



**SINGLE BEAM SCANNING
SPECTROPHOTOMETER
Models M209T & M509T**



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General Information

The apparatus described in this manual is designed to be used by properly trained personnel in a suitable equipped laboratory. For the correct and safe use of this apparatus it is essential that laboratory personnel follow generally accepted safe procedures in addition to the safety precautions called for in this manual.

The covers on this instrument may be removed for servicing. However, the inside of the power supply unit is a hazardous area and its cover should not be removed under any circumstances.

There are no serviceable components inside this power supply unit. Avoid touching the high voltage power supply at all times.

Some of the chemicals used in spectrophotometer are corrosive and/or inflammable and samples may be radioactive, toxic, or potentially infective. Care should be taken to follow the normal laboratory procedures for handling chemicals and samples.

Safety

The safety statements in this manual comply with the requirements of the HEALTH AND SAFETY AT WORK ACT, 1974.

Read the following before installing and using the instrument and its accessories. The instrument should be operated by appropriate laboratory technicians.

General

The apparatus described in this manual is designed to be used by properly trained personnel in a suitable equipped laboratory. For the correct and safe use of this apparatus it is essential that laboratory personnel follow generally accepted safe procedures in addition to the safety precautions called for in this manual.

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Care should be taken to follow the normal laboratory procedures for handling chemicals and samples.

Electrical

Before switching on the apparatus, make sure it is set to the voltage of the local power supply (see Installation).

The power cord shall be inserted in a socket provided with a protective earth contact. The protective action must not be negated by the use of an extension cord without a protective conductor.

Warning

Any interruption of the protective conductor inside or outside the apparatus or disconnection of the protective earth terminal is likely to make the apparatus dangerous. Intentional interruption is prohibited.

Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and be secured against any unintended operation.

NEVER touch or handle the power supply on CAMSPEC M209T & M509T due to the high voltage.

The protection is likely to be impaired if, for example, the apparatus

- Shows visible damage
- Fails to perform the intended measurements
- Has been subjected to prolonged storage under unfavourable conditions
- Has been subjected to severe transport stresses

Introduction

The CAMSPEC M209T & M509T series are single beam, general purpose instruments designed to meet the needs of the Conventional Laboratory, They are ideal for various applications, such as: Clinical Chemistry, Biochemistry, Petrochemistry, Environmental Protection, Food and Beverage Labs, Water and Waste Water Labs and other fields of quality control and research.

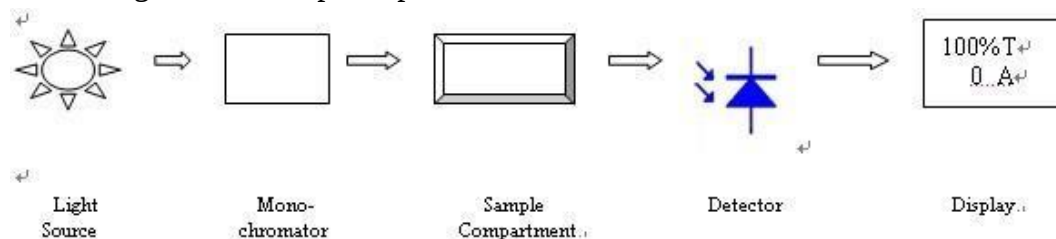
Both the M209T & M509T Series features a digital display of photometric result, easy operation and wavelength range of 325nm to 1100nm for M209T and 190nm to 1100nm for model M509T.

M209T is ideal for measurements in the visible wavelength region of the electromagnetic spectrum and M509T in ultraviolet and visible wavelength region.

Working Principle

The spectrophotometer consists of five parts: 1) Halogen and deuterium (for M509T only) lamp to supply the light; 2) A Monochromator to isolate the wavelength of interest and eliminate the unwanted second order radiation; 3) A sample compartment to accommodate the sample solution; 4) A detector to receive the transmitted light and convert it to an electrical signal; and 5) A digital display to indicate absorbance or transmittance. The block diagram below illustrates the relationship between these parts.

Block diagram for the Spectrophotometer



In your spectrophotometer, light from the lamp is focused on the entrance slit of the monochromator where the collimating mirror directs the beam onto the grating. The grating disperses the light beam to produce the spectrum, a portion of which is focused on the exit slit of the monochromator by a collimating mirror. From here the beam is passed to a sample compartment through one of the filters, which helps to eliminate unwanted second order radiation from the diffraction

grating. Upon leaving the sample compartment, the beam is passed to the silicon photodiode detector and causes the detector to produce an electrical signal that is displayed on the digital display. The M209T & M509T Series incorporate an USB bi-directional port for connecting to a PC for using the Application Software.

The USB Port is for data collection for use with the application software.

Unpacking Instructions

Carefully unpack the contents and check the materials against the following packing list to ensure that you have received everything in good condition:

Packing List

Unless otherwise specially ordered the spectrophotometer package should include the following items.

Description:_____	Quantity
Spectrophotometer.....	1
Power Cord.....	1
Cuvettes, Glass	Set of 4
Cuvettes, Quartz (M509T only).....	Set of 2
Dust Cover.....	1
Operating and Software Manuals and Application Software on USB.....	1

Specifications

M209T Specifications

Display	Touch screen
Light sources	Tungsten-Halogen
Monochromator	1200 lines/mm grating
Detectors	Silicon Photodiode
Wavelength Range	325- 1000nm
Wavelength Accuracy	± 0.8nm
Wavelength Repeatability	< 0.1 nm
Noise	< 0.001A @ 500nm 0A
Zero Drift	< 0.003A per hour after warm-up
Bandpass	2 nm
Stray Light	<0.1%T @ 340 nm
Photometric Accuracy	0.5%
Photometric Range	-0.3to 3.0A, 0-200%T and -9999C and +9999C
Printer Interface	Bluetooth (optional)
Computer Interface	USB for PC control
Power Requirements	110/120V, 220/230V, 50/60 Hz, 135VA
Dimensions	510 x 420 x 210 packed 645 x 535 x 370
Weight	13Kg packed 16Kg

M509T Specifications

Display	Touch screen
Light sources	Tungsten-Halogen and Deuterium
Monochromator	1200 lines/mm grating
Detectors	Silicon Photodiode
Wavelength Range	190- 1000nm
Wavelength Accuracy	$\pm 0.8\text{nm}$
Wavelength Repeatability	$< 0.1\text{nm}$
Noise	$< 0.001\text{A @ } 500\text{nm } 0\text{A}$
Zero Drift	$< 0.003\text{A}$ per hour after warm-up
Bandpass	2 nm
Stray Light	$< 0.1\%T @ 220\text{nm}$ and 340 nm
Photometric Accuracy	0.5%
Photometric Range	-0.3to 3.0A, 0-200%T and -9999C and +9999C
Printer Interface	Bluetooth (optional)
Computer Interface	USB for PC control
Power Requirements	110/120V, 220/230V, 50/60 Hz, 135VA
Dimensions	510 x 420 x 210 packed 645 x 535 x 370
Weight	14Kg packed 17Kg

Installation:

1. After carefully unpacking the contents, check the materials with the packing list to ensure that you have received everything in good condition.
2. Place the instrument in a suitable location away from direct sunlight. In order to have the best performance from your instrument, keep it as far as possible from any strong magnetic or electrical fields or any electrical device that may generate high-frequency fields. Set the unit up in an area that is free of dust, corrosive gases and strong vibrations.
3. Remove any obstructions or materials that could hinder the flow of air under and around the instrument.
4. Turn on the instrument and allow it to warm up for 15 minutes before taking any readings.

Instrument appearance:





Operation

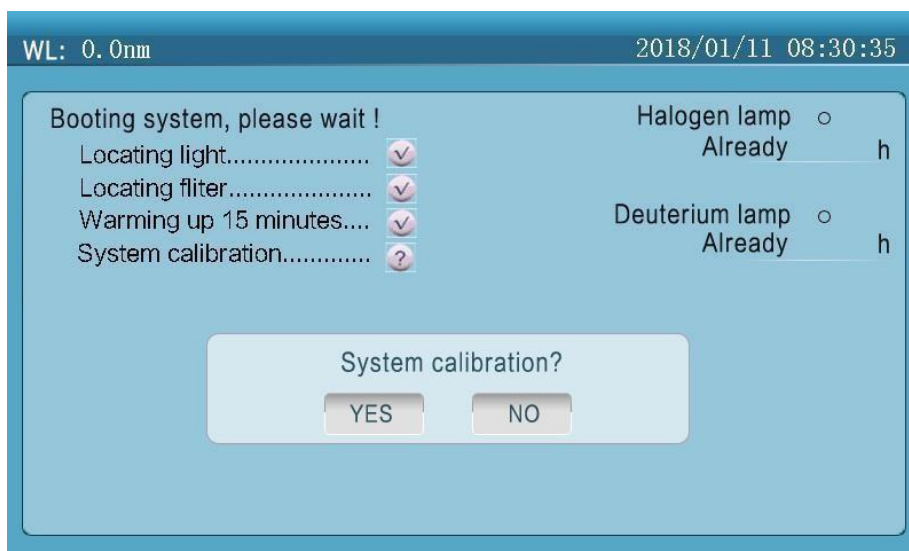
Preparation and Initialization

Turn on the spectrophotometer by pressing the Power Switch (IO) on the back of the instrument.

The instrument will automatically run a self-initialization check. The screen displays sequentially the checking status.



(You may press CANCEL to skip 15 minutes warm up which is not recommended).



After 15 minutes warm up you need to choose either to run full System Calibration or not. If you choose No, the instrument will use the previously saved calibration data and the display will move to the main menu and ready to use. If you select Yes, the instrument will go through system calibration. Below are some displays showing system calibration process.

(Note: If previously saved data is lost the instrument will automatically run system calibration)



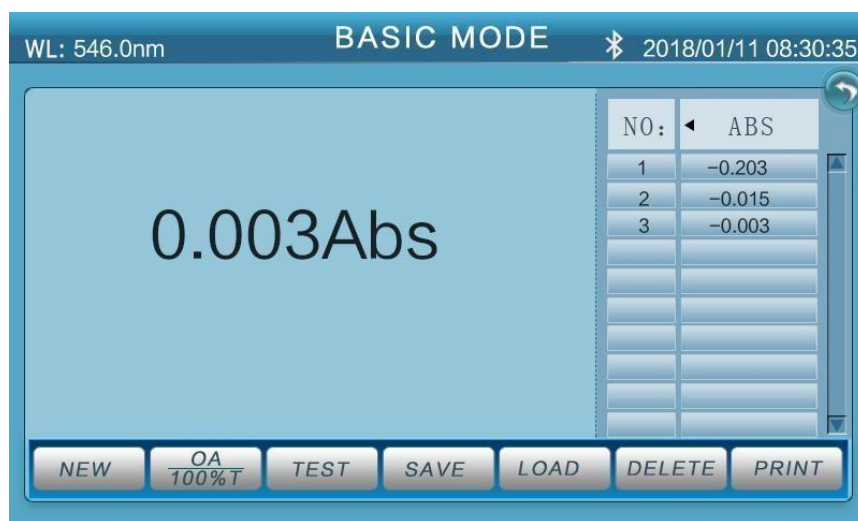
The instrument is ready for use. Below is the Main Menu.



Basic Mode

Press ABS/T% to enter the **BASIC MODE**

Press the right side %T/ABS to select type of test (%T/Abs)



Press the upper left corner wavelength number to setup wavelength, it will pop-up settings wavelength dialog, press ESC to cancel.

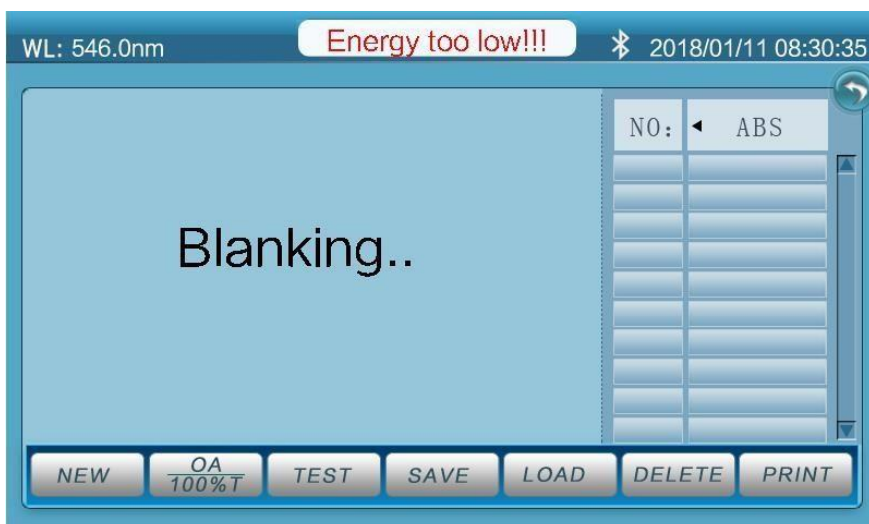
Enter the desired wavelength as shown below:



Press **【OK】** button to confirm. The instrument will go from previous wavelength (546nm) to the desired wavelength (500nm) and automatically blank.



Note: You must blank your reference before measure any sample. Follow your lab procedures for preparing the reference liquid and the steps below to set the blank: Make a blank reference solution by filling a clean cuvette with distilled or deionized water or other specified solvent. Wipe the cuvette with tissue to remove the fingerprints and droplets of liquid. Fit the blank cuvette into the 4-cell holder and place the cuvette in the slot nearest you. Push the rod so that the cuvette is in the light path. Close the lid. Set 0.000A or 100%T by pressing 0A/100%T button.



Note: If “Energy low!” is displayed it might indicate the reference is too dark or the light beam energy from the lamp is too weak.

Now it is ready to measure your samples:

Remove the blank cuvette if you are testing more than 3 samples. Set it aside in the case that you may need to reset 0A/100%T later (i.e. change wavelength).

Rinse a second cuvette (or more) with a small amount of sample solution to be tested.

Fill the cuvette and wipe it.

Put the sample cuvette(s) in the sample compartment. Close the lid. The current sample test result is displayed on the screen.

Note:

□ If you are reading more than one cuvette, be sure to carefully move the cuvette holder to the next position by pulling on the sample holder rod until the holder “click” into place.

□ If you are reading 3 or less samples, then place the reference cuvette in the position nearest you, and the samples in the next available position. This will shorten the time to read samples and minimize the sample handling (opening and closing the sample compartment lid, etc.)

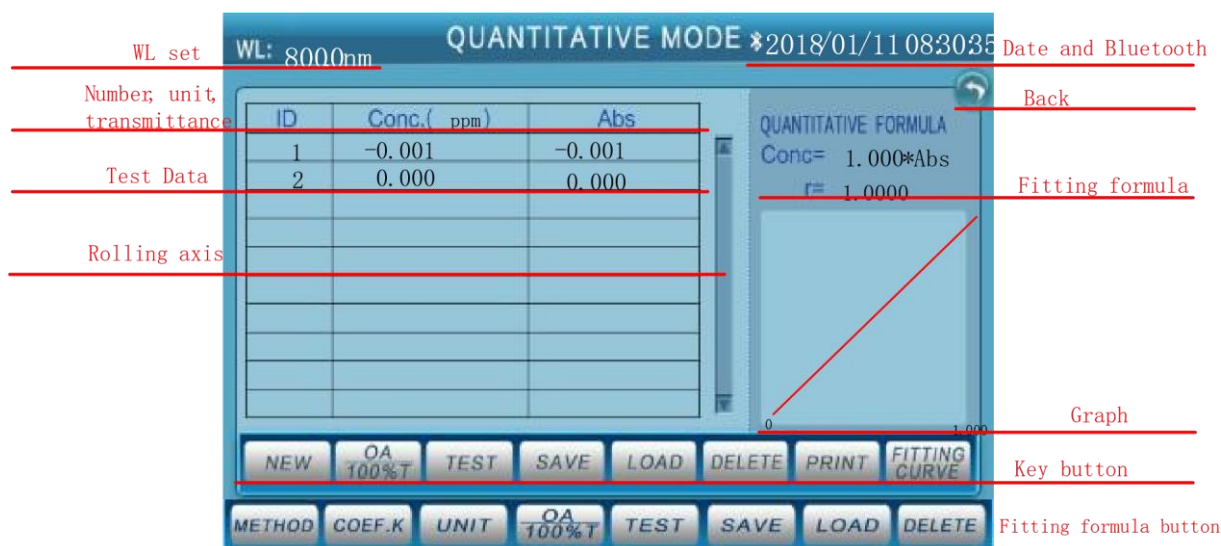
To print the result press **PRINT** button. If you have setup the Bluetooth printer first.

Quantitative

Test method (curve) must be defined and established before quantitative tests can be run.

This instrument has an open platform for you to establish your own test methods (curves).

Such established method will be saved as defined test in “Pre-defined Test List”.



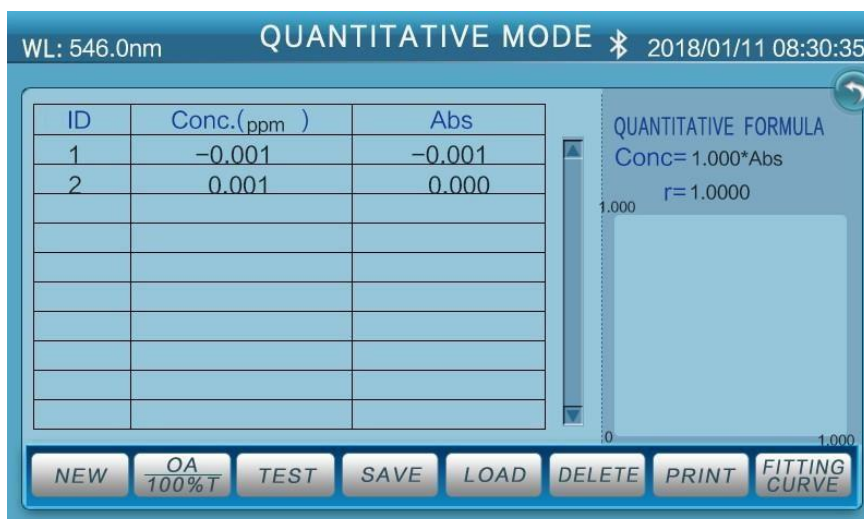
This instrument allows user to:

- Create New Curve
- Edit pre-defined and saved curve
- Delete pre-defined and saved curve
- Load pre-defined and saved curve
- Add pre-defined and saved curve to your favourite test folder for easy and fast access.

To access quantitative test, select “**Quantitative mode**” at the main menu.

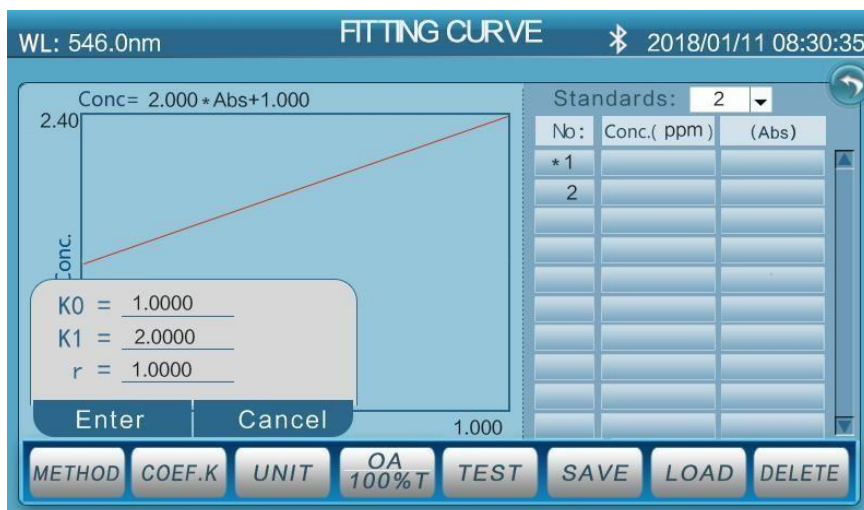
Creating a New Curve

In “**Quantitative**” mode press “**Fitting Curve**” to get into the interface and setup. You can establish standard curve using known Standards solution or using known Coefficient.



Press **METHOD** fitting method. There are 2 methods for you to choose: First-order linear zero; and First-order linear.

Press **COEF. K** to enter directly a known standard curve.



The constants to be entered are depending on which fitting method selected. The table below lists the relation:

Fitting Method	Fitting Equation	constants
First order linear	$C = K1 \times A$	$K1, r^*$
First order linear zero	$C = K0 + K1 \times A$	$K0, K1, r^*$

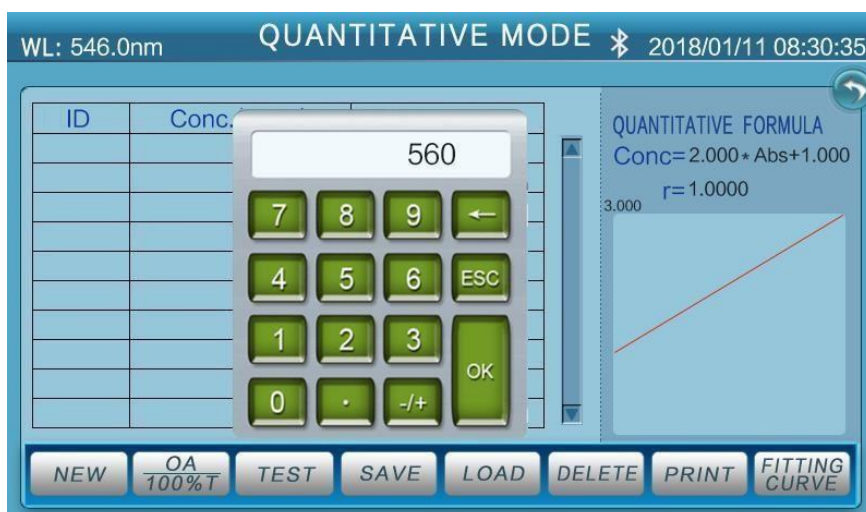
*r: regression co-efficient, default=1

Press **UNIT** to choose test unit, such as ppb ppm %...etc.

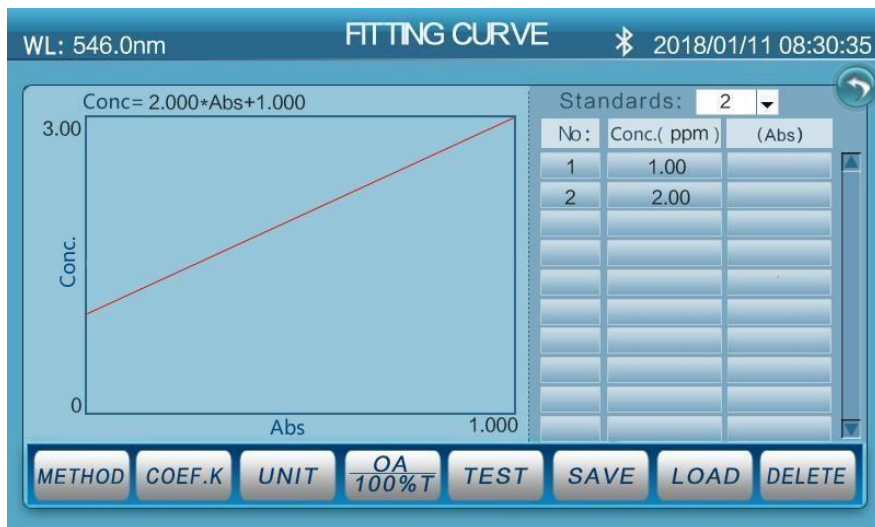


Click the back button to return quantitative interface, before going back to quantitative interface, you can choose to save the current test date or not.

After saving the date, the system will return to quantitative interface. Choose the wavelength you need.



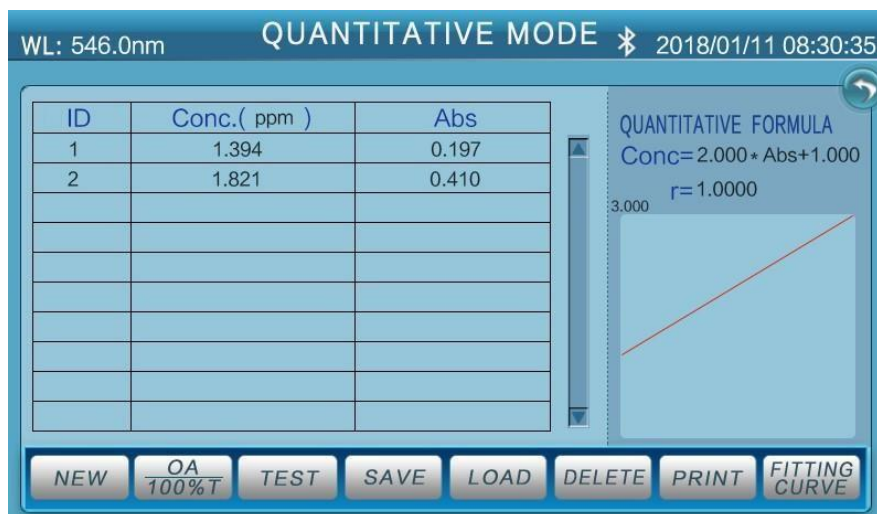
Put the Reference solution in the light path and Press “OA/100%T” to blanking. Then put the Sample solution in the light path and press “TEST.”



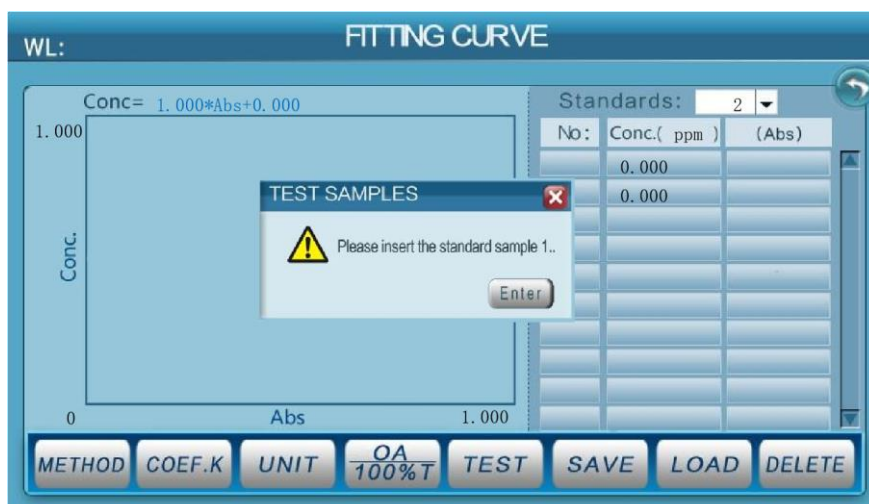
According to the formula: $\text{Conc} = 2.000 \times \text{Abs} (0.197) + 1.000$, at 546nm the Conc. is 1.394 for sample 1.

Establish a standard curve based on concentration

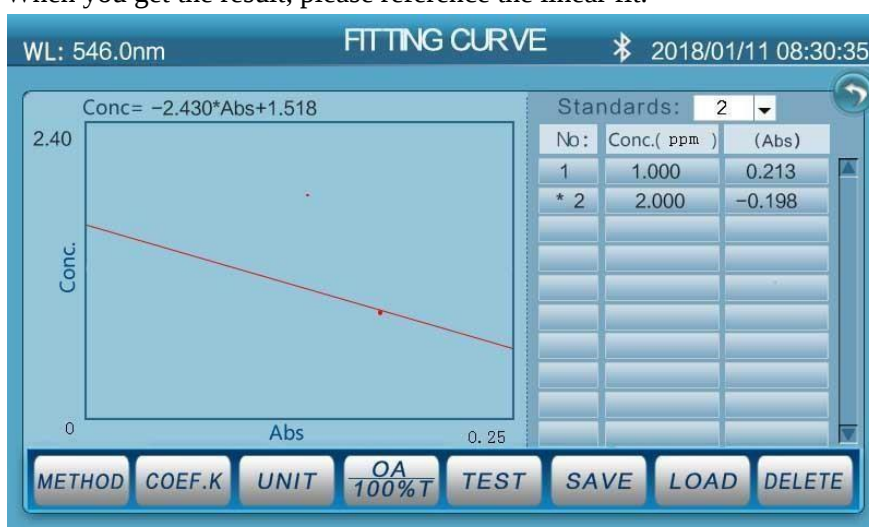
1. Numeric keys to enter the value of the standard concentration of the solution



2. Put the reference into light path, set the wavelength, and blank it. Then pull the rod to each sample, to get the sample Abs and curve fit.



When you get the result, please reference the linear fit.



To print the result, setup the Bluetooth printer (as shown in page 31) then press the **PRINT** button.

Quantitative Test Report

Date&Time:2018/03/29 10:36:00

Conc=1.000*Abs+0.000

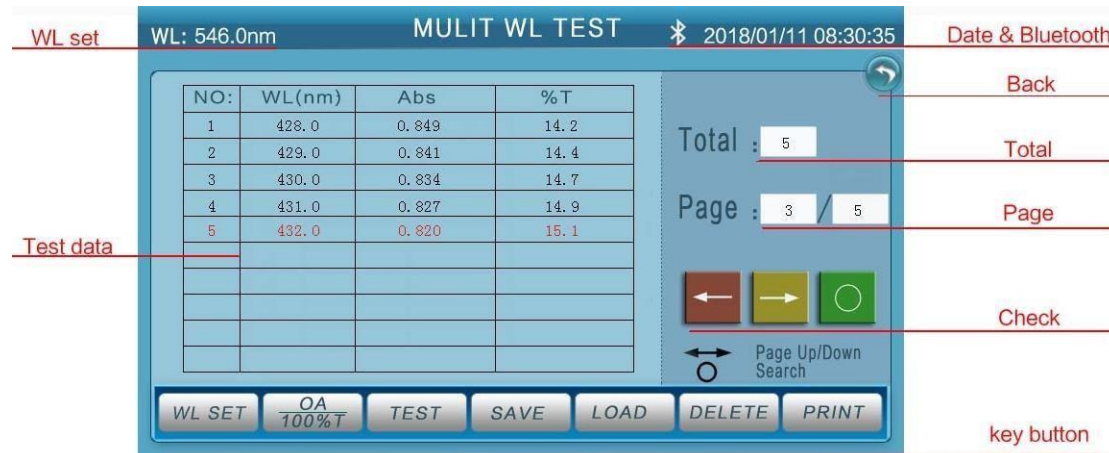
R=0.0000

Wavelength:546.0nm

Nopm bs (eff) Conc (ppm)

Multi Wavelength

Press Multi-WL into the test interface.



Press WL SET to set test WL, maxim 10 WL.

After first WL point set finish press OK, it will automatically jump to next WL, press ESC to stop WL input.



Wavelength change and delete:

After finish WL setting, user can change or delete WL.

1. Press the wavelength you want to change or delete.
2. See right side test WL number, and do the change or delete.
3. If user deletes the WL, system will automatically move the next test number up.

After WL SET, press BACK to back to the test interface.

At Multi-WL test interface, press OA/100% T to blanking, the system will blank all WL set before. After blanking, put the sample into the light path and press test. System will automatically test all wavelength user set.

WL: 546.0nm

MULIT WL TEST

2018/01/11 08:30:35

NO:	WL(nm)	Abs	%T
1	546	0.017	96.2
2	550	0.020	95.5
3	1000	0.254	55.7
4	570	0.025	94.4

Total : 4

Page : 3 / 5

Page Up/Down Search

WL SET

OA
100%T

TEST

SAVE

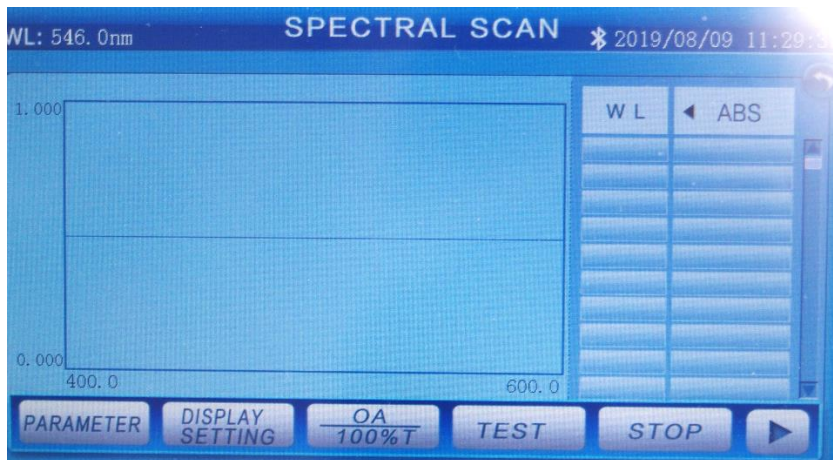
LOAD

DELETE

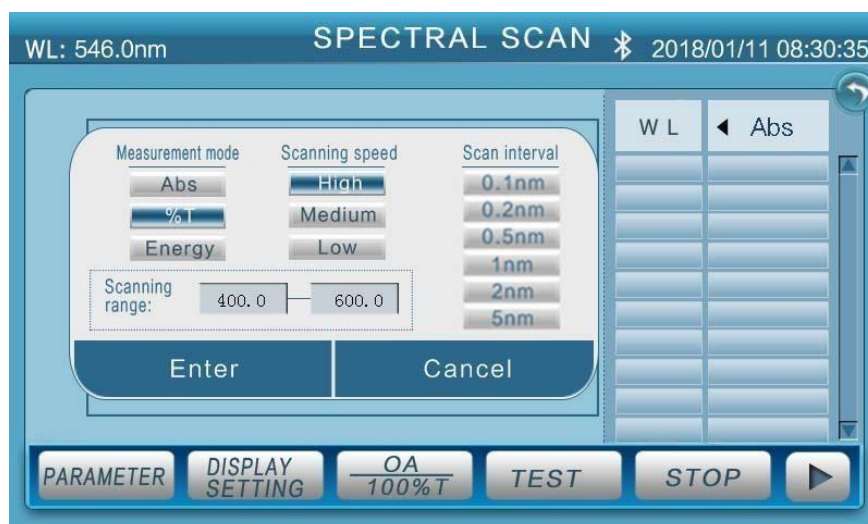
PRINT

Spectral

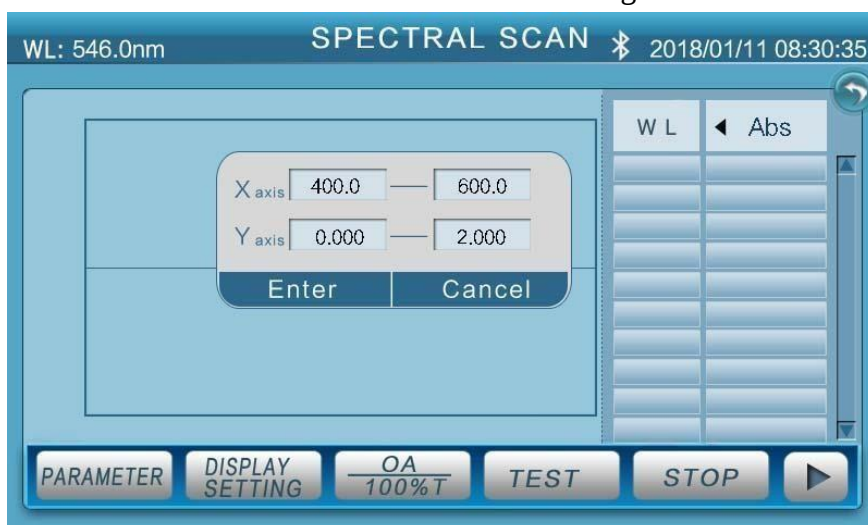
Press **Spectral** in main menu for WL Scan test.



Press **“PARAMETER”** for WL Scan range, scan mode, scan speed and scan interval.



Press **“DISPLAY SETTINGS”** for the WL range and Abs / %T.



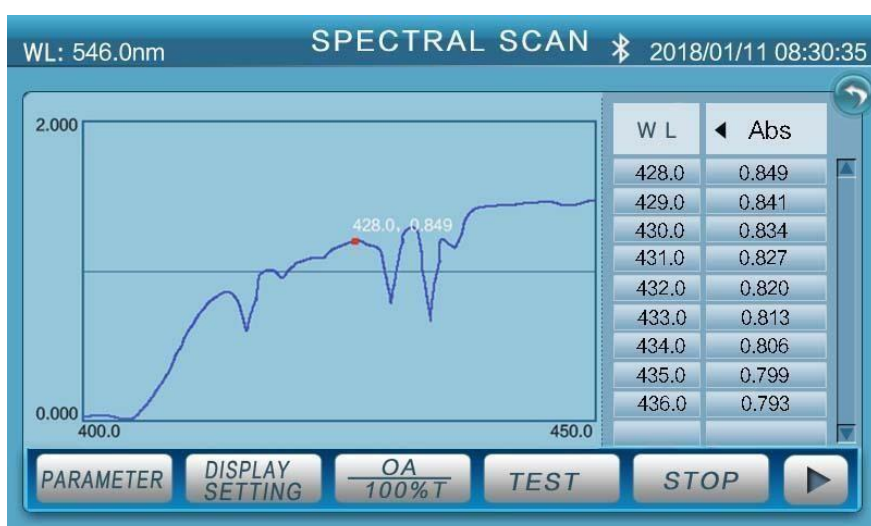
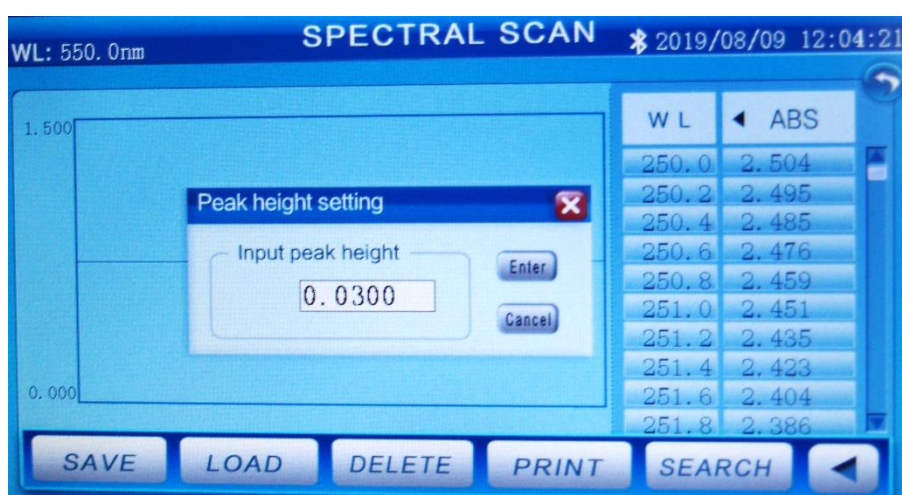
After inputting the settings, press 0A/100%T to scan the baseline/blank, then put sample into light path, press “**TEST**” to scan the sample. If the user wants to stop the scan, press “**STOP**,” then press “**ENTER**.”

Graph processing Change the ruler

After you finish scanning, you can press “**DISPLAY SETTINGS**” to change the X and Y axis. Touch any point of the graph and see the result.

Graph search

Press “**SEARCH**” to search the peaks. You need set your own peak height.





Store, print, load, delete

1. After you finish the sample scan, you can press **SAVE**, then enter the file name to save the graph.
2. Press **LOAD** and choose the file to load a scan and it will show on the screen.
3. To print the result, setup the Bluetooth printer (as shown in page 31) then press the **PRINT** button.
4. To delete previously saved data, press "**DELETE**," then press "**ENTER**."

Wavelength Scan Test Report

Files name:

Date&Time: 2019/08/08 14:12:34

Scan from: 250.0nm

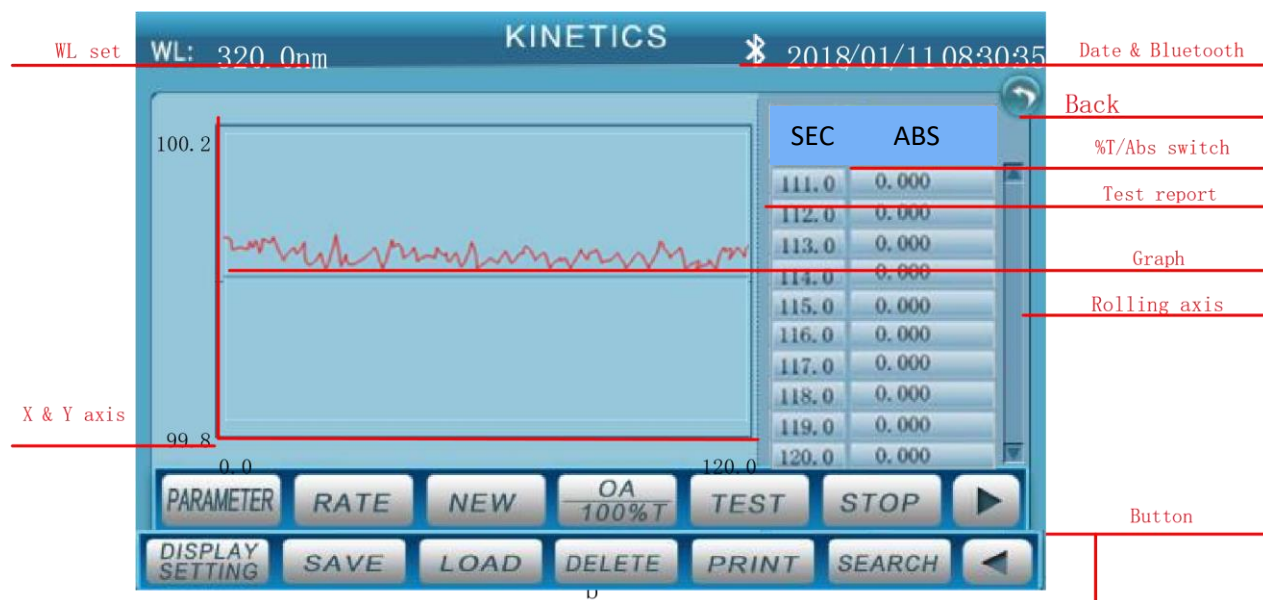
Scan to: 550.0nm

Scan step: 0.2nm

Peak Height: 0.0300 Abs

Kinetics

Press Kinetics to go to the kinetics test interface.



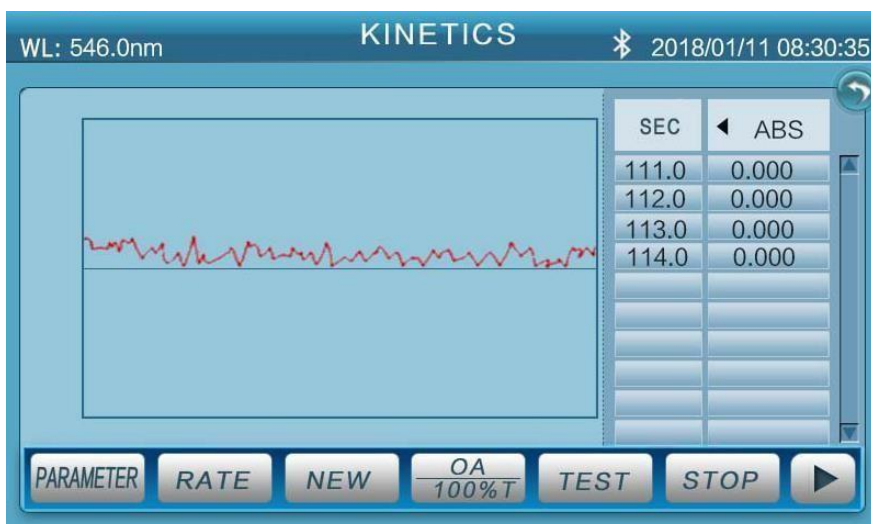
Parameter settings

When you get into the kinetics interface, press **PARAMETER** to set WL, scan time and scan interval.

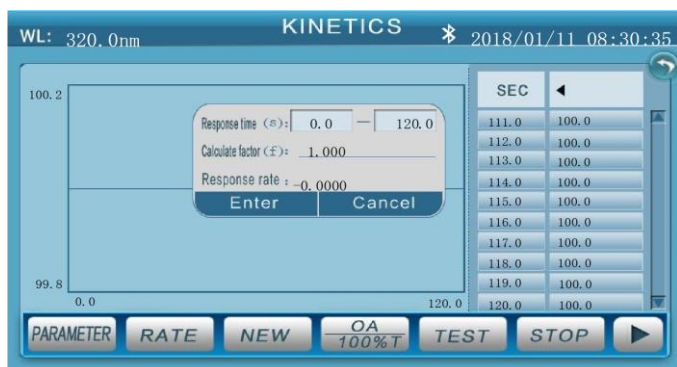


TEST

1. After setting the parameters, put the reference into light path and press OA/100%T blanking it.
2. Put the sample into light path, and press TEST to start. After finishing the test the buzzer will sound two times and show the test result.



- After test has finished, you can press **RATE** to observe the Kinetic reaction rate calculation. Input the response time and calculate factor, then press **ENTER** to get the response rate.



After you finish the sample, you can press **SAVE**, then enter the file name to save the graph.

Press **LOAD** and choose the file to load and it will show on the screen.

To print the result, setup the Bluetooth printer (as shown in page 31) then press the **PRINT** button.

To delete previously saved data, press "**DELETE**," then press "**ENTER**."

Kinetics test Report

	NO.	Time (s)	Abs	%T
1.	0.0	0.000	99.98	
2.	0.0	0.000	99.98	
3.	0.0	0.000	99.97	
4.	0.0	0.000	99.97	
5.	0.0	0.000	99.98	
6.	0.0	0.000	99.99	
7.	0.0	0.000	99.98	
8.	0.0	0.000	99.96	
				
9.	0.0	0.000	99.98	

DNA/Protein – M509T Only

Press DNA in main menu for DNA/Protein

The screenshot shows the 'DNA/PROTEIN' measurement screen. At the top, it displays 'WL: 600.0nm', a Bluetooth icon, and the date/time '2018/03/27 10:05:0'. Below this is a table with columns: ID, 260.0nm, 280.0nm, 320.0nm, C-DNA, Protein, and DNA Ratio. The first row contains the values: 0.140, 0.174, 0.053, 0.114, 12.210, and 0.072. Below the table are buttons: SELECT, OA/100%T, TEST, SAVE, LOAD, DELETE, and PRINT. A 'Back' button is also visible in the top right corner.

ID	260.0nm	280.0nm	320.0nm	C-DNA	Protein	DNA Ratio
	0.140	0.174	0.053	0.114	12.210	0.072

Parameter setting / measurement method

Press **SELECT** to go to parameter settings.

The screenshot shows the 'DNA-Test Method' settings dialog box. It has two tabs: 'WL Set' and 'Coefficient Set'. Under 'WL Set', there are fields for 'Test WL1' (260.0), 'Test WL2' (280.0), and 'Reference WL' (320.0). Under 'Coefficient Set', there are fields for 'Unit' (ppd), 'Ratio' (1.000), 'DNA f1' (62.900), 'Protein f1' (1552.000), 'DNA f2' (36.000), and 'Protein f2' (757.300). There are 'Cancel' and 'Enter' buttons at the top right of the dialog box.

Settings

To use a simpler or different algorithm, you can enter your own values for f1-f2.

“Absorbance difference 1” is for testing at the wavelength 260nm, 280nm and 320nm (optional) and the “Absorbance difference 2” is for testing at the wavelength 260nm, 280nm and 320nm

Set DNA factor

The instrument has default factor calculation values, which can be altered by the customer.

Unit= Concentration unit;

DNA-f=DNA default;

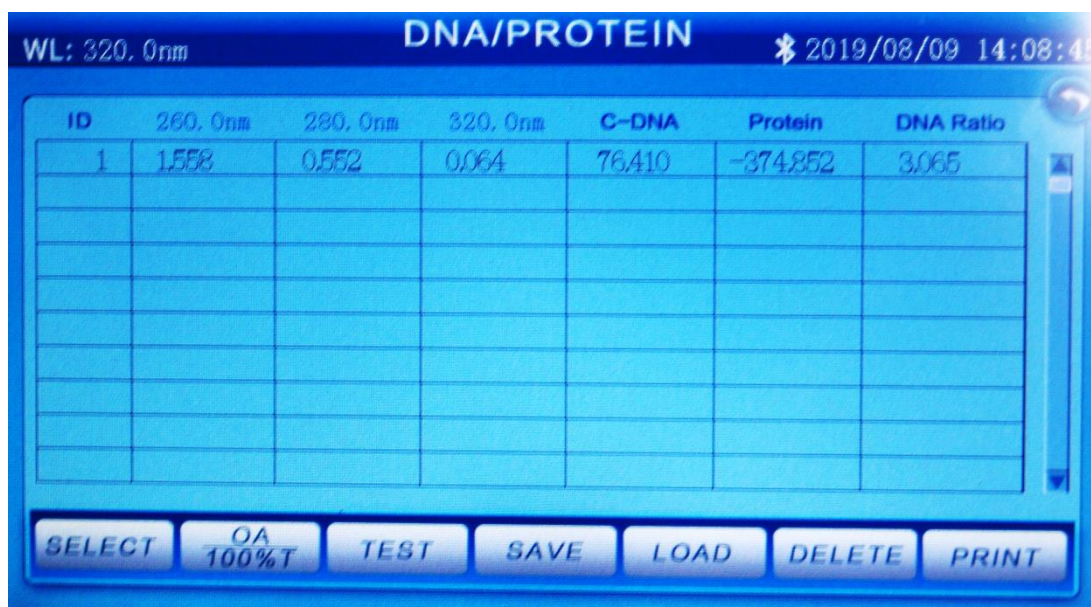
Ratio= Absorbance ratio; Protein=Protein default;

Then select with/without reference. If selected with reference (no), the A ref. will be

“0”

Test

1. Put the reference into light path. Press OA/100% to blank it.



The screenshot shows the instrument's display with the title "DNA/PROTEIN" and a date/time stamp "2019/08/09 14:08:45". The wavelength is set to "WL: 320.0nm". Below the title is a table with 7 columns: ID, 260.0nm, 280.0nm, 320.0nm, C-DNA, Protein, and DNA Ratio. The first row contains the values 1, 1.558, 0.552, 0.064, 76.410, -374.852, and 3.065. Below the table are several control buttons: SELECT, OA 100%T, TEST, SAVE, LOAD, DELETE, and PRINT.

ID	260.0nm	280.0nm	320.0nm	C-DNA	Protein	DNA Ratio
1	1.558	0.552	0.064	76.410	-374.852	3.065

2. Put the sample into light path, press TEST to get the result.

Save, print, load and delete

After you finish the sample, you can press **SAVE**, then enter the file name to save the graph.

Press **LOAD** and choose the file to load and it will show on the screen.

To print the result, setup the Bluetooth printer (as shown in page 31) then press the **PRINT** button.

To delete previously saved data, press “**DELETE**,” then press “**ENTER**.”

Print data:

DNA/Protein Test		
Report Files name:		
Date&Time:2018/03/29		
12:21:34		
Sample---001		
260nm	0.000Abs	
280nm	0.000Abs	
320nm	-0.000Abs	
C-		
DNA	ppm	ppm
C-Pro	ppm	ppm
Ration		
15.242		

PC Online

Load up the application software and plug your PC into the instrument using a USB cable.

Press **PC Online** on the instrument to connect to your PC via a USB cable.



When connection is successful, the caption will read “Controlled by Computer.”

USB Port

The USB Port on the side of the instrument is for raw data collection from the instrument onto a USB drive. This can be used for data analysis using the application software provided. Refer to software manual on USB drive.

Setting and Calibration

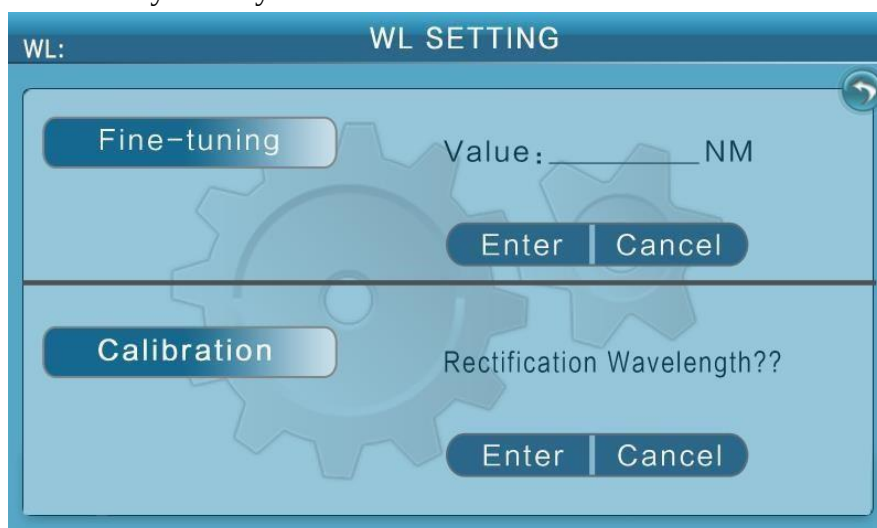
Press **SETUP** to go to the system setting.



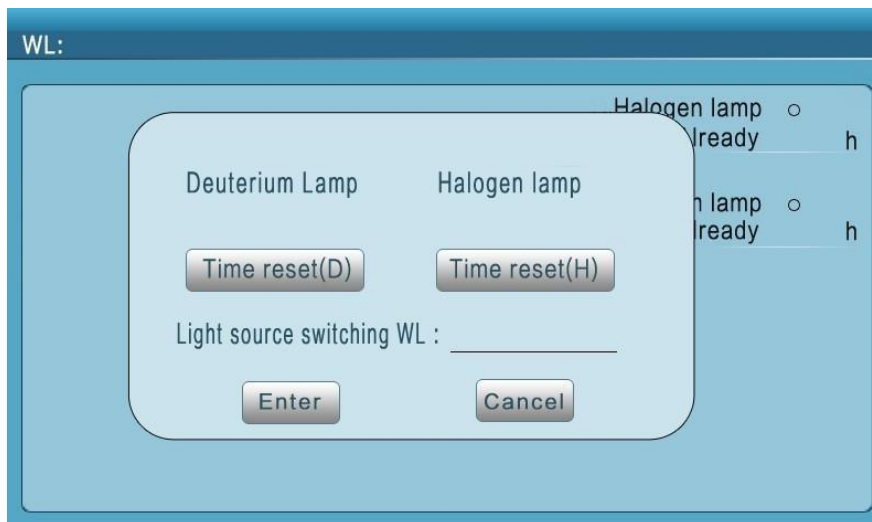
WL calibration

Wavelength fine-tuning should not be adjusted by customer (engineer only).

Wavelength Calibration is to ensure wavelength and test result accuracy and can be run at any time by customer.



Light Management



In the light management, you can turn on or turn of the light source. And reset the lamp usage time.

Set light source switching point, and press Enter.

Note: after switching point is set, you must restart the instrument.

Time setting

In the system setting (SETUP), press TIME SETTING, the numeric keypad will jump up and you can enter the time yourself. ** (year) ** (month) ** (day) , ** (time) ** (min.) ** (sec.) .



Dark current

Dark current test is generally used for zero correction, if absorbance is reading slightly incorrect.

WL:

DARK CURRENT

S/N	Dark current
1	
2	
3	
4	
5	
6	
7	
8	

Test
Dark current

light current

S/N:

—

+

Energy:

Language

Press **LANGUAGE** get into language setting interface.

WL:

LANGUAGE

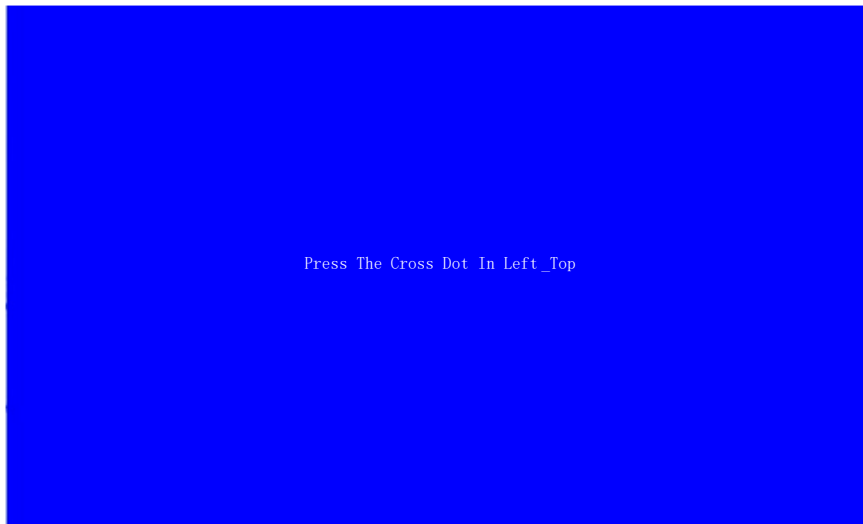
Choose:

≡ Chinese (China)

≡ English (America)

Touch screen calibration

Press Touch Correction to go to touch screen calibration, follow the prompts on the screen.



Factory Value

In the system SETUP press Factory Value to restore factory default settings. This is for engineers only. Under no circumstances should the customer restore the factory values.



Bluetooth

In the system SETUP, press Bluetooth to go to Bluetooth interface.



Press **Find** to find the device you want to connect i.e. Bluetooth printer.

Once device is found, press **NAME** to edit the device name.

Appendix A - M509T Only

Appendix A

DNA/Protein Test Algorithm

Test Name	Method	Wavelength(s)	Calculations	Parameters	Displayed Units
DNA MEASUREMENT					
DNA/Protein Concentration and DNA purity	Absorbance difference (260,280)	$A_1=A_{260nm}$ $A_2=A_{280nm}$ $A_{ref}=A_{320nm}$ (optional)	DNA concentration: $(A_1-A_{ref})f_1-(A_2-A_{ref})f_2$ Protein concentration $(A_2-A_{ref})f_3-(A_1-A_{ref})f_4$	$f_1=62.9$ $f_2=36.0$ $f_3=1552$ $f_4=757.3$	DNA: μ g/ml Protein: μ g/ml
	Absorbance difference (260,230)	$A_1=A_{260nm}$ $A_2=A_{230nm}$ $A_{ref}=A_{320nm}$ (optional)	DNA concentration: $(A_1-A_{ref})f_1-(A_2-A_{ref})f_2$ Protein concentration $(A_2-A_{ref})f_3-(A_1-A_{ref})f_4$	$f_1=49.1$ $f_2=3.48$ $f_3=183$ $f_4=75.8$	
	Absorbance ratio	$A_1=A_{260nm}$ $A_2=A_{280nm}$ or A_{230nm} $A_{ref}=A_{320nm}$ (optional)	$\text{Ratio} = \frac{A_1 - A_{ref}}{A_2 - A_{ref}}$	None	No units(ratio)

Fault Finding

PROBLEM	POSSIBLE	SOLUTION
Instrument Inoperative	Power cord not connected to outlet.	Plug instrument in.
	Dead power outlet.	Change to a different outlet.
	Internal fuse blown or defective electronic component.	call an authorised service engineer.
	Improper power input.	Check the power supply (100v-230v).
Instrument cannot set 100%T (0.000A)	Light beam blocked.	check sample holder. See if holder is properly positioned and nothing is blocking light path.
	Lamp is misaligned.	Check to see if light is focused properly on entrance slit of the monochromator. Call Technical Service for details.
	Lamp light is weak or lamp is defected.	Replace the lamp.
	Defective electronic component.	Call an authorised service engineer.
Incorrect T% to Absorbance correlation	Bubbles or particles in solution.	Check sample preparation and analytical procedure.
	Defective electronic component.	call an authorised service engineer.
Display does not change regardless of sample concentration	Concentration reading frozen".	Sample solution too dark, dilute it and redo the measurement.
	Wrong wavelength setting.	Check sample procedure and wavelength setting.
	Insufficient sample volume.	Fill cuvette with more sample solution.
	Stray sample preparation vapors.	Prepare the sample away from the instrument. use proper ventilation.
	Bubbles or particles in solution.	Check sample preparation and analytical procedure.
	Defective electronic component or loose wiring.	Check wiring connections; call an authorized service engineer.
Instrument drift and noise	Lamp not adjusted properly. (misalignment).	Check lamp has been properly installed or has moved during transit
	Lamp old or defective.	Replace with a new lamp
	Power to lamp is not stable.	Check the power supply PCB to the lamp
	Defective or dirty detector or defective electronic component.	call an authorised service engineer.
Incorrect readings obtained	Insufficient sample volume.	Fill cuvette with more sample solution.
	Wrong wavelength setting.	Check analytical procedure and wavelength setting. Check wavelength accuracy according to procedure in this manual
	Stray sample preparation vapors.	Prepare the sample away from the instrument. use proper ventilation.
	Bubbles or particles in solution.	Check sample preparation and analytical procedure.
	Instrument out of electronic calibration	Call an authorised service engineer.

Error Messages

Error message will display on the LCD screen if an error is detected by the instrument itself. Each error message represents a certain error that occurs during the self-calibration or during operation.

Error Message	Definition (function)	Causes/Solutions
Locating lamp...X	Instrument unable to locate the lamp change-over switch	<i>If D2/halogen change-over motor does not work (M509T Only)</i> 1) J3 connector on CPU and motor cable maybe loose 2) D2/halogen motor is malfunctioning 3) U3 Chips (TD62083) on is defective. <i>If D2/halogen change-over motor works</i> 1) J9 connector on CPU and micro-switch cable maybe loose 2) micro-switch maybe malfunctioning
Locating filter...X	Instrument unable to initialize and/or locate the secondary filter	<i>If the Filter wheel driving-motor does not work</i> 1) J17 Connector on CPU and motor cable maybe loose. 2) Filter driving motor maybe defective 3) U3 (TD62083) on the CPU maybe defective <i>If Filter driving motor works</i> 1) J4 connector on CPU and filter opt coupler cable maybe loose. 2) Opt-coupler (ST178) maybe malfunctioning
WL Zero-order!		1. Light beam alignment is off or is blocked 2. Halogen lamp is off or dead. 3. Filter wheel is malfunctioning and incorrect filter is brought into the optical path.
Sys energy low!	Pass system calibration and WL calibration but detects light beam energy low.	Energy to the detector is low. The 0-order energy count is less than 35000 1. Light beam alignment is off 2. Filter wheel is malfunctioning and incorrect filter is brought into the optical path.
WL Sensor 1...X	Unable to locate the WL calibration starting point	<i>Show "WL sensor 1 ...X" after humming(jamming):</i> Wavelength bar starting sensor is malfunctioning or dead and the bar may be jammed at the bar-front end. 1) Check the sensor 2) Move the WL bar out of jam by pulling the WL driving belt counter clockwise manually

WL Sensor 1...X(continued)	Unable to locate the WL calibration starting point	Show” WL sensor 1 ...X” without humming: If Wavelength-driving motor does not work, 1) J11 connector on CPU or the motor cable maybe loose. 2) Wavelength-driving motor is defective. 3) U8 (TD62064) on CPU is defective. If wavelength-driving motor works, 1) J5 connector on CPU for Opt coupler maybe loose. 2) WL Opt coupler (GK102) is malfunctioning.
		3) Light beam is misaligned or blocked failing to reach the detector. 4) Lamp is off/dead 5) Detector PCB malfunctioning (dark current either
WL Sensor 2...X	Wavelength bar reaches the back end and triggers the backend protection sensor	1. WL driving motor is malfunctioning and running reversely 2. WL bar protection micro-switch is defective
System calibration...X	Unable to complete system calibration	If Wavelength-driving motor does not work, 1) J11 connector on CPU or the motor cable maybe loose. 2) Wavelength-driving motor is defective. 3)U8 (TD62064) on CPU is defective. If wavelength-driving motor works, 1) J5 connector on CPU for Opt coupler maybe loose. 2)WL Opt coupler (GK102) is malfunctioning. 3)Light beam is misaligned or blocked failing to reach the detector. 4)Lamp is off/dead 5)Detector PCB malfunctioning (dark current either negative or too high)
Energy low!!		Lamp not on or dead 1) Light is on but light beam fails to reach detector 2) Light may be blocked 3) Reference is too dark 4) Light optical path miss-aligned: not focused on entrance slit; or internal optics off aligned to cause light beam not out from the exit slit to sample compartment. 5) Secondary filter positioning is malfunctioning Detector PCB malfunctioning (dark current too small or negative or the board is defective)
Energy high!!		1. Secondary filter positioning is malfunctioning 2. Detector PCB malfunctioning (dark current either too high or the board is defective)

Lamp Replacement

Halogen Lamp Replacement M509T

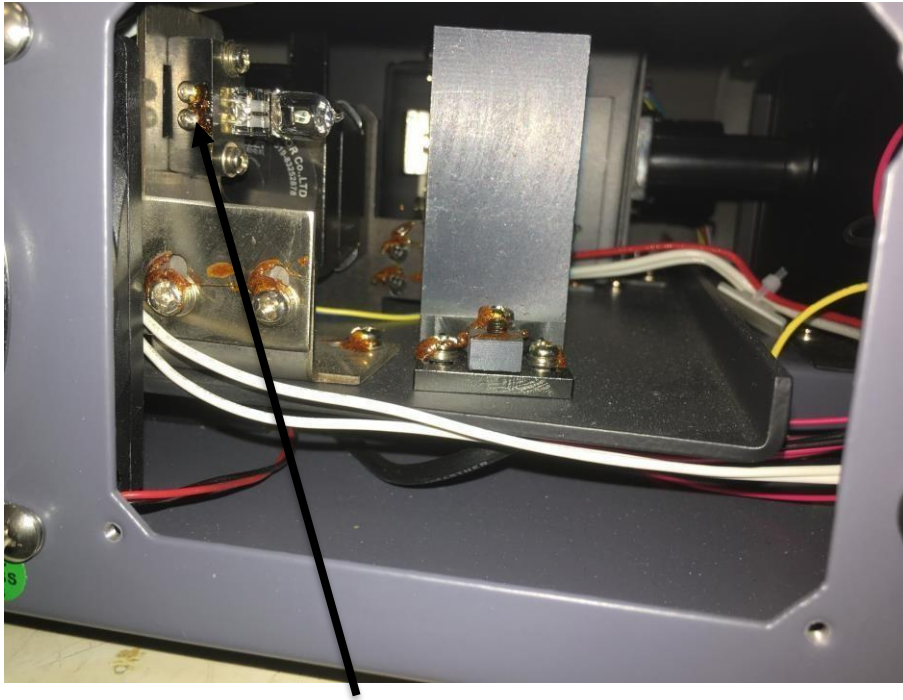
CAUTION: The lamp may be very hot. Ensure to take precautions to prevent possible burns.

CAUTION: Do not handle the lamp with bare fingers. Use tissue or cloth when handling the lamp. The oil from your fingers can cause the lamp to burn out prematurely.

- 1 Use screwdriver to loosen M3 screws and remove the cover on the back of the instrument.



- 2 Loosen the 2 lamp-securing screws (M2). Pull the bulb out and replace with a new lamp (12V 20W) of the same type. The filament type must be identical. Secure the new lamp with the locking screw. Tight it firm but do not over-tight to avoid damaging or breaking the lamp



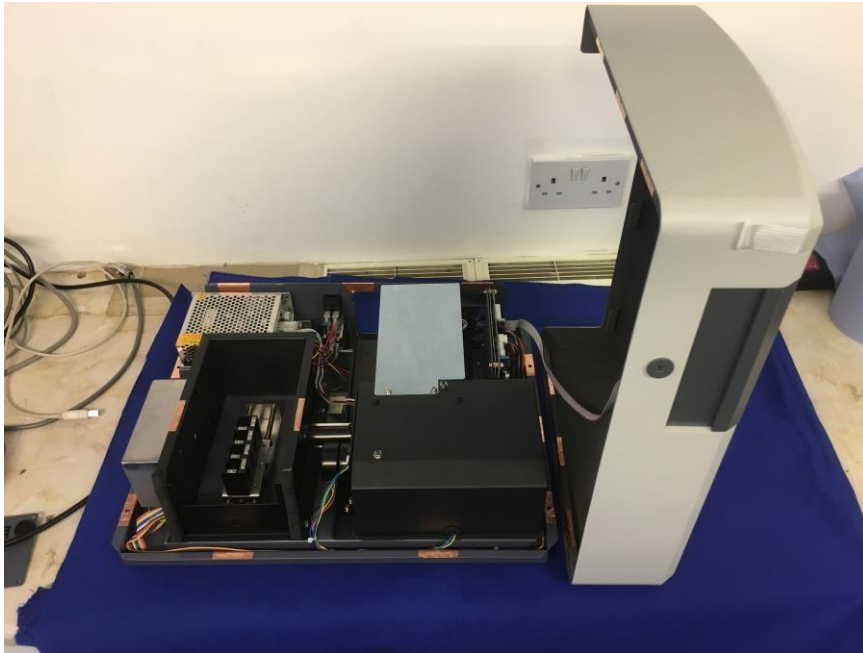
M2 Screws

Halogen Lamp Replacement M209T

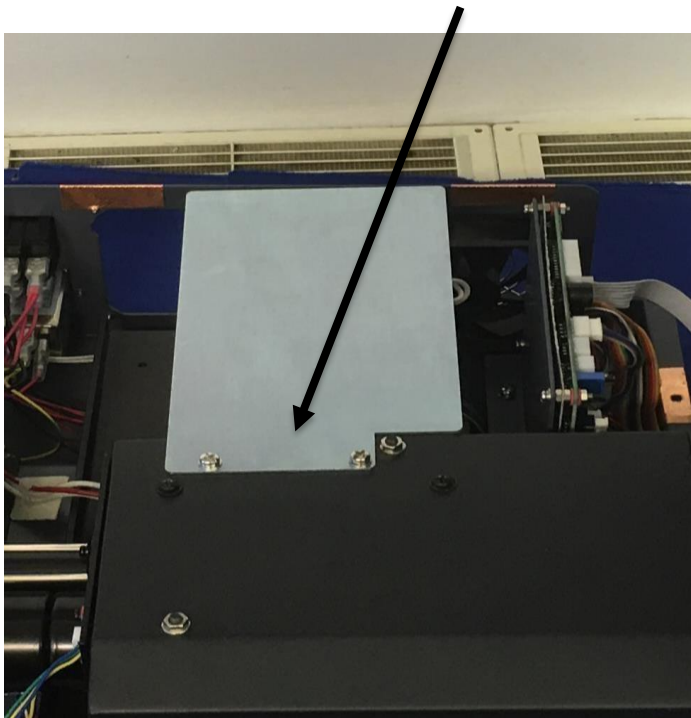
1. Switch off the instrument and disconnect the power cable.
2. Use screw driver to loosen M3 screws (see the picture below) and take off the upper case.



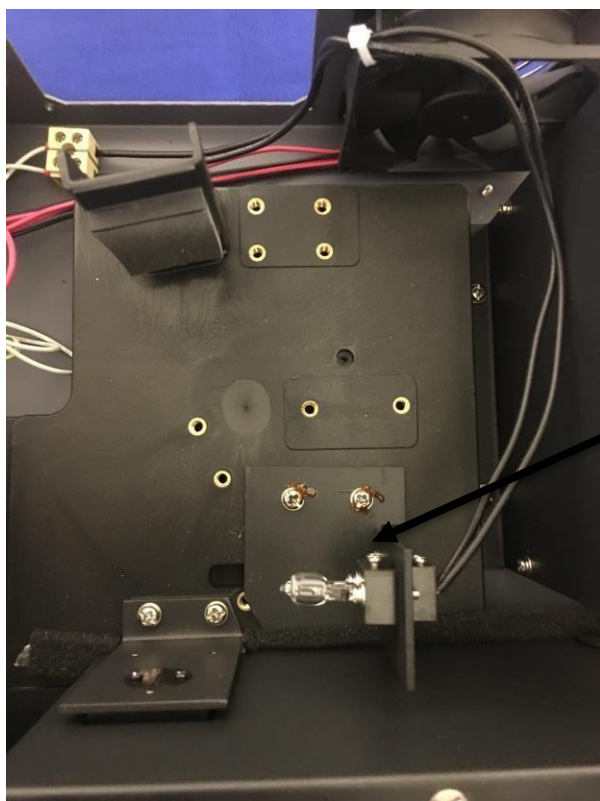
3. Place top cover as below diagram being careful with the cables on the right hand side of the instrument.



4. Use screw driver to loosen 2 x M4 screws and remove protective cover.



5. Loosen the 2 lamp-securing screws (M2). Pull the bulb out and replace with a new lamp (12V 20W) of the same type. The filament type must be identical. Secure the new lamp with the locking screw. Tight it firm but do not over-tight to avoid damaging or breaking the lamp.



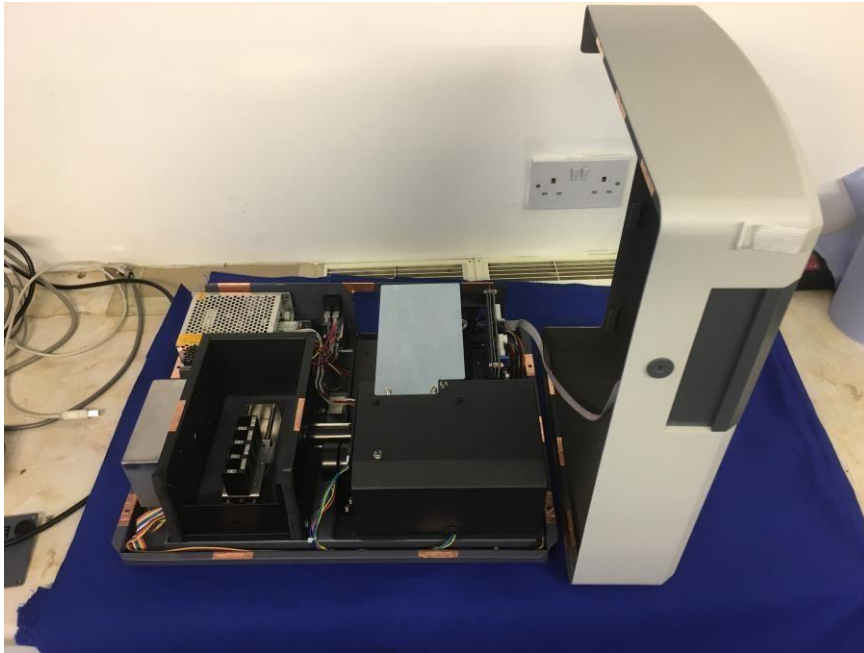
M2 Screws

Deuterium lamp Replacement M509T

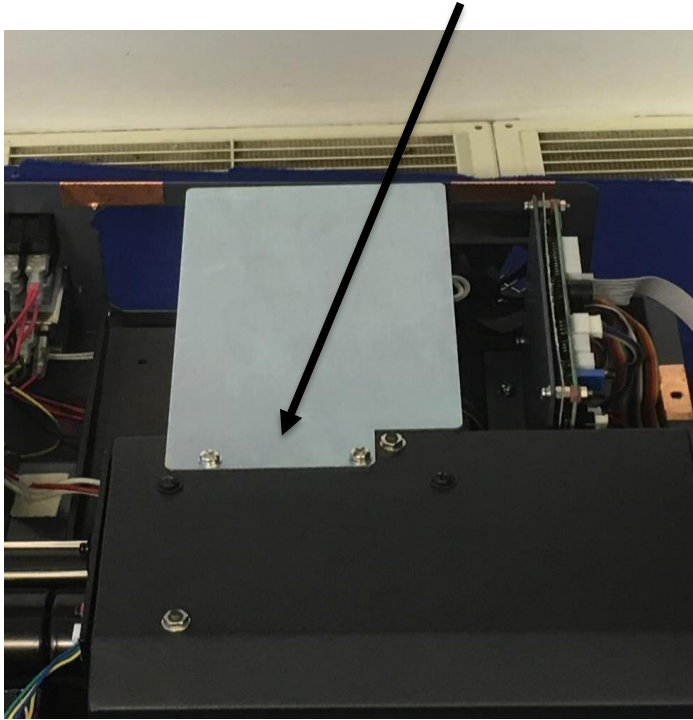
- 1 Switch off the instrument and disconnect the power cable.
- 2 Use screwdriver to loosen M3 screws (see the picture below) and take off the upper case.



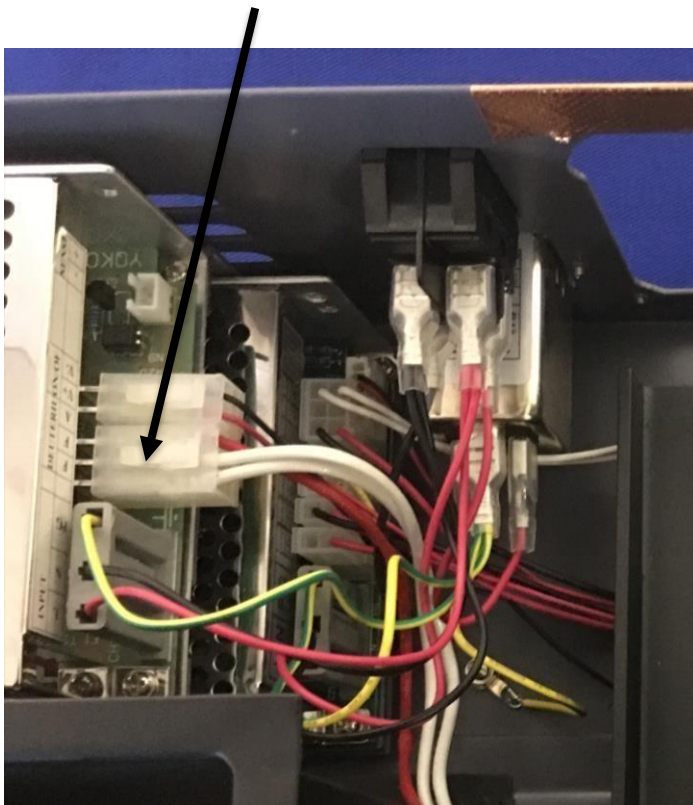
- 3 Place top cover as below diagram being careful with the cables on the right side of the instrument.



- 4 Use screw driver to loosen 2 x M4 screws and remove protective cover.



5 Unplug the connect cable.



6 Use screw drive to loosen 2 x M4 screws (see the picture below) take out the

lamp. And replace a new one.

