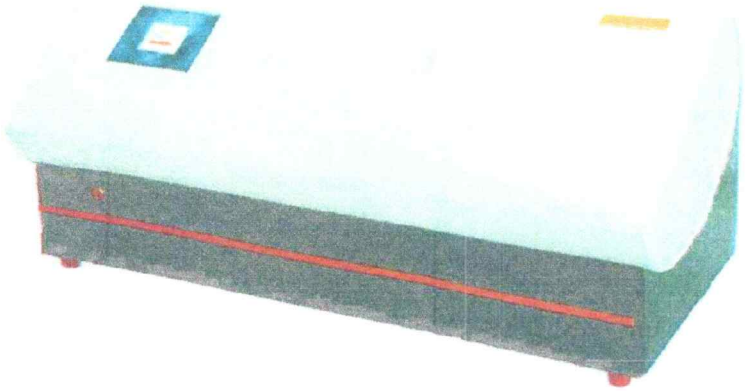


Automatic Polarimeter

Product Manual

CONTENTS

Security

Warning: this instrument is only for laboratory use. If the instrument is damaged in the process of use without following the operation instructions, the manufacturer refuses to bear all consequences.

Warning: if the instrument is not used correctly or the operation is not carried out according to the instructions in the operation manual, the company will not bear the safety problems of the instrument.

Warning: if the instrument is not operated according to the requirements of this manual, the safety performance of the instrument may be weakened.

Warning: please make sure that the water, electricity and air supply of the instrument are closed after the test!(please operate according to the actual situation!)

Warning: please use the power cord provided by company.Other power lines will affect the safety performance of the instrument.

Warning: this instrument is equipped with special power plug for grounding to prevent electric shock.Use a grounded socket.

Warning: danger of electric shock.Only qualified personnel can open the cover and panel.

Note: when the instrument fails, please do not use it, and contact the nearest company service center in time.

Note: this instrument must be repaired by a person authorized by company.Company recommends using original spare parts.If spare parts from other sources are used, the warranty is no longer valid.

Note: unpacking, assembly and installation of the instrument shall be completed by authorized personnel of company.

I. Overview

1.1. Overview

A polarimeter is an instrument for measuring optical rotation of a substance. By measuring optical rotation, the concentration, content, purity, etc. of a substance can be analyzed and determined. Polarimeters are broadly applied in industrial departments like sugar refinery, pharmacy, petroleum, foods and chemical engineering, as well as relevant colleges and universities and research institutes.

The fully automatic polarimeter ("instrument" for short hereinafter) has a light emitting diode (LED) as its light source, thus avoiding the trouble of frequently replacing sodium lamps. The instrument has a built-in Peltier precise temperature control system with heating and cooling functions. If temperature-controlled test tubes are used, optical rotation of samples can be measured in a temperature-controlled way. The instrument is provided with a 8-inch touch screen to provide window-type operation interfaces for human-machine interactions, with simplicity, visuality, comfort, stability and reliability.

II. Instrument Usage

1. Conditions of using instrument

1.1 The instrument shall be installed on a firm workbench to avoid vibration. The instrument shall be peripherally at least 10cm away from the walls to ensure prompt heat radiation.

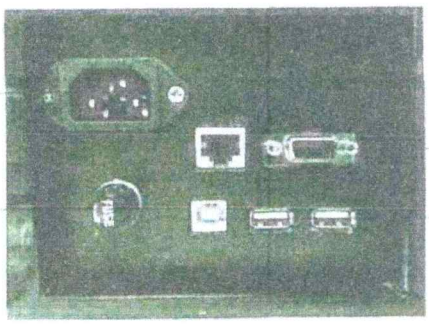
1.2 The instrument shall be kept dry to avoid moisture and corrosion by corrosive gas, and shall be used in a working environment at 20℃ as far as possible.

1.3 The instrument has a 220V 50Hz alternating power supply (an electronic AC voltage stabilizer must be used if the voltage is unstable). Insert the power plug into the power socket and ensure that the ground pin is reliably grounded.

III. Instrument Structure and Principle

1. Instrument view

Instrument front view



2. Basic application principle

As well known, visible light is electromagnetic waves having a wavelength of 380nm~780nm. According to statistical law, corresponding light vibration spreads in all possible directions vertical to the light transmission direction. Amplitudes (light intensity) of corresponding light vectors in all the possible directions are equal to each other. This is usually called natural light. By using some devices (e.g., polarizers), the vibration direction can be fixed in a certain orientation vertical to the light wave propagation direction, forming so-called plane-polarized light. When plane-polarized light passes through a substance, its vibration direction deflects by an angle. This substance is called optically active substance. The deflection angle of polarized light is called optical rotation. If plane-polarized light passes through a pure optically active substance, its optical rotation magnitude is related to the following three factors:

a) Wavelength λ of plane-polarized light: different wavelengh leads to different optical rotation.

b) Temperature t of the optically active substance: different temperature leads to different optical rotation.

c) Type of the optically active substance; different optically active substances lead to different optical rotation.

A magnitude called specific rotation $[\alpha]_\lambda^t$ is used to represent optical rotary power of a substance.

It is generally regulated that optical rotation measured when the polarization tube length is 1dm (100mm), the solution concentration of the substance to be measured is 1g/mL, the temperature is t℃ and the wavelength of plane-polarized light is λ is called specific rotation of this substance, which is represented by

$[\alpha]_\lambda^t$. Specific rotation is decided by the substance structure only; therefore, it is a physical constant specific to a substance.

$$\alpha_\lambda^t = [\alpha]_\lambda^t \bullet L \bullet C \qquad (1)$$

In the formula, L is length of the test solution (optical rotation test tube), and the instrument length unit is mm; C is concentration of the optically active substance in the test solution, and the instrument usually has the concentration represented by grams of the optically active substance per 100mL of solution.

If the specific rotation $[\alpha]_\lambda^t$ of the test substance is known, according to the optical rotation α_λ^t measured with certain wavelength and at certain temperature and the test solution length L, concentration C of the optically active substance in the solution can be calculated based on Formula (2).

$$C = \alpha_\lambda^t / [\alpha]_\lambda^t \cdot L \qquad (2)$$

If a non-optically-active substance is contained in the solution in addition to the optically active substance, content or purity of the optically active substance can be calculated according to the concentration used during solution preparation and concentration C of the optically active substance obtained from Formula (2).

3. Optical null principle

Letting natural light pass through the polarizer and analyzer, with the null position being the position where the light transmission directions of the polarizer and analyzer are orthogonal to each other, relationship between the angle α of the analyzer from the orthogonal position and intensity I of incident light of the analyzer, according to the Malus law, is as follows:

$I=I0COS2\alpha$

It is shown by curve A in Fig. 1.

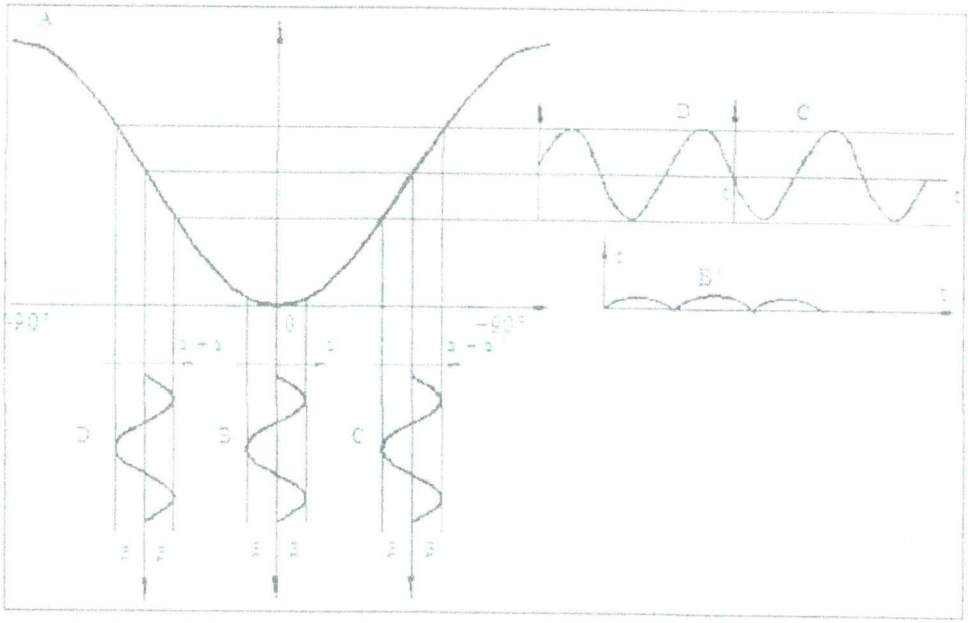


Fig. 1

When sinusoidal alternating voltage $u=Usin2\pi ft$ with frequency f is applied at the two ends of the Faraday coil, according to the Faraday magneto-optic effect, an additional rotation angle will be superposed on the vibration plane of the passing-through plane polarized light: $\alpha1=\beta\cdot sin2\pi ft$. If a Faraday coil exists between the polarizer and analyzer, intensity signal of the emergent light of the analyzer will be as follows:

a)At the orthogonal position, it can be derived that light intensity signals of the curves B and B' in Fig. 1 is a constant light intensity supplemented with an alternating light intensity with frequency 2f.

b)At an offset position in the right of the orthogonal position, it can be derived that light intensity signals of the curves C and C' in Fig. 1 is a constant light intensity supplemented with an alternating light intensity with frequency f, as shown by

curve C'.

c) At an offset position in the left of the orthogonal position, it can be derived that light intensity signals of the curves D and D' in Fig. 1 is a constant light intensity supplemented with an alternating light intensity with frequency f, as shown by curve D'; but the alternating light intensity phase is just opposite to that at the right offset position.

Therefore, it is necessary to judge if the alternating light intensity with component f in the light intensity signal is zero. It can be accurately judged if the polarizer and analyzer are at the orthogonal position, the phase of the alternating light intensity with component f can be judged, and it can also be judged if the polarizer is at an offset position in the left or right of the orthogonal position.

4. Instrument Structure

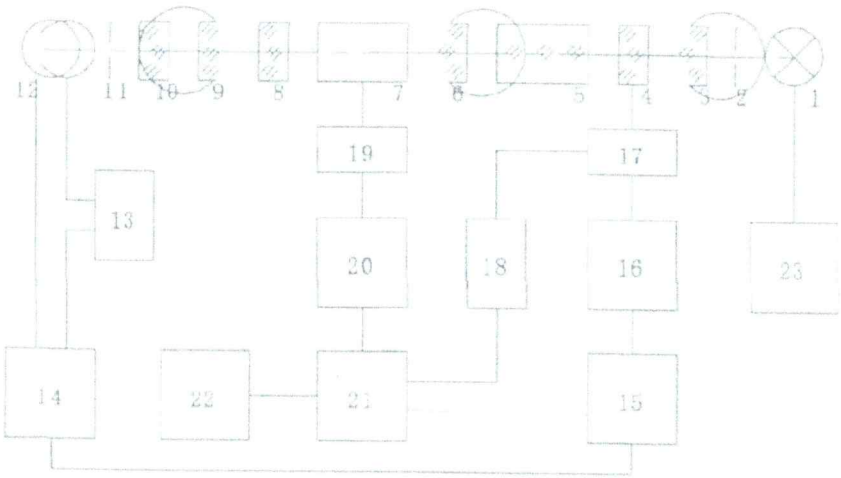


Fig. 2

1. LED	2. Diaphragm	3. Condenser lens
4. Polarizer	5. Modulator	6. Collimating lens
7. Test tube	8. Analyzer	9. Objective lens
10. Color filter	11. Diaphragm	12. Photomultiplier

13.Automatic high voltage	14. Pre-amplification	15. Motor control
16. Servo motor	17.Mechanical transmission	18. Rotary coding and counting
19.Heating and cooling	20.Temperature control	21. SCM control
22.Liquid crystal display	23.Light source power supply	

Fig. 2 is the structural block diagram of the instrument. Light emitted from the LED passes through the diaphragm, condenser lens, polarizer, Faraday modulator and collimating lens in sequence. A beam of plane polarized light that has been collimated with the vibration plane varying

along with the alternating voltage in the Faraday coil is formed, is emitted into the analyzer via the test tube containing the solution to be tested, and then enters the photomultiplier via the receiving objective lens, color filter, diaphragm and monochromatic light with wavelength 589.3nm. The photomultiplier converts the light intensity signal into an electric signal which is then amplified by the pre-amplifier. Automatic high voltage means that high voltage of the photomultiplier automatically varies along with the light intensity emitted into the photomultiplier, so as to meet the need of measuring dark samples with low transmittance.

If the analyzer deviates from the orthogonal position with respect to the plane of the plane polarized incident light, the light intensity signal will be converted by the photomultiplier into an electric signal with frequency f through an alternating light intensity signal with frequency f. The electric signal will be input into the motor control part via the pre-amplifier, and will then, through frequency selecting and power amplification, drive the servo motor to drive rotation of the polarizer through mechanical transmission, so that the polarized light plane generated by

the polarizer and the analyzer will reach the orthogonal position, the electric signal with frequency f will disappear, and the servo motor will stop running.

Once the instrument starts to run as normal, the polarizer stops at the orthogonal position automatically by following the above process. At this time, the counter is cleared to zero and the position is defined as the null position. When the test tube containing the sample with optical rotation α is put into the sample chamber, the plane polarized incident light deviates from the orthogonal position from the analyzer by an angle α, and then the polarizer turns the polarized light by an angle α again by following the above process, to obtain a new orthogonal position. The rotary encoder counter and SCM circuit convert the angle α turned by the polarizer into optical rotation, and the measurement result is displayed on the liquid crystal display.

The instrument has a temperature controller to control sample temperature. To control the temperature, a temperature-controlled optical rotation test tube shall be used. Actual temperature of the polarization tube is measured by a platinum resistor and input into the SCM. The temperature value is displayed on the liquid crystal display. At the same time, a temperature control signal is sent to a temperature control circuit to control the semiconductor cooler to cool down or heat, so as to keep the polarization tube temperature close to the set value. Operations can be done on the liquid crystal screen with keys, to enable or disable temperature control.

IV. Operating conditions of the instrument

1.1 Technical index

a、Measurement mode:Optical rotation, specific rotation, concentration and international sugar degree

b、Light source:LED, with a service life of 100,000 hours

c、Operating wavelength:589.3nm(sodium D spectrum)

d、Measurable min. sample transmittance:1%

e、Measurement range:±89.99°(optical rotation)

f、Min. reading:0.001° (optical rotation)

g、Indication error:±0.01° (-45°≤optical rotation ≤+45°)

±0.02°(polarimeter <-45° or optical rotation >+45°)

h、Repeatability (standard deviation):0.002° (optical rotation)

i、Temperature control range:10℃-50℃ (below room temperature of 20℃

j、Temperature control stability:±0.1℃

k、Temperature control accuracy:±0.3℃

l、Resolution:±0.1℃

Note: all index parameters are measured at the ambient temperature of 23℃ and the power supply of 220V 50Hz

1.2 Technical specifications

a、Display mode:8 inch, 1.902×1.080p_50HZ resolution, true-color TFT, touch, large-screen liquic crystal display

b、Test tube:Ordinary type: 200mm and 100mm

c、Temperature-controlled type: 100mm

d、Instrument external interfaces:1 USB_B interface, 2 USB_A interfaces, 1 RS232 serial interfaces and 1 network interface

e、Power supply:AC 220V±22V, 50Hz, 250W

f、Instrument dimension:708mm×330mm×287mm

g、Instrument net weight: 26kg

2. Instrument interfaces and usage

2.1. Login interface

Start up the instrument, and wait a moment until the screen jumps to the login window (there's no need to login by default; login at the time of startup can be set in the user interface), as shown in Fig. 3:

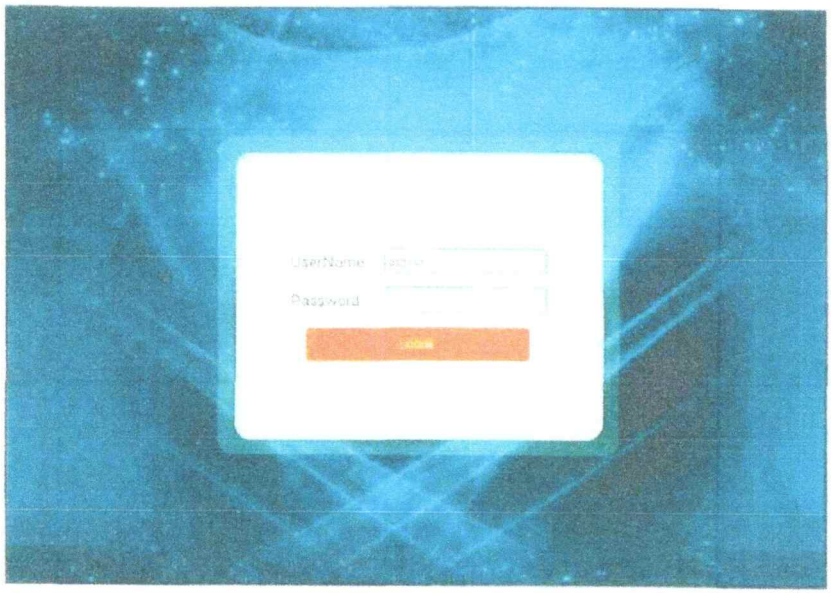


Fig. 3

Enter the login interface, input the user name and password, and click LOGIN to go to the test interface.

Administrator user name: admin Default password: 888888.

Note: keep the administrator password in mind. Please contact the manufacturer if you forget it.

2.2 Main interface and menu bar

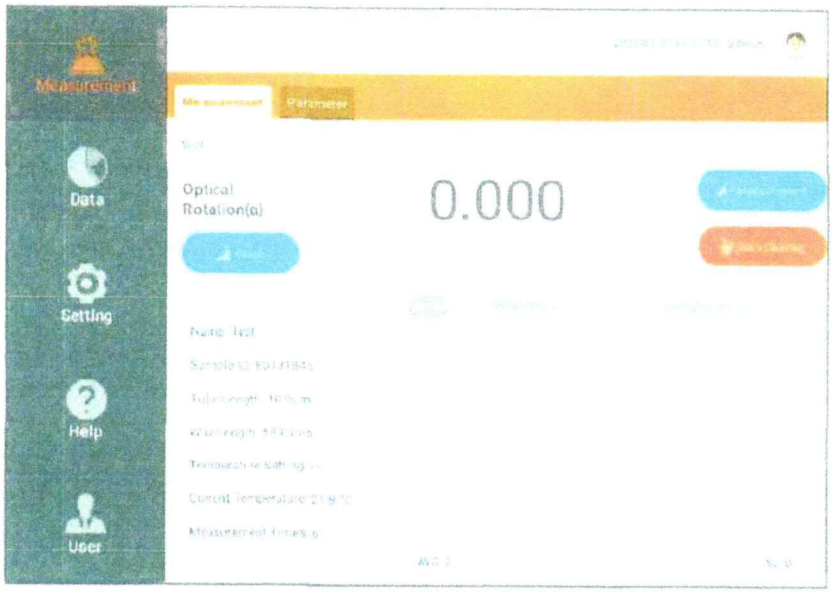


Fig. 4

There are 5 menu items in the left part of the main interface: Measurement, Data, Setting, Help and User. The right part shows the Measurement interface by default after startup. Click Menu at the upper left corner and the menu bar in the left part of the main interface will pop up.

2.3. Measurement interface

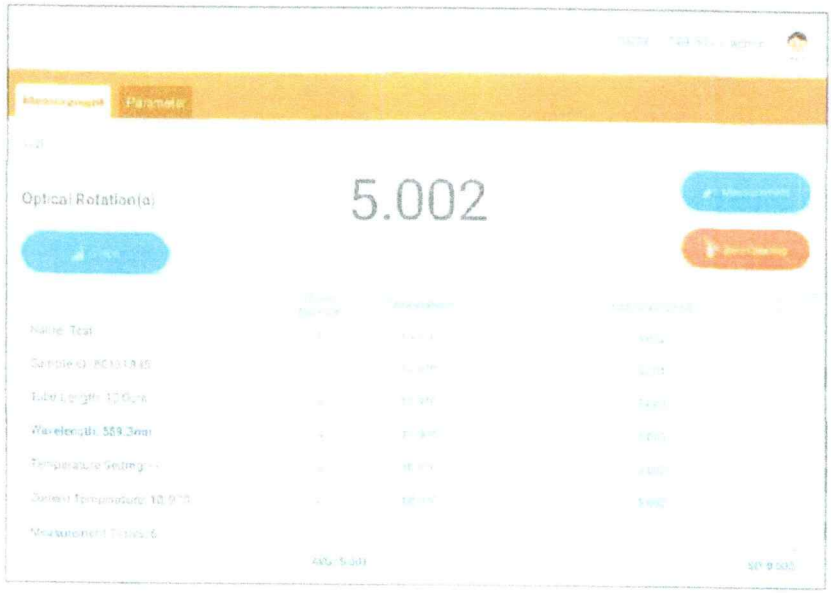


Fig. 5

In this interface, the user can perform measurement or zero clearing to display the current measurement data and data graph.

Measurement: the instrument starts measurement and records the measurement data, during measurement, do not successively click on the Measurement button.

Zero Clearing: reset the measurement data to zero and clean the data in the data field below.

Parameter: in this field, the user can see the sample name, sample No., test tube length, wavelength, temperature and measurement times that have been set and the temperature acquired in real time.

Graph: click Graph to hide the data items and show the graph box as shown in Fig. 6.

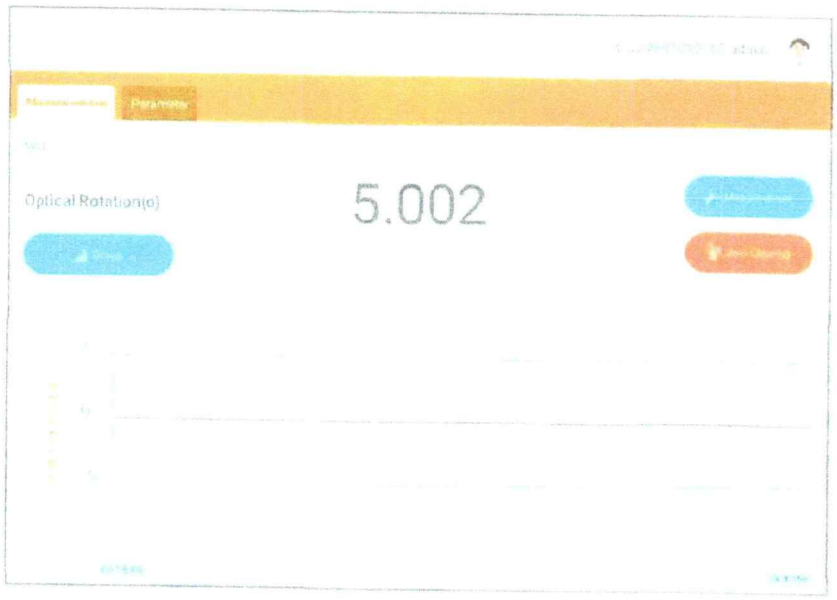


Fig. 6

The left end shows the optical rotation data range, and the two lower ends show the time range. One piece of real-time data is acquired from the graph once every second.

2.4 Instructions for parameter setting interface

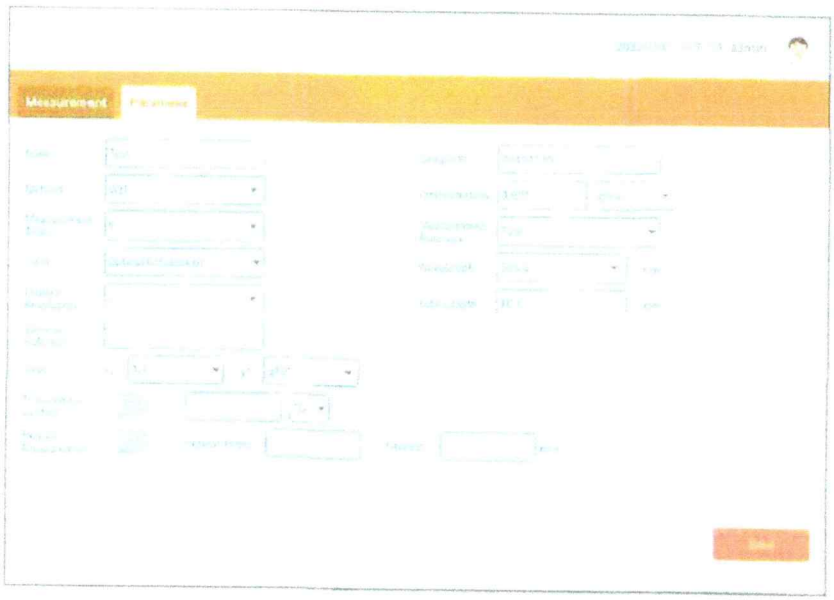


Fig. 7

Before measurement, click the secondary menu Parameter to set the parameters, as shown in Fig. 7.

There are two parameter setting methods:

Method 1: set temporary parameters based on your test; after setting, you may save them without selecting the measurement method.

Method 2: click the dropdown menu of Method, and select a measurement method that has been saved (measurement methods can be set or added in Method Setting Management in the Setting page).

Function description of interface in Fig. 7:

Name: fill the name of the sample to be measured.

ID: the sample No. can be set.

Method: select an existing measurement method; if the method conforms to the measurement requirements for this time, you can measure without modifying other parameters.

Concentration: input the sample concentration; it is mandatory when the result type is specific rotation; it is in g/L, g/ml or g/100ml.

Measurement Times: times of automatically repeated measurement of the instrument, ranging from 1-6.

Measurement Accuracy:fast measurement or high-accuracy measurement.

Index: optical rotation, specific rotation, concentration and international sugar degree.

Wavelength: 589.3nnm by default.

Display Precision: number of decimal places.

Tube Length: input length of the test tube, which is mandatory in the specific rotation or concentration mode.

Specific Rotation: input specific rotation of the sample, which is mandatory when the result type is concentration.

Graph: select the time range in X axis of the graph: 1H, 2H or 4H; select the optical rotation data range in Y axis: ±10, ±20, ±30, ±40, ±50, ±60, ±70, ±80 or ±90.

Temperature: you can choose to enable or disable the temperature control function; after enabling it, input the set temperature value, and choose the temperature unit; the temperature range is 10℃~50℃.

Automatic Measurement: after enabling Automatic Measurement, fill the measurement repeat times and interval between each measurement; the repeat times range from 1~60.

Note: parameter setting cannot be saved if the measurement has not completed yet.

2.4.1 Description of temperature control

To measure the sample in temperature control mode, the temperature-controlled optical rotation test tube must be used.

Charge the test tube with the sample, and make sure that there's no bubble in it. Put the temperature-controlled test tube containing the sample into the sample chamber, attach the heat conducting plane of the test tube closely to the heat transmission plane of the sample chamber, insert the temperature sensor into the thermometer hole of the temperature-controlled test tube, and close the sample chamber cover.

Note: make sure to insert the temperature sensor into the thermometer hole of the temperature-controlled test tube, so that the temperature can be

controlled normally.

At this time, the sample temperature begins to change toward the set temperature, until reaching the set value. When the temperature gets stable, repeat measurement for more times, to ensure that the measurement results are correct.

Before removing the temperature-controlled test tube or when temperature-controlled measurement is not performed, enter the temperature control interface and click the button for disabling temperature control, so that temperature control is disabled.

2.5 Instructions for data interface

Click Data in the menu bar and the data interface will pop up, as shown in Fig. 8.

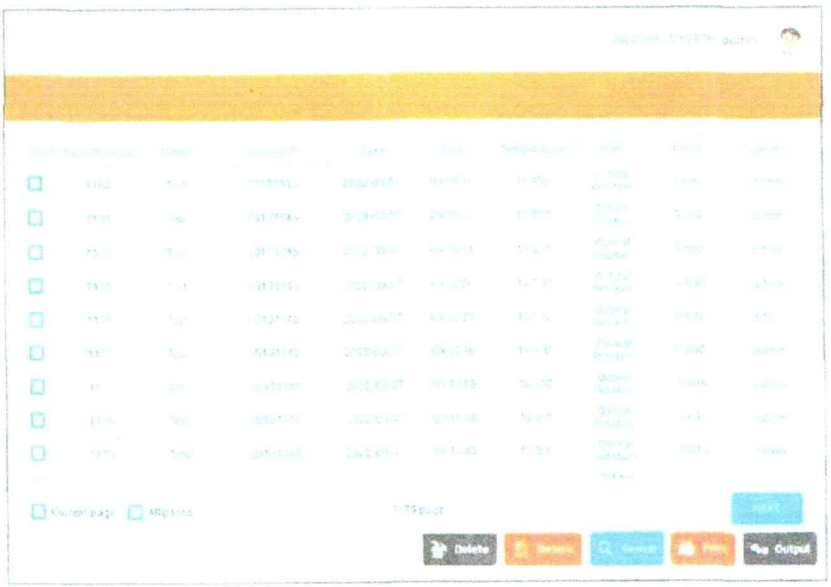


Fig. 8

The serial number, sample name, sample No., measurement date, measurement time, temperature, result type, measurement value and operator of the measurement data are recorded in the data interface. Among them, the serial number increases consecutively. The data can be deleted, checked for details,

searched, printed and output.

Delete: delete selected data, which can be a single piece of data, a single page of data or all data.

Details: select a single piece of data, click Details, and a box as shown in Fig. 9 below will pop up, from which more detailed measurement information can be seen.

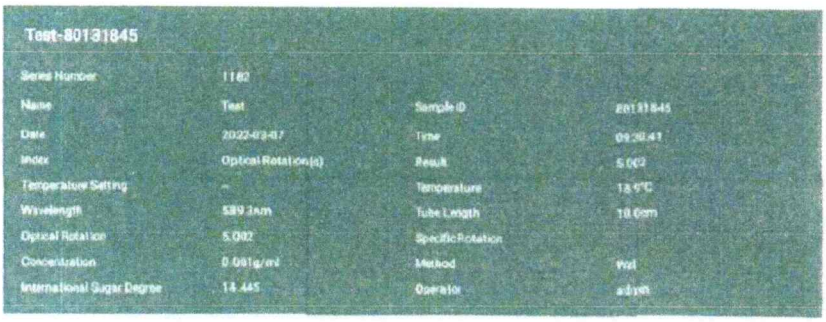


Fig. 9

Search: click Search and a box as shown in Fig. 10 below will pop up, in which the date range, sample name, operator and data range can be set, with either single or multiple search conditions; after setting, click Search.

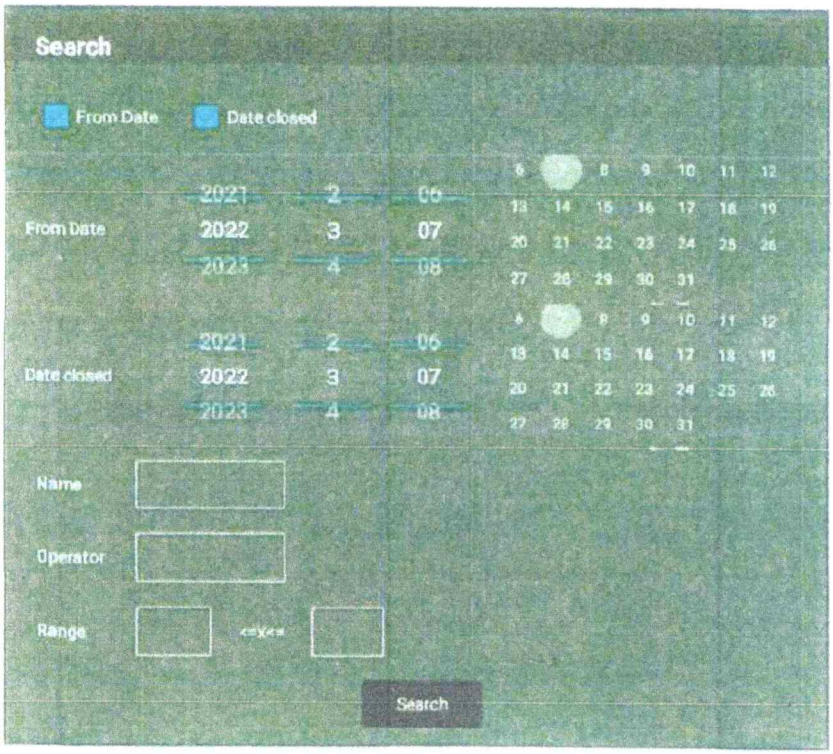
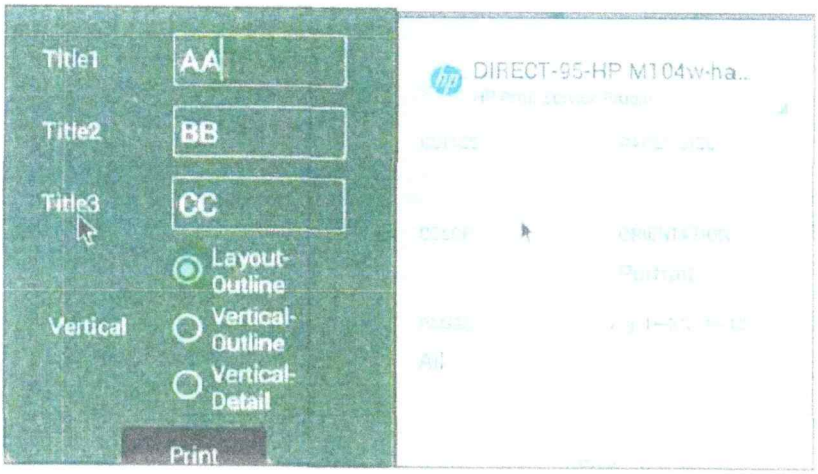


Fig. 10

Print: you can print a singlox as shown in Fig. 11-A below will pop up; fill the titles and select e piece of data, a single page of data or all data; click Print and a bthe layout in the pop-up box, click Print, and the basic printing information box as shown in Fig. 11-B will pop up; After modifying the basic printing setting, like copies and direction, click Print; before printing, make sure that the printer corresponds to the correct driver.



Figs. 11-A and 11-B

Output: select data, click Output in the interface as shown in Fig. 8, and a box as shown in Fig. 12 below will pop up. Fill the file name and titles, choose the export format you want, and click Save; an MD5 value is generated at the same time, which can be seen in Help; besides, output to PDF format takes longer time than EXCEL format.

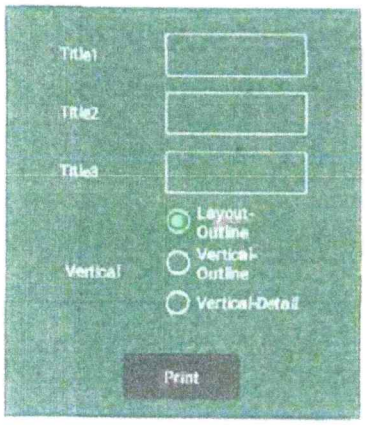


Fig. 12

2.6 Instructions for setting interfaces

2.6.1 General setting

Click Setting, then choose Setting, and a page as shown in Fig. 13 will appear:

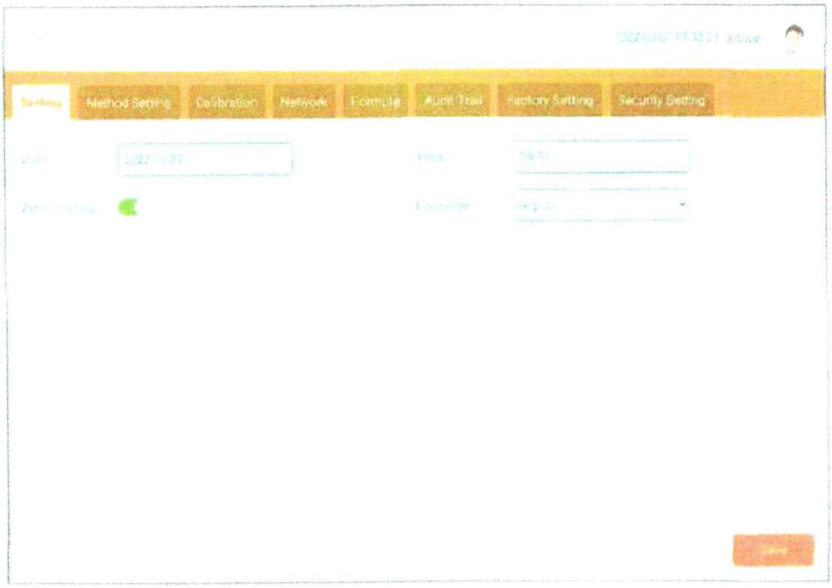


Fig. 13

In the Setting interface, the time and date can be modified, the language can be switched between Chinese and English, and automatic zero clearing can be enabled or disabled; when automatic zero clearing is enabled, the measured stable data within a certain range (within ±0.01) is automatically cleared to zero.

2.6.2 Method setting

Click Method Setting, and the tab as shown in Fig. 14 below will appear.

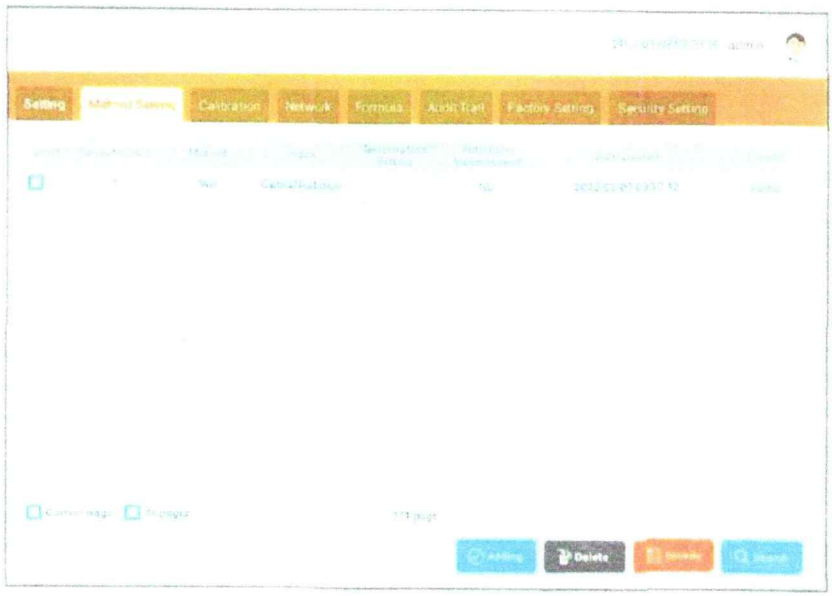


Fig. 14

One method is used by default. Select this method to delete it or view the details; the details can be seen in Fig. 15 below; click Modify to reset the parameters.

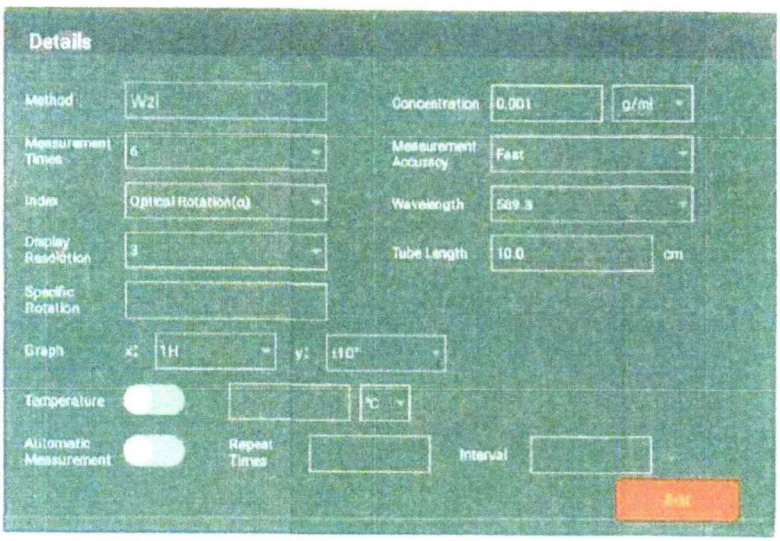


Fig. 15

Note: the current method cannot be changed during measurement.

Click Adding in Fig. 14 and a box as shown in Fig. 16 will pop up, in which the

name and other parameters of a new method can be set; after that, click Save, and the newly added method can be seen in the Method Setting interface.

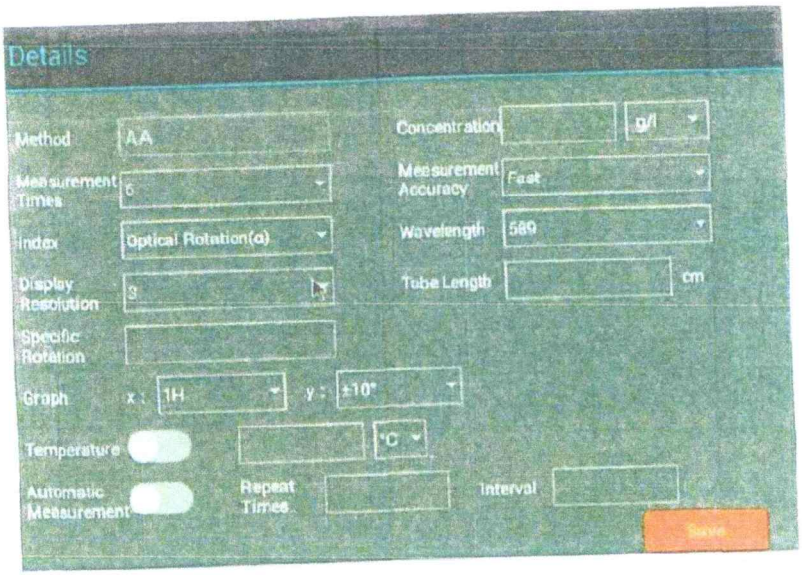


Fig. 16

If too many methods have been set, you can click Search to view the method you want, as shown in Fig. 17.

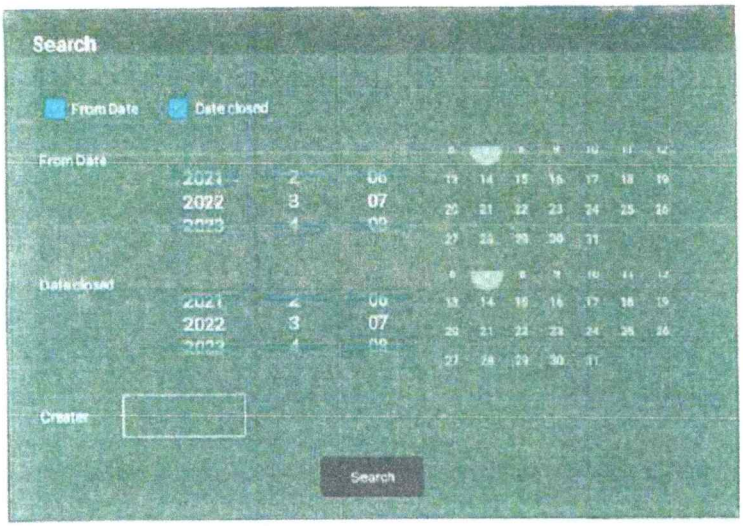


Fig. 17

The expected method can be searched based on the creation date and creator of the method;

2.6.3 Calibration

Click Calibration, and the tab as shown in Fig. 18 below will appear;

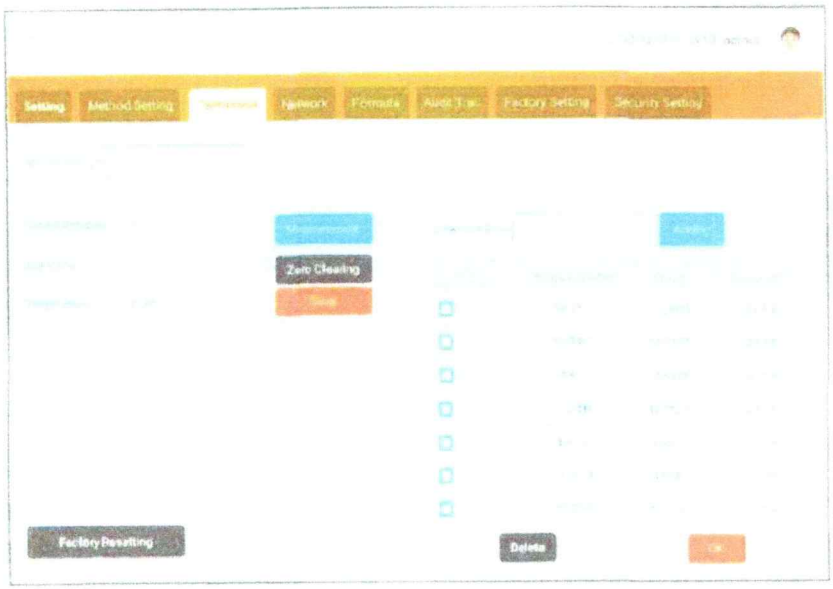


Fig. 18

Wavelength Option: choose wavelength to be calibrated; the default wavelength is 589nm; after choosing the wavelength, you will be prompted that it has been successfully selected;

Measurement: measurement is automatically performed for three times, and the average value is calculated;

Zero Clearing: clear the measurement data to zero, and clear the three measurement results;

Save: save the average measurement value to the display box on the right, and corresponding data is matched automatically; Note that the value can be saved only after the reference value is added, and the saved data gets valid after the instrument is restarted;

Reference Value and Adding: fill the reference value and click Adding to add it into the display box; they are listed in descending order;

Delete: select the data to be deleted;

OK: save the data in the display box after it is automatically ordered;

Factory Resetting: you can call and display the data calibrated by the manufacturer for this band; click OK and wait a moment until factory resetting is completed.

Note: do not click Factory Resetting and OK during measurement calibration; calibration operation is unavailable when the measurement in the main interface has not been completed yet.

2.6.4 Network setting

As shown in Fig. 19 below, to connect to a wireless network on the left, you can select the corresponding wireless router; to connect to a wired network on the right, you can enter the corresponding IP address.

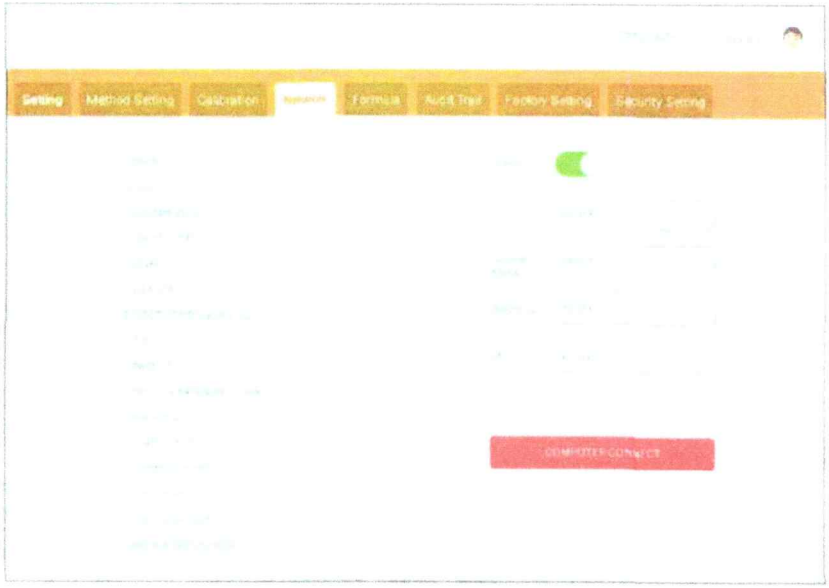


Fig. 19

2.6.5 Formula edition

Click Formula, and the tab as shown in Fig. 20 below will appear:

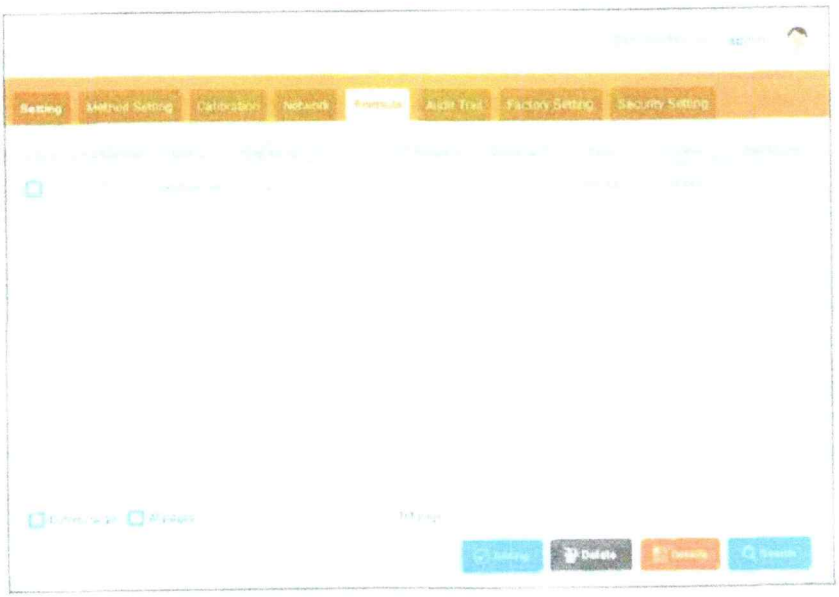


Fig. 20

You can add, modify and delete formulas in this tab:

Adding: click Adding and a box as shown in Fig. 21 below will pop up; fill the name and basic parameters of the formula, and the range of x (mandatory), and click Save; To add multiple formulas, click Add Result Range, and a new formula will be generated.

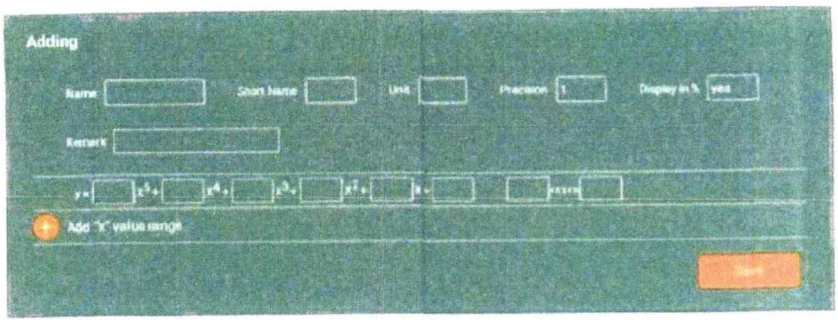


Fig. 21

Delete: you can delete the selected formula;

Details: click Details to see the detailed information of the formula;

2.6.6 Audit Trail

Settings or operations influencing the measurement results and not recorded in data are recorded in audit trail, from which you can search for related operation records;

As shown in Fig. 22, each item contains the operator, time, date, operation interface, sub-interface and operation incident.

Fig. 22

Output: you can output the selected audit trail as a file by filling the file name in the popup box and click OK.

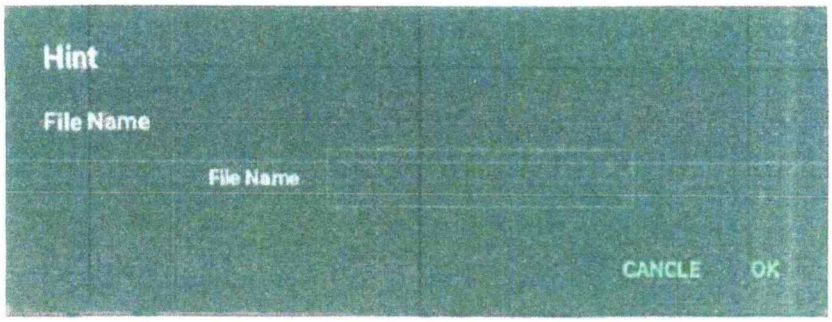


Fig. 23

Search: you can set the date range and operator to search for operation records;

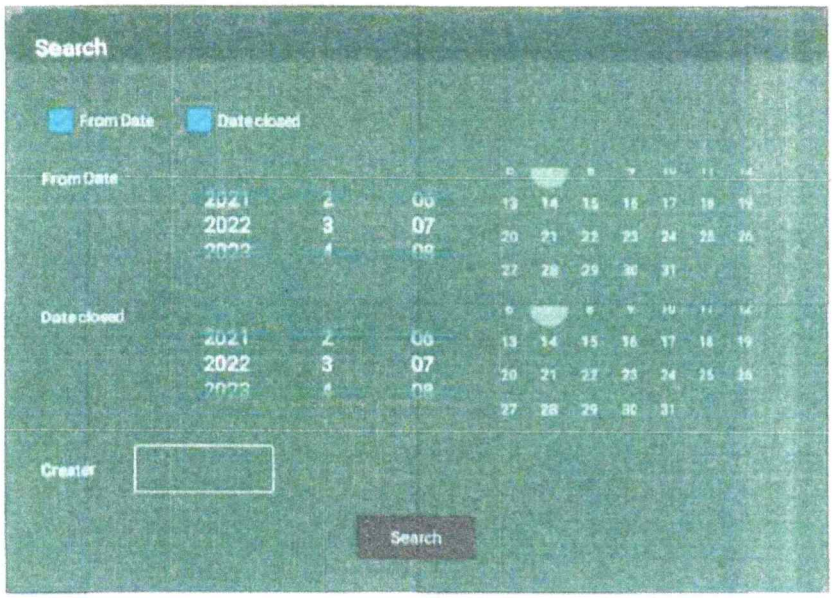


Fig. 24

2.6.7 Factory setting

The factory setting only can be modified by the manufacturer only, and does not need to be used by users.

2.7 Help

2.7.1 MD5

When the data is output, a file is generated and an MD5 value is generated automatically at the same time. The MD5 value is irreversible once being modified. You can judge if the file has been modified based on the MD5 value, as shown in Fig. 25 below.

Output: output the MD5 value as a file;

Search: search for the MD5 value by the time and operator;

The popup boxes for outputting and searching for the MD5 value are the same as those for audit trail, as shown in Figs. 23 and 24 above.

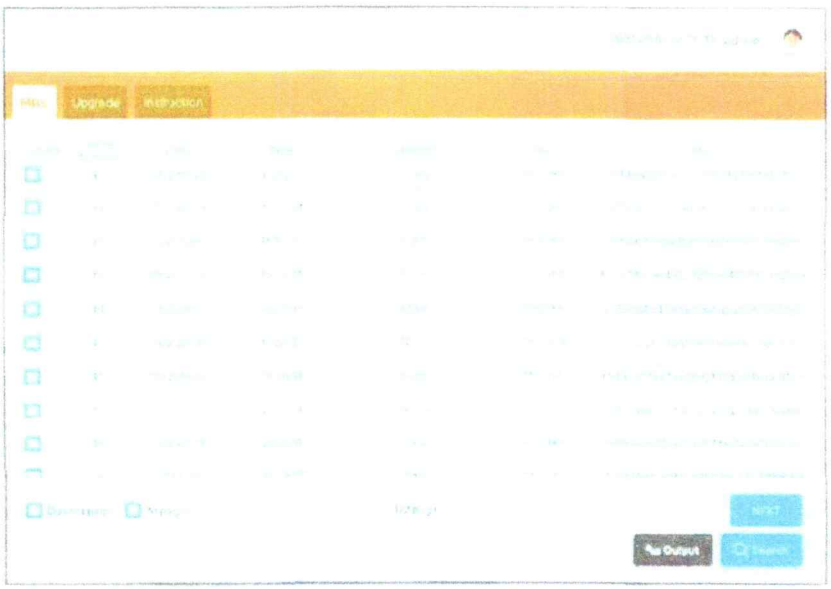


Fig. 25

2.7.2 Version upgrade

Click Upgrade and the system will automatically detect a USB flash drive. If there's a new version, upgrade will be performed automatically and the system will automatically log out after completing upgrade. Login again.

Historical data is remained after version upgrade.

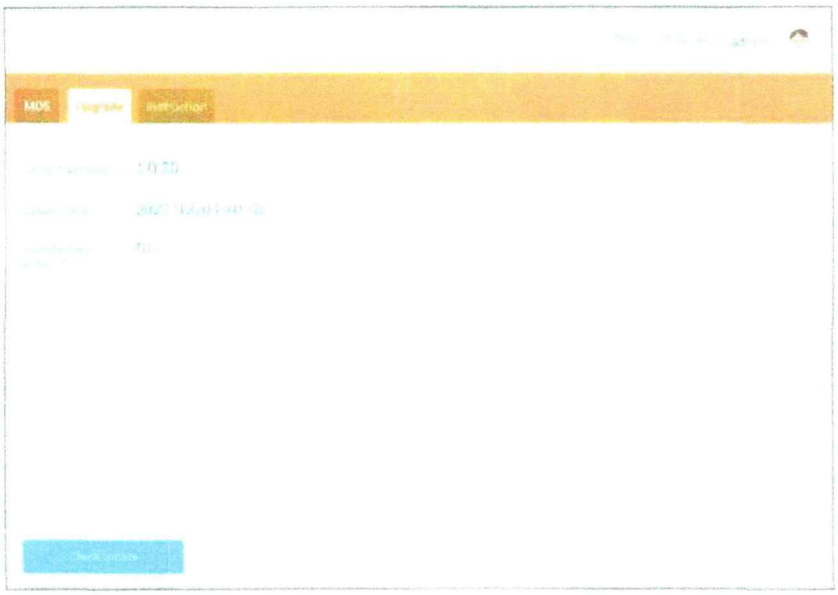


Fig. 26

2.7.3 Instruction

Instructions and precautions for specific rotation and concentration are provided;

The manufacturer's contact information is provided for users for consultation;

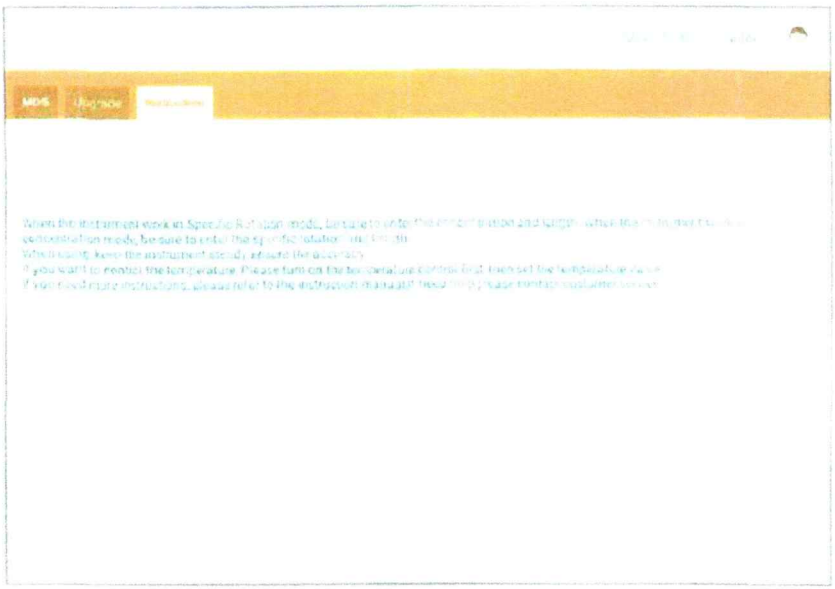


Fig. 27

2.8 User

2.8.1 User setting

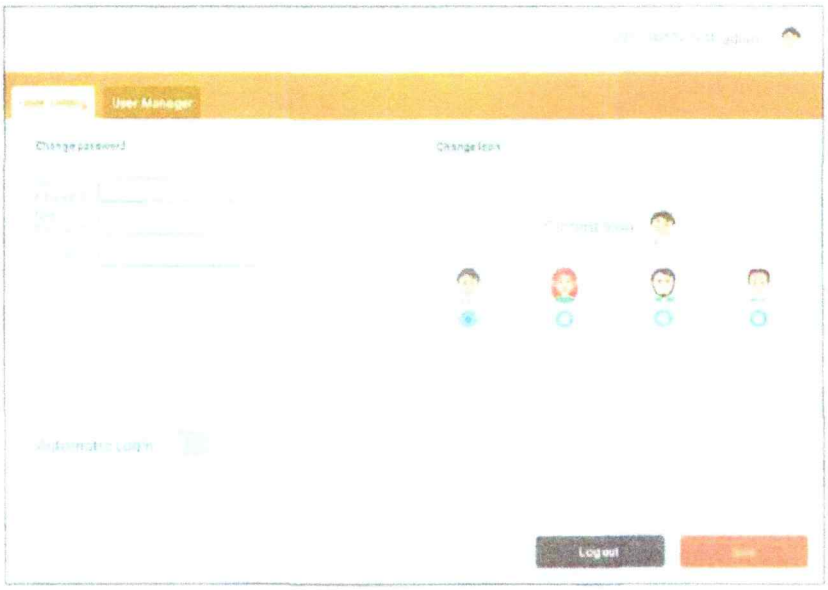


Fig. 28

In the page in Fig. 28, the current user can modify the login password, and set user photo and automatic login. After that, click Save to save the current settings. Then click Log out to return to the login interface and re-enter the new password. If automatic login is enabled, you can login without entering the password at the time of restart.

2.8.2 User management

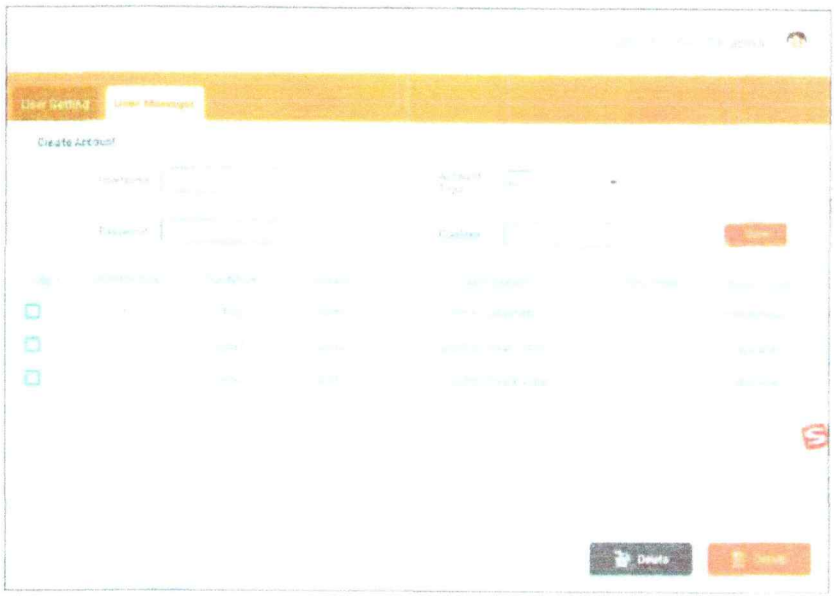


Fig. 29

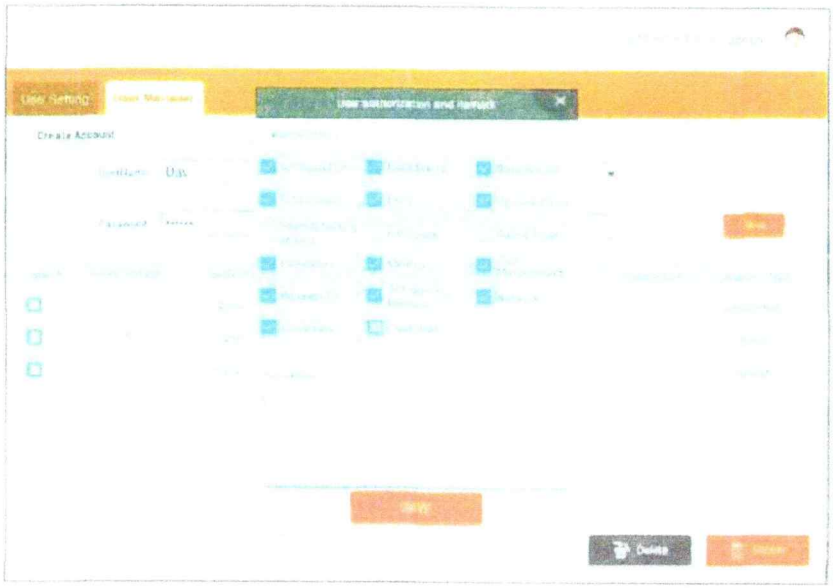


Fig. 30

In this interface, the administrator can add a new user and set the user name, type and password. Click Save, and the authority assignment box will pop up. The administrator can select authorities for this user, operate corresponding

interfaces, and fill user description. Interfaces and operation keys, that the user has no access to, are hidden and invisible.

When the instrument is started up, the user can input the corresponding account and password to login.

Note: due to continuous upgrade of the software version, the actual interfaces might be a little different from this Manual. The actual interfaces shall prevail.

2.8.3. Suggested sample operation steps

[1] Put the test tube containing distilled water or other blank solvent into the sample chamber, close the sample chamber cover, press Zero Clearing, and the reading will be shown as 0. If there are bubbles in the test tube, let them float at the convex neck; wipe the fog drops at the two ends of the light transmission plane with soft cloth. Do not screw the test tube nut too tightly to avoid giving rise to stress and thus affecting the reading. Note the mark, position and direction of the test tube when placing it.

[2] Remove the test tube. Inject the sample to be tested into the test tube, and put the test tube into the sample chamber at the same position and in the same direction, and close the sample chamber cover. The instrument will display the optical rotation (or corresponding indicating value) of the sample.

[3] If the instrument is set to automatically perform measurement for n times, n readings will be generated and their average value will be displayed. If the measurement times are set to 1, click Repeat to manually repeat measurement. If the repeat times n>1, press Repeat, and the instrument will clear the previous measurement values and successively repeat n times.

[4] Press Zero Clearing before each measurement.

[5] After using the instrument, turn the power switch off.

4. The data can be saved either as an EXCEL file or a text file.

(1) The formula for calculating specific rotation is $[\alpha]=100\alpha/LC$

Wherein, α is the measured optical rotation (degree)

C is weight of the measured substance per 100mL of solution (gram)

L is solution length (decimeter)

Specific rotation can be measured in mode 2.

(2) Sample purity can be calculated from the measured specific rotation:

Purity = actually measured specific rotation / theoretical specific rotation

(3) Regulation on measurement of international sugar degree:

It is regulated in International Sugar Scale to prepare 100mL solution with 26g pure sugar, and measure through sodium light with a 2dm test tube at 20℃. The optical rotation is +34.626°, and the sugar degree is 100°Z. International sugar degree can be directly read from the instrument in mode 4.

2.9 Calibration of instrument

(1) Calibration preparation and temperature requirements: after starting the instrument, open the cover, take out the standard tube and put it next to the instrument, and let it stand for 20 minutes.The room temperature should be between 18℃ and 25℃. The temperature should be stable and the fluctuation should not exceed 0.3℃.

(2) In the test interface, click "congruent" at the top left of the display screen, and select "Setting" in the left pop-up menu bar, as shown below:

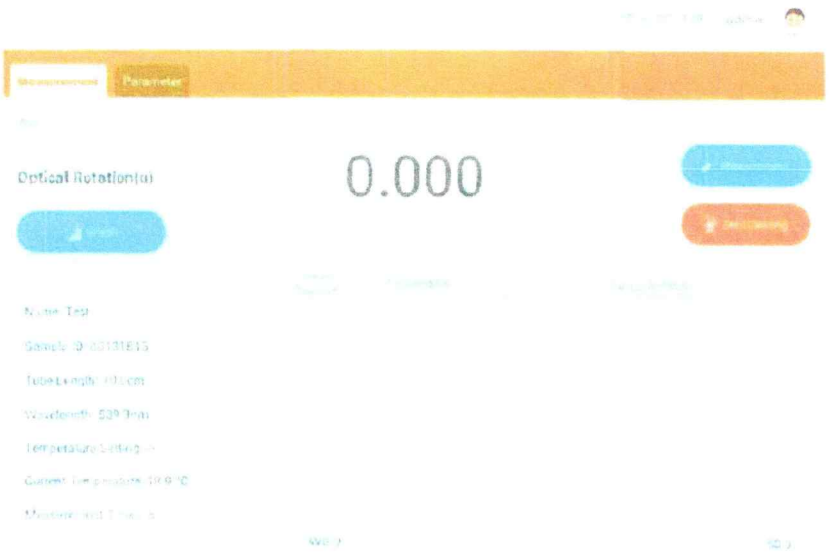


Fig. 31

Fig. 32

(1) Select 'Calibration' on the setting interface, as shown in the figure below:

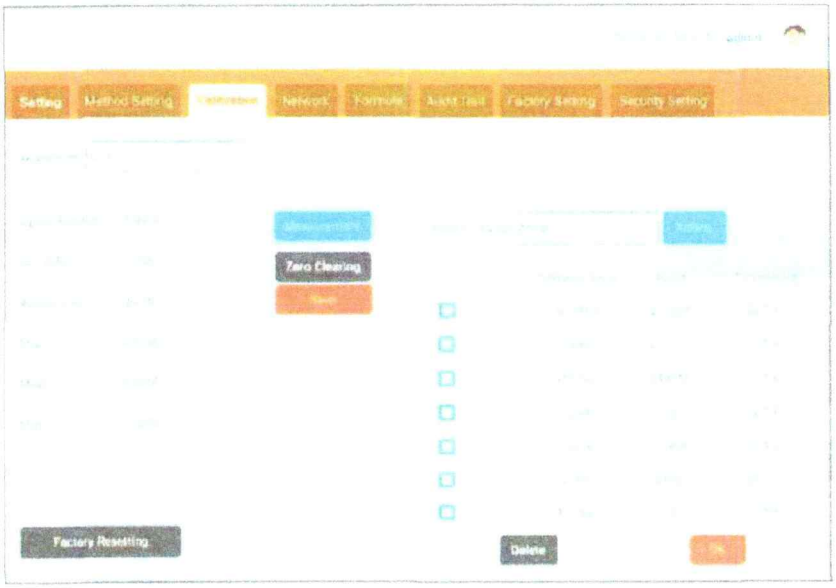


Fig. 33

(1) Select the standard value in the instrument and click 'Delete' (if the existing standard value of the instrument is the same as the value of the standard tube to be corrected, it is unnecessary to Delete) as shown in the figure:

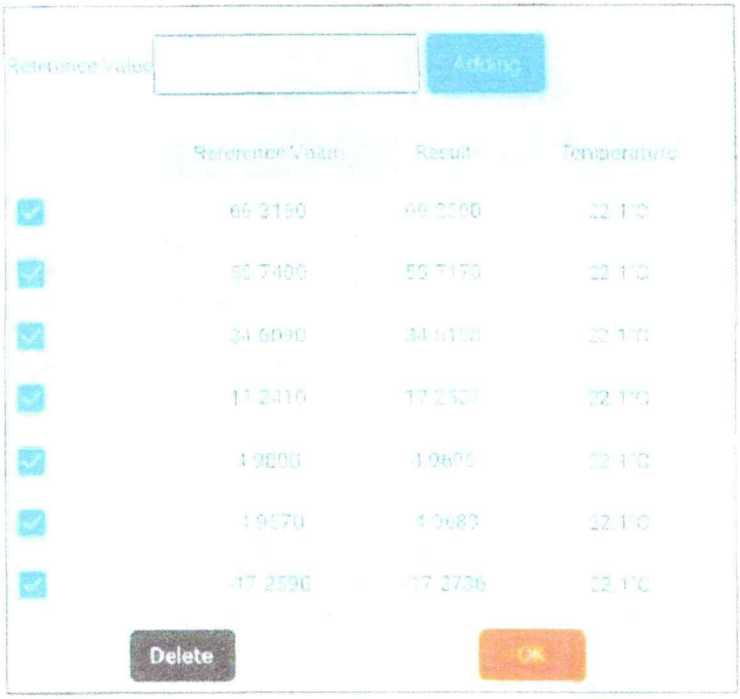


Fig. 34

(1) Enter the standard value to be calibrated in the standard value input field in sequence, and click 'Adding'.The standard value will be sorted automatically after input, as shown in the following figure:

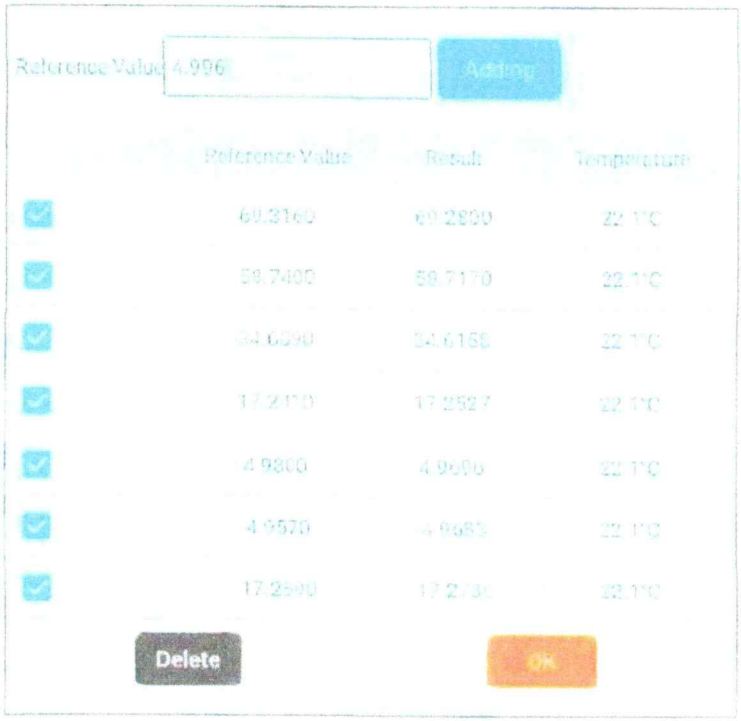


Fig. 35

(1)Click 'Zero Clearing' and put the standard tube into the control greenhouse. The instrument will be automatically tested for 3 times and the average value will be calculated.Take out the standard tube; if the rotation does not return to Zero automatically, click 'Zero Clearing' manually, put in the standard sub-calibration once again, and take out the standard tube after three tests to obtain the average value;If the rotation returns to zero, click 'Save', as shown in the figure.

The calibration of one standard tube is completed, and the calibration of the rest of the standard tubes is repeated in the sequence from positive to negative or from negative to positive.

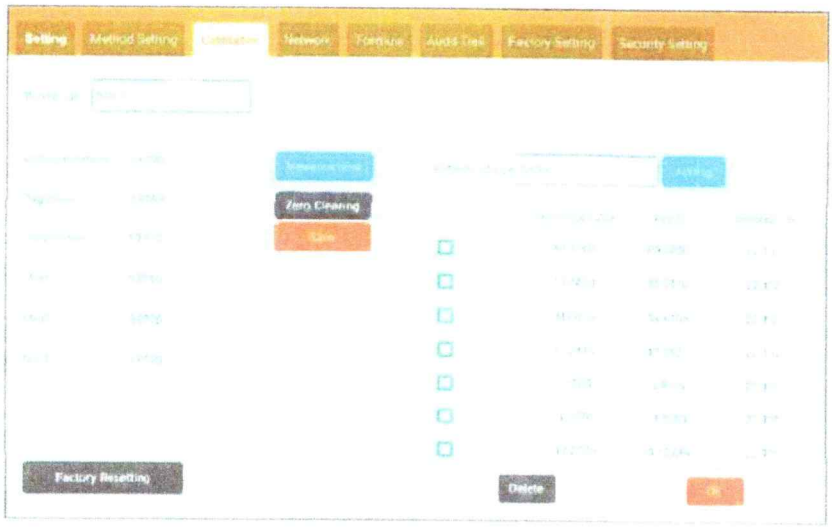


Fig. 36

1. Click 'OK' after all the correction is complete, and the data can be tested on the test interface after the data is saved.

2. If the measured data is not satisfied after calibration, it can be corrected again, or click "Factory Reseting" to restore the Factory calibrated data.

2.10 shutdown operation

(1) Make sure the device is in the following state before each shutdown

(2) The test sample in the instrument has been taken out.

(3) The temperature control function is turned off.

V. Common Failures and Trouble shooting

Failure	Cause Analysis	Countermeasures
The light does not work when the power switch is turned on	1.The power switch fails. 2.The LED fails. 3.The 2A fuse fails.	1.Replace the power switch or return it to the manufacturer for repair. 2.Replace the light source or return it to the manufacturer for repair. 3.Replace the 2A fuse.
The touch interface does not give response	1.The color-screen touch panel contacts the casing under force. 2.The color screen has quality problems.	1.Reduce contact area of the color-screen touch panel. 2.Check for quality problems.
The counter does not work	1.The encoder plug gets loose. 2.The encoder power supply fails.	1.Connect the plug. 2.Check the power supply. 3.Return it to the manufacturer for repair.
Cannot access to cloud server	1.Network connect failure.	1、Please check network whether recognize IP address successful.
Cannot connect printer	1.Network connection problem. 2.Printer response method.	1.whether connect printer network . 2.Whether printer response automatically.

VI. Storage and transportation

1.The instrument shall be kept dry to avoid moisture and corrosion by corrosive gas, shall be protected from violent vibration, and shall be used in a working environment at 20℃ as far as possible.

2.Keep the optical rotation test tube to be put into the sample chamber clean as far as possible, and wipe it with soft cloth before putting it into the latter, to avoid the instrument from being corroded by corrosive liquid.

VII. Factory description

1. This product is warranted for one year from the date of sale (subject to invoice

2. date and without deferred warranty agreement), provided that the following

3. conditions are not covered by the warranty:

4. The warranty period is exceeded;

5. Damage due to improper use;

6. Damage caused by self-disassembly without the permission of the manufacturer;

7. Damage due to improper transportation and storage.

VIII. Environmental protection notice

This electronic device cannot be discarded along with unsorted ordinary garbage. Inappropriate treatment can be harmful to the environment and human health. Please refer to local waste disposal regulations for collection and treatment equipment. Attachments to this electronic device cannot be discarded along with unsorted ordinary garbage. Inappropriate treatment can be harmful to the environment and human health. Please refer to local waste disposal regulations for collection and treatment equipmen.

IX. Appendix

3.1 Data backup software operation manual

1. The upper computer includes the following files, as shown in Fig 37:

Fig. 37

2. Start the instrument and log in the user account to the following interface, as shown in Fig 38:

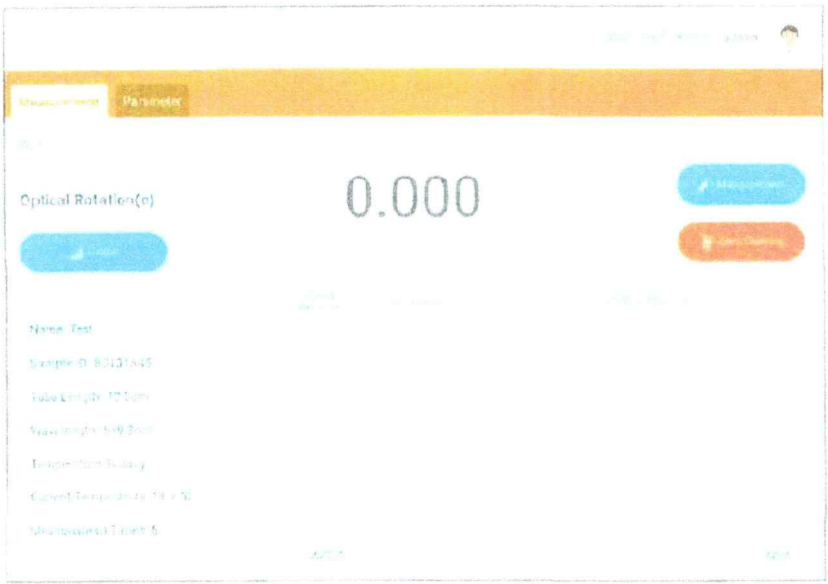


Fig. 38

3. use USB to RS232 line to connect the instrument and PC (RS232 interface to connect the instrument, USB connector to connect the PC), as shown in Fig 39

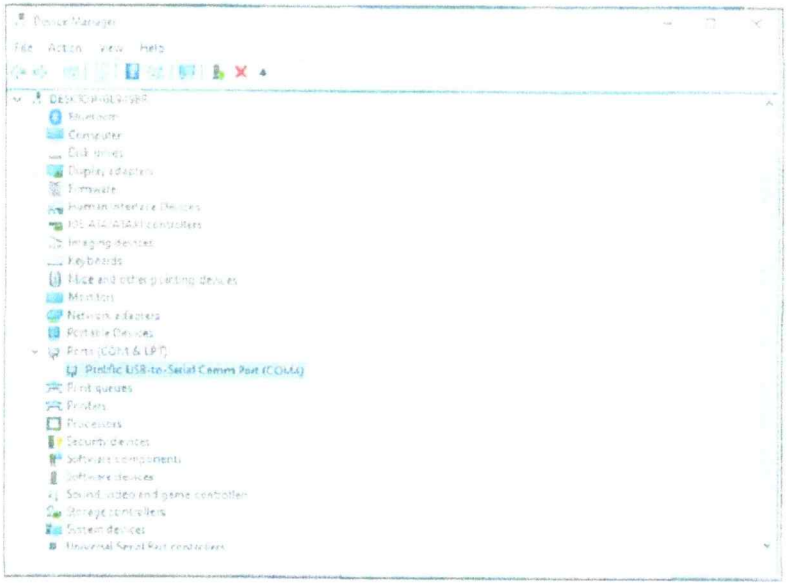


Fig. 39

4. Set the baud rate of the serial port to 115200, data bit to 8bits, parity check to none, stop bit to 1, and no control flow

5. Open the upper computer software, as shown in Fig 40, select the COM port connected to the computer, and the upper computer configuration is complete.

Fig. 40

6. Click the menu bar in the upper left corner of the instrument interface, select "Settings" in the popup frame, and then select "Network Settings" to pop up the interface as shown in Fig 41

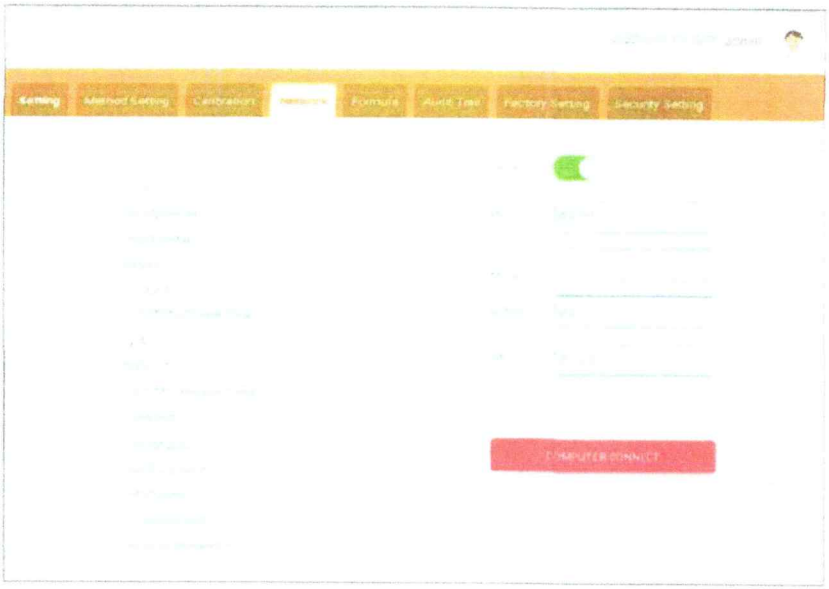


Fig. 41

7. Click "Connect computer", the red box turns green, and the connection is successful, as shown in Fig 6 below

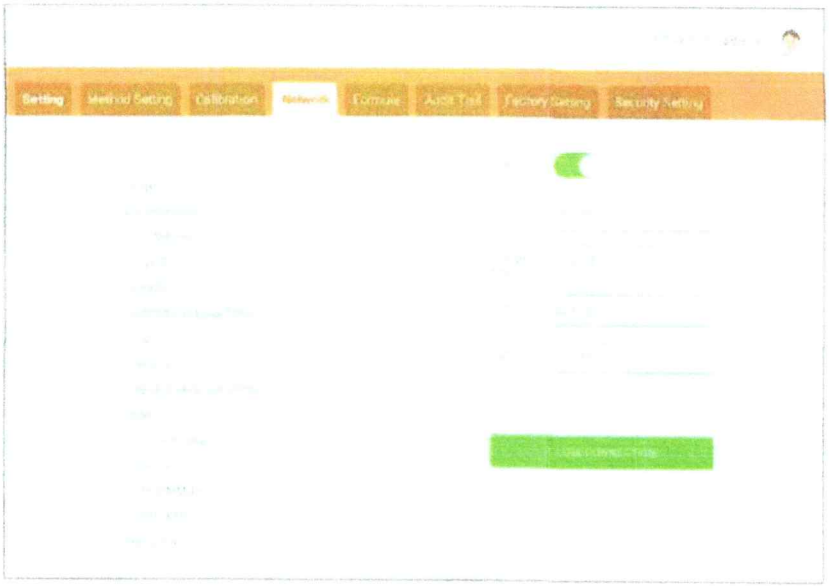


Fig. 42

8. Click the menu bar in the upper left corner of the instrument interface and select "Data" in the popup frame, as shown in Fig 43

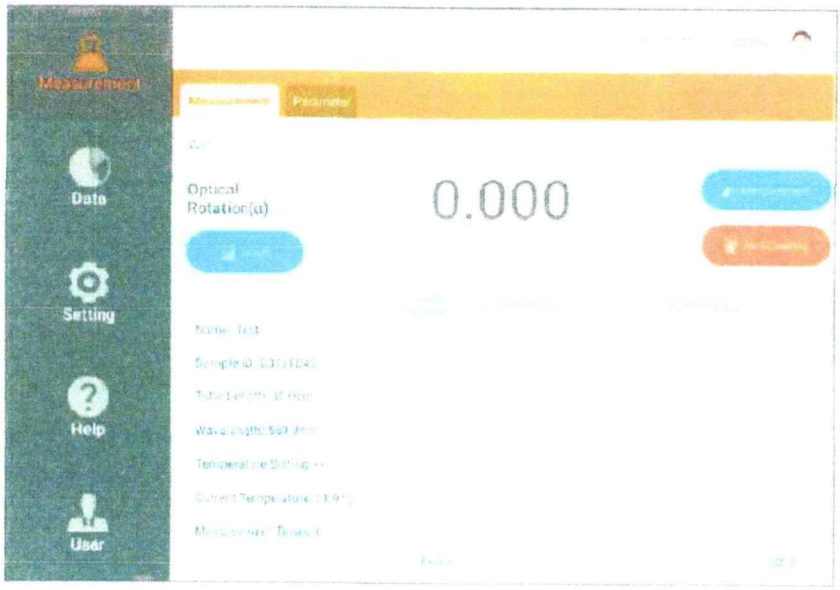


Fig 43

9. Check the data to be exported and click the "Export" button. In the dialog box shown in Fig 44 below, select "Computer" and click "OK" to complete the data export

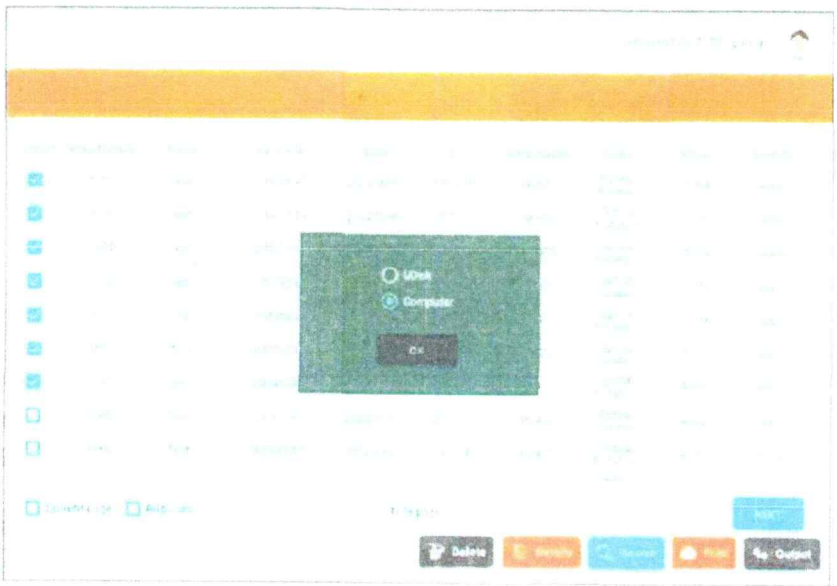


Fig 44

10. Check whether the exported data exists on the interface of the upper computer, as shown in Fig 45. If the data is not deleted, the upper computer stores the data by default. Click "Search" to set the test date interval of the data, as shown in Fig 46. You can view the previously exported data.

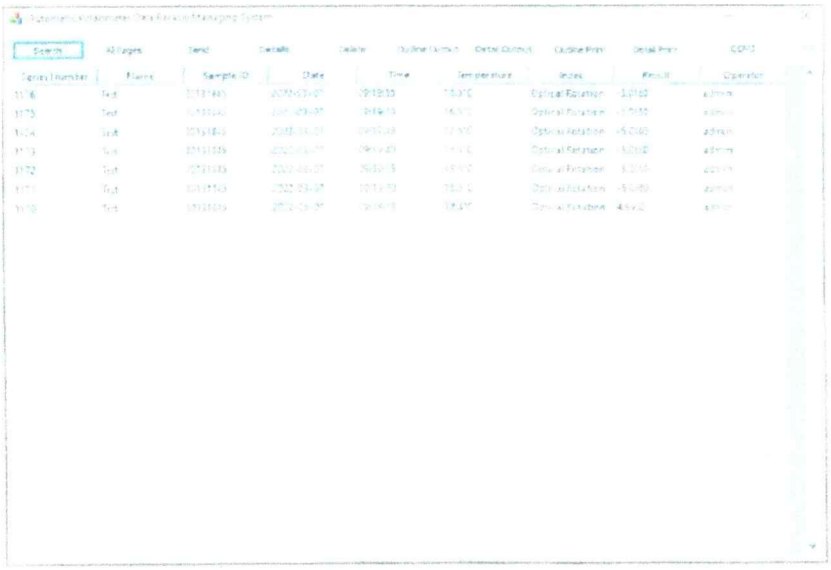


Fig 45

Fig 46

11. When it is necessary to send data back to the instrument, the upper computer should first query the data to be sent back, select the data to be sen

back, click "Send" button, the data can be transmitted to the gyroscope. refresh the data page of the gyroscope, if there is returned data, the data is successfully transmitted.