Maya2000 and Maya 2000-Pro Spectrometers

Installation and Operation Manual

Document Number 020-00000-000-02-0508

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About This Manual

Document Purpose and Intended Audience

This document provides the user of a Maya2000 Series Spectrometer with instructions for setting up, calibrating and performing experiments with their spectrometer.

Document Summary

Chapter	Description
Chapter 1: *Introduction*	Contains descriptive information about the Maya2000 Series Spectrometers and how sampling works. It also provides a list of system requirements, interface options, and shipment components.
Chapter 2: *Installing the Maya2000 Series*	Provides installation and configuration instructions.
Chapter 3: *Troubleshooting*	Contains recommended steps to isolate and correct common problems.
Appendix A: *Calibrating the Wavelength of the Maya2000 Series*	Provides instructions for calibrating the Maya2000 Series Spectrometers.
Appendix B: *Specifications*	Contains technical specifications and connector pinouts for the Maya2000 Series Spectrometers.

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 is located at: **http://www.oceanoptics.com/technical/SpectraSuite.pdf**.
- Detailed instructions for the Breakout Box are located at: **http://www.oceanoptics.com/technical/HR4_breakout.pdf**
- Detailed instructions for external triggering are located at: **http://www.oceanoptics.com/technical/external-triggering.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.

Warranty

Our 3-Year Warranty, currently the best in the industry, covers all Ocean Optics miniature fiber optic spectrometers – regardless of the application – from manufacturing defects. It ensures you of the highest level of craftsmanship and reliability for years to come. Our warranty information is located at **http://www.oceanoptics.com/corporate/3-year%20warranty%20certificate.pdf**.

Service

For additional peace of mind, we offer an Annual Service Package (ASP) to maintain your scientific investment. This plan includes yearly wavelength calibration, preventive maintenance service and privileged customer status plan for all our MAYA2000 series spectrometers. More information on available ASPs is located at **http://www.oceanoptics.com/Services/servicepackages.asp**
Contact us to learn more about these great service packages.

Chapter 1

Introduction

Product Overview

The Ocean Optics Maya2000 Series Spectrometers have been engineered specifically for low light-level, UV-sensitive and other scientific applications such as fluorescence, DNA sequencing and Raman spectroscopy. These next-generation spectrometers have great quantum efficiency, high dynamic range, extreme sensitivity and excellent deep-UV (<190 nm) response.

Ocean Optics Maya2000 Pro High-Sensitivity Fiber Optic Spectrometer

The Maya2000 Series Spectrometers feature the Hamamatsu FFT-CCD back-thinned detector, which offers excellent performance characteristics. Because of their great native UV-response, FFT-CCD detectors do not require UV-sensitive coatings, eliminating batch-to-batch variations. Other performance advantages of this detector include great signal-to-noise characteristics, low dark current and good signal processing speed.

The Maya2000 Series' onboard module has 10 user-programmable digital I/O lines for interfacing to other equipment; and a pulse generator for triggering other devices. You can use the I/Os to flash a lamp, stop/start a process, and send a message/alarm during the spectrometer's integration period. The spectrometer's operating parameters can be controlled through software. In fact, wavelength calibration coefficients unique to each spectrometer are programmed into a memory chip right on the spectrometer.

TheMaya2000 Series' high-speed electronics have been designed for considerable flexibility in connecting to various modules and external interfaces, including PCs, PLCs and other embedded controllers, through USB 2.0 communications. Its USB 2.0 interface enables full spectral scans into memory every 7 milliseconds.

The Maya2000 Series Spectrometers operate via USB interface.

External triggering is not supported by the Maya2000 Series Spectrometers.

Models

The Maya2000 Series Spectrometers consist of two models, the Maya2000 and the Maya2000 Pro. While these spectrometers have similar performance for most parameters, the Maya2000 has slightly faster readout time, and the Pro offers better dynamic range and signal-to-noise. See *Maya2000 Series Spectrometers Specifications* for a side-by-side comparison.

Features

- Hamamatsu S9840 (Maya2000) or Hamamatsu S10420 Detector
  - Peak QE: >90% for Maya2000; 75% for Maya2000 Pro
  - Back-thinned for good UV sensitivity
  - MPP operation for low noise
- Spectrometer Design
  - Symmetrical Crossed Czerny Turner
  - 101mm focal length
  - 14 grating options, including the HC-1 composite grating for coverage from 175-1100 nm (additional charge)
  - 6 slit widths
- Electrical Performance
  - 16 bit, 150KHz A/D converter
  - Integration times: 17ms to 10sec for Maya2000; 17ms to 5sec for Maya2000 Pro
- Embedded microcontroller allows programmatic control of all operating parameters and standalone operation
  - USB 2.0 480Mbps (high-speed) & 12Mbps (full speed)
  - RS232 115Kbaud
  - Multiple communication standards for digital accessories (SPI, I2C)
- Onboard Pulse Generator
  - 2 programmable strobe signals for triggering other devices
  - Software control of nearly all pulse parameters
- Onboard GPIO
  - 10 user-programmable digital I/Os

- EEPROM storage for
  - Wavelength Calibration Coefficients
  - Linearity Correction Coefficients
  - Absolute Irradiance Calibration (optional)
- Plug-n-play interface for PC applications
- 30-pin connector for interfacing to external products
- CE certification

System Requirements

You can use the Maya2000 Series' USB connectivity with any computer that meets the requirements for the spectrometer operating software being used (Windows 98/Me/2000/XP, Mac OS X and Linux). See *About SpectraSuite Software*.

EEPROM Utilization

An EEPROM memory chip in each Maya2000 Series contains wavelength calibration coefficients, linearity coefficients, and a serial number unique to each individual spectrometer. The OOI 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 Software

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 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 OOI software.
7. OOI software compares the sample to the reference measurement and displays processed spectral information.

Modular Sampling Accessories

Ocean Optics offers a complete line of spectroscopic accessories for use with the Maya2000 Series. Most of our spectroscopic accessories have SMA connectors for application flexibility. Accordingly, changing the sampling system components is as easy as unscrewing a connector and replacing an accessory.

Interface

The Maya2000 Series has a USB connector, enabling you to connect the spectrometer to a desktop or notebook computer via a USB port. SpectraSuite software is available to operate your spectrometer for an additional charge.

Computer Interface	Operating System Requirements	Part Needed	Description of Part
Computer via USB Port	SpectraSuite: Windows2000/XPfor PC, OS X version 10.0 or later for Mac, or Red Hat 9 or later, Fedora (any version), Debian 3.1 (Sarge), and SUSE (9.0 or later) for Linux	USB-CBL-1 (included)	Cable that connects from USB port on Maya2000 Series to USB port on desktop or notebook PC

Shipment Components

- Maya2000 Series Spectrometer

The following information and documentation also ships with the Maya2000 Series Spectrometer:

- **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.

- **Wavelength Calibration Data Sheet**

  Each spectrometer is shipped with a Wavelength Calibration Data Sheet that contains information unique to your spectrometer. Your spectrometer 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*.

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

Other Accessories Available

Visit us at **www.OceanOptics.com** for a complete list of products available for all of your spectroscopy needs.

- **Fibers**
- **Light Sources**
- **Integrated Sampling Systems**
- **Cuvettes**
- **Filter Holders**
- **Lithium Ion Battery Pack**
- **HR4-BREAKOUT Breakout Box**

Breakout Box

Ocean Optics also offers the Breakout Box (HR4-BREAKOUT), a passive module that separates the signals from their 22-pin port to an array of standard connectors and headers, enabling easy access to a variety of features found in Ocean Optics' Maya2000 Series Spectrometer. In addition to the accessory connector, the breakout box features a circuit board based on a neutral breadboard pattern that allows custom circuitry to be prototyped on the board itself.

Chapter 2

Installing the Maya2000 Series Spectrometers

Overview

You must install the operating software application prior to connecting your Maya2000 Series Spectrometer to a computer. The Ocean Optics SpectraSuite spectrometer operating software installs the drivers required for the Maya2000 Series spectrometer installation. If you do not install the software first, the system will not properly recognize the Maya2000 Series.

If you have already connected the Maya2000 Series to the computer prior to installing the operating software, consult *Chapter 3: Troubleshooting* for information on correcting a corrupt Maya2000 Series installation.

Maya2000 Series Installation

This section contains instructions for connecting the Maya2000 Series Spectrometer to a computer. To connect the Maya2000 Series Spectrometer to a computer via the USB port, the computer must be running a Windows 98/Me/2000/XP, Mac OS X or Linux operating system.

► *Procedure*

Follow the steps below to connect the Maya2000 Series to a computer via the USB port:

1. Install the spectrometer operating software on the destination computer.
2. Locate the USB cable (USB-CBL-1) provided with the Maya2000 Series Spectrometer.
3. Insert the square end of the cable into the side of the spectrometer.
4. Insert the rectangular end of the cable into the USB port of the computer.

If you installed SpectraSuite prior to connecting the spectrometer, SpectraSuite installs the spectrometer drivers. If the drivers do not successfully install (or if you connected the spectrometer to the computer before installing SpectraSuite), consult *Chapter 3: Troubleshooting*.

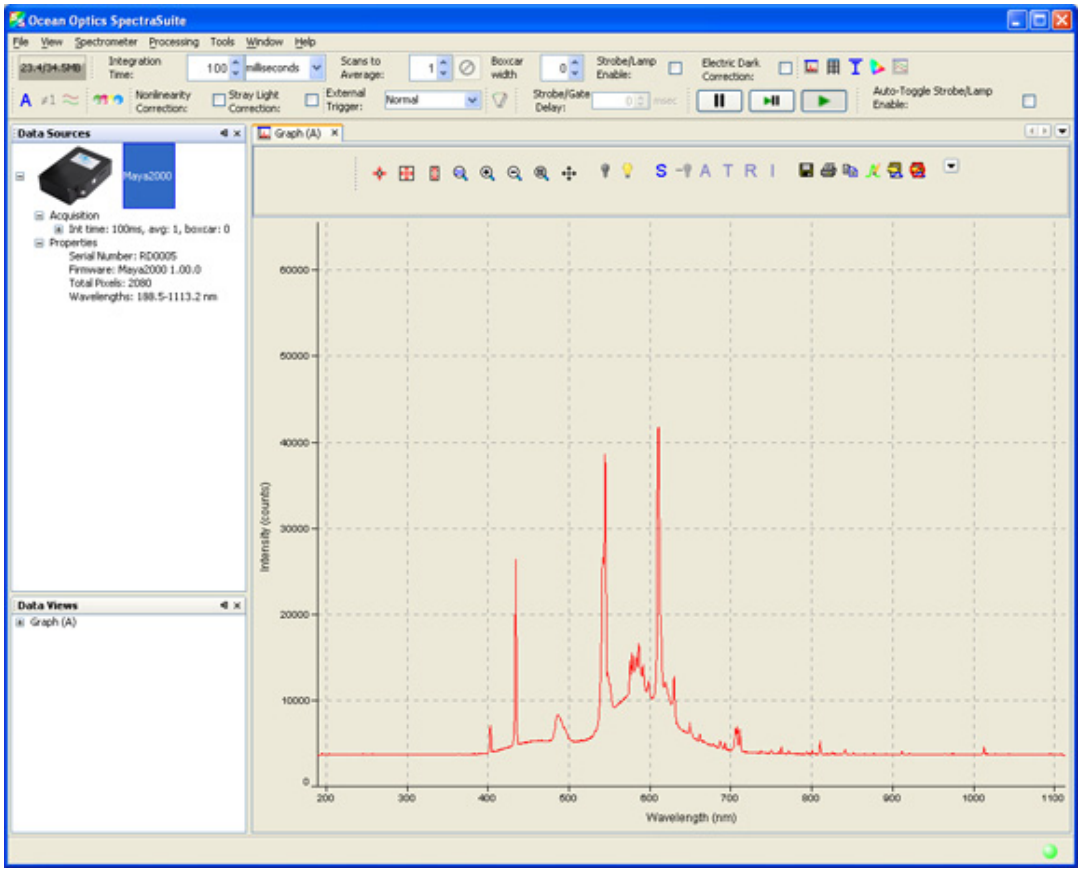
If you have followed the previous steps and started SpectraSuite, the spectrometer is already acquiring data. Even with no light in the spectrometer, there should be a dynamic trace displayed in the bottom of the graph. If you allow light into the spectrometer, the graph trace should rise with increasing light intensity. This means the software and hardware are correctly installed.

Note the spectrometer(s) that you have installed are listed in the Data Sources pane of your SpectraSuite software.

Once you install the software and hardware, and establish your sampling system, you are ready to take measurements.

Configuring the Maya2000 Series Spectrometers

If you have followed the previous steps and started SpectraSuite, the spectrometer is already acquiring data. Even with no light in the spectrometer, there should be a dynamic trace displayed in the bottom of the graph. If the graph does not automatically appear, select **File | New | Spectrum Graph**. If you allow light into the spectrometer, the graph trace should rise with increasing light intensity. This means the software and hardware are correctly installed.



Connect Spectroscopic Accessories

To find operating instructions for Maya2000 Series-compatible products (such as light sources, sampling chambers, and probes), consult the *Software and Technical Resources* CD or the Ocean Optics website at **http://www.oceanoptics.com/technical/operatinginstructions.asp**.

Chapter 3

Troubleshooting

Overview

The following sections contain information on troubleshooting issues you may encounter when using the Maya2000 Series Spectrometer.

Maya2000 Series Spectrometers Connected to Computer Prior to Software Installation

Windows Operating Systems

If you connected your Ocean Optics Maya2000 Series device to the computer prior to installing your SpectraSuite spectrometer operating software application 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 the Maya2000 Series 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 the Maya2000 Series Spectrometer 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.

Appendix A

Calibrating the Wavelength of the Maya2000 Series Spectrometers

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 Maya2000 Series.

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:

$$\lambda_p = I + C_1 p + C_2 p^2 + C_3 p^3$$

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/pixel^2)

C_3 = the third coefficient (nm/pixel^3)

You will be calculating the value for I and the three Cs.

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 Maya2000 Series spectrometer
- 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

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Note

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

Calibrating the Wavelength of the Spectrometer

► *Procedure*

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

1. Place the spectrometer operating software 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

5. 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**
6. 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
Adjusted R Square	0.999999607
Standard Error	0.125540214
Observations	22

R Squared

Intercept

	Coefficients	Standard Error
Intercept	190.473993	0.369047536
X Variable 1	0.36263983	0.001684745
X Variable 2	-1.174416E-05	8.35279E-07
X Variable 3	-2.523787E-09	2.656608E-10

First coefficient

Second coefficient

Third coefficient

7. 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 Maya2000 Series Spectrometer onto an EEPROM memory chip in the spectrometer.

You can overwrite old calibration coefficients on the EEPROM using the Maya2000 Series Spectrometer via the USB port.

► *Procedure*

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

1. Ensure that the Maya2000 Series is connected to the PC and that you have closed all other applications.
2. Point your browser to **http://www.oceanoptics.com/technical/softwaredownloads.asp** and scroll down to **Microcode**. Select **USB EEPROM Programmer**.
3. Save the setup file to your computer.
4. Run the **Setup.exe** file to install the software. The **Welcome** screen appears.
5. Click the **Next** button. The **Destination Location** screen appears.
6. 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.
7. Click the **Next** button. The **Start Installation** screen appears.
8. Click the **Next** button to begin the installation. Once the installation finishes, the **Installation Complete** screen appears.
9. Click the **Finish** button and reboot the computer when prompted.
10. Navigate to the **USB EEPROM Programmer** from the Start menu and run the software.
11. Click on the desired spectrometer displayed in the left pane of the **USB Programmer** screen.
12. 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.
13. Repeat Step 12 for all of the new values.
14. 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 Maya2000 Series Spectrometer.

Appendix B

Specifications

Overview

This appendix contains information on spectrometer operation, specifications, and system compatibility. It also includes accessory connector pinout diagrams and pin-specific information.

How the Maya2000 Series Works

The optical bench has no moving parts that can wear or break; all the components are fixed in place at the time of manufacture.

Maya2000 Series Components Table

Ocean Optics permanently secures all components in the Maya2000 Series Spectrometers at the time of manufacture. Only Ocean Optics technicians can replace interchangeable components, where noted.

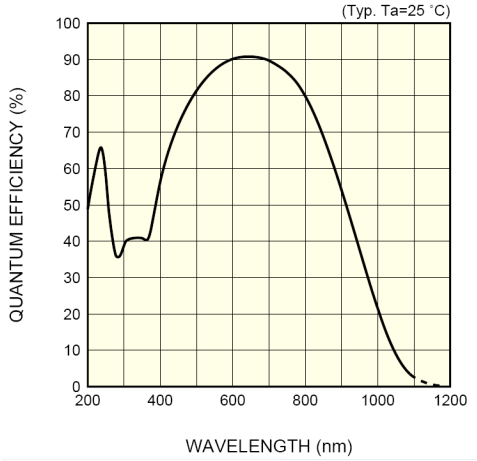
Item	Name	Description
1	SMA Connector	Secures the input fiber to the spectrometer. Light from the input fiber enters the optical bench through this connector.
2	Slit	A dark piece of material containing a rectangular aperture, which is mounted directly behind the SMA Connector. The size of the aperture regulates the amount of light that enters the optical bench and controls spectral resolution. You can also use the Maya2000 Series Spectrometer without a Slit. In this configuration, the diameter of the fiber connected to the spectrometer determines the size of the entrance aperture. Only Ocean Optics technicians can change the Slit.
3	Filter	Restricts optical radiation to pre-determined wavelength regions. Light passes through the Filter before entering the optical bench. Both bandpass and longpass filters are available to restrict radiation to certain wavelength regions. Only Ocean Optics technicians can change the Filter.
4	Collimating Mirror	Focuses light entering the optical bench towards the Grating of the spectrometer. Light enters the spectrometer, passes through the SMA Connector, Slit, and Filter, and then reflects off the Collimating Mirror onto the Grating.
5	Grating	Diffracts light from the Collimating Mirror and directs the diffracted light onto the Focusing Mirror. Gratings are available in different groove densities, allowing you to specify wavelength coverage and resolution in the spectrometer. Only Ocean Optics technicians can change the Grating.
6	Focusing Mirror	Receives light reflected from the Grating and focuses the light onto the CCD Detector or L2 Detector Collection Lens (depending on the spectrometer configuration).
7	Detector with OFLV Filter	Eliminates second-order effects and is used with an HC-1 Grating in a 200-950 nm wavelength system in a Maya2000 Series spectrometer.
8	Back-thinned Area Detector	Provides 90% (Maya200) or 75% (Maya2000 Pro) quantum efficiency and bins pixels in a vertical column to acquire light form the entire height of the spectrometer's slit image. This improves light collection and signal-to-noise significantly. This 2D area detector is back-thinned (back-illuminated) and does not require the detector upgrade that is normally applied to other detectors. Only Ocean Optics technicians can add or remove the Detector.

Maya2000 Series Spectrometers Specifications

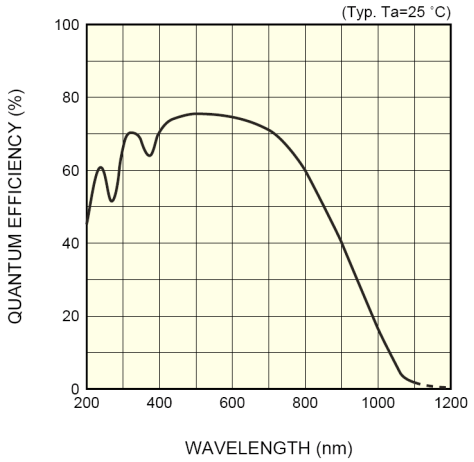
The following sections provide specification information for the CCD detector in the Maya2000 Series spectrometers, as well as for each model Maya2000 Series Spectrometer itself.

CCD Detector Specifications

Specification	Maya2000	Maya2000 Pro
Detector	Hamamatsu S9840, back-thinned FFT-CCD	Hamamatsu S10420, back-thinned FFT-CCD
Thermoelectric cooling	No	
Number of pixels	All: 2080 x 20 Active: 2048 x 14	All: 2068 x 70 Active: 2048 x 64
Spectral range	200-1100 nm with window, Deep UV option available (150nm). Deep UV option includes purge port and window removal. 175-1100 nm with HC1 grating.	
Pixel size	14 µm square	
Pixel well depth	130 Ke-	200 Ke-
Column height	196 µm square	896 µm square
Detector active area (mm)	28.672 horizontal x 0.196 vertical	28.672 horizontal x 0.896 vertical
Quantum efficiency: Peak QE QE @ 250 nm	 >90% 55%	 75% 60%



Quantum Efficiency of Maya2000 S9840 Detector



Quantum Efficiency of Maya2000Pro S10420 Detector

Maya2000 Series Spectrometer Specifications

Specification	Maya2000	Maya2000 Pro
Dimensions (LxWxH)	148.6 mm (5.85 in.) x 109.3 mm (4.30 in.) x 50.4 mm (1.98 in.)	
Weight	0.96 kg (2.12 lbs.)	
Temperature Operation Storage	–0 °C to +50 °C –30 °C to +70 °C	
Humidity	0 – 90% noncondensing	
Power consumption	500 mA @ 5 VDC	
Supply Voltage	4.5 – 5.5 V	
Power-up Time	~ 2s depending on code size	
Gratings	14 gratings available	
Entrance aperture	5, 10, 25, 50, 100 or 200 µm wide slits	
Order-sorting filters	6 OF series available	
Focal length (input)	f/4, 101 mm	
Optical resolution (FWHM)	Depends on grating and size of entrance aperture	

Specification	Maya2000	Maya2000 Pro
Stray light	<0.05% at 600 nm; <0.10% at 435 nm	
A/D converter	16 bit, 150 kHz	16 bit, 150 kHz+
Dynamic range Spec Typical	 5000:1 8000:1+	 8000:1 12000:1+
Signal-to-noise ratio	350:1	450:1
Non-linearity Uncorrected Corrected	 ~4% <1.0%	 ~10.0% <1.0%
Fiber optic connector	SMA 905 to single-strand optical fiber (0.22 NA)	
Integration time	14 ms to 10 seconds	17 ms to 5 seconds
Interfaces	USB 2.0	

System Compatibility

You can use the Maya2000 Series' USB connectivity with any computer that meets the requirements for the spectrometer operating software being used (Windows 98/Me/2000/XP, Mac OS X and Linux). See *About SpectraSuite Software*.

Alternately, the Maya2000 Series has a serial port for connecting to PCs, PLCs, and other devices with a Windows 32-bit operating system that support the RS-232 communication protocol. However, this connection method requires an external power supply to power the Maya2000 Series, the HR4000 Breakout Box, and a serial cable.

30-Pin Accessory Connector Pinout

The Maya2000 Series features a 30-pin Accessory Connector, located on the side of the unit as shown:

Location of Maya2000 Series 30-Pin Accessory Connector

30-Pin Accessory Connector Pinout Diagram

When facing the 30-pin Accessory Connector on the front of the vertical wall of the Maya2000 Series Spectrometer, pin numbering is as follows:

USB Port	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29

30-Pin Accessory Connector Pinout Diagram

30-Pin Accessory Connector – Pin Definitions and Descriptions

The following table contains information regarding the function of each pin in the Maya2000 Series Spectrometer's 30-Pin Accessory Connector:

Pin #	Function	Input/Output	Description
1	RS232 Rx	Input	RS232 receive signal – Communicates with a PC over DB9 Pin 3
2	RS232 Tx	Output	RS232 transmit signal – Communicates with a PC over DB9 Pin 2
3	GPIO (2)	Input/Output	General purpose software-programmable, digital input/output (channel number)
4	N/A	N/A	Reserved
5	Ground	Input/Output	Ground
6	I^2C SCL	Input/Output	I^2C clock signal for communication to other I^2C peripherals
7	GPIO (0)	Input/Output	General purpose software-programmable, digital input/output (channel number)
8	I^2C SDA	Input/Output	I^2C data signal for communication to other I^2C peripherals
9	GPIO (1)	Input/Output	General purpose software-programmable, digital input/output (channel number)
10	Ext. Trigger In	Input	TTL input trigger signal
11	GPIO (3)	Input/Output	General purpose software-programmable, digital input/output (channel number)
12	V_{CC} or $5V_{IN}$	Input or Output	Input power pin for Maya2000 Series – When operating via USB, this pin can power other peripherals – Ensure that peripherals comply with USB specifications (no TEC power)
13	SPI Data Out	Output	SPI Master Out Slave In (MOSI) signal for communication to other SPI peripherals
14	V_{CC} or $5V_{IN}$	Input or Output	Input power pin for Maya2000 Series – When operating via USB, this pin can power other peripherals – Ensure that peripherals comply with USB specifications (no TEC power)
15	SPI Data In	Input	SPI Master In Slave Out (MISO) signal for communication to other SPI peripherals
16	GPIO (4)	Input /Output	General purpose software-programmable, digital input/output (channel number)
17	Single Strobe	Output	TTL output pulse used as a strobe signal – Has a programmable delay relative to the beginning of the spectrometer integration period

Pin #	Function	Input/Output	Description
18	GPIO (5)	Input/Output	General purpose software-programmable, digital input/output (channel number)
19	SPI Clock	Output	SPI clock signal for communication to other SPI peripherals
20	Continuous Strobe	Output	TTL output signal used to pulse a strobe – Divided down from the master clock signal
21	SPI Chip Select	Output	SPI Chip/Device Select signal for communication to other SPI peripherals
22	GPIO (6)	Input/Output	General purpose software-programmable, digital input/output (channel number)
23	N/A	N/A	Reserved
24	N/A	N/A	Reserved
25	Lamp Enable	Output	TTL signal driven Active HIGH when the Lamp Enable command is sent to the spectrometer
26	GPIO (7)	Input/Output	General purpose software-programmable, digital input/output (channel number)
27	Ground	Input/Output	Ground
28	GPIO (8)	Input/Output	General purpose software-programmable, digital input/output (channel number)
29	Ground	Input/Output	Ground
30	GPIO (9)	Input/Output	General purpose software-programmable, digital input/output (channel number)

30-Pin J2 Accessory Connector - Part Numbers

The part numbers for the 30-pin accessory connector on the Maya2000 Series Spectrometer are as follows:

- The connector is Pak50™ model from 3M Corp. Headed Connector – Part Number **P50–030P1–RR1–TG**.
- The mating connector is Part Number **P50–030S–TGF**.
- Mating the two components requires two 1.27 mm (50 mil) flat ribbon cables (3M 3365 Series is recommended).

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