FOUR E'S SCIENTIFIC

Operating Instructions

SPT-NanoF/SPT-Nano

Micro-volume Spectrophotometer

Contents

Contents

1. Safety Instructions

Carefully review this manual and adhere to the provided safety instructions and operational procedures. Neglecting to do so could lead to personal injury or device damage. If you have any questions or require assistance, don't hesitate to reach out to your local seller for technical support.

1) Position the instrument on a secure and steady work surface in an area free from corrosive gases, smoke, direct sunlight, excessive air currents, or strong magnetic field disruptions.
2) Prior to usage, ensure that the power supply voltage matches the specified requirement indicated on the device nameplate to prevent any potential harm to the equipment and mitigate safety risks.
3) Prior to usage, please be familiar with the device structure and all operating procedures. Please strictly follow the operating steps mentioned in this manual. Failure to do so may result in inaccurate test results or damage to the device.
4) Don't attempt to disassemble the device. Changing components or adjusting certain parameters inside the device must only be accomplished by certified maintenance personnel.
5) Disconnect the power supply if the device will not be used for an extended period of time (>1 week). This extends the lifespan of the device and reduces the risk of power surges.
6) Disconnect the power supply and immediately contact your local authorized seller or a qualified technician if you encounter any of the following situations:

- The device has come into contact with liquids.
- The device exhibits abnormal functioning.
- You detect unusual sounds, smells or visible smoke.
- The device has suffered physical damage, e.g., it has taken a fall from a significant height.

2. Product Overview

The SPT-NanoF/SPT-Nano Micro volume spectrophotometers (UV-Vis), featuring a built-in 7-inch color touchscreen, can perform all detection functions without the need for connecting to an external computer. This device provides a comprehensive spectral range (190-800nm) for precise quantitative analysis of DNA, RNA, proteins, and more, and its user-friendly interface ensures straightforward operation.

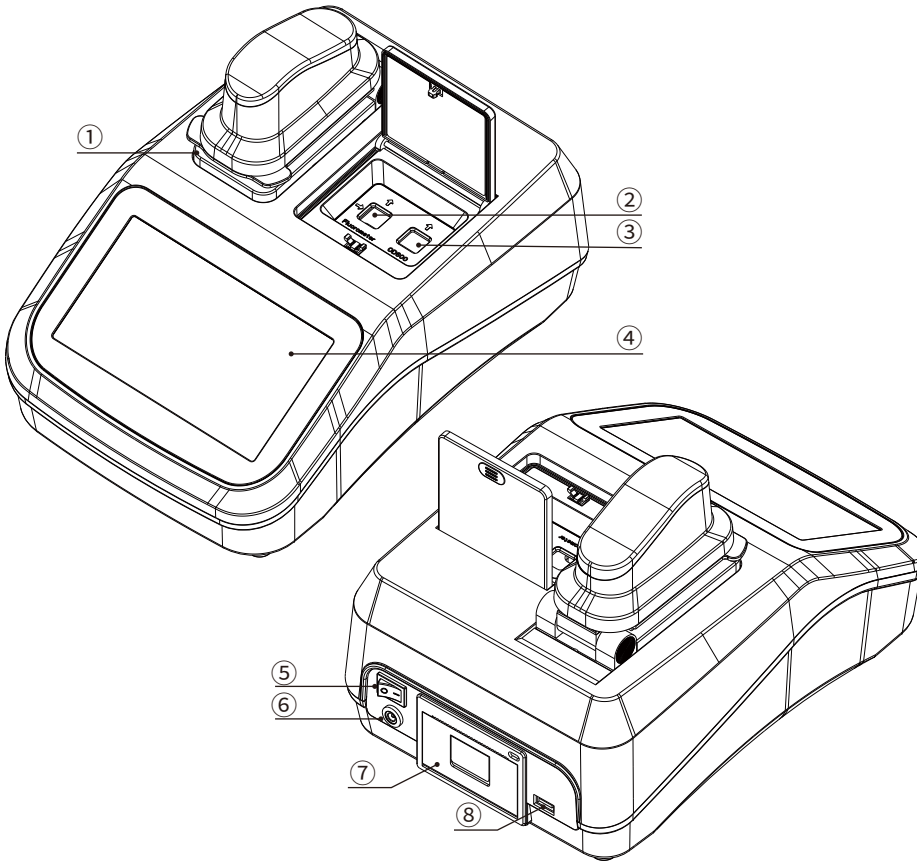
The instrument can achieve accurate and precise measurements with micro-volume samples as small as 0.5-2μl and can detect high-concentration samples without the need for dilution. The Xenon flash lamp light source enables immediate use without warm-up time and provides high stability and a long operational lifespan.

2.1. Package Contents

Unpack the package carefully and examine the contents for potential damages that may have occurred during transit. If you observe discernible damage, please promptly contact your local seller for assistance. In the event of any discernible damage to the device, refrain from connecting the device to a power source to avoid any potential risks or further harm.

Model	**SPT-NanoF**	**SPT-Nano**
Name	**Quantity**	
Main unit（with built-in fluorometer）	1	—
Main unit (without built-in fluorometer)	—	1
Power adapter	1	1
PCR Tube Holder (PCR Tube-to-Cuvette Slot Adapter)	1	—
Printing paper	1	1
Instruction Manual	1	1

2.2. Instrument Structure



① Upper pedestal arm

② Fluorometer (only for SPT-NanoF)

③ OD600

④ Touch Screen

⑤ Power switch

⑥ 12V Power port

⑦ Printer (Recommended printing paper: 57mm[W], 30mm[Φ])

⑧ USB-A port

(Compatible with USB in FAT32 format, for data export and firmware upgrade)

2.3. Operating Conditions

- Ambient temperature: 5°C~35°C
- Relative humidity: 20%~80%
- Position the device away from air vents and exhaust fans to minimize inadvertent sample evaporation.

2.4. Specifications

Model	**SPT-NanoF (built-in Fluorescence Detection)**	**SPT-Nano**
Wavelength range	190-800nm	
Minimum sample size	0.5~2μL	
Path length (auto-ranging)	0.05mm (high concentration) 0.2mm (high concentration) 1mm (normal concentration)	
Light source	Xenon flash lamp	
Detector type	2048px, CMOS	
Wavelength accuracy	1nm	
Spectral resolution	≤3nm	
Absorbance precision	0.003Abs	
Absorbance Accuracy	1% (4.096A at 260nm)	
Absorbance Range	0.04～300A	
Lower Limit of Detection	2 ng/μL(dsDNA); 0.06 mg/mL (BSA)	
Maximum Concentration	15,000 ng/μL(dsDNA); 440 mg/mL (BSA)	
Sample pedestal material	Aluminum alloy and Quartz fiber	
Power supply	AC100V-240V, 50Hz/60Hz (power adapter)	
Operating power	48W	
Standby power	8W	
Software	Android	
Data Output	USB 2.0, built-in printer	

Model	SPT-NanoF (built-in Fluorescence Detection)	SPT-Nano
OD600nm Measurement		
Sample Holder Type	Cuvette	
Cuvette Dimensions	12.5x12.5x45mm; Z-Height: 8.5mm	
Light source	LED	
Wavelength range	600±8nm	
Absorbance range	0~4A	
Fluorescence detection		
Sample Holder Type	0.5mL PCR Tube (with PCR Tube Holder for Cuvette Slot)	-
Excitation filters	wavelength 435-485nm	-
Emission filters	wavelength 530-560nm	-
Sensitivity	dsDNA: 0.5pg/μL	-
Linear dynamic range	R2≥0.995	-
Repeatability	≤1.5%	-
Dimensions and Weight		
Dimension (W x D x H)	318*220*205mm	
Weight	4.1kg	

3. General Operation

3.1. Pedestal Mode

3.1.1. Pedestal Measurement

A minimal sample volume as small as 0.5–2μL is sufficient for pedestal measurement in our microvolume spectrophotometer. From the pathlength options of 1mm, 0.2mm, and 0.05mm, the device automatically selects the optimal pathlength based on the sample concentration. Simply pipette 0.5–2μL of your sample directly onto the pedestal, lower the upper pedestal arm, and liquid column will automatically form. The device utilizes a high-performance pulsed xenon flash lamp as its light source, while analysis

of the transmitted light through the sample is carried out using a state-of-the-art spectrometer equipped with a linear CMOS array.

3.1.2. Pedestal Sample Volume Requirements

Although there is no strict requirement on the sample volume, it is essential that the amount is sufficient to form a liquid column between the upper and lower pedestal arm when performing pedestal measurement.

The formation of a liquid column is based on the surface tension properties of your sample. The main factor determining the surface tension of a droplet is the hydrogen bonding found within the lattice of water molecules in solution. Generally, all additives (including protein, DNA, RNA, buffer salts and detergent-like molecules) can diminish surface tension by disrupting the hydrogen bonding network between water molecules. Consequently, while a mere 1μL sample is adequate for most measurements, increasing the sample size to 2μL can ensure proper liquid column formation for samples with reduced surface tension.

Recommended sample volume：

● Aqueous solutions of nucleic acids: 1μL

● Pure protein：2μL

● Bradford, BCA or Lowry assay：2μL

● Microbial cell suspensions：2μL

It is best to use a precision pipette (0-2μL) with precision tips to assure that sufficient sample(1-2μL) is delivered. Pipettes with lower precision (ranging from 0-10μL volume and higher) may exhibit limitations in accurately dispensing 1μL volumes onto the measurement pedestal. If users are unsure about their sample characteristics or pipette accuracy, a 2μL sample is recommended.

3.1.3. Basic Use of the Pedestal

The main steps for using pedestal mode are listed below:

1) Before measurement, wipe the upper and lower pedestal using air-laid paper.

2) Open the upper pedestal arm and pipette the sample onto the lower pedestal.

3) Close the upper pedestal arm.

4) If “Auto-mode” has been selected, the device will measure the sample automatically after closing the arm.
5) If “Auto-mode” has not been selected, you can initiate the spectral measurement using the software interface on the touchscreen display. There are also options in the UI to set sample measurement parameters and to perform baseline correction before measurement.
6) When the measurement is complete, open the upper pedestal arm and wipe both the upper and lower pedestal using air-laid paper.

3.2 OD600 and Fluorometer Modules

Our SPT-NanoF features a covered compartment with two cuvette slots, one designated for the fluorometer module and the other for the OD600 module. The OD600 module is designed to be used directly with a cuvette, while for the fluorometer, we offer a specialized PCR tube holder that allows a 0.5mL PCR tube to fit into the cuvette slot.

3.2.1 OD600 Module

The OD600 module is used to measure the optical density of a sample at a wavelength of 600 nanometers, often employed for assessing the concentration and growth of microbial cells in microbiology and related fields.

Our OD600 module is designed for use with cuvettes measuring 12.5mm x 12.5mm x 45mm, featuring a 10mm path length and a Z-height of 8.5mm.

● **OD600 Sample Volume Requirement**:

It is essential to verify that the sample volume within the cuvette is sufficient in order to enable incident light to traverse a substantial section of the sample during measurement. The optical beam, which is 1mm in width, is focused approximately 8.5mm above the cuvette's base, i.e., the beam height is 8.5mm. For specific guidance on recommended sample volumes, please consult the cuvette manufacturer.

● **OD600 Workflow**:

1) Prepare a cuvette and add the blanking solution to the cuvette.
2) Open the compartment lid and insert the cuvette. Ensure the translucent surface corresponds with the direction of the light path (indicated by the arrow) on the

instrument.

3) Close the compartment lid and ensure it stays closed during measurement or blanking.

4) Tap the “OD600” icon on the home screen to enter the settings page. Set the corresponding parameters and start the blank measurement by tapping the “Blank” button.

5) When blanking is complete, remove the cuvette.

6) Remove the blanking solution, clean the cuvette, and load the sample into the cuvette.

7) Insert the sample-loaded cuvette into the slot, close the lid, and tap the “Measure” button.

3.2.2 Fluorometer Module

Our single channel fluorometer module is utilized for quantifying the fluorescence of a sample, fit for analysis in applications such as molecular biology and biotechnology. Our fluorescence detection module can be accessed via the left cuvette slot under the compartment lid. It is tailored to accommodate 500μL (0.5mL) PCR tubes by employing our custom 500μL PCR tube holder. The PCR tube holder adapts a 500μL PCR tube to seamlessly fit into the cuvette slot of the fluorometer.

● **Fluorometer Sample Volume Requirements**:

To optimize light transmission through the sample, it is advisable to have a sample volume of at least 200μL or more.

● **Fluorometer Workflow**:

1) Place at least 200μL of your sample into a 500μL PCR tube.

2) Insert the PCR tube into the PCR tube holder, and then position it in the fluorescence detection slot. Ensure the positioning of the tube and tube holder correspond with the fluorescence excitation and emission paths.

3) Close the compartment lid, and ensure it remains closed throughout the measurement.

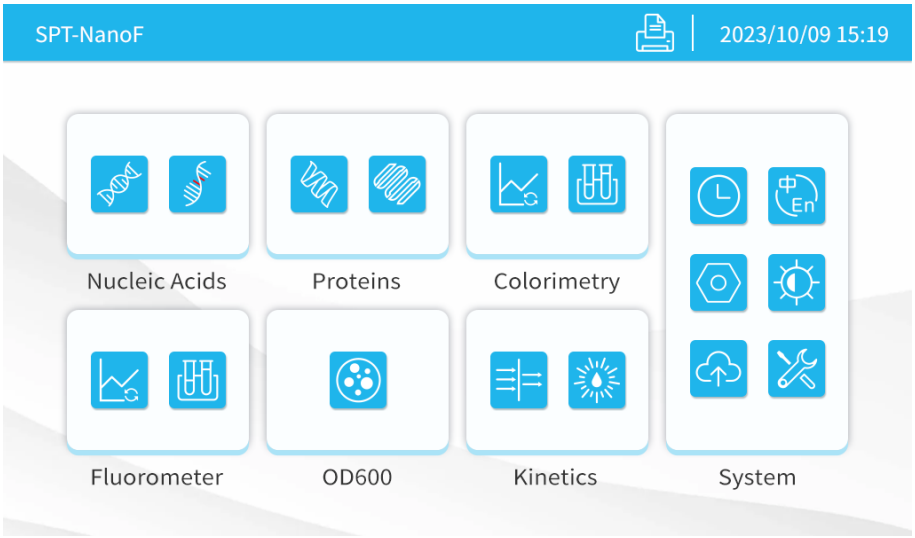
4) Tap the “Fluorometer” icon on the home screen to enter the settings page.

5) Set the corresponding parameters and tap the “Measure” button to start sample measurement.

6) Once the measurement is finished, remove the PCR tube and PCR tube holder to prepare for the next measurement.

4. Software Functions

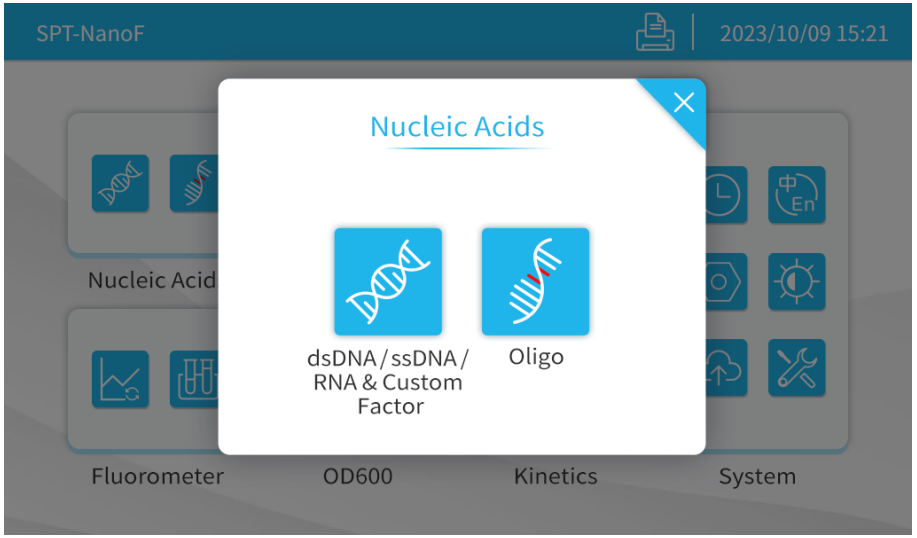
4.1. Main Interface



When the device starts, it will enter the home screen, which includes these commonly used modes: Nucleic Acids, Proteins, Colorimetry, Fluorometer, OD600, Kinetics and System.

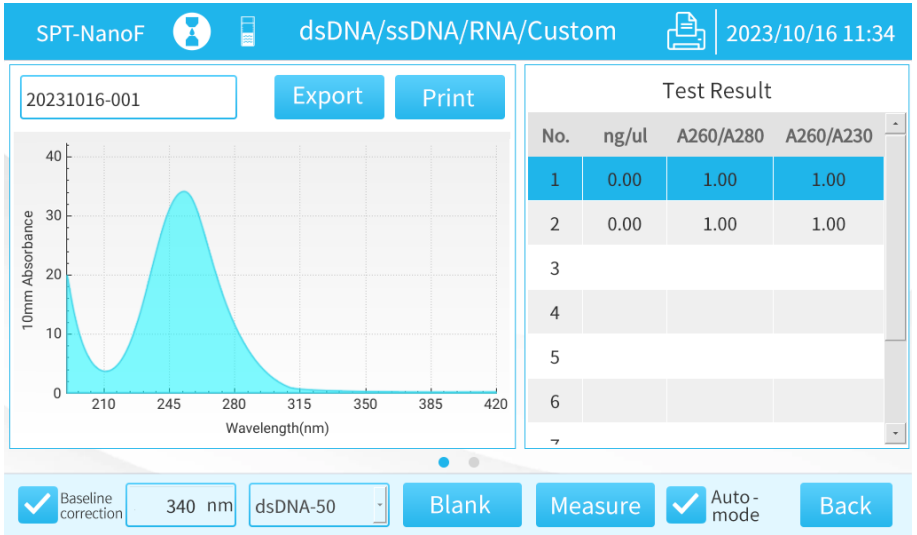
4.2. Nucleic Acids

The concentration and purity of nucleic acid samples can be easily measured using this microvolume spectrophotometer. To measure nucleic acid samples, select the “Nucleic Acids” application module. The device will automatically select the optimal pathlength among the 1mm, 0.2mm and 0.05mm pathlength based on the sample concentration. After completing the measurement, our software automatically converts the absorbance values obtained using the selected pathlength into values corresponding to a 10mm pathlength. Consequently, the Nucleic Acids module presents the 10mm-equivalent absorbance values on the screen for a clear and viewable display of the data.



4.2.1. dsDNA / ssDNA / RNA & Custom Factor

● Sample Measurement:



Before making a sample measurement, use a suitable buffer to make a blank control. The blank control liquid is the buffer that dissolves the analyte. The pH and ion concentration of the blank control liquid should be the same as the measurement sample.

1) When conducting tests, the system will automatically generate a test ID number, with the format being “year/month/day-serial number”.

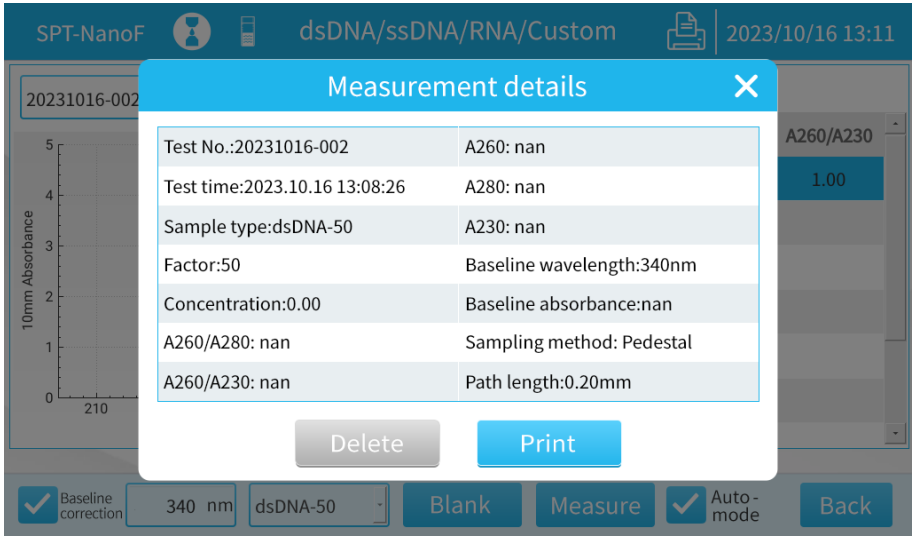
2) Select sample type, “dsDNA”, “RNA”, “ssDNA”, etc., or “Custom Factor”. Input the extinction coefficient if applicable. The default sample type is “dsDNA”.

3) If baseline correction is selected, the default calibration wavelength is 340nm. The user can enter a different calibration wavelength according to their specific measurement procedure.

4) Open the upper pedestal arm, clean the upper and lower pedestal before measurement. Add a 1-2μl blank control sample to the pedestal. Then close the pedestal and tap the “Blank” button to start measurement.

5) When the blank measurement is complete, clean the upper and lower pedestal and now add the sample for measurement. If the “Auto-mode” checkbox has been selected, the sample will be measured automatically once putting down the pedestal arm, without the need to tap the “Measure” button.

6) When the measurement is complete, the sampling curve will show the absorbance of the current sample on the left-hand side of the screen, and the test results on the right-hand side of the screen.



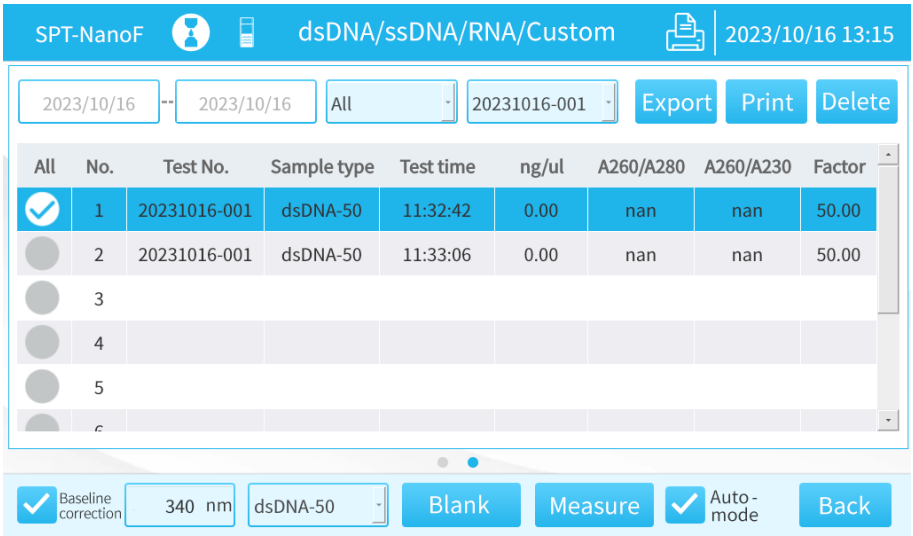
7) Double tap the test result to view the measurement details.

8) Wipe the upper and lower pedestal in preparation for the next measurement.

9) The **“Export”** or **“Print”** buttons are used to export/print the current test data.

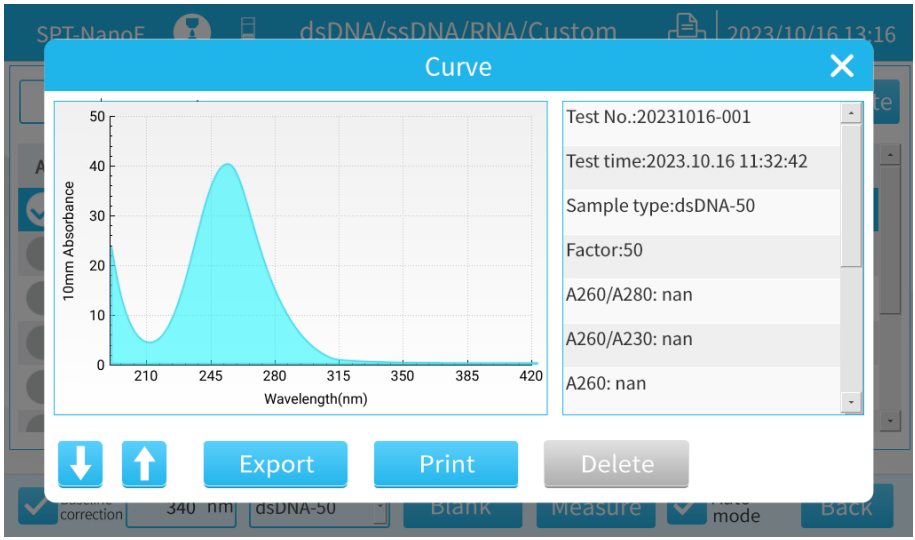
(If multiple blank measurements have been performed, the sample measurement will be calculated based on the most recent blank measurement.)

● Test Result:



Swipe left on the screen to access the “Test Result” page.

Select the start date, end date, sample type and test no. to filter through the testing records. Double tap a record to view a detailed report and test curve.

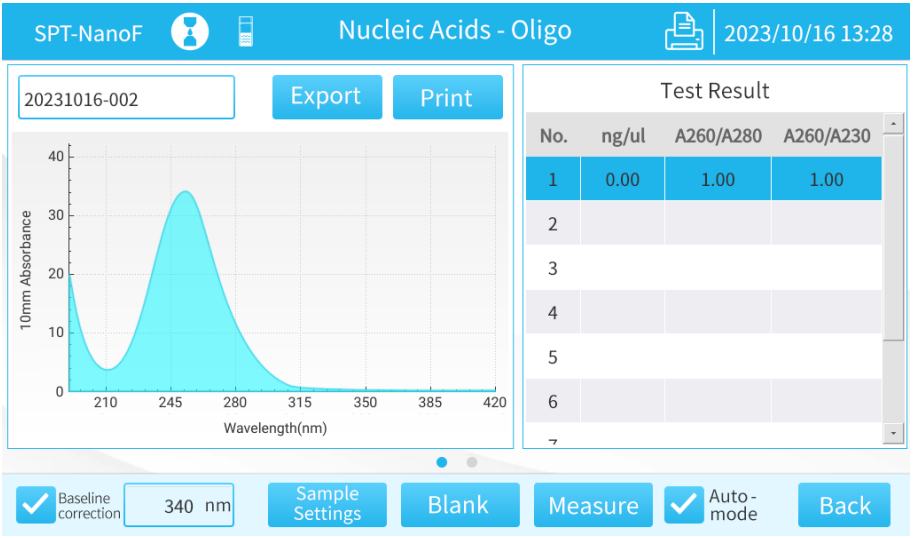


Export: Insert the USB disk drive into the USB port, select the test data and tap the "Export" button to export the test data. (Select "All" to export all test data.)

Print: Ensure that the printing paper is properly loaded into the device. Select the test data and tap the "Print" button to print.

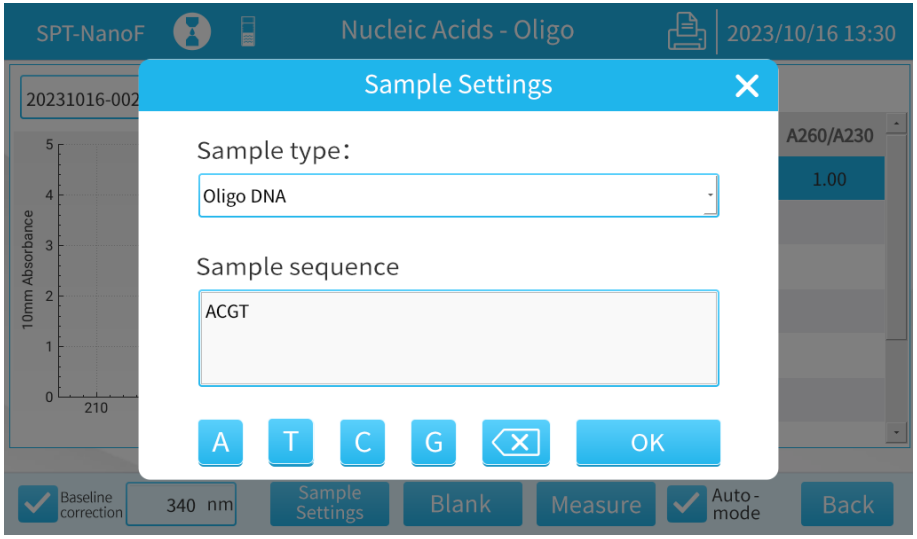
4.2.2.Oligo

● Sample Measurement:



Before making a sample measurement, use a suitable buffer to make a blank control. The blank control liquid is the buffer that dissolves the analyte. The pH and ion concentration of the blank control liquid should be the same as the measurement sample.

1) When conducting tests, the system will automatically generate a test number, with the format being "year/month/day-serial number".



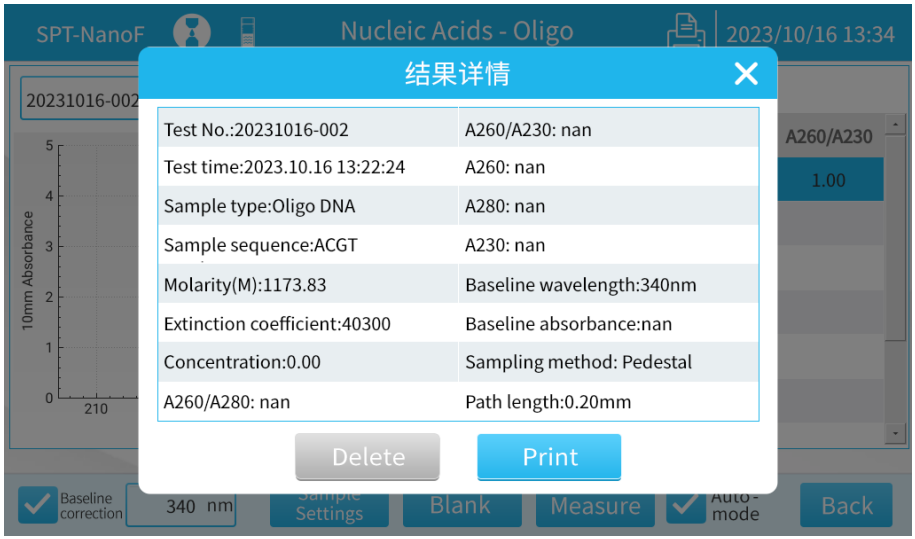
2) Tap the “Sample Settings” button, select sample type “Oligo DNA” or “Oligo RNA”, and select sample sequence by tapping A, T, C, G, U. Then tap the “OK” button to save all settings.

3) If baseline correction is selected, the default calibration wavelength is 340nm and the user can enter calibration wavelengths depending on the measurement.

4) Open the upper pedestal arm, clean the upper and lower pedestal before measurement. Add a 1-2μl blank control sample to the pedestal. Then close the pedestal and tap the “Blank” button to start measurement.

5) When the blank measurement is complete, clean the upper and lower pedestal and add sample to measure. If the “Auto-mode” checkbox has been selected, the sample will be measured automatically as soon as the pedestal arm is lowered, eliminating the need to manually tap the “Measure” button.

6) When the measurement is complete, the sampling curve will show the absorbance of the current sample on the left-hand side of the screen, and the test results are located on the right-hand side of the screen.

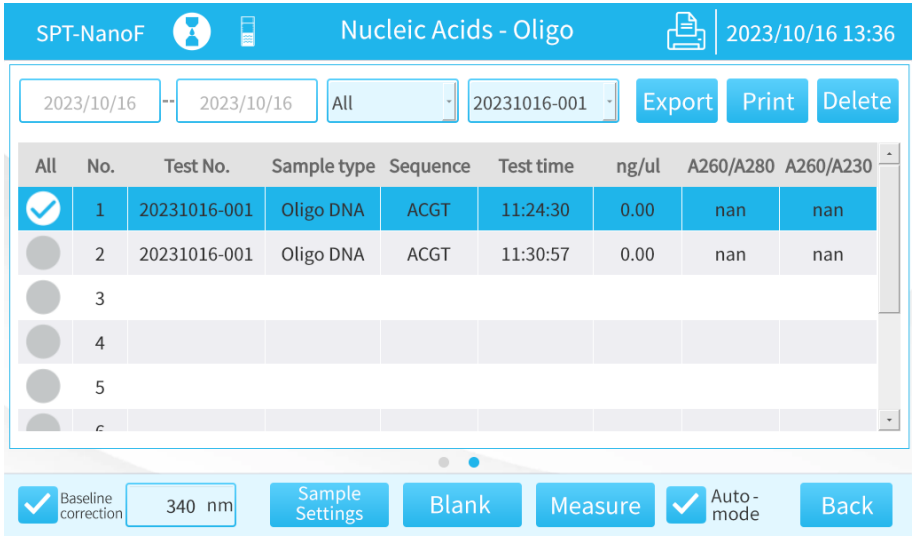


7) Double tap the test result to view the measurement.

8) Wipe the upper and lower pedestal in preparation for the next measurement.

(If multiple blank measurements have been performed, the sample measurement will be calculated based on the most recent blank measurement.)

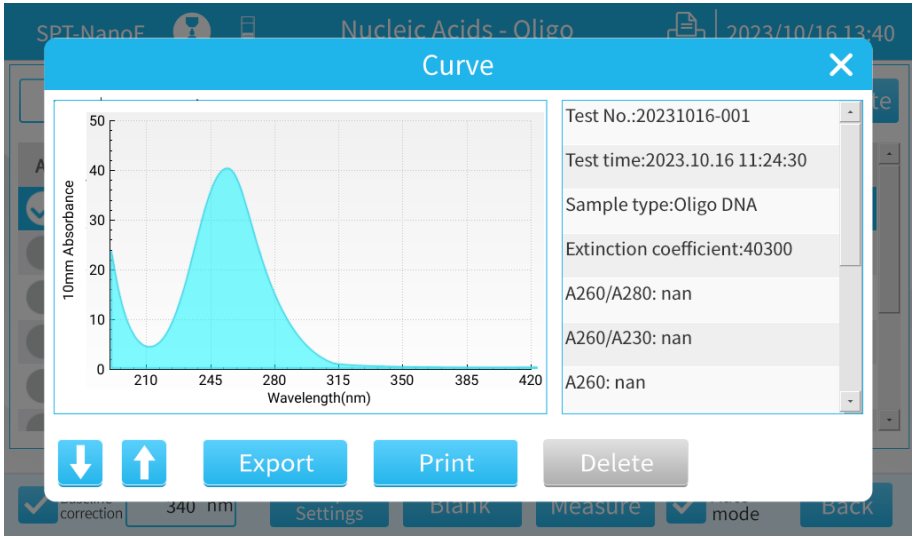
● Test Result:



Swipe left on the screen to access the “Test Result” page.

Select the start date, end date, sample type and test no. to filter through the testing

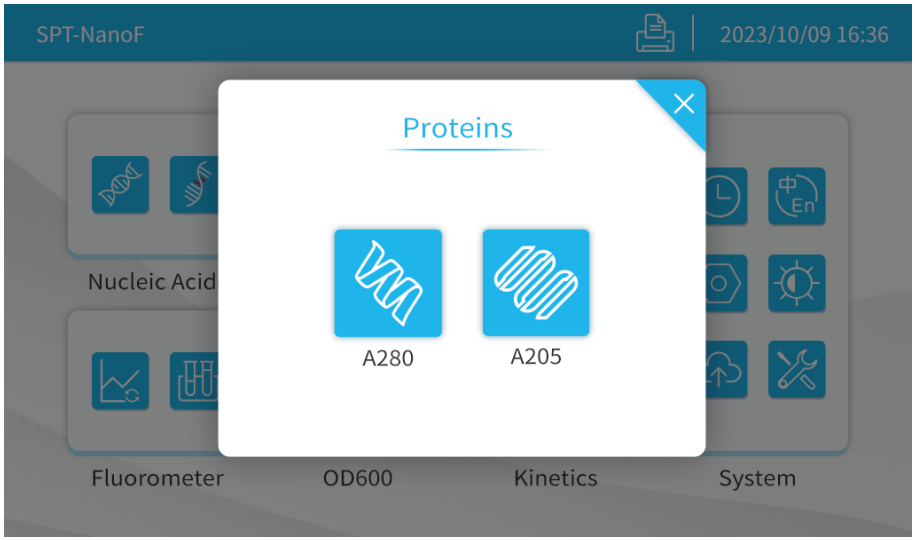
records. Double tap a record to view a detailed report and test curve.



Export: Insert the USB disk drive into the USB port, select the test data and tap the "Export" button to export the test data. (Select "All" to export all test data.)

Print: Ensure that the printing paper is properly loaded into the device. Select the test data and tap the "Print" button to print.

4.3 Proteins

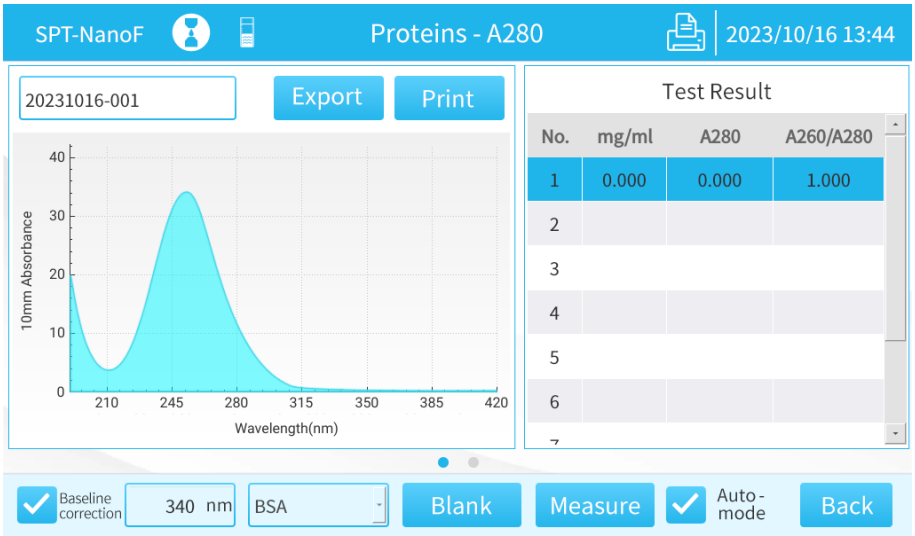


4.3.1. Protein A280

Proteins, in contrast to nucleic acids, can exhibit considerable diversity. The Protein A280 method is applicable to purified proteins that contain Trp, Tyr residues or Cys-Cys disulfide bonds and exhibit absorbance at 280nm. This method does not require the generation of a standard curve. Within this module, the UV spectrum is displayed, and the protein's absorbance at 280nm (A280) is measured, allowing for the calculation of concentration (mg/ml). Analogous to the Nucleic Acid module, the Protein A280 module also displays and records 10mm-equivalent absorbance values on the screen.

Note: If the sample contains major peptide bonds and little to no amino acids, it is advisable to use the Protein A205 mode instead of the Protein A280 mode.

● Sample Measurement:



Before making a sample measurement, use a suitable buffer to make a blank control. The blank control liquid is the buffer that dissolves the analyte. The pH and ion concentration of the blank control liquid should be the same as the measurement sample.

1) When conducting tests, the system will automatically generate a test number, with the format being “year/month/day-serial number”.

2) Select the sample type by tapping the dropdown menu. The default sample type is

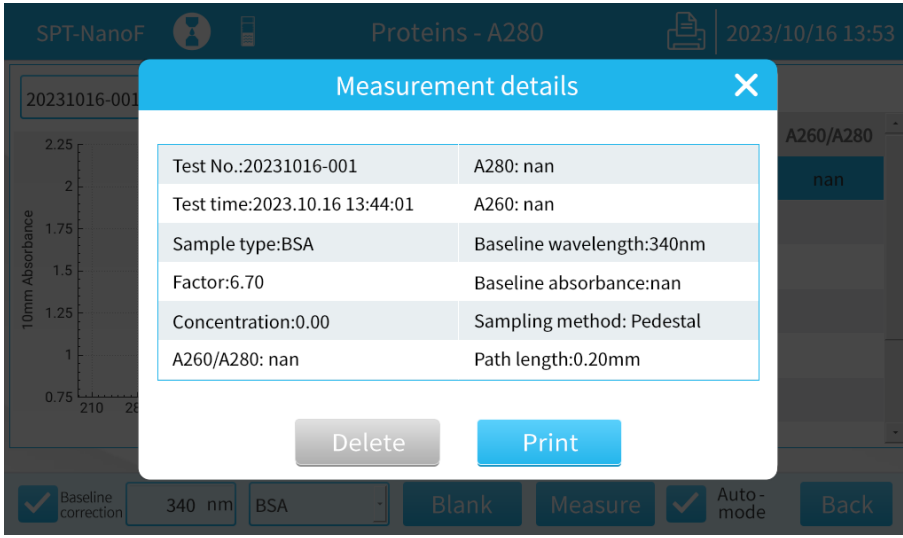
“BSA”.

3) If baseline correction is selected, the default calibration wavelength is 340nm and the user can enter calibration wavelengths depending on the measurement.

4) Open the upper pedestal arm, clean the upper and lower pedestal before measurement. Add a 1-2μl blank control sample to the pedestal. Then close the pedestal and tap the “Blank” button to start measurement.

5) When the blank measurement is complete, clean the upper and lower pedestal and add sample to measure. If the “Auto-mode” checkbox has been selected, the sample will be measured automatically as soon as the pedestal arm is lowered, eliminating the need to manually tap the “Measure” button.

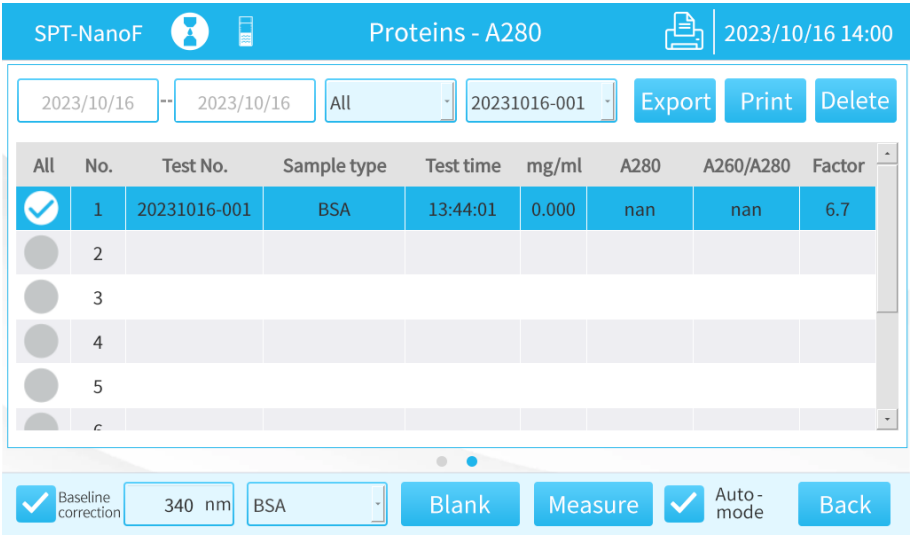
6) When the measurement is complete, the sampling curve will show the absorbance of the current sample on the left-hand side of the screen, and the test results are located on the right-hand side of the screen.



7) Double tap the test result to view the measurement details.

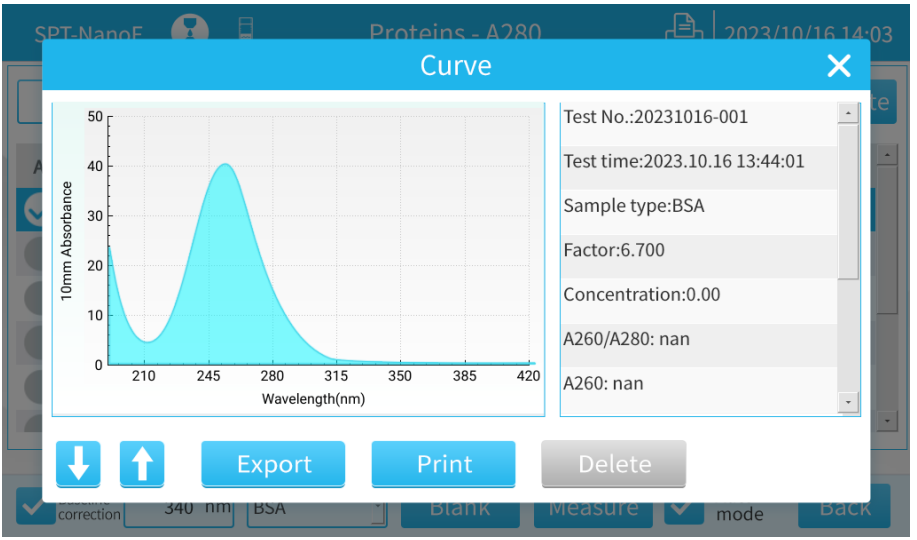
8) Wipe the upper and lower pedestal in preparation for the next measurement. (If multiple blank measurements have been performed, the sample measurement will be calculated based on the most recent blank measurement.)

● Test Result:



Swipe left on the screen to access the “Test Result” page.

Select the start date, end date, sample type and test no. to filter through the testing records. Double tap a record to view a detailed report and test curve.



Export: Insert the USB disk drive into the USB port, select the test data and tap the “Export” button to export the test data. (Select “All” to export all test data.)

Print: Ensure that the printing paper is properly loaded into the device. Select the test

data and tap the “Print” button to print.

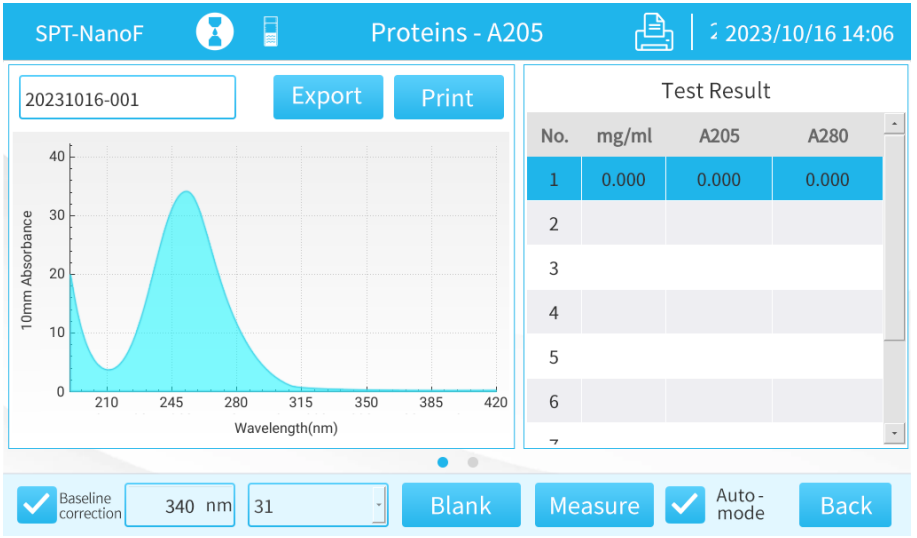
Delete: Select the data and tap the “Delete” button to delete.

4.3.2. Protein A205

The Protein A205 method monitors the absorbance of the peptide bond at 205 nm.

Note: If the sample includes significant quantities of amino acids such as tryptophan and tyrosine, or if it contains cysteine-cysteine disulfide bonds, it is recommended to employ the Protein A280 method instead of Protein A205.

● Sample Measurement:



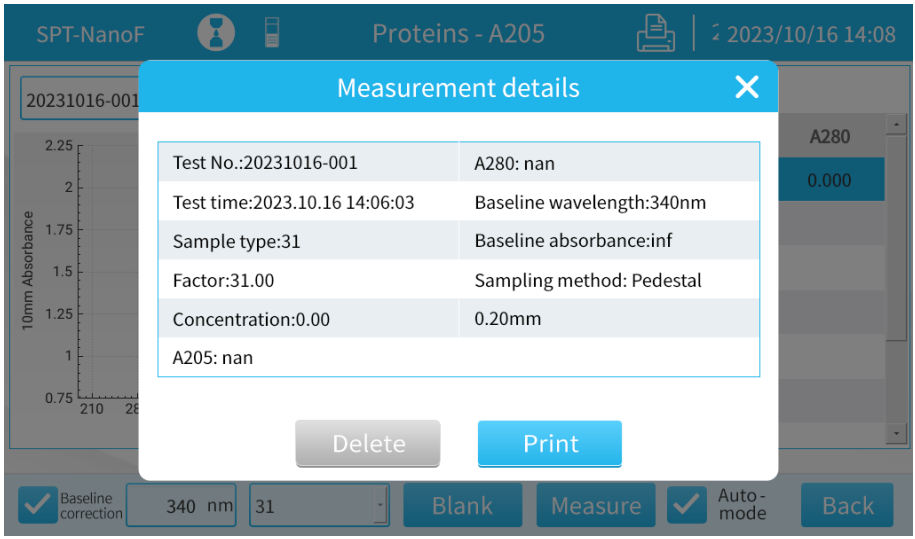
Before making a sample measurement, use a suitable buffer to make a blank control. The blank control liquid is the buffer that dissolves the analyte. The pH and ion concentration of the blank control liquid should be the same as the measurement sample.

1) When conducting tests, the system will automatically generate a test number, with the format being “year/month/day-serial number”.
2) Select the sample type by tapping the dropdown menu. The default selected sample type is “31”.
3) If baseline correction is selected, the default calibration wavelength is 340nm and the user can enter calibration wavelengths depending on the measurement.
4) Open the upper pedestal arm, clean the upper and lower pedestal before measurement.

Add a 1-2μl blank control sample to the pedestal. Then close the pedestal and tap the “Blank” button to start measurement.

5) When the blank measurement is complete, clean the upper and lower pedestal and add sample to measure. If the “Auto-mode” checkbox has been selected, the sample will be measured automatically as soon as the pedestal arm is lowered, eliminating the need to manually tap the “Measure” button.

6) When the measurement is complete, the sampling curve will show the absorbance of the current sample on the left-hand side of the screen, and the test results are located on the right-hand side of the screen.

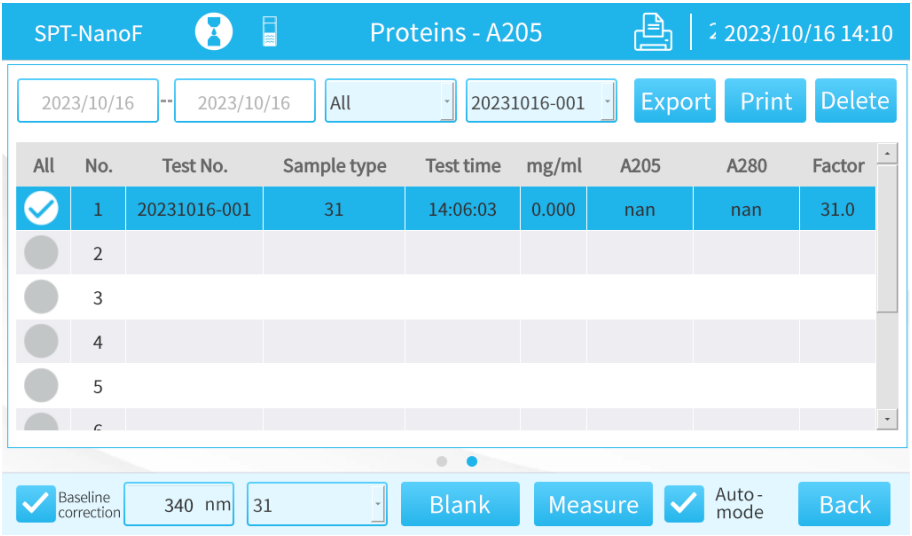


7) Double tap the test result to view the measurement details.

8) Wipe the upper and lower pedestal in preparation for the next measurement.

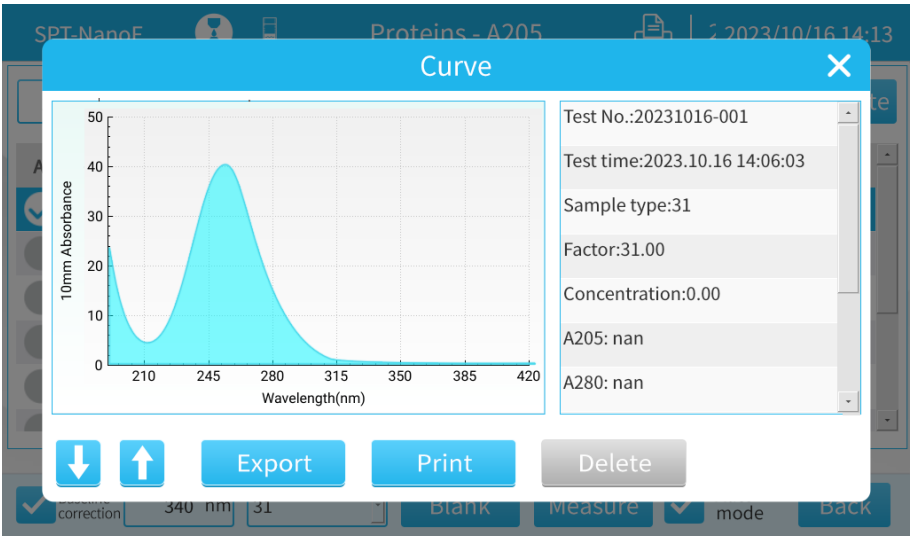
(If multiple blank measurements have been performed, the sample measurement will be calculated based on the most recent blank measurement.)

● Test Result:



Swipe left on the screen to access the “Test Result” page.

Select the start date, end date, sample type and test no. to filter through the testing records. Double tap a record to view a detailed report and test curve.



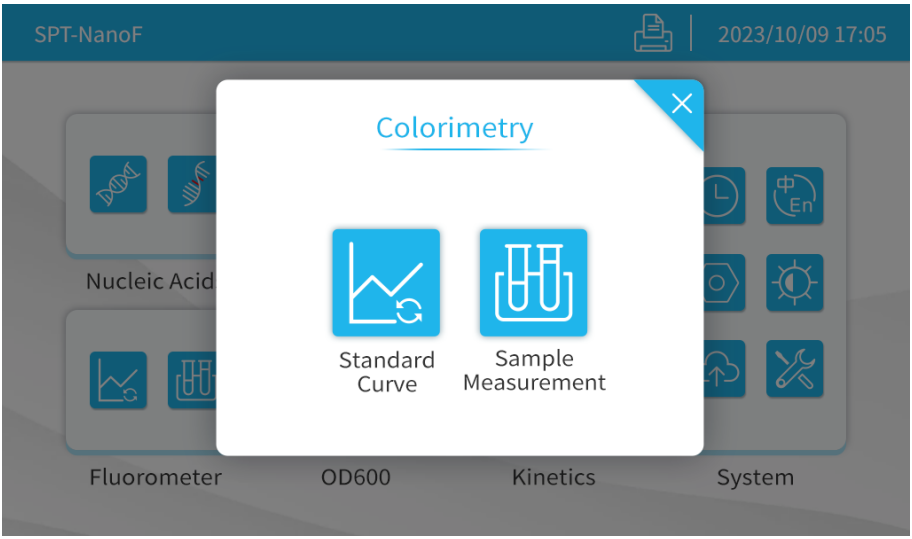
Export: Insert the USB disk drive into the USB port, select the test data and tap the “Export” button to export the test data. (Select “All” to export all test data.)

Print: Ensure that the printing paper is properly loaded into the device. Select the test

data and tap the “Print” button to print.

Delete: Select the data and tap the “Delete” button to delete.

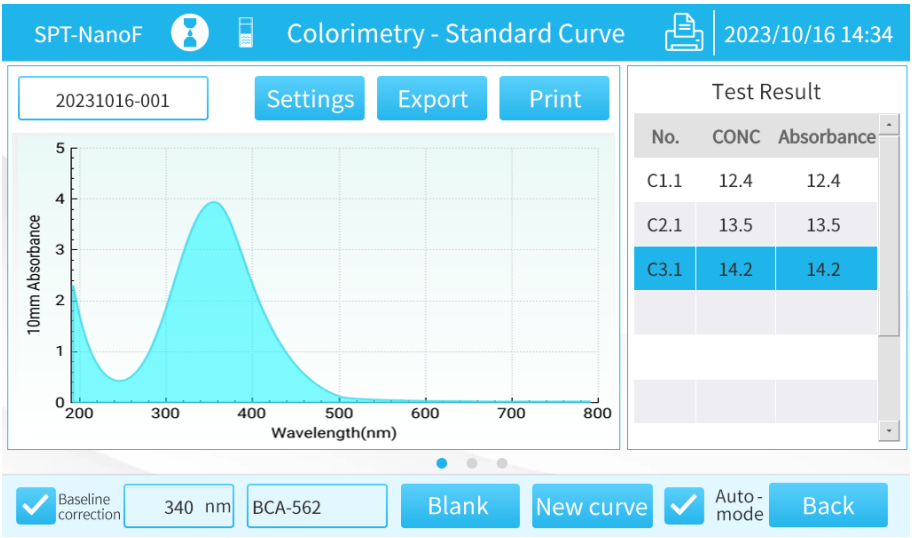
4.4. Colorimetry



4.4.1. Standard Curve

A standard curve is required before starting sample measurement.

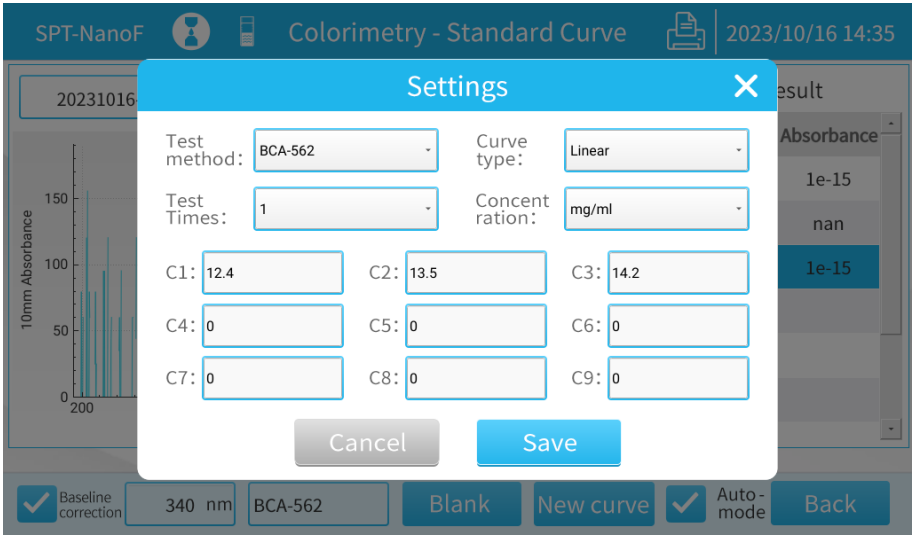
● Measurement Steps:



Before making a sample measurement, use a suitable buffer to make a blank control. The blank control liquid is the buffer that dissolves the analyte. The pH and ion concentration of the blank control liquid should be the same as the measurement sample.

1) In the home screen, tap “Colorimetry” then tap “Standard Curve”. When conducting tests, the system will automatically generate a test number, with the format being “year/month/day-serial number”.

2) Tap the “Settings” button to set parameters. “Test Times” refers to the number of times each sample is tested. The average values are used to build the standard curve. You may input standard solution concentration values for up to 9 different concentrations. Input the concentration values into the designated C1 through C9 boxes as needed.



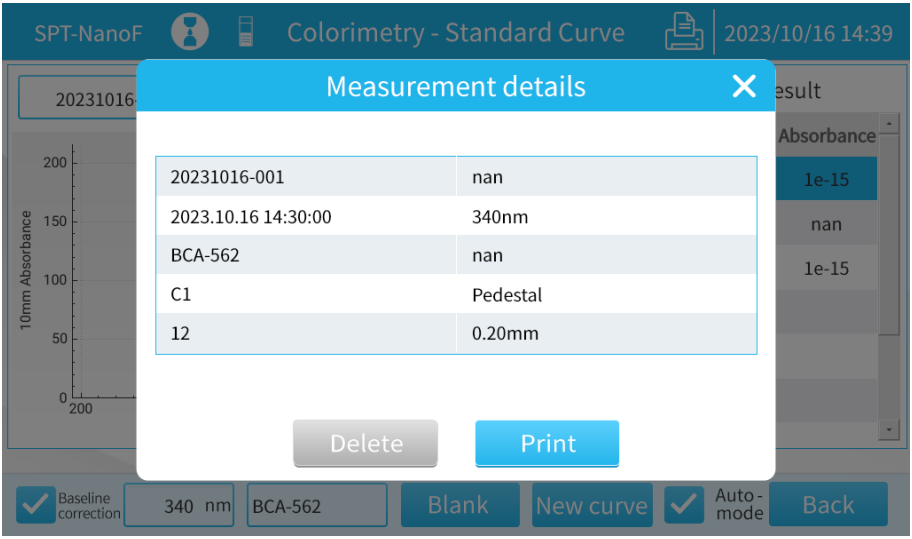
3) If baseline correction is selected, the default calibration wavelength is 340nm and the user can enter calibration wavelengths depending on the measurement.

4) Open the upper pedestal arm, clean the upper and lower pedestal before measurement. Add a 1-2μl blank control sample to the pedestal. Then close the pedestal and tap the “Blank” button to start measurement.

5) When the blank measurement is complete, tap the “New curve” button to add a new testing group, then tap “Measure” to start measurement.

6) Clean the upper and lower pedestal and add sample to measure. If the “Auto-mode” checkbox has been selected, the sample will be measured automatically as soon as the pedestal arm is lowered, eliminating the need to manually tap the “Measure” button.

7) When the measurement is complete, the sampling curve will show the absorbance of the current sample on the left-hand side of the screen, and the test results are located on the right-hand side of the screen.

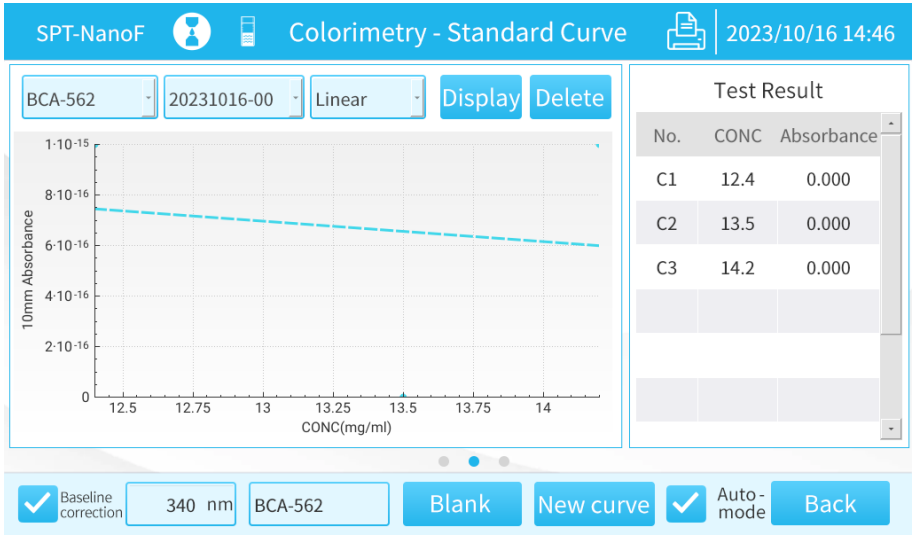


8) Double tap the test result to view the measurement details.

9) Wipe the upper and lower pedestal in preparation for the next measurement.

(If multiple blank measurements have been performed, the sample measurement will be calculated based on the most recent blank measurement.)

● Standard Curve：



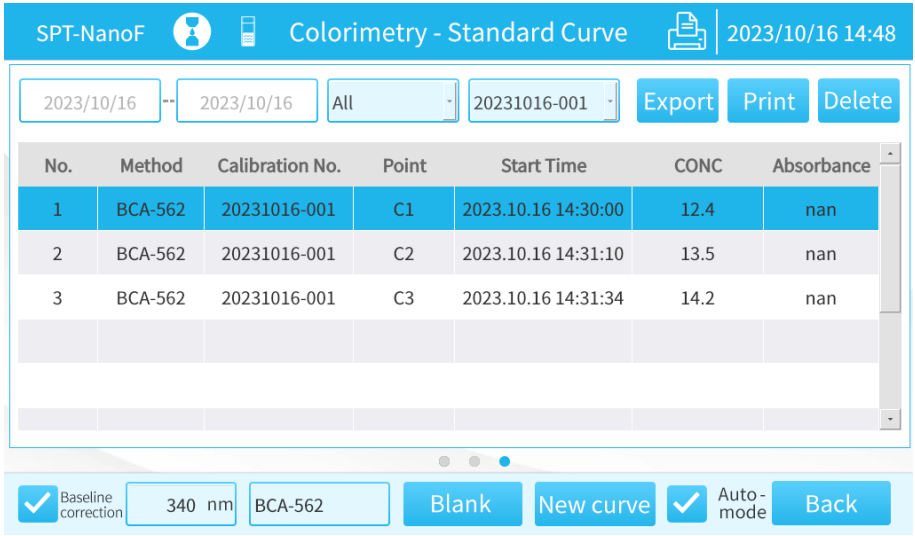
1) Swipe left on the screen to view standard curve.

2) Select the sample type and calibration no. to filter through the testing records.

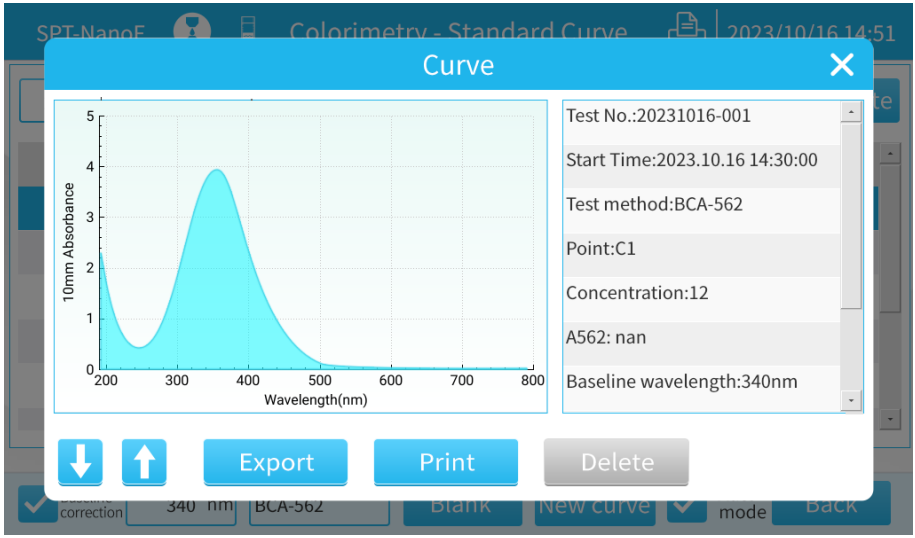
3) **Display:** Select the curve type and tap the “Display” button. A curve is produced based on the curve type you have chosen. (Note: The sample test result is based on the standard curve. Once the sample has been tested, the curve cannot be changed.)

4) **Delete:** Tap the “Delete” button to delete the current standard curve.

● Test Result:



Swipe left on the screen to enter the test result page.



Select the start date, end date, sample type and test no. to filter through the testing records. Double tap a record to view a detailed report and test curve.

Export: Insert the USB disk drive into the USB port, select the test data and tap the "Export" button to export the test data. (Select "All" to export all test data.)

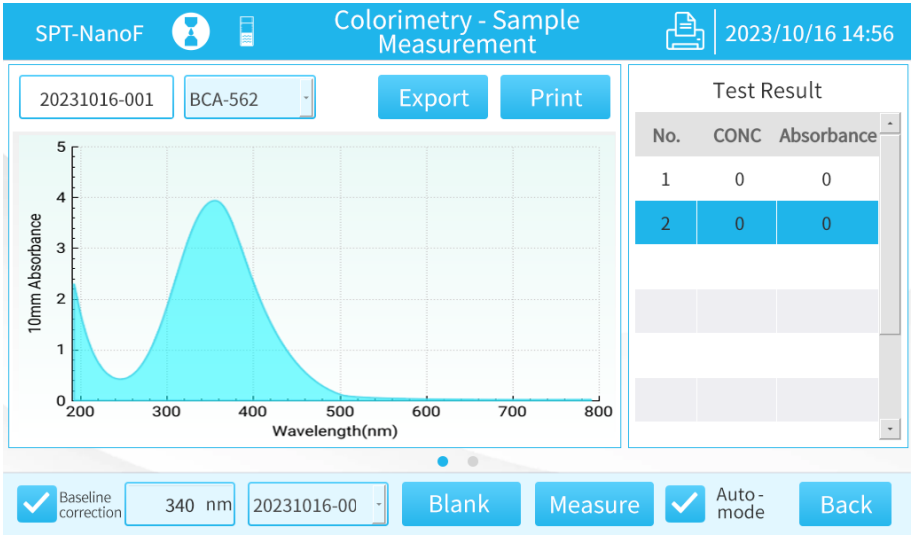
Print: Ensure that the printing paper is properly loaded into the device. Select the test

data and tap the “Print” button to print.

Delete: Select the data and tap the “Delete” button to delete.

4.4.2. Sample Measurement

● Measurement Steps：

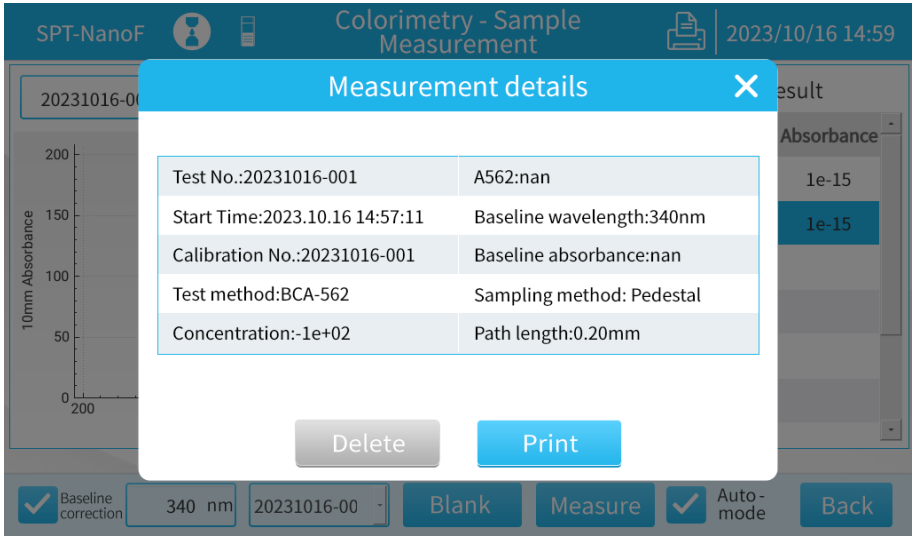


Before making a sample measurement, use a suitable buffer to make a blank control. The blank control liquid is the buffer that dissolves the analyte. The pH and ion concentration of the blank control liquid should be the same as the measurement sample.

1) In the home screen, tap “Colorimetry” then tap “Sample Measurement”. When conducting tests, the system will automatically generate a test number, with the format being “year/month/day-serial number”.
2) Select the sample type, then tap the calibration number (on the left-hand side of the “Blank” button).
3) If baseline correction is selected, the default calibration wavelength is 340nm and the user can enter calibration wavelengths depending on the measurement.
4) Open the upper pedestal arm, clean the upper and lower pedestal before measurement. Add a 1-2μl blank control sample to the pedestal. Then close the pedestal and tap the “Blank” button to start measurement.

5) When the blank measurement is complete, clean the upper and lower pedestal and add sample to measure. If the “Auto-mode” checkbox has been selected, the sample will be measured automatically as soon as the pedestal arm is lowered, eliminating the need to manually tap the “Measure” button.

6) When the measurement is complete, the sampling curve will show the absorbance of the current sample on the left-hand side of the screen, and the test results are located on the right-hand side of the screen.

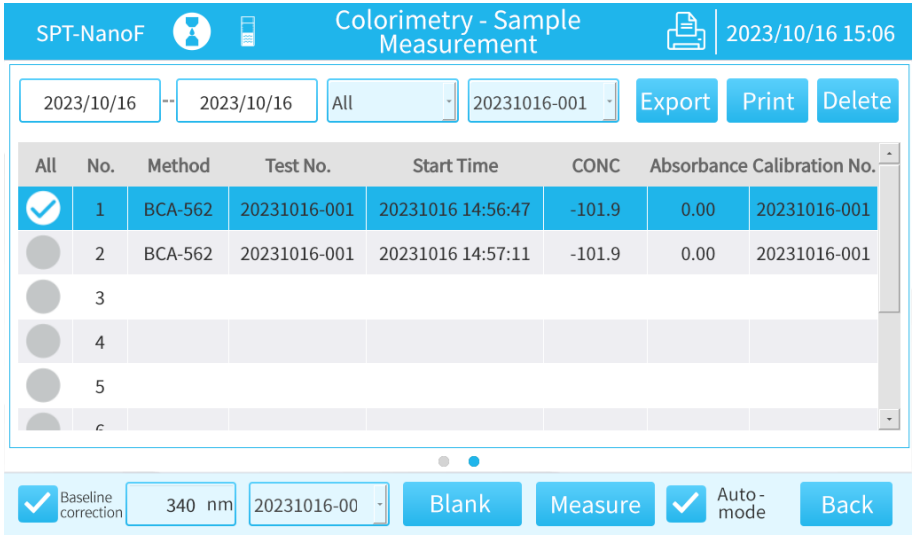


7) Double tap the test result to view the measurement details.

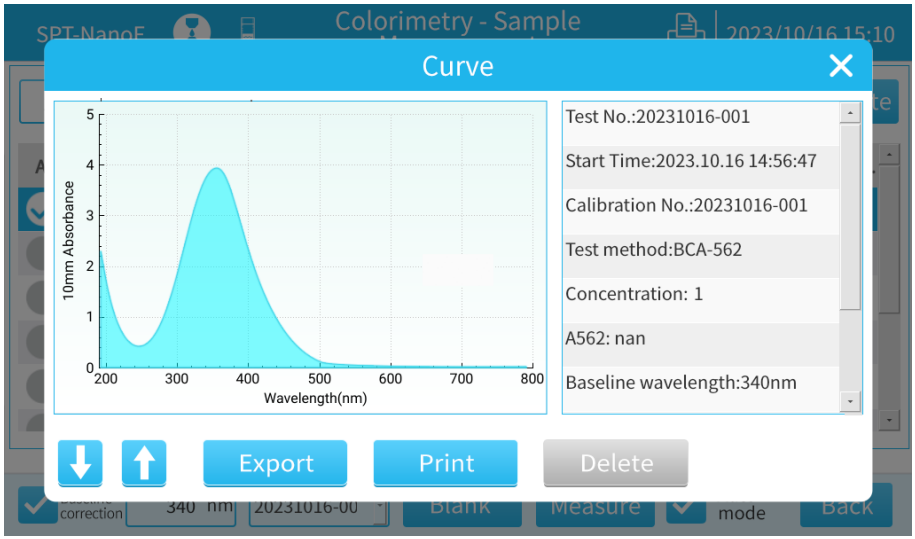
8) Wipe the upper and lower pedestal in preparation for the next measurement.

(If multiple blank measurements have been performed, the sample measurement will be calculated based on the most recent blank measurement.)

● Test Result:



Swipe left on the screen to enter the test result page.



Select the start date, end date, sample type and test no. to filter through the testing records. Double tap a record to view a detailed report and test curve.

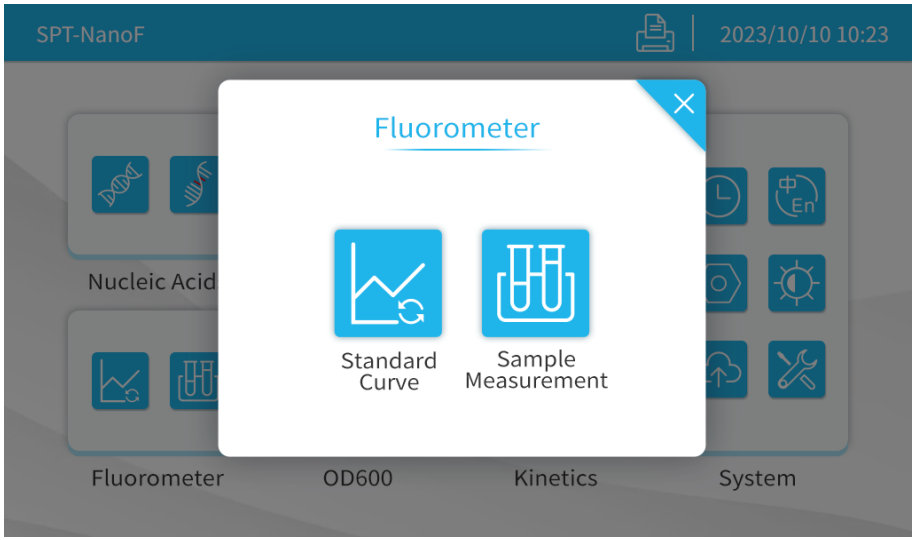
Export: Insert the USB disk drive to the USB port, select the test data and tap the "Export" button to export the test data. (Select "All" to export all test data.)

Print: Ensure that the printing paper is properly loaded into the device. Select the test

data and tap the “Print” button to print.

Delete: Select the data and tap the “Delete” button to delete.

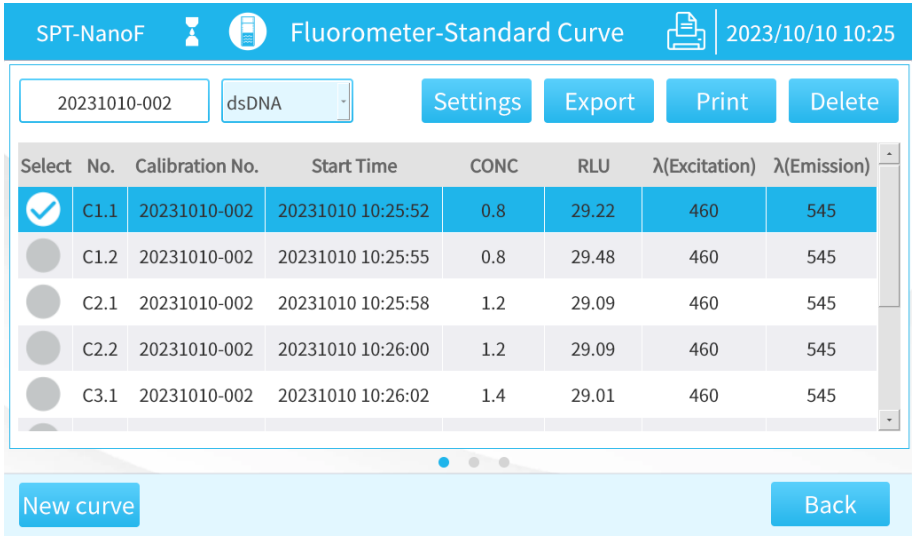
4.5. Fluorometer



4.5.1. Standard Curve

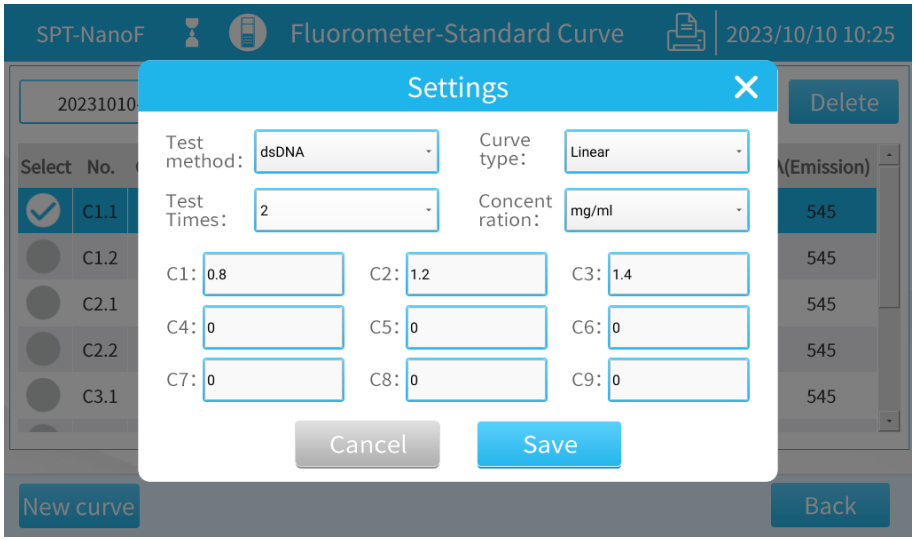
A standard curve is required before starting fluorescence measurement.

● Measurement Steps:



1) When conducting tests, the system will automatically generate a test number, with the format being “year/month/day-serial number”.

2) Tap the “Settings” button to set the parameters. “Test Times” refers to the number of times each sample is tested, and the average values are used to build the standard curve. You may input standard sample concentration values for up to 9 different concentrations. Input the concentration values in the designated C1 through C9 boxes as necessary.



3) Tap the “New curve” button to add a new testing group.

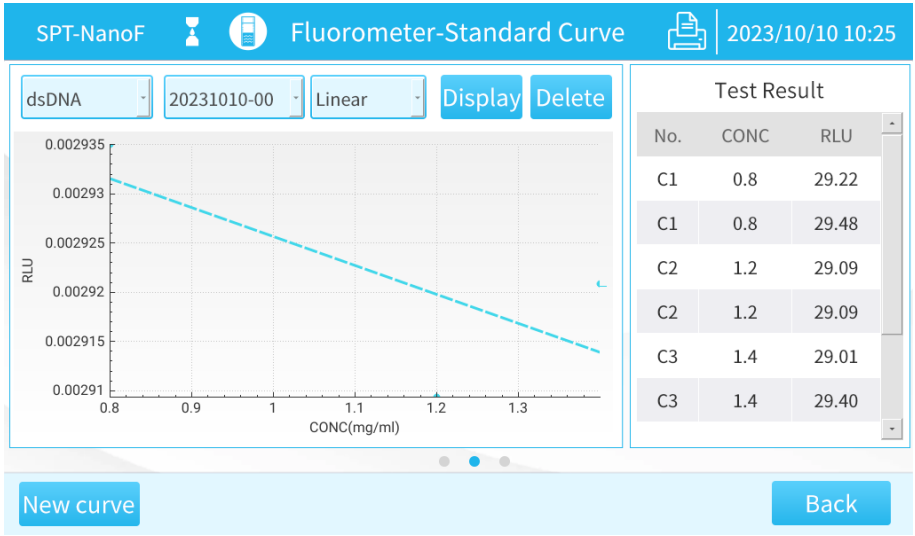
4) Add the standard sample into the PCR tube and put it into the PCR tube holder. Insert the PCR tube holder into the Fluorometer slot.

5) Tap “Measure” to start measurement.

6) When the measurement is complete, check the current test data on the screen.

7) Remove the standard sample in preparation for the next measurement.

● Standard Curve：



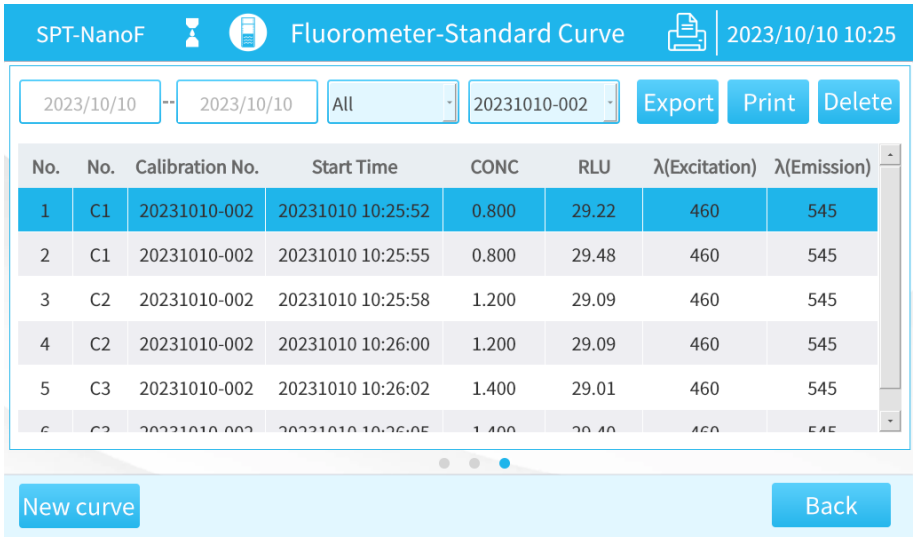
Swipe left on the screen to view standard curve.

Select the sample type and calibration number to filter through the testing records.

Display: select the curve type and tap the “Display” button. A curve is produced based on the curve type you have chosen. (Note: The sample test result is based on the standard curve. Once the sample has been tested, the curve cannot be changed.)

Delete: Tap the “Delete” button to delete the current standard curve.

● Test Result：



Swipe left on the screen to enter the test result page.

Select the start date, end date, sample type and calibration no. to filter through the testing records. Double tap a record to view a detailed report and test curve.

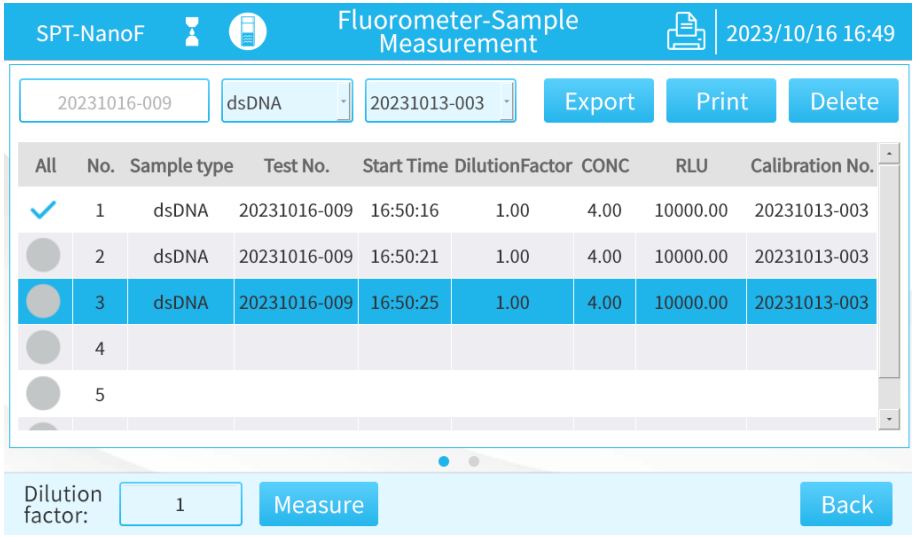
Export: Insert the USB disk drive to the USB port, select the test data and tap the "Export" button to export the test data. (Select "All" to export all test data.)

Print: Ensure that the printing paper is properly loaded into the device. Select the test data and tap the "Print" button to print.

Delete: Select the data and tap the "Delete" button to delete.

4.5.2. Sample Measurement

● Measurement Steps:



Before making a sample measurement, use a suitable buffer to make a blank control. The blank control liquid is the buffer that dissolves the analyte. The pH and ion concentration of the blank control liquid should be the same as the measurement sample.

1) When conducting tests, the system will automatically generate a test number, with the format being "year/month/day-serial number".
2) Select the sample type and the calibration number.
3) Input the dilution factor into the box.
4) Add the sample into the PCR tube and put it into the PCR tube holder. Insert the

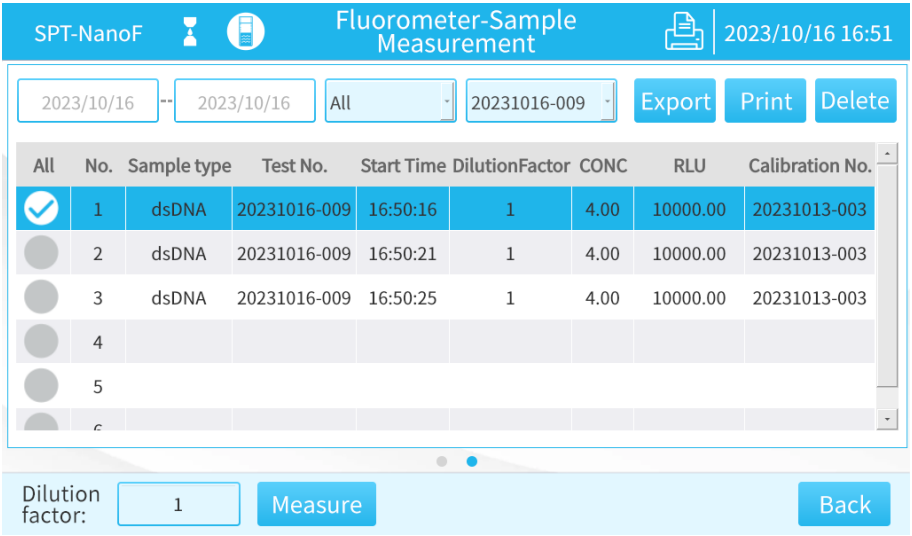
PCR tube holder into the Fluorometer detection slot.

5) Tap the “Measure” button to start measurement.

6) When the measurement is complete, check the current test data on the screen.

7) Remove the sample in preparation for the next measurement.

● Test Result:



Swipe left on the screen to enter the test result page.

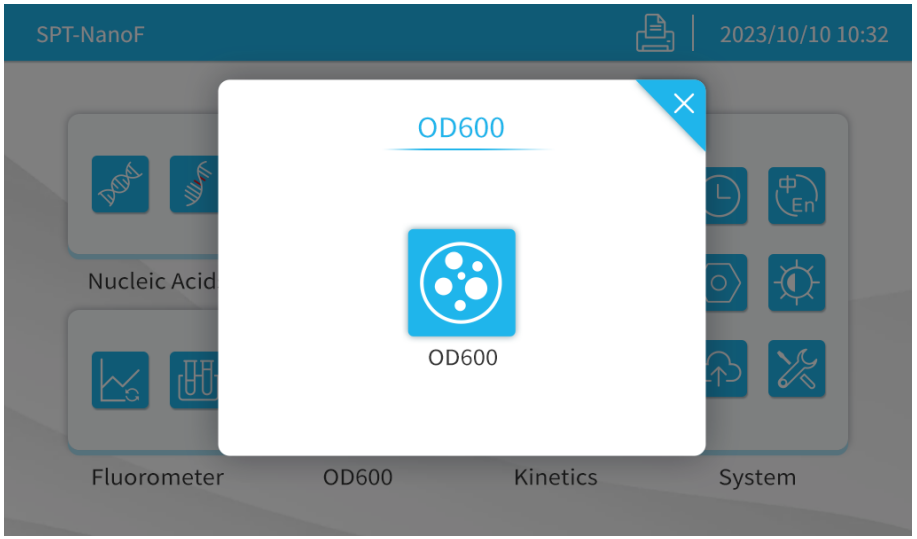
Select the start date, end date, sample type and test no. to filter through the testing records. Double tap a record to view a detailed report and test curve.

Export: Insert the USB disk drive into the USB port, select the test data and tap the “Export” button to export the test data. (Select “All” to export all test data.)

Print: Ensure that the printing paper is properly loaded into the device. Select the test data and tap the “Print” button to print.

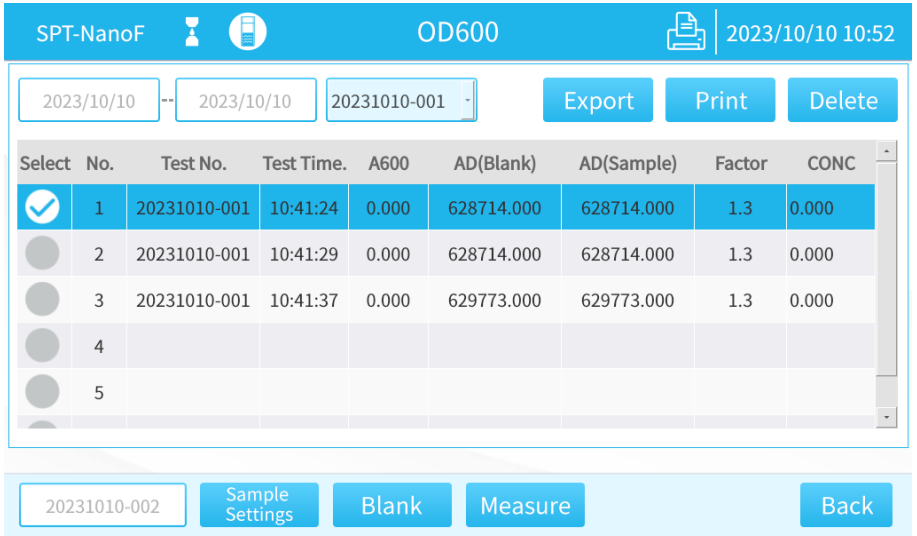
Delete: Select the data and tap the “Delete” button to delete.

4.6. OD600



In the home screen, tap the “OD600” icon to enter the testing page.

● Sample Measurement:



Before making a sample measurement, use a suitable buffer to make a blank control. The blank control liquid is the buffer that dissolves the analyte. The pH and ion concentration of the blank control liquid should be the same as the measurement sample.

1) Tap “Sample Settings” to input the factor (this is the conversion factor between

absorbance and concentration).

2) Put the blank control sample into the cuvette, insert the cuvette into the OD600 slot, and tap “Blank” to start blank measurement.

3) When the blank measurement is complete, load your sample into the cuvette. Then insert the loaded cuvette into the OD600 slot and tap “Measure” to start sample measurement.

4) When the sample measurement is complete, check the current test result on the screen. (If multiple blank measurements have been performed, the sample measurement will be calculated based on the most recent blank measurement.)

● Test Result：

Select the start date, end date, sample type and test no. to filter through the testing records. Double tap a record to view a detailed report and test curve.

Export: Insert the USB disk drive into the USB port, select the test data and tap the “Export” button to export the test data. (Select “All” to export all test data.)

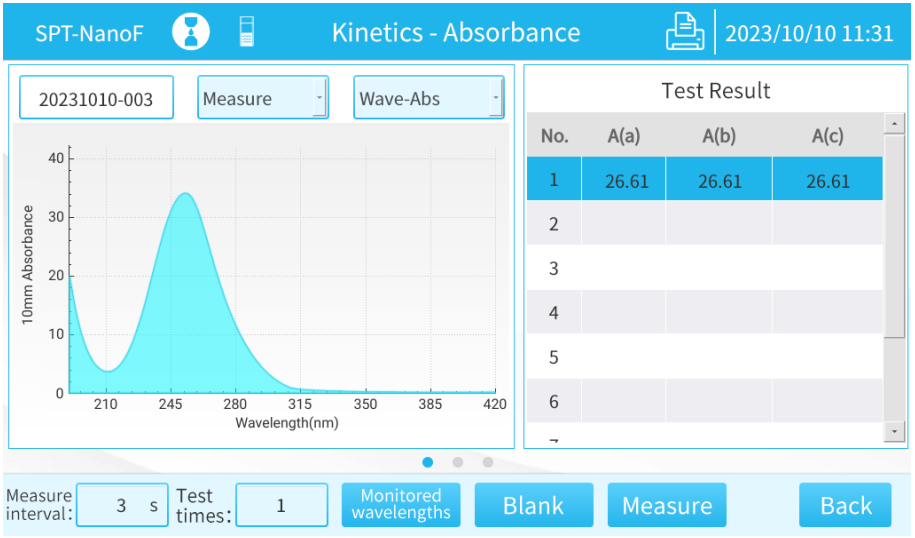
Print: Ensure that the printing paper is properly loaded into the device. Select the test data and tap the “Print” button to print.

Delete: Select the data and tap the “Delete” button to delete.

4.7.Kinetics

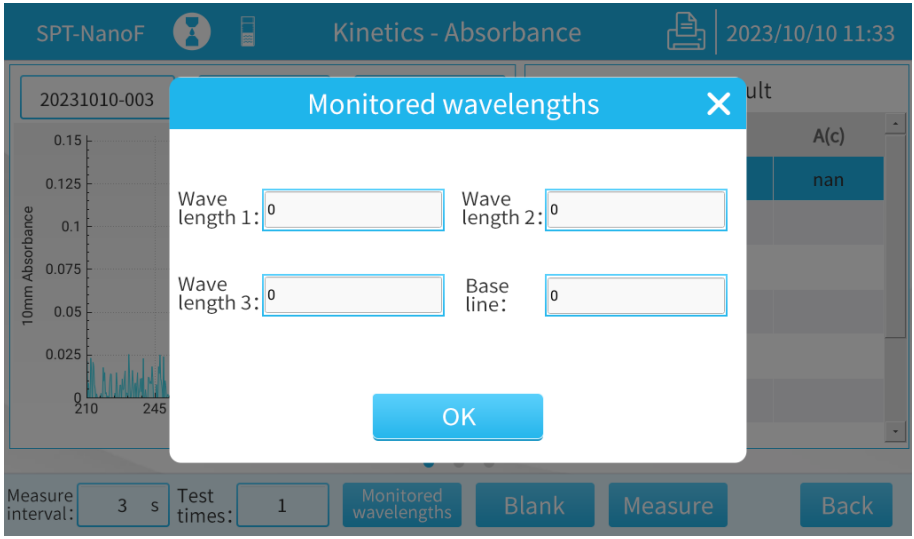
4.7.1. Absorbance

● Sample Measurement:



Before making a sample measurement, use a suitable buffer to make a blank control. The blank control liquid is the buffer that dissolves the analyte. The pH and ion concentration of the blank control liquid should be the same as the measurement sample.

1) When conducting tests, the system will automatically generate a test number, with the format being “year/month/day-serial number”.
2) Input the measure interval and test times on the boxes.
3) Tap the “Monitored wavelengths” button to set parameters. Users can set three wavelength setpoints and baseline and tap “OK” to save.



4) Open the upper pedestal arm, clean the upper and lower pedestal before measurement. Add a 1-2μl blank control sample to the pedestal. Then close the pedestal and tap the “Blank” button to start measurement.

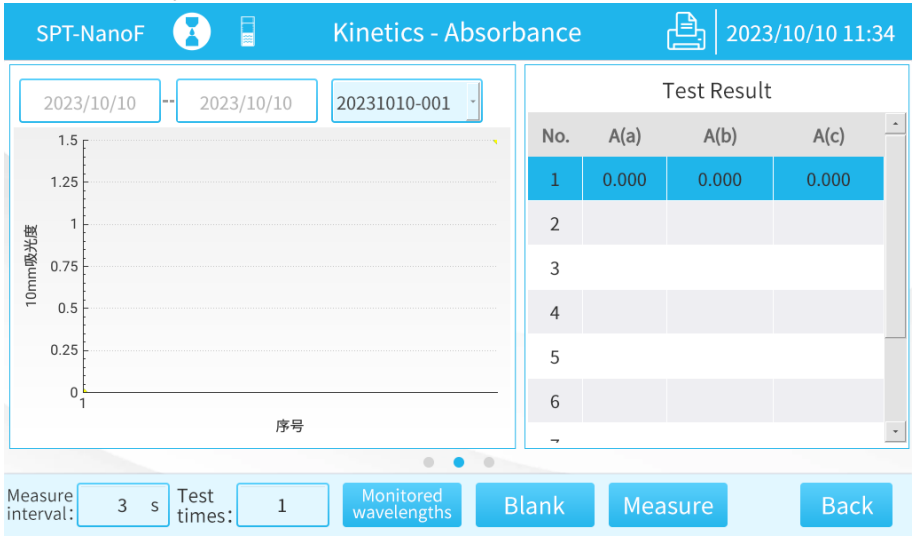
5) When the blank measurement is complete, clean the upper and lower pedestal and add sample to measure.

6) Tap “Measure” to start sample measurement.

7) When the measurement is complete, the sampling curve will show the absorbance of the current sample on the left-hand side of the screen, and the test results are located on the right-hand side of the screen.

8) Clean the upper and lower pedestal in preparation for the next measurement. (If multiple blank measurements have been performed, the sample measurement will be calculated based on the most recent blank measurement.)

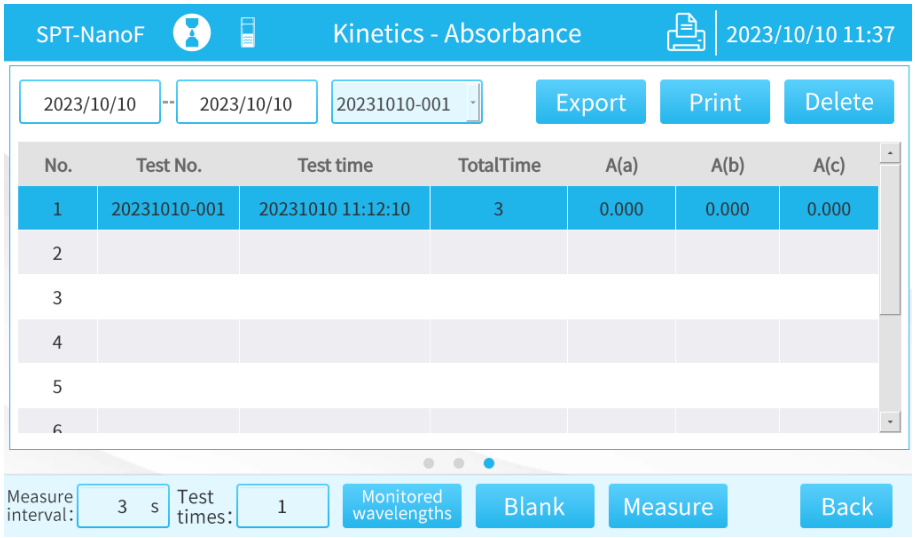
● Graph Display:



Swipe left on the screen to enter the graph display page.

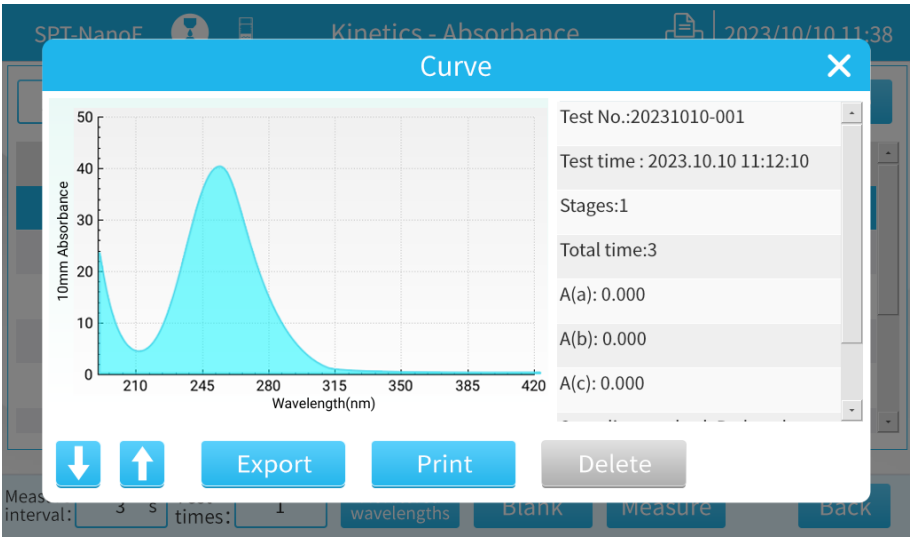
Select start date, end date and test no. to filter through testing records.

● Test Result:



Swipe left on the screen to enter the test result page.

Select the start date, end date, sample type and test no. to filter through the testing records. Double tap a record to view a detailed report and test curve.



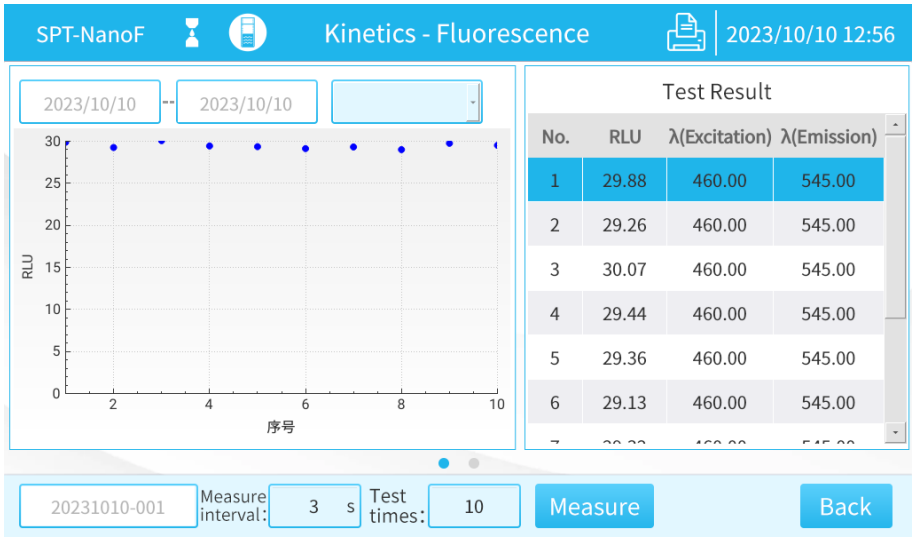
Export: Insert the USB disk drive to the USB port, select the test data and tap the “Export” button to export the test data. (Select “All” to export all test data.)

Print: Ensure that the printing paper is properly loaded into the device. Select the test data and tap the “Print” button to print.

Delete: Select the data and tap the “Delete” button to delete.

4.7.2.Fluorescence

● Sample Measurement:



1) When conducting tests, the system will automatically generate a test number, with the format being “year/month/day-serial number”.

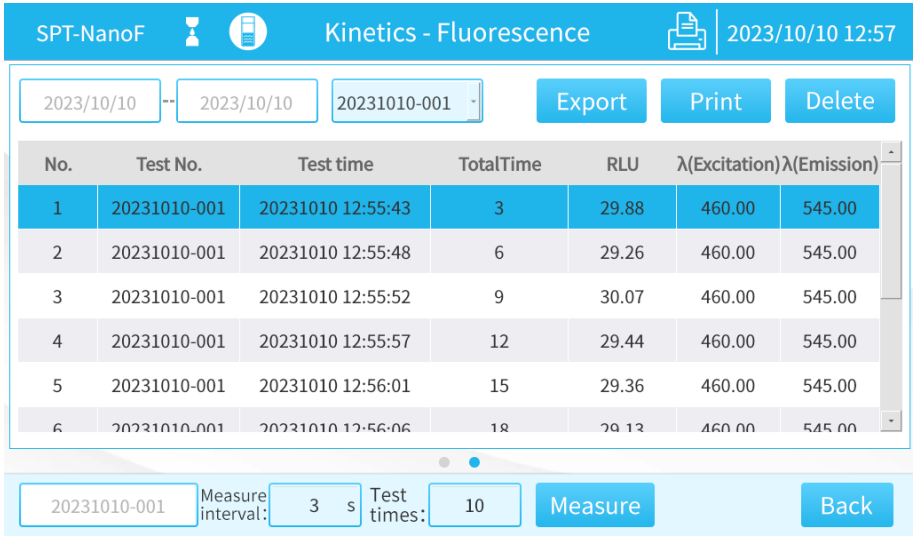
2) Input measure interval and test times.

3) Tap the “Measure” button to start sample measurement.

4) When the measurement is complete, a dot plot is shown on the left-hand side of the screen, displaying the fluorescence intensity over time.

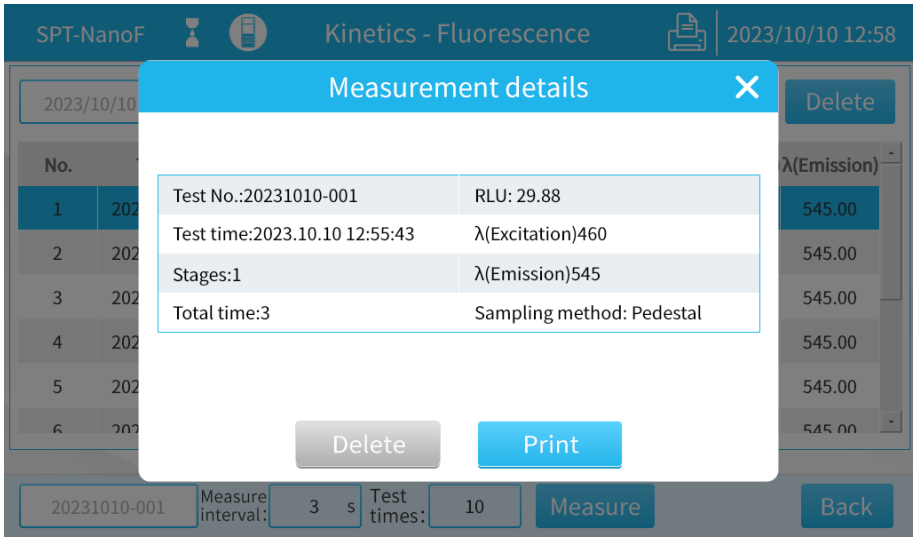
5) The test result is shown on the right-hand side of the display. Double tap a record to view the detailed test report.

● Test Result:



Swipe left on the screen to enter the test result page.

Select the start date, end date, sample type and test no. to filter through the testing records. Double tap a record to view a detailed report and test curve.

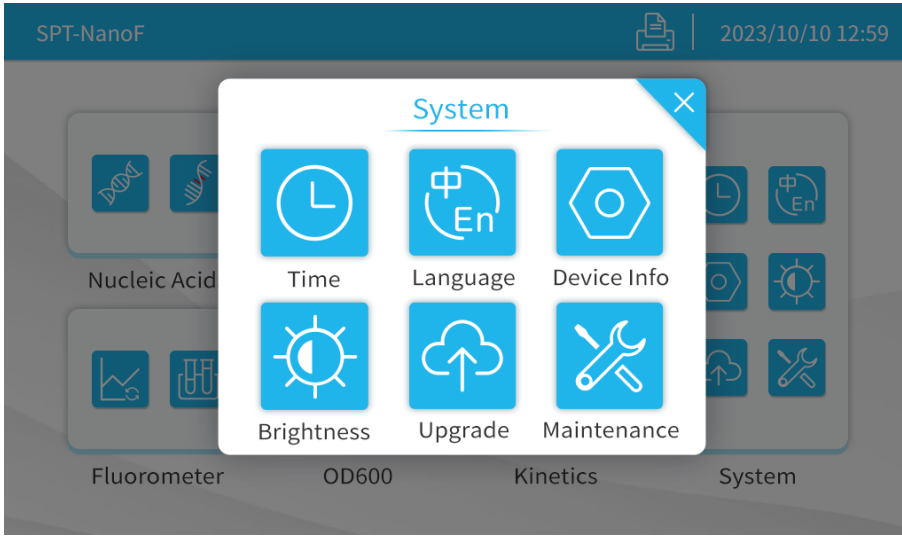


Export: Insert the USB disk drive into the USB port, select the test data and tap the "Export" button to export the test data. (Select "All" to export all test data.)

Print: Ensure that the printing paper is properly loaded into the device. Select the test data and tap the "Print" button to print.

Delete: Select the data and tap the “Delete” button to delete.

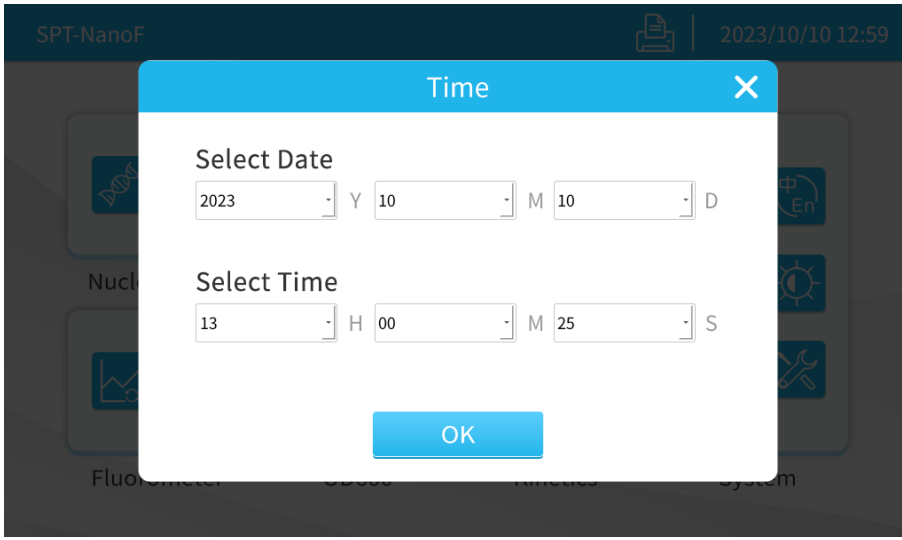
4.8. System



The system includes six modules. Tap on any module icon for the associated settings.

4.8.1. Time

Tap the “Time” icon to set date and time, and tap “OK“ to save the settings.

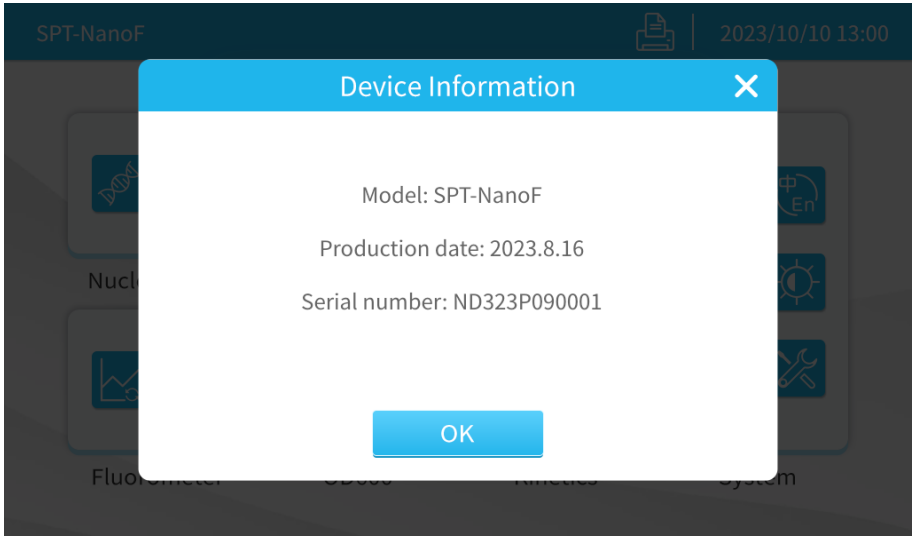


4.8.2. Language

Tap the “Language” icon to select “简体中文” or “English”, and tap “OK“ to save the settings.

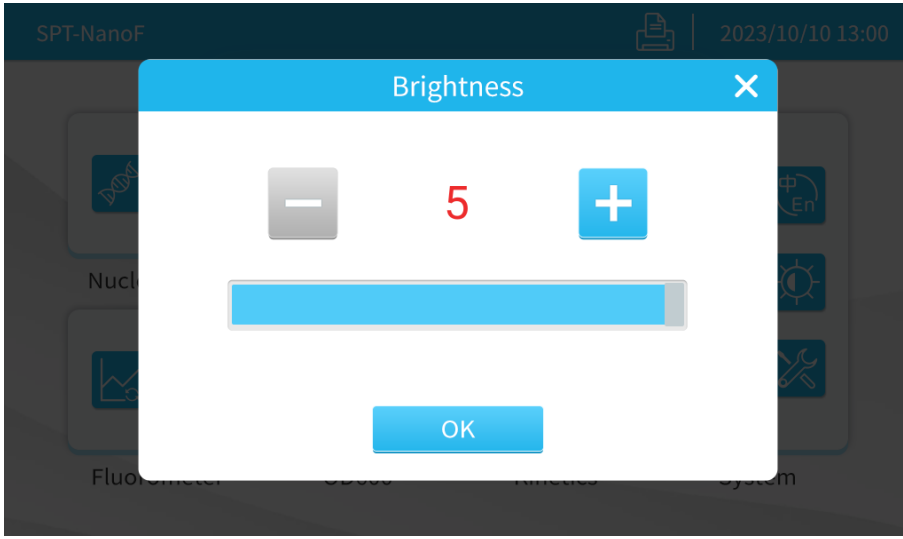
4.8.3. Device Information

Tap the “Device Info” icon to view detailed information about this device.



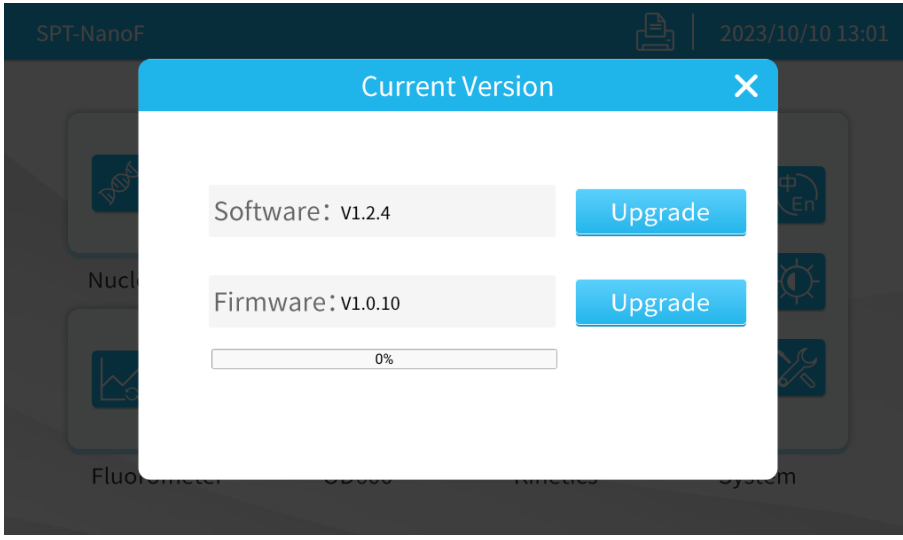
4.8.4. Brightness

Tap the" Brightness" icon to adjust the brightness of the screen from level 0 to level 5 by tapping " + " " - " button or dragging the slider.



4.8.5. Upgrade

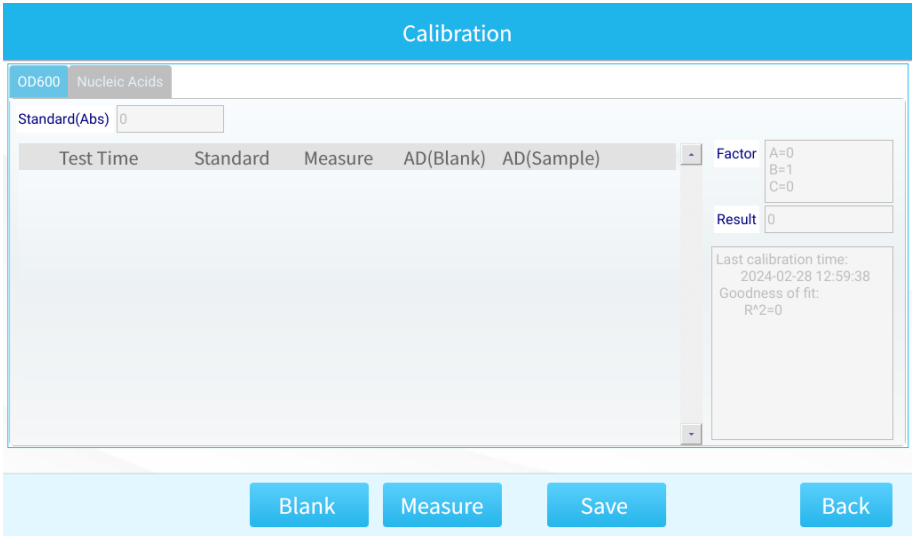
Tap the "Upgrade" icon to view the current software version. For upgrading software or firmware, first save the upgraded version in the USB disk drive, insert the USB disk drive into the device and tap "Upgrade" button to upgrade them to newer versions.



4.8.6. Maintenance

Tap the “Maintenance” icon, enter the password “411111111” to access the calibration interface:

1. OD600 Calibration



The OD600 module can be calibrated with the use of visible absorbance references in an absorption cuvette. The reference materials may be either glass-based filters or liquid-based standards, with known absorbance values at 600nm.

- Preparation: Prepare one blank reference. Prepare a minimum of 2 reference materials (3 or more recommended) with known absorbance values at 600nm. The OD600 mode has an absorption range of 0-4A. Prepare as many reference materials as necessary for the absorption range you require. For a complete calibration, we recommend at least 4 reference standards with absorbance values within and slightly outside of the range 0-4A. For example: 0.8A, 1.7A, 2.8A, 4.2A all at 600nm.
- Calibration steps:

1) Insert the blank reference into the OD600 slot.

2) Tap the “Blank” button to measure the blank.

3) Insert a reference material into the OD600 slot, and enter its known absorbance value at 600nm.

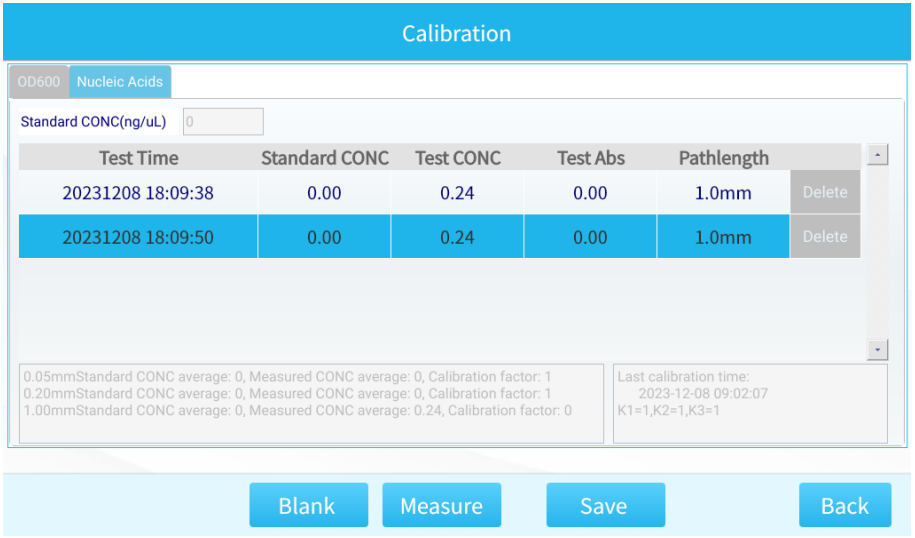
4) Tap the “Measure” button repeatedly (with a 5-second pause interval) to take repeated absorbance value measurements. If there are any erroneous outliers, tap the “Delete” button to remove them. It is recommended to obtain at least 3 valid measurements.

5) Repeat Steps 3 and 4 for each reference material prepared.

6) Tap the “Save” button to finish the calibration.

● Goodness-of-fit result: The best correlation coefficient value for a calibration result is 1.0. The closer the value is to 1.0, the better the calibration result.

2. Nucleic Acids Calibration



The microvolume pedestal mode can be calibrated using reference dsDNA samples with known concentration values.

● Preparation: Prepare one blank control, and 3 reference dsDNA samples, each sample containing a dsDNA concentration value within each of the following ranges: 0-750 ng/μl; 750-3,750 ng/μl; and 3,750-15,000 ng/μl. Each range corresponds to one of the three pathlengths possible with our device. 0-750 ng/μl corresponds to 1.0mm, 750-3,750 ng/μl to 0.2mm, and 3,750-15,000 ng/μl to 0.05mm.

● Calibration steps:

1) Standard concentration (ng/μl): Enter the known concentration for the current reference sample. The calibration pathlength will be automatically chosen based upon this value.
2) Open the upper pedestal arm, clean the upper and lower pedestal.
3) Add a 1-2μl blank control droplet to the pedestal. Then close the pedestal and tap the “Blank” button to start measurement.
4) Open the upper pedestal arm, clean the upper and lower pedestal again.
5) Add a 1-2μl reference sample droplet to the pedestal, then tap “Measure”.
6) Repeat Step 4 and 5 using the same reference sample to obtain repeated measurements. If there are any erroneous outliers, tap “Delete” to remove them. It is recommended to obtain at least 3 valid measurements.
7) Tap “Save” to finish the calibration.

Repeat the above calibration steps for each reference sample prepared.

5. Maintenance and Cleaning

5.1. Pedestal Maintenance

- Promptly remove any liquid from the pedestal following each measurement. Upon completing all measurements, cleanse the pedestal with pure water, ensuring thorough drying to prevent damage from solutions or solvents. Disconnect the power supply before cleaning and refrain from using corrosive cleaning agents.
- Avoid exposing the device to hydrogen fluoride (HF) in any form, as it can dissolve the silica fibers in the pedestal.
- Prevent any liquids from infiltrating the gap between the pedestal and the device's body to avoid potential damage. Should any liquid spill or overflow, promptly wipe it away.
- Failing to wipe off liquid on the pedestal in a timely manner after sample testing or after prolonged instrument use may result in residual impurities on the pedestal's surface, including the sample and its oxides.

1. Use pure water to remove impurities such as sample residues and oxides on the surface of the optical fiber head of the pedestals. The steps are as follows:

1) Add 3-5ul of pure water to the metal surface of the optical fiber at the bottom base.

2) Put the upper pedestal arm down to form a liquid column and let it stand for 2-3 minutes.

3) Wipe water with a clean, lint-free cloth.

2. In the case where pure water does not effectively remove the residue on the surface of the pedestal, please use dilute hydrochloric acid (0.5mol/L) to remove impurities such as sample residues and sample oxides on the surface of the optical fiber head of the pedestals. The steps are as follows:

1) Add 3-5ul of dilute hydrochloric acid (0.5mol/L) to the metal surface of the optical fiber at the bottom pedestal.

2) Put the upper pedestal arm down to form a liquid column and let it stand for 2-3 minutes.

3) Wipe the diluted hydrochloric acid with a clean, lint-free cloth.

Note: Following the removal of impurities on the surface of the optical fiber head with dilute hydrochloric acid (0.5mol/L), be sure to then employ pure water to remove the dilute hydrochloric acid residue on the surface.

5.2.Machine Use and Maintenance

1. Shield the device from direct exposure to sunlight.
2. Refrain from introducing airflow during operation to maintain accuracy.
3. Operate the device in a dry environment and avoid high humidity.
4. Regularly clean the instrument's surface using a soft, lint-free cloth.
5. Prohibit the use of corrosive cleaning agents on the device.
6. If the device exhibits any abnormalities, please document the process and observed anomalies, and promptly get in touch with your local seller.

6. Warranty

We guarantee that our scientific instruments adhere to the most rigorous engineering and quality standards. This instrument is warranted to be free from defects in materials and workmanship under normal use and service, for a period of 12 months from the date of dispatch. The warranty is extended only to the original purchaser. For claims under the warranty, please contact your local seller. After the warranty period expires, the manufacturer retains the right to invoice the cost price for the repair or maintenance of a faulty device, along with any associated service fees.

Scope of Warranty

The following conditions are not covered under the warranty.

- Faults or damage caused by negligence, improper installation, improper operation, or failure to use and maintain the machine in accordance with the instructions in this operating manual.
- Issues caused by unauthorized disassembly or modification.

FOUR E'S SCIENTIFIC

Date：2024.04.09

Version：V1.1