206-93068B

INSTRUCTION MANUAL

User's System Guide

UV-1601

SHIMADZU RECORDING SPECTROPHOTOMETER

(P/N 206-67001)

SHIMADZU CORPORATION

CHROMATOGRAPHIC & SPECTROPHOTOMETRIC INSTRUMENTS DIVISION

Preface

Thank you for your purchase of the Shimadzu Recording Spectrophotometer UV-1601.

The UV-1601 is a newly designed instrument equipped with all of the basic spectrophotometer functions in a compact body. The UV-1601 can also be applied to a variety of analysis using our optional software, available on IC cards.

In order for you to fully employ and effectively utilize the functions of this instrument, it is recommended that you carefully read this manual before using the UV-1601, and thereafter keep it close at hand for future reference.

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Chapter 1 Installation

1.1 Parts Inspection

This instrument is shipped with the following items. Upon opening the shipping container, confirm that all of the listed parts are accounted for in your shipment.

Table 1.1.1 Standard Contents

	Description		Part No.	Qty.	Comments
1	Spectrophotometer		206-67010	1	
2	Standard Accessories (One of the following) For 100V, 120V sites For 220V, 240V sites		 206-67099 206-67099-01	1	
	2-1	AC Power Cord	071-60814-01 or 071-60814-05	1	
	2-2	Fuses	072-01652-22 or 072-01652-19	2	4.0A (for 100,120V) 2.0A (for 220,240V)
	2-3	Ground Adapter	071-60803-01	1	(for 100,120V)
3	Operating Manual (Installation & Maintenance)		206-96062	1	
4	Operating Manual		206-96064	1	

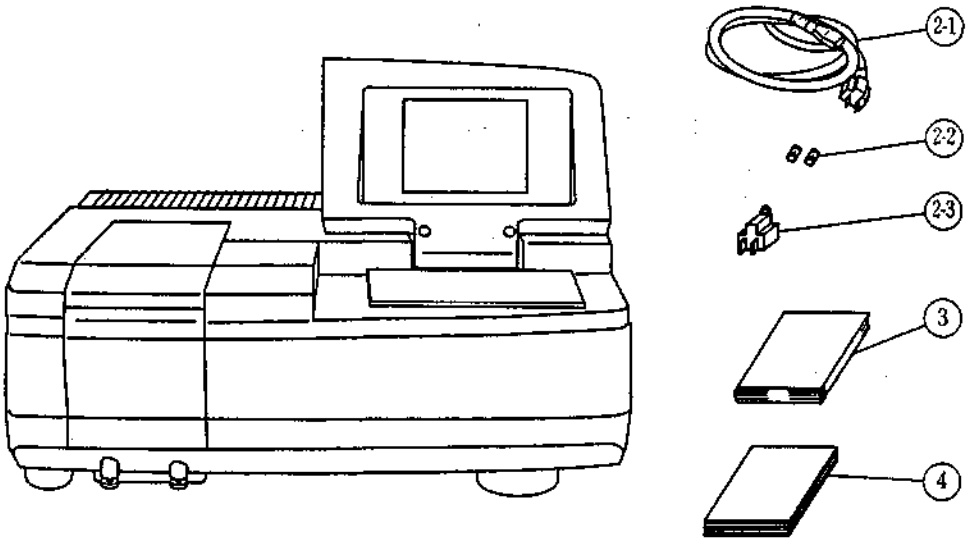


Fig. 1.1.1 Standard Contents

[NOTE]	A thin protective film has been applied to the surface of the keyboard. This film will not be a hindrance if the keyboard is used with it in place, but if the film begins to peel during use and makes the keyboard difficult to see, peel it entirely from the surface.

1.2 Installation Site

In order to fully utilize the features of this instrument and to be able to use it for a long time in a stable condition, please install it in a location that meets the following conditions.

Any deterioration in function or mechanical damage that occurs as the result of use in a location that differs from these conditions will not be covered by the warranty, even if they occur within the warranty period. Please take care in advance.

Room temperature during use of 15 to 35℃.

Out of direct sunlight.

No strong vibration, or continuous weak vibration.

No strong magnetic fields or electromagnetic fields.

Humidity of 45 to 80%.

No corrosive gases, or organic or inorganic gases with absorptivity in the ultraviolet range.

Low amounts of dust.

The dimensions of the UV-1601 are 550mm x 470mm x 380mm (200mm at closing LCD unit)(WxDxH). The minimum floor space required for installation is 700mm x 500mm (WxD). In addition, do not place anything in front of the fan on the left side as it may hinder ventilation.

The UV-1601 weighs 18kg. Install the unit on a flat surface that will support this weight.

1.3.1 Power Supply

The power consumption of this instrument is 160VA. Please use a power supply with a capacity of 160VA or greater. The allowable voltage fluctuation range is 10%. If the voltage fluctuates more than 10%, please use a voltage stabilizer.

1.3.2 Ground

The power cord for this instrument is a 3-wire type which includes a ground wire. If the electrical outlet is of the 2-wire type, be sure to ground the instrument from the earth terminal of the power cord or the ground terminal on the left side of the instrument.

1.3.3 Connecting the Power Cable

(1) Check to see that the power switch on the unit is OFF (so that the ○ is pushed in).

(2) Check to see that the voltage setting switch display is the power supply voltage being used.

If the power supply voltage displayed is different from the one being used, use a standard screwdriver to open the fuse holder lid, remove the circular plug and insert the plug in the position that displays the power supply voltage being used. 50Hz and 60Hz are common. (See "3.5 Replacing Fuses" for how to open the fuse holder lid.)

[NOTE] If the power supply voltage being used is 220V/240V, the fuse should be a 2.0A fuse.

(3) Insert the enclosed power cable into the power connector on the left side of the unit.

(4) Insert the power cable into the outlet.

(5) Turn ON the unit power switch.

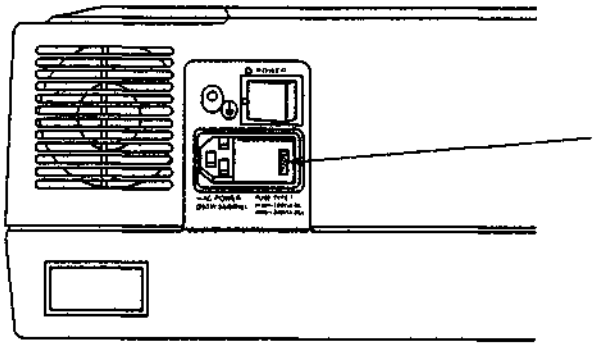


Fig. 1.3.1 Voltage selector

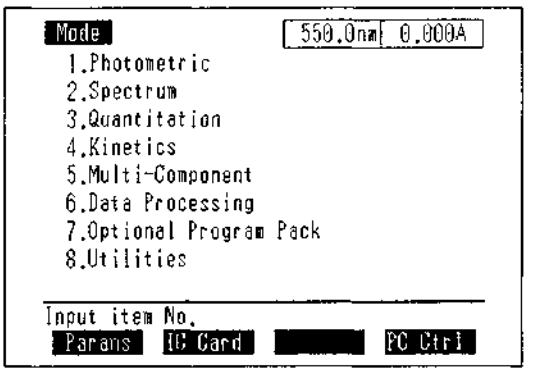
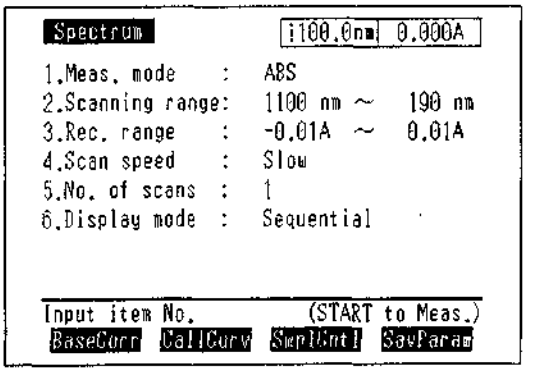
1.4 Installation Function Check

Once installation is complete, check the function of the following items. In the event that a function(s) does not fulfill the specification listed below due to a shock during shipment, immediately notify the nearest service representative.

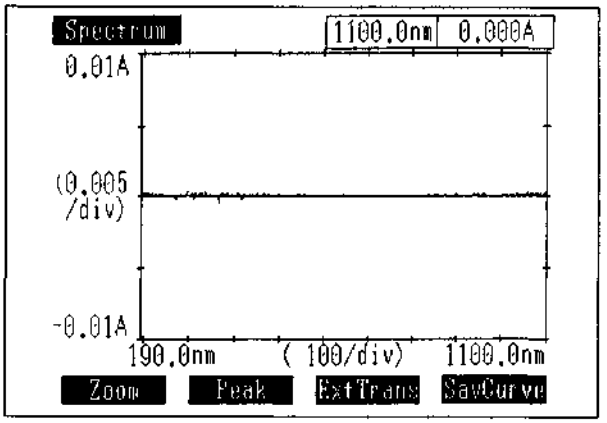
1.4.1 Baseline Flatness

Procedure

Table 1.4.1 Procedure (Baseline Flatness)

Step	Operation, Monitor Display	Key Operation
1	Turn ON power (Let sit for 30 minutes after automatic initialization)	
2		
3	Select "2. Spectrum"	[2]
4	Set the measurement mode to "ABS" (Absorbance mode).	Enter [1] until "ABS" is displayed.
5	Set scan range to 1100~190nm	[2][1][1][0][0][E] [1][9][0][E]
6	Set photometric range to -0.01~0.01Abs.	[3][-][0][.][0][1] [E][0][.][0][1][E]
7	Set scan speed to "Slow".	[4][4][E]
8		

continued.

Step	Operation, Monitor Display	Key Operation
9	Perform baseline correction.	[F1]
10	Start measurement.	[START/STOP]
11		
12	When baseline measurement restarts, press the [START/STOP] key again. When you press the [RETURN] key, the process will return to Step 8. At this point, press the [MODE] key to return to Step 2.	

Normal Specification

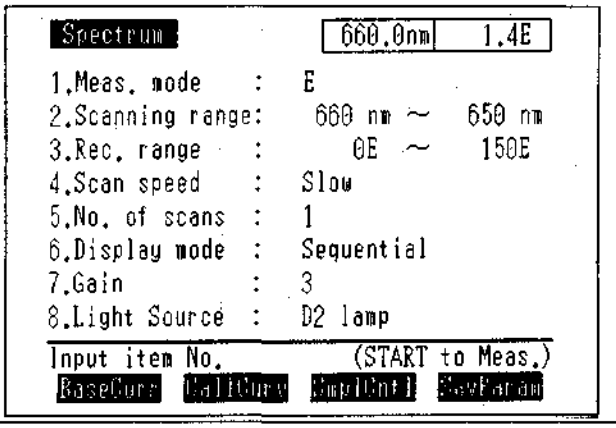
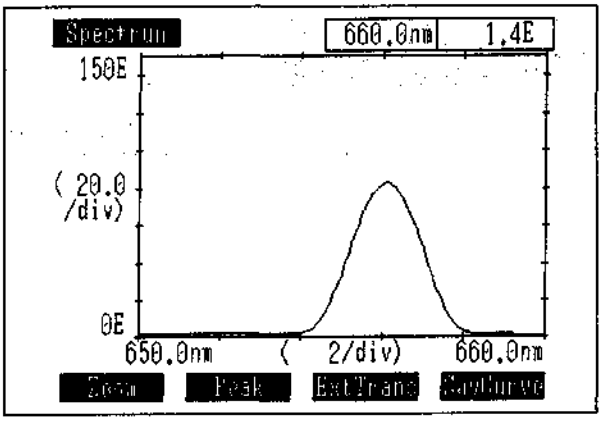
Baseline flatness should be within ±0.002Abs, not including shock noise.

1.4.2 Wavelength Accuracy

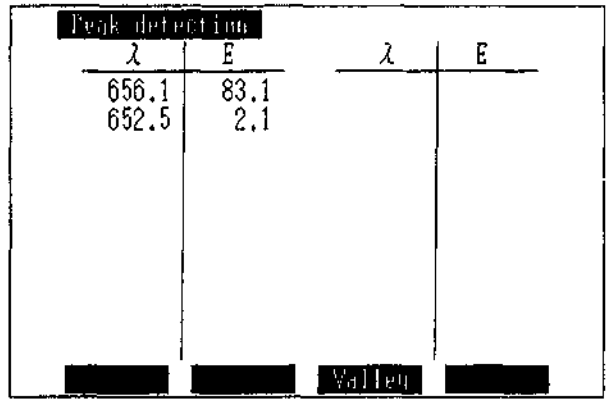
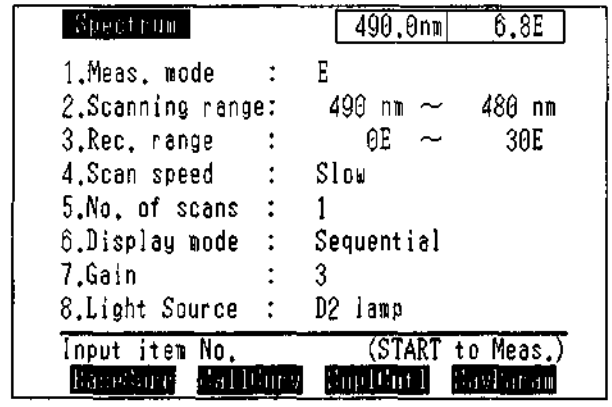
Measurement Procedure

Start from Step 4 of the "Baseline Flatness" procedure.

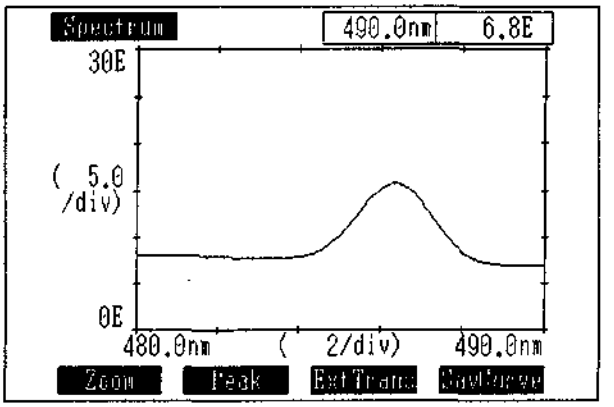
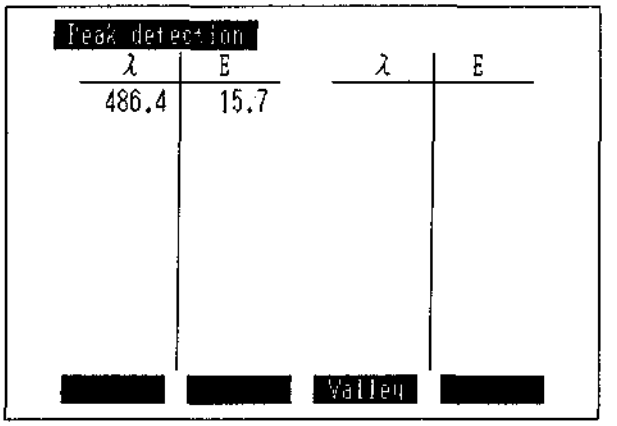
Table 1.4.2 Procedure (Wavelength Accuracy)

Step	Operation, Monitor Display	Key Operation
1	Set the measurement mode to "E".	Enter [1] until "E" is displayed
2	Set the scan range to 660~650nm.	[2][6][6][0][E] [6][5][0][E]
3	Set the recording range to 0~150E	[3][0][E][1][5][0][E]
4	Set scan speed to "Slow".	[4][4][E]
5	Set the gain to 3.	[7][3][E]
6	Set the light source selection to the D2 lamp.	[8][2][E]
7		
8	Start measurement.	[START/STOP]
9		

continued.

Step	Operation, Monitor Display	Key Operation
10	Perform peak detection.	[F2]
11		
12	Find the difference between the wavelength of the peak found and 656.1nm.	
13	Return to the Parameter Setting screen.	[RETURN],[RETURN]
14	Set the scan range to 490~480nm.	[2][4][9][0][E][4][8][0][E]
15	Set the recording range to 0~30E.	[3][0][E][3][0][E]
16		
17	Start measurement.	[START/STOP]

continued.

Step	Operation, Monitor Display	Key Operation
18		
19	Perform peak detection.	[F2]
20		
21	Find the difference between the wavelength of the peak found and 486.0nm.	

Normal Specification

Within ±0.5nm

Chapter 2 Construction

Contents

2.1.1 Front and Top Views

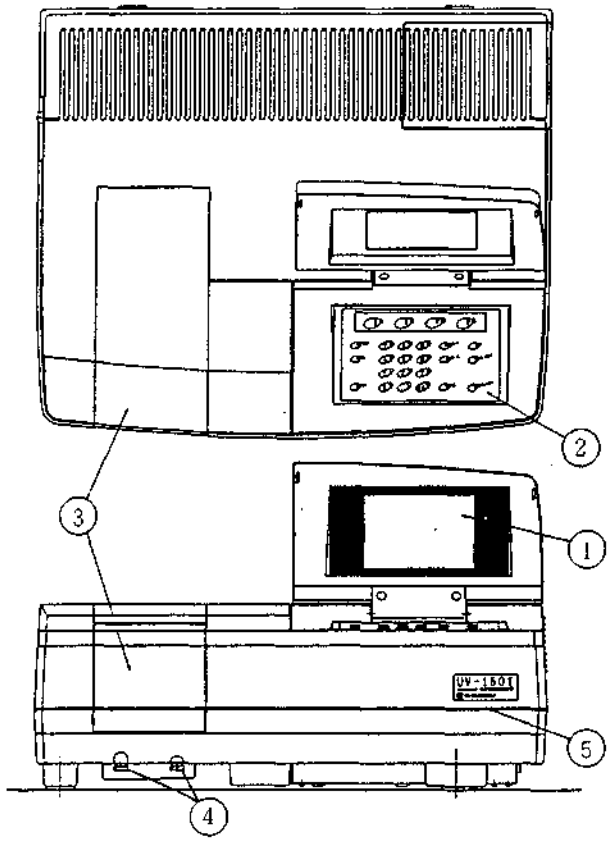


Fig. 2.1.1 Front and top views of UV-1601

① LCD Unit

This displays the operation menus and measurement results, etc. This is a 320x240 dot resolution, backlit LCD unit. You may adjust the angle and intensity for optimum visibility.

② Keyboard

This is the input component for giving operation commands and numeric values to the instrument. See "2.3 Keyboard" for detailed instructions.

③ Sample Compartment

This is the component in which the sample being measured is set. See "2.2 Sample Compartment" for details.

④ Sample Compartment Set Screws (knurled thumbscrews). These are screws for fastening the sample compartment unit..

⑤ LED

This lights when the power to the unit is ON.

2.1.2 Left Side View

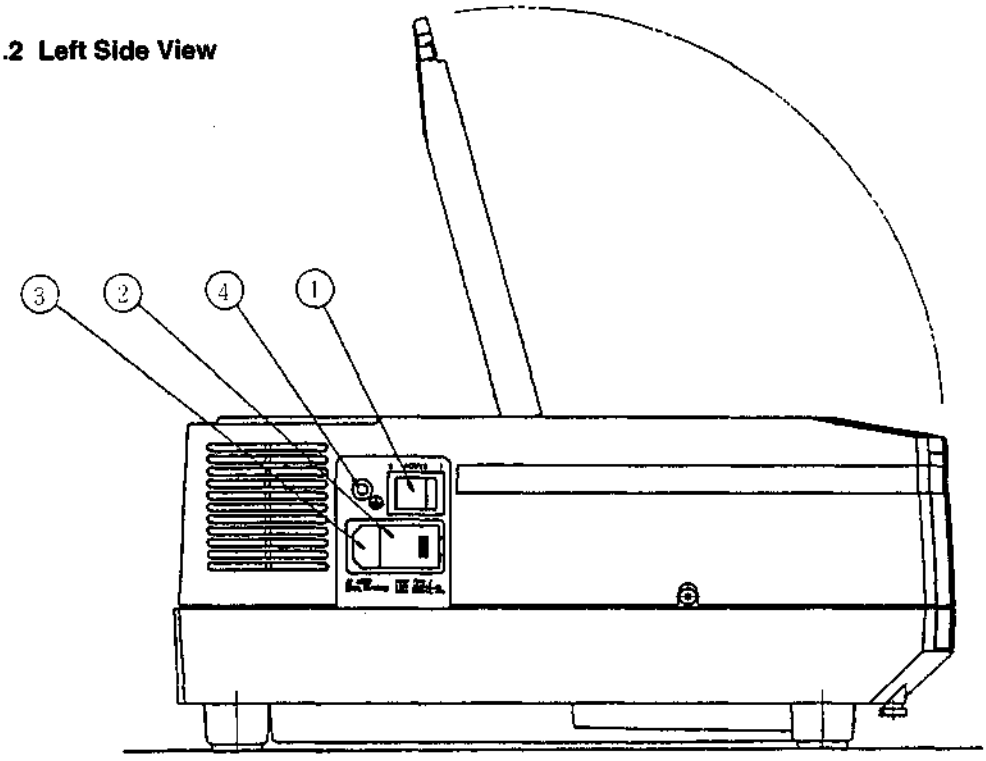


Fig. 2.1.2 Left side view of UV-1601

① Power Switch

This is the switch for turning the unit ON/OFF.

ON: when I is pushed in.

OFF: when ○ is pushed in.

② Voltage Selector/Fuse Holder

You can switch this between 4 levels (AC100, 120, 220, 240) according to the input power. Use two 4.0A fuses for the 110, 120V range, two 2.0A fuses for the 220, 240V range.

③ AC Power Connector

Connect the enclosed AC power cable to supply power from an AC electrical outlet.

④ Ground Terminal

This is the terminal for connecting to ground. When using an ungrounded power supply, you must be sure to connect this ground terminal to ground.

2.1.3 Right Side View

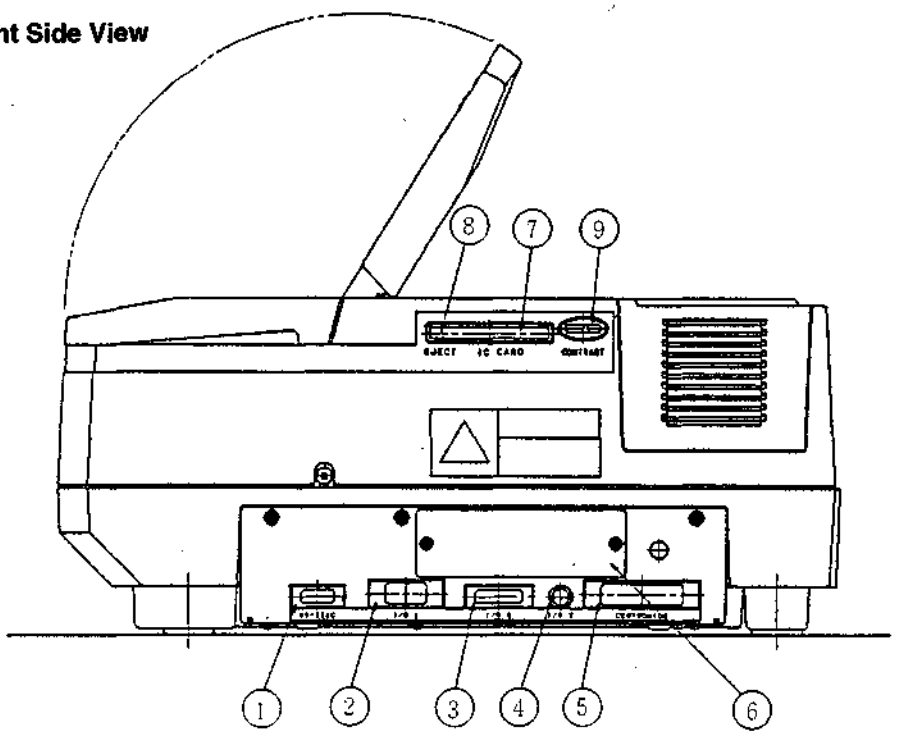


Fig. 2.1.3 Right side view of UV-1600

① RS-232C Connector

This is a standard RS-232C interface. This can be used to connect an optional printer or a computer equipped with a standard RS-232C interface.

② Attachment Connector (I/O 1)

This is the interface for connecting the optional "Auto Sample Changer (ASC-5)" or "Cell Positioner (CPS-240A)" accessory.

③ Attachment Connector (I/O 2)

This is the interface for connecting the optional "Sipper 160" accessory.

④ Attachment Connector (I/O 3)

This is the output interface through which temperature settings are transmitted from the UV-1600 to the temperature regulator when the optional "Thermoelectrically Temperature Controlled Sipper Unit (TSU-2200)" accessory is installed.

⑤ Printer Connector (Centronix)

This is the interface for connecting an optional printer.

⑥ Expansion Board Slot

This is the slot for inserting expansion boards, such as the analog output interface board, etc. Normally,

the slot is covered.

⑦ IC Card Slot

This is the slot for inserting optional IC cards (Data Pack,Program Pack).

⑧ Eject Button

This is the button to press on for pulling out a inserted IC card.

⑨ Contrast Adjustment Knob

This adjusts the contrast on the LCD unit screen.

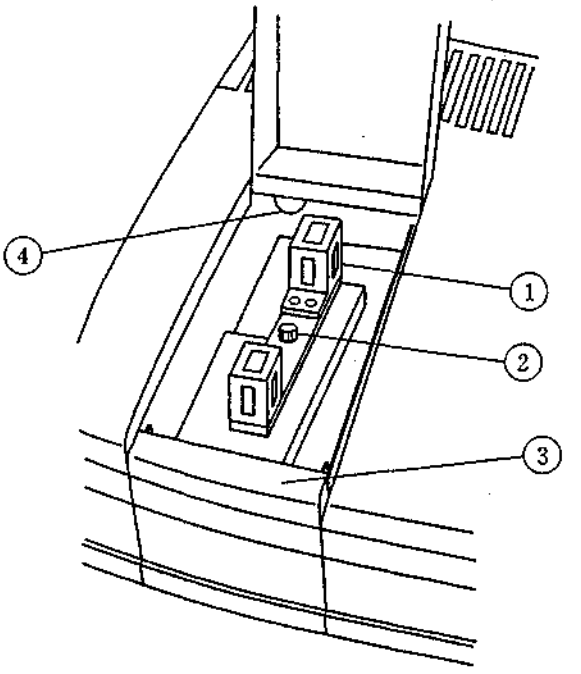


Fig. 2.2.1 Sample compartment

① Cell Holder

The cell holder for the rectangular 10mm light path cells has one sample cell holder and one reference cell holder.

② Cell Holder Set Screws

The cell holder can be easily removed by loosening the cell holder set screws.

③ Cover, Sample Compartment

When using a flow cell, etc., holes are needed to pass tubing, etc. through. Therefore, this "Cover, Sample Compartment" can be removed and exchanged with different types of front panels.

(Please refer to Chapter5. "5.5 Removing & Securing " Cover, Sample Compartment")

④ Multi-cell Holder Drive Connector

This is the connector for driving the optional "Multi-cell Holder" accessory.

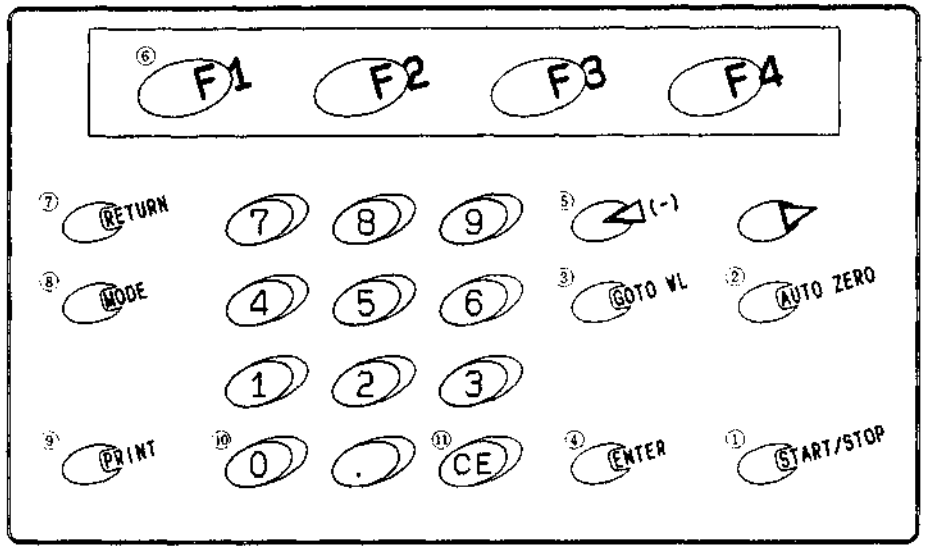


Fig. 2.3.1 Keyboard

① START/STOP Key

This is the key for starting and stopping measurement once parameter setting has been completed.

② AUTO ZERO Key

When you press this key, the current wavelength will automatically be set to 0Abs (100%T). Make sure that prior to sample measurement a blank cuvette is placed in both sample and reference sides.

③ GOTO WL Key

This is the key that is used to change the current wavelength.

④ ENTER Key

When you enter a value, press this key after the value to set the entering value.

⑤ Cursor Keys (◁(-),▷)

Use these keys to move the cursor in the LCD screen left or right. The left cursor key can also be used to enter a negative (-) value when entering numeric values.

⑥ Function Keys (F1 through F4)

These are the keys corresponding to the functions that are displayed at the bottom of the LCD unit screen.

⑦ RETURN Key

Use this key to return to the one preceding screen from the current screen.

⑧ MODE Key

Use this key to move from the Parameter Setting screen to the main Mode screen.

⑨ PRINT Key

Use this key to output a hard copy of the monitor screen.

⑩ Numeric Keys

Use these keys to enter numeric values.

⑪ CE Key

Use this key to clear a numeric value entry error. When you press this key, the numeric value which has been entered will be cleared and then you may reenter the appropriate value.

2.4 Light Source Compartment

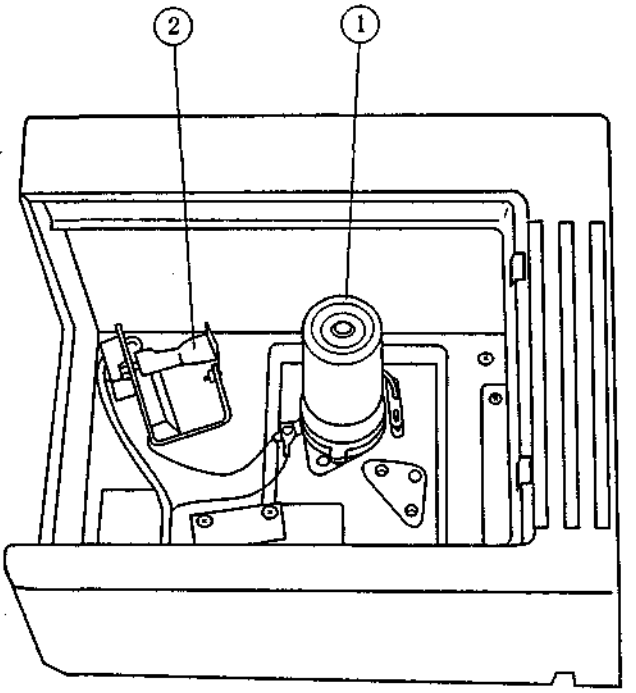


Fig. 2.4.1 Light source compartment

① Deuterium Lamp (D2 Lamp)

This is the ultraviolet range (190nm to light source switch wavelength*) light source.

② Tungsten Halogen Lamp (WI Lamp)

This is the visible & near infrared range (light source switch wavelength* to 1100nm) light source.

* Light source switch wavelength

The light source switch can be set anywhere in the range from 295nm to 364nm in 0.1nm increments. For details, refer to the "Operating Manual ", Chapter 10, "10.2 Setting Instrument Parameters", <4. Light Source Switching Wavelength>.

2.5.1 Optical System

A schematic of the optical system is shown in Figure 2.5.1.

D2	:	Deuterium lamp	W	:	Window Plate
WI	:	Halogen lamp	M1～M5	:	Mirrors (M3 is a half-mirror)
F	:	Filter	L	:	Lens
G	:	Diffraction grating	Sam	:	Sample cell
S1	:	Entrance slit	Ref	:	Reference cell
S2	:	Exit slit	P.D.	:	Photodiodes

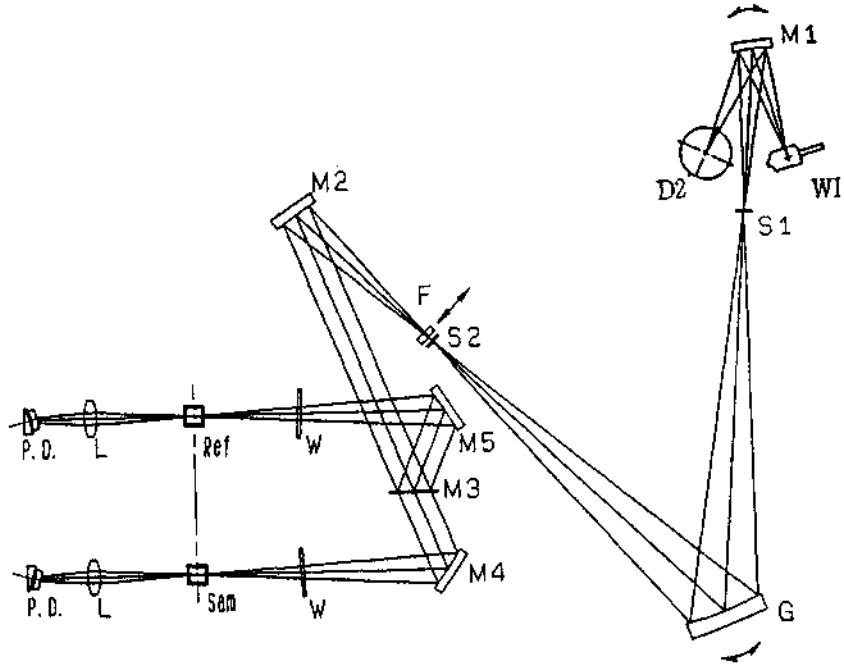


Fig. 2.5.1 Schematic of optical system

The light coming from the light source (deuterium lamp D2 or halogen lamp WI) is reflected by mirror M1 and then enters the monochromator. Light source switching is entirely automatic, with the instrument selecting the next light source according to the wavelength.

Deuterium lamp: 190nm to light source switch wavelength

Halogen lamp : Light source switch wavelength to 1100nm

The light source switch wavelength can be set anywhere in the range from 295.0 to 364.0nm (default setting: 340.8nm).

With the exception of the light sources and light source mirrors, the optical system is constructed so as to prevent exposure to dust and contaminants.

The monochromator slit aperture is fixed at 2nm.

The diffraction grating comprises a 900 line/mm aberration-correcting concave holographic grating made originally by SHIMADZU, realizing a monochromator of simple construction and with little aberration.

The light coming out of the monochromator passes through a stray light cutting filter F and strikes the mirror M2 and is then split by the half-mirror M3 into the sample-side beam and the reference-side beam, which then pass through their respective cells and strike the detectors (photodiodes).

The relationship between the positions of the cell holders and the beams is as shown in Figure 2.5.2.

The image of the exit slit S2 appears near the cell position in the sample compartment. The cross section of the beam on the image plane is

Width approx. 1mm Height approx. 10mm

Since the beam cross section is wider than the above value at the front surface of the cell, when microcells (the width of light- through window is under 2.0mm) are being used, please order the "Micro Cell Holder with mask " (P/N 204-06896) separately.

Whenever possible, please use black cells for the microcells, as they are minimally affected by scattered light.

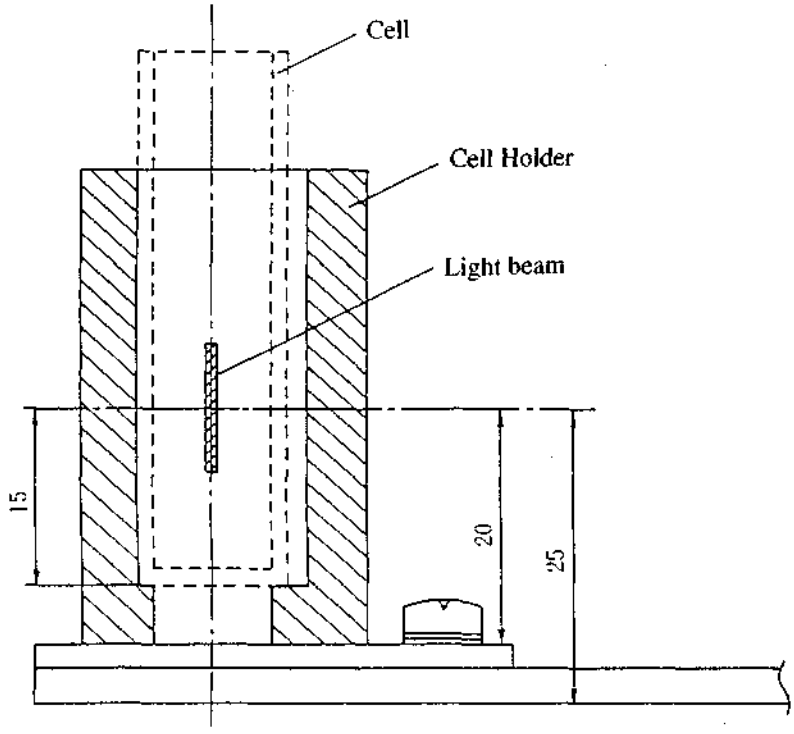


Fig. 2.5.2 Positional relationship of cell holder (cell) and light beam

2.5.2 Electrical System

A schematic of the electrical system is shown in the figure below.

The center of control is the microcomputer (CPU), which performs all controls of light sources, switching of light sources, filter switching, wavelength scanning pluse moter, LCD monitor display, key-board and printer, RS-232C interface etc.

After the sample-side beam and reference-side beam are picked up by detectors (photodiodes) and converted into the voltage by pre-amplifier, The signal is then fed into an A/D converter and finally read by the CPU.

On energy-measurment mode (of spectrum mode) only the signal from the sample-side beam is read. in this case,S/R switching status is "Normal" . If the status is "Reverse", only the signal from the reference-side beam is read.

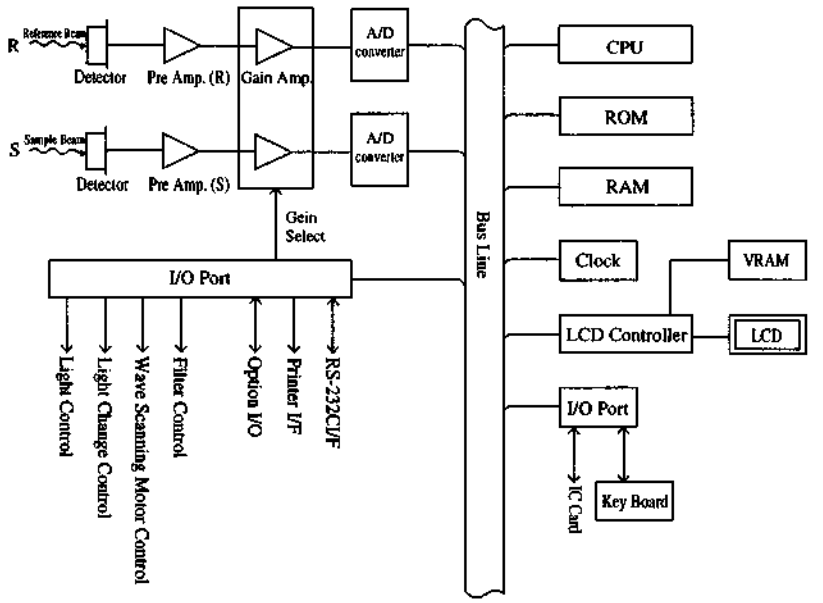


Fig. 2.5.3 Schematic of electrical system

Chapter 3
Maintenance & Checking

3.1 Daily Maintenance & Periodic Maintenance

(1) Cleaning Sample Compartment (Daily)

When handling large numbers of liquid samples, check the floor of the sample compartment for spilled solution samples. Wipe up spilled samples immediately. Please be aware that if spilled samples are left, they may evaporate and the vaporized gas will fill the light path in the sample compartment, corroding the interior and causing inaccurate measurement results.

(2) Checking Baseline Flatness (Monthly)

Inspect the flatness of the baseline according to the procedure in Chapter 1 "1.4.1 Baseline Flatness". If there is an abnormality in the baseline (the curve is greater than ±0.002Abs), correct the instrument baseline according to Section 3.3, (5) " 'Instrument Baseline Correction' Procedure" in this chapter.

(3) Checking Wavelength Accuracy (Monthly)

Inspect the wavelength accuracy according to the procedure in Operating manual, Chapter10"10.2 Setting Instrument Parameters" <7.Instrument Maintenance & Inspection>. If there is an abnormality in the wavelength accuracy (the peak wavelength shift is greater than 0.5nm), contact your Service Representative.

3.2 Initialization & Error Display

When the power switch is turned ON, the spectrophotometer performs various checks and initial settings in the order shown in the table on Fig. 3.2.1, and if everything is normal, initialization is completed after about 3.5 minutes. Each step will be highlighted in the display as it is completed. If a step is properly completed, the star next to it is also highlighted. However, if any kind of abnormality is detected, initialization of that step is interrupted without highlighting the star mark. If an error message is displayed, inspect the instrument according to the check point items in the table. If the problem is still unclear, contact your Service Representative and describe the displayed error message.

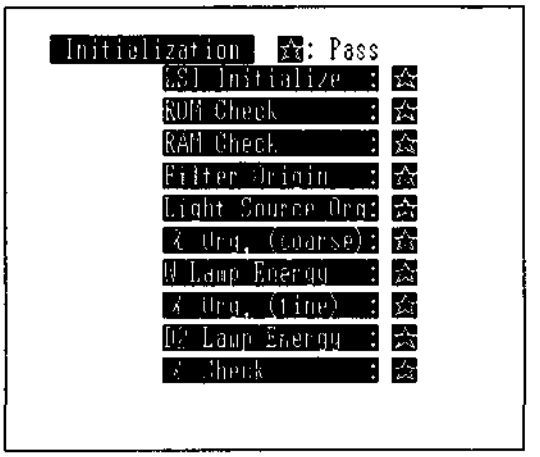


Fig. 3.2.1 Initialization screen

Table 3.2.1 Initialization and Errors

	Display	Description	Remedial Action
1	LSI Initialize	Initialize each I/O	Try turning the power OFF and then ON again. If the same error occurs again, contact your Service Representative.
2	ROM Check	Check program ROM	
3	RAM Check	Check memory elements (RAM)	Try turning the power OFF and then ON again. If the same error occurs again, contact your Service Representative as it is possible that the backup battery is dead.
4	Filter Origin	Detect reference position of filter	Try turning the power OFF and then ON again. If the same error occurs again, contact your Service Representative.

continued.

	Display	Description	Remedial Action
5	Light Source Org.	Detect reference position of motor that drives light source switching mirror	Same as above
6	[lambda] Org. (coarse)	Detects mechanical wavelength origin position	Same as above
7	W Lamp Energy	Checks whether or not the WI lamp (tungsten iodine lamp) light energy is at full level	• Remove the light source compartment cover and check if the WI lamp is lit. If it is not lit, try turning the power ON again. If it still does not light, the lamp must be replaced.*
8	[lambda] Org. (fine)	Checks 0-order light which is the optical origin	• Check to see if there is something in the sample compartment that is obscuring the light.
9	D2 Lamp Energy	Checks whether or not the D2 lamp (deuterium lamp) light energy is at sufficient level	• Remove the light source compartment cover and check if the D2 lamp is lit. If it is not lit, try turning the power ON again. If it still does not light, the lamp must be replaced.*
10	[lambda] Check	Checks wavelength by detecting the intensity line at 656.1nm using the D2 lamp	• Check to see if there is something in the sample compartment that is obscuring the light.

* Refer to Fig .3.4.3 and Fig. 3.4.4 on Page 3-9 to remove the light source compartment cover.

3.3 What To Do If System Does Not Operate Properly

There are many instances in which the spectrophotometer will not operate properly as the result of consumable part deterioration, an operational error or neglect of maintenance and inspection. Please check the following items. If the cause of operation failure is still unknown after this inspection, contact your Service Representative.

(1) Does not operate at all. Nothing appears on the LCD unit screen.

Checking Point	Remedial Action
1. Is the power cord securely connected?	Securely connect the cord.
2. Is the fuse blown?	Replace the fuse. 110,120V site: 4.0A 220,240V site: 2.0A
3. Is the LCD contrast adjustment knob in the correct position?	Adjust the contrast.

(2) After power is ON, error message is displayed during initialization.
Inspect the check points listed in "Table 3.2.1 Initialization and Errors".

(3) Numbers cannot be entered from the keyboard.

Checking Point	Remedial Action
1. Is an incorrect value being entered? Example GOTO WL=1150nm	Enter the correct value.
2. Is the computer IC or the keyboard defective?	Contact our Service Representative.

(4) Photometry values are odd.

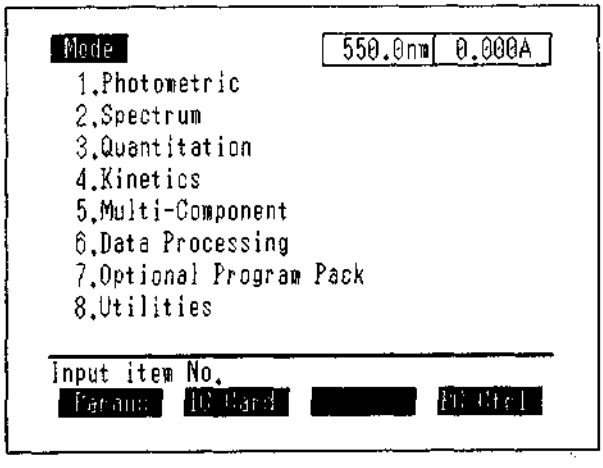
Checking Point	Remedial Action
1. Did you press mistakenly the [AUTO ZERO] key during measurement?	Return to the blank condition (reference condition) and press the [AUTO ZERO] key again. Perform proper processing.
2. Sample processing error	
3. Is the cell being used appropriate?	Do not use a glass cell in the ultraviolet range.

(5) Baseline curve does not meet normal specifications.

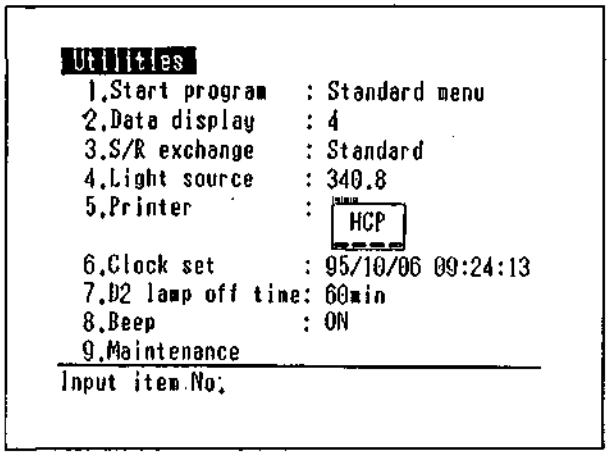
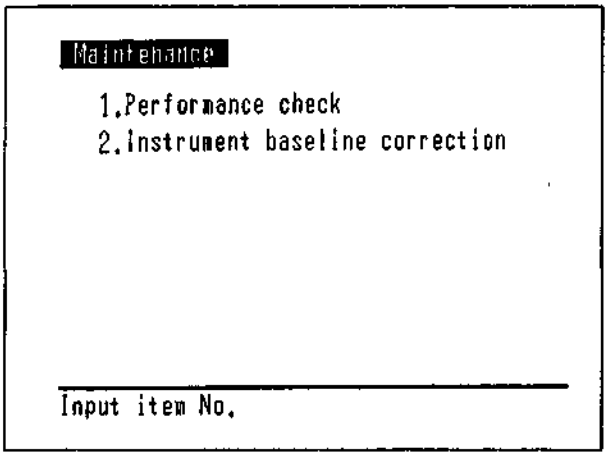
Cheching Point	Remedial Action
1. When correcting the baseline, did you put a solvent with high absorbance in the cell holder on only one side?	Place cells with the same solvent in both the sample side and the reference side and perform baseline correction again.
2. Is the beam on only one side restricted?	Set the beam conditions so that they are identical on both the sample side and the reference side.
3. Are you using a optional accessory?	Some of the unit specifications may not be met when certain of optional accessories are installed.
4. If none of the above three scenarios applies.	Correct the instrument baseline by the following procedure.

• "Instrument Baseline Correction " Procedure

Table 3.3.1 Instrument Baseline Correction Procedure

Step	Operation, Monitor Display	Key Operation
1	Return to the Top Menu.	Press the [RETURN] key until the screen changes. Then press the [MODE] key.
2		

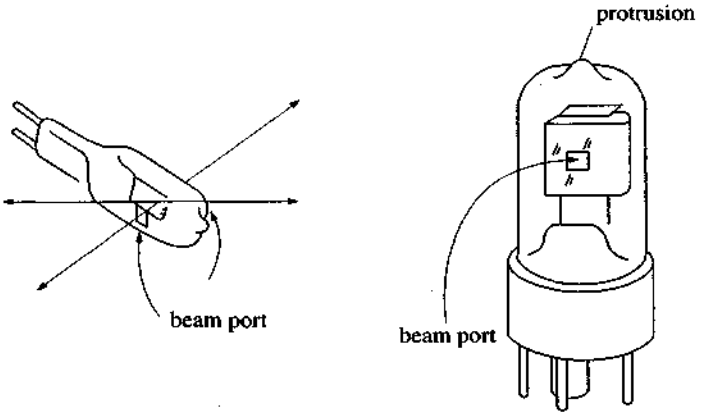
continued.

Step	Operation, Monitor Display	Key Operation
3	Select " 8. Utilities "	[8]
4		
5	Select " 9. Maintenance "	[9]
6		
7	Select " 2. Instrument baseline correction "	[2]

3.4.1 Light Source Specifications

Table 3.4.1 Light Source Specifications

	WI Lamp	D2 Lamp
Part No.	062-65004-06	062-65055-05
Type	64440	L-6380
Average life	2000 hours	500 hours
Characteristics	12V 50W	Discharge voltage: 75~95V Discharge current: 300mA Discharge start voltage: 230~350V
Shape	Fig. 3.4.1(a)	Fig. 3.4.1(b)



(a) WI Lamp (b) D2 Lamp

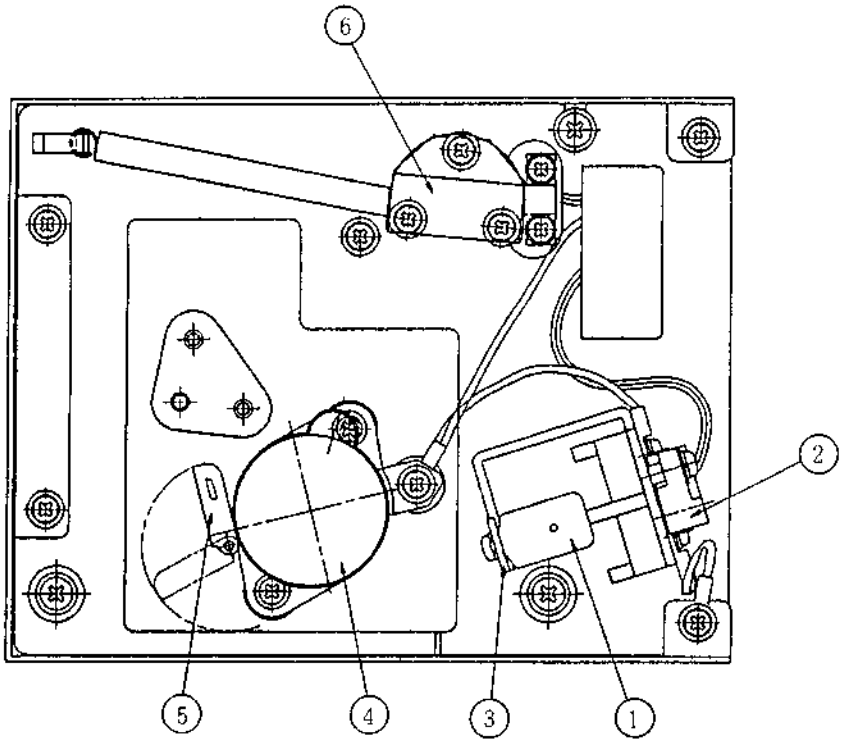
Fig. 3.4.1 Light source appearances

3.4.2 Light Source Replacement Procedure

[NOTE] 1. The light source and light source compartment both get very hot. To change a light source, turn off the power and then change the light source only after checking to see that it has cooled sufficiently.

2. Please wear gloves when handling the light source so as not to leave fingerprints on the beam port of the new light source. A fingerprint will burn onto the bulb, and when the light source gets hot, light transmission will deteriorate.

3. Be especially careful when removing and mounting the light source compartment cover so that the back of the cover does not strike the protrusion on the top of the D2 lamp (deuterium lamp). Such a hit could cause a leak in the tube's vacuum.



(1) WI lamp
(2)WI lamp socket
(3) WI lamp retainer spring
(4) D2 lamp
(5) D2 lamp lock fitting
(6) Light source switching mechanism

Fig. 3.4.2 Interior of light source compartment

•Replacing the D2 lamp

(1) Press on the parts indicated by the arrows in Figure 3.4.3 on the sides of the light source cover, lift the cover up and release, the "catch".

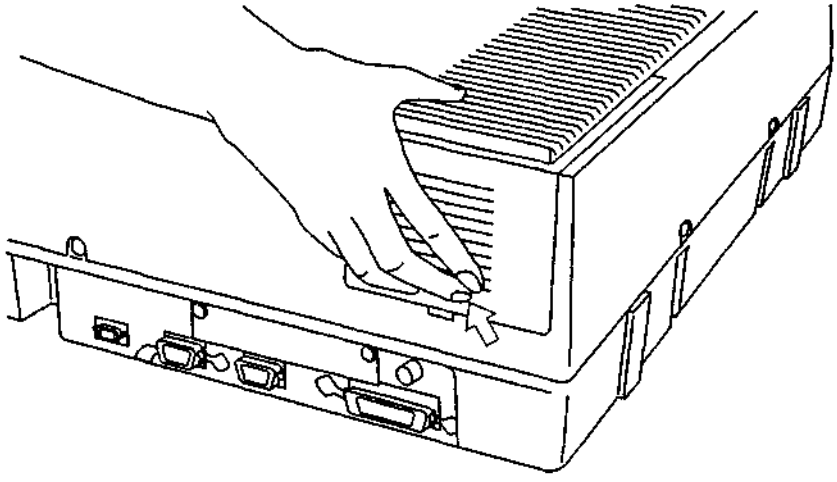


Fig. 3.4.3 Light source cover

(2) Next, pull the light source cover in the direction of the arrow in Figure 3.4.4 to remove the light source cover.

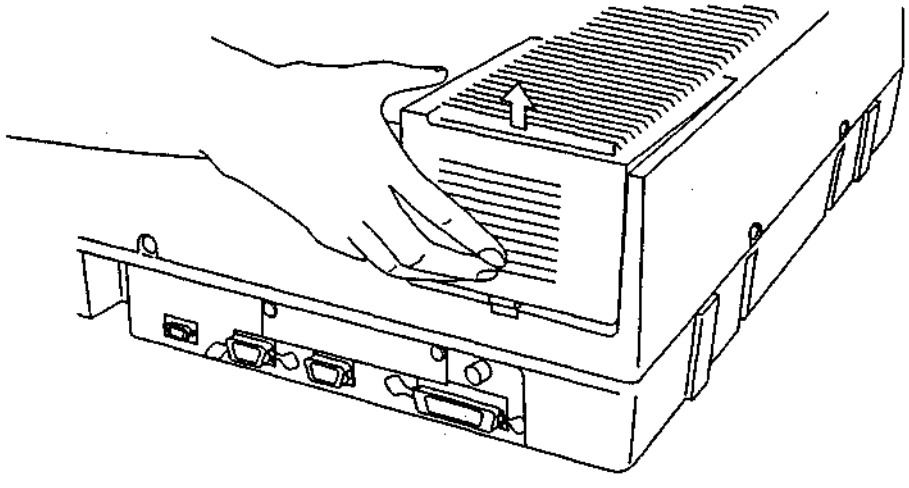


Fig. 3.4.4 Removing the light source cover

(3) Insert the tip of a standard screwdriver into the hole in the lock fitting of the D2 lamp in the light source compartment. Then turn the screwdriver slightly counter-clockwise to release the spring and loosen the lock fitting.

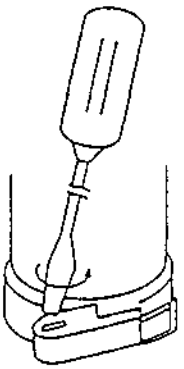


Fig. 3.4.5 Removing the D2 lamp

(4) Slowly extract the D2 lamp upward and remove it from its socket.

(5) Insert the new D2 lamp in the socket. Check at that time to see that it is well seated.

(6) Insert the standard screwdriver into the hole in the lock fitting. Then secure the D2 lamp by slowly turning the screwdriver clockwise.

(7) Turn ON the power.

(8) Press the [GOTO WL] key and set the wavelength to 250nm.

(9) Check to see that the beam is shining into the monochromator entrance slit properly. The spectrophotometer will automatically make horizontal adjustments. (The center of the beam does not necessarily have to match the center of the slit.) If the lamp has not been replaced properly, the beam may not match with the entrance slit in the vertical direction.

(10) Close the light source compartment cover.

Replacing the WI lamp

(1) Press on the parts indicated by the arrows in Figure 3.4.3 on the sides of the light source cover, lift the cover up and release the "catch".

(2) Next, pull the light source cover in the direction of the arrow in Figure 3.4.4 to remove the light source cover.

(3) Remove the WI lamp retainer spring from the end of the top of the WI lamp. Since there is fear of touching the D2 lamp with your hand at this time, either cover the D2 lamp with a clean piece of paper or cloth or remove the D2 lamp before performing this operation. (Refer to "Replacing D2 Lamp" for the procedure of removing the D2 lamp.)

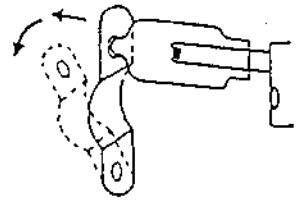


Fig. 3.4.6 Removing the WI lamp

(4) Extract the WI lamp from its socket.

(5) Please wear gloves so as not to contaminate the beam port of the WI lamp. Then, holding the new WI lamp so as to grasp it from the top and bottom, insert it into its socket.

(6) Insert the protrusion at the top of the WI lamp into the hole in the retainer spring so that the WI lamp does not fall out.

(7) Reset the previously removed D2 lamp. Refer to "Replacing D2 Lamp" for the method of resetting the D2 lamp.

(8) Turn ON the power.

(9) Check to see that the beam is shining into the monochromator entrance slit properly. The spectrophotometer will automatically make horizontal adjustments. (The center of the beam does not necessarily have to match the center of the slit.) If the lamp has not been replaced properly, the beam may not match with the entrance slit in the vertical direction.

(10) Close the light source compartment cover.

3.5 Replacing Fuses

When the fuse burns out, replace it by the following procedure. Use only the specified fuse.

(1) Turn OFF the power.

(2) Remove the power cord from the power connector.

(3) Use a standard screwdriver to open the cover on the fuse holder, as shown in Figure 3.5.1.

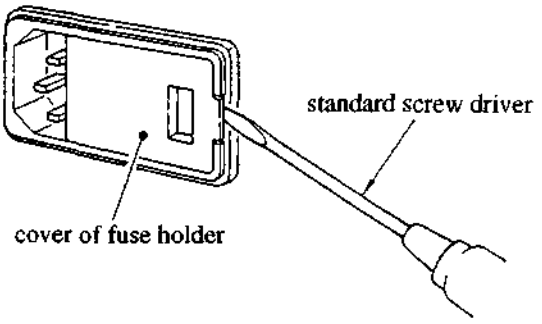


Fig. 3.5.1 Opening the fuse holder cover

(4) Pull out the fuse holder, as shown in Figure 3.5.2.

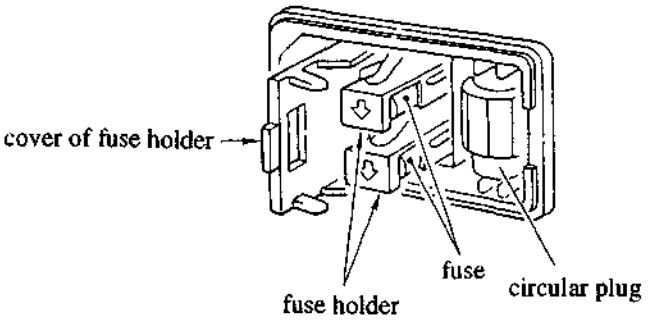


Fig. 3.5.2 Interior of fuse holder

(5) Remove the old fuse from the fuse holder and replace it with the new fuse. Of the two fuses, you need only replace the burned out fuse. (If both fuses are burned out, replace both fuses.)

(6) After replacing the fuse, push the fuse holder in so that the arrow on the fuse holder points down.

(7) Close the fuse holder cover until you hear its snap shut.

[NOTE]	After replacing the fuse, turn ON the power switch and check to see that the unit initializes properly.

3.6 List of Consumable Parts, Spare Parts

Part Name	Model	Part No.
Tungsten iodide lamp	64440	062-65004-06
Deuterium lamp	L-6380	062-65055-05
Cover, sample compartment		206-80401
Cell holder assembly		202-30215
Fuse, 4.0A (for 100, 120V)		072-01652-22
Fuse, 2.0A (for 220, 240V)		072-01652-19
AC power cord (for 100, 120V)		071-60814-01
AC power cord (for 220, 240V)		071-60814-05
Ground adapter (for 100, 120V)		071-60803-01
CPU printed circuit board		206-67045
Preamp assembly		206-67055
Console board assembly		206-67075
Keyboard		206-69620
LCD		078-12114-11
Backup battery	CR2032	074-73307-01

Chapter 4 Specifications

4.1 Hardware Specifications

Measurement Wavelength Range	190~1100nm
Spectral Band Width (Resolution)	2nm
Wavelength Display	0.1nm units
Wavelength Setting	0.1nm units (1nm units in scan)
Wavelength Accuracy	±0.5nm On-board automatic wavelength calibration mechanism
Wavelength Repeatability	±0.1nm
Wavelength Scanning Speeds	GOTO WL command : approx. 6000nm/min Very Fast : approx.3200nm/min Fast : approx.2200nm/min Medium : approx. 370nm/min Slow : approx. 260nm/min Very slow : approx. 160nm/min
Sampling Interval	1.0nm (2.0mm) : 910nm>=lambda range>=500nm 0.5nm (1.0mm) : 500nm>= lambda range>=200nm 0.2nm (0.5mm) : 200nm> =lambda range>=100nm 0.1nm (0.2mm) : 100nm> =lambda range The sampling interval inside ( ) indicates the one at "Very Fast" wavelength scanning speed. (Where in, "lambda range" is the difference between the measurement start wavelength and the measurement end wavelength.)
Light Source Switching	Automatic switching with wavelength range. Can be set anywhere in range from 295.0nm to 364.0nm (340.8nm is recommended)
Stray Light	Less than 0.05%
Photometric System	Double beam optics
Photometric Range	Absorbance : -0.5~3.999Abs (when uncorrected baseline curve is within 0.5Abs) Transmittance : 0~300%
Recording Range	Absorbance : -3.99~3.99Abs Transmittance : -399~399%
Photometric Accuracy	±0.004Abs (at 1.0Abs) ±0.002Abs (at 0.5Abs)
Photometric repeatability	±0.002Abs (at 1.0Abs) ±0.001Abs (at 0.5Abs)
Auto Zero Function	[AUTO ZERO] key enables one-touch setting

Baseline Stability	±0.001Abs/h
Baseline Flatness	±0.002Abs
Noise Level	0.002Abs
Baseline Correction	Automatic correction using computer memory 2-level baseline correction (High- precision instrument baseline correction function)
Light Source	50W halogen lamp (long-life 2000 hour), Deuterium lamp (socket-type), On-board automatic light source positioning mechanism
Monochromator	Uses aberration-correcting concave blazed holographic grating
Detector	Silicon photodiode
LCD	Backlit (320x240 dot), Adjustable contrast
Sample Compartment	Interior dimensions 110x230x105 (mm) (WxDxH) (Partial depth 155mm) Distance between beams 100mm Removable type 2-screw attachment Beam dimensions 1x10mm (WxH) (at center of sample compartment)
Power Supply	100, 120, 220, 240V 50/60Hz 160Va
Dimensions	550x470x380 (200 at closing LCD unit) (mm) (WxDxH)
Weight	18kg
Ambient Temperature	Room temperature 15~35°C,
Humidity	Humidity 45~80%

4.2 Software Specifications

Photometric	(1) Fixed-wavelength measurement Up to 6 cells can be measured (When using CPS-240 or multicell accessory) (2) Quantitation by K-factor method (3) Photometric modes : T%, Abs (4) Save/Load table data function Automatic data print function
Spectrum	(1) Photometric modes: Abs, T%, E Wavelength range : 190~1100nm Scan speeds : Very Fast , Fast, Medium, Slow, Very slow Vertical axis : Abs:-3.99~3.99 recording range T%, E:-399~399 Scan repetitions : 1~99 Recording method : Overlay/Sequential selectable (2) Spectrum Data Processing Functions Peak/Valley Detection (Up to 20 each) Zoom/Reduce/Expand Display data with cursor Save/Load data (Units: 6, Data packs: 27) (3) Spectrum data can be transmitted externally through RS-232C port
Quantitation	(1) Measurement methods: One-wavelength quantitation, Two-wavelength/Three-wavelength quantitation, Quantitation by derivative (1~4 order) calculation (2) Quantitation methods: Automatically calculate concentration by K-factor method Automatically calculate concentration by one-point calibration curve method Multi-point calibration curve (1-3 order regression calibration curve) (3) Measurement parameters: Quantitation by repeat measurement (1~9 times) and taking the average measurement value thereof Derivative quantitation order (1~4) Number of standard samples for multi-point calibration curve (2~10) Order of calibration curve (1~3) Select pass-through-origin conditions (4) Save/Load table data function (5) Automatic data print function
Kinetics	(1) Measurement time (1~6000 sec, 1~6000 min) (2) CPS, multi-cell compatible (3) Save/Load time course data function (4) Calculate Activity (5) Time course data can be transmitted externally through RS-232C port.

Multi-Component Analysis	(1) Up to 8 components (2) Pure and mixed samples of each constituent component can be used as standard samples (3) Besides measurement parameters, standard sample data can also be filed (4) Equally spaced wavelengths or random wavelengths can be selected for measurement wavelengths (5) Quantitation can be done by calling up spectra
Data processing	Data processing of spectrum data and time course data (1) Add, subtract, multiply, divide between two spectral data (2) Add, subtract, multiply, divide between two spectral data and constants (3) Derivative (1, 2, 3, 4 order), and Smoothing (4) Integration (Area calculation) (5) Pick peak (6) Pick point (7) Display curve (8) Read cursor

Chapter 5
Optional Accessories

CONTENTS

5.1 Printer

The HCP-1A (P/N 206-81009) thermal printer is available for use as the output device for the UV-1601. Use this to output hard copies of the screen image or for numeric output, such as photometric values, etc.

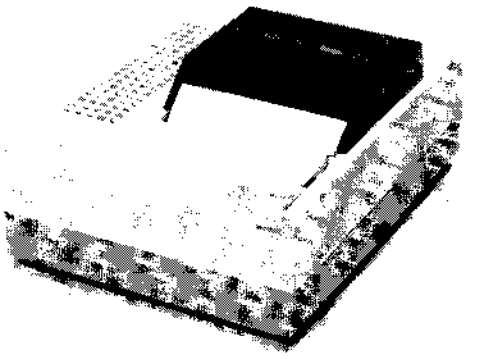


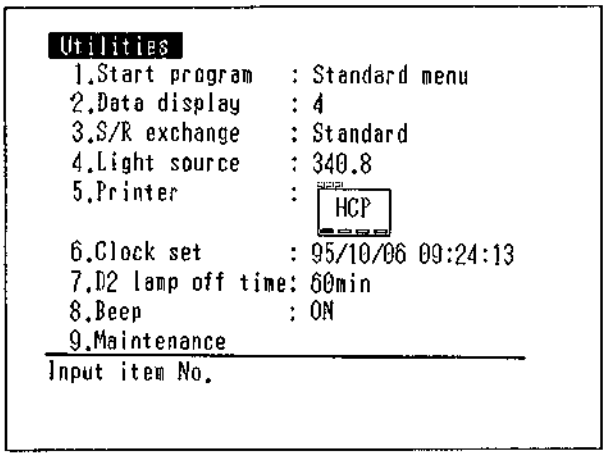
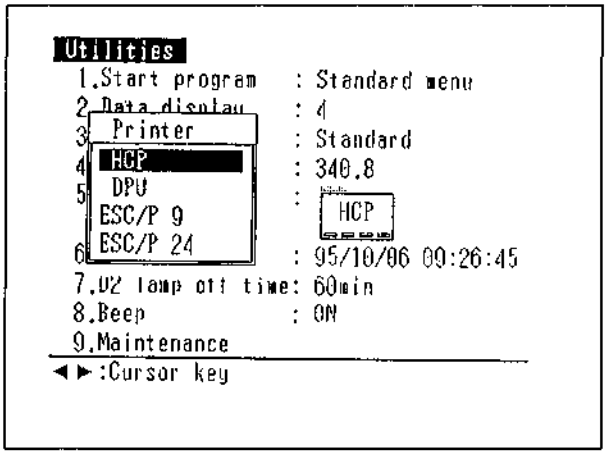
Fig. 5.1.1 Thermal printer

5.1.1 Installation Procedure

Table 5.1.1 Printer Installation Procedure

Step	Operation, Monitor Display	Key Operation
1	Return to the Top Menu.	Press the [RETURN] key until the screen changes. Then press the [MODE] key.
2	Mode 550.0nm 0.000A 1.Photometric 2.Spectrum 3.Quantitation 4.Kinetics 5.Multi-Component 6.Data Processing 7.Optional Program Pack 8.Utilities Input item No.	

continued.

Step	Operation, Monitor Display	Key Operation
3	Select "8. Utilities"	[8]
4		
5	Select "5. Printer"	[5]
6		
7	Select "HCP"	[◄] or [►]

5.1.2 Operating Procedure

(1) Hard copy of screen : A hard copy of the screen will be printed when you press the [PRINT] key.

(2) Print using function key: When the function keys are assigned a [PRINT] function as in modes in which the measurement results are recorded in table format, as in Photometrics, all of the table data will be printed.

(3) Print numeric data for each measurement: When the measurement results are obtained in the form of numeric values, as in Photometrics, the measurement results will be automatically printed if the printer is simply connected to the unit.

(4) To feed paper: Press the [ON LINE] key on the printer to turn the on line display OFF. Then press the [FEED] key.
After using this, press the [ON LINE] key again to turn the on line display back ON.

5.2 Multi-cell Sample Compartment

A multi-cell Sample Compartment (P/N 206-69160), which can measure 6 cells at once, is available as an option.

5.2.1 Installation Procedure

(1) Turn OFF the UV-1601 power switch.

(2) Loosen the knurled screws (2) at the front edge of the sample compartment of the unit.

(3) Lift the entire sample compartment up and pull out.

(4) Remove the slide panel from the multi-cell holder.

(5) Insert the multi-cell holder connector into the socket in the back wall of the sample compartment.

(6) Firmly insert the multi-cell holder into the front of the sample compartment so that the lead edge of the multi-cell holder engages with the positioning pin at the back of the sample compartment mounting area.

(7) Press down on the multi-cell holder from the top so that the positioning pin on the front-bottom of the multi-cell holder inserts into the sample compartment positioning aperture.

(8) Tighten the knurled screws (2) at the front edge of the sample compartment.

(9) Mount the slide panel that was removed. *

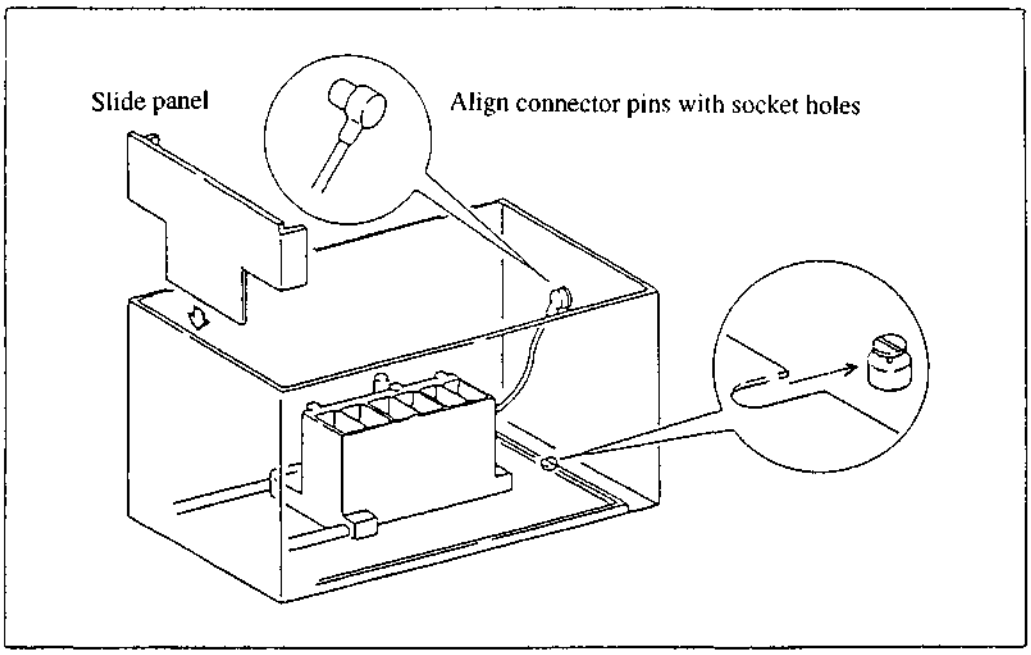


Fig. 5.2.1 Mounting the multi-cell holder

(10) Turn ON the unit power switch.

(11) Check to see that the initialization process is properly completed.

(12) Press the [GOTO WL] key and set the wavelength to "530nm".

(13) Using a white piece of paper (a business card or the like), check to see that the center of the beam matches with the center of the cell position at the position of the front-most cell in the multi-cell holder. It is abnormal for the light to strike the cell holder without passing through the cell holder hole. In this case contact your Service Representative.

※NOTE : Insted of the slide ponel, "Cover, Sample Compartment" can be attached to the Multi-cell Sample Compartment. Please refer to "5.5 Removing & Securing "Cover, Sample Compartment" ".

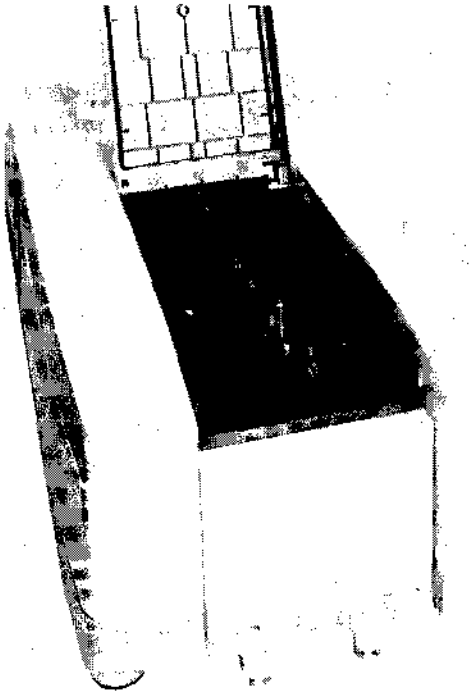


Fig. 5.2.2 Mounting the multi-cell holder

5.2.2 Operating Procedure

Please refer to Chapter 11 "11.1 Multi-cell" of the Operating Manual for the operating procedure of the UV-1601 when the multi-cell holder is installed.

The CPS-240A thermoelectrically temperature controlled cell positioner is an temperature controlled cell holder for maintaining the temperature of 6 cells at a constant temperature. The CPS-240A is for use with 10mm rectangular cells, but a flow cell type, the CPS-240B, is also available. The UV-1601 screen displays and this operating manual are based on the typical CPS-240.

CPS-240 Main Specifications		
Possible number of cells	:	Sample side 6 (w/ temperature control) Reference side 1 (w/o temperature control)
Temperature setting range	:	16~60°C
Temperature accuracy	:	±0.5°C
Temperature control precision	:	±0.1
Ambient operating temperature	:	15~35°C

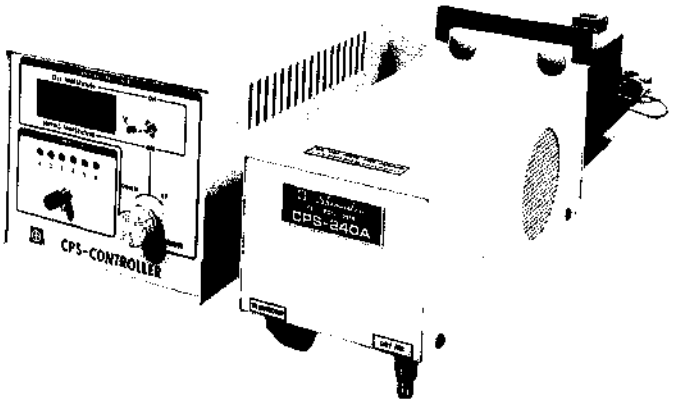


Fig. 5.3.1 CPS-240

5.3.1 Installation Procedure

(1) Turn OFF the UV-1601 power switch.

(2) Loosen the knurled screws (2) at the front edge of the sample compartment.

(3) Lift the entire sample compartment up and pull out.

(4) Insert the lead edge of the base of the CPS-240 into the positioning pin at the back of the sample compartment mounting area on the spectrophotometer.

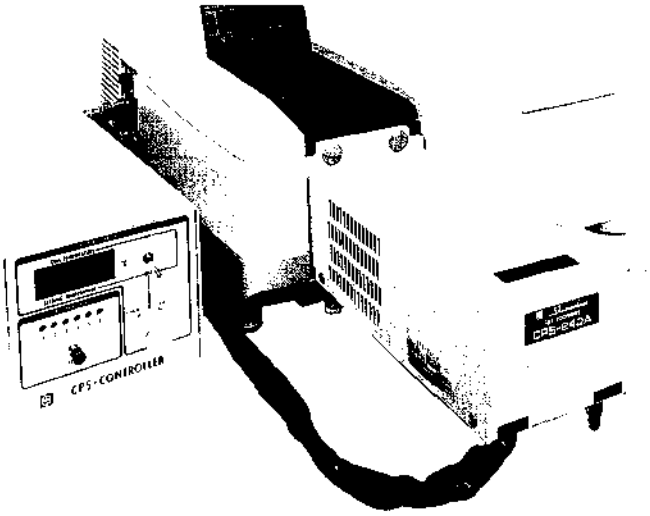


Fig. 5.3.2 Installing the CPS-240

(5) Press down on the CPS-240 from the top so that the sample compartment positioning pin on the front-bottom of the CPS-240 inserts into the sample compartment positioning hole on the unit.

(6) Tighten the knurled screws (2) beneath the front of the sample compartment.

(7) Connect the CPS-240 with the spectrophotometer according to the figure 5.3.3.

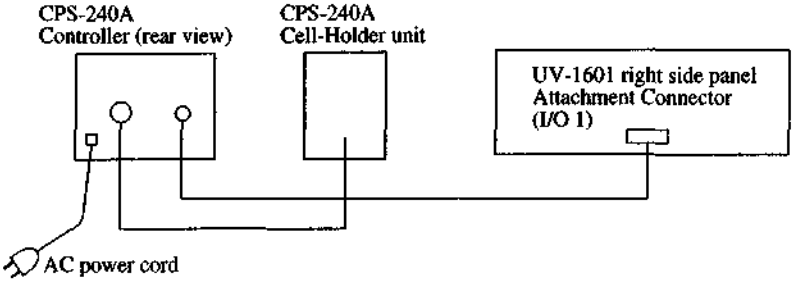


Fig. 5.3.3 Connecting the CPS-240 cable

5.3.2 Operating Procedure

Please refer to Chapter 11 "11.1 Multi-cell" of the Operating Manual for the operating method of the UV-1601 when the CPS-240 is installed.

However, set <1. Sample module > in the Sample Control screen for each measurement mode to "3. CPS-240". Also set the temperature for the CPS-240 with the CPS-240 Controller.

Please refer to the CPS-240 Operating Manual for detailed operating instructions for the CPS-240

5.4 Sipper

Liquid samples can be consecutively aspirated and measured using a peristaltic pump which is driven by a stepping motor.

The following 4 types of sipper units are available depending on the sample quantity required and whether or not there is temperature regulator.

	Minimum required sample quantity	Standard required sample quantity	Remarks
Sipper 160 Type L	1ml	2ml	No temp reg
Sipper 160 Type T	0.8ml	1.5ml	No temp reg
Sipper 160 Type C	1.0ml	2.5ml	w/ temp reg
Sipper 160 Type U	0.3ml	0.5ml	No temp reg
TSU-2200	0.8ml	1.5ml	w/ temp reg

Sipper unit has the following two purposes.

(1) Automatic aspiration and measurement of manually loaded samples.

(2) Fully automatic measurement when linked with an auto-sample changer.

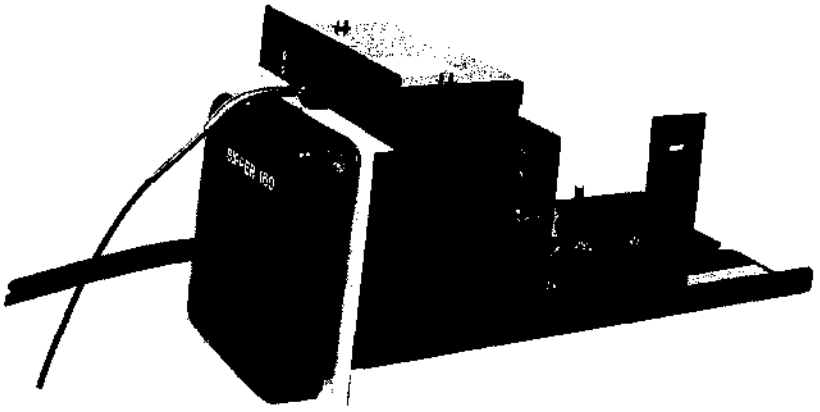


Fig. 5.4.1 Sipper 160

5.4.1 Installation Procedure

(1) Turn OFF the UV-1601 unit power switch.

(2) Loosen the knurled screws (2) beneath the front edge of the sample compartment.

(3) Lift the entire sample compartment up and pull out.

(4) Insert the notched edge of the base of the sipper unit into the positioning pin at the back of the sample compartment mounting area on the spectrophotometer, and slide the front down into place.

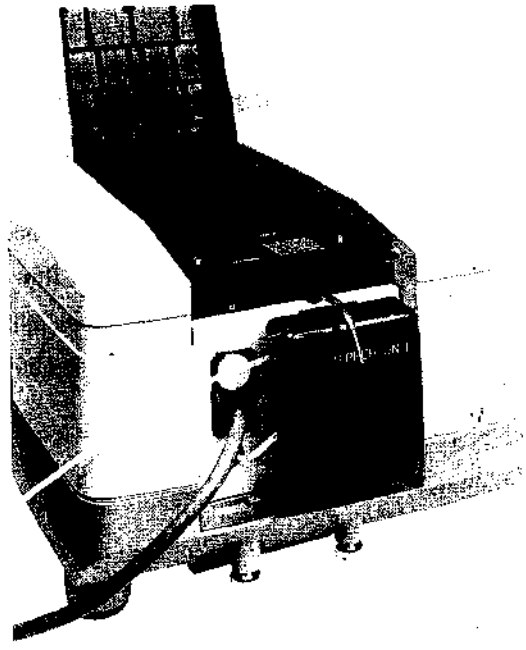


Fig. 5.4.2 Installing the Sipper 160

(5) Press down on the sipper unit from the top so that the sample compartment positioning pin on the front-bottom of the sipper unit fits into the positioning hole on the unit.

(6) Tighten the knurled screws (2) below the sample compartment of the unit.

(7) Securely connect the sipper unit cable to the attachment connector (I/O2) on the right side of the spectrophotometer.

5.4.2 Operating Procedure

Please refer to Chapter 11 "11.2 Sipper" of the Operating Manual for the operating Procedure of the UV-1601 when the sipper is installed.

Please refer to the Sipper 160 Operating Manual for detailed operating instructions for the sipper unit.

[NOTE] Failure of the instrument to initialize properly may be attributable to one of the following.

1) The flow cell is not properly mounted when using a sipper unit, and the beam does not pass through the center of the cell and consequently does not properly strike the detector.

2) The flow cell may be properly set, but there is some sample remaining in the cell, causing the beam to bend.

If initialized fails, In this case, it will be necessary to fill the flow cell with distilled water and turn the power ON again.

You can draw distilled water into the flow cell by pressing the lever on the sipper unit while "UV-1601" is on the monitor display after turning the power back ON.

Dust can stick to the inside walls of the flow cell when the flow cell is dry, making it easy for bubbles to form. Therefore, rinse the flow cell after completing measurements and then fill it with distilled water before you turn the power of the unit OFF. This will prevent problems from occurring during initialization.

5.5 Removing & Securing "Cover, Sample Compartment"

There are optional accessories, such as the constant temperature single cell holder (P/N 202-30858-04) and 10 mm micro flow cell (P/N 204-06222), which are mounted in place of the sample compartment's (standard) cell holder. These may also have tubing fitted to their front panel to work with the circulating water bath.

In order to mount these front panels which are equipped with tubing, it is necessary to remove the "Cover, Sample Compartment" from the standard sample compartment unit. In this case, please follow the following procedure.

5.5.1 Removing the "Cover, Sample Compartment"

(1) Turn OFF the UV-1601 unit power switch.

(2) Loosen the knurled screws (2) beneath the sample compartment on the unit.

(3) Lift the entire sample compartment up and pull out.

(4) Turn the sample compartment unit upside-down and, as shown in Figure 5.5.1, forcibly twist the "Cover, Sample Compartment" in the direction of arrows with your thumb to remove the cover.

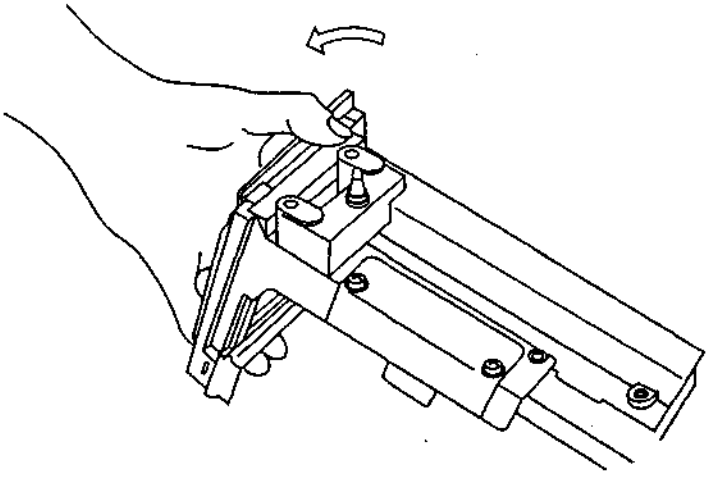
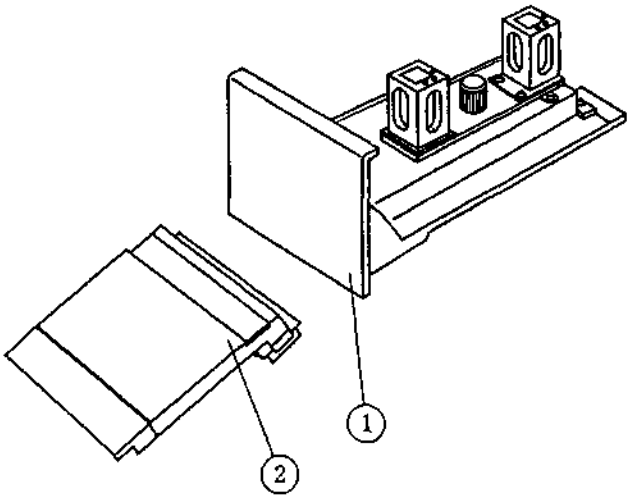


Fig. 5.5.1 Removing the "Cover, Sample Compartment"



(1) Sample compartment unit

(2) "Cover, Sample Compartment"

Fig. 5.5.2 The "Cover, Sample Compartment", removed

(5) Mount the Sample Compartment on the main unit.

(6) Tighten the knurled screws (2) below the sample compartment of the unit.

(7) Install the optional accessory being mounted.

5.5.2 Securing the "Cover, Sample Compartment"

(1) Turn OFF the UV-1601 unit power switch.

(2) Remove the optional accessory which has been mounted.

(3) Loosen the knurled screws (2) beneath the front edge of sample compartment.

(4) Lift the entire sample compartment up and pull out.

(5) Match up the protrusions on the sample compartment unit with the protrusions on the "Cover, Sample Compartment" (2 places) shown by the arrows in Figure 5.5.3.

(6) Press the "Cover, Sample Compartment" against the sample compartment unit, in the direction of the arrows in Figure 5.5.4, until it snaps into place.

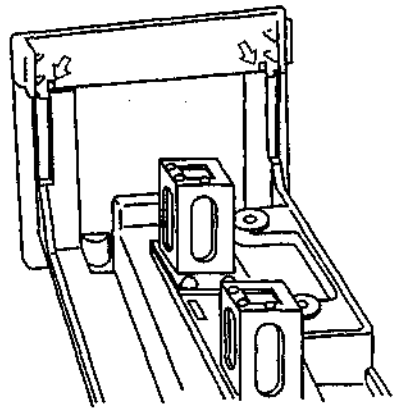


Fig. 5.5.3 Mounting the "Cover, Sample Compartment"

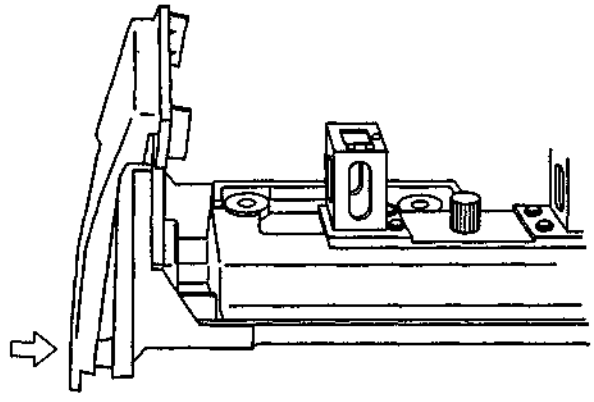


Fig. 5.5.4 "Cover, Sample Compartment" mounting direction

(7) Mount the sample compartment unit on the unit.

(8) Tighten the knurled screws (2) below the front edge of the sample compartment.

Caution : IC card should be handled with care (to protect the program or data)

1. Avoid phsically extreme shock.
2. Do not try to bend
3. Keep out of high temperature and direct sunlight
4. Keep out of strong magnetic fields and the shock of static electricity.

5.6.1 Program Pack

Optional program Pack (IC card) provides optional functions to UV-1601.

•Operating procedure

(1) Firmly insert the Program Pack into the IC card slot of the right side of the spectrophotometer.(shown in Fig 5.6.1) The Program Pack can be inserted/removed whenever the power switch of the spectrophotometer is ON or OFF.

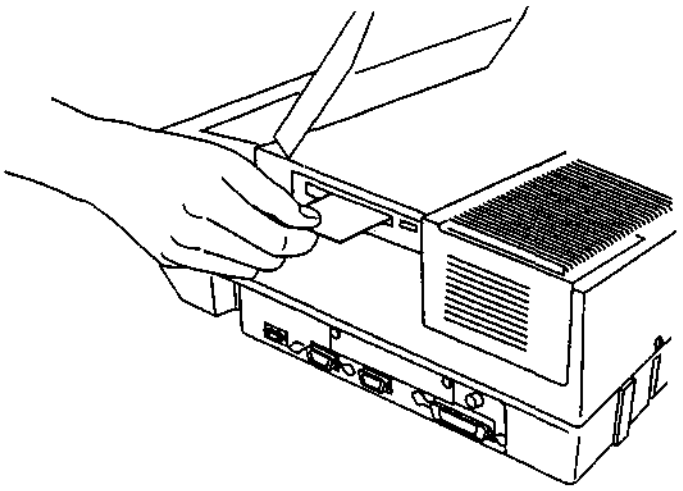


Fig 5.6.1 Inserting the IC card

(2) Select "7. Optional Program Pack" on the Top Menu. (shown in Fig 5.6.2)

The optional program inserted is automatically loaded to the spectrophotometer and its menu (or parameter setting) screen is displayed.

Please refer to Chapter 9 "Optional Program Pack" of the Operating Manual for the operating procedure of the UV-1601 with the Program Pack.

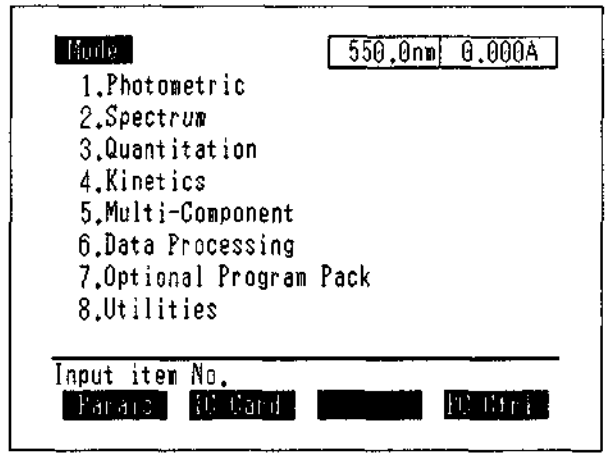


Fig 5.6.2 Top Menu Screen

5.6.2 Data Pack

The Data Pack provides 2 types of memory functions.

(1) Parameter memory function

UV-1601 itself is able to store 16 sets of parameter files.

In addtion to this, one Data Pack IC Card is able to store 79 sets

(2) Data memory function

UV-1601 itself is able to store 5 sets of time course or spectral data curves, or of photometric or quantitation data table.

In addition to this, one Data Pack IC card is able to store 27 sets.

• Operating Procedure

(1) Firmly insert the Data Pack into the IC card slot of the right side of the spectrophotometer. (shown in Fig 5.6.1) The Data Pack can be inserted/removed whenever the power switch of the spectrophotometer is ON or OFF. The stored parameters and data in the Data Pack are kept after removing from the spectrophotometer, since the Data Pack has a own battery inside.

Caution	: Removing Data Pack from UV-1601 If the Data Pack is removed from the UV-1601 while data is being written to or read from the Data Pack, data stored in the Data Pack may be destroyed. Since writing to or reading from the Data Pack is accomplished relatively quickly, perform some key operation and then allow about 2～3 seconds before removing the Data Pack from the UV-1601.

Table 5.6.1 Consumable parts for Data Pack

Consumable parts for Data Pack (lithium batery)		
P/N	Description	Life
074-73306-03	battery, CR2325	approx. 4 years

5.7 List of Optional Accessories

Table 5.7.1 List of Optional Accessories

Part No.	Name
206-14046	Specular reflectance Measuring Attachment 5 ° angle
204-05557-01	Thermoelectrically Temperature Controlled Cell Holder TCC-240A
204-05837-01	Temperature Controlled Cell Positioner CPS-240A
206-69160	Multi-cell Sample Compartment
206-65108	Thermoelectric Sipper TSU-2200
200-92504	Auto Sample Changer ASC-3
204-09100	Auto Sample Changer ASC-5
204-08270-01	Sipper 160 model L
204-08270-02	Sipper 160 model T
204-08270-03	Sipper 160 model C
204-08270-04	Sipper 160 model U
204-06222-01	Micro Flow Cell 5mm
204-06222	Micro Flow Cell 10mm
200-65022	Constant-temperature water circulating device TB-85
204-29230	Sample Waste Unit SWA-2
202-30858-04	Constant temperature Cell Holder
204-27206-02	Constant temperature four Cell Holder
204-23118-01	Long-Path Rectangular Cell Holder
204-27208	Four-cell, Rectangular Long Path Cell Holder
202-06216-02	Cylindrical Cell Holder
204-06896	Micro Cell Holder with mask
204-00850-01	Four-cell Sample Compartment Unit with Holder
204-27588-03	Front Panel with Holes for Sample Compartment
204-51774-01	Gel Scanner GSC-3A
204-58909	Film Holder
206-14334	Super-Micro Cell Holder
206-69746	Capillary Cell Set
206-12852	Flow-Thru Cell for liquid chromatography (with holder)
204-04757	Analog Output Interface
200-91513	Recorder U135-MU
206-81350	Printer DPU-411
206-81009	Thermal Printer, HCP-1A
200-86381	RS-232C Cable
200-86408	RS-232C Cable IBM/AX

Table 5.7.2 List of Optional Cells

Name		Shape	Quartz (S cell)	Glass (G cell)	Quartz(IR cell)	Q'ty	Special holder
Square cell, optical length 10mm		A	200-34442	200-34565	200-66579-01	1	Not required
Square cell, matching type		A	201-98716	201-98746		2/set	Not required
Sealed-type square cell, optical length 10mm		B	200-34444	200-34444-01	200-66579-21	1	Not required
Semi microcell,optical length 10mm required sample volume 1.0mL or more		C	200-66501	200-66501-01	200-66579-11	1	Not required
Semi microcell, optical length 10mm required sample volume 1.0mL or more		D	200-66551		200-66579-12	1	Not required
Super-micro black cell, with 10mm optical path and required sample volume of 50µL or more		K	200-66578-11			1	Super-micro cell holder (206-14334) req'd
Micro black cell, with 10mm opti-cal path and required sample volume of 50µ L more		L	200-66578-12			1	Super-micro cell holder (206-14334) req'd
Cylindrical cell (OD 25µ") (ID 22µ")	L(Optical.length) = 10mm	E	200-34448 (quartz window)	200-34448-01 (glass window)	200-66579-31 IR quartz window	1	Cylindrical cell holder (204-06216) req'd
	L = 20mm		200-34472 (quartz window)	200-34472-01 (glass window)	200-66579-32 IR quartz window	1	
	L = 50mm	F	200-34473-01 (quartz window)	200-34473-03 (glass window)	200-66579-33 IR quartz window	1	
	L = 100mm		200-34473-02 (quartz window)	200-34473-04 (glass window)	200-66579-34 IR quartz window	1	
Square long absorption cell	L = 20mm	G	200-34446	200-34446-01	200-66579-02	1	Long-path rectangular cell holder (204-23118-01)req'd
	L = 50mm		200-34944	200-34944-01	200-66579-03	1	
	L = 100mm		200-34676	200-34676-01	200-66579-04	1	
Short optical lentth cell	L = 1mm	H	200-34660-01	200-34662-01	200-66579-05	1	Short optical length cell spacer req'd
	L = 2mm		200-34655	200-34662-11	200-66579-06	1	
	L = 5mm		200-34449	200-34449-01	200-66579-07	1	
Spacer for short optical length cell K	for 1mm	J		204-21473-03		1	Not required
	for 2mm			204-21473-01		1	
	for 5mm			204-21473-02		1	

Nomencla-ture	Optical length	Shape	Quartz cell (S cell)	Capacity	Optical width of cell	Special holder	Remarks
Flow cell	L=10mm	I	200-34670	1.5mL	4x36	Not req'd, but front plate with hole req'd	For general use,without tubes

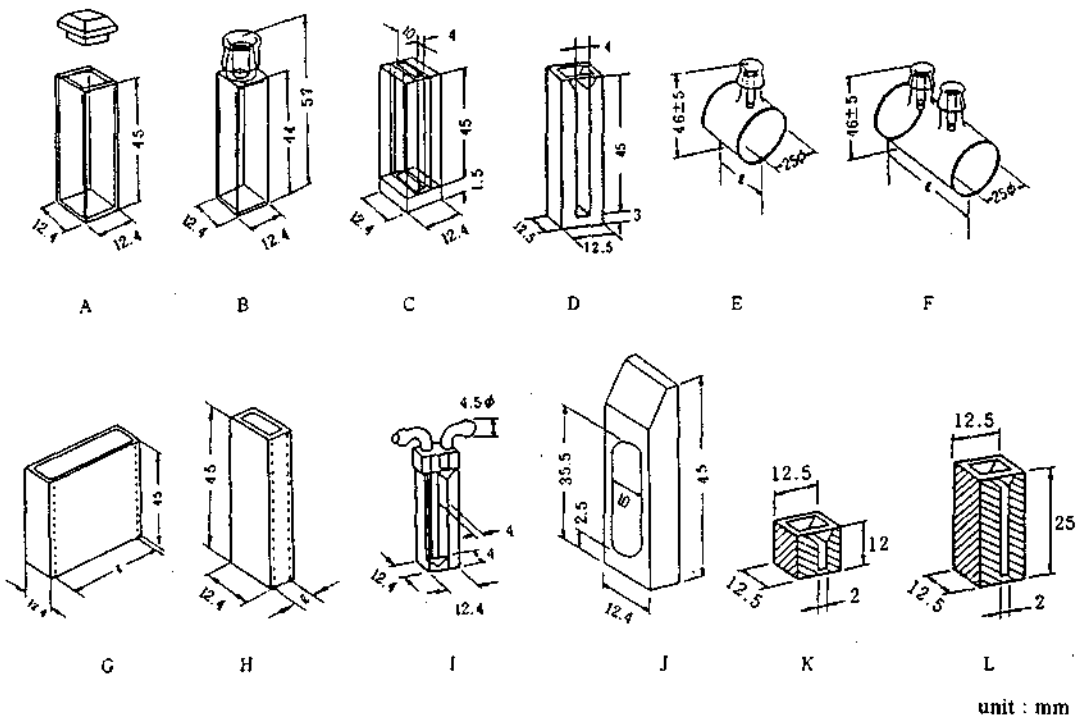


Fig 5.7.1 Optional Cell Shapes

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INSTRUCTION MANUAL

Operation Guide

UV-1601

SHIMADZU RECORDING
SPECTROPHOTOMETER
(P/N 206-67001)

SHIMADZU CORPORATION
CHROMATOGRAPHIC & SPECTROPHOTOMETRIC
INSTRUMENTS DIVISION

Preface

Thank you for your purchase of the Shimadzu Recording Spectrophotometer UV-1601.

The UV-1601 is a newly designed instrument equipped with all of the basic spectrophotometer functions in a compact body. The UV-1601 can also be applied to a variety of analysis using our optional software, available on IC cards.

In order for you to fully employ and effectively utilize the functions of this instrument, it is recommended that you carefully read this manual before using the UV-1601, and thereafter keep it close at hand for future reference.

This Instruction Manual (Operetion Guide) describes the operation of this instrument.
In Chapter 1, the basic key operations, etc. will be explained.
The software for this instrument basically comprises 8 modes for measurement (or data processing, instrument parameter setting, etc.). Chapter 2 describes the methods for selecting these modes and the operations which are shared by several of the measurement modes.
From Chapter 3 on, the details about operation in the various modes are explained.
Of the operations which are shared by the various modes, "Sample Module Control" and "PC Control" are treated in detail in Chapter 11 and Chapter 12.

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Chapter 5 Quantitation Mode

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Chapter 1. Before Operating...

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1.1 Turning ON Power and Initialization

When the power is turned ON, the spectrophotometer is checked and initialized according to the items shown in the screen in Figure 1.1. The time required for this initialization is approximately 3 minutes 30 seconds if all of the items are properly completed. As each item enters its initialization operation, it is highlighted. Then, when the initialization for that item is properly completed, the star next to it is also highlighted. However, if any abnormality is detected, the initialization process is interrupted at that item, without its star being highlighted. Please refer to the "Installaton & Maintenance Manual", "3.2 Initialization and Error Display" regarding the content of the checks performed for each item and the points to check if an error is indicated.

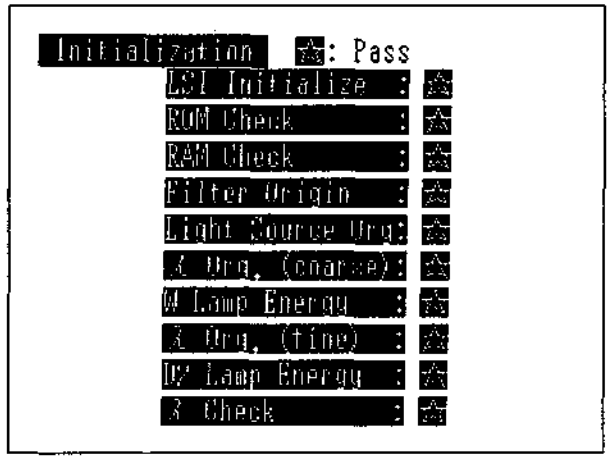


Fig. 1.1 Initialization screen

The UV-1601 keyboard is shown in Figure 1.2. The modes and settings in the various screens can be selected using the number keys 0 through 9 or the function keys F1 through F4. When selecting modes or settings, it is not necessary to press the ENTER key after you have pressed the number keys or function key. On the other hand, when entering numeric values, such as wavelength settings orm display mode, etc., you must press the ENTER key to confirm that value.

Otherwise, refer to the "Installaton & Maintenance Manual", "2.3 Keyboard" for details.

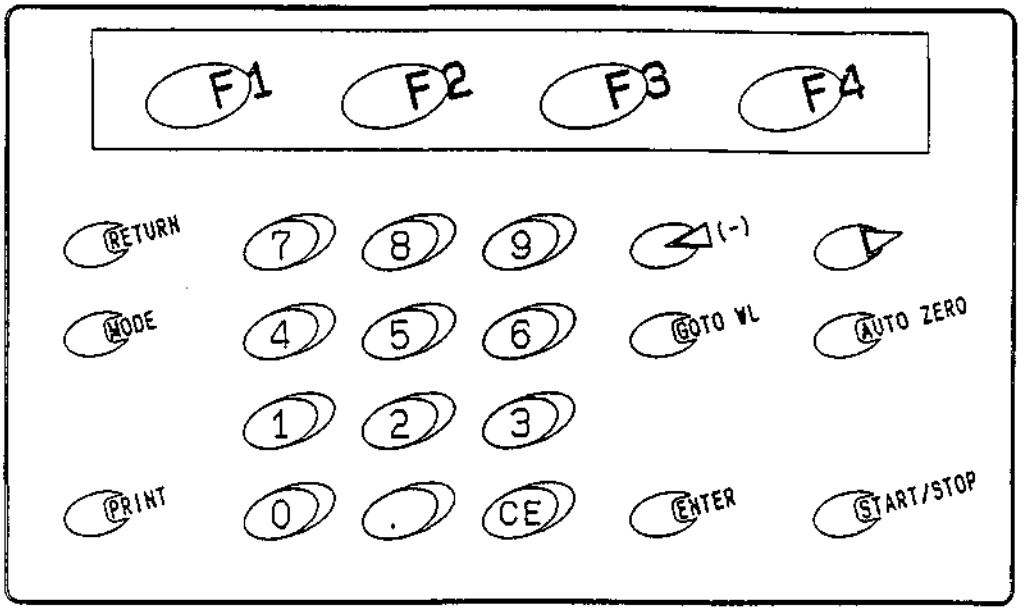


Fig. 1.2 Keyboard

1.3 Screen Copy and Data Printout

When the thermal printer HCP-1A (optional) (P/N 206-81009) is installed, the UV-1601 can print out hard copies of the screen or the measurement results. Connecting this printer makes the following 3 types of printouts possible.

(1) Hard copy of screen : Press the [PRINT] key to print a hard copy of the screen.

(2) Print using function keys: When a function key has a [Print Out] function, as in a mode such as Photometrics in which the measurement results are recorded in table form, all of the tabular data will be printed out.

(3) Print numeric data for : In modes in which the measurement results are obtained as numeric values, as each measurement is acquired (as with Photometric) these measurements will automatically be printed.

The UV-1600 can be connected to a commercially available printer for personal computer that conforms to the printer command ESC/P of EPSON. Connecting to the printer complied with ESC/P enables following output in addition to the above mentioned three types of printouts.

(4) Print waveform

In the spectrum mode and kinetics mode, it is possible to plot the waveform (spectrum) on A4 size paper when it is displayed on the screen. It is half as large as A4 paper. Examples in each mode by the 24-pin printer are displayed in Fig. 1.3 and Fig. 1.4.

By pressing the [PRINT] key while the waveform is being displayed, printing of the waveform or its hard copying can be selected.

For the connection of the printer, refer to the "5.1 Printer" of the "Instruction manual - Installation and Maintenance".

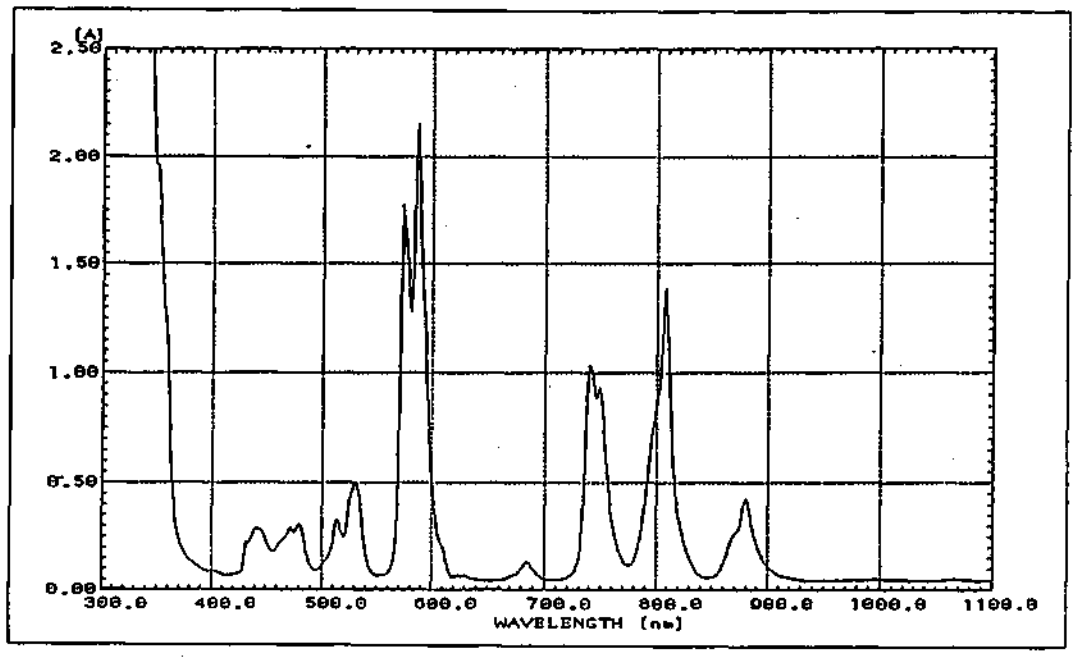


Fig. 1.3 Waveform print(Spectrum mode)

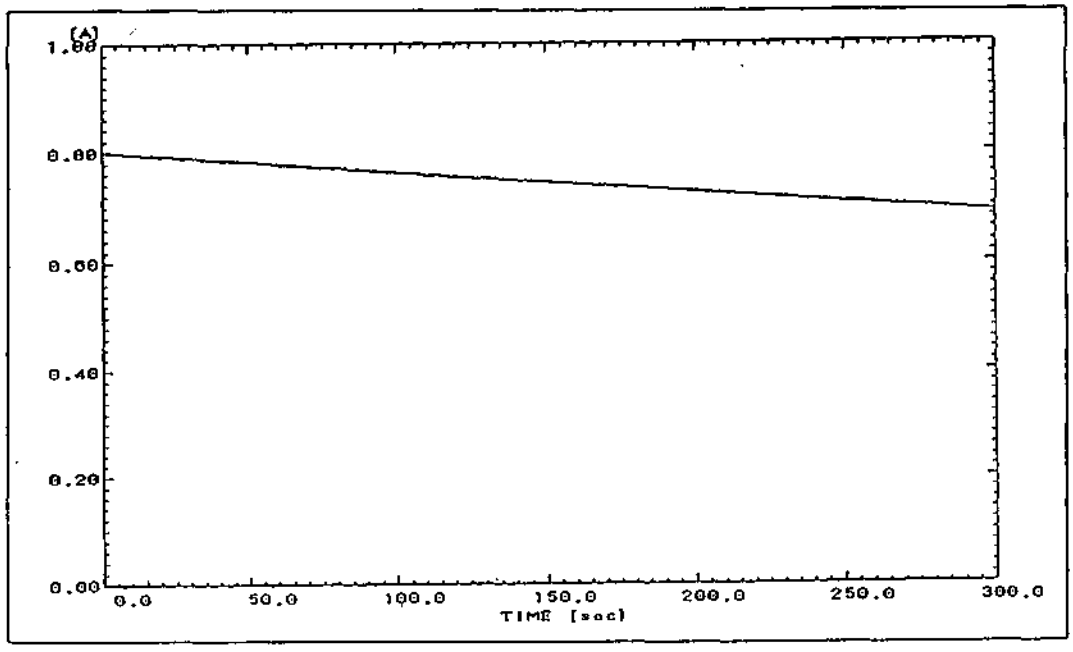


Fig. 1.4 Waveform print(Kinetics mode)

Chapter 2
Mode Selection and Shared Operations

The Mode Selection screen which is displayed after initialization is completed, and the operations which are shared by the various modes are explained in this chapter.

CONTENTS

2.1 Mode Selection Screen

After initialization is completed, the Mode Selection screen is displayed.

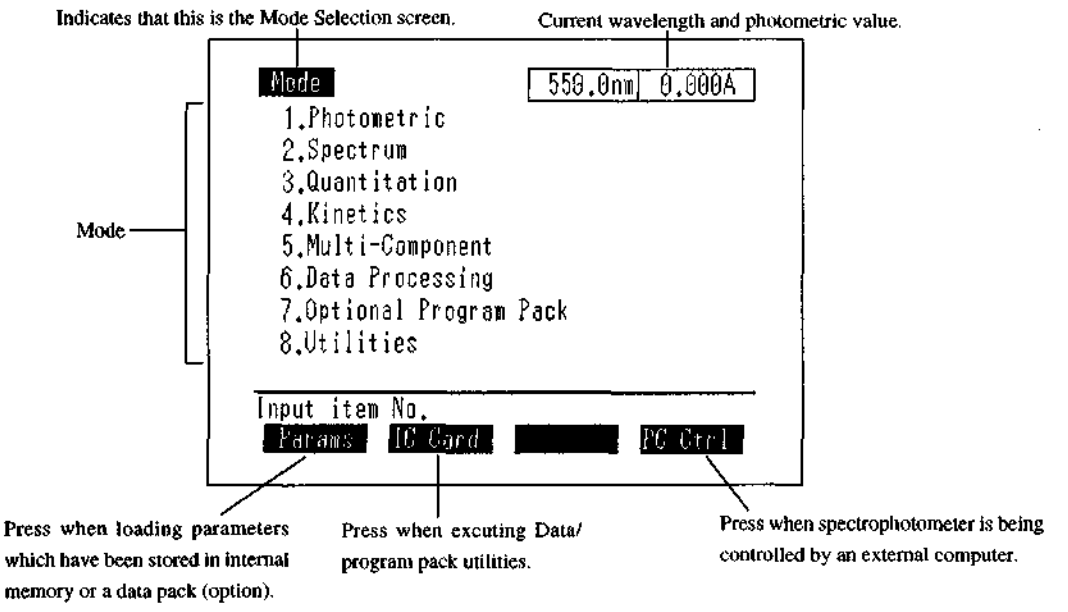


Fig. 2.1 Mode Selection screen

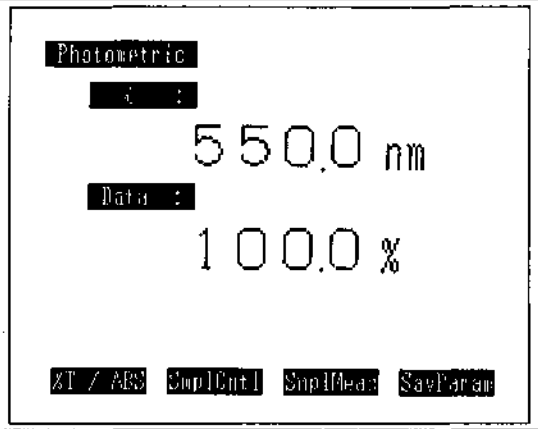
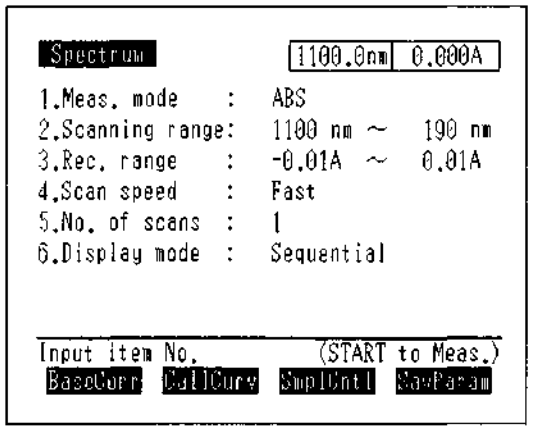
Enter an item number 1. through 8. to select that mode.

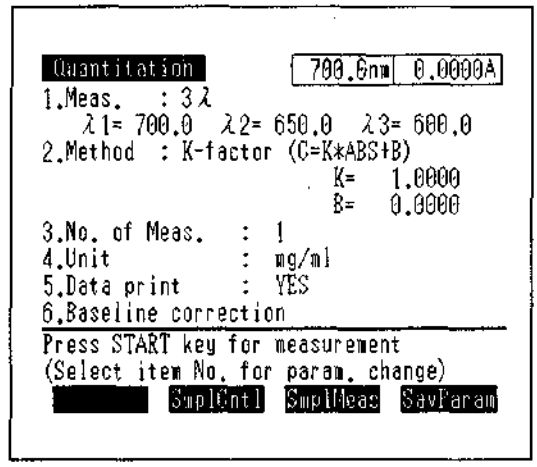
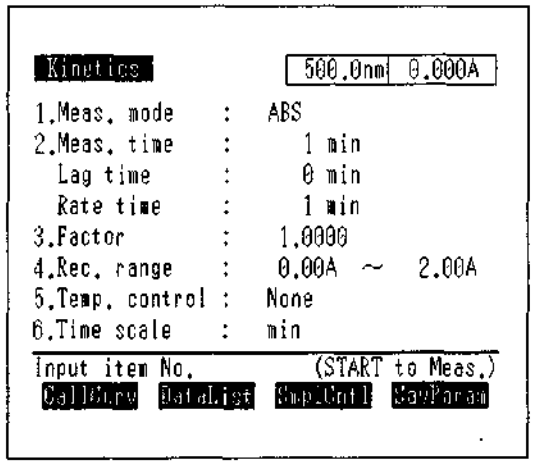
When you select the respective modes, the Parameter Configuration screen shown in "2.2 Overview of Various Modes" will be displayed.

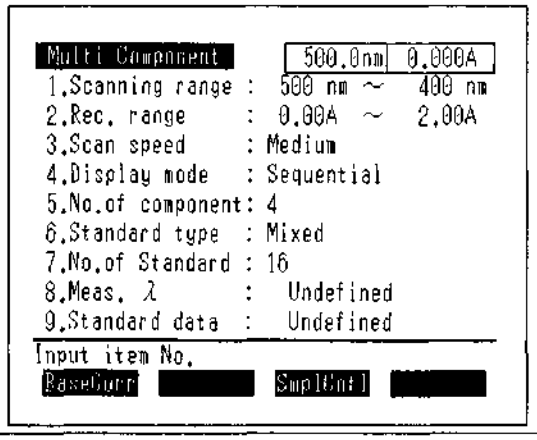
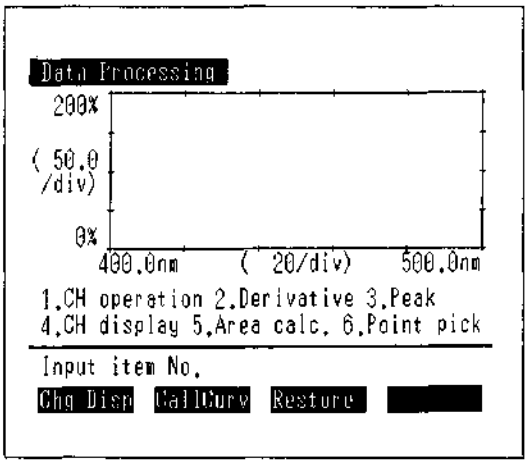
[Params], [IC Card] and [PC Ctrl] are function keys with the various functions noted in Figure 2.1. These are explained in "2.3 Operations Shared by Various Modes".

When you select the various modes in the Mode Selection screen, their respective Parameters Configuration screens will be displayed. The Parameter Configuration screen for each mode and an overview of each are shown below.

Table 2.1 List of Parameter Cnofiguration Screens

Item	Configuration Screen	Overview of Respective Mode
1. Photometric		Measures the absorbance or % transmittance of a sample at a fixed wavelength. (See Chapter 3 Photometric)
2. Spectrum		Scans a wavelength range to measure the absorbance and % transmittance of a sample as a function of wavelength. Single beam energy measurement can also be performed. (See Chapter 4 Spectrum)

Item	Configuration Screen	Overview of Respective Mode
3. Quantitation		Creates a calibration curve from a standard sample and quantitates an unknown sample. Measurement methods are 1-wavelength method 2-wavelength method 3-wavelength method Derivative quantitation In addition, the following methods are available for calibration curve generation K-factor method Single point calibration curve method Multi-point calibration curve method (See Chapter 5 Quantitation)
4. Kinetics		Calculates enzyme activity from the time-dependent change in absorbance. Up to 6 samples can be measured at once using a multi-cell or CPS-240 (both options). Time-dependent changes in % transmittance can also be measured. (See Chapter 6 Kinetics)

Item	Configuration Screen	Overview of Respective Mode
5. Multi-component		Enables samples with up to 8 constituent components to be measured and quantitated. (See Chapter 7 Multi-component)
6. Data Processing		This is the mode in which a variety of processing can be performed on data have been obtained by wavelength or time scanning. Add/Subtract/Multiply/Divide spectra Add/Subtract/Multiply/Divide spectra with a constant - Arithmetic Operations Derivative and smoothing Peak/Valley detection Calculate spectrum area Tabulate wavelength (time) and data values (See Chapter 8 Data Processing)

Item	Configuration Screen	Overview of Respective Mode
7. Optional Program Pack		Select this when using the optional program pack. (See Chapter 9 Optional Program Pack)
8. Utilities	Utilities 1.Start program : Standard menu 2.Data display : 4 3.S/R exchange : Standard 4.Light source : 340.8 5.Printer : ESC/P (L.margin = 5) 6.Clock set : 05/Apr/96 09:27:41 7.D2 lamp off time: ∞ 8.Beep : ON 9.Maintenance Input item No.	This is the mode for setting and changing the basic operating parameters of the instrument. (See Chapter 10 Utilities)

Operations which are shared by several of the modes will be explained here. The operations which are unique to the various modes will be explained in the chapter on the respective mode.

2.3.1 Load Parameters [Params]

Mode Selection screen (F1) key

In order to facilitate entering measurement parameters for each application, you can save the measurement mode and measurement parameters in memory and then load them from the Mode Selection screen. (Refer to "2.3.4 Save Parameters" about saving measurement parameters.)

Up to 16 sets of measurement parameters can be stored in the instrument memory, and if a data pack (option) is used, a total of 95 parameter sets can be stored.

When you select [Params], the parameter file list will be displayed.

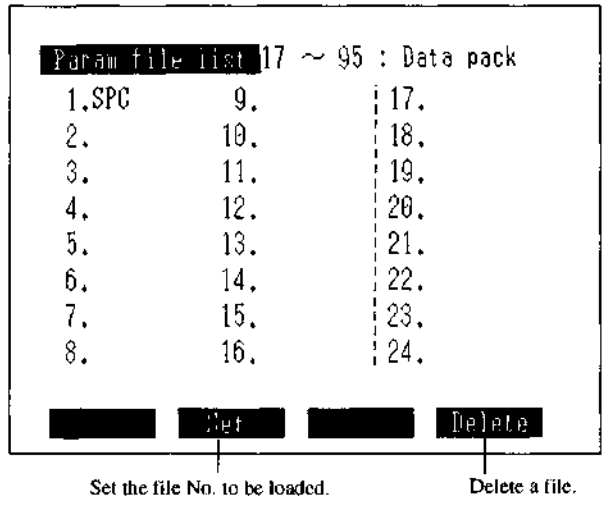


Fig. 2.2 Parameter file list

Select [Set] and enter the file No. for the parameters to be loaded. The screen will switch to the Parameters Configuration screen for the measurement mode stored in that file.

You can delete the file corresponding to the specified number after selecting [Delete].

You can also use the (◁) (▷) keys to change the page displayed in the Parameter file list screen.

2.3.2 IC Card [IC Card]

Mode Selection screen (F2) key

This displays the Data/program pack utilities screen.

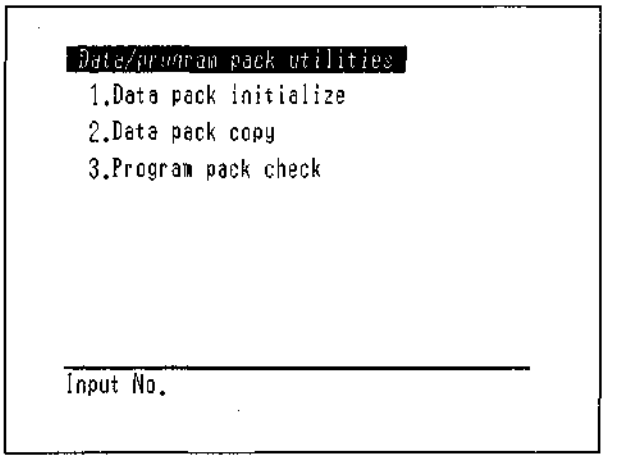


Fig. 2.3 Data/program pack utilities screen

There are 3 functions available for the optional IC cards (data pack and program pack).

<1. Data pack initialize>

This function is the equivalent of a disk format on a personal computer.

A data pack absolutely must be initialized before it is used.

CAUTION! Initializing a data pack that is in use will delete all of the information stored on it.

<2. Data pack copy>

This function copies the contents of one data pack to another data pack. Due to the memory capacity of the instrument, the copy processes is divided into two steps. Therefore, it will be necessary to insert the data packs (source and destination) two times each. Please note that the optional program pack cannot be copied.

<3. Program pack check>

This is to check the contents of the program pack. The results of the title, mode No., version no. and check sum (check for content errors) checks will be displayed.

2.3.3 PC Control [PC Ctrl]

Mode Selection screen (F4) key

Please see "Chapter 12 PC Control" regarding the [PC Ctrl] key.

2.3.4 Save Parameters [SavParam]

Photometric	Parameter Configuration screen	(F4) key
Spectrum	Parameter Configuration screen	(F4) key
Quantitation	Parameter Configuration screen	(F4) key
Kinetics	Parameter Configuration screen	(F4) key

This is the function for saving all of the measurement parameters for the current measurement mode in the instrument memory or a data pack (option). The stored parameters can be loaded using [Params].

When you select [SavParam], a parameter file list is displayed.

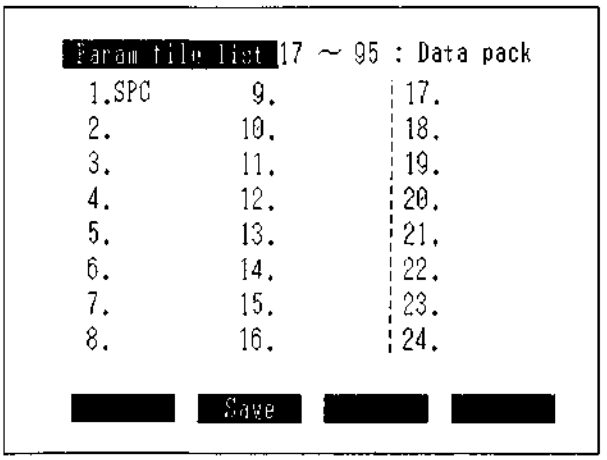


Fig. 2.4 Parameter file list

When you select [Save] and enter the file No. in which the parameters are to be saved, Character input screen will be displayed.

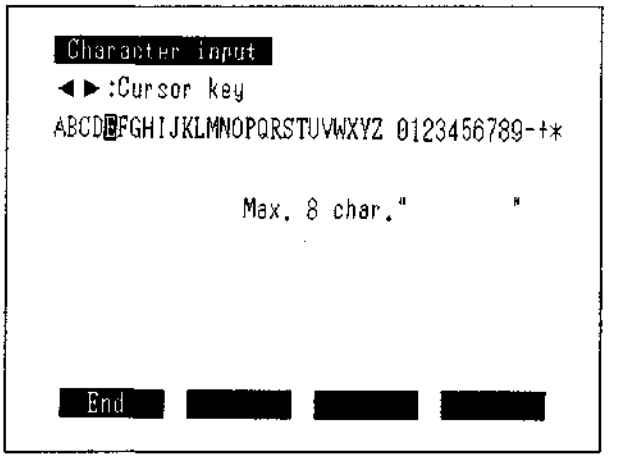


Fig. 2.5 Character input screen

Use the ◁ ▷ keys to move the cursor to the character that you wish to enter and then press the [ENTER] key to input the character. The characters 0 through 9 can be directly entered by pressing the corresponding number key. (Up to 8 characters)

If you make a mistake entering a character, you can delete it with the [CE] key.

The space between the Z and 0 (zero) is a "space" which can also be entered. However, a "space" can not be placed at the front of a filename.

When you are finished entering and select [End], the measurement parameters will be saved to the file of the specified number under the filename which was entered.

2.3.5 Measurement Screen [SmplMeas]

Photometric Parameter Configuration screen (F3) key
Quantitation Parameter Configuration screen (F3) key

In modes which handle numeric data, such as photometric values and concentrations, etc., you can switch from the parameter configuration screen to a measurement screen that displays the measured values.

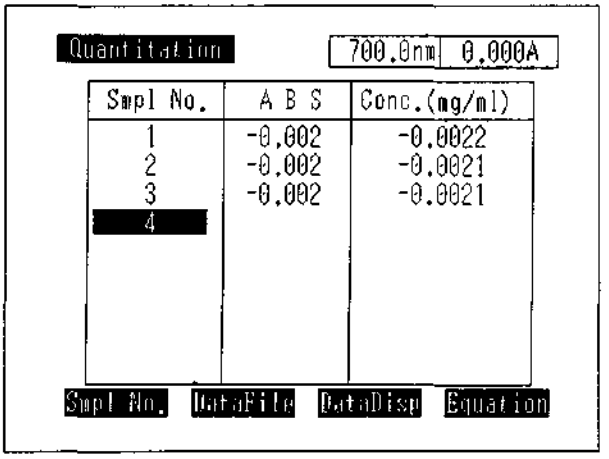


Fig. 2.6 Photometric measurement screen

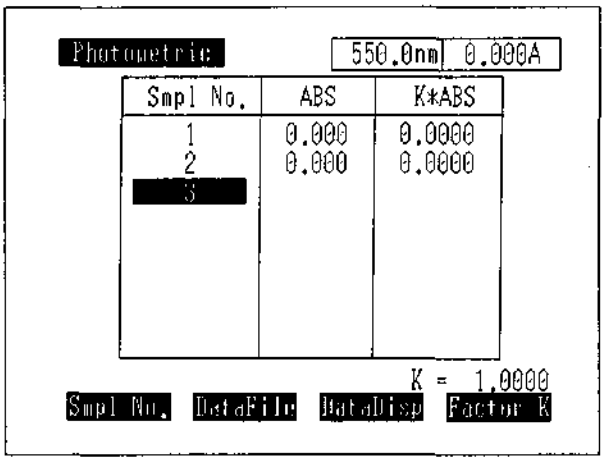


Fig. 2.7 Quantitation measurement screen

2.3.6 Start Measurement

(START) key

In the Photometric, Spectrum, Quantitation and Kinetics modes, you can start measurement by pressing the [START] key in the Parameter Configuration screen or the Measurement screen.

Please refer to Chapter 7 Multi-component Quantitation Mode" regarding that mode.

2.3.7 Sample Control [SmplCntl]

Photometric	Parameter Configuration screen	(F2) key
Spectrum	Parameter Configuration screen	(F3) key
Quantitation	Parameter Configuration screen	(F2) key
Kinetics	Parameter Configuration screen	(F3) key
Multicomponent	Parameter Configuration screen	(F3) key

Set the sample module control parameters.

Settings include the sample module type, number of cells, sipper (option) parameter settings, black correction, etc.

For more details, refer to "Chapter 11 Sample Module Control".

2.3.8 Baseline Correction [BaseCorr]

Spectrum	Parameter Configuration screen	(F1) key
Quantitation (except for 1-wavelength quantitation)		
	Parameter Configuration screen	(6) key
Multicomponent	Parameter Configuration screen	(F1) key

This function corrects the baseline in measurement modes which perform wavelength scanning or multi-wavelength measurement.

Baseline correction under the set measurement parameters is started by pressing a key.

To stop correction while it is in process, press the [START/STOP] key.

2.3.9 Save Curve and Call Curve [SavCurve]/[CallCurv]

[SavCurve] is the function which saves spectrum data or time course data to a file.

Also, [CallCurv] is the function for loading to the screen curves which have been saved in a file.

Up to 6 curves can be saved in the instrument memory, while a total of 32 can be saved if an optional data pack (option) is used.

Of these, the data measured in the immediately preceding measurement are automatically saved in the dedicated File No. 0 (zero) under the filename "Original", and data cannot be manually saved to this file using [SavCurve].

These functions for handling curves are available in the Spectrum, Kinetics and Data Processing modes.

In addition, the [CallCurv] function is also available in the Multicomponent mode.

(Chapter 7 Multi-component Quantitation Mode)

[SavCurve]	Spectrum	Measurement screen	(F4) key
	Kinetics	Measurement screen	(F4) key
	Data Processing	Processing screen	(F4) key
[CallCurv]	Spectrum	Parameter Configuration screen	(F2) key
	Kinetics	Parameter Configuration screen	(F1) key
	Multi-component	Measurement screen	(F2) key
	Data Processing	Item Selection screen	(F2) key

When you select [SavCurve] or [CallCurv], a Curve file directory is displayed on the screen. Now, if there are no measurement data from an immediately preceding measurement, the [Save] function will not be displayed.

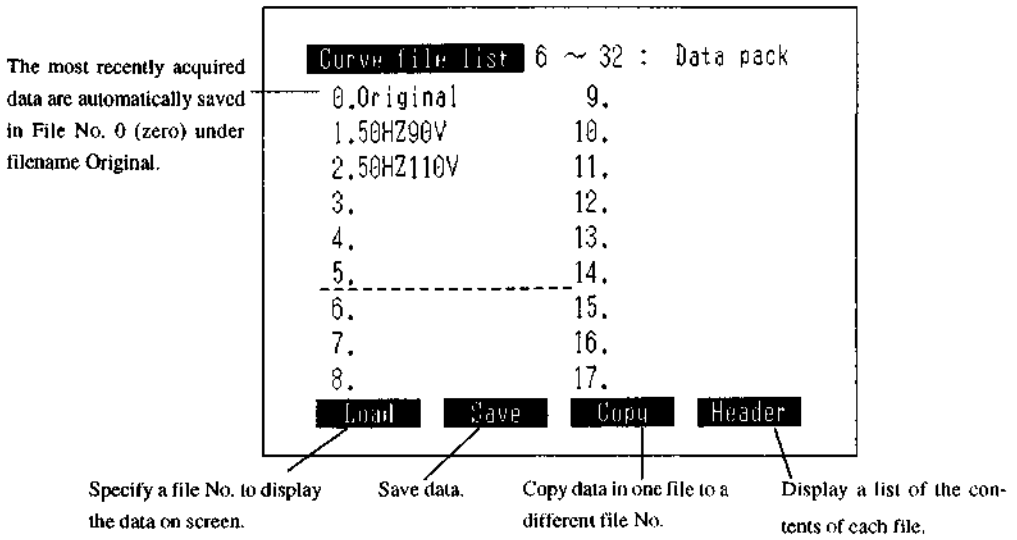


Fig. 2.8 Curve file directory screen

The displayed page of the Curve file directory screen can be switched using the (◁) (▷) keys.

[Load]

This displays the data for the specified file No. on the screen.

If the data type (the vertical axis unit and measured mode are the same) and horizontal axis units match, data can be overlaid on the same screen by consecutively entering file Nos.

When overlaying data, the vertical and horizontal axes for the initially displayed data will be displayed.

NOTE! Since the files which are displayed on the curve file screen or the data file screen use the same area of memory, exactly identical files will be displayed. Consequently, the data files for the various modes are mixed together. Files of different modes cannot be displayed on screens of the measurement mode.

[Save]

This saves measured or processed data in memory areas No. 1 through 32.

When you press [Save], you will be instructed on the screen to enter a file No. When you enter a file No. 1 through 32, the Character input screen will be displayed.

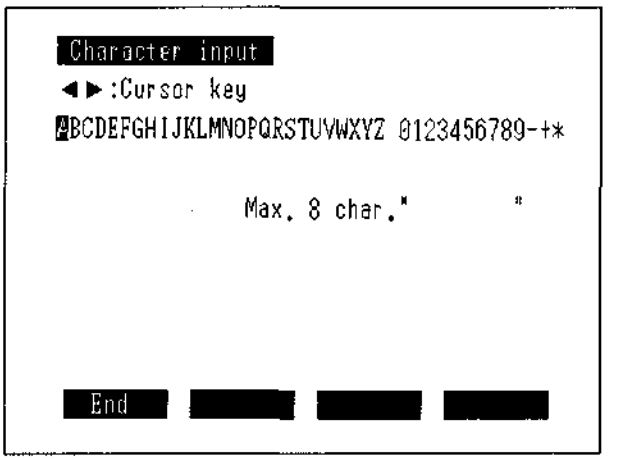


Fig. 2.9 Character input screen

Use the ◁ ▷ keys to move the cursor to the character that you wish to enter and then press the [ENTER] key to input the character. The characters 0 through 9 can be directly entered by pressing the corresponding number key. (Up to 8 characters)

If you make a mistake entering a character, you can delete it with the [CE] key.

The space between the Z and 0 (zero) is a "space" which can also be entered. However, a " space" can not be placed at the front of a filename.

When you are finished entering and select[End] , the measurement parameters will be saved to the file of the specified number under the filename which was entered.

[Copy]

You can copy data between file Nos. 0 through 32. Specify the copy source and copy destination file Nos. as instructed on the screen. No. 0 can't be specified as the destination.

[Header]

You can display the range of the horizontal axis (measurement time or wavelength range) and the units thereof (sec, min, nm) as well as the units of the vertical axis (ABS, T%, E) in the list (Curve file list) so as to see the type of data saved in each of the file Nos. 0 through 32.

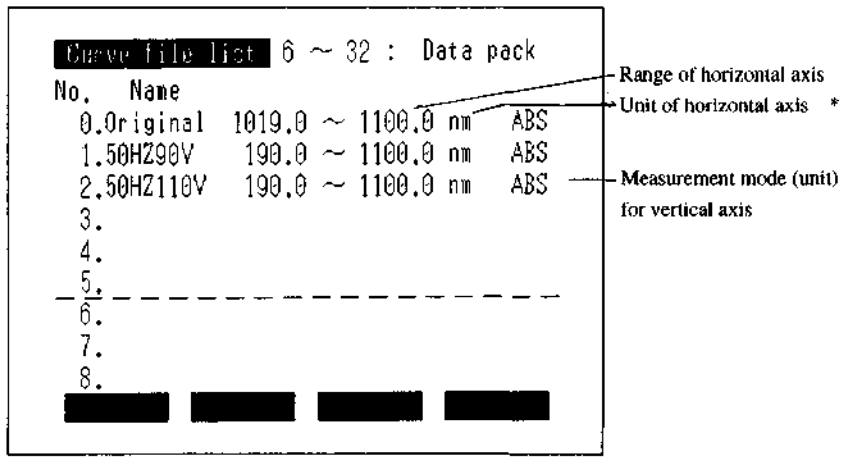


Fig. 2.10 Curve file list screen (Header)

* The data for Photometrics or Quantitation will display the measured wavelength. In the 2 λ or 3 λ quantitation, the longest wavelength will be shown. The data for Kinetics measurements done using a multi-cell or CPS-240 (both option) has a special format in which up to 6 curves can be simultaneously saved in one file. Therefore,"Particular Format" will be displayed with those data.

File No. 0 "Original" ;

The most recently acquired data are automatically saved in the dedicated File No. 0 (zero) under the filename "Original".

The screen can be returned to the immediately preceding condition after file processing, such as display, copy, or data processing ("Chapter 8 Data Processing Mode") have been performed by loading file No. 0.

Other data cannot be saved in file No. 0.

2.3.10 Data Management [DataFile]

Photometric Measurement screen	(F2)	key
Quantitation Measure Unknown Sample screen	(F2)	key

Numeric data tables, such as the photometric values and concentrations obtained in the Photometric and Quantitation modes, can be saved to and loaded from the instrument memory or an data pack (option).

Up to 6 files of data tables can be saved in the instrument memory, while if an data pack (option) is also used, a total of 32 files can be saved.

In addition, the maximum quantity of data comprising the various data tables is 166 data for Photometric mode and 182 data for Quantitation mode.

Of these, the table data up to the immediately preceding measurement are automatically saved in the dedicated File No. 0 (zero) under the filename "Original".

The Data file list screen is displayed when you select [DataFile].

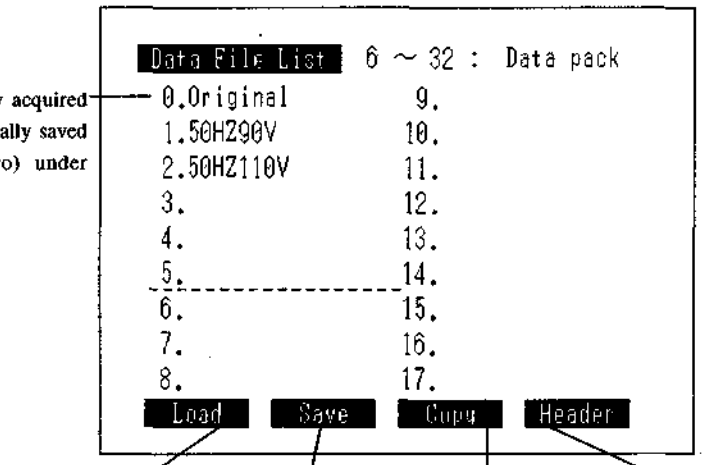


Fig. 2.11 Data File List screen

The operation of each function is the same as [SavCurve] and [CallCurv].

Now, if there are no measurement data from the immediately preceding measurement, the [Save] function is not displayed.

2.3.11 Data Display [DataDisp]

Photometric	Measurement screen	(F3) key
Quantitation	Measure Unknown Sample screen	(F3) key
Kinetics	Measurement screen (Data table)	(F4) key

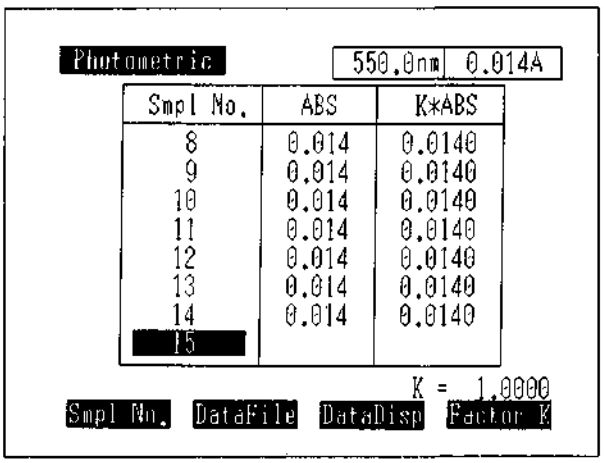
It is possible to display numeric data tables in the Photometric, Quantitation and Kinetics modes.

In measurements which handle numeric data, as the measurement is repeated, the data are successively scrolled across the screen and no more than the immediately preceding 8 data can be displayed on the screen.

The display data function enables the data which preceded these 8 to be displayed.

The amount of data which can be displayed using [DataDisp] is up to 166 in Photometric mode, 182 in Quantitation mode and 133 in Kinetics mode.

For example, an instances in which sample Nos. 1 through 14 were measured in the Photometric mode is shown below.



The data for Nos. 1 through 7 have been scrolled off-screen and cannot be seen in this screen.

Fig. 2.12 Measurement screen example (Nos. 1 through 14)

When you select [DataDisp], the display will change to the Data Display screen.

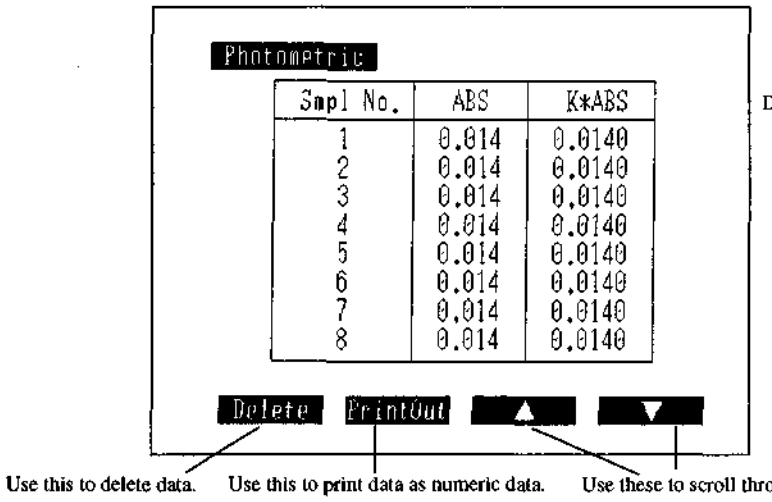


Fig. 2.13 Data Display screen (Photometric mode)

[Delete]

This enables you to delete the entire numeric data table at once.

[PrintOut]

This enables you to print all of the data as a numeric data table on the printer (option). (The [PRINT] key on the keyboard will give a hard copy of the screen currently being displayed.)

No.	ABS	K*ABS
1	0.014	0.0140
2	0.014	0.0140
3	0.014	0.0140
4	0.014	0.0140
5	0.014	0.0140
6	0.014	0.0140
7	0.014	0.0140
8	0.014	0.0140
9	0.014	0.0140
10	0.014	0.0140
11	0.014	0.0140
12	0.014	0.0140
13	0.014	0.0140
14	0.014	0.0140

Fig. 2.14 Printer output (Photometric mode)

[▲][▼]

These enable you to scroll through the data table 8 lines at a time.

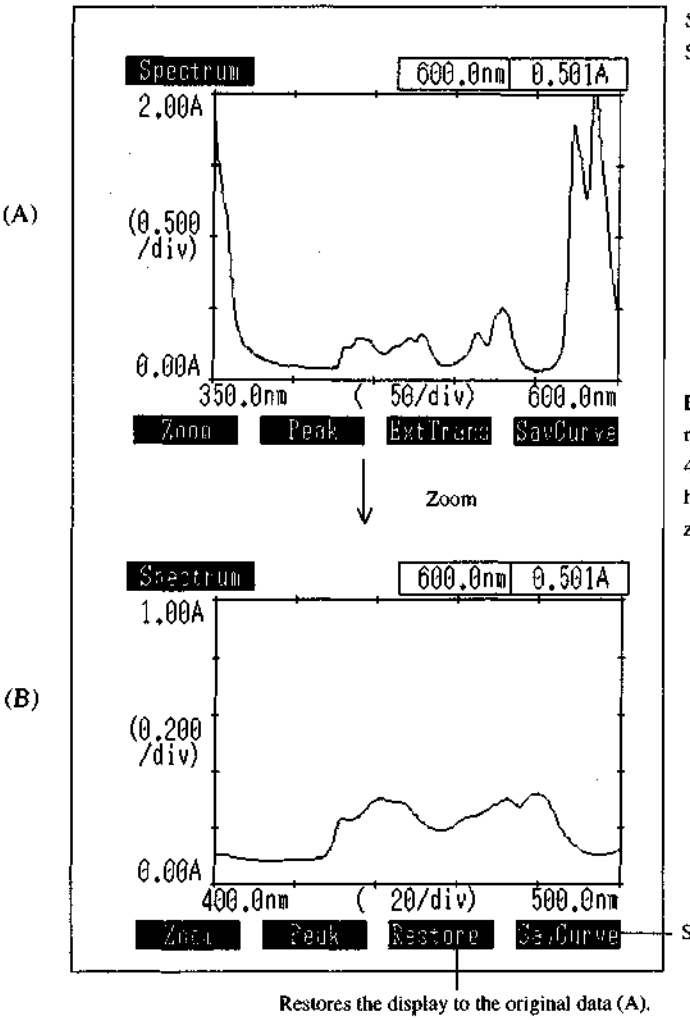
2.3.12 Enlarge/Reduce [Zoom]

Spectrum	Measurement screen	(F1) key
Kinetics	Measurement screen	(F1) key
Data Processing	Processing screen	(F1) key

This is the function to changing the displaying range on the vertical and horizontal axes in the measure mode which deals with the curve data such as spectrum/kinetics/data processing.

Select [Zoom] and enter the values for the vertical axis maximum and minimum and horizontal axis minimum and maximum, in that order, to change the ranges on the vertical and horizontal axes.

If you press the (◁)(▷) keys while entering horizontal axis values, the cursor will be displayed, enabling data values to be read directly from the curve. Press [Enter] while the cursor is displayed and the value of the point on the horizontal axis on which the cursor is resting at that time will become the entered value.



Spectrum screen
Select [Zoom]

Example where the 0~1Abs range on vertical axis and the 400~500nm range on the horizontal axis in (A) is zoomed.

Saves the data in (B).

Restores the display to the original data (A).

(A) Spectrum screen

(B) Zoomed screen

Fig. 2.15 Zoom function

Select [Restore] to return the zoomed data to the original data.

Even if you execute [Zoom] again, [Restore] will return to the (A) display.

You can save the data resulting from the [Zoom] by selecting [SavCurve] in the (B) display (see 2.3.9 Save Curve and Call Curve).

NOTE! 1) If curves are overlaid on the screen using the [CallCurv] function, a [Zoom] will be executed only on the data which were displayed on the screen first, and the other data will be deleted from the screen.

2) When measurement results have been overlaid, a [Zoom] command will be executed on the most recently acquired data; all other data will be deleted.

2.3.13 External Transmission [ExtTrans]

Spectrum	Measurement screen	(F3)	key
Kinetics	Measurement screen	(F3)	key

In the Spectrum and Kinetics modes, you can transmit curve data, such as spectrum data, etc., as text data from the RS-232C port. Use this when loading data to a personal computer, etc.
In the case of spectrum data, the wavelengths and measured values will be paired and output from the higher to the lower wavelength. In the case of kinetics data, the times and measured values will be paired and output from the early end of the course.

Also, in the spectrum mode, spectrum data can be output in analog signal by using the analog output interface (option). Refer to the analog output interface manual for output to the analog output interface.

NOTES! In order to use the RS-232C port on your PC, it will be necessary to make the following settings on your PC in advance. Refer to the MS-DOS manual for more details.

(1) Install and enable the RS-232C interface driver in the system.

(2) Set the RS-232C transmission parameters so that they are the same as those on the UV-1601 side. The UV-1601 transmission specifications are Baud rate: 9600bps

Data bit length	:	7
Stop bit	:	1
Parity	:	Odd
X-parameter	:	None

Refer to "12.1 Connecting to PC" for information on the connection cable.

Use the MS-DOS COPY command for loading on the PC side. The COPY command receives data over the RS-232C port. Enter

COPY AUX DATA.1

and then press the [ExtTrans] key on the UV-1601 to input the currently displayed data

from the RS-232C port (shown as AUX) and save it under the filename DATA.1.
The external transmission function comprises one-direction transmission of data from the UV-1601.
Data transmission is executed continuously in one direction at a speed which presumes that the data are being loaded to a PC. Data are output from the RS-232C port approximately every 20ms. While this speed will be appropriate for most PCs, data may be lost with a slower PC. In addition, if you connect a printer to the RS-232C interface and attempt to print the transmission data, all of the data may not be able to be printed if the printer has a small internal buffer.

* MS-DOS is a product of MicroSoft Corp.

2.3.14 Read Cursor Function

Spectrum	Measurement screen	◁ ▷	keys
Kinetics	Measurement screen	◁ ▷	keys
Data Processing	Item Selection screen	◁ ▷	keys
Data Processing	Processing screen	◁ ▷	keys

In the Spectrum, Kinetics and Data Processing modes, you can use the cursor to read values at any point along the horizontal axis for the data which are displayed on the screen.

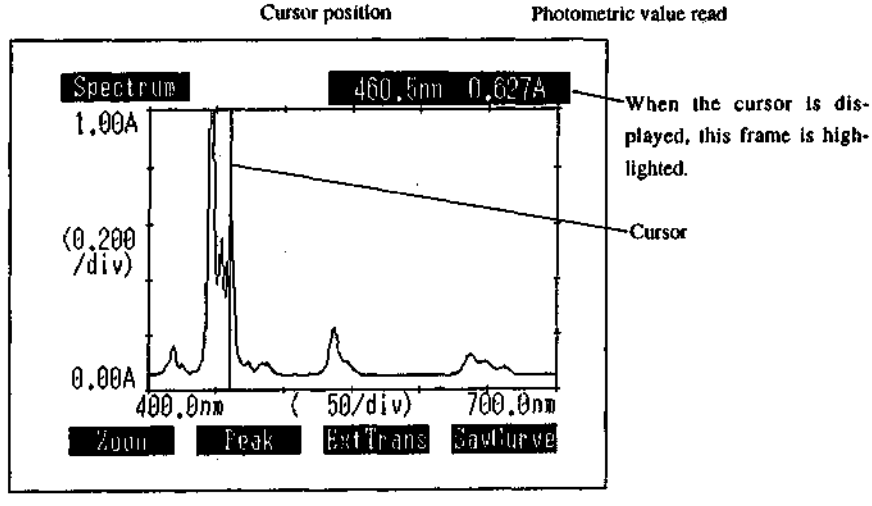


Fig. 2.16 Read cursor screen (Spectrum)

In a screen in which a spectrum, etc. is being displayed, the cursor will be displayed when you press a cursor key (◁)(▷). Hold the cursor key down to move the cursor quickly. At the same time, The frame at the top-right of the screen which normally displays the current wavelength and data will be highlighted and the wavelength (or time value) and photometric value at the cursor position can be read.
Press any key except for a cursor key (◁)(▷) and the [PRINT] key to make the cursor disappear. When Rec. mode is Overlay, the wavelength (or time value) and photometric value at the cursor position will be displayed for the most recently displayed curve.

Chapter 3 Photometric Mode

CONTENTS

3 Photometric Mode

This is the fixed wavelength measurement mode. This measures the absorbance (ABS) or % transmittance (T%) at a fixed wavelength.

By repeating a measurement, you can create and display a table of the measurement results.

It is also possible to quantitate the results by the K-factor method.

This is a simple quantitation method. A sample concentration C is expressed as C=K*ABS, and when the value for K (K = Conc. of Std / absorbance of Std) is already known, you can enter the value for K and measure the concentration of unknown samples.

Up to 166 data can be saved in one file.

When you select <1. Photometric> in the Mode Selection screen, the measurement parameter configuration screen will be displayed.

In this screen, measured values can be output in analog signal at fixed intervals by using the optional analog output interface. For the analog output interface, refer to the analog output interface manual.

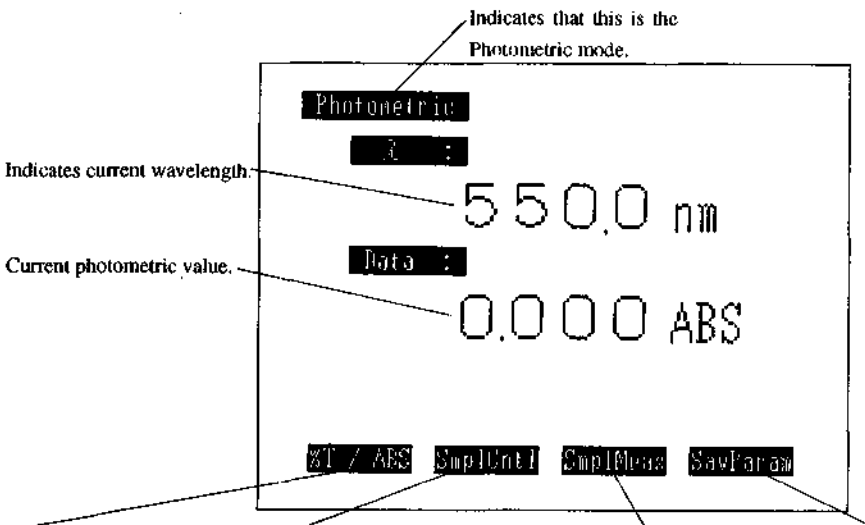


Fig. 3.1 Measurement parameter configuration screen

Setting Measurement Parameters

3.2.1 Set Wavelength

Use the [GOTO WL] key to set the wavelength.

3.2.2 [T%/ABS]

You can switch between the % transmittance mode (T%) and absorbance mode (ABS) each time you press the [T%/ABS] key.

3.2.3 Sample Control [SmplCntl]

Set the type of sample module, the number of cells, the blank correction function, etc.

(See 2.3.7 Sample Control)

3.2.4 Save Parameters [SavParam]

You can save the current measurement parameters to internal memory or to a data pack (option).

(See 2.3.4 Save Parameters)

3.3.1 Measurement Screen [SmplMeas]

Determine the parameters and then press the [SmplMeas] or [START] key to switch to then measurement screen.

(At the same time that you press the [START] key, the first measurement will be performed.)

The method of assigning sample Nos. in the measurement screen in Figure 3.2 differs when a standard sample compartment and sipper unit (option) are used, and when a multi-cell and CPS-240 (both options) are used.

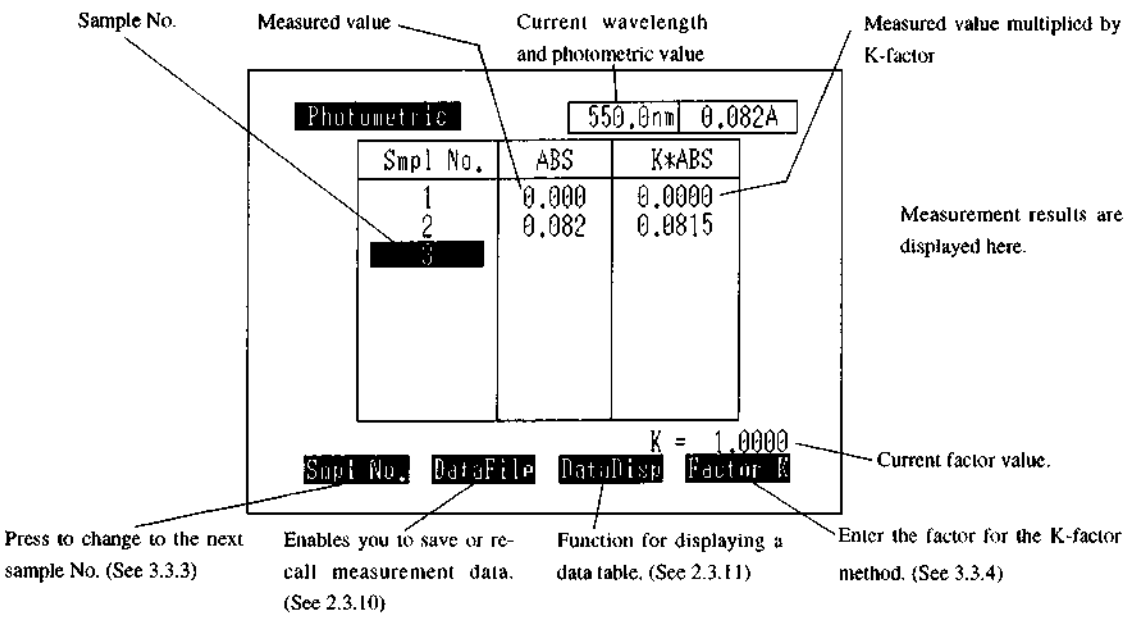


Fig. 3.2(A) Photometric measurement screen (for standard cell holder or when only one cell is being used)

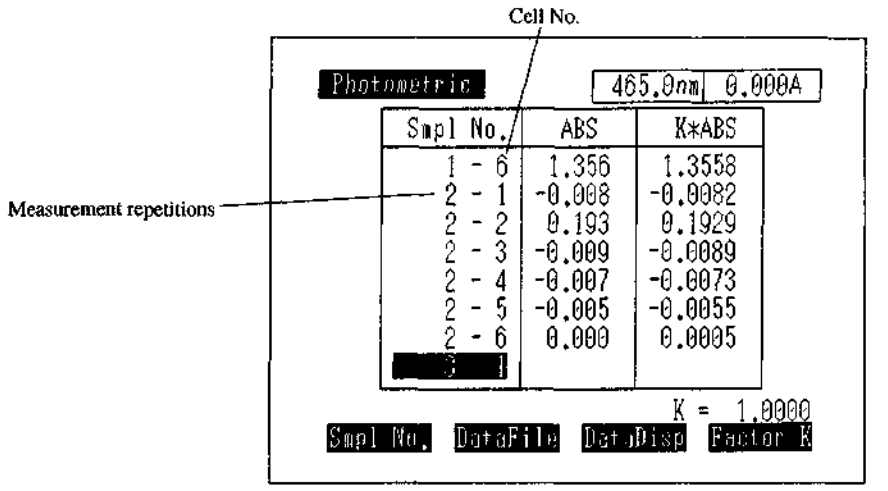


Fig. 3.2(B) Photometric measurement screen (when up to 6 cells are occupied when using a multi-cell or CPS-240A)

3.3.2 [AUTO ZERO]

When blank correction is necessary, set the blank sample and press then [AUTO ZERO] key before measurement Sets the photometric value at this time to 0ABS (100%).

3.3.3 Sample No. [Smpl No.]

You can reassign the number for the next sample being measured.
The sample number input range is 0 to 9999.

3.3.4 [Factor K] (Quantitation by K-factor method)

When the absorbance and concentration are directly proportional, this is a simple quantitation method that calculates the concentration by multiplying the absorbance by a certain conversion factor K.

In the measurement screen, select [Factor K] and then enter the value for K from the keyboard as instructed on the screen.

The current value for K is displayed in the lower-right of the screen. In addition, the value for factor * absorbance =K * ABS is displayed in the right-hand column of the table.

In the transmittance mode, the value for factor K*T% is displayed in the right-hand column of the table.

NOTE!	When performing quantitation by the K-factor method, it is suggested that the measurement mode be set to ABS (absorbance).

3.4.1 Data Print and Screen Copy

When a printer (option) is connected, the measurement results will be printed on the printer for every measurement.

No.	ABS	K*ABS
1	0.057	0.0566
2	0.057	0.0566
3	0.057	0.0566
4	0.057	0.0566
5	0.057	0.0566
6	0.057	0.0566
7	0.057	0.0566
8	0.057	0.0566
9	0.057	0.0566
10	0.057	0.0566
11	0.057	0.0566

Fig. 3.3 Sample printout

You can also print a hard copy of the current screen on the printer by pressing the [PRINT] key.

3.4.2 Data Management [DataFile]

This function is for saving the measurement data to memory, or calling up data to the screen.

(See 2.3.10 Data Management [DataFile])

3.4.3 Data Display [DataDisp]

This function is for displaying a list of measurement data, including data which has scrolled off the screen.

The data table can be printed or data can be deleted.

(See 2.3.11 Data Display [DataDisp])

Chapter 4 Spectrum Mode

CONTENTS

4 Spectram Mode

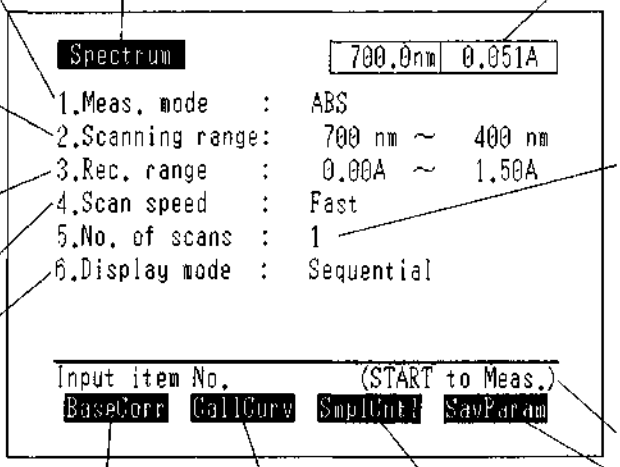
This is the mode in which spectral measurement is performed.

There are three types of measurement available: ABS (absorbance), T% (% transmittance) and single beam E (energy).

Measured spectra can be saved to memory and be subjected to various data processing in the Data Processing mode (Chapter 8).

When you select <2. Spectrum> in the Mode Selection screen, the measurement parameter configuration screen will be displayed.

The measurement parameter configuration screens differ slightly for the ABS (absorbance) and T% (% transmittance) measurement modes (Fig. 4.1) and for the E (energy) measurement mode (Fig. 4.2).



Select absorbance (ABS), % transmittance (T%) or energy (E) measurement.

Shows that the instrument is in spectrum mode.

Shows the current wavelength and photometric value.

Shows the wavelength range over which the spectrum will be measured.

Shows the vertical axis range when a spectrum is displayed.

Shows the scan speed.

Shows how many times the spectrum will be measured for the same sample for each time the [START] key is pressed.

Select whether to overlay each spectrum on the same screen as they are measured or to renew the screen, deleting the previously acquired data each time a spectrum is measured.

Indicates the operating mode.

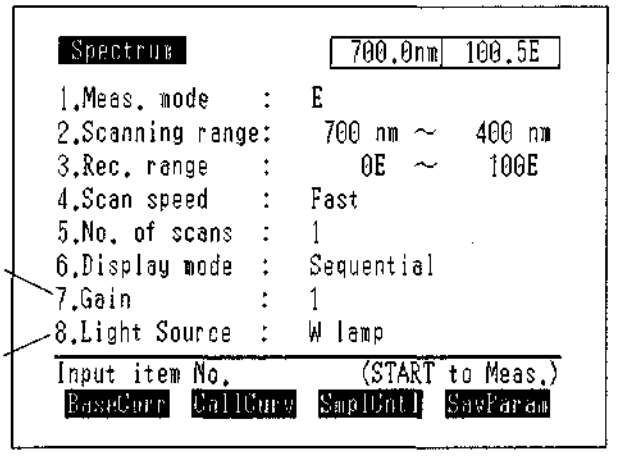
Perform baseline correction. (See 2.3.8)

Call up data stored in internal memory or a data pack. (See 2.3.9)

Set parameters for the sample module. (See 2.3.7)

Enables current measurement parameters to be saved. (See 2.3.4)

Fig. 4.1 Measurement parameter configuration screen (ABS, T% modes)



Set the gain for the photometer amplifier.

Set the light source to be used.

Fig. 4.2 Measurement parameter configuration screen (E mode)

4.2.1 Setting Parameter Items

Set the measurement parameter for each item using key dialogue.

<1. Meas. mode>

Successive selection of item number 1 cycles from ABS -> T% -> E. Simultaneously, the range in <3. Rec. range> also cycles from ABS, T% to E.

<2. Scanning range>

Set the range of the wavelength scan. Enter the scan starting and ending wavelength, in that order. The wavelength input range is 190nm to 1100nm and the starting wavelength must be the longer wavelength of the two.

The minimum scan range is 1nm.

(Scan start wavelength) - (Scan end wavelength) >= 1nm

<3. Rec. range>

Set the range for the vertical axis during spectrum recording. Input ranges

ABS : ±3.99A

T% : ±399%

E : ±399E

<4. Scan speed>

The following 5 wavelength scanning speed levels are available.

1. Very Fast
2. Fast
3. Medium
4. Slow
5. Very Slow

(See 4.6 Scanning Speed and Data Sampling Interval)

<5. No. of scans>

Set the number of times a scan will be repeated.

If this is set to 2 or more times, the interval setting will be displayed with the scanning repetitions on the same display line.

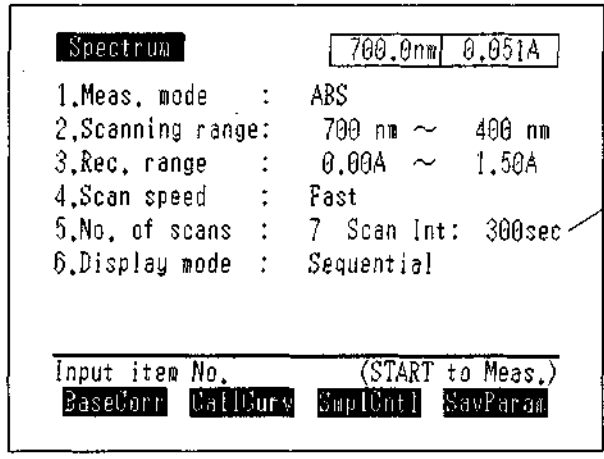


Fig. 4.3 Parameter Configuration screen with scan interval displayed

When you press the [START] key once, measurement will be repeated only the set number of times.

The scan interval is the time from the scan starting time to the next starting time.

If the time required for the actual scan is longer than the set time for the scan interval, the next scan will be performed without any wait time.

If the set scan interval time is longer than the time required for the actual scan, the next scan will start after waiting the amount of time equal to the difference between the two times. During the wait time, the number of remaining scan repetitions and the remaining wait time will be displayed.

<6. Display mode>

This parameter will toggle between Sequential<->Overlay each time this item is selected.

Sequential; The screen is renewed for each scan and only the spectrum from that measurement is displayed.

Overlay; The spectrum display for each scan is left as it is so that multiple spectra are overlaid in the display. If the No. of scans is set to 2 or more, each spectrum will be overlaid on the preceding spectra.

<7. Gain> (E mode only)

This will be displayed only in the E (energy) mode.

This sets the gain for the photometer amplifier so that measurement can be performed without saturation of the energy curve.

The minimum setting is 1 and the maximum is 4. Sensitivity is increased by approximately 4 times with each level.

<8. Light Source> (E mode only)

This will be displayed only in the E (energy) mode

Select the light source when performing energy measurement. Measurement will be performed using the selected light source, regardless of the scanning wavelength range.

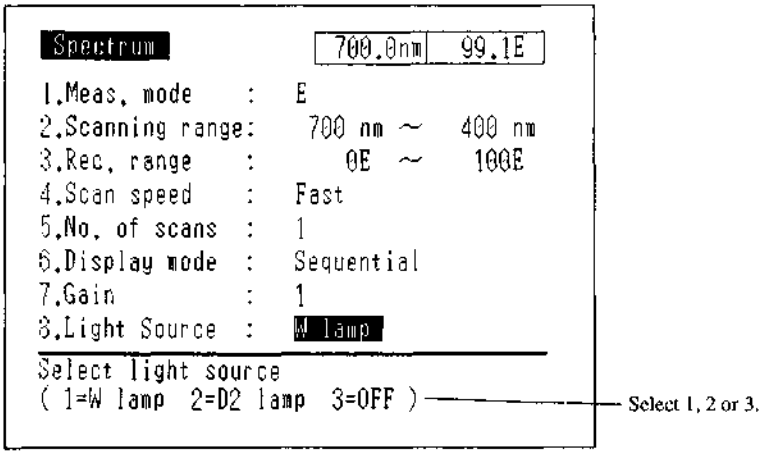


Fig. 4.4 Light source selection screen

4.2.2 Baseline Correction [BaseCorr]

This allows you to set a blank sample and correct the baseline under the measurement parameters which have been set.

(See 2.3.8 Baseline Correction)

4.2.3 Call Curve [CallCurv]

This allows you to recall data which have been stored in the instrument memory or a data pack (option) to the screen.

(See 2.3.9 Save Curve and Call Curve [SavCurve]/[CallCurv])

4.2.4 Sample Control [SmplCntl]

Set the parameters such as sample module type.

(See 2.3.7 Sample Control [SmplCntl])

4.2.5 Save Parameters [SavParam]

You can save the current measurement parameters to the instrument memory or a data pack card (option).

(See 2.3.4 Save Parameters [SavParam])

Once you have determined the parameters and press the [START] key, the display will switch to the measurement screen and measurement will begin. The measurement screen at the end of measurement be similar to that shown in Figure 4.5.

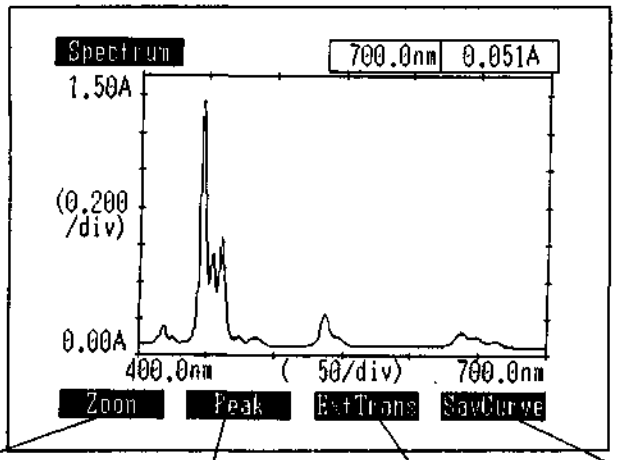


Fig. 4.5 Measurement screen

Press the [START/STOP] key again to interrupt measurement.

The measurement results can be output to the printer (option) as a hard copy of the screen by pressing the [PRINT] key. When connected to a printer conforming to the ESC/P, it is possible not only to print a hard copy but to plot the spectrum in a half size of A4 paper. (Fig. 1.3)

Post-measurement Processing

After measurement is completed, you can perform the following types of data processing.

4.4.1 Cursor Functions

You can read the photometric value at any wavelength on the spectrum using the cursor.

(See 2.3.14 Cursor Functions)

4.4.2 Enlarge/Reduce [Zoom]

You can enlarge and reduce the spectrum by changing the ranges of the vertical and horizontal axes of the displayed spectrum.

(See 2.3.12 Enlarge/Reduce [Zoom])

4.4.3 Peak Table [Peak]

Detect the peaks in a spectrum and display the results as a table of the peak wavelengths and peak data.

If you press [Valley] in the peak table screen, the valleys will be detected and the results displayed as a table.

The maximum number of peaks/valleys which can be detected is 20.

Press the [RETURN] key in the peak table screen (or valley table screen) to return to the spectrum display screen (Measurement screen). At this time, marks will be displayed in the positions that correspond with the peaks and valleys of the displayed spectrum.

The peak detection algorithm (computation principle) uses the 6-point successive comparison method.

This method takes a data sampling point which is at a set wavelength interval and compares it with the preceding data point and the succeeding data point. If the data increases for 6 or more times followed by 6 or more continuous decreasing conditions, declares that a "peak" has been detected. The opposite situation is detected as a "valley".

If the positive or negative condition is reversed even one time in these 6 comparisons, data comparison is again repeated from that time point.

While peak detection accuracy and repeatability are a matter of course with this kind of algorithm, they are subject to the sampling point interval and the shape of the spectrum pattern, particularly, the sharpness of the spectrum and the noise level in the vicinity of peaks and valleys. There are instances in which peak detection will not be performed, depending on how the parameters are selected.

Peak detection accuracy and repeatability are poor in broad absorption patterns, while rather good repeatability and accuracy are obtained for sharp absorption patterns, as with the absorption spectrum for a didymium filter.

The sampling point interval depends on the measurement wavelength range, as in Table 4.1. When

detecting peaks in an extremely sharp spectrum, the measurement wavelength range must be 100nm or less.

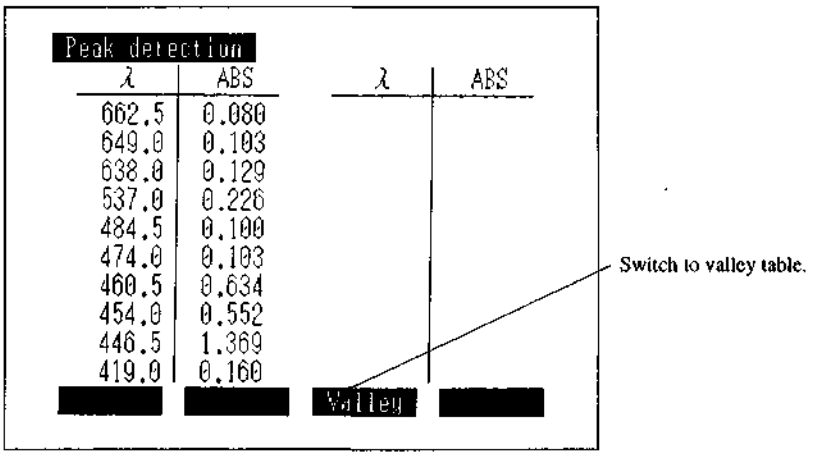


Fig. 4.6(A) Peak table

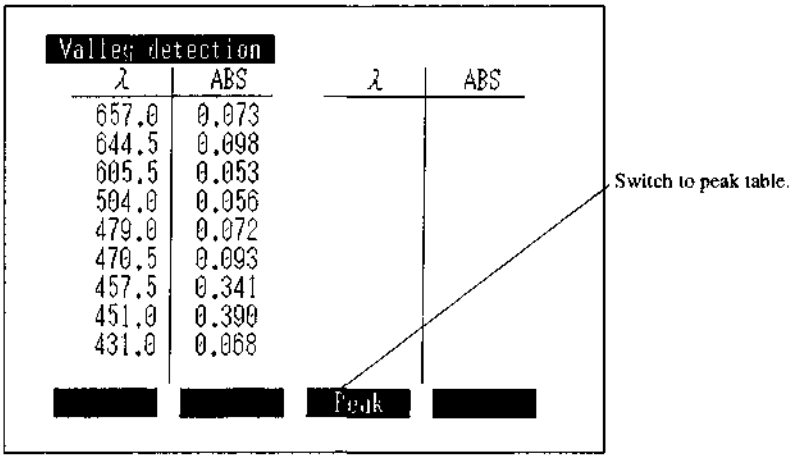
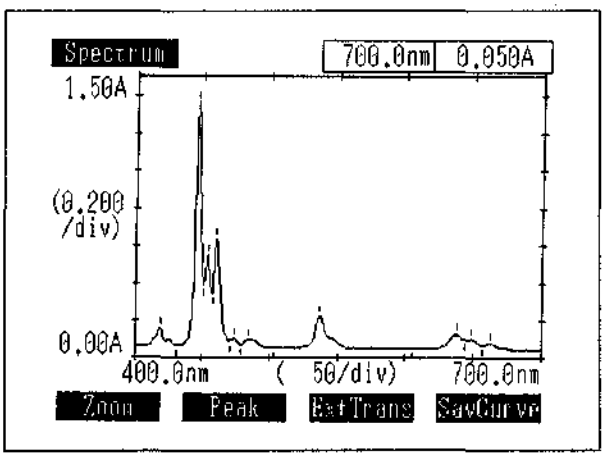


Fig. 4.6(B) Valley table



Marks showing peaks and valleys are added.

Fig. 4.6(C) Peak/valley display screen

4.4.4 External Transmission [ExtTrans]

This enables you to transmit the spectrum data to an external computer, etc. from the RS-232C port.

(See 2.3.13 External Transmission [ExtTrans])

4.4.5 Save Curve [SavCurve]

This enables you to save the spectrum data to the instrument memory or a data pack (option).

(See 2.3.9 Save Curve [SavCurve])

4.5 Data Processing Mode

Once spectrum data measurement is completed, you can return to the mode selection screen and select <6. Data Processing> to perform data processing, such as derivative, arithmetic operations and area computation, etc. on the measured spectrum.

If you shift to another measurement mode, the measured data will be deleted, but when you move to the data processing mode, acquired data will become available for processing. (See Chapter 8 Data Processing Mode)

Scanning Speed and Data Sampling Interval

The data sampling interval is determined by the set scanning speed and the scanning wavelength range. (Table 4.1)

Table 4.1 Data Sampling Interval

Scanning range [λ Range (nm)] (Start Wavelength - End Wavelength)	Scanning speed	
	Not Very Fast	Very Fast
910nm ≧ range ≧ 500nm	1.0nm	2.0nm
500nm > range ≧ 200nm	0.5nm	1.0nm
200nm > range ≧ 100nm	0.2nm	0.5nm
100nm > range	0.1nm	0.2nm

Chapter 5
Quantitation Mode

CONTENTS

5 Quantitation Mode

This is the mode in which unknown samples are quantitated by creating a calibration curve from standard samples. The following 4 types of quantitation are available depending on the number of wavelengths used in the measurement method:

One-wavelength method

Two-wavelength method

Three-wavelength method

Derivative quantitation

The two/three-wavelength methods create the calibration curve and measure the unknown sample using several wavelengths. These are effective in eliminating the effects of dispersion due to interfering components and contaminants and in correcting "floating" of the baseline due to bubbles. For more details, see "5.6 Two/Three-wavelength Quantitation Method".

Derivative quantitation is a method of quantitation using the derivative of a spectrum. For more details, see "5.7 Derivative Quantitation Method".

The following 3 methods are available for creating calibration curves.

K-factor (C=K*ABS+B) method

Single point calibration curve method

Multi-point calibration curve method

The K-factor method is one in which you manually enter the factors K and B for the calibration curve.

The Single point method is one in which the calibration curve is created by measuring a single standard sample.

The multi-point method is one in which the calibration curve is created by measuring multiple (up to 10) standard samples. The multi-point method will not only create a straight line, but can also generate 2nd and 3rd order curve fits of the data.

The quantitated data can be saved to memory or a data pack (option). Up to 182 data can be saved per file.

When you select <3. Quantitation> in the mode selection screen, the measurement parameters configuration screen in Figure 5.1 will be displayed.

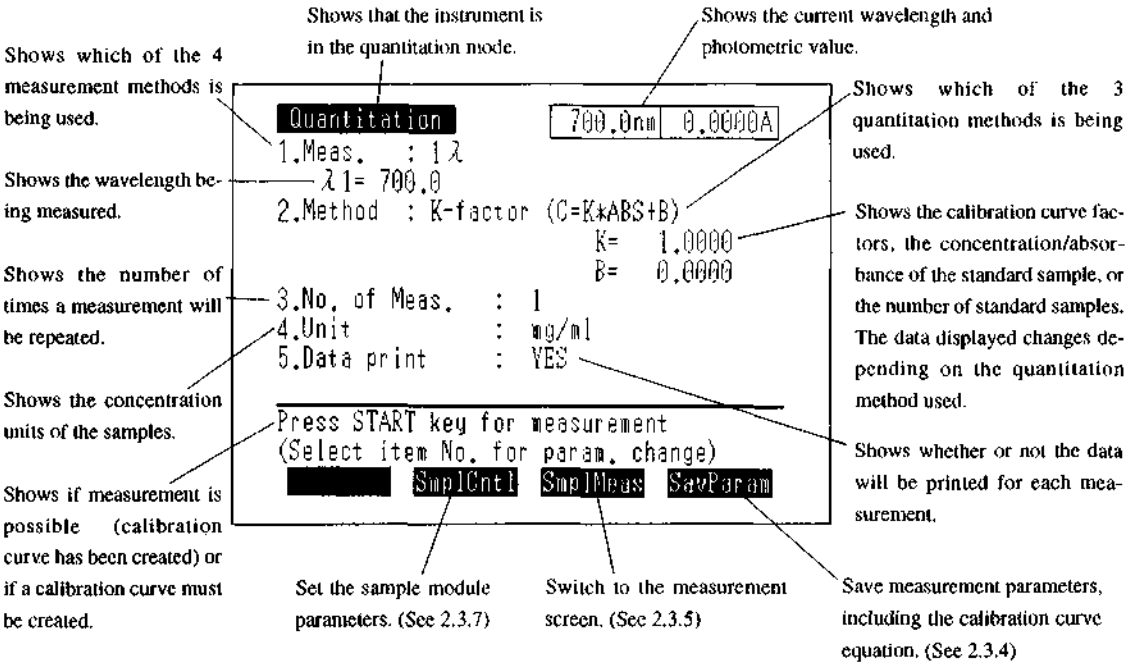


Fig. 5.1 Measurement parameter configuration screen

5.2.1 Set Parameters Items

Set the various measurement parameter items in a dialogue format. Select the parameter to be set by entering the item number.

<1. Meas.> (Measurement method)

The measurement method selection screen is shown in Figure 5.2.

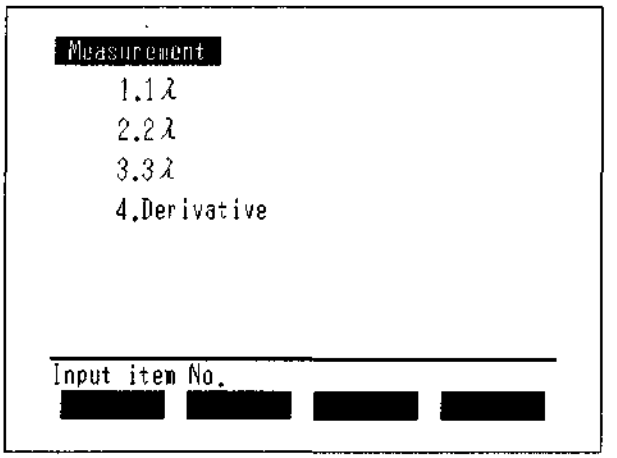


Fig. 5.2 Measurement method selection screen

Select the measurement method from the following 4 types and then enter the measurement wavelength as instructed on the screen.

Furthermore, if you select <4. Derivative>, enter the order of derivative (1st~4th).

<1. 1 λ >

Enter measurement wavelength λ_1.

<2. 2 λ >

Enter measurement wavelengths λ_1 and λ_2. λ_1 and λ_2 will be set in the order they were entered.

(See 5.6 Two/Three-wavelength Quantitation Method)

<3. 3 λ >

Enter measurement wavelengths λ_1, λ_2 and λ_3. λ_1, λ_2 and λ_3 will be sorted automatically in the order of $\lambda_1 > \lambda_2 > \lambda_3$ after they were entered.

(See 5.6 Two/Three-wavelength Quantitation Method)

<4. Derivative>

Enter the measurement wavelength λ_1 and the order of derivative.

(See 5.7 Derivative Quantitation Method)

<2. Method> (Quantitation method) ... (Create calibration curve)

The quantitation method can be selected from 3 methods, as shown in the screen in Figure 5.3. If you select single point calibration curve or multi-point calibration curve, create the calibration curve before measuring the unknown sample.

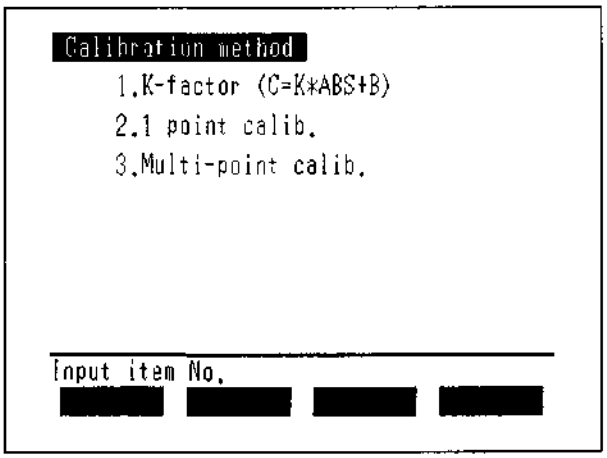


Fig. 5.3 Quantitation method selection screen

<1. K-factor (C=K*ABS+B)>

The relationship between the concentration C and absorbance ABS of a sample is expressed as C=K*ABS+B, and when the values for the constants K and B are already known, you can manually enter the values for K and B to create the calibration curve.

If you enter K and B, you can set a blank sample, press the [AUTO ZERO] key to set ABS=0 and immediately measure the blank sample.

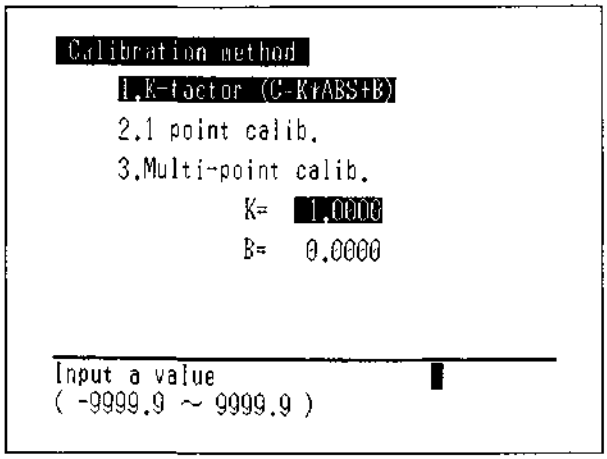


Fig. 5.4 K/B input screen

<2. Single point calib.>

This will measure the concentration of an unknown sample by finding the value for K in the calibration curve equation C=K*ABS from a single standard sample of known concentration. The calibration curve will be a straight line defined by the origin and the absorbance and concentration of the standard sample.

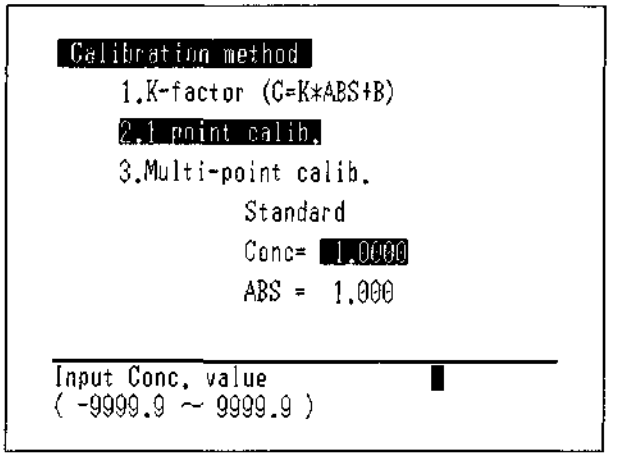


Fig. 5.5 Single point calibration curve creation screen

In order to create a calibration curve, first key in the concentration of the standard sample according to the instructions on the screen. Next, determine the value for ABS for the standard sample. (Fig. 5.5) There are two methods for entering the value for ABS, shown below.

1) Key input

   Enter the numeric value for ABS from the keyboard.

2) Measurement input (using only cell 1)

   Set the standard sample and press the [START] key.

   In the case of a multi-cell or CPS-240(both options), use only cell 1.

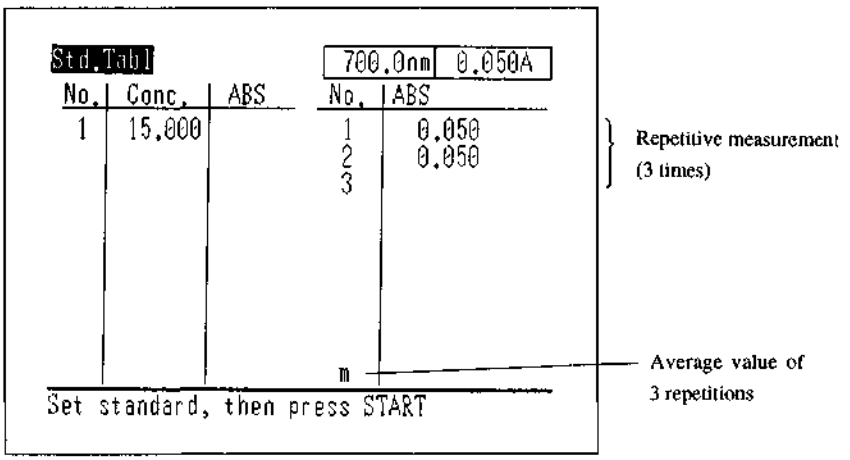


Fig. 5.6 Single point calibration curve creation screen (Repetitive measurement)

If the number of repetitions is set to 2 or higher, an indicator of the number of repetitions will be displayed and the average value will be used to determine the K value.

The results of each measurement will be displayed in the measurement value table on the right. After the repetitive measurements are completed, the average value (represented by m at the bottom of the right side) will be displayed in the concentration table on the left.

<3. Multi-point calib.>

1st/2nd/3rd order calibration curves can be created by the least square method from 1 to 10 standard samples of known concentrations.

Enter the number of standards samples (1-10), the order number (1-3) and whether or not to pass through the origin according to the instructions on the screen.

The number of standard samples must be more than the order number of the calibration curve when "0 intercept: YES" is selected, and must be more than (order number + 1) when "0 intercept: NO" is selected.

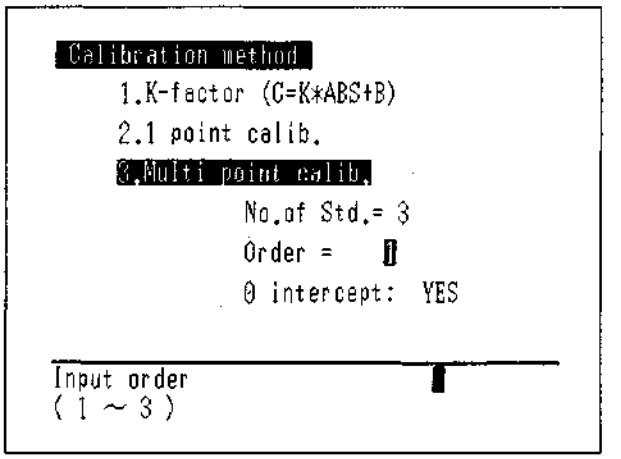


Fig. 5.7 Multi-point calibration curve parameter configuration screen

When setting of the items is completed, the screen will return to the parameter configuration screen. If you press the [START] key at this time, the display will switch to the calibration curve creation screen (concentration table). (Fig. 5.8)

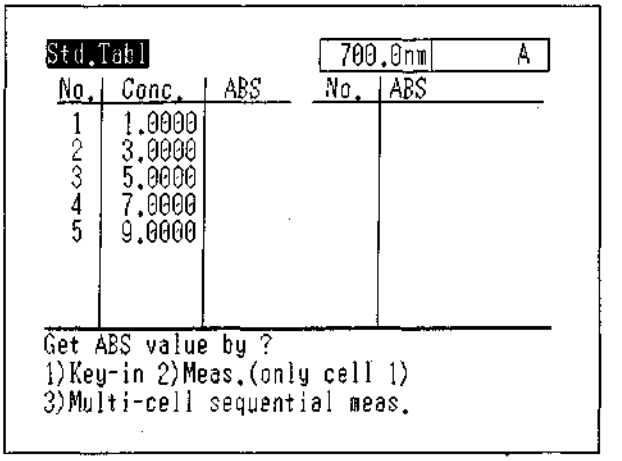


Fig. 5.8 Multi-point calibration curve creation screen

First, key in the concentration value for each standard sample (5 standard samples in the illustrated example) according to the instructions on the screen. The input order and the size of the concentration value are unrelated.

Next, enter the ABS value for each sample in order of the standard sample No. The following 3 input methods are available.

1) Key input

Enter the numeric value for ABS from the keyboard.

2) Measurement input (use only cell 1)

Set the standard samples in the standard sample module or sequentially in cell 1 of the Multi-cell or CPS-240 (both options) and press the [START] key to measure the sample.

3) Multi-cell sequential measurement input

You can continuously measure the standard samples by setting the standard samples in order in cells 1 through 6 of the Multi-cell or CPS-240A (both options) and pressing the [START] key.

(In the case, there must be 6 or fewer standard samples.)

Once you have completed entering the values for ABS, a table of concentrations and ABS (concentration table) will be created.

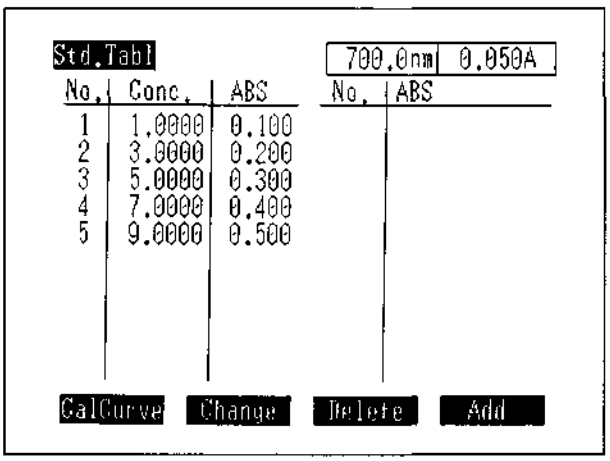


Fig. 5.9 Completed concentration table screen

In this screen, you can switch to screens for changing, deleting or adding standard sample data ([Change]/ [Delete]/[Add]) or for displaying the calibration curve ([CalCurve]).

(See 5.3 Calibration Curve Display and Modification)

<3. No. of Meas.> (Number of Measurements)

Determine how many times the same sample will be measured during measurement.

If this is set to 2 or more, the average value of the multiple measurements will be used as the ABS value for the standard sample when the calibration curve is created. When measuring an unknown sample , the measured value for each repetition and the average value will be displayed.

(See 5.4.1 Measurement Screen)

NOTE! If you interrupt repetitive measurements by pressing the [RETURN] key, the average value will not be computed.

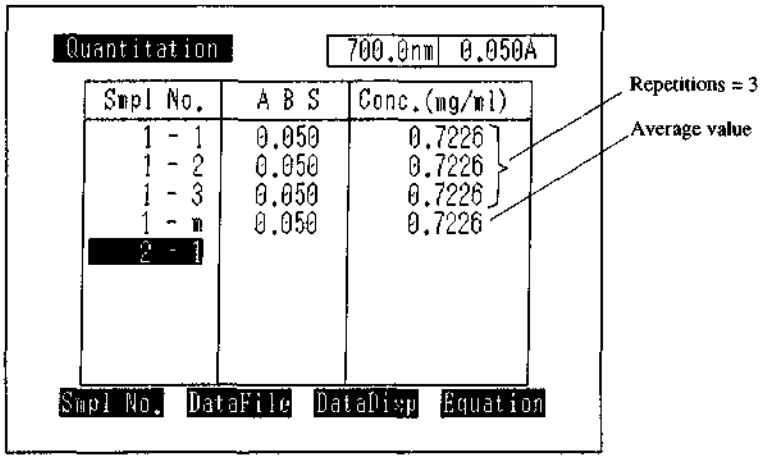


Fig. 5.10 Sample data display screen (Unknown sample measurement screen)

NOTE! When a Multi-cell or CPS-240 (both options) is used and the number of cells has been set to 2 or more, the No. of Meas. function takes precedence. In this case, automatic measurement using multiple cells cannot be performed.

<4. Unit>

Specify the unit of concentration using number 0 through 8.

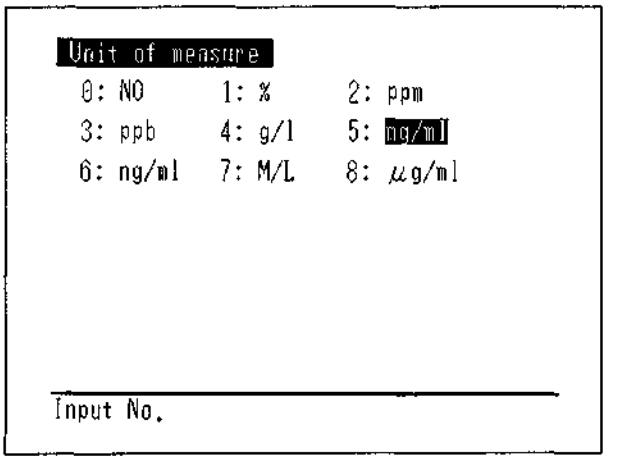


Fig. 5.11 Unit input screen

<5. Data print>

You can select whether or not to print the data for each measurement to the printer (option).

(See 5.4.1 Measurement Screen)

No.	ABS	mg/ml
1-1	0.050	0.7226
1-2	0.050	0.7208
1-3	0.050	0.7226
1-m	0.050	0.7220
2-1	0.050	0.7226
2-2	0.050	0.7226
2-3	0.050	0.7226
2-m	0.050	0.7226
3-1	0.050	0.7226
3-2	0.050	0.7226
3-3	0.050	0.7226
3-m	0.050	0.7226

Fig. 5.12 Sample printout

When data print is set to "YES", the data for each unkown sample measurement will be printed to the printer.

5.2.2 Sample Control [SmplCntl]

Set the parameters such as the sample module being used, the number of cells, etc.

(See 2.3.7 Sample Control)

5.2.3 Measurement Screen [SmplMeas]

Switch to the screen for unknown sample measurement.

(See 2.3.5 Measurement Screen)

5.2.4 Save Parameters [Savparam]

This enables you to save the current measurement parameters, including the calibration curve which has been created, to the instrument memory or an data pack (option).

(See 2.3.4 Save Parameters [SavParam])

A single point or multi-point calibration curve which has been created can be displayed on the screen by selecting [CalCurve] in concentration table screen.

5.3.1 Single point Calibration Curve

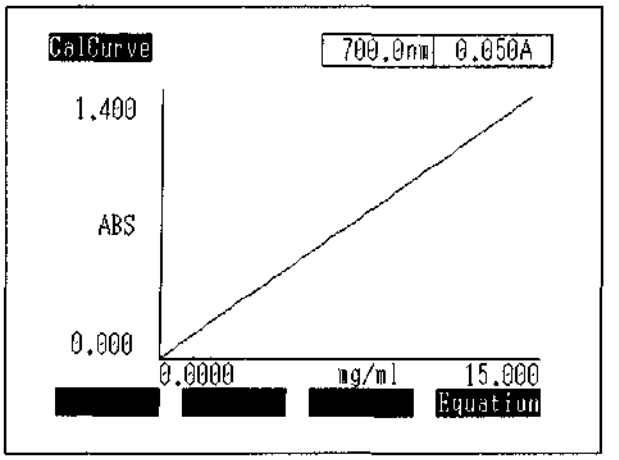


Fig. 5.13 Single point calibration curve display

The equation for the calibration curve will be displayed by selecting [Equation].

Calibration curve correction is performed by returning to the parameter configuration screen and selecting [CalCurve] again and then re-entering the standard sample data.

5.3.2 Multi-point Calibration Curve

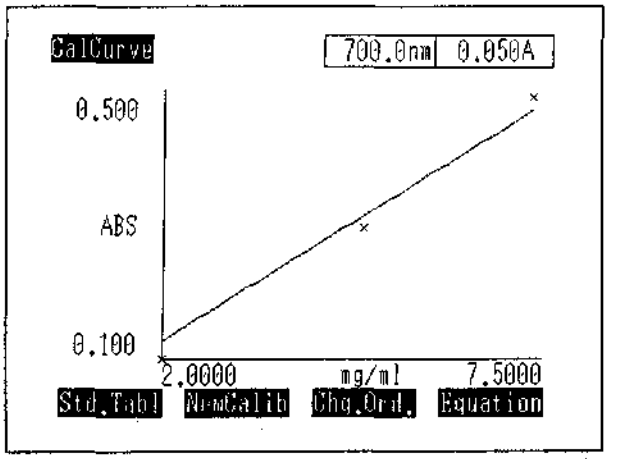


Fig. 5.14 Multi-point calibration curve display

The coordinate positions of each standard sample are shown by the x marks.

You can change the values for the concentration and ABS for all of the standard samples and create a new calibration curve using [NewCalib]. All standard sample data up to that point will be deleted when [NewCalib] is executed.
You can change the order of the calibration curve with [Chg.Ord.].
The equation for the calibration curve will be displayed by [Equation].
Press [Std.Tabl] to display a table of the concentrations and ABS for the standard samples (concentration table) on screen.

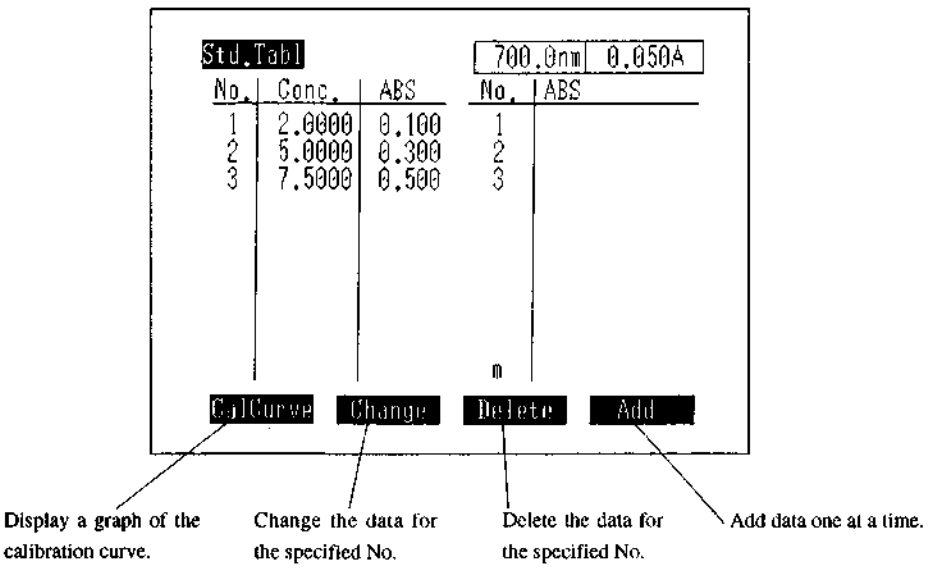


Fig. 5.15 Concentration table

You can [Change], [Delete] or [Add] standard sample data in the concentration table screen.

[Change] : Allows you to change the concentration or ABS for the standard sample at the specified No.
[Delete] : Deletes the data at the specified No.
[Add] : Allows you to add concentration and ABS standard samples, one at a time.

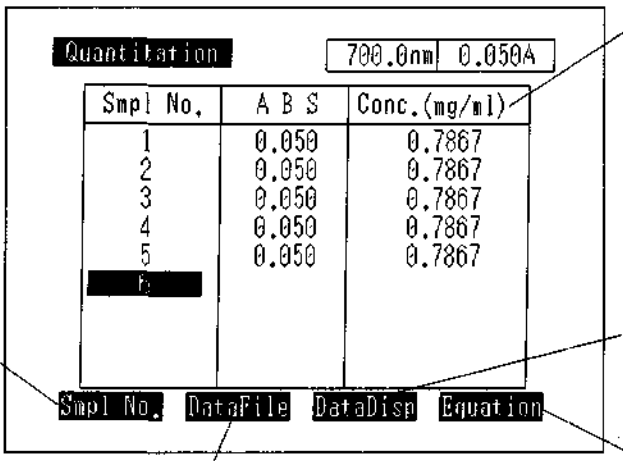
In all of these cases, the calibration curve will automatically be recalculated.
You can switch to the calibration curve screen using [CalCurve].

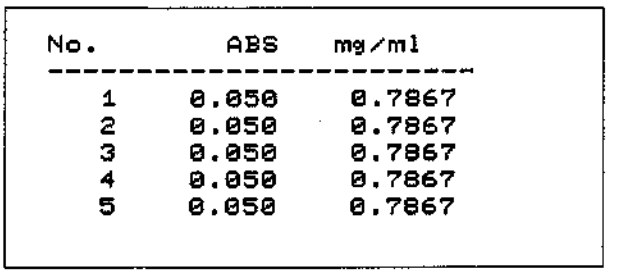
5.4.1 Measurement Screen

When creation of the calibration curve has been completed, you can switch to the measurement screen using the [SmplMeas] or the [START] key and perform measurements.

(The first measurement will be performed when the [START] key is pressed.)

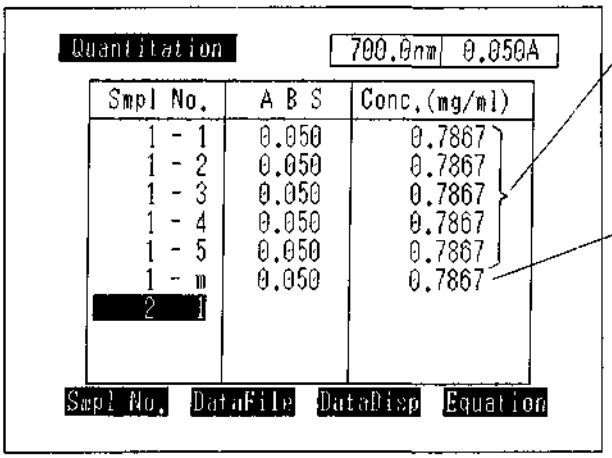
The display format in the measurement screen will differ somewhat depending on the settings for the No. of measurements and sample control.





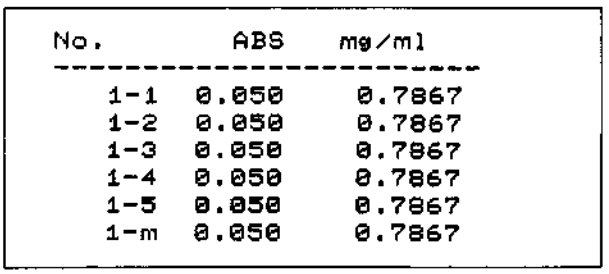
Sample printout

(A) Measurement screen (1 cell, 1 measurement)



Measure Sample No. 1 five times.

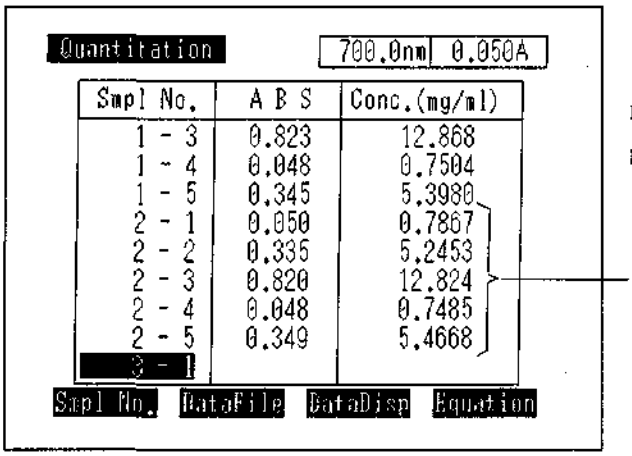
Average value of measurement Nos. 1 through 5 of Sample No. 1.

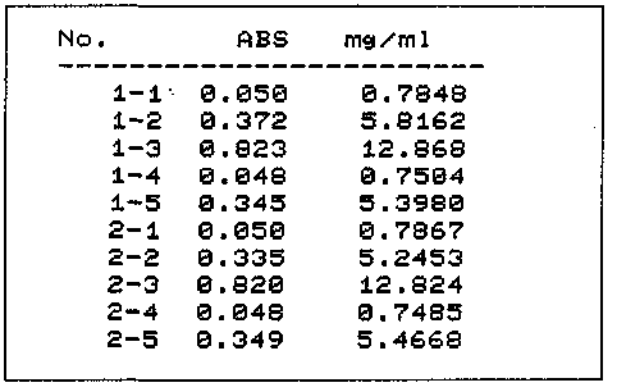


No.	ABS	mg/ml
1-1	0.050	0.7867
1-2	0.050	0.7867
1-3	0.050	0.7867
1-4	0.050	0.7867
1-5	0.050	0.7867
1-m	0.050	0.7867

Sample printout

(B) Measurement screen (1 cell, 5 measurements)





(C) Measurement screen (5 cells, 1 measurement)

Fig. 5.16 Measurement screens and data printout examples

5.4.2 Sample No. [Smpl No.]

This allows you to change the number of the sample to be measured next.

The sample No. input range is 0 to 9999.

5.4.3 Data Management [DataFile]

This function saves measurement data or recalls saved data to the screen.

(See 2.3.10 Data Management [DataFile])

5.4.4 Data Display [DataDisp]

This function displays a list of measurement data, including data which have been scrolled off the screen.

You can also print or delete the data table.

(See 2.3.11 Data Display [DataDisp])

5.4.5 Display Equation [Equation]

This displays the equation used to compute a calibration curve created as a single point or multi-point calibration curve. The factor values in the K-factor method are displayed in the parameter configuration screen.

An example of a multi-point calibration curve. A single point calibration curve will not display the correlation coefficient r^2.

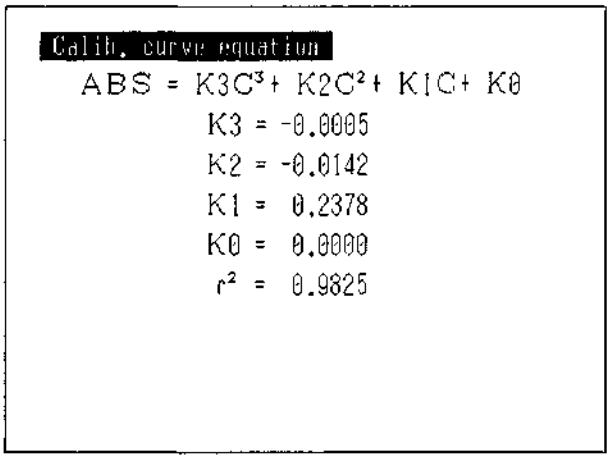


Fig. 5.17 Sample calibration curve equation display

5.5 Save Calibration Curve

A calibration curve can be saved to memory at the same time that the other measurement parameters are saved using the [SavParam] function in the parameter configuration screen.
(See 2.3.4 Save Parameters [SavParam])
A saved calibration curve can be recalled at the same time as the other measurement parameters using [Params] in the mode selection screen.
(See 2.3.1 Call Parameters [Params])

Two/Three-wavelength Quantitation Method

This is an accurate quantitation method which can be used to eliminate the effects of dispersion due to interfering components and contaminants and in correcting "floating" of the baseline due to bubbles when such conditions exist.

5.6.1 Two-wavelength Quantitation

This method quantitates based on the difference between the photometric values at two wavelengths. This allows for the elimination of the effects of interfering components.

Where B_1 and B_2 are the absorbances for the target component B at wavelengths λ_1 and λ_2, and C_1 and C_2 are the absorbances for the interfering component C ($A_1=B_1+C_1$, $A_2=B_2+C_2$), when wavelengths λ_1 and λ_2 are selected so that $C_1=C_2$, then $A_1-A_2=B_1-B_2$ so that only the information for the target compound is left. Normally, the absorbance wavelength for the target component is set for λ_1.

An example of two-wavelength measurement is shown in Figure 5.18.

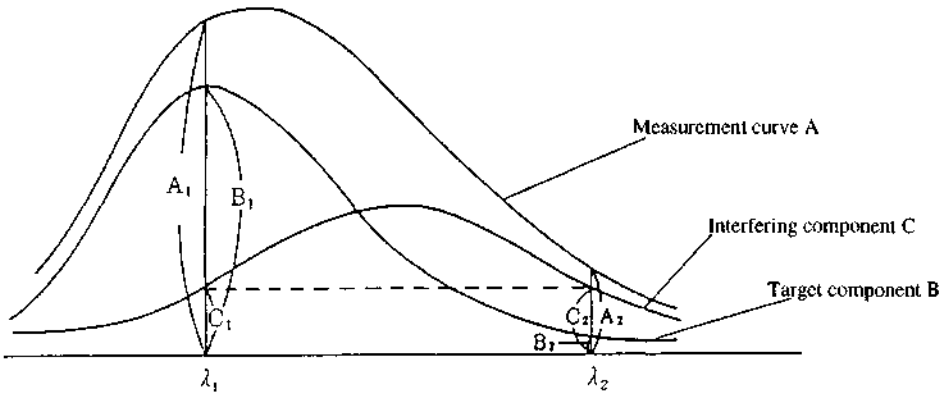


Fig. 5.18 Schematic diagram of two-wavelength quantitation

Quantitation measurement is then performed according to these parameters.

5.6.2 Three-wavelength Quantitation

The following calculation is performed based on the photometric values at three wavelengths.

$$A_2-A_4 \quad (\text{Where, } A_4=\frac{(\lambda_1-\lambda_2)A_3+(\lambda_2-\lambda_3)A_1}{\lambda_1-\lambda_3})$$

(See Fig. 5.19) Three-wavelength computation also eliminates the effects of interfering components, while also being useful in eliminating "floating" of sloped baselines due to dust, etc.

The elimination of the effects of an interfering component will be explained below using Figure 5.19.

If λ_1, λ_2 and λ_3 are taken so that the points S, T and U of the interfering component are connected by a single straight line, then $A_2-A_4=B_2-B_4$ leaving only the information for the target component. Normally, the absorbance wavelength for the target component is set for λ_2. Quantitation measurement is then performed according to these parameters.

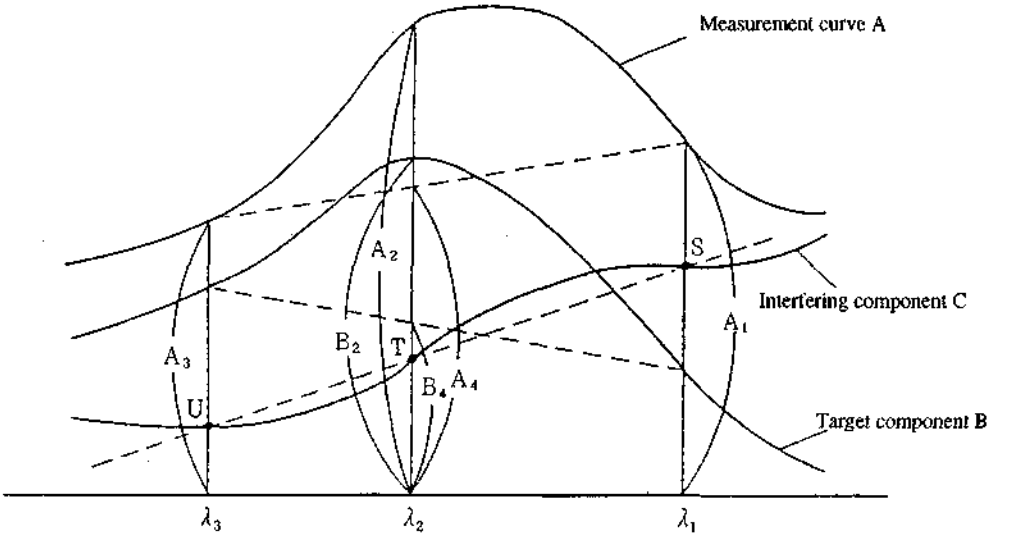


Fig. 5.19 Schematic diagram of three-wavelength quantitation

Derivative Quantitation Method

This method of quantitation uses the derivative value at a set wavelength(s). Derivative quantitation has the following advantages.

(A) Absorption bands can be recognized when there are two or more absorption bands overlapping at the same wavelength or at slightly different wavelengths.

(B) Weak absorption bands which are hidden in portions where the absorbance increases sharply relative to wavelength.

(C) The single greatest point of absorption can be recognized in broad absorption spectra.

(D) Since a straight line correlation can be drawn between the derivative value and the concentration, quantitative analysis becomes simpler in the presence of a background.

The 2nd derivative spectrum in a case where two absorption bands overlap at different wavelengths is shown in Figure 5.20. (a) is the normal spectrum, where the absorption band B cannot be discerned in the spectrum A+B in which the absorption bands A and B are overlapped. The 2nd order derivative of this is shown in (b), where the spectrum A+B is obtained by the combination of the derivatives of absorption bands A and B. Thus, the absorption band B, which was hidden in the larger absorption band A, can clearly be discerned in the 2nd derivative.

Refer to "8.4 About Derivative Processing" for details on derivative calculations.

Derivative in the quantitation mode is calculated from 17 points of data before and after the center of the set wavelength. The derivative wavelength difference $\Delta\lambda$ is constant at 0.8nm. In addition, the order of derivative can be set from 1st through 4th.

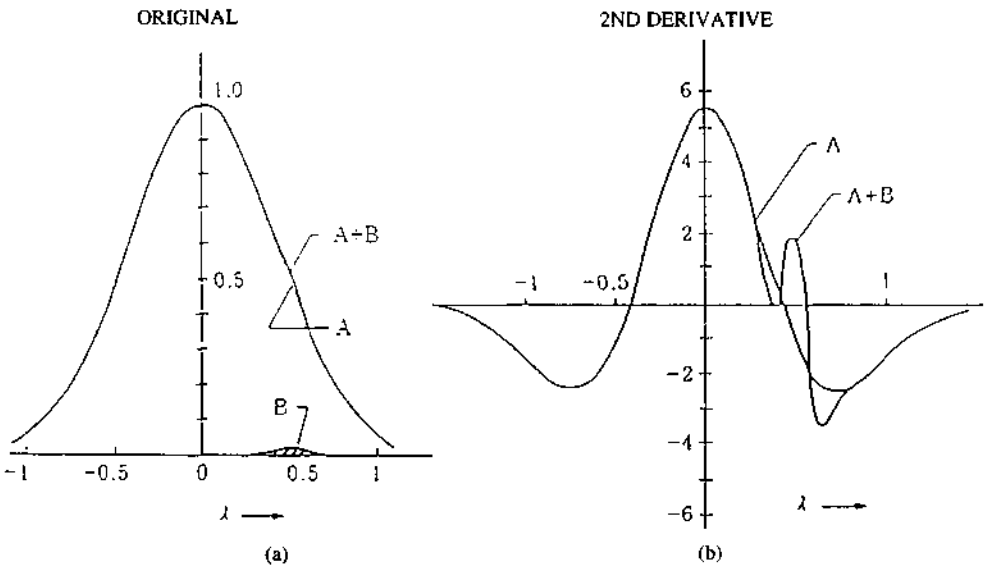


Fig. 5.20 2nd derivative spectrum with two absorption bands - Overlapping at different wavelengths -

Chapter 6
Kinetics Mode

CONTENTS

6 Kinetics Mode

In this mode, the time-dependent changes in absorbance or % transmittance at a fixed wavelength are measured and recorded. This mode includes an enzyme activity calculation function, a typical application of time change measurement.

This comprises finding the enzyme activity from the time changes in absorbance (enzyme reaction curve) caused as a result of enzymatic reactions.

The time changes in absorbance will be displayed on screen and the absorbance can be found at each sampling interval, set according to the (Lag time) + (Rate time) and amount of change in absorbance will be calculated Rate time.

The segment after measurement has started which is not subject to activity computation can be set as the "Lag time". The segment designated "Rate time" is evenly divided and the rate of change (Δ Abs/min) is found for the rate time by the least square of 21 points. The activity value is then found by multiplying this result by a factor.

The rate of change (Δ Abs/min) can be recalculated for different segments by resetting the "Lag time" and "Rate time" for the same reaction curve.

Measurement Parameter Configuration Screen

When you select <4. Kinetics> in the mode selection screen, the following measurement parameters configuration screen will be displayed.

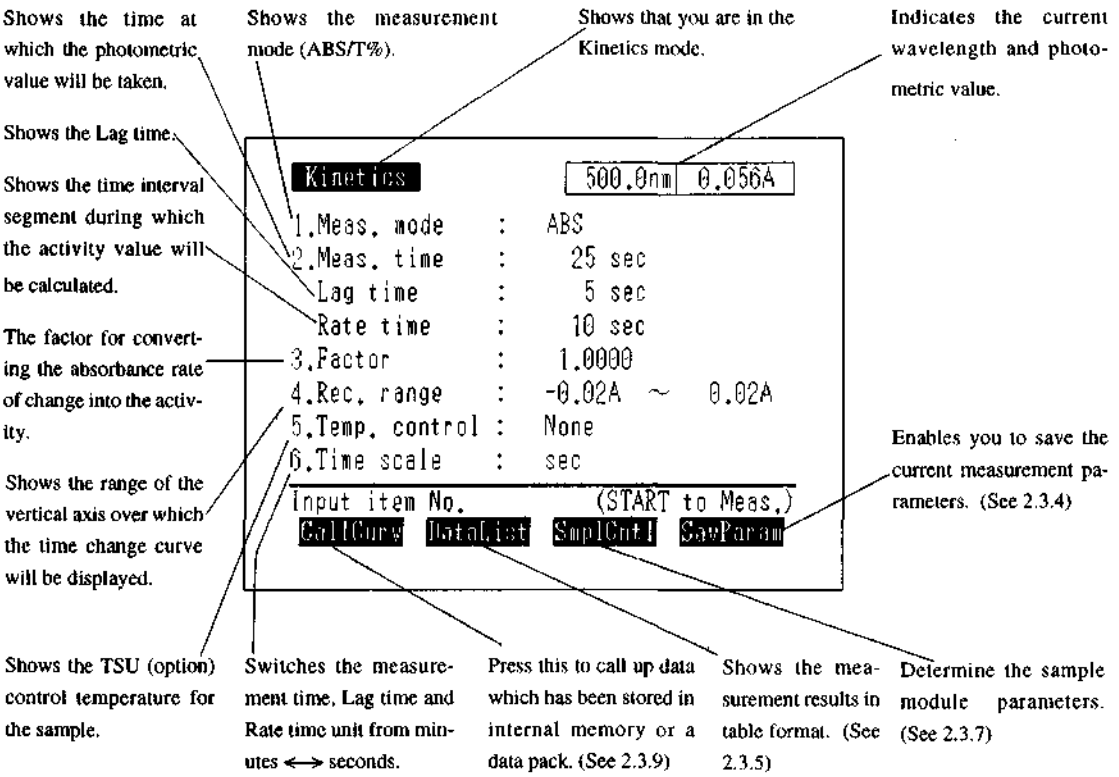


Fig. 6.1 Kinetics parameter configuration screen

6.2.1 Set Parameter Items

Set the various measurement parameter items through dialogue from the keyboard. Select the parameter to be set by entering its item number.

<1. Meas. mode>

Set the measurement mode. Set to % transmittance (T%) or absorbance (ABS).

<2. Meas. time, Lag time, Rate time>

For the measurement time, enter the total time during which absorbance data will be acquired. For the Lag time, enter the segment of time from the start of measurement during which data will not be subject to activity calculations. For the Rate time, enter the time from immediately after the Lag time during which activity calculation will be performed. The total of the Lag time plus the Rate time cannot exceed the measurement time.

(Measurement Time) ≧ (Lag Time) + (Rate Time)

The input ranges are <Meas. time> = 1 to 6500, <Lag time> = 0 to 6400, <Rate time> = 1 to (Meas. time) - (Lag time). (The unit of time can set to "sec" or "min" in item <6. Time scale>.)

<3. Factor> (-9999.9 to 9999.9)

This is the factor for converting the absorbance rate of change into the activity value.

[(Activity Value) = (Factor) × (Absorbance Rate of Change { Δ ABS/min})]

The input range is -9999.9 to 9999.9.

<4. Rec. range>

Enter the maximum and minimum values on the vertical axis for when the reaction curve is displayed on the screen. The input range is -3.99 to 3.99 in the ABS mode and -399 to 399 in the %T mode.

<5. Temp. control> (25, 30, 37, None)

This item is designed to enable temperature control from the UV-1601 by mounting an electronic cooling/heating temperature control sipper TSU (option) on the sample module. There are 4 selections available: None, 25, 30 and 37.

<6. Time scale>

You can switch the unit of time between (Minutes) and (Seconds). When you press the (6) key, the display for parameter setting <2. Meas. time, Lag time, Rate time> toggles between min<->sec.

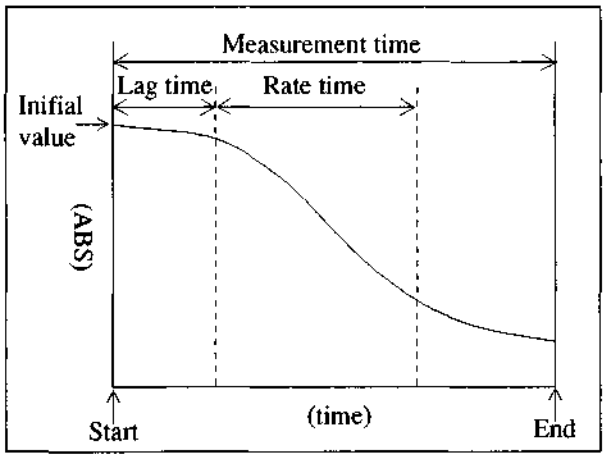


Fig. 6.2 Lag time and Rate time

6.2.2 Call Curve [CallCurv] (F1 key)

This enables you to recall data which have been saved in the instrument memory or a data pack (option) to the screen.

(See 2.3.9 Save Curve and Call Curve [SavCurve]/[CallCurv])

6.2.3 List Data [DataList] (F2 key)

List the measurement results (sample No., initial value (ABS), Δ ABS/min, activity) in table format, as shown in Figure 6.3.

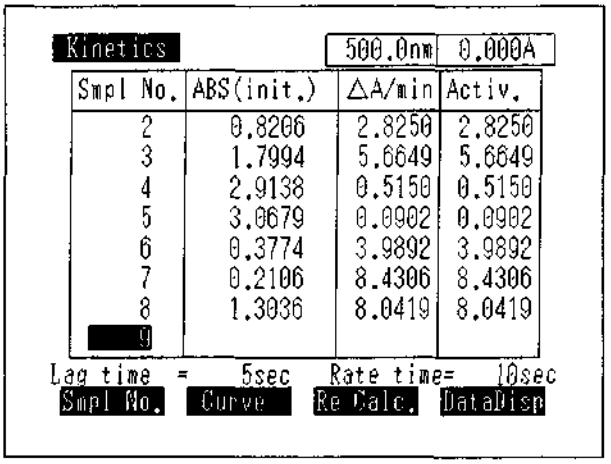


Fig. 6.3 Data table screen

(1) Sample No. [Smpl No.] (F1 key)

Enables you to renumber the sample to be measured next.

The sample number input range is 0 to 9999.

(2) Reaction Curve [Curve] (F2 key)

Enables you to redisplay the reaction curve.

(3) Recalculate [Re-Calc.] (F3 key)

Enables you to change the Lag time and Rate time and recalculate the activity value.

(4) Display Data [DataDisp] (F4 key)

This is the function for displaying the data table. It enables you to display the measurement data, including data which have scrolled off the screen. The maximum number of measurement is 133. You can also print the table or delete data.

(See 2.3.11 Data Display)

6.2.4 Sample Control [SmplCntl] (F3 key)

Set the sample module being used or the number of cells, etc.

(See 2.3.7 Sample Control [Smpl Cntl])

6.2.5 Save Parameters [SavParam] (F4 key)

Enables you to save the current measurement parameters to the instrument memory or a data pack (option).

(See 2.3.4 Save Parameters [SavParam])

About the Data Sampling Interval

The time interval at which data are acquired is determined by the measurement time. (Table 6.1)

Table 6.1 Measurement Time and Data Sampling Interval

Measurement Time (sec/min)	Data Sampling Interval (sec/min)
1 ~ 100	0.1
101 ~ 200	0.2
201 ~ 500	0.5
501 ~ 1000	1.0
1001 ~ 2000	2.0
2001 ~ 5000	5.0
5001 ~ 6553	10.0

When performing kinetics measurements of multiple samples using a Multi-cell (option) or CPS-240 (option), set the number of cells used in Sample Control to 2 or more (up to 6). Item No. 2 in the parameter configuration screen changes as shown in Figure 6.4.

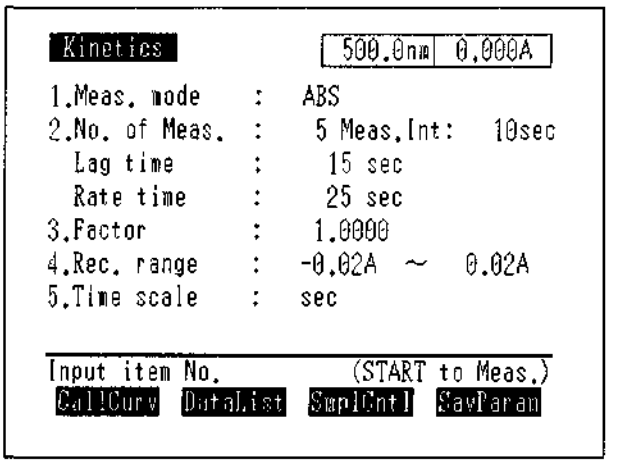


Fig. 6.4 Kinetics parameter configuration screen (when using Multi-cell)

<Meas. time>, used when measuring only one sample, changes to <No. of Meas.> and <Meas. Int>. The <No. of Meas.> sets how many times one sample will be measured, and <Meas. Int> is the time from the end of one measurement until the next measurement is performed.

In other words, (Measurement Time) = (Measurement Interval) × {(No. of Measurements) - 1} × (No. of Cells)

About the Settings

No. of Meas, Meas. Int, Lag time, Rate time, No. of Cells

Since these values are interrelated, they are all entered in sequence, with the exception of the No. of cells, in the same dialog. As for the entry sequence, first determine the number of cells. Press the [SmplCntl] function key and enter the number of cells used in item No. 2 of the sample control screen. This will determine the minimum value which can be entered for the measurement interval (Meas. Int). Now, the allowable input ranges for each of the following items will be displayed during on-screen dialogue as they are adjusted based on the related settings.

No. of Meas. : Any number of times from 2 to 99 may be entered.

Meas Int : The minimum allowable entry value is determined by the number of cells used, and the maximum allowable entry value is determined by the No. of Meas. setting. Set this so that the measurement time, determined by Measurement Interval x (No. of Measurements - 1) is less than 6500.

The minimum allowable input value for the measurement interval is determined by the setting for the number of cells used, as shown in Table 6.2.

Table 6.2 Relationship Between Minimum Measurement Interval and the No. of Cells Used

No. of Cells Used	Minimum Allowable Meas. Int. (Multi-cell) (sec)	Minimum Allowable Meas. Int. (CPS-240) (sec)
6	10	15
5	9	13
4	8	11
3	7	9
2	6	7

The operation and resulting reaction curves when the number of cells used is 3, the number of measurements is 10 and the measurement interval is 15sec are shown below.

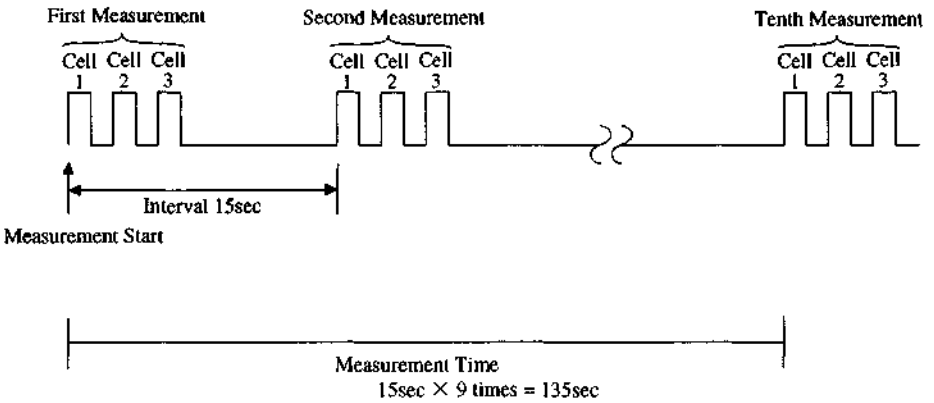


Fig. 6.5 Multi-cell measurement operation

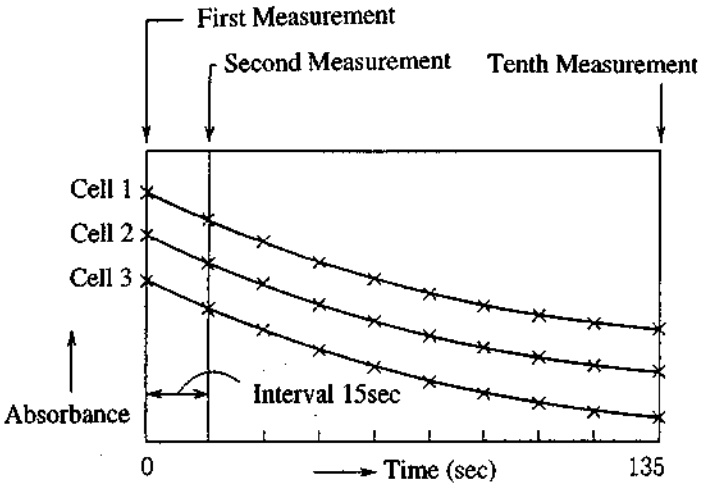


Fig. 6.6 Reaction curve record (No. of cells = 3)

As can be seen in Figures 6.5 and 6.6, the data of each cell acquired at the identical measurement time are shown in the same time period (i.e., the cell operating time is ignored), and the data for each cycle is con nected by a straight line. In addition, the reaction curve measurement time (i.e., the horizontal axis range) is the Measurement Interval × (No. of Measurements - 1).

Lag time

This defines the time from when you press the [START] key until rate calculation starts. In the reaction curve screen, this corresponds to the time from 0.0sec (0.0min) until the point of the first dotted line, as in Figure 6.7. The maximum value is determined such that the two measurement (i.e., one interval) can be maintained as the rate calculation time, since it is necessary to perform at least two measurements for rate calculation. Consequently, the maximum allowable Lag time is

$$\frac{\text{Interval} \times (\text{No. of Meas.} - 1)}{\text{Measurement Time}} - \text{Interval}$$

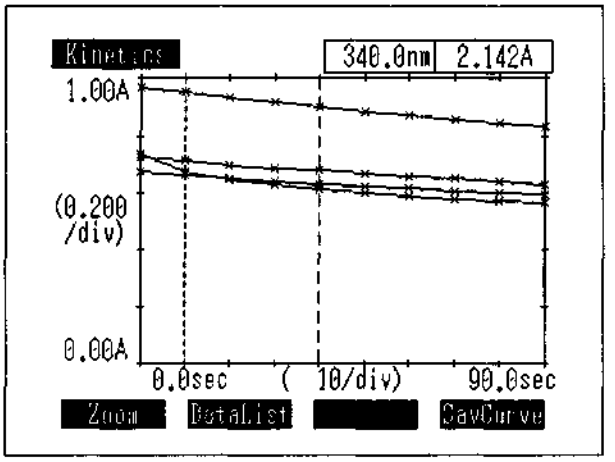


Fig. 6.7 Kinetics measurement screen (No. of cells = 4)

Rate time

The activity value is calculated using the data of this time segment. The rate (Δ ABS/min) can be calculated if there are at least two measurement points within the set Rate time. Consequently, the minimum Rate time which may be set is the time during which two measurements can be performed.

(This time does not necessarily match the interval time.) The maximum allowable Rate time is (Total measurement time - Lag time).

When there is a lot of data in the Rate time, the slope of the data can be found from a regression curve using up to 21 data points. The Rate time is the time between the two dotted lines in the reaction curve screen.

If you press the [START] key in the measurement parameter configuration screen, the display will switch to a screen displaying the reaction curve and the absorbance changes in the sample will be displayed in real time.

The dotted lines in the display screen show the end of the Lag time and the end of the Rate time.

When the measurement time is completed, after the measurement results data table has been displayed, the display will switch to the reaction curve screen in Figure 6.8.

Time course curve can be recorded on the pen recorder in real time by using the optional analog output interface. For the analog output interface, refer to the analog output interface manual.

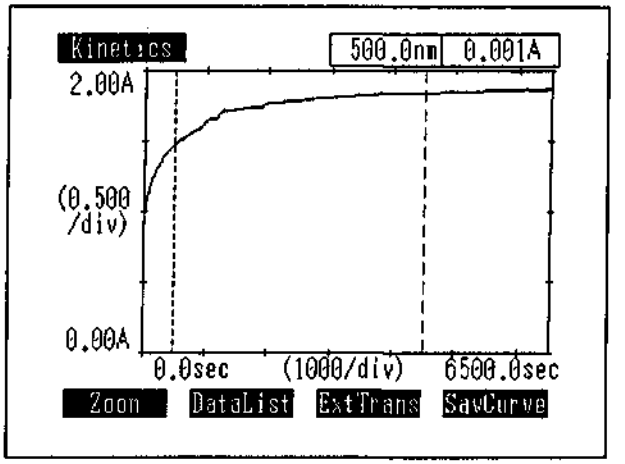


Fig. 6.8 Kinetics measurement screen (Reaction curve)

If a printer (option) is connected, the values which correspond with the various items in the data table will be printed each time one measurement is completed. As for the reaction curve, a hard copy can be printed by pressing the [PRINT] key after completing measurement. If a printer conforming to ESC/P is connected, the reaction curve can be printed in a half size of A4 paper. (Fig. 1.4)

```
Init.ABS   dA/min   Activ.
-----------------------
No.    1
  0.7229   11.732   11.732
No.    2
  0.0000   20.318   20.318
No.    3
  0.1705   2.2601   2.2601
No.    4
  0.4288   5.7789   5.7789
```

Fig. 6.9 Sample printout

Chapter 7
Multi-component Quantitation Mode

CONTENTS

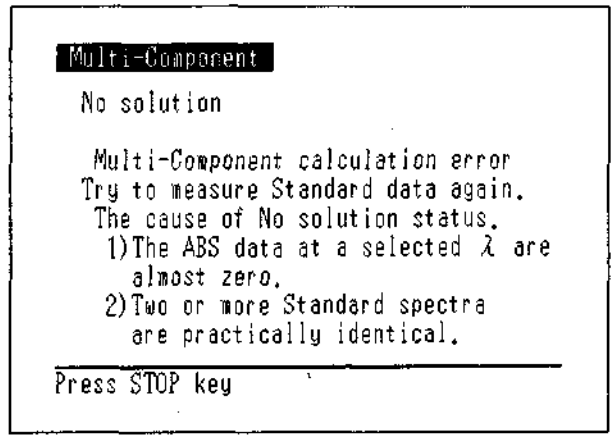
7 Multi-component Quantitation Mode

The multi-component quantitation mode is the mode in which the concentration of each constituent component is determined by using the absorption spectrum of the mixed sample with pure standards or standards made up of multiple constituent components.

1) Mixed samples with up to 8 constituent components can be quantitated.
2) In addition to using pure samples of each constituent component as the standard samples, a mixed sample in which the concentration of each constituent component is known may also be used.
   The effects of interference among the various constituent components can be minimized by using a mixed sample as the standard sample.
3) The standard sample data can be saved with the measurement parameters in memory. In addition, a spectrum saved in memory can be used as the standard sample or unknown sample data. However,unlike other parameter files, these can only be saved one at a time.
4) The measurement wavelengths can be set at uniform intervals or randomly set. You can freely select the measurement wavelengths to improve measurement accuracy.

NOTES!

1) If Multi-component quantitation calculation cannot be performed due to, e.g., an unsuitable standard sample, the error message "Multi-component calculation error" will be displayed on the screen.



2) If a sample whose absorbance is virtually zero, or a sample with a closely similar absorption spectrum shape is used as the standard sample, isolation quantitation calculations may not be able to be performed or accurate values may not be found.
3) If a mixed sample with 4 or more constituent components is used as the standard sample, it is highly probable that isolation quantitation calculations will not be able to be performed.

7.1 Load Stored Measurement Parameters

When you select <5. Multi-Component> in the mode selection screen, a screen will be displayed for loading measurement parameters and standard sample data which have been saved.

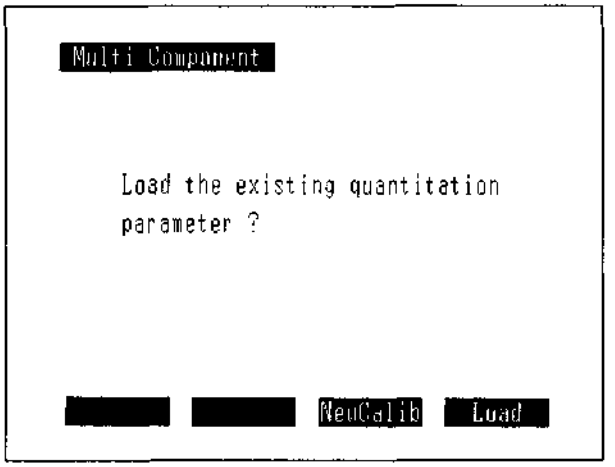


Fig. 7.1 Load saved parameters screen

Only one set of the measurement parameters from the multi-component quantitation mode can be saved together with the standard sample data in a separate memory location from other measurement modes.

When you select [Load], the measurement parameters which have been saved in memory are loaded. You may also select [NewCalib] to reset new parameters.

Now, if there are no parameters saved, this screen will not be displayed.

NOTE!

Standard sample data which are saved are only those data which are required for quantitation calculations. Spectra cannot be saved.

To save a standard sample spectrum, it must have already been measured in the spectrum mode and the results saved to memory. (See 4.4.5 Save Curve [SavCurve])

Spectrum which have been saved using the [CallCurv] function can be used as standard sample data. (See 7.4.2 Measure Standard Sample)

7.2 Measurement Parameter Configuration Screen

When you load parameters or select new settings, the parameter configuration screen will be displayed.

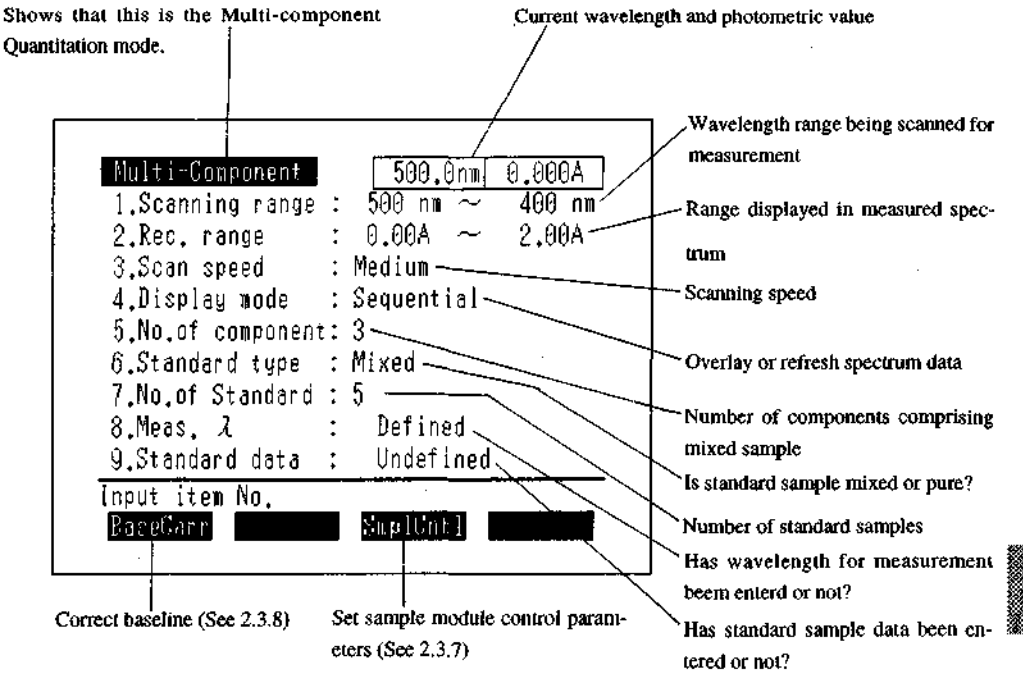


Fig. 7.2 Parameter Configuration screen

7.2.1 Baseline Correction [BaseCorr]

This allows you to correct the baseline in the measurement parameters which have been set.

(See 2.3.8 Baseline Correction [BaseCorr])

7.2.2 Sample Control [SmplCntl]

Set the type of sample module.

(See 2.3.7 Sample Control [SmplCntl])

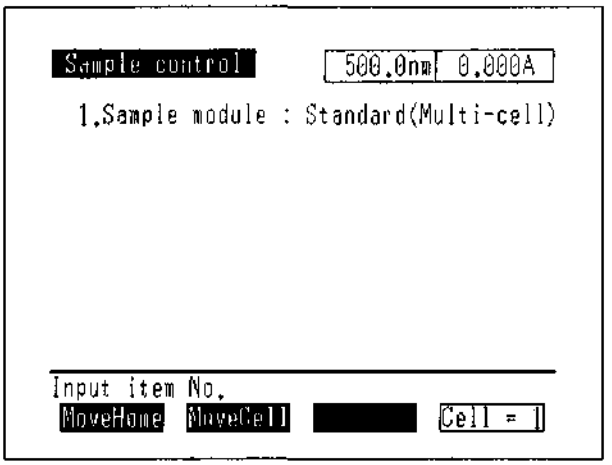


Fig. 7.3 Sample control screen

In the Multi-component quantitation mode, multiple cells cannot be measured automatically using a Multi-cell (optional).

7.3 Setting Measurement Parameters

The multi-component quantitation mode has more parameters to be set than other measurement modes. Set the various items according to the instructions on the screen.

Parameters <1.> through <4.> are virtually identical with those in the Spectrum mode (See Chapter 4).

Some parameter items are interrelated. e.g. <5. No. of component> and <7. No. of Standard>

NOTE!

When you change parameter items <1.> and <5.> through <9.>, the standard sample data will be deleted. If you have selected one of these items by mistake, you can cancel by pressing [RETURN].

If you press [ENTER], the standard sample data settings will be deleted.

<1. Scanning range>

Set the wavelength range over which the absorbance will be measured.

<2. Rec. range>

Enter the range for the vertical axis when displaying the absorption spectrum on screen for a standard sample measurement or unknown sample measurement.

<3. Scan speed> (Fast, Medium, Slow, Very Slow)

Set the wavelength scanning speed from among 4 levels.

<4. Display mode>

Select whether to overlay absorption spectra for standards or unknown samples, or rewrite the spectrum for each measurement.

<5. No. of components>

Enter the number of components that comprise the mixed sample. The entry range is 2 to 8 components.

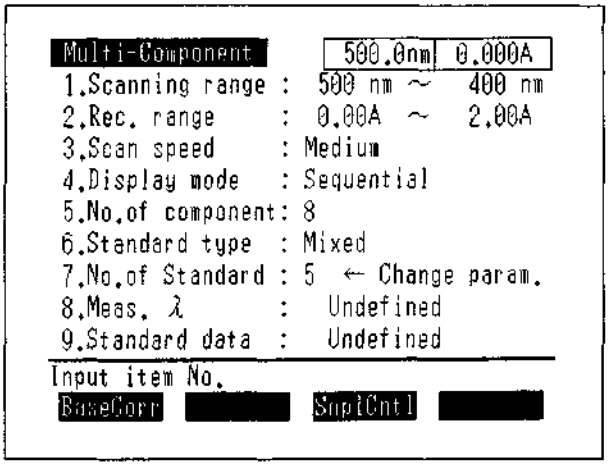


Fig. 7.4 No. of components entry screen

The number of constituent components is related to both <6. Standard type> and <7. No. of Standard>.

If it becomes necessary to change the No. of standards because there has been a change in the No. of components, you will be instructed on screen to "Change param."

In addition, if <6. Standard type> is set to "Pure", <7. No. of Standard> will automatically be overwritten with the same number as the No. of components.

<6. Standard type>

Select a number to indicate whether the standard sample is a pure sample made from a single component or a mixed sample of known concentrations of more than one component.

<7. No. of Standard>

Enter the number of standard samples. If the standard is pure, the No. of standard samples will automatically be set to the same number as the No. of components.

When the standard sample is a mixed sample, the input range is (No. of components + 1) to 16.

<8. Meas λ >

Select the wavelength for measurement of standards and unknowns. The concentration of the sample will be calculated from the absorbance at specified measurement wavelengths in the spectrum.

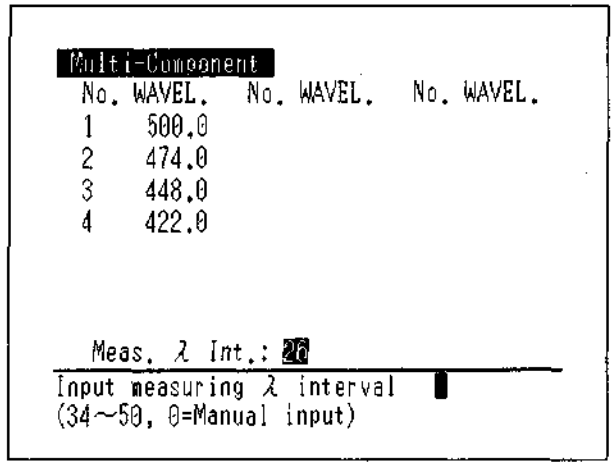


Fig. 7.5 Measurement wavelength input screen

You can enter wavelengths by setting an equal interval using the starting wavelength (long wavelength) as a standard or by numerically entering any desired wavelength values. Key in the wavelength interval or the number of desired wavelengths and their values as instructed on the screen. The input screen for entering desired wavelengths is shown below.

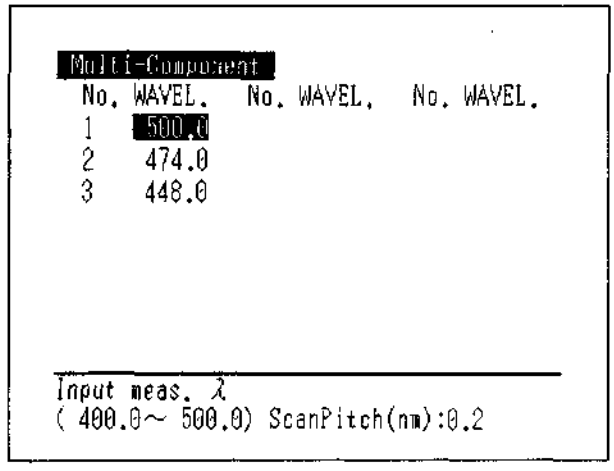


Fig. 7.6 Desired wavelength input screen

The numbers of wavelengths which can be specified are as follows.

For pure samples: Only the same number as (No. of components)

For mixed samples: (No. of components) ~ (No. of standard - 1)

When entering desired wavelengths, you cannot enter two or more of the same wavelength, or a wavelength that exceeds the scanning range.

You also may not enter a wavelength that does not align with the sampling pitch of the wavelength scan (displayed as ScanPitch(nm)).

(see 4.6 Scanning Speed and Data Sampling Interval)

If the entered wavelength is inappropriate, a message will be displayed inviting you to enter another wavelength.

Once you have set the measurement wavelengths, "Defined" will be displayed in <8. Meas. λ > of the parameter configuration screen.

<9. Standard data>

This allows you to enter the standard sample concentrations, after that to measure the standard sample absobance spectra.

This parameter is explained in "7.4 Measuring Standard Sample".

When you select <9. Standard data> in the parameter configuration screen, a standard sample concentration input screen will be displayed.

The standard sample concentrations are entered and the standard sample absorbance spectra are measured in this screen.

Parameters <1.> through <8.> must be set in the parameter configuration screen in order to measure the standard sample(s).

The concentration input screen differs slightly depending on whether the standard sample is pure or mixed.

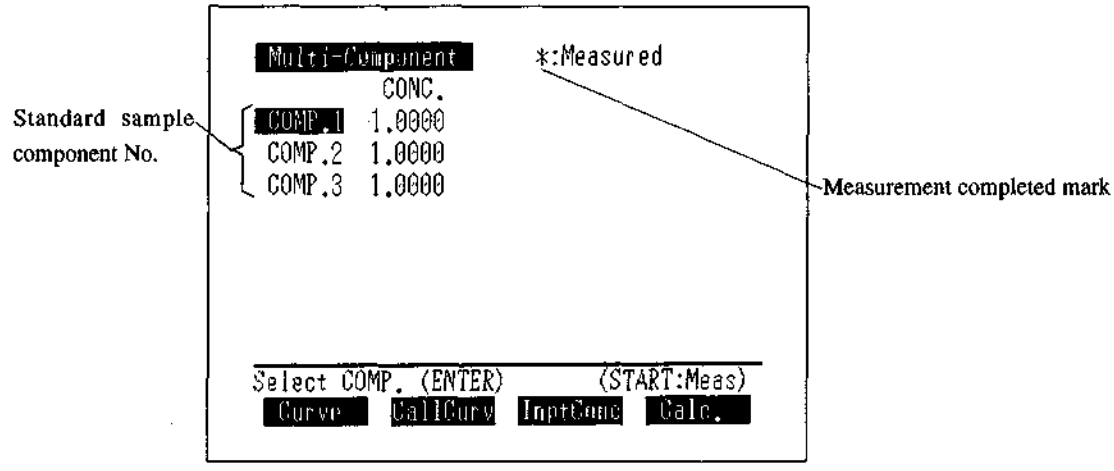


Fig. 7.7 Standard sample data input screen (Pure)

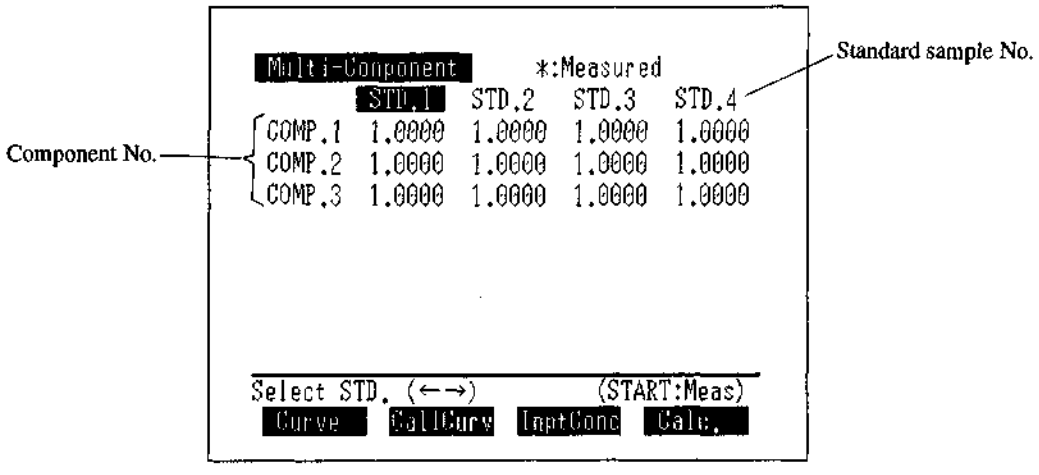


Fig. 7.8 Standard sample data input screen (Mixed sample)

7.4.1 Enter Concentration [InptConc]

When <Standard type> = Pure

When you select [InptConc], the concentration column (CONC.) for each standard (COMP. 1...) will be highlighted in order. Key in the concentrations in order as instructed on the screen. Confirm the entered concentration value with the [RETURN] key.

When <Standard type> = Mixed

Use the cursor keys [<][>] to select the number of the standard sample (STD. 1...) whose concentration is to be entered. (The selected standard sample No. will be highlighted.)
Enter the concentration for each component of the selected standard sample just as when the standard type is pure. Confirm the entries for one standard sample by pressing the [RETURN] key.

7.4.2 Measure Standard Sample

When you have completed entering all of the standard sample concentrations, the instrument will enter standby mode to measure the standard sample.

When <Standard type> = Pure

Use the [ENTER] key to specify standard sample No. (COMP. 1...), set the standard sample and press the [START] key to display the spectrum measurement screen and start measurement. When measurement of one standard sample is completed, use the [ENTER] key to specify the next standard sample No. and thereafter measure the samples in the same way.
An "*" will be placed in front of the sample Nos. (COMP. 1...) of the standard samples which have been measured.

When <Standard type> = Mixed

Use the cursor keys [<][>] to specify the standard sample No. (STD. 1...), set the standard sample and press the [START] key to display the spectrum measurement screen and start measurement. When measurement of one standard sample is completed, use the cursor keys to specify the next standard sample No. and thereafter measure the samples in the same way.
An "*" will be placed in front of the sample Nos. (STD. 1...) of the standard samples which have been measured.

[CallCurv]

Whether the sample is pure or mixed, you can call up absorbance spectrum measured in the Spectrum mode which have already been saved in memory and use them as the standard sample data.

Specify the standard sample No. just as when performing measurement, and then call the spectrum from memory with [CallCurv] (See 2.3.9 Save Curve and Call Curve [SavCurve]/[CallCurv]).

7.4.3 Display Curve

When you select [Curve], spectrum is display on the screen.

When the Display mode is Sequential,the spectrum measured latest will be display. In the case of Overlay, All measured spectra will be display.

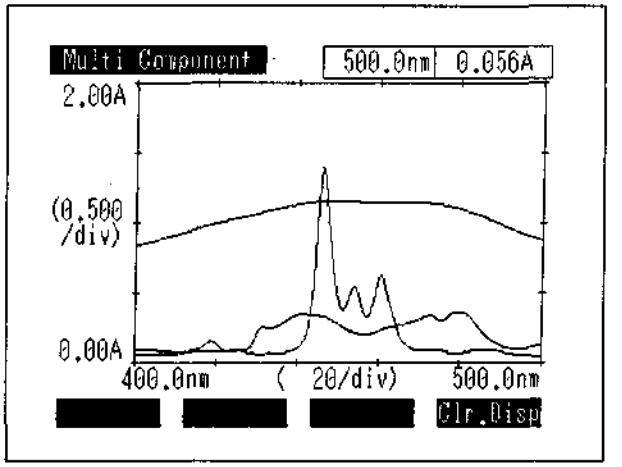


Fig. 7.9 Spectrum display screen

When you select [Clr.Disp],Spectra is displayed will be cleared. But the data for calculating the isolation quantitation parameter still remains .

7.4.4 Calculate

When you select [Calc.] after all standard data are entered and measured, the parameters for quantitation will be calculate. "Busy" is displayed on the upper right corner during calculation.

Note:When you execute the calculation, the measured spectrum will be deleted.

The result of calculation is confirmed by entering [RETURN] key. After that Parameter Configuration screen will be displayed.

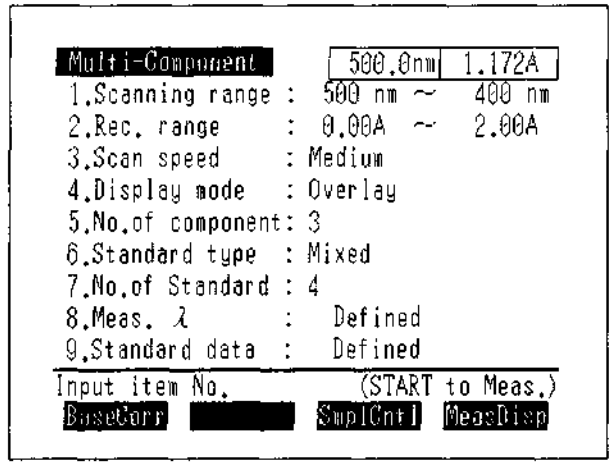


Fig. 7.10 Parameter Configuration screen (parameter is confirmed)

When "Defined" is displayed in <8.Meas. λ > and <9.Standard data> of the parameter configuration screen, you can start to measure unknown samples using the [SmplMeas] or the [START] key and perform measurements.

After you finish setting quantitation parameters, push [MeasDisp] key to switch the measurement parameter configuration screen into the component concentration screen.

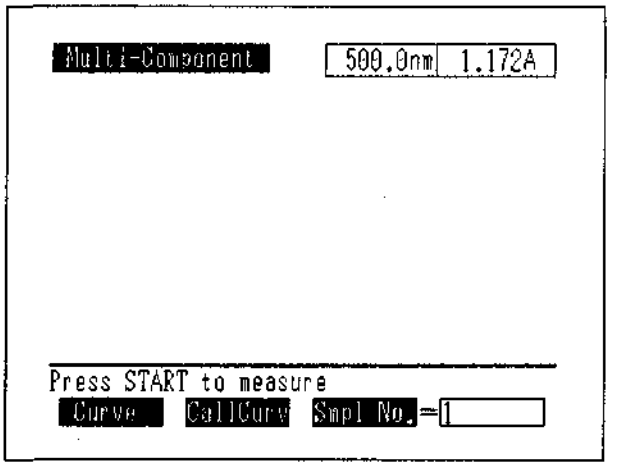


Fig 7.11 Component concentration screen (before measurement)

Set an unknown sample and press [START] key. Then the spectrum display screen comes up and the measurement begins.After setting quantitation parameters are completed, you can start the measurement by hitting [START] key in the measurement parameter configuration screen.

7.5.1 Display Measurement Results

When the measurement is over, the display turns to the component concentration screen, and the concentration of each component in the unknown sample. If a printer is connected to the instrument, the result is printed out automatically.

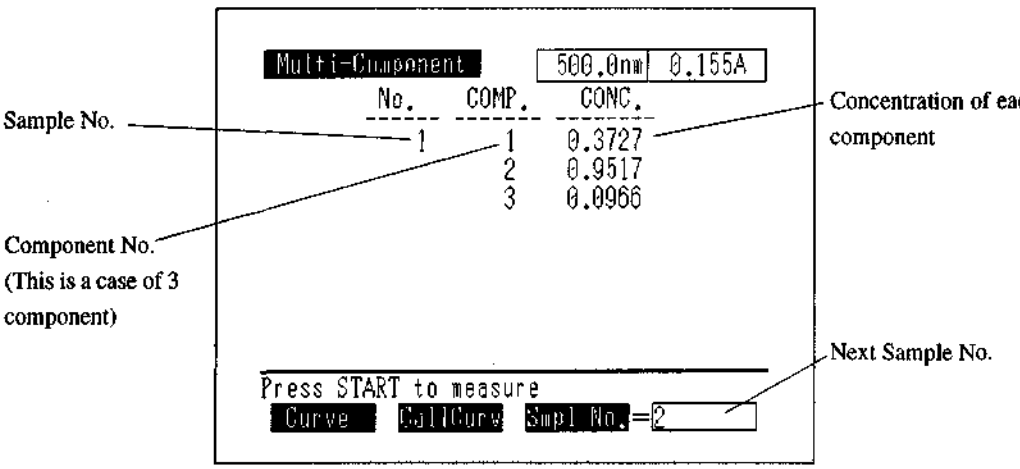


Fig 7.12 Component concentration screen (after measurement)]

No.	COMP.	CONC.
1	1	0.3727
	2	0.9517
	3	0.0966

Fig 7.13 Sample printout

[Smpl No.]

This allows you to change the number of the sample to be measured next. The input range for sample No. is 0 to 9999.

[Curve]

This allows you to display the spectrum of an unknown sample which has been measured. (See 7.4.3 Display Curve [Curve])

[CallCurv]

This allows you to call up the spectrum of an unknown sample which has been saved in memory and perform quantitation. (See 7.4.2 Measure Standard Sample)

7.6 End

When you press the [RETURN] key, the screen returns to the parameter configuration screen. Furthermore, when you press the [MODE] key, the screen for saving measurement parameters and standard sample data is displayed.

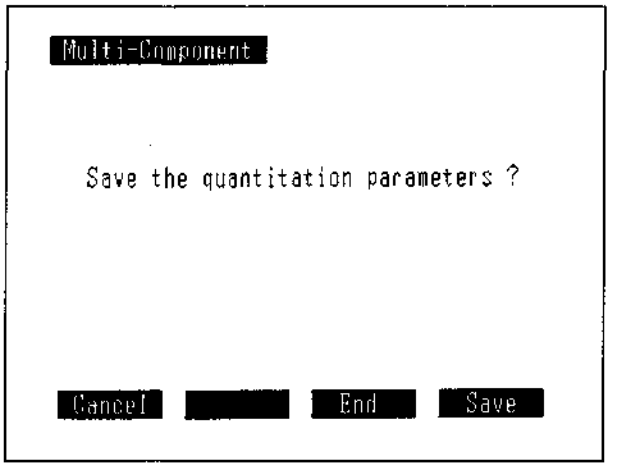


Fig. 7.14 Save parameter screen

Only one set of measurement parameters and standard sample data can be saved in a different memory area from the measurement parameters of other measurement modes.
(Standard sample data which are saved are only those data which are required for multi-component quantitation. Spectra cannot be saved.)

[Cancel] : Return to the parameter configuration screen without saving the measurement parameters, etc.
[End] :Return to the mode selection screen without saving the measurement parameters, etc.
[Save] :Save the measurement parameters, etc. and then return to the mode selection screen.
When you select [Save], previously stored measurement parameters will be deleted.

Note that if all of the measurement parameters and standard sample data have not been set, and the save parameters screen will not be displayed.

Chapter 8
Data Processing Mode

CONTENTS

8 Data Processing Mode

In this mode, the following 6 processing functions can be performed on wavelength and time scanning data measured in the Spectrum and Kinetics (only when one cell is used) modes.

<1. CH operation>

Enables arithmetic operations with curve data and numerical value, and arithmetic operations between curve data with matching vertical axis units (ABS, T%, E) and horizontal axis units (nm, sec, min).

<2. Derivative>

Perform derivative processing on curve data.

Enables you to set the wavelength difference $\Delta \lambda$ or time difference ΔT for the derivative calculations, and perform 1st to 4th order derivative processing.

You can also perform smoothing processing by setting 0 (zero) as the derivative order.

<3. Peak>

Enables the peaks and valleys in a curve data to be detected and a table of the numeric values to be displayed. Up to 20 peaks and valleys can be detected.

<4. CH display>

Calls curve data saved in memory to screen. Enables you to overlay several data.

<5. Area calc.>

Calculates the area bounded by the curve and horizontal axis.

The calculated area inside and outside the curve will be displayed.

<6. Point pick>

Enables the ordinate values corresponding to the abscissa values specified with arbitrary or a fixed interval to be displayed in a numeric table. Up to 20 points can be displayed.

NOTE!

In this mode, files in which curve data are saved can be expressed with CH (channels).

8.1 Processing Item Selection Screen

When you select <6. Data Processing> in the mode selection screen, the processing item selection screen shown below will be displayed.

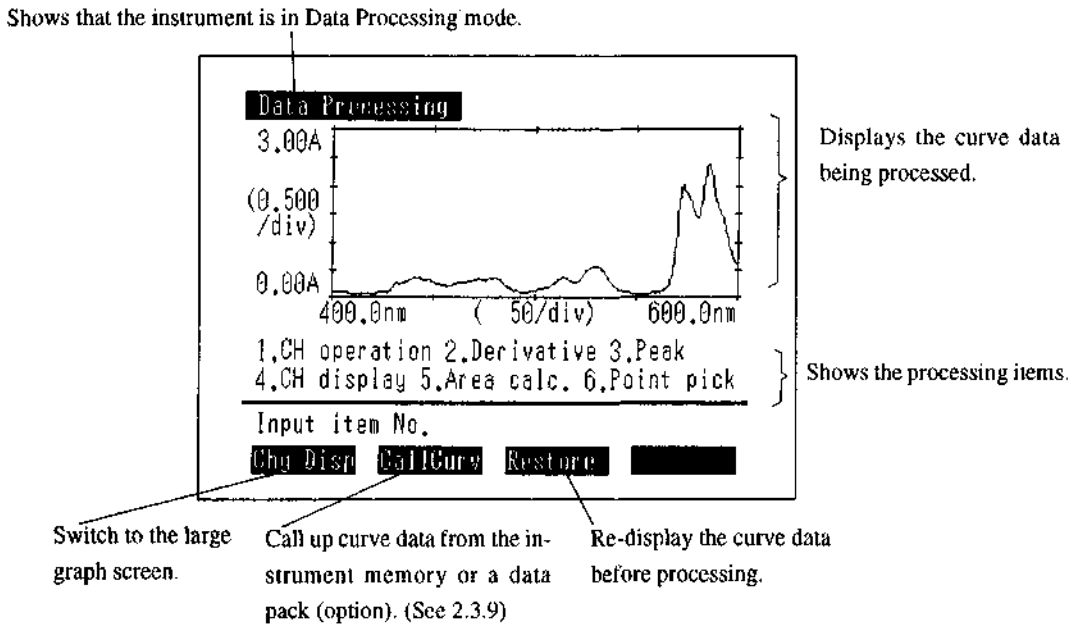


Fig. 8.1 Processing item selection screen

8.2.1 Select Processing Item

Select the processing item from among the item numbers <1. CH operation> through <6. Point pick> in the processing item selection screen.

8.2.2 Select Processing Data

Once measurement has been performed in the Spectrum or Kinetics mode and you return to the mode selection screen and then select <6. Data Processing>, the data which have just been measured will be displayed in the processing item selection screen, where you can perform data processing on those data. If you wish to process data which have been stored in the instrument memory or a data pack (option), use [CallCurv] to specify the file No. and call the curve data to the processing item selection screen. (See 2.3.9)

NOTE!

The [CallCurv] key does not have an overlay function in Data Processing mode.
You can overlay data with the CH display function (See 8.3 Processing Items, <4. CH display>).

8.2.3 Change Screens [Chg Disp]

This displays the curve data which have been displayed in the processing item selection screen over the entire screen.

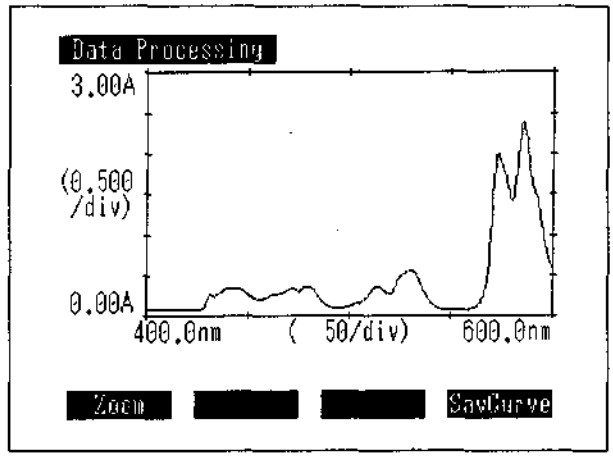


Fig. 8.2 Switched screen

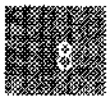
The curve data can be zoomed ([Zoom]) in this screen (See 2.3.12 [Zoom]). You can also save the displayed data using [SavCurve] (See 2.3.8 Save Curve/Call Curve [SavCurve]/[CallCurv]).
You can also use the cursor to read any curve data value on the vertical axis (See 2.3.14 Cursor Functions).

NOTE!
There is no [Restore] function for [Zoom] in the Data Processing mode (See 2.3.12 Enlarge/Reduce [Zoom]).
The original data can be re-displayed using [Restore] in the processing item selection screen.

Press the [RETURN] key to return to the processing item selection screen.
At this time, the curve data showing the results of data processing (including [Zoom]) will be displayed in the curve data display area of the processing item selection screen.

8.2.4 [Restore]

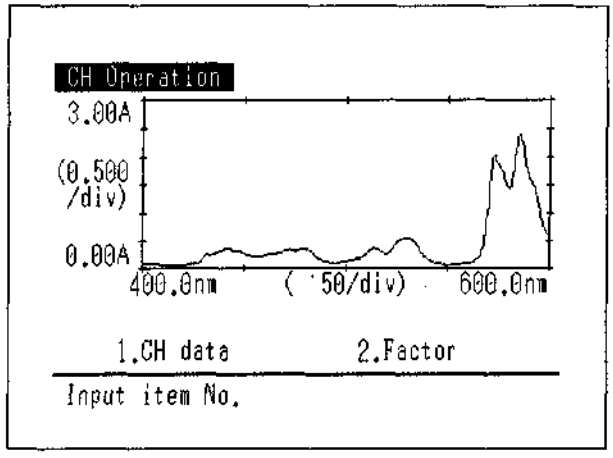
You can display the screen with the data before data processing.
Use this to perform a different process, or to redo processing, on the original data.



<1. CH operation>

This allows you to perform arithmetic operations (+, –, ×, ÷) between the curve data displayed in the processing item selection screen and another curve called up from instrument memory or a data pack (option) or some numeric value.

When you select <1. CH operation> in the processing item selection screen, the CH operation screen will be displayed.



Original data

Fig. 8.3 CH operation screen

Select <1. CH data> in this screen to perform operations between curve data, or select <2. Factor> to perform operations between curve data and a numeric value.

<1. CH data>

This allows you to perform arithmetic operations (+, –, ×, ÷) between the curve data being displayed in the processing item selection screen and the curve data in the specified file No.

NOTE!

The units on the vertical axes (ABS, T%, E) of the two curves must be the same. If the ranges of the horizontal axes differ, the operation will be performed for the area in which the ranges overlap. Where (Absorbance data over 500 to 600nm) + (Absorbance data over 550 to 650nm) is specified, the operation will be performed and the results shown for the 550 to 600nm range.

Furthermore, if the sampling interval for the two sets of data differ (See 4.6 Scanning Speed and Data Sampling Interval or 6.3 About the Data Sampling Interval), the operation will be performed after the interpolating data of the larger sampling interval so that it lines up with the smaller sampling interval.

When you select <1. CH data>, the curve file list screen will be displayed.

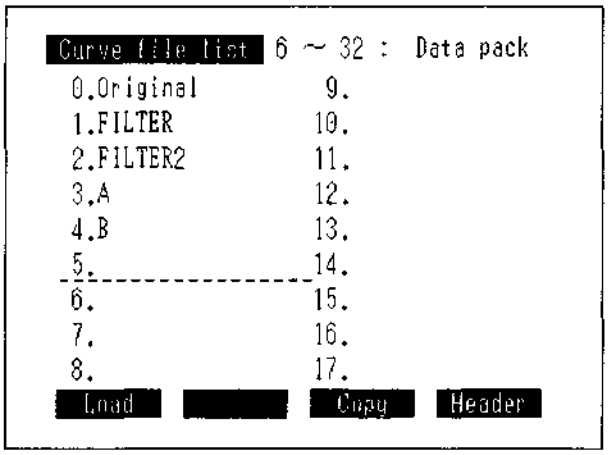
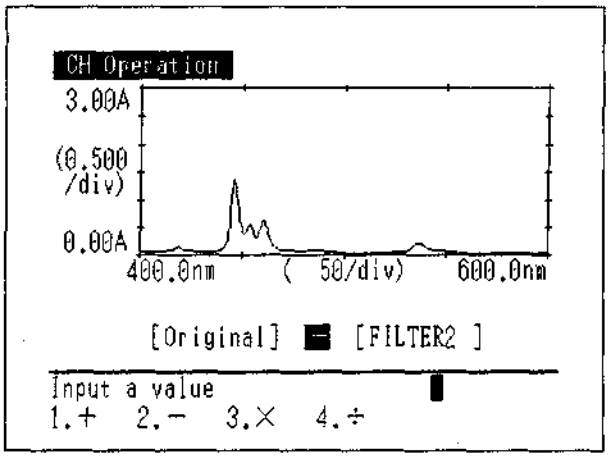


Fig. 8.4 Curve file list screen

Specify the file No. for the curve data by the same operation used for [CallCurv] (See 2.3.9 Save Curve and Call Curve [SavCurve]/[CallCurv]). The specified curve data (in this case, file No. 2 "FLTER2") will be displayed on the arithmetic processing screen. In addition, the filename will be displayed on the right side of the screen.

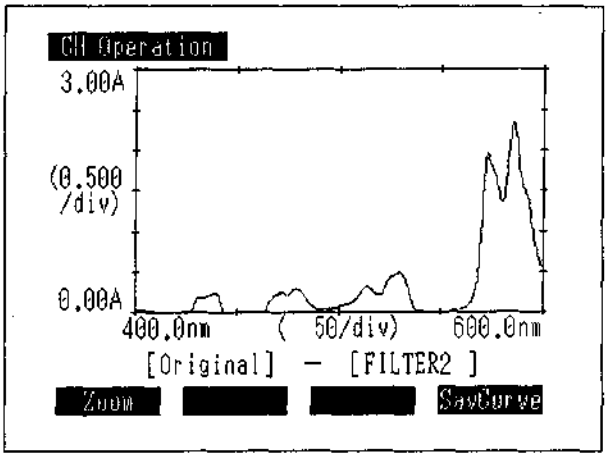


Data from "FILTER2"

Fig. 8.5 Operation selection screen which follows the curve call.

The operation will be performed between the curve data which was already being displayed in the processing item selection screen and the one which is loaded this time from the instrument memory or a data pack (option).

The operation symbol (+, -, x, ÷) is selected by number as instructed by the screen.



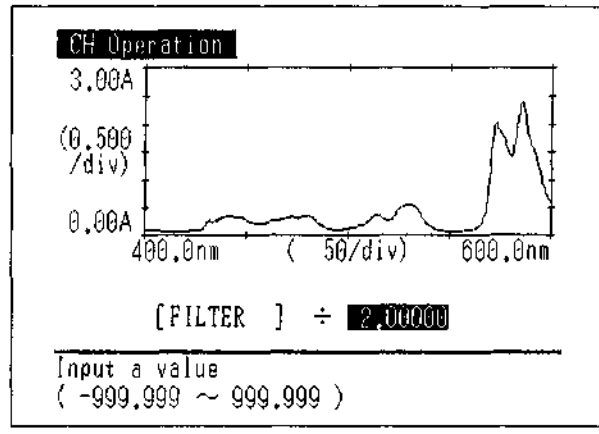
8.6 Arithmetic Results Display screen

In this screen, you can save to memory curve data resulting from [Zoom] (See 2.3.12 Zoom [Zoom]) and from calculation results (See 2.3.9 Save Curve and Call Curve [SavCurve]/[CallCurv]).

Press the [RETURN] key to return the display to the processing item selection screen. At this time, the curve data resulting from calculations are displayed on the screen. You can re-display the curve data before processing (Left side of arithmetic operation) using the [Restore] key.

<2. Factor>

This executes arithmetic operations between the curve data displayed in the CH operation screen (in the case of Fig. 8.7, the File No. 1 "FILTER" called from memory) and a numeric value. When you select <2. Factor>, a numeric value input screen will be displayed.



File No. 1 "FILTER"

Fig. 8.7 Numeric value input screen

When you enter a numeric value (1.0 in the case in Fig. 8.7) and select an arithmetic symbol (- in the case in Fig. 8.7) according to the instructions on the screen, the operation will be executed and the results displayed just as in <1. CH data>.

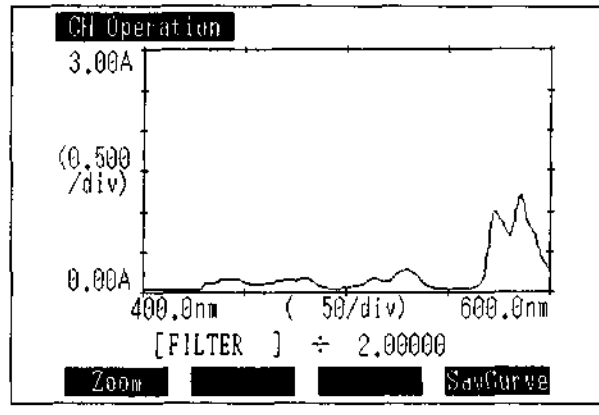


Fig. 8.8 Operation results display screen

Operation after this is the same as in <1. CH data>.

<2. Derivative>

This performs derivative or smoothing processing on the curve data displayed in the processing item selection screen.

The 1st to 4th order derivative curve is computed by digital derivative operation processing using the convolution method, based on the data from 17 wavelength (time) points on either side of the curve data. In addition, smoothing processing can be performed on 17 points of data.

Select <2. Derivative> to display the derivative processing screen.

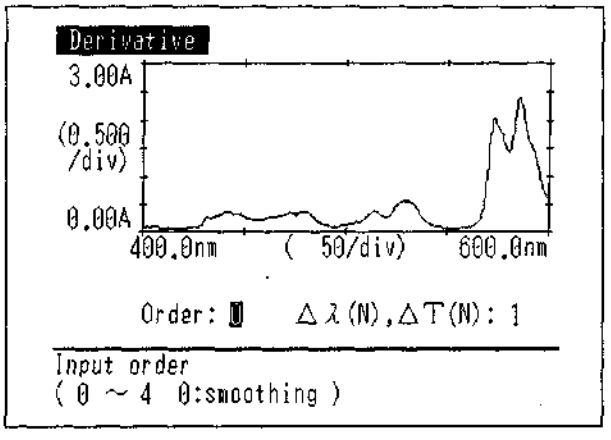


Fig. 8.9 Derivative processing screen

Enter the order of the derivative (0 ~ 4th, 0 indicating smoothing processing) and the coefficient Δ λ (N) or ΔT(N) that determines the difference between the derivative wavelengths (times). Refer to "8.4 About Derivative Processing" regarding the relationship between the value of this coefficient and the derivative wavelength (time) difference, and regarding derivatization, smoothing, etc.

The results from the derivative of the curve data displayed in the derivative processing screen where ORDER=2 and Δ λ (N)=1, are shown in Figure 8.10.

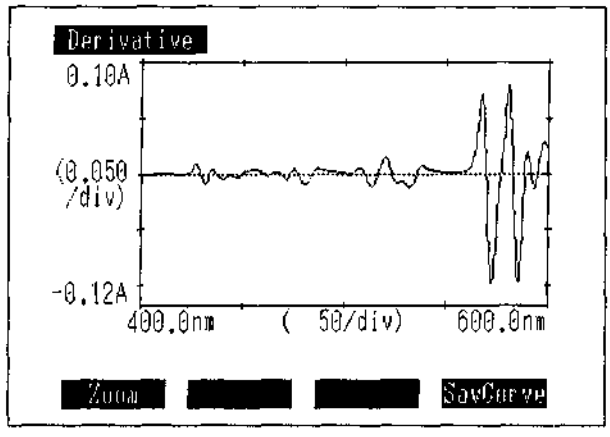


Fig. 8.10 Derivative results display screen

Operation after this is the same as with <1. CH operation>.

<3. Peak detection>

This detects the peaks or valleys in the curve data displayed in the processing item selection screen and displays a list of the results. Up to 20 peaks, valleys can be detected.

Operation is the same as for [Peak] (See 4.4.3 Display Peaks [Peak]) in the Spectrum mode.

When you press the [RETURN] key to return to the processing item selection screen, marks indicating the peaks and valleys will be added to the curve data.

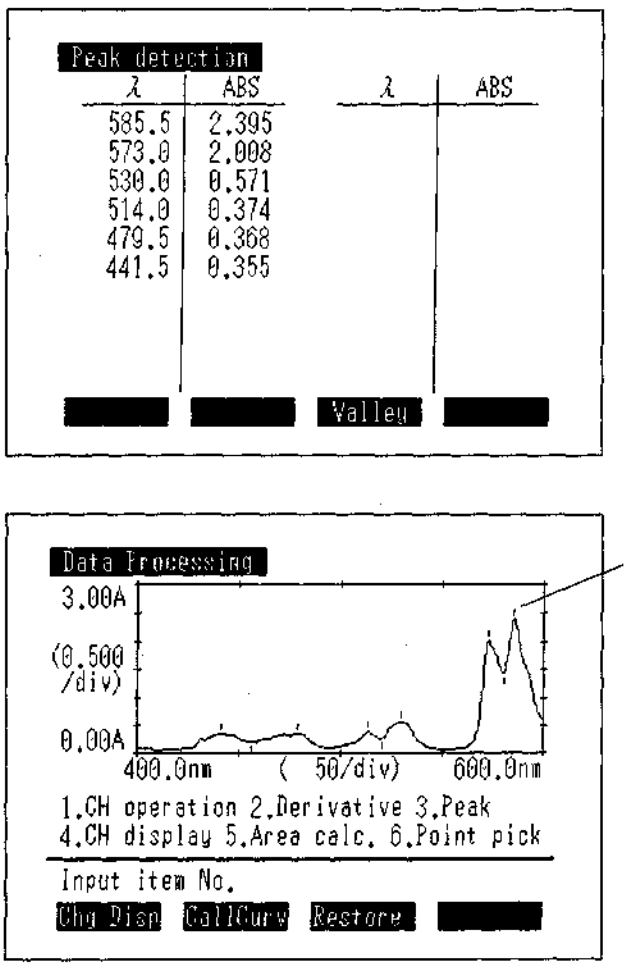


Fig. 8.11 Peak detection screen

<4. CH display>

This allows you to display curve data which has been stored in the instrument memory or a data pack (option) on screen. Multiple curve data with the same horizontal axis units can be displayed overlaid on the screen.

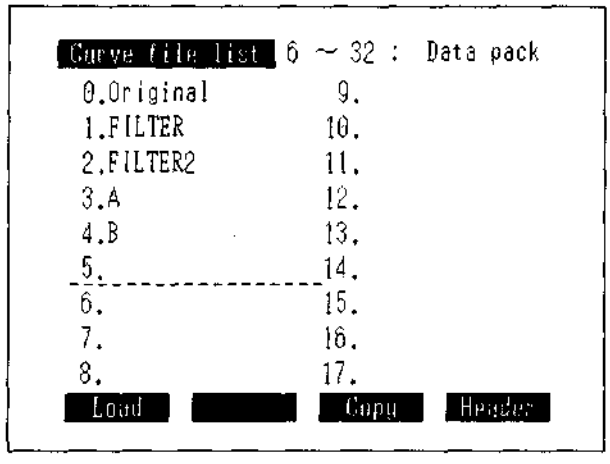


Fig. 8.12 Curve file list screen

When you select <4. CH display>, the curve file list screen will be displayed.

The operation method is the same as for [CallCurv] (See 2.3.9 Save Curve and Call Curve [SavCurve]/ [CallCurv]).

An example is shown in which two curve data, file No. 3 and file No. 4, are displayed overlaid. (Fig. 8.13)

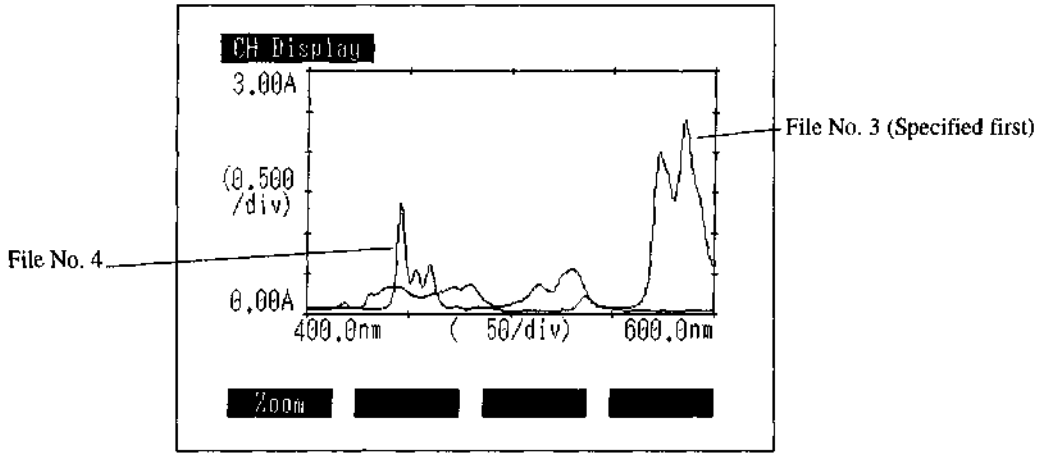


Fig. 8.13 Overlaid display example

You can change the ranges on the vertical and horizontal axes using [Zoom]. (See 2.3.12 Enlarge/ Reduce [Zoom]) When data are displayed overlaid, the overlaid data will all be affected by the changes in range. (Fig. 8.14)

The [RETURN] key will return you to the processing item selection screen. The data for the specified file No. (in the case of overlaid data, the data for the file No. which was specified first) will be displayed in the curve data display area. Data processing can be performed on these data.

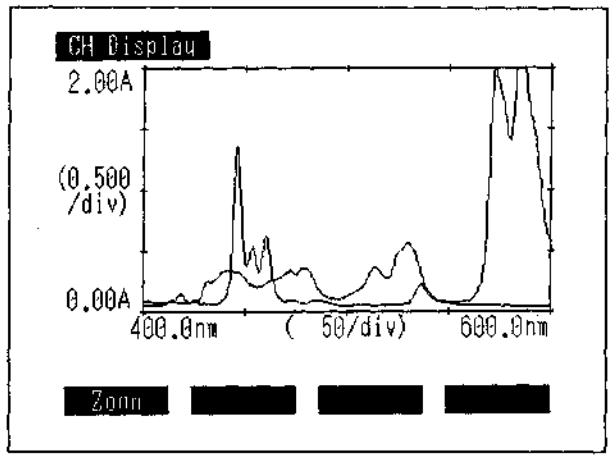


Fig. 8.14 Zoom (overlay)

<5. Area calc.>

This calculates the area bounded by the curve and the horizontal axis.

When you select <5. Area calc.>, the area calculation screen will be displayed (Fig. 8.15)

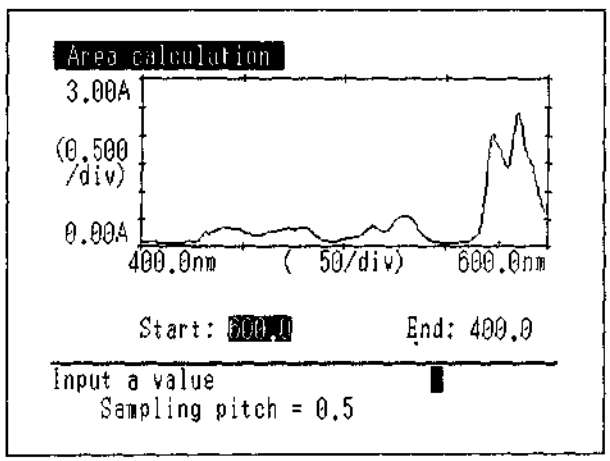


Fig. 8.15 Area calculation screen

Enter the horizontal range over which the area will be calculated according to the instructions on the screen.

Press one of the ◁ ▷ keys to display a cursor. While the cursor is displayed, you can specify the start point or end point by moving the cursor and pressing [ENTER].

When you enter the range, the calculation will be executed and the result displayed. (Fig. 8.16)

If the value at the start (or end) point does not match up with a sampling point, the calculation will be performed between the nearest sampling points in the outside of the specified range.

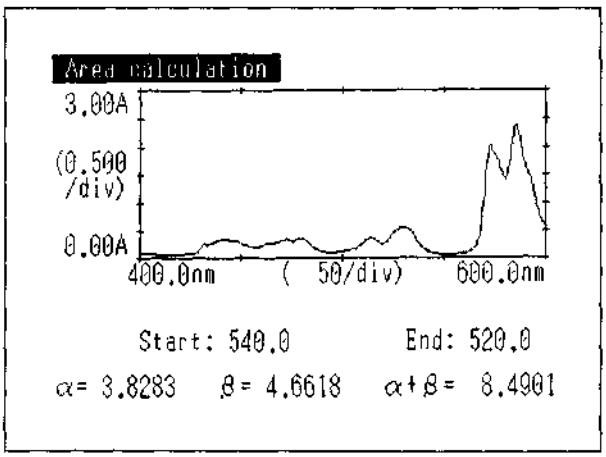


Fig. 8.16 Calculation results display screen

The calculation results are expressed as the values for α, β and $\alpha+\beta$. For ABS, E:

α = the area of the portion bounded by the curve data and a straight line connecting the start and end points on the data

β = the area of the portion bounded by a straight line connecting the start and end points on the curve data and the horizontal axis.

For T%:

α = the area of the portion bounded by a straight line connecting the start and end points on the data and the curve data

β = the area of the portion bounded by the curve data and the horizontal axis.

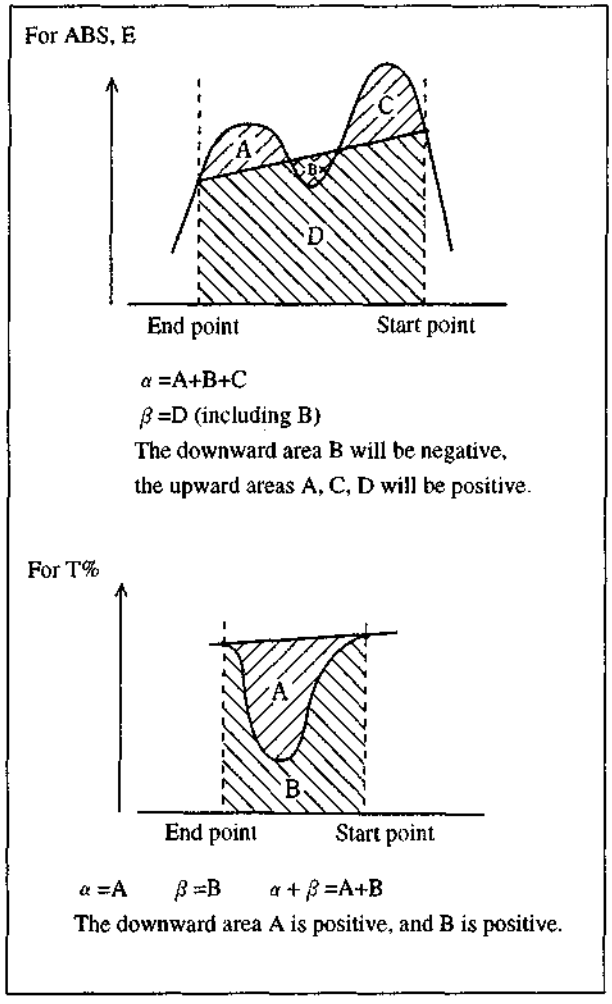


Fig. 8.17 Area calculation schematic diagram

Press the [RETURN] key to return to the processing item selection screen.

<6. Point pick>

This will display a list of ordinate data for up to 20 points at a specified interval from a specified abscissa (wavelength, time). Inputting "-" for the start point of abscissa enables the ordinate data corresponding to up to 20 points of arbitrary abscissa values to be displayed.When you select <6. Point pick>, the point pick screen will be displayed.

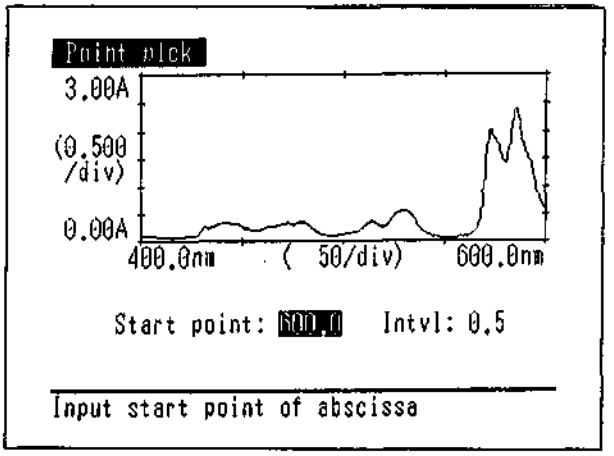


Fig. 8.18 Point pick screen

Enter the starting abscissa (maximum limit of wavelength or minimum time) and the interval according to the instructions on the screen. An example is shown in which the start wavelength is 500nm and the interval is 5nm.

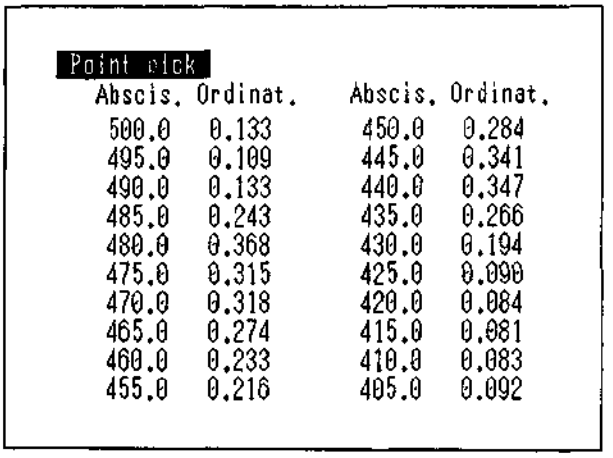


Fig. 8.19 Point pick value display screen

When arbitrarily inputting abscissa values, input the points and the abscissa values for those points according to the instruction on the screen.

Press the [RETURN] key to return to the processing item selection screen.

8.4.1 Derivative Wavelength (Time) Difference

The derivative wavelength difference $\Delta\lambda$ or derivative time difference ΔT is determined by the value for the wavelength (time) range of the curve data and the value for $\Delta\lambda$ (N) or ΔT(N) which is keyed in. This relationship is illustrated in tables 8.1 and 8.2. Generally, the noise decreases and the amplitude of the derivative spectrum increases as the value for $\Delta\lambda$ or ΔT is greater, but the resolution of the derivative spectrum curve deteriorates if the value is too great. Determine $\Delta\lambda$ and ΔT taking noise and resolution into consideration.

Table 8.1 Correlation between the input value for $\Delta\lambda$ (N) and the derivative wavelength difference $\Delta\lambda$

	Wavelength Scanning Range (nm)				$\Delta\lambda$			
	λ range >500	$500 \geqq \lambda$ range >200	$200 \geqq \lambda$ range >100	$100 \geqq \lambda$ range	1st	2nd	3rd	4th
				1	0.8	0.7	0.7	0.6
			1	2	1.6	1.4	1.4	1.2
				3	2.4	2.1	2.1	1.8
			2	4	3.2	2.8	2.8	2.4
		1		5	4.0	3.5	3.5	3.0
			3	6	4.8	4.2	4.2	3.6
				7	5.6	4.9	4.9	4.2
			4	8	6.4	5.6	5.6	4.8
				9	7.2	6.3	6.3	5.4
	1	2	5		8.0	7.0	7.0	6.0
			6		9.6	8.4	8.4	7.2
			7		11.2	9.8	9.8	8.4
$\Delta\lambda$ (N)		3			12.0	10.5	10.5	9.0
			8		12.8	11.2	11.2	9.6
			9		14.4	12.6	12.6	10.8
	2	4			16.0	14.0	14.0	12.0
		5			20.0	17.5	17.5	15.0
	3	6			24.0	21.0	21.0	18.0
		7			28.0	24.5	24.5	21.0
	4	8			32.0	28.0	28.0	24.0
		9			36.0	31.5	31.5	27.0
	5				40.0	35.0	35.0	30.0
	6				48.0	42.0	42.0	36.0
	7				56.0	49.0	49.0	42.0
	8				64.0	56.0	56.0	48.0
	9				72.0	63.0	63.0	54.0

Table 8.2 Correlation between the input value for Δ T(N) and the derivative time difference Δ T

	RECORDING TIME (SEC)							Δ t (SEC)			
	6500≧T >5000	5000≧T >2000	2000≧T >1000	1000≧T >500	500≧T >200	200≧T >100	100≧T >10	1st	2nd	3rd	4th
							1	0.8	0.7	0.7	0.6
						1	2	1.6	1.4	1.4	1.2
							3	2.4	2.1	2.1	1.8
						2	4	3.2	2.8	2.8	2.4
					1		5	4.0	3.5	3.5	3.0
						3	6	4.8	4.2	4.2	3.6
							7	5.6	4.9	4.9	4.2
						4	8	6.4	5.6	5.6	4.8
							9	7.2	6.3	6.3	5.4
				1	2	5		8.0	7.0	7.0	6.0
						6		9.6	8.4	8.4	7.2
						7		11.2	9.8	9.8	8.4
					3			12.0	10.5	10.5	9.0
						8		12.8	11.2	11.2	9.6
						9		14.4	12.6	12.6	10.8
			1	2	4			16.0	14.0	14.0	12.0
					5			20.0	17.5	17.5	15.0
				3	6			24.0	21.0	21.0	18.0
					7			28.0	24.5	24.5	21.0
ΔT(N)			2	4	8			32.0	28.0	28.0	24.0
					9			36.0	31.5	31.5	27.0
		1		5				40.0	35.0	35.0	30.0
			3	6				48.0	42.0	42.0	36.0
				7				56.0	49.0	49.0	42.0
			4	8				64.0	56.0	56.0	48.0
				9				72.0	63.0	63.0	54.0
	1	2	5					80.0	70.0	70.0	60.0
			6					96.0	84.0	84.0	72.0
			7					112.0	98.0	98.0	84.0
		3						120.0	105.0	105.0	90.0
			8					128.0	112.0	112.0	96.0
			9					144.0	126.0	126.0	112.0
	2	4						160.0	140.0	140.0	120.0
		5						200.0	175.0	175.0	150.0
	3	6						240.0	210.0	210.0	180.0
		7						280.0	245.0	245.0	210.0
	4	8						320.0	280.0	280.0	240.0
		9						360.0	315.0	315.0	270.0
	5							400.0	350.0	350.0	300.0
	6							480.0	420.0	420.0	360.0
	7							560.0	490.0	490.0	420.0
	8							640.0	560.0	560.0	480.0
	9							720.0	630.0	630.0	540.0

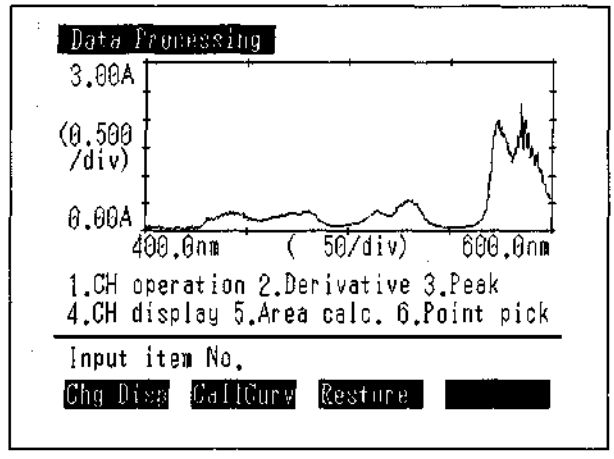
8.4.2 Values at Ends of Derivative Spectrum

Since the derivative value is calculated at each wavelength (time) in derivative processing, the data before and after each individual wavelength are required. There are instances in which the derivative values at the ends of the curve data are incorrect because the data for the points required for calculation have to be extrapolated in order to perform the derivative calculations.

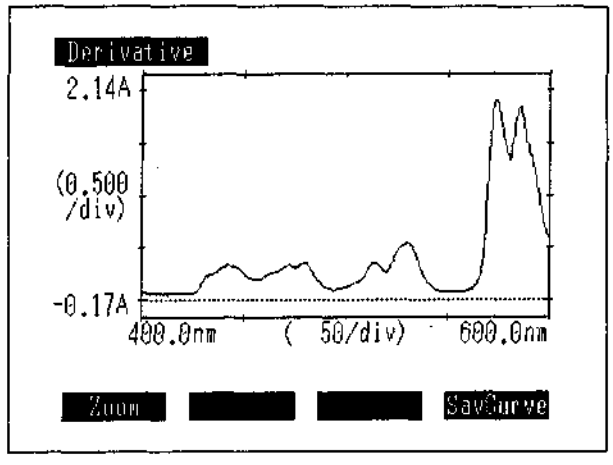
8.4.3 Smoothing Processing

Smoothing processing is data processing which uses the same method as derivative processing to reduce the noise in curve data.

An example of smoothing processing is illustrated below. (Figs. 8.20(A), (B))



(A) Before smoothing



(B) After smoothing

Fig. 8.20 Smoothing processing

Chapter 9
Optional Program Pack

The UV-1601 can employ new functions using the optional program pack (IC card).

CONTENTS

9.1 Starting the Optional Program Pack

Insert the optional program pack into the IC card slot in the right side of the UV-1600 chassis and then select <7. Optional Program Pack> in the mode selection screen to start the optional program.

If the optional program pack is not inserted properly, the messages "No valid pack" or "No valid program pack" "Insert program pack then press 'ENTER'" will be displayed.

9.2 Optional Program Pack Auto-start

If <1. Start program> in the <8. Utilities> mode of the mode selection screen has been set to "Optional Program Pack", a program pack which is inserted into the IC card slot while the power is ON will automatically be started. If the optional program pack is improperly inserted in this condition, the messages "IC card is not properly installed!" "Set program pack and press 'ENTER'" will be displayed.

Chapter 10 Utilities Mode

CONTENTS

10 Utilities Mode

This is the mode for setting the instrument's operating parameters, such as the light source switching wavelength, printer setup or the number of data columns displayed.

The parameters which can be set in this mode are parameters which are shared with other modes.

These will also be stored internally, even if the power is turned OFF.

10.1 Utilities Menu Screen

When you select <8. Utilities> in the mode selection screen, the utilities menu shown in Figure 10.1 will be displayed.

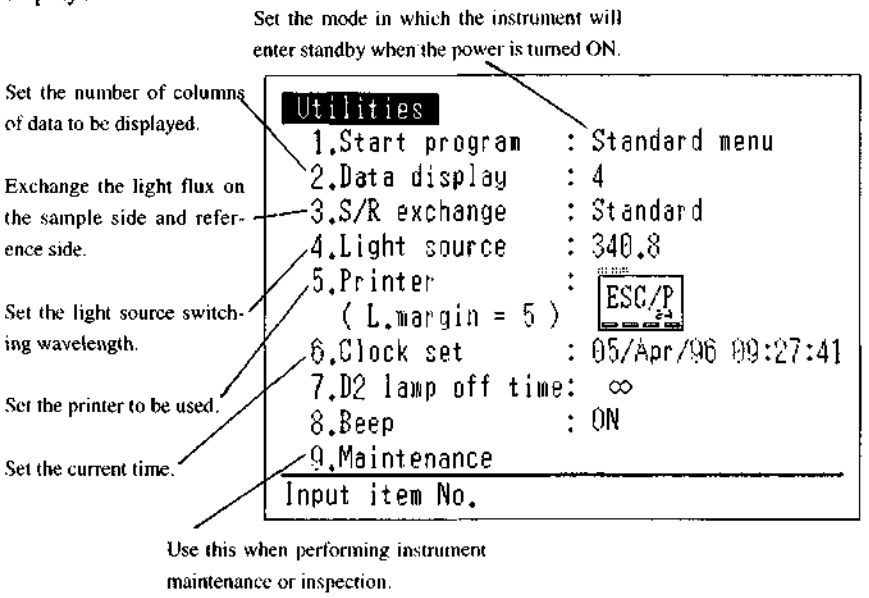


Fig. 10.1 Utilities menu screen

<1. Start program>

This function determines the mode in which the instrument will be in after the power is turned ON and initialization is completed. Select the item with the cursor key ◀ or ▶.

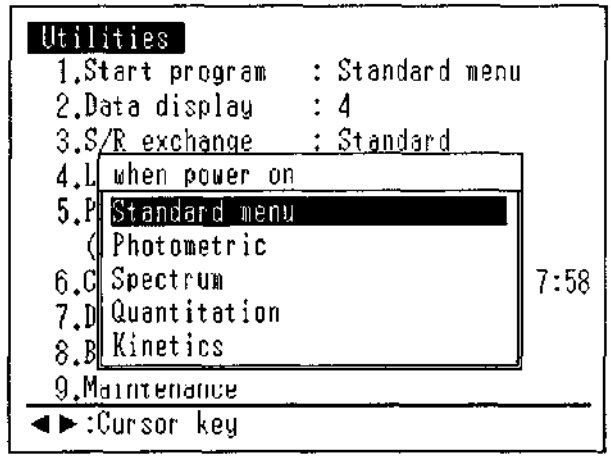


Fig. 10.2 Start program selection screen

(1) Standard menu

The instrument is set to this mode for shipping. The mode selection screen will be displayed when the power is turned ON.

(2) Photometric, Spectrum, Quantitation, Kinetics, and Multi-Component

The instrument will stand by at the parameter configuration screen of the selected mode.

(3) Data processing

Stands by at the processing item selection screen.

(4) Optional program pack

The program pack inserted in the slot will automatically start. If the program pack is not properly inserted into the slot, the messages "No valid pack" or "No valid program pack" "Insert program pack then press 'ENTER'" will be displayed.

(5) Stored param. file

The measurement parameter file stored in instrument memory and set here will be called up and the instrument will go to standby.

Saving Measurement Parameters...

Save measurement parameters to a file by pressing the [SavParam] function key in the measurement parameter configuration screen for the respective mode.

See "2.3.4 Save Parameters [SavParam]" for more details.

(6) PC control

The instrument automatically goes to the PC control mode. (See 12 PC control)

<2. Data display>

You can switch the photometric data display between 4 and 5 columns.

<3. S/R exchange>

This allows you to exchange the sample side light flux with the reference side light flux. When set to "Standard", the front of the sample compartment will be the sample light flux and the back will be the reference light flux. When set to "Reverse", the front of the sample compartment will be the reference light flux and the back will be the sample light flux. "Reverse" is used when special accessories are installed. "Standard" is normally used.

<4. Light source>

The UV-1601 uses an ultraviolet deuterium lamp (D2 lamp) and a visible-nearinfrared tungsten-iodine lamp (WI lamp). The switching wavelength for these two lamps is set to 340.8nm at the time of shipping, but it can be set to any value between 295.0 and 364.0nm.

<5. Printer setting>

The printer to be connected is selected and the format of a hard copy is set.

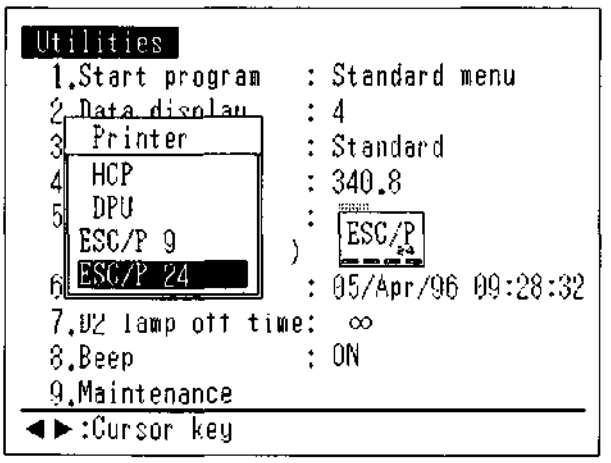


Fig. 10.3 Printer selection screen

(1) Following four types of printers can be connected.

HCP

Set this when the screen copy printer HPC-1A (option) is being used.

DPU

Set this when the DPU-411 printer (option) is being used.

ESC/P9

Set this when using a printer that supports the ESC/P control code for EPSON 9-pin printers.

ESC/P24

Set this when using a printer that supports the ESC/P control code for EPSON 24-pin printers.

This is also applied for laser printers.

When selecting ESC/P9 and ESC/P24, the left margin can also be set. The setting range is from 0 to 9.

NOTE!	If you do not properly select the printer type, the printer will not operate properly.

(2) Date print

Set this whether the date should be printed in the hard copy output.

(3) Function key print

Set this whether the region to display function keys should be output in a hard copy.

<6. Clock set>

Use this to set the time of the clock. The clock is the 24-hour type and is set in the order (Year/Month/Date Hour: Minute:Second). Since it has a battery back-up, it is not necessary to set the clock every time you turn ON the power.

Ex.) 10/Dec/94 12:34:56

<7. Turning OFF the D2 lamp automatically>

D2 lamp is automatically turned OFF when measurement is not performed. The following 4 kinds of time are available for OFF timer setting. When nothing is executed during the set time, the lamp is turned OFF.

10 min, 30 min, 60 min, ∞

<8. Buzzer sound>

Set this to turn ON/OFF of the buzzer.

<9. Maintenance>

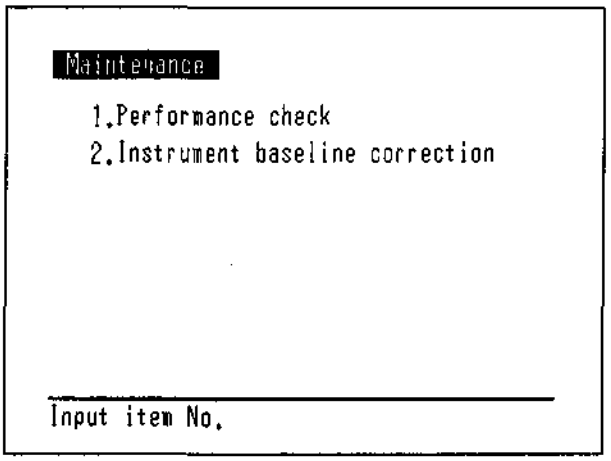


Fig. 10.4 Instrument maintenance and inspection screen

(1) Performance check

This runs a performance check of the spectrophotometer regarding the following items and the results are displayed with the date and instrument serial number. The same information will automatically be printed out if there is a printer connected.

1) Wavelength accuracy

Measures the emission line of the D2 lamp (656.1nm, 486.0nm) to find the difference between those peak wavelengths.

2) Repeatability of wavelength setting

Measures the emission line of the D2 lamp (656.1nm, 486.0nm) 3 times to find the variance in those results.

3) Resolution

Finds the half width of the emission line of the D2 lamp.

4) Initialize

Prints the initialization results when the power was turned ON. (In this function, the initialization operation is not performed.)

```
*****        C H E C K        *****

Date : 93/12/21 19:36:23

Serial No. : 1993-12-20

Wavelength accuracy

          656.1nm              486.0nm
    1     656.2      0.1       485.9      -0.1
    2     656.2      0.1       486.0       0.0
    3     656.1      0.0       485.9      -0.1
   ------------------------------------------
Repeatability     0.1                     0.1
of wavelength
Setting

Resolution :  1.91

Initialize

   LSI INITIALIZE                    : OK
   MEMORY ROM CHECK                  : OK
   MEMORY RAM CHECK                  : OK
   FILTER MOTOR INITIALIZE           : OK
   LIGHT MOTOR INITIALIZE            : OK
   SCAN MOTOR INITIALIZE             : OK
   WI ENERGY CHECK                   : OK
   WAVELENGTH ORIGIN 1 SEARCH        : OK
   D2 ENERGY CHECK                   : OK
   WAVELENGTH ORIGIN 2 SEARCH        : OK


      SHIMADZU Corporation Kyoto Japan
```

Fig. 10.5 Function check results printout

(2) Instrument baseline correction

In addition to normal baseline correction, this instrument also has an instrument baseline correction function. Instrument baseline correction corrects and records the optical balance of the spectrophotometer itself at narrow correction intervals. The recorded instrument baseline is then used during baseline correction in the various measurement modes. The baseline correction in each of the modes performs correction at a relatively coarse correction interval over a specified wavelength range, but is also able to correct even fine optical imbalances in the instrument in a short time. If the correction measurements in this correction are not performed at the same intervals as the data acquisition interval used during measurement in a past baseline correction, differences and shock noise which could not be corrected can be eliminated.

Since the instrument baseline changes due to time-dependent changes in the instrument, it is recommended that you perform instrument baseline correction during periodic inspections (once per month) or when the flatness of the baseline is especially poor. When a special accessory has been used which restricts the light flux in the sample module, etc., sufficient baseline correction results will be obtained by performing instrument baseline correction once and then performing baseline correction in the various modes starting from the next time the instrument is used.

Chapter 11
Sample Module Control
(Multi-cell, Sipper Operation)

CONTENTS

11 Sample Module Control (Multi-cell, Sipper Operation)

When you use a function key to call up the sample control screen from a measurement parameter configuration screen, you can set the measurement parameters for the sample module.

The 3 following accessories are available which can be mounted in place of the standard sample module and operated in synchronization with the main instrument.

1. Multi-cell (Cell holder capable of handling 6 cells.)
2. Sipper (Perform measurements while drawing sample into a flow cell using a pump.)
3. CPS-240 (6 cell holder with a temperature regulation function.)

Refer to "Chapter 5 (Optional) Special Accessories" in the " Instruction Manual - User's System Guide" for the instructions for mounting the various accessories.

This accessory is equipped with 6 sample-side cell holders and one reference-side cell holder.

The 6 sample-side cell holders can be moved automatically or by key operations on the spectrophotometer unit.

The cell holders are number from 1 in the front to 6 in the back.

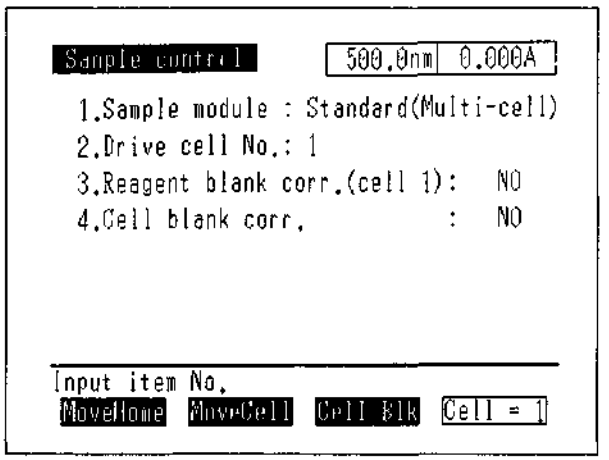


Fig. 11.1 Sample control screen (Multi-cell)

(1) Sample module

Specify the name of the instrument mounted in the sample module. This can be set to 1. Standard (Multi-cell), 2. Sipper or 3. CPS-240. Set this to 1. even when using a standard sample module.

(2) Drive cell No.

Enter the number of cells being measured. The input range is 1 to 6.

(3) Reagent blank corr. (cell 1)

This indicates that the sample being used as the reagent blank has been placed in the cell position 1. Enter the [3] key to switch the display between "YES" and "NO".

Refer to "11.4 About the Blank Correction Function" for details about "reagent blank correction".

(4) Cell blank corr.

Set whether or not to perform cell blank correction on the measurement results. Enter the [4] key to switch the display between "YES" and "NO".

Refer to "11.4 About the Blank Correction Function" for details about "cell blank correction".

(5) [MoveHome] (F1 key)

This moves cell 1 (the cell inserted into the front-most cell holder) into the measurement light path.

(6) [MoveCell] (F2 key)

This advances the holder one cell. If cell 6 is the cell which is currently in the light path, the holder will move to cell 1 when you press this key.

(7) [Cell Blk] (F3 key)

This acquires absorbance (transmittance) data for the cell which is inserted in the respective cell holder. Cell blank correction subtracts the absorbance acquired at this time from the sample measurement results for each cell. (The two are divided for transmittance.)

When "Cell blank corr." is set to "YES", be sure to perform cell blank correction for the cell being used.

This function operates only when "Cell blank corr." is set to "YES".

(8) [Cell = 1]

This indicates the current cell position. (Nothing will happen if you press the F4 key.)

NOTE!	Cells cannot be automatically moved and measured in modes which are accompanied by a spectrum display (Spectrum mode, Multi-component Quantitation mode). Press the [MoveCell] (F2) key when you wish to move the cell.

This is an accessory that uses a pump to draw liquid sample into a flow cell.

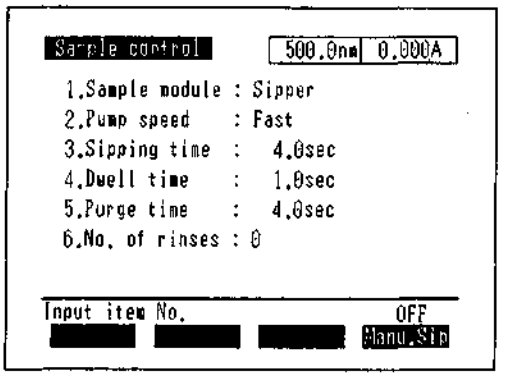


Fig. 11.2 Sample control screen (Sipper)

(1) Sample module

When the sample module setting is Sipper, a screen like the one above is displayed.

(2) Pump speed

This indicates the pump rotation speed. The input range is 1 to 4: 1. Fast, 2. Medium, 3. Slow, 4. Halt. Select the 4. Halt when using the electromagnetic valve.

(3) Sipping time

Set the time that the sample will be aspirated. The input range is 0 to 99.9 seconds.

(4) Dwell time

Set the time interval between aspiration of a sample and measurement. The input range is 0 to 99.9 seconds.

(5) Purge time

Set the time after measurement is completed that the sample will be purged. The input range is -99.9 to 99.9 seconds. When set to a negative value, the pump will reverse to purge the sample, In other words, the sample will be discharged from the tube through which it was aspirated.

(6) No. of rinses

Set the number of times that the inside of the flow cell will be rinsed before measurement. The sip-purge operation will be repeated the number of times set here. Measurement is not performed during this operation.

(7) [Manu.Sip] (F4 key)

This key switches the manual suction function ON/OFF. Each time you press this key, the function toggles between ON<—>OFF. Manual sipping draws the sample while the sipper lever is pressed, regardless of the sipping time setting, and no measurement is performed.

* When using the auto sample changer ASC-5 (option) for link measurement, refer to the manual for ASC-5.

The CPS-240 is an isothermic cell holder which is used to simultaneously hold the 6 cells at a set temperature through electronic control.

The various settings are the same as for a Multi-cell. Refer to "11.1 Multi-cell Sample Compartment". Refer to the CPS-240 manual regarding setting the temperature of the CPS-240.

About the Blank Correction Function

The blank correction functions included in modes in which a Multi-cell or CPS-240 are available in [SmplCntl] are used in the following instances.

1. Reagent blank correction

Using the sample placed in cell position 1 as a blank, the cells in the other positions (2-6) are measured. In other words, after the samples in cell positions 2 through 6 have been measured, the measured value for the sample in cell position 1 is subtracted from the various measured values.

Because of this, even if time changes occur in the blank sample or drift develops due to the increasing temperature of the instrument, accurate data can be acquired by canceling these fluctuating factors.

2. Cell blank correction

Even though cells are constructed in the same manner, there are naturally going to be slight optical differences. In cell blank correction, at first blank samples are placed in a square cells and the measured values in that condition are recorded. Then, when an unknown sample is measured and those results are displayed, the previously recorded blank measured value is canceled from the various measurement results. Thus, the measured value of only the sample is obtained.

If both of these two blank correction functions are functioning, the measured value for the other cells can be corrected with the sample in cell 1 as the reagent blank, while also performing a cell blank for each individual cell.

Blank correction is one type of data processing and is calculated as subtraction for absorbance and division for transmittance.

Note that the standard measurement modes in which the blank correction function can be used are the Photometric mode, Kinetics mode and one-wavelength quantitation.

Table 11.1 Blank Correction List

	Cell Position		Cell blank corr.=NO Reag blank corr.=NO	Cell blank corr.=NO Reag blank corr.=YES	Cell blank corr.=YES Reag blank corr.=NO	Cell blankcorr.=YES Reag blank corr.=YES
Output Data	Cell n (n=2-6)	ABS	An	An-A1	An-an	(An-an)-(A1-a1)
		T%	Tn	Tn/T1×100(%)	Tn/tn×100(%)	Tn·t1/tn/·T1×100(%)
	Cell 1 (Cell used as reagent blank)	ABS	A1	A1	A1-a1	A1-a1
		T%	T1	T1	T1/t1 ×100(%)	T1/t1×100(%)

Wherein,

An: Absorbance with no blank correction on cell n

Tn: Transmittance with no blank correction on cell n

an: Cell blank value for cell n (absorbance)

n: Cell blank value for cell n (transmittance)

NOTES! The range over which correction can be performed, due to internal data processing calculation restrictions, are up to 399.9% for transmittance and down to -0.602Abs for absorbance.

When a blank correction function is working, accurate data are obtained only when an actual measurement operation has been performed (when the [START] key has been pressed). Please note that the value displayed in the upper right corner of the sample control screen or measuring mode, which indicates the current value, displays the uncorrected value.

Chapter 12 PC Control

This is the mode in which the UV-1601 is controlled by an external computer (PC). An RS-232C interface is used.

CONTENTS

12.1 Connecting to a PC

Use the cable specified in the wiring specifications below as the RS-232C interface cable that connects the UV-1601 to a PC. Connect the RS-232C connector on the right side of the UV-1601 with the RS-232C connector on the PC.

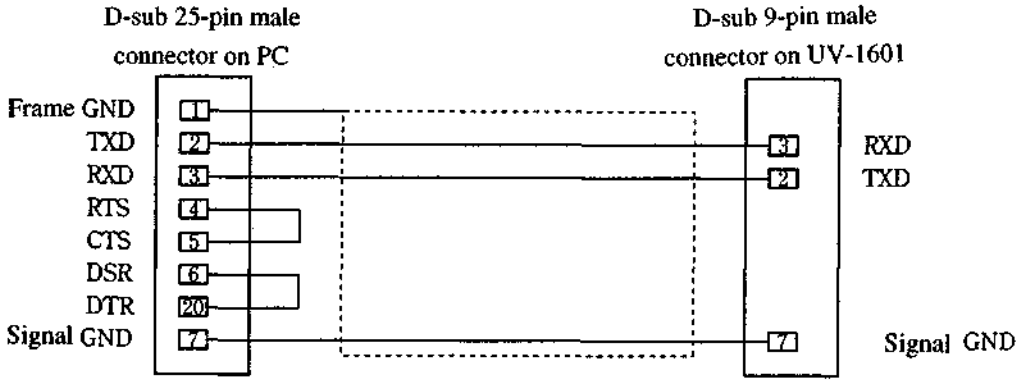


Fig. 12.1 RS-232C cable for UV-1601

The part number of this UV-1601 RS-232C cable is 200-86381.

A total of 3 wires are actually used: 2 for input/output and 1 for ground.

The connector for connecting to the PC, when seen from the PC side as above, has the control wire pins connected to each other so that input and output are always enabled. In addition, the No. 1 pin is connected to the cable shield.

In the case of an IBM-PC or DOS/V PC, a 9-pin, not 25-pin, connector is used on the external computer side. In this case, use a cable which is wired as shown below.

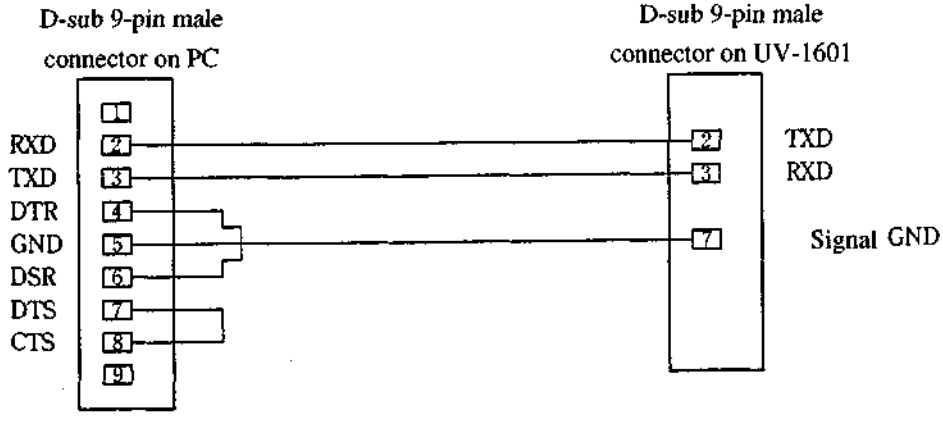


Fig. 12.2 RS-232C cable for UV-1601 (IBM)

The part number of this UV-1601 RS-232C cable is 200-86408.

A total of 3 wires are actually used: 2 for input/output and 1 for ground.

The connector for connecting to the PC, when seen from the PC side as above, has the control wire pins connected to each other so that input and output are always enabled. In addition, the No. 1 pin is connected to the cable shield.

When you select [PC Ctrl] (F4 key) in the mode selection screen, the following screen is displayed. It becomes possible to communicate with PC via the RS-232C interface.

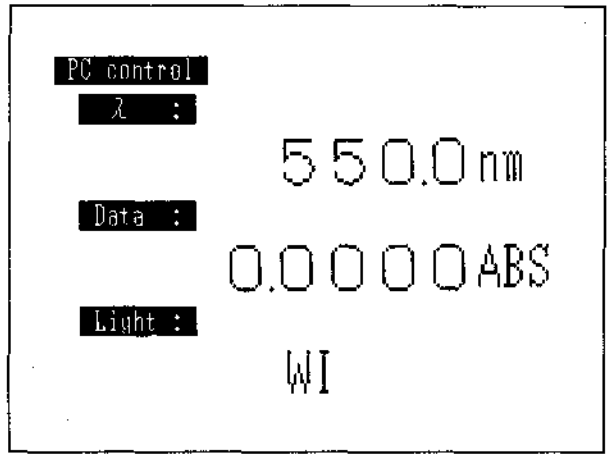


Fig. 12.3 PC control mode screen

The exchange of signals (communication) with the PC must be performed with one being the "speaker" and the other the "listener". In this case, the speaker will be referred to as the master and the listener as the slave.

The exchange of signals is performed under a set procedure (protocol). These signals comprise not only commands and data, but also codes for the control of the procedure (control codes). The control codes shown in the table below are used in the exchange of signals between the UV-1601 and a PC.

Control Code (Hexadecimal)	Direction	Function
ENQ ($05) (Enquiry)	Master to Slave	Enquiry code sent when you wish to send commands or data. In particular, the first ENQ of a series of transactions also indicates the start of communication.
EOT ($04) (End of Transmission)	Master to Slave	Code for announcing the end of communication. Use this when there are no more data to be sent.
ESC ($1B) (Escape)	Bi-directional	Code sent when you wish to interrupt communication.
ACK ($06) (Acknowledge)	Slave to Master	Code returned from receiving side in affirmative response to a command, data or code which has been sent.
NAK ($15) (Negative Acknowledge)	Slave to Master	Code returned from receiving side in negative response to a command, data or code which has been sent.
NUL ($00) (Null)	Master to Slave	Code for recognizing the end of a variable-length signal, such as a command or data, etc. This is also called the terminator.

Table 12.1 Control Codes

The transmission parameters are as follows.

Transmission rate: 9600bps
Data bits: 7 bits
Stop bit: 1 bit
Parity bit: Odd

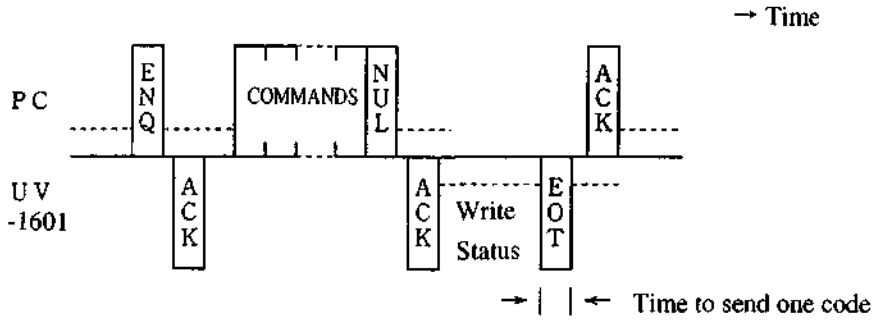
The types of commands sent from the PC to the UV-1601 can be generally classified as follows according to the direction of the data flow.

a) Write command ... Allows the status of the UV-1601 to be set.

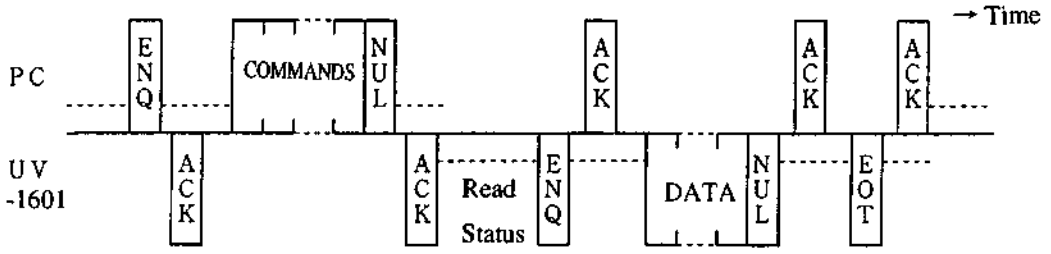
b) Read command ... Allows the status of the UV-1601 to be recognized.

The procedures for these commands have several types. A time chart is shown below. In the figure, the "..."mark indicates the master. Please note that the master and slave roles alternate in the communication process.

a) Write command ... Protocol A



b) Read command ... Protocol B, Protocol B'



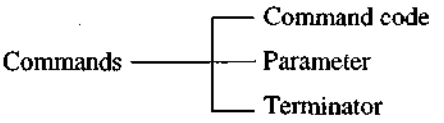
There are also repeating commands in this portion ←——→

This is Protocol B'.

The write command in a) is protocol A, the type in which data are received only once from the external computer at the read command in b) is protocol B, and when there are multiple data received it is called protocol B'.

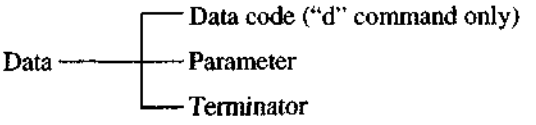
Explanation of Commands and Data

The commands which can be sent from an external computer are made up of the following elements.



A command code consists of a single lower-case alphabetic code. The number of a parameter is depends on the command code. Commands can be divided into those with no parameter, those with only one parameter and those with multiple parameters. When there are multiple parameters, it is necessary to separate the parameters with a symbol (delimiter). "," (comma) is used as the delimiter. Since all parameters are sent as ASCII text, if you wish to set the number 15, this would be expressed in hexadecimal as $31,$35. NUL is used as the terminator.

Data which is sent from the UV-1601 have the following structure.



Only "d" command has a Data Code "d", any other commands have no Data Code. There is only one parameter, reflected by a text string. If the parameter is 10.36, it would be expressed in hexadecimal as $31,$30,$2E,$33,$36. NUL is used as the terminator.

Command List

The terminator symbol has been omitted from the command format places in the command list. When sending to the UV-1601, send a terminator code (NUL) right after the content shown in the table as the actual command. "n" and "m" in the command format indicate parameters. The protocol types are A, B and B' and correspond with the time chart in 12.2.

Table 12.2 Command List

Command	Protocol	Name	Processing Content and Usage Notes
a	A	Measure	Performs wavelength scan. The measured data are stored in the continuous data memory area in the UV-1601. Use the f command when retrieving data.
cn	A	Baseline correction	Performs baseline correction. The parameter n corresponds with the baseline number as shown below. n=0: baseline n=1: instrument baseline This corrects the baseline every 1.6nm over the domain set by the scan range h command. The instrument baseline is corrected for the entire wavelength range at 0.1nm intervals.
d	B	Data output trigger	Outputs the current data. When this command is sent, the UV-1601 performs one measurement and outputs the data as shown below. dk The parameter k is the current data and is formatted as shown below, according to the measurement mode. Abs : ±x.xxxy Not Abs: ±xxx.xy The sign of the parameter is output only if the parameter is negative, while a space is output if the parameter is positive. In addition, y is output if the number of columns of data display (Data display) instrument parameter for the UV-1601 is set to 5.
hn,m	A	Scanning range	Set the scanning range. The parameters n and m correspond with the start wavelength and end wavelength. Use a "," (comma) as the delimiter between the parameters. 190 ≦n,m ≦1100 n-m ≧ 10

Command	Protocol	Name	Processing Content and Usage Notes
jn	A	Scanning speed	Set the scanning speed. The parameter n corresponds with the speed number as shown below. n=1: Fast n=2: Medium n=3: Slow n=4: Very Slow
vn	A	Measurement mode	Set the measurement mode. The parameter n corresponds with the mode number as shown below. n=1: T% n=2: Abs n=3: Energy
wn	A	Wavelength setting (go to λ)	Set the wavelength. The parameter n uses the value which is 10 times the wavelength being set. To set a wavelength of 500.0nm, set 5000. n must meet the following condition. 1900 ≦ n ≦11000
x	A	Auto zero	Performs auto-zeroing (sets the absorbance under the current conditions at zero, or the current transmittance at 100).
fn	B'	Transfer file data	Retrieves data which have been stored in the memory area of the UV-1601 by the measure command a. The parameter n is the number of data points that you wish to retrieve, and allows you to retrieve n pieces of data from the start of the file (in the case of a spectrum, from the long wavelength end). If you set the parameter to a number which is greater than the number of data points saved in the memory area, processing will end at the point where you ran out of data. n meets the following condition. 1 ≦ n ≦1001 The data will be output as follows. k For the data which is sent, it is necessary to send an ACK response for each piece of data. The parameter k is a pairing of the wavelength at the time of measurement and the data. The format is as follows, depending on the measurement mode at the time (Top is Abs, bottom is not Abs). zzzz.zΔ Δ ±x.xxxy

Command	Protocol	Name	Processing Content and Usage Notes
			zzzz.z Δ Δ ±xxx.xy z is the wavelength, x and y are the measurement data and Δ represents "space" data. The sign of the parameter is output only if the parameter is negative, while a space is output if the parameter is positive. In addition, y is output if the number of columns of data display (Data display) instrument parameter for the UV-1601 is set to 5.
o	A	Sipper suction	Execute the sipper suction operation. The settings done on the UV-1601 are used for the sipper parameters at the Spectrum mode, such as pump speed and sip time, etc. This command is valid only if a sipper is connected to the sample compartment module.
p	A	Sipper purge	Execute the sipper purge operation. The settings done on the UV-1601 are used for the sipper parameters at the Spectrum mode, such as pump speed and purge time, etc. This command is valid only if a sipper is connected to the sample compartment module.
qn	A	Move cell position	Move the cell position of the Multi-cell holder or CPS-240. Parameter n decides the direction. n = 1: Move 1 cell forward (Multi-cell & CPS-240) n = 2: Move to the cell 1 (Multi-cell) Move 1 cell backward (CPS-240) This command is valid only if Multi-cell or CPS-240 is connected to the sample compartment module.
q	B	Check cell position	Check the cell position in the multi-cell or CPS-240. When this command is executed, data are returned from the UV-1601 as follows. k The parameter k corresponds with the cell position number as follows. $1 \leqq k \leqq 6$ This command is valid only when a multi-cell or CPS-240 is connected to the sample compartment module.
r	B	Check ASC nozzle	Check the nozzle condition in the auto-sample

Command	Protocol	Name	Processing Content and Usage Notes
			changer ASC-3 or ASC-5 (both options). If this shows that the nozzle is lowered, the sample suction operation can begin. When this command is executed, data are returned from the UV-1601 as follows. k The parameter k corresponds with the nozzle status number as follows. 0= nozzle is raised 1= nozzle is lowered This command is valid only when the ASC-3 or ASC-5 is connected.

12.5 Sample Program

Sample programs 1, 2 and 3 will be introduced for the protocol types A, B and B' described in Section 12.2. BASIC is used as the program language. These will run on NEC 98 series computers or IBM personal computers and their compatibles.

So that these will operate independently, insert a statement to initialize the RS-232C port in the front half of the program (the line OPEN "COM1:...). However, Since there is no statement for setting the transmission rate for an NEC 98 series computer, refer to the operating manual for the PC that you will be using and set the transmission rate to 9600.

The program list shown below will run on an NEC 98 series computer. For an IBM personal computer, modify the initialization statement for the RS-232C port as follows.

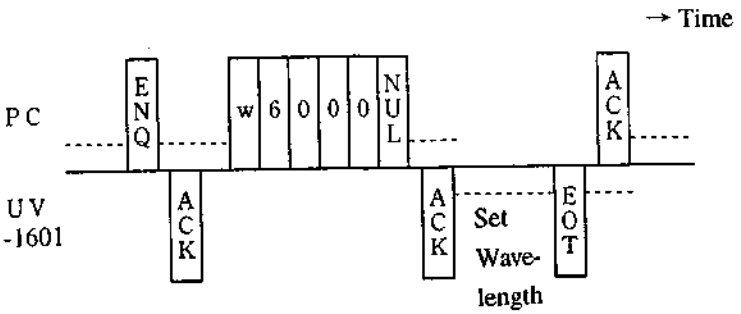
OPEN "COM1:9600,O,7,1" AS #1

Program 1. (Sample program for Protocol A)

Content:

Set the wavelength to 600.0nm.

Protocol Procedure:



Program List:

```
100  'UV-1601 PC Control Program
110  DIM BUF$(32)
120  ENQ$=CHR$(&H5) : EOT$=CHR$(&H4) : ESC$=CHR$(&H1B)
130  NUL$=CHR$(&H0) : ACK$=CHR$(&H6) : NAK$=CHR$(&H15)
140  '
150  'GO TO λ
160  OPEN "COM1:071NN" AS #1
170  FOR I=0 TO 99 : NEXT
180  PRINT #1,ENQ$;
```

```
190   IF INPUT$(1,#1)<>ACK$ THEN 170
200   FOR I=0 TO 99 : NEXT
210   PRINT #1, "w6000" +NUL$;
220   IF INPUT$(1, #1)<>ACK$ THEN BEEP : PRINT #1, ESC$; : GOTO 250
230   IF INPUT$(1, #1)<>EOT$ THEN BEEP : PRINT #1, ESC$; : GOTO 250
240   PRINT #1, ACK$;
250   CLOSE #1
260   END
```

Explanation of Program List:

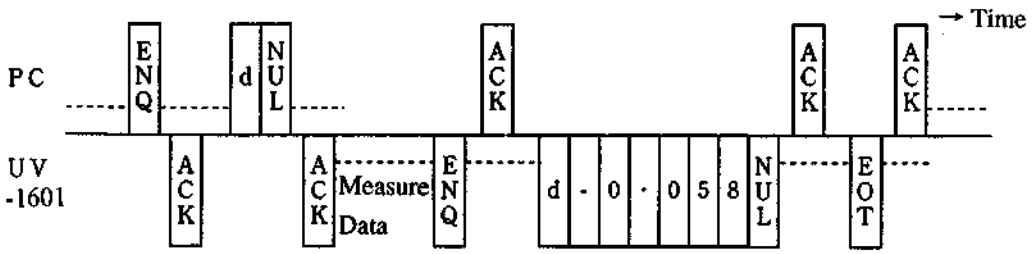
Line 110	Define receiving buffer
Lines 120-130	Define control codes
Line 160	Set transmission parameters for RS-232C (Data: 7 bits, Stop: 1 bit, Parity: odd)
Lines 170, 200	Timing adjustment. Since processing speed of the UV-1601 is slower than that of the PC, standby time is inserted.
Lines 180-190	Send ENQ, receive ACK
Lines 210-220	Send command, receive ACK
Lines 230-240	Receive EOT, send ACK
Line 250	Close RS-232C port

Program 2. (Sample program for Protocol B)

Content:

Retrieve and display current data.

Protocol Procedure:



Program List:

```
100   'UV-1601 PC Control Program
110   DIM BUF$(32)
120   ENQ$=CHR$(&H5) : EOT$=CHR$(&H4) : ESC$=CHR$(&H1B)
130   NUL$=CHR$(&H0) : ACK$=CHR$(&H6) : NAK$=CHR$(&H15)
140   '
150   'Trigger
160   OPEN "COM1:071NN" AS #1
170   FOR I=0 TO 99 : NEXT
180   PRINT #1, ENQ$;
190   IF INPUT$(1, #1)<>ACK$ THEN 170
200   FOR I=0 TO 99 : NEXT
210   PRINT #1, "d" +NUL$;
220   IF INPUT$(1, #1)<>ACK$ THEN BEEP : PRINT #1, ESC$; : GOTO 320
230   IF INPUT$(1, #1)<>ENQ$ THEN BEEP : PRINT #1, ESC$; : GOTO 320
240   PRINT #1, ACK$;
250   BUF$=""
260   C$=INPUT$(1, #1)
270   IF C$<>NUL$ THEN BUF$+C$ : ACK$ : GOTO 260
280   PRINT #1, ACK$;
290   PRINT "Current data:"; MID$(BUF$, 2, LEN(BUF$))
300   IF INPUT$(1, #1)<>EOT$ THEN BEEP : PRINT #1, ESC$; : GOTO 320
310   PRINT #1, ACK$;
320   CLOSE #1
330   END
```

Explanation of Program List:

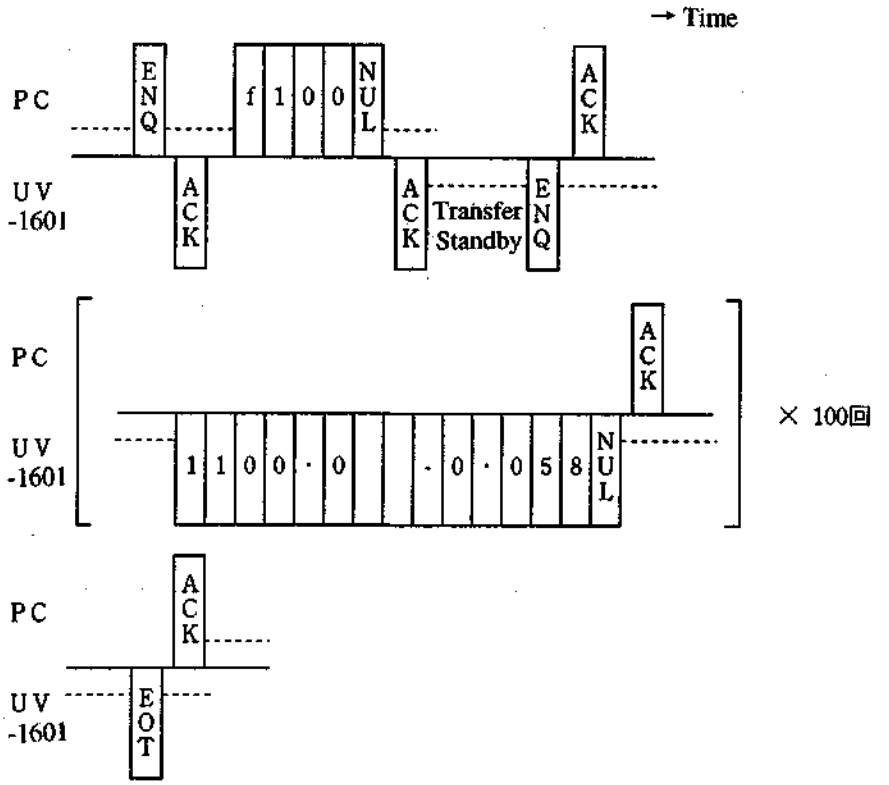
Lines 180-190	Send ENQ, receive ACK
Lines 210-220	Send command, receive ACK
Lines 230-240	Receive ENQ, send ACK
Lines 250-280	Receive data, send ACK
Line 290	Delete data code at head of data, display current data
Lines 300-310	Receive EOT, send ACK

Program 3. (Sample program for Protocol B')

Content:

Retrieve 100 points of data for kinetics or spectrum which were obtained from a spectrum obtained by measurement command a or by key operation of the UV-1601 instrument. This sample is programmed so that the loop, rather than continuing until 100 points are received, continues until an EOT signal is received from the UV-1601.

Protocol Procedure:



Program List:

```
100   'UV-1601 PC Control Program
110   DIM BUF$(32)
120   ENQ$=CHR$(&H5) : EOT$=CHR$(&H4) : ESC$=CHR$(&H1B)
130   NUL$=CHR$(&H0) : ACK$=CHR$(&H6) : NAK$=CHR$(&H15)
140   '
150   'Transfer Data File
160   OPEN "COM1:071NN" AS #1
170   FOR I=0 TO 99 : NEXT
180   PRINT #1, ENQ$;
190   IF INPUT$(1, #1)<>ACK$ THEN 170
200   FOR I=0 TO 99 : NEXT
210   PRINT #1, "f100" +NUL$;
220   IF INPUT$(1, #1)<>ACK$ THEN BEEP : PRINT #1, ESC$;: GOTO 360
230   N=1
240   C$=INPUT$(1, #1)
250   IF C$=EOT$ THEN 350
260   IF C$<>ENQ$ THEN BEEP : PRINT #1, ESC$;: GOTO 360
270   PRINT #1, ACK$;
280   BUF$=""
290   C$=INPUT$(1, #1)
300   IF C$<>EOT$ THEN 350
310   IF C$<>NUL$ THEN BUF$=BUF$+C$ : GOTO 290
320   PRINT #1, ACK$;
330   PRINT USING "### &          &" ;N, BUF$
340   N=N+1 : GOTO 280
350   PRINT #1, ACK$;
360   CLOSE #1
370   END
```

Explanation of Program List:

Lines 180-190	Send ENQ, receive ACK
Lines 210-220	Send command, receive ACK
Lines 240-270	Receive ENQ, send ACK
Lines 280-320	Receive data, send ACK
Line 330	Display Nth data
Lines 300, 350	Receive EOT, send ACK

Chapter 13 Index

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Record Of Revision

Date	No.	Changed Page	Description
95.11	206-93070B	1-3,1-4,2-20 3-2,4-8,6-11 8-1,8-16,10-3 10-4,10-5,11-4	

Note) A...Added Page No.

D...Deleted Page No.

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3500 – 04600 – 400NK – E

Electro Magnetic Compatibility

Notice: Description of this section are only applied to the model for EU (European union) market :206-67001-96SE

This instrument complies with European standard EN55011 class A for electro magnetic emission and EN50082-1 for electro magnetic interference.

1)Electro Magnetic Emission

This instrument complies with European EMI(Electro Magnetic Interference) standard EN55011 class A equipment.
The standard classifies that class A equipment are suitable for use in all environment other than domestic environment.

Notice:When a electro magnetic disturbance occur to those instrument being used close to this product, Take appropriate distance between instruments to eliminate the disturbance.

2)Immunity to Electro Magnetic Interference

This instrument complies with European standard EN50082-1 for electro magnetic immunity. Stated below are the test conditions

1)Immunity to Electro Static Discharge IEC801-2
8kv Air Discharge.

2)Immunity to Strong Electro Magnetic Field IEC801-3
3v/m
Performance criteria for the test was as follows.
Display on the operation panel should not be changed except for photometric read out value.

3)Immunity to burst/fast transient noise from power supply. IEC801-4
2kv to AC power line and protective earth.

Notice:Compliance to the standard does not ensure that the instrument can work with any level of Electro Magnetic interference stronger than the level tested.
Interference greater than the value specified in the condition above may cause malfunction of the instrument .
To avoid electro magnetic disturbance, following notices are recommended to be followed.

1)Before touching the instrument,discharge the electro statics charged in operator's body to ground by touching metallic structure connected to ground.
2)Do not install this instrument in such environment where strong electro magnetic fields are generated near by.

5.7 List of Optional Accessories (Add this list)

*For Europe:
These accessories, shown as bellow, DO NOT comply with the requirements of the EMC Directive 89/336/EEC, the Directive 93/68/EEC amending Directive 89/336/EEC.

Part No.	Name
204-05557-##	Thermoelectrically Temperature Controlled Cell Holder TCC-240A*
204-05837-##	Temperature Controlled Cell Positioner CPS-240A*
206-65108-##	Thermoelectric Sipper TSU-2200*
200-92504	Auto Sample Changer ASC-3*
204-09100-##	Auto Sample Changer ASC-5*
200-65022	Constant-temperature water circulating device TB-85*
204-29230	Sample Waste Unit SWA-2*
204-51774-01	Gel Scanner GSC-3A*
200-91513	Recorder U135-MU*
206-81350-##	Printer DPU-411*
206-81009-##	Thermal Printer HCP-1A*

-##:Dash No. is different for power supplying voltage.

Regulatory Information

For Europe:
The product complies with the requirements of the EMC Directive 89/336/EEC, the Directive 93/68/EEC amending Directive 89/336/EEC.

Product name	: UV-Visible Spectrophotometer
Model name	: UV-1601
Manufacturer	:SHIMADZU EUROPA GmbH
Address	: Albert-Hahn-Strasse 6-10, D-47269 Duisburg, F.R.Germany

Note: This product is produced by SHIMADZU EUROPA GmbH according to the drawings which were designed by SHIMADZU CORPORATION

Address	: 1, NISHINOKYO-KUWABARACHO, NAKAGYO-KU, KYOTO, 604, JAPAN