
SINNOWA

User's Manual

Sino 005/3/2 Electrolyte Analyzer

Sinnowa Medical Science & Technology Co., Ltd

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1 Introduction

1.1 Working Principle

K⁺, Na⁺, Cl⁻ and Ca⁺⁺ are important constituents of blood. Only if these constituents are in normal range people can keep fit. SINO-electrolyte analyzer is based on ISE (Ion selectivity electrode) for measuring ions, which is quick and accurate. Samples can be whole blood, serum, plasma and urine. Please read the manual carefully before operation.

1.2 Application

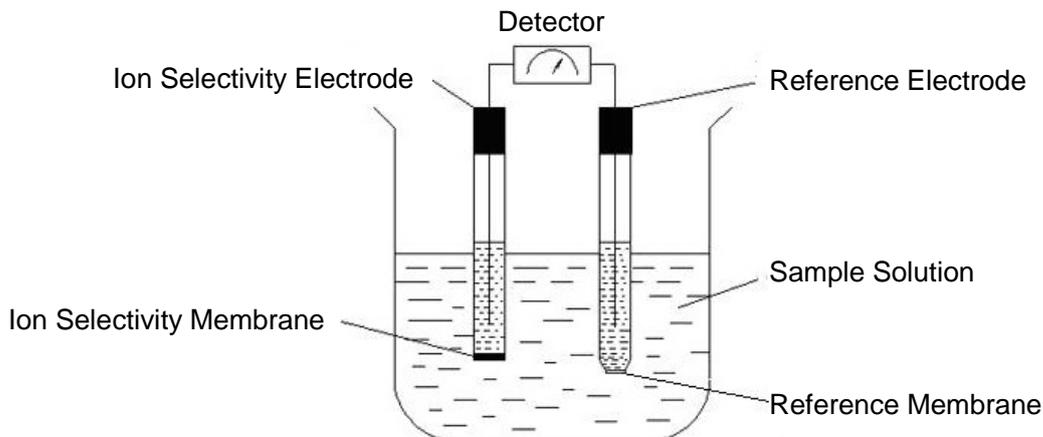
Table 1 Application of EA series

Model	Tested Items
SINO 005	K ⁺ , Na ⁺ , Cl ⁻ , Ca ⁺⁺ , PH
SINO-003	K ⁺ , Na ⁺ , Cl ⁻
SINO-002	K ⁺ , Na ⁺

1.3 Ion Selectivity Electrodes

1.3.1 Introduction

The principle of instrument is based on potentiometry between ion electrode and reference electrode. Most of the salt in electrolyte solution is in ion state. The electronic exchange between electrode and solution forms an electronic flow which represents the ion concentration.



The above reaction follows the formula of Nernst's:

$$E = E_0 + \frac{2.303RT}{nF} \log a_x f_x$$

E-- The voltage value of ion selectivity electrode in the measured solution

T-- Absolute temperature

E₀-- Standard value of voltage of selectivity electrode

F-- Faraday constant

n-- Electric charge of the ion measured

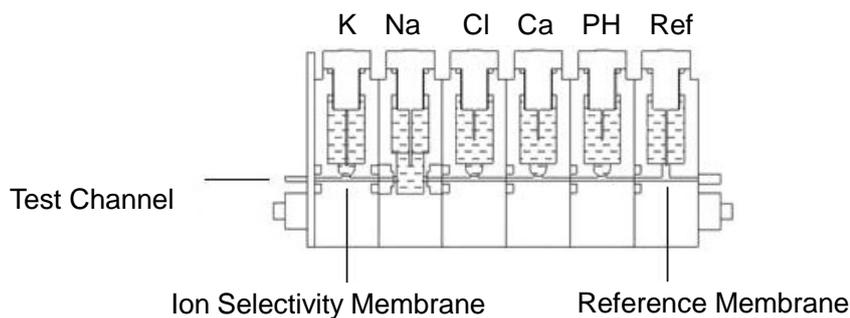
a_x-- The activity of ion measured

R-- Gas constant

f_x-- The activity modulus of the ion measured

1.3.2 The Structure of Sino Ion Selectivity Electrode

Sino electrolyte analyzer measures the concentration of ion by using different models of ion selectivity electrodes, including K⁺, Na⁺, Cl⁻, Ca⁺⁺, PH and reference electrode.

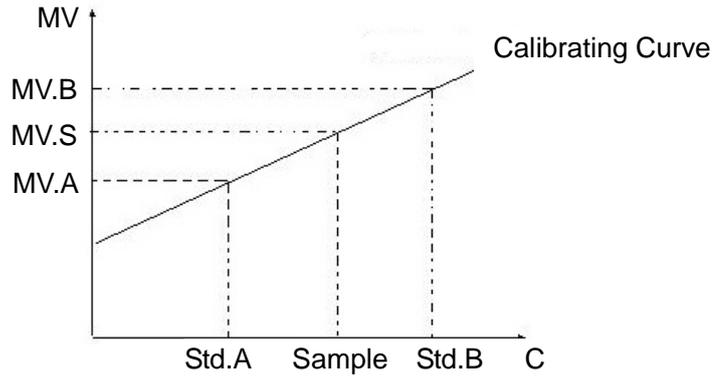


1.3.3 The Principle of Measurement

Electrolyte analyzer measures the concentration of K⁺, Na⁺, Cl⁻, Ca⁺⁺ and PH by the method of comparison. The measurement steps are as follows:

-- Measure two known standard solutions (standard A and standard B) to get the electric potentials and set up calibrating curve.

-- Measure the electric potential difference (MV value) between the sample and reference electrode, and compares it with calibrating curve to get sample's ion concentration. The following figure shows the measurement principle.



1.4 Basic Technical Specifications

Table 2 Basic Technical Specifications

Item	Range	Precision
K	0.5-10mmol/L	CV≤1.0%
Na	50-200mmol/L	CV≤1.0%
Cl	50-200mmol/L	CV≤1.5%
Ca	0.2-5mmol/L	CV≤2.0%
PH	6-9	CV≤1.0%

1.5 The Structure of Analyzer

1.5.1 Appearance

Front view shows as Figure 1. Back view shows as Figure 2.



Figure 1



Figure 2

1.5.2 Main Components

Sino components include electrode holder, pump, valve, waste container and reagent containers, as shown in Figure3.

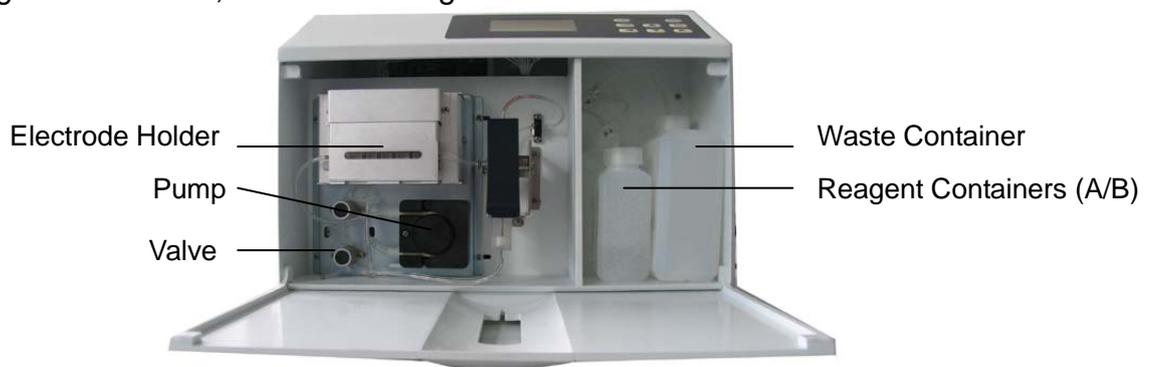


Figure 3

2 Installation

2.1 Working Conditions

Power: 220V 50HZ / 110V 60HZ

Temperature: 10°C-35°C

Humidity: < 85%

Please keep the instrument away from electromagnetism field, heating source, direct sunlight, ultraviolet and radiation. It has to be well ground connected and set in clean environment.

2.2 Reagents and Consumables

Reagents and consumables show in Figure 4 – 9.

Standard A



Fig4.1

Standard B



Fig5

Detergent C



Fig6

Detergent D



Fig6.1

Electrode Electrolyte



Fig7

Reference Electrolyte



Fig8

Print Paper



Fig9

2.3 Installation and Disassembly

2.3.1 Contents Checking

Please check its package and contents referring to packing list as soon as the instrument is received. For any damage or loss, please contact forwarder or our local distributor.

2.3.2 Installation

Installation steps are as follows:

- Place the analyzer on the surface of a table or a desk.
- Open the seal of reagent Standard A and B, insert reagent tube in each container, and position Standard A and B in reagent chamber referring to Figure 3.
- Insert waste tube into the waste container and position the container in the chamber referring to Figure 3.

Notice:

- The end of tube must reach the bottom of reagent container. But the waste tube should be placed on the upside of waste container.



Figure 10

- Check if the electrodes and the holder are fixed well.
- The sequence of electrodes from right to left is K^+ , Na^+ , Cl^- , Ca^{++} , PH and Reference electrode.

2.3.3 Disassembly

The way to disassemble the electrode holder is shown as Figure 11–13.

- a. Disconnect tube as shown in Figure 11.

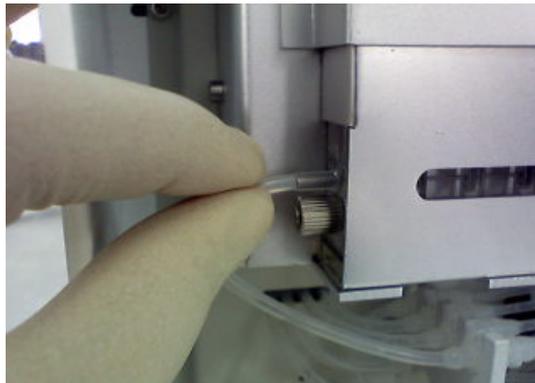


Figure 11

- b. Take out the electrode holder as shown in Figure 12.
Push the bottom of the holder upward a little bit and then drag the holder out.



Figure 12

- c. Check the electrodes and the holder as shown in Figure 13.



Figure 13

3 Operation

3.1 Startup

Switch on.

- “SINO 005” (SINO 003 or SINO 002) shows on screen
- Make ringing sound automatically.
- Show “Flushing! “
- Print “SINO 005” (SINO 003 or SINO 002) automatically with date and time.
- Aspirate standard A, the screen shows “Calibrate A”
- 25 to 30s later, the screen shows as Figure 14

MV	
K=94.6	Na=70.5
Cl=79	Ca=84.2
PH=110.2	

Figure 14

- Aspirate standard B, the screen shows “Calibrate B”
- 25 to 30s later, the screen shows as Figure 15

MV	
K=96	Na=73.2
Cl=85.5	Ca=86.6
PH=112.2	

Figure 15

- The screen shows as Figure 16 after several seconds

P
One-Point Cal.

Figure 16

j. Then the screen shows as Figure 17.

Cal. Passing			
K	YES	Na	YES
Cl	YES	Ca	YES
PH	YES		

Figure 17

When the instrument is ready for testing, the display shows as Figure 18.

Main Menu	
Analyze	QC
Setup	Service

Figure 18

3.2 Main Menu

3.2.1 Analysis

Select "Analyze" and then the screen shows as Figure 19.

Analyze
Blood Analyze
Urine Analyze

Figure 19

3.2.1.1 Blood Analysis

Press **NO** to return to the main menu, select "Blood Analyze" to enter blood analysis program. The screen shows as Figure 20.

Blood Analyze	
ID=000	
YES	NO

Figure 20

Press **YES**. The screen shows as Figure 21

Blood Analyze
Please open probe!

Figure 21

Open probe. The screen shows as Figure22.

Please Press Yes!

Figure 22

Place sample tube under probe and make sure the head of probe reaches the sample. Press **YES**, the analyzer will aspirate the sample and start testing. The screen shows as Figure 23.

Aspirating!

Figure 23

After the sample is aspirated into probe, the probe must be pushed back within 10s; otherwise the analyzer will give alarms. The screen shows as Figure24.

Please Close Probe!

Figure 24

After closing the probe the screen shows as Figure25.

Reading!

Figure 25

When test is finished, the results are displayed (for example) as Figure26.

CONC.	mmol/l
K=4.00	Na=140.0
Cl=100.0	Ca=1.25
PH=7.38	

Figure 26

Then analyzer automatically washes electrode and prints report. The screen shows as Figure27.

Continue?

Figure 27

Press **YES** to test another sample.

Press **CAL**, the analyzer calibrates again.

Press **NO** to return to main menu.

3.2.1.2 Urine Analysis

Choose “Urine analyze” in main menu, the screen shows as Figure 28.

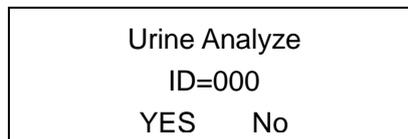


Figure 28

The process is the same as test blood.

Notice: Urine must be diluted by mixing 100ul urine sample with 900ul ion-free water before test.

3.2.2 Quality Control

Thanks to the analyzer’s excellent QC design, we recommend user to perform QC tests upon installation, changing reagent, once a month or in any necessary case. Choose “Q.C.” in the main menu, the screen shows as Figure29.

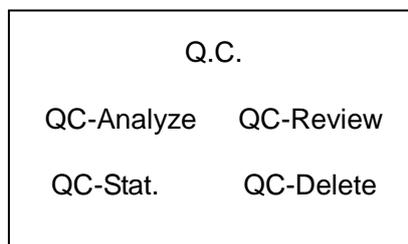


Figure 29

3.2.2.1 QC Analysis

“QC-Analyze” is to check if the analyzer can produce correct result or not. If QC is out of range, the analyzer can not produce correct result and then the user has to check the instrument and the reagent. Sino analyzer can perform three level controls (high, normal and low.). Choose “QC-Analyze “to enter QC analysis program, the screen shows as Figure30.

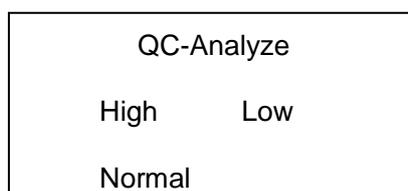


Figure 30

If user wants to analyze the high level, please choose "High". The screen shows as Figure 31.

High	
ID=000	
YES	NO

Figure 31

Press **NO** to return to previous page. Press **YES** to confirm.

3.2.2.2 QC Data Statistic

According to QC test data, the "QC Stat." function can work out three levels of statistics: AVERAGE, SD and CV.

Select "QC-Stat." to enter QC stat program, the screen shows as Figure32.

QC-Stat.	
High	Low
Normal	

Figure 32

Choose "High". If data exists, the screen shows as Figure 33. "11" means 11 QCs are tested and "30" means 30 QC tests can be saved at this level.

High
11/30

Figure 33

Press **YES**, the display shows as Figure34.

Statistic!

Figure 34

The screen shows the statistic data by following sequence: SD, AVERAGE and CV.

First is statistic data of SD level, the screen shows as Figure35.

SD	
K=X.X	Na=X.X
Cl=X.X	Ca=X.XX
PH=X.X	

Figure 35

Press **YES**, the display shows as Figure36.

AVERAGE	
K=X.XX	Na=XXX.X
Cl=XXX.X	Ca=X.XX
PH=X.XX	

Figure 36

Press **YES** again, the screen shows as Figure37.

CV	
K=X.XX	Na=X.XX
Cl=X.XX	Ca=X.XX
PH=X.XX	

Figure 37

Press **YES** again to print out all the statistic data.

Press **NO** to go back to QC menu.

If less than 5 QC tests are stored, the analyzer can not show statistics data and the screen shows as Figure38.

Not Enough Data!

Figure 38

Choose "QC-Review" to review the data.

Choose "QC-Delete" to delete all the data.

3.2.3 System Setup

The system of SINO analyzer has to be set after startup. Choose "Setup" to enter setup menu. The screen shows as Figure39.

Setup	
Time	Parameter
Printer	Others

Figure 39

Set up time, parameter, printer or the model of calibration.

3.2.3.1 Time Setup

Choose “Time” in the Setup menu. The screen shows as Figure 40. Press ↑ or ↓ to change number and ← or → to choose the number to be changed. Press **YES** to save the modification and then return to the Setup menu. Press **NO** to cancel.

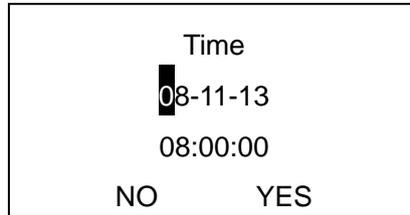


Figure 40

3.2.3.2 Printer Setup

Choose “Printer” in the Setup menu, then the screen shows as Figure 41.

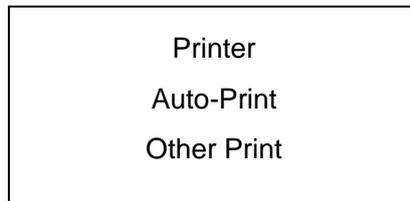


Figure 41

Then choose “Auto-Print”, the screen shows as Figure 42.



Figure 42

Choose **YES** to print every test result automatically.

Set other print function as Figure 43 to activate the print function by selecting each item. Choose **YES** to print, **NO** not to print.

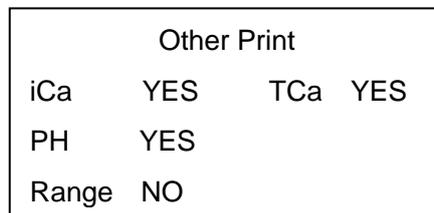


Figure 43

3.2.3.3 Parameter Setup

Choose “Parameter” in Setup menu, then the screen shows as Figure 44.

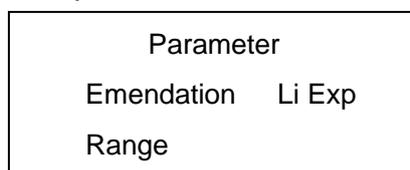


Figure 44

Choose “Emendation”, the screen shows as Figure 45. The accuracy of high value (or middle value) and low value can be changed by adjusting the slope(k). The fixed error of high, normal and low values can be eliminated by adjusting intercept (d).

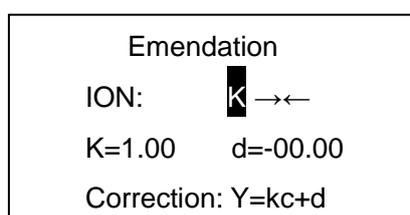


Figure 45

The slope (k) and intercept (d) are obtained according to the calculation of two samples with different concentration and respective target value. According to the four values (two target values: S1, S2 and two measured values: M1, M2), the value of k & d can be obtained through formula:

$$K = \frac{XS2 - XS1}{XM2 - XM1} \quad d = XS1 - K * XM1$$

To get the “K” and “d” value, operator must use two samples with different concentration of the same manufacturer and the same lot, and then calculate “K” and “d” values based on the target values and measured values. The necessary data show in Table 3.

Table 3 The Necessary Data for K and d Values

Test	Sample1		Sample 2	
	Target Value S1 (XS1)	Measure Value M1 (XM1)	Target Value S2 (XS2)	Measure Value M2 (XM2)
K				
Na				
Cl				
Ca				

Calculate the “k” and “d” value, and then input “K, d” into the equipment. If good repetition is obtained, the measured values should be in accordance with the target ones.

The normal range is the test results of healthy people. Choose “Range”, the screen shows as Figure 46.

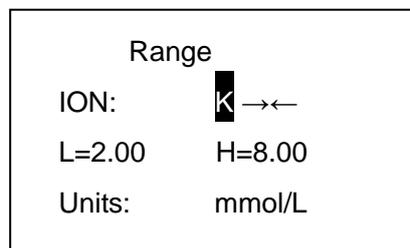


Figure 46

Press ← or → to change the items.

Press **NO** to back to the previous menu. Choose “Li Exp”, the screen shows as Figure 47.

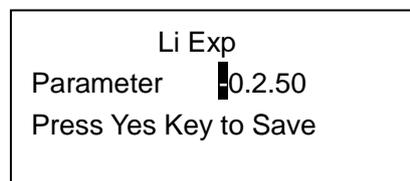


Figure 47

Press  to change the numbers. Press **YES** to confirm.

Li Exp is set for measuring ion Li. There is no need to set it since there is no Li electrode in EA-5/3/2.

3.2.3.4 Other Setup

Choose “Others” in setup menu, the screen shows as Figure 48.

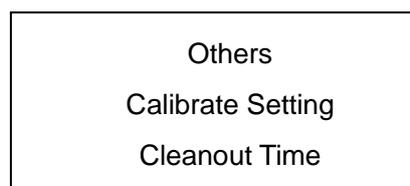


Figure 48

Choose “Calibrate Setting”, the screen shows as Figure 49.

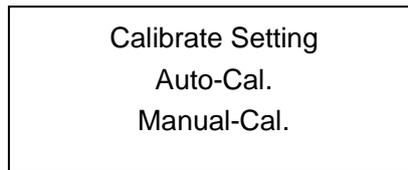


Figure 49

Under “Auto-Cal.”, the device will calibrate automatically after measuring each sample. While under “Manual-Cal.”, users must go back to the main menu to press **CAL** and then the equipment will calibrate. If choose “Manual-Cal.”, please calibrate after each 5-10 measurements.

Choose “Cleanout Time”, the screen shows as Figure 50.

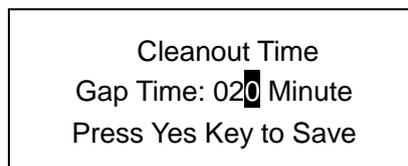


Figure 50

Press ← or → to choose the number to be changed. Press ↑ or ↓ to change numbers.

The range of set value for the time is from 20m to 480m. Original factory default is 20m, which means the instrument flushes every 20 minutes when it is in standby mode to get best cleaning result. If the user doesn’t have large number of samples everyday and wants to save reagents, 60m or 90m is the best.

3.2.4 System Service

SINO analyzer has 4 system service programs as shown in Figure 51.

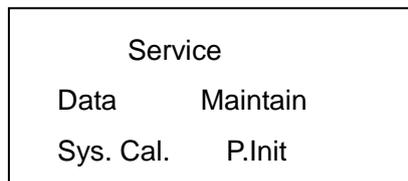


Figure 51

3.2.4.1 System Data

Choose “Data” in the service menu, the screen shows as Figure 52.

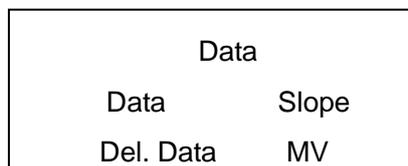


Figure 52

Choose "Data" to show the data of ID, the screen shows as Figure 53.

Blood	100709001
K=0.22	Na=3.7
Cl=6483.8	Ca=0
	PH=8.69

Figure 53

Press **NO** to return to the main menu.

Choose "Slope" to show the electrode slope. The normal range is 20-80. Slope lower than 30 means the electrode is aged and needs to be replaced.

Choose "MV" to show MV value. The MV range of each electrode should be 50-120. If lower than 50MV, the electrode needs to be replaced.

If the electrode MV value is lower than 50, the analyzer can't pass calibration or the measurement is not correct.

Choose "Del. Data" to delete all the data.

3.2.4.2 System Calibration

Choose "Sys. Cal." in the Service menu, the screen shows as Figure 54.

Two-Point Cal.?	
YES	NO

Figure 54

Press **YES**, the device will run two points calibration. It will test Std. A and Std. B to get the slope. Then test Std.A to check if the result is identical to the true value of Std.A. If yes, the calibration is passed, otherwise the screen shows "continue calibrating?". Press **YES** to repeat the process of calibration.

Notice: If system calibration can not pass by 2 continuous times, press **NO** to enter the main menu and repeat the calibration after 30mins or ask local service for help.

3.2.4.3 Maintenance

Choose "Maintain" in the Service menu, the screen shows as Figure 55.

Maintain	
Cleaning	Pump.C
Checking	Update

Figure 55

Choose "Cleaning", the screen shows as Figure 56.

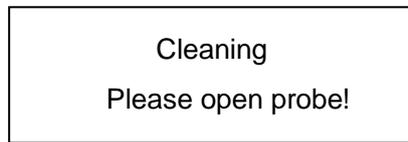


Figure 56

Open the probe to aspirate de-protein solution, then the screen shows as Figure 57.

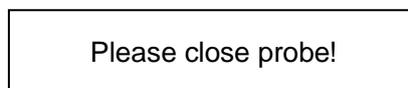


Figure 57

Close the probe, the screen shows as Figure 58.

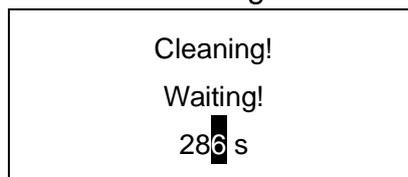


Figure 58

Then remove protein from electrode and tube.

The instrument will return to the previous menu and flush itself automatically after 300s of countdown. Press **NO** to back to the previous menu directly.

Choose "Checking" in the menu, the screen shows as Figure 59.

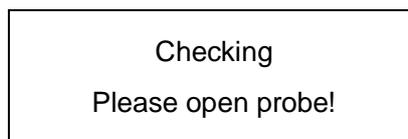


Figure 59

Open the probe, the screen shows as Figure 60.

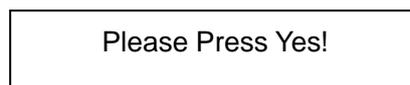


Figure 60

Press **YES**, the device will aspirate Std A automatically. Then the screen shows as Figure 61.

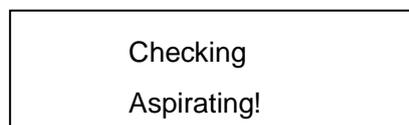


Figure 61

After Std A is aspirated, the screen shows as Figure 62.

Reading!

Figure 62

12s later, the screen shows as Figure 63.

Checking	MV
K= XX	Na=XX
Cl= XX	Ca=XX
PH=XX	

Figure 63

Notice: The MV value will be refreshed in 1s or so. If MV is not stable after 60-second refreshing, it indicates MV is not stable, and the electrode needs to be maintained or changed.

Press **No** to return to previous page.

Choose "Pump.C" in the menu, the screen shows as Figure 64. Valve A and Valve B will open and be tested respectively. No sound being heard means the valves are wrong and need to be checked or replaced.

Please Wait.....

Figure 64

Users do not need to update the system.

3.2.4.4 P. Init

Choose "P.Init" in the service menu, the screen shows as Figure 65. The instrument begins to flush the tubes.

Flushing!

Figure 65

4 Maintenance

4.1 Daily Maintenance

- Check standard A or B.
- Check the waste container is full or not.
- The analyzer must be calibrated after changing reagent.

-- Prevent air into tube. If air bubble exists inside the tube, it will cause error results. There are three ways to eliminate air bubbles:

- a. Start up again.
- b. Repeat calibration so that the air bubble can be removed out of electrode.
- c. Empty the waste container.

Notice: The end of reagent tube must reach the bottom of the bottle.

4.2 Weekly Maintenance

Remove protein and clean the tube with detergent. Protein Removing must be done every week (for large quantity of tests, please do it twice), because it plays an important role in extending the life of electrode.

4.3 Half-Year Maintenance

- Change pump tubing.
- Change electrode electrolyte.
- Electrode electrolyte must be added if the internal solution is reduced, otherwise stability of electrode will be decreased.

When adding electrode electrolyte, please rotate to open the head of electrode, empty the electrode solution and fill it up with electrolyte solution by syringe, then cover the head. The electrode electrolyte does not need to be changed if the electrode works well.

Notice:

-- The electrode sequence should not be reversed; otherwise air bubble will enter the electrode. Please remove air bubble before installing electrodes to the holder.

-- When adding electrolyte solution, the needle of syringe should not enter the electrode to prevent damage to the sensitive membrane.

If the pump tube is used for a long time, the protein will be deposited and cause wrong test result, so the analyzer must be cleaned regularly.

4.4 Shutdown Maintenance

If the Sino Analyzer won't be used in a long period of time, shut it down and maintain it as follows:

- Take out reagent bottle and empty it.

- Rinse to remove reagent inside tube according to startup steps.
- Turn off electrical source.
- Take out the electrode and store it.
- Loose pump tube.

4.5 Precautions

- Sino analyzer must keep 24 hours running for extending the life of electrode.
- Use electrolyte analyzer control (Ion) when performing QC.
- No air-bubble in the sample during test or it must be measured again.
- No air-bubble in the standard solution during calibration or it must be measured again.
- Measure sample as quick as possible. Measurement has to be conducted within 2 hours after the sample is collected.
- Use heparin as anticoagulant.
- Samples must be stored at room temperature, do not be frozen.
- Hemolysis can increase the K value.
- Don't use alkalescent heparin as anticoagulant including EDTA, citrate and Oxalate.
- The best sample is serum, since K,Na and Ca exist in many anticoagulants, which will affect the test results.
- Don't use any unknown reagent to the instrument, because they may destroy the performance of ISE ion electrode.

5 Troubleshooting

Slope of Na or PH out of range

--Enter into menu of SINO: 'Service'--'Maintain', run 'cleaning'. When says 'Press YES to continue', let the machine aspirate the Electrode activation solution as sample, machine will finish this procedure and quit automatically after 300 seconds.

No Electricity Input

Possible causes:

- Power outage.
- Power wire is not correctly linked to electricity source.
- Fuse breakage.

Solutions:

- Shut down the instrument and turn it on again a few minutes later.
- Well connect the power wire.

Deficiency of Repeatability

Possible causes:

- Electrode is not stable.
- Electrode is not activated.
- Leakage between two electrodes.
- Clot exists in electrode.
- Contamination exists in the channel of electrode.
- There is no KCl crystal in the reference electrode.
- The MV value of electrode is lower than 50.
- The slope of electrode is lower than reference slope.
- Strong interference of electromagnetism.
- No enough reagents or reagents have gone bad.

Solutions:

- Calibrate the instrument again after 30 minutes.
- Fix the electrode well.
- Take the electrode away and wipe dust off.
- Clean the instrument with absolute alcohol.
- Replace the reference electrode.
- Calibrate again or replace electrode.
- Remove the interference source and cover the shield correctly.
- Replace reagent.

Low Accuracy

Possible causes:

- "SYSTEM CALIBRATION" is not done.
- "SYSTEM CALIBRATION" can pass but the slope is beyond the limit.
- The veracity of all items is not good.
- The reagents have gone bad.
- k/d is not set.

Solutions:

- Do "SYSTEM CALIBRATION" 2 to 3 times.
- Replace the corresponding electrode or reagent.
- Replace the reference electrode.
- Replace reagent.
- Set k/d.

No Sample Sucked and Air Bubbles Inside Tube

Possible causes:

- Sample probe or tube is blocked.
- Tee connector is blocked.
- Electrode is blocked.
- Tube is aged.
- The tube is broken/ leaked.

Solutions:

- Clean probe.
- Clean channel.
- Clean electrode.
- Replace tube.
- Reinstall tube.
- Replace pump tube.

END

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