

UV /VIS SPECTROPHOTOMETER



Instruction Manual



Model : LUV - 200B

Labnics Equipment

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Preface

The LUV-200B is an all-purpose UV-VIS Spectrophotometer with scan function. It is widely used in medicine, environmental monitoring, commodity inspection, food inspection, agricultural chemistry, teaching in colleges and universities, metallurgy, geology, machine manufacturing, and petrochemical industries, and is a helpful tool for analysts to carry out qualitative and quantitative analysis of materials.

The main features of the LUV-200B are as follows:

- Fully automated operations: automatic change-over between W lamp and D2 lamp; automatic filter changing; automatic wavelength calibration; W lamp and D2 lamp On/Off auto-control; automatic zero and 100%T adjustment.
- Automatic peak-picking; easy operations for replacing W lamp and D2 lamp.
- Friendly interface; abundant operation prompts; convenient and fast operations.
- Blue LCD display module with 320×240 large screen.
- Economical embedded single-chip micro-processor control system.
- Rich and powerful functions:
 - I. Five basic measurement modes: WL Scan (A, T, E), Photometric measurement (Fixed WL measurement, A, T), Quantitation (Concentration Measurement, A, C), Time Scan (Kinetics Measurement, A, T), Real Time Measurement (A, T, C, E);
 - II. Powerful spectrum processing functions: Spectrum Save, Spectrum Load, Peak-Valley Pick, Derivative Spectrum, Data Printing at Intervals, Activity Calculation, Cursor locating, Spectrum Zooming, A-T Conversion, Spectrum Printing;
 - III. Data Processing functions: data save, data looking up, data deleting and data printing, etc.;
 - IV. Cell error can be corrected;
 - V. Parameters can be saved for a long time after turning off the instrument;
 - VI. Spectrum and data can be stored when sudden power failure occurs;
 - VII. Spectrum and data can be sent to computer via RS-232 interface.

Chapter 1 Installation

Please read the instructions in this chapter carefully before unpacking and installing the instrument.

1.1 Unpacking

When unpacking, please check the packing list to confirm that all items are included and in good condition. Should any parts be missing or damaged, contact the dealer immediately.

1.2 Site requirements

The instrument should be installed in a place that satisfies the following requirements:

- (1) Avoid direct sunlight and ensure adequate ventilation.
- (2) Do not install the instrument where there may be corrosive gas or excessive dust.
- (3) Avoid placement where strong and sustained vibrations occur.
- (4) Keep away from devices that generate magnetic or electric fields, or emit high frequency electromagnetic waves. The instrument should be placed on a stable horizontal weight-bearing workbench. The back of the instrument should be at least 15cm away from the wall to ensure effective ventilation.
- (5) Keep away from high-temperature and high-humidity environments
Operating temperature: 5~35 C
Operating humidity: <85%
- (6) Power supply: AC voltage 220V±22V (110V±10V); Frequency 50Hz±1Hz (60Hz±1Hz); Total power consumption: 180W.
Power supply system required by the instrument should be a three-phase and four-line zeroing protection system.
- (7) To ensure the normal and reliable operation of the instrument, it is better to use a purified regulated power supply.

1.3 Installation

- (1) After unpacking, place the instrument on the workbench.
- (2) Connecting external cables.
 - A. Connect the printer interface cable to the corresponding socket on the main unit (if a printer is equipped).
 - B. Connect the power cords of the main unit and the printer to an AC outlet.

1.4 Inspection after installation

WARNING!

1. In very cold areas, the instrument should be left alone for 8 hours before turning on the power to ensure there is no moisture or condensation inside the instrument and a temperature balance has been achieved.
2. Before turning on the power, examine all cables to ensure correct and secure connections, the compliance of the power supply with the requirements and the security of the earthing of the whole system. The instrument can be turned on and operated when these requirements have been satisfied.

- (1) Turn on the printer (If you want to print). For the mini-printer, just connect the power cord.
- (2) Turn on the spectrophotometer (the power switch is at the right side of the instrument). The instrument model will be displayed on-screen. The tungsten lamp and the deuterium lamp will light in sequence (first W lamp, after 15 sec. D2 lamp).
- (3) After the lamp ignition, the initialisation page will be displayed, as shown in Fig. 1-1.

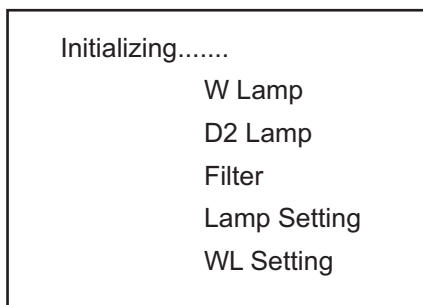


Fig. 1-1 Initialisation page

The initialisation result is displayed after the initialisation process is finished. If initialisation runs smoothly, "OK" will be displayed after each item. Press any key (except "RESET" key) to enter the Main Menu. If a problem was encountered during initialisation, "ERR" will be shown. Proceed according to the prompt on the screen. If "ERR" persists after several initialisation attempts, please contact your local dealer for service. Please refer to Chapter 4 for details of later operations of the instrument.

- (4) Each time you turn on the instrument allow the instrument to warm up for 10-30 minutes after initialisation. Generally speaking, longer preheating time is required for Wavelength Scan and Time Scan measurements; and longer preheating is also needed for high reproducibility of measured data.

Chapter 2 Specifications and Main Functions

2.1 Basic parameters of instrument

Wavelength range	200~1100nm
Range of transmittance (%T)	0%T~220%T
Range of absorbance (Abs)	-0.301A~3.000A
Spectral bandwidth	2nm
Minimum sampling interval	0.1nm
Energy range	0.000V ~ 9.999V

2.2 Main specifications

Wavelength accuracy	0.5nm
Wavelength reproducibility	0.3nm
Stray light	0.3% T (NaI, at 220nm)
Photometric accuracy	0.5%T (0%T ~ 100%T)
Photometric reproducibility	0.3%T
Baseline flatness	0.005A
Drift	0.004A/30 min (at 500nm; after preheated)

2.3 Main Functions

1. Self-diagnosis function.

The instrument can automatically recognise most errors (including operation error) and gives out prompts or alarms.

2. Parameters can be saved.

The instrument saves the user-set parameters automatically. The saved parameters will not be lost after power is turned off.

3. Wavelength Scan measurement (WL Scan)

- a) Maximum sample collection points: 4000
- b) Minimum sampling interval: 0.1nm
- c) Maximum scanning speed: 1000nm/min (maximum moving speed: 3000nm/min)

4. Fixed wavelength measurement (Photometric Measurement)

- a) Maximum of nine wavelengths can be measured at one time.
- b) Cell matching error can be corrected.

5. Quantitative Measurement (Quantitation)

- a) Linear regression with least square method. Up to 9 standard samples can be input.
- b) Factors of calibration curve can be input directly to obtain concentration value.
- c) Adjust decimal numbers automatically according to concentration range to ensure correct relative deviation.
- d) Cell matching error can be deducted.

6. Kinetics measurement (Time scan)

- a) Time range: 0 ~ 6000 sec. (min)
- b) Minimum sampling time-interval: 0.1 sec.
- c) Maximum sample collection points: 4000
- d) Cell matching error can be deducted.

7. Real Time Measurement

- a) Always in measuring state; T, A, C, E are refreshed at the same time.
- b) Input wavelength value directly to change wavelength as you wish.
- c) Real-time data can be printed out.

8. Data Process (Photometric Measurement, Quantitation)

- a) Data Lookup
- b) Data Delete
- c) Data Print

9. Spectrum Process (Time Scan, WL Scan)

- a) Save and load spectrum
- b) Spectrum zoom and conversion
- c) Cursor locating
- d) Activity calculation (kinetics spectrum)
- e) Peak-valley pick and derivative spectrum
- f) Print out spectrum curve and print data at intervals

10. System setting

- Control tungsten and deuterium lamp On/Off;
- Set initial wavelength;
- Set the state of the buzzer;
- Re-initialisation can be done to calibrate the instrument.

Chapter 3 Structure

Model LUV-200B Spectrophotometer is comprised of the power supply, light source, monochromator, sample compartment, detecting system, motor control, micro-processor, keyboard and LCD display. An RS232 interface and printer port are available. The block diagram of the instrument is shown in Fig. 3-1. The optical system scheme is shown in Fig. 3-2.

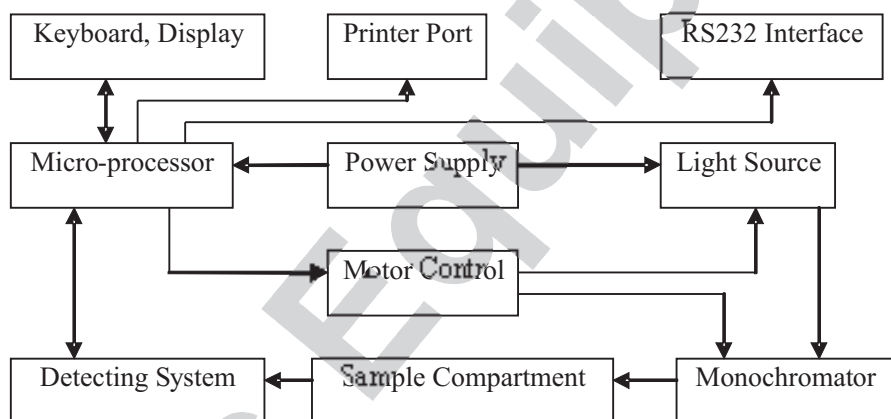
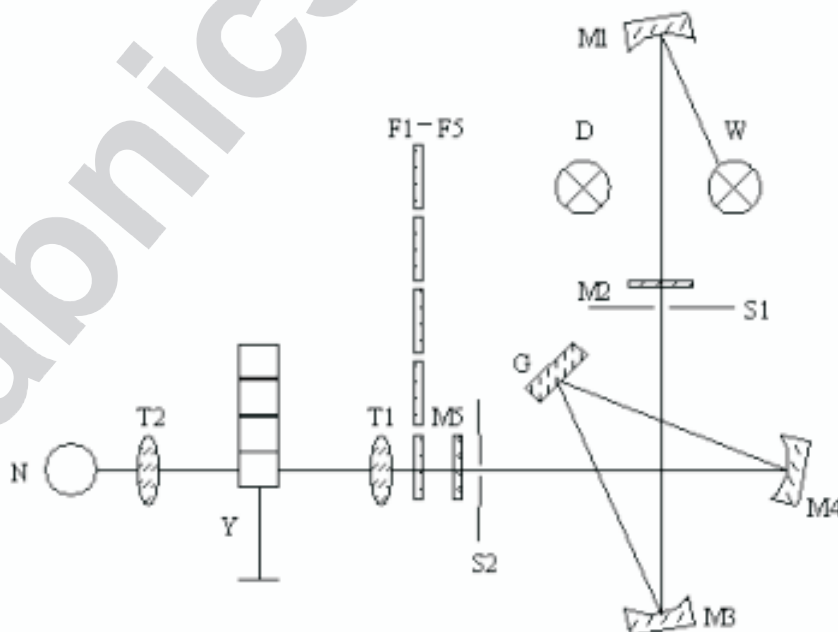


Fig. 3-1 Block Diagram of Instrument



D:	Deuterium lamp	W:	Tungsten lamp
G:	Grating	N:	Receiver
M1:	Collecting mirror	M2:	Protective sheet
M3, M4:	Collimating mirrors	T1, T2:	Lens
F1~F5:	Filters	S1, S2:	Slits
Y:	Sample cell		

Figure 3-2 Optical system

Chapter 4 Operation

Before operation, please pay attention to the following points:

- (1) Operation prompt: If a prompt question appears on the screen, press [CE] key to give a negative answer, or press [ENTER] key to give a positive answer.
- (2) After entering the function operation, be sure not to press the keys unnecessarily, as this may cause malfunction of the instrument.
- (3) When measurements are being performed, the sample compartment door must remain closed.

Note

The rules of data input are:

1. For WL value, T(%T) value, time value in kinetics measurement, and sampling interval, only one decimal digit is permitted;
2. Maximum of three decimal digits are permitted for following values: curve factors K and B, absorbance (A), energy (E), concentration (C) and activity factor;
3. If a parameter is a range, input it in the sequence from small to large

Note

The method for setting parameters is:

1. "Select" type: (working mode, scan speed, wavelength sampling interval, lamp on/off) Move the cursor to the corresponding item by pressing the [↓] and [↑] keys, and select via [←] and [→] arrow keys.
2. "Input & Confirm" type: (WL range, photometric range, Lamp Change WL, etc.) Move the cursor to the corresponding item by pressing the [↓] and [↑] keys. Input the data, which will be displayed on the upper right of the screen. If the entry is incorrect, press [CE] key to cancel. Otherwise, press [ENTER] to confirm. The newly input data will replace the original data.
3. "Input" type: (Total WLs, Total STDs) Move the cursor to the corresponding item by pressing the [↓] and [↑] keys. Input the data.

Please read the following descriptions for the functions and operation of the instrument.

4.1 Main Menu

The main menu is shown in Fig. 4-1. Press corresponding keys to enter different operating modes.

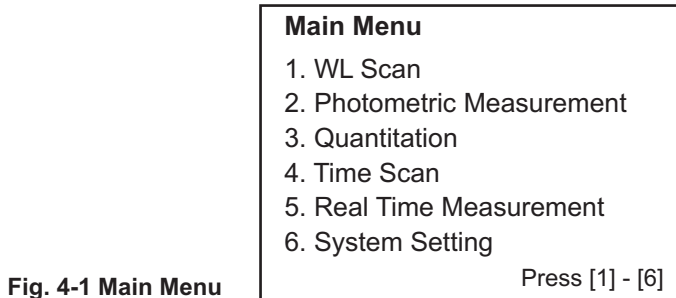


Fig. 4-1 Main Menu

4.2 Wavelength scanning measurement mode

Wavelength scanning may be used for the qualitative analysis of samples. The real-time spectrum of samples will be displayed on LCD and can be printed out or downloaded to computer.

4.2.1. Parameter setting

Before measurement, please verify parameters are set properly.

Press [F1] key in the "WL Scan" page. The parameter setting page will appear on the screen, as shown in Fig. 4-2.

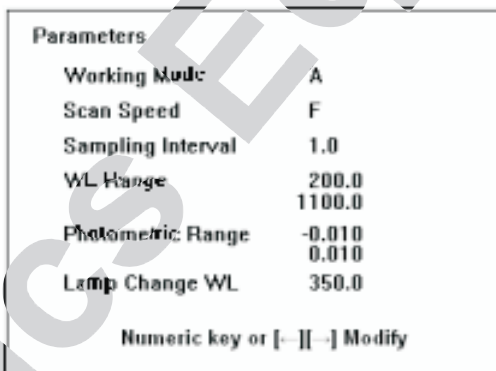


Fig.4-2

Parameter Setting Page in WL Scan Mode

There are two types of parameter settings:

"Select" type: "Working Mode", "Scan Speed" and "Sampling Interval"

"Input & confirm" type: "WL Range", "Photometric Range" and "Lamp Change WL"

Please pay attention to the following points in parameter settings.

A. Photometric range:

This parameter refers to the coordinate range displayed on the screen and is not related to the measurement. If it is selected improperly, the spectrum may not be observed. In addition, the photometric measurement range of the instrument is 0%T ~ 200%T (or -0.301Abs ~ 3.000Abs). If the set range is exceeded, an error will display.

B. Sampling interval:

For complex spectra, smaller sampling intervals should be chosen, as large sampling intervals may yield distorted spectra. However, excessively small sampling intervals will reduce the scan speed and

range. For scanning the full wavelength range, the minimum sampling interval is 0.5nm. Pay attention to select a suitable match of wavelength range and sampling interval. There are six options for sampling intervals setting: 0.1nm, 0.2nm, 0.5nm, 1.0nm, 2.0nm and 5.0nm.

C. Lamp change WL:

Lamp change wavelength can be set within the entire wavelength range, normally at 340 nm ~ 360 nm when measuring absorbance or transmittance.

After setting the parameters, press [RETURN] to go to the wavelength scan main menu.

4.2.2 Scanning measurement

After setting parameters, put the reference and sample to be measured in the sample holder, and close the sample compartment door.

Press [F2] key in the wavelength scan main menu to start measurement.

Using the external sample selection lever, pull the reference or sample into the light path as directed by the prompt on the screen. Press [ENTER] to begin measurement. During baseline measurement, only the current wavelength position is displayed on the screen. For sample measurement, the real-time spectrum, current wavelength and photometric value will be displayed on the screen dynamically.

If the user intends to stop scan measurement, press [RETURN] key to return to wavelength scan main menu. In this case, the temporary spectrum in the instrument will be removed from view.

After the measurement, dynamic display stops. Spectrum processing can be performed.

4.2.3 Spectrum Processing

A. Cursor Moving

Press "←" and "→" keys to set the cursor at the middle of the spectrum. There are two methods of moving the cursor:

- Manual: press "←" or "→" keys to move one data point leftwards or rightwards;
- Rapid: Pressing numeric keys "0" to "4" corresponds to 5 left-moving speed levels, while numeric keys "5" to "9" correspond to 5 right-moving speed levels. Pressing "←" or "→" keys can stop the cursor from moving at any time. If the cursor has moved to one side, it will return to the middle position automatically.

During cursor movement, the wavelength and corresponding A(T) value at the cursor position is displayed at the top of the screen.

B. Spectrum zoom:

Press [F1] key to enter the parameter setting page. Change "Wavelength Range" (The range should not exceed the set range of measurement) and "Photometric Range" by entering new values. Return to the wavelength scan menu and press [DATA] key. The zoomed spectrum will be displayed.

C. A-T conversion:

Change "working mode" between Absorbance (A) to Transmittance (T) in the parameter setting page. Press "DATA" key to convert between A and T in the Wavelength Scan menu.

D. Spectrum Processing page:

Press [F3] key to enter the spectrum processing page. (Save Spectrum, Load Spectrum, Peak-Valley Pick, Derivative Spectrum, Print data at Intervals)

a. Save Spectrum

The instrument can save one spectrum in memory. After another wavelength scan is made, two spectra are present: one is the spectrum stored in the memory (which will not be lost even when the instrument is turned off); the other is a temporary spectrum (which will be lost after the instrument is turned off). To save the temporary spectrum, select "Save Spectrum". As only one spectrum can be saved in the memory, saving a new spectrum will overwrite the previous one.

When the instrument is first turned on and no scanning measurement has been made, the temporary spectrum does not exist. If you click "Save Spectrum" at this time, a prompt "No Spectrum to Save" will appear.

b. Load Spectrum

This function loads the saved spectrum as a temporary spectrum for spectral processing. All spectrum processing operations are done to the temporary spectrum. If no spectrum is in memory, the warning "No Spectrum to Load" will appear. If there is a spectrum in memory and a scan measurement has been made, "Load Spectrum" will overwrite the recent scan spectrum stored in temporary memory. A screen prompt will appear to verify overwriting it.

c. Peak/valley picking

On the upper left of the Peak/Valley Pick page, measurement mode "A" is displayed by default. It can be changed in the parameter setting page. The threshold sensitivity is displayed on the bottom left of the page.

The threshold sensitivity is the smallest difference between peak and valley in each group. Threshold sensitivity is the only standard for peak-valley detection. The threshold should be selected according to users' requirements. Selecting excessively small values will yield too many peaks and slow down determination. Excessively large thresholds can result in no peaks or valleys detected.

Press numerical keys to input the threshold value. Press [ENTER] to confirm.

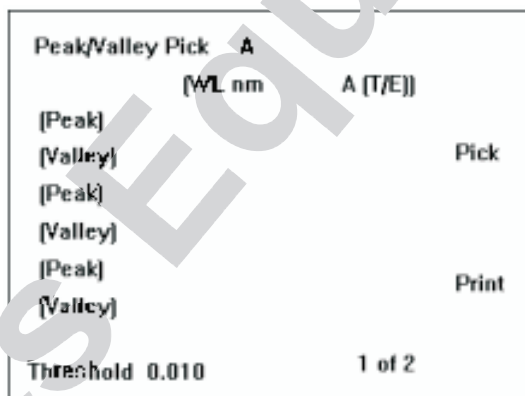


Fig. 4-3 Peak-valley picking menu

After setting up the threshold sensitivity, press [F2] key to start peak picking. The figure shown on the upper right of the screen indicates the percent completion of the peak-picking process. The result includes peak/valley positions and intensity values (as shown in Fig. 4-3).

If several peaks/valleys are detected, a page display at the lower right of the screen ("1 of 2") is indicated. If there are several pages of peak-valley data, press [↓] or [↑] key to change pages.

Press [F4] (Print) key to print the peak-valley picking result.

Press [RETURN] key to return to the wavelength scan main menu.

d. Derivative Spectrum

Select the total number of points used to draw the derivative spectrum (1st order only). The cursor data value is the value from the original spectrum.

e. Printing Data at Intervals

Select number of points for printing interval to print out data at intervals on the spectrum.

4.2.4 Printing

Press [F4] key to print. A prompt line "Printing..." appears on the upper right of the screen. Printing may be slow. To cancel printing, press [CE] key. (Because the system is busy, key response may be slower than usual) If no spectrum prints, verify that the coordinate range is set correctly.

Note!

1. If there is no current temporary spectrum, all functions in "Spectrum Process" except "Load Spectrum" are invalid.
2. Limited by the instrument's storage ability, only one spectrum can be stored in the memory and only one temporary spectrum can be saved before turning off the instrument. After selecting "Save Spectrum", "Load Spectrum" or "Scanning Measurement", original corresponding spectrum will be deleted.

4.3 Photometric measurement mode

Press the numeric key [2] in the main menu to enter the Photometric Measurement mode (Fig. 4-4). Multi-samples at multi-wavelengths can be measured at the same time in this mode. The maximum wavelength that can be monitored is nine. Each wavelength corresponds to each sample.

Photometric Measurement							
No.	WL	T%	A	PARAM	MEAS	PROC	PRINT

Fig. 4-4
The Main Menu of Photometric Measurement Mode

4.3.1 Parameter setting

Press [F1] key in the main menu of photometric measurement mode. The parameter setting page as shown in Fig. 4-5 will appear on the screen.

Parameters	
Cell Corr	OFF
Lamp Change WL	350.0
Total WLS	9
WL1	200.0
WL2	300.0
WL3	400.0
WL4	500.0
WL5	600.0
WL6	700.0
WL7	800.0
WL8	900.0
WL9	1100.0

Numeric key or [-] [-] Modify

Fig. 4-5
Parameter Setting Page in Photometric Measurement Mode

There are three types of parameter settings, which are the same as in the wavelength scan mode:

- "Select" type: "Cell Corr."
- "Input & confirm" type: "Lamp Change WL", "WL1" ... "WL9"
- "Input" type: "Total WLS"

Please pay special attention to the following points:

- A. Total Wavelength number (Total WLS): After "Total WLS" is set, the total number of WL and the WL values shown will refresh automatically. The measurement runs in the set wavelength sequence. Setting the wavelength values in order of increasing wavelength will speed up measurements.

B. Cell Correction:

If cell correction is turned "On", cell correction measurement will be performed before running the sample measurement.

Method:

Set "Cell Corr." to "On". Press [F2] in photometric measurement page. The prompt "Cell Correction" will appear on the screen. Press [ENTER] to proceed. The instrument will ask you to input the number of total cells (n) to be matched, excluding the reference cell. One cell should be taken as the reference cell. Other cells should be numbered from 1 to "n" (max 9). Press numeric key to input "n" and proceed according to the prompt. To avoid measurement inaccuracies, it is important that during sample measurement the matched cells be put in the same positions in the cell holder where they were during cell correction measurement.

The system displays the cell correction result on the screen after it is made. If cell correction measurement is not satisfactory, press [F2] to repeat. Press [DATA] to call out all cell correction data. Observe the data according to the prompt at the lower right of the screen.

After cell correction measurement is finished, press [RETURN] to go back to Photometric Measurement page to continue the measurement.

4.3.2 Measurement running

Photometric measurement is comparatively simple - it can be considered a special form of wavelength scanning measurement. After setting the parameters, two situations can exist:

- "Cell Correction" is set at "Off". Put the reference and sample in the sample compartment directly and press [F2] to start measurement according to the prompts on the screen. As it is a manual sample cell holder, only one sample can be measured at a time. After one measurement is finished, press [F2] to continue to the next sample.
- "Cell Correction" is set at "On": press [F2] to carry out cell correction measurement first. After cell correction, press [RETURN] to go back to the photometric measurement main menu. There will be prompts shown on the screen. Proceed according to the prompts. After the reference is measured, a prompt "Input Sample Cell NO.:n" will be displayed. Press [ENTER] to confirm the default number "n" or press numerical keys to input a new number. The sample number must be the same as the cell number.

The measured results will be displayed right after the measurements are made.

4.3.3 Data Process

The measured results in photometric measurement mode will be saved automatically, and are numbered in measurement order. 99 data groups can be stored, and each group includes No., WL, T and A values. If the number of groups to be saved exceeds 99, a warning prompt will be displayed on the screen. You can look up, print and delete the saved data.

Press [DATA] key in the photometric measurement page to display all data. Press [↑] or [↓] change the pages displayed.

Press [F3] key to select delete mode. You can delete all the data or just delete the selected one(s).

Press [F4] key to print out data. When measurement is finished, press [F4] to print currently measured results. The serial number printed is that numbered when data is saved, which is different to that shown on the screen. When all data are displayed, pressing [F4] will print out all photometric measurement results.

4.4 Quantitative measurement (Quantitation)

Press [3] key to enter the quantitative measurement menu as shown in Fig. 4-6.

Quantitation			
No.	C	A	PARAM
			MEAS
			CURVE
			PRINT
WL	440.0	Total n	[←] CLR

Fig. 4-6 Quantitation page

4.4.1 Parameters

Press [F1] to enter the Parameters page, as shown in Fig. 4-7.

Parameters		
Cell Corr		Off
Lamp Change WL		350.0
WL		440.0
Total STDs		3
Factors	K	0.640
	B	0.001
Formula		$C=KA+B$
Numeric key or [←] [→] Modify		

Fig. 4-7
Parameter setting
in Quantitation

There are three types of parameters:

"Select" type:

"Cell Corr"

"Input" type:

"Total STDs"

"Input & Confirm" type:

"Lamp Change WL", "WL", "Factors" and "Formula"

Please pay attention to the following points:

- One standard curve (curve formula) is stored in the memory of the instrument. Before quantitation measurement, see if the stored curve meets your requirement or not. If not, set up a new curve yourself. The instrument will save the newly set curve automatically.
- The Cell Correction operations are similar with that in photometric measurement. But in quantitative analysis, the cells can be corrected only at one wavelength point.
- The maximum of 9 standard samples can be used.

4.4.2 Setting up standard curve

Before quantitative measurement, the standard working curve of absorbance A and concentration C ($C = KA + B$) should be set up. After a standard curve is set up, the instrument will save the curve formula automatically. For different kinds of samples and different sample batches, a new standard working curve should be set up. The user should decide if it is necessary to set up a new curve according to the specific application.

There are two methods for establishing standard curves:

- Input factor K and B directly.

In parameter setting, user can input factors K and B directly according to previous experience.

- Set up the standard curve by measuring standard samples.

This method can be performed by first order data regression with the least square method with up to nine standard samples.

Press [F3] in the quantitation main menu to enter the calibration curve page, as shown in Fig. 4-8.

Calibrate Curve			
Std. No	Input C	A	PARAM
1			
2			MEAS
			CURVE
			PRINT
WL 440.0			

The total number of standards to be used can be set in the parameter setting page. The calibration curve, $C=KA+B$, may be established by inputting the concentration of the standards and measuring the absorbance (A), and also by inputting both the concentration and the absorbance directly.

Press " ← " or " → " key to select A or C to be input.

Press [F1] key to set parameters;

Press [F2] key to measure the absorbance A of the standard sample;

Press [F3] key to display the established curve. The factors K, B and R of the curve will be displayed on the screen too.

Press [F4] key to print out the calibration curve and A, C values of the standard samples.

4.4.3 Concentration Measurement (Quantitation)

After setting up the standard working curve, put the reference and unknown sample into the sample compartment. Press [F2] in the quantitation main menu to start measurement according to the prompts on the screen. If the number displayed at "No." column is "n" instead of "1", it means that there are already n-1 groups of data stored in the memory.

The measured data will be saved automatically, and numbered in the sequence of measurement (Max 9). If the number of data groups exceeds 9, the prompt "Memory Full" will appear. In the quantitation main menu and in concentration measurement, a prompt "Total n [-] CLR" is displayed at the lower right of the screen, which means n groups of data have been saved. Pressing "-" will clear out all data. It is suggested that the user print out or record useful values to avoid lost data.

The operations of looking up and printing data are similar to the "Data Process" method in photometric measurement. The only difference occurs when printing-in quantitation mode, all data stored will be printed out directly, including current data and that stored in memory.

4.5 Time Scan Mode (Kinetics Measurement Mode)

This mode is used to observe a sample's variation with time and to calculate the activity value of the sample. It is also used to check the stability and noise of the instrument.

4.5.1 Parameters

Press [F1] to enter parameters page.

There are two types of parameters:

"Select" type: "Time Unit", "Cell Corr."

"Input & Confirm" type: "Sampling Interval", "WL", and "Time Range".

There are two options for Time Unit: min. sec.

In the parameter setup, note:

- A. The measuring time should match the sampling interval. For longer measuring times, larger sampling intervals should be used. If they do not match, an error message will appear on the screen. The user will need to set them again.

B. The Cell Correction operations in Time Scan are similar to photometric measurement, except that cell correction can only be done at one wavelength.

After parameters are set, press [RETURN] key to go back to the time scan measurement page.

4.5.2 Scan Measurement

After setting parameters, put the reference and sample into the cell holder, close the sample compartment door, then press [F2] to start scanning.

Pull the sample cell lever according to the prompt on the screen to complete the entire scanning measurement. When the sample scanning measurement is being made, the real-time spectrum, current time and photometric value will be displayed on the screen dynamically.

You can stop scanning by pressing [RETURN] key and go back to Time Scan main menu. (The temporary spectrum will be cleared).

After the measurement is finished, the dynamic display stops. Perform any spectrum processing and press [F4] to print out the spectrum.

Caution!

The newly scanned time spectrum will overwrite the original one whether it is a time spectrum or a wavelength spectrum. No warning will be displayed before overwriting.

4.5.3 Spectrum Process

Spectrum process operations are similar to WL Scan mode, please refer to the description in WL Scan mode.

4.5.4 Activity Calculation

Press [F3] to enter the Spectrum Process page, select Activity Calculation to display the page in Fig. 4-9.

Activity Calculation		
Time Range:	0.0	CALCU
	1800.0	
Activity Coefficient:	1.000	PRINT
Activity:	[x.xxx]	

Fig. 4-9 Activity Calculation Menu

"Time Range" and "Activity Coefficient" are all "Input & Confirm" type parameters.

After parameters are set, press [F2] to obtain activity value; press [F4] to print out parameters and measured results.

Caution!

During the activity calculation, new results will overwrite the old. As there is no "Save" function, please print out or write them down beforehand (activity factors can be saved in memory).

4.6 Real Time Measurement

This function is relatively easy and simple to operate. If the measured results do not need to be saved, Real Time measurement can be used for Fixed WL Measurement (photometric measurement) and Concentration Measurement (quantitative measurement). The interface is shown in Fig. 4-10.

Real Time Measurement	
T =	
A =	100%T
C =	
E =	PRINT
WL	C = KA+B

Fig. 4-10 Real Time Measurement Page

In this mode, the instrument is in the measurement state all the time. T, A, C and E display refreshes continuously. Press [F2] key to adjust 100% T (Abs 0). Press [F4] to print real time data. To change wavelength, input wavelength value directly and press "ENTER" key to confirm.

Note that the concentration value C obtained in this mode is calculated from the current existing curve formula. If you want to use a new curve, it must be set up in quantitation mode first.

4.7 System Setting

The system setting page is shown in Fig. 4-11. Only "Initial WL" is an "Input & Confirm" type parameter. Others are all of "Select" type.

- A. Lamp On/Off.
- B. Grid: toggle grid background in WL scan and Time Scan spectrum.
- C. Buzzer: If "Yes" is selected, the buzzer will sound after initialisation, scan completion, or any error during the measuring process.
- D. Re-initialise: Setting "Re-initialise" to On will not restart the lamps (not needed for warming up). In this "Re-initialise" process, wavelength calibration and energy peak-picking can be done automatically. If you are not satisfied with the stability, reproducibility or photometric accuracy of the instrument, you can perform "Re-initialise" here. Before "Re-initialise" begins, please make sure nothing blocks the light path in the sample cell. Note that re-initialisation is a bit different from the "RESET" key.
- E. Printer: to set the type of the printer. "Mini" means the system mini printer; "General" means ordinary pin printer, LQ-300K+ compatible.

System Setting V3.1	
W Lamp	: On
D2 Lamp	: On
Initial WL	: 500.0
Grid	: No
Buzzer	: No
Re-initialise	: No
Printer	: Mini

Press numerical keys or [←] [→] keys to modify.

Fig.4-11 System Setting page

Chapter 5 Maintenance

5.1 Items for attention in operation

- (1) All instrument systems must be reliably grounded.
- (2) Where not provided, a regulated power supply with anti-interference and purifying capability should be installed to ensure the stable and reliable operation of the instrument.
- (3) No parts, components and elements of any part of the whole system should be removed arbitrarily.
- (4) The instrument should not be cleaned with organic solvents.
- (5) Pay attention to moisture-proof the instrument in areas of high humidity and temperature. Instruments not used for a long time should be turned on periodically for drying.
- (6) For measurement only in visible range, the deuterium lamp may be turned off after the instrument has passed initialisation in order to extend its operating life.
- (7) To improve the operating performance of the instrument, the manufacturer may make small changes to instruments of the same model. There may be slight differences between instrument descriptions and the actual instrument. Users will not be notified of these modifications.
- (8) The instrument is of Class I safety and is designed and tested according to the "JB5517 - 91 Basic safety requirements for electrical protection of optical instruments". The supplied products are guaranteed for their safety. To ensure safe operation and the safety of the instrument, users must comply with the instructions and items for attention included in this Operating Instruction.

5.2 Measures taken when operation of the instrument is abnormal

When the instrument is in an abnormal state during operation, the user should carefully observe its behaviour and take note for later use by a service engineer.

- (1) When an error prompt appears on the screen of the instrument, carefully check if there is something wrong with the operating method, the parameter settings are well matched, the samples are correct, and the lamp is ignited, etc. If there is no confirmed operator or setting error, attempt operation once again. If the error persists, contact the vendor for further assistance.
- (2) When errors in computer programs are discovered or the system crashes, please check if the installing conditions are correctly followed as described in the operating manual. If the problem persists, contact the vendor or a qualified service engineer.
- (3) If the screen suddenly turns dark and there is no display on the screen when the instrument is on (standby mode), press "RETURN" key or any one of numerical keys (1 ~ 9). Normally the display will be recovered and the measured result will not be lost.
- (4) If the instrument enters a new page from another and some content from the old page is still displayed in the new page beside those of the new page, press "RETURN" to go back to the old page and enter the new page again. Normally, the phenomenon will disappear.
- (5) If there is something wrong with the instrument during operation, first refer to the following troubleshooting table. If the problem cannot be corrected, please contact the vendor or a qualified service engineer.

Error	Possible Cause	Solution
No response when starting the instrument	The plug is loose or the fuse is broken.	Connect the plug well; replace the fuse.
W(D2) lamp error	The W(D2) lamp is damaged. Something is wrong with the W(D2) lamp power supply circuit.	Replace with a new W(D2) lamp. Contact a service engineer.
Filter, lamp setting error	1. The plug is loose; 2. Something is wrong with the motor; 3. The optical coupler does not work.	1. Check the inner plugs and connections & make sure they are connected securely; 2. Replace with a new motor or optical coupler. 3. Contact a service engineer.
Wavelength initialisation error.	1. The light is blocked in the sample cell; 2. The sample compartment door was opened during Initialisation; 3. The wavelength shift is too large.	1. Remove the light-block from the sample cell; 2. Close the sample compartment door during initialisation; 3. Contact a service engineer.
Photometric accuracy and reproducibility are not satisfactory.	1. The absorbance value of the sample is too big (>2A); 2. Glass cell is used in UV range; 3. The cell is not clean enough; 4. The sample cell holder is dirty, etc.	1. Dilute the sample; 2. Use quartz cell for UV range; 3. Clean the cell; 4. Clean the sample cell holder; 5. Contact the service engineer.
"Energy is too low" appears.	1. A light block is in the sample cell; 2. Glass cells are used in UV range; 3. The cell is not clean enough; 4. Lamp change wavelength is wrong; 5. The sample compartment door is not closed during initialisation.	1. Remove the blocking element; 2. Use quartz cells in UV range; 3. Clean the cells; 4. Set lamp change between 340~360nm; 5. Close the sample compartment door and perform initialisation again.

5.3 Replacing Lamps

The Deuterium and tungsten lamps are consumable parts having finite lifetimes. If a lamp's operating time has exceeded the normal operating period, even if it still functions, the light energy and lamp stability will deteriorate. If the stability and reproducibility of the instrument decreases and this cannot be traced to vibration, unstable power supply or other reasons listed in Table 5-1, a lamp change is probably necessary.

The following points should be observed when replacing lamps:

1. When removing the upper cover of the instrument, pay attention not to pull the connecting cable on the cover with force. Do not touch the optical parts inside the instrument.
2. If screws drop into the instrument, take them out immediately to avoid short circuits.
3. During lamp installation, do not touch the lamp window. Fingerprints can contaminate the lamp and lower the output energy. Lamps can be cleaned with alcohol-soaked absorbent cotton and then dried with dry absorbent cotton.
4. When installing the upper cover of the lamp housing and upper cover of the instrument, make sure the connecting cable of the instrument is not compressed or impeded.
5. The lamp wiring should be reliably connected and secured; otherwise the performance of the instrument will be affected.

5.3.1 Replacement of deuterium lamp

- (1) Switch off the instrument; remove the power cord.
- (2) Remove the upper cover of the instrument according to the following procedure:
 - I. Loosen and remove the locking screws located at two sides of the upper cover of the instrument (two screws each side, altogether four screws).
 - II. Lift the instrument cover with care and put it at the left side of the instrument. You can see the lamp housing as shown in Fig. 5-1.

Lamp Housing



Fig. 5-1 Lamp Housing (Outside)

- (3) Detach the upper cover of the lamp housing.
Remove the two screws located on the upper cover of the lamp housing (Be careful! Don't drop the screws into the instrument. It is not easy to retrieve them). Then take off the upper cover of the lamp housing. The positions of D2 lamp and W lamp are shown in Fig.5-2.

D2 Lamp lead wires W lamp lead wires W lamp connection screws

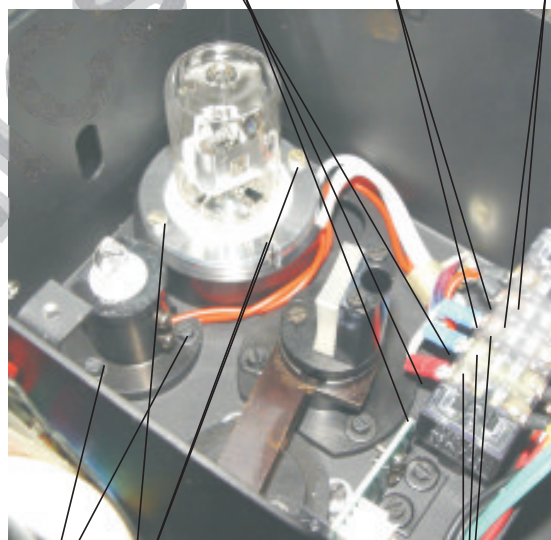


Fig. 5-2 Lamp Housing (Inside)

W Lamp Holding Screw

D2 Lamp Holding Screws

D2 Lamp Connection Screws

(4) Replace the deuterium lamp (refers to Fig.5-2)

- A. Loosen the two connection screws of D2 lamp lead-wires (no need to detach them), and remove the three lead-wires from the connection board (Note: the colour of one lead-wire is different from that of the other two lead-wires, so its installing position must be remembered).
- B. Unscrew the three lamp mounting screws. Remove the deuterium lamp by pulling upwards from the holder.
- C. Insert a new lamp into the base with care. Thread the three lead-wires out from the bottom of the lamp holder to the position on the connection board.
- D. Screw down the three holding screws of the D2 lamp.
- E. Connect the three lead-wires to the connection board securely and tighten the connection screws.
Note: Pay special attention to the colour of the three lead-wires. The three lead-wires should be connected to the corresponding positions on the connection board.

Caution

UV radiation from the deuterium lamp may hurt your eyes and skin. Please do not look directly at the light window. If necessary, adjust the position of the light spot as soon as possible, and avoid long exposure to UV radiation.

(5) Assemble the upper cover of the lamp housing and the instrument.

(6) Switch on the instrument. If initialisation is correct, the replacement of the deuterium lamp is finished.

5.3.2 Replacement of tungsten lamp

1. Switch off the instrument, remove the power cord;
2. Remove the upper cover of the instrument (as described in Section 5.3.1).
3. Remove the upper cover of the lamp housing (as described in Section 5.3.1).
4. Replace the tungsten lamp according the following procedures (refer to Fig.5-2):
 - I. Loosen the two connection screws of W lamp lead-wires (no need to detach them), and take out the two lead-wires from the connection board
 - II. Loosen the two holding screws and remove the tungsten lamp upwards from the holder.
 - III. Insert a new lamp into the base with care. Lead the two lead-wires out from the bottom of the lamp holder to the position on the connection board.
 - IV. Tighten the two W lamp holding screws.
 - V. Connect the two lead-wires to the connection board securely by tightening the connection screws.
5. Assemble the upper cover of the lamp housing and the instrument.
6. Switch on the instrument. If initialisation is correct, the replacement of tungsten lamp is finished.

5.4 Consumable parts and spare parts

Tungsten lamp with holder	20W/12V
Deuterium lamp with holder	L6302-54
Fuse tube	5×20mm; F 3A

Chapter 6 Acceptance of the Instrument

6.1 Items for attention in acceptance check

- (1) Acceptance check should be performed according to Section 1.4 and 6.2 of the Operating Instructions, unless there are special requirements for the instrument specifications and the acceptance check method which were specified in the purchase order.
- (2) This acceptance check method conforms with the stipulations in relevant national standards.
- (3) Since the laboratory conditions provided by users may differ, this acceptance check method is just a basic method provided for users.
- (4) When performing an acceptance check, the laboratory conditions should comply with the requirements in Section 1.2. The instrument should be preheated for 30 minutes after it has been turned on.

6.2 Acceptance check method

6.2.1 Wavelength accuracy and reproducibility

Specification:

Wavelength accuracy	$\pm 0.5\text{nm}$
Wavelength reproducibility	$< 0.3\text{nm}$

A. Setting parameter in wavelength scanning mode

Working mode:	E
Wavelength range:	480nm ~ 660nm
Photometric range:	0.000~1.000 (adjusted based on requirements)
Sampling interval:	0.1nm
Lamp change WL:	800nm (Please resume 360nm after the acceptance check!)

B. Put a blank into the cell as the sample. After obtaining the energy spectrum of the characteristic peaks of the deuterium lamp, observe the maximum value of the two characteristic peaks with the cursor. They should satisfy the requirements of $656.1 \pm 0.5\text{nm}$ and $486.0 \pm 0.5\text{nm}$.

C. Repeat the above measurement three times. The error between the three measured maximum values should be less than 0.3nm.

D. If the above requirements have been satisfied, the acceptance check of this item is passed. Otherwise this check should be performed again after re-initialisation.

6.2.2 Baseline flatness

Specification: 0.005A (200nm ~ 1100nm)

A. Setting parameters in wavelength scanning mode

Working mode:	A
Wavelength range:	200nm~1100nm
Photometric range:	-0.010A~0.010A
Sampling interval:	1nm
Lamp change WL:	360nm

B. Put blanks as both the reference and the sample. After the measurement, observe the measured data with the cursor. The maximum deviation of the spectrum should be less than 0.005A.

C. If the above requirements have been satisfied, then the acceptance check of this item has been successful.

Appendix A

Reference Table of Terms and Abbreviations

Terms and Abbreviations	Explanation
Abs, A	Absorbance
T%, % τ	Transmittance
Conc., C	Concentration (content), unit is decided by standard sample.
E	Energy (normally energy of light source), used only when accepting the instrument
WL	Wavelength (unit: nm)
m, min	Minute (time unit)
s, sec	Second (time unit)
Series interface (port)	Used to communicate with computer. If LUV-200B is connected to a PC, the COM1 should be used.
Spectrum bandwidth	In theory, monochromatic light is required when carrying out material analysis. In practice, the instrument cannot produce pure monochromatic light. Instead, it produces light in a wavelength range with certain wavelengths at the centre. The width of the range is the spectrum bandwidth. The smaller the spectrum bandwidth, the higher the analysis accuracy. For smaller bandwidths, though, stability and reproducibility can deteriorate. If there is no special requirement otherwise, a wider spectrum bandwidth is suggested to ensure higher stability and reproducibility.
Cell Correction	When carrying out material analysis, if higher analytical accuracy is required, error caused by sample cell variance between the reference and the sample should be very small. If the cells are not well matched before using, the cell error can be calibrated through Cell Correction function, but operation regulations must be noted. After performing cell correction, sample cells should not be cleaned again. Otherwise a larger error may be measured. Cells with a matching error less than 1%T should not require cell correction operation.
Std. Curve (Calibration Curve)	The standard curve shows the corresponding relationship between the measured absorbance and concentration. The standard curve can be set up by measuring the absorbance of standard samples of known concentration (normally, the absorbance values of the standards should be less than 1A) or entering the curve factors directly. Generally, concentration values of samples to be measured should be in the range of the standards. The standards used should be distributed evenly across the entire concentration range.

Appendix B

Reference Table for printing terms

Printing Terms	Explanation
Scan Spectrum	Spectrum obtained by scanning
Time	Time, input by user
Operator	Operator, input by user
Reference	Reference used in measurement, input by user
Sample	Sample to be measured, input by user
Sampling interval	
Peak & Valley	peak/valley picking
Threshold	Sensitivity of threshold for peak/valley picking
WL range	Wavelength range
Time range	
Peak	Peak position
P-value	Peak value
Valley	Valley position
V-value	Valley value
Spectrum data	Spectrum data when selecting "Print Data at Intervals"
Activity Calculation	Calculation of kinetic activity
Activity Coefficient	Ranging from 0.000 to 9.999
Activity Value	
Photo results	Photometric measuring results
Conc. Results	Measured result of concentration (quantitative analysis result)
Std. curve	Standard curve formula
R	Relative coefficient of standard curve: the closer to "1", the better.
Std. C	Concentration value of standard sample
Std. A	Absorbance value of standard sample
Cell corr. results	Results of cell correction

