OOIIrrad

Irradiance Software Manual

Version 1.0

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Quick Start

This Quick Start provides *brief* instructions on setting up your system, installing the software, configuring the software, calibrating the spectral response of your system, and taking measurements. These instructions are provided in greater detail throughout this manual. Refer to the **Table of Contents** to locate *detailed* directions on specific functions and components.

Step 1: Install OOIIrrad Software

Your A/D converter should already be installed. (See the operating instructions that came with your A/D converter for directions.) Before installing OOIIrrad, make sure that no other applications are running.

1. Insert "Disk 1" into your floppy drive. (When prompted, insert Disks 2 and 3.) Execute **Setup.exe**.
2. At the "Welcome" dialog box, click **Next>**.
3. At the "Destination Location" dialog box, you can choose **Browse** to pick a destination directory. Click **Next>**.
4. At the "Backup Replaced Files" dialog box, select either **Yes** or **No**. We recommend selecting Yes. If you select Yes, you can choose **Browse** to pick a destination directory. Click **Next>**.
5. Select a Program Manager Group. Click **Next>**. At the "Start Installation" dialog box, click **Next>**.
6. At the "Installation Complete" dialog box, choose **Finish>**. When prompted, **restart your computer**.

Step 2: Configure OOIIrrad Software

Now you need to configure your software by selecting options and entering information in a few dialog boxes. Start OOIIrrad.

Configure Hardware

Next, the Configure Hardware dialog box opens. The parameters in this dialog box are usually set only once -- when OOIIrrad is first installed and the software first opens. For detailed instructions on this dialog box, see page 11.

- **Spectrometer Type** . Choose the spectrometer you are using.
- **A/D Converter Type** . Select the A/D converter you are using.
- **Base Address (I/O Range)** . Select a Base Address. (This entry is for ADC1000 and DAQ700 cards.)
- **IRQ (Interrupt Request)** . Select an IRQ. (This entry is for ADC1000 and DAQ700 cards.)
- **SAD500 Serial Port** . Choose the COM port number your computer is using to interface to your SAD500. (This entry is for SAD500 converters.)
- **SAD500 Baud Rate** . Select the SAD500 operating speed. (This entry is for SAD500 converters.)
- **SAD500 Pixel Resolution** . Enter a resolution value. This value specifies that every n^{th} pixel of the spectrometer is transmitted from the SAD500 to the PC. (This entry is for SAD500 converters.)
- **Compress SAD500 Data** . Enable this function to minimize the amount of data transferred over the RS-232 connection. (This entry is for SAD500 converters.)

Configure Spectrometer

Select **Spectrometer | Configure Spectrometer** from the menu to configure your system and set important system parameters. Each spectrometer channel is shipped with a Wavelength Calibration Report. Enter all information from the report in this dialog box. For more information on this dialog box, see pages 11-12.

Configure Fibers

Select **Spectrometer | Configure Fibers** from the menu to enter the fiber diameter values for each channel in your setup. If using a bare fiber, enter the fiber's diameter here. If using a fiber with a CC-3 cosine corrector, enter 3,900. For detailed instructions on this dialog box, see page 12.

Set Acquisition Parameters

For detailed information about acquisition parameters, see pages 7-8.

- **Scans to Average**. Enter a value to implement a sample averaging function.
- **Smoothing Size**. Enter a value here to implement a technique that averages across spectral data.
- **Nominal Integration Period**. The higher the integration time, the longer the detector "looks" at the incoming photons. If the intensity is too low, increase this value. If too high, decrease the value.
- **Actual Integration Period**. This value is displayed after you enter your Nominal Integration Period and take a scan. You cannot modify this value, except by changing the Nominal Integration Period.

Step 3: Calibrate your System with the LS-1-CAL

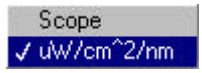
Before beginning the process of calibrating the absolute spectral response of your system with the LS-1-CAL Calibrated Tungsten Halogen Light Source, make sure that the optical setup you wish to use for your application, you also use when calibrating.

For detailed instructions on calibrating the absolute spectral response of your system with the LS-1-CAL, see pages 13-14.

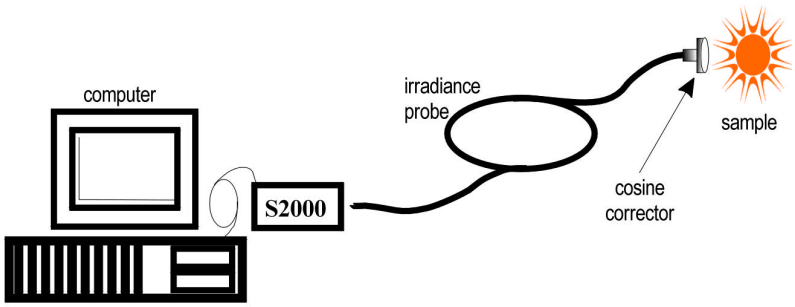
Step 4: Take your Measurements

By now you have set up your spectrometer and sampling optics, established your acquisition parameters, calibrated the spectral response of your system, and taken your reference and dark scans. Now you are ready to take your absolute irradiance measurements.

1. Change from Scope Mode into **Irradiance Mode**.
2. Position the probe or fiber at the light or emission source you wish to measure.
3. Select the **Scan** button. If you wish to take multiple scans, make sure the **Continuous** option is selected.
4. Save the spectrum by choosing **File | Save**.



A If at any time any sampling variable changes -- including integration time, averaging, smoothing, etc. -- you must store new reference (re-calibrate the spectral response of your system) and dark scans.



A typical configuration for an irradiance experiment.

OOIIrrad Irradiance Software Installation

Install OOIIrrad

Before installing OOIIrrad, make sure that no other applications are running.

1. Insert "Disk 1" into your floppy drive. (When prompted, insert Disks 2 and 3.) Execute **Setup.exe**.
2. At the "Welcome" dialog box, click **Next>**.
3. At the "Destination Location" dialog box, you can choose **Browse** to pick a destination directory. Click **Next>**.
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5. Select a Program Manager Group. Click **Next>**. At the "Start Installation" dialog box, click **Next>**.
6. At the "Installation Complete" dialog box, choose **Finish>**. When prompted, **restart your computer**.

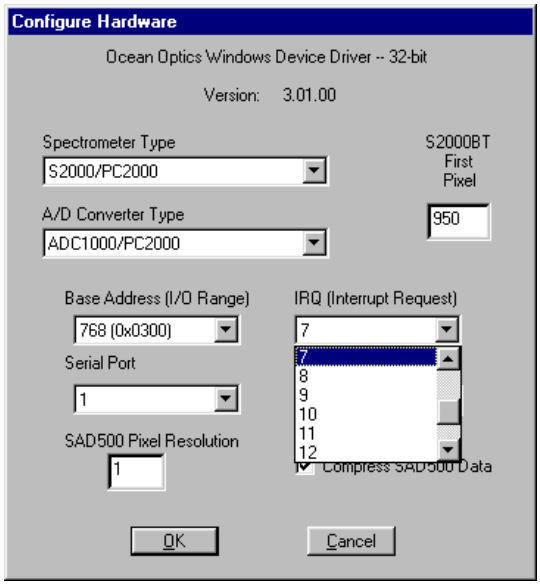
Run OOIIrrad

After you restart your computer, navigate to the OOIIrrad icon and select it. The first time you run OOIIrrad after installation, you must enter values for your hardware.

Configure Hardware Dialog Box

The parameters in this dialog box are usually set only once -- when OOIIrrad is first installed and the software first opens. The Base Address and IRQ values are settings chosen when you install your A/D converter. (See the operating instructions that came with your A/D converter for more information.)

- **Spectrometer Type** . Choose the spectrometer you are using.
- **A/D Converter Type** . Select the A/D converter you are using.
- **Base Address (I/O Range)** . Choose an available setting you found in your computer. In this dialog box, the Base Address is given in decimal, followed by the hexadecimal equivalent in parenthesis. For example, "**768 (0x0300)**" gives the Base Address as 768 decimal and 300 hexadecimal. (This entry is for ADC500, ADC1000, and DAQ700 A/D converters.)
- **IRQ (Interrupt Request)** . Choose an available setting you found in your computer. (This entry is for ADC500, ADC1000, and DAQ700 A/D converters.)
- **SAD500 Serial Port** . Choose the COM port your computer is using to interface to your SAD500. (This entry is for SAD500 A/D converters.)



- **SAD500 Baud Rate** . Select the speed at which the SAD500 will operate. (This entry is for SAD500 A/D converters.)

- **SAD500 Pixel Resolution** . Enter resolution values from 1 to 500. This value specifies that every n^{th} pixel of the spectrometer is transmitted from the SAD500 to the PC. Your resolution value depends on your experiment. By sacrificing pixel resolution, you gain speed. The transfer of one complete spectra requires ~0.4 seconds when communicating at 115,200 baud rate. If you need your information in <0.4 seconds, increase the resolution or enable data compression. (This entry is for SAD500 A/D converters.)

- **Compress SAD500 Data** . Enable this function to minimize the amount of data transferred over the RS-232 connection. Transmission of spectral data over the serial port is a relatively slow process. Enabling this function insures that every scan transmitted by the SAD500 will be compressed, greatly increasing the data transfer speed of the SAD500. (This entry is for SAD500 A/D converters.)

A If you do not see the "Configure Hardware" screen, exit the software. Then select **Start** | **Run**, and type **`C:\windows\ooidrv.ini`** for Windows 95/98 systems or **`c:\winnt\ooidrv.ini`** for Windows NT systems. Notepad will open. Edit this file for our device driver by finding the "Initialized" entry and making sure this line reads **`Initialized=0`**. Save the OOIDRV.INI file and exit Notepad. Restart OOIIrrad. You should now see the "Configure Hardware" dialog box.

OOIIrrad Irradiance Software Functions

OOIIrrad, our new 32-bit, acquisition and display operating software for the IRRAD2000 Spectroradiometer, performs a number of valuable functions in measuring the absolute spectral intensity (calculated in $\mu W/cm^2/nm$) for light and other emission sources. OOIIrrad provides a real-time interface to a variety of signal-processing functions. Data acquisition parameters -- such as averaging, smoothing, and adjusting the integration time -- are displayed just to the right of the graph for easy access. With OOIIrrad, you have the ability to obtain photopic data -- calculated in lumens or lux per unit area -- based on a CIE standard visibility curve.

You can also control the parameters for all system functions such as acquiring data, designing the graph display and configuring the cursor. Another feature provides you with the ability to create a spreadsheet display of lamp output intensity by wavelength.

The OOIIrrad software will be updated and improved continuously. Obtain free upgrades at **www.oceanoptics.com/ Software_Updates.asp**. In order to download the free software upgrade, you will need the password located on the back of the Ocean Optics Software and Resources Library.

Display Functions

Several functions are accessed not through the menu but through buttons and task bars directly on the display screen, on the top and to the right of the graph area. From the display screen, you can choose a mode to view your data, choose a mode to acquire data, take scans of your sample, scale the graph, store a dark spectrum, configure the cursor, configure the graph, enter data acquisition parameters, and analyze displayed photopic data.

View Data Modes

Scope Mode

This mode allows you the ability to have complete control of signal processing before calibrating the spectral response of your system and taking absolute irradiance measurements. Use this spectral view mode when configuring your setup, adjusting the integration time, performing the spectral response calibration, and taking a dark scan.

The signal graphed in Scope Mode is the raw voltage coming out of the A/D converter. Once you open OOIIrrad and it begins to acquire data, you see the raw voltage from the detector expressed in A/D counts. Be careful when using this mode, as it represents a combination of several factors: the intensity of the light source, the reflectivity of the grating and the mirrors in the spectrometer's optical bench, the transmission of the fibers, the response of the detector, and the spectral characteristics of the sample.

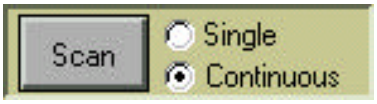
mW/cm^2/nm (or Absolute Irradiance Mode)

The signal graphed in this mode is the calibrated irradiance intensity of the sample. Use the Irradiance Mode after calibrating the spectral response of your system and taking a dark scan.

Acquire Data Modes

Scan/Stop Button

When in **Single** mode, the Scan button acts as a snapshot. After selecting the Single mode, click on the Scan button to take an irradiance scan of the sample. The button depresses and Stop replaces Scan. The button will stay depressed until the scan has been completed (the time set in the Nominal Integration Period box).



When in **Continuous** mode, the Scan button continuously takes as many irradiance scans of the sample as needed. After each integration cycle, another scan will immediately begin. The button depresses and Stop replaces Scan. Click on Stop to halt the scanning process and discontinue acquiring data.

Scale the Graph

Auto Scaling

The **Auto Scale Y** function automatically adjusts the vertical scale of a current graph so the entire vertical spectrum fills the graph. The **Auto Scale X** function automatically adjusts the horizontal scale of a current graph so the entire horizontal spectrum fills the graph.

X and Y Scaling

You can change the vertical and/or horizontal scales of the graph by simply clicking on an X and Y endpoint and manually typing in a value. The graph will then resize itself.

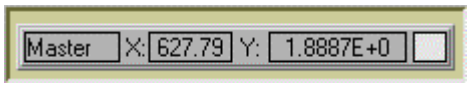
Store a Dark

This function stores the current spectrum as the dark spectrum for all active channels. A dialog box opens with the message **Block light path to spectrometer for a DARK scan. Will be save in "dark.txt."** The dark spectrum is taken with the light path to the sample blocked. Saving a dark spectrum is requisite before the computer can make the calculation of absolute irradiance spectra.

Cursor Functions

Channel

When the cursor is being used, the first box in the configure cursor task bar names the spectrometer channel the cursor is currently reporting.



X and Y Values

When the cursor is being used, the second and third box in the configure cursor task bar gives the X value and Y value of the cursor point.

Cursor Properties

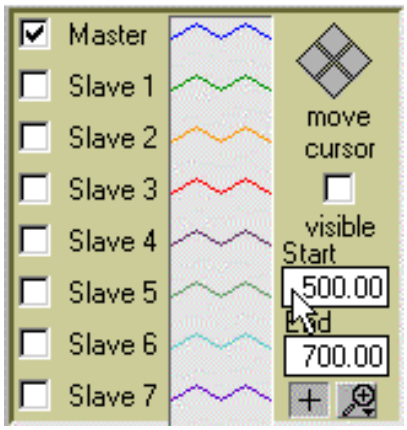
To the right of the X and Y values of the cursor is a cursor selection button that allows you to choose a cursor style and a point style. You can also choose a color for the cursor and whether or not to display the name of the channel the cursor is currently reporting. Finally, you can bring the cursor to the center of the spectrum or center the spectrum around the cursor's current position.

Graph Functions

These functions provide you with several graphing tools. You can also select the foreground and background colors for each channel.

Channels Activated

Choose which channels should be displayed in the graph by clicking in the box to the left of the channel's name.



Display Properties

Also, you can click on the channel's name or designated spectrum color to choose from several aesthetic functions such as: the plot design of the spectrum, the point style used in the spectrum, the line style and width desired, color or the plot, and a bar plot design. You can also choose to fill the baseline in the spectrum.

Move Cursor

To move the cursor left or right in small increments in the graph area, click on the left and right sections of the "move cursor" diamond. The top and bottom sections of the "move cursor" diamond will send the cursor to the next or previous channel in your system.

Enable Cursor

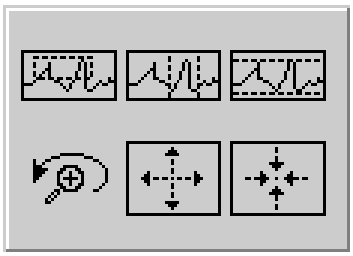
To activate the cursor functions, the **visible** box must be checked. To view the graph without the cursor, simply deselect the visible box.

+ Sign

When the + is selected, the pointer becomes a crosshair symbol, enabling you to drag the cursor around the graph.

Magnify Symbols

There are several magnify functions from which to choose. The function chosen will remain in use until another magnify icon or the crosshair symbol is selected. Clockwise, beginning with the top left symbol, the magnify icons perform the following functions:



1. magnifies a specific area by clicking and dragging a box around the area
2. zooms in on the horizontal scale, but the vertical scale remains the same
3. zooms in on the vertical scale, but the horizontal scale remains the same
4. zooms in approximately one point vertical and horizontal, click once or press continuously
5. zooms out approximately one point vertical and horizontal, click once or press continuously
6. reverts to the last zoom function

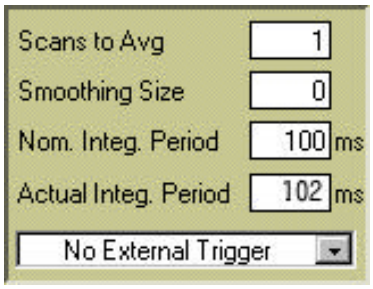
Acquisition Parameters

Scans to Average

Enter a value to implement a sample averaging function that averages x number of spectra. The value chosen affects all channels in the system. The higher the value entered the better the signal-to-noise ratio. The S:N improves by the square root of the number of scans averaged.

Smoothing Size

Enter a value here to implement a boxcar smoothing technique that averages across spectral data. This method averages a group of adjacent detector elements. A value of 5, for example, averages each data point with itself, 5 points to its left and 5 points to its right. The greater this value, the smoother the data and the higher the signal-to-noise ratio. If the value entered is too high, a loss in spectral resolution will result. The S:N improves by the square root of the number of pixels averaged.



Nominal Integration Period

The integration time of the spectrometer is analogous to the shutter speed of a camera. The higher the integration time, the longer the detector "looks" at the incoming photons. If the intensity is too low, increase this value. If the intensity is too high, decrease the value. While watching the graph trace in Scope Mode, adjust the Nominal Integration Time until the signal intensity level is approximately 3500 counts.

Actual Integration Period

This value is displayed after you enter your Nominal Integration Period and take a scan. You cannot modify this value. The value will change if the Nominal Integration Period changes. The calculations used for the Actual Integration Period are:

Nominal Integration x 1.024 milliseconds (for the ADC500, ADC1000, and SAD500)
Nominal Integration x 1.28 milliseconds (for the DAQ-700)

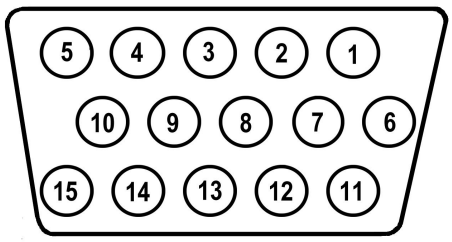
No External Trigger and External Software Trigger

With the IRRAD2000 and OOIIrrad Operating Software, you have two methods of acquiring data. In the No External Trigger Mode (or Normal Mode), the spectrometer is "free running." That is, the spectrometer is continuously scanning, acquiring, and transferring data to your computer, according to parameters set in the software. In this mode, however, there is no way to synchronize the scanning, acquiring and transferring of data with an external event.

In the External Software Trigger Mode, the spectrometer is "free running," just as it is in the Normal Mode. The spectrometer is continually scanning and collecting data. With each trigger, the data collected up to the trigger event is transferred to the software. If you continuously apply triggers, such as by holding down the button on an external switch, this mode is equivalent to operating in the Normal Mode. All acquisition parameters are still set in the software. You should use the External Software Trigger Mode if you are using a continuous illumination source, and the light intensity is constant before, during and after the trigger.

To Use the Software Mode:

1. Supply a line from your triggering device to Pin 3 of the J2 Accessory Connector to provide the positive voltage +5VDC to the spectrometer. (See figure below for pin location.) We do not advise using an outside source to supply the voltage, as it is based on a referenced ground and your reference may be different from ours. Using Pin 3 to supply voltage ensures that the spectrometer will receive the appropriate voltage for the trigger event.
2. Supply a line from Pin 8 of the J2 Accessory Connector to your triggering device. (See figure below for pin location.)
3. Set your acquisition parameters in the software's display screen.
4. Select **External Software Trigger** in the software's display screen.
5. Once you select **External Software Trigger**, it will appear on your computer that your spectrometer is unresponsive. Instead, it is waiting for the trigger. Activate your triggering device.



J2 (D-SUB-15) Accessory Connector (female)

It is important to note that since this is a level-triggered mode, the amount of delay between the trigger pulse and when a spectrum is acquired is indeterminate because the delay is dependent upon:

- how fast the software polls the Pin 8 line and recognizes it is HIGH
- the amount of time until the start of the next integration period

Photopic Units Display

You have the ability to view calculated photopic data based on a CIE standard visibility curve, which is reported in lumens or lux per unit area. To change the photopic data displayed to lumen or to lux, select **Spectrometer | Configure Spectrometer** from the menu. In the bottom of the Configure Spectrometer dialog box, find the entry that reads **Display photopic data as**. Select either lumen or lux. For the photopic data to appear in the photopic display area, the channel must be activated and **Spectrometer | Lumen** (or **Lux**) **Values** must be selected from the menu.

Lumen

By selecting Lumen, the lumen values will be displayed to the right of the graph. A lumen is a "light watt." Lumens are calculated as the absolute spectral response of the human eye.

Lux

By selecting Lux, the lux values will be displayed to the right of the graph. The lux value is arrived by calculating the lumen per square meter. Lux is also called a meter candle.

File Menu Functions

Open

Select **File | Open** from the menu to open a dialog box that allows you to reload a saved set of spectra. If you saved the dark or the reference spectra, they are also restored.

Save

Select **File | Save** from the menu to save the current sample spectrum as a tab-delimited ASCII file. Serial numbers and data acquisition parameters are included in the headers of these files.

Export

Select **File | Export** from the menu to export the current sample spectrum as a tab-delimited ASCII file for use in other applications, such as Microsoft Excel.

Printer Setup

Select **File | Print Setup** from the menu to select and configure a printer for printing graphical spectra.

Print

Select **File | Print** from the menu to print a graph. The graph title, grid and cursor are all printed if they are displayed on the screen.

Restore Settings

Select **File | Restore Settings** from the menu to open a saved display settings file . By default, these files have a **.cfg** extension.

Save Settings

Select **File | Save Settings** from the menu to save display settings. By default, display settings files have a **.cfg** extension.

Exit

Select **File | Exit** from the menu to quit OOIIrrad. A message box appears asking you if you are sure you want to exit the software.

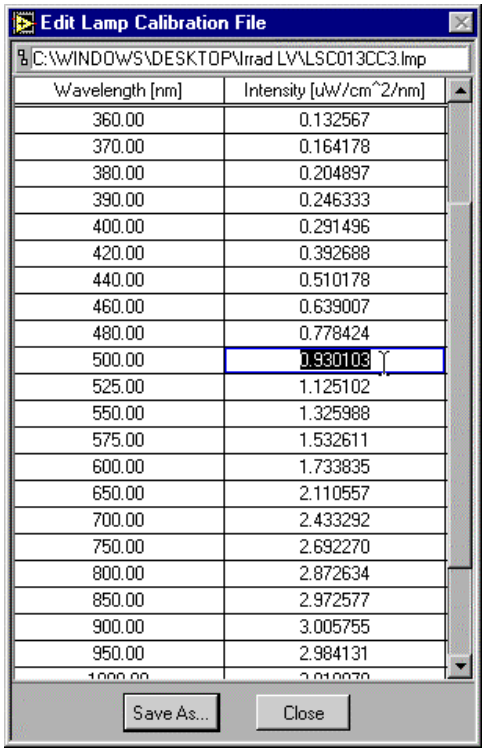
Lamp Menu Functions

Select Lamp

This function is used when selecting a lamp file for calibrating the spectral response of your system with the LS-1-CAL Calibrated Tungsten Halogen Light Source. With your LS-1-CAL, you also received two Lamp Calibration Reports and a disk with file copies of the reports. One file has the calibration numbers for calibrating the spectral response of your system with the lamp and a bare fiber; its name contains the lamp's serial number, followed by **FIB.LMP**. The second file has the calibration numbers when calibrating the spectral response of your system with the lamp and a CC-3 cosine corrector and fiber; its name contains the lamp's serial number, followed by **CC3.LMP**.

These two files should be copied from the disk into your OOIIrrad directory. When you are about to calibrate the spectral response of your system, you will choose the Lamp Calibration Report file that reflects your optical setup.

Edit Lamp Calibration File



This file came with the LS-1-CAL Calibrated Tungsten Halogen Light Source and contains the data necessary to calibrate the spectral response of your system before taking absolute irradiance measurements.

You should only edit this data if you wish to use another calibrated light source with your system. Select **Lamp | Edit Lamp Calibration File** from the menu and delete or change intensity and wavelength values for your lamp. When you change the calibration data, click **Save As** and rename the lamp calibration file. Always rename the edited file; the data for the LS-1-CAL should remain unaltered.

View Lamp File

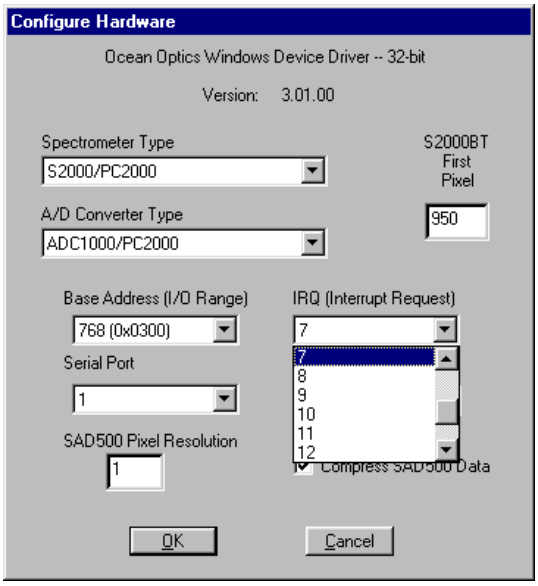
This function gives you the opportunity to verify that the calibration process was done correctly by viewing the spectral data of the LS-1-CAL after using the lamp to calibrate the spectral response of your system. When viewing the lamp file, make sure the lamp calibration points overlap with the active spectral data. You can only view the lamp's spectral output if you are in Irradiance Mode. If you are in Scope Mode and select **Lamp | View Lamp Data** from the menu, you will receive a message box instructing you to change from Scope Mode to Irradiance Mode.

Spectrometer Menu Functions

Configure Hardware

The Configure Hardware dialog box sets the hardware parameters for the spectrometer. The parameters in this dialog box are usually set only once -- when OOIIrrad is first installed and the software first opens. Options include:

- **Spectrometer Type** . Choose the spectrometer you are using.
- **A/D Converter Type** . Select the A/D converter you are using.
- **Base Address (I/O Range)** . Choose an available setting you found in your computer. In this dialog box, the Base Address is given in decimal, followed by the hexadecimal equivalent in parenthesis. For example, "**768 (0x0300)**" gives the Base Address as 768 decimal and 300 hexadecimal. (This entry is for ADC500, ADC1000, and DAQ700 A/D converters.)
- **IRQ (Interrupt Request)** . Choose an available setting you found in your computer. (This entry is for ADC500, ADC1000, and DAQ700 A/D converters.)
- **SAD500 Serial Port** . Choose the COM port your computer is using to interface to your SAD500. (This entry is for SAD500 A/D converters.)
- **SAD500 Baud Rate** . Select the speed at which the SAD500 will operate. (This entry is for SAD500 A/D converters.)
- **SAD500 Pixel Resolution** . Enter resolution values from 1 to 500. This value specifies that every n^{th} pixel of the spectrometer is transmitted from the SAD500 to the PC. Your resolution value depends on your experiment. By sacrificing pixel resolution, you gain speed. The transfer of one complete spectra requires ~0.4 seconds when communicating at 115,200 baud rate. If you need your information in <0.4 seconds, increase the resolution or enable data compression. (This entry is for SAD500 A/D converters.)



- **Compress SAD500 Data** . Enable this function to minimize the amount of data transferred over the RS-232 connection. Transmission of spectral data over the serial port is a relatively slow process. Enabling this function insures that every scan transmitted by the SAD500 will be compressed, greatly increasing the data transfer speed of the SAD500. (This entry is for SAD500 A/D converters.)

Configure Spectrometer

Select **Spectrometer | Configure Spectrometer** from the menu to configure your system and set important system parameters. Each spectrometer channel is shipped with a Wavelength Calibration Report. Enter all information from the report in this dialog box.

Lamp Serial

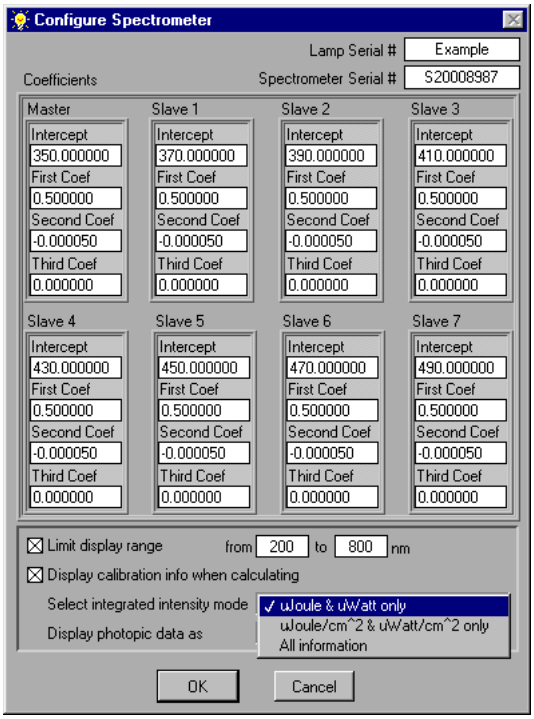
Enter the serial number from the bottom of your LS-1-CAL into this area. (However, when you later choose a Lamp File before calibrating, the software will enter the lamp's serial number for you.)

Spectrometer Serial

Enter the serial number from the bottom of the spectrometer into this area. Entering the serial number is not mandatory, but some acquisition functions will display serial numbers in the data files.

Intercept

Enter the Intercept from the Wavelength Calibration Report that came with each channel in your system.



First, Second and Third Coefficients

Enter the First Coefficient, Second Coefficient and Third Coefficient from the Wavelength Calibration Report that came with each channel in your system.

Limit display range

If this box is selected, you can enter the graph display range in the boxes to the immediate right. Enter the first wavelength of the spectral range to be displayed. Enter the last wavelength of the spectral range to be displayed.

Display calibration info when calculating

If this box is selected, you will be able to view the results of the procedure for calibrating the spectral response of your system. The diagnostic screen provides you with the spectral results of the calibration procedure in three graphs. The top left graph represents the linear 15th order polynomial regression. The top right graph represents the dark scan. The bottom graph is the calibration curve representing the spectral response of the process.

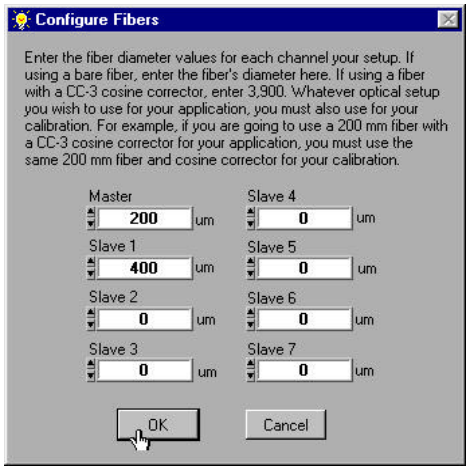
Select integrated intensity mode

You can choose to have the integrated spectral data displayed in µJoule and µWatt, in µJoule/cm^2 and µWatt/cm^2, or both. Joule is a unit of energy and watt is a unit of power equal to one joule per second. To have this data displayed, you must also select **Spectrometer | mJoule and mWatt** (or **mJoule/cm^2 and mWatt/cm^2**) **Values** from the menu.

Display photopic data as

By selecting Lumen, the lumen values will be displayed to the right of the graph. A lumen is a "light watt." Lumens are calculated as the absolute spectral response of the human eye. By selecting Lux, the lux values will be displayed to the right of the graph. The lux value is arrived by calculating the lumen per square meter. Lux is also called a meter candle. These values become present when the channel on the graph is activated.

Configure Fibers



Enter the fiber diameter values for each channel in your setup. If using a bare fiber, enter the fiber's diameter here. If using a fiber with a CC-3 cosine corrector, enter 3,900. Whatever optical setup you wish to use for your application, you must also use when calibrating the spectral response of your system. For example, if you are going to use a 200-µm fiber with a CC-3 cosine corrector for your application, you must use the same 200-µm fiber and cosine corrector when calibrating the spectral response of your system.

Scan

When the single mode is selected in the display screen, the Scan menu function acts as a snapshot. After selecting the Single mode, select **Spectrometer | Scan** from the menu to take an absolute irradiance scan of the sample. The Scan button depresses and Stop replaces Scan. The button will stay depressed until the scan has been completed (the amount of time in the Nominal Integration Period box).

When the continuous mode is selected in the display screen, select **Spectrometer | Scan** from the menu to continuously take scans. After each integration cycle, another scan will immediately begin. The Scan button depresses and Stop replaces Scan. Click on Stop to halt the scanning process and stop acquiring data.

Store Dark

This function stores the current spectrum as the dark spectrum for the channel activated. A dialog box opens with the message **Block light path to spectrometer for a DARK scan. Will be save in "dark.txt."** The dark spectrum is taken with the light path to the sample blocked. You must use the same Nominal Integration Period for your dark and irradiance scans. Saving a dark spectrum is requisite before the computer can make the calculation of absolute irradiance spectra.

Calibrate

This function is for calibrating the spectral response of your system with the LS-1-CAL Calibrated Tungsten Halogen Light Source. Before beginning, make sure the optical setup you wish to use for your application, you also use when calibrating the spectral response of your system. For example, if you use a 200-µm fiber with a CC-3 cosine corrector for your application, you must use the same 200-µm fiber and CC-3 for your calibration. Also, make sure that the disk containing the two Lamp Calibration Report files, one for using the LS-1-CAL with a fiber and one for using it with a CC-3 cosine-corrected irradiance probe, is ready to install into your computer.

1. Use an Allen wrench to loosen the set screw on the LS-1-CAL's SMA connector.
2. If you are using a bare fiber with the lamp, withdraw the inner barrel from the SMA connector. Screw this connector barrel onto the end of your fiber. The connection should be tight. Insert the barrel/fiber all the way into the LS-1-CAL's SMA connector.
   If you are using a fiber and cosine corrector with the lamp, remove the inner barrel from the SMA connector. Screw the CC-3 cosine corrector onto the end of the fiber. The connection should be tight. Insert the CC-3/fiber all the way into the LS-1-CAL's SMA connector.
3. Use an Allen wrench to tighten the set screw on the SMA connector of the LS-1-CAL. Take the other end of the fiber and screw it all the way into the SMA connector of the spectrometer.
4. Plug the switching AC adapter (the black rectangle-shaped box) into the back of the LS-1-CAL. The adapter stabilizes the power coming into the lamp to insure constant spectral intensity.
5. Plug the wall transformer end of the power cord into a standard 110V outlet. Plug the other end into the back of the switching AC adapter.
6. Find the on/off switch on the back of the lamp and turn the lamp on.
7. Let the LS-1-CAL warm up for at least 15 minutes before using.
8. Insert the disk that came with your lamp into your computer. The disk contains two ASCII files. These files have the same information as the Lamp Calibration Reports that came with your LS-1-CAL. One file has the calibration numbers for calibrating the spectral response of your system with the lamp and a bare fiber; its name contains the lamp's serial number, followed by **FIB.LMP**. The second file has the calibration numbers when calibrating the spectral response of your system with the lamp and a CC-3 cosine-corrector and fiber; its name contains the lamp's serial number, followed by **CC3.LMP**.
9. Copy these two files into your OOIIrrad directory. (The default directory is **Program Files | OOIIrrad**.)
10. Start OOIIrrad. Make sure you are in **Scope Mode**.
11. Under the **Lamp** menu options, choose **Select Lamp**. A window opens in which you must choose the Lamp Calibration Report file that reflects your optical setup.

12. Under the **Spectrometer** menu options, choose **Configure Fibers**. Enter the fiber diameter values for each channel in your setup. If using a bare fiber, enter the fiber's diameter here. If using a fiber with a CC-3 cosine corrector, enter 3,900. Whatever optical setup you wish to use for your application, you must also use for calibrating the spectral response of your system. For example, if you are going to use a 200-µm fiber with a CC-3 cosine corrector for your application, you must use the same 200-µm fiber and CC-3 for calibrating the spectral response of your system.
13. To the right of the displayed spectrum, enter the data acquisition parameters for your setup. The values for Scans to Average and Smoothing Size must be the same for your reference, dark and irradiance scans. You may use a different integration period for your reference scan, but you must use the same integration period for your dark and irradiance scans.
14. Under **Spectrometer** menu options, choose **Calibrate** and then select the channel you are calibrating.
15. A dialog box opens with the message **Verify lamp was ON for at least 15 minutes for a REFERENCE scan.** Make sure nothing is blocking the light path going to your spectrometer. Your setup (spectrometer, fiber, and sampling optics) for taking a reference should be identical to your setup for measuring your sample, except that the sample you want to measure must be absent while taking a reference. Taking a reference spectrum is requisite before the software can calculate absolute irradiance measurements. Click **OK**.
16. Another dialog box opens with the message **Block light path to spectrometer for a DARK scan.** If possible, do not turn off the light source. Instead, completely block the light path going to your spectrometer by inserting an opaque object into the lamp's filter slot. Taking a dark spectrum is requisite before the software can calculate absolute irradiance measurements. Click **OK**. The spectral response of your system is calibrated.
17. If you selected **Display calibration info when calculating** in the **Configure Spectrometer** dialog box, you will now see the results of the calibration procedure. The top left graph represents the linear 15^{th} order polynomial regression. The top right graph represents the dark scan. The bottom graph is the calibration curve representing the spectral response of the process.
18. The calibration procedure is saved in a file named **CH0.CAL** for calibrating the master spectrometer channel, **CH1.CAL** for calibrating the first slave spectrometer channel, and so on.

Lumen and Lux Values

Photopic data can be displayed in lumen or lux values in the photopic display area. Select **Spectrometer | Configure Spectrometer** from the menu. In the bottom of the Configure Spectrometer dialog box, find the entry that reads **Display photopic data as**. Select either **Lumen** or **Lux**. For the photopic data to appear in the photopic display area, the channel must be activated and **Spectrometer | Lumen** (or **Lux**) **Values** must be selected from the menu.

A lumen is a "light watt." Lumens are calculated as the absolute spectral response of the human eye. The lux value is arrived by calculating the lumen per square meter. Lux is also called a meter candle. These values will be displayed to the right of the graph.

mJoule and mWatt Values

The information provided in these boxes is the irradiance intensity data of the sample. Joule is a unit of energy and watt is a unit of power equal to one joule per second. In order for this information to be displayed, select **Spectrometer | Configure Spectrometer** from the menu. In the bottom of the Configure Spectrometer dialog box, find the entry that reads **Select integrated intensity mode**. You can choose to have the spectral data displayed in µJoule and µWatt, in µJoule/cm^2 and µWatt/cm^2, or both. For the photopic data to appear in the photopic display area, the channel must be activated and **Spectrometer | mJoule and mWatt** (or **mJoule/cm^2 and mWatt/cm^2**) **Values** must be selected from the menu.