

# **OOIBase32™**

## **Spectrometer Operating Software Manual**

Version 1.0

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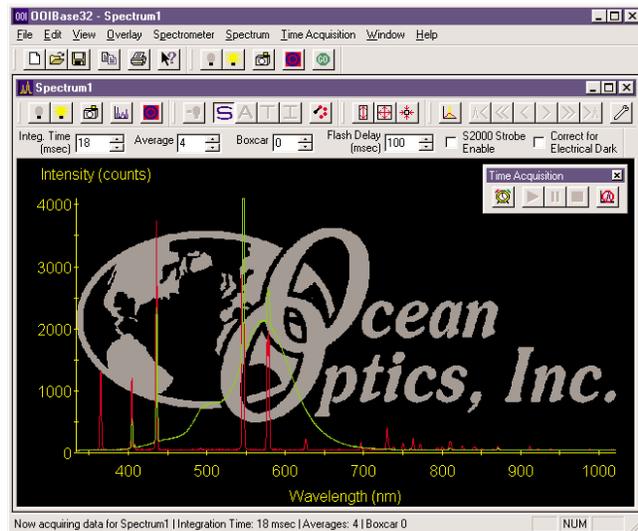
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# Introduction

**OOIBase32 SPECTROMETER OPERATING SOFTWARE** is our next generation of operating software for all Ocean Optics spectrometers. OOIBase32 is a 32-bit, user-customizable, advanced acquisition and display program that provides a real-time interface to a variety of signal-processing functions for Windows 95/98, Windows 2000 and Windows NT users, such as electrical dark-signal correction, stray light correction, boxcar pixel smoothing, and signal averaging. With OOIBase32 you have the ability to perform spectroscopic measurements such as absorbance, reflectance and emission; control all system parameters; collect data from up to 8 spectrometer channels simultaneously and display the results in a single spectral window; and perform reference monitoring and time acquisition experiments.

OOIBase32 is the latest edition of operating software for all Ocean Optics spectrometers. This change from 16-bit to 32-bit operating software reflects Ocean Optics' decision to upgrade its software to accommodate the increase of 32-bit operating systems. OOIBase, our original operating software, could not work with Windows NT. Additionally, OOIBase did not allow for multiple channels to be shown in one spectral window. OOIBase32 includes the functions of the original OOIBase, but numerous editing, viewing and spectral processing functions have been added. The chart below outlines the significant changes from OOIBase to the new and improved OOIBase32.



OOIBase	OOIBase32
16-bit program	32-bit program
Supports up to 8 spectrometer channels, with each channel in its own spectral window	Supports up to 8 spectrometer channels in each spectral window
Supports single A/D card	Supports multiple A/D cards simultaneously
No overlays	Up to 8 overlays for each spectral window
All spectral windows must share the same acquisition parameters	Each spectral window can have separate acquisition parameters
Limited advanced spectral features	Comprehensive advanced reference features (dual-beam reference, stray light and linearity correction, time acquisition)
Not customizable	Customizable
User-friendly	More user-friendly
No internal troubleshooting	Internal troubleshooting
Time series acquisition of full spectra	Time acquisition of discrete wavelengths
No time normalization	Supports time normalization

Ocean Optics also offers numerous add-on software programs for applications such as color and irradiance measurements, oxygen sensing, pharmaceutical dissolution testing, and Raman spectroscopy. You can also purchase device drivers, code for software development, and custom programming services.

**Free OOIBase32 upgrades are available via our web site at [www.OceanOptics.com](http://www.OceanOptics.com)**

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## Quick Start

This section provides *brief* instructions on setting up your system, installing your A/D converter, and installing and configuring the software. You can find detailed A/D installation instructions in your spectrometer manual. In this manual, refer to the **Table of Contents** to locate *detailed* directions on specific OOIBase32 functions.

### Step 1: Interface the A/D Converter to your PC

#### **If your A/D card is the ADC500 or the ADC1000 or if you are installing a PC2000**

1. The default settings for our A/D products are a Base Address (or Input/Output Range) of 768 decimal and an IRQ of 7. You will need to match Base Address and IRQ settings on the A/D card to available settings in your computer. First determine which settings are not being used by other hardware devices.
  - ◆ If you have Windows 95/98, go to **Start | Settings | Control Panel**. Double-click the **System** icon. Choose the **Device Manager** tab and double-click on “Computer” at the top of the list of devices. Under **View Resources**, note available settings -- numbers unassigned to hardware. Remember that these I/O settings are expressed in hexadecimal and correspond to our Base Address, which is given in decimal, followed by the hexadecimal equivalent in parenthesis.
  - ◆ If you have Windows NT, go to **Start | Programs | Administrative Tools (Common) | Windows NT Diagnostics**. Click on the **Resources** tab. Select the **IRQ** button. Find an available IRQ. Select the **I/O Port** button. Find an available I/O Range (Base Address).
2. Note these available settings. When you first run OOIBase32, you must enter these values in the “Configure Hardware” dialog box.
3. Turn off the computer and take off the computer cover. Ground yourself to the computer chassis or power supply and remove the A/D card from its static-shielded bag.
4. If necessary, change the position of the switches on the A/D board. For the ADC500, the Base Address is set via the bank of 6 switches labeled SW1 on the A/D board and the IRQ is set via the bank of 4 switches labeled SW2 on the A/D board. For the ADC1000 and PC2000, there is only one bank of switches on the A/D board: the Base Address may be changed via the first 6 switches and the IRQ may be changed via the last 3 switches. (See **Appendix A** in your spectrometer manual for switch positions.)
5. Insert the A/D card into an ISA-bus slot and connect the necessary cables from the A/D card to the spectrometer. Make sure the connections are snug and restart your computer.

#### **If your A/D converter is the DAQ-700**

1. Install NI-DAQ version 6 CD Driver Software -- the device driver library necessary for Windows 95/98 and NT systems to properly use the DAQ-700 on your computer.
2. Insert the DAQ-700 into any available PCMCIA slot.
3. Find the IRQ and Base Address values.
  - ◆ If you have Windows 95/98, select **Start | Settings | Control Panel**. Double-click the **System** icon. Select the **Device Manager** tab. Double-click the hardware group named **Data Acquisition Devices**. Double-click **DAQCard-700**. Click the **Resources** tab. Find the check box next to **Use Automatic Settings**. Clear that check box (deselect it). Now change the settings for either (or both) the Input/Output Range or the Interrupt Request. To make this change, double-click either **Input/Output Range** or **Interrupt Request**. A dialog box giving the current hardware setting appears. Use the two small arrows to the right side of the **Value** box to change the hardware interface parameters. Choose values that say **No devices are conflicting**. Click **OK**. Click **Yes** at the “Creating a Forced Configuration” message box.
  - ◆ If you have Windows NT, go to **Start | Programs | Administrative Tools (Common) | Windows NT Diagnostics**. Click on the **Resources** tab. Select the **IRQ** button. Find the IRQ that your computer assigned to the A/D converter. Select the **I/O Port** button. Find the I/O Range (Base Address) that your computer assigned to the DAQ-700.
4. Note these values. When you first run OOIBase32, enter them in the “Configure Hardware” dialog box.

### **If your A/D converter is the SAD500**

If your A/D converter is the SAD500 and is mounted onto the spectrometer, connect the cable from the SAD500 to your PC. If you ordered your SAD500 in its own housing, attach another cable from the spectrometer to the SAD500. Note the serial port number (also called COM Port) on the PC to which you are interfacing. Plug the +12VDC wall transformer into an outlet and connect it to the SAD500.

## **Step 2: Install OOIBase32 Software**

Before installing OOIBase32, make sure that no other applications are running.

1. Insert “Disk 1” into your floppy drive. (When prompted, insert Disks 2, 3, and 4.) 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. 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>**.
7. When prompted to do so, **restart your computer** when the installation is complete.

## **Step 3: Configure OOIBase32 Software**

After you restart your computer, navigate to the OOIBase32 icon and select it. Now that your A/D converter and software have been installed, you need to configure your software. The first time you run OOIBase32 after installation, you must follow several prompts to configure your system before taking measurements.

### **Operator and Serial Number Dialog Box**

First, a prompt to enter a user name and serial number appears. Certain data files will include this information in the header. (If, at a later date, you wish to change the operator name and serial number, select **Edit | Settings** from the menu and then choose the **Registration** tab.) You can find the serial number of your OOIBase32 software on the Disk 1 label. Click **OK**.

### **Default Spectrometer Configuration File**

Next, the following message appears:

This appears to be the first time OOIBase32 has been executed. Please select a default spectrometer configuration file from the following screen. This spectrometer configuration file will be used each time OOIBase32 is started.

A file open dialog box then appears. You must choose the default spectrometer configuration file. Navigate to the OOIBase32 directory, and choose the file with **.spec** as the extension. The **.spec** extension is preceded by the serial number of your spectrometer (a default spectrometer configuration file will be named something similar to **I2J613.spec**).

### **Configure Hardware Dialog Box**

Next, the **Configure Hardware** dialog box opens. The parameters in this dialog box are usually set only once -- when OOIBase32 is first installed and the software first opens. Choose the spectrometer you are using and select the appropriate A/D converter. For the Base Address (I/O Range) and Interrupt Request (IRQ) settings, choose the same settings as the switches on the A/D board. If your A/D converter is the SAD500, you must specify in the Serial Port box the same COM port as the one being used to interface to your SAD500. (For detailed instructions on interfacing your A/D converter to your spectrometer, refer to the **Operating Manual and User’s Guide** that came with your spectrometer.) Click **OK**.

### **Spectrometer Configuration Dialog Box**

Now that OOIBase32 is running, you need to configure your system. Select **Spectrometer | Configure** from the menu. Go through each page in the **Spectrometer Configuration** dialog box to set system parameters. (For detailed information on each page of this dialog box, see pages 17-20.)

- ◆ In the **Wavelength Calibration** page, the coefficients for each spectrometer channel in your system have already been loaded as part of the **[your serial number].spec** spectrometer configuration file. Check the **Enabled** box for each spectrometer channel in your system.
- ◆ In the **A/D Interface** page, enter the same values as you did in the **Configure Hardware** dialog box.
- ◆ In the **Detector Linearity** page, the algorithm necessary to correct any non-linearity has already been loaded as part of the spectrometer configuration file.

When you exit OOIBase32, all of this configuration information will be stored in the spectrometer configuration file. The next time you run OOIBase32, the software will use the **[your serial number].spec** file as the standard for your spectrometer configuration. If you wish, save the spectrometer configuration file with a different name by choosing **Spectrometer | Save Configuration As** from the OOIBase32 menu.

At this point, OOIBase32 should be acquiring data from your spectrometer. There should be a dynamic trace responding to light near the bottom of the displayed graph.

### **OOIBase32 Settings Dialog Box**

It is a good idea to configure several OOIBase32 operation parameters. Choose **Edit | Settings** from the menu to open the **OOIBase32 Settings** dialog box. Go through each page of this dialog box to select options for saving, opening, and printing data; to choose waveform sound files for various program events; to configure default setting files; and to select other important options such as storing and copying data and choosing warning messages. (For detailed information on each page of this dialog box, see pages 8-10.)

### **Configure Data Acquisition Dialog Box**

Finally, select **Spectrum | Configure Data Acquisition** from the menu to set your data acquisition parameters in the **Configure Data Acquisition** dialog box. The **Basic** page allows you to set the integration time and choose averaging and boxcar smoothing values. The **External Trigger** page allows you to specify the external trigger mode and automatically save data for each external trigger. The **Strobe** page allows you to control external strobe events with the spectrometer. (For detailed information on each page of this dialog box, see pages 22-24.)

## **Step 4: Connect sampling optics**

For detailed information on connecting and operating sampling optics such as light sources, sampling chambers, fibers, or any other Ocean Optics spectroscopic accessory, refer to the operating instructions that came with the accessory or the **Operating Manual and User's Guide** that came with the spectrometer.

## **Getting Help**

Comprehensive on-line assistance is available from the **Help** menu. The Help files provide instructions on all buttons, options, items, and dialog boxes in OOIBase32. However, if the on-line Help does not answer your question, please contact our Technical Support Department.

# File Menu Functions

## **New**

To create a new spectral window for displaying spectral data, click on the new icon or select **File | New** from the menu. By default, the graph is placed in scope mode. All active channels in a spectral window share the same data acquisition parameters.

If you need a channel in your setup in a separate spectral window, open a new spectral window, select **Spectrometer | Configure** and choose the **Wavelength Calibration** page. Under Spectrometer Channel, select or deselect the Channel Enabled. Now create different parameters for the new spectral window, such as a different integration time. One spectral window can operate with up to 8 channels and 8 overlays.

## **Open**

Clicking on the open icon provides you with an open dialog box allowing you to choose, under **Files of Type**, either Processed Spectra, Grams/32 SPC Files, or All Files. To open specific file types, select **File | Open** from the menu and then choose dark, sample dark, reference, sample, processed, or experiment data files.

When you open a data file and the acquisition parameters of the file do not match the file currently open, a warning box allows you to change the acquisition parameters, ignore the disparity between the parameters, or cancel the opening of the data file.

### **Dark**

Selecting **File | Open | Dark** from the menu opens a dialog box allowing you to select and open one or more dark spectra. A dark spectrum is taken with the light path blocked.

### **Sample Dark**

Selecting **File | Open | Sample Dark** from the menu opens a file open dialog box allowing you to select and open one or more sample dark spectra. A sample dark spectrum is made in the time normalization mode with the integration time set to that of the sample spectrum.

### **Reference**

Selecting **File | Open | Reference** from the menu opens a file open dialog box, allowing you to select and open one or more reference spectra. A reference spectrum is taken with the light source on and a blank in the sampling region.

### **Sample**

Selecting **File | Open | Sample** from the menu opens a file open dialog box allowing you to select and open one or more sample spectra. A sample spectrum is made while in scope mode with the sample in the sampling region.

### **Processed**

Selecting **File | Open | Processed** from the menu opens a file open dialog box allowing you to select and open one or more processed spectra. Processed spectra are made while in absorbance, transmission, or relative irradiance mode. They are made after the dark and reference spectra are taken. When selecting a processed spectrum, the active spectral window goes into snapshot mode and data acquisition stops. To resume acquisition, simply select the snapshot icon.

### Experiment

Selecting **File | Open | Experiment** from the menu opens a file open dialog box allowing you to select and open a complete set of acquisition and processing parameters for the active spectral window.

### **Close**

Selecting **File | Close** from the menu immediately closes the active spectral window. You are not given an opportunity to save acquisition parameters or the spectra.



### **Save**

Clicking on the save icon provides you with an open dialog box allowing you to save, under **Files of Type**, either Processed Spectra, Grams/32 SPC Files, or All Files. To save specific file types, select **File | Save** from the menu and then choose dark, sample dark, reference, sample, processed, or experiment data files. When saving data, all active channels in the spectral window are saved.

You can opt to name spectra automatically by enabling the **Autoincrement Filenames** function. (See more on Autoincrement Filenames on the next page.) If the Autoincrement Filenames function is *not* enabled, a save file dialog box opens every time you choose a save command.

### Dark

To save a dark spectrum, select **File | Save | Dark** from the menu. If the Autoincrement Filenames function is enabled, this command automatically saves all dark spectra. If the Autoincrement Filenames function is *not* enabled, this command opens a save file dialog box. A dark spectrum is taken with the light path blocked.

### Sample Dark

To save a sample dark spectrum, select **File | Save | Sample Dark** from the menu. If the Autoincrement Filenames function is enabled, this command automatically saves all sample dark spectra. If the Autoincrement Filenames function is *not* enabled, this command opens a save file dialog box. A sample dark spectrum is made in the time normalization mode with the integration time set to that which will be used for the sample spectrum.

### Reference

To save a reference spectrum, select **File | Save | Reference** from the menu. If the Autoincrement Filenames function is enabled, this command automatically saves all reference spectra. If the Autoincrement Filenames function is *not* enabled, this command opens a save file dialog box. A reference spectrum is taken with the light source on and a blank in the sampling region.

### Sample

To save a sample spectrum, select **File | Save | Sample** from the menu. If the Autoincrement Filenames function is enabled, this command automatically saves all sample spectra. If the Autoincrement Filenames function is *not* enabled, this command opens a save file dialog box. A sample spectrum is made while in scope mode with the sample in the sampling region.

### Processed

To save a processed spectrum, select **File | Save | Processed** from the menu. If the Autoincrement Filenames function is enabled, this command automatically saves all processed spectra. If the Autoincrement Filenames function is *not* enabled, this command opens a save file dialog box. Processed spectra are taken while in absorbance, transmission, or relative irradiance mode after storing dark and reference spectra.

**Experiment**

To save an experiment, select **File | Save | Experiment** from the menu. Each time you save an experiment, you are saving the stored dark, reference, sample, and processed spectra, along with all overlays and acquisition parameters in the experiment.

**Autoincrement Filenames**

To name spectra automatically, enable the Autoincrement Filenames function by selecting **File | Autoincrement Filenames | Enabled**. When enabled, choosing any save command automatically saves all spectra in the spectral window, and names the files with a base name and numerical index you specify. An autoincremented filename of Test.00012.Master.Irradiance is characterized as:

- Test .....the base name that you have specified
- 00012 .....a sequential numerical index, which begins from a number you have specified
- Master .....the spectrometer channel, which is automatically added to the filename
- Irradiance .....the extension, which is automatically added to the filename and indicates the data was saved while in relative irradiance mode

If the Autoincrement Filenames function is *not* enabled, a save file dialog box opens every time you choose a save command.

**Enabled**

Selecting **File | Autoincrement Filenames | Enabled** from the menu enables (or disables) the auto-increment filenames function. When enabled, it automatically generates a filename for saved spectra.

**Base Name**

Selecting **File | Autoincrement Filenames | Base Name** from the menu opens the **Autoincrement Filename Properties** dialog box and allows you to set the base name for autoincremented files.

**Starting Index**

Selecting **File | Autoincrement Filenames | Starting Index** from the menu opens the **Autoincrement Filename Properties** dialog box, and allows you to set the starting index for autoincremented files. If you enter “1” as the starting number for your files, the number in the filename will appear as 00001. Therefore, the next spectrum saved will have 00002 in the filename.



**Print**

To print a graph, click on the print icon or select **File | Print** from the menu to display a print dialog box. You can choose to print graphs in color, or in black and white by configuring the printing page of the **OOIBase32 Settings** dialog box. Background images are disabled during printing.

**Print Preview**

To preview the graphical spectra about to be printed, select **File | Print Preview** from the menu.

**Print Setup**

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

**Exit**

To exit out of OOIBase32, select **File | Exit** from the menu. You will *not* receive a prompt asking if you are sure you want to exit OOIBase32.

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# Edit Menu Functions

## Copy Spectral Data

To copy spectral data (the data as numerical values) to the Windows clipboard, select **Edit | Copy Spectral Data** . Then select either **All Spectrometer Channels** or **Selected Spectrometer Channels**. The spectral data is tab-delimited and includes wavelength and intensity information as well as an optional header to allow for easy identification of the spectrometer channel or overlay. Spectral data can be copied and then pasted directly into applications such as Microsoft Excel.

### **All Spectrometer Channels**

To copy spectral data to the clipboard for all active spectrometer channels and overlays in a spectral window, select **Edit | Copy Spectral Data | All Spectrometer Channels**.

### **Selected Spectrometer Channels**

To copy spectral data for specific channels or overlays in a spectral window, select **Edit | Copy Spectral Data | Selected Spectrometer Channels** from the menu. Check the channels and overlays you want copied to the clipboard in the **Select Spectrometer Channels to Copy** dialog box.



## Copy Graphical Spectra

To copy graphical spectra (the data as graphed) to the Windows clipboard, click on the copy icon or select **Edit | Copy Graphical Spectra** from the menu. The graphic can then be pasted into any application that accepts a Windows metafile (Microsoft Word and Excel, for example).

☞ To change the function of the copy icon from copying graphical spectra (the data as graphed) to copying spectral data (the data as numerical values), see **Misc. Settings** on page 10.

## Settings

To access the important **OOIBase32 Settings** dialog box, which allows you to configure many aspects of the operation of OOIBase32, select **Edit | Settings** from the menu.

### **File Saving**

This page of the OOIBase32 Settings dialog box provides options for saving files. Options include:

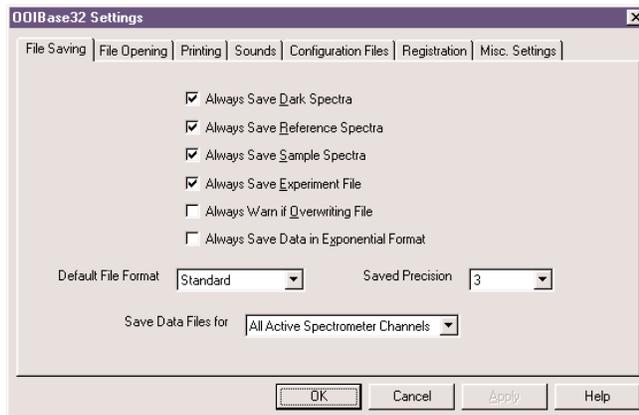
◆ **Always Save Dark Spectra** , **Always Save Reference Spectra** , and **Always Save Sample Spectra**. Enable these functions to automatically save dark, reference, and sample spectra each time you save a processed spectrum.

☞ Why would you want to enable these functions? If you follow these steps . . .

1. Store a dark spectrum in scope mode by clicking the dark icon or selecting **Spectrum | Store Dark**.
2. Store a reference spectrum in scope mode by clicking the reference icon or selecting **Spectrum | Store Reference**.
3. Switch to absorbance, transmission, or relative irradiance mode. Save your measurement as a processed spectrum by choosing **File | Save | Processed** from the menu.

. . . the only data you saved is the processed spectrum. Storing data is different from saving data. The software stores the dark and reference data to calculate processed spectra (spectra taken in absorbance, transmission, or relative irradiance mode). When you exit OOIBase32, stored data is deleted. To save a dark spectrum, for example, select **File | Save | Dark** from the menu. Or, enable the functions above to automatically save these spectra when you manually save a processed spectrum.

- ◆ **Always Save Experiment File.** Enable this setting to save the experiment configuration file each time you save a processed spectrum.
- ◆ **Always Warn if Overwriting File:** Enable this setting to receive a warning when a data file is about to be overwritten.
- ◆ **Always Save Data in Exponential Format.** Enable this setting to list spectral data (not graphical data) in an exponential format. (An 'e' is used as the exponential separator.)
- ◆ **Default File Format.** Choose to save spectral data in 1 of 3 ways:
  - No Header: an ASCII file , tab delimited, without a header
  - Standard: an ASCII file, tab delimited, with a header (recommended)
  - Grams/32: GRAMS/32<sup>®</sup>-compatible SPC file
- ◆ **Saved Precision .** Select a value from 0 to 10 decimal places to specify the precision of the spectral data saved in files or copied to the clipboard.
- ◆ **Save Data Files for.** Choose if you want data saved for all active spectrometer channels, or for selected spectrometer channels. If you choose to save for selected channels, a dialog box asking you to choose the channels opens each time you try to save spectral data.



### File Opening

This page of the OOIBase32 Settings dialog box provides options for opening data files. Options include:

- ◆ **Insure that Acquisition Parameters Match.** Enable this function to give you a warning if you are about to open a file that has different acquisition parameters than what is currently being used.
- ◆ **Warn if File Without a Header is Opened.** Enable this function to give you a warning if you are about to open a data file without a header.
- ◆ **Check for File Conformity.** Enable this function to give you a warning if there is any parameter mismatches between the file you are about to open and the file already open.
- ◆ **Wavelength Tolerance (nm).** Choose the tolerance, in nanometers, of the difference in wavelengths between the files you open and the spectrometer configuration currently being used. Use this option only if the **Insure that Acquisition Parameters Match** and **Check for File Conformity** boxes are selected.

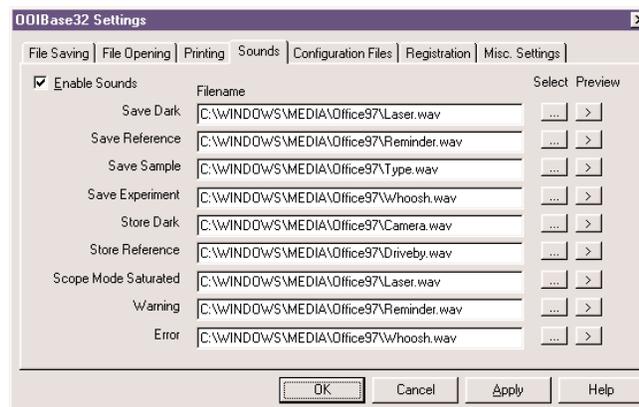
### Printing

This page of the OOIBase32 Settings dialog box allows you to print in either color or black and white.

### Sounds

This page of the OOIBase32 Settings dialog box allows you to select sounds for various software events. Options include:

- ◆ **Save Dark, Save Reference, Save Sample, Save Experiment, Store Dark and Store Reference.** Choose alert sounds for these file-saving and spectrum-storing events.
- ◆ **Scope Mode Saturated.** Choose an alert sound for scope mode signal saturation. This alert sounds when you are in other modes, such as the absorbance mode.
- ◆ **Warning and Error.** Choose alert sounds for these messages.

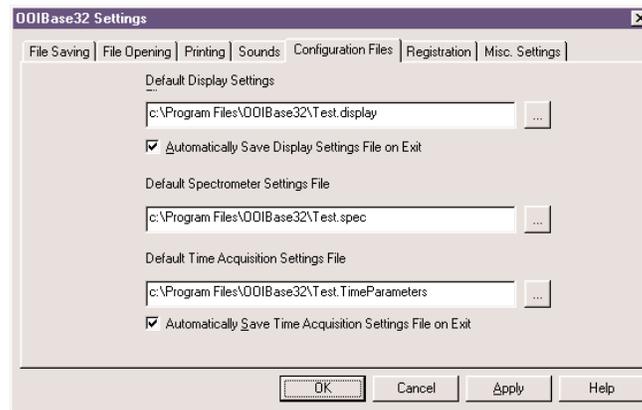


- ◆ **Filename.** Specify the path to and the name of the waveform sound file. Or, use the Select button.
- ◆ **Select.** Click on the ellipsis button to open a file open dialog box and navigate to the waveform file you wish to use for the event. (OOIBase32 does not come with any waveform files.)
- ◆ **Preview.** Click on the arrow button to hear a preview of the sound chosen.
- ◆ **Enable Sounds.** Check this box so the sounds you selected for certain events will take place.

**Configuration Files**

This page of the OOIBase32 Settings dialog box configures default setting files. Options include:

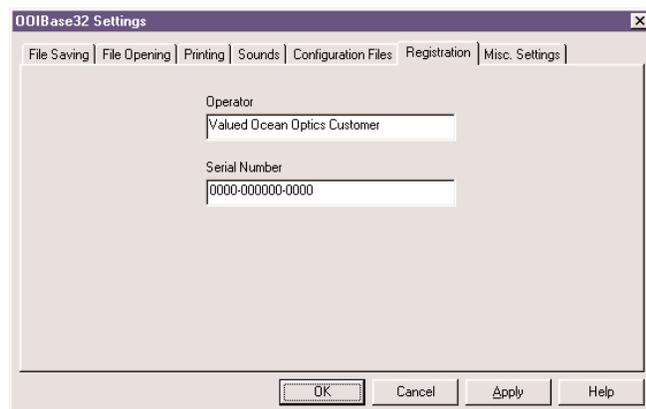
- ◆ **Default Display Settings .** Specify the path to and the name of the **.display** file you want used when OOIBase32 starts or a new spectral window opens. Or, click on the ellipsis button to navigate to the **.display** file you want. The display file contains settings such as trace color, trace width, graph scale, etc.



- ◆ **Automatically Save Display Settings File on Exit.** Automatically save any display changes to your default display settings file when OOIBase32 exits or a spectral window closes. If you do not select this box, but at any time want to save new display settings, select **View | Display Property Files | Save Display Settings** from the menu.
- ◆ **Default Spectrometer Settings File.** Specify the path to and the name of the **.spec** file you want used when OOIBase32 starts or a new spectral window opens. Or, click on the ellipsis button to navigate to the **.spec** file you want. The spectrometer settings file contains settings such as the A/D interface, wavelength calibration, etc.
- ◆ **Default Time Acquisition Settings File.** Specify the path to and the name of the **.TimeParameters** file you want used when OOIBase32 starts or a new spectral window opens. Or, click on the ellipsis button to navigate to the **.TimeParameters** file you want. The time acquisition settings file contains all of the time acquisition parameters.
- ◆ **Automatically Save Time Acquisition Settings File on Exit.** Automatically save any time acquisition settings changes to your default time acquisition settings file when OOIBase32 exits or a spectral window closes. If you do not select this box, but at any time want to save time acquisition settings, select **Time Acquisition | Configure | Save Parameters** from the menu.

**Registration**

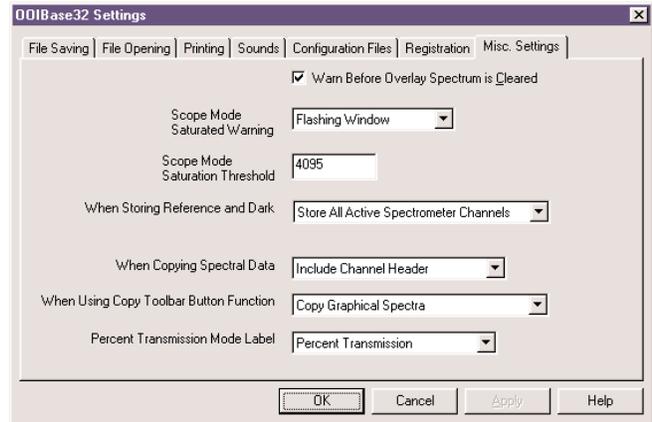
This page of the OOIBase32 Settings dialog box allows you to enter an **Operator** name and the software **Serial Number**. These entries are included in the header of some data files.



**Misc. Settings**

This page of the OOIBase32 Settings dialog box includes a variety of options, which include:

- ◆ **Warn Before Overlay Spectrum is Cleared.** Enable this setting to receive a warning before an overlay spectrum is cleared from the spectral window.
- ◆ **Scope Mode Saturated Warning.** Select the method for receiving a warning when the scope mode signal saturates the detector. You receive this warning when in other modes, such as the absorbance mode. (To choose a warning *sound* for scope mode saturation, see the **Sounds** page.)
- ◆ **Scope Mode Saturation Threshold.** Select a scope mode intensity threshold value *if* you selected a Scope Mode Saturated Warning method. Choose any value up to 4095. The value you enter is the intensity at which the saturation warning will appear.
- ◆ **When Storing Reference and Dark.** Choose whether dark and reference spectra are stored for all enabled spectrometer channels, or for selected channels.
- ◆ **When Copying Spectral Data.** Choose if you want to include a header in your spectral data files.
- ◆ **When Using Copy Toolbar Button Function.** Change the function of the copy icon. Configure the copy icon to copy graphical data (the data as graphed) or spectral data (the data as numerical values). The default for the copy icon, however, is set to copy graphical data.
- ◆ **Percent Transmission Mode Label .** Select **Percent Transmission** or **Percent Reflection** as your vertical axis label when you are in the transmission mode. Both transmission and reflection measurements are made while in the transmission mode, as the mathematics required to calculate transmission and reflection measurements are identical. Select the label to reflect your measurement. The label you select will be displayed on the vertical axis of the graphed spectrum when you are in the transmission mode.



# View Menu Functions

## Display Properties

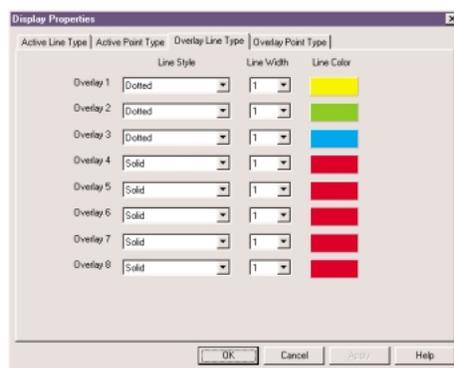
This command opens a **Display Properties** dialog box allowing you to easily configure the way in which spectra are plotted. To make these changes, select **View | Display Properties** from the menu.

### Active Line Type

These settings allow you to set the line design connecting the data points in an active spectrum. The **Line Style** sets the style, the **Line Width** sets the pixel width, and the **Line Color** sets the line's color.

### Active Point Type

These settings allow you to configure the points representing each pixel in an active spectrum. The **Point Style** sets the style (solid, dotted, etc.), the **Point Size** sets the size (in relative units), the **Fill Pattern** sets the pattern (solid, crosshatch, etc.), and the **Fill Color** sets the color of the points.



### Overlay Line Type

These settings allow you to set the line design connecting the points in an overlay spectrum. The **Line Style** sets the style, the **Line Width** sets the pixel width, and the **Line Color** sets the color of the line.

### Overlay Point Type

These settings allow you to configure the points representing each pixel in an overlay spectrum. The **Point Style** sets the style (dot, box, etc.), the **Point Size** sets the size (in relative units), the **Fill Pattern** sets the pattern (solid, crosshatch, etc.), and the **Fill Color** sets the color of the points.

## Display Property Files

### Save Display Settings

To save display settings, select **View | Display Property Files | Save Display Settings** from the menu. (By default, these files have a **.display** extension.) After saving the file, you can opt for it to be the default display settings file, the file used when OOIBase32 starts or a new spectral window opens.

### Restore Display Settings

To open a saved display settings file, select **View | Display Files | Restore Display Settings** from the menu, navigate to and open a saved display settings file. (By default, these files have a **.display** extension.)

## Spectrum Scale



### Autoscale

To adjust the scale of the spectra in the current spectral window such that they fill the display vertically, click on the autoscale icon or select **View | Spectrum Scale | Autoscale** from the menu.



### Set Scale

To specify the minimum and maximum limits of both the wavelength and amplitude axes, click on the set scale icon or select **View | Spectrum Scale | Set Scale** from the menu.



### Unscale

To reset the scale, click on the unscale icon or select **View | Spectrum Scale | Unscale** from the menu.

## Background Image

### Visible

To enable or disable the presence of a bitmap file in the background of the spectral window, select **View | Background | Visible** from the menu.

### Select Bitmap

To choose a background picture, select **View | Background Image | Select Bitmap** from the menu, navigate to and select a Windows bitmap (bmp) file as a background picture for the spectral window.

## Set Graph Background Color

To choose a background color for the spectral window, select **View | Set Graph Background Color** from the menu.

## Set Graph Text Color

To choose a color for text in the spectral window, select **View | Set Graph Text Color** from the menu.

## Rename Spectral Window

To rename the spectral window, select **View | Rename Spectral Window** from the menu. This title is for display purposes only, and is not saved with any configuration setting.

## Cursor



### Enabled

To enable or disable the display of a vertical cursor for the spectral window, click on the cursor icon or choose **View | Cursor | Enabled** from the menu.



### Configure

To configure the cursor's style, width, and color; assign the cursor to a spectrometer channel; and set a precision value for the cursor's position; click on the configure cursor icon or select **View | Cursor | Configure** from the menu.

## Grid

To enable or disable the display of a grid, choose View | Grid | Enabled from the menu. To configure the grid's style and color, select View | Grid | Configure from the menu

## Main Toolbars

To choose which dockable toolbars are displayed in the main OOIBase32 window, select **View | Main Toolbars** from the menu. Main toolbars include General Functions and Global Functions.

### General Functions

The functions in this toolbar control general OOIBase32 functions.

- |  |   |
|--|---|
|  Open a new spectral window |  Copy  |
|  Open a saved file          |  Print |
|  Save processed spectrum    |  Help  |

### Global Functions

The functions in this toolbar control the behavior of all open spectral windows and are referred to as global functions.

- |   |   |
|---|---|
|  Take a dark spectrum globally                       |  Reset acquisition parameters globally |
|  Take a reference spectrum globally                  |  Kick Start                            |
|  Take a snapshot or freeze data acquisition globally |   |

## Spectrum Toolbars

To choose which dockable toolbars are displayed in a spectral window, select **View | Spectrum Toolbars** from the menu. Spectrum toolbars include Spectrum Controls, Cursor Controls, Graph Scale, Spectral View Mode, Time Acquisition, and the Acquisition Parameters dialog bar.

### Spectrum Controls

The functions in this toolbar control spectral data acquisition for a designated spectral window.

-  Take a dark spectrum for a designated spectral window
-  Take a reference spectrum for a designated spectral window
-  Take a snapshot or freeze data acquisition for a designated spectral window
-  Configure data acquisition
-  Reset acquisition parameters for a designated spectral window

### **Cursor Controls**

The functions in this toolbar control cursor activity for a designated spectral window.

	Enable the cursor		Configure the cursor
	Move cursor 1 pixel to the right		Move cursor 1 pixel to the left
	Move cursor 25 pixels to the right		Move cursor 25 pixels to the left
	Move cursor to the next right peak		Move cursor to the next left peak

The cursor can also be moved via the following keystrokes:

<b><u>Keystroke</u></b>	<b><u>Command</u></b>
Page Down.....	Moves cursor 25 pixels to the left
Page Up.....	Moves cursor 25 pixels to the right
← (left arrow).....	Moves cursor 1 pixel to the left
→ (right arrow).....	Moves cursor 1 pixel to the right
↓ (down arrow).....	Moves cursor to beginning pixel
↑ (up arrow).....	Moves cursor to end pixel
<, (less than, comma).....	Moves cursor to previous peak
>. (greater than, period) ....	Moves cursor to next peak

### **Graph Scale**

The functions in this toolbar control the graph for a designated spectral window.

	Autoscale the graph		Unscale the graph
	Set the scale of the graph		

### **Spectral View Mode**

The functions in this toolbar control the spectral processing in a designated spectral window.

	Subtract dark spectrum		Configure the spectrometer
	See spectrum in Scope Mode		See spectrum in Transmission Mode
	See spectrum in Absorbance Mode		See spectrum in Relative Irradiance Mode

### **Time Acquisition**

The functions in this toolbar control the Time Acquisition feature.

	Activate Time Acquisition		Stop Time Acquisition
	Start Time Acquisition		Suspend Graph updates
	Pause Time Acquisition		

### Acquisition Parameters

The Acquisition Parameters dialog bar gives you immediate access to the most important data acquisition features of OOIBase32. If selected, the dialog bar appears in each spectral window you open and its values apply to every active channel in that spectral window. To display this dialog bar, select **View | Spectrum Toolbars** from the menu and choose **Acquisition Parameters**.



- ◆ **Integ. Time** (or **ADC Freq.** for S1000 spectrometers)  
The value entered here sets the integration time (S2000 and S1024DW spectrometers) or the ADC frequency (S1000 spectrometers) for all active spectrometer channels in a particular spectral window. The integration time of the spectrometer is analogous to the shutter speed of a camera. The higher the value specified for the integration time, the longer the detector “looks” at the incoming photons. If your scope mode intensity is too low, increase this value; if too high, decrease the value. Adjust the integration time and other acquisition parameters so that the greatest amount of light you anticipate for your application causes a signal of ~3500 counts while in scope mode. (The *actual* integration time, which depends on the speed of your A/D converter, is displayed in the main status bar.)
- ◆ **Average**  
The value entered here sets the number of discrete spectral acquisitions that are accumulated before OOIBase32 receives a spectrum. The larger the value, the better the signal-to-noise (S:N) ratio. The S:N improves by the square root of the number of spectra averaged.
- ◆ **Boxcar**  
The value entered here sets the boxcar smoothing width, a 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 5 points (or bins) to its left and 5 points to its right. The greater this value, the smoother the data and the higher the S:N. However, if the value entered is too high, a loss in spectral resolution results. The S:N improves by the square root of the number of pixels averaged.
- ◆ **Flash Delay (msec)**  
The value entered here sets the delay, in milliseconds, between strobe signals sent out of the spectrometer. You must be operating from an ADC1000 A/D card and with an external strobe source for this parameter to take effect.
- ◆ **Strobe Enable**  
This box allows you to enable or disable the triggering of external strobes through the spectrometer. You would only select Strobe Enable if you were operating an external strobe source. To purchase one of our strobe light sources, contact an Ocean Optics Applications Scientist.
- ◆ **Correct for Electrical Dark**  
The first 24 pixels in S2000 Spectrometers do not respond to light but they do produce an electrical signal. When you select the Correct for Electrical Dark box, the average value of these first 24 optical black pixels is subtracted from the entire spectrum. Use this function to compensate for the drift of the dark signal. (Our S1024DW Deep Well Spectrometers do not have these black pixels so enabling this function with an S1024DW has no effect on the spectrum.)

 Enabling **Correct for Electrical Dark** does *not* replace the **Store Dark Spectrum** function.

### Main Status Bar

To toggle the display of the status bar in the main OOIBase32 window, select **View | Main Status Bar** from the menu. The main status bar contains detailed acquisition parameters, including the *actual* integration time, averaging, boxcar smoothing, the spectral window collecting data and external triggering mode.

# Overlay Menu Functions

## Select to add overlay

Display or clear data in one of the 8 overlay slots for each spectral window. If you wish to open a spectrum as an overlay, select **Overlay** from the menu and then choose a **Select to add overlay** slot. A file open dialog box appears allowing you to navigate to and choose a saved spectrum file. If you want to clear the overlay, select **Overlay** from the menu and then choose the file you want cleared from the spectral window. You may also choose **Clear All** to clear all overlay files from the spectral window.

To receive a warning before an overlay spectrum clears from a spectral window, select **Edit | Settings** from the menu and choose the **Misc. Settings** page. Check the **Warn Before Overlay Spectrum is Cleared** box.

## Clear All

Clear all displayed overlays in the current spectral window by selecting **Overlay | Clear All** from the menu.

# Spectrometer Menu Functions

## Configure

This command opens the **Spectrometer Configuration** dialog box, giving you the ability to configure your spectrometer. Parameters for wavelength calibrating, A/D converter interfacing, reference monitoring, stray light correcting and detector linearity correcting are set in this dialog box. The parameters set in this dialog box apply only to a designated spectral window. Each spectral window may have a different spectrometer configuration. To access this important dialog box, select **Spectrometer | Configure** from the menu.

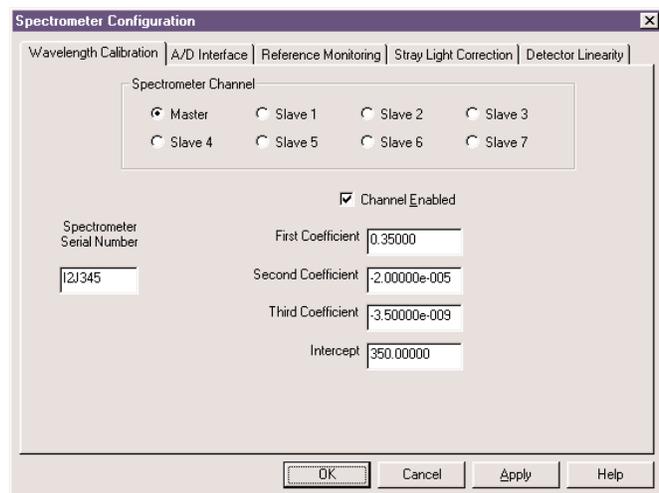
The information contained in the Spectrometer Configuration dialog box is loaded into the software as part of the default spectrometer file. Existing customers who have downloaded OOIBase32 from our web site must enter this data.

### Wavelength Calibration

This page of the Spectrometer Configuration dialog box allows you to enter or change the serial number of your spectrometer and the wavelength calibration coefficients of each spectrometer channel, as well as enable or disable specific spectrometer channels for a designated spectral window.

The coefficients for each **Spectrometer Channel** in your system are loaded as part of the spectrometer configuration file. Select the **Channel Enabled** box to activate a channel in the spectral window.

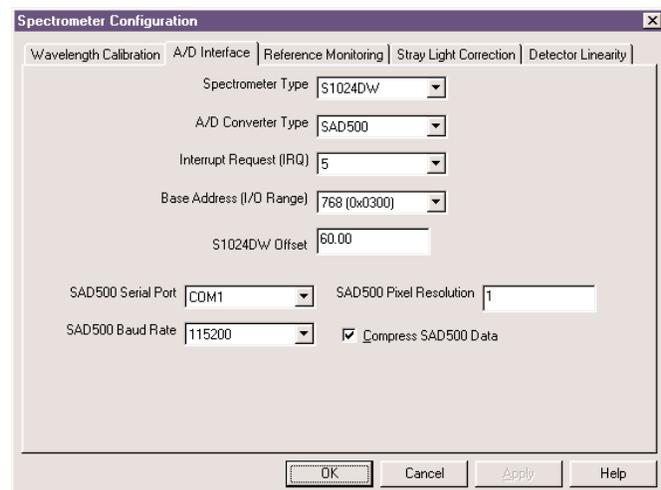
When you select a channel, make sure the **First Coefficient**, **Second Coefficient**, **Third Coefficient**, and **Intercept** values correspond to the numbers on your calibration report. As of July 1999, we began calculating third coefficients for all systems. If the calibration report that came with your spectrometer does not contain a third coefficient, enter a 0.



### A/D Interface

This page of the Spectrometer Configuration dialog box sets the hardware parameters for the spectrometer. Options include:

- ◆ **Spectrometer Type**. Choose the spectrometer you are using.
- ◆ **A/D Converter Type**. Select the A/D converter you are using.
- ◆ **Interrupt Request (IRQ)**. Choose the same setting as the switches on the A/D board. (This entry is not visible if you chose the SAD500 as your A/D converter.)
- ◆ **Base Address (I/O Range)**. Choose the same setting as the switches on the A/D board. (This entry is not visible if you chose the SAD500 as your A/D converter.)

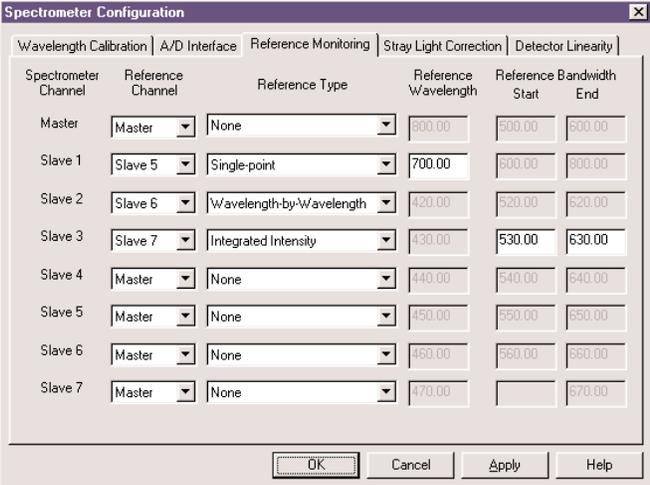


- ◆ **S1024DW Offset** . Adjust the signal baseline by entering a value. Some S1024DW Deep Well Spectrometer units have a negative baseline, which does not affect any data since all data is referenced from the same baseline. If your unit has a negative baseline and you want to insure the baseline (and therefore your data) is positive, you can enter an offset value to raise the baseline. (This entry is only visible if you chose the S1024DW as your spectrometer.)
- ◆ **SAD500 Serial Port**. Choose the COM port number your computer is using to interface to your SAD500. (This entry is only visible if you chose the SAD500 as your A/D converter.)
- ◆ **SAD500 Baud Rate**. Select the speed at which the SAD500 will operate. (This entry is only visible if you chose the SAD500 as your A/D converter.)
- ◆ **SAD500 Pixel Resolution**. Enter resolution values from 1 to 500. This value specifies that every  $n^{\text{th}}$  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 only visible if you chose the SAD500 as your A/D converter.)
- ◆ **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 only visible if you chose the SAD500 as your A/D converter.)

### Reference Monitoring

This page of the Spectrometer Configuration dialog box allows you monitor a reference for variations in spectral intensity based on light source and system drift.

Over time, the detected light from a source fluctuates or drifts. For extended experiments, you will achieve the best results if you can take frequent reference spectra. However, for those of you who cannot afford that luxury, you can choose to monitor your light source and OOIBase32 will correct for any drift that might occur. OOIBase32 allows you to do a traditional, dual-beam type of reference monitoring with a two-channel system. However, for those users with single-channel spectrometer systems, we can still correct for drift . We offer three kinds of reference monitoring: Wavelength-by-Wavelength, Integrated Intensity, and Single Point.



Spectrometer Channel	Reference Channel	Reference Type	Reference Wavelength	Reference Bandwidth Start	Reference Bandwidth End
Master	Master	None	800.00	500.00	800.00
Slave 1	Slave 5	Single-point	700.00	500.00	800.00
Slave 2	Slave 6	Wavelength-by-Wavelength	420.00	520.00	520.00
Slave 3	Slave 7	Integrated Intensity	430.00	530.00	630.00
Slave 4	Master	None	440.00	540.00	640.00
Slave 5	Master	None	450.00	550.00	650.00
Slave 6	Master	None	460.00	560.00	660.00
Slave 7	Master	None	470.00		670.00

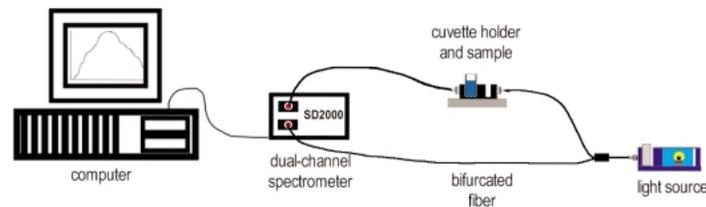
Ⓜ If your reference is in a region that has low scope mode intensity, you will introduce noise into the corrected sample spectrum. Increase signal averaging to increase the S:N . For the best results, make sure that the scope mode intensity of the region or wavelength that you are using as your reference is at least 15% of the peak intensity.

### Wavelength-by-Wavelength

To use the Wavelength-by-Wavelength option you must have at least two spectrometer channels in your system that have been configured for the same wavelength range. This option can correct for detected light drift if the drift is uniform or not uniform. For example, drift associated with a tungsten lamp is often spectrally uniform, but drift associated with a deuterium lamp is not. You would be able to correct for detected light drift from either of one of these sources using this method.

To monitor a reference using the Wavelength-by-Wavelength option:

1. Attach a bifurcated fiber to the light source.
2. Attach one leg of the bifurcated fiber to the reference spectrometer channel.
3. Attach the second leg to the sample.
4. Attach another fiber from the sample to the second spectrometer channel.
5. One spectrometer channel looks at the reference while the other looks at the sample. Both channels must be viewed in the same spectral window.
6. In the software, go to **Spectrometer | Configure** and select the **Reference Monitoring** page. Under **Spectrometer Channel**, find the channel that you will use for your experiment. Then select a **Reference Channel**. Under **Reference Type**, select **Wavelength-by-Wavelength**.
7. Store a dark and a reference spectrum of your sample while in scope mode.
8. Change into the spectral view mode necessary for taking your measurement. For any spectral view mode, the software corrects for the drift. The sample spectrum reflects the corrected spectrum in the spectral window.



Typical setup for Wavelength-by-Wavelength Reference Monitoring.

### Integrated Intensity

This reference monitoring option is available if you cannot do the dual-beam type of reference monitoring. However, it is only possible for the software to correct for drift using this option if the drift from the detected light is uniform. For example, drift associated with a tungsten lamp is often spectrally uniform, but drift associated with a deuterium lamp is not. Monitoring a deuterium lamp would not be possible with this option. Pick this option before the Single Point option if you can afford to use as your reference an *area* of the wavelength region versus a single wavelength point.

Use the Integrated Intensity option if:

- ◆ you do not have two spectrometer channels identically configured
- ◆ the drift of the light source is uniform
- ◆ you can afford to sample a wavelength area as opposed to a single wavelength point

To monitor a reference using the Integrated Intensity option:

1. Attach a fiber from the light source to the sample. Attach a fiber from the sample to the spectrometer.
2. In the software, go to **Spectrometer | Configure** and select the **Reference Monitoring** page. Under **Spectrometer Channel**, find the channel that you will use for your experiment. Then select a **Reference Channel**. Under **Reference Type**, select **Integrated Intensity**.
3. Choose the **Start** and **End** for the **Reference Bandwidth**. The software will use the wavelength area between these two points as the monitoring region. However, you must know if the region you choose as the reference area is in a non-absorbing region of the sample (if you are doing absorbance measurements) or is in the 100% transmission or reflectivity region of the sample (if you are doing transmission or reflection measurements).
4. Store a dark and a reference spectrum of your sample while in scope mode.
5. Choose the spectral view mode necessary for taking your measurement or stay in scope mode. For any spectral view mode, if a drift occurs, the software makes the correction. The sample spectrum reflects the correction in the spectral window.

### Single Point

This reference monitoring option is available if you cannot do the dual-beam reference monitoring. However, it is only possible for the software to correct for drift using this option if the drift from the detected light is uniform. For example, drift associated with a tungsten lamp is often spectrally uniform, but drift associated with a deuterium lamp is not. Monitoring a deuterium lamp would be impossible with this option. Pick this option over the Integrated Intensity option only if you cannot afford to use as your reference an *area* of the wavelength region and are restricted to monitoring a single wavelength point.

Use the Single Point option if:

- ◆ you do not have two spectrometer channels identically configured
- ◆ the drift of the light source is uniform
- ◆ you cannot afford to sample a wavelength area and are restricted to monitoring one wavelength point

To monitor a reference using the Single Point option:

1. Attach a fiber from the light source to the sample. Attach a fiber from the sample to the spectrometer.
2. In the software, go to **Spectrometer | Configure** and select the **Reference Monitoring** page. Under Spectrometer Channel, find the channel that you will use for your experiment. Then select a Reference Channel. Under Reference Type, select Single Point.
3. Choose the **Reference Wavelength** point to monitor. However, you must know if the wavelength point you choose as the reference point is in a non-absorbing region of the sample (if you are doing absorbance measurements) or is in the 100% transmission or reflectivity region of the sample (if you are doing transmission or reflection measurements).
4. Store a dark and a reference spectrum of your sample while in scope mode.
5. Change into the spectral view mode necessary for taking your measurement or stay in scope mode. For any spectral view mode, if a drift occurs, the software makes the correction. The sample spectrum reflects the correction in the spectral window.

### Stray Light Correction

This page of the Spectrometer Configuration dialog box allows you to enable or disable the feature and to enter the stray light correction constant for each spectrometer channel. Stray light is light detected at a wavelength or wavelengths other than those at which the light *should* be detected. All spectrometers experience the effects of stray light. By enabling the stray light correction, the **Correction Constant** reduces every pixel's intensity to compensate for the total amount of stray light in the spectrometer.

### Detector Linearity

This page of the Spectrometer Configuration dialog box allows you to enable or disable the detector linearity correction and to enter the correction coefficients for each spectrometer channel in your system. For new customers, the algorithm to correct any non-linearity was loaded as part of the spectrometer configuration file. For those who have downloaded OOIBase32 from our web site, contact us for more information.

## Open Configuration

Selecting **Spectrometer | Open Configuration** from the menu opens an open file dialog box, allowing you to navigate to and select a file containing saved spectrometer configuration parameters. After selecting the file, a message box asks if you would like to make the selected configuration file the default. Choose yes or no. Then a spectral window with these selected and saved parameters will open. You can save multiple configuration files and switch easily among them.

## Save Configuration As

Selecting **Spectrometer | Save Configuration As** from the menu opens a save file dialog box, allowing you to save the current spectrometer configuration parameters. After the file is named and saved, you can opt to have the spectrometer configuration file saved as the default, and OOIBase32 will use that file each time the software starts or a new spectral window opens.

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# Spectrum Menu Functions



## Store Dark

To store a dark spectrum for all enabled spectrometer channels in a spectral window, click on the store dark icon or select **Spectrum | Dark** from the menu. The dark spectrum is taken with the light path to the sample blocked. Storing a dark spectrum is requisite before the software can calculate absorbance, transmission, and relative irradiance spectra. This command merely stores a dark spectrum. You must use the Save Dark command to permanently save the dark spectrum to disk.



## Store Reference

To store a reference spectrum for all enabled spectrometer channels in a spectral window, click on the store reference icon or select **Spectrum | Reference** from the menu. This spectrum is taken with the light source on and a blank in the sampling region. Storing a reference spectrum is requisite before the software can calculate absorbance, transmission, and reflection spectra. This command merely stores a reference spectrum. You must use the Save Reference command to permanently save the reference spectrum to disk.



## Snapshot

To halt data acquisition and take a snapshot of activity in a spectral window, click on the snapshot icon or select **Spectrum | Snapshot** from the menu.



## Emergency Reset

To reset acquisition parameters for a spectral window, click on the emergency reset icon or select **Spectrum | Emergency Reset** from the menu. By selecting this command, the software sets the integration time to 100 msec, sets averaging to 1, turns off boxcar smoothing and disables external triggering.



## Kick Start

To kick start data acquisition and restart the acquisition loop without resetting any acquisition parameters, click on the kick start icon or select **Spectrum | Kick Start** from the menu.



## Store Global Dark

To store a dark spectrum for all enabled channels in all spectral windows, click on the store global dark icon or select **Spectrum | Global | Store Global Dark** from the menu. A dark spectrum is taken with the light source off or with the light path blocked. Saving a dark spectrum is requisite before the software can calculate absorbance, transmission, and relative irradiance spectra. You must use the Save Dark command to permanently save the dark spectrum to disk.



## Store Global Reference

To store a reference for all enabled channels in all spectral windows, click on the store global reference icon or select **Spectrum | Global | Store Global Reference** from the menu. A reference spectrum is taken with the light source on and a blank in the sampling region. Saving a reference spectrum is requisite before the software can calculate absorbance, transmission, and reflection spectra. You must use the Save Reference command to permanently save the reference spectrum to disk.



## Global Snapshot

To halt data acquisition and take a snapshot of activity in all spectral windows in OOIBase32, click on the global snapshot icon or select **Spectrum | Global | Global Snapshot** from the menu.



## Global Emergency Reset

To reset acquisition parameters for all spectral windows in OOIBase32, click on the global emergency reset icon or select **Spectrum | Global | Global Emergency Reset** from the menu. By selecting this command, the software sets the integration time to 100 msec, sets averaging to 1, turns off boxcar smoothing and disables external triggering.



## Configure Data Acquisition

To set data acquisition parameters for all active channels in a specific spectral window, click on the configure data acquisition icon or select **Spectrum | Configure Data Acquisition** from the menu. Most of these parameters can be accessed on the Acquisition Parameters dialog bar.

### Basic

This page allows you to specify acquisition parameters.

#### ◆ Integration Time (or A/D Frequency)

The value entered here sets the integration time in milliseconds (for S2000 and S1024DW spectrometers) or the ADC frequency in kHz (for S1000 spectrometers) for all active spectrometer channels in a spectral window. The integration time of the spectrometer is analogous to the shutter speed of a camera. The higher the value specified for the integration time, the longer the detector “looks” at the incoming photons. If your scope mode intensity is too low, increase this value; if too high, decrease the value. Adjust the integration time and other parameters so that the greatest amount of light you anticipate for your application causes a signal of ~3500 counts while in scope mode. The *actual* integration time, which depends on the speed of your A/D converter, is displayed in the main status bar.

#### ◆ Spectra to Average

The value entered here sets the number of discrete spectral acquisitions that are accumulated before OOIBase32 receives data. The larger the value, the better the signal-to-noise ratio (S:N). The S:N improves by the square root of the number of spectra averaged.

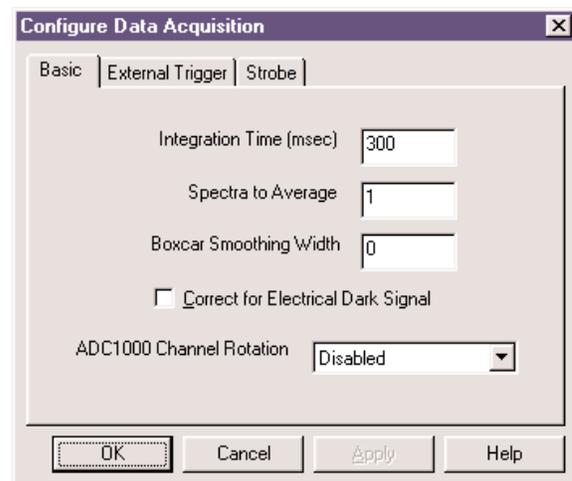
#### ◆ Boxcar Smoothing Width

The value entered here sets the boxcar smoothing width, a 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 5 points to its left and 5 points to its right. The greater this value, the smoother the data and the higher the S:N ratio. However, 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.

#### ◆ Correct for Electrical Dark Signal

The first 24 pixels in S2000 Spectrometers do not respond to light but they do produce an electrical signal. When you select the Correct for Electrical Dark Signal box, the average value of these first 24 optical black pixels is subtracted from the entire spectrum. Use this function to compensate for the drift of the dark signal. (Our S1024DW Deep Well Spectrometers do not have these black pixels so enabling this function with an S1024DW has no effect on the spectrum.)

 Enabling **Correct for Electrical Dark Signal** does *not* replace the **Store Dark** function.



◆ **ADC1000 Channel Rotation**

The ability to enable this feature appears in this dialog box only if you are using the ADC1000 as your A/D converter. Enabling this function allows you to acquire spectral data from multiple spectrometer channels simultaneously, making this function especially useful for applications involving pulsed light sources, transient spectral events, or long integration times. An example of this process with a triple-channel spectrometer would work as follows:

1. Select **Spectrum | Configure Data Acquisition** from the menu. Select the **Basic** page. Choose acquisition parameter values. Set the integration time for the reference spectrum.
2. For the **ADC1000 Channel Rotation** function, pick the channels to include in the rotation, such as **Master—Second Slave**.
3. Select **Spectrometer | Configure** from the menu and choose the **Wavelength Calibration** page. Make sure the channels selected for this process (Master, Slave 1 and Slave 2) are enabled in one spectral window. Channels not included in the rotation must be disabled.
4. Store a reference and dark spectrum.
5. Set the integration time for your sample scan and take your sample spectra.
6. The ADC1000 accepts data acquired from every third pixel in each channel's detector. Pixel #0 is acquired from the master channel, pixel #1 from the first slave, and pixel #2 from the second slave. As this repeats, pixel #3 is acquired from the master, and so on until 2048 pixels are acquired. The device driver *fills in* the pixels that are not used, so that the acquired spectra still *appears* to have 2048 pixels.

The more channels included in the rotation process, the greater the loss in spectral resolution. Without using this function, one channel uses all 2048 pixels in the detector. If you enable this function and rotate two channels, each channel uses 1024 pixels. Rotate three channels, and each uses 682 pixels.

### External Trigger

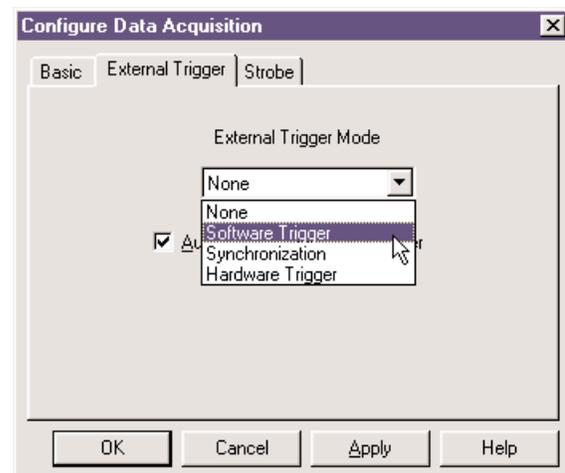
Our S2000 and S1024DW Spectrometers provide four methods of acquiring data. In the Normal Mode, Ocean Optics spectrometers are “free running.” That is, the spectrometer is continuously scanning, acquiring, and transferring data to your computer, according to parameters set in the software. In this mode, however, there is no way to synchronize the acquisition of data with an external event. To synchronize data acquisition with external events, three other modes of acquiring data are available:

◆ **External Software Trigger**

In this 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 certain external switches, this mode is equivalent to operating in the Normal Mode. In the Software Mode, you set the integration time in the software. All other acquisition parameters are set in the software as well. The source for the integration clock comes from the A/D converter.

◆ **External Synchronization Trigger**

In this mode, the spectrometer is idle until you apply the initial trigger to the spectrometer. With each trigger, the spectrometer stops taking its current scan and data is transferred to the software, it begins a new scan and integrates until another trigger is applied. In the Synchronization Mode, the integration time is set by the frequency of triggers applied to the spectrometer. All other acquisition parameters are set in the software. The source for the integration clock is the external triggering device itself, such as a periodic TTL signal.



◆ **External Hardware Trigger**

In this mode, the spectrometer is idle until you apply a trigger to the spectrometer. With each trigger, the spectrometer is cleared and then begins integrating for a fixed period of time (determined by the jumpered pins on the spectrometer's circuit board), the data is transferred to the software, and the spectrometer then sits idle waiting for the next trigger. In the Hardware Mode, you set the integration time by putting jumpers over pins on the spectrometer's circuit board. Other acquisition parameters are set in the software. The source for the integration clock is the external triggering device itself. This mode is ideal for use with short-pulse events.

**Strobe**

This page of the Configure Data Acquisition dialog box allows you to enable or disable the triggering of external strobes through the spectrometer. The value entered in the **Delay Between Flashes (msec)** box sets the delay, in milliseconds, between strobe signals sent out of the spectrometer. This parameter only has an effect when using an ADC1000 A/D card and when operating an external strobe source.

**S** | **Scope Mode**

To view data in scope mode, click the scope mode icon or select **Spectrum | Scope Mode** from the menu. The signal graphed in scope mode is the raw voltage coming out of the A/D converter. This spectral view mode is unique to Ocean Optics. It allows you to control signal processing functions before taking absorbance, reflection, and relative irradiance measurements. Use scope mode when configuring your setup, adjusting the integration time, and taking dark and reference scans. Be careful when using this mode, as it represents a combination of several factors: the light intensity, grating reflectivity, the fiber transmission, the detector response, etc.

 **Scope Mode Minus Dark**

To switch the current spectral window into scope mode and subtract the stored dark spectra from each channel before the spectrum is displayed, click the scope mode minus dark icon or select **Spectrum | Scope Mode Minus Dark** from the menu. This command is useful if you are trying to look at a change in an emission spectrum or are trying to eliminate from the spectra fixed pattern noise caused by very long integration times. The subtract dark spectrum function only acts on the spectra displayed in scope mode.

**A** | **Absorbance Mode**

This command switches the current spectral window into Absorbance Mode. To view data in absorbance mode, click the absorbance mode icon or select **Spectrum | Absorbance Mode** from the menu. Before this can occur, both the dark and reference spectra must be stored. The absorbance of a solution is related to the concentration of the species within it. The relationship, known as Beer's Law, is:

$$A_{\lambda} = \epsilon_{\lambda} c l$$

where  $A$  is the absorbance at wavelength  $\lambda$ ,  $\epsilon$  is the extinction coefficient of the absorbing species at wavelength  $\lambda$ ,  $c$  is the concentration and  $l$  is the optical pathlength.

This relationship is used to determine the concentration of a species in solution. Absorbance is calculated by the following equation. When this equation is evaluated for each pixel of the detector, the absorbance spectrum is produced.

$$A_{\lambda} = -\log_{10} \left( \frac{S_{\lambda} - D_{\lambda}}{R_{\lambda} - D_{\lambda}} \right)$$

where  $S$  is the sample intensity at wavelength  $\lambda$ ,  $D$  is the dark intensity at wavelength  $\lambda$ ,  $R$  is the reference intensity at wavelength  $\lambda$ .

## T Transmission Mode

This command switches the current spectral window into Transmission Mode. This is also the spectral processing mode used for Reflection spectroscopy, as the math necessary to compute reflection is identical to that required for transmission. To view data in transmission mode, click the transmission mode icon or select **Spectrum | Transmission Mode** from the menu. Before this can occur, both the dark and reference spectra must be stored. The transmission of a solution is calculated by the following equation:

$$\%T_{\lambda} = \frac{S_{\lambda} - D_{\lambda}}{R_{\lambda} - D_{\lambda}} \times 100\%$$

where  $S$  is the sample intensity at wavelength  $\lambda$ ,  $D$  is the dark intensity at wavelength  $\lambda$ ,  $R$  is the reference intensity at wavelength  $\lambda$ .

To change the label on the vertical axis in transmission mode from **Percent Transmission** to **Percent Reflection**, select **File | Settings** from the menu and choose the **Miscellaneous Settings** tab. The very last function allows you to choose between the two labels. This function is useful when saving or copying graphical spectra.

## I Relative Irradiance Mode

This command switches the current spectral window into Relative Irradiance Mode. To view data in relative irradiance mode, click the relative irradiance mode icon or select **Spectrum | Relative Irradiance Mode** from the menu. Before this can occur, the reference spectrum must be made with a blackbody of known color temperature. A dark spectrum is usually obtained by preventing light from entering the fiber that connects to the spectrometer. Relative irradiance spectra are a measure of the intensity of a light source relative to a reference emission source. Relative irradiance is calculated by the following equation:

$$I_{\lambda} = B_{\lambda} \left( \frac{S_{\lambda} - D_{\lambda}}{R_{\lambda} - D_{\lambda}} \right)$$

where  $B$  is relative energy of the reference calculated from the color temperature,  $S$  is the sample intensity at wavelength  $\lambda$ ,  $D$  is the dark intensity at wavelength  $\lambda$ ,  $R$  is the reference intensity at wavelength  $\lambda$ .

## Reference Color Temperature

To access the **Reference Color Temperature** dialog box, allowing you to enter the color temperature (in Kelvin) of your blackbody reference lamp used in relative irradiance measurements, select **Spectrum | Reference Color Temperature** from the menu. You must enter this data in order to take relative irradiance measurements. (The Ocean Optics LS-1 has a color temperature of 3100 Kelvin, and the LS-1-LL has a color temperature of 2800 Kelvin.)

Enabling the **Assume Second Order Light is Being Detected** function forces the software to assume that the light being detected is from the second order of the grating. This function is designed for use only with the S2000-1330 spectrometer.

## Take Log of Vertical Scale

This function takes the base-10 logarithm of any vertical axis in scope, absorbance, transmission, or relative irradiance mode. It is especially useful for emphasizing smaller spectral features. This function is designed for use only with the S2000-1330 spectrometer.)

## Time Normalized Intensity

The Time Normalized Intensity mode is utilized for experiments where the reference and sample scans cannot use the same integration times because either the reference or the sample is saturating the spectrometer's detector. In this mode, you can use one integration time for the reference and a different integration time for sample spectra. Here, the data is normalized as a function of time. However, in order for this processing technique to produce valid spectral data, separate dark spectra must be stored for each integration time used. For step-by-step time normalized intensity experiment instructions, see page 39.

### **Enable**

To enable or disable the time normalized intensity mode, select **Spectrum | Time Normalized Intensity | Enable** from the menu.

### **Store Reference Dark**

To store a reference dark spectrum for all enabled spectrometer channels in the active spectral window while in time normalized intensity mode, select **Spectrum | Time Normalized Intensity | Store Reference Dark** from the menu. The reference dark spectrum is taken with the light path blocked and with the integration time set to the value to be used for acquiring the reference spectra. Storing a reference dark spectrum is requisite before the software can calculate absorbance, transmission, and relative irradiance spectra in the time normalized intensity mode.

### **Store Sample Dark**

To store a sample dark spectrum for all enabled spectrometer channels in the active spectral window while in time normalized intensity mode, select **Spectrum | Time Normalized Intensity | Store Sample Dark** from the menu. The sample dark spectrum is taken with the light path blocked and with the integration time set to the value to be used for acquiring the sample spectra. Storing a sample dark spectrum is requisite before the software can calculate absorbance, transmission, and relative irradiance spectra in the time normalized intensity mode.

### **Store Reference**

To store a reference spectrum for all enabled spectrometer channels in a spectral window while in time normalized intensity mode, select **Spectrum | Time Normalized Intensity | Store Reference** from the menu. This spectrum is taken with the light source on and a blank in the sampling region. Storing a reference spectrum is requisite before the software can calculate absorbance, transmission, and reflection spectra in the time normalized intensity mode.

# Time Acquisition Menu Functions

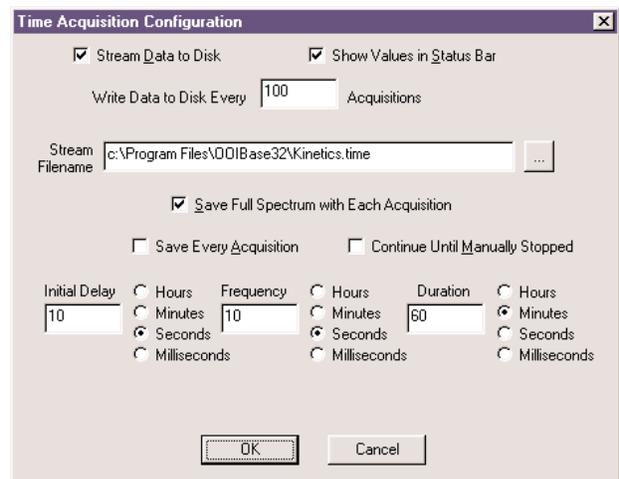
## Configure

For step-by-step instructions on setting up and executing a time acquisition experiment, read this section and then turn to the **Time Acquisition Experiments** on pages 37-38.

### Configure Acquisition

To open the **Time Acquisition Configuration** dialog box allowing you to configure and establish the parameters for time acquisition processing, select **Time Acquisition | Configure | Configure Acquisition** from the menu. Options include:

- ◆ **Stream Data to Disk.** Enable this setting to continuously save time acquisition data to disk.
- ◆ **Write Data to Disk Every X Acquisitions.** Enter a value to set the frequency for saving data. The value is the number of acquisitions the software reads before data is saved. The smaller this number, the more frequently data is saved. The larger this number, the less frequently data is saved; but entering a large number enhances the performance of the time acquisition process.
- ◆ **Show Values in Status Bar.** Enable this function to see the time acquisition values in the status bar. These values replace the cursor values.
- ◆ **Stream Filename.** Name the file for the time acquisition process. Clicking on the ellipsis to the right of this box opens a file save dialog box allowing you to navigate to a designated folder.
- ◆ **Save Full Spectrum with each Acquisition.** Enable this function to save full spectra.
- ◆ **Save Every Acquisition.** Enable this function to store data for every spectral acquisition during the time acquisition process. (If you select this feature, you will not need to set the **Frequency** for acquiring data.)
- ◆ **Continue Until Manually Stopped.** Enable this function to store data until you manually stop the acquisition process by clicking on the stop icon or selecting **Time Acquisition | Stop**. (If you select this feature, you will not need to set the **Duration** for acquiring data.)
- ◆ **Initial Delay.** Enter a value to set the delay before the time acquisition process begins. However, the delay countdown cannot begin until you initiate the time acquisition process by clicking on the start icon or selecting **Time Acquisition | Start** from the menu. Be sure to select **Hours**, **Minutes**, **Seconds** or **Milliseconds** immediately to the right of the initial delay entry.
- ◆ **Frequency.** Enter a value to set the frequency of the data collected in a time acquisition process. Data from a time acquisition is stamped with a time that is accurate to 1 millisecond. Be sure to select **Hours**, **Minutes**, **Seconds** or **Milliseconds** immediately to the right of the frequency entry. (Enabling the **Save Every Acquisition** box prevents you from using the frequency setting.)
- ◆ **Duration.** Enter a value to set the length of time for the entire time acquisition process. Be sure to select **Hours**, **Minutes**, **Seconds** or **Milliseconds** to the right of the duration entry. (Enabling the **Continue Until Manually Stopped** box prevents you from using the duration setting.)



### Configure Time Channels

To open the **Time Acquisition Channel Configuration** dialog box allowing you to set up the “time channels” for a time acquisition process, select **Time Acquisition | Configure | Configure Time Channels** from the

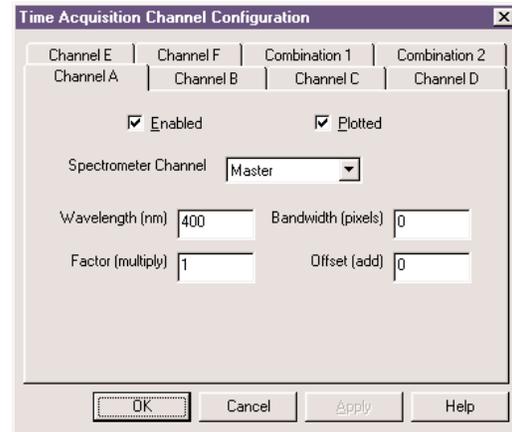
menu. You can collect spectral data as a function of time, from up to 6 single wavelengths (designated as Time Channels A through F ) and up to two mathematical combinations of these wavelengths (designated as Time Channel Combinations 1 and 2).

**Time Channels A through F**

To configure a time acquisition process for a single wavelength, select **Channel A** through **Channel F**.

Options include:

- ◆ **Enabled.** Select this function to set the time acquisition calculation for the wavelength. Without selecting Enabled, the time acquisition process will not calculate data.
- ◆ **Plotted.** Enable this function to see a real-time graph of the acquired data in a spectral window. Each Time Channel enabled for a time acquisition process means that you have one less Overlay available in the same spectral window as the time acquisition process.
- ◆ **Spectrometer Channel.** Select a spectrometer channel for your time acquisition process.
- ◆ **Wavelength (nm).** Specify the analysis wavelength.
- ◆ **Bandwidth (pixels).** Specify the number of pixels averaged around the analysis wavelength.
- ◆ **Factor (multiply).** Select a multiplicative factor to apply to the data before it is plotted or stored.
- ◆ **Offset (add).** Select an additive constant to apply to the data after the factor is applied and before the data is plotted or stored.



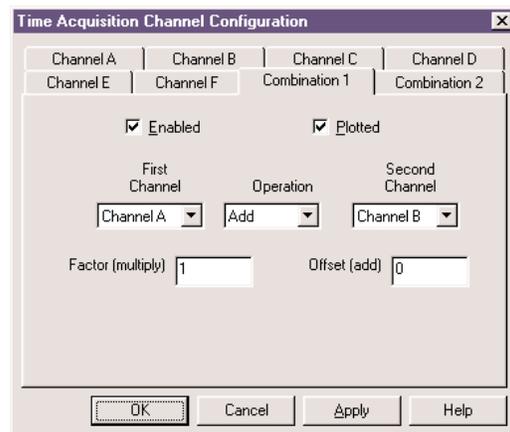
☞ The equation for the Factor and Offset functions is: Results = (Factor x Data) + Offset

**Time Channel Combination 1**

To configure a time acquisition process for a combination of two time channels, select **Combination 1**.

Options include:

- ◆ **Enabled.** Select this function to set the time acquisition calculation for the wavelength. Without selecting Enabled, the time acquisition process will not calculate data.
- ◆ **Plotted.** Enable this function to see a real time graph of the acquired data in a spectral window. Each Combination enabled for a time acquisition process means that you have one less Overlay available in the same spectral window as the time acquisition process.
- ◆ **First Channel.** Specify Time Channel A through F for the first time acquisition channel.
- ◆ **Operation.** Select the mathematical operation to produce the data for Combination 1.
- ◆ **Second Channel.** Specify Time Channel A through F for the second time acquisition channel.
- ◆ **Factor (multiply).** Select a multiplicative factor to apply to the data before it is plotted or stored.
- ◆ **Offset (add).** Select an additive constant to apply to the data after the factor is applied and before the data is plotted or stored.



☞ The equation for the Factor and Offset functions is: Results = (Factor x Data) + Offset

The **Combination 2** page is almost identical to the Combination 1 page except that you have the option of choosing Combination 1 for your **First Channel** or **Second Channel**.

### **Restore Parameters**

To open a file open dialog box allowing you to select and open a file with the complete set of time acquisition parameters, including the configuration settings for all time channels, select **Time Acquisition | Configure | Restore Parameters** from the menu.

### **Save Parameters**

To save a complete set of time acquisition parameters, including the configuration settings for all time channels, select **Time Acquisition | Configure | Save Parameters** from the menu. After saving this file, you may designate the parameters file as the default for future time acquisition experiments.



### **Activate Time Acquisition**

To activate the time acquisition mode, click on the icon or select **Time Acquisition | Activate Time Acquisition** from the menu. (This function *prepares* OOIBase32 for time acquisition processing; it does not *start* the acquisition of data.)



### **Start**

To start the time acquisition process, click on the start icon or select **Time Acquisition | Start** from the menu. If you have selected to stream data to disk, the data file is opened at this point. Once started, time acquisition can be paused, stopped or permitted to run for the previously defined duration.



### **Pause**

To pause the time acquisition process, click on the pause icon or select **Time Acquisition | Pause** from the menu. If you selected a duration for the process, the amount of time paused applies. If the duration expires while in pause mode, the process terminates, but all collected data is saved. It is possible to pause a time acquisition process and change the parameters without losing any previously stored data.



### **Stop**

To stop the time acquisition process, click on the stop icon or select from the **Time Acquisition | Stop** menu. You can stop a time acquisition at any point during the acquisition. If you specified to stream data to disk, any collected data is saved.



### **Suspend Graph Display**

To suspend the graph display during a time acquisition process, click on the suspend graph display icon or select **Time Acquisition | Suspend Graph Display** from the menu. Depending on your hardware, OOIBase32 can spend up to 90% of its processing time calculating and drawing the graph. Suspending the display allows data to be collected at a higher frequency. (On a typical 400 MHz Pentium II, data is collected 10 times per second with the display. With the display suspended, data is collected 40 times per second. These times depend on the spectrometer configuration and acquisition parameters.)

## **Save Data**

To save data from a time acquisition process, select **Time Acquisition | Save Data** from the menu. This command saves the time acquisition data that is currently shown in the spectral window. This function is not the same as streaming Data to Disk, and is limited to the last 2048 time acquisitions. Data is stored in a tab-delimited ASCII file, with time data arranged in columns. The first column is a time stamp for each acquisition, and is in seconds.

## Window Menu Functions

To arrange all spectral windows in a horizontally overlapping design, select **Window | Cascade** from the menu. To stack all spectral windows on top of one another, select **Window | Tile Horizontally** from the menu. To arrange all spectral windows side by side, select **Window | Tile Vertically** from the menu.

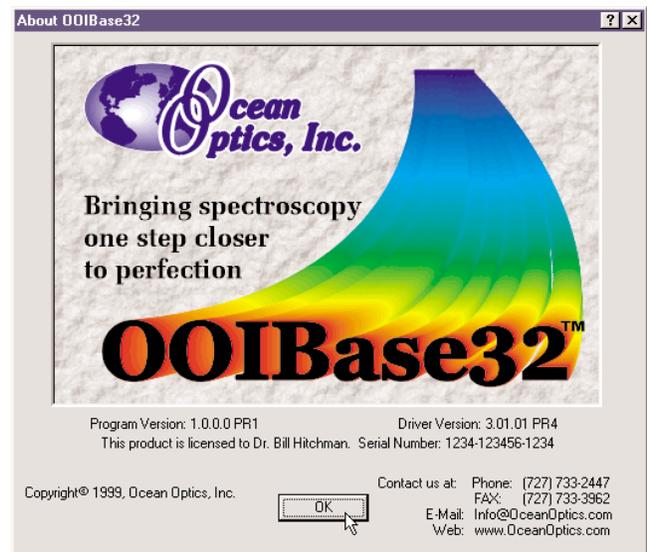
## Help Menu Functions

### Help Topics

OOIBase32 contains extensive help files. If you click on the help icon and then click on the toolbar button or menu item, a help file pertaining to that item opens. Also, on the bottom right of many dialog boxes is a **Help** button. Clicking on that button opens the help topic pertaining to the dialog box. You also have the option of selecting **Help | Help Topics** which contains three ways of accessing information. The **Contents** page lists all help topics according to subject area. The **Index** page lists all help topics in alphabetical order. By typing a word in the **Find** page, you are provided with all of the help topics that contain that designated word. You can also press the F1 key on your keyboard at any time to open the context-sensitive help files.

### About OOIBase32

The **About OOIBase32** dialog box contains important information regarding OOIBase32 such as the program version, the driver version, software licensee, and the software serial number. This dialog box also contains information on how to contact Ocean Optics. To access this dialog box, select **Help | About OOIBase32** from the menu.



## Toolbar Buttons

- |   |   |   |                                    |
|---|---|---|------------------------------------|
|    | Open a new spectral window  |    | Autoscale the graph                |
|    | Open a saved file   |    | Set the scale of the graph         |
|    | Save processed spectrum   |    | Unscale the graph                  |
|    | Copy graphical or spectral data   |    | Enable the cursor                  |
|    | Print   |    | Move cursor to the next left peak  |
|    | Help  |    | Move cursor 25 pixels to the left  |
|    | Subtract dark spectrum  |    | Move cursor 1 pixel to the left    |
|    | See spectrum in scope mode  |    | Move cursor 1 pixel to the right   |
|    | See spectrum in absorbance mode   |    | Move cursor 25 pixels to the right |
|   | See spectrum in transmission mode   |   | Move cursor to the next right peak |
|  | See spectrum in relative irradiance mode                                  |  | Configure the cursor               |
|  | Configure the spectrometer  |   |                                    |
|  | Take a dark spectrum globally or for a designated spectral window         |   |                                    |
|  | Take a reference spectrum globally or for a designated spectral window    |   |                                    |
|  | Freeze data acquisition globally or for a designated spectral window      |   |                                    |
|  | Configure data acquisition  |   |                                    |
|  | Reset acquisition parameters globally or for a designated spectral window |   |                                    |
|  | Kick start data acquisition   |   |                                    |
|  | Activate time acquisition   |   |                                    |
|  | Start time acquisition  |   |                                    |
|  | Pause time acquisition  |   |                                    |
|  | Stop time acquisition   |   |                                    |
|  | Suspend graph updates   |   |                                    |

# Experiment Tutorial

Before you begin your experiment, double-check that you have correctly installed your A/D converter, installed the operating software, and set up your light source and other sampling optics. Next:

1. Open OOIBase32. Although you already configured your hardware when you installed your A/D converter, double-check that the A/D Interface settings correspond to your setup by choosing **Spectrometer | Configure** from the menu.
2. Now check your spectrometer setup configurations in OOIBase32. A Wavelength Calibration Data Sheet is shipped with each spectrometer channel. You will need the numbers on this sheet. Select **Spectrometer | Configure** from the menu. For each spectrometer channel in your system, enable the channel and enter the First Coefficient, Second Coefficient, Third Coefficient, and Intercept. (As of July 1999, we began calculating third coefficients for all spectrometer systems; however, existing customers will have to enter a zero as their third coefficient.)
3. Adjust your acquisition parameters using the **Acquisition Parameters** dialog bar or the **Configure Data Acquisition** dialog box.
4. Acquiring spectral data from your spectrometer is quite simple. Assuming that you have followed the previous steps and started OOIBase32, your spectrometer is already acquiring data. Even with no light in the spectrometer, you should see a fluctuating trace on the bottom of the graph. If you put light into the spectrometer, you should see the graph trace rise with increasing light intensity. If this occurs, you have correctly installed your hardware and software.
5. Once you install and configure your hardware and software, and have set up your system, you are ready to take your measurements. There are four basic optical measurements from which to choose: absorbance, transmission, reflection, and relative irradiance measurements. The type of measurements you wish to make determines the configuration of the sampling optics for your system. The choice of reference and data analysis determines how the spectral results are presented. For each measurement, a reference and dark spectrum must first be made. After taking a reference and a dark spectrum, you may take as many absorbance, transmission, reflection, or relative irradiance measurement scans as you want. However, if at any time any sampling variable changes (integration time, averaging, smoothing, angle, temperature, fiber size, etc.) you *must* store a new dark and reference spectrum for your processed data to be accurate.

## Application Tips

If the signal you collect saturates the spectrometer (peaks are off the scale), you can decrease the light level on scale by:

- ◆ Decreasing the integration time
- ◆ Attenuating the light going into the spectrometer
- ◆ Switching to a smaller diameter fiber
- ◆ Using a neutral density filter with the correct optical density

If the signal you collect has too little light, you can increase the light level on scale by:

- ◆ Increasing the integration time
- ◆ Switching to a larger diameter fiber
- ◆ Avoiding the use of any optical filters

## Absorbance Experiments

Absorbance spectra are a measure of how much light is absorbed by a sample. For most samples, absorbance is linearly related to the concentration of the substance. The software calculates absorbance using the following equation:

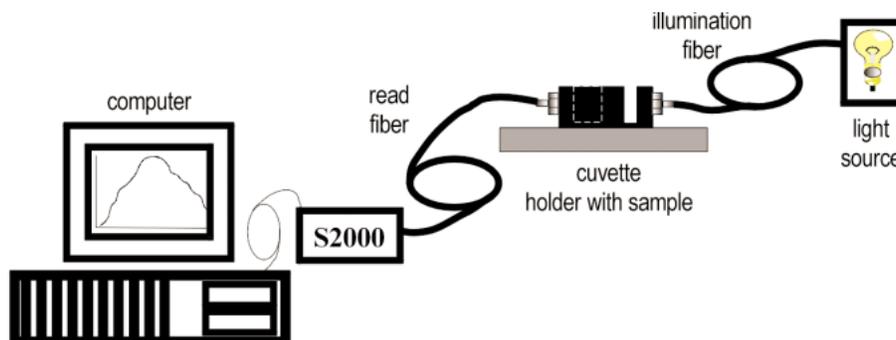
$$A_{\lambda} = -\log_{10} \left( \frac{S_{\lambda} - D_{\lambda}}{R_{\lambda} - D_{\lambda}} \right)$$

where  $S$  is the sample intensity at wavelength  $\lambda$ ,  $D$  is the dark intensity at wavelength  $\lambda$ ,  $R$  is the reference intensity at wavelength  $\lambda$ .

Absorbance can also be expressed as proportional to the concentration of the substance interacting with the light. Common applications include the quantification of chemical concentrations in aqueous or gaseous samples. To take an absorbance measurement:

1. Make sure you are in scope mode, by either clicking the **scope mode** icon on the toolbar, or selecting **Spectrum | Scope Mode** from the menu. Make sure the signal is on scale. The peak intensity of the reference signal should be about 3500 counts. Take a reference spectrum by first making sure nothing is blocking the light path going to your sample. The analyte you want to measure must be absent while taking a reference spectrum. Take the reference reading by clicking the **Store Reference Spectrum** icon on the toolbar or selecting **Spectrum | Store Reference** from the menu.
2. While still in **scope mode**, take a dark spectrum by first completely blocking the light path going to your sample. If possible, do not turn off the light source. Take the dark reading by clicking the **store dark spectrum** icon on the toolbar or selecting **Spectrum | Store Dark** from the menu. If you must turn off your light source to store a dark spectrum, make sure to allow enough time for the lamp to warm up before continuing your experiment.
3. Begin an absorbance measurement by first making sure the sample is in place and nothing is blocking the light going to your sample. Then choose the **absorbance mode** icon on the toolbar or select **Spectrum | Absorbance Mode** from the menu. To save the spectrum, click the **save** icon on the toolbar or select **File | Save | Processed** from the menu.

⚠ If at any time any sampling variable changes -- including integration time, averaging, boxcar smoothing, distance from light source to sample, etc. -- you must store a new reference and dark spectrum.



A typical configuration for an absorbance experiment.

## Transmission Experiments

Transmission is the percentage of energy passing through a system relative to the amount that passes through the reference. Transmission Mode is also used to show the portion of light *reflected* from a sample. Transmission and reflection measurements require the same mathematical calculations. The transmission is expressed as a percentage (%T) relative to a standard substance (such as air). The software calculates %T (or %R) by the following equation:

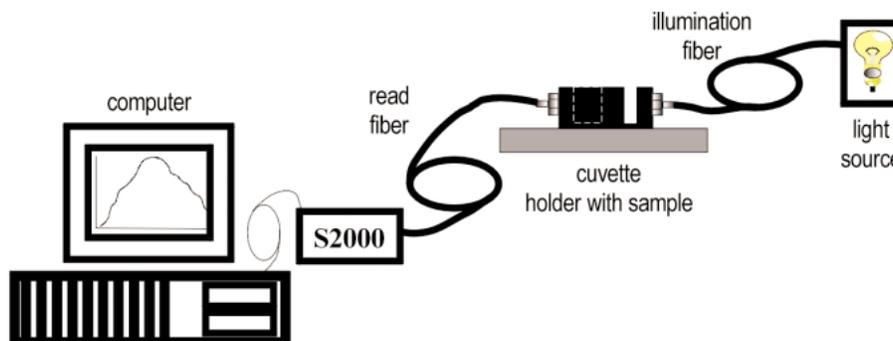
$$\%T_{\lambda} = \frac{S_{\lambda} - D_{\lambda}}{R_{\lambda} - D_{\lambda}} \times 100\%$$

where  $S$  is the sample intensity at wavelength  $\lambda$ ,  $D$  is the dark intensity at wavelength  $\lambda$ ,  $R$  is the reference intensity at wavelength  $\lambda$ .

Common applications include measurement of transmission of light through solutions, optical filters, optical coatings, and other optical elements such as lenses and fibers. To take a transmission measurement:

1. Make sure you are in scope mode, by either clicking the **scope mode** icon on the toolbar, or selecting **Spectrum | Scope Mode** from the menu. Make sure the signal is on scale. The peak intensity of the reference signal should be about 3500 counts. Take a reference spectrum by first making sure nothing is blocking the light path going to your sample. The analyte you want to measure must be absent while taking a reference spectrum. Take the reference reading by clicking the **store reference spectrum** icon on the toolbar or selecting **Spectrum | Store Reference** from the menu.
2. While still in **scope mode**, take a dark spectrum by first completely blocking the light path going to your sample. If possible, do not turn off the light source. Take the dark reading by clicking the **store dark spectrum** icon on the toolbar or selecting **Spectrum | Store Dark** from the menu. If you must turn off your light source to store a dark spectrum, make sure to allow enough time for the lamp to warm up before continuing your experiment.
3. Begin a transmission measurement by first making sure the sample is in place and nothing is blocking the light going to your sample. Then choose the **transmission mode** icon on the toolbar or select **Spectrum | Transmission Mode** from the menu. To save the spectrum, click the **save** icon on the toolbar or select **File | Save | Processed** from the menu.

⚠ If at any time any sampling variable changes -- including integration time, averaging, boxcar smoothing, distance from light source to sample, etc. -- you must store a new reference and dark spectrum.



A typical configuration for a transmission experiment.

## Reflection Experiments

Reflection is the return of radiation by a surface, without a change in wavelength. The reflection may be:

- ◆ Specular , in which the angle of incidence is equal to the angle of reflection.
- ◆ Diffuse , in which the angle of incidence is not equal to the angle of reflection.

Every surface returns both specular and diffuse reflections. Some surfaces may return mostly specular reflection, others more diffuse reflection. The glossier the surface, the more specular the reflection. Reflection is expressed as a percentage (%R) relative to the reflection from a standard (such as our WS-1 white reference for a diffuse reflection measurement or a plane mirror for specular reflection):

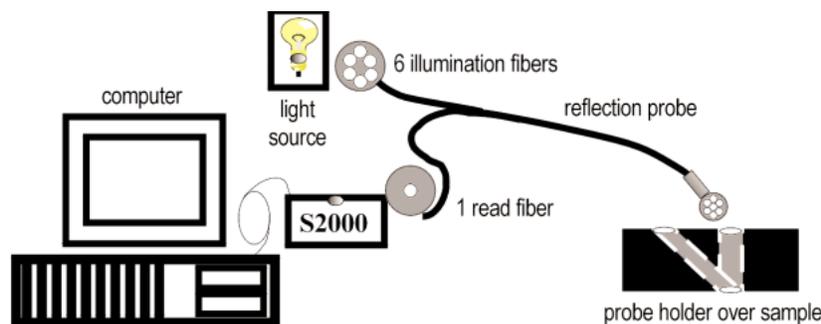
$$\%R_{\lambda} = \frac{S_{\lambda} - D_{\lambda}}{R_{\lambda} - D_{\lambda}} \times 100\%$$

where  $S$  is the sample intensity at wavelength  $\lambda$ ,  $D$  is the dark intensity at wavelength  $\lambda$ ,  $R$  is the reference intensity at wavelength  $\lambda$ .

Both transmission and reflection measurements are made while in the transmission mode, as the mathematics required to calculate reflection and transmission measurements are identical. (If you want the vertical axis label to match your measurement, select **File | Settings** from the menu, choose the **Miscellaneous Settings** tab, find **Percent Transmission Mode Label** and select **Percent Reflection** as the label.) Common applications include measuring the reflection properties of mirrors and anti-reflection coatings, and measuring the visual properties of the color in paints, graphic arts, plastics, and food products. To take a reflection measurement:

1. Make sure you are in scope mode, by either clicking the **scope mode** icon on the toolbar, or selecting **Spectrum | Scope Mode** from the menu. Make sure the signal is on scale. The peak intensity of the reference signal should be about 3500 counts. Take a reference spectrum by first making sure nothing is blocking the light path going to your sample. The analyte you want to measure must be absent while taking a reference spectrum. Take the reference reading by clicking the **store reference spectrum** icon on the toolbar or selecting **Spectrum | Store Reference** from the menu.
2. While still in **scope mode**, take a dark spectrum by first completely blocking the light path going to your sample. If possible, do not turn off the light source. Take the dark reading by clicking the **store dark spectrum** icon on the toolbar or selecting **Spectrum | Store Dark** from the menu. If you must turn off your light source to store a dark spectrum, make sure to allow enough time for the lamp to warm up before continuing your experiment.
3. Begin a reflection measurement by first making sure the sample is in place and nothing is blocking the light going to your sample. Then choose the **transmission mode** icon on the toolbar or select **Spectrum | Transmission Mode** from the menu. The mathematics required to calculate reflection measurements are identical to those necessary to compute a transmission spectrum. To save the spectrum, click the **save** icon on the toolbar or select **File | Save | Processed** from the menu.

Ⓜ If at any time a sampling variable changes -- including integration time, averaging, boxcar smooth-ing, distance from light source to sample, etc. -- you must store a new reference and dark spectrum.



A typical configuration for a reflection experiment.

## Relative Irradiance Experiments

Irradiance is the amount of energy at each wavelength from a radiant sample. In relative terms, it is the fraction of energy from the sample compared to the energy collected from a lamp with a blackbody energy distribution, normalized to 1 at the energy maximum. Relative irradiance is calculated by the following equation:

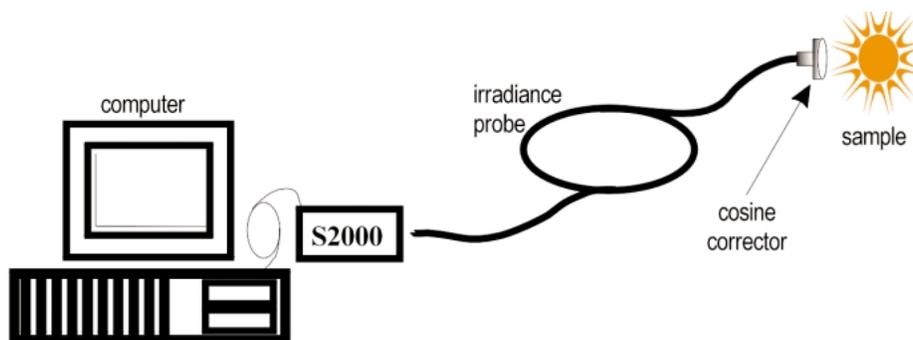
$$I_{\lambda} = B_{\lambda} \left( \frac{S_{\lambda} - D_{\lambda}}{R_{\lambda} - D_{\lambda}} \right)$$

where  $B$  is relative energy of the reference calculated from the color temperature,  $S$  is the sample intensity at wavelength  $\lambda$ ,  $D$  is the dark intensity at wavelength  $\lambda$ ,  $R$  is the reference intensity at wavelength  $\lambda$ .

Common applications include characterizing the light output of LEDs, incandescent lamps and other radiant energy sources such as sunlight. Also included in irradiance measurements is fluorescence, in which case the spectrometer measures the energy emitted by materials that have been excited by light at a shorter wavelength. To take a relative irradiance measurement:

1. Make sure you are in scope mode, by either clicking the **scope mode** icon on the toolbar, or selecting **Spectrum | Scope Mode** from the menu. Make sure the signal is on scale. The peak intensity of the reference signal should be about 3500 counts. The light source must be a blackbody of known color temperature. Take the reference reading by clicking the **store reference spectrum** icon on the toolbar or selecting **Spectrum | Store Reference** from the menu.
2. While still in **scope mode**, take a dark spectrum by completely blocking the light path. Take the dark reading by clicking the **store dark spectrum** icon on the toolbar or selecting **Spectrum | Store Dark** from the menu. If you must turn off your light source to store a dark spectrum, make sure to allow enough time for the lamp to warm up before continuing your experiment.
3. Take a relative irradiance measurement by first positioning the fiber at the light source you wish to measure. Then choose the **irradiance mode** icon on the toolbar or select **Spectrum | Relative Irradiance Mode** from the menu. In the **Reference Color Temperature** dialog box, enter the light source's color temperature in Kelvin and click **OK**. To save the spectrum, click the **save** icon on the toolbar or select **File | Save | Processed** from the menu.

⚠ If at any time any sampling variable changes -- including integration time, averaging, boxcar smoothing, distance from light source to sample, etc. -- you must store a new reference and dark spectrum.



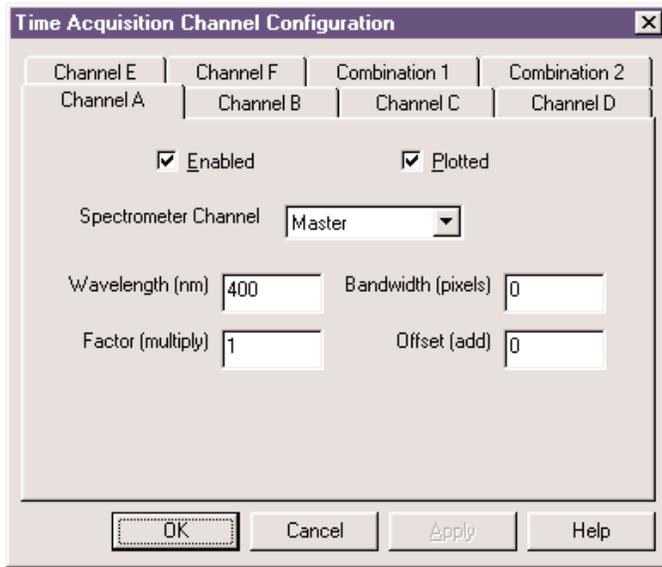
A typical configuration for an irradiance experiment.

For measuring *absolute* spectral intensities, Ocean Optics offers the **IRRAD2000**, a low-cost spectroradiometric system. The system includes a high-sensitivity, radiometrically calibrated miniature fiber optic spectrometer, a 200  $\mu\text{m}$  optical fiber, a cosine-corrected irradiance probe, a NIST-traceable calibrated light source, an A/D converter, and operating software.

## Time Acquisition Experiments

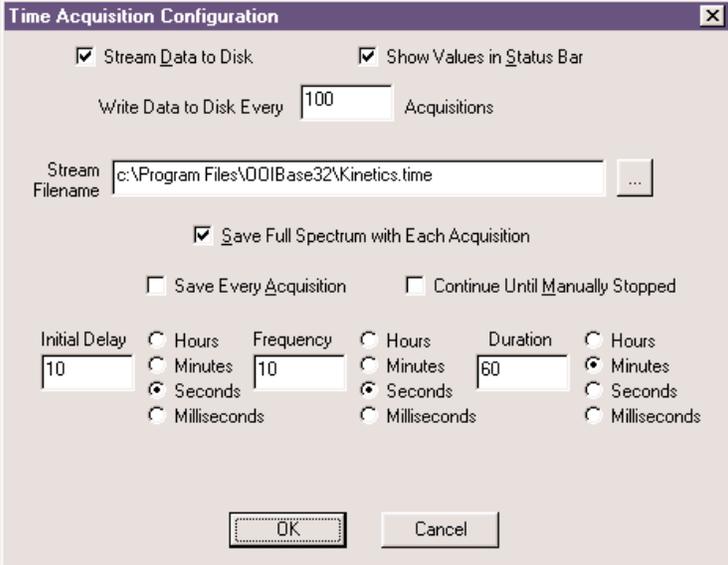
Time acquisition experiments track processes, perform kinetic analyses, and monitor spectral events as a function of time. You can collect as a function of time spectral data from up to 6 single wavelengths (designated as Channels A through F) and up to two mathematical combinations of these wavelengths (designated as Combinations 1 and 2). You can acquire data in any mode. (Before reading this section, read the **Time Acquisition Menu Functions** section on pages 27-29.) To perform a time series experiment, follow these steps:

1. While in scope mode, store reference and dark spectra, if desired, and choose a view mode, such as absorbance.
2. Access the Time Acquisition Channel Configuration dialog box by selecting **Time Acquisition | Configure | Configure Time Channels** from the menu.
  - ◆ Select **Enabled** to set the time acquisition calculation for the wavelength. Without selecting Enabled, the time acquisition process will not calculate data.
  - ◆ Enable **Plotted** to see a real-time graph of the acquired data in a spectral window.
  - ◆ Select a **Spectrometer Channel** for your time acquisition process.
  - ◆ In the **Wavelength (nm)** box, specify the analysis wavelength. For **Bandwidth (pixels)**, specify the number of pixels averaged around the analysis wavelength.
  - ◆ Select a multiplicative **Factor** to apply to the data before it is plotted or stored. Select an additive constant or **Offset** to apply to the data after the factor is applied and before the data is plotted or stored. The equation for the Factor and Offset functions is:  $\text{Results} = (\text{Factor} \times \text{Data}) + \text{Offset}$ .
3. If desired, configure a time acquisition process for the second single wavelength by selecting the **Channel B** page. To configure a time acquisition process for the third, fourth, fifth, and sixth single wavelengths, select the **Channel C**, **Channel D**, **Channel E**, and **Channel F** pages, respectively, and set the necessary parameters.
4. If desired, configure a time acquisition process for a combination of two time channels by selecting **Combination 1**.
  - ◆ Select **Enabled** to set the time acquisition calculation for the wavelength.
  - ◆ Enable **Plotted** to see a real time graph of the acquired data in a spectral window.
  - ◆ Specify Time Channel A through F for the **First Channel**.
  - ◆ Select the mathematical **Operation** to produce the data for Combination 1.
  - ◆ Specify Time Channel A through F for the **Second Channel**.
  - ◆ Select a multiplicative **Factor** to apply to the data before it is plotted or stored. Select an additive constant or **Offset** to apply to the data after the factor is applied and before the data is plotted or stored. The equation for the Factor and Offset functions is:  $\text{Results} = (\text{Factor} \times \text{Data}) + \text{Offset}$ .
5. If desired, configure a time acquisition process for the **Combination 2** page. It is almost identical to the



Combination 1 page except that you have the option of choosing Combination 1 for your **First Channel** or **Second Channel**.

6. Click the OK button for the Time Acquisition Channel Configuration dialog box.
  7. Access the Time Acquisition Configuration dialog box by selecting **Time Acquisition | Configure | Configure Acquisition** from the menu.
    - ◆ Enable **Stream Data to Disk** to save time acquisition data.
    - ◆ Enter a value in the **Write Data to Disk Every X Acquisitions** box to set the frequency for saving data. The smaller this number, the more frequently data is saved. The larger this number, the less frequently data is saved; but entering a large number enhances the performance of the time acquisition process.
- ℞ At specified time intervals, data from OOIBase32 is stored into time acquisition channels or combination channels. This data can be simply plotted in a spectral window, or streamed to disk, or both. Up to 2048



acquisitions can be displayed in a spectral window. If more than 2048 acquisitions are gathered, only the last 2048 of them will be displayed. To store more than 2048 acquisitions, you *must* stream the data to disk. Writing data to the disk is a slow process (relative to the speed of some spectral acquisitions) and causes a decrease in system performance. However, writing data to disk more frequently gives a larger margin of safety.

- ◆ Enable **Show Values in Status Bar** to see the time acquisition values in the status bar. These values replace the cursor values.
  - ◆ Name the **Stream Filename** for the time acquisition process. Clicking on the ellipsis to the right of this box opens a file save dialog box allowing you to navigate to a designated folder.
  - ◆ Enable the **Save Full Spectrum with Each Acquisition** to save full spectra.
  - ◆ Enable **Save Every Acquisition** to store data for every spectral acquisition during the time acquisition process.
- ℞ There are options to either store data for each acquisition, or to collect data only after a specified delay. Several factors affect the minimum time acquisition frequency, including integration time, number of spectrometer channels, samples averaged, and computer speed. If you specify that you want data to be stored every 100 milliseconds, it is guaranteed that the delay will be *at least* 100 milliseconds, but could be much longer depending on your experimental configuration. OOIBase32 spends a large amount of time calculating, rendering and displaying the spectra in a spectral window. You have the option to suspend graph display, which greatly improves performance.
- ◆ Enable **Continue Until Manually Stopped** to store data until you manually stop the acquisition process

- by clicking on the stop icon or selecting **Time Acquisition | Stop**.
- ◆ Enter an **Initial Delay** to set the delay before the time acquisition process begins. However, the delay countdown cannot begin until you initiate the time acquisition process by clicking on the start icon or selecting **Time Acquisition | Start** from the menu. Be sure to select **Hours, Minutes, Seconds** or **Milliseconds** immediately to the right of the initial delay entry.
  - ◆ Enter a value to set the **Frequency** of the data collected in a time acquisition process. Data from a time acquisition is stamped with a time that is accurate to 1 millisecond. Be sure to select **Hours, Minutes, Seconds** or **Milliseconds** immediately to the right of the frequency entry.
  - ◆ Enter a value to set the **Duration** for the entire time acquisition process. Be sure to select **Hours, Minutes, Seconds** or **Milliseconds** to the right of the duration entry.
8. Click the OK button for the Time Acquisition Configuration dialog box.
  9. Initiate the Time Acquisition mode by either clicking on the alarm clock icon in the Time Acquisition toolbar or selecting **Time Acquisition | Activate Time Acquisition** from the OOIBase32 menu. You can then start a time acquisition process by selecting the start icon or by selecting **Time Acquisition | Start** from the menu.

## Time Normalized Intensity Experiments

The Time Normalized Intensity mode is most often utilized for relative irradiance experiments, or experiments where the reference and sample scans cannot use the same integration times because either the reference or the sample is saturating the spectrometer's detector. By following the procedures below, data is normalized as a function of time even if you use one integration time for the reference and a different integration time for the sample. However, in order for this processing technique to produce valid spectral data, separate dark spectra must be stored for each integration time used.

1. Make sure you are in Scope Mode by selecting the Scope Mode icon or choosing **Spectrum | Scope Mode** from the menu.
2. Enable the Time Normalized Intensity mode by selecting **Spectrum | Time Normalized Intensity | Enable** from the menu. Make sure there is a check mark next to **Enable**.
3. Set your acquisition parameters for your experiment and the integration time for your Reference Dark and Reference scans by selecting **Spectrum | Configure Data Acquisition** from the menu or accessing the acquisition parameters dialog bar above the graph.
4. Store a Reference Dark spectrum for all enabled spectrometer channels in the active spectral window by selecting **Spectrum | Time Normalized Intensity | Store Reference Dark** from the menu. The reference dark spectrum is taken with the light path blocked and with the integration time set to the value to be used for acquiring the reference spectra. Storing a reference dark spectrum is requisite before the software can calculate absorbance, transmission, and relative irradiance spectra in the time normalized intensity mode.
5. Store your Reference spectrum for all enabled spectrometer channels in a spectral window by selecting **Spectrum | Time Normalized Intensity | Store Reference** from the menu. This spectrum is taken with the light source on and a blank in the sampling region. Storing a reference spectrum is requisite before the software can calculate absorbance, transmission, and reflection spectra in the time normalized intensity mode.
6. Change your integration time for your Sample Dark and Sample scans. This parameter is the only acquisition parameter that you can change and still have valid spectral data. Change the integration time by selecting **Spectrum | Configure Data Acquisition** from the menu or accessing the **Integ. Time (msec)** box in the acquisition parameters dialog bar above the graph.
7. Store a Sample Dark spectrum for all enabled spectrometer channels in the active spectral window by selecting **Spectrum | Time Normalized Intensity | Store Sample Dark** from the menu. The sample dark spectrum is taken with the light path blocked and with the integration time set to the value to be used for acquiring the sample spectra. Storing a sample dark spectrum is requisite before the software can calculate absorbance, transmission, and relative irradiance spectra in the time normalized intensity mode.
8. Select the Absorbance, Transmission, or Relative Irradiance icons and begin taking your sample scans.

## File Formats

There are several types of files created by OOIBase32. You can choose to view and edit any of these tab-delimited ASCII files with any text editor. The types of files created by OOIBase32 are:

- ◆ Spectral Data Files
- ◆ Experimental Parameters Files
- ◆ Display Properties Files
- ◆ Spectrometer Configuration Files
- ◆ Time Acquisition Parameters Files
- ◆ Time Acquisition Data Files and Stream Files
- ◆ Grams/32 SPC Files

Below is a description of each file's format as well as the format for data that is copied to the clipboard (Copied Data Clipboard Format).

### Spectral Data Files

A Spectral Data File consists of a header that contains all the data acquisition and processing parameters in effect when the data file was written, followed by tab-delimited spectral data.

The information provided in a Spectral Data File includes the date and time the file was saved, the name of the user, and the software serial number specified in the Registration page of the OOIBase32 Settings dialog box. A Spectral Data File also includes the Spectrometer Channel used to report the data, the integration time (in milliseconds), spectra averaged, and boxcar smoothing width. Also included in the file is the status of the correct for electrical dark algorithm, the status of the dual-beam reference, and the reference channel used when the file was saved. Below is an example of a Spectral Data File .

```
OOIBase32 Version 0.0.1.0 Data File
+++++
Date: Tuesday, January 05, 1999, 11:47:41
User: Valued Ocean Optics Customer
Spectrometer Serial Number: I2J345
Spectrometer Channel: Slave1
Integration Time (msec): 7
Spectra Averaged: 1
Boxcar Smoothing: 0
Correct for Electrical Dark: Disabled
Time Normalized: Enabled
Dual-beam Reference: Disabled
Reference Channel: Master
>>>>Begin Spectral Data<<<<<
370.00      0.00
370.36      0.00
370.72     23.14
371.08     23.14
```

### Experimental Parameters Files

An Experimental Parameters File contains all of the acquisition parameters necessary to conduct an experiment, such as integration time (in milliseconds), the delay between flashes (in milliseconds), boxcar smoothing width, and spectra averaged. The file also notes if the correct for electrical dark is enabled (1 if enabled, 0 if disabled) and the type of triggering used (0 for no trigger, 1 for software trigger, 2 for synchronization or 3 for hardware trigger). The view mode (Scope, Absorbance, Transmission, or Irradiance) and color temperature (in Kelvin) of the reference lamp for irradiance measurements are also included.

The information provided in an Experimental Parameters File includes settings information such as the active display settings file and the spectrometer configuration file used when the experiment was saved. Additional information includes data about each spectrometer channel in your setup. The file notes whether or not each channel was enabled (1 if enabled, 0 if disabled), and whether or not a dark or reference spectra was stored (1 if stored, 0 if not stored). The file also names the saved files of the dark, reference, and sample spectra. Below is an example of an Experimental Parameters File.

```
[Acquisition Parameters]
Integration Time=7
Flash Delay=100
Boxcar=0
Averages=1
Correct Dark=0
External Trigger=0
View Mode=Scope Mode
ColorTemperature=3100

[Settings]
Display File=c:\Program Files\ooibase32\ADC1000.display
Spectrometer File=c:\Program Files\ooibase32\ADC1000.spec

[Channel0]
Enabled=1
Dark Stored=1
Reference Stored=1
Dark Filename=c:\Program Files\OOIBase32\Test.Master.dark
Reference Filename= c:\Program Files\OOIBase32\Test.Master.reference
Sample Filename= c:\Program Files\OOIBase32\Test.Master.sample
```

## Display Properties Files

A Display Properties File contains the parameters used when drawing a spectrum. It names the screen origin of the window, as well as its size. Next, it lists the RGB color value for the spectral window background, the RGB color value for the axes and labels, whether or not a background bitmap is displayed (1 if displayed, 0 if not displayed) and the file name of the background bitmap selected. The file also contains numerous values for the X and Y axes, such as the minimum and maximum *autoscale* values of both the X and Y axes, the minimum and maximum *displayed* values on the X and Y axes and the title associated with the Y axis.

Also included are the parameters set for the cursor. The file tells you if the cursor was active (1 if active, 0 if not active), the pixel location of the cursor, the spectral trace in control of the cursor, and if the cursor was displayed in the status bar (1 if displayed in the status bar, 0 if it is not). As with the cursor properties, the file also contains the properties set for the graph trace. These properties include the line style, fill pattern, RGB color values, and width of the graph trace and graph points. Below are the numbers that correspond to patterns and styles specified in a Display Properties File .

<u>Line Pattern</u>	<u>Fill Pattern</u>	<u>Point Style</u>
0=None	0=None	0=None
1=Solid	1=Solid	1=Dot
2=Long Dash	2=25%	2=Box
3=Dotted	3=50%	3=Triangle
4=Short Dash	4=75%	4=Diamond
5=Long-Short-Long Dash	5=Horizontal Stripe	5=Star
6=Dash Dot	6=Vertical Stripe	6=Vertical Line
	7=45° Stripe	7=Horizontal Line
	8=135° Stripe	8=Cross
	9=Diagonal Hatch	9=Circle
	10=Cross Hatch	10=Square
		11=Inverted Triangle
		12=Diagonal Cross
		13=Open Triangle
		14=Open Circle
		15=Open Diamond

Below is an example of a Display Properties File.

```
[WindowPlacement]
WindowPlacement=0,1,-1,-1,-4,-23,3,3,753,466

[GraphSettings]
BackgroundColor=0
ForegroundColor=65535
BackgroundBitmapActive=1
BackgroundBitmapFilename=D:\OOIProg\working\ooibase32\Gray1OnBlack.bmp
YAxisMax=4100.0000000000000000
YMax=4100.0000000000000000
XAxisMax=1003.115851399641500
XMax=1003.115851399641500
YAxisMin=0.0000000000000000
YMin=0.0000000000000000
XAxisMin=350.0000000000000000
XMin=350.0000000000000000
YTitle=Intensity (counts)
CursorActive=1
CursorPixel=1001
CursorActiveTrace=0
CursorInStatusBar=1

[Cursor]
LinePattern=2
FillPattern=2
LineColor=16711935
LineWidth=1
PointStyle=5
PointColor=255
PointSize=3

[Trace0]
LinePattern=2
FillPattern=2
LineColor=255
LineWidth=1
PointStyle=1
PointColor=255
PointSize=3
```

## Spectrometer Configuration Files

The Spectrometer Configuration File contains all the settings for your spectrometer and A/D interface. This file is the most important type of file in OOIBase32 as it controls how your spectrometer communicates with your computer.

The Spectrometer Configuration File contains extremely important information, such as the type of spectrometer and A/D converter that you are using. It includes the serial number of the spectrometer, the interrupt request of the A/D converter, the base address (I/O range) of the A/D converter, the serial port number for a SAD500, and the pixel resolution of the SAD500 serial port.

The most important line in a Spectrometer Configuration File is the **Initialized** line. This line tells you if the spectrometer has been successfully operated. It provides **Initialized = 1** if the spectrometer has been successfully operated, **Initialized = 0** if there is a problem. Also included in this file are the first and second wavelength calibration coefficients (and a third if you own a spectrometer manufactured after July 1999), and the wavelength calibration intercept. Below is a list of the additional functions included in a Spectrometer Configuration File.

NLEnabled	1 if detector linearity correction enabled, 0 if not enabled
SLEnabled	1 if stray light correction is enabled, 0 if not enabled
SLConstant	stray light constant applied
NLCoefs	detector linearity correction coefficients
ChannelEnabled	1 if spectrometer channel enabled, 0 if not enabled
ReferenceChannel	reference spectrometer channel used in reference monitoring, 0 for Master, 1 for Slave 1, etc.
ReferenceType	type of reference monitoring applied, 0=none, 1=single point, 2=wavelength-by-wavelength, 3=integrated intensity
ReferenceWavelength	reference wavelength, used in single point reference monitoring
ReferenceBandwidthStart	starting wavelength of the integrated intensity for reference monitoring
ReferenceBandwidthEnd	ending wavelength of the integrated intensity for reference monitoring
ReferenceWavelengthPixel	spectrometer pixel of the reference wavelength used in reference monitoring
ReferenceBandwidthStartPixel	spectrometer pixel of the starting integrated intensity wavelength used in reference monitoring
ReferenceBandwidthEndPixel	spectrometer pixel of the ending integrated intensity wavelength used in reference monitoring

Below is an example of a Spectrometer Configuration File.

```
[General]
SpectrometerType=S2000
ADCType=ADC1000
SerialNumber=I2J345
SpectrometerSubType=0
IRQ=5
BaseAddress=768
SerialPort=0
SerialPortResolution=0
ADC1000RotationEnabled=0
ADC1000Rotation=0
Initialized=1
DisplayLimitedRange=0

[Channel0]
WLFirst=0.378815
WLSecond=-1.718910e-005
WLIntercept=179.220001
NLEnabled=0
SLEnabled=1
SLConstant=0.000000e+000
NLCoef0=0.000000e+000
NLCoef1=0.000000e+000
NLCoef2=0.000000e+000
NLCoef3=1.230000e+002
NLCoef4=0.000000e+000
NLCoef5=0.000000e+000
NLCoef6=0.000000e+000
NLCoef7=0.000000e+000
ChannelEnabled=1
ReferenceChannel=0
ReferenceType=0
ReferenceWavelength=800.000000
ReferenceBandwidthStart=500.000000
ReferenceBandwidthEnd=600.000000
ReferenceWavelengthPixel=1351
ReferenceBandwidthStartPixel=426
ReferenceBandwidthEndPixel=723
```

## Time Acquisition Parameters Files

The Time Acquisition Parameters File contains all of the information and parameters specified for a time acquisition process. The file includes the preference for streaming all data to disk (1 if stream data to disk, 0 if not), the filename specified if data streams to disk, and the preference for saving every acquisition or using a delay between acquisitions (1 if save every acquisition, 0 if use delay).

The file specifies the initial delay after the start of the time acquisition and the unit of time for the delay. It specifies how frequently the data is collected and the unit of time for the frequency. It also specifies the duration of the time acquisition process and the unit of time for the duration. Also included is the preference for acquiring data until manually stopped), the preference for showing values in the status bar (1 if values shown, 0 if not), and the log frequency or number of acquisitions before data is streamed to disk.

For each time channel (Channels A through F) used, the file lists if each is enabled (1 if enabled, 0 if not enabled). Then the file lists the Wavelength selected, the Pixel for the selected wavelength, the bandwidth for the current analysis wavelength, the multiplicative factor specified, the additive offset specified, and if the data is plotted (1 if displayed, 0 if not displayed). Finally, the spectrometer channel chosen is named. (Rate Only and Rate Bandwidth functions are not enabled in this release of OOIBase32.)

For each time channel combination (Combinations 1 and 2) used, the file lists if each is enabled (1 if enabled, 0 if not enabled), the multiplicative factor specified, and the additive offset specified. Then the file lists the first and second time channels for the combination calculation (A through F and Combo 1). Finally, the mathematical operation is specified -- add, subtract, multiply or divide the results of the two time channels. (Rate Only and Rate Bandwidth functions are not enabled in this release of OOIBase32.)

Below is an example of a Time Acquisition Parameters File:

```
[Acquisition Parameters]
StreamDataToDisk=1
Filename=C:\WINDOWS\DESKTOP\xx1.time
SaveEveryAcquisition=1
InitialDelay=1
InitialDelayUnit=Seconds
Frequency=1
FrequencyUnit=Seconds
Duration=20
DurationUnit=Seconds
ContinueUntilManuallyStopped=0
ShowValuesInStatusBar=1
LogFrequency=20
Save Full Spectram=0

[ChannelA]
Enabled=1
Wavelength=400.00000000000000
Pixel=599
Bandwidth=0
Factor=1.0000000000000000
Offset=0.0000000000000000
Plotted=1
SpectrometerChannel=Master
RateOnly=0
RateBandwidth=0

[Combo1]
Enabled=1
Factor=1.0000000000000000
Offset=0.0000000000000000
FirstChannel=A
SecondChannel=B
Operation=Add
RateOnly=0
RateBandwidth=0
```

## Time Acquisition Data Files and Stream Files

The first column of a time acquisition data or stream file contains the time stamp, in seconds, of each acquisition. Data from a time acquisition is stamped with a time that is accurate to 1 millisecond. These time stamps represent the time lapse after clicking on the time acquisition start icon or selecting **Time Acquisition | Start** from the menu. Subsequent columns contain the wavelengths and combination wavelengths selected in the Configure Time Channels dialog box. All data is tab-delimited.

Time (sec)	Channel A	Channel B	Combo 1
1.020	42.000	41.333	40.727
1.053	42.000	42.000	41.818
1.083	47.000	42.333	41.545
1.114	48.000	41.333	41.636
1.156	43.000	42.000	40.000
1.186	40.000	42.000	42.363
1.217	42.000	40.666	41.363

## Grams/32 SPC Files

OOIBase32 can save and open data files in the Galactic Software GRAMS/32® SPC file format. Details on this file format can be obtained from: <http://www.galactic.com/galactic/data/spcfile.htm>. OOIBase32 can only open SPC files that were originally saved in OOIBase32.

## Copied Data Clipboard Format

OOIBase32 can copy spectral data directly to the Windows clipboard. For further data analysis, paste this data into a variety of applications, including Microsoft Excel. The data is arranged in columns, with the wavelengths and spectral intensities for each selected spectrometer channel in adjacent columns. An optional header identifies each tab-delimited column. Below is an example of how the data copied to the clipboard is formatted.

Master WL	Master Data	Slave1 WL	Slave 1 Data
179.22	0.000	328.49	0.000
179.60	0.000	328.87	0.000
179.98	0.025	329.25	1.002
180.36	0.029	329.62	1.026
180.73	0.032	330.00	1.035
181.11	0.038	330.38	1.042

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## Installed Files

The following files are installed during an OOIBase32 installation. The default OOIBase32 installation directory is **C:\Program Files\OOIBase32**. If you chose to install OOIBase32 in another directory, the files below are installed in the directory that you designated.

C:\Program Files\OOIBase32Beta1\OOIBase32.exe	Main executable file
C:\Program Files\OOIBase32Beta1\OOIBase32.hlp	Main help file
C:\Program Files\OOIBase32Beta1\OOIBase32.cnt	Help file contents
C:\Program Files\OOIBase32Beta1\Version History.txt	Version release history
C:\Program Files\OOIBase32Beta1\OOIBase32QuickStart.pdf	Quick-start guide to OOIBase32
C:\Program Files\OOIBase32Beta1\OOIDrv32.dll	Spectrometer device driver
C:\Program Files\OOIBase32Beta1\install.log	Uninstall information
C:\Program Files\OOIBase32Beta1\UnWise.exe	Uninstall program
C:\Program Files\OOIBase32Beta1\Default.spec	Default spectrometer file
C:\Program Files\OOIBase32Beta1\Default.display	Default display file
C:\Program Files\OOIBase32Beta1\Backgrounds	Directory containing several background bitmaps (bitmaps not included)

The following files can be installed in your system directory:

Comctrl32.dll  
Ctl3d32.dll  
Mfc40.dll  
Mfc42.dll  
Msvcrt40.dll  
Oich2d32.dll  
Oleaut32.dll  
Olepro32.dll  
Shw95dll.dll  
Threed32.ocx  
Wow32.dll

If you chose to make backup copies of files during your installation, the original files are placed in the backup subdirectory of your OOIBase32 Installation.