MODELS 6400/6405
SPECTROPHOTOMETERS
OPERATING MANUAL

640 050/REV B/11-99

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CONTENTS

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SECTION 8 **WARNING AND ERROR MESSAGES**

SAFETY

Please read this information carefully prior to installing or using this equipment.

1. The units described in this manual are designed to be operated only by trained personnel. Any adjustments, maintenance or repair must be carried out as defined in this manual by a person qualified to be aware of the hazards involved.

2. It is essential that both operating and service personnel employ a safe system of work in addition to the detailed instructions specified in this manual.

3. The covers on the units should only be removed by personnel who have been trained to avoid the risk of shock.

4. References should always be made to the Health & Safety data supplied with any of the chemicals used. Generally accepted laboratory procedures for the safe handling of chemicals should be employed.

5. If it is suspected that safety protection has been impaired in any way, the unit must be made inoperative and secured against any intended operation. The fault condition should be immediately reported to the appropriate servicing authority.

SECTION 1

INTRODUCTION

1.1 INSTRUMENT DESCRIPTION

The Models 6400 and 6405 incorporate a wide range of features designed to satisfy the needs of users seeking to maximise the efficiency of routine and specialised UV and Visible spectroscopy tasks.

Menu based operation guides the user through all the available modes and ensures that unfamiliar operators are able to complete satisfactory analyses. Multi-language capability allows screen instructions to be presented in a choice of English, French, German, Italian, Spanish, Swedish or Portuguese.

The 6400 and 6405 spectrophotometers incorporate an innovative optical system which reduces stray light and enhances overall reliability by minimising the number of optical elements employed. The sample chamber allows total sample presentation flexibility with cells from 100mm path length down to micro-sample capacity being readily accommodated. Eight position motor driven multi-cell changer and sipper pump accessories are available, either factory fitted or as user installable options. In addition, an electronically temperature controlled Peltier cell holder is available for situations where a constant temperature is essential.

A scanning facility is provided on both the 6400 and 6405. The scan range, speed and resolution can be user adjusted and the resultant scan, which appears in real time on the graphics display, can be auto scaled to give enhanced visibility. Peaks and valleys are labelled with wavelength and absorbance values and can be readily down loaded to the optional internal printer or, via the serial interface, to a PC. A cursor facility allows the user to interrogate specific parts of the scanned data.

Full kinetics capability is incorporated into each unit and allows, usually in conjunction with the Peltier cell block, full analysis of timed reactions.

Methods producing non-linear results can also be accommodated by using powerful in-built software in conjunction with the multi-cell changer. Up to seven data points can be determined automatically and used to construct a curve. A variety of statistical methods are available to ensure a close correlation to all curve shapes.

Design of the units is such that minimal routine maintenance will be necessary in normal use.

This manual has been produced to help guide you through the many operating modes and features available on the 6400 and 6405. Our hope is that operation of the units is such that reference to this manual will be required only rarely. It is our aim to ensure that all information needed to operate these products satisfactorily is contained within. If, however, you experience any difficulties please contact the manufacturer or your local distributor for guidance.

1.2 INSTRUMENT SPECIFICATIONS

Transmittance	
Range:	0 to 199.9%T
Resolution:	0.1%T
Accuracy:	±0.1% @ 10%T
Stray Light:	<0.05% @ 340nm
Absorbance	
Range:	-0.300 to 3.000A
Resolution:	0.001A
Photometric Accuracy:	±0.005Abs @ 1.0Abs
Drift:	<±0.001Abs/hour after 15 minute warm up
Concentration	
Range:	-300 to 9999 (resolution dependant)
Resolution:	0.001/0.01/0.1/1
Units:	ppm, mg/l^{-1}, g/l^{-1}, M, %, blank
Factor:	0.000 to 9999.99
Wavelength	
Range:	320 to 1100nm (6400) 190 to 1100nm (6405)
Resolution:	0.1nm
Accuracy:	±1.0nm
Bandwidth:	5nm
Maximum Scan Speed:	1400nm/min
Readout:	240x128 pixel reflective LCD
Outputs:	Analogue / RS232 serial port
Light Source:	Tungsten Halogen (6400/6405) Deuterium (6405)
Input Voltage:	115Va.c. / 230Va.c. ±20%
Input Power:	100VA (6400) 200VA (6405)
Size:	520 x 330 x 180mm
Weight:	15Kg

SECTION 2

INSTALLATION

2.1 UNPACKING

Remove the Model 6400/6405 from the packaging and ensure the following items are present:
1. Model 6400 / 6405 Spectrophotometer
2. Mains cable
3. Pack 100 disposable cuvettes
4. Optional accessories (as ordered)

Any shortages or damage should be reported immediately to the manufacturer or your local distributor.

2.2 INSTALLATION

The 6400 / 6405 are designed to operate on 230V or 115V (50/60Hz) mains supply.
The standard 2 metre cable supplied with the unit is fitted with an IEC type connector which can be plugged directly into the POWER IN socket on the rear panel.
The mains fuse is housed within the POWER IN socket. When replacing the fuse the unit should be disconnected from the mains supply.
In the event of the fuse failing after replacement, it is advisable to consult with the manufacturer or your local distributor before proceeding further.

Fuse rating: 1.6A (T-type) for 230V operation
3.15A (T-type) for 115V operation

NOTE: The unit should be positioned within 1.5 metres of an earthed mains supply.

VOLTAGE SELECT

NOTE: When changing the voltage select switch position always ensure the fuse rating is correct.

Before attempting to change the voltage select, disconnect the unit from the mains supply. Withdraw the fuse holder from the power input socket and remove the fuse. Extract the grey fuse retainer and rotate so that the correct voltage is visible through the aperture in the fuse holder. Replace the fuse retainer in its holder, fit the correct fuse and push the assembly back into the power input socket.

MAINS CONNECTIONS

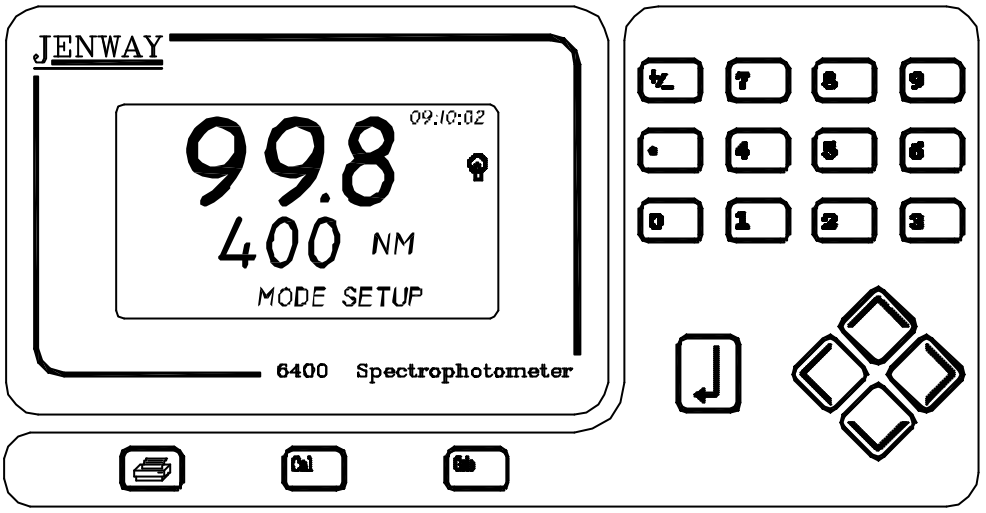
The unit may have been supplied with a moulded connector suited for use with your local supply outlet. If, however, it has been supplied without a plug fitted, a suitable plug for your local supply should be wired as follows:
The wires are colour coded to conform to the internationally recognised standard such that:

BROWN	**LIVE**
BLUE	**NEUTRAL**
GREEN/YELLOW	**EARTH**

IMPORTANT: THE UNIT MUST BE EARTHED

The green/yellow wire in the a.c. supply must be connected to a properly grounded terminal.

2.3 CONTROLS



Print key - Provides a mode dependent printout - refer Section 7 for examples.

Cal key - performs a photometric calibration at the current wavelength.

Goto key - used to set wavelength.

used to select the displayed menu option and for entering values.

used to move horizontally and vertically between menu options. Up and down arrow keys are also used to select non-numeric set up parameters.

Icons

The following icons may appear on the instrument display during operation.

UV lamp on (6405 only)
This icon will flash during pre-strike warm up.

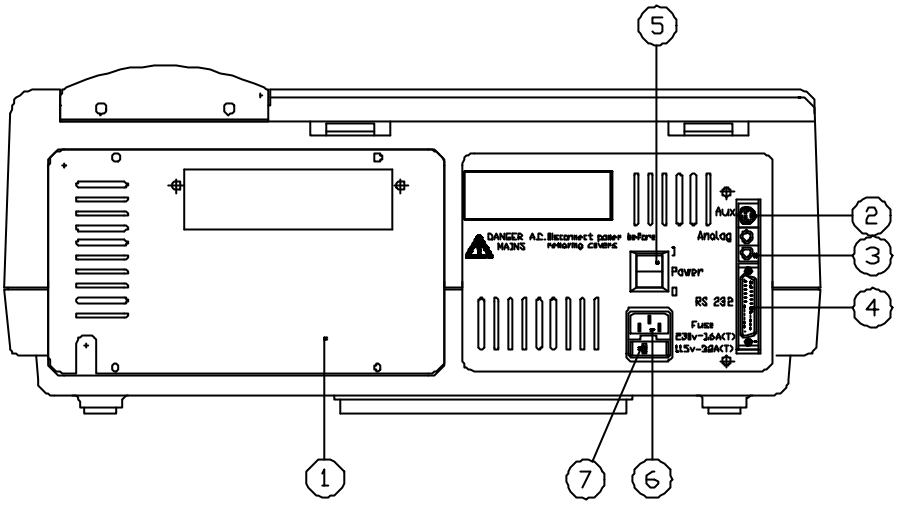
Tungsten Halogen lamp alight. If the lamp(s) fail the symbol will not be shown.

Current cell holder position in multi-cell holder (0 - 7).
0 = position 0 which is the default for blank.

Recalled scan in Spectrum mode or calibration curve in Quantitation mode.

2.4 INPUTS / OUTPUTS

Fig. 2.4.1 Rear Panel Layout



1. **LAMP ACCESS PANEL** — This panel allows the user to gain access to the lamps when replacement is necessary.

NOTE: **The lamp access panel and all ventilation slots must not be covered or obstructed at any time.**

2. **Aux. SOCKET** — 7 pin DIN socket. Serial communications port for the auxilliary peltier control unit.

3. **Analog SOCKETS** — 2 x 4mm pin sockets for analogue output.

4. **RS232 SOCKET** — 25 way output socket for RS232.

5. **ROCKER SWITCH** — On/Off switch for the unit.

6. **POWER IN SOCKET** — IEC type connection socket for mains cable.

7. **FUSE HOLDER** — Fuse ratings - 1.6A T-type for 230V
3.15A T-type for 115V

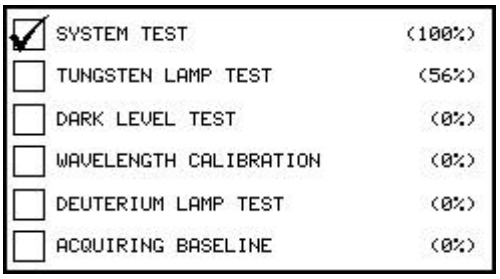
SECTION 3

OPERATION

3.1 OPERATING OVERVIEW

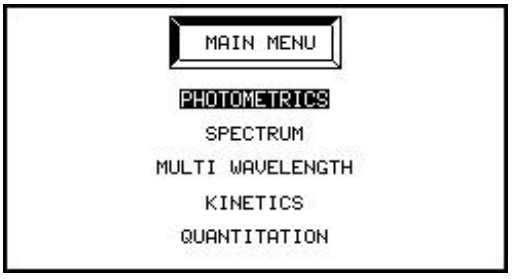
This section has been provided as an overview of the product functions. For specific instructions on each mode of operation please refer to the appropriate section as detailed in the Contents section at the front of this manual.

Power On Systems Test

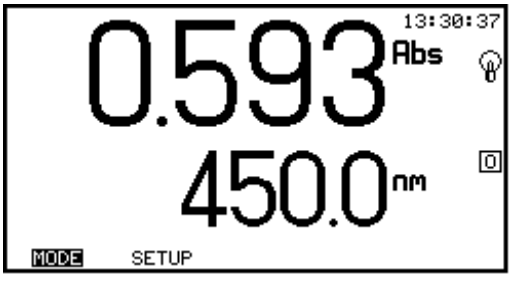


These test the instrument's memory and lamp. Wavelength calibration is also performed by finding the peak transmittance at 0nm. An initial baseline is also acquired.
A failure will be be shown by a X appearing in the box to the side of the parameter under test, together with an error message.
(Refer to Section 8 Warning and Error Messages for explanatory notes and action)

Operating Mode Menu

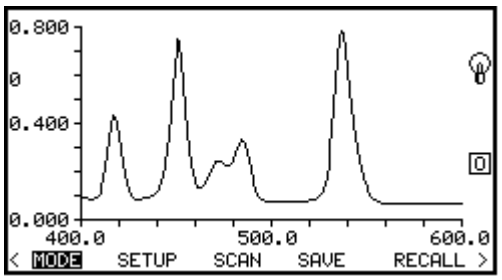


Photometrics



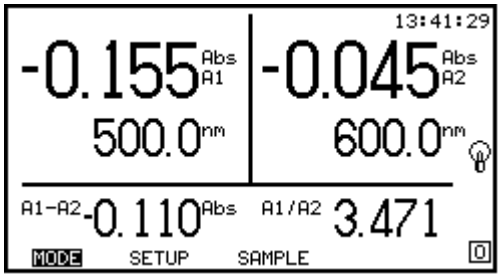
This is the basic measurement mode that displays transmittance, absorbance or concentration at a single wavelength.
Calibration is performed using the Cal key.
Wavelength is set using the Goto key or the up and down arrow keys.
Concentration is calculated from absorbance multiplied by a factor plus a user entered offset. Readings can be printed to the in-built printer or serial port.

Spectrum



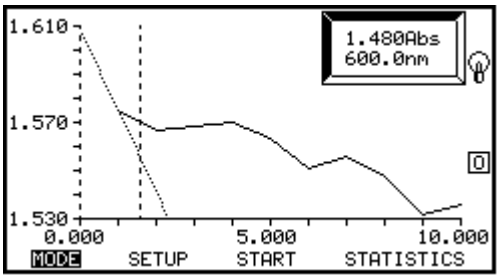
This mode allows samples to be scanned between two user set wavelengths at 5nm, 1nm or 0.2nm intervals. The highest scan rate is attained by scanning at 5nm intervals.
Scan statistics which list peaks and valleys can be displayed.
An optional peak and valley filter can be employed which only lists peaks and valleys that exceed a percentage of the difference between the maximum peak and the minimum valley.
A movable cursor (left and right arrow keys) can be used to take readings directly from the scan in increments of the scan interval.
The scan axis can be automatically re-scaled on completion of a scan.
Two scans can be stored.
A baseline can be manually acquired.
The instrument can be set to repeat a scan at a user set interval for a user set number of times.
The instrument can be set to print out on completion of an auto-repeat scan.
Printed information includes the scan parameters and the statistical information. The in-built printer allows graphical printout of the spectrum. Spectrum data points are printed over the serial port.

Multi Wavelength



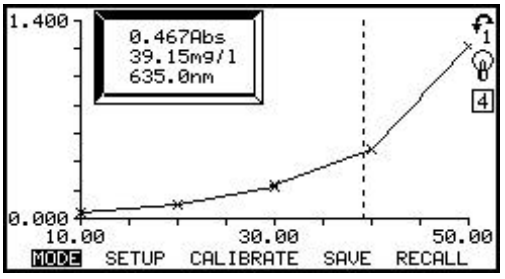
This mode allows transmittance or absorbance measurement at two user set wavelengths. Difference and ratio of the two readings are also displayed.
The user initiates a measurement at the two wavelengths by selecting the sample menu option.
Calibration is also performed automatically at the two wavelengths.

Kinetics



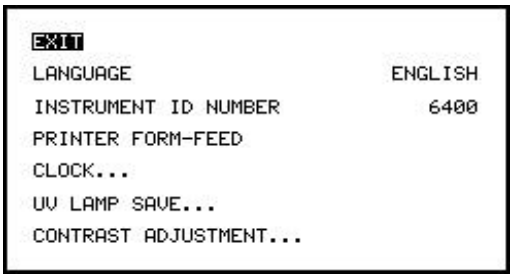
This mode allows kinetics rate measurements to be made. Absorbance or transmittance versus time is displayed graphically.
The user can enter the kinetics lag time and run time.
Alternatively, the kinetics run time can be set to commence when the absorbance or transmittance exceeds or falls below a user set level.
The kinetics factor can be set by the user.
The graphical axis can be set to automatically re-scale on completion of the kinetics run.
A line of best fit can be displayed. The line of best fit can be restricted to a user set portion of the kinetics run.
Post-kinetics statistics, which includes the initial absorbance or transmittance level, the change in absorbance or transmittance, the kinetics value and the equation of the line of best fit (y=mx + c).
The in-built printer allows graphical printout of the kinetics run.

Quantitation



This mode is only available when the instrument is fitted with a multi-position cell holder.
This mode allows a calibration curve of absorbance or transmittance versus concentration to be constructed.
Sample concentrations are displayed using the relationship of concentration versus absorbance or transmittance derived from the calibration curve. The calibration curve is displayed graphically.
The multi-position cell holder forms an integral part in the operation of quantitation mode. Two to seven calibration standards are loaded into the cell holder in positions 1 to 7. The user enters the number of calibration standards used and their concentrations (using the cell holder to identify each standard). Cell holder position 0 is reserved for zero absorbance calibration or for subsequent sample measurement.
The curve fit employed for constructing the calibration curve can be selected between linear interpolation (straight lines between calibration points), linear regression (line of best fit) or linear regression through zero (line of best fit that passes through point 0,0).
The concentration graph axis can be automatically recalled on completion of a calibration. Two calibration curves can be stored, together with the calibration standards used to construct the curve.

3.2 INSTRUMENT SET-UP MENU

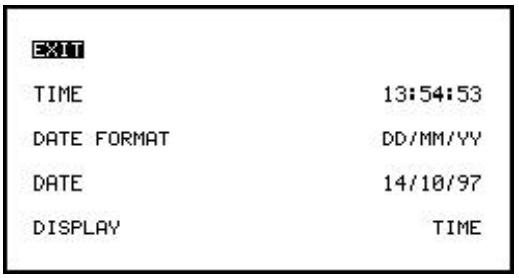


Language
Allows selection of the instrument operating language.

Instrument ID Number
Allows entry of a value between 1 and 999999 that appears on all printouts. This can be used to provide identification of the instrument.

Printer Form Feed
Advances paper in the in-built printer by four lines. Used when fitting a new paper roll.

Clock...
Allows access to the clock set-up menu.



Time
Allows entry of the time (24 hour clock).

Date Format
Allows selection between European date format (day/month/year) or American date format (month/ day/year). The selected format is applicable to all displayed dates.

Date
Allows entry of the date (in the selected format).

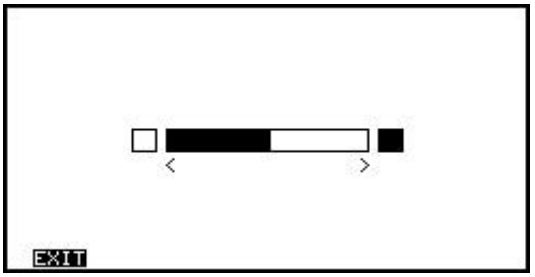
Display
Allows choice of time, date or neither display in measuring modes.

UV Lamp Save...
Allows access to the UV lamp save menu.

Enable
Turns the lamp save feature on or off. When on, the deuterium lamp will only be switched on when the wavelength (or scan range in spectrum mode) falls below the wavelength set in this menu. When off, the deuterium lamp is permanently on.

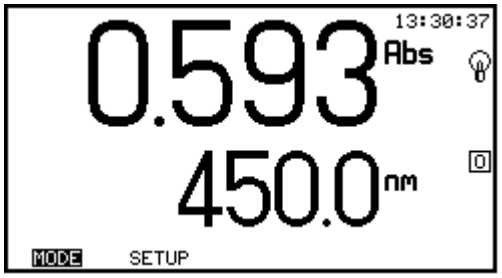
Wavelength
The wavelength below which the UV lamp will be switched on. This is only used if the UV lamp save feature is enabled.

Contrast Adjustment...
Allows adjustment of the display contrast. The left and right arrow keys can also be used for contrast adjustment when the instrument is in the operating mode menu.



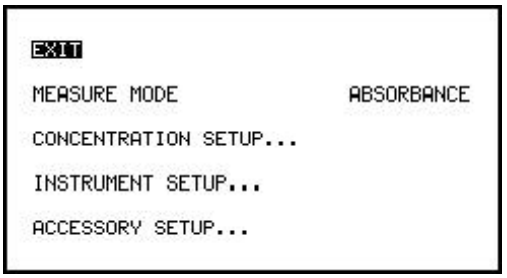
3.3 PHOTOMETRICS MODE

Having selected the Photometrics Mode from the Main Menu options the following display will be shown:



It is recommended that set-up parameters be reviewed prior to calibration or measurement to ensure the selected measurement mode and values are correct.

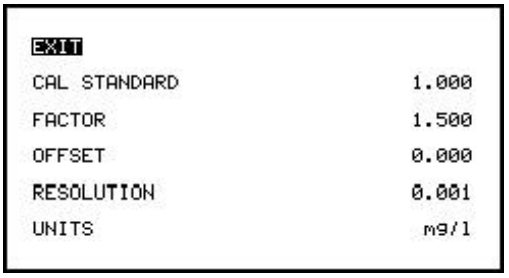
Select SET UP mode using the ◇ key and press ↵



MEASURE MODE

Select %Transmittance, Absorbance or Concentration - ↵

CONCENTRATION SETUP... ↵



Cal Standard

Allows entry of the calibration standard that is calibrated to by pressing the Cal key when the measure mode is set to Concentration. Absorbance is calibrated to this standard by calculating the multiplication factor that produces the calibration standard concentration.

Factor

Allows direct entry of the absorbance multiplication factor for concentration measurement mode.

Offset
Allows the zero absorbance concentration to be offset by the value entered. The offset is set to zero by calibration to a standard.

Resolution
The maximum resolution that concentration readings are displayed to can be set up to three decimal places. The instrument will automatically display concentration readings to the maximum possible resolution using this parameter. For example, a concentration value of 1 can be displayed as 1, 1.0, 1.00 or 1.000, depending on the resolution set. This parameter does not affect the measuring range for concentration: a concentration value of 1999 will be displayed as 1999, regardless of the resolution setting.

Units
Allows selection of the displayed concentration units.

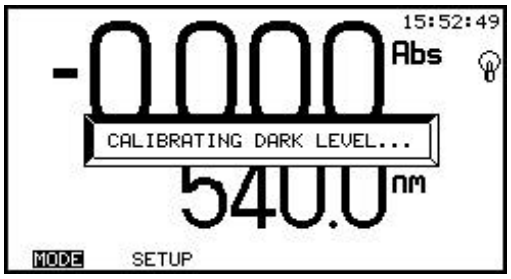
Each parameter can then be set using the keys and pressing to confirm value entered.

To exit the **CONCENTRATION MENU** use the key and then press to return to the main set up options.

To select the **INSTRUMENT SET UP MENU ...** use the key and press . The instrument will enter the menu.
For details on setting up these parameters refer Section 3.2. .

NOTE: **ACCESSORY SET UP...** will only be displayed if an accessory is fitted to the instrument.

Preparing to Make a Measurement



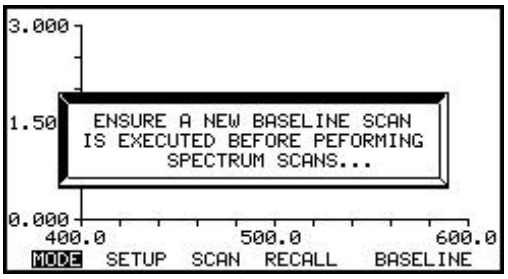
Select the required wavelength using the up/down keys, or by pressing the Goto key and entering the required value using the numeric keypad. Press to confirm.
Open the sample chamber lid and place a blank sample in position. Close the sample chamber lid and press the Cal key. The display will momentarily show - Calibrating Dark Level and then Calibrating Light Level. The display will then update to show 100.0%T or 0.000Abs, depending on mode selected. Remove the blank sample from the sample chamber.
The instrument is now ready to perform a measurement.
Place the unknown sample into the sample chamber and close the lid. The instrument display will show the sample value directly as %T or Absorbance, as appropriate.

3.4 SPECTRUM MODE

Having selected the Spectrum Mode from the Main Menu options the following display will be shown:

Spectrum Mode Pre-Scan Menu

A blank graph is displayed, using the current settings for measurement mode, the y-axis range and the scan wavelength range.



Mode
Takes the instrument back to the operating mode menu.

Set-up
Allows access to the spectrum mode set-up menu and instrument set-up menu.

Scan
Executes a scan between the current start and end wavelengths at the scan interval. Zero transmittance is calibrated prior to starting the scan. The scan can be paused and continued, or can be aborted.

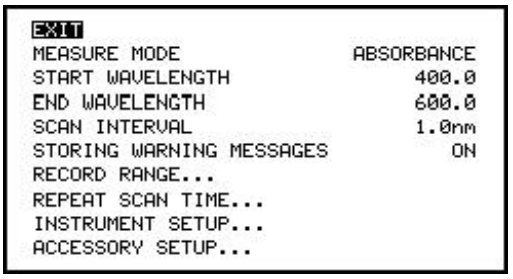
Recall
Allows a previously saved scan to be recalled onto the display. The time and date at which the scan was saved are momentarily displayed. Recalling a scan does not change the next scan set-up parameters. Up to two saved scans can be recalled, plus a current scan if one has been performed (current scan data is lost if the operating mode is changed, or if the instrument is switched off).

Baseline
Acquires a new baseline over the operating wavelength range for the instrument.

It is recommended that set-up parameters be reviewed prior to calibration or measurement to ensure the selected measurement mode and values are correct.

Select **SET UP** mode using the ◇ key and press ↵

Set Up Menu



Each parameter can then be set using the keys and pressing to confirm value entered.

Measure Mode
Selects between transmittance or absorbance for the scan y-axis.

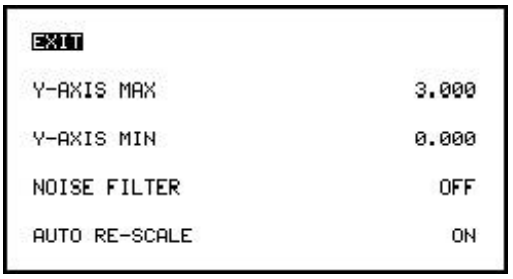
Start Wavelength
The wavelength at which the scan will commence.

End Wavelength
The wavelength at which the scan will finish.

Scan Interval
The wavelength interval at which the instrument will scan.

Storing Warning Messages
When a scan is saved with two scans already saved, the instrument prompts to confirm the new scan save since the oldest saved scan will be overwritten. This message can be suppressed by setting the storing warning messages to off. With the storing messages off, a scan save will automatically overwrite the oldest previously saved scan with no further user intervention.

Record Range...
Allows access to the spectrum record range menu option which allows the y-axis range to be set.



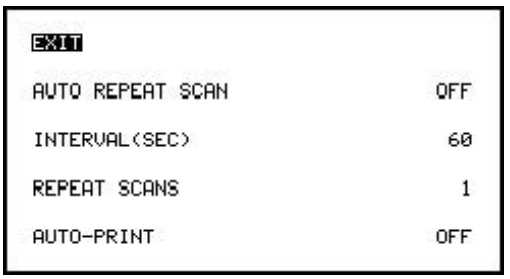
Y-Axis Max
The highest absorbance or transmittance (depending on the measurement mode) that is displayed on the scan axis.

Y-Axis Min
The lowest absorbance or transmittance (depending on the measurement mode) that is displayed on the scan axis.

Noise Filter
The post-scan statistical feature will list all turning points (peaks and valleys) when the noise filter is set to off. If the noise filter is set to fine, medium or coarse then peaks and valleys which deviate from the preceding peak or valley by a percentage of the total excursion of the scan (the difference between the highest peak and the lowest valley) are omitted from the statistcal peaks and valleys tables. More peaks and valleys will be omitted if the noise filter is set to coarse (only those peaks and valleys which exceed 10% of the total excursion) than for medium (5%) or fine (1%) settings.

Auto Re-Scale
This feature can be turned on or off. When auto re-scale is on, the instrument will automatically change the Y-Axis minimum and maximum points to display the scan to it's greatest resolution. If set to off, then the Y-Axis will use the user set maximum and minimum points.

Repeat Scan Time...
Allows access to the repeat scan set up menu, which allows the instrument to automatically repeat a scan a number of times at a user set time interval.



Auto Repeat Scan
Turns the automatic feature which repeats a scan at a user set time interval on or off.

Interval (Sec)
Allows entry of the time interval (in seconds) at which the instrument will repeat a scan when this feature is turned on. The interval between scans begins upon completion of the first user initiated scan, including the time to print the scan if the automatic print feature is turned on.

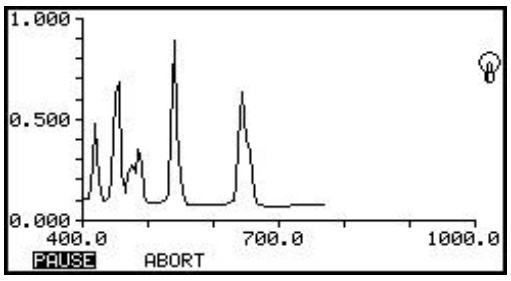
Repeat Scans
The number of times a scan will be repeated when the automatic repeat scan feature is turned on. This does not include the first scan, which must be initiated by the user.

Auto Print
If this option is turned on and the automatic repeat scan feature is turned on, then the instrument will automatically print the scan (either to the in-built printer or to the serial port) upon completion of a scan.

Instrument Set Up...
Allows access to the instrument set up menu.
For details of setting up these parameters refer Section 3.2.

Accessory Set Up...
This will only be displayed if an accessory is fitted to the instrument.

Performing a Scan



It is recommended that a new baseline scan is carried out prior to performing spectrum scans.

Select BASELINE from the menu options at the bottom of the display using the left arrow key and then press ↵ . A baseline scan will now be executed.

Select SCAN from the menu options at the bottom of the display using the right arrow key.

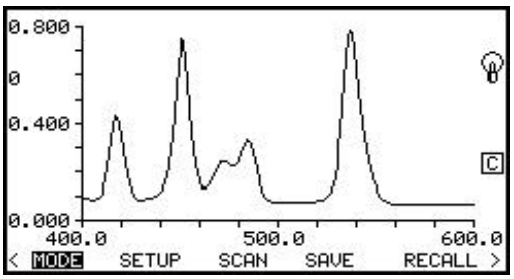
Open the sample chamber lid and place the sample in position. Close the sample chamber lid.

Press SCAN and then the ↵ key to confirm. The instrument display will then show a blank graph with the option to PAUSE or ABORT the scan.

On completion, the display will update to show the performed scan.

Spectrum Mode - Post Scan Menu

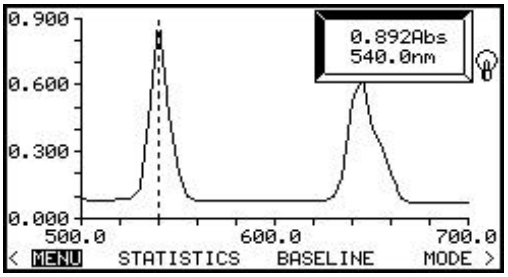
Once a scan has been performed or recalled, the following additional menu options are displayed. Displayed < and > symbols indicate that further menu options are available and can be accessed using the left and right arrow keys.



Save

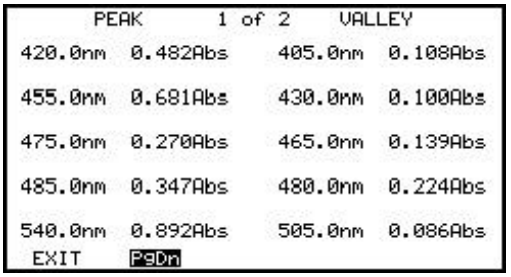
Allows the displayed scan to be saved in non-volatile memory. A recalled scan cannot be saved. If saving a scan will overwrite an already saved scan then a warning message will be displayed, requiring a confirmation to overwrite the old scan. This message can be disabled, negating the need to confirm the save scan option.

Cursor



The menu option allows a movable cursor to be displayed on the scan. The absorbance or transmittance at the selected wavelength is displayed. The cursor can be moved to scanned wavelengths using the left and right or Goto keys. Selecting the cursor menu option changes the displayed menu option to MENU. The enter key must be pressed to allow access to the other displayed menu options and quit using the cursor.

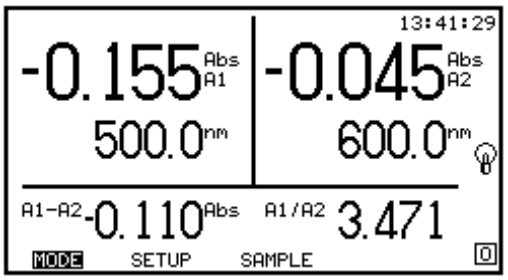
Statistics



Displays the absorbance or transmittance and wavelengths of the peaks and valleys for the displayed scan. The effects of small noise peaks can be reduced by using the optional noise filter (accessible under the spectrum set up record range menu). Multiple pages of peaks and valleys can be scrolled through using the page up and page down menu options.

3.5 MULTI-WAVELENGTH MODE

Having selected the Multi-Wavelength Mode from the Main Menu options the following display will be shown:

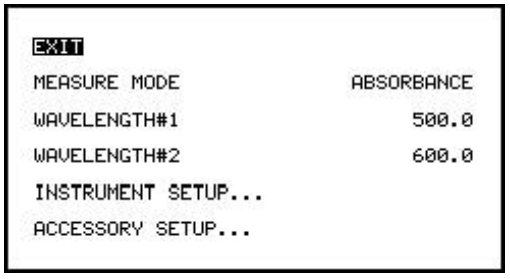


Mode
Takes the instrument back to the operating mode menu.

Set-up
Allows access to the multi-wavelength mode set-up menu and instrument set-up menu.

Sample
Initiates a sample measurement sequence. This measures the absorbance or transmittance at the first user set wavelength, followed by the measurement of the absorbance or transmittance at the second user set wavelength. Both measurements are displayed, together with the difference and ratio of the readings at the two wavelengths.

Multi-Wavelength Set-up Menu



Measure Mode
Selects between transmittance or absorbance display of readings (at both wavelengths) and the difference and ratio displays.

Wavelength #1
The first wavelength to be measured (displayed on the left hand side of the multi-wavelength screen). The transmittance or absorbance reading at this wavelength is referenced as T1 or A1, respectively.

Wavelength #2
The second wavelength to be measured (displayed on the right hand side of the multi-wavelength screen). The transmittance or absorbance reading at this wavelength is referenced as T2 or A2, respectively.

Instrument Set-up...
Allows access to the instrument set up menu.

Accessory Set-up...
Only displayed if an accessory is fitted.

It is recommended that set-up parameters be reviewed prior to calibration or measurement to ensure the selected measurement mode and values are correct.

Select **SET UP** mode using the  key and press 

Performing a Measurement

Having selected the required wavelengths from the SET UP menu the instrument is now ready to perform a measurement.
Open the sample chamber lid and place the blank sample in position. Close the sample chamber lid and press the Cal key. The display will momentarily show - Calibrating Dark Level, Calibrating Light Level and then Reading Sample at the set wavelength. This will be repeated for the second wavelength measurement. The display will then update to show 100.0%T or 0.000Abs, depending on mode selected.
Remove the blank sample from the sample chamber.

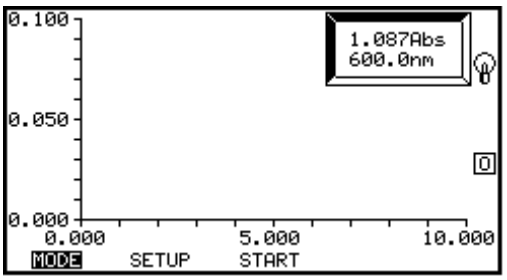
The instrument is now ready to perform a measurement.

Place the unknown sample into the sample chamber and close the lid. Move the cursor to SAMPLE using the RH key and press  to confirm. The instrument will now measure the sample at the selected wavelengths and, when completed, the lower portion of the instrument display will update to show the sample value directly as %T or Absorbance, as appropriate.

3.6 KINETICS MODE

Having selected Kinetics Mode from the Main Menu options the following display will be shown:

Kinetics Pre-Measurement Menu



Mode
Takes the instrument back to the operating mode menu.

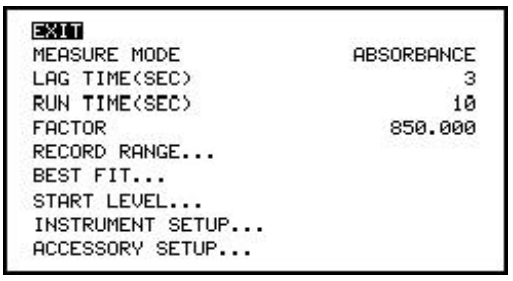
Set-up
Allows access to the kinetics mode set up menu and instrument set-up menu.

Start
Begins a kinetics run. This commences with a lag time wait or wait for the absorbance or transmittance to reach a user set level (if this feature is enabled). After the lag time, or when the level is reached (if enabled) then the run time commences. Readings of absorbance or transmittance are taken and displayed graphically at a time interval of 0.5% of the user set run time, until the total run time has expired. For example, if the run time is set to 60 seconds, readings will be taken every 0.3 seconds.

It is recommended that set-up parameters be reviewed prior to calibration or measurement to ensure the selected measurement mode and values are correct.

Select **SET UP** mode using the ◆ key and press ↵

Kinetics Set-up Menu



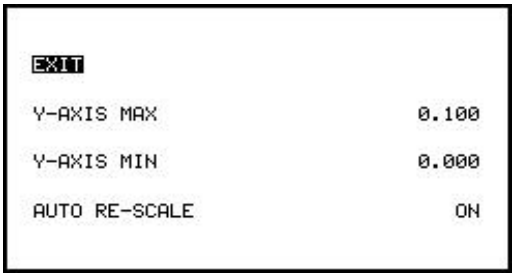
Measure Mode
Selects between transmittance or absorbance display on the kinetics graph Y-Axis.

Lag Time
The time in seconds that the instrument waits to commence taking run time readings after the user starts a kinetics measurement. If the instrument is set to start on a level, then this time is ignored.

Run Time
The time period over which the instrument records and displays absorbance or transmittance. Results taken during this period are used for the post measurement statistical calculations.

Factor
This value is multiplied by the average absorbance or transmittance changing rate to give the enzyme value (EV).

Record Range...
Allows access to the kinetics record range menu option which allows the Y-Axis range to be set.

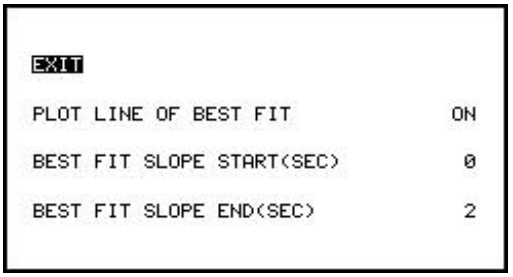


Y-Axis Max
The highest absorbance or transmittance (depending on the measurement mode) that is displayed on the kinetics axis.

Y-Axis Min
The lowest absorbance or transmittance (depending on the measurement mode) that is displayed on the kinetics axis.

Auto Re-Scale
When auto re-scale is on, the instrument will automatically change the Y-Axis minimum and maximum points to display the scan to it's greatest resolution. If set to off, then the Y-Axis will use the user set maximum and minimum points.

Best Fit...
Allows access to the line of best fit selection menu.

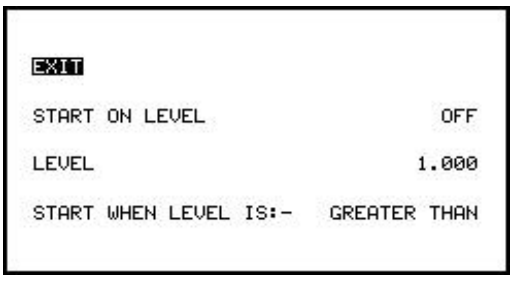


Plot Line of Best Fit
Turns the displayed kinetics run line-of-best-fit on or off.

Best Fit Slope Start
The instrument can be set to only calculate the line of best fit over a portion of the kinetics run time. The best fit slope start is used to enter the elapsed run time from which the instrument should commence the line of best fit calculations.

Best Fit Slope End
The best fit slope end is used to enter the elapsed run time up to which the instrument will base the line of best fit calculations.

Start Level...
Allows access to the start kinetics run on level or after lag time set-up menu.



Start On Level
If set to on, then the instrument will wait until the measured absorbance or transmittance reaches the user set start level before recording kinetics run time readings when a kinetics measurement is started. If set to off, then the instrument will wait for the user set lag time before taking run time readings when a kinetics measurement is started.

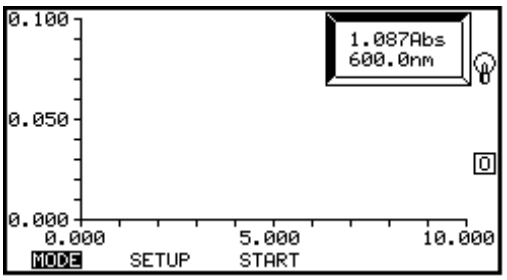
Level
The absorbance or transmittance value from which to commence taking kinetics run time reading is set by this parameter. This parameter is only used if the start on level feature is switched on.

Start When Level Is...
When the start on level feature is turned on, then the kinetics run time readings will be taken when the measured absorbance is greater or less than the value set by the above level parameter.

Instrument Set-up...
Allows access to the instrument set-up menu.

Accessory Set-up...
Only displayed if an accessory is fitted.

Performing a Measurement



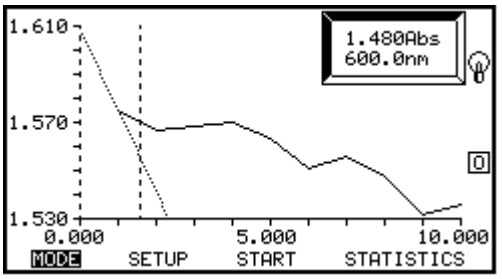
Select the required wavelength range using the Goto key and the numeric keypad. Press ↵ to confirm.

Open the sample chamber lid and place the blank sample in place. Close the sample chamber lid. Press the Cal key. The display will momentarily show - Calibrating Dark Level and then Calibrating Light Level. The calibration details and selected wavelength will be shown in the box located in the top right hand corner of the main display.
Remove the blank sample from the sample chamber.

The instrument is now ready to perform a kinetics measurement.

Place the unknown sample into the sample chamber and close the lid. Move the cursor to START using the arrow keys and press ↵ to confirm. The instrument display will then show a blank graph with the option to ABORT the scan.

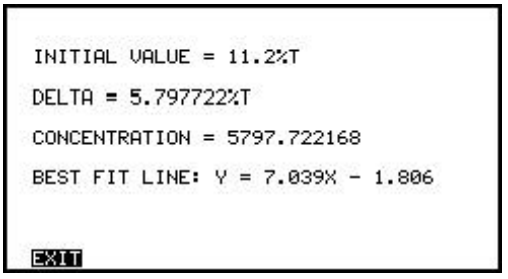
Kinetics Post-Measurement Mode



Once a kinetics run has been performed the kinetics menu displays the following additional menu option:

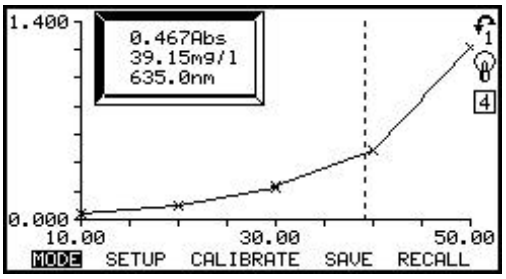
Statistics

Displays the first absorbance or transmittance reading taken (initial value), the average rate of change of absorbance or transmittance (delta), the product of the average rate of change and the user set kinetics factor (EV), and the equation of the line of best fit (Y is absorbance or transmittance, X is time in seconds).



3.7 QUANTITATION MODE

This menu can only be accessed when using the optional multi-cell holder.



Mode
Takes the instrument back to the operating mode menu.

Set-up
Allows access to the quantitation mode set-up menu and instrument set-up menu.

Calibrate
Constructs a quantitation calibration curve. The current settings for the standard concentrations and the number of standards are used. The instrument automatically measures the absorbance or transmittance at each cell holder location and plots the point on the graphical display at the associated standard concentration. The instrument automatically moves on to the next standard. A photometrics calibration is performed prior to constructing the calibration curve. A photometrics calibration can also be performed by pressing the Cal key.

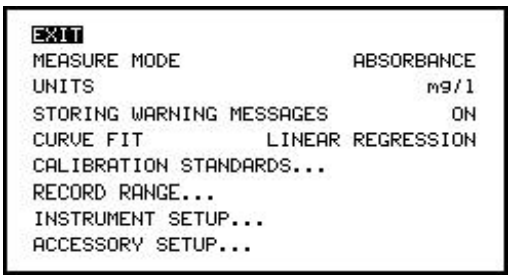
Save
Saves a calibration curve and the associated calibration standards in non-volatile memory. A recalled calibration curve cannot be saved. If saving a calibration curve will over write an already saved calibration curve then a warning message will be displayed, requiring confirmation to over write the old calibration curve. This message can be disabled, negating the need to confirm the save calibration curve option.

Recall
Recalls a previously saved calibration curve. The calibration curve is displayed and the standard concentrations changed to match those of the saved calibration curve. The time and date at which the calibration curve was saved are momentarily displayed. Up to two saved calibration curves can be recalled, plus a current calibration curve if one has been performed (current calibration curve data is lost if the operating mode is changed, or if the instrument is switched off).

It is recommended that set-up parameters be reviewed prior to calibration or measurement to ensure the selected measurement mode and values are correct.

Select **SET UP** mode using the ◆ key and press ↵

Quantitation Set-up Menu



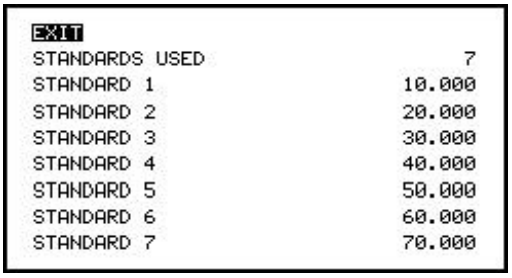
Measure Mode
Selects between transmittance or absorbance display on the quantitation graph Y-Axis.

Units
Selects the concentration units of measurement.

Storing Warning Messages
When a calibration curve is saved with two calibration curves already saved, the instrument prompts to confirm the new save, since the oldest saved calibration curve will be overwritten. This message can be suppressed by setting the storing warning messages to be off. With the storing messages off, a calibration curve save will automatically over write the oldest previously saved calibration curve with no further user intervention.

Curve Fit
Allows selection of the curve fit method for constructing the calibration curve. The options are linear interpolation (straight lines between calibration points), linear regression (line of best fit) or linear regression through zero (line of best fit that passes through point 0,0). Displayed sample concentrations are calculated from the relationship of absorbance or transmittance using the selected curve fitting method.

Calibration Standards...
Allows access to the menu for entering concentration calibration standards.

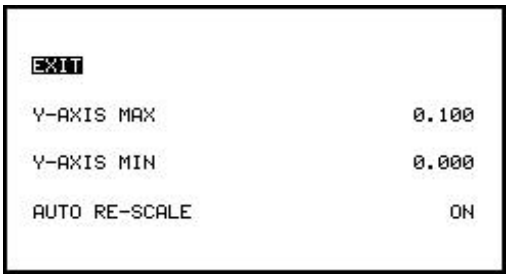


Standards Used
Allows entry of the number of concentration standards that are to be used to construct the calibration curve.

Standard 1
Allows entry to the concentration value of the standard in cell holder position 1.

Standard 2-7
Allows entry of the concentration values for the standards held in cell holder position 2 to 7. Values for cell positions 3 to 7 do not have to be entered, depending on the number of standards to be used.

Record Range...
Allows access to the quantitation record range menu option which allows the Y-Axis range to be set.



Y-Axis Max.
The highest absorbance or transmittance (depending on the measurement mode) that is displayed on the calibration curve Y-Axis.

Y-Axis Min
The lowest absorbance or transmittance (depending on the measurement mode) that is displayed on the calibration curve Y-Axis.

Auto Re-Scale
When auto re-scale is on, the instrument will automatically change the Y-Axis minimum and maximum points to display the scan in it's greatest resolution. If set to off, the Y-Axis will use the user set maximum and minimum points.

Instrument Set-up...
Allows access to the instrument set-up menu.

Accessory Set-up...
Only displayed if an accessory is fitted.

Performing Measurements

This mode is only available when the instrument is fitted with the multi-position cell holder.
Instrument set up parameters should be checked and reset prior to performing calibration and measurement.

Two to seven calibration standards should be loaded into the cell holder in positions 1 to 7. Cell holder 8 is reserved for zero absorbance calibration or for subsequent sample measurement.

The number of calibration standards to be used and their concentrations (using the cell holder positions as identification) should be entered via the CALIBRATION STANDARDS... mode.

CALIBRATE should then be selected from the menu and the  key pressed to confirm.

Once a successful calibration is completed the instrument is now ready for sample measurement.

Selecting a specific sample number in the cell holder can be made using the numeric keypad or by pressing the 0 key and then using the up/down keys. Cell positions will be shown as a column down the left hand side of the display area.

3.8 GOOD PRACTICE GUIDELINES

1. For optimum performance blank and sample calibration should be carried out at the beginning and end of every sample batch.
2. To ensure accurate results are obtained the sample area lid should be kept in the closed position during measurement.
3. The styrene cuvettes supplied with the unit are disposable (i.e. ideally they should be used once and then thrown away). Some repeat use is possible providing extreme care is taken during cleaning to ensure no damage occurs to the polished surface.

NOTE: **The plastic cuvettes supplied with the unit are not suitable for use below a wavelength of 310nm.**
Other grades of UV plastic cuvettes can be used down to 275nm. If the unit is being used below this wavelength, UV grade quartz glass cuvettes must be used.

4. UV quartz glass cells should be used for measurements below 310nm.
5. Plastic cuvettes are not suitable for use with organic solvents.
6. Glassware used in the preparation of standards should be made of a high grade borosilicate glass. The use of soda glass should be avoided wherever possible as leaching can occur during prolonged contact, giving erroneous results.
7. Glass cuvettes should be thoroughly cleaned after use. Discard when scratches become evident in polished surfaces.
8. Chemical reagents should, wherever possible, be of high grade quality. Contamination can cause problems, even at very low levels. Diluents (i.e. water or solvents) must be free from impurities.
9. There are some substances which do not follow Beer's Law. When attempting a new method it is advised that linearity checks should be performed over the range of concentrations being used. This can be carried out by preparing a quantity of known strength solutions and checking the results.

    a) Deviations from Beer's Law may occur at high concentrations by association of molecular ionic species.
    b) Deviations from Beer's Law may occur at low concentrations by variation in hydration, introducing changes in the nature of complex ions.
    c) Absorption which does not obey Beer's Law will require a graph of known standards to be plotted. This should indicate Reading vs Concentration. The reading obtained from the unknowns can then be related to the concentration from the graph.
10. Samples and standards can "outgas" when left in the cuvette. Bubbles formed on the cuvette walls will cause reading errors.
11. When entering the SPECTRUM mode it is recommended that a baseline scan should be carried out.

SECTION 4

MAINTENANCE

4.1 GENERAL

The 6400/6405 have been designed to give optimum performance with minimal maintenance. It is only essential to keep the external surfaces clean and free from dust. The sample area lid should be kept clean and accidental spillage should be wiped away immediately.
To give added protection when not in use, the unit should be disconnected from the mains supply and covered with the optional dust cover (640 133). For longer term storage or re-shipment, it is recommended that the unit be returned to the original packing case.

NOTE: The 6400/6405 Monochromator is a non-serviceable unit and no attempt should be made to repair this item. Failure to observe this recommendation will result in the loss of Warranty Claim on this product.
In the unlikely event of the monochromator requiring service or calibration, it is essential that the Manufacturer or your local Distributor be contacted immediately for advice.

4.2 TUNGSTEN HALOGEN LAMP REPLACEMENT

If the lamp fails during operation the lamp symbol on the right hand side of the display will extinguish. Replacement tungsten halogen lamps are available from the manufacturer or your local distributor.

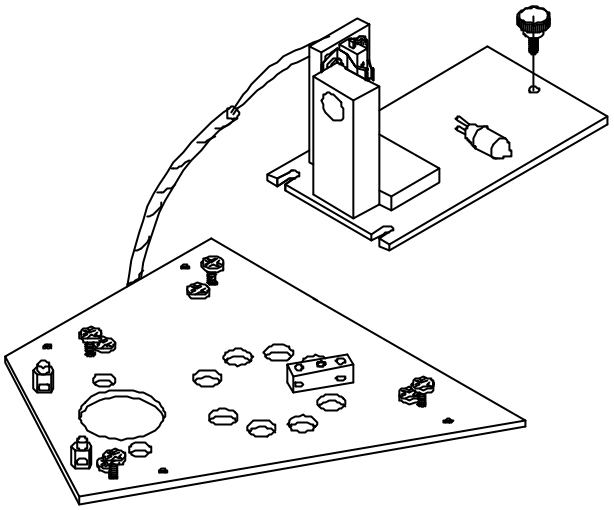
CAUTION: The following safety precautions should be observed prior to attempting the light source replacement procedure:

1. **The lamp runs at high temperatures, therefore, care should be taken to allow the lamp and mounting parts to cool prior to handling.**
2. **Do not touch the glass envelope when fitting the lamp as finger marks will damage the lamp. Should accidental finger marks occur, the surface of the lamp may be cleaned carefully using iso-propyl alcohol.**
3. **A supply of 400 volts is present. All normal safety precautions must be observed.**

1. Disconnect the unit from the mains supply. Access to the tungsten halogen lamp can be gained via the lamp access panel located at the rear of the unit. Lamp replacement should be carried out by removing the 4 slot head screws from the panel.
   NOTE: The panel is attached to the unit case via a short earthing cable. Do not strain or attempt to remove this cable.

2. To remove the lamp carrier assembly loosen off the thumbscrew and carefully withdraw the complete assembly, as far as the connecting wires will allow.

3. Remove the old lamp from the ceramic base and discard safely.



4. Carefully remove the new lamp from it's box and cut the end of the protective plastic sleeve. Gently slide the lamp to this end and whilst holding the lamp by the plastic sleeve, insert into the ceramic base, taking care to push the lamp fully home.

5. Carefully remove the plastic sleeve.

6. Refit the lamp carrier assembly into the rear panel compartment, making sure the lamp carrier slots into the appropriate spigots on the lamp housing base.

7. Refit the lamp access panel to the rear of the unit, taking care not to trap the earthing cable in the casework. Secure into position using the 4 fixing screws.

4.3 DEUTERIUM LAMP REPLACEMENT (MODEL 6405)

The deuterium lamp has an extended life of 2000 hours. Should the lamp need to be replaced the following procedure should be carried out:

If the lamp fails during operation the front panel symbol  will extinguish.

Replacement deuterium lamps are available from the Manufacturer or your local Distributor.

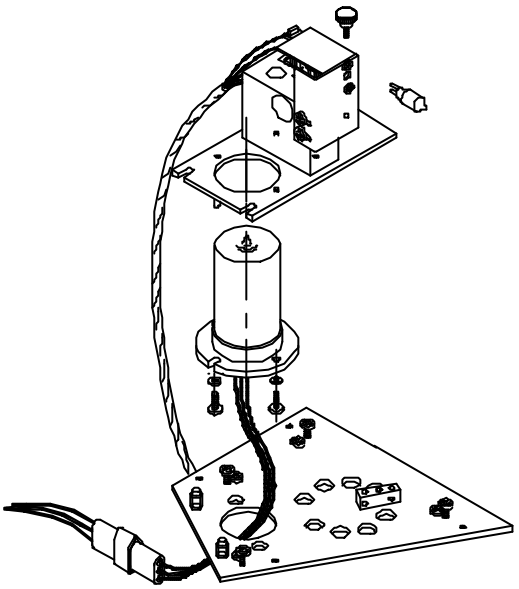
CAUTION: The following safety precautions should be observed prior to attempting the light source replacement procedure:

1. **The lamp runs at high temperatures, therefore, a heat resistant glove should be worn.**
2. **Safety glasses must be worn when UV emissions are present.**
3. **Protective gloves should be worn when handling the replacement lamp to prevent damage from finger marks.**
4. **A supply of 400 volts is present. All normal safety precautions must be observed.**

1. Disconnect the unit from the mains supply. Access to the deuterium lamp can be gained via the lamp access panel located at the rear of the unit. Lamp replacement should be carried out by removing the 4 slot head screws from the panel.
   NOTE: The panel is attached to the unit case via a short earthing cable. Do not strain or attempt to remove this cable.

2. To remove the lamp carrier assembly loosen off the thumbscrew and carefully withdraw the complete assembly, as far as the connecting wires will allow.

3. The deuterium lamp is attached to the lamp carrier by a white connecting socket and 2 fixing screws on the under side of the lamp. Carefully turn the plate, taking care not to strain any of the wires, and disconnect the lamp from the white connecting socket. Remove the 2 fixing screws from the lamp and place carefully to one side. Remove the lamp from the carrier and dispose of safely.



4. Carefully remove the new lamp from it's box and fit into the lamp carrier, noting the position of the locating spigot. Secure into place using the 2 fixing screws. Refit the plug into the white connecting socket.

5. Refit the lamp carrier assembly into the rear panel compartment, making sure the lamp carrier slots into the appropriate spigots on the lamp housing base.

6. Refit the lamp access panel to the rear of the unit, taking care not to trap the earthing cable in the casework. Secure into position using the 4 fixing screws.

SECTION 5

ACCESSORIES

5.1 ACCESSORIES

The following list of items are available for use as optional accessories for use with the Models 6400 / 6405 as specified:

Order Code	Description
641 001	Printer Unit Assembly
060 287	Printer Paper Roll - qty 1
060 288	Printer Ribbon - qty 1
642 001	Sipper Pump Assembly
642 100	Sipper Pump Tubing Kit
035 025	Visible Flow-through Cell 1.8ml
035 045	Visible Flow-through Cell 80µl
035 044	UV Flow-through Cell 1.8ml (6405)
035 047	UV Flow-through Cell 80µl (6405)
643 001	(Peltier) Heated Cell System European 230V - comprising heated cell block and external power supply module.
643 031	(Peltier) Heated Cell System U.S. 115V - comprising heated cell block and external power supply module.
644 001	Eight position motorised multi-cell changer
645 001	Vacuum Pump
645 100	Vacuum Pump Tubing Kit
035 026	Pour in/suck out Cell
646 001	Universal Test Tube Holder
060 331	12mm dia. x 75mm Glass Test Tubes - Pack 100
060 179	12mm dia. x 75mm Plastic Test Tubes - Pack 100
060 335	24mm dia. x 150mm Glass Test Tubes - Pack 50
647 001	(Peltier) Heated Sipper Pump System European 230V - comprising heated cell block for flow-through cells and external power supply module.
647 031	(Peltier) Heated Sipper Pump System U.S. 115V - comprising heated cell block for flow-through cells and external power supply module.

The 5 accessory items listed below are for use with the standard Sipper Pump 642 001 & the Peltier Heated Systems 647 001 /647 031:

642 100	Sipper Pump Tubing Kit
035 025	Visible Flow-through Cell 1.8ml
035 045	Visible Flow-through Cell 80µl
035 044	UV Flow-through Cell 1.8ml (6405)
035 047	UV Flow-through Cell 80µl (6405)

Order Code	Description
630 005	Universal Cell Holder (5 to 100mm path length)
644 003	Eight cell rack for 10mm cells
Special	Eight cell rack for 40mm cells
648 001	Water heated single cell block
649 001	Eight cell water jacketed cell holder (requires 644 001)
037 301	External Peltier Cooler for use with 646 001 (230V)
037 302	External Peltier Cooler for use with 646 001 (110V)
037 201	Water (refridgerant) Circulator for use with 646 001 (230V)
037 202	Water (refridgerant) Circulator for use with 646 001 (110V)
035 123	Micro (500µl) Glass Cuvette
035 124	Ultra-micro Quartz Cuvette
035 125	Micro (500µl) Quartz Cuvette
035 126	Semi-micro (1ml) Glass Cuvette
035 127	Semi-micro (1ml) Quartz Cuvette
035 128	Flow-through (450µl) Glass Cuvette
035 129	Flow-through (450µl) Quartz Cuvette
035 130	Flow-through (750µl) Glass Cuvette
035 131	Flow-through (750µl) Quartz Cuvette
035 027	Visible (glass) 10mm path length Cell
035 028	UV (quartz) 10mm path length Cell (6405)
035 086	Visible (glass) 20mm path length Cell
035 029	Visible (glass) 40mm path length Cell
035 030	UV (quartz) 40mm path length Cell (6405)
035 087	Visible (glass) 50mm path length Cell
035 079	Visible (glass) 100mm path length Cell
035 078	Plastic 100mm path length Cell - Pack 100
060 229	Plastic standard Cuvettes (3.5ml) - Pack of 500
060 230	UV Plastic standard Cuvettes (3.5ml) - Pack of 100 (6405)
060 232	UV Plastic standard Cuvettes (3.5ml) - Pack of 500 (6405)
060 087	Plastic semi-micro Cuvettes (1.6ml) - Pack of 100
060 231	UV Plastic semi-micro Cuvettes (1.6ml) - Pack of 100
035 088	Visible Calibration Standards
035 091	UV/Visible Calibration Standards (6405)
542 009	Interface Cable Kit
640 133	6400/6405 Dust Cover

SPARES

Order Code	Description
012 075	6400/6405 Tungsten Lamp - 1
640 508	6405 Deuterium Lamp (with plug fitted) - 1

SECTION 6

INTERFACING

6.1 SERIAL INTERFACE

The Models 6400 and 6405 have a bi-directional RS232 interface set to:

1200 baud
7 data bits
odd parity
1 stop bit

The 25 way D connector allows a standard one-to-one interconnection lead to be used.

The RS232 serial interface allows data to be read from the 6400/6405 by sending simple ASCII character commands. Similarly, this interface can also be used to remotely operate the basic functions of the instrument. There are two levels of commands which can be sent to the instrument:

1. Single ASCII character commands, which instruct the instrument to send back data. These commands can be used during normal operation of the instrument at any time and are detailed in Table 1.

2. Commands that are terminated by the ACSII carriage return character. These commands can be used to remotely control the instrument and are only acted upon when the instrument is put into remote control mode. Remote control mode is enabled by sending an ASCII R followed by a carriage return (<cr>) *when the instrument is displaying in the operating mode menu.* Table 2 details the remote control commands.

Table 1 - Normal Operation Serial Commands

Command	Action	Serial Response	Notes
D or D	Print displayed reading	Dependent on instrument operating mode	Same function as pressing the print key.
V or v	Request photometrics voltage	xxxx.xxx<cr>	Returns a voltage (mV) proportional to optical transmission.
W or w	Request wavelength	xxx.x<cr>	Returns the current wavelength (nm).

Table 2 - Remote Control Mode Serial Commands (<cr> is ASCII carriage return)

Command	Action	Serial Response	Notes
R<cr>	Enter remote control mode	none	Switches the instrument into remote control mode. This command is only accepted when the instrument is displaying the operating mode menu. Instrument display will indicate remote control mode enabled.
X<cr>	Exit remote control mode	none	Returns the instrument to normal keypad operation.
Gxxx.x<cr>	Go to wavelength	none	Sets the wavelength to the value of xxx.x in the command string.
ZA<cr>	Zero absorbance	none	Calibrates the current wavelength to zero absorbance (100%T).
ZT<cr>	Zero transmittance	none	Calibrates the current wavelength to 0%T (dark calibration).
A<cr>	Request absorbance	xx.xxx<cr>	Returns the current absorbance value, based on the last photometrics calibration.
T<cr>	Request transmittance	xxx.x<cr>	Returns the current transmittance based on the last photometrics calibration.
C<cr>	Request concentration	xxxx.xxx<cr>	Returns the current concentration based on the last photometrics calibration and concentration factor and offset values.
CO±xxxx.xxx<cr>	Set concentration offset	none	Sets the concentration offset (±9999.99) to the value specified by ±xxxx.xxx in the command string.
Fxxxx.xx<cr>	Set concentration factor	none	Sets the concentration factor (9999.99) to the value specified by xxxx.xx in the command string.
PB<cr>	Perform a baseline scan	none	Acquires a spectrum baseline scan over the operating wavelength of the instrument.
SBxxx.x<cr>	Set the scan start wavelength	none	Sets the start wavelength for a spectrum scan to the value specified in xxx.x in the command string.
SExxx.x<cr>	Set the scan end wavelength	none	Sets the end wavelength for a spectrum scan to the value specified by xxx.x in the command string.
SIx.x<cr>	Set the scan wavelength interval	none	Sets the spectrum scan interval to the value specified by x.x in the command string.Valid intervals are 0.2, 1.0 and 5.0 nm.
SMA<cr>	Set the scan measurement mode to absorbance	none	Scans will return absorbance values.
SMT<cr>	Set the scan measurement mode to transmittance	none	Scans will return transmittance values.

Command	Action	Serial Response	Notes
SS<cr>	Start scanning	www.w,xxx.xxx<cr>	Returns the wavelength (www.w) and absorbance or transmittance xxx.xxx at each scanned point as specified by the current scan start wavelength, scan end wavelength, scan interval and scan measurement mode.
SP<cr>	Scan pause	none	Pause the current scan.
SR<cr>	Resume scan	none	Resume a paused scan.
SA<cr>	Abort scan	none	Abort the current scan.
UL0<cr>	Deuterium lamp off	none	Turns the 6405 deuterium lamp off.
UL1<cr>	Deuterium lamp on	none	Turns the 6405 deuterium lamp on.
SC<cr>	Close the dark shutter	none	Closes the dark shutter to block light entering the sample chamber.
SO<cr>	Open the dark shutter	none	Opens the dark shutter to allow light to enter the chamber.
ACxxx,yyy,zzzz<cr>	Accessory control	xxx,yyy,zzzz<cr>	Allows remote control of active accessories. Contact Jenway for details of the accessory control commands.

6.2 RS232 OUTPUT

The bi-directional RS232 interface is available on the rear panel 25 way D type connector.
The connections are as follows:

TXD 2 - INPUT TO 6400/6405
RXD 3 - OUTPUT FROM 6400/6405
RTS 4 - LINKED TO CTS
CTS 5 - LINKED TO RTS
DSR 6 - OUTPUT FROM 6400/6405
DCD 8 - OUTPUT FROM 6400/6405
DTR 20 - INPUT TO 6400/6405 (must be active)
GND 7

Suggested interconnections are detailed below:

6400/6405		IBM PC XT (25 way "D")	
TXD 2	——	2	TXD (From PC)
RXD 3	——	3	RXD (To PC)
RTS 4	——	4	RTS (From PC)
CTS 5	——	5	CTS (To PC)
DSR 6	——	6	DSR (To PC)
DCD 8	——	8	DCD (To PC)
DTR 20	——	20	DTR (From PC)
GND 7	——	7	GND

6400/6405			IBM PC XT (9 way “D”)
TXD 2	——————	3	TXD (From PC)
RXD 3	——————	2	RXD (To PC)
RTS 4	——————	7	RTS (From PC)
CTS 5	——————	8	CTS (To PC)
DSR 6	——————	6	DSR (To PC)
DCD 8	——————	1	DCD (To PC)
DTR 20	——————	4	DTR (From PC)
GND 7	——————	5	GND

NOTE: The Interface Cable Kit (Order Code: 542 009) can be used to implement the above interconnections.

6.3 RECORDER OUTPUT

This is available via the 4mm rear panel sockets. The level is proportional to the displayed reading, depending on the measurement mode:

Transmission	1mV per 0.1%T
Absorbance	1mV per 0.001ABS
Concentration	1mV per concentration unit

SECTION 8

WARNING AND ERROR MESSAGES

a) Messages relating to Power On Self Test

Self Test Failure
This warning occurs after the power-on system tests have been performed. The system test check boxes will indicate which test has failed (this may or may not allow the instrument to be used, depending on the failure detected, see below).

Warning - Operating Parameters Corrupt Restoring to Default Settings
This warning is reported during the power-on system tests if the instrument detects that data stored in the system non-volatile memory is no longer valid. This may occur if the instrument has not been used for several months, or if the battery backup supply is not functioning correctly. The instrument will operate as normal after this warning is reported, but all system parameters will be restored to their default settings and any stored data lost. The instrument requires a user key press to clear the warning message and proceed with the remaining system tests.

Warning - Tungsten Lamp Failure
This warning is reported when the instrument detects that the tungsten lamp has failed.

Warning - Deuterium Lamp Failure
This warning is reported if the deuterium lamp fails to strike during the power-on system tests. The warning message can be cleared by pressing a key, and will allow the instrument to operate in the visible spectrum as normal. Once the warning message has been cleared, the instrument will continue to attempt to strike the deuterium lamp (as a deuterium lamp ages, it is possible that the time allowed for the lamp to strike during the UV lamp test will be insufficient).

Error - Unable to Acquire Dark Level
During the system tests, the instrument reads the zero transmittance (dark) level. This error will be displayed if the level is above a pre-set threshold. The most likely cause is that the sample chamber has been left open. The test can be repeated by pressing a key. The instrument cannot be operated until this test has been successfully completed.

Fatal Error- System Calibration Data Failure
This error is reported if the instrument detects that the calibration data required for accurate measurements has been corrupted or cannot be read. This information is stored on the detector board, therefore, this error will occur if an internal connector has failed, or if there has been a failure on the detector board. The instrument cannot be operated if this error is detected.

Fatal Error - Calibration Failure
This error occurs if the instrument cannot perform a successful wavelength calibration by finding the peak transmittance at 0nm as part of the power-on system test. The error is associated with a serious system failure probably caused by failure of an internal connection to the monochromator or associated control circuitry. The instrument cannot be operated if this error is detected.

Remote Control Enabled... Press Enter to Resume Normal Operation...

This message is displayed on the operating mode menu display when the instrument is put into remote control mode. In remote control mode, the instrument is controlled by commands sent over the RS232 serial interface rather than via the keypad. Remote control mode can be disabled by the appropriate serial command or by pressing the Enter key. The instrument will then operate as normal via the keypad.

Unable to Acquire Peak Level

During the wavelength calibration system test, the instrument finds the peak transmittance at 0nm. This error is reported if the 0nm peak transmittance does not exceed a pre-set threshold. The most likely cause is that a sample has been left in the sample chamber that absorbs too much zero order light, or that the tungsten lamp has failed. The test can be repeated by pressing a key if the cause of the failure has been corrected. The instrument cannot be operated until this test has been successfully completed.

Dark Level Too High

This error occurs during a photometrics calibration when the instrument is calibrating to zero transmittance (dark). If the light level is above a pre-set threshold, normally caused by leaving the sample chamber open, then the calibration is aborted and this message displayed. Since the instrument calibrates zero transmittance by blocking the monochromatic light entering the sample chamber using a solenoid, it is possible that failure of this mechanism will also cause this error.

b) Photometrics, Spectrum, Multi-Wavelength, Kinetics and Quantitation Modes

Dark Level Too High

This error occurs during a photometrics calibration when the instrument is calibrating to zero transmittance (dark). If the light level is above a pre-set threshold, normally caused by leaving the sample chamber open, then the calibration is aborted and this message displayed. Since the instrument calibrates zero transmittance by blocking the monochromatic light entering the sample chamber using a solenoid, it is possible that failure of this mechanism will also cause this error.

Light Level Too Low

This error occurs during a photometrics calibration when the instrument is calibrating to 100% transmittance (zero absorbance). If the light level is below a pre-set threshold then the calibration is aborted and this message displayed. This usually occurs if the blank sample has high absorbance at the current wavelength, for example, if a sample has inadvertently been left in the sample chamber instead of the blank standard. This error can also occur if the lamp has failed, or, in the case of the 6405, if the deuterium lamp has failed to strike or is in the process of warming up (deuterium lamp symbol flashing).

Printer Error

This error occurs when the instrument attempts to print but detects that the printer is busy (not ready) for more than ten seconds.

No Graphics Printer Connected

This warning is displayed if the user attempts to print information when a printer unit is not fitted in the instrument and an external device is not connected to the serial port.

c) Photometrics Mode

Concentration Factor Too High
This error is reported when the resulting multiplication factor required for a photometrics mode concentration calibration is calculated to be outside of the instrument limits.

d) Spectrum Mode

No Spectrum Data Available
This warning occurs when an action which processes the data from a scanned spectrum is performed. For example, pressing the print key with only a blank scan graph will report this warning rather than printing the blank axis. Similarly, if the recall menu option is selected and no scans have been saved, then this message is reported.

Saving a Recalled Scan is Not Permitted
This warning message is displayed when the user attempts to save a scan that has already been saved (that is, has been recalled from memory). No data is lost if this warning is reported.

Performing a Baseline Scan will Invalidate Spectrum Data
The instrument prompts the user to confirm a manual baseline scan because the current scan is referenced to the current baseline information. Since it is likely that the baseline information will change (because of instrument drift) when a new baseline is acquired, the appearance of the displayed scan may change slightly. Saved scans are stored with the baseline information relevant at the time of saving, and are not affected by performing a manual baseline.

Ensure a New Baseline Scan is Executed Before Performing Spectrum Scans...
This message is displayed on entry into Spectrum mode as a reminder to perform a baseline scan prior to performing sample scans. Since the instrument always has baseline data to allow reasonably accurate sample scans, this message can be ignored, but for best accuracy a new baseline should be performed prior to performing sample scans.

No Spectrum Data to Save
This warning message is displayed when the user attempts to save a spectrum when only the blank axis are displayed, that is, without having previously performed a scan.

No Data to Acquire Statistics
This error is displayed if the user attempts to view statistics with no scan or kinetics run data.

Warning Invalid Scan Range
This warning message occurs when one of the parameters that defines the scan range and scan interval is set to a value that cannot be scanned or which is beyond the scanning range of the instrument. For example, the instrument cannot scan between 540nm and 544nm at 5nm intervals (the interval must be less than the scan range, in this example, either 1nm or 0.2nm). Similarly, if the scan start or end wavelength will not be reached at the scan interval, then the instrument changes either the start or end wavelength to fall on an exact number of scan intervals. For example, with a scan interval set to 1nm, and the start wavelength set to 540.5nm, an attempt to enter an end wavelength of 640nm will produce an invalid scan range warning, and the end wavelength will be changed to 640.5nm.

Warning - Existing Data Will Be Overwritten
This warning message is displayed when the user attempts to save a spectrum scan or quantitation calibration curve and previous data has already been stored. The instrument can store two scans and quantitation calibration curves, but must over write the oldest stored data if a subsequent scan or calibration curve is stored. This warning message can be disabled.

No Data Stored at this Location
Up to two scans can be sequentially stored in memory. This warning is displayed when the user attempts to recall a scan from one of the memory areas (locations) which does not hold a previously stored scan. The message is displayed for information only: no corrective action is required.

No Data to Print
This warning is displayed when the user attempts to print a blank graph from spectrum, kinetics or quantitation mode.

e) Multi-Wavelength Mode - please refer to a)

f) Kinetics Mode

No Data to Print
This warning is displayed when the user attempts to print a blank graph from spectrum, kinetics or quantitation mode.

Invalid Slope Range
This error is reported when the user selects an invalid region of a kinetics run for the line of best fit. For example, when the line of best fit end point is set to be less than the line of best fit start point. The error is automatically corrected.

No Data to Acquire Statistics
This error is displayed if the user attempts to view statistics with no scan or kinetics run data.

g) Quantitation Mode

Warning - Existing Data Will Be Overwritten
This warning message is displayed when the user attempts to save a spectrum scan or quantitation calibration curve and previous data has already been stored. The instrument can store two scans and quantitation calibration curves, but must over write the oldest stored data if a subsequent scan or calibration curve is stored. This warning message can be disabled.

No Data Stored at this Location
Up to two scans can be sequentially stored in memory. This warning is displayed when the user attempts to recall a scan from one of the memory areas (locations) which does not hold a previously stored scan. The message is displayed for information only: no corrective action is required.

No Data to Print
This warning is displayed when the user attempts to print a blank graph from spectrum, kinetics or quantitation mode.

Insufficient Data to Construct a Calibration Curve
This warning message is displayed if the user aborts a quantitation calibration before two or more calibration points have been performed. The instrument cannot construct a calibration curve with less than two calibration points so will display a blank axis.

Insufficient Data to Save Calibration Method
This warning message is displayed if the user aborts a quantitation calibration and then attempts to save the aborted calibration.

The Modification of Stored Method Parameters is not Permitted
This warning message is displayed when the user attempts to change the calibration standards of a recalled quantitation method. A calibration curve of a recalled method can be re-constructed by repeating the calibration. The number of standards and standard concentration can be viewed but not changed.

No Quantitation Data to Save
This warning message is displayed when the user attempts to save a calibration curve when only the blank axis are displayed, that is, without having previously performed a quantitation calibration.

h) Accessories

This Operation is Unavailable Whilst Continuous Pumping is Enabled
This message is displayed if the sipper pump accessory is fitted and the user attempts to take up a sample (or flush) when the sipper pump has been set to continuous pumping (from within the sipper pump set-up menu).

Still Pumping...
This message is displayed if the sipper pump accessory is fitted and the user attempts to perform a sipper pump operation before the sipper pump has completed the last operation. For example, if the user selects the flush menu option whilst the sipper pump is still taking up the sample.

SECTION 7

EXAMPLE PRINTOUTS

a) Photometrics Mode

Note: Cell holder position will only be given when the multi-cell holder is fitted.

```
========================================
6400 SPECTROPHOTOMETER

PHOTOMETRICS MODE       15:14:29 19/11/97
INSTRUMENT ID NUMBER:           6400

OPERATOR.....................

SAMPLE ID.....................
LAST CALIBRATED:        15:13:59 19/11/97
WAVELENGTH:                345.0nm
========================================
001    100.0%T 345.0nm 15:14:33 19/11/97
  CELL HOLDER POSITION:          0

002    100.2%T 345.0nm 15:56:00 19/11/97
  CELL HOLDER POSITION:          0

003    100.3%T 345.0nm 15:56:06 19/11/97
  CELL HOLDER POSITION:          0

004    100.3%T 345.0nm 15:56:08 19/11/97
  CELL HOLDER POSITION:          0
```

b) Spectrum Mode

```
========================================
6400 SPECTROPHOTOMETER

SPECTRUM MODE          16:00:03 19/11/97
INSTRUMENT ID NUMBER:              6400

OPERATOR.....................................

SAMPLE ID.....................................
START WAVELENGTH:                  600.0nm
END WAVELENGTH:                    700.0nm
SCAN INTERVAL:                     5.0nm
SAMPLE NUMBER:                     11
CELL HOLDER POSITION:              4
LAST BASE LINE         14:51:56 19/11/97
========================================
  nm    Abs
600.0,   0.297
605.0,   0.313
610.0,   0.332
615.0,   0.359
620.0,   0.402
625.0,   0.453
630.0,   0.508
635.0,   0.552
640.0,   0.568
645.0,   0.544
650.0,   0.485
655.0,   0.400
660.0,   0.314
665.0,   0.232
670.0,   0.172
675.0,   0.127
680.0,   0.097
685.0,   0.076
690.0,   0.064
695.0,   0.055
700.0,   0.050

NOISE FILTER: COARSE(10%)
      PEAK              VALLEY
640.0nm   0.568Abs
END OF POST SCAN DATA
```

c) Multi-Wavelength Mode

```
========================================
6400 SPECTROPHOTOMETER

MULTI WAVELENGTH        16:02:21 19/11/97
INSTRUMENT ID NUMBER:              6400

OPERATOR.....................

SAMPLE ID.....................
LAST CALIBRATED:        16:02:16 19/11/97
WAVELENGTH 1:                 500.0nm
WAVELENGTH 2:                 600.0nm
========================================
001                16:02:24 19/11/97
  W1  500.0nm   1.417Abs
  W2  600.0nm   1.551Abs
  A1 - A2 =    -0.134Abs
  A1 / A2 =     0.913
  CELL HOLDER POSITION:            4
```

d) Kinetics Mode

```
========================================
6400 SPECTROPHOTOMETER

KINETICS MODE          16:04:22 19/11/97
INSTRUMENT ID NUMBER:              6400

OPERATOR.....................

SAMPLE ID.....................
CELL HOLDER POSITION:              6
LAST CALIBRATED:       11:12:26 14/11/97
WAVELENGTH:                    600.0nm
FACTOR:                      100.000
RUN TIME(SEC):                 10 SEC
========================================
 TIME      Abs
   0,   1.874
   1,   1.870
   2,   1.867
   3,   1.852
   4,   1.842
   5,   1.824
   6,   1.801
   7,   1.805
   8,   1.800
   9,   1.796
  10,   1.792

INITIAL VALUE = 1.874Abs
DELTA = -0.008185Abs
CONCENTRATION = -0.818499
Y = -0.014X + 1.891
```

e) Quantitation Mode

```
========================================
6400 SPECTROPHOTOMETER

QUANTITATION MODE       16:06:52 19/11/97
INSTRUMENT ID NUMBER:              6400

OPERATOR.....................

SAMPLE ID.....................
LAST CALIBRATED:         16:05:33 19/11/97
WAVELENGTH:                    635.0nm
STANDARDS USED : 5
CAL STANDARD 1 :   10.000   74.8%T
CAL STANDARD 2 :   20.000   66.3%T
CAL STANDARD 3 :   30.000   49.1%T
CAL STANDARD 4 :   40.000   28.1%T
CAL STANDARD 5 :   50.000    5.4%T
LINEAR INTERPOLATION
========================================
 CAL STANDARD     %T
  10.000,       74.76
  20.000,       66.34
  30.000,       49.13
  40.000,       28.12
  50.000,        5.39
001     5.4%T  50.00mg/l  635.0nm
   16:06:59 19/11/97
   CELL HOLDER POSITION:             5
```

EC Declaration of Conformity

Jenway Models 6400 and 6405 Spectrophotometers comply with the following European Standards:

EN 50081-1:1992	Electromagnetic compatibility - Generic emission standard
EN 50082-1:1992	Electromagnetic compatibility - Generic immunity standard (Performance criterion B)
EN 61010-1:1993	Safety requirements for electrical equipment for measurement, control and laboratory use

Following the provision of:

EMC Directive - 89/336/EEC and Low Voltage Directive - 73/23/EEC

Thank you for reading this data sheet.

For pricing or for further information, please contact us at our UK Office, using the details below.

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