



Jaz

Installation and Operation Manual

Document Number 013-RD000-000-02-1008

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About This Manual

Document Purpose and Intended Audience

This document provides the users of Jaz with instructions for setting up, calibrating and performing experiments with their Jaz unit.

Document Summary

Chapter	Description
Chapter 1: Introduction	Contains descriptive information about Jaz and how sampling works. It also provides a list of system requirements, interface options, and shipment components.
Chapter 2: Installing	Provides installation instructions.
Chapter 3: Operating Jaz	Provides instructions for using Jaz without SpectraSuite software. For information on using Jaz with SpectraSuite, see the SpectraSuite manual (see Product-Related Documentation below).
Chapter 4: Maintenance	Contains recommended steps to isolate and correct common problems. Also contains instructions for obtaining software updates.
Appendix A: Calibrating the Wavelength of	Provides instructions for calibrating the Jaz spectrometer module.
Appendix B: Specifications	Contains technical specifications for the Jaz stack and its individual modules.

Product-Related Documentation

You can access documentation for Ocean Optics products by visiting our website at <http://www.oceanoptics.com>. Select *Technical* → *Operating Instructions*, then choose the appropriate document from the available drop-down lists. Or, use the **Search by Model Number** field at the bottom of the web page.

- Detailed instructions for SpectraSuite Spectrometer Operating Software are located at: <http://www.oceanoptics.com/technical/SpectraSuite.pdf>.

Engineering-level documentation is located on our website at *Technical* → *Engineering Docs*.

You can also access operating instructions for Ocean Optics products from the *Software and Technical Resources* CD that ships with the product.

Upgrades

Occasionally, you may find that you need Ocean Optics to make a change or an upgrade to your system. To facilitate these changes, you must first contact Customer Support and obtain a Return Merchandise Authorization (RMA) number. Please contact Ocean Optics for specific instructions when returning a product.

Service

Our Total Technical Service protection plans protect your spectrometer for one year for any contingency - no matter what the circumstances, including total loss. Under these plans, Ocean Optics will repair or replace your instrument with no deductible or any other out-of-pocket expense required from you. HR service plans include the following:

- **TTS-JAZ:** Protects your Ocean Optics Jaz spectrometer for any contingency for 1 year. Provides for full spectrometer replacement, if necessary. Limited to 1 full replacement per year.

In addition, we also have the WAVECAL-USB spectrometer maintenance and calibration service available to recalibrate, clean and perform any adjustments necessary on your spectrometer.

Contact us to learn more about these great service plans.

Chapter 1

Introduction

Product Overview

Jaz is a community of stackable, modular and autonomous component modules that combine to create a community of smart sensing instruments that is unfettered by the limits of traditional optical sensing instrumentation: a powerful microprocessor and onboard display eliminate the need for a PC; stackable, autonomous instrument modules allow users to customize the system to their changing application needs; and Ethernet connectivity plus SD card data storage capability facilitate remote operation.

Jaz is built on a platform that expands to include a light source, rechargeable lithium-ion battery and up to 8 spectrometer modules to make Jaz the first analytical instrument easily adaptable for the field, lab or process environment. Jaz can also connect to a computer via the USB port. When connected through a USB 2.0 or 1.1, the spectrometer draws power from the host computer. Jaz, like all USB devices, can be controlled by our SpectraSuite software, a completely modular, Java-based spectroscopy software platform that operates on Windows, Macintosh and Linux operating systems.

Jaz is extremely adaptable. It can be powered via battery, USB connection, over the Ethernet, or from a power outlet. The Jaz display can be rotated 180 degrees in either direction and the faceplate itself can be specified for either orientation. You can order the specific modules needed for your particular application to be built in the Jaz stack, making Jaz a uniquely customizable scientific instrument and eliminating the cost of unnecessary components.



Stack of Jaz Modules

Jaz Modules

Jaz consist of a stack of individual spectroscopic instruments specified by the user to suit their unique application. Modules available for the Jaz stack include the following:

Module	Description
JAZ-S	Spectrometer and grating (up to 8 can be configured in a stack)
JAZ-DPU	Processor (CPU), OLED display and keypad
JAZ-E	Ethernet and memory module. Includes one slot for an SD card (up to 2 GB).
JAZ-B	Battery (lithium-ion) and memory module. Includes two slots for an SD card (up to 2 GB each).
JAZ-UV-VIS	Deuterium-tungsten halogen light source
JAZ-VIS-NIR	Tungsten-halogen light source
JAZ-L640	640 nm red LED
JAZ-L590	590 nm yellow LED
JAZ-L450	450 nm blue LED
JAZ-L395	395 nm UV LED
JAZ-WHITE	White LED

A Jaz Combo consists of a combination of up to three JAZ-S spectrometer modules and a JAZ-DPU module.

Features

- ❑ Sony ILX511B 2048-element linear silicon CCD array detector
- ❑ 14 grating options, UV through shortwave NIR
- ❑ Responsive from 200 to 1100 nm
- ❑ Maximum Wavelength range 650 nm
- ❑ Sensitivity of up to 75 photons/count at 400 nm; 41 photons/count at 600 nm
- ❑ An optical resolution of ~0.3 to 10.0 nm (FWHM)
- ❑ Integration times from 3 ms to 65 seconds
- ❑ EEPROM storage for
 - Wavelength Calibration Coefficients
 - Linearity Correction Coefficients
 - Absolute Irradiance Calibration (optional)

- ❑ SD card data storage
- ❑ Low power consumption of ~ 2.5 W
- ❑ 16 bit, 3MHz A/D Converter
- ❑ 20-pin connector for interfacing to external products
- ❑ 8-hour rechargeable lithium-ion battery
- ❑ Up to 3 spectrometer channels in a stack for simultaneous multipoint measurement
- ❑ CE Certification
- ❑ RoHS compliant
- ❑ Ethernet IEEE 802.3 compliant 10/100

System Requirements

You can use the Jaz USB connectivity with any computer that meets the following requirements:

- Operating system is one of the following:
 - Windows – 98/Me/2000/XP
 - Apple Macintosh – OS X version 10.0 or later
 - Linux – Red Hat 9 or later, Fedora (any version), Debian 3.1 (Sarge), and SUSE (9.0 or later)
- Ocean Optics’ SpectraSuite software application installed and configured for use.

EEPROM Utilization

An EEPROM memory chip in each JAZ-S spectrometer module contains wavelength calibration coefficients, linearity coefficients, and a serial number unique to each individual spectrometer module. The SpectraSuite software application reads these values directly from the spectrometer, enabling the ability to “hot-swap” spectrometers between computers without entering the spectrometer coefficients manually on each computer.

About SpectraSuite

Although Jaz is unique in that it can perform a number of spectroscopy measurements and display results right on its display screen, SpectraSuite spectrometer operating software is also available to enhance Jaz’s functionality. SpectraSuite is the latest generation of operating software for all Ocean Optics spectrometers. It is a completely modular, Java-based spectroscopy software platform that operates on Windows, Macintosh and Linux operating systems. The software can control any Ocean Optics USB spectrometer and device, as well as any other manufacturer’s USB instrumentation using the appropriate drivers.

SpectraSuite is a user-customizable, advanced acquisition and display program that provides a real-time interface to a variety of signal-processing functions. With SpectraSuite, you have the ability to perform spectroscopic measurements (such as absorbance, reflectance, and emission), control all system parameters, collect and display data in real time, and perform reference monitoring and time acquisition experiments. Consult the SpectraSuite manual for hardware requirements when using SpectraSuite (see [Product-Related Documentation](#)).

Sampling System Overview

How Sampling Works

Ocean Optics components function in a sampling system as follows:

1. The user stores reference and dark measurements to correct for instrument response variables.
2. The light from the light source transmits through an optical fiber to the sample.
3. The light interacts with the sample.
4. Another optical fiber collects and transmits the result of the interaction to the spectrometer.
5. The spectrometer measures the amount of light and transforms the data collected by the spectrometer into digital information.
6. The spectrometer passes the sample information to SpectraSuite.
7. SpectraSuite compares the sample to the reference measurement and displays processed spectral information.

Interface Options

Jaz is field-portable and can collect data as a free-standing unit from the battery embedded in the stack. The Jaz stack also has both USB and Ethernet port connectors, enabling you to connect the spectrometer to a computer via a USB port or to the network via a connection from the Ethernet port to a Power Over Ethernet (POE) bridge or a switch to the network (e.g., a network hub). Your Jaz stack receives power from either connection, and both connections enable Jaz to be recognized by SpectraSuite software.

Shipment Components

Jaz is a scalable system, allowing you to design the instrument most appropriate for your application. However, a typical Jaz system would consist of the following components:

❑ Packing List

The packing list is inside a plastic bag attached to the outside of the shipment box (the invoice arrives separately). It lists all items in the order, including customized components in the spectrometer (such as the grating, detector collection lens, and slit). The packing list also includes the shipping and billing addresses, as well as any items on back order.

❑ Jaz Stack

Usually consists of up to eight spectrometer modules (JAZ-S), a CPU module (JAZ-DPU), a battery/memory module (JAZ-B), and an Ethernet/SD module (JAZ-E).

❑ Mini USB Cable (USB-CBL-MINI)

Use this cable to connect your Jaz spectrometer module to a computer running on a Windows, Mac or Linux operating system.

- ❑ **Ethernet Cable**
A 14-foot cable to connect the JAZ-E module to a bridge or switch to access the network.
- ❑ **Power Supply (USB-CBL-PS)**
A 5 V power supply to provide an extra power source in addition to the battery, USB power and POE (Power Over Ethernet).
- ❑ **Wavelength Calibration Data Sheet**
Each spectrometer is shipped with a Wavelength Calibration Data Sheet that contains information unique to your spectrometer. SpectraSuite Operating Software reads this calibration data from your spectrometer when it interfaces to a computer via the USB port.

Note

Please save the Wavelength Calibration Data Sheet for future reference.

- ❑ **Software and Technical Resources CD**
Each order ships with the Ocean Optics *Software and Resources CD*. This disc contains software, operating instructions, and product information for all Ocean Optics software, spectrometers, and spectroscopic accessories. You need Adobe Acrobat Reader version 6.0 or higher to view these files. Ocean Optics includes the Adobe Acrobat Reader on the *Software and Technical Resources CD*.

Ocean Optics software requires a password during the installation process. You can locate passwords for the other software applications on the back of the *Software and Technical Resources CD* package.

Additional Equipment Available

In addition to the [Jaz Modules](#), the following software and accessories are available for use with Jaz. Visit us at www.OceanOptics.com for a complete list of products available for all of your spectroscopy needs.

- ❑ **SpectraSuite Operating Software**
See [About SpectraSuite](#) for more information.
- ❑ **Fibers**
- ❑ **Light Sources**
- ❑ **Integrated Sampling Systems**
- ❑ **Cuvettes**
- ❑ **Filter Holders**

Chapter 2

Installing Jaz

Overview

Your Jaz unit is field-portable and can collect data as a free-standing unit from the battery embedded in the stack. You also have two options for connecting Jaz to a computer to process the data you have collected:

- A USB connection directly to a computer running SpectraSuite.
- An Ethernet connection to a computer network.

Note

Your Jaz unit receives power from either connection.

If you have purchased SpectraSuite software, you must install it prior to connecting Jaz Spectrometer to a computer. The SpectraSuite software installation installs the drivers required for Jaz. If you do not install SpectraSuite first, the computer will not properly recognize Jaz.


If you have already connected Jaz to a computer running on a Windows platform prior to installing SpectraSuite, consult [Jaz Connected to Computer Prior to SpectraSuite Installation](#) for information on correcting a corrupt Jaz installation.

Installing SpectraSuite Software

You can install SpectraSuite either from the CD you received or from the Ocean Optics website (<http://www.oceanoptics.com/technical/softwaredownloads.asp>).

If you already have SpectraSuite Core version 2.0.97 and OmniDriver Wrapper 2.0.52 or greater, just perform a software update so that SpectraSuite recognizes your Jaz unit (see [Software Updates](#)).

► Procedure

1. Close all other applications running on the computer.
2. Double-click on the SpectraSuite.exe file located in SpectraSuite | bin folder (or SpectraSuiteMac.sh for Mac users) to run the software executable. For a destination, navigate to the C:\Program Files\OceanOptics folder.
3. Connect your Jaz unit to your computer (see [Installing the Jaz Unit](#)).
4. Power-on your Jaz unit by pressing the Power button .

2: Installing Jaz

5. For Windows PC users: The PC will launch the New Hardware Wizard. Follow instructions in the Wizard so that your PC will properly recognize the Jaz unit.
6. Reboot your computer when requested.
7. **To install on a Windows PC:** Navigate to **Install Ocean Optics Software | SpectraSuite | Windows OS**. The installation process begins.
8. **To install on a Mac:** Double-click on the CD icon and open the OceanOptics.html file to launch the CD. Then, navigate to Install Ocean Optics Software | SpectraSuite | Mac OS. Double-click on the newly selected .dmg file, and copy the SpectraSuite icon to Desktop or Applications.
9. **To install on a Linux Platform:** See the SpectraSuite Installation and Operation Manual for full instructions.
10. Follow the prompts on the Installation Wizard.
11. Click **OK** to restart your computer. You have now installed the SpectraSuite software.

Note the Jaz units that you have installed are listed in the Data Sources pane.

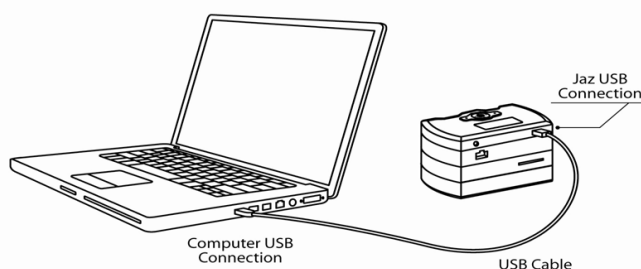
Installing the Jaz Unit

This section contains instructions for connecting Jaz directly to a computer through the USB port or to the network through the Ethernet port.

Connecting Jaz to a Computer via USB

► Procedure

1. Connect the USB (B) cable that you received with your Jaz unit from the JAZ-DPU module to your computer.



2. When first connecting Jaz to your computer, you must run the Hardware Wizard for your PC to recognize the new hardware. For Mac users, this step is not necessary.
3. In SpectraSuite, select **Spectrometer | Rescan Devices**. Your Jaz unit should be recognized in SpectraSuite's Data Sources pane as indicated by this icon:



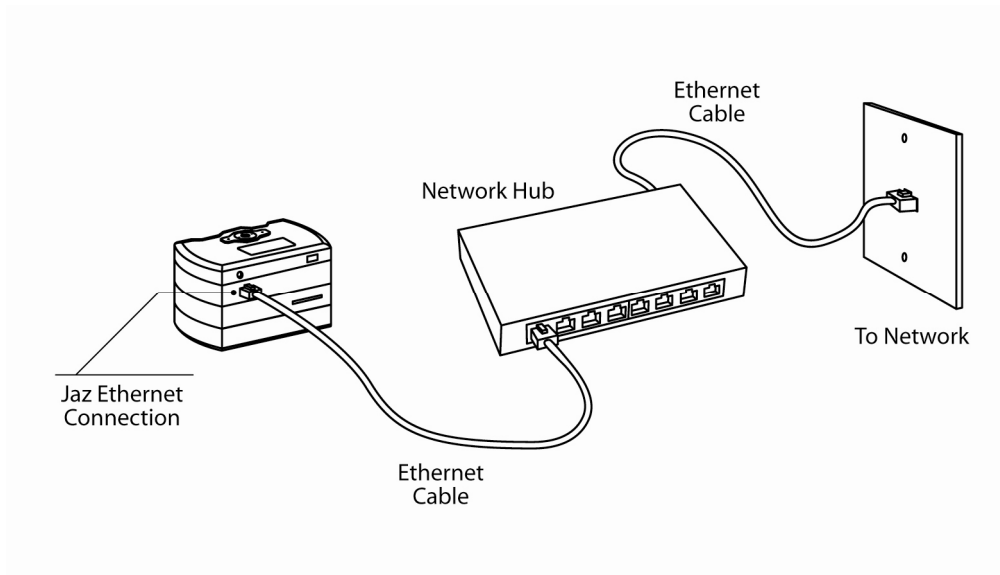
Ethernet Connection

You can connect Jaz to the network via the Ethernet port on the JAZ-E module.

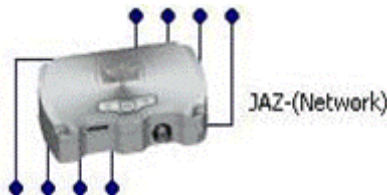
► **Procedure**

Follow the steps below to connect the port on the Jaz Ethernet & Memory module to a Power Over Ethernet (POE) bridge or a switch to the network (e.g., an 8-port network hub):

1. Connect the Ethernet cable that you received with your Jaz unit from the Jaz unit's Ethernet connector to a Power Over Ethernet (POE) bridge or a switch to the network (e.g., an 8-port network hub).



2. In SpectraSuite, select **Spectrometer | Rescan Devices**. Your Jaz unit should be recognized in SpectraSuite's Data Sources pane as indicated by this icon:



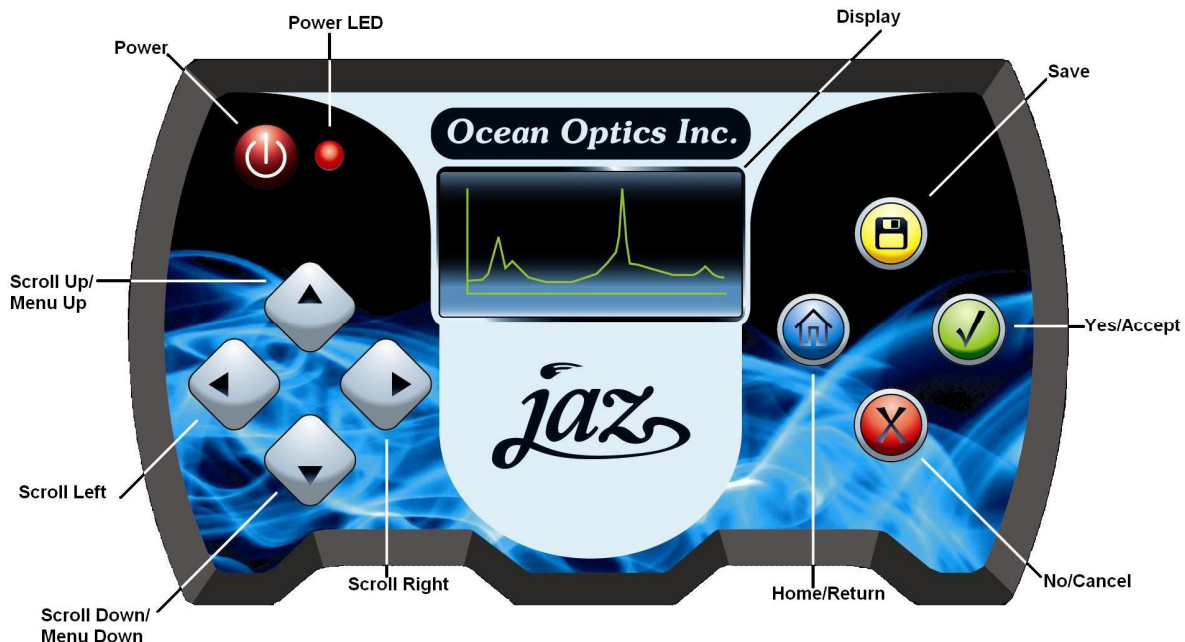
Operating Jaz

Overview

Jaz is designed to perform a wide number of functions as a standalone instrument, untethered to a computer. These functions include the following:

- Power on/off the Jaz stack
- Perform absorbance, reflectance and irradiance experiments and read the results on the Jaz display screen
- View and edit network settings
- View battery charge
- Set display backlight intensity
- Update the flash memory and system information
- Rotate the display screen 180 degrees
- Set date and time
- Control light source modules in the stack

The Jaz faceplate providing you with your interface to the modules in your Jaz stack is shown below:



Powering Your Jaz Unit

The Jaz unit can be powered from the USB connection as well as from the Ethernet connection. You can also power Jaz using the 5 VDC power supply cable and transformer that came with your unit.

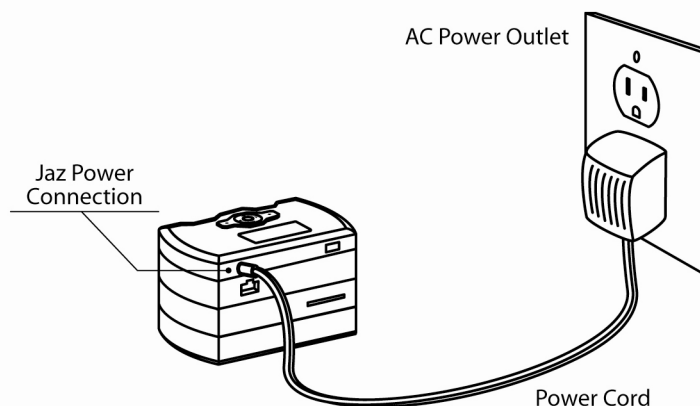
Note


You can plug the power supply into your Jaz unit concurrently with the USB or Ethernet connection without harming the equipment. This may even be necessary if the USB connection does not supply sufficient power to drive the Jaz stack, or your Ethernet connection is not over a POE-enabled switch/hub.

The Jaz stack contains a battery module that should allow for several hours of field operation before the unit must be recharged. A power save feature dims the screen to 50% intensity, then darkens the screen totally after 3 minutes of inactivity.

► Procedure

1. Connect the power supply cable that you received with your Jaz unit from the unit's power connector on the JAZ-DPU module to a wall outlet.



2. Press the Power button () in the center of the Jaz unit to power up the Jaz stack. It can take the Jaz stack 2 – 3 seconds to power up.


Jaz Menus

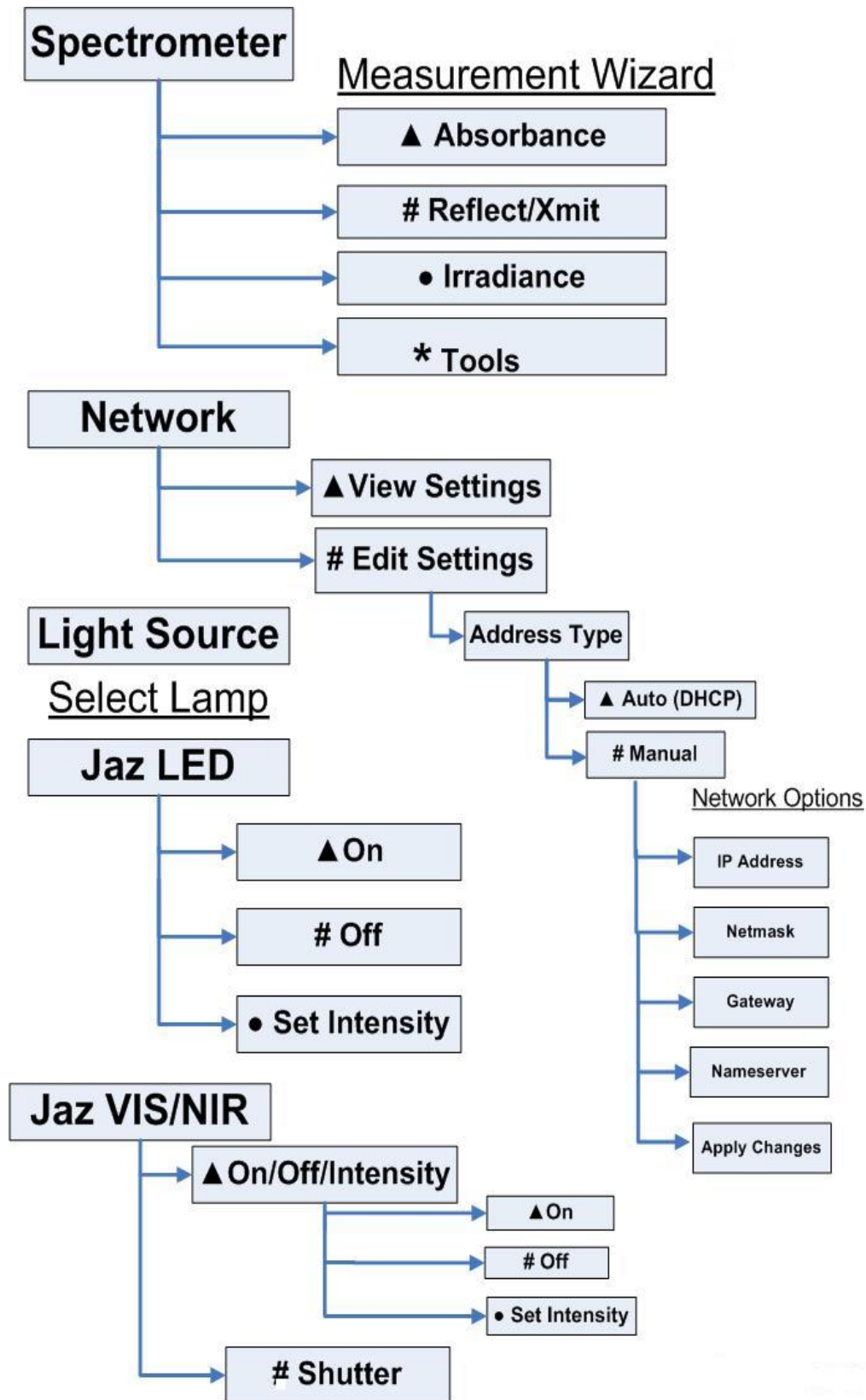
Your Jaz unit is unique from other spectrometers in that it offers you an interactive menu screen to perform the following functions:

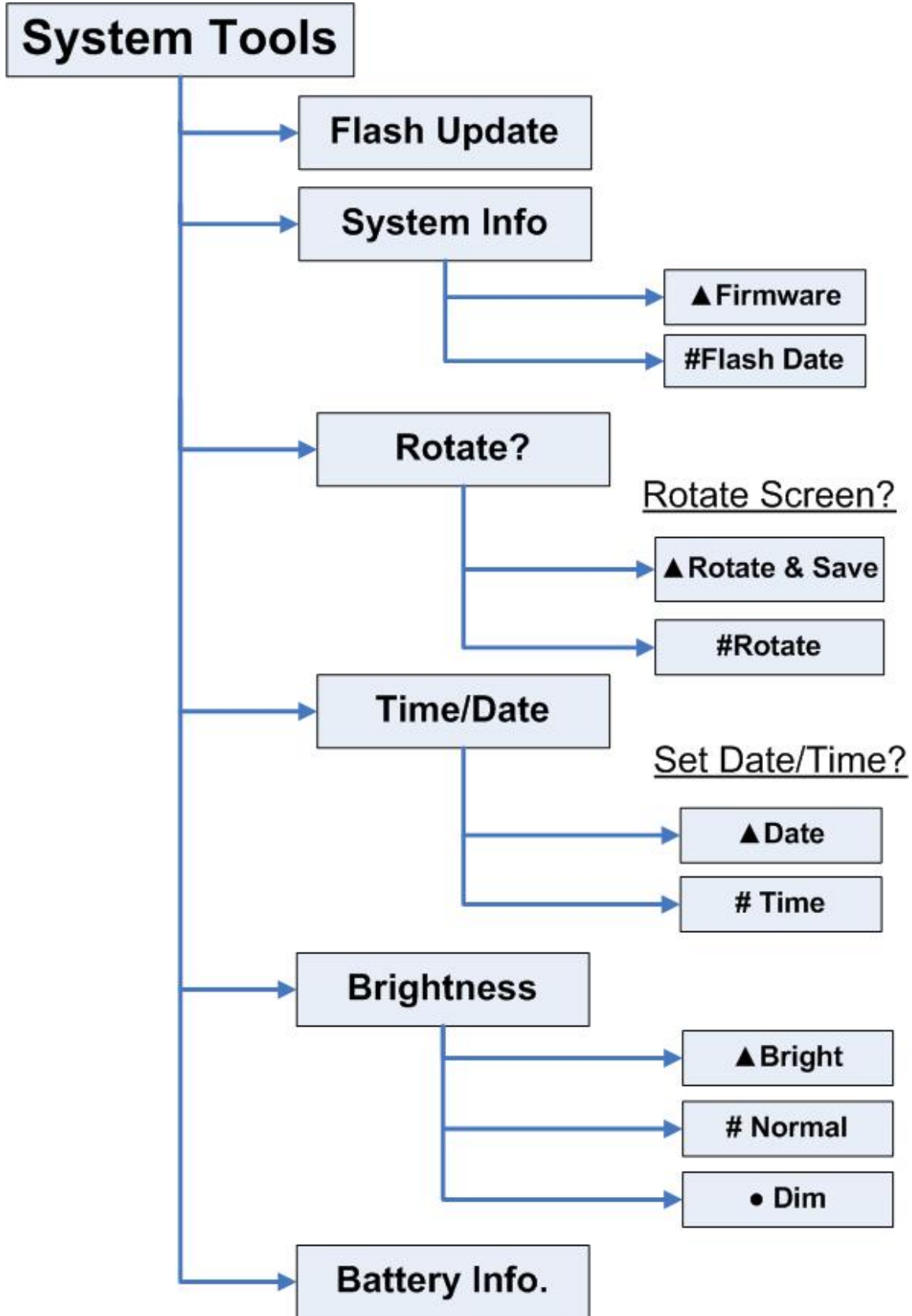
- **Spectrometer:** Displays the Measurement Wizard. See [Measurement Wizards](#) for more information.
- **System Tools:**
 - Downloads an update to the Jaz flash memory.
 - Rotates the display screen orientation. **Rotate-Save** rotates the screen display 180 degrees and saves the screen orientation as the default. **Rotate** rotates the screen display until Jaz is rebooted.
 - Adjusts the brightness of the OLED screen.
 - Displays the charge percentage of the battery module in the stack (if included).
- **Light Source:** Provides control over the light source module, if included in the stack.
- **Network:** View and set the Jaz IP address, net mask gateway, and Name Server address.

Note

Jaz has a screen saver that blanks the display screen after a few minutes of inactivity.

Press any button other than Save () on the faceplate to redisplay the screen without performing that button's function. The Save button actually performs a save before redisplaying the screen.





Measurement Wizards

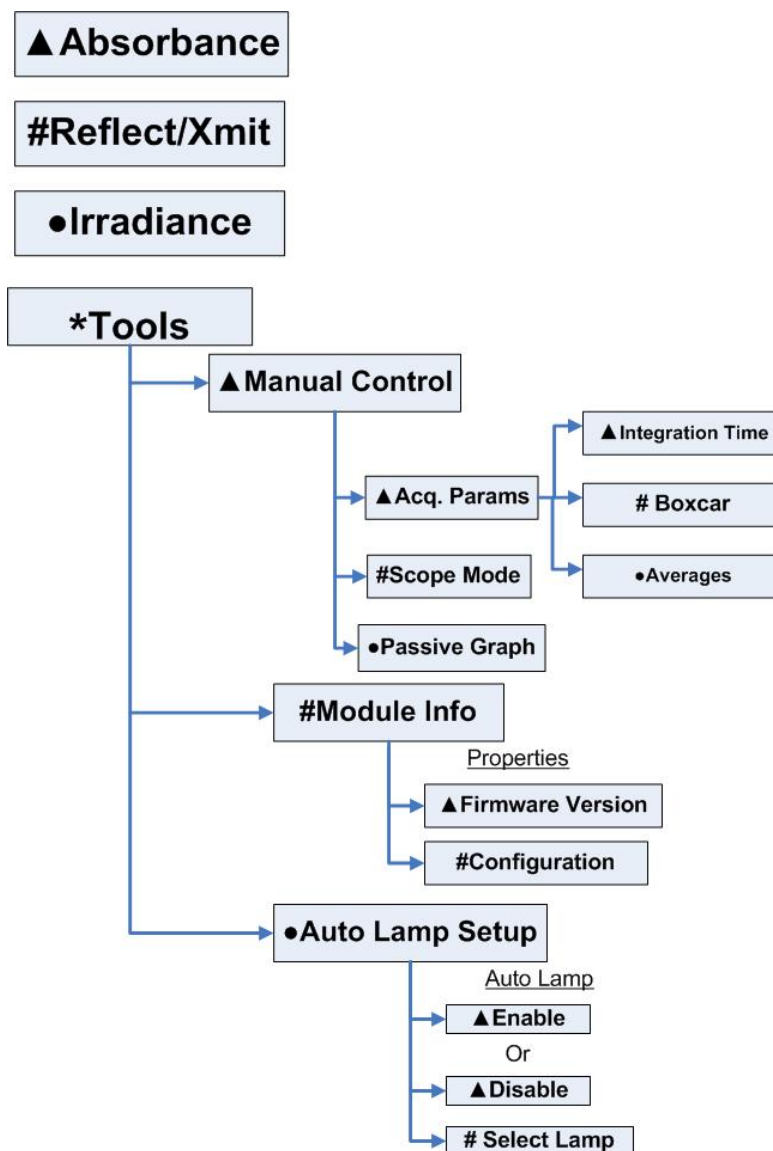
Jaz features shortcut wizards that are accessible via the Jaz keypad (icons on the navigation keys) for the following measurements:

- ▲ Absorbance
- # Reflection/Transmittance
- Irradiance

Press the button on the keypad that corresponds to the icon for the desired measurement (▲, #, or ●).

* Tools

The Tools menu item provides additional functionality for manual setting of acquisition parameters, retrieving information about the spectrometer module properties, and lamp set-up (if applicable).



Maintenance

Overview

This chapter contains Jaz software updates, maintenance and troubleshooting issues.

Software Updates

Ocean Optics is constantly striving for excellence and innovation in our products. Updates for both SpectraSuite and Jaz software are available to ensure that you always have the most recent software.

SpectraSuite

SpectraSuite is updated frequently. You can download the latest version from the Ocean Optics website www.oceanoptics.com or use the Update Center in SpectraSuite (**Tools | Update Center**).

Jaz

Select **System Tools | Flash Update** from the Jaz menu to download Jaz updates.

Jaz Troubleshooting

The following sections contain information on troubleshooting issues you may encounter when using Jaz.

Jaz Connected to Computer Prior to SpectraSuite Installation

Windows Operating Systems

If you connected Jaz to a computer prior to installing SpectraSuite on a Windows platform, you may encounter installation issues that you must correct before your Ocean Optics device will operate properly.

Follow the applicable steps below to remove the incorrectly installed device, device driver, and installation files.

Note

If these procedures do not correct your device driver problem, you must obtain the *Correcting Device Driver Issues* document from the Ocean Optics website:
<http://www.oceanoptics.com/technical/engineering/correctingdevicedriverissues.pdf>.

Remove the Unknown Device from Windows Device Manager

► Procedure

1. Open Windows Device Manager. Consult the Windows operating instructions for your computer for directions, if needed.
 2. Locate the **Other Devices** option and expand the **Other Devices** selection by clicking on the "+" sign to the immediate left.
-

Note

Improperly installed USB devices can also appear under the Universal Serial Bus Controller option. Be sure to check this location if you cannot locate the unknown device.

3. Locate the unknown device (marked with a large question mark). Right-click on the **Unknown Device** listing and select the **Uninstall** or **Remove** option.
4. Click the **OK** button to continue. A warning box appears confirming the removal of the Unknown Device. Click the **OK** button to confirm the device removal.
5. Disconnect Jaz from your computer.
6. Locate the section in this chapter that is appropriate to your operating system and perform the steps in the following [Remove Improperly Installed Files](#) section.

Remove Improperly Installed Files

► Procedure

1. Open Windows Explorer.
 2. Navigate to the **Windows | INF** directory.
-

Note

If the INF directory is not visible, you must disable the Hide System Files and Folders and Hide File Extensions for Known File Types options in Windows Folder Options. Access Windows Folder Options from Windows Explorer, under the **Tools | Folder Options** menu selection.

3. Delete the **OOI_USB.INF** in the INF directory. If your computer is running either the Windows 2000 or XP operating system, you must also delete the **OOI_USB.PNF** file in the INF directory.
4. Navigate to the **Windows | System32 | Drivers** directory.
5. Delete the **EZUSB.SYS** file.
6. Reinstall your Ocean Optics application and reboot the system when prompted.
7. Plug in the USB device.

The system is now able to locate and install the correct drivers for the USB device.

Mac Operating Systems

Since there are no device files for Jaz in a Mac operating system, you should not encounter any problems if you installed the spectrometer before the SpectraSuite software.

Linux Operating Systems

For Linux operating systems, all you need to do is install the SpectraSuite software, then unplug and replug in the spectrometer. Technically, the driver files for Linux simply give nonprivileged users permission to use newly connected hardware. There isn't any long-term harm to plugging in the device before installing the software.

Jaz Troubleshooting Tips

The following table provides additional information for troubleshooting Jaz issues. If these suggested solutions do not solve the problem, please contact us for Technical Support (also see [Service](#)).

Problem	Possible Cause(s)	Suggested Solution(s)
Jaz does not initialize correctly.	Unit was powered on too quickly after being powered off.	Wait 10-15 seconds before powering on Jaz.
USB Jaz turns on and then powers down before it completes initialization	Only the Jaz-DPU (CPU module) + Jaz-S (spectrometer module) can be powered over USB (unless the unit also includes a battery). While a JAZ-DPU + JAZ-E (Ethernet) + JAZ-S might sometimes power over USB, the available USB power may not always successfully power the Jaz stack.	Use the accessory +5V power supply.
Jaz power LED doesn't turn on (PoE, USB operation or +5V power, no battery).	Jaz needs to power its internal electronics before it can fully power up.	Wait 10 seconds after plugging in Jaz before pressing the power button

3: Operating Jaz

Problem	Possible Cause(s)	Suggested Solution(s)
Jaz display blanks out	Jaz has an automatic screensaver that turns on 3 minutes after the last key press.	While any key press will bring back the display, pressing the SAVE key (floppy disk) is recommended since other keys might cause an unwanted command to be executed. A future release of the firmware will ignore the first key press when restoring the display from screen-saver operation.
I plugged in the Ethernet connection after the Jaz powered up, and now see a "Network Unplugged" message when "View Settings" is selected.		If you select #Edit Settings and select Auto (DHCP), the Jaz will try again to acquire a network address.
Jaz does not communicate with SpectraSuite via USB.	Jaz needs to boot completely before initiating USB communication.	Restart Jaz and wait until it displays the menu screen before starting (or re-scanning devices) in SpectraSuite.
Jaz can get an IP address and can be pinged over Ethernet, but won't otherwise communicate.	The battery is nearly empty, causing Jaz to lose the connection.	Plug Jaz into the wall power receptacle or use the Power over Ethernet capability.

Appendix A

Calibrating the Wavelength of Jaz

Overview

This appendix describes how to calibrate the wavelength of your spectrometer. Though each spectrometer is calibrated before it leaves Ocean Optics, the wavelength for all spectrometers will drift slightly as a function of time and environmental conditions. Ocean Optics recommends periodically recalibrating the Jaz spectrometer.

About Wavelength Calibration

You are going to be solving the following equation, which shows that the relationship between pixel number and wavelength is a third-order polynomial:

$$\lambda_p = I + C_1p + C_2p^2 + C_3p^3$$

Where:

λ = the wavelength of pixel p

I = the wavelength of pixel 0

C_1 = the first coefficient (nm/pixel)

C_2 = the second coefficient (nm/pixel²)

C_3 = the third coefficient (nm/pixel³)

You will be calculating the value for I and the three C s.

Calibrating the Spectrometer

Preparing for Calibration

To recalibrate the wavelength of your spectrometer, you need the following components:

- A light source capable of producing spectral lines

Note

Ocean Optics' HG-1 Mercury-Argon lamp is ideal for recalibration. If you do not have an HG-1, you need a light source that produces several (at least 4-6) spectral lines in the wavelength region of your spectrometer.

-
- A Jaz spectrometer module
 - An optical fiber (for spectrometers without a built-in slit, a 50- μm fiber works best)
 - A spreadsheet program (Excel or Quattro Pro, for example) or a calculator that performs third-order linear regressions

Note

If you are using Microsoft Excel, choose **Tools | Add-Ins** and check **AnalysisToolPak** and **AnalysisToolPak-VBA**.

Calibrating the Wavelength of the Spectrometer

► Procedure

Perform the steps below to calibrate the wavelength of the spectrometer:

1. Place SpectraSuite into Scope mode and take a spectrum of your light source. Adjust the integration time (or the A/D conversion frequency) until there are several peaks on the screen that are not off-scale.
2. Move the cursor to one of the peaks and position the cursor so that it is at the point of maximum intensity.
3. Record the pixel number that is displayed in the status bar or legend (located beneath the graph). Repeat this step for all of the peaks in your spectrum.
4. Use the spreadsheet program or calculator to create a table like the one shown in the following figure. In the first column, place the exact or true wavelength of the spectral lines that you used. In the second column of this worksheet, place the observed pixel number. In the third column, calculate the pixel number squared, and in the fourth column, calculate the pixel number cubed.

Independent Variable	Dependent Variables			Values Computed from the Regression Output	
True Wavelength (nm)	Pixel #	Pixel # ²	Pixel # ³	Predicted Wavelength	Difference
253.65	175	30625	5359375	253.56	0.09
296.73	296	87616	25934336	296.72	0.01
302.15	312	97344	30371328	302.40	-0.25
313.16	342	116964	40001688	313.02	0.13
334.15	402	161604	64964808	334.19	-0.05
365.02	490	240100	117649000	365.05	-0.04
404.66	604	364816	220348864	404.67	-0.01
407.78	613	375769	230346397	407.78	0.00
435.84	694	481636	334255384	435.65	0.19
546.07	1022	1044484	1067462648	546.13	-0.06
576.96	1116	1245456	1389928896	577.05	-0.09
579.07	1122	1258884	1412467848	579.01	0.06
696.54	1491	2223081	3314613771	696.70	-0.15
706.72	1523	2319529	3532642667	706.62	0.10
727.29	1590	2528100	4019679000	727.24	0.06
738.40	1627	2647129	4306878883	738.53	-0.13
751.47	1669	2785561	4649101309	751.27	0.19

- Use the spreadsheet or calculator to calculate the wavelength calibration coefficients. In the spreadsheet program, find the functions to perform linear regressions.
 - If using Quattro Pro, look under **Tools | Advanced Math**
 - If using Excel, look under **Analysis ToolPak**
- Select the true wavelength as the dependent variable (Y). Select the pixel number, pixel number squared, and the pixel number cubed as the independent variables (X). After executing the regression, you will obtain an output similar to the one shown below. Numbers of importance are noted.

Regression Statistics

Multiple R 0.999999831
 R Square 0.999999663 ← R Squared
 Adjusted R Square 0.999999607
 Standard Error 0.125540214
 Observations 22

	<u>Coefficients</u>	<u>Standard Error</u>	
Intercept	190.473993	0.369047536	← First coefficient
X Variable 1	0.36263983	0.001684745	
X Variable 2	-1.174416E-05	8.35279E-07	← Second coefficient
X Variable 3	-2.523787E-09	2.656608E-10	← Third coefficient

- Record the Intercept, as well as the First, Second, and Third Coefficients. Additionally, look at the value for R squared. It should be very close to 1. If not, you have most likely assigned one of your wavelengths incorrectly.

Keep these values at hand.

Saving the New Calibration Coefficients: USB Mode

Ocean Optics programs wavelength calibration coefficients unique to each Jaz spectrometer module onto an EEPROM memory chip in Jaz.

You can overwrite old calibration coefficients on the EEPROM if you are using Jaz via the USB port.

► Procedure

To save wavelength calibration coefficients using the USB mode, perform the following steps:

- Ensure that Jaz is connected to the computer and that you have closed all other applications.
- Point your browser to <http://www.oceanoptics.com/technical/softwaredownloads.asp> and scroll down to **Microcode**. Select **USB EEPROM Programmer**.
- Save the setup file to your computer.
- Run the **Setup.exe** file to install the software. The **Welcome** screen appears.
- Click the **Next** button. The **Destination Location** screen appears.
- Accept the default installation location, or click the **Browse** button to specify a directory. Then, click the **Next** button. The **Program Manager Group** screen appears.
- Click the **Next** button. The **Start Installation** screen appears.
- Click the **Next** button to begin the installation. Once the installation finishes, the **Installation Complete** screen appears.
- Click the **Finish** button and reboot the computer when prompted.
- Navigate to the **USB EEPROM Programmer** from the Start menu and run the software.
- Click on the desired Jaz device displayed in the left pane of the **USB Programmer** screen.
- Double-click on each of the calibration coefficients displayed in the right pane of the USB Programmer screen and enter the new values acquired in Steps 5 and 6 of the [Calibrating the Wavelength of the Spectrometer](#) section in this appendix.
- Repeat Step 12 for all of the new values.
- Click on the **Save All Values** button to save the information, and then **Exit** the USB Programmer software.

The new wavelength calibration coefficients are now loaded onto the EEPROM memory chip on the Jaz spectrometer module.

Appendix B

Specifications

Overview

This appendix contains specification information for the Jaz stack and its individual modules.

Specification	Value
Power Consumption	250 mA @ 5 VDC
Computer interface	USB in JAZ-DPU module Ethernet in JAZ-E module
Computer requirements	IBM-compatible PC with Pentium or better microprocessor 32 MB RAM (16 MB) Windows 98/Me/2000/XP, Mac OS X and Linux when using the USB interface on desktop or notebook PCs.
Operating software	SpectraSuite (for an additional \$199)
Fiber optic connector	SMA 905 to single-strand optical fiber
Spectrometer Module (JAZ-S)	
Grating Options	14 different gratings, UV through Shortwave NIR
Detector	2048-element linear silicon CCD array; L2 Collection Lens
Wavelength range	200-1100 nm; maximum 650 nm
Entrance aperture	5, 10, 25, 50, 100 or 200 μ m wide slits or fiber (no slit)
AgPlus Mirrors	Provide reflectivity >95% over the visible and NIR wavelength range and over a wide range of angles of incidence
Signal-to-noise ratio	250:1
Integration time	3 ms to 65 seconds
Data transfer rate	USB: 60 scans per second Ethernet: 20 scans per second

B: Specifications

Specification	Value
Optical resolution	~0.3-10.0 nm FWHM
Dark noise	50 RMS counts
Dynamic range	1300:1
OLED Display Module (JAZ-DPU)	
OLED Display	128 x 64 OLED
Keypad	Pushbutton functions; functionality can be rotated 180°
Onboard computer	Embedded processor with data processing and storage capability
Ethernet & Memory Module (JAZ-E)	
Ethernet	100 Mbps; IEEE 802.3-compliant 10/100
Data Storage	Via SD card
Battery & Memory Module (JAZ-B)	
Type	Rechargeable lithium-ion
Life	8 hours before recharging
L450 Blue LED Light Source (JAZ-L450)	
Type	LS-450 LED
VIS-NIR Light Source Module (JAZ-VIS-NIR)	
Type	Tungsten-halogen
Bulb life (estimated)	1100 hours
UV-VIS light Source Module (JAZ-UV-VIS)	
Type	Deuterium-tungsten-halogen

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