new one (see figure 5-35).

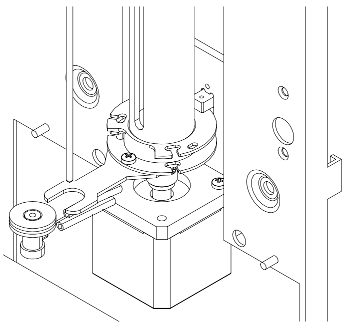


Figure 5-35

9. When replacing the sample probe wipe block, insert the two inlet tubing and clip the sample probe wipe block into the hold plate. Pay attention to the corresponding relationship between the tubing and the tubing connector. Connect the tubing with flag to the tubing connector at the bottom of the probe wipe block. Install the probe wipe block to the original position.

Connect the inlet tubing with mark to the lower end.

10. Insert the sample probe into the sample probe wipe block. Insert the localizer of the sampler probe from the bottom end of the sample probe wipe block. Hold the localizer to make it cling closely to the sample probe wipe block until the bottom end of the sample probe contacts the localizer.

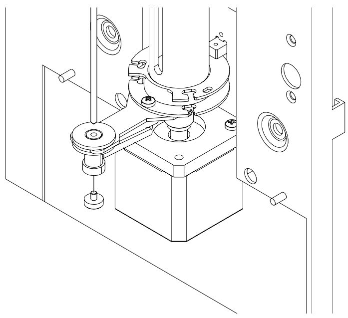


Figure 5-36

11. Fasten the fixing screw of the sample probe.

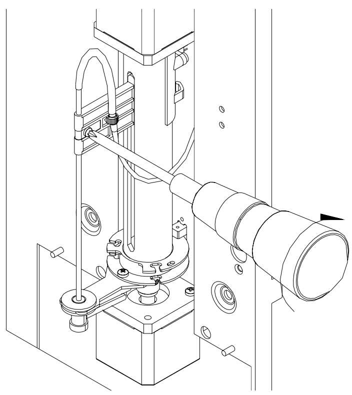


Figure 5-37

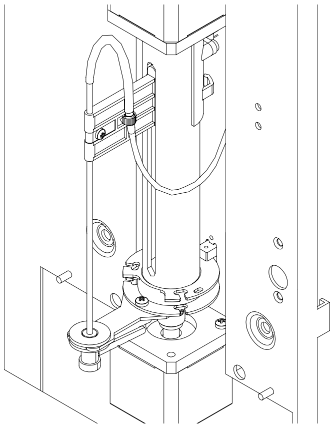


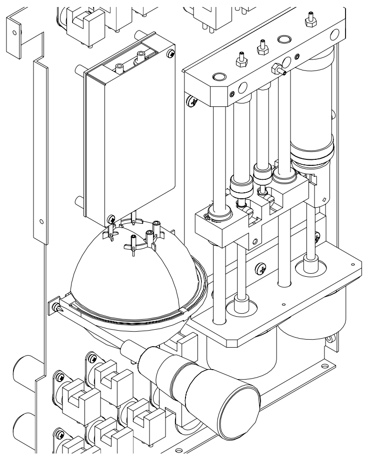
Figure 5-38

12. Press [ENTER] to close dialog and sample probe returns to ready position.

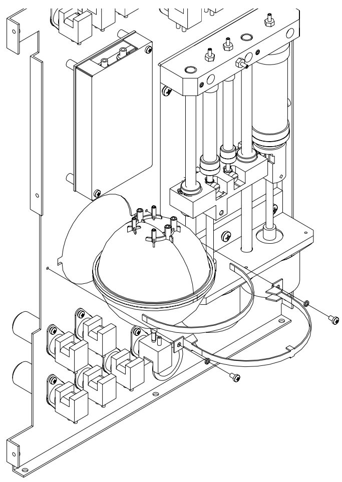
5.1.4 Replace Vacuum Chamber

⚠ **WARNING** ⚠
Potential biohazard

Pull off the tubing connected to the outlet of the vacuum chamber. Remove the fixing screw of the vacuum chamber so as to remove the clip, washer and vacuum chamber in turn (see figures 5-39 through 5-40). Then install the chamber by following the above steps in reserve order.



Figures 5-39



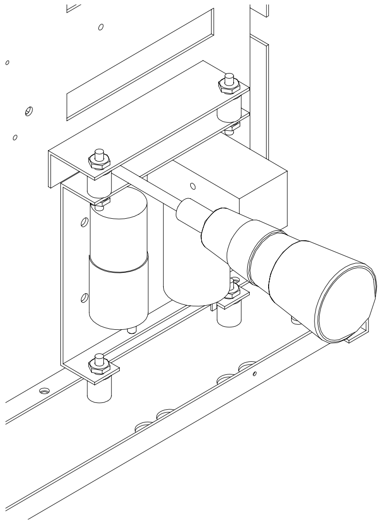
Figures 5-40

5.1.5 Replace Pump

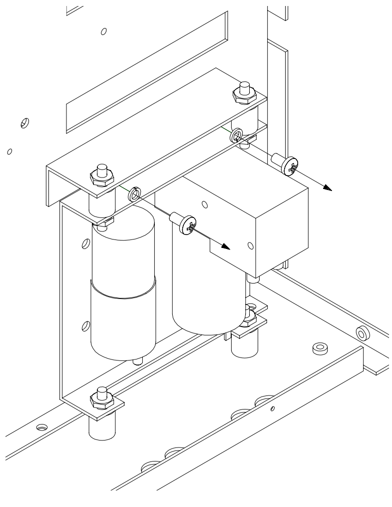
⚠ WARNING ⚠

Potential biohazard

1. Pull off the tubing connected to the corresponding pumps. Remove the two screws used to fixing the bracket.



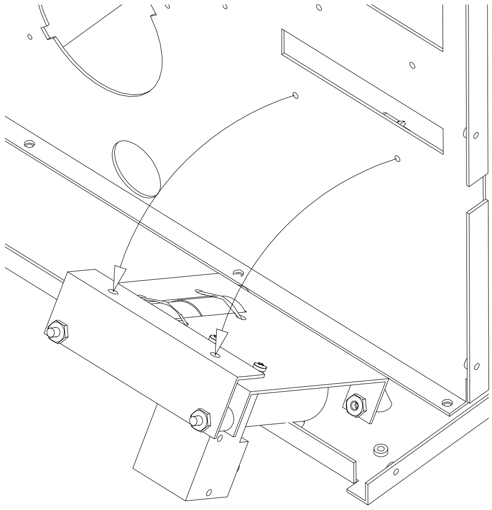
Figures 5-41



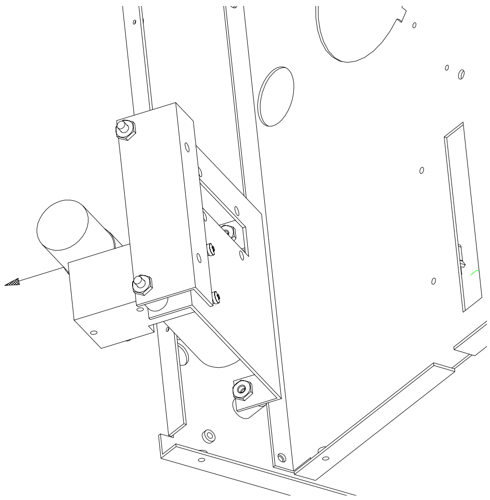
Figures 5-42

2. Use hand to tilt the bracket and the pump outward as shown in figures. If to replace

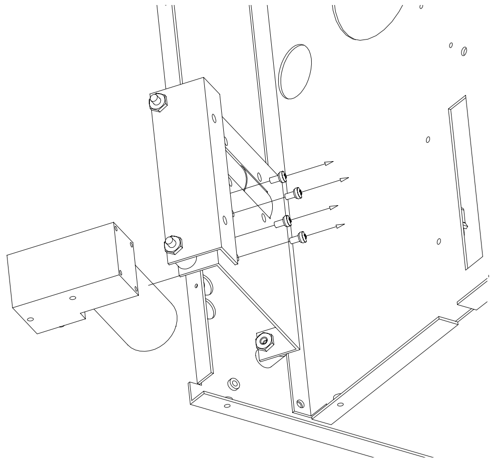
the pressure pump, just cut off the white tie around the pump, then remove and replace the pump. If to replace the vacuum pump, remove the four fixing screws on the back of the pump and then remove the pump. Follow the reversed steps to install the new pump.



Figures 5-43



Figures 5-44



Figures 5-45

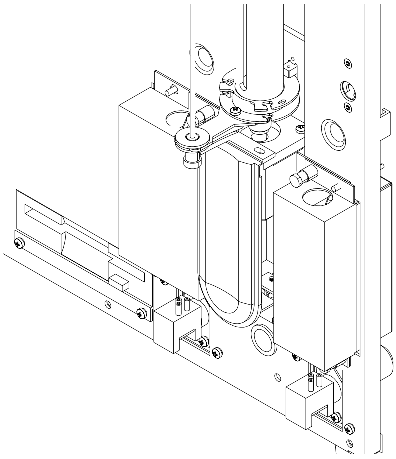
5.1.6 Replace Count Bath

⚠ WARNING⚠

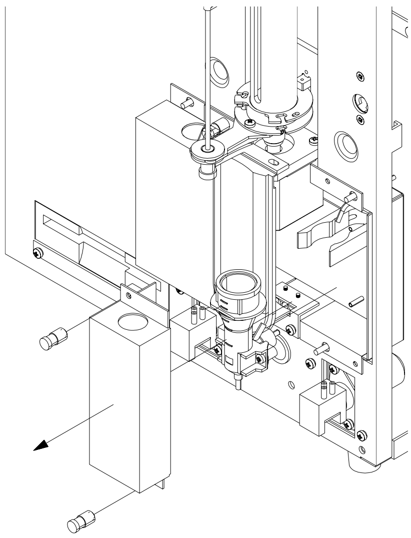
Potential biohazard

Remove RBC bath.

Remove the fixing screw on the shielding box of the RBC bath. Then remove the shielding box. Take out the RBC bath assembly from the clips. Pull off the tubing connected to the RBC bath and disconnect the connector of the RBC bath inside the enclosure; remove the RBC bath assembly.



Figures 5-46

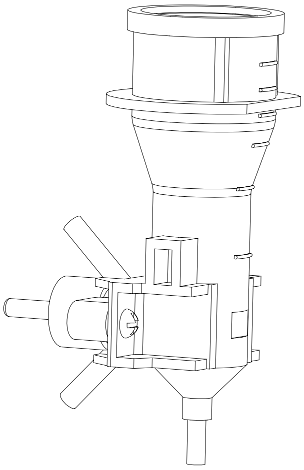


Figures 5-47

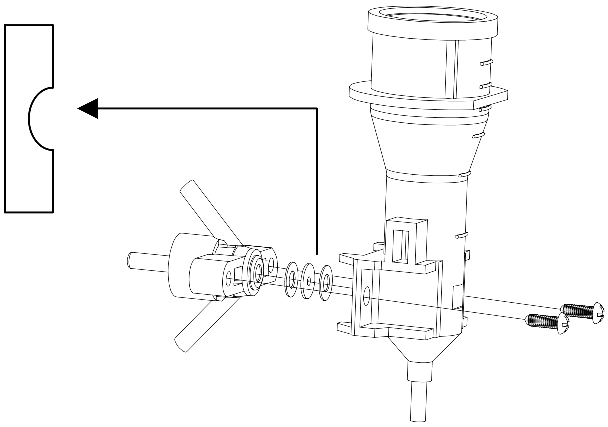
When replacing the RBC bath, you must replace the tubing connected to the metal junction.

Use a nipper to remove the RBC/PLT aperture.

Remove the two screws and then take out the aperture between two washers.



Figures 5-48



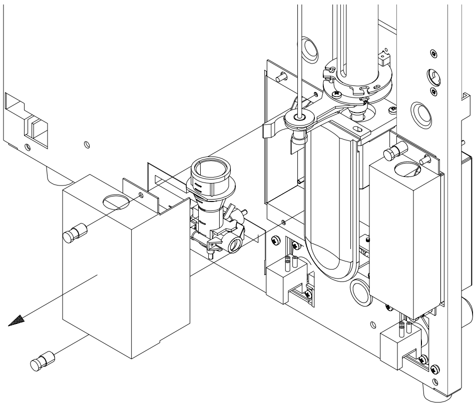
Figures 5-49

Note: The concave side of the aperture must face to the front bath.

Remove WBC bath.

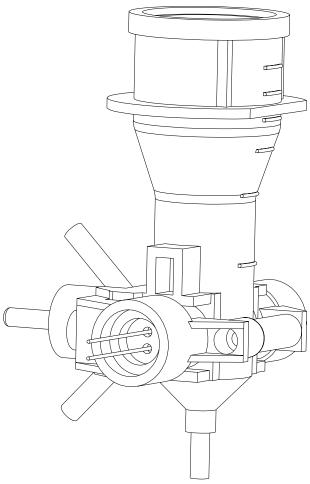
Remove the fixing screw on the shielding box of the WBC bath. Then remove the shielding box. Take out the WBC bath assembly from the clips. Pull off the tubing connected to the WBC bath and disconnect the connector of the WBC bath inside the enclosure; remove the WBC bath assembly.

When replacing the WBC bath, you must replace the tubing connected to the metal junction.

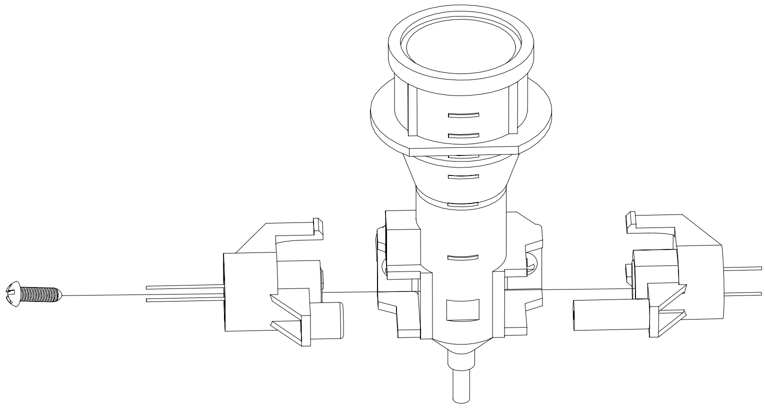


Figures 5-50

Remove HGB assembly



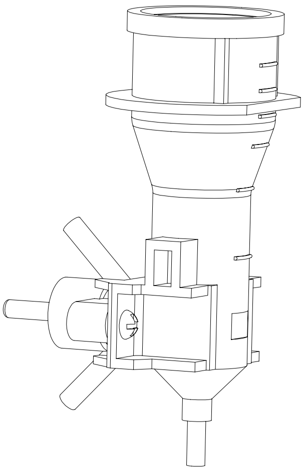
Figures 5-51



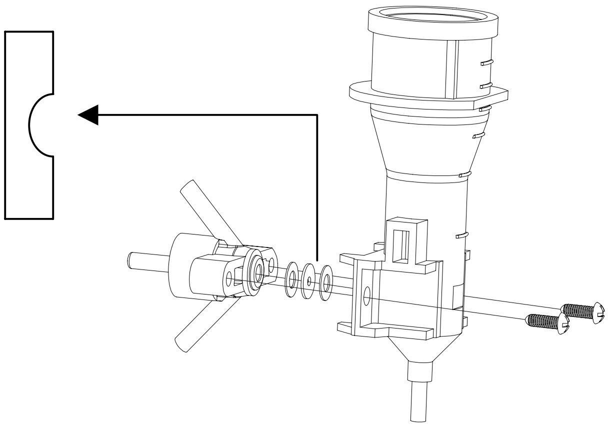
Figures 5-52

Remove the WBC aperture.

Remove the two screws and then take out the aperture between two washers.



Figures 5-53



Figures 5-54

⚠**Note**⚠**: The concave side of the aperture must face to the front bath.**

5.1.7 Clean or Replace V11 or V12 Valve

WARNING

Potential biohazard

Open the front panel.

1. Push the switch and open the right side door of the machine.

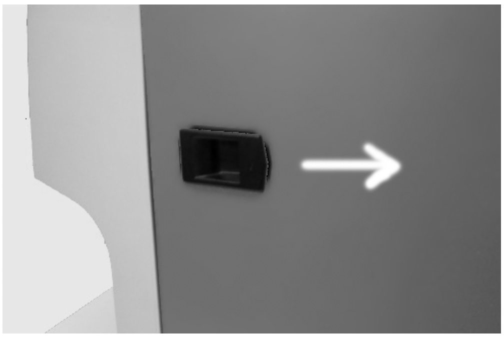


Figure 5-55

2. Lift up the switch and open the front panel.

Figure 5-56

3. Figure 5-61 shows the machine with the front panel opened.

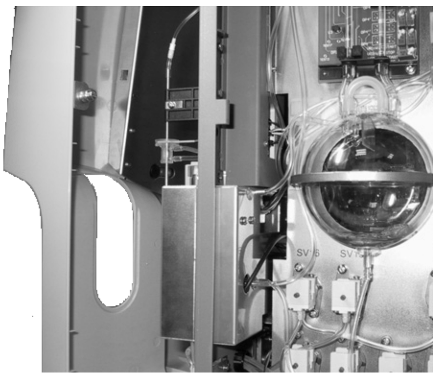


Figure 5-57

5.1.8 Replace V11 or V12

1. In Menu operation, move the cursor to the “Service/Maintenance” item, press [ENTER] to access the Maintenance screen. Press [←] [↑] [→] [↓] to move the cursor to “Empty Baths”.

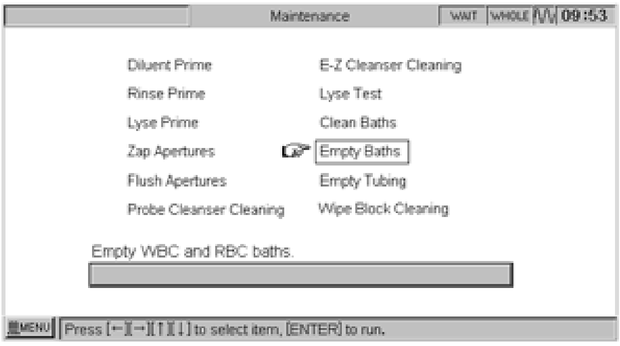


Figure 5-58

2. Press [ENTER] to empty baths.

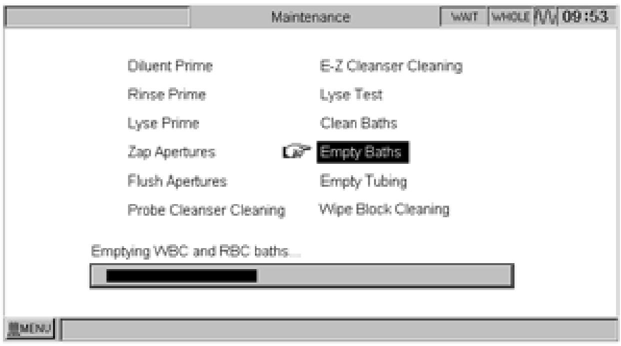


Figure 5-59

3. Remove the three fixing screws of the top plate, and then remove the top plate.

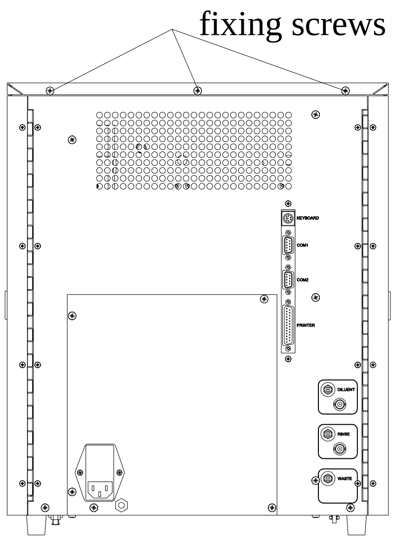


Figure 5-60

4. Disconnect the connecting tubing of V11 or V12. Record the connecting positions of tubing. disconnect the connector wire of V11 or V12.

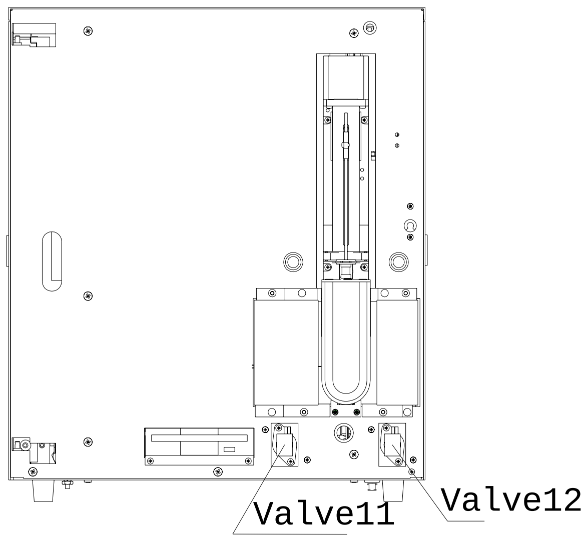


Figure 5-61

5. Remove the two fixing screws of the valve to take out V11 or V12.

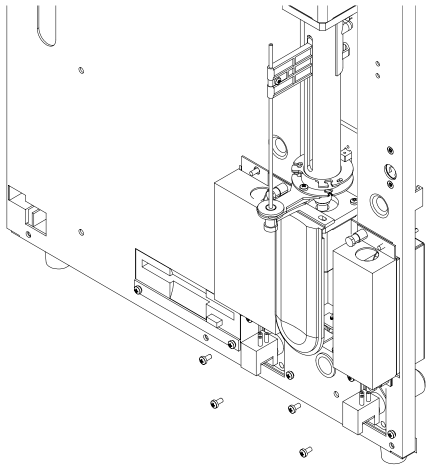


Figure 5-62

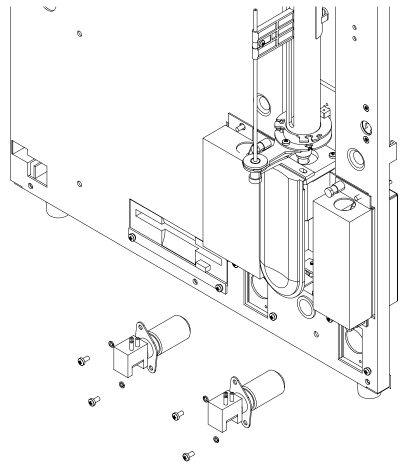


Figure 5-63

6. Replace the old valve with new one.

Connect the connector of driving wire of valve.

Connect the tubing to the valve.

Install the valve to instrument.

7. After that, press [ENTER] to prime the diluent into baths.

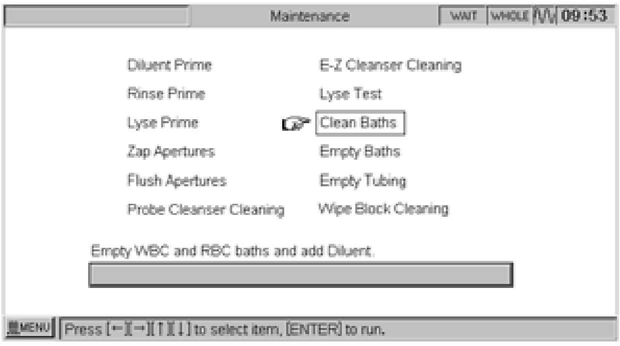


Figure 5-64

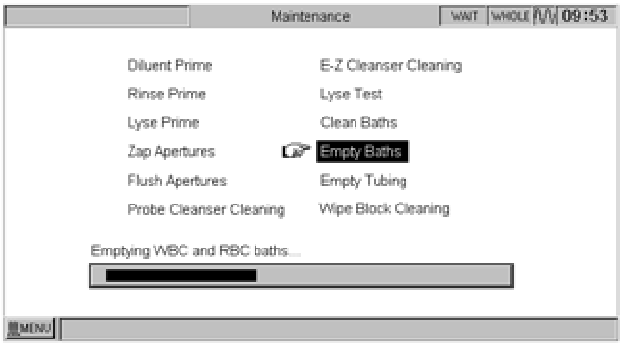


Figure 5-65

9. Test V11 or V12 by selecting “Service/Valve Test” and check if the valve can work normally.

5.1.9 Clean V11 or V12

1. Remove the valve from the instrument as above.
2. Use T9 screwdriver (in kit box) to unscrew the four fixing screws on the valve bonnet, open the bonnet, note the position and direction of NO valve port.
3. Use distilled water to clean the valve membrane inside the bonnet, do not let liquid flow into the valve seat.
4. Dispose the foreign object in the valve; then mount the valve bonnet. Use T9 screwdriver to fasten the screws.

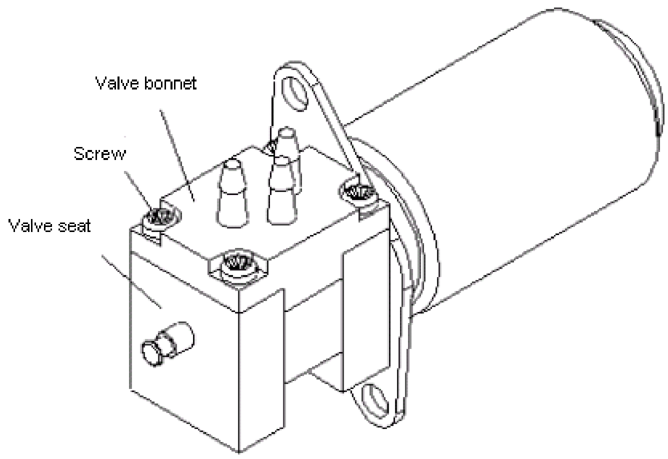


Figure 5-66

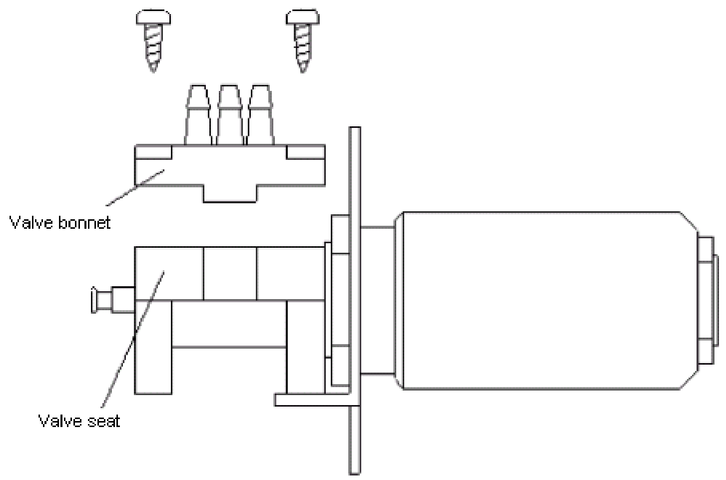


Figure 5-67

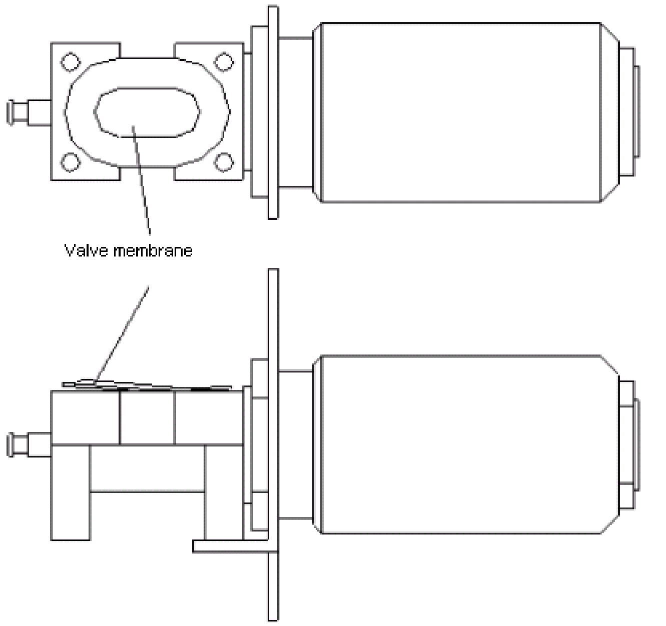


Figure 5-68

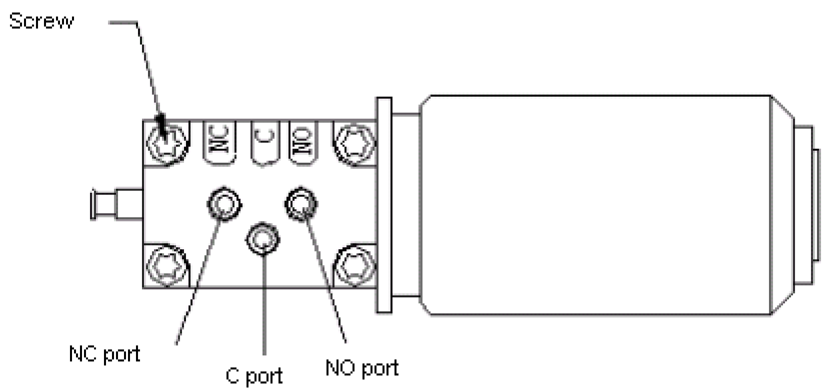


Figure 5-69

5.1.10 Replace TFT Screen

1. Open the left side door, then screw-off the 3pcs screws on the shield cover (Figure 5-70)
2. Disconnect the ground wire and data cable (Figure 5-71)

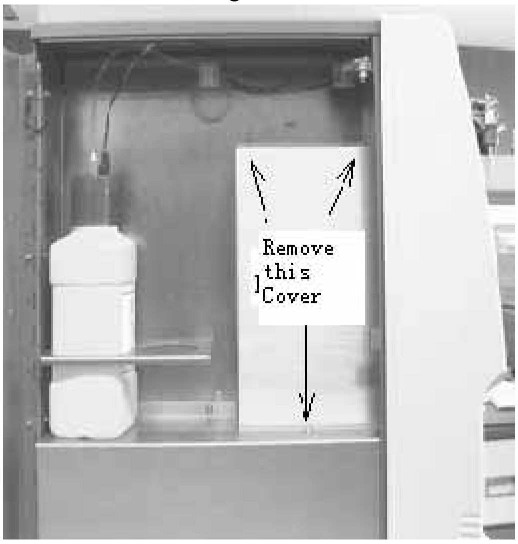


Figure 5-70

Figure 5-71

3. Open the unit's front pane, and screw off the joint and ground wire (Figure 5-72)
4. Disconnect the cable to keyboard, then lift the front panel and take it out (Figure 5-73)

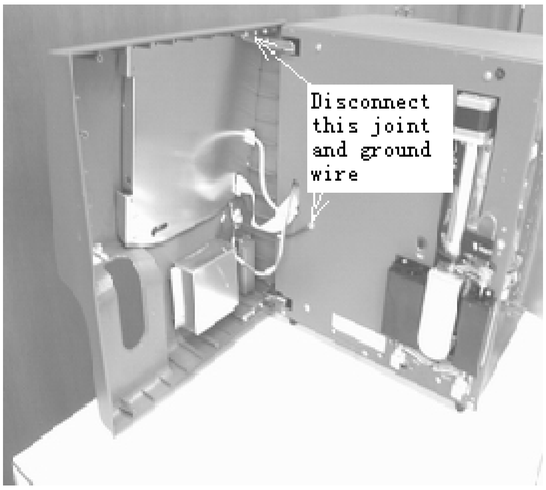


Figure 5-72

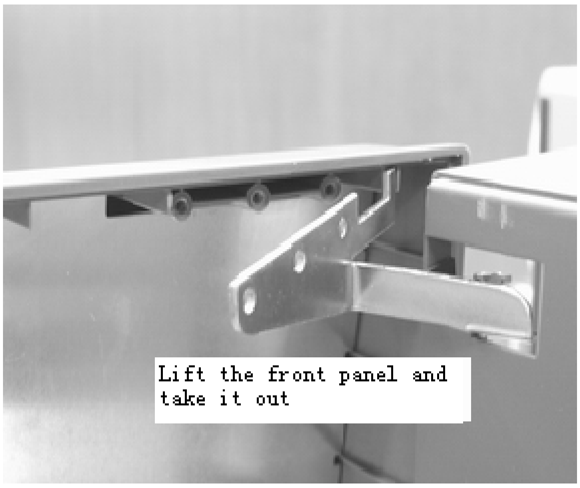


Figure 5-73

5. Screw off the 7pcs screws that fix the TFT bracket, disconnect the backlight cable (Figure 5-74)
6. Screw off the 4pcs screw caps that fix the TFT screen, disconnect all cables (Figure 5-75)

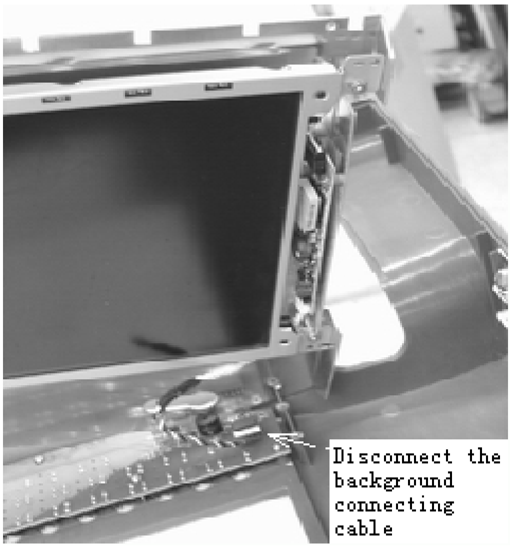


Figure 5-74

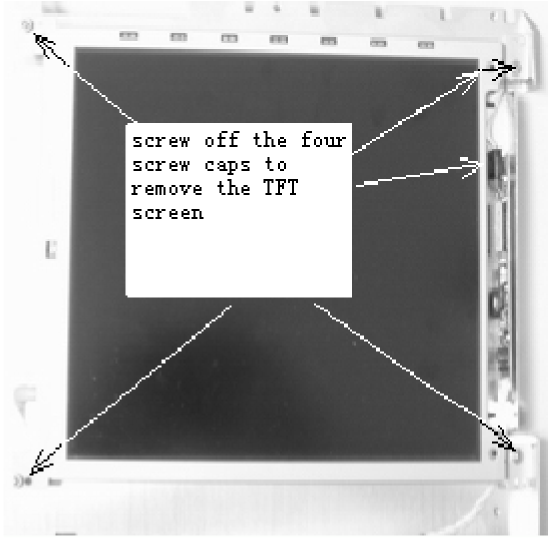


Figure 5-75

7. If the TFT background with bad brightness or contrast after replace TFT screen, please refer to followed picture to adjust (Figure 5-76 & Figure 5-77)

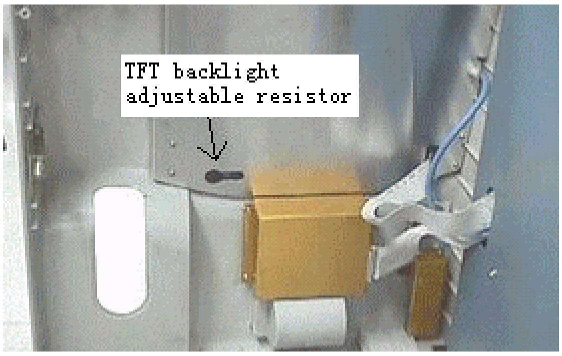


Figure 5-76

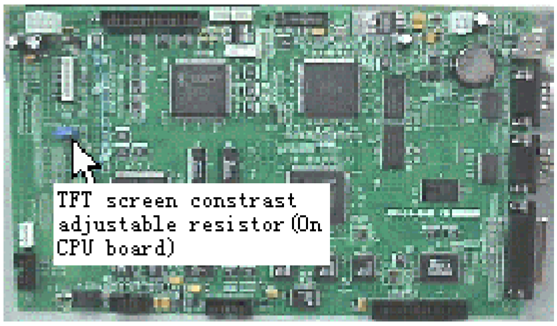


Figure 5-77

5.1.11 Replace Recorder Paper

Open the door of the recorder

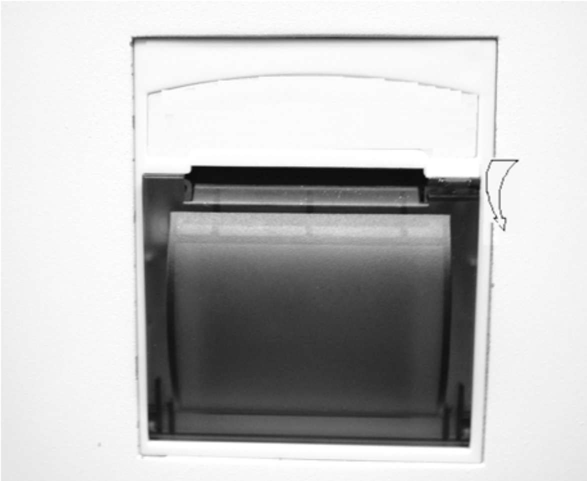


Figure 5-78

Pull the bar up and insert the record paper into the recorder box.

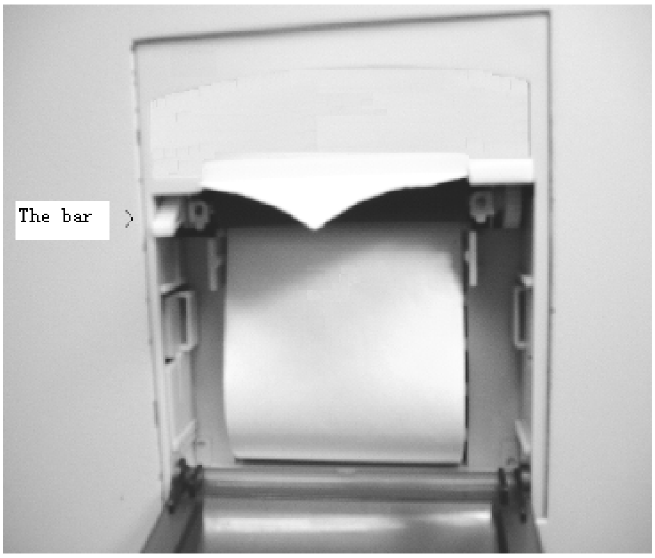


Figure 5-79

Press down the bar

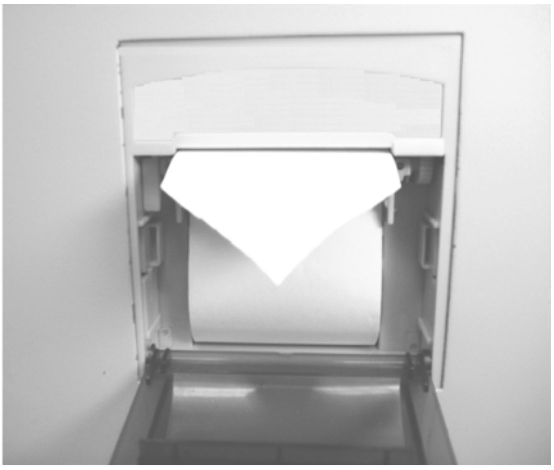


Figure 5-80

Close the door of the recorder.

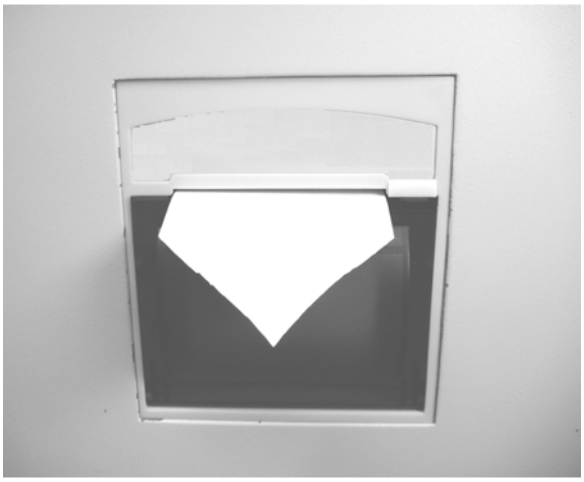


Figure 5-81

5.1.12 Replace Recorder Module

Open the door of the recorder

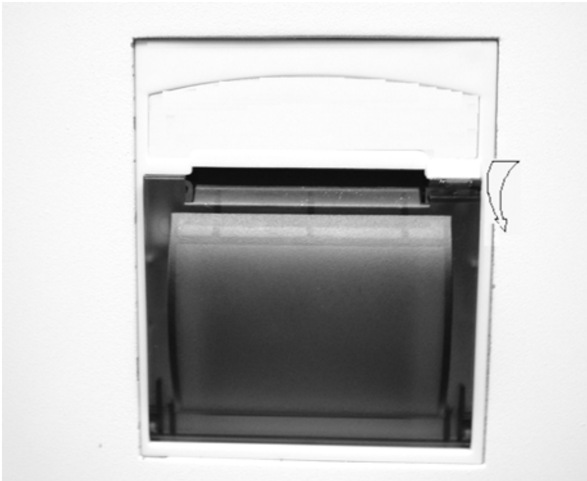


Figure 5-82

Screw off the two screws that fix the recorder module

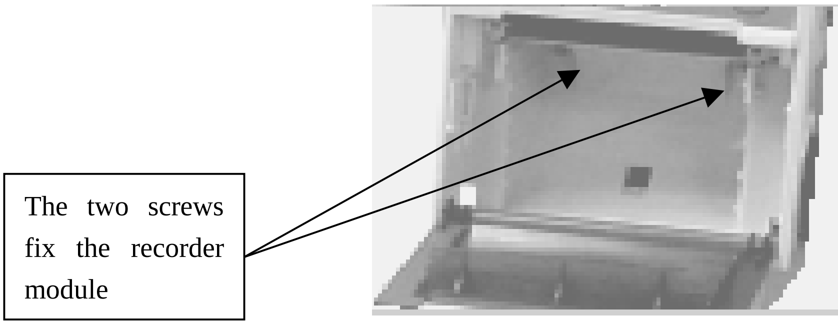


Figure 5-83

Remove the recorder module using small slotting screwdriver to

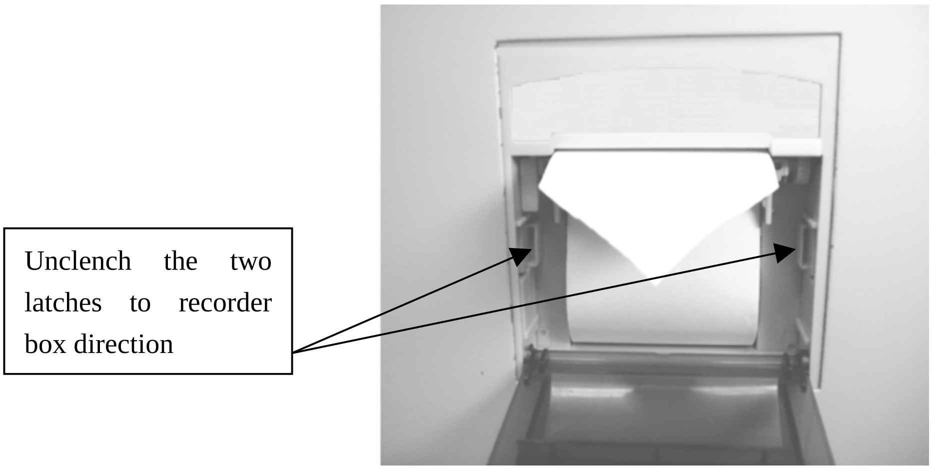


Figure 5-84

5.2 Disassemble/assemble Circuit Boards

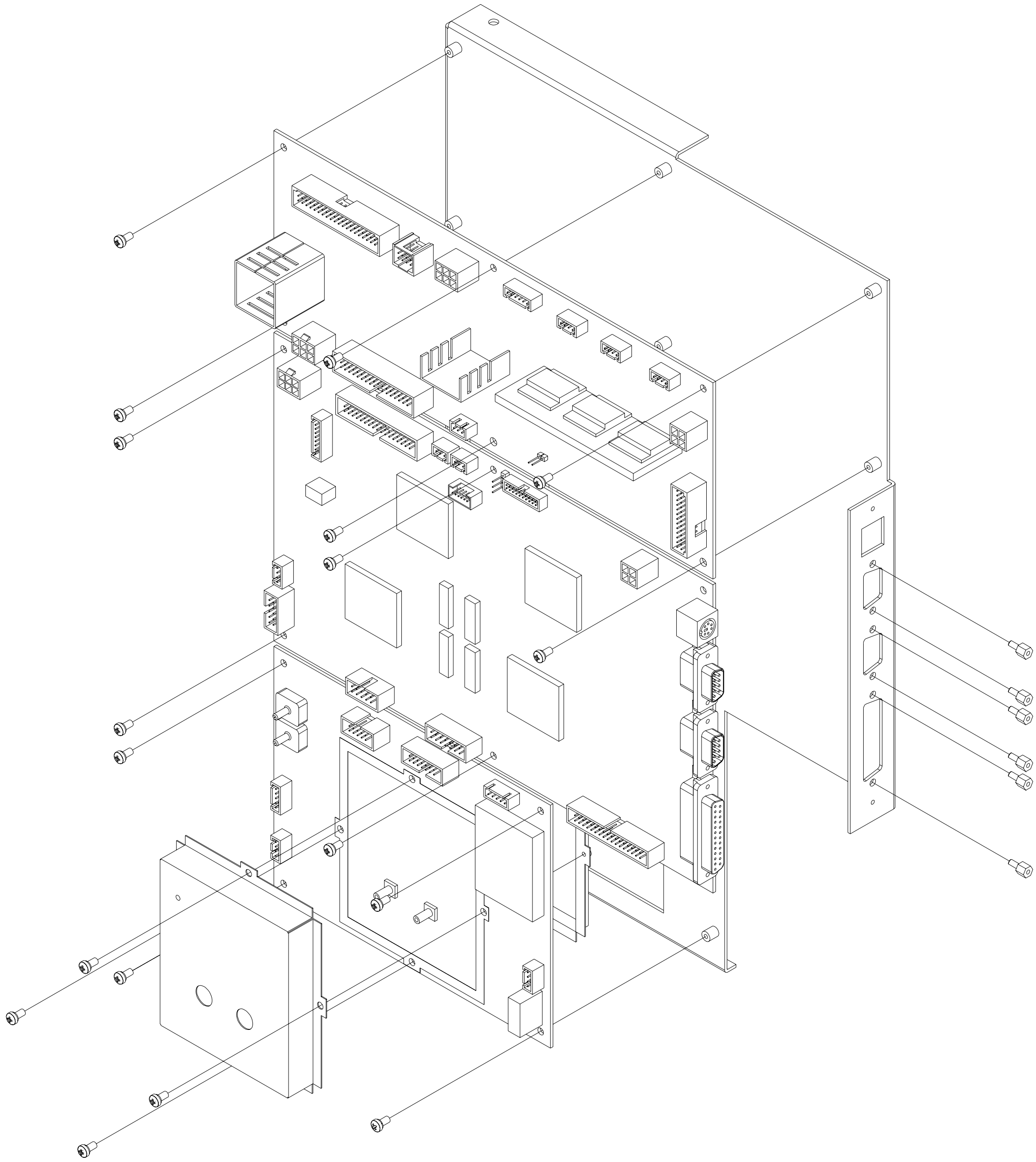


Figure 5-85

5.3 Connect Power Supply

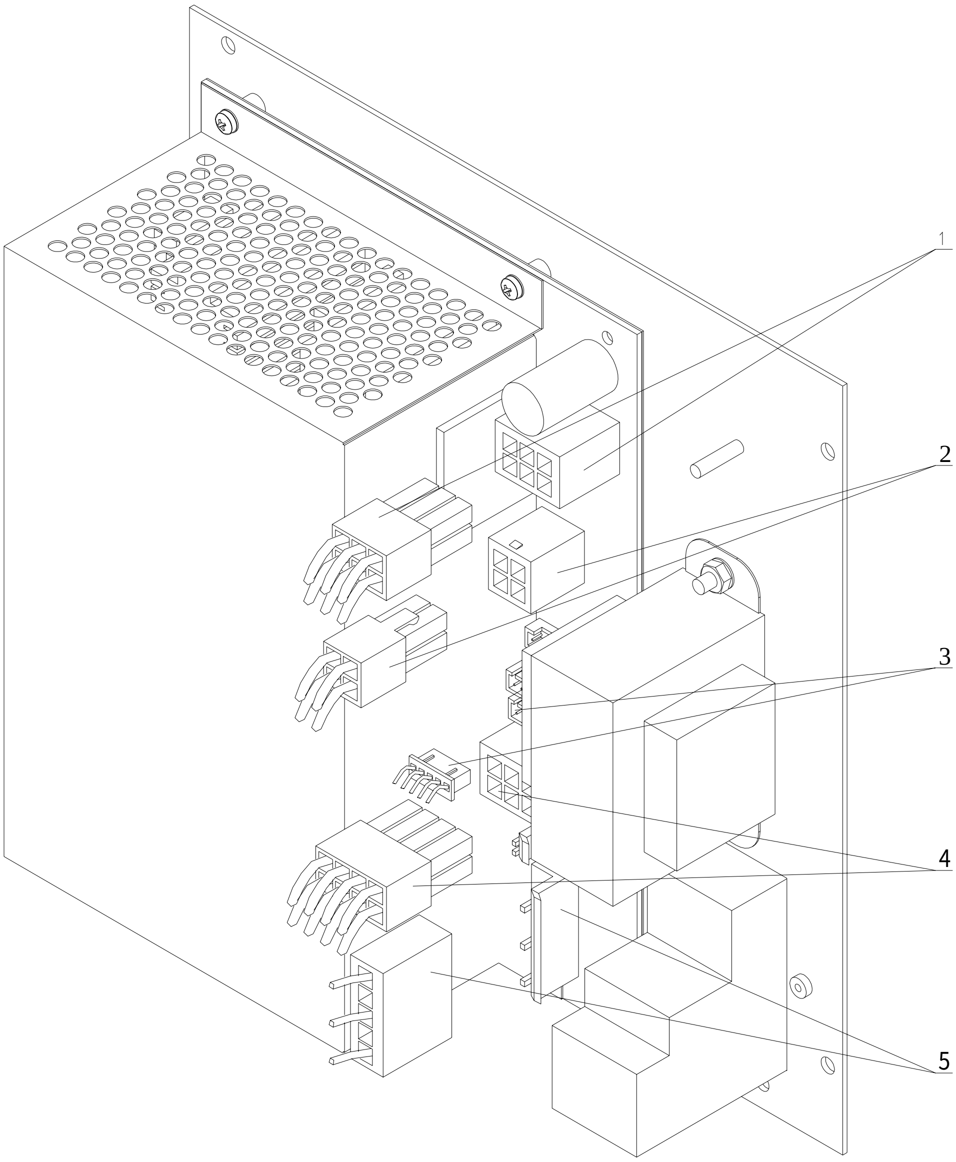


Figure 5-86

No.	Socket	Plug
1	P7	07095（12V）
2	P8	07096（30V）
3	P4	07110（FDD）
4	P2	07094（5V）
5	P1	07106（AC input）

P7——+12V Connector

PIN	Defined	Explanation
1	GND	+12Vp power Ground
2	PGND	+12Vp power Ground
3	PGND	+12Vp power Ground
4	+12VP	+12 VP
5	+12VP	+12 VP
6	+12VP	+12 VP

P8——+30V Connector

PIN	Defined	Explanation
1	30GPGND	30V power Ground
2	30GPGND	30V power Ground
3	+30VP	+30VP
4	+30VP	+30VP

5.4 Connect Circuit Boards

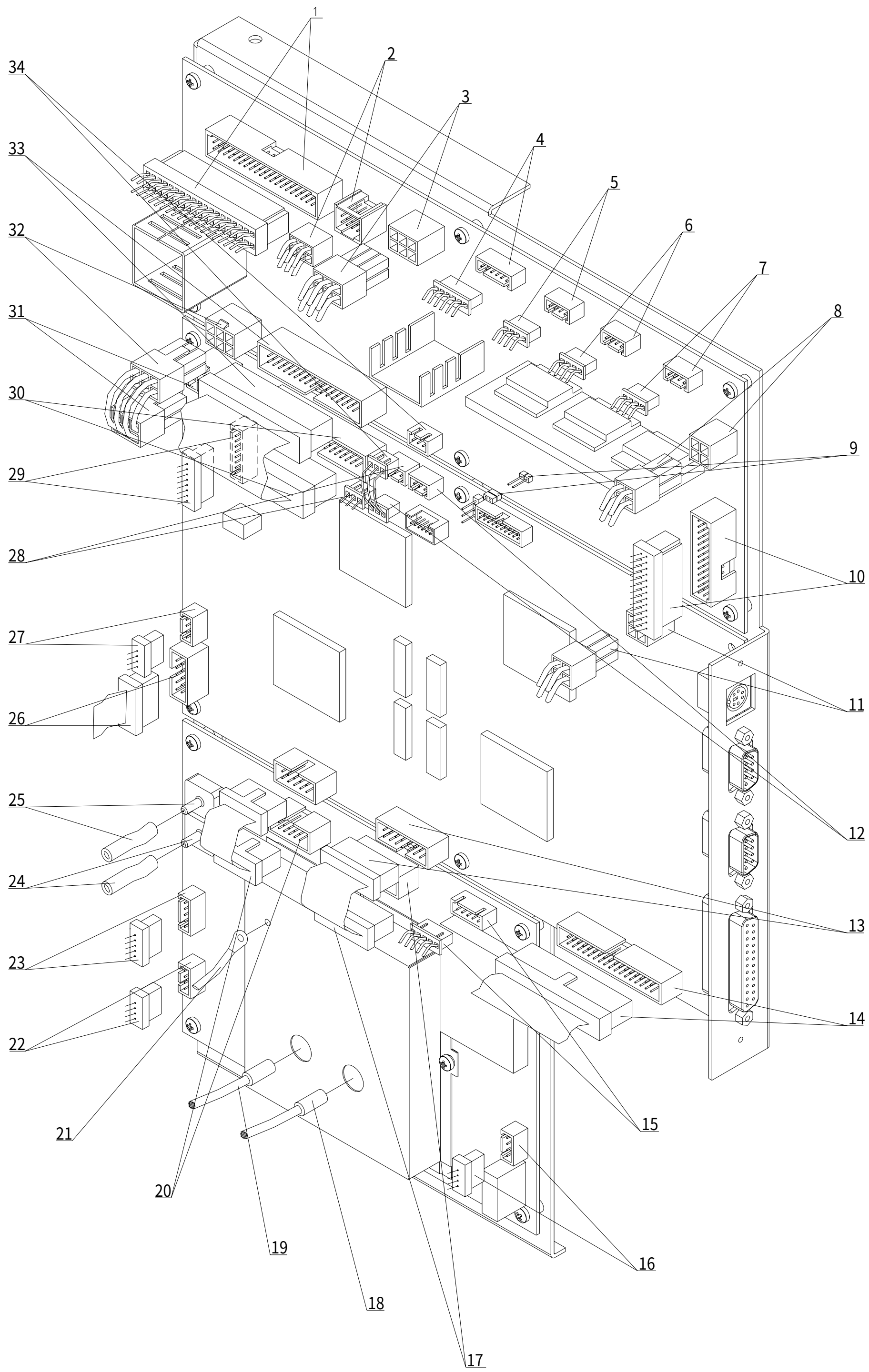


Figure 5-87

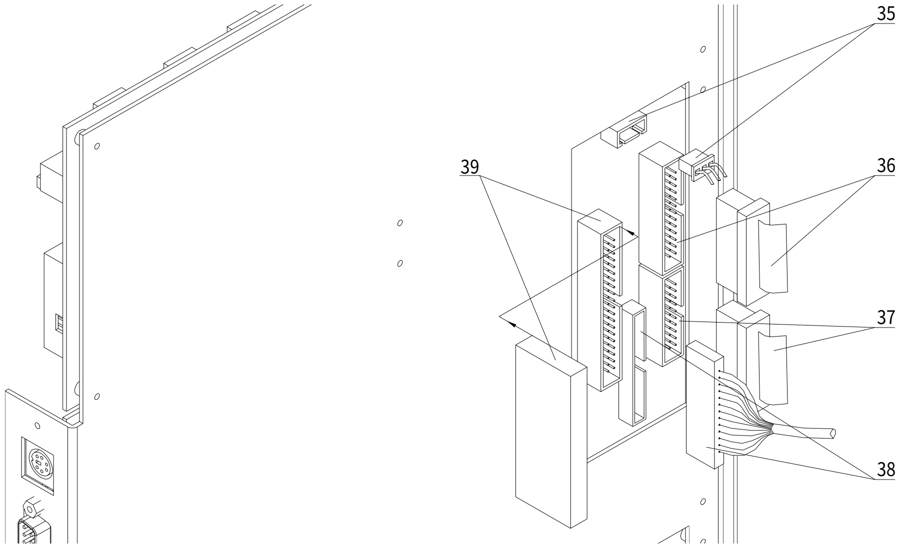


Figure 5-88

No.	Socket	Plug	No.	Socket	Plug
1	J1	07094	21	Shield Wire	
2	J2	07075	22	J5	07100
3	J13	07095	23	J6	07102
4	J4	07076	24	U34	From Pressure Chamber
5	J6	07078	25	U26	From Vacuum Chamber
6	J7	10ml	26	J18	3001-21-07098X
7	J8	50ul	27	J22	07085
8	J12		28	J6	07091
9	JP1	Jumper	29	J16	07087
10	J10	07087	30	J4	3001-21-07093X
11	J8	+5V	31	J9	07092
12	J20	3001-21-07116C	32	J11	07092
13	J21	07115	33	J3	3001-21-07093X
14	J3	3001-21-07108X	34	J9	07091
15	J8	+5V	35	J15	19459A
16	J7	From Transformer	36	J14	C-3001-21-07105
17	J2	3001-21-07114X	37	J1	C-3001-20-18452
18	RBC Socket	3001-21-07103X	38	J14	DiskOnModule Disk 19459A
19	WBC Socket	3001-21-07103X			
20	J1	3001-21-07114X			

5.4.1 CPU board connectors defined

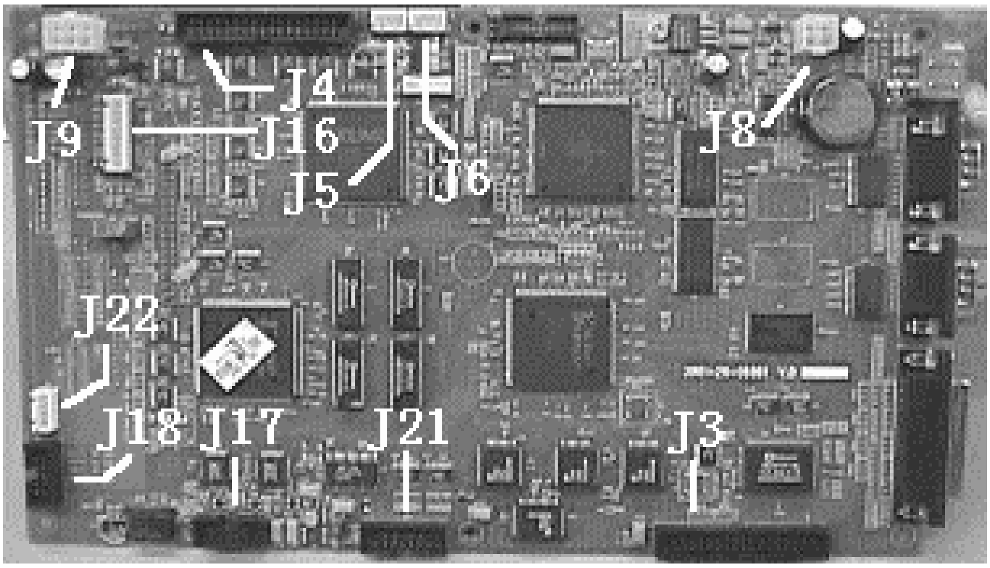


Figure 5-89

J2——No use

J3——FDD connector

J4——Valves and pumps' signal connector

PIN	defined	Explanation
1	/VALVE17	Value's drive signal
2	/VALVE0	Value's drive signal
3	/VALVE18	Value's drive signal
4	/VALVE1	Value's drive signal
5	/VALVE19	Value's drive signal
6	/VALVE2	Value's drive signal
7	/VALVE20	Value's drive signal
8	/VALVE3	Value's drive signal
9	/VALVE21	Value's drive signal
10	/VALVE4	Value's drive signal
11	/VALVE22	Value's drive signal
12	/VALVE5	Value's drive signal
13	/VALVE23	Value's drive signal
14	/VALVE 6	Value's drive signal
15	DVCC	power
16	/VALVE 7	value 7 control
17	DVCC	power
18	/VALVE8	value 8 control
19	DVCC	power
20	/VALVE9	Value's drive signal
21	DVCC	power
22	/VALVE10	Value's drive signal
23	/PUMP0	Pump 0 control

24	/VALVE11	Value's drive signal
25	/PUMP1	Pump 1 control
26	/VALVE12	Value's drive signal
27	/PUMP2	Pump 2 control
28	/VALVE13	Value's drive signal
29	/PUMP3	Pump 3 control
30	/VALVE14	Value's drive signal
31	DGND	Signal GND
32	/VALVE15	Value's drive signal
33	DGND	Signal GND
34	/VALVE16	Value's drive signal

J5——Serial Port

PIN	defined	Explanation
1	RXD3	Receive
2	DGND	Digital GND
3	TXD3	Transmit

J6——Serial Port

PIN	defined	Explanation
1	SIN	Receive
2	DGND	Digital GND
3	SOUT	Transmit

J8——+5V Power Supply

PIN	defined	Explanation
1	GND	Digital GND
2	GND	Digital GND
3	V5P0	+5V
4	V5P0	+5V

J9——+12V & Printer Power

PIN	defined	Explanation
1	+12VP	+12V
2	PGND	Power GND
3	Vprn	Printer Power
4	+12VP	+12V
5	PGND	Power GND
6	Vprn	Printer Power

J14——HD Connector

J15——HD Power Supply

PIN	defined	Explanation
1	+12VP	+12V
2	PGND	Power GND
3	V5P0	+5V
4	GND	Digital GND

J16

PIN	defined	Explanation
1	DGND	Digital GND
2	LQ1	
3	DGND	Digital GND
4	LQ2	
5	DGND	Digital GND
6	LQ3	
7	DGND	Digital GND
8	LQ5	

J17——A/D Input

PIN	defined	Explanation
1	AWBC	WBC Signal
2	+12VP MON	＋12VP Monitor signal
3	ARBC	RBC Signal
4	DVCC　MON	DVCC Monitor signal
5	APLT	PLT Signal
6	AGND	AGND
7	AGND	AGND
8	+12VA	＋12VA ADC
9	AGND	AGND
10	+12VA	＋12VA ADC

J18——MTB Board connector

PIN	defined	Explanation
1	V5P0	+5V
2	START1	WBC Start
3	GND	Digital GND
4	STOP1	WBC Stop
5	NC	NC
6	START2	RBC Start
7	PGND	Power GND
8	STOP2	RBC Stop
9	+12VP	+12V
10	HGB_LIGHT	HGB Light control

J19——BDM Connector

PIN	Defined	Explanation
1	NC	
2	/BKPT	
3	GND	Digital Ground
4	DSCLK	
5	GND	Digital Ground
6	NC	
7	/HR	
8	DSI	
9	JU3_2	3.3V / 5V Select jumper
10	DSO	
11	GND	Digital Ground
12	PST3	
13	PST2	
14	PST1	
15	PST0	
16	GND	Digital Ground
17	JU3_2	
18	PSTCLK	
19	GND	Digital Ground
20	/TA	

J20——Keyboard Connector

PIN	Defined	Explanation
1	KEYIN0	
2	KEYIN1	
3	KEYIN2	
4	KEYIN3	
5	KEYIN4	
6	KEYIN5	
7	KEYIN6	
8	BUZZER	
9	KOUT0	
10	KOUT1	
11	KOUT2	
12	KOUT3	
13	V5P0	+5V
14	GND	Digital Ground
15	GND	Digital Ground
16	PGND	Power GND
17	PGND	Power GND
18	+12VP	+12V

19	+12VP	+12V
20	LCDBCTL	LCD Background brightness control

J21——A/D Control Signal

PIN	Defined	Explanation
1	V5P0	+5V DDC
2	GND	Digital Ground
3	XCHS4	
4	DGAIN2	
5	XCHS3	
6	DGAIN1	
7	XCHS2	
8	DGAIN0	
9	XCHS1	
10	DBURN0	Zap Control 0
11	XCHS0	
12	DBURN1	Zap Control 1
13	HGB_LIGHT1	HGB light Control
14	DCONST0	Constant Current control

J22——Start Key

PIN	Defined	Explanation
1	KEYIN5	KEYIN0
2	KEYIN5	
3	KEYOUT3	
4	KEYOUT3	

5.4.2 Power Driver Board Connectors Defined

J1——Valves Drive

PIN	Defined	Explanation
2	Q_VAL0	Valve Drive
4	Q_VAL1	Valve Drive
6	Q_VAL2	Valve Drive
8	Q_VAL3	Valve Drive
10	Q_VAL4	Valve Drive
12	Q_VAL5	Valve Drive
14	Q_VAL6	Valve Drive
16	Q_VAL7	Valve Drive
18	Q_VAL8	Valve Drive
20	Q_VAL9	Valve Drive
22	Q_VAL10	Valve Drive
24	Q_VAL11	Valve Drive
26	Q_VAL12	Valve Drive
28	Q_VAL13	Valve Drive
30	Q_VAL14	Valve Drive
32	Q_VAL15	Valve Drive
34	Q_VAL16	Valve Drive
36	Q_VAL17	Valve Drive
38	Q_VAL18	Valve Drive
40	Q_VAL19	Valve Drive
42	Q_VAL20	Valve Drive
44	Q_VAL21	Valve Drive
46	Q_VAL22	Valve Drive
48	Q_VAL23	Valve Drive
50	PGND	GND
1,3…49	+12VP	+12V

J2——Pump Drive

PIN	Defined	Explanation
1	+12VP	+12V
2	Q_PUMP0	Pump Drive
3	+12VP	+12V
4	Q_PUMP1	Pump Drive
5	+12VP	+12V
6	Q_PUMP2	Pump Drive
7	+12VP	+12V
8	Q_PUMP3	Pump Drive

J3——Pumps & Valves Control

PIN	Defined	Explanation
1	VAL17	Valve Control
2	VAL0	Valve Control
3	VAL18	Valve Control
4	VAL1	Valve Control
5	VAL19	Valve Control
6	VAL2	Valve Control
7	VAL20	Valve Control
8	VAL3	Valve Control
9	VAL21	Valve Control
10	VAL4	Valve Control
11	VAL22	Valve Control
12	VAL5	Valve Control
13	VAL23	Valve Control
14	VAL6	Valve Control
15	DVCC	Digital GND
16	VAL7	Valve Control
17	DVCC	Digital GND
18	VAL8	Valve Control
19	DVCC	Digital GND
20	VAL9	Valve Control
21	DVCC	Digital GND
22	VAL10	Valve Control
23	PUMP0	Valve Control
24	VAL11	Valve Control
25	PUMP1	Valve Control
26	VAL12	Valve Control
27	PUMP2	Valve Control
28	VAL13	Valve Control
29	PUMP3	Valve Control
30	VAL14	Valve Control
31	DGND	Digital GND
32	VAL15	Valve Control
33	DGND	Digital GND
34	VAL16	Valve Control

J4——Rotatory Motor Drive

PIN	Defined	Explanation
1	803_ORANGE	Rotatory Motor Drive Signal
2	803_BLUE	Rotatory Motor Drive Signal
3	803_YELLOW	Rotatory Motor Drive Signal
4	803_BROWN	Rotatory Motor Drive Signal

5	803_RED	Rotatory Motor Drive Signal
6	803_BLACK	Rotatory Motor Drive Signal

J6——Fluctuating Motor Drive

PIN	Defined	Explanation
1	851_WHITE	Fluctuating Motor Drive Signal
2	851_YELLOW	Fluctuating Motor Drive Signal
3	851_BLUE	Fluctuating Motor Drive Signal
4	851_RED	Fluctuating Motor Drive Signal

J7 ——10ml Motor Drive

PIN	Defined	Explanation
1	L1_D	10 ml Motor Drive Signal
2	L1_C	10 ml Motor Drive Signal
3	L1_B	10 ml Motor Drive Signal
4	L1_A	10 ml Motor Drive Signal

J8——50ul/2.5ml Motor Drive

PIN	Defined	Explanation
1	L2_D	50Ul/2.5ml Motor Drive Signal
2	L2_C	50Ul/2.5ml Motor Drive Signal
3	L2_B	50Ul/2.5ml Motor Drive Signal
4	L2_A	50Ul/2.5ml Motor Drive Signal

J9——Serial Port

PIN	Defined	Explanation
1	TXD_PC	Transmit
2	DGND	Digital GND
3	RXD_PC	Receive

J10——Position Sensors Connector

PIN	Defined	Explanation
1	P1_803	Rotatory motor’s position 1
2	P2_803	Rotatory motor’s position 2
3，4	GND	GND
5	SD1	Rotatory motor’s position 1 EN Signal
6	SD2	Rotatory motor’s position 2 EN Signal
7	SK1	Rotatory motor’s sensor 1 Drive
8	SK2	Rotatory motor’s sensor 2 Drive

9	P1_851	Rotatory motor's position 1
10	P2_851	Rotatory motor's position 2
11，12	GND	GND
13	SD3	Fluctuating motor's position 1 EN Signal
14	SD4	Fluctuating motor's position 2 EN Signal
15	SK3	Fluctuating motor's sensor 1 Drive
16	SK4	Fluctuating motor's sensor 2 Drive
17	P_L1	10ml motor's position
18	P_L2	2.5ml/50ul motor's position
19，20	GND	GND
21	SD5	10ml motor's position EN Signal
22	SD6	2.5ml/50ul motor's position EN Signal
23	SK5	10ml motor's sensor Drive
24	SK6	2.5ml/50ul motor's sensor Drive

J14——Power Connector

PIN	Defined	Explanation
1	+12VP	CPU board Power supply
2	PGND	PGND
3	7.2V	Printer power
4	+12VP	CPU board Power supply
5	PGND	PGND
6	7.2V	Printer power

J13——+12V Connector

PIN	Defined	Explanation
1	GND	+12Vp power Ground
2	PGND	+12Vp power Ground
3	PGND	+12Vp power Ground
4	+12VP	+12 VP
5	+12VP	+12 VP
6	+12VP	+12 VP

J12——+30V Connector

PIN	Defined	Explanation
1	30GPGND	30V power Ground
2	30GPGND	30V power Ground
3	+30VP	+30VP
4	+30VP	+30VP

5.4.3 Analog Board's connectors defined

J1——Connect to CPU Board

PIN	defined	Explanation
1	AWBC	WBC Signal
2	+12VP MON	＋12VP Monitor signal
3	ARBC	RBC Signal
4	DVCC　MON	DVCC Monitor signal
5	APLT	PLT Signal
6	AGND	AGND
7	AGND	AGND
8	+12VA	＋12VA ADC
9	AGND	AGND
10	+12VA	＋12VA ADC

J2——A/D Control Signal

PIN	Defined	Explanation
1	V5P0	+5V DDC
2	GND	Digital Ground
3	XCHS4	
4	DGAIN2	
5	XCHS3	
6	DGAIN1	
7	XCHS2	
8	DGAIN0	
9	XCHS1	
10	DBURN0	Zap Control 0
11	XCHS0	
12	DBURN1	Zap Control 1
13	HGB_LIGHT1	HGB light Control
14	DCONST0	Constant Current control

J3&J4——RBC & WBC Sensors

J5——TEMP Sensor connector

PIN	Defined	Explanation
1	RT_ENVIR1	
2	RT_ENVIR2	
3	RT_REAGENT1	
4	RT_REAGENT2	

J6——HGB Connector

PIN	Defined	Explanation
1	GND	AGND

2	HGB-	Constant Current -
3	GND	AGND
4	HGB_IN	HGB Signal
5	HGB+	Constant Current +

J7——AC Power Connecter

PIN	Defined	Explanation
1	120VAC2	120VAC
2	120VAC1	120VAC
3	53VAC2	53VAC
4	53VAC1	53VAC

J8——+5V Power

PIN	Defined	Explanation
1	+5VGND	+5VGND
2	+5VGND	+5VGND
3	+5VGND	+5VGND
4	+5VPOW	+5V
5	+5VPOW	+5V

5.4.4 Keyboard Connectors defined

J1——Connect to CPU board

PIN	Defined	Explanation
1~7	I0~I6	Keyboard Scan signal input
8	I7	Buzzer control signal
9~12	O0~O3	Keyboard Scan signal input
13	+5V	+5V
14	DGND	DGND
15	DGND	DGND
16	PGND	Power GND
17	PGND	Power GND
18	+12V	+12V
19	+12V	+12V
20	LCDBCTL	LCD backlight brightness control

J2——LCD backlight brightness control

PIN	Defined	Explanation
1	+12V	+12V
2	PGND	PGND
3	CTL	Brightness Control
4	VBACK	LCD Brightness adjust
5	NC	

J3——Connect to Indicator Board

PIN	Defined	Explanation
1	DGND	DGND
2	+5V	+5V
3	LCDBCTL	LCD Brightness control Signal
4	MCUBCTL	LCD Brightness control Signal

J4——Contrast Adjustment Connector

PIN	Defined	Explanation
1	DGND	DGND
2	Vcon	Contrast Adjust

5.4.5 Indicator Board Connector Defined

PIN	Defined	Explanation
1	GND	+3.3VGND
2	VDD	+3.3V
3	LED	LED Indicator Control
4	NC	

5.4.6 MTB Connector Defined

J1——MTB Board Connector

PIN	Defined	Explanation
1	+5V	＋5V
2	WBC_START	WBC Start Count
3	DGND	DGND
4	WBC_STOP	WBC Stop Count
5	NC	NC
6	RBC_START	RBC Start Count
7	PGND	PGND
8	RBC_STOP	RBC Stop Count
9	+12V	＋12VP
10	CTL_CNT	Detect sensor

Chapter 6 Adjustment

This section introduces how to adjust the gain of the channels.

6.1 General

Adjust the Gain of the Channel in the Following Situations:

Replace count bath

RBC count bath: RBC, PLT

WBC count bath: WBC (whole blood), WBC (prediluted) and HGB

Replace aperture

RBC aperture: RBC, PLT

WBC aperture: WBC (whole blood), WBC (prediluted)

Replace analog signal board

WBC (whole blood), WBC (prediluted), RBC, HGB and PLT

Re-install system software

HGB

Replace HGB unit

HGB

6.2 Adjusted procedures

Access the Gain Screen

Access the “Password” screen and set the password to “3210”.

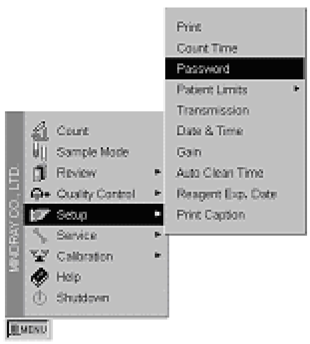


Figure 6-1

Figure 6-2

Press [MENU] key to access menu operation. Move the cursor onto “Setup/Gain” option, press [ENTER] to access the Gain screen.

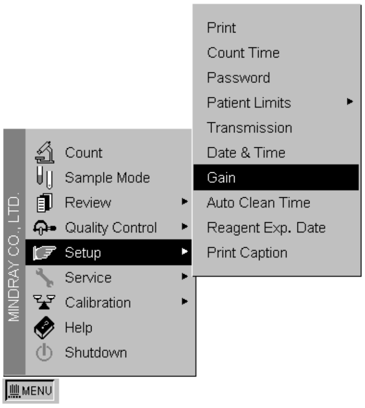


Figure 6-3

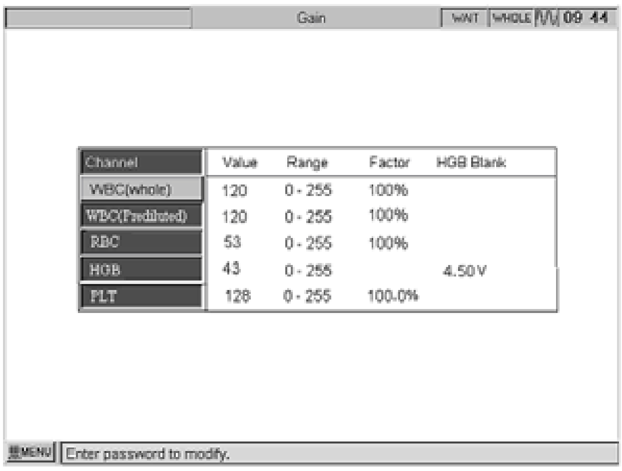


Figure 6-4

Value: value of the digital potentiometer of the current channel

Range: adjustable range of the digital potentiometer

Factor: rate of change related to the channel gain (amplifying multiple) when accessing the screen.

WBC (whole blood): gain of WBC channel in whole blood mode

WBC (prediluted): gain of WBC channel in prediluted mode

RBC: gain of RBC channel

HGB: gain of HGB channel

PLT: gain of PLT channel

6.3 Gain of WBC (whole blood and prediluted) Channel

Use normal volunteers' fresh EDTA-K_2 anticoagulant venous blood to set up the gain of WBC (whole blood) channel and gain of WBC (prediluted) channel.

In Count screen, analyze anticoagulant venous blood specimens and **make the end position of histograms of most blood samples between 320-350fl** through adjusting the digital potentiometer of WBC (whole blood) channel. See figure 6-5.

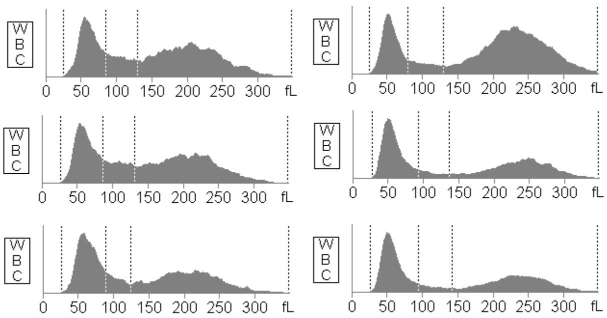


Figure 6-5

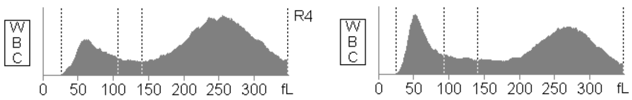


Figure 6-6

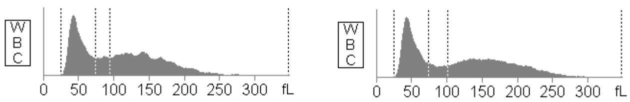


Figure 6-7

See figure 6-4, press [↑] [↓] to move the cursor onto "WBC (whole blood)" option, press [←] [→] to change its value. The greater the current value is, the larger the channel gain will be.

Analyze more than 5 fresh EDTA-K_2 anticoagulant venous blood specimens of healthy persons in whole blood mode.

Controls or calibrators cannot replace the blood specimens.

After confirming the gain of WBC (whole blood) channel, set up the value of WBC (prediluted) channel so as to make it the same as the value of WBC (whole blood) channel.

Analyze more than 5 fresh capillary blood specimens of healthy persons in preduiluted mode. If most of the WBC histograms are satisfied, the gain of WBC (prediluted) need not be adjusted. Otherwise adjust the value according the WBC histograms until confirming the gain of WBC (prediluted).

6.4 Gain of RBC Channel

Set the factory calibrating factor and user calibrating factor of MCV to 100%. Adjust the digital potentiometer of RBC channel so as to make the difference between the MCV value obtained from controls measurement and assay less than 2% in the "Count" screen.

1. Set the factory calibrating factor of MCV to 100%
   Access the "Password" screen and set the password to "5678".

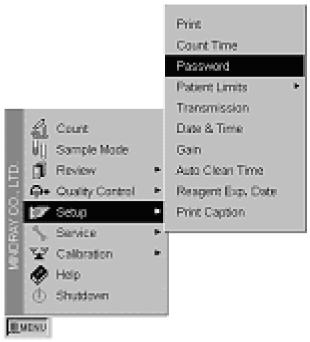


Figure 6-8

Figure 6-9

Access the "Calibration/Manual Calibration" screen, set the calibrating factor of MCV to 100%.

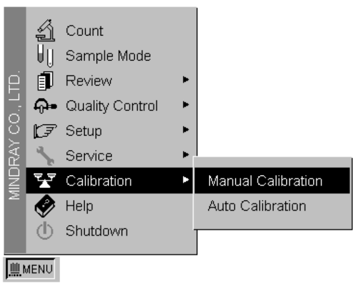


Figure 6-10

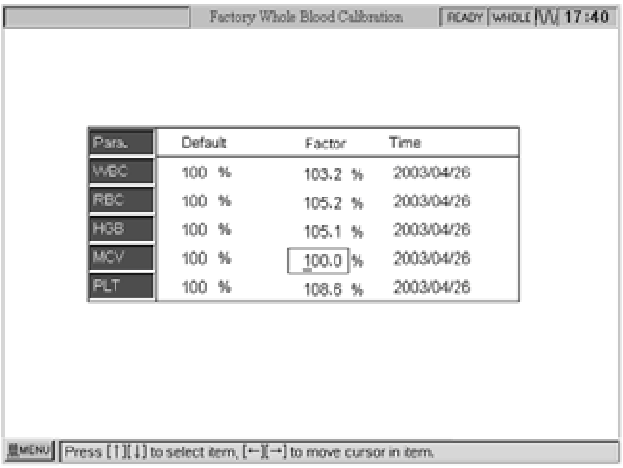


Figure 6-11

After entering the new calibrating factor, press [MENU] key to return to menu operation. The dialog box as shown below will pop up.

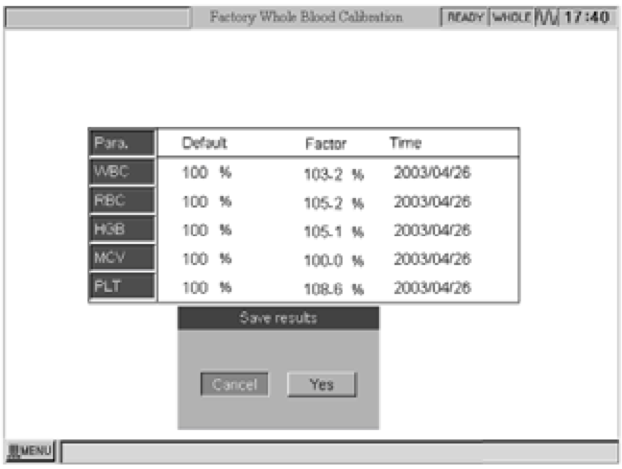


Figure 6-12

Select [Yes], the system will save the new calibrating factors.

2. Set the user calibrating factor of MCV to 100%.
   Access the “Password” screen and set the password to “0000”.

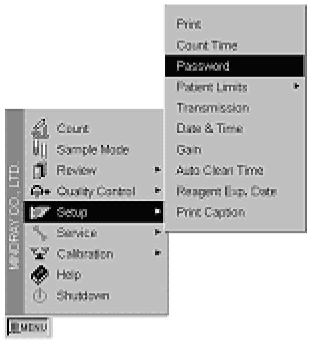


Figure 6-13

Figure 6-14

Access the "Calibration/Manual Calibration" screen, set the calibrating factor of MCV to 100%.

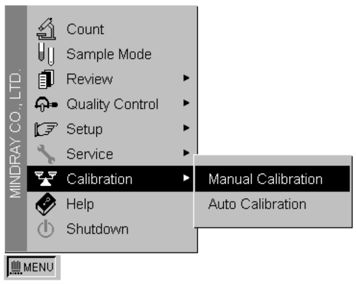


Figure 6-15

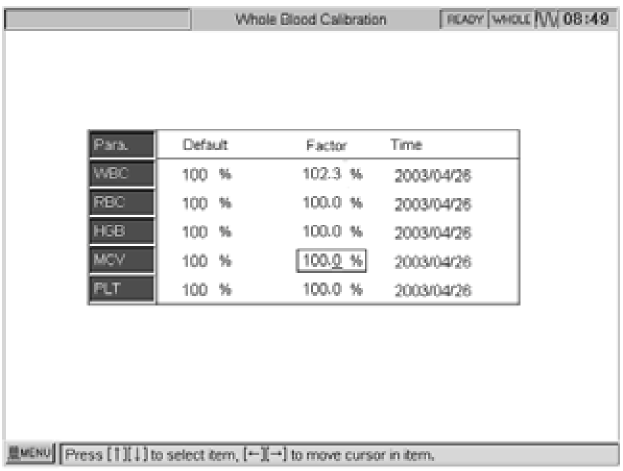


Figure 6-16

After entering the new calibrating factor, press [MENU] key to return to menu operation. The dialog box as shown below will pop up.

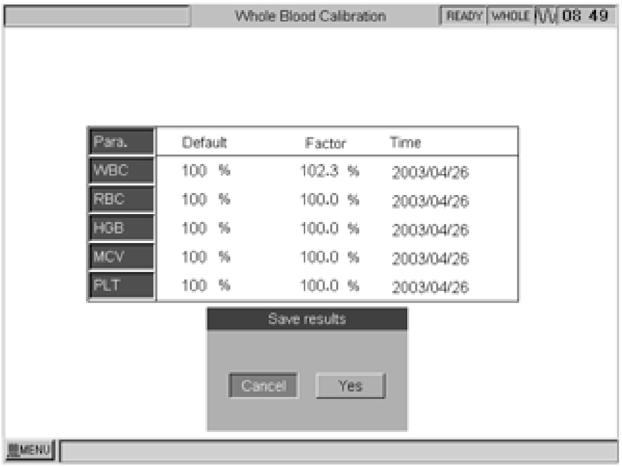


Figure 6-17

Select [Yes], the system will save the new calibrating factor.

3. Use control data to confirm gain

   In whole blood mode, count twice in the Count screen by using control. Calculate the average value of MCV.

$$RBC\ \text{factor} = \frac{MCV\ \text{assay}}{MCV\ \text{measured value}} \times 100 \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

   As shown in figure 6-4, press [↑] [↓] to move the cursor onto “RBC” option, press [←] [→] to modify the factor to make it the same as the calculated result of formula (1).

6.5 Gain of PLT Channel

After confirming the gain of RBC channel, set up the gain of PLT channel.

As shown in figure 6-4, press [↑] [↓] to move the cursor to “PLT” item, press [←] [→] to modify **the current value of PLT to make it the same as the current value of RBC**.

6.6 Gain of HGB Channel

1. As shown in figure 6-4, press [↑][↓] to move the cursor to “HGB” item, press [←][→] to modify the background voltage value of HGB within the range of 4.3-4.5V.

2. Adjust the VR4 and VR3 that on the analog board to adjust HGB background voltage. (VR4 controls HGB base-point voltage, VR3 controls HGB background voltage).

6.7 Adjust Display Brightness

Remove the top cover of the Hematology analyzer, there is a unique Variable-resistance on the CPU board. You can adjust it to modify the display brightness real time.

6.8 Adjust Vacuum and Pressure

VR1 controls vacuum and VR2 controls reference pressure(atmospheric pressure).
VR5 controls pressure and VR6 controls reference pressure(atmospheric pressure).
Vacuum should be at least lower 22Kpa than atmospheric pressure.

6.9 Adjust Count time

Count time is indicating the time of that liquid surface inside the glass tube of the volumetric unit flow from the upper optical coupler to the lower optical coupler.

Under a certain vacuum, the count time is decided by the following factors:

1. Diameter of the aperture
2. Thickness of the aperture
3. Inside diameter of the glass tube
4. Length between the upper and lower optical couplers

For HEMATOLOGY ANALYZER, when the vacuum (negative pressure) is 230mBar, the count time of WBC is between 11.5 and 15 seconds and the flow time of RBC is between 14 and 19 seconds.

After each count, the system will compare the count time of WBC and RBC with the reference count time pre-defined in the system.

If the real count time is 2 seconds longer than the reference count time, the system will give "Clog" alarm.

If the real count time is 2 seconds shorter than the reference count time, the system will give "Bubbles" alarm.

It is forbidden to adjust the vacuum value discretionarily in order to meet the requirement for count time of WBC and RBC.

The reference count time should be reset in the following status:

1. The volumetric metering board or the volumetric glass tube has been changed.
2. The count baths or the apertures have been changed.
3. The analog signal board has been changed or the system vacuum has been adjusted.
4. The system vacuums are excursion because the parts are aging.

Set up the reference count time:

1. Confirm that vacuum error does not occur.
2. Execute "Probe Cleanser Cleaning" in "Service/Maintenance".
3. Execute 6 blank counts and write down the WBC count time and RBC count time of each time.
4. Calculate the average time of the 6 WBC counts and RBC counts.
5. Enter "3000" in the "Setup/Password" screen.

6. Set the WBC count time and RBC count time in the “Setup/Count Time” screen to the average time above.
7. Enter “0000” in the “Setup/Password” screen.

6.10 Adjust Auto Clean Time

The Hematology analyzer should be cleaned after measure 4 hours or 50 samples; it's better for maintenance and making the equipment under good working condition.

1. Refer to Figure 6-13 & Figure 6-14, input password "3000".
2. Move the cursor to "Auto Clean Time" item, press [←][→] to modify the auto clean time.

6.11 Adjust Volumetric Metering Board

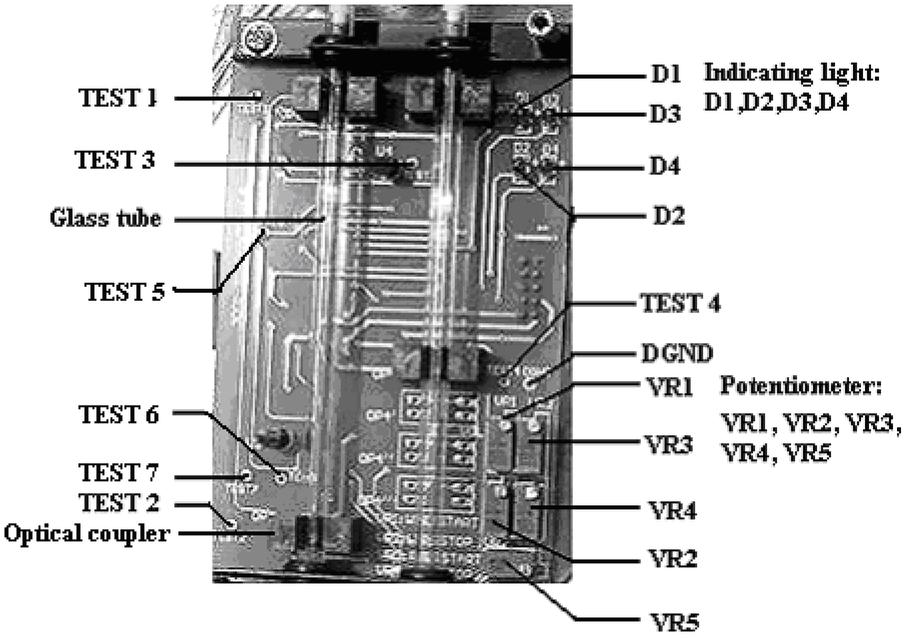


Figure 6-18

The volumetric metering board and two glass tubes construct the volumetric unit. The volumetric metering board consists of four optical couplers, five potentiometers and four indicating lights.

The four indicating lights correspond respectively to the four optical couplers. When there is no liquid inside the glass tubes, the lights are off. When the liquid surface passes through the optical coupler, the corresponding light will light on.

Optical Coupler	Indicating Light	Potentiometer	Test Point
WBC_Start	D1	VR1	TEST 1
WBC_Stop	D2	VR2	TEST 2
RBC_Start	D3	VR3	TEST 3
RBC_Stop	D4	VR4	TEST 4

The volumetric metering board should be adjusted in the following status:

1. The volumetric metering board has been changed.
2. The parts of the volumetric metering board have been changed.
3. The optical couplers status can't correspond to the liquid surface in the glass tubes because the parts are aging.

Tools:

1. digital multimeter
2. slotting screwdriver

The procedures of adjusting the volumetric metering board:

1. Remaining the instrument running.
2. Remove the metal shield box of the volumetric unit.
3. Use the DC 20V level of the digital multimeter, connect the red pen toTEST6 and the black pen to TEST7. Adjust potentiometer of VR5 to make the voltage is 0.55±0.02V.
4. Execute the “Rinse Prime” in “Service/Maintenance” screen to fill the liquid into the glass tubes. Use the DC 20V level of the digital multimeter; connect the black pen to DGND and use the red pen to measure TEST1, TEST2, TEST3 and TEST4. The voltage of each point should be higher than 3.0V.
5. If any voltage is lower than 3.0V, adjust the corresponding potentiometer of VR1, VR2, VR3 or VR4 to make the voltage higher than 3.0V.
6. Press the support rods of valve V7 and valve V17 to empty the liquid in the glass tubes. Use the DC 20V level of the digital multimeter; connect the black pen to DGND and use the red pen to measure TEST1, TEST2, TEST3 and TEST4. The voltage of each point should be lower than 2.0V.
7. If any voltage is higher than 2.0V, adjust the corresponding potentiometer of VR1, VR2, VR3 or VR4 to make the voltage lower than 2.0V.
8. Repeat procedures 4 through 7 until that if there is liquid in the glass tubes, the four indicating lights are on and if there is no liquid in the glass tubes, the four indicating lights are off.
9. Run background count; affirm that the count start time and stop time correspond to the liquid surface in the volumetric glass tubes.
10. Cover the metal shield box of the volumetric unit.

6.12 Re-calibrating Instrument

After setting up the gain, calibrate the instrument again. Refer to the operator's manual of the instrument to obtain the information about calibration.

Chapter 7 Maintenance

7.1 Daily maintenance

If the instrument works day and night or the sample >100 /day, the user should execute "probe cleanser cleaning" operation once every day.
The step is:
Press "MENU" button→ "Service" → "Probe cleanser cleaning"

If quantity of samples more than 50pcs, the user should at least set the "Auto clean time" less than 8hours. It means the user should execute this program once everyday.
The step is:
Press "MENU" button→ "Setup" →"Auto clean time"

If the user turns off the instrument every day, the user should execute "probe cleanser cleaning" operation once every three days.
The step is:
Press "MENU" button→ "Service"→ "Probe cleanser cleaning"

Use E-Z cleanser to execute shutdown program.
Refer to instruction of shutdown program.

Dispose the waste liquid.

Clean the instrument and TFT screen with wet soft cloth. Clean the TFT screen, only water or distill water are available, otherwise will damage the screen.

Check the rest reagents, if the remained regents are not enough, the user should change a new one.

Check the regents' expiration date.

7.2 Monthly maintenance

Use probe cleanser to clean the sample probe wipe block.
The step is:
Press "MENU" button→ "Service"→ "Wipe block cleaning"

Use sample probe localizer to correct the position of the sample probe.
The step is:
1. Press "MENU" button →"Setup" →"Password"→ Input password "3210"→ "Service" →"System test"→ "Fluctuating Motor" to make the sample probe moving up.
2. Loose the screw that fix the sample, then use localizer to adjust the position of sample probe.

Use E-Z cleanser or probe cleanser to clean the baths
The step is:
Press “MENU” button ⟶ “Service” ⟶ “Clean baths”

Calibrate the unit.
Refer to Section 5 “Calibration” of operation manual.

7.3 Half-year maintenance

Replace vacuum filters, if necessary, should replace the pressure filters.
Refer to the item of “Replace Filter” in section 8 “Maintenance” of operation manual.

Delete the old stored data.
The step is:
Press “MENU” button ⟶ “Review” ⟶ “Sample Review” ⟶ Press the button of 5 to delete all of the stored data.

Clean the valves, especially clean the V11 and V12.
All of the disassembling and cleaning procedures please refer to the chapter 5 System Structure.

Clean the two baths and apertures after disassemble them.
Please refer to the chapter 5 System Structure.

Check the stability of HGB background voltage.
The step is:
Press “MENU” button ⟶ “Setup” ⟶ “Password” ⟶ Input Password “3210” ⟶ “Gain” ⟶ Adjust the HGB value

Check the stability of vacuum.
The step is:
Press “MENU” button ⟶ “Service” ⟶ “System Status” or “System test” ⟶ “Vacuum”

Test all valves’ work status.
The step is:
Press “MENU” button ⟶ “Service” ⟶ “Valves test”

Check the status of syringe.

Clean inside of the equipment.

Chapter 8 Spare Part List

P/N	ITEM
3001-10-07046	50ul Syringe
3001-10-07047	10ml Syringe
3001-10-18499	Rotatory Motor (4S42Q-12048)
3001-10-13054	Fluctuating Motor (2S42Q-05640)
3001-10-07050	Syringe Motor
3001-10-07059	Sample Probe
3001-10-07252	Vacuum Pump
3001-20-06898	START Key
3001-20-07274	Keypad Panel(English)
3001-30-18451	Display assembly
3001-20-07072	Transformer
3001-20-07245	3-Way Valve
3001-20-07246	2-Way Valve
3001-30-06860	CPU Board
3001-30-06862	Power Drive Board
3001-30-06864	Volumetric Metering Board
3001-30-06866	Keypad Board
3001-30-06870	Indicator Board
3001-30-06880	Sample Probe Assembly
3001-30-06889	Syringe Assembly
3001-30-06923	CAP Component For Lyse
3001-30-06924	CAP Component For Diluent
3001-30-06925	CAP Component For Rinse
3001-30-06930	RBC Bath
3001-30-06931	WBC Bath
3001-30-06957	Sample Probe Wipe Block
3001-30-07000	Mini-Switch Assembly
3001-30-07021	Vacuum Chamber
3001-30-07131	Power Supply Board(220V)
3001-30-18473	Power Supply Board(110V)
TR6D-30-16662	Recorder Board (TR60-D)
3001-30-07154	Recorder Board
3001-30-07156	Analog Signal Board
530B-10-05275	Pressure Pump

M90-100032---	2.5ml Syringe
3001-30-07175	HGB Unit
900E-10-04913	Inverter(CXA-L0612-VJL 'TDK')
2000-10-03061	Inverter (CXA-L0612-VMR 'TDK')
3001-10-07149	Thermal head (THERNAL EPL2001S2)
59BR-10-08830	Thermal head (ALPS PTMBL1306A)
M30-000015---	Thermal Print Paper(58mm Width)
A30-000001---	Thermal Print Paper(50mm Width)
3001-10-07068	Tubing(ID1/16'、OD1/8')
M90-100035---	Tubing(ID0.02、OD0.06)
M90-100071---	Tubing(ID3/32'、OD5/32')
0000-10-10828	DiskOnModule Disk (64M)
3001-20-07247	Localizer
A22-000005	Sample Cup

Chapter 9 Performance Test

After disassembling or replacing parts or troubleshooting, the following testing must be carried out in order to ensure that the instrument can operate correctly.

Do not use any results reported by HEMATOLOGY ANALYZER for medical and clinical diagnosis before all performance items are satisfied requirement.

Background Check

The background result must satisfy the specification requirement.

Parameter	Background Range	Unit
WBC	≤0.3	$\times 10^9$/L
RBC	≤0.03	$\times 10^{12}$/L
HGB	≤1	g/L
HCT	≤0.5	%
PLT	≤10	$\times 10^9$/L

Calibration

The instrument must be calibrated after disassembling or replacing parts or troubleshooting. Further information and procedures are given in HEMATOLOGY ANALYZER Operator's Manual, Section 5: Calibration.

Imprecision

Two samples from normal, healthy donors were obtained. Precision was evaluated by performing 11 consecutive measurements on these blood samples. One sample is tested in whole blood mode and another is tested in prediluted mode. Calculate the mean coefficient of variation (CV %) of the 10 results except the first sample for the parameters: WBC, HGB, PLT, RBC, and MCV.

Imprecision Specifications

Parameter	Level	Unit	CV%
WBC	7.0-15.0	10^9/L	≤ 2.5
RBC	3.5-6.0	10^{12}/L	≤ 2
HGB	110 – 180	g/L	≤ 1.5
MCV	80.0 – 110.0	fL	≤ 0.5
PLT	200 – 500	10^9/L	≤ 5

Carryover

Carryover was determined for the following parameters: WBC、RBC、HGB and PLT. Analyze the high-level controls for three consecutive times (i1、 i2、 i3) on the HEMATOLOGY ANALYZER and then immediately run background test for three consecutive times (j1, j2, j3). Carryover was calculated with the formula: Carryover (%)= [(j1-j3) / (i3-j3)]×100%

Carryover

Parameter	Carryover	Unit
WBC	≤0.5	%
RBC	≤0.5	%
HGB	≤0.5	%
PLT	≤1	%

Linearity

Run the test in prediluted mode.

Select one extra-high concentration sample each for WBC、RBC、PLT and HGB. Individually analyze WBC、RBC、PLT and HGB according to the linear concentrations of 100%, 80%, 60%, 40%, 20% and 10%. Analyze the sample of each concentration for 2 times. Calculate the average value and use it as the result. Respectively make the linear regression analysis of WBC、RBC、PLT and HGB using two-way analysis of variance.

Linearity Limits

Parameter	Linearity range	Unit	Difference (whichever is greater)
WBC	0.3 ～ 99.9	$\times10^9$/L	±0.3 or ±5%
RBC	0.20 ～ 9.99	$\times10^{12}$/L	±0.05 or ±5%
HGB	0 ～ 300	g/L	±2 or ±3%
PLT	10 ～ 999	$\times10^9$/L	±10 or ±10%

Chapter 10 Histograms and Pulse Graphs

10.1 Histograms

This section demonstrates some usual WBC histograms.

1. Normal histogram

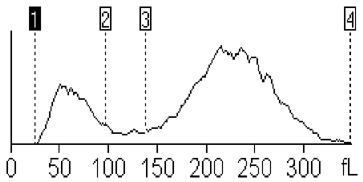


Figure 10-1

⚠**NOTE**⚠:

Blood cells lain between the first and the second discriminators are lymphocyte; those between the second and the third discriminators are mid-sized cells; those between the third and the fourth discriminators are granulocyte. The fourth discriminator is the fixed line.

2. No differential result because the WBC histogram is over-narrowly compressed.

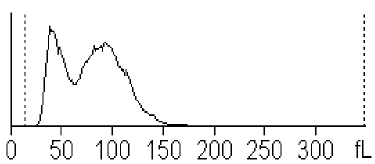


Figure 10-2

3. No differential result because WBC count result is less than a certain value (WBC < 0.5).

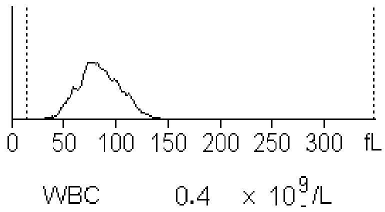


Figure 10-3

4. No differential result because the peak of WBC histogram lies in the middle of the histogram and thus cannot identify the type of peak cells.

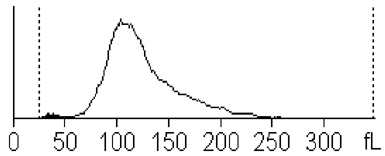


Figure 10-4

5. Increased nucleated erythrocytes or interference or inadequate hemolysis.

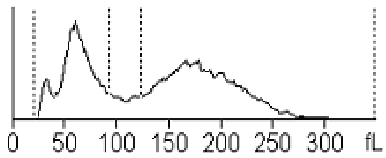


Figure 10-5

6. Severe interference in WBC channel (identifying if it is interfered by observing the pulse graph)

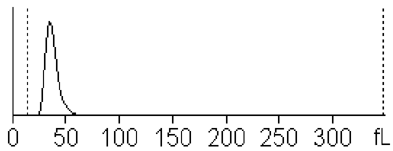


Figure 10-6

7. No lyse reagent or poor hemolysis

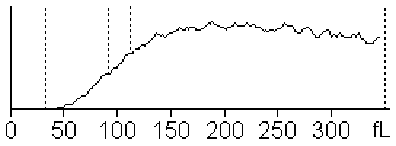


Figure 10-7

8. Increased neutrophilic granulocytes

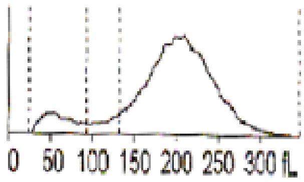


Figure 10-8

9. Increased lymphocytes

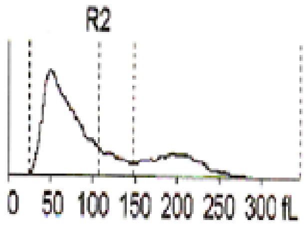


Figure 10-9

10. Tumor patient

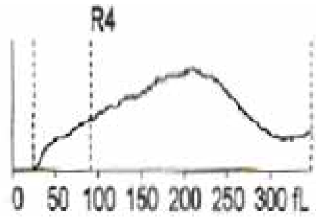


Figure 10-10

11. Increased mid-sized cells

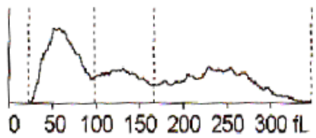


Figure 10-11

10.2 Pulse Graphs

After each count, the system can save the original sampling pulses of this time. We can analyze the reason leading to the fault by viewing these original data.

Enter password “3210”, after a count, you can view the WBC pulse graph of this count by pressing “1” and RBC pulse graph by pressing “2” and PLT pulse graph by pressing “3”. Presses “ENTER” to exit.

When the instrument is working normally, the length of pulse data is related to the concentration of the blood sample. The length of the pulse data should be within a limit range. For general samples, the range should be:

WBC: < 1M RBC: < 600K PLT: < 1M

Data length of abnormal sample will not lie in this range.

Length of normal level controls data should be:

WBC：400 ~ 700K RBC：250 ~ 450K PLT：300 ~ 600K

10.2.1 Normal Pulse Graphs

- WBC pulse graph of normal sample

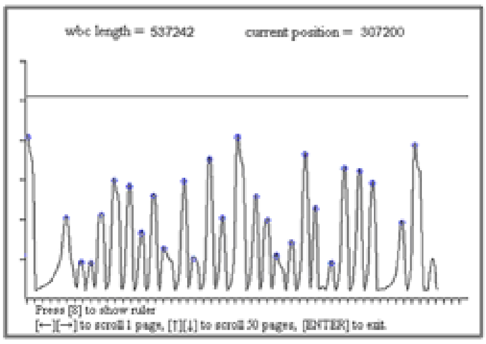


Figure 10-12

- Pulse graph of normal WBC background

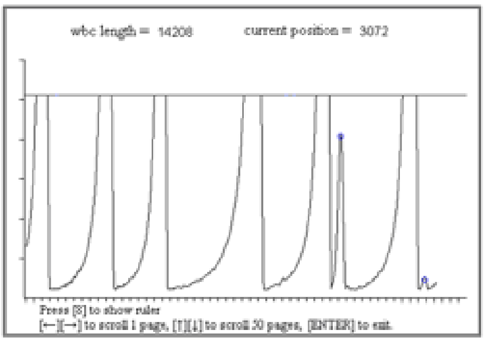


Figure 10-13

● RBC pulse graph of normal sample

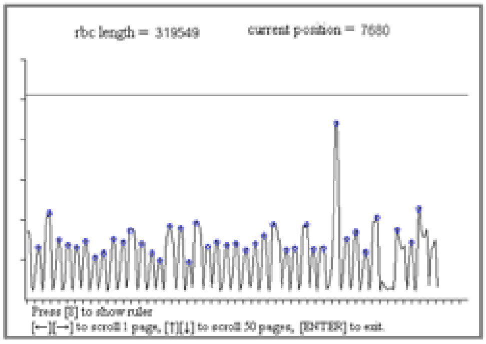


Figure 10-14

● Pulse graph of normal RBC background

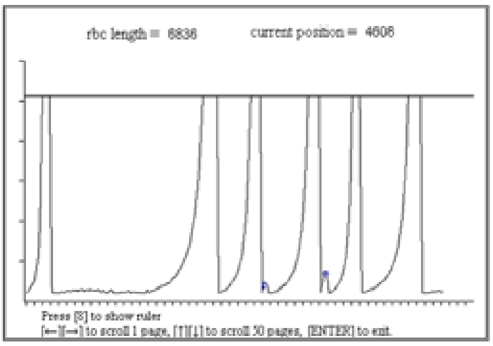


Figure 10-15

● PLT pulse graph of normal sample

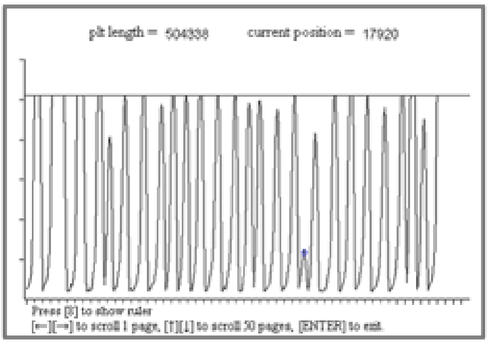


Figure 10-16

- Pulse graph of normal PLT background

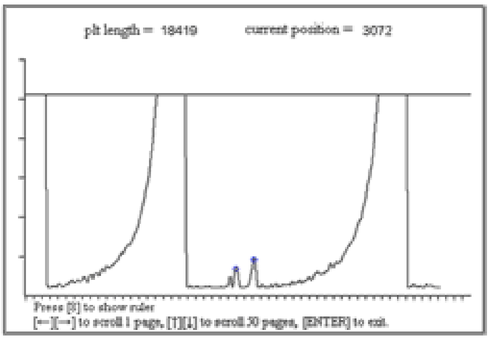


Figure 10-17

10.2.2 Abnormal Pulse Graphs

- Severe interference in WBC channel

  Data length increases obviously (background)

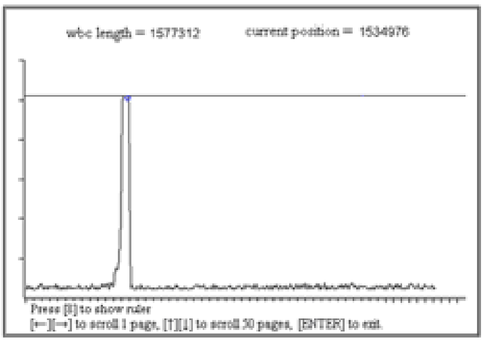


Figure 10-18

- Severe interference in WBC channel

Data length increases obviously (normal sample)

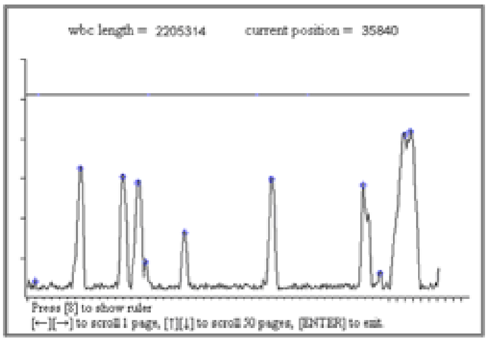


Figure 10-19

- Severe interference in RBC channel

  Data length increases obviously (background)

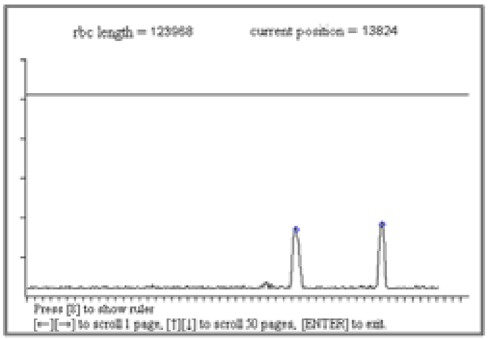


Figure 10-20

- Severe interference in RBC channel

  Data length increases obviously (normal sample)

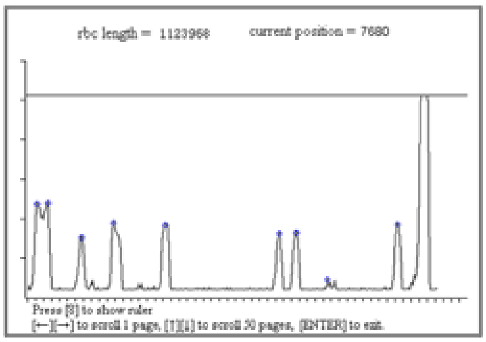


Figure 10-21

- Severe interference in PLT channel

  Data length increases obviously (background)

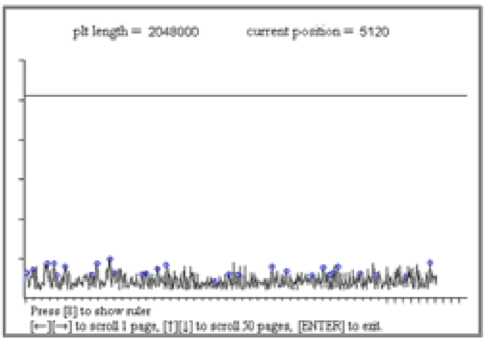


Figure 10-22

- Severe interference in PLT channel

  Data length increases obviously (normal sample)

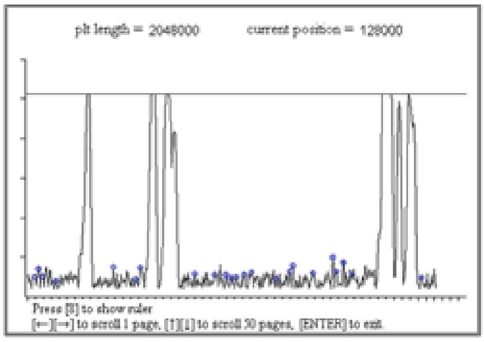


Figure 10-23

- Interference occurs because gain of PLT channel is too large

  Data length increases (background count)

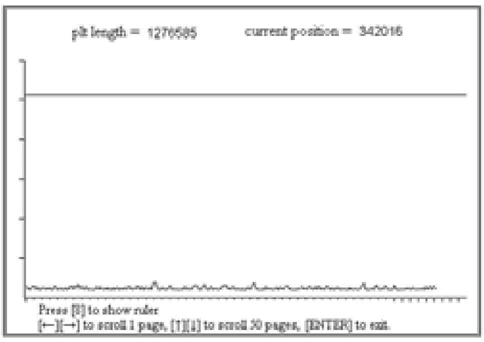


Figure 10-24

- Interference occurs because gain of PLT channel is too large

  Data length increases (normal sample)

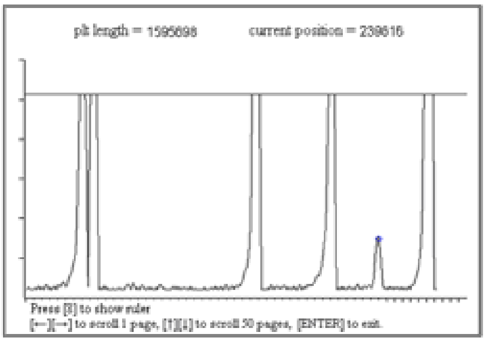


Figure 10-25

- Slight interference in WBC channel

  Data length does not increase obviously (normal sample)

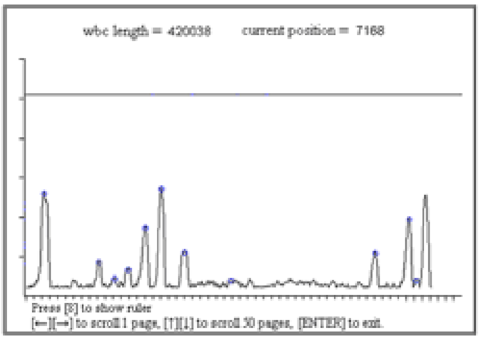


Figure 10-26

- Inadequate or no hemolysis in WBC channel

  Data length increases

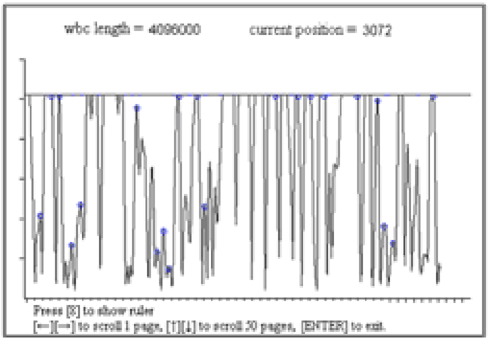


Figure 10-27

- Slight interference in RBC channel

  Data length does not increase obviously (normal sample)

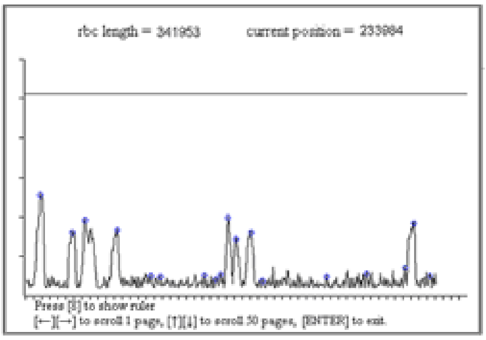


Figure 10-28

● Sample of too dense concentration in RBC channel (Does not occur in normal situation)

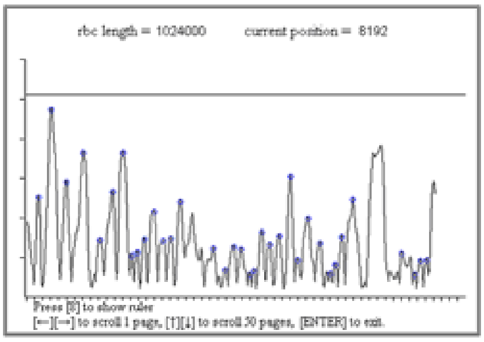


Figure 10-29

● Slight interference in PLT channel

Data length does not increase obviously (normal sample)

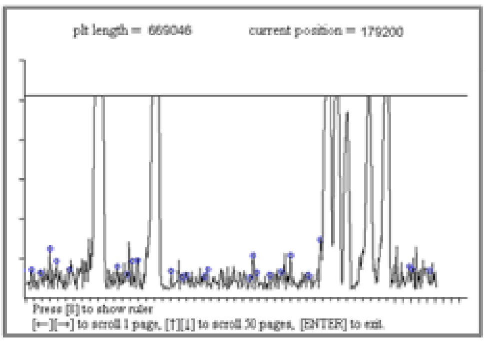


Figure 10-30

● Sample of too dense concentration in PLT channel(Does not occur in normal situation)

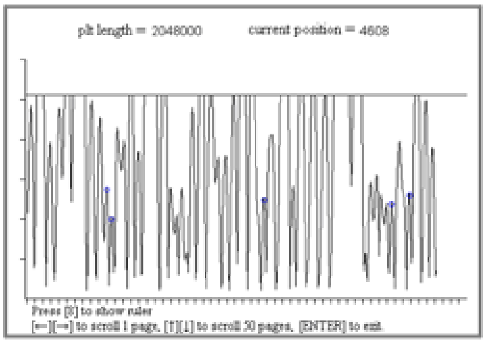


Figure 10-31

- Interference in WBC channel caused by inverter

  Feature: sine wave with cycle of 20～26us

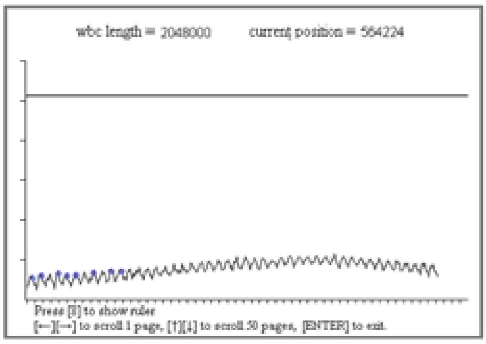


Figure 10-32

- Measuring interference from inverter

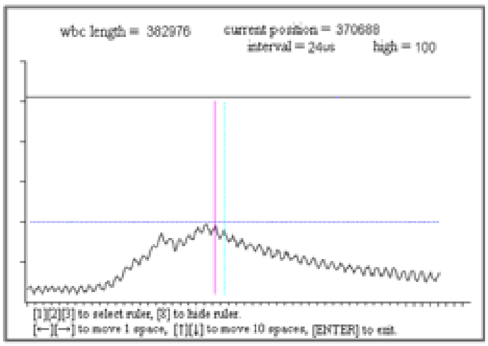


Figure 10-33

- Insufficient liquid in WBC bath during count

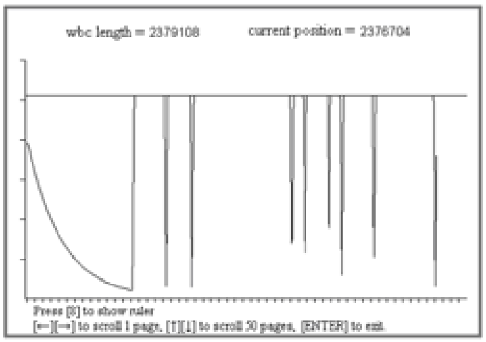


Figure 10-34

- Interference in RBC channel from tubing

  Feature: data length increases, the base line of signal is not stabile.

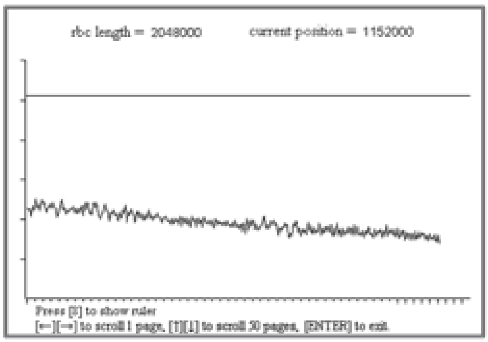


Figure 10-35

- Insufficient liquid in RBC bath during count

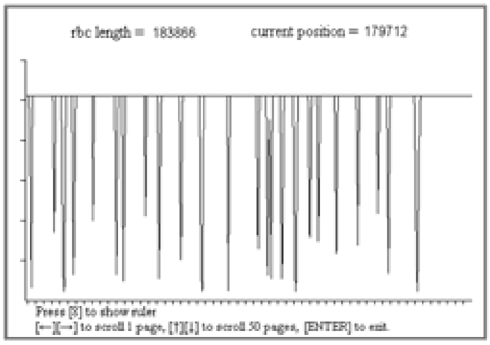


Figure 10-36

- Interference in PLT channel from tubing

Feature: data length increases, the base line of signal is not stabile.

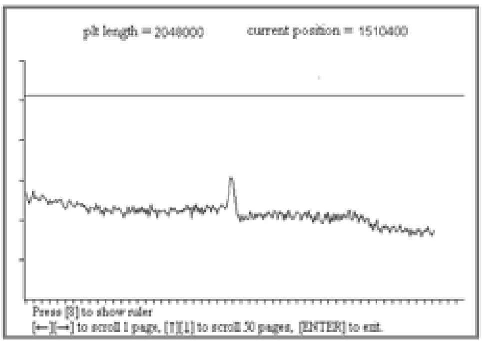


Figure 10-37

- Insufficient liquid in RBC bath during count

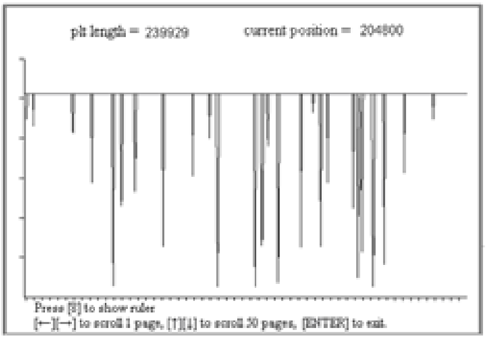


Figure 10-38

- Interference in WBC channel from tubing

Feature: data length increases, the base line of signal is not stabile.

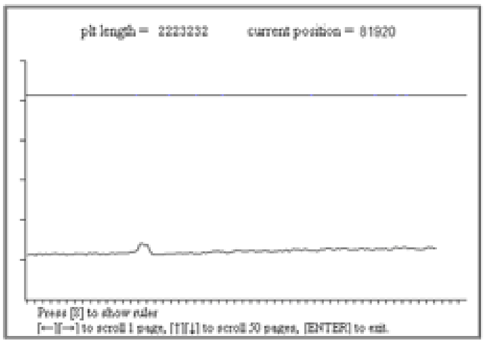


Figure 10-39

Chapter 11 Password and Upgrade software

11.1 Password

HEMATOLOGY ANALYZER software system set more than one password to realize different functions.

Password	Functions
3000	1. Modify the [Count Time] in "Setup" menu. 2. Modify the [Auto Clean Time] in "Setup" menu. 3. Modify the [Gain] in "Setup" menu. 4. Control the rotatory motor and fluctuating motor to replace probe wipe block.
5678	1. Run and print the factory calibration. 2. Calibrate in "Service/System Status". 3. Test the running status of the motor in "Service/System Test".
3210	1. The functions of the expanded keys are valid. allowing: (1) All functions of password "3000". (2) Display pulse graph of sample data. (3) System software upgrade (Shift+F8). 2. Disable functions of the expanded keys after the password set to 3333.
3333	1. Disable functions of the expanded keys. 2. Enable functions of the expanded keys after the password changes to 3210.

11.2 Upgrade System Software

The system software has been set up in the hematology analyzer. After turning on the instrument you can use this method to upgrade the system software in the "Count" screen.

In the process of upgrading program, make sure not to power off the system; otherwise the whole system program may be destroyed and the system will not start up again.

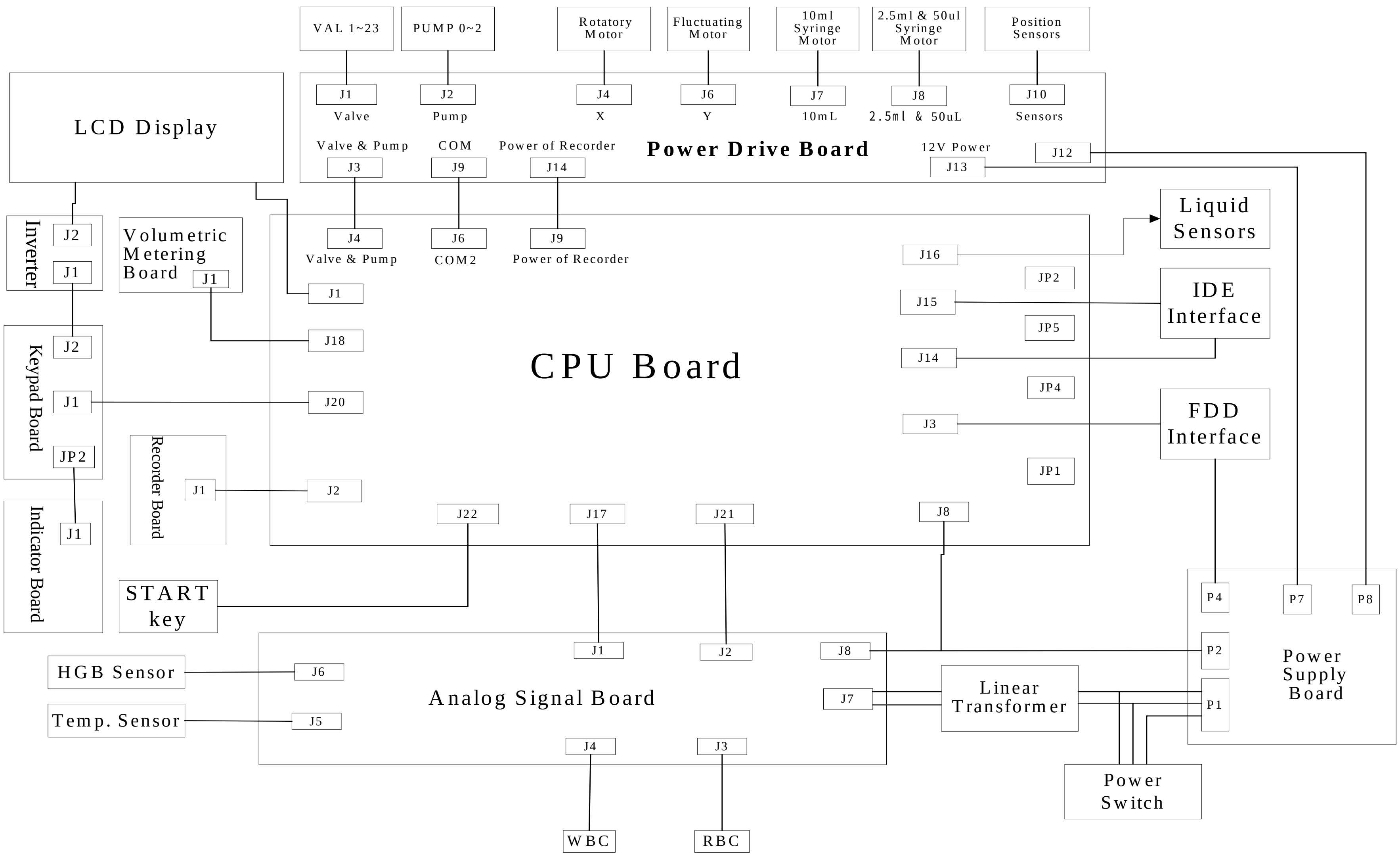
The procedures are as the following:

1. Turn on the hematology analyzer and wait until the system accesses the "Count" screen.
2. In menu operation, move the cursor onto "Setup/Password" and press [Enter] key to access "Password" screen. Enter "3210" and then return to "Count" screen.
3. Insert the floppy disk with HEMATOLOGY ANALYZER upgrade software into the floppy disk driver.
4. Press "Shift+F8" (pressing "Shift" key and "F8" key on the keyboard at the same time), the HEMATOLOGY ANALYZER system software will read the floppy disk and upgrade the program automatically. After the upgrade process has finished, the system will start up automatically.
5. If the upgrade software on the floppy disk cannot be read or found, the system will report error and return "Count" screen automatically.
6. In the process of upgrading the files, if "Floppy open error" is reported, please check if the floppy disk has been inserted and if the floppy disk driver connection is correct. If "Read floppy disk error" or "No update files" is reported, please replace the floppy disk with correct data and execute the operation again.
7. If the upgrade process is failed, the system will automatically restore the software with original version, report error and return "Count" screen automatically.

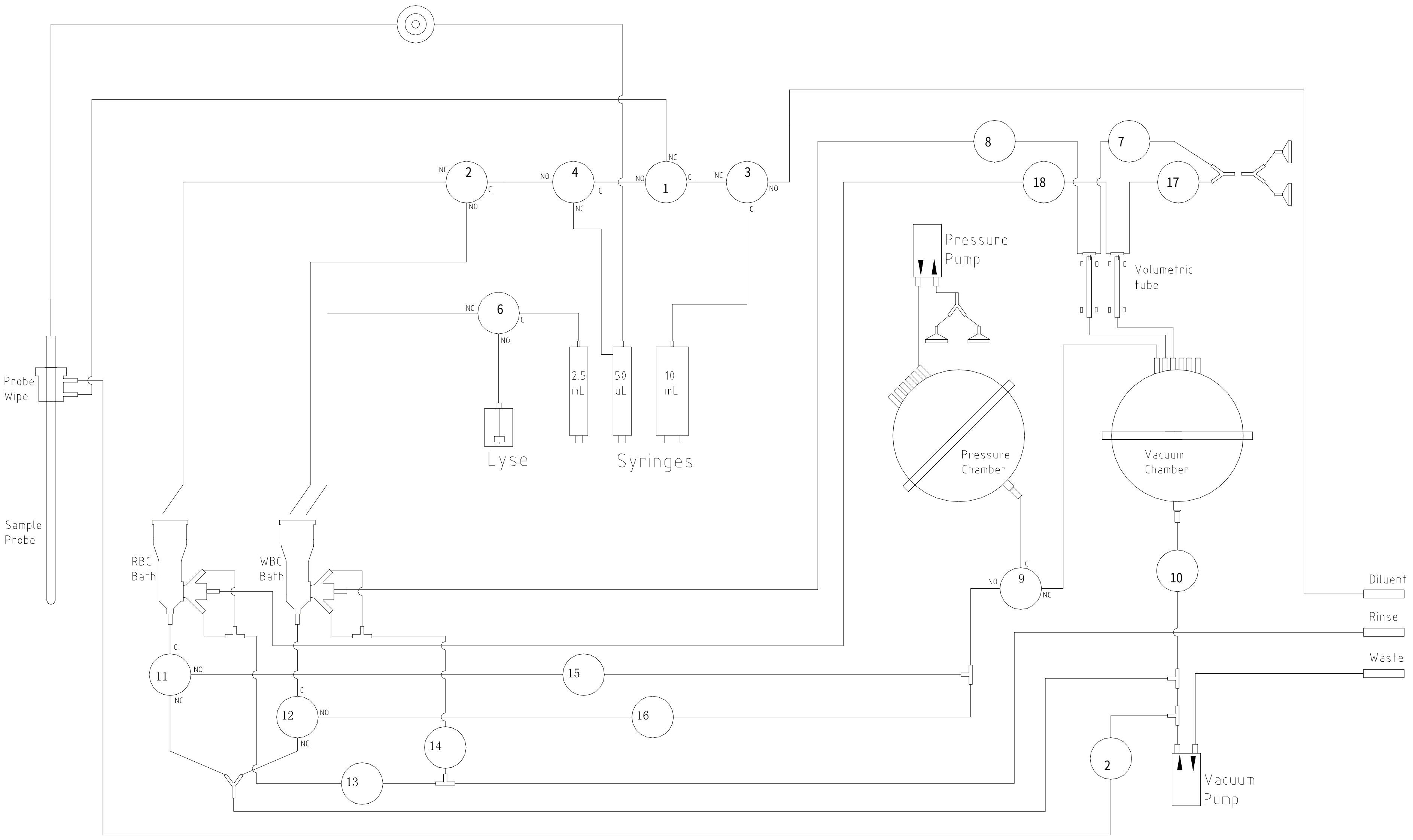
The DiskOnModule disk must be replaced by a new one with the system software if the upgrade process is failed and the instrument can't start up again.

Appendix

Hardware Diagram of BC-3000PLUS



Hydraulic Diagram of BC-3000PLUS



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