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TIANGEN BIOTECH (BEIJING) Co., LTD

Version no.: OS220816

TGem Ultra Spectrophotometer

User's Manual



Model	Product Name
OSE-260- 05	TGem Ultra Spectrophotometer (Standard)
OSE-260- 06	TGem Ultra Spectrophotometer (Cuvette)

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Important instructions

1. Routine practice

Attention	The items contain particularly important information, so please read them carefully. If users do not follow the instructions, the instrument may not work properly or may be damaged.
 **Warning**	Users are required to exercise special care in performing a particular step or method. Failure to follow the requirements correctly will potentially result in serious personal injury.

2. Security

In all operations, maintenance and repairs of this instrument, the following basic safety precautions and the warnings and cautions indicated in this manual must be observed. Failure to comply with these measures or the warnings and cautions noted elsewhere in this manual may affect the basic functions provided by the instrument, as well as result in failure to meet the safety standards for which the instrument was designed and manufactured, and affect the intended range of use of the instrument.

TIANGEN Biotech (Beijing) Co., Ltd. shall not be liable for any consequences resulting from the user's failure to comply with the following requirements.

Attention	This instrument is a Class I device in accordance with GB4793.1 standard, with protection class IP20. This instrument is a product for indoor use.

2.1 Instrument grounding

In order to avoid electric shock accidents, the input power line of the instrument must be reliably grounded. This instrument uses a three-prong grounding plug, which has a 3rd (grounding) pin and can only be used with a grounding type power outlet, which is a safety device. If the plug cannot be inserted into the socket, then an electrician should be asked to install the correct socket and not to make the grounded plug lose its safety protection.

2.2 Stay away from electrically charged circuits

Operators are not allowed to dismantle the instrument protection, replace components or make in-instrument adjustments without authorization, if necessary, it must be done by licensed professional maintenance personnel, and it is strictly prohibited to replace components when the power supply is connected.

2.3 Caution: Use of power supply

Before turning on the AC power, make sure that the output voltage of the power adapter is the same as the voltage required by the instrument (12V), and make sure that the rated load of the power outlet is not less than the maximum load of 30W required by the instrument.

2.4 Caution: Power cable

The instrument should normally be used with the supplied power cord. If the power cord is broken, it must be replaced and repairs are not allowed. When replacing it, users must use the same type and the same specification of power cord instead. When this instrument is in use, do not place anything on the power cord and do not place the power cord in a place where people flow.

2.5 Power cord plugging and unplugging

Power cord plugging and unplugging must be correctly handheld plug operating parts, plug insertion should ensure that the plug is completely, tightly inserted into the socket, do not force the power cord pull, tug when pulling out the plug.

2.6 Caution: Placement of the instrument

The instrument should be placed in a place free of corrosive gases, fumes and dust, and the room should be free of strong light, strong airflow or strong magnetic field interference. The table where the instrument is placed should be horizontal and stable.

When stop working, the power should be turned off. When the instrument is not used for a long time, the power should be cut off, unplugged, and the instrument covered with soft cloth or plastic film to prevent dust and foreign objects from entering.

2.7 Caution: Operation

(1) Avoiding drops of liquid on the surface of the apparatus during experimental operations;

(2) When experimenting in base mode, the sample should be added dropwise to the appropriate position on the instrument;

(3) When experimenting in cuvette mode, the cuvette should be placed in the appropriate position on the instrument.

Attention	The instrument should be immediately disconnected from the power supply by unplugging it from the electrical outlet and contacting the supplier or requesting qualified maintenance personnel in the following cases: • Spilling of liquid into the instrument; • Instruments exposed to rain or water; • The instrument is not working properly, especially if any abnormal sounds or smells are present; • Dropped instruments or damaged cases; • There is a significant change in instrument function.

3. Instrument use and maintenance

3.1 Base maintenance

(1) Sample Compatibility Statement

The base portion of the TGem Ultra is accessible to most solvents and solutions commonly used in life science laboratories, including methanol, ethanol, propanol, isopropanol, butanol, acetone, ether, chloroform, carbon tetrachloride, DMSO, DMF, acetonitrile, tetrahydrofuran, toluene, hexane, benzene, sodium hydroxide, sodium hypochlorite, dilute

hydrochloric acid, dilute nitric acid, and dilute acetic acid.

(2) Base use and maintenance

Please wipe off the liquid from the base immediately after test the sample. If users do not continue test, please clean the base with pure water and wipe it dry. This way the solution or solvent will not cause damage to the base.

Exposure to any form of hydrogen fluoride (HF) is prohibited; fluoride ions will dissolve the quartz fiber inside the base.

Do not allow any liquid to enter the gap between the base and the body, as this may damage the instrument. If any liquid is spilled, wipe it off immediately.

3.2 Whole instrument use and maintenance

Please be sure to read the instruction manual carefully before use.

Avoid direct sunlight. Avoid direct wind blowing when working, so as not to affect the accuracy.

Try to avoid using it in an environment with high humidity.

Wipe the surface frequently with a clean soft cloth to keep the surface clean. The use of corrosive cleaning agents is strictly prohibited.

In case of abnormalities, please record the process and phenomenon in detail and contact our company in time.

 **Warning**	• When the instrument is being cleaned, the power must be cut off. • The instrument surface is strictly prohibited to be cleaned with corrosive cleaning agents.

4. After-sales service

The TGem Ultra Spectrophotometer warranty period is 12 months. Damage to the instrument caused by improper use by the user, use under non-conforming conditions and unauthorized repair or modification is not covered by the warranty. For repair of instruments outside the warranty period, TIANGEN will charge repair costs according to the after-sales service standards.

 **Warning**	• This instrument should be inspected immediately after unpacking according to the list on the packing list, and the contents of the packing box. If users find any damaged or missing items, please contact the supplier immediately. • After unpacking the instrument, please keep the box and packing materials properly for maintenance. TIANGEN BIOTECH (BEIJING) CO., LTD. will not be responsible for any damage to the instrument due to improper packing during delivery to the service department.

Products

The TGem Ultra is a full wavelength ultra-micro UV-Visible spectrophotometer in the wavelength range of 185-910 nm, offering not only a base mode for easy measurement of trace samples (as shown in FIG.1-1), but also the ability to use a conventional cuvette (as shown in FIG.1-2) for sample test.

In base mode, the product can detect 0.5-2 μl of sample with very high accuracy and reproducibility of the test. When using the base mode for sample test, surface tension is applied to keep the sample between the two test fibers, which allows the instrument to detect higher concentrations without dilution, measure concentrations up to 200 times the concentration range of a normal spectrophotometer, and adjust the height of the column between the fibers in real time to obtain more accurate test data. Compared to traditional cuvette test methods, the base mode eliminates the complex cuvette cleaning process and requires only dust-free paper wipes for easy cleanup. In addition, for samples with low concentration, volatile or with relatively low surface tension that do not easily form a liquid column, a cuvette can be used for measurement.

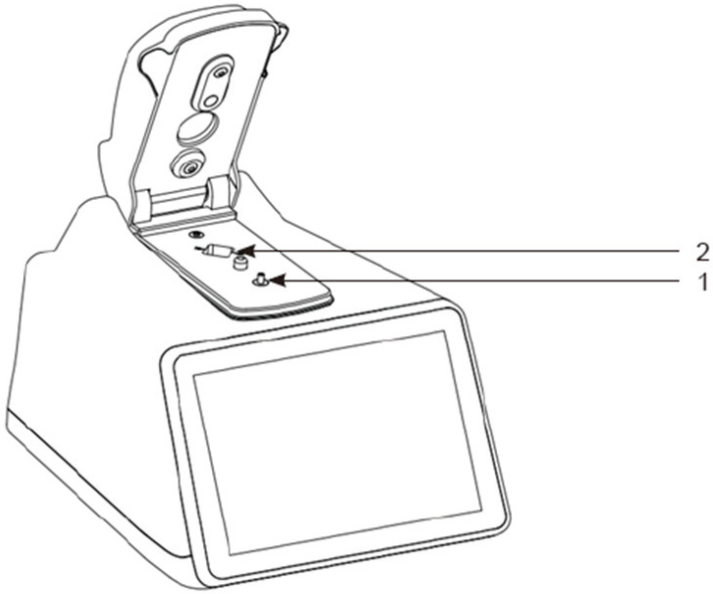

FIG.1

1. Instrument parameters

Product name		TGem Ultra Spectrophotometer (Standard)	TGem Ultra Spectrophotometer (Cuvette)
Cat. No.		OSE-260- 05	OSE-260- 06
Test unit		2048 pixel linear CCD array	
Minimum sample size		0.5 μl	
Optical range length		Automatic switching between 0.03/0.05/0.1/0.2/1.0 mm	
Wavelength range		185-910 nm	
Wavelength accuracy		±1 nm	
Spectral resolution		≤1.8 nm (FWHMat Hg 253.7 nm)	
Accuracy of optical density		0.002 Abs (1 mm optical range), or 1% CV, whichever is greater	
Optical density accuracy		3%(at 0.64A at 350 nm)	
Base minimum test concentration		2 ng/μl dsDNA	
Base maximum test concentration		27500 ng/μl dsDNA	
Test time		≤5 sec	
Cuvette	Heating temperature		37±0.5°C
	Stirring speed		10-900 rpm, 10 speed steps adjustable
	Optical density range		0-1.5A (10 mm)
	Minimum test concentration		0.2 ng/μl dsDNA
Display		7-inch, 1280*800 pixels color display, capacitive touch screen, support gesture operation	
Operating System		Android	
Internal storage space		8GB	
Data interface		USB, WIFI	
Power supply		AC110V-220V, 50Hz/60Hz (power adapter)	
Weight		2.2 kg	2.3 kg

2. Package Composition

Items	Quantity	Unit
Host instrument	1	Set
Power cord	1	Pcs
Power adapter	1	Pcs
Instruction manual	1	Copies
Performance Inspection Report	1	Copies
Packing list	1	Copies
Certificate of Conformity	1	Copies
Product Warranty Card	1	Copies
32G USB Disk	1	Pcs

Precautions before using the instrument

As shown in FIG.2, open the upper arm before the instrument power switch is turned on, remove the anti-collision spacer, and then lower the upper arm gently. This anti-collision spacer is to prevent the upper arm from colliding with the positioning post during the movement of the instrument. After the instrument has been used, it is recommended that the crash spacer be returned to the position shown in FIG.2.

As shown in FIG.3, before using the instrument, connect the 12V adapter power cable to the power connector on the back of the instrument, plug the three-pronged plug into the power socket to turn on the power, and turn on the instrument power switch to start the instrument; the USB A-type interface can both be used for product program upgrade and data export.

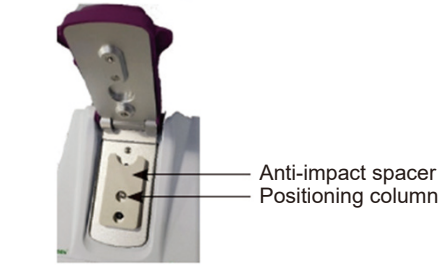

FIG.2

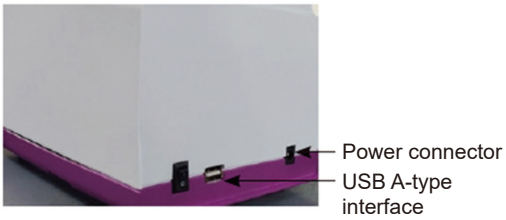

FIG.3

As shown in FIG.4, when switching between base mode and cuvette mode, the screen pops up a progress indication of channel switching, please do not open the upper arm during the channel switching process, and wait for successful channel switching before proceeding to the next operation.

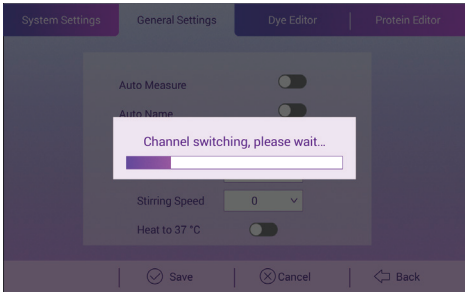

FIG.4

Software and basic operation

The instrument starts self-test after power on, the self-test process is shown in FIG.5, and the display shows the main page as FIG.6 after the self-test is passed. This product does not need to be preheated and can be measured directly. The main interface of the instrument includes sample test, data review, setup, system status, and instrument diagnostics.

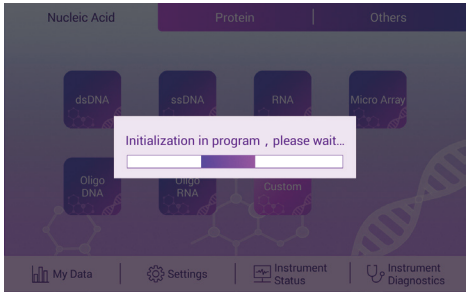

FIG.5

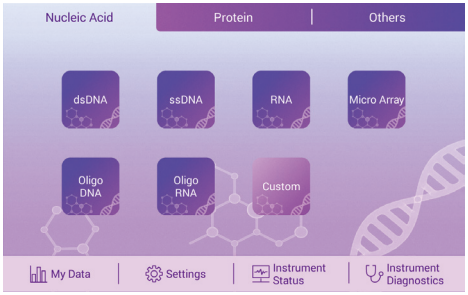

FIG.6

1. Test interface (dsDNA as an example)

The three main categories of nucleic acids, proteins, and others are displayed at the top of the sample test interface (e.g., FIG.6), with corresponding subcategories under the main categories. Click the dsDNA subcategory under Nucleic Acid Category to enter the dsDNA test interface, as shown in FIG.7, which mainly includes the menu, status bar, data window and function buttons.

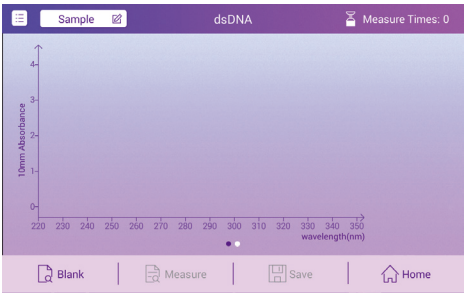

FIG.7

1.1 Menu

The menu is located in the upper left corner, as shown in icon . Click on the menu bar as shown in Fig.8. It is mainly used for export and system setup functions.

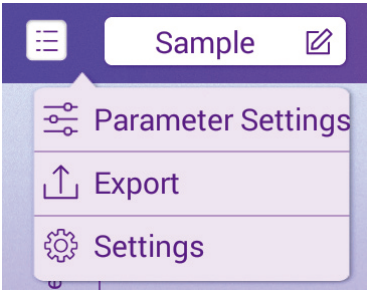

FIG.8

(1) Parameter Settings: Used to set the parameters of the test sample.

Baseline calibration: The default calibration wavelength is 340 nm, and users can check or uncheck the baseline calibration according to the experimental requirements. As shown in FIG.9.

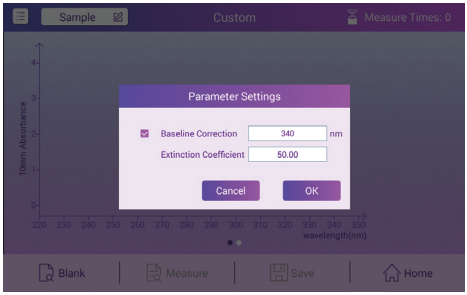

FIG.9

Extinction coefficient: The corresponding extinction coefficient can be entered, as in FIG.9.

Sample type: Users can set the sample type corresponding to the test, as in FIG.10.

Dyes: Users can select preset dyes or use the dye editing function to add new dyes, as shown in FIG.10.

Dye slope correction Correct the optical density for dyes due to subtraction of any shifts in optical density from 400nm to 750nm in the slope baseline at the wavelength of the dye analysis caused by light scattering particles, as shown in FIG.10.

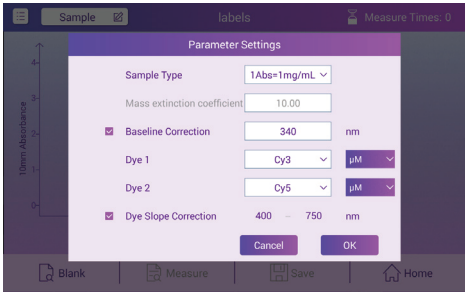

FIG.10

Optical density correction: The user-defined optical density correction input is used to display the optical density correction of the spectrogram, which is obtained by subtracting the optical density correction value from the optical density at all wavelengths in the sample spectrum, as shown in FIG.11.

Cell conversion factor 10^8: User-defined factor for detecting recognized factors of cell types, or empirically by using solutions with known concentrations of cells in the same medium for study. The default value is 1.00×10^8, which is the accepted coefficient used for most bacterial cell suspensions, such as E. coli, as shown in FIG.11.

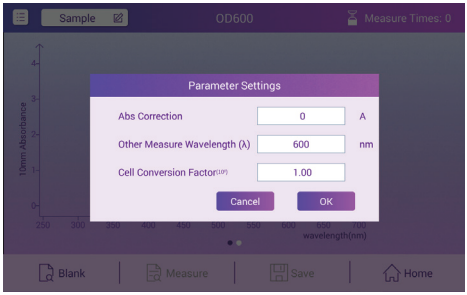

FIG.11

(2) Export: Export the test data to a USB flash drive.

(3) Setting: For quick access to the system setting screen.

1.2 Status bar

As shown in FIG.12, the status bar from left to right corresponds to the name of the test, the

type of test, and the current number of tests.



FIG.12

(1) Test name: Located on the leftmost side of the top status bar, it is used to display the test name when editing a single test, which can be edited. Click on the name to edit the content. If users activate "Auto Naming" function in the setting (see the description of "Setting"), then after each test, it will be name automatically as Sample1, Sample2, Sample3, Sample4... .

(2) Test category: Located in the middle of the top status bar, it is used to display the category selection of the current experiment.

(3) The icon / is used to display the current for base/cuvette test.

(4) Number of tests: Located on the rightmost side of the top status bar, it is used to show the current number of tests.

1.3 Data window

The data window mainly includes a graph, a list of sample details, and a list of test results. The chart coordinates and titles will vary for different test contents.

The dots below the curve, as shown in the icon , represent how many sub-pages the current page has, the purple dot indicates the location of the current page, the icon indicates that there are two sub-pages, currently in the first page, users can slide left/right to switch pages. As shown in Figure 14, switch to the second sub-page.

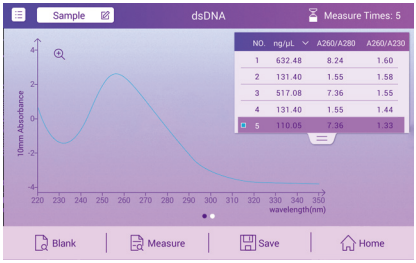

FIG.13

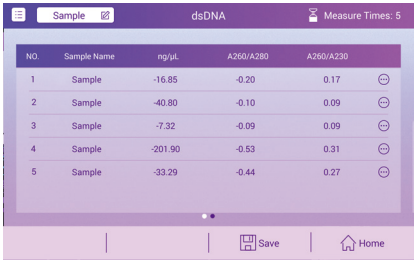

FIG.14

(1) Curves: As shown in FIG.13, the curves show the curves of the latest samples tested.

(2) List of test results: As shown in FIG.15, the list of test results is displayed on the right side of the data area after the test is completed. Click on a row in the list to select a sample and update the graph, with up to five spectral curves displayed overlapping. Click on the selected row again to uncheck it.

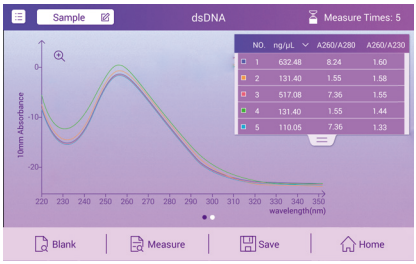

FIG.15

(3) List of details: Swipe the screen to the left from Figure 15 to switch to the sample detail list, as shown in Figure 16, click the icon after the line to enter the detail page, as shown in Figure 17.

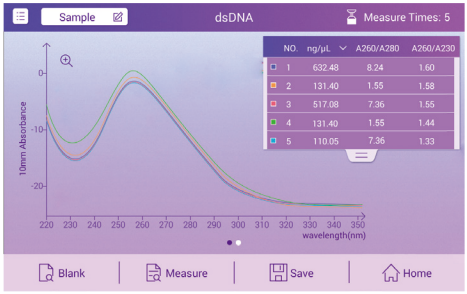

FIG.16

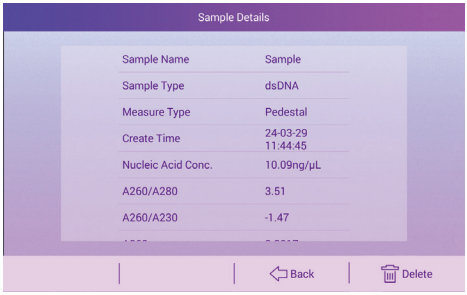

FIG.17

(4) Details page: As shown in FIG.17, the details page is used to display more information about the test. Click "Back" to return to the previous page, click "Delete" to delete the test.

1.4 Function button

The function buttons are divided into four buttons, as shown in FIG.18, corresponding to "Blank", "Measure", "Save" and "Home".



FIG.18

(1) Blank: Use the buffer in which the sample was dissolved to make a blank control. A blank control must be done before performing the sample test.

(2) Measure: Start the sample test. This function key is grayed out when users first enter an application and can only be used after a good blank control. When test, if users do not lift the upper arm to add samples, click "test" directly, the system prompts "please re-sample", users need to lift the upper arm, re-sample, put down the upper arm, click "test" to start sample test.

(3) Save: Save the current experiment record. When users first enter the application, the

Save button is grayed out and unclickable and must be tested at least once before it can be used. No test data can be saved.

(4) Home: Return to the main interface.

2. Data review

The data review is used to view the saved experiment information, as shown in FIG.19.

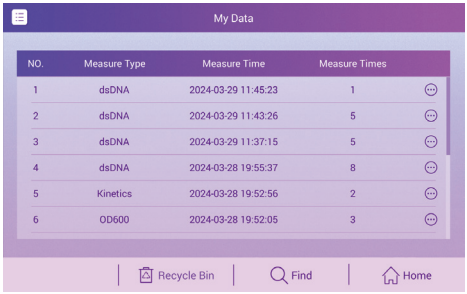

FIG.19

2.1 Main functions of data view

(1) Disk Status: Click "My Data" in the main interface to enter the my data homepage, as shown in FIG.19, click the menu bar in the upper left corner to bring up the menu, click Select Disk Status to view the current disk space usage of the instrument, as shown in FIG.20.

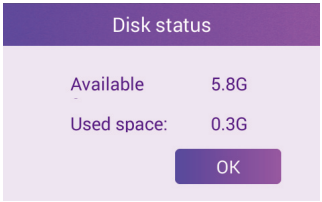

FIG.20

(2) Find: Click "My Data" in the main interface to enter the data browsing homepage, as shown in FIG.19, click the "Find" button below to enter the search page and select the screening criteria, as shown in FIG.21.

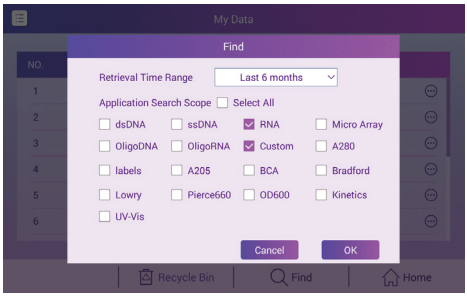

FIG.21

The search criteria include the following:

Search time range - time at the time of the experiment, "last 1 day", "last 2 days", "last 1 week ", "last 2 weeks", "last 1 month", "last 2 months", "last 6 months". " seven time ranges to choose from.

Application Search Range - Used to filter the view of the specified application, when selected only the checked application categories will be displayed. Click "Select All" to automatically check all applications.

(3) Delete: Click "My Data" on the main screen to enter the Data Browse homepage. Long press a line to select, selected, the original "Find" button becomes "Delete", as shown in FIG.22, click "Delete", users can delete the experiment from the database.

Note: Multiple rows can be selected for deletion at the same time.

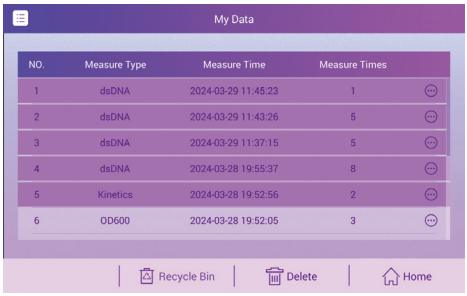

FIG.22

(4) View data: Click “My Data” in the main interface to enter the data browsing homepage, click , users can view the details of the group of data.

3. Setting

In the main screen, click the "Settings" function button, or click "Menu" in any test item and select "Settings". The instrument settings are divided into four modules, including "System Settings", "General Settings", "Dye Editor" and "Protein Editor".

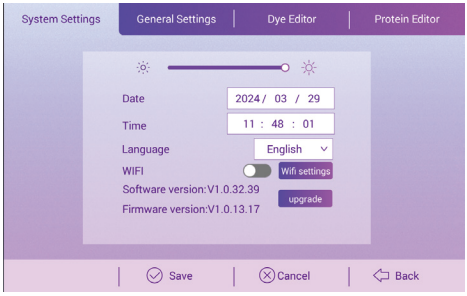

FIG.23

Save: Click the "Save" button to save all the operations set in the settings screen. And prompt "Settings Saved", as shown in FIG.22.

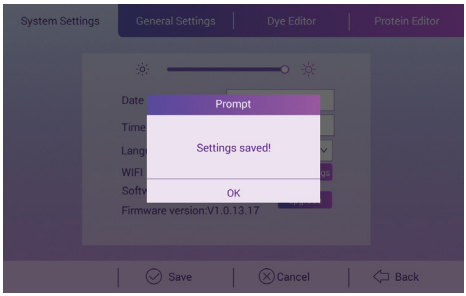

FIG.24

Cancel: Click the "Cancel" button to cancel the operation in this page and return to the previous page.

Back: Click the "Back" button to keep the editor's delete operation and return to the previous page.

3.1 System setting

The following elements are included, as shown in FIG.24:

Brightness - adjusts the brightness of the instrument's touch screen

Date and time - manually set the instrument's time and date, using a 24-hour time format;

Language-Switch the language of the instrument, Chinese or English optional;

WIFI - WIFI hotspot parameter settings;

Software version - the current version of the software;

Firmware version - the current version of the firmware;

USB disk upgrade - please contact our after-sales technician.

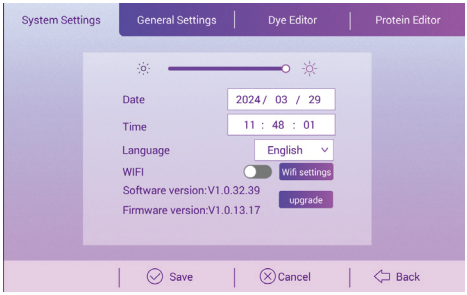

FIG.25

3.2 General setting

The following elements are included, as shown in FIG.25:

Auto-detect - If auto-detect is enabled, during base test, lower the upper arm and test will

begin automatically without the need to click the "Detect" button.

Auto-naming - Automatically assigns a sample name using the base name (default is Sample) followed by a number starting with "1".

Use cuvette - Select the cuvette style as shown in FIG.26. If this option is selected, the following additional options will be provided:

Optical range: Set the cuvette optical range (width) before using the cuvette for blank test or before sample test.

Stirring speed: If stirring is used, place the stirring microsphere in the sample cuvette and set the stirring speed range.

Heated to 37°C: If the sample cuvette needs to be heated, users can select this item and the cuvette heater will heat the cuvette to 37°C.

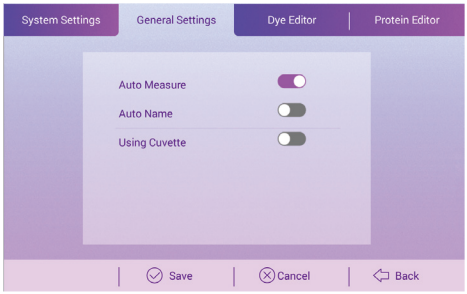

FIG.26

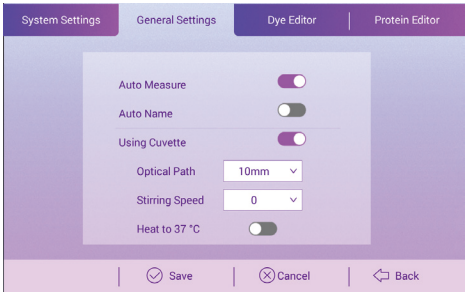

FIG.27

3.3 Dye editor

Use the dye editor to add user-defined dyes to the list of available dyes in the GeneChip parameter settings and ProteinChip parameter settings, and to specify the available dyes in the list.

If the dye is selected prior to the test, a correction is applied to the optical density of the tested sample and the resulting sample concentration and purity ratio.

To use the Dye Editor, on the Home screen, click the Settings function button to go to the Settings page and select the Dye Editor tab as shown in FIG.28;

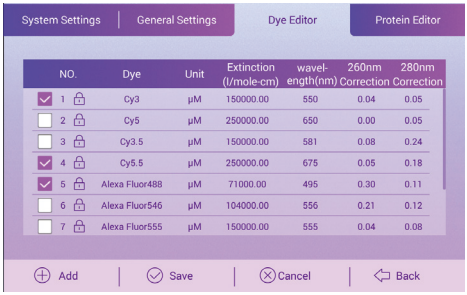

FIG.28

The dye editor includes the following operations:

(1) represents a locked dye (predefined: not editable or deletable).

(2) User-defined dyes (user defined: Can be edited or deleted)

(3) Add or remove dyes: To add or remove dyes from the Dye 1 and Dye 2 drop-down lists in the GeneChip Parameter Settings or ProteinChip Parameter Settings, select or deselect the corresponding checkboxes.

(4) Add user-defined dyes: Click "Add" button to automatically add a custom dye at the bottom.

(5) Edit user-defined dyes: Click on the dye users want to edit to enter the editing state, as shown in FIG.27.

Dye: Enter a unique name for the new dye.

Units: The default units selected to display the concentration of the dye.

Wavelength: The specified wavelength in nm (between 450 nm and 700 nm) for detecting the optical density of the dye.

260 nm correction: Specify the 260 nm correction value for the dye.

280 nm correction: Specify the 280 nm correction value for the dye.

(6) To delete user-defined dyes: Select a line and click "Delete" to permanently delete the user-defined dye.

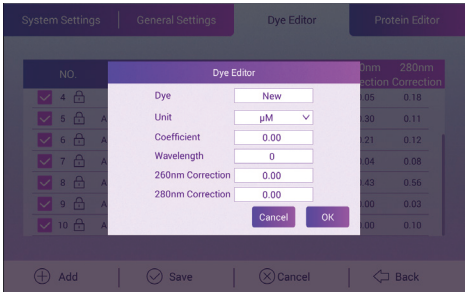

FIG.29

3.4 Protein editor

Use the Protein Editor to add user-defined proteins to the list of available protein sample types in the Protein A280 parameter settings and ProteinChip parameter settings, as shown in FIG.30.

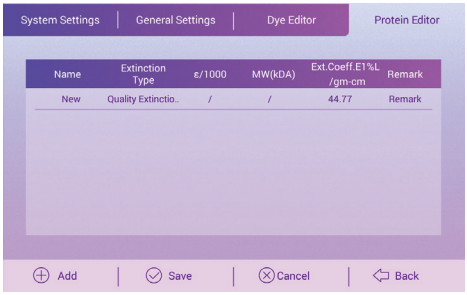

FIG.30

The Protein Editor includes the following content operations:

(1) Adding user-defined proteins: Click "Add" button to automatically add a custom protein at the bottom;

(2) Edit user-defined proteins: Select a row and click it to enter editing status, as shown in FIG.29.

Name: Enter a unique name for the protein;

Extinction type: Specify the molar extinction coefficient or mass extinction coefficient used by the user to customize the protein. If Mass Extinction Coefficient is selected, enter the mass extinction coefficient in L/gm-cm for a 10 mg/ml (ε1%) protein solution. If Molar Extinction Coefficient (ε) is selected, enter it in M-10 mm-1 divided by 1000 (i.e., ε/1000). For example, for a protein with a molar extinction coefficient of 210000 M-10 mm-1, enter 210, and enter the molecular weight (MW) in kilodaltons (kDa);

Remark: Add a note for the protein.

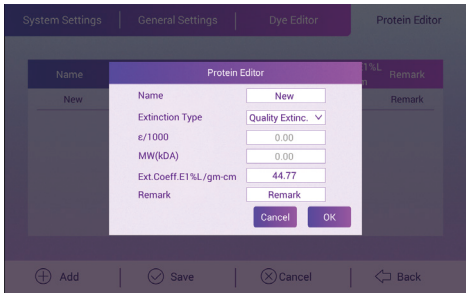

FIG.31

(3) To delete user-defined dyes: Select a line and click "Delete" to permanently delete the user-defined protein.

4. Instrument diagnosis

Spectral intensity diagnostics to confirm that the internal spectrometer is operating and calibrated properly; spectral diagnostics to confirm that the fiber movement is normal.

Enter the main interface of the instrument, click the "Instrument Diagnosis" button at the bottom right corner to enter the instrument diagnosis interface, as shown in FIG.32.

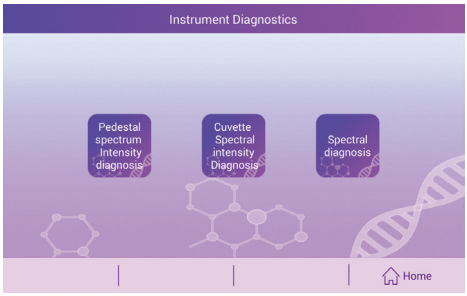

FIG.32

4.1 Base spectral intensity diagnosis

(1) Click "Base Spectrum Intensity Diagnosis" on the "Instrument Diagnosis" interface to enter the "Base Spectrum Intensity Diagnosis" interface, as shown in FIG.31.

(2) Add any reagents to the top of the base and click the "Test" button on the screen.

(3) After the test is completed, the spectrum in the upper right corner of the screen: UV, offset, visible are green "√", then the base spectrum intensity is normal; if there is a red "X" appears, please contact our company after-sales for solving the problem.

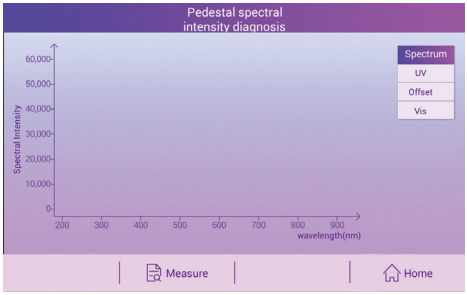

FIG.33

4.2 Cuvette spectral intensity diagnosis

(1) Click "Cuvette Spectral Intensity Diagnosis" on the interface of "Instrument Diagnosis" to enter the interface of "Cuvette Spectral Intensity Diagnosis", as shown in FIG.32.

(2) The cuvette test tank is not filled with reagent and the "Test" button is clicked on the screen.

(3) After the test is completed, the spectrum in the upper right corner of the screen: UV, offset, visible are green "√", then the base spectrum intensity is normal; if there is a red "X" appears, please contact our company after-sales for solving the problem.

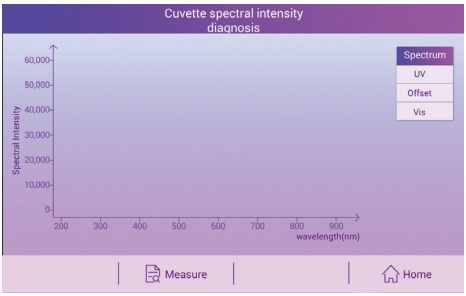

FIG.34

4.3 Spectral diagnosis

(1) After the spectral intensity diagnosis, click "Spectral Diagnosis" to enter the "Spectral Diagnosis" interface, as shown in FIG.33.

(2) Add 1-2 μl of pure water to the bottom base, lower the upper arm and click "Blank".

(3) Wipe the pure water from the base with clean, dust-free paper, add 2 μl of potassium dichromate to the bottom base and click the "Measure" button to perform the test.

(4) The tested value will be displayed in the current optical density and the average optical density (the average value of multiple potassium dichromate tests), and the corresponding error should meet within 2% error for 1 mm, within 5% error for 0.2 mm, within 15% error for 0.1 mm, within 35% error for 0.05 mm, and within 45% error for 0.03 mm.

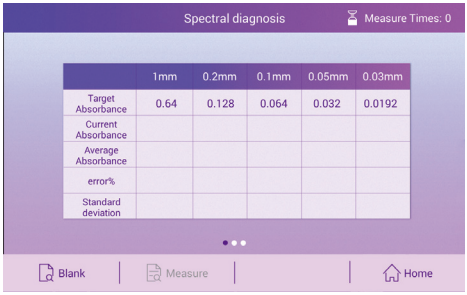

FIG.35

Attention	Spectral diagnosis needs to be done ten times. At the end of ten tests, the relevant data will be automatically stored in the software to complete the spectral diagnosis.

Basic measurement operations

1. Basic base inspection operations

(1) Lift the upper arm (as in FIG.36-1), add the blank solution to the test base (as in FIG.36-

2), lower the upper arm, and click "Blank" to measure the blank value.

(2) Lift the upper arm, wipe the solution on the upper and lower bases (FIG.36-2 and 36-3) with clean dust-free paper, add 1-2 μl of sample to the test base, lower the upper arm, and click "Measure" to complete the sample test.

(3) After all samples are tested, lift the upper arm and wipe the samples on the upper and lower bases with clean dust-free paper, then take 2μl of pure water and add it to the upper and lower bases and wipe the water clean with clean dust-free paper to avoid the residue of samples on the bases.

(4) After the test is complete, click "Save", enter the file name, and click "Confirm".

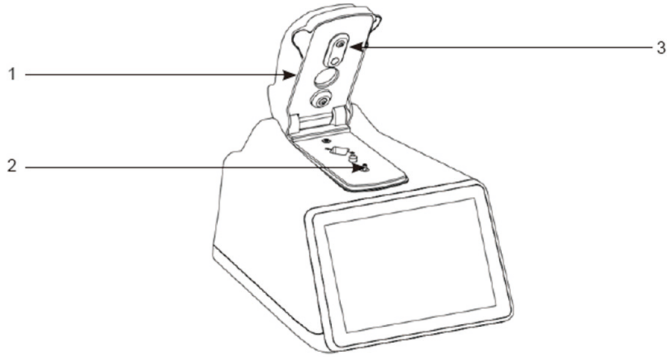

FIG.36

2. Basic operation of cuvette test

Cuvette	Outer dimensions of the cuvette: 12.5 mm (L) × 12.5 mm (W) × 45 mm (H).
Measurement	Optional cuvette optical ranges: 10, 5, 2 and 1 mm;
Specification	Test zone: 8.5 mm high from the bottom;

If the measurement wavelength is less than 340 nm, please choose quartz or other UV-permeable cuvettes.

(1) In the main interface, click "Settings", or in any test item, click "Menu" and select "Settings", and in "General Settings "Select the "Use cuvette" option, set the "Optical range", "Stirring speed" and whether to "Heat to 37°C" and click "Save".

(2) Prepare two cuvettes, one to add the blank test solution and one to add the sample, ensuring that the amount of liquid added is sufficient to cover the light beam. The beam (2 mm wide) is positioned 8.5 mm above the bottom of the cuvette, add liquid as recommended by the cuvette manufacturer.

(3) Enter the test interface, click "Menu" in the parameter settings, check the baseline correction, set the corresponding parameters.

(4) Lift the upper arm and insert the cuvette with the blank solution into the instrument. When inserting the cuvette, note that the light-transmitting surface of the cuvette

corresponds to the direction of the light path pointing above the instrument (in the direction of the arrow shown in FIG.37). Lower the upper arm and click "Blank test".

(5) Lift the upper arm, take out the cuvette with the blank solution, put in the cuvette with the sample, lower the upper arm and click "Test" to finish the sample test.

(6) After the test is completed, remove the cuvette, pour out the sample and clean the cuvette.

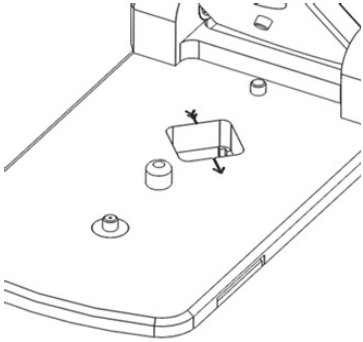

FIG.37

Attention	Regardless of the mode used for test, the upper arm must be lowered. If the upper arm is not lowered, the instrument will prompt "Please close the upper arm" or "Experimental data abnormal" in the middle of the interface. Before doing the base test, remove the cuvette so that users can ensure that the upper arm is placed in the correct position.

3. Base test blank cycle

We recommend running the blank control as a sample to confirm that the instrument is performing well and that no sample remains on the base, and running the blank cycle as follows:

(1) Enter the test interface, add 2 μl of pure water to the base, lower the upper arm, click "Test", lift the upper arm after the test and wipe the sample from the upper and lower bases with clean dust-free paper.

(2) Use a pipette to add 2 μl of pure water to the base, lower the upper arm, click "Test", lift the upper arm after the test and wipe the sample from the upper and lower bases with clean dust-free paper.

(3) Repeat the above-mentioned second part of the pure water test steps twice; save the data results after test, lift the upper arm, wipe the samples on the upper and lower bases with clean dust-free paper, and then lower the upper arm.

(4) The change in optical density of 260 should not exceed 0.04 A for the three tests observed on the display; although a blank test is not required between each sample, we recommend that a blank test be performed preferably every 30 min when test multiple samples.

Nucleic acid test

Sample types in this category include "double-stranded DNA (dsDNA)", "single-stranded DNA (ssDNA)", "RNA", "GeneChip ", "oligo DNA", "oligo RNA" and "custom".

1. dsDNA test

The concentration and quality of dsDNA can be easily tested using this product. To test dsDNA, first select the dsDNA function on the main page. dsDNA test can display the optical density from 220 nm to 350 nm.

1.1 Nucleic acid concentration calculation

Use the Beer-Lambert law for nucleic acid concentration calculations:

$$C=(A*\varepsilon)/b$$

C - Nucleic acid concentration in ng/μl

A - Absorbance value in AU

ε - The extinction coefficient in ng-cm/μl, typically 50 ng-cm/μl for dsDNA

b - optical path in cm

When the base mode is selected, the instrument uses a short optical range of 1.0 mm to 0.05 mm for test, allowing test of highly concentrated samples without dilution. The instrument can accurately test double-stranded DNA at concentrations ≤27,500 ng/μl without dilution. For each sample, the software automatically selects the best test optical range for the test.

When the optical density of the test sample is ≥ 3.0 (at 10 mm optical range), a smaller amount of sample can be used for the test.

The graph shows the optical density for the current sample calibrated to 10 mm optical range.

Nucleic acid concentration test

Refer to "Basic measurement operation" for the test steps.

The test results include the following:

Sample type: The type of sample to be tested.

Sample name: Enter the sample name before sample test.

Test method: Whether the test is performed on a cuvette, or a base.

Creation time: The system time when the test was performed.

A230 (10 mm optical range): Displays the optical density at 230 nm under 10 mm optical range.

A260 (10 mm optical range): Displays the optical density at 260 nm under 10 mm optical range.

A280 (10 mm optical range): Displays the optical density at 280 nm under 10 mm optical

range.

260/280 - The optical density ratio at 260 nm and 280 nm, which is used to determine the purity. If this ratio is small, it indicates the presence of protein, phenol or other contaminants, which have significant optical absorption at 280 nm.

260/230 - The optical density ratio at 260 nm and 230 nm, which is a secondary indicator of nucleic acid purity. This ratio for pure nucleic acids is larger than the 260/280 ratio, and a low ratio indicates that there are contaminants in the nucleic acid.

Concentration value - The concentration value calculated from the optical density and the extinction coefficient at 260 nm, which unit can be selected in the following drop down box.

2. ssDNA test

ssDNA concentration and mass can be easily tested using this instrument. To test ssDNA, users need to select on the main page ssDNA test can display the optical density from 220 nm to 350 nm.

2.1 Nucleic acid concentration calculation

Use the Beer-Lambert law for nucleic acid concentration calculations:

$$C=(A*\varepsilon)/b$$

C - Nucleic acid concentration in ng/μl

A - Absorbance value in AU

ε - The extinction coefficient in ng-cm/μl, typically 33 ng-cm/μl for ssDNA

b - Optical path in cm

When the base mode is selected, the instrument uses a short optical range of 1.0 mm to 0.05 mm for test, allowing test of highly concentrated samples without dilution. The instrument can accurately test ssDNA at concentrations ≤27500ng/μl without dilution. For each sample, the software automatically selects the best test optical range for the test.

When the optical density of the test sample is ≥ 3.0 (at 10 mm optical range), a smaller amount of sample can be used for the test.

The sampling curve shows the optical density for the current sample calibrated to a 10 mm optical range.

2.2 Nucleic acid concentration test

Refer to "Basic measurement operation" for the test steps.

The test results include the following:

Sample type: The type of sample to be tested.

Sample name: Enter the sample name before sample test.

Test method: Whether the test is performed on a cuvette, or a base.

Creation time: The system time when the test was performed.

A230 (10 mm optical range): Displays the optical density at 230 nm under 10 mm optical range.

A260 (10 mm optical range): Displays the optical density at 260 nm under 10 mm optical range.

A280 (10 mm optical range): Displays the optical density at 280 nm under 10 mm optical range.

260/280 - The optical density ratio at 260 nm and 280 nm, which is used to determine the purity. If this ratio is small, it indicates the presence of protein, phenol or other contaminants, which have significant optical absorption at 280 nm.

260/230 - The optical density ratio at 260 nm and 230 nm, which is a secondary indicator of nucleic acid purity. This ratio for pure nucleic acids is larger than the 260/280 ratio, and a low ratio indicates that there are contaminants in the nucleic acid.

Concentration value - The concentration value calculated from the optical density and the extinction coefficient at 260 nm, which unit can be selected in the following drop down box.

3. RNA test

RNA concentration and mass can be easily tested using this instrument. To test RNA, users need to select RNA function on the main page RNA test can display the optical density for samples from 220 nm to 350 nm.

3.1 Nucleic acid concentration calculation

Use the Beer-Lambert law for nucleic acid concentration calculations:

$$C=(A*\varepsilon)/b$$

C - Nucleic acid concentration in ng/μl

A - Absorbance value in AU

ε - The extinction coefficient in ng-cm/μl, typically 40 ng-cm/μl for RNA

b - Optical path in cm

When the base mode is selected, the instrument uses a short optical range of 1.0 mm to 0.03 mm for test, allowing test of highly concentrated samples without dilution. The instrument can accurately test RNA at concentrations ≤27500 ng/μl without dilution. For each sample, the software automatically selects the best test optical range for the test.

When the optical density of the test sample is ≥ 3.0 (at 10 mm optical range), a smaller amount of sample can be used for the test.

The graph shows the optical density for the current sample calibrated to 10 mm optical range.

3.2 Nucleic acid concentration test

Refer to "Basic measurement operation" for the test steps.

The test results include the following:

Sample type: The type of sample to be tested.

Sample name: Enter the sample name before sample test.

Test method: Whether the test is performed on a cuvette, or a base.

Creation time: The system time when the test was performed.

A230 (10 mm optical range): Displays the optical density at 230 nm under 10 mm optical range.

A260 (10 mm optical range): Displays the optical density at 260 nm under 10 mm optical range.

A280 (10 mm optical range): Displays the optical density at 280 nm under 10 mm optical range.

260/280 - The optical density ratio at 260 nm and 280 nm, which is used to determine the purity. If this ratio is small, it indicates the presence of protein, phenol or other contaminants, which have significant optical absorption at 280 nm.

260/230 - The optical density ratio at 260 nm and 230 nm, which is a secondary indicator of nucleic acid purity. This ratio for pure nucleic acids is larger than the 260/280 ratio, and a low ratio indicates that there are contaminants in the nucleic acid.

Concentration value - The concentration value calculated from the optical density and the extinction coefficient at 260 nm, which unit can be selected in the following drop down box.

4. GeneChip

Use the GeneChip application to quantify nucleic acids that have been labeled for use with up to two fluorescent dyes. The application reports the nucleic acid concentration, the A260/A280 ratio and concentration, and the optical density of the dye tested, allowing test of dye concentrations down to 0.2 pmol/µl.

4.1 Test concentration range

The instrument can accurately detect fluorochrome-labeled nucleic acid concentrations up to 100 pmol/µl of Cy3 as well as 750 ng/µl of DNA.

The graph shows the optical density for the current sample calibrated to 10 mm optical range.

4.2 Dye editing

Users can select preset dyes in the instrument software or use the dye editing function to add new dyes. To add a new dye, select the Dye Editor in "Setting" and fill in the appropriate calibration parameters by referring to the dye manufacturer's instructions. When the appropriate dye is selected, the 260 nm calibration will be automatically applied to the nucleic acid concentration calculation. Please refer to "Setting dye editor" for detailed operation. The default setting is Cy3 for dye 1 and Cy5 for dye 2.

4.3 Gene chip test

Refer to "Basic measurement operation" for the test steps.

The test results include the following:

Sample type: The type of sample to be tested.

Sample name: Enter the sample name before sample test.

Test method: Whether the test is performed on a cuvette, or a base.

Creation time: The system time when the test was performed.

A260 (10 mm optical range): Displays the optical density at 260 nm under 10 mm optical range.

A280 (10 mm optical range): Displays the optical density at 280 nm under 10 mm optical range.

260/280 - The optical density ratio at 260 nm and 280 nm, which is used to determine the purity of DNA and RNA. If this ratio is small, it indicates the presence of protein, phenol or other contaminants, which have significant optical absorption at 280 nm.

Concentration value - The concentration value is calculated from the optical density at 260 nm and specific extinction coefficients, which unit can be selected in the following drop down box.

Dye Editor - Select dyes, the default choices are: Dye 1 (Cy3), Dye 2 (Cy5).

Dye 1 concentration - The concentration of dye 1 at the corresponding light range.

Dye 2 concentration - The concentration of dye 2 at the corresponding optical range.

pmol/μl - The concentration calculated based on the extinction coefficient of each fluorescent dye, which unit can be selected in the drop-down box.

5. Oligo DNA test

5.1 Nucleic acid concentration calculation

Use the Beer-Lambert law for nucleic acid concentration calculations:

$$C=(A*\varepsilon)/b$$

C - Nucleic acid concentration in ng/μl

A - Absorbance value in AU

ε - The extinction coefficient in ng-cm/μl, the extinction coefficient of Oligo DNA should be entered manually by the user

b - optical path in cm

When the base mode is selected, the instrument uses a short optical range of 1.0 mm to 0.05 mm for test, allowing test of highly concentrated samples without dilution. The instrument can accurately test Oligo DNA at concentrations ≤27,500 ng/μl without dilution. For each sample, the software automatically selects the best test optical range for the test.

When the optical density of the test sample is ≥ 3.0 (at 10 mm optical range), a smaller amount of sample can be used for the test.

The graph shows the optical density for the current sample calibrated to 10 mm optical range.

5.2 Nucleic acid concentration test

Refer to "Basic measurement operation" for the test steps.

The test results include the following:

Sample type: The type of sample to be tested.

Sample name: Enter the sample name before sample test.

Test method: Whether the test is performed on a cuvette, or a base.

Creation time: The system time when the test was performed.

A230 (10 mm optical range): Displays the optical density at 230 nm under 10 mm optical range.

A260 (10 mm optical range): Displays the optical density at 260 nm under 10 mm optical range.

A280 (10 mm optical range): Displays the optical density at 280 nm under 10 mm optical range.

260/280 - The optical density ratio at 260 nm and 280 nm, which is used to determine the purity. If this ratio is small, it indicates the presence of protein, phenol or other contaminants, which have significant optical absorption at 280 nm.

260/230 - The optical density ratio at 260 nm and 230 nm, which is a secondary indicator of nucleic acid purity. This ratio for pure nucleic acids is larger than the 260/280 ratio, and a low ratio indicates that there are contaminants in the nucleic acid.

Concentration value - The concentration value calculated from the optical density and the extinction coefficient at 260 nm, which unit can be selected in the following drop down box.

6. Oligo RNA

6.1 Nucleic acid concentration calculation

Use the Beer-Lambert law for nucleic acid concentration calculations:

$$C=(A*\varepsilon)/b$$

C - Nucleic acid concentration in ng/μl

A - Absorbance value in AU

ε - The extinction coefficient in ng-cm/μl, the extinction coefficient of Oligo RNA should be entered manually by the user

b - optical path in cm

When the base mode is selected, the instrument uses a short optical range of 1.0 mm to 0.05 mm for test, allowing test of highly concentrated samples without dilution. The instrument can accurately test Oligo RNA at concentrations ≤27,500 ng/μl without dilution. For each sample, the software automatically selects the best test optical range for the test.

When the optical density of the test sample is ≥ 3.0 (at 10 mm optical range), a smaller amount of sample can be used for the test.

The graph shows the optical density for the current sample calibrated to 10 mm optical range.

6.2 Nucleic acid concentration test

Refer to "Basic measurement operation" for the test steps.

The test results include the following:

Sample type: The type of sample to be tested.

Sample name: Enter the sample name before sample test.

Test method: Whether the test is performed on a cuvette, or a base.

Creation time: The system time when the test was performed.

A230 (10 mm optical range): Displays the optical density at 230 nm under 10 mm optical range.

A260 (10 mm optical range): Displays the optical density at 260 nm under 10 mm optical range.

A280 (10 mm optical range): Displays the optical density at 280 nm under 10 mm optical range.

260/280 - The optical density ratio at 260 nm and 280 nm, which is used to determine the purity. If this ratio is small, it indicates the presence of protein, phenol or other contaminants, which have significant optical absorption at 280 nm.

260/230 - The optical density ratio at 260 nm and 230 nm, which is a secondary indicator of nucleic acid purity. This ratio for pure nucleic acids is larger than the 260/280 ratio, and a low ratio indicates that there are contaminants in the nucleic acid.

Concentration value - The concentration value calculated from the optical density and the extinction coefficient at 260 nm, which unit can be selected in the following drop down box.

7. User-defined

The concentration and mass of self-defined nucleic acids can be easily measured using this instrument. To detect custom nucleic acids, select the custom function on the main page. User defined test can display the optical density for samples from 220 nm to 350 nm. Custom function detects nucleic acid concentration with a custom extinction coefficient.

7.1 Nucleic acid concentration calculation

Use the Beer-Lambert law for nucleic acid concentration calculations:

$$C=(A*\varepsilon)/b$$

C - Nucleic acid concentration in ng/μl

A - Absorbance value in AU

ε - The extinction coefficient in ng-cm/μl, the extinction coefficient of this application should be entered manually by the user

b - optical path in cm

When the base mode is selected, the instrument uses a short optical range of 1.0 mm to 0.05 mm for test, allowing test of highly concentrated samples without dilution. The instrument can accurately test user-defined nucleic acids at concentrations ≤27500 ng/μl without dilution. For each sample, the software automatically selects the best test optical range for the test.

When the optical density of the test sample is ≥ 3.0 (at 10 mm optical range), a smaller amount of sample can be used for the test.

The graph shows the optical density for the current sample calibrated to 10 mm optical range.

7.2 Nucleic acid concentration test

Refer to "Basic measurement operation" for the test steps.

The test results include the following:

Sample type: The type of sample to be tested.

Sample name: Enter the sample name before sample test.

Test method: Whether the test is performed on a cuvette, or a base.

Creation time: The system time when the test was performed.

A230 (10 mm optical range): Displays the optical density at 230 nm under 10 mm optical range.

A260 (10 mm optical range): Displays the optical density at 260 nm under 10 mm optical range.

A280 (10 mm optical range): Displays the optical density at 280 nm under 10 mm optical range.

260/280 - The optical density ratio at 260 nm and 280 nm, which is used to determine the purity. If this ratio is small, it indicates the presence of protein, phenol or other contaminants, which have significant optical absorption at 280 nm.

260/230 - The optical density ratio at 260 nm and 230 nm, which is a secondary indicator of nucleic acid purity. This ratio for pure nucleic acids is larger than the 260/280 ratio, and a low ratio indicates that there are contaminants in the nucleic acid.

Concentration value - The concentration value calculated from the optical density and

the extinction coefficient at 260 nm, which unit can be selected in the following drop down box.

Protein test

1. Protein A280

Proteins are highly diverse and the A280 function is mainly used to detect those pure proteins containing Trp, Tyr residues or containing Cys- Cys disulfide bonds, which have larger optical density values at 280 nm. This method does not require the construction of a standard curve, and the software will calculate the protein concentration directly after the test of the optical density. As with the nucleic acid test, the A280 spectrogram shows data at 10 mm optical range.

Note: If the sample contains major peptide bonds and few or no amino acids, use Protein A205 application instead of Protein A280.

1.1 Test concentration range

The instrument can detect up to 400 mg/ml of BSA in base mode without dilution. The software can automatically test the optical density of each sample using different optical ranges.

Smaller amounts of samples can be used when the 10 mm optical density of the sample is >3.0 (>4.5 mg/ml BSA).

The graph shows the optical density for the current sample calibrated to 10 mm optical range.

Protein A280 test type options

1Abs=1 mg/ml	The optical density of 1 mg/ml protein at 280 nm was 1A.
BSA	The mass extinction coefficient was used to calculate the protein concentration with reference to calf serum albumin: the mass extinction coefficient at 280 nm for 10 mg/ml of protein was 6.7.
IgG	With reference to IgG, the mass extinction coefficient was used to calculate the protein concentration: the mass extinction coefficient at 280 nm for 10 mg/ml of protein was 13.7.
Lysozyme	With reference to lysozyme, the mass extinction coefficient was used to calculate the protein concentration: the mass extinction coefficient at 280 nm for 10 mg/ml of protein was 26.4.
(ε+MW)	Users can enter their own molar extinction coefficients as a reference for protein test
(ε1%)	Users can enter their own mass extinction coefficient as a reference for the 10 mg/ml protein test.

1.2 Protein concentration test

Refer to "Basic measurement operation" for the test steps.

The test results include the following:

Sample type: The type of sample to be tested.

Sample name: Enter the sample name before sample test.

Test method: Whether the test is performed on a cuvette, or a base.

Creation time: The system time when the test was performed.

Type: Six preset samples available for protein analysis and concentration calculation. These selections can be made in the drop-down box next to the type. The default is 1Abs = 1 mg/ml.

Concentration value - The concentration value calculated from the optical density of the protein at 280 nm and the chosen extinction coefficient. The concentration unit can be selected from the drop-down box next to it. The default unit is mg/ml.

A280 (10 mm optical range) - Displays the optical density at 280 nm under of 10 mm optical range.

260/280 - The ratio of optical density values at 260 nm and 280 nm.

2. Protein chip

Use protein microarray applications to quantify proteins and fluorescent dyes used for protein-coupled arrays, as well as to detect metalloproteins, such as hemoglobin, by optical density ratios. This application reports the protein concentration tested at 280 nm and the optical density of the dye tested, allowing test of dye concentrations down to 0.2 pmol/µl. This information is particularly useful for assessing the protein/dye binding (degree of labeling) for downstream applications.

2.1 Test concentration range

The instrument can accurately detect fluorescent dye-labeled proteins at concentrations up to: 100 pmol/µl of Cy3

The sampling curve shows the optical density for the current sample calibrated to a 10 mm optical range.

2.2 Protein microarray test

Users can select preset dyes in the instrument software or use the dye editing function to add new dyes. To add a new dye, select the Dye Editor in "Setting" and fill in the appropriate calibration parameters by referring to the dye manufacturer's instructions. When the appropriate dye is selected, the 280 nm calibration will be automatically applied to the protein concentration calculation. Please refer to "Setting dye editor" for detailed operation. The default setting is Cy3 for dye 1 and Cy5 for dye 2.

Refer to "Basic measurement operation" for the test steps.

The test results include the following:

Sample type - The type of sample to be tested.

Sample type - The type of sample to be tested.

Test method - Whether the test is performed on a cuvette, or a base.

Creation time - The system time when the test was performed.

Baseline calibration - If baseline calibration is selected, the default calibration wavelength is 340 nm, and the user can enter a different calibration wavelength depending on the test needs. Under any test, the baseline is automatically set to the optical density at the calibration wavelength. This value is subtracted from the reading at all wavelengths. If this function of baseline correction is not selected, the baseline of the spectrum will be shifted and the calculated protein concentration value will be higher than the true value.

Concentration values - The software uses a specific extinction coefficient and optical density at 280 nm to calculate the concentration. The concentration unit can be selected in the drop-down box.

Dye Editor - Select dyes, the default choices are: Dye 1 (Cy3), Dye 2 (Cy5).

Dye 1 concentration - The concentration of dye 1 at the corresponding light range.

Dye 2 concentration - The concentration of dye 2 at the corresponding optical range.

pmol/μl - The concentration calculated based on the extinction coefficient of each fluorescent dye, which unit can be selected in the drop-down box.

Dye slope correction - Correct the optical density for dyes due to subtraction of any shifts in optical density from 400 nm to 750 nm in the slope baseline at the wavelength of the dye analysis caused by light scattering particles.

3. Protein A205

Quantitative analysis of purified peptides and other proteins of the 1-peptide bond was applied using protein A205, where optical density at 205 nm is shown. This application reports the protein concentration and two optical density values (A205 and A280). A single point baseline correction can also be used

Note: If the sample contains major amino acids, such as tryptophan and complexine, or cysteine-cysteine disulfide bonds, use protein A280 application instead of protein A205.

3.1 Test concentration range

The instrument can detect up to 400 mg/ml of BSA in base mode without dilution. The software can automatically test the optical density of each sample using different optical ranges.

A small volume test can be selected when the 10 mm optical density of the sample is >3.0 (>4.5 mg/ml BSA).

The sampling curve shows the optical density for the current sample calibrated to a 10 mm optical range.

Protein A205 test type options

31	ε0.1% (1 mg/ml) at 205 nm=31
Range	ε0.1% (1 mg/ml) at 205 nm=27+120*(A280/A205)
(ε1%)	User-defined input extinction coefficient

3.2 Protein A205 test

Refer to "Basic measurement operation" for the test steps.

The test results include the following:

Sample type - The type of sample to be tested.

Sample type - The type of sample to be tested.

Test method - Whether the test is performed on a cuvette, or a base.

Creation time - The system time when the test was performed.

Type - Six preset samples available for protein analysis and concentration calculation. These selections can be made in the drop-down box next to the type. The default is 1Abs = 1 mg/ml.

Concentration value - The concentration value calculated from the optical density of the protein at 205 nm and the chosen extinction coefficient. The concentration unit can be selected from the drop-down box next to it. The default unit is mg/ml.

A280 (10 mm optical range) - Displays the optical density at 280 nm under of 10 mm optical range.

A280 (10 mm optical range) - Displays the optical density at 280 nm under of 10 mm optical range.

4. Protein BCA

BCA is a colorimetric method for detecting the concentration of non-pure proteins, which is commonly used for diluted protein concentrations and for those proteins that contain light-absorbing impurities in the UV region. The BCA method requires the construction of a standard curve prior to protein quantification.

The BCA method is a method to detect Cu+ ions, which are reduced to Cu+ ions by proteins in an alkaline environment. Two BCA molecules of binoquinoline dicarboxylic acid and a Cu+ ion form a purple chelate. In the presence of protein, the chelate formed by Cu-BCA had a maximum optical density at 562 nm, using the optical density at 750 nm as the baseline.

4.1 BCA method test range

Commercially available BCA kits have two protein test ranges:

The routine test uses a reagent/protein sample volume ratio of 20:1 and test concentrations range from 0.20 mg/ml to 8.0 mg/ml (BSA). When using the base test, 4 µl of sample and 80 µl BCA of reagent are recommended.

The volume ratio of reagent/sample used for micro-test is 1:1, and the concentration of

protein can be tested from 0.01 mg/ml to 0.20 mg/ml. To prepare enough sample for the base test, it is recommended to use 10 µl of sample and 10 µl of BCA reagent (using PCR tubes).

Follow the kit manufacturer's instructions to prepare the standards and construct the standard curve. Ensure that the processing time and ambient temperature of each sample are consistent throughout the test.

The sampling curve shows the optical density for the current sample calibrated to a 10 mm optical range.

4.2 BCA standard curve

A standard curve in its simplest form can consist of just two points including two standard points. The standard curve can include up to 7 standard points, and there is no order requirement for test each standard point.

Standard points can only be added to the standard curve when the sample is tested. When the first sample is started, no standard points can be added to the standard curve.

Attention	If a previously saved experiment record is selected, all sample concentrations are calculated based on the standard curve in the experiment record. Only one standard curve can be saved per experimental record.

4.3 BCA test

Prepare samples by referring to the reagent manufacturer's instructions.

Test steps:

(1) The software can detect up to 7 standards by entering the concentration of each standard in the parameter settings. The standard spot can be repeated several times.

Attention	The standard curve requires a minimum of 2 standard points. It is recommended that multiple standards be tested and that the concentration range of the standards cover the concentration range of the samples. For this analysis, it is recommended to use the setting "Linear"

(2) Blank controls were made with suitable buffers. Pure water is usually used as a blank control.

Base mode: Take 1-2 µl of pure water and add it to the base, lower the upper arm and click the blank test.

Cuvette mode: pay attention to the direction of the arrow on the instrument when inserting the cuvette. The beam (2 mm wide) is positioned 8.5 mm above the bottom of the cuvette, add liquid as recommended by the cuvette manufacturer.

(3) Select a standard point, add the corresponding standard according to the same steps as above to do the blank test, click the test button to start the test, and do the sample test after all the standard points have been tested. If the "Repeat" setting is greater than 1, the test is repeated.

(4) After the standard point test is completed, a prompt box will pop up to confirm whether to continue to add standards, no longer add standards, enter the sample test mode, according to the same steps as above to do the blank test on the sample, click the test to start test samples.

(5) If users use the base mode to test, use clean dust-free paper to wipe the upper and lower bases clean after the test is completed. If the cuvette mode is used for test, the cuvette needs to be removed after the test is completed, thoroughly cleaned and dried.

The test results include the following:

Sample type - The type of sample to be tested.

Test method - Whether the test is performed on a cuvette, or a base.

Creation time - The system time when the test was performed.

Concentration - The concentration unit of the current sample.

Optical density value (562 nm) - Optical density value of the complex at 562 nm.

Curve Type - Displays the curve type of the current standard curve, including discrete, linear, multi-order equation, etc. The default selection is linear.

Repeat Count - Enter the number of times a reference or identical standard or sample was averaged to produce the concentration value associated with it.

Standards - Enter the actual concentration value for each standard.

R2 - indicates the degree to which the standard curve fits the standard data points (1.0 indicates a perfect fit; all points are exactly on the curve).

Attention	The status of the valid curve simply indicates that the number of samples tested has met the minimum number of sample points required for the standard curve. The state of the standard curve is not indicative of the fit of the standard curve and to include a relatively wide range of tested concentrations, a greater number of standard points are required.

5. Protein Bradford

Bradford is a commonly used method for protein quantification. It is usually used for concentration test of relatively low concentrations of proteins. As with other colorimetric methods, a standard curve must be constructed for the Bradford method to detect protein concentrations.

The Bradford method is based on the protein's ability to bind Kaumas Brilliant Blue in an acidic solution, causing the maximum absorption peak of the dye to change to 595 nm to detect the protein concentration. The optical density of the protein-dye compound at 595 nm was measured and baseline correction at 750 nm was done to calculate the concentration of the protein. The reagents used in the experiments can be purchased from multiple manufacturers.

5.1 Bradford method test range

commercially available Bradford kits have two protein test ranges:

Routine tests use a 50:1 volume ratio of reagent/protein sample, with test concentrations ranging from 0.10 mg/ml to 8.0 mg/ml (BSA) and an optimal linear concentration range of 0.01-1 mg/ml. When using the base test, 4 µl of sample and 200 µl of Bradford reagent are recommended.

The volume ratio of reagent/sample used for micro-test is 1:1, and the concentration of protein can be tested from 15 µg/ml to 125 µg/ ml. To prepare enough sample for the base test, it is recommended to use 10 µl of sample and 10 µl of Bradford reagent and use PCR tubes.

Follow the kit manufacturer's instructions to prepare the standards and construct the standard curve. Ensure that the processing time and ambient temperature of each sample are consistent throughout the test.

The graph shows the optical density for the current sample calibrated to 10 mm optical range.

5.2 Bradford test

Refer to "BCA test" for the test steps.

6. Protein Lowry

The Lowry method involves the reaction of protein with copper sulfate in an alkaline environment to form copper-protein complexes. The Folin-Ciocalteu reagent effectively reduces the copper complex, producing a blue product proportional to the amount of protein. The concentration of the protein was calculated by measuring the optical density of the blue product at 650 nm and baseline correction at 405 nm. The reagents used in the experiments can be purchased from multiple manufacturers. As with other colorimetric methods, a standard curve needs to be constructed before the Lowry method can be used for protein quantification.

6.1 Lowry method test range

It is recommended to use 20 µl of protein sample and 100 µl of Lowry reagent for the reaction. The range of sample concentrations that can be tested on this instrument is from 0.20 mg/ml to 4 mg/ml.

Follow the kit manufacturer's instructions to prepare the standards and construct the standard curve. Ensure that the processing time and ambient temperature of each sample are consistent throughout the test. Protein standards (BSA) for the construction of standard curves can be purchased from the kit manufacturer.

The graph shows the optical density for the current sample calibrated to 10 mm optical range.

6.2 Lowry Test

Refer to "BCA test" for the test steps.

7. Protein Pierce 660

The Protein Pierce 660 is primarily used to quantify the concentration of those total proteins that contain reducing agents or detergents using a reagent/sample volume ratio of 15:1.

When using the base test, 4 µl of sample and 60 µl of reagent are recommended.

Follow the kit manufacturer's instructions to prepare the standards and construct the standard curve. Ensure that the processing time and ambient temperature of each sample are consistent throughout the test. Protein standards for constructing standard curves can be purchased from the kit manufacturer.

7.1 Pierce 660 method test range

When using 4 µl of sample and 60 µl of reagent, Pierce 660 nm can detect concentrations ranging from 50 µg/ml to 125 µg/ml.

The graph shows the optical density for the current sample calibrated to 10 mm optical range.

7.2 Standard curve

A standard curve must be constructed prior to the test. It is recommended to use the dye without the protein for the blank control and reference points.

Attention	This is different from other protein quantification methods, which use pure water as a blank control.

7.3 Pierce 660 test

Refer to "BCA test" for the test steps.

OD600 test

The OD600 test uses a spectrophotometer to detect the scattered light through the cell suspension and derive the corresponding optical density. For this instrument, the biggest difference between base test and cuvette test is that the optical range is different, and the spectrogram shows the spectral test results from 250 nm to 700 nm. The OD600 application is used to detect the growth rate of bacterial or other microbial cell cultures by measuring the optical density of the cell growth culture at 600 nm. The Beer-Lambert equation and user-entered conversion factors are used to correlate optical density with concentration. The reported concentration values can be used to determine the stage of the cultured cell population.

1. Sample homogeneity

Make sure the samples are homogeneous before test. Before using the base for test, the sample should be mixed uniformly and then added to the base for test. The stirring function can be used when test with cuvettes.

2. Test range

Thanks to the relatively short test optical range, the instrument can detect relatively high concentrations of cell suspensions. Since a larger band of spectra can be displayed, the more dilute samples can be tested at lower wavelengths, for example at 400 nm. Users can also use cuvettes to detect more dilute samples.

3. Sterilization of test base

If disinfection is required, use a disinfectant solution, such as 0.5% sodium hypochlorite that can be used to clean the base to ensure that no biologically active material remains on the base.

Attention	Instead of using a spray bottle to spray disinfectant on the instrument, users can use the disinfectant to moisten the dust-free paper to wipe the upper and lower bases of the instrument and the outside of the instrument, then clean the instrument with pure water on the dust-free paper, and finally wipe the instrument with dry paper.

4. OD600 concentration test

Refer to "Basic measurement operations"

The test results include the following:

Sample type - The type of sample to be tested.

Test method - Whether the test is performed on a cuvette, or a base.

Creation time - The system time when the test was performed.

Optical density correction - User-defined baseline values can be adjusted by entering data for optical density values between 0A and 300A, with optical density correction values subtracted from optical density values at all wavelengths in the sample spectrum.

600 nm (Abs) - Optical density value at 600 nm using a user-defined baseline.

Other test wavelength (λ) - a user-defined wavelength at which another wavelength can be entered for test if desired (for diluted samples exhibiting low optical density at 600 nm), which is used to calculate cell concentration if another wavelength is specified.

A (λ) - User-specified standardized and corrected optical density values for other test wavelengths (λ).

Coefficient (10) - This user-defined coefficient. Accepted coefficients for detecting cell types or empirically by using solutions with known concentrations of the same medium to study cells. The default value is 1×10^{8}, which is the accepted coefficient used for most bacterial cell suspensions, such as E. coli.

Cell culture concentration (10) - reported in cells/ml. Calculated using the corrected A600 optical density values based on the Beer- Lambert equation.

UV-VIS test

The UV-Visible function allows the instrument to function like a normal UV-Visible spectrophotometer. The optical density values of samples from 185 nm to 910 nm can be displayed, and up to 40 wavelengths can be specified for optical density test.

1. Test concentration range

The instrument is capable of detecting optical density values equivalent to 300 A at a 10 mm optical range when using the auto-adjustment range mode.

The sampling curve shows the optical density for the current sample calibrated to a 10 mm optical range.

2. Perform UV-Vis test

(1) Specifying up to 40 wavelengths to be tested and whether to use automated optical range adjustment;

(2) Baseline calibration can be selected, with a default calibration wavelength of 750 nm, or a new calibration wavelength can be entered;

(3) Selecting the overlay display allows the results of experiments with multiple test samples to be displayed in the sampling curve box;

(4) Refer to "Basic measurement operation" for the test steps.

Kinetics

Can be used for kinetic test of samples in cuvettes. Up to 3 wavelengths between 185 nm and 910 nm can be specified for continuous absorbance test at user-defined intervals in up to 5 stages.

1. Kinetics test

(1) Select the "Other" option in the main screen and click "Kinetics".

(2) The Kinetics screen is displayed, as shown in the figure. If one or more kinetic methods are available for the currently selected data storage location, they will be listed in the box on the left and a description of the selected method is displayed in the box on the right.

(3) Select a method:

Click on the method name in the left box and select an existing method

By clicking "Create", specify the method setting and select save method to create a new method

Edit the name of an existing method by clicking on "Method Name" and selecting "Edit"

Delete existing methods by clicking on the "Method Name" and selecting "Delete" (if there is only one kinetic method, the delete function is not available)

Set cuvette options related to, for example, heating or stirring by clicking on General Settings in > Settings (for more information, see General Settings).

Caution: If the cuvette light range is not 10 mm, specify the correct light range in the "General Settings".

(4) Click on "Run".

(5) For blank test, put enough blank test solution in a clean and dry cuvette to cover the optical range of the instrument. Lift the upper arm of the instrument and insert the blank cuvette into the cuvette slot, ensuring that the optical path of the cuvette is aligned with the optical path of the instrument, and click "Blank test".

(6) If "Heat to 37°C" is selected in the general settings, a message will appear telling the current temperature and waiting for the heater to reach the target temperature before starting test.

(7) Wait for the blank test to complete, then remove the cuvette.

Attention	The sample must be newly added for each test.

(8) For sample test, put enough blank test solution in a clean and dry cuvette to cover the optical range of the instrument. Insert the sample cuvette into the cuvette holder, make sure it is aligned with the light path, and click "Test". After starting the test, users can click "Stop" before allstages are completed to end the experiment early and wait for allstages of the test to be completed.

Attention	Reagents can be added to the sample solution at any time during the test.

(9) After the test is completed, remove the cuvette and clean the cuvette.

2. Perform dynamics creation

(1) Select the "Other" option in the main screen and click "Kinetics".

(2) By clicking "Create", specify the method setting and select save method to create a new method (If there is no current kinetic method, it will automatically go to the kinetic method creation page), as shown in FIG.38.

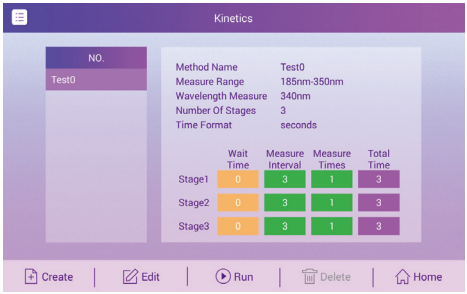

FIG.38

(3) Enter a method name, select a wavelength range, and specify up to three test wavelengths.

(4) Select the number of stages and time units (minutes and seconds).

(5) Specify the number of intervals, the interval time and the delay between stages for each stage. The colored rows and boxes on the right side clearly indicate specific stages. The colored rows indicate the start and end times of each stage, and the colored boxes correspond to the delay and test numbers specific to each stage.

(6) Click "Save" to save the method and return to the Kinetics menu.

(7) Click "Run" to run the method.

3. Perform kinetic editing

3.1 Refer to "Creating dynamics".

The test results include the following:

Sample type - The type of sample to be tested.

Test method - Whether the test is performed on a cuvette, or a base.

Creation time - The system time when the test was performed.

Sample type - the type of the test performed.

Stage - what stage the test is at.

Time - The time from the start of the test to the current test.

Cuvette Light Range - The optical range used to perform the test.

Alarms and alerts

1. Experimental data abnormalities Prompt box message: Experimental data anomaly. Solution: Whether the upper arm was opened during the experiment. Wipe the base and cuvette slot clean with dust-free paper and retest.	4. Base motor abnormality Prompt box message: Base motor abnormal Solution: Restart the instrument and retest.
2. Xenon lamp anomaly Prompt box message: Xenon lamp abnormal. Solution: Check whether the upper arm is opened, check whether the base is clean, whether there is any light-blocking material in the cuvette slot, wipe the base fiber optic clean with dust-free paper, and restart the instrument to complete the experiment.	5. Base motor operation blockage Prompt box message: Base motor operation blockage Solution: Restart the instrument.
3. Spectrometer communication failure Prompt box message: Spectrometer communication failed Solution: 1) Retest; 2) Restart the instrument and retest.	6. Base channel not found Prompt box message: Base channel not found Solution: Check whether the upper arm is opened, check whether there is any foreign matter covering the base, wipe the base fiber optic clean with dust-free paper and restart the instrument for test.

7. Cuvettes channel not found Prompt box message: cuvette channel not found Solution: Check whether the upper arm is opened, check whether there is any foreign matter blocking in the cuvette slot, wipe the cuvette pool and fiber optic with dust-free paper and restart the instrument for test.	11. No flash drive found Prompt box message: No USB flash drive found Solution: Make sure the USB disk has been inserted into the USB port of the instrument, plug and unplug the USB disk, and make sure the USB disk is plugged in place.
8. Communication failed Prompt box message: Communication failed Solution: Restart the instrument and redo the test.	12. USB flash drive has been pulled out, export failed Prompt box message: USB disk has been pulled out, export failed Solution: When exporting data, make sure that the USB port of the instrument is connected to the USB disk, plug and unplug the USB disk, make sure that the USB disk communication is normal, and then carry out the data export operation again.
9. Operation timeout Prompt box message: Operation timeout Solution: Restart the instrument and redo the test.	13. Please close the upper arm Prompt box message: Please close the upper arm Solution: Check that the upper arm is covered. Re-run the test.
10. Initialization failed Prompt box message: Initialization failed Solution: Restart the instrument.	14. Please re-sample Prompt box message: Please re-sample Solution: Wipe the base (or cuvette trough) clean with dust-free paper, refill the sample, and the amount of sample matches the standard, and test again.

15. The starting serial number cannot be larger than the ending serial number

    Prompt box message: The start number cannot be greater than the ending number

    Solution: The starting serial number entered should be less than or equal to the ending serial number.

16. The starting number cannot be 0

    Prompt box message: The start number cannot be 0.

    Solution: Enter a number greater than 0 for the starting serial number.

17. Maximum input*

    Prompt box prompt message: Maximum input * (* is the total number of experimental results in the instrument)

    Solution: The amount of experimental data imported from the network cannot be greater than the total amount of experimental data within the instrument.

18. File already exists

    Prompt box message: The file already exists!

    Solution: In local import, please select the unimported experimental data.

19. Incorrect file type

    Prompt box message: Incorrect file type!

    Solution: Select the file type "CSV" and the correct content to import.

20. The file users selected does not exist, please select again

    Prompt box message: The file users selected does not exist, please select again!

    Solution: Select the file that exists in the import directory.

21. Please connect the instrument first

    Prompt box message: Please connect the instrument first.

    Solution: Perform an online operation before performing a network import operation.

22. Connection failed, please reconnect

    Prompt box message: Connection failed, please reconnect.

    Solution: Confirm that the instrument WIFI is on, confirm that the host computer is connected to the instrument WIFI hotspot, and click the "Online" button again.

23. The start time cannot be later than the end time

    Prompt box message: Start time must not be later than the end time.

    Solution: When screening experimental data, the start time in the time condition should be no greater than the end time.

Fault, cause and solution

If a fault occurs, check the cause of the fault according to the following table and take corresponding countermeasures to eliminate the fault.

Fault	Cause	Solution
No response to power on	Loose plug	Plugged in
Photometric accuracy error, repeatability error is too poor	1. High optical density of the sample (>2A) 2. Glass cuvettes were used in the wavelength range below 350 nm 3. The cuvette is not clean enough 4. Dirt on the base 5. Other reasons	1. Diluted samples 2. Use quartz cuvette 3. Wipe the cuvette clean 4. Remove dirt from the base 5. Contact our company
The error is reported after the completion of the self-test or switching path on the computer	1. There are light-blocking objects in the cuvette slot 2. Glass cuvettes were used in the wavelength range below 350 nm 3. The cuvette is not clean enough 4. Foreign objects in the base 5. Base fiber not aligned 6. Switching parts stuck	1. Remove the light blocker in the sample cell 2. Use quartz cuvette 3. Wipe the cuvette clean 4. Wipe the base fiber clean 5. Contact our company 6. Contact our company

In case of failure other than the above table, please contact our company in time so that we can help users solve the problem in time.

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