



# *SmartReader*

**MR-9600**

**User Manual**

**Version 3.1**



P.O. Box 709 Edison, NJ 08818 USA  
Ph: 908-769-5555 EM: [info@BenchmarkScientific.com](mailto:info@BenchmarkScientific.com)

Thank you for purchasing the MR-9600 microplate reader. This user manual describes the instrument's features, specifications, as well as complete operating instructions, please read carefully before operation. Keep this user manual for later use.

**Please keep the box and packaging material for your microplate reader. In the event that service is required, the box will be needed for shipping the instrument to our Service Department.**

### **Initial Inspection**

Please check 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**

PO Box 709

Edison, NJ 08818

USA

Phone: 908-769-5555

Website: [www.benchmarkscientific.com](http://www.benchmarkscientific.com) / [www accuris-usa.com](http://www accuris-usa.com)

Email: [info@benchmarkscientific.com](mailto:info@benchmarkscientific.com) / [info@accuris-usa.com](mailto:info@accuris-usa.com)

## Safety warnings and guidelines

### 1 Important information for safe use

Users should have a clear understanding of how to use this instrument before operation, please read this user manual carefully prior to operation.



Improper operation of this instrument may cause injury or electric shock. Please read the manual carefully and operate safely according to the guidelines.



**This instrument is for research use only!**

### 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 effect on the useful life, performance, and safety features of the instrument.



This product is a normal indoor Instrument which conforms to Standard B style- I type- GB9706.1.



Note: Possibility of Biological Hazards. All samples for test, quality control, and calibration should be considered infectious, and any parts of the instrument or consumables that contact samples may also be infectious. Always wear gloves when operating this device.



Before using the device, read the Manual carefully. These units are designed for use in laboratory environments. The device must be used by experienced personnel with the appropriate training.



Notice: Avoid injury. Keep your body and hands away from the motorized drawer and any other moving parts during operation.



The operator should not open or repair the Instrument by himself. This may void the warranty and cause damage to the instrument. If service is required, please contact Benchmark Scientific or your local distributor to arrange repair.



Before powering on, confirm that the electrical supply available matches the voltage required for the instrument as specified on the serial number plate. Also confirm that the rated load of the electrical outlet is not lower than required. If the electric line is damaged, replace it with the same type.



The Instrument should be installed in an area put in an area with minimal dust, away from wet areas, and away from direct sunlight. In addition the installation location should have sufficient ventilation, but away from electromagnetic interference and heat sources. The vent on the Instrument is designed for proper cooling of the internal components. Do not cover the vent, or place the instrument in a location where the vent can be blocked.



Power off the instrument when not in use. If the instrument will not be used for a long period of time, cover it with a cloth or plastic to protect it from dust.



Disconnect the power cord from the jack at once in the following cases, and contact Benchmark or your local distributor:

- Liquid enters the Instrument;
- Abnormal operation: such as abnormal sound or smell.
- Instrument dropped or outer housing damaged.
- The function has obviously changed.

### 3 Maintenance of the Instrument

The microplate holder should be cleaned using a cloth damp with a small amount of alcohol.

Other parts and the outer housing of the instrument can be cleaned as needed with a cloth damp with water or a mild detergent.

## Contents

Safety warnings and guidelines.....	II
Contents.....	IV
Chapter 1 Introduction.....	1
Chapter 2 Features.....	2
Chapter 3 Instrument Overview.....	3
Chapter 4 Installation.....	5
1. Initial check .....	5
2. Installation.....	5
3. Installation steps .....	5
Chapter 5 Operation guide.....	6
Section 1 Instrument self-check.....	6
Section 2 Protocol interface .....	7
1. Keyboard function and operation .....	7
1.1 Keyboard function.....	7
1.2 Input Buttons.....	11
1.3 Running a Protocol.....	12
2. Protocol setting .....	13
2.1 Measure settings.....	13
2.2 Layout.....	16
2.2.1 Layout.....	16
2.2.2 Standard concentration.....	18
2.3 Shake setting .....	19
2.4 Calculate.....	21
2.4.1 Kinetic setting.....	22
2.4.2 Preprocess setting (double wavelength) .....	23
2.4.3 Curves fitting .....	24
2.5 Interpret .....	25
2.6 Quality Control .....	25
Section 3 Results .....	27
1. Results interface .....	27
1.1 Raw data.....	27
1.2 Interpret Result .....	29
1.3 Analysis.....	29
1.4 Curve .....	30
1.5 QC Result .....	30
2. Kinetic Results interface .....	31
2.1 Kinetic Raw data.....	31
2.2 Kinetic Analysis.....	32
2.3 Kinetic Curve .....	32
Section 4 Settings.....	34
1. Language .....	34
2. Filter .....	35

3. Maintenance .....	36
4. Date and Time .....	37
Section 5 Help .....	38
Chapter 6 Maintenance .....	39
Chapter 7 Trouble shooting.....	43
Chapter 8 Accessories .....	44

## Chapter 1 Introduction

This MR-9600 microplate reader is an instrument for EIA test, measuring concentration, absorbance, measuring positive or negative reaction between antibody and antigen in samples by reading enzymatic color change – Enzyme Linked Immunosorbent Assay (ELISA).

### Key Features and Benefits:

- 1) Easy-to-use controls: 7 inch, color touch screen and 3 external keys.
- 2) Operating system allows acquisition, editing and saving of data.
- 3) Can be used independently from a computer, data can be saved and transferred by USB drive.
- 4) 8 position optical filter wheel; 4 standard optical filters are included, additional optional filters are available.
- 5) 8 channel vertical optical path, zero dispersion single mode fiber measurement system, automatic plate well center position function.
- 6) 96-well visual layout allows easy setting of blank, sample, positive/negative control, quality control and multi-value control.
- 7) Multi-choice tests on single plate.
- 8) Single or double wavelength measurement.
- 9) Self-checking optical path, top reading, mechanical motion.
- 10) Adjustable Plate shaking function, time and speed.
- 11) Quartz Halogen, energy saving light source.
- 12) Multiple ports for data export.
- 13) Measurement results can be exported as .CSV file, compatible with MS Excel.

## Chapter 2 Features

### Operating conditions

Ambient operating temperature: 4°C~45°C

Relative humidity: ≤70%

Input Power: AC100-240V, 50-60Hz, 2A

### Specifications

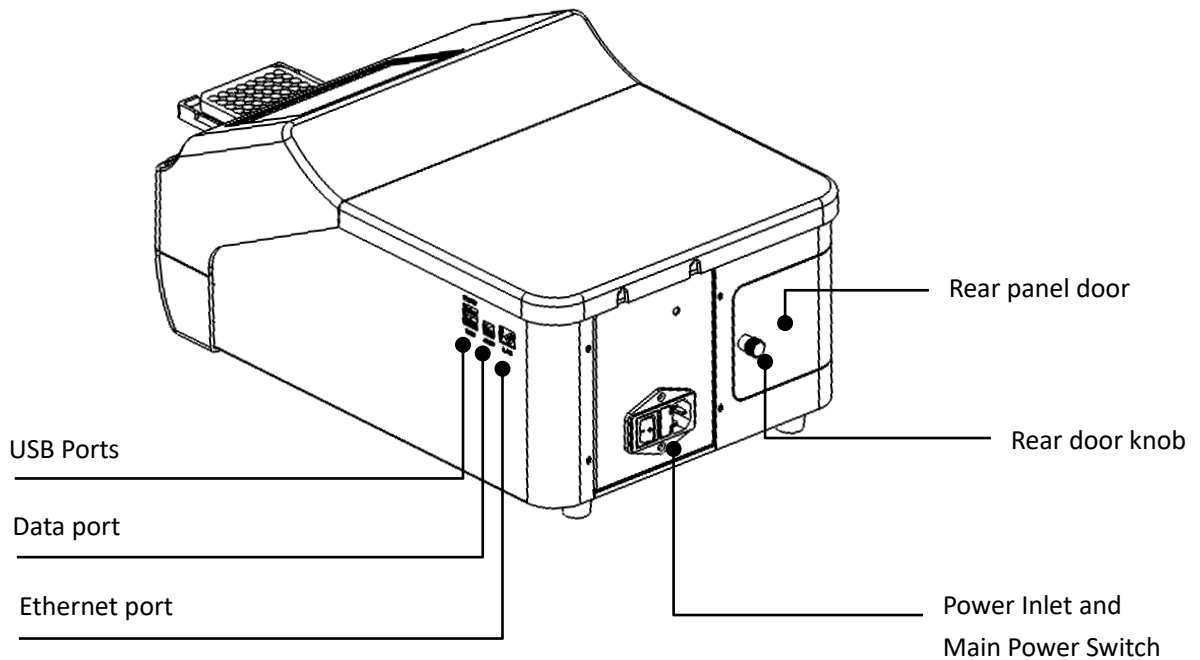
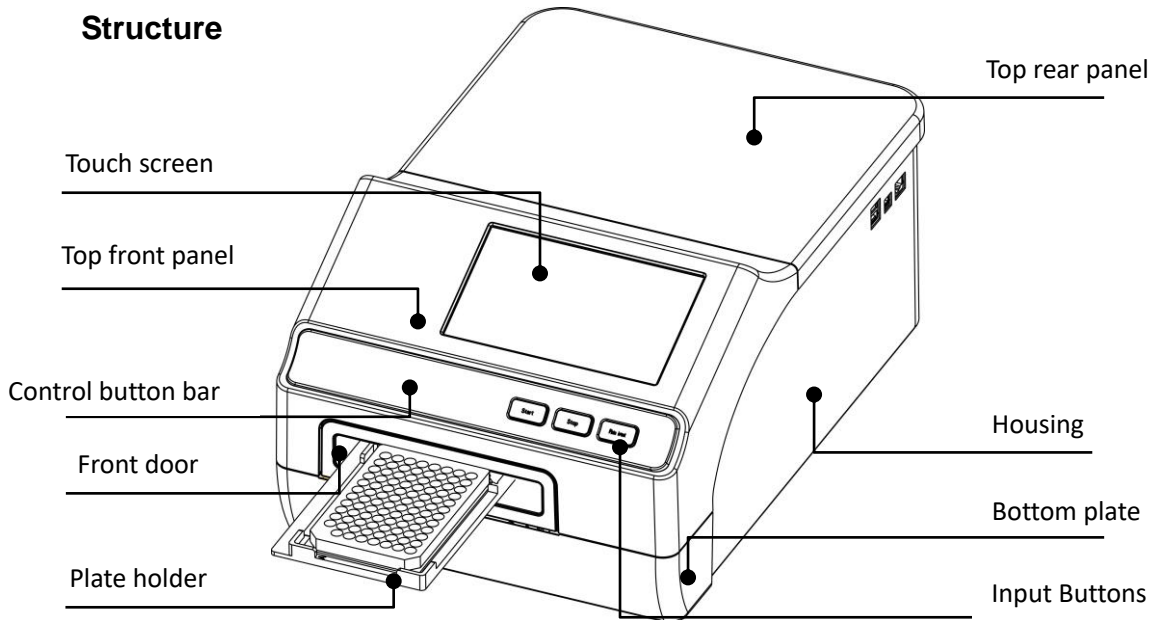
Parameter \ Model	MR-9600
Light source	6V, 10W, Quartz-Halogen lamp
Light source est. life	300 hours
Wavelength	400~750nm
Optical filter	Four standard filters included: 405,450,492,630nm. Filter wheel holds up to 8 filters.
Detector Type	Silicon photodetector
Read-out range	0.000-4.000 Abs
Resolution	0.001Abs
Linearity	±1% ( 0~2.000A) , ±2% (2.000~4.000A)
Precision	CV≤0.2% (0-3Abs); CV≤1% (3-4Abs)
Accuracy (450nm)	±0.005Abs (0 ~2.0 Abs), ±1% (2.0~3.0 Abs), ±1.5% (3.0~4.0 Abs)
Channel deviation	<0.01Abs at 450nm
Measurement Speed	Single wavelength <15s/96well plate, double wavelength <28s/96well plate (Normal speed setting)
Dimension (WXDXH)	295x440x225mm / 11.5x17x9 inches
Weight (kg)	10kg



## Chapter 3 Instrument Overview

Before first use of this instrument, please read this chapter carefully.

### Structure



There are three input buttons: "Start" "Stop" and "Plate in/out"

Plate holder: Holds one standard footprint, 96-well microplate.

USB Ports: For connection of keyboard, mouse and USB drive. (the upper port is for printer connection)

Data port: for PC connection. (contact Benchmark Scientific for updated software and features)

Ethernet port: for PC connection. (contact Benchmark Scientific for updated software and features)

Rear door panel: can be opened to replace light source and access optical filter wheel.

Knob: To lock and unlock the rear door.

## Chapter 4 Installation

### 1. Initial check

Each MR-9600 is thoroughly tested before shipping, but please check again when you receive the instrument and contact your local distributor or manufacturer if:

- The outer package is damaged
- The outer package has any obvious moisture stains
- The outer package has marks of impact
- The outer package has signs of being opened

**After opening, please check the instrument and box contents.**

- Confirm that all ordered accessories have been included.
- Check the instrument's appearance for any damage.

### 2. Installation

- Locate the instrument on a flat dry and clean work table, keeping the front side with enough space for the plate holder to move in and out, also keep 15cm space for back, left and right side for ventilation.
- Operating environment requirements:
  - a. The environment should be free of corrosive steam or smoke.
  - b. Ambient temperature should be within +4°C to +45°C.
  - c. Do not install in a high humidity area (Relative humidity should be from 10% to 80%).

**Note: KEEP THE INSTRUMENT AWAY FROM CORROSIVE GASSES AND LIQUID!**

### 3. Installation steps

- 1) Place the instrument on a stable and level surface.
- 2) Connect the instrument to an appropriate power outlet using the provided power cord.

**Warning: Don't connect instrument to power socket without ground wire.**

- 3) Switch on the main power using the switch on the rear of the Instrument. The front panel will cycle through a start-up and self-test screen.

## Chapter 5 Operation guide

### Section 1 Instrument self-check

This chapter introduces default protocol operation, beginning with self-check after power on. Refer to the picture below:



Fig 1: Start up screen

## Section 2 Protocol interface

After the self-check, the software enters into the main Protocol interface.

There are 4 tabs in the software: Protocol, Results, Settings and Help.

You can choose the tabs using the touch screen, or using a connected mouse.

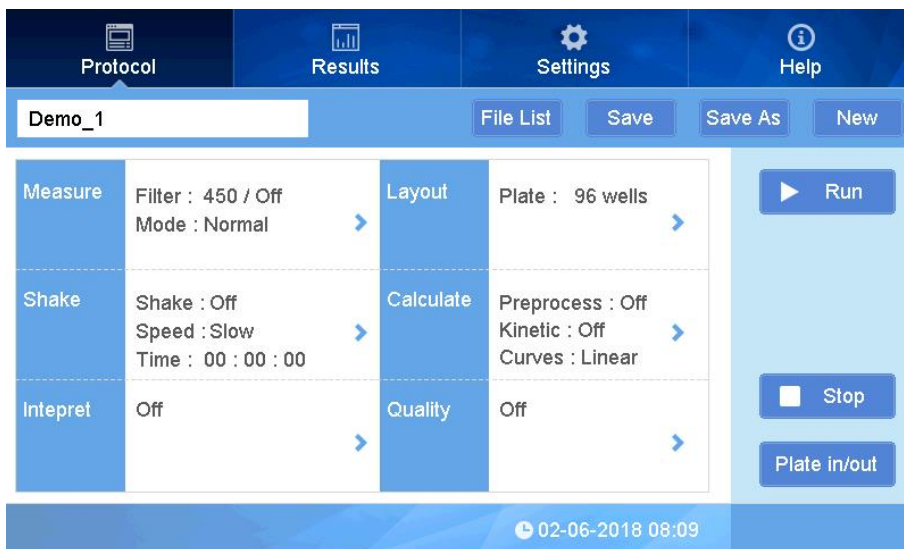


Fig 2

You can create, save, measure, set parameters. Refer to Fig 2.

### 1. Keyboard function and operation

#### 1.1 Keyboard function

- ① Current protocol name:

As shown in Fig 2, the current protocol is default Demo\_1. The upper left box shows the current protocol name to use.

- ② Click on  to create a new protocol

Input a new protocol name, click "OK" or "return". (Fig. 3)

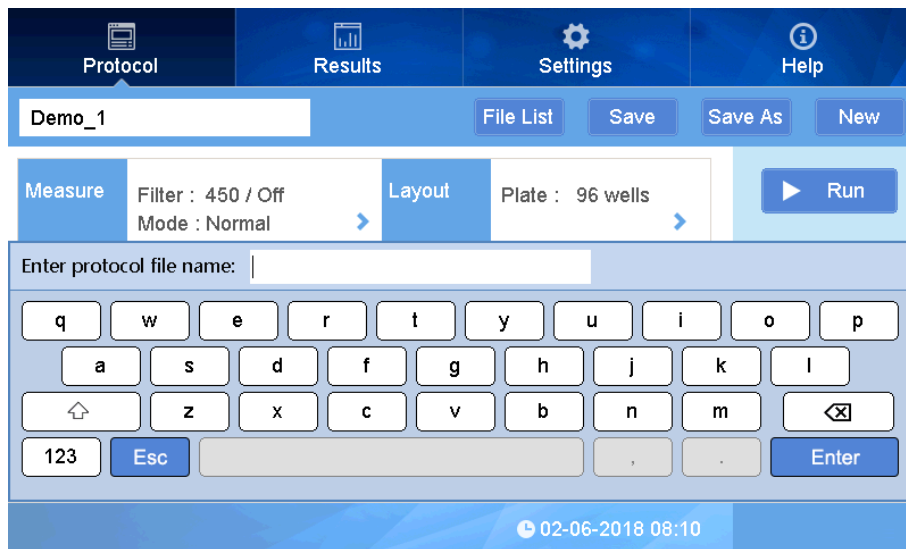


Fig 3

- ③ **Save** Save current protocol

After creating a new name and protocol settings, click "Save", and the protocol will be saved to memory.

**Note: If a new protocol is used to read a plate, and data is saved, the main parameters will be grayed out and cannot be changed. If new protocol is not used, the parameters can be changed.**

- ④ **Save as** Save as a new named protocol

After opening a current protocol, you can modify it and save it as a new one. After saving,

- ⑤ Click **File List** to open an existing protocol.

Click "File List" button to view the list (Fig 4) of all the protocol files. Choose the protocol file and click the "Open" button, you can view the specific information of the protocol.

Click the "**Data** ↑↓" or "**Time** ↑↓" button to sort the protocol files.

Click the "**◀**", "**▶**", "**◀◀**", "**▶▶**" to toggle through pages.



Fig 4

⑥ Click “Batch OP” (Fig 5) to enter the interface for batch deleting, importing and exporting protocol files.

**Delete**

delete the chosen protocol file (Fig 7).

**USB Drive**

**Disk...**

Click “USB Drive” to exchange protocol files between internal disk drive and external USB Drive (see Fig 6 to 8 ).

**Export Report**

Export results from the internal disk to the external USB drive, files can be exported individually or in batches.

**Export Protocol**

Export the protocol files from the internal disk to external USB drive, files can be exported individually or in batches.

**Import**

Import files from the external USB drive to internal disk drive.

**Sel. all**

Select all protocol files on the internal disk or the USB drive, the button will change to

“ **Desel. all** ”.

**Back**

Go back to the main protocol interface.

**Note: Protocol files on the external USB drive cannot be deleted using the instrument.**

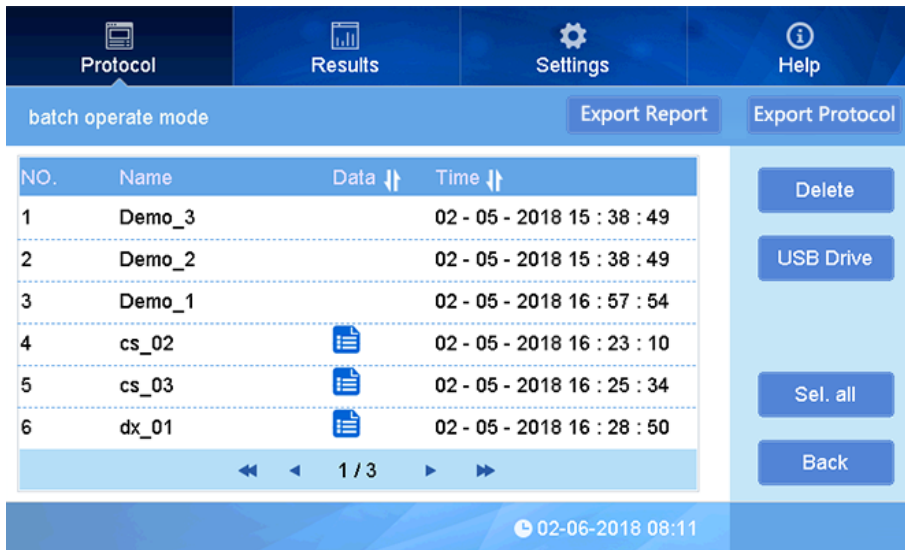


Fig 5



Fig 6



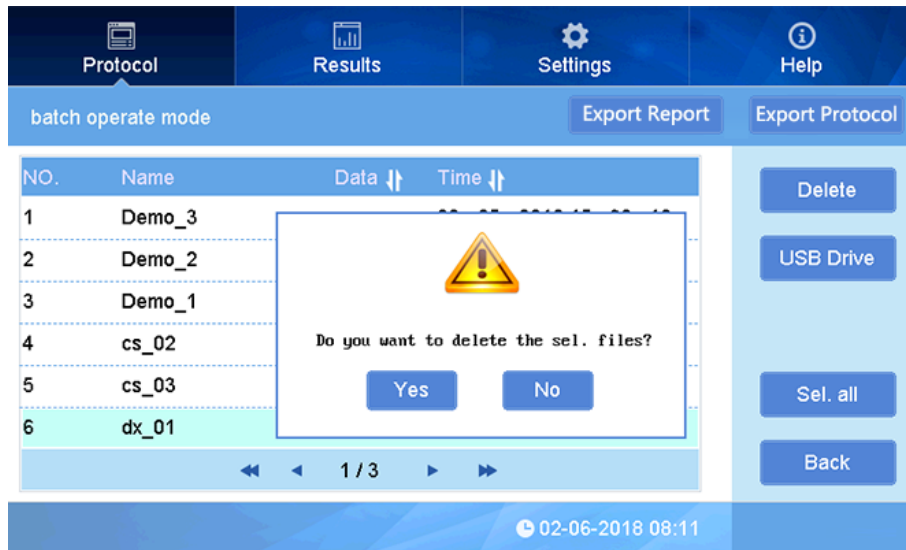


Fig 7

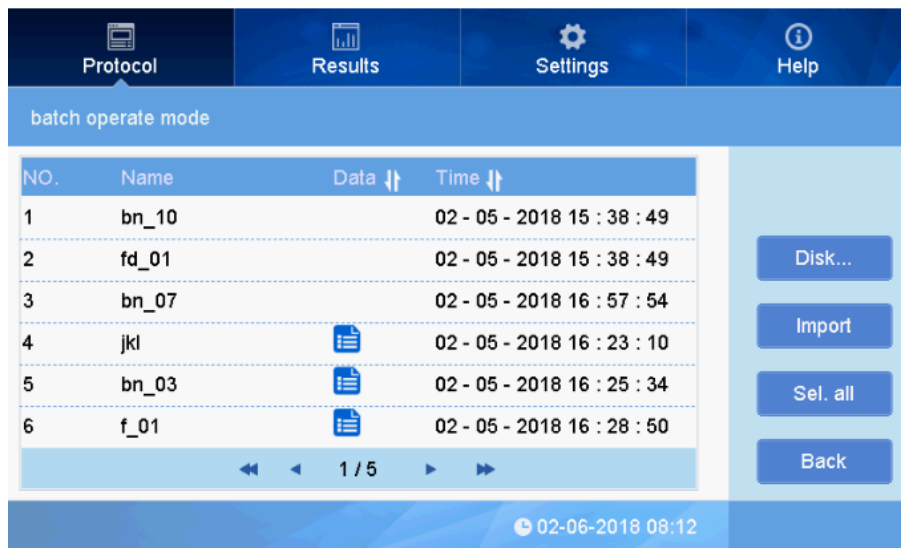





Fig 8

## 1.2 Input Buttons

-  **Run** Click to run a protocol
-  **Stop** Click to stop a running protocol
-  **Plate in/out** Click to open or close the plate drawer

### 1.3 Running a Protocol

Measurement:

① Choose a Demo protocol, set parameters as need, or press **Open** to choose an existing a protocol or press **New** to set up a new protocol (see below for creating a new protocol).

② Click **Plate in/out** to open the plate holder drawer, and place the plate onto the holder. Make sure that A1 on the plate aligns with A1 on plate holder. (see Fig 9.)



Fig 9

③ Click **Start** to begin the reading of the plate. A box will appear to enter the name for the results file.

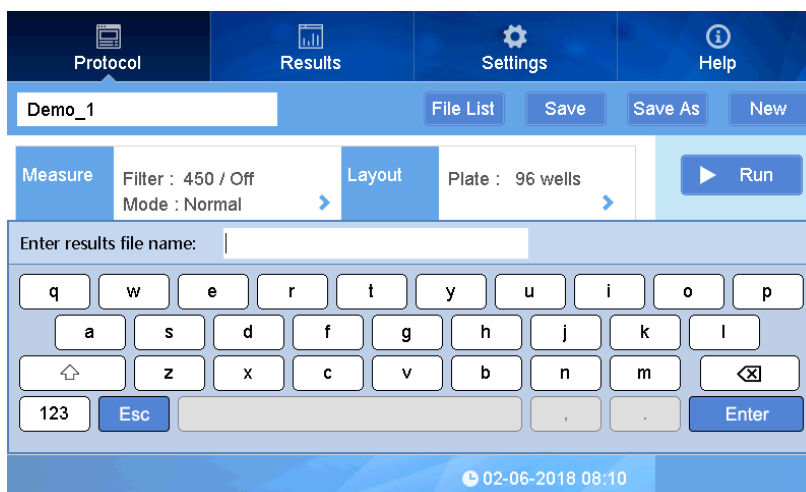


Fig 10

**Note:** During a reading, a dialog box will indicate “measuring now”, and all buttons are disabled, except for “Stop” which can be used to interrupt the measurement.

④ Measurement will take approximately 15 seconds, and upon completion the display will switch to the “Report” interface to display measurement results (see Fig 11).

	1	2	3	4	5	6	7	8	9	10	11	12
A	2.260	1.515	0.051	0.088	0.049	0.103	0.062	0.059	0.070	0.069	3.759	3.456
B	1.384	0.048	0.070	0.057	0.056	0.055	0.058	0.053	0.056	0.066	0.083	0.066
C	0.050	0.064	0.042	0.089	0.051	3.702	0.053	3.231	0.099	0.050	0.069	0.058
D	0.066	0.066	1.301	3.181	0.055	0.066	0.049	0.081	3.182	0.075	0.065	0.073
E	0.056	1.786	0.073	3.325	0.056	2.014	2.861	0.072	0.057	0.055	0.051	0.075
F	0.049	0.063	2.191	3.558	0.049	0.839	1.597	0.055	0.052	0.054	0.070	0.053
G	0.055	0.081	3.189	0.057	0.091	2.053	0.049	0.094	3.046	0.057	0.050	0.076
H	3.223	0.091	0.054	0.063	0.054	0.136	0.065	0.053	0.128	0.053	0.066	0.058

Fig 11

Results will depend on the parameters set. See section 3 on “Report Interface” for additional information.

## 2. Protocol setting

After clicking **New** or choosing one of the demo protocols, one can create a new protocol protocol by setting the parameters (wavelength, shaking settings, layout, data calculations, etc) and the protocol can be saved.

### 2.1 Measure settings

Filter (Wavelength) and mode (reading speed) can be set in the Measure settings.

① On interface “Protocol”, click on “Measure” to set the parameters. See Fig 12.

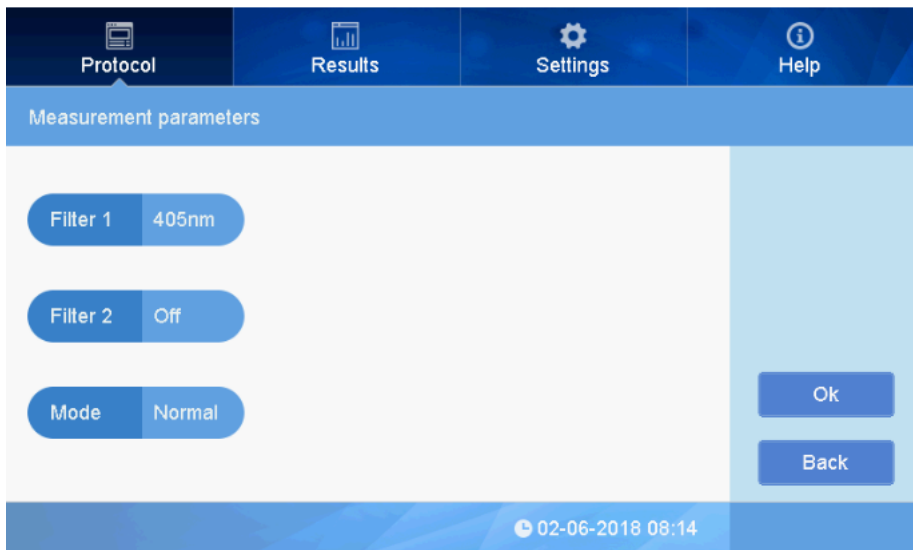


Fig 12

② Filter 1 setting

Click to the right side of “Filter 1” to choose the filter wavelength. See Fig 13.

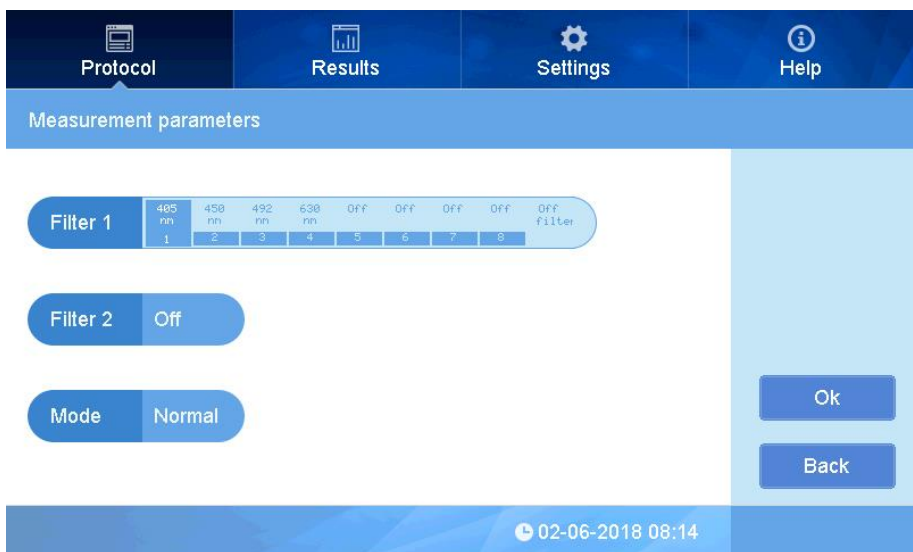


Fig 13

There are 4 standard filter included: 405nm, 450nm, 492nm, 630nm, choose a filter for the Filter 1 wavelength.

③ Filter 2 Setting:

This instrument can measure at a single wavelength or two wavelengths. Click to the right side of “Filter 2” to choose a wavelength (choose a different wavelength than Filter 1), see figure 14.

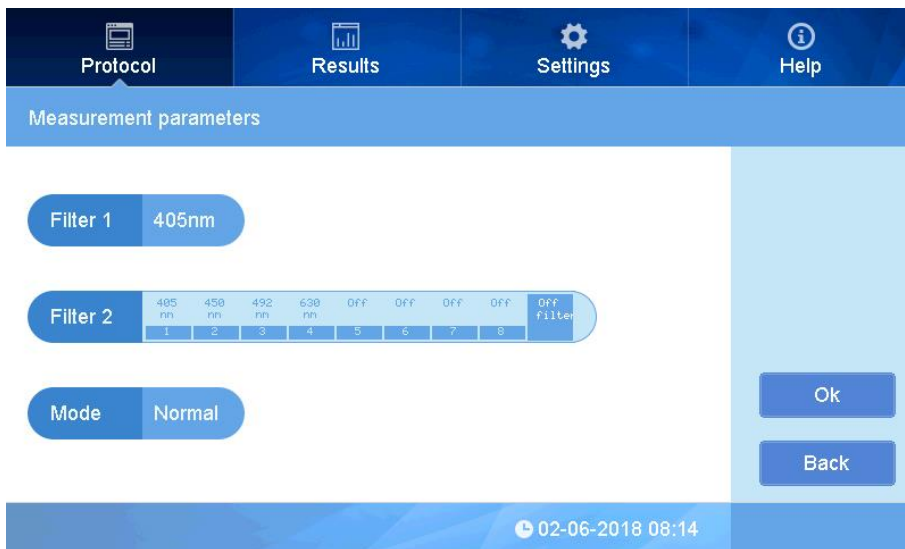


Fig 14

**Note:** For a single wavelength measurement, choose “Off” for filter 2.

④ Measurement speed setting:

There are two speeds: Fast or Normal. Click to the right side of “Mode” to choose the running speed, see figure 15.

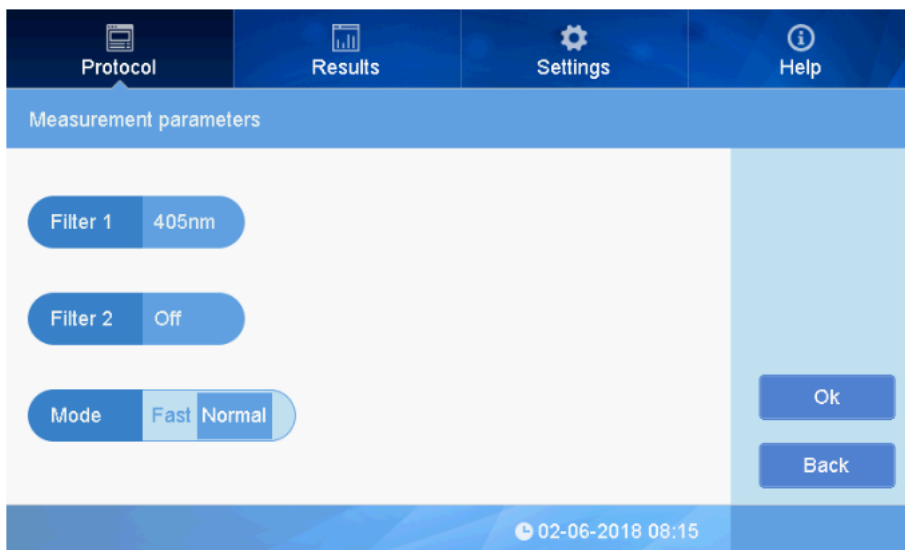


Fig 15

**Note:** “Normal” mode is recommended .

⑤ Press “OK” to finish setting and return back to main interface.

## 2.2 Layout

### 2.2.1 Layout

① In the “Plate layout” interface, press “Layout” to set up the layout of the sample plate. On the right side there are some buttons “Concentration”, “Delete all”, “OK”, “Back”, see Fig 16

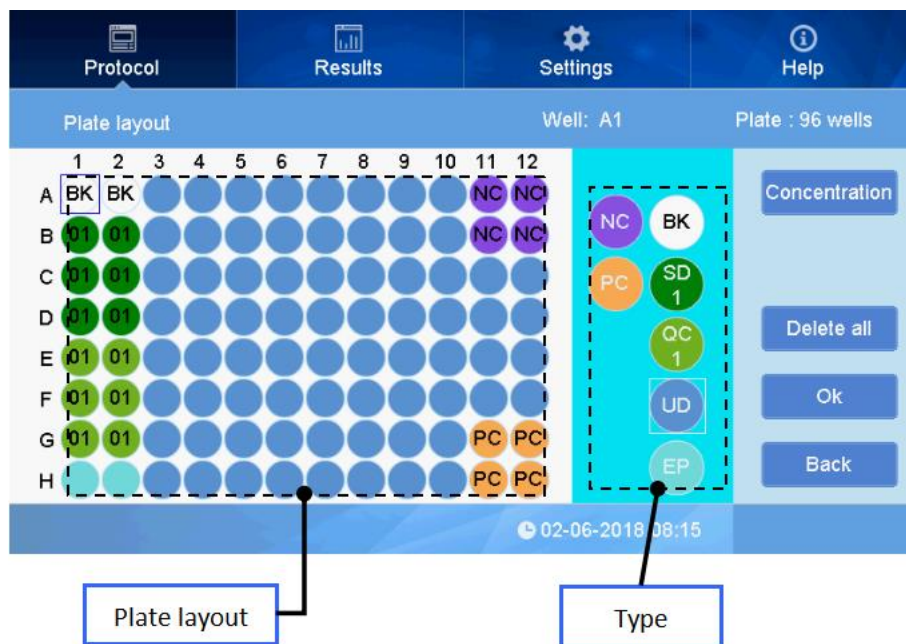


Fig 16

② Setting the Layout: First choose the type for setting specific wells (the type selected will have a white frame), see UD (unknown sample) in Fig 16, then select well positions on plate layout.


The selected positions on the layout will match the color of the chosen type.

③ Choose a Type from these seven options: BK,SD,QC,UD,EP,NC,PC, (defined below)



: Blank well for blank control, you can set several wells as blank.



: Standard sample well to set standard curve. Press  Type key ( see Fig 17), to get a

menu of numbers for the standard, 1 through 12. Choose the number you need, the number bar will disappear, and select the well position on layout.

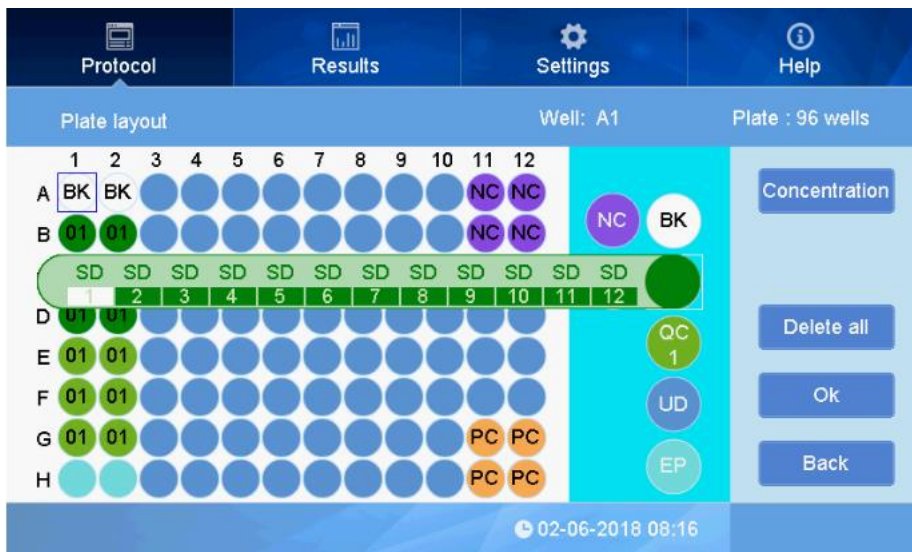


Fig 17

There are 12 standard values available, and several wells can be set with the same number.



: QC control well. The setting procedure is the same as that for standard sample position. (See

Fig 18)

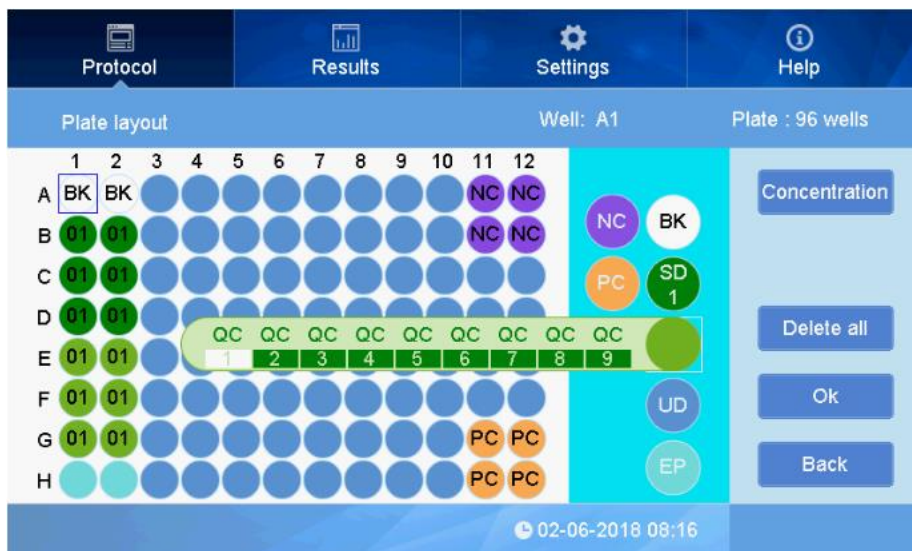


Fig 68

There are 9 available QA control values, and you may set several wells with same number.



: Unknown sample position. Set several positions as unknown samples.



: Empty position, for the corresponding positions on the microplate without a sample, the measurement result will show EP rather than data.



: Negative control position.



: Positive control position.

④ After setting all position types, press “OK” to return to the “Protocol” interface. If there are standard samples, input the standard sample concentrations before starting the plate reading.

### 2.2.2 Standard concentration

On the “Plate layout” interface, press “Concentration” at the top right, and this will open the interface for “Set standard concentration”. See Fig 19:



Fig 19

① 12 standard default values will be shown on this interface. It is only necessary to set the concentration for the standard positions that have been set in the layout. The ones which have not been set in the layout will not be considered.

② Click the concentration number twice to input the concentration value. See Fig 20.



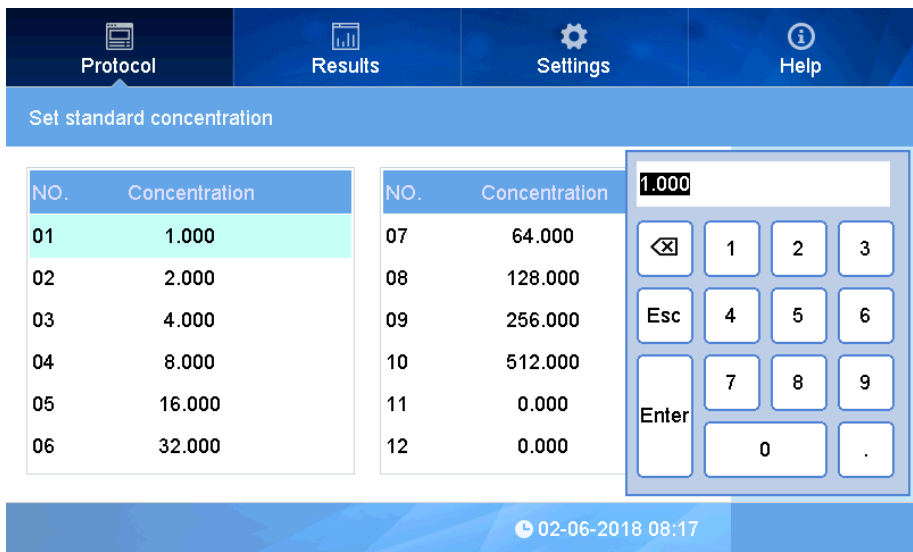


Fig 20

**Note:** Make sure the No. (number) for each of the standards is corresponding correctly to the position of the standards as set up in the layout, any mistake will affect the curve fitting and measurement result.

③ Concentration units can be selected by pressing the "Unit" button at the top right side of the screen, see Fig 21.



Fig 21

④ Press "OK" to confirm and return back to the "Plate layout", and then "OK" again to return to the main Protocol interface.

**2.3 Shake setting**

This instrument can shake the sample plate to help settle the liquid samples onto the bottom surface of

the wells and to also to mix the samples.

- ① On the “Protocol” interface, click “Shake” to enter the “Shaking parameters” interface.

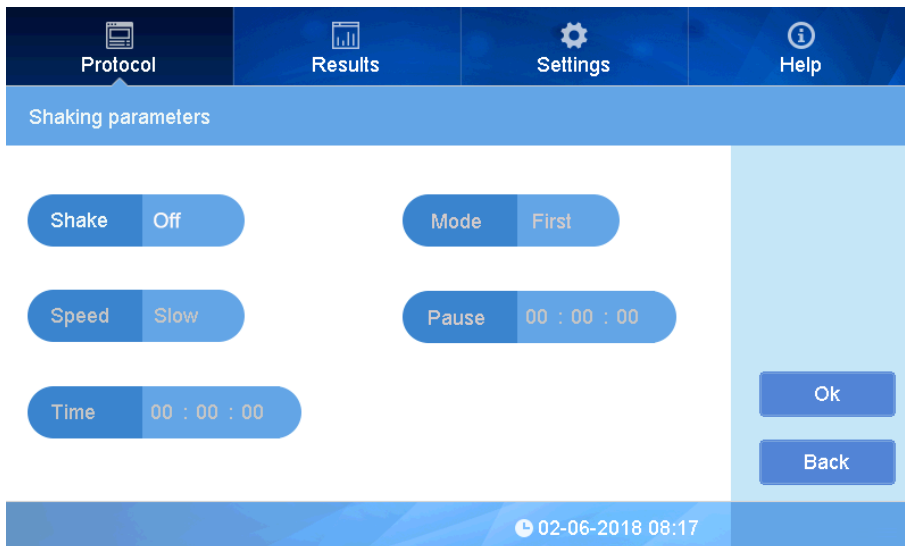


Fig 22

- ② Click “Shake” to choose “On” or “Off”, see Fig 23:



Fig 23

- ③ Click “Speed” to set Slow, Normal, or Fast shaking speed. See Fig 24.

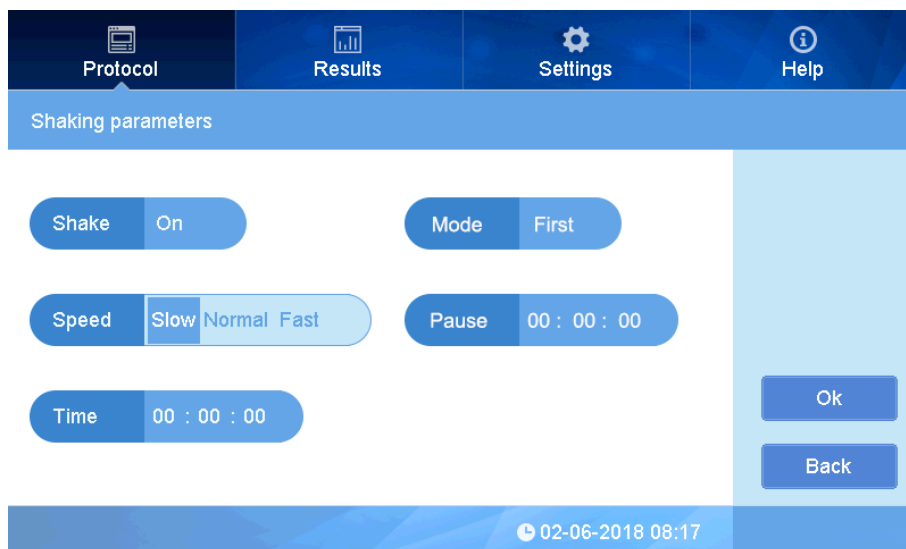


Fig 24

- ④ Click “Time” to set the shaking time, input numbers to set HH/MM/SS, See Fig 25

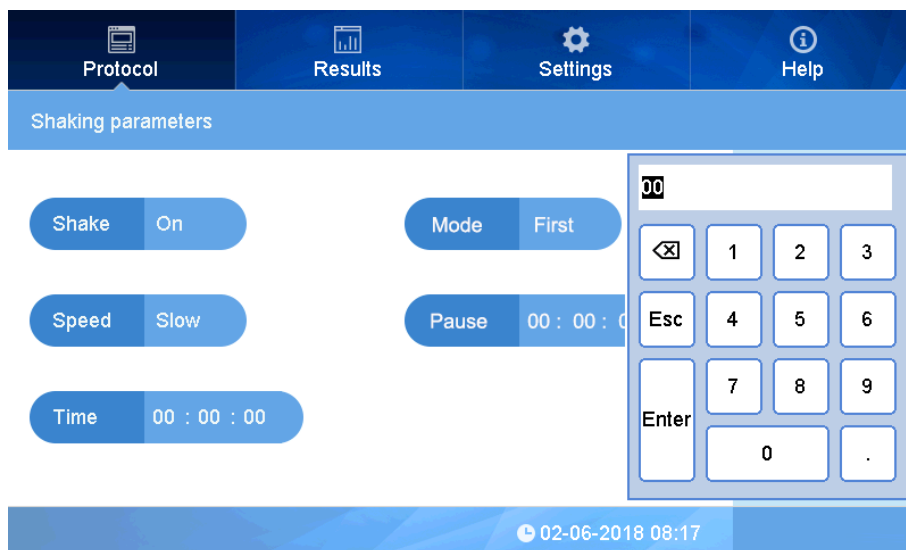


Fig 25

- ⑤ There are two options in “Mode” setting: “First” and “Each”. Choose “First” to shake only before the first reading in a multiple reading. Choose “Each” to shake each time before a reading in a kinetic assay.
- ⑥ Click the “Pause” button to set a pause time between shaking and reading absorbance.
- ⑦ Press **OK** to complete the settings, and return to the “Protocol” interface.

## 2.4 Calculate

This interface is for setting the sample processing method, including Kinetic, Preprocess and Curves.

2.4.1 Kinetic setting

- ① On the “Protocol” interface, click “Calculate” to enter “Calculation parameters”. Click Kinetic and choose On or Off.

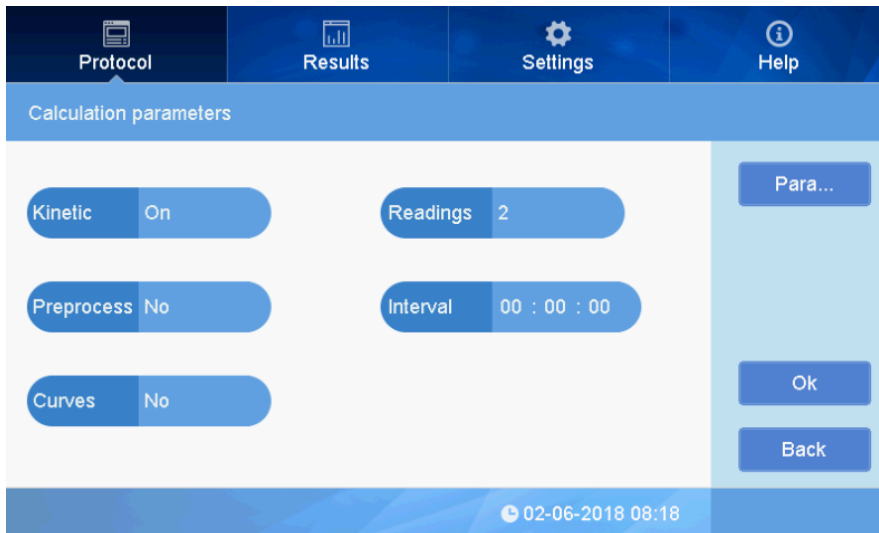


Fig 26

- ② When Kinetic is “On”, you may click “Readings”, and input the number of desired measurement readings.
- ③ Click the hours, minutes or seconds on the “Interval” button to set the interval between each reading. The time format is: HH/MM/SS,
- ④ At the right side of the screen, click “Para...” to set the kinetic parameters, See Fig 27:

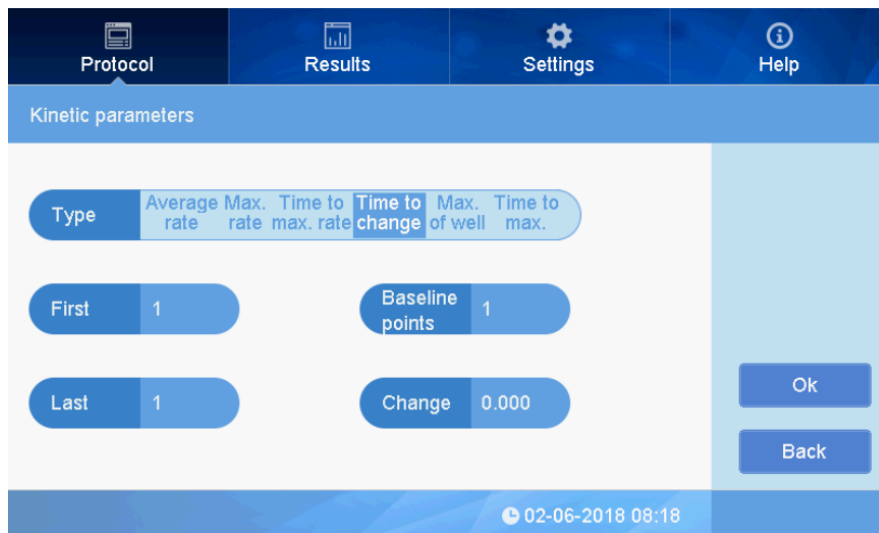


Fig 27

- a. Type: There are different options including: average rate, max rate, time to change, max absorbance of well, and time to max absorbance. Take average rate as an example, the result

shows the average rate of absorbance changing in each well.

When the type is set for “time to change”, the three parameters at right are active, see Fig 28, Set parameters according to experimental requirements.

Baseline select: There are two options in “Baseline select” setting: “End” and “Begin”.

Baseline Points: Set the baseline point.

Change: Set change value. (If the absorbance change is less than setting one, it will not be recorded)

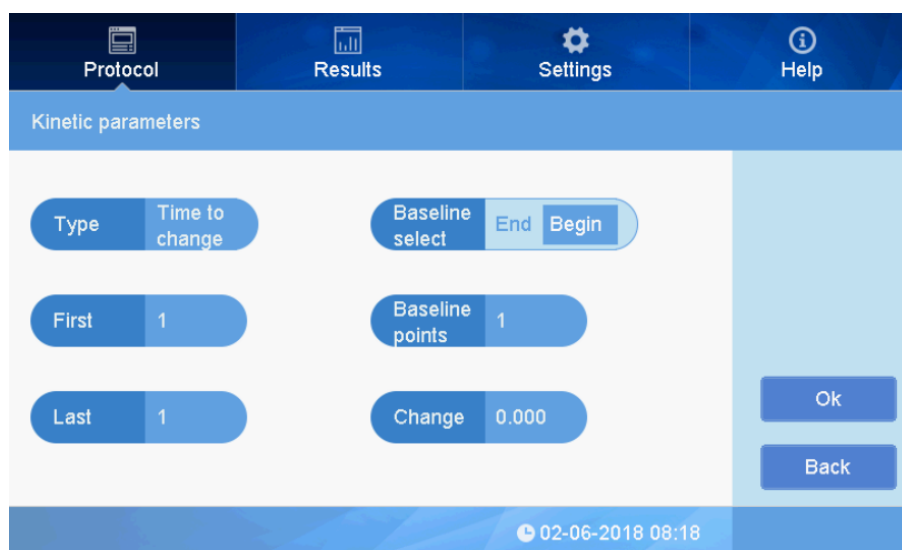


Fig 28

- b. First readings: Beginning reading point of data record.
- c. Last readings: End reading point of data record.

#### 2.4.2 Preprocess setting (double wavelength)

In the “Calculate parameters” interface, click the right side of the “Preprocess” button, and a menu will appear as shown in Fig. 29.:

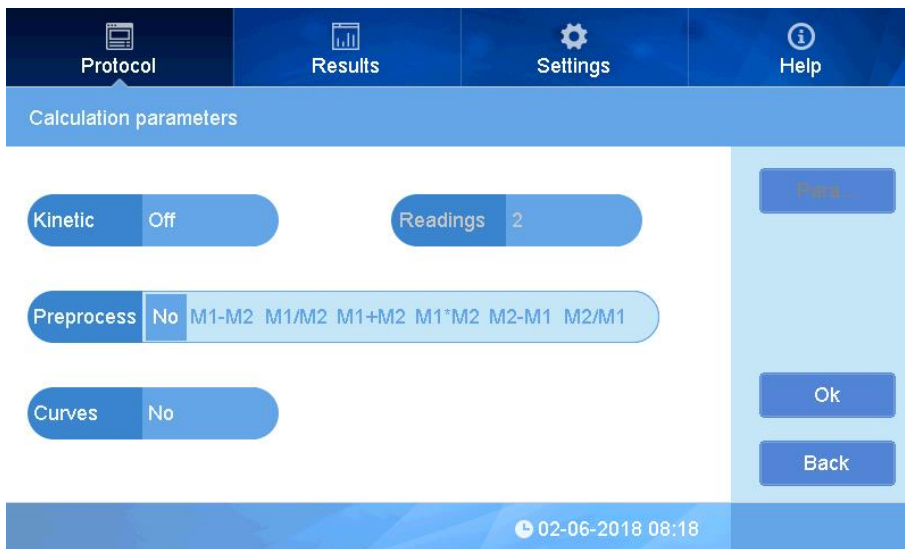


Fig 29

Choose the preprocess calculation desired when testing 2 wavelengths.

Choices include :  $M1-M2$ ,  $M1/M2$ ,  $M1+M2$ ,  $M1*M2$ ,  $M2-M1$ ,  $M2/M1$  ( $M1$  and  $M2$  represent the measurement values for the first and second wavelengths) .

### 2.4.3 Curves fitting

In the "Calculation parameters" interface, Click "Curves" to choose the curve fitting option.

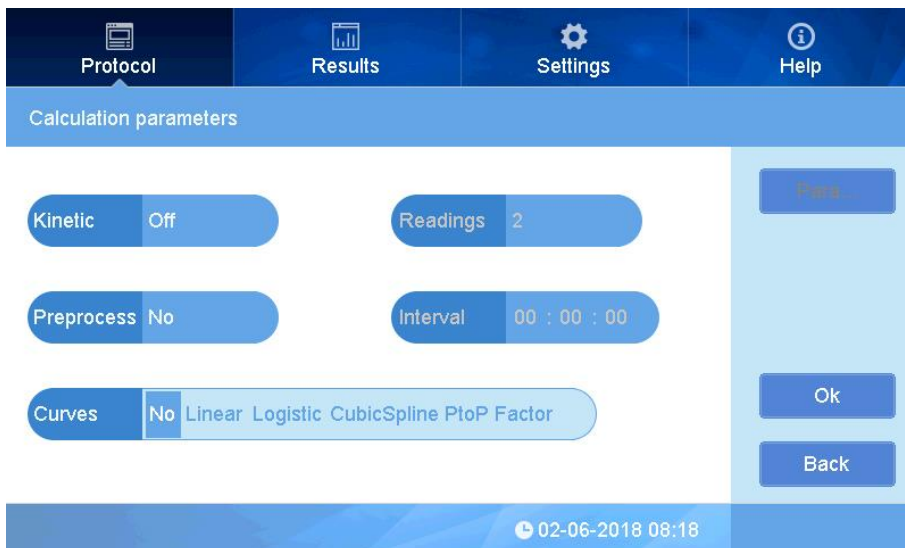


Fig 30

Options include: No (Off), Linear, Logistic, Cubic Spline, Point to Point, and Factor.

After the measurement, the software will produce a curve fitting using the sample absorbance

value data and the standard concentration values.

## 2.5 Interpret

For interpret(qualitative analysis) results which relative to Positive and Negative Controls.

- ① In the "Protocol" interface, click "Interpret". Choose "On"

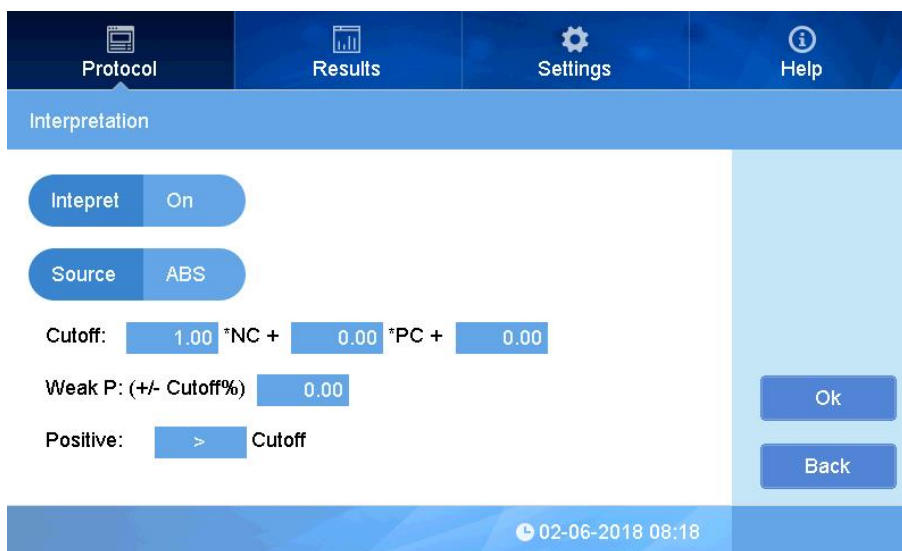


Fig 31

- ② Click "Source", choose "ABS" (absorbance) or "conc." (concentration) as desired. Formula for threshold value "cutoff":  $a \times NC + b \times PC + c$ , the "a,b,c" are reagent control coefficient, can be set as needed, "NC" is the negative control average value, "PC" is the positive control average value.

Click coefficient "a" to type the coefficient value needed to multiply by NC, and confirm by pressing "OK", set "b and c" the same way. If "cutoff" does not require a coefficient calculation with "PC" or "NC", then b and c can be left as zero.

- ③ **Weak P: (+/- Cutoff%)**  is judged as a "weak positive": Input a value which means the measurement result within this Cutoff % would be judged as a weak positive. The value comes from the calculation of Weak positive percentage according to the reagent user manual.

- ④ Click symbol ">" to toggle between ">" and "<" comparing Positive interpretation to "Cutoff", set it according to the reagent user manual.

- ⑤ Click "OK" to complete and return to main interface.

## 2.6 Quality Control

- ① In the "Protocol" interface, click "Quality", to open the "Quality controls" interface:



Fig 32

- ① Click “ABS” to choose ABS or conc. (concentration), as the quality control variables
- ② Click the button “On” / “Off” to turn on or off the quality control.



Fig 33

- ③ Click the values in the “Target” to set Quality controls concentration or ABS value, click values in the SD column to set the standard deviation value for QC concentration or ABS. Set Concentration value, ABS and SD according to the reagent kit user manual.
- ④ When using Quality controls, set the QC samples in the Layout interface, refer to the section of the manual on setting up the plate “Layout”.



## Section 3 Results


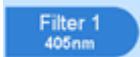
The “Results” interface shows measurement results as well as the history data of the latest measurements. After a measurement in the Protocol interface, the display will switch to the “Results” screen automatically, showing the current protocol measurement result. You can also view results by clicking the “Results” tab at the top of the screen.

In the “Results” interface, you may choose to view different calculated values from the measurement: Raw data, Interpret, Analysis, Curve, and QC.

Interpret, Analysis, Curve, and QC values will be available if these processes have been set to “On” in the “Protocol” interface. If they have been set to “Off, there will be no results.

### 1. Results interface



#### 1.1 Raw data

Click the button  to display the raw ABS (absorbance reading) values. Per Fig. 34, if the measurement was set to use and calculate with 2 wavelengths, click  to choose the wavelength filter (absorbance) data to view.



	1	2	3	4	5	6	7	8	9	10	11	12
A	2.260	1.515	0.051	0.088	0.049	0.103	0.062	0.059	0.070	0.069	3.759	3.456
B	1.384	0.048	0.070	0.057	0.056	0.055	0.058	0.053	0.056	0.066	0.083	0.066
C	0.050	0.064	0.042	0.089	0.051	3.702	0.053	3.231	0.099	0.050	0.069	0.058
D	0.066	0.066	1.301	3.181	0.055	0.066	0.049	0.081	3.182	0.075	0.065	0.073
E	0.056	1.786	0.073	3.325	0.056	2.014	2.861	0.072	0.057	0.055	0.051	0.075
F	0.049	0.063	2.191	3.558	0.049	0.839	1.597	0.055	0.052	0.054	0.070	0.053
G	0.055	0.081	3.189	0.057	0.091	2.053	0.049	0.094	3.046	0.057	0.050	0.076
H	3.223	0.091	0.054	0.063	0.054	0.136	0.065	0.053	0.128	0.053	0.066	0.058

Fig 34

Click  to enter into the export report interface (See Fig 35 and 36), then click  to export the raw data and/or the Analysis data to a USB drive (connect the USB drive into the port on the right side of the instrument)

Export interface for a typical “end point” reading:

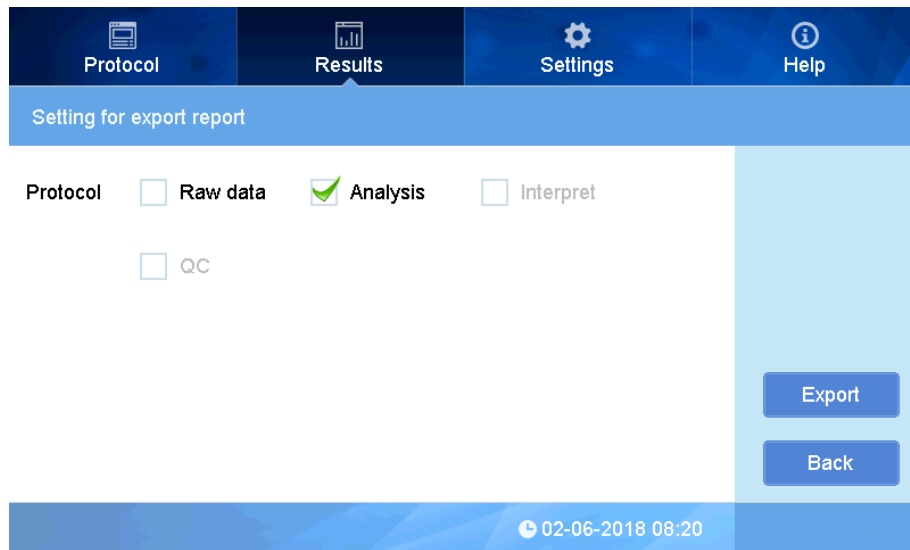


Fig 35

Export Interface for Kinetic Reading Data

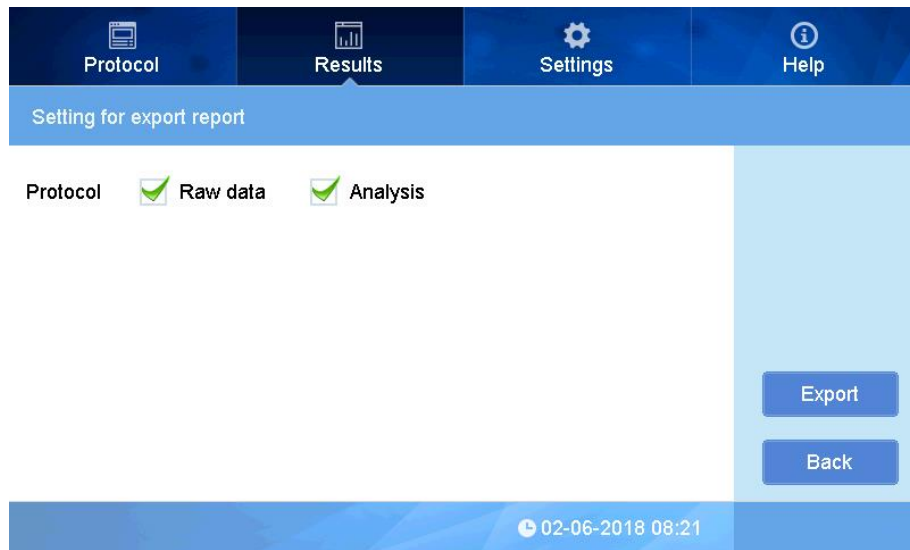



Fig 36

Click  to print data if connect to thermal printer(Optional)

## 1.2 Interpret Result

Click  to show the current interpreted measurement results.

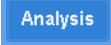


Fig 37

Symbol “+” and “++” above each ABS means positive. “++” in red = standard positive, “+” in blue = weak positive. On the right side the threshold value “Cutoff” is displayed, refer to sections 2.5 for details (Fig 37).

**Note:** On the print results, “P” indicates positive, and “+” is weak positive which is different from the display on the screen.

## 1.3 Analysis

Click  to display the quantitative analysis results. (Fig 38)

The quantitative results show calculations of concentration using the correlation of absorbance to concentration as established by the standards settings and also the curve fit.



shows the pre-process method of the curve fitting. See section 1.4 “Curves”.

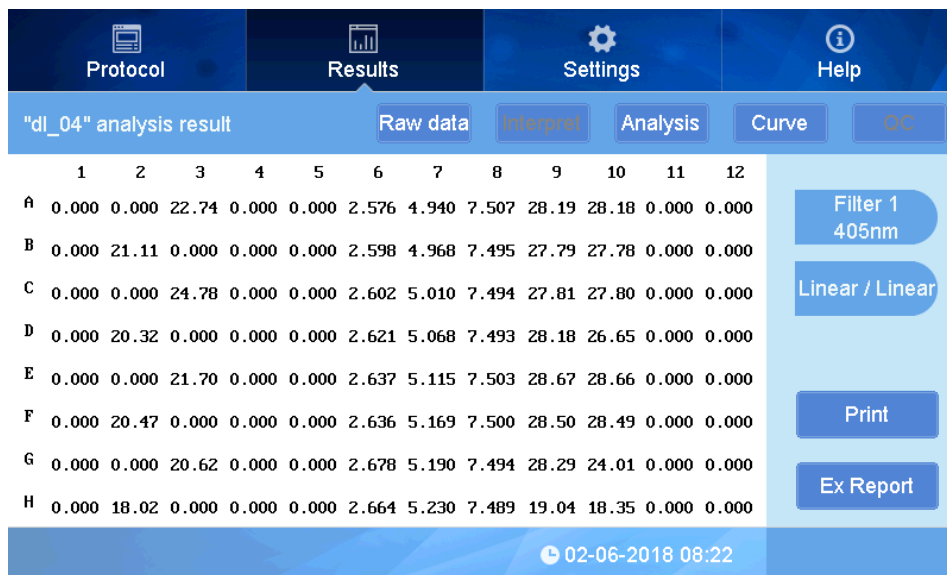


Fig 38

**1.4 Curve**

Press “Curve” to view the curve of the concentration value vs. ABS reading value. Fig 39 shows a curve fitting with Linear/Linear setting (linear scale for Absorbance on the y-axis, linear scale for concentration on the x-axis). If the fit of the curve is not optimal, it is possible to adjust the curve fitting settings. The choices for curve fitting are Linear/Linear, Linear/Log, Log/Linear, Log/Log.

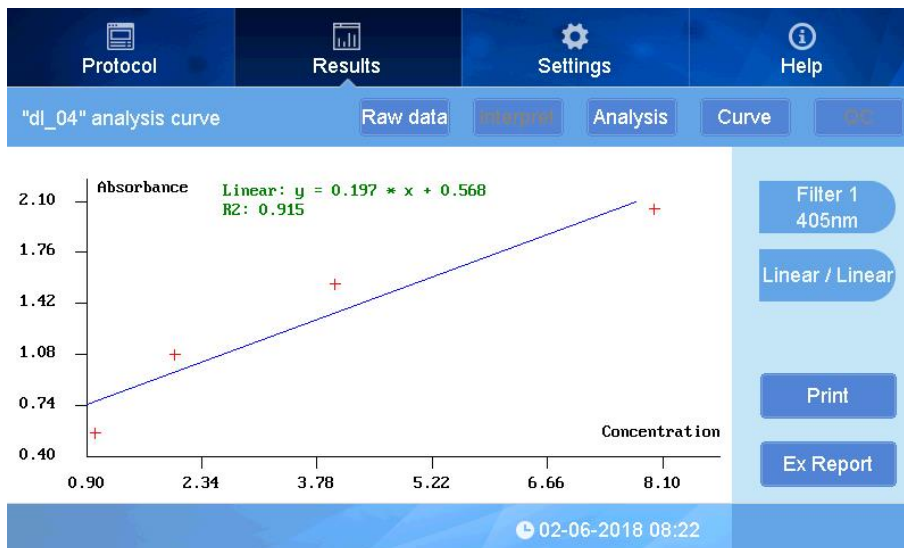


Fig 39

**1.5 QC Result**

When a protocol is set with QC measurement, the results of QC samples on the plate will be interpreted as “Passed” or “Failed”. see Fig 40.

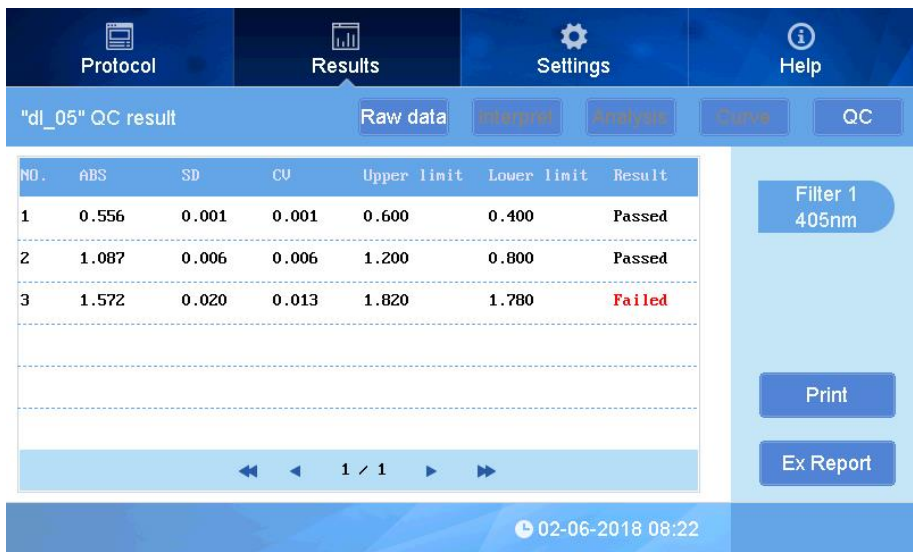




Fig 40

2. Kinetic Results interface

2.1 Kinetic Raw data



Fig 41

The picture above showing the ABS values for measurement Cycle 1. Use  to scroll through the cycles.  indicates the cycle No., click this button and input cycle No. to jump to a specific cycle number. Numbers in red indicate absorbance outside of the range of the instrument.

### 2.2 Kinetic Analysis



Fig 42





indicates the data processing method of kinetics measurement. (See section 2, 2.4.1 Kinetics setting)

### 2.3 Kinetic Curve



Fig 43

The kinetic curve can be displayed for each sample position, showing ABS detection value vs cycle number.

Press  to shift sample position on microplate, (ie, A1, A2, A3, etc) when at A1, click  to view the absorbance curve for all sample positions simultaneously. See Fig 44.

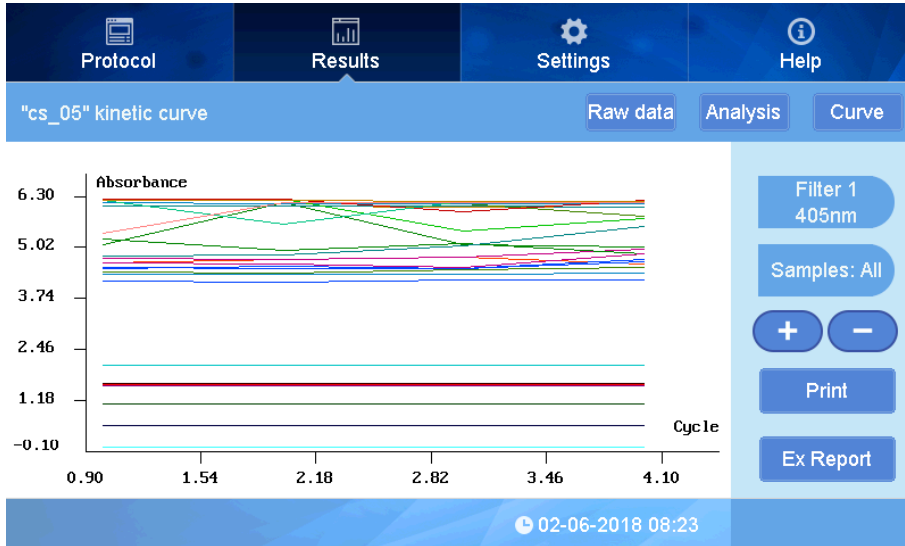


Fig 44

### Section 4 Settings

The Settings interface allows changing the Language, setting filter values (if a filter is added or removed), maintenance, printer settings, quality control, screen calibration, and date and time setting.

Click "Settings" at the upper area of the main interface:

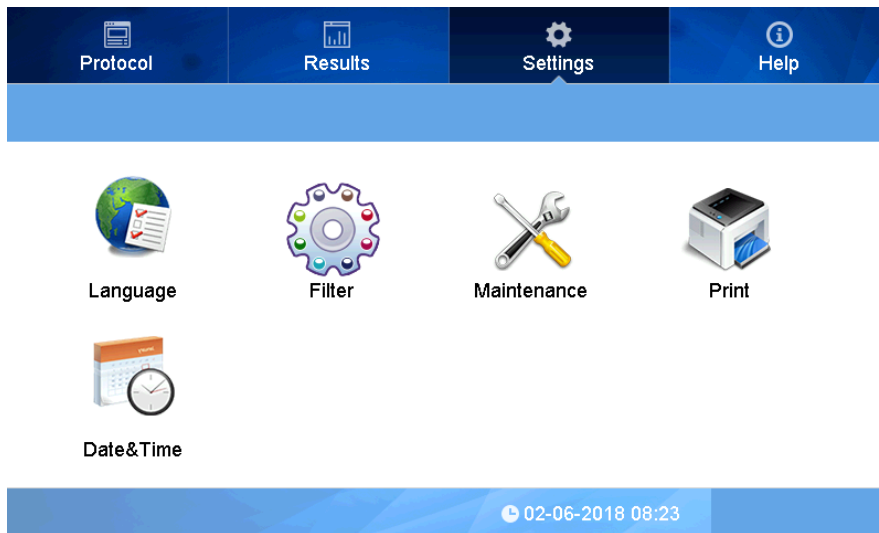


Fig 45

#### 1. Language

Steps:

- ① Press the "Language" icon in the Settings interface :

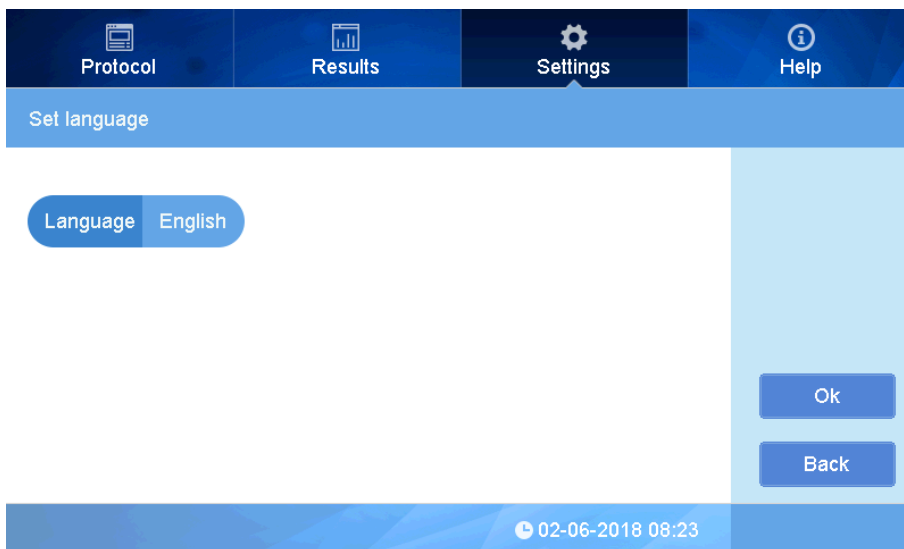


Fig 46

- ② Click to the right side of Language, see picture below :



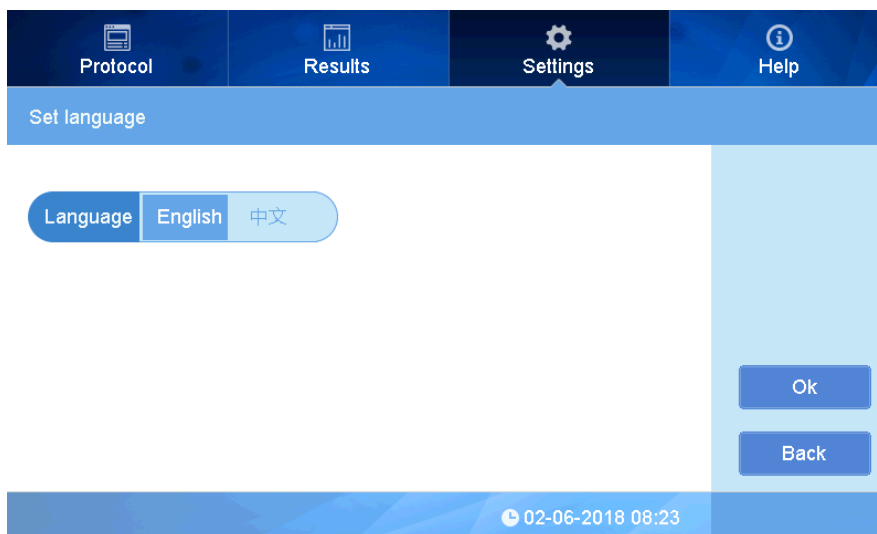


Fig 47

Select the language needed and press OK to complete. Currently English and Chinese are available.

## 2. Filter

This instrument is equipped with four standard filters which have positions on the filter wheel from 1-4. Up to 8 filters can be installed (purchased with the instrument, or added later).

When additional filters are purchased together with instrument, the filter may be installed prior to shipping and the filter wheel settings already adjusted. If additional filters are purchased later, the customer will need to update the filter wheel settings.

**Note: Install new filters in the instrument prior to adjusting the filter wheel settings in the software.**

**Please refer to Chapter 4, section 3 for details.**

- ① Click the Filter icon in interface of setting, see Fig 48.

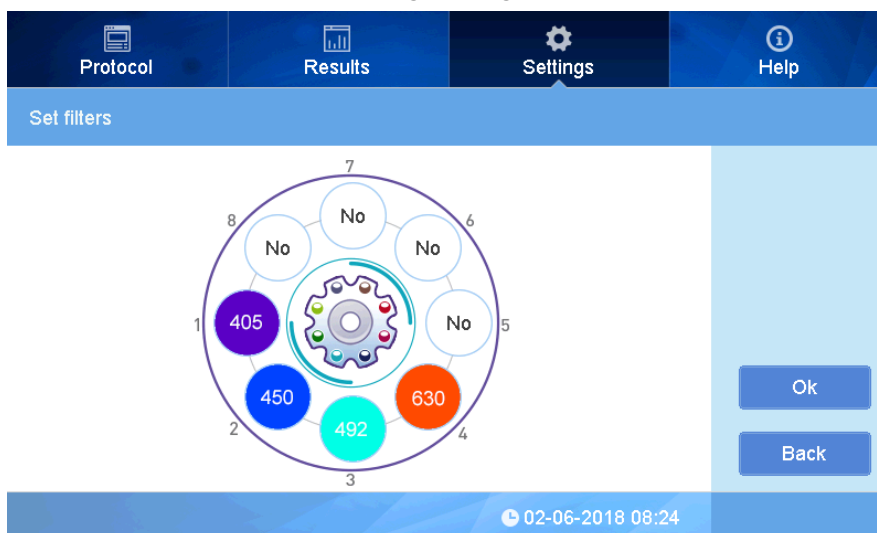


Fig 48

- ② Click the blank position No., input the wavelength using the pop up window (Fig 49).

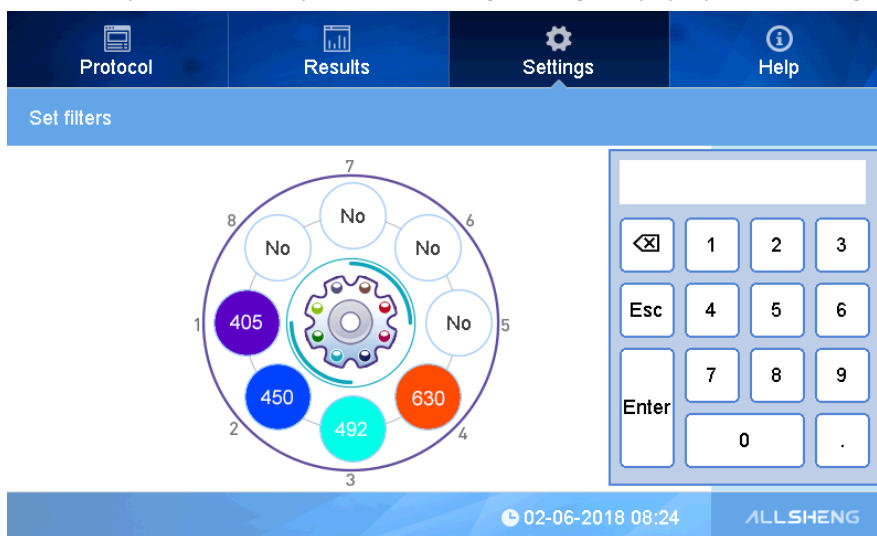


Fig 49

In case of a wrong input, double click to input again.

The instrument is equipped standard with 1-4 filters installed, and the wavelengths are as picture above.

**Note: The position No. in software and filter wheel must be the same, or it will lead to incorrect readings.**

Click OK to complete after setting.

### 3. Maintenance

Here you can adjust the microplate drawer options, and authorized service personnel can adjust factory settings (password protected).

- ① Click "Maintenance" to enter into the interface (Fig 50).

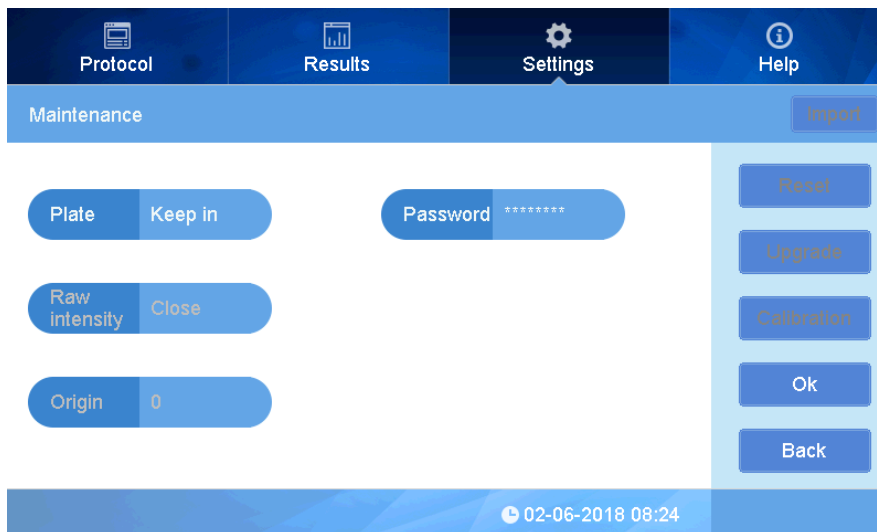


Fig 50



This setting is used to adjust how the microplate drawer is controlled, and it can be set as “Keep in” or “Keep out”. “Keep in” means the microplate drawer will stay closed after a measurement, while “Keep out” means the microplate drawer will open after a measurement. If other maintenance settings need to be adjusted, contact Benchmark Scientific.

**4. Date and Time**

Click “Data&time” in the Settings main menu to set the Time and Date. The format of Date: month/date/Year, Time: Hours:minutes:seconds. (Fig 51).

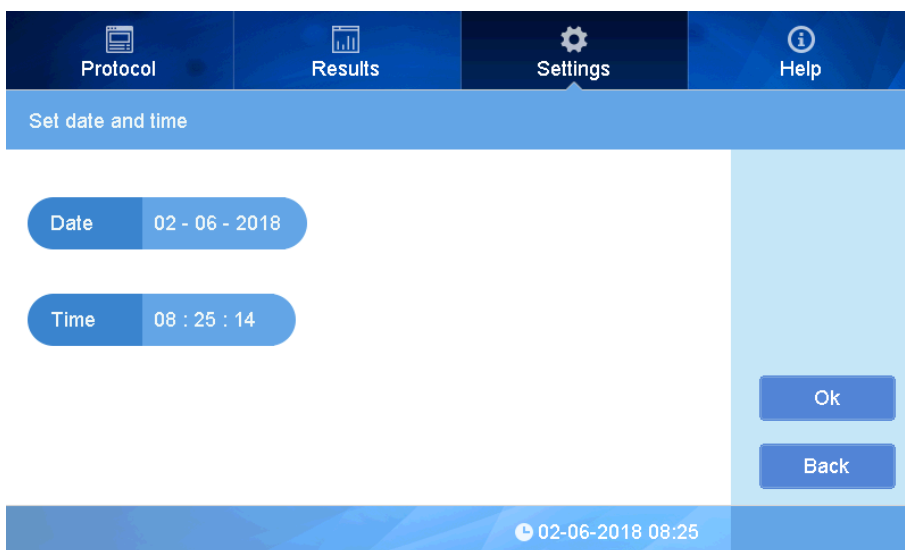


Fig 7

In order to change the date and time, click the area to set, (Fig 52).

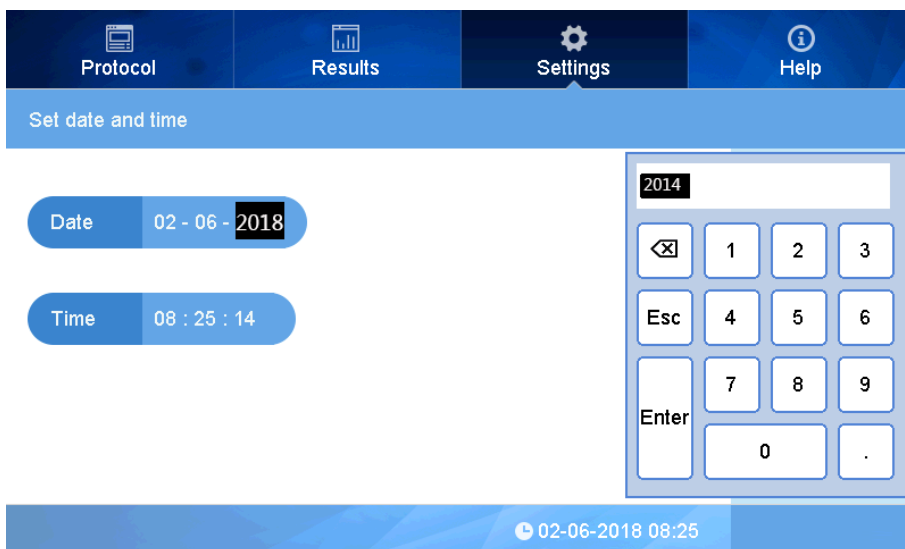


Fig 8

Click “OK” to complete the setting.

## Section 5 Help

This area provides a brief introduction and overview for every function button as (fig 53).

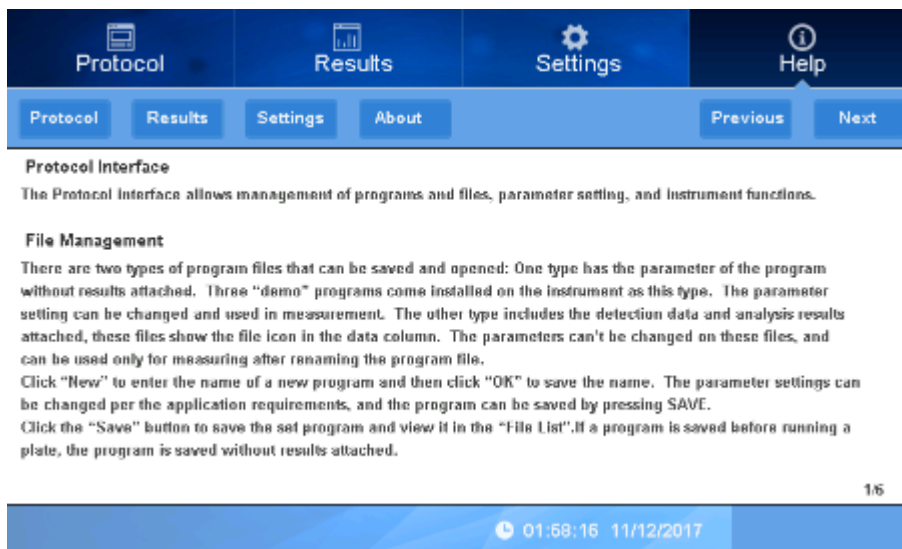


Fig 53

- ① Click “Protocol”, “Results”, “Settings” to review a summary of each function.
- ② Click “About” to see the current firmware version.

## Chapter 6 Maintenance

- Avoid moisture to prevent corrosion.
- Keep the instrument away from strong electromagnetic interference sources.
- The Instrument has been calibrated at the factory, so calibration should not be required. If there are any issues with operation or performance, please contact Benchmark Scientific or your distributor.
- Do not turn off power to instrument in the middle of a reading or when the drawer is opening or closing.
- Parts replacement:

All of the components of this instrument have been designed, manufactured and tested to ensure quality and long life. If used properly, according to this instruction manual, the main electronic and mechanical parts will not need regular maintenance.

### Light source replacement:

Contact Benchmark Scientific for information on ordering a new Halogen Lamp if replacement is required.

**Replacement steps:** (make sure to switch off power, and unplug the instrument before starting)

- a. Open the back door of the instrument, locate the light source (see Fig 54), loosen the screws on light source connector using a small screw driver, remove this connector by gently pulling it upwards.
- b. Loosen the light source fixing plate and remove it, disconnect the light source by pulling upward and remove it from the instrument. (Caution: if used recently, the light source may be hot)
- c. Replace the new light source by reversing the above steps, pay attention to the position of the light on the light source part, then connect the fixing plate. See Fig54

**Note :** Do not touch the glass surface of the lamp, always hold it at the base. Do not use excessive force to prevent damage.

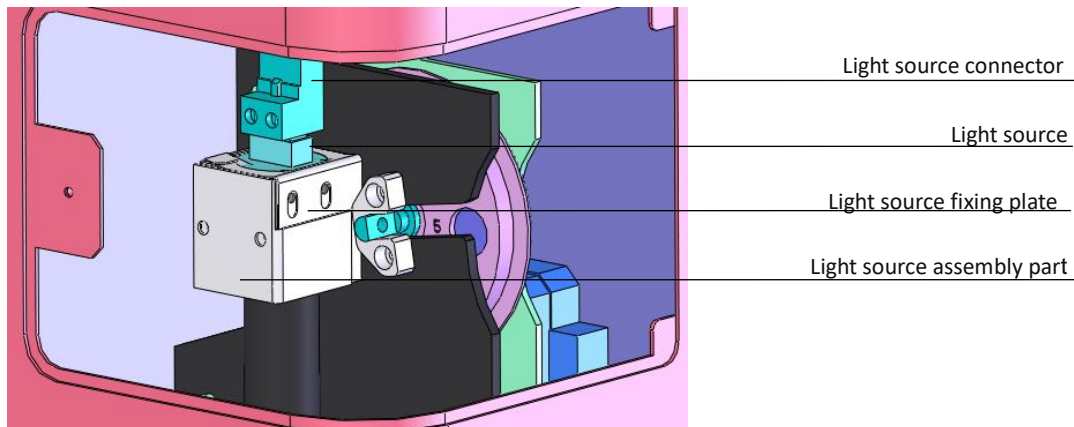


Fig 54

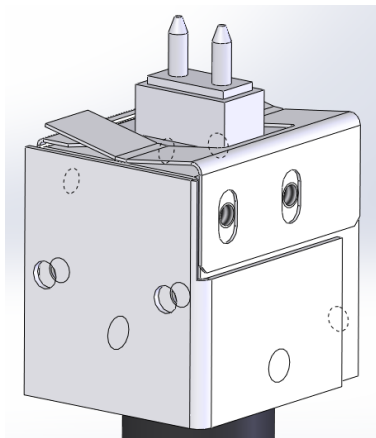


Fig 55

### Adding an optical filter

The SmartReader 96 Instrument is equipped with four standard filters inside. If other wavelengths are needed, additional filters can be installed. Always turn off the instrument before changing the filters, and follow the below instructions. It is recommended to wear laboratory gloves to prevent touching the optical filter glass.

- Loosen the knob to open the back door, and remove the optical filter wheel using the included Allen key, (see Fig 56).
- Remove the fixing plate by removing the screws, then place any new filters in open positions. Arrows on filters should be same as light incident direction. See fig 57. Replace the fixing plate and screws.
- Load the wheel back into the slot with the number marks facing the rear of the instrument, and re-fasten it with the Allen screw.

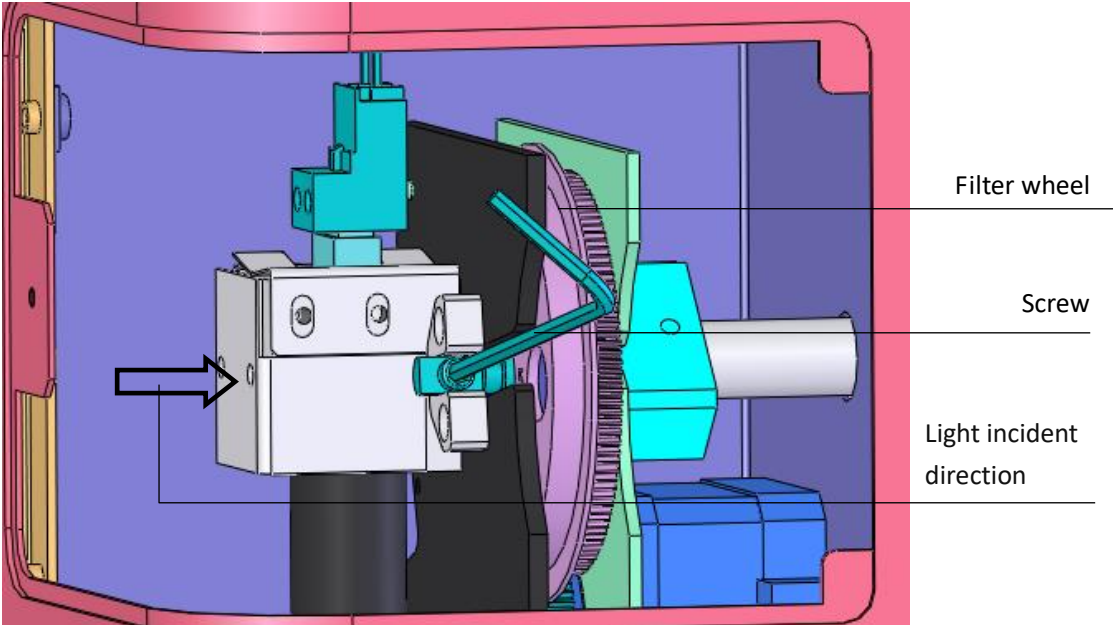


Fig 56

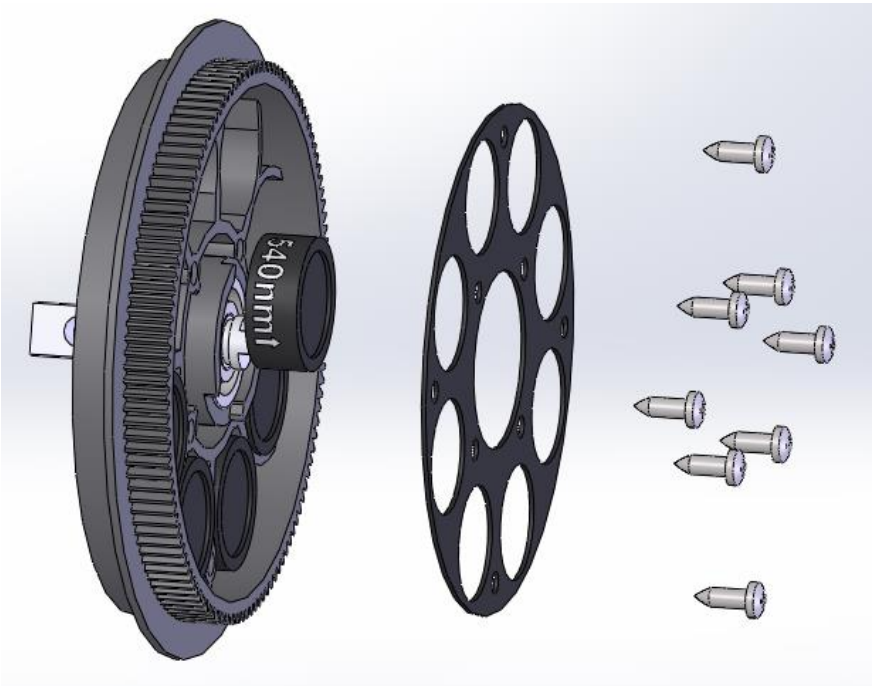


Fig 57

**Note:**

- The SmartReader Instrument is equipped with four standard filter inside, please ignore these steps if additional filters are not needed.
- Do not touch the filters with bare hands to avoid fingerprints or smudging which can lead to inaccurate readings.
- Be careful not to touch any other mechanical or electrical parts inside the instrument when installing the filter wheel.

**Storage and transportation**

1. This instrument should stored and operated in an environment with temperature  $-10^{\circ}\text{C}\sim 40^{\circ}\text{C}$ , relative humidity less than 80%, in a well ventilated area free of any corrosive gasses.
2. Avoid heavy shocks, vibration, and humidity during transportation.



## Chapter 7 Trouble shooting

### Trouble analysis and trouble shootings

No	Trouble	Analysis	Trouble shooting
1	Instrument will not start	Problem with power input	Check power supply, Check cable plug status, Check fuse, Check voltage of outlet
2	Lamp will not turn on	Power to lamp failure, Lamp defective	Check power before replacement, Replace the lamp
3	Weak light	Lamp defective	Replace lamp
4	No reset signal of microplate	Photoelectric switch defective	Replace photoelectric switch. Contact service department.
5	Measurement result with big deviation or no result. Filter wheel does not work, or turn too much before stopping.	Filter wheel photoelectric switch defective	Replace Filter wheel photoelectric switch. Contact service department.
6	Microplate does not move forward or no backward.	There is something obstructing the movement	Check microplate holder
7	Measurement result not precise	Microplate is not placed correctly in the drawer.	Check if microplate is properly fitting the holder.
8	Start measurement is interrupted	Communication interrupted.	Press "stop", restart to measure.
9	"Strong light"	New filter added using software, but without filter on wheel.	Delete the filter setting which is not needed. Make sure new filters are in correct slot number.

## Chapter 8 Accessories

No.	Item	Specs	Unit	Qty	Remark
1	Microplate Reader		Pc	1	
2	Power cord		Pc	1	
3	Touch pen		Pc	1	
4	Mouse	Logitech	Pc	1	
5	Allen wrench	2.5mm	Pc	1	For installing or changing optical filters
6	Operation Manual		Pc	1	
7	Cross screwdriver	SATA 62307	Pc	1	For removing filter wheel fixing plate.
8	Performance test statement		Pc	1	
9	Packing List		Pc	1	

The MR9600 is equipped with four filters: 405nm, 450nm, 492nm, 630nm.

Contact Benchmark Scientific or your local distributor for information and pricing on additional filters.

**Memo**

[Empty memo box]

**Benchmark**   
**Scientific**  
P.O. Box 709 Edison, NJ 08818 USA  
Ph: 908-769-5555 EM: [info@BenchmarkScientific.com](mailto:info@BenchmarkScientific.com)