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NanoBio 200

UV VIS Spectrophotometer

User Manual

PREFACE

Thank you for purchasing NanoBio 200 series UV VIS Spectrophotometer. This user manual contains the function and operation process of the instrument. In order to ensure the correct use of the instrument, please read the manual carefully before operating the instrument. Please keep the manual in a safe place so that you can read it quickly if you encounter problems.

Optosky will provide comprehensive technical support and services, support unlimited software upgrade, provide IQ/OP/PQ certification support, etc.

The Instruction Note Icon

⚠ : The ISO Universal warning icon indicates the safety information that the user must follow. This information relates to a danger that exists or is likely or likely to result in personal injury or even death.

ℹ : Information ICONS remind readers of relevant facts and conditions about using the device.

This manual is V2.1 version.

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CONTENT

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1.Summarize

1.1.Product Summarize

NanoBio 200 is a full-wavelength (190-850 nm) UV VIS Spectrophotometer developed by OPTOSKY. Based on more than 20 years of spectroscopic instrument development experience, it adopts self-produced high-performance optical fiber spectrometer and high-stability pulsed xenon lamp produced by Hamamatsu Company in Japan. It can detect nucleic acid, protein and cell solution quickly and accurately.The machine is less than 3kg, smaller and lighter weight so that you can easily control no matter what kind of occasion. At the same time, it also has the advantages of easy to use, less sample consumption (only 0.5-2μ L), no preheating, rapid cleaning of residual samples, no need for colorimetry or other sample positioning device, samples do not need to dilute and so on.

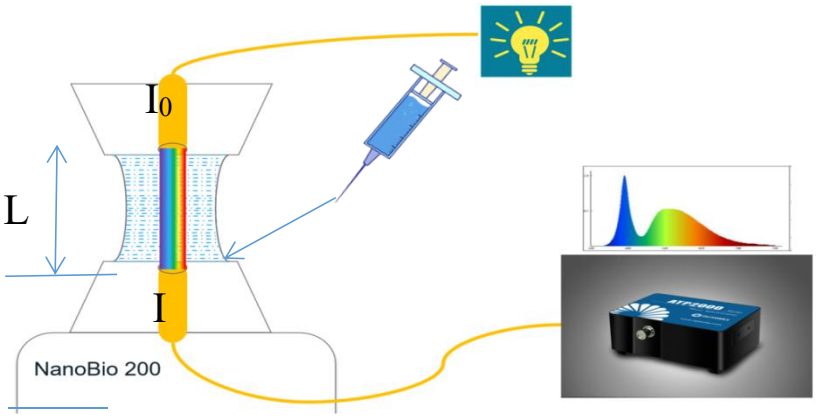
NanoBio 200 ultra micro spectrophotometer, the use of very simple, detection, directly with pipette, the sample point on the measurement probe, close the lid, can be measured; After the measurement, the sample

can be wiped or recycled directly. The NanoBio 200 has become a fixture in many laboratories

NanoBio 200 ultra micro spectrophotometer, is a mainly used for the detection of nucleic acid and protein trace uv spectrophotometer. It uses a high energy pulsed xenon lamp source to provide 230nm, 260nm, and 280nm spectral detection.

NanoBio 200 is based on The Android operating system and has a 7-inch capacitive touch screen, which can be tested on a single machine without computer connection. The detection data can be printed or output via USB to facilitate user analysis and storage.

1.2.Working Principle



The working principle of spectrophotometer is mainly based on Lambert-Beer law. First, use our pipetting gun to draw 0.5-2μ L of our sample and place it on our lower base to form a small liquid bead. Then, press our upper base downward to form a liquid column and click to test.At this point, the broad wavelength light I0 from our light source passes through the liquid column, and the light intensity I passing through the sample will be recorded.Each substance has its own specific wavelength of absorption, and the amount of the absorption of a specific wavelength is proportional to the concentration of the substance, i.e. Lambert-beer（Lambert-Beer）law。

$$A = \varepsilon L\, c$$

In the formula:

A——Absorbance, $A = -\log I/I_0$;

ε——Absorptivity ;

L——Optical path Length (optical path);

c——Concentration;

The wavelength of selective absorption of light by a substance and the corresponding absorption coefficient are the physical constants of the substance. When the absorption coefficient of a pure substance is known under certain conditions, the same conditions can be used to match the

tested substance into a solution and determine its absorbance, and the content of the substance in the tested substance can be calculated from the above formula.

1.3.Technical Parameters

Parameters	Specifications
Sample Size	0.5 - 2.0 μL
Measurement Cycle	~ 3 seconds
Optic Path Length	0.5mm（1.0,0.25,0.05Optional）
Wavelength Range	190 ~850 nm
Light Source	Xenon flash lamp
Detector Type	2048 pixel linear CCD array
Wavelength Accuracy	1 nm
Wavelength Resolution	≤ 2 nm (FWHM at Hg 546 nm)
Absorbance Precision	0.003 Abs/(1mm)
Detection Limit	2 ng/μL (dsDNA)
Max Concentration	15,000 ng/μL (dsDNA)
Absorbance Range	0.04 ~ 300 (10 mm)
DNA range	2 ~ 15000ng/ul (dsDNA)

Surface Construction	304 stainless steel and quartz fiber
Operation System	Android OS
Panel Type	Capacity Touch Panel
Panel Size	7inch
Panel Resolution	800 X 1080
Endurance Time	6 hrs
Li-ion Battery	55 Wh
Operating Voltage	12V DC
Power Consumption	9W
Standby Power	1.5W
Dimensions	290 X 210 X 220 mm
Weight	3.2kg

1.4.Application Fields

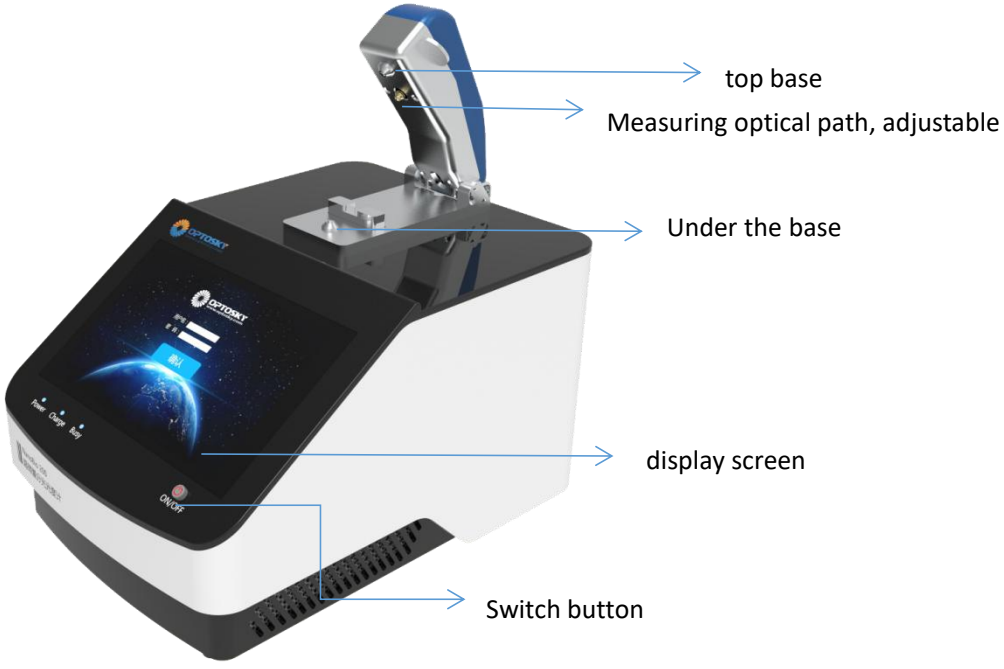
NanoBio 200 UV VIS spectrophotometer, effective wavelength range is 190-850nm, can be in the ULTRAVIOLET, visible, near infrared spectral region for qualitative and quantitative analysis of samples; NanoBio 200 instrument has the advantages of simple structure, fast detection, suitable for the analysis of nucleic acid, protein and other trace

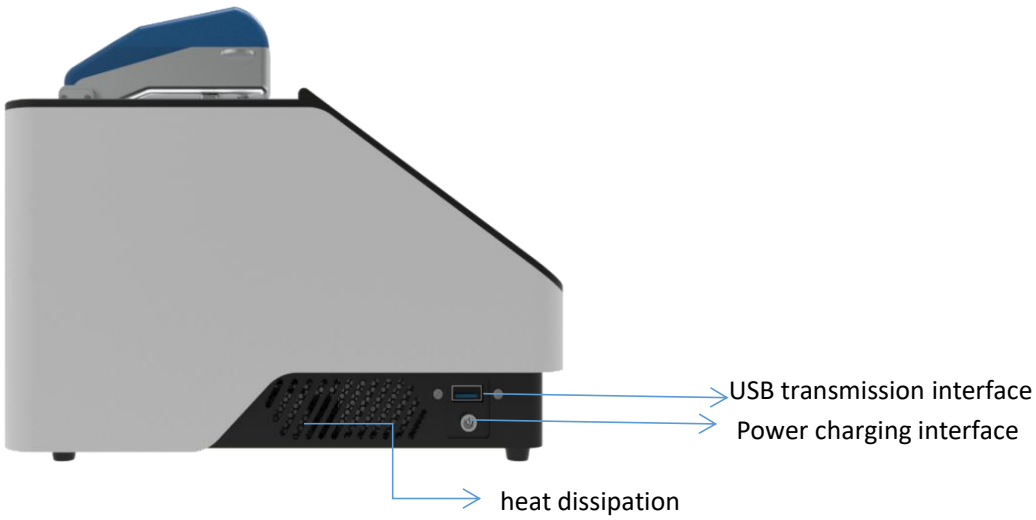
samples, and has special advantages in scientific research laboratories, hospitals, biological laboratories, chemical laboratories, environmental testing and other fields.

2.Configuration List

Project	Number
NanoBio 200	1
12V/5APower Adapter	1
NanoBio 200User manual	1

3.Hardware Interface





4.Basic Operation of Instrument

4.1.Selection of Test Sample Size

Although the amount of liquid sample used is not a critical factor in the accuracy of the test, an effective liquid column must be formed between the upper and lower bases to ensure the accuracy of the test.So whether an effective liquid column can be formed has a great relationship with the surface tension of our liquid, and the main factor determining the surface tension of liquid is the hydrogen bond between water molecules in the solution.Normally, substances in water such as proteins, salt ions, and detergents reduce surface tension by breaking the hydrogen bonds

between water molecules.Although 1ul is sufficient for most samples, it is recommended that the sample characteristics or pipette accuracy be uncertain， It is better to use 2μL sample size for detection to ensure the accuracy of detection results.

4.2.Test the Use of the Base

4.2.1. Dropping Liquid

Lift the upper base and use a precision pipette to add trace sample (2μL) to the lower base.

Figure 1: Dropping Liquid

4.2.2.Liquid column formation

Lower the upper base, naturally form a liquid column between the upper base and the lower base, and then start the test.

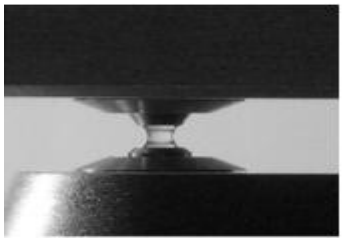


Figure 2: Liquid Column

4.2.3.Clean

After the test is completed, lift the upper base and wipe the samples on the upper and lower bases with clean dust-free paper so as not to affect the next test.

The focus of attention

• At the end of the test, remember to wipe the upper and lower bases three times with ultrapure water.

• Do not use an injector or spray bottle near the instrument as fluid can flow into the instrument and may cause permanent damage.

• Do not use hydrofluoric acid (HF) fluoride ions on the base which can permanently damage quartz fiber optic cables

5. Basic Operation of Software

5.1.Login Interface

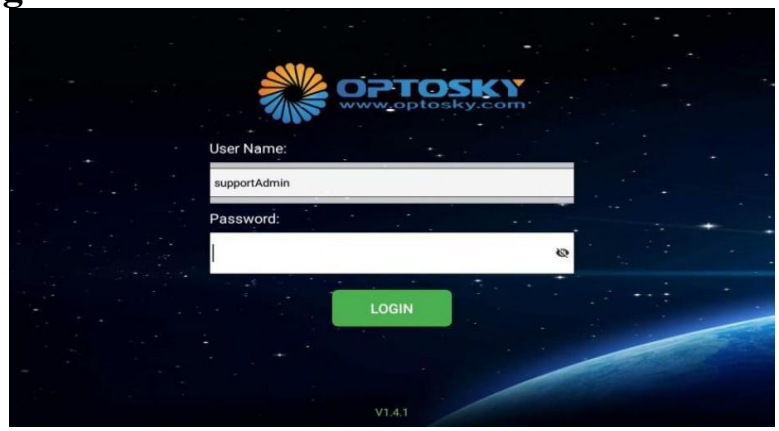


Figure 3: Login Interface

Long press the "on" button and wait for the screen to light up to start up. The login interface is shown in Figure 3.

5.2.Main Interface

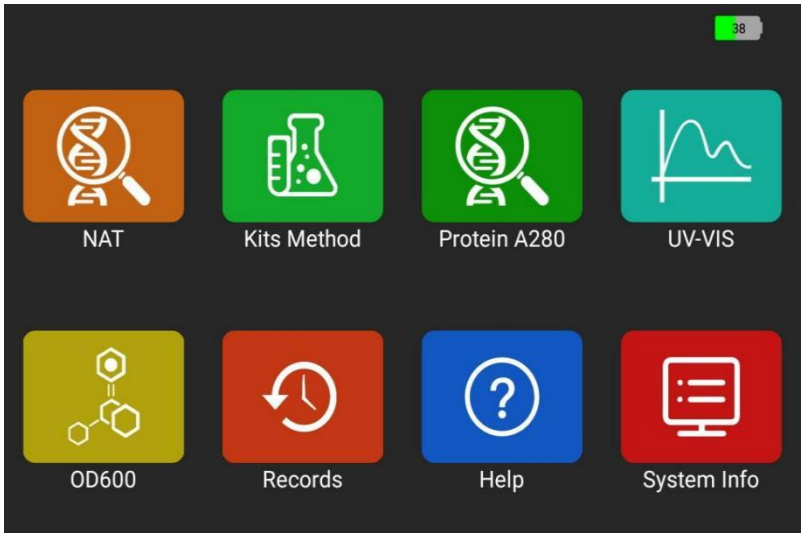


Figure 4: Main Interface

Enter the password and login to the main interface. The main interface is divided into eight color blocks: nucleic acid detection module, Kit module, protein A280 module, UV-Visible full Spectrum module, OD600 module, history record module, help module and system information module.

5.3.Nucleic Acid Testing

5.3.1.Overview of Nucleic Acid Testing

Using NanoBio 200, nucleic acid concentration can be easily detected，To test, please select on the main screen 

.

Use Beer－Lambert law Calculated nucleic acid concentration：

$$b = \frac{A * \varepsilon}{C}$$

C＝Nucleic Acid Concentration，unit ng/μL

A＝Absorbance

ε ＝Absorptivity，unit ng-cm/μL

b＝Optical Path，unit cm Extinction coefficient of nucleic acid in general ε为：

Double-Stranded DNA: 50ng-cm/μL,

Single-Stranded DNA: 33ng-cm/μL, RNA：40ng-cm/μL.

NanoBio 200 can use1.0mm，0.5mm，0.25mm,0.05mmOptical path detection (optional before delivery), This allows detection of high concentration samples without dilution.The absorbance of nucleic acid test is normalized to a value of 1cm optical path.NanoBio 200.It can accurately detect double-stranded DNA with concentration ≤15000ng/μL without dilution.

5.3.2Basic Operation of Nucleic Acid Detection Interface

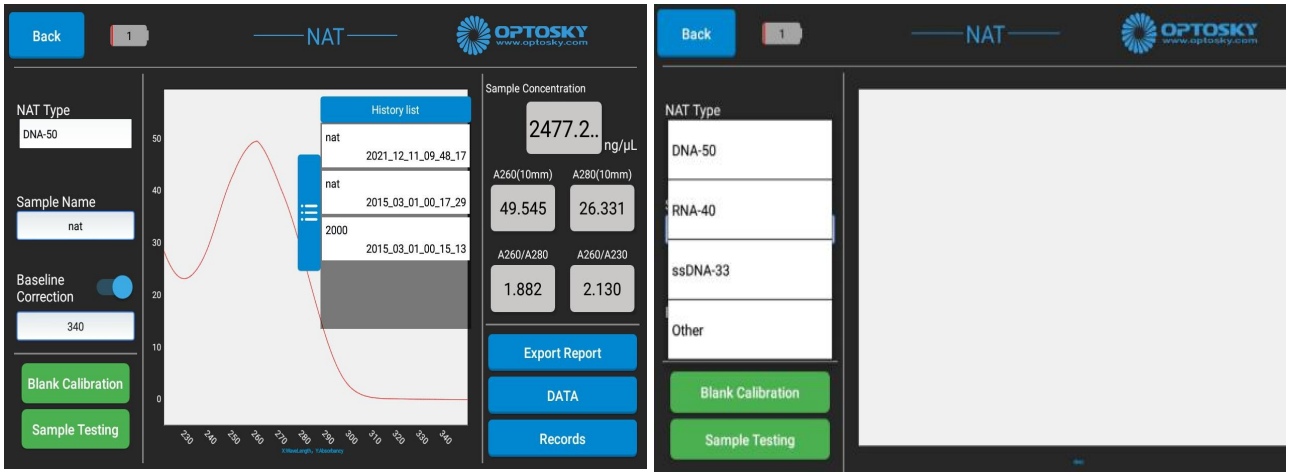
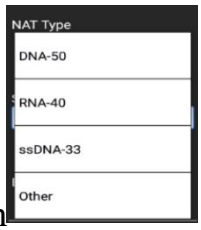


Figure 5: Nucleic acid detection interface

1. On the "Main Interface" screen, select the nucleic acid detection module and click to enter the interface as shown in Figure 5, and then select DNA-50 (double-stranded DNA), ssDNA-33 (single-stranded DNA) in the type of nucleic acid , RNA-40 （RNA） Or custom 

, It depends on the sample to be tested.

2. Naming the sample name 

。

3. If necessary, specify a baseline correction (the selected wavelength must be a wavelength with no absorption peak, generally the default is 340nm, the baseline calibration must be set before the sample detection,

and the setting is invalid after the sample detection) 

。

4. Pipette 1-2 μL of blank detection solution to the lower base, then lower the detection arm, click 

.

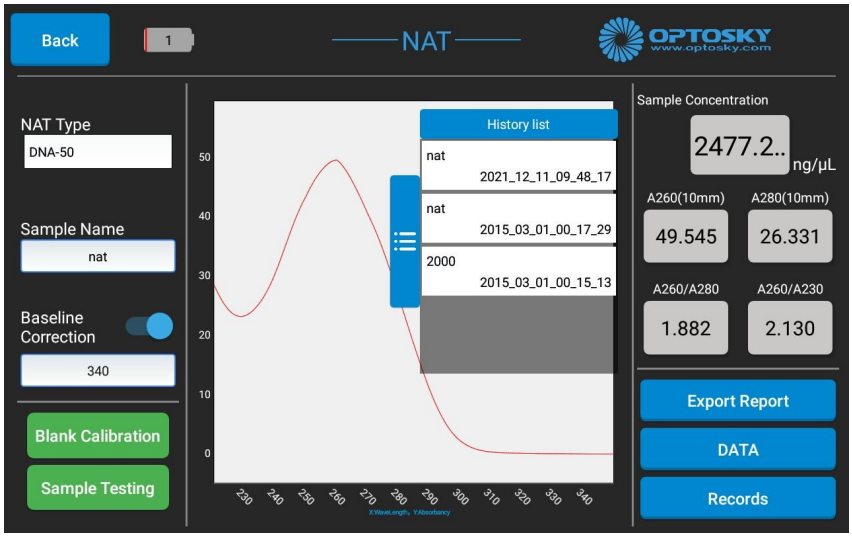


Figure 6: Blank Check Completion Interface

5. After blank calibration is completed, lift the detection arm as shown in FIG. 6 and wipe the upper and lower bases with the new laboratory dust-free paper.

6. Remove 1-2 μL sample solution to base, then lower detection arm, click 

, After the detection is completed, the measurement results also show the concentration of nucleic acid,A260(10mm)、A280(10mm)、A260/A280 and A260/A230、 both A260/A280 和 A260/A230 Used to

judge the purity of nucleic acid.

A260/A280： The ratio of absorbance at 260nm and 280nm. This value is used to determine the purity of DNA and RNA. The ratio of pure DNA is around 1.8, and the ratio of pure RNA is around 2.0. If this ratio is too small, it indicates the presence of protein, phenol or other contaminants.

A260/A230： The ratio of absorbance at 260nm and 230nm, which is a secondary indicator of nucleic acid concentration. The ratio of pure nucleic acid is larger than the 260/280 ratio, generally between 1.8-2.2. If the ratio is low, it means that there are contaminants in the nucleic acid. If the 260/280 ratio in the sample is slightly lower than the standard value of 1.8 or 2.0,But 260/230 has dropped significantly, so the cause of contamination is most likely protein residues rather than guanidine salt residues; if the maximum absorption peak appears at 270nm, 260/280=1-1.5, 260/230=1-1.5, then the cause of contamination It is most likely to be phenol residue; if the sample 260/280 meets the requirements and 260/230 <1, the cause of contamination is most likely to be guanidine salt residue.

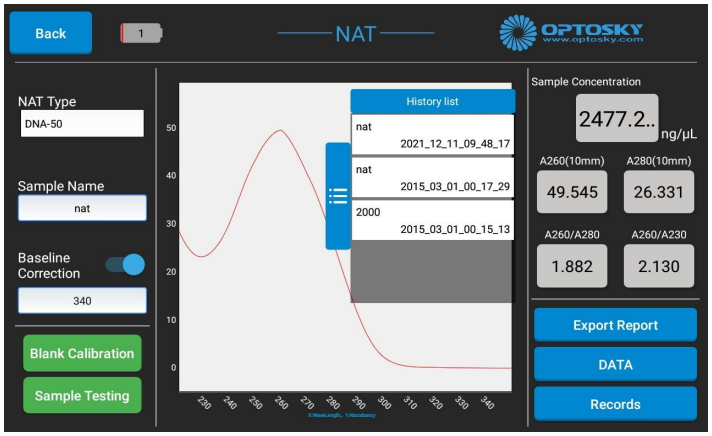


Figure 7: Completion interface of nucleic acid test

7. After the test is completed, there will be a floating box on the interface to display the history list of the current test, which is convenient for data comparison and can also be shrunk and moved.

8.Lift the inspection arm and wipe the upper and lower bases with new dust-free paper.

9.Test results we can report output 

and data output 

, The output mode can be local or USB disk, or it can be re-viewed in the detection record as shown in Figure 8.

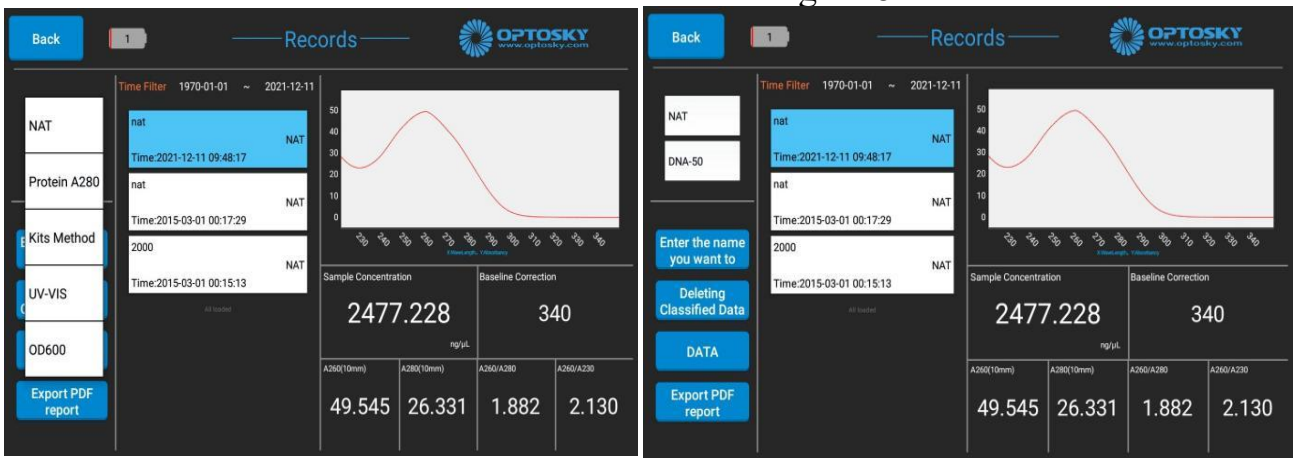


Figure 8: Detection record interface

Note: Microvolume absorbance test, normalized to 10.0mm equivalent.

5.4.Kit Method

5.4.1Kit Method Summarize

BCA,Lowry,Bradford Both are methods to detect the concentration of impure protein through a kit method.Before measuring the sample, make a standard curve. That is, the absorbance of different concentrations of standard proteins at fixed wavelengths is measured, and the software automatically generates a standard curve.When the sample is measured again, the software automatically calculates the concentration of the sample. The wavelength detected by BCA method is 562nm, Bradford method is 595nm and Lowry method is 650nm.BCA method: Bivalent copper ions can be reduced to univalent copper ions by proteins under alkaline conditions. Univalent copper ions interact with unique BCA Solution A(containing BCA) to produce sensitive color reactions. The two molecules of BCA chelate with a copper ion to form a purple reaction complex. The water-soluble complex shows strong absorbance at 562nm, and the absorbance and protein concentration have a good linear

relationship over a wide range, so the protein concentration can be inferred from the absorbance value.

Bradford Reagent protein quantification is a fast, ready-to-use optical quantification method for total protein.Under acidic conditions, the Coomassie Brilliant Blue G-250 dye binds to the hydrophobic region of the protein, causing the maximum absorption peak to change from 465 nm to 595 nm, and the color changes from brown to blue at the same time. The depth of the blue compound is proportional to the protein concentration. relation.Mix the protein sample or diluted BSA with Bradford reagent and measure the absorbance at 595nm. In the case of establishing a standard curve established by a series of diluted BSA, the protein concentration can be determined according to the standard curve.The protein-dye complex is detected at 595nm and baseline corrected at 750nm. Corresponding kits can be purchased from multiple manufacturers. Each kit will be equipped with Bradford reagent and standard protein as standard. According to its instructions, prepare the standard solution and use our standard curve module to model，The A595 value of the sample after testing should be within the range of the standard curve. If it exceeds this range, the sample needs to be diluted or concentrated as appropriate. Since the light absorption values of

different proteins are different, more accurate results can be obtained if the target protein can be used as a standard curve.

Lowry method： Under alkaline conditions, protein interacts with copper to form protein-copper complex.This complex reduces the phosphomolybdic acid-phosphotungstic acid reagent (Folin phenol reagent) to produce a dark blue complex (a mixture of phosphomolybdenum blue and phosphotungsten blue),This dark blue complex has a maximum absorption peak at 650nm, and the color depth is proportional to the protein content.It can be detected at 650nm and calibrated at 405nm.This method is easy to operate, and the sensitivity is 100 times higher than that of the biuret method. The quantitative range depends on each kit manufacturer. The color reaction of Folin phenol reagent is caused by tyrosine, tryptophan, and cysteine. Therefore, if the sample contains phenolphthalein, citric acid, and sulfhydryl compounds, they will all interfere.In addition, different proteins have slightly different color strengths due to the different contents of tyrosine and tryptophan. If the content of tyrosine and tryptophan in the protein in the sample is significantly different from that in BSA, please use the Bradford or BCA method. Since the kits of each manufacturer are slightly different, use the standard curve according to the instructions of the kit manufacturer.

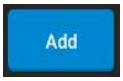
5.4.2Kit Method Basic Software Operation

1. Open the main interface of the kit method 

. Enter the kit detection interface, as shown in Figure 9.

If the item you want to measure has no standard curve, you need to establish a standard curve,click 

First enter the model list interface as shown in Figure 10.

2. Then click 

Enter the standard curve establishment interface as shown in FIG. 11.

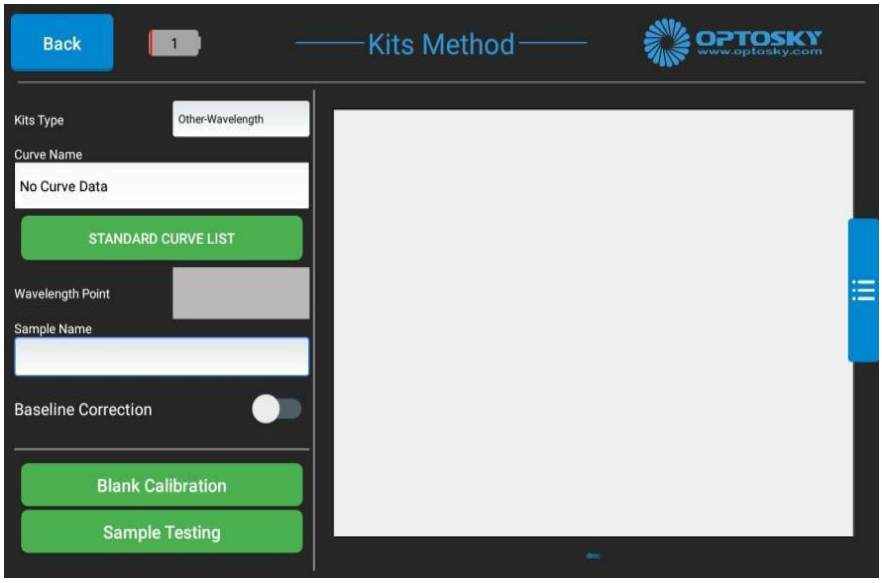


Figure 9: Kit detection interface

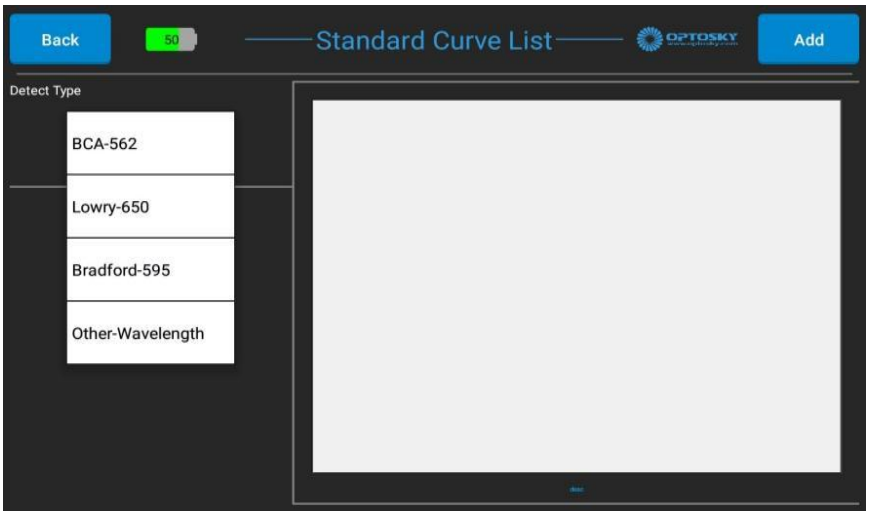


Figure 10 Standard Curve Model List Interface

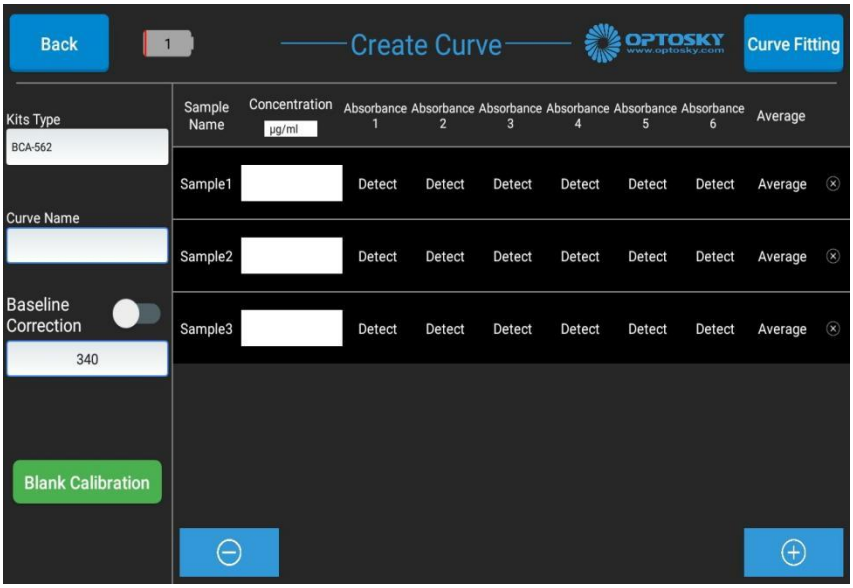


Figure 11: Standard curve creation interface

3. Choose the kit type first, we have BCA method, Bradford method, Lowry or custom.

4. Name the established standard curve.

5. Choose the wavelength of the baseline correction according to your needs. The BCA method generally selects the baseline correction at

750nm, the Lowry method selects the baseline correction at 405nm, and the Bradford method selects the baseline correction at 750nm.

6. Using buffer to establish a blank control,Add 2μL blank solution to lower base, lower upper base and click "blank check".

7. Finally, the standard solution of at least two points should be prepared according to the instruction of the kit. In order to accurately prepare more than 5-7 points,We can freely add or reduce the points of standard products on the interface, and test them successively according to the equipped concentration from low to high. First input the concentration, and then click Test.The six values can be tested repeatedly, and the instrument will perform a linear fit based on the final mean.The results after fitting will be displayed on the modeling result interface as shown in Figure 12.The instrument is very intuitive K value、b value、R^2，in order to make sure R^2 value More than 0.99 can be used,After building and saving，You can select the desired standard curve at the standard curve of our kit detection interface for application.The concentration of the tested sample must be within the linear range of the standard curve, beyond which dilution or concentration is required.

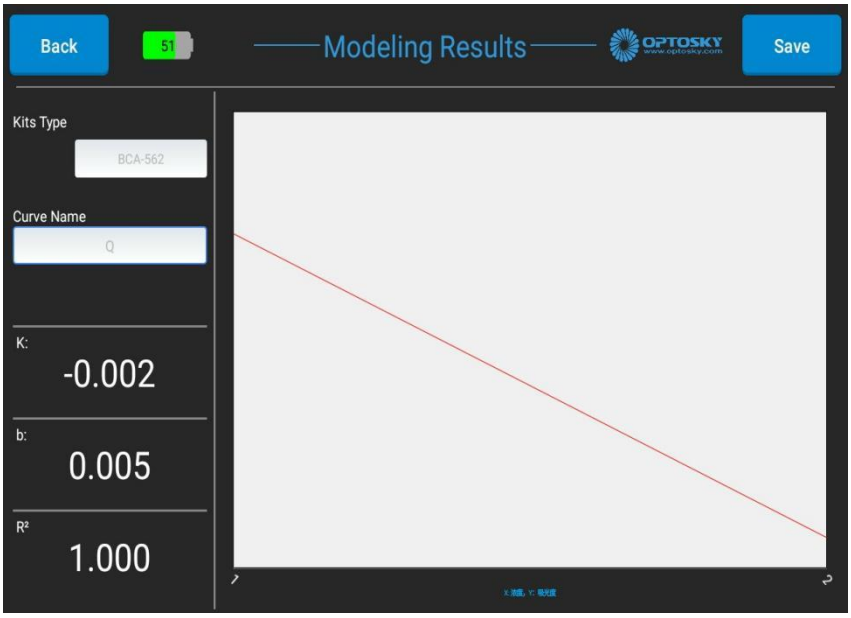


Figure 12: Modeling Result Interface

5.5. Protein A280

5.5.1. An Summarize of Protein A280

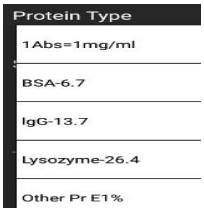
Proteins and nucleic acids are different and have a strong diversity.Protein A280Function is used to detect those containing tryptophan（Trp）, Tyrosine (Tyr) residues or pure proteins containing cysteine-cysteine (Cys-Cys) disulfide bonds, these proteins have obvious absorbance at 280nm.This method does not need to construct a standard curve but the software directly calculates the protein concentration after detecting the absorbance value. Protein A280 displays the ultraviolet absorption spectrum and detects the absorption at 280nm

Calculate the concentration (mg/ml) after the light value.Like nucleic acid detection, Protein A280 records and displays data under 10mm optical path. The default baseline correction wavelength of the protein is 340nm.

5.5.2.Protein A280 Software Basic Operation

1.Select the protein A280 module in the main interface to enter the detection interface as shown in Figure 13.

2.We first choose the type of protein to detect, choose 1Abs=1mg/mlDo 1Abs=1mg/ml test, BSA-6.7 for BSA test, lgG-13.7 for lgG test, Lysozyme-26.4 for Lysozyme test,Other custom ε1% detection.



The formula is as follows:

• C(1Abs=1mg/mL)= A280(10mm) mg/mL(It is recommended to use when the extinction coefficient is unknown and a rough estimate of the protein concentration is acceptable for solutions without other interfering substances.Assuming that a 0.1% (1 mg/mL) protein solution produces 1.0A at 280 nm (where the optical path is 10 mm), that is, ε1% = 10.)

• C(BSA)= A280(10mm) ×10/6.7 mg/mL （Bovine serum albumin，6.7L/gm-cm）

• C(IgG)= A280(10mm) ×10/13.7 mg/mL（Any mammalian antibody，13.7L/gm-cm）

• C(Lysozyme) = A280(10mm) ×10/26.4 mg/mL （Proteolysozyme，26.4L/gm-cm）

• C(Other protein) = A280(10mm) ×10/ E1% mg/mL （Other proteinsE1%,User - specified mass extinction coefficient）

3.Naming of sample name. 

4.： The user can input the calibration wavelength value (the default calibration wavelength is 340nm). If the baseline correction is selected, the background value at this wavelength will be deducted during measurement. 

5.Using the protein dissolving solvent as a blank control, drop the solvent onto the base and lower the detection arm，click 

button，The program automatically records blank values.

6.Wipe solvent from base with clean, dust-free paper.

7.Drop the sample onto the base, lower the detection arm,click 

button.

8.Results in a few seconds（Numbers and figures）

9.After the test, wipe the upper and lower bases clean.

10.Protein concentration values are shown at the right， A280(10mm)，

A260(10mm)/A280(10mm).

11.Report output is possible 

,data output 

,

detection record 

check.

Figure 13: Protein A280 Detection Interface

5.6.UV-Vis

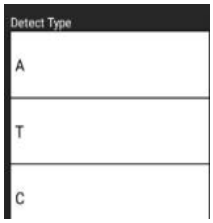
5.6.1.Full Wavelength Overview

NanoBio 200 has a common uV-vis spectrophotometer function,Full wavelength scanning is available， The wavelength scanning range is 190nm-850nm，And it has its own unique advantages，Our display mode can choose absorbance A, transmittance T, and concentration C, which is more intuitive. The user can choose three wavelengths for the detection result, and the corresponding value will be displayed visually on the right side of the spectrum. After re-entering, the last selected wavelength will be defaulted.When you need to view other wavelengths, modify the wavelength and click Update. The detection steps are the same as nucleic acid detection. Test results can also be reported output, data output, test record view.

5.6.2. Procedue for Full-Wavelength Detection Interface

1.Open the UV-VIS module on the main interface and enter the detection interface, as shown in Figure 14.

2.Choose absorbance measurement A, transmittance measurement T, or concentration measurement C according to your needs.



3.Naming of sample name. 

4.Determine whether to perform baseline correction based on testing needs,User can input correction wavelength value(The default calibration wavelength is 340nm). If baseline calibration is checked, the background value at this wavelength will be deducted during measurement.

5.Use the protein-dissolving solvent as a blank control, drop the solvent onto the base, put down the upper base, and form a liquid column, click 

button，The program automatically records blank values.

6.Wipe the solvent from the base with a clean lint-free paper.

7.Drop the sample onto the base, put down the detection arm, and click 

button.

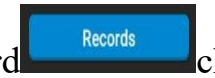
8.Results in a few seconds (numerical values and graphics)

9.Wipe the upper and lower bases clean at the end of the test.

10.The right side shows the absorbance values under three groups of self-selected wavelengths. If the selected mode is transmittance, it is the transmittance values under three groups of wavelengths.If the selected mode is concentration, you need to create a standard curve, which is similar to the kit method.

11.Detection results can be reported output 

, data output 

, detection record 

check.

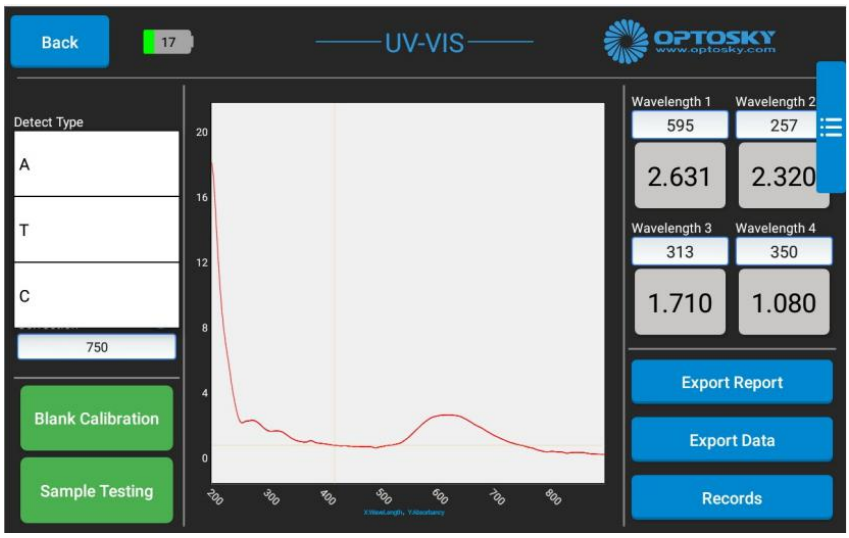


Figure 14: Full-Wavelength Detection Interface

5.7.OD600

5.7.1.OD600 Method Summarize

OD600 refers to the absorbance of a solution at 600nm. One of its important applications is to use the absorbance of bacteria to measure the concentration of bacterial culture solution, so as to estimate the growth of bacteria.

5.7.2.OD600 Detecting Steps

1.Select the OD600 module on the main interface to enter the OD600 detection interface as shown in the following figure.

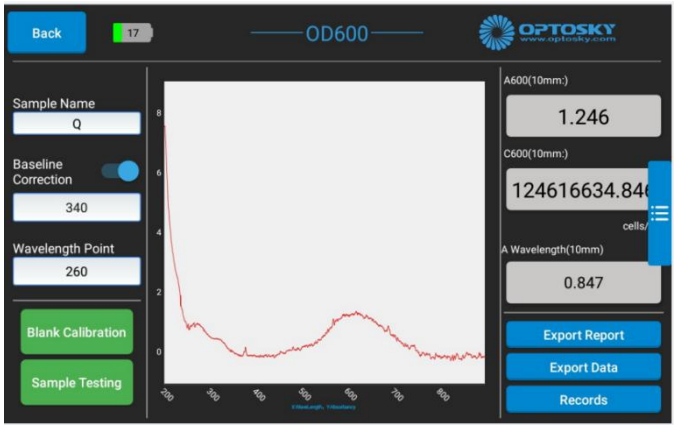


Figure 15: OD600 Detection Interface

2.Naming of sample name. 

3.The user can input the calibration wavelength value (the default calibration wavelength is 340nm). If the baseline correction is selected, the background value at this wavelength will be deducted during measurement. 

4.Use the cell dissolving solvent as a blank control, drop the solvent onto the base, put down the upper base, and form a liquid column,click 

button,The program automatically records blank values.

5.Wipe solvent from base with clean, dust-free paper.

6.Drop the sample onto the base, lower the detection arm,click 

button.

7.Results (numerical and graphic) in a few seconds.

8.After the test, wipe the upper and lower bases clean.

9.Display on the rightA600,C600， A(λ)。

5.8.History Record

After the detection, we can view the historical records, export and delete the data. When viewing, we can quickly search according to the classification of detection items.

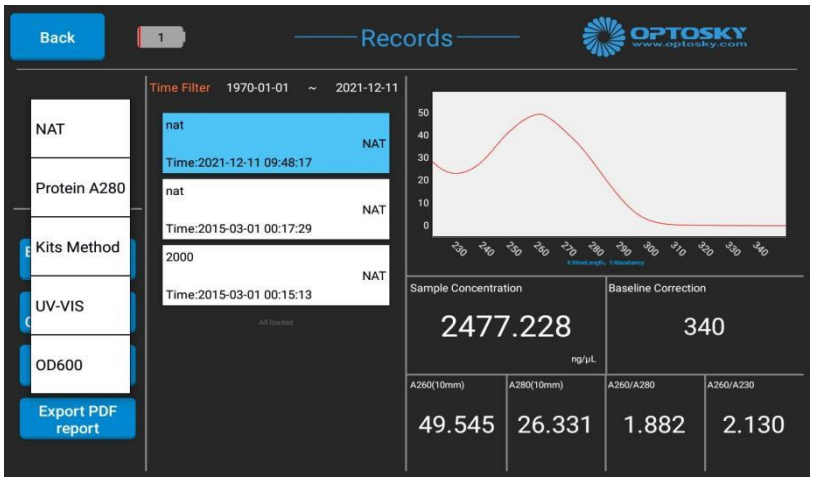


Figure 16: History Record Interface

5.9.Help

The user manual of our instrument is stored in the help module, which is convenient for everyone to check anytime and anywhere.

5.10.System Information

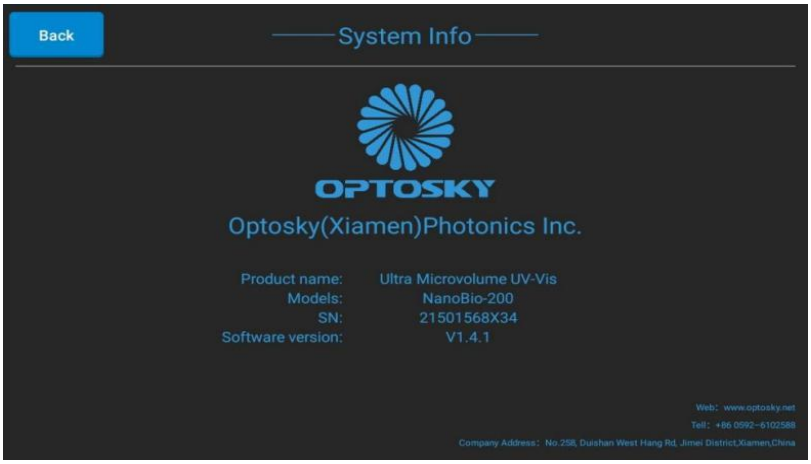


Figure 17: System Information Interface

The system information records the product name, model number, SN number and software version number of our instrument.As well as our company's website, contact information, address for users to inquire.