Operation Manual

V1.0

SmartDrop™ L

NS1000

ACCURIS INSTRUMENTS

Thank you for purchasing the SmartDrop™ L Nano Spectrophotometer. This user manual details the instrument's features, specifications, as well as complete operating instructions; please read it carefully before operation. Keep this user manual for later use.

Important:

Please keep the box and packaging material for this instrument. If service is required, the box will be needed to ship the instrument to our Service Department.

Initial Inspection

Please inspect the instrument as well as all included accessories when you first open the packaging. If you find anything damaged or missing, please contact Benchmark Scientific or your local distributor immediately.

BENCHMARK SCIENTIFIC / ACCURIS INSTRUMENTS
PO Box 709
Edison, NJ 08818
USA
Phone: 908-769-5555
Website: www.benchmarkscientific.com/ www.accuris-usa.com

Safety Warnings and Guidelines

1. Important information for safe use

Users should understand how to use this instrument before operating. Please read this manual carefully prior to operation.

Any improper operation may cause injury. Please read this manual carefully and operate safely according to the guidelines.

2. Operation and Maintenance

The operation and maintenance of the instrument should comply with the basic guidelines and warnings below. Incorrect operation or maintenance will have detrimental effects on the life, performance, and safety features of the instrument.

The instrument is a normal indoor instrument which conforms to class Ⅰ of the GB 4793.1 standard.

This instrument is designed for use in a laboratory environment. The device must be operated by skilled laboratory personnel with appropriate training.

To prevent injury or voiding the warranty, the operator should not attempt to repair the instrument without explicit guidance from Accuris Instruments. If service is required, please contact Accuris Instruments or your local distributor for repair.

Before powering on, confirm that the voltage used meets the electrical requirements of the instrument as stated on the rating plate. If the electric cord is damaged, replace it with the same type of cord. Hold the socket firmly before pulling the plug from an outlet. Do not pull the electric cord.

The instrument should be installed in an environment of standard room temperature, low dust, low humidity, and away from direct sunlight, electromagnetic interference, and heat sources. Do not block the vents on the instrument.

Always power off the instrument when you are finished using it. Unplug the power cord and cover the instrument with a cloth or plastic sheet to prevent excessive dust from entering the housing.

Pull the connector plug from the electrical outlet immediately and contact the vendor in the event of:

- Liquid entering the housing.
- Abnormal operation: such as any abnormal sound or smell.
- The instrument is dropped or there is any damage to the housing.
- Any malfunction.

3. Maintenance

The pedestal should be cleaned regularly using a soft cloth dampened with deionized water. The instrument housing should be cleaned regularly using a soft cloth dampened with a small amount of alcohol.

Table of Contents

Chapter 1 Introduction

The SmartDrop™ L nano spectrophotometer measures 1.0μL – 2.0μL samples with high accuracy and reproducibility and employs surface tension to position the sample for measurement. The system includes a cuvette slot for OD600 readings & a built-in printer for printing results. The SmartDrop L can measure highly concentrated samples without dilution (100X concentration of samples measured by a standard cuvette spectrophotometer).

1. Key Features

- User-Friendly Input & Operation – Touch screen for programming and operation (a mouse can also be connected).
- Multifunctional software for Nucleic Acids, Protein A280, & OD600 measurements.
- dsDNA detection range from 10ng/μL – 2500ng/μL.
- Fast & accurate measurements (< 6 seconds).
- 2 cuvettes included (optical glass) for OD600 measurements.

Chapter 2 Specifications

1. Required Installation Environment

Environmental Temperature: 5°C～35°C

Relative Humidity: ≤ 70%

Input Voltage: DC 24V, 2A (Adapter CSA, UL, CE marked)

2. Specifications

Model		**SmartDrop™ L (NS1000)**
Minimum Sample Size		1.0μL – 2.0μL
Path Length		0.5mm
Light Source / Life		UV LED / 8000h
Detector Type		UV Silicon Photocell
Wavelength Range		260, 280, 600nm
Wavelength Accuracy		± 1 nm
Absorbance Precision		0.005Abs
Conc. Accuracy		±5ng [10,500) ±2% [500,2000) ±3% [2000,2500]
Absorbance Range		0.2-50 (10mm equivalent)
Detection Concentration Range		10ng/μL dsDNA ～ 2,500ng/μL dsDNA
Detection Time		< 6 seconds
OD600	**Abs range**	0~4.000 Abs
	Abs stability	[0,3）≤0.5% [3,4）≤2%
	Abs repeatability	[0,3）≤0.5%, [3,4）≤2%
	Abs Precision	[0,2）≤0.005A, [2,3）≤1%， [3,4）≤2%
Voltage input		DC 24V, 2A
Power		25W
Dimensions（W×D×H）		20.8cm × 28.0cm ×18.6cm / 8.2in x 11.0in x 7.3in
Weight		3.6 kg / 7.9 lbs

Chapter 3 Instrument Overview

1. Structure

Front

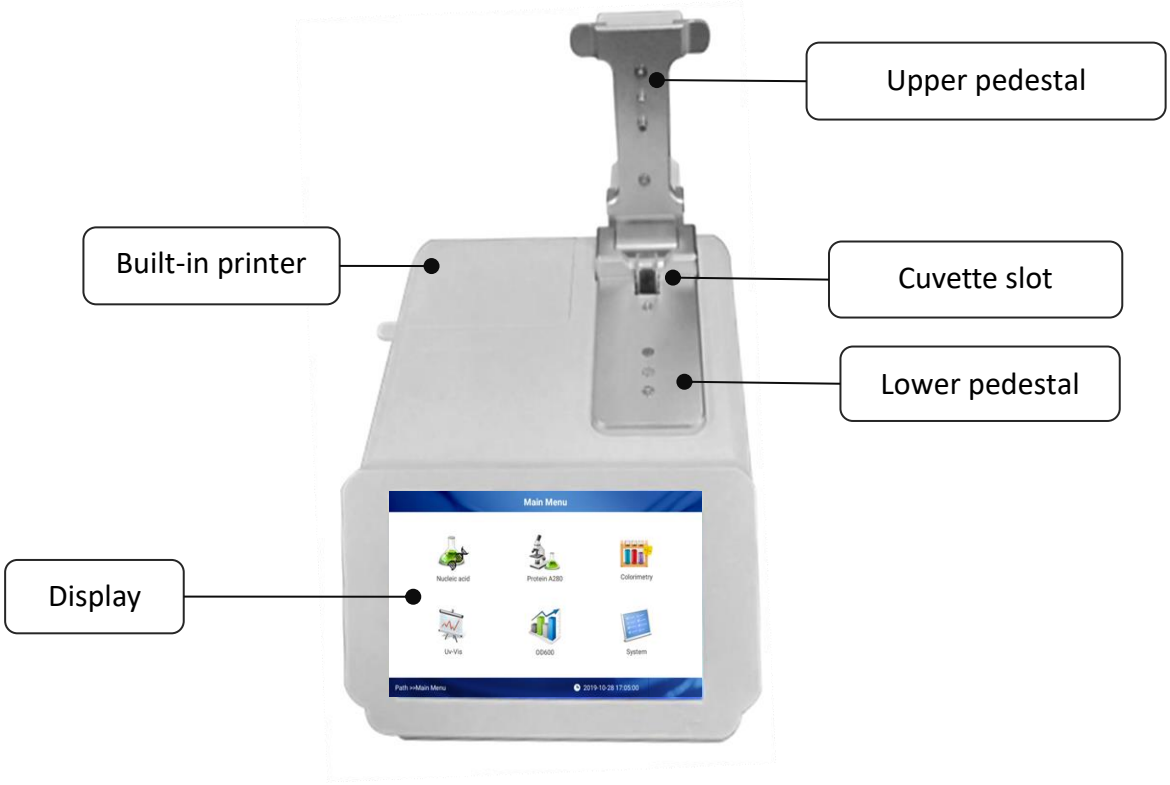


Fig. 1 Front

Back

Fig. 2 Back

2. Sample Size Requirements

Surface tension is a critical factor in the formation of the sample column for measurement. The hydrophobic interactions between water molecules in a sample solution is key in creating & maintaining surface tension. The presence of solutes (proteins, DNA, RNA, salt ions, detergent molecules) significantly reduces surface tension and hinders the formation of the sample column. For most samples, a 1µL sample size is enough; however, to ensure accurate and precise measurements, a 2µL sample size is recommended to allow the formation of the sample column for measurement.

To ensure precise and accurate measurements, it is essential that a complete liquid column forms between the upper pedestal and lower pedestal. It is recommended that a precision pipettor (0-2µL) be used to dispense samples.

3. Dispensing Samples onto The Lower Pedestal

Lift the upper pedestal and pipette the sample (1.0µL – 2.0µL) onto the lower pedestal (**Fig. 3**).

Fig. 3 Dispense Sample

Fig. 4 Sample Drop

Lower the upper pedestal onto the sample to form the sample column (**Fig. 5**).

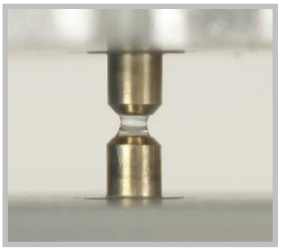


Fig. 5 Sample Column

Note: Please exercise caution when lowering the upper pedestal onto the sample.

To prevent sample carryover, use a soft laboratory wipe and deionized water to clean both pedestals in between sample measurements (**Fig. 6**).

Fig. 6 Clean & Wipe Pedestal

4. OD600 Measurement

The SmartDrop L includes a cuvette slot for OD600 measurements. Lift the upper pedestal to expose the cuvette slot. Select the OD600 interface on the touch screen. Set a “blank” as required for the experiment (blank = air, empty cuvette, or buffer in cuvette). Then add 2~3mL of sample into the cuvette. Place the cuvette into the slot and start the measurement (**Fig. 7**).

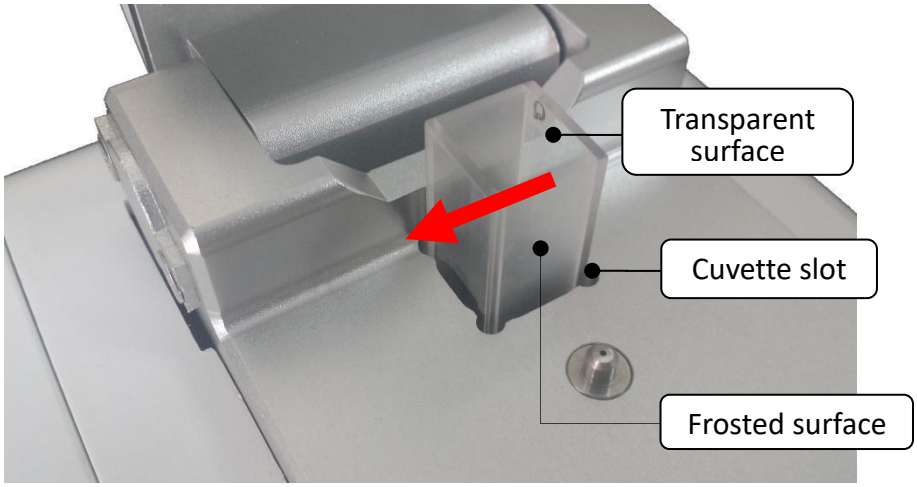


Fig. 7 Cuvette Port

Note： The direction of the light path is shown by the red arrow in the figure above. Please ensure the cuvette is loaded with the correct orientation.

Chapter 4 Programming & Operation

1. Start-up Interface

Upon powering on the instrument, it will perform a self-check, and the start-up screen will be displayed (**Fig. 8)**

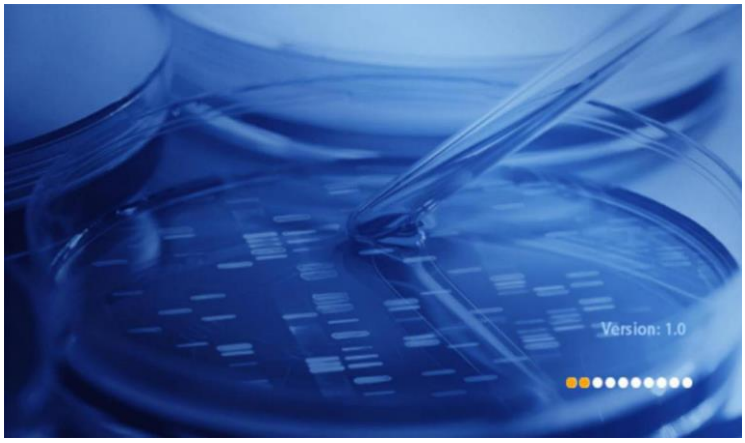


Fig. 8 Start-up Interface

2. Main Menu Interface

Fig. 9 Main Menu Interface

After start-up, the main menu interface will be displayed. There are 4 options: Nucleic Acids, Protein A280, OD600, & System Settings

3. Nucleic Acids Interface

Beer-Lambert's Law for DNA/RNA quantitation

The following "Beer—Lambert" equation is used to calculate the concentration of nucleic acids:

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

C＝Sample DNA concentration, unit : ng/μL
A＝Sample absorbance, unit : A
ε＝extinction coefficient, unit: ng-cm/μL
b＝Path Length, unit: cm

Standard DNA/RNA extinction coefficients :
dsDNA：50ng-cm/μL
ssDNA：33ng-cm/μL
RNA：40ng-cm/μL

When the sample column is used, highly concentrated nucleic acid samples can be measured without dilution using a 0.5mm path length. The SmartDrop L will measure and display sample absorbance values of the 10mm pathlength equivalent of up to 50 A.

The SmartDrop L will accurately measure dsDNA samples up to 2500ng/μL without dilution.

Select "Nucleic acid" from the main menu to enter the Nucleic Acid Interface:

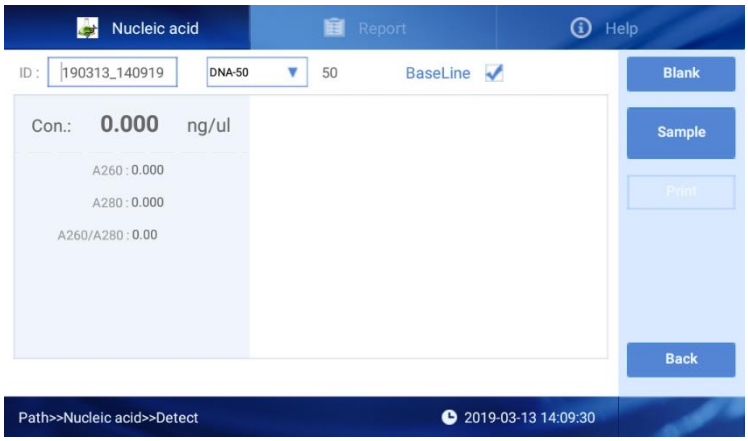


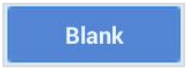
Fig. 10 Nucleic Acids Interface

Fig 10; there are three tabs in the Nucleic Acids Interface: Nucleic Acids, Report, and Help.

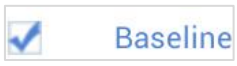
- ID : 191028_170755 : The sample ID name has a default value of the current date and time. Users can rename the sample ID. One sample ID can contain up to 1000 measurement values.

- 

: Select the sample type: DNA-50 for dsDNA, RNA-40 for RNA, ssDNA-33 for ssDNA. For a different nucleic acid type, select “others” and enter the extinction coefficient.

- 

: Perform a blank reading. This step is essential before measurement. Blank absorbance values are typically in the range of 0.004-0.03 Abs and are valid for up to 30 minutes. The instrument will automatically remind the user to perform another blank reading after 30 minutes.

- 

: Spectrum normalization; The baseline is automatically set to the absorbance of the sample at 365nm and can be modified. This feature can remove spectroscopic signals from sample measurements by subtracting the measured absorbance at a specified baseline correction wavelength from the absorbance values at all wavelengths of a measured sample.
    - **Note:** If baseline calibration is not performed, the spectroscopic signals will not be separated from interference/background effects and will lead to inaccurate results.

- The  icon appears in the upper right corner to indicate an error in reading blank/sample volumes. Please clean and wipe the pedestal and perform another blank reading. If the problem persists, contact Accuris Instruments.

Operation:

1. Set the Sample ID.
2. Clean the upper and lower pedestals with a lint-free wipe, add 2μL buffer solution to perform a blank reading.
3. Clean the buffer solution on the pedestals with a wipe.
4. Measure a 2μL sample volume and click “Measure” to detect the sample.
   Note: A blank reading must be performed prior to sample measurements. The sample volume must be equivalent to the volume used to set the blank reading.
5. Clean and dry the pedestal between measurements.

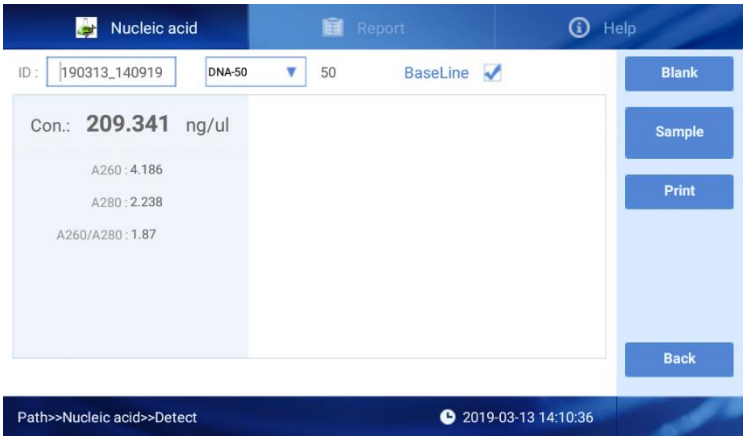
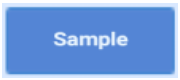


Fig. 11 Nucleic Acid Sample Results

The sample concentration and absorbance ratios will display on the left side of the interface **(Fig. 12)**.

Fig. 12 Sample Concentration & Absorbance Ratios

Conc.：Calculated nucleic acid concentration.
A260: The sample absorbance at 260nm (10mm pathlength equivalent).
A280: The sample absorbance at 280nm (10mm pathlength equivalent).
A260/A280: The ratio of corrected absorbance values at 260nm to corrected absorbance values at 280nm. An A260/A280 ratio of ~1.8 is generally accepted as pure for DNA (~2.0 for RNA). Acidic solutions will under-represent the A260/A280 ratio by 0.2 – 0.3 units, whereas basic solutions will over-represent the A260/280 ratio by 0.2 – 0.3 units.



: Begin sample measurement.

: Print the calculated data.

: Return to the main menu interface.

Nucleic Acid Report Interface

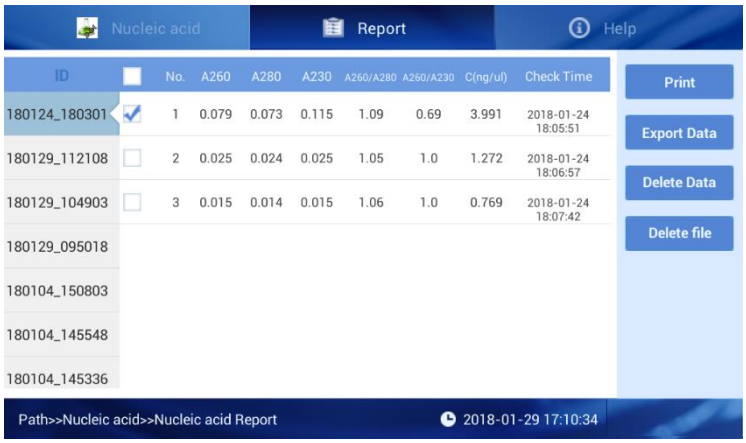


Fig. 13 Nucleic Acid Report Interface

Select the “Report” tab at the top of the Nucleic Acid Interface (**Fig. 13**).

Users can select previously saved results by the file name.

Print : Print the selected data from the built-in printer.

Export Data : Export the result to a USB flash drive.

Delete Data : Delete the selected results.

Delete file : Delete the selected files

4. Protein A280 Interface

Introduction

The Protein A280 interface can be used to quantify purified proteins that contain amino acids such as tryptophan, tyrosine, or cys-cys disulfide bonds. These amino acids exhibit peak absorbance at 280nm. The following sample types can be selected: “A280”, “BSA”, “IgG”, “Lysozyme”, & “Others”.

This interface does not require the generation of a standard curve. Sample absorbance values (260nm & 280nm) and A260/A280 ratios can be measured and displayed. A baseline correction can be used for normalization. Like the Nucleic Acids interface, the Protein A280 interface automatically displays 10mm pathlength equivalent data.

Protein A280 Interface

Select “Protein A280” from the main menu interface.

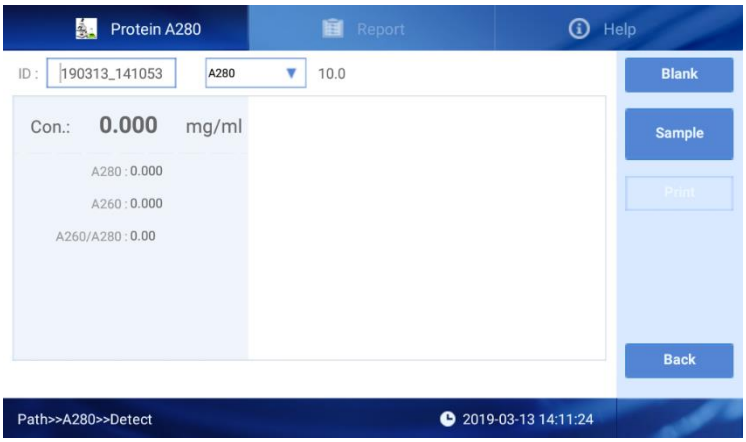


Fig. 14 Protein A280 Interface

Fig. 14; There are three options at the top of the screen, Protein A280, Report, and Help.

- ID : 191028_171239 : The sample ID name has a default value of the current date and time. Users can rename the sample ID. One sample ID can contain up to 1000 measurement values.
- A280 : Select the sample type: A280, BSA, IgG, Lysozyme. Select “others” and type in the extinction coefficient.
- Blank : Perform a blank reading. This step is essential before measurement. Blank absorbance values are typically in the range of 0.004-0.03 Abs and are valid for up to 30 minutes. The instrument will automatically remind the user to perform another blank reading.

- The icon appears in the upper right corner to indicate an error in reading blank/sample volumes. Please clean and wipe the pedestal and perform another blank reading. If the problem persists, contact Accuris Instruments.

Operation:

6. Set the Sample ID.
7. Clean the upper and lower pedestals with a wipe, add 2μL buffer solution to perform a blank reading.
8. Clean the buffer solution on the pedestals with a wipe.
9. Measure a 2μL sample volume and click “Measure” to detect the sample.
   Note: A blank reading must be performed prior to sample measurements. The sample volume must be equivalent to the volume used to set the blank reading.
10. Clean and dry the pedestal between measurements.

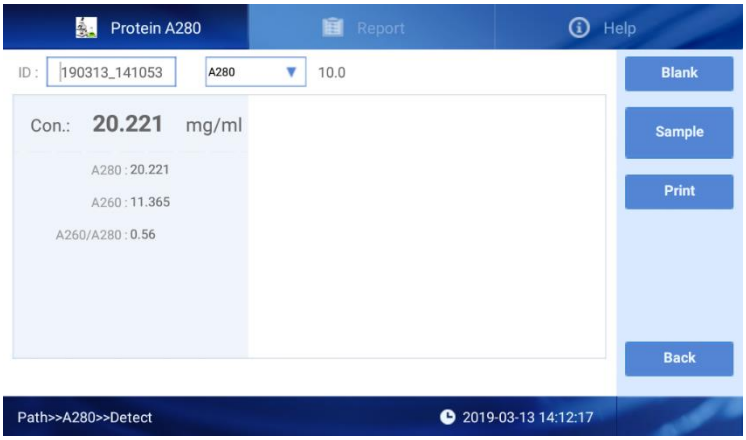


Fig. 15 Protein Sample Results

The sample concentration and absorbance ratios will display on the left side of the interface **(Fig. 16)**.

Fig. 16 Sample Concentration & Absorbance Ratios

Conc.: Calculated protein concentration.
A260: The sample absorbance under 260nm (10mm pathlength equivalent).
A280: The sample absorbance under 280nm (10mm pathlength equivalent).
A260/A280: The ratio of corrected absorbance values at 260nm to the corrected absorbance values at 280nm.This ratio can be used as a secondary measure of

nucleic acid purity. An A260/A280 ratio within the range of ~1.8 – 2.2 as pure for nucleic acids. Lower ratio values indicate the presence of contaminants that absorb strongly at or near 280nm.

Protein A280 Report Interface

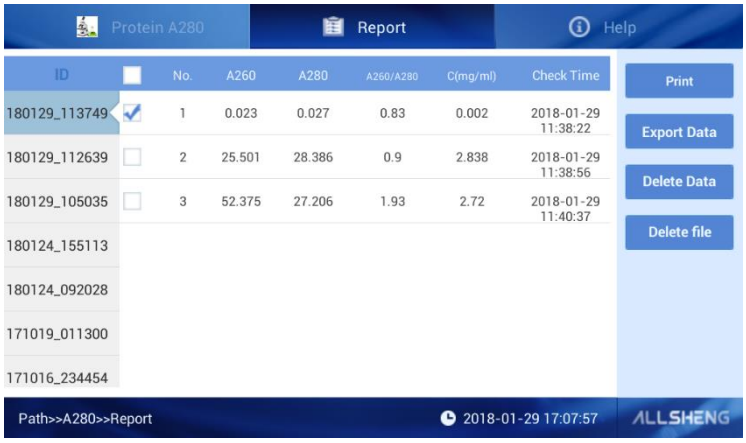


Fig. 17 Protein Report Interface

Note: This interface is similar to the Nucleic Acids detection interface (**see section 3**).

5. OD600 Interface

Introduction

The OD600 function allows for measuring absorbance values at 600nm. It is commonly used for measuring the growth rate of bacterial cell cultures by measuring absorbance of the culture in growth media at 600nm. The Beer-Lamber equation is used to calculate the concentration (**see section 3**). This interface does not require the generation of a standard curve.

OD600 Measurement

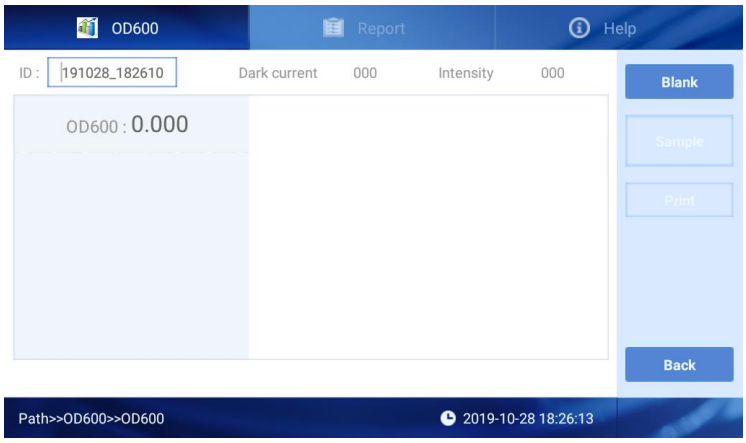


Fig. 18 OD600 Detection Interface

Operation

1. Set the Sample ID.
2. Lift the upper pedestal to expose the cuvette slot.
3. Set a blank as required for the experiment (blank = air, empty cuvette, or buffer in cuvette)
4. Measure a 2-3mL sample volume and click “Measure” to detect the sample.

Note: A blank reading must be performed prior to sample measurements. The sample volume must be equivalent to the volume used to set the blank reading.

OD600 Report Interface

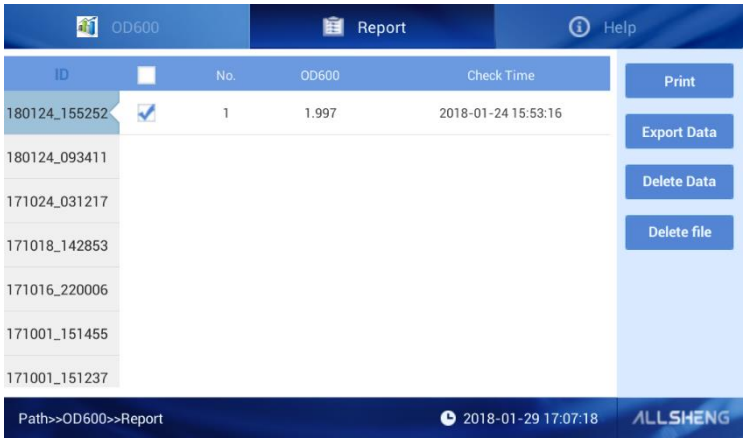


Fig. 19 OD600 Report Interface

Note: This interface is similar to the Nucleic Acids detection interface (**see section 3**).

6. System Settings Interface

Click “System” on the main interface to enter the System Settings Interface **(Fig. 20)**.

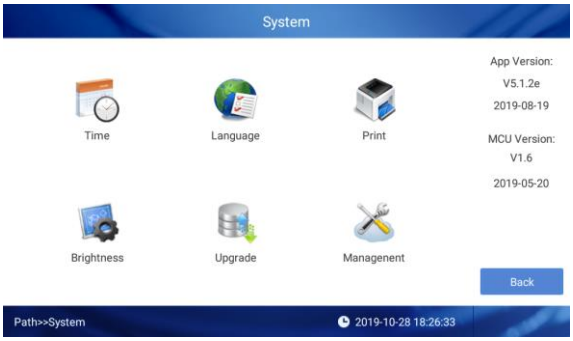


Fig. 20 System Settings Interface

Date & Time Settings Interface

Click the “Time” icon to enter the date and time settings interface (**Fig. 21**).

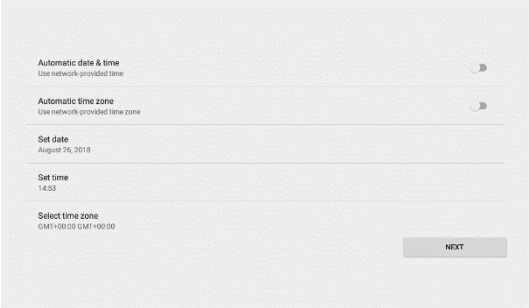


Fig. 21 Date and Time Settings Interface

Click “Set date” to enter the Date Settings Interface **(Fig. 22)**. Click “Set Time” to enter the Time Settings Interface **(Fig. 23)**.

Fig. 22 Date Settings Interface

Fig. 23 Time Settings Interface

Print

Click the “Print” icon to set the print mode.

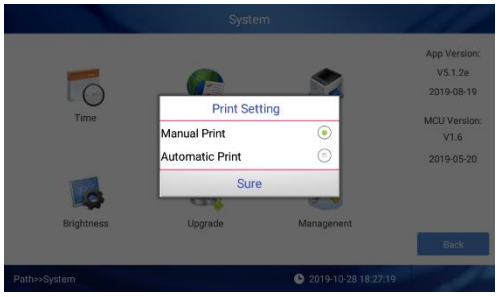


Fig. 24 Print Settings Interface

Brightness

Click the “Brightness” icon to enter the Brightness Settings Interface. Use the slider to adjust the brightness of the display.

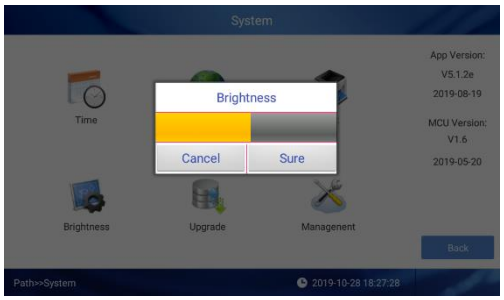


Fig. 25 Brightness Settings Interface

Chapter 5 Troubleshooting

Fault	Analysis	Troubleshooting
Instrument does not power on.	No power supply, Switch defective, Power adapter defective.	Check the power supply, Replace the switch, Contact Accuris Instruments.
Measurement results not precise	Sample column unformed, Pedestal contaminated	Add sample again, make sure the liquid column formed well, Clean the pedestals, Contact Accuris Instruments.
OD600 module failure	Poor connection between cable and board.	Contact Accuris Instruments.
Insufficient light intensity error	Analysis module defective, optical fiber broken.	Contact Accuris Instruments.
Touch screen error	Power supply does not have effective grounding.	Provide effective grounding power supply.
Communication timeout	Analysis module communication failure.	Contact Accuris Instruments.