Red Tide
USB650 Fiber Optic Spectrometer

Installation and Operation Manual
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About This Manual

Document Purpose and Intended Audience

This document provides the users of Red Tide Spectrometers with instructions for setting up, calibrating and performing experiments with their spectrometer.

Document Summary

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

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**.
- Detailed instructions for external triggering are located at: **http://www.oceanoptics.com/technical/external triggering.pdf.**
- Detailed instructions for the Pasco Xplorer GLX are located at: **ftp://ftp.pasco.com/manuals/English/PS/PS-2002/012-08950F/012-08950F.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.

Chapter 1

Introduction

Product Overview

The Ocean Optics Red Tide Spectrometer is a preconfigured, off-the-shelf spectrometer where all of the optical bench options such as grating, and entrance slit size are already selected. The red Tide can be used with various Ocean optics spectrometer accessories, light sources and sampling optics to create application-specific systems for various absorbance, reflection and emission applications.

The Red Tide is low-cost and has a small footprint, making it ideal as a general purpose instrument for budget-conscious teaching and research labs. It has a wavelength range of 350–1000 nm and uses a detector with 650 active pixels; that's 650 data points in one full spectrum, or one data point per nanometer.

Data programmed into a memory chip on each Red Tide includes wavelength calibration coefficients, linearity coefficients, and the serial number unique to each spectrometer. Our spectrometer operating software simply reads these values from the spectrometer — a feature that enables hot swapping of spectrometers among computers.

The Red Tide Spectrometer connects 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, eliminating the need for an external power supply. The Red Tide also interfaces to Pasco's Xplorer GLX, a unique combination of datalogger and lab analysis tool that eliminates the need for a computer.

The Red Tide, 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.

Ocean Optics Red Tide Fiber Optic Spectrometer

Features

- Sony ILX511 linear silicon CCD array detector
- Responsive from 350 to 1000 nm
- Sensitivity of up to 75 photons/count at 400 nm
- An optical resolution of ~2.0 (FWHM)
- Integration times from 3 ms to 65 seconds (15 seconds typical maximum)
- Embedded microcontroller allows programmatic control of all operating parameters
- EEPROM storage for
  - Wavelength Calibration Coefficients
  - Linearity Correction Coefficients
  - Other configuration parameters
- Low power consumption of only 450 mW
- 12 bit, 1MHz A/D Converter
- 3 triggering modes
- 2 programmable strobe signals for triggering other devices
- 24-pin connector for interfacing to external products
- Programmable for Standalone Operation
- CE Certification

System Requirements

You can use the Red Tide's 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 with the Red Tide.

EEPROM Utilization

An EEPROM memory chip in each Red Tide contains wavelength calibration coefficients, linearity coefficients, and a serial number unique to each individual spectrometer. 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

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.

Modular Light Sources and Sampling Accessories

Ocean Optics offers a complete line of spectroscopic accessories for use with the Red Tide. 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. Available accessories include the following:

- USB-ISS-UV-VIS Integrated Sampling System for Cuvettes (200–1100 nm)
- USB-ISS-VIS Integrated Sampling System for Cuvettes (390–900 nm)
- USB-LS-450 Pulsed Blue LED Module
- USB-DT Deuterium Tungsten Light Source (200–2000 nm)

Shipment Components

The following information and documentation ships with the Red Tide 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.

- **USB Cable (USB-CBL-1)**

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

- **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 Needed

- **SpectraSuite Operating Software**

  SpectraSuite is the only spectrometer operating software that works with the Red Tide. See *About SpectraSuite* for more information. The Red Tide can also be used with the Pasco Xplorer GLX.

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**

Chapter 2

Installing the Red Tide

Overview

You must install the SpectraSuite software application prior to connecting the Red Tide Spectrometer to the computer. The SpectraSuite software installation installs the drivers required for Red Tide installation. If you do not install SpectraSuite first, the system will not properly recognize the Red Tide.

If you have already connected the Red Tide to a computer running on a Windows platform prior to installing SpectraSuite, consult *Chapter 3: Troubleshooting* for information on correcting a corrupt Red Tide installation.

Red Tide Installation

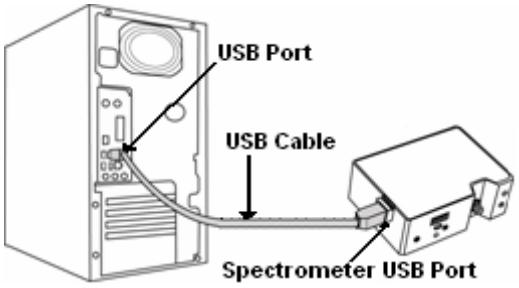
Note

The USB port on a computer can power up to five Red Tide spectrometer channels. Systems with more than five channels require a powered USB hub.

► *Procedure*

Follow the steps below to connect the Red Tide to a computer via the USB port:

1. Install SpectraSuite on the destination computer. See the *SpectraSuite Spectrometer Operating Software Installation and Operation Manual* (see *Product-Related Documentation*).
2. Locate the USB cable (USB-CBL-1) provided with the Red Tide.
3. Insert the square end of the cable into the side of the Red Tide.
4. Insert the rectangular end of the cable into the USB port of the computer.



If you installed SpectraSuite prior to connecting the Red Tide, the SpectraSuite installs the Red Tide drivers. If the drivers do not successfully install (or if you connected the Red Tide 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.

Connect Spectroscopic Accessories

To find operating instructions for Red Tide-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**.

External Triggering Options

You can trigger the Red Tide using a variety of External Triggering options through the 10-pin Accessory Connector on the spectrometer. See Appendix B: *External Triggering* for more information.

Chapter 3

Troubleshooting

Overview

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

Red Tide Connected to Computer Prior to SpectraSuite Installation

Windows Operating Systems

If you connected your Ocean Optics Red Tide device to the computer prior to installing your Ocean Optics 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 Red Tide 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 Red Tide 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 Red Tide

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 Red Tide.

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)

R_λ = the reference intensity at wavelength λ

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 Red Tide 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 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

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 Red Tide onto an EEPROM memory chip in the Red Tide.

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

► *Procedure*

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

1. Ensure that the Red Tide is connected to the computer 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 Red Tide device 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 Red Tide.

Appendix B

External Triggering

Overview

The Red Tide supports three triggering modes, which are set with the Trigger Mode command. A detail of each triggering mode follows.

Normal (Free Running)

In this mode, the Red Tide uses the user-defined integration clock and continuously scans the CCD array.

External Software Trigger

In this mode, the Red Tide uses the user-defined integration clock; however, the A/D converter is required to wait until the Trigger Input Signal goes HIGH before it acquires the data at the start of the next integration period. This is an asynchronous trigger mode that allows the user to define an integration period.

External Hardware Trigger

In this mode, the Red Tide uses an internally generated clock to generate the integration period. On the rising edge of this signal, the internal logic resets the CCD array, integrates for 50ms. This is a synchronous trigger mode but the integration time is fixed. OEMs can contact Ocean Optics for other periods.

Appendix C

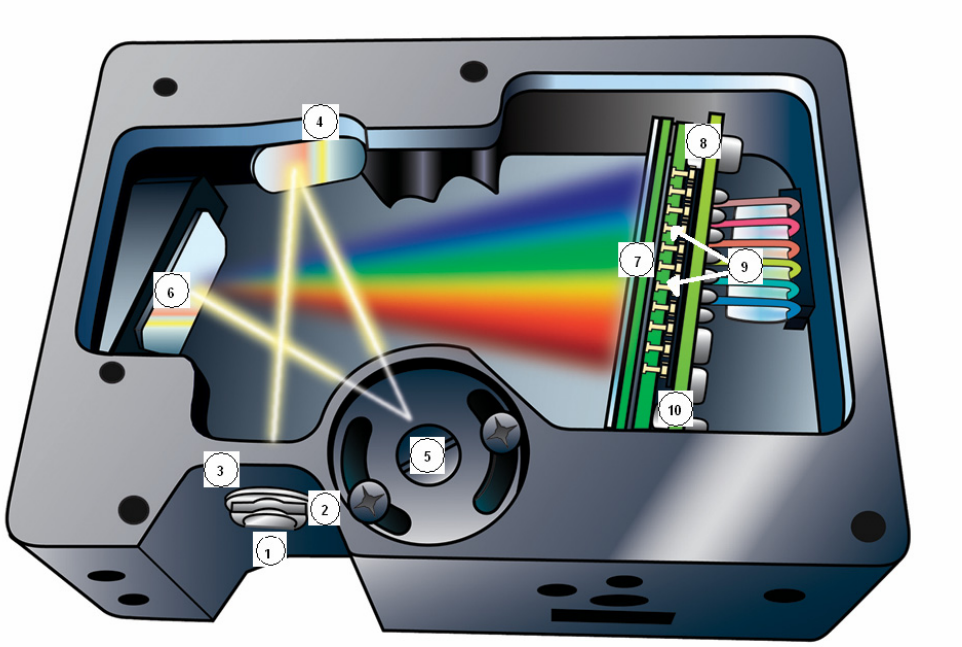
Specifications

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 Red Tide Works

Below is a diagram of how light moves through the optical bench of an Red Tide Spectrometer. The optical bench has no moving parts that can wear or break; all the components are fixed in place at the time of manufacture. Items with an asterisk (*) are user-specified.



Red Tide Spectrometer with Components

See *Red Tide Components Table* on the following page for an explanation of the function of each numbered component in the Red Tide Spectrometer in this diagram.

Red Tide Components Table

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

Item	Name	Description
1	SMA 905 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 (from 5 µm to 200 µm) regulates the amount of light that enters the optical bench and controls spectral resolution. You can also use the Red Tide without a Slit. In this configuration, the diameter of the fiber connected to the Red Tide 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. Specify standard or SAG+. 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. Only Ocean Optics technicians can change the Grating.
6	Focusing Mirror	Receives light reflected from the Grating and focuses first-order spectra onto the detector plane.
7	L4 Detector Collection Lens	An optional component that attaches to the Detector to increase light-collection efficiency. It focuses light from a tall slit onto the shorter Detector elements. The L4 Detector Collection Lens should be used with large diameter slits or in applications with low light levels. It also improves efficiency by reducing the effects of stray light. Only Ocean Optics technicians can add or remove the L4 Detection Collection Lens.
8	Detector (UV or VIS)	Collects the light received from the Focusing Mirror or L4 Detector Collection Lens and converts the optical signal to a digital signal. Each pixel on the Detector responds to the wavelength of light that strikes it, creating a digital response. The spectrometer then transmits the digital signal to the SpectraSuite application.

Item	Name	Description
9	OFLV Filters	OFLV Variable Longpass Order-sorting Filters block second- and third-order light. These filters are optional.
10	UV4 Detector Upgrade	The detector's standard window is replaced with a quartz window to enhance spectrometer performance (<340 nm). This upgrade is optional.

Red Tide Specifications

The following sections provide specification information for the CCD detector in the Red Tide, as well as the Red Tide Spectrometer itself.

CCD Detector Specifications

Specification	Value
Detector	Sony ILX511 CCD
No. of elements	2048 pixels
Sensitivity	75 photons per count at 400 nm
Pixel size	14 µm x 200 µm
Pixel well depth	~62,500 electrons
Signal-to-noise ratio	250:1 (at full signal)
A/D resolution	12 bit
Dark noise	3.2 RMS counts
Corrected linearity	>99.8%

Red Tide Spectrometer

Specification	Value
Dimensions	89.1 mm x 63.3 mm x 34.4 mm
Weight	190 g
Power consumption	90 mA @ 5 VDC

Specification	Value
Detector	2048-element linear silicon CCD array
Detector range	200-1100 nm
Entrance aperture	25 µm-wide slit
Order-sorting filters	Installed longpass and bandpass filters
Focal length	42 mm input; 68 mm output
Optical resolution	~2.0 nm FWHM
Stray light	<0.05% at 600 nm; <0.10% at 435 nm
Dynamic range	2×10^8 (system); 1300:1 for a single acquisition
Fiber optic connector	SMA 905 to single-strand optical fiber (0.22 NA)
Data transfer rate	Full scans into memory every 13 milliseconds with USB 2.0 port
Integration time	10 microseconds to >60 seconds (detector's limit is ~15 sec)
Interfaces	USB 2.0, 480 Mbps (USB 1.1 compatible); RS-232 (2-wire) @ 115.2 K baud
Operating systems	Windows 98/Me/2000/XP, Mac OS X, and Linux when using the USB port.
Analog channels	No

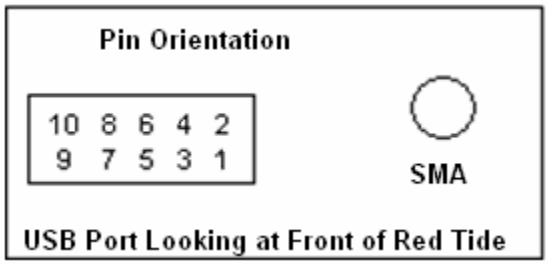
10-Pin Accessory Connector Pinout

The Red Tide features a 10-pin Accessory Connector, located on the front of the unit as shown:

Location of Red Tide 10-Pin Accessory Connector

10-Pin Accessory Connector Pinout Diagram

When facing the 10-pin Accessory Connector on the front of the vertical wall of the Red Tide, pin numbering is as follows:



10-Pin Accessory Connector Pinout Diagram

10-Pin Accessory Connector – Pin Definitions and Descriptions

The following table contains information regarding the function of each pin in the Red Tide's 10-Pin Accessory Connector:

Pin #	Function	Input/Output	Description
1	V_{CC}, V_{USB}, or $5V_{IN}$	Input or Output	Input power pin for Red Tide – When operating via USB, this pin can power other peripherals – Ensure that peripherals comply with USB specifications
2	RS232 Tx	Output	RS232 transmit signal – Communicates with a computer over DB9 Pin 2
3	RS232 Rx	Input	RS232 receive signal – Communicates with a computer over DB9 Pin 3
4	Lamp Enable	Output	TTL signal driven Active HIGH when the Lamp Enable command is sent to the spectrometer
5	Continuous Strobe	Output	TTL output signal used to pulse a strobe – Divided down from the master clock signal
6	Ground	Input/Output	Ground
7	External Trigger In	Input	TTL input trigger signal – See External Triggering Options document for info
8	Single Strobe	Output	TTL output pulse used as a strobe signal – Has a programmable delay relative to the beginning of the spectrometer integration period
9	I^2C SCL	Input/Output	The I^2C clock signal for communications to other I^2C peripherals.
10	I^2C SDA	Input/Output	The I^2C Data signal for communications to other I^2C peripherals.

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