



Optical Transmittance Spectrophotometer (OTS)

Installation and Operation Manual

Document Number OTS-00000-000-02-1008

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About This Manual

Document Purpose and Intended Audience

This document provides the user of the Optical Transmittance Spectrophotometer (OTS) with instructions for setting up, operating, and replacing the bulb.

Document Summary

Chapter	Description
Chapter 1: Introduction	Contains descriptive information about the OTS system. It also provides a list of system requirements, interface options, and shipment components.
Chapter 2: Installing the OTS	Provides installation instructions.
Chapter 3: Troubleshooting	Contains recommended steps to isolate and correct common problems.
Appendix A: Bulb Replacement	Provides instructions for replacing the bulb in the internal HL2000-HP-FSHA.

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.

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 the Ocean Optics miniature fiber optic spectrometer inside the OTS – regardless of the application – from manufacturing defects. It ensures you of the highest level of craftsmanship and reliability for years to come.

The OTS light source is covered for one year (not including the bulb).

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. 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 Optical Transmittance Spectrophotometer (OTS) is a compact system consisting of a USB2000+ Spectrometer, an HL2000-HP-FHSA light source and a FOIS integrating sphere that is specifically designed for accurate, repeatable measurements of optical filters, glass and ophthalmic lenses. OTS is ideal for both in-line and in-lab applications where transmittance accuracy (to +/- 1.0%) and precision (+/- 0.1%) are critical. Common applications include measurement of optical coatings, windows and filters, and glass and plastic components. The OTS is particularly useful for measuring tint color, photopic transmittance and UV cutoff of ophthalmic lenses and for characterizing photochromic, electrochromic and sun lens materials.



Ocean Optics Optical Transmittance Spectrophotometer

About the System

The OTS covers the 380-780 nm wavelength range and accepts samples from 10-150 mm in diameter and up to 10 mm thickness. The system consists of the following components:

- High-resolution miniature linear CCD-array USB2000 Spectrometer configured for 380-780 nm (SLIT-50, Grating #1)
- High-power, tungsten halogen light source
- Fiber optic integrating sphere for collecting signal transmitted through the sample
- Optics for improved beam collimation and spectral sensitivity distribution (including a BG34 Schott standard colored glass filter for greater sensitivity and less noise in the total visible spectrum)
- Short optical fiber to channel signal from the integrating sphere to the spectrometer
- Customized lens transmittance and color calculation software measures and displays up to 10 measurements at once. This custom software calculates T(avg 380-780nm), Luminous Transmittance T_v , and color: $L^* a^* b^*$, hue (h) and Chroma (C^*).



Features

Characteristics

Spectral range:	380-780 nm
Detection:	Miniature fiber optic spectrometer
Light source:	High-power tungsten halogen (360-2000 nm)
Sample collection:	Fiber optic integrating sphere
Color calculations:	CIE color characteristics
Measurement calibration:	Manual calibration using known filter standard (not included); calibration time <30 seconds
System calibration:	Recommend annual recalibration
Transmittance calibration standards:	Available (contact an Applications Scientist for details)
Typical samples measured:	Windows, filters, glass and plastic lenses
Sample size:	10-150 mm diameter, up to 10 mm thickness
Optical stage:	White powder-coated aluminum (optional black anodized aluminum version available)

Software:	Customized lens transmittance and color calculation software
Quality:	Conforms with ISO 8980-3, ISO 13666:1998, and CIE standards and norms
Manufacturing compliance:	CE/UL/RoHS/WEEE

Performance

Transmittance measurement accuracy:	+/-1.0%
Transmittance measurement precision:	+/-0.1%
Data acquisition time:	typically <5 seconds
Light source output:	20 watts
Light source stability:	0.5% (~15 minutes to stabilize)
Light source drift:	<0.3% per hour
Bulb lifetime:	2,000 hours
Bulb color temperature:	3,000 K
Light source temperature:	5 °C - 35 °C
Light source humidity:	5-95% RH

Computer & Power Requirements

Operating systems:	Windows Operating System
Computer interfaces:	USB 2.0 @ 480 Mbps
Power requirements:	100-240V, 50-60 Hz, 1.5A

EEPROM Utilization

An EEPROM memory chip in each spectrometer 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.

Shipment Components

- ❑ OTS system

The following information and documentation also ships with the OTS:

❑ **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.

Installing the OTS

Overview

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

If you have already connected your OTS system to the computer prior to installing the operating software, consult *Chapter 3: [Troubleshooting](#)* for information on correcting a corrupt OTS installation.

OTS Installation

This section contains instructions for connecting the OTS to a computer. To connect the OTS to a computer via the USB port, the computer must be running a Windows 2000/XP/Vista operating system.

► **Procedure**

Follow the steps below to connect the OTS 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 OTS.
3. Insert the square end of the cable into the USB port on the OTS.
4. Insert the rectangular end of the cable into the USB port of the computer.
5. Plug the power cord for the OTS light source into a power outlet (100-240V, 50-60Hz).

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

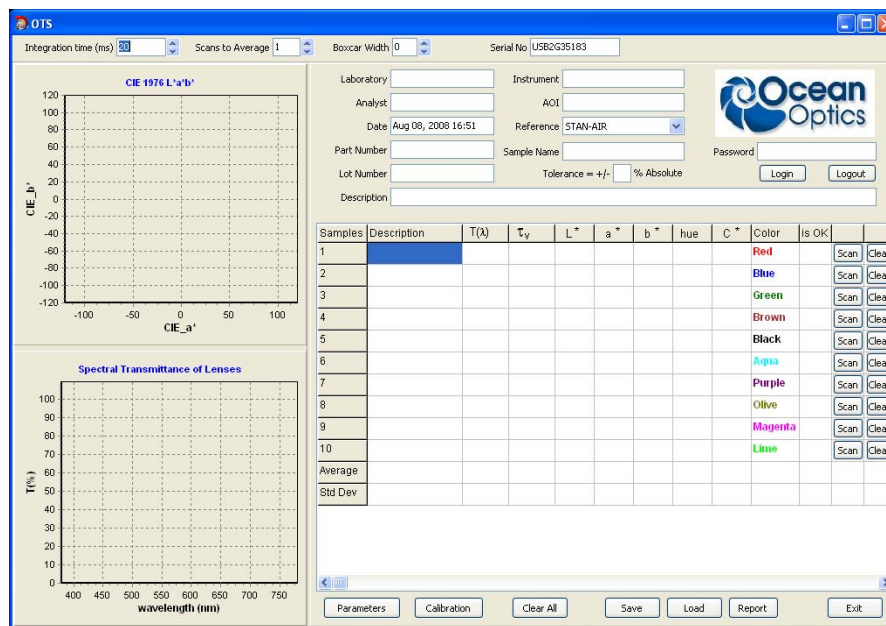
Once you install the software and hardware, you are ready to take measurements.

Measuring Transmittance

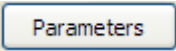

To use the OTS to measure transmittance of lenses, windows, etc., be sure that light source cord is connected with appropriate power (100-240V, 50-60Hz) to the rear of the OTS, and also the USB cord is connected between the OTS and a computer on which the OTS software has been loaded.

► Calibration Procedure

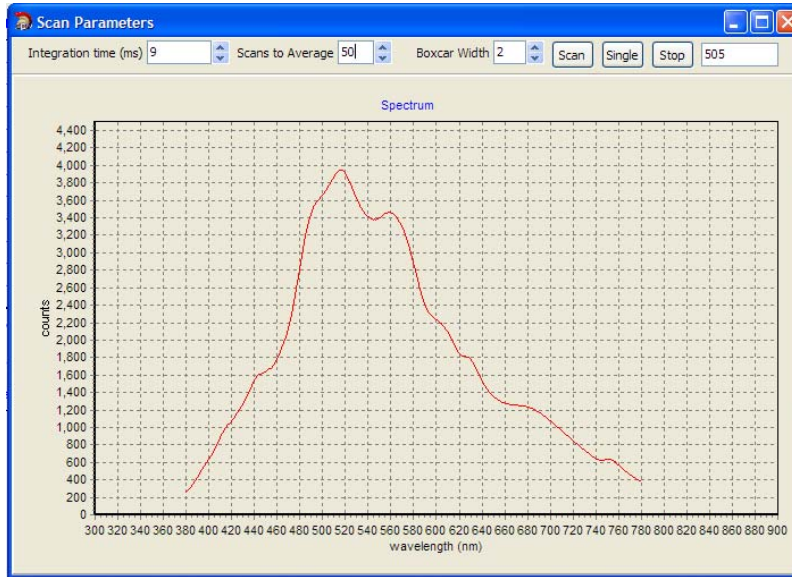
1. Turn on the OTS by flipping the lighted rocker switch on the side of the lamp support arm to the “On” position. If the light in the switch does not come on, check the power cord connections.
2. Double-click the OTS.exe application icon to open the OTS software. The OTS main screen appears.



OTS Main Screen (just after opening software)

3. Set up spectrometer parameters by clicking the  button.
4. In the Scan Parameters window, click the  button and adjust integration time to a value where the signal peak is between 3400 and 3600 counts, and with no signal saturation anywhere in the spectrum. Then set scan average, and boxcar. (For example, integration time = 9, scans averaged = 50, and Boxcar = 2). Close the window to return to the main screen.

Examples of correctly and incorrectly adjusted intensity profiles are shown below:

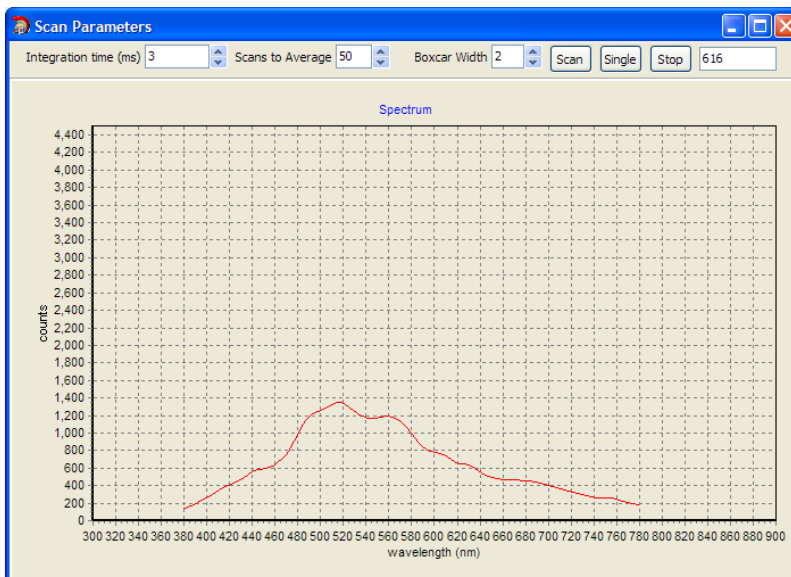


Correctly Adjusted Integration Time


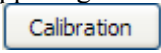


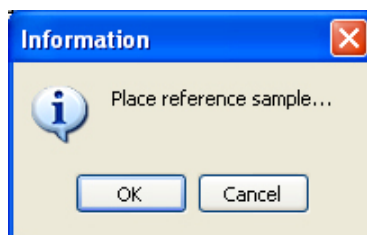
Incorrectly Adjusted Integration Time: Integration time set too high; part of spectrum is saturated

2: Installing the OTS

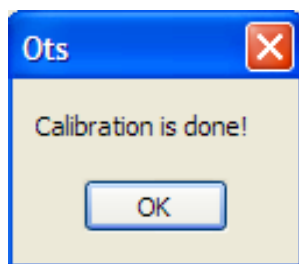


Incorrectly Adjusted Integration Time: Integration time set too low

5. When finished with setting parameters, close the Scan Parameters window by clicking the red  in the upper right corner of the Scan Parameters window (*not the OTS window!*).
6. Calibrate OTS. To do this, click the drop-down menu in the Reference box (in the upper right of the Main screen) to choose to calibrate to either Fused SiO₂ or Air. Then, click the  button. The following popup dialog box appears:



7. If you are calibrating using fused SiO₂ as the standard, place the thin SiO₂ sample on the stage. If you are calibrating using air as the standard, place no sample on the stage. Click OK, and leave the calibration piece in place until the following dialog box appears:



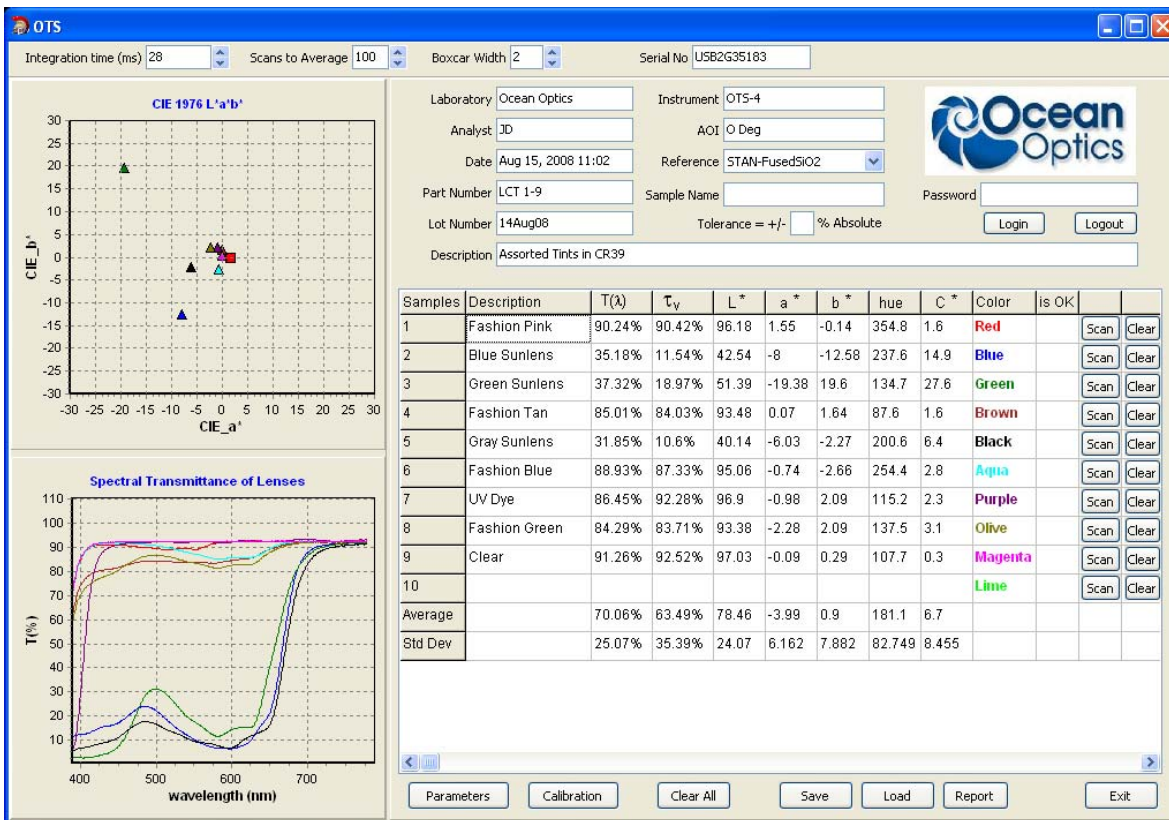
8. Click OK to return to the Main screen.

► **Measurement of Transmittance Procedure**

1. Place a tint sample on the stage and click a Scan button to acquire the spectra and calculate the color info for the sample. Up to 10 measurements may be made and compared. Average Transmittance $T(\lambda)$, Luminous Transmittance τ_v , and the color parameters $L^*a^*b^*$, along with hue and Chroma are displayed for each measurement.

Luminous transmittance is calculated in accordance with ISO 13666:1998(E/F). L^* , a^* , b^* , hue, and Chroma are all calculated from the measured spectra using the D65 illuminant and 10-degree observer.


The average and standard deviation for all data displayed are shown at the bottom of the table.



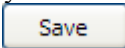
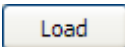
The color of the symbols in the a^*-b^* plot, as well as the data in the spectral transmittance plot are shown in the column labeled Color.

2. You can add details to specify laboratory, analyst, part number, lot number, etc.
3. Adjust the scaling on the charts, if desired. To do this, right-click on either chart, and then adjust to the desired axis range for the vertical and horizontal axes of both the a^*-b^* and spectral transmittance plots.
4. Delete individual data sets by clicking the Clear button pertaining to that row of data. Clear all displayed data at once by clicking the Clear All button.

► **Creating Reports Procedure**

By clicking the  button, the information on the screen, including charts, data table, and sampling details may be previewed, printed out, or saved in Native Printer Output (PRN) or Rave Snapshot File (NDR) format.

► **Saving Data Procedure**

Data can be saved in .txt format, for later retrieval by the OTS software or for viewing or further management using spreadsheet software. Press the  button and assign a name and location for the new .txt file. Load these .txt files in the OTS software for later reviewing of the saved results by pressing the  button.

Troubleshooting

Overview

The following sections contain information on troubleshooting issues you may encounter when using the OTS system.

OTS Connected to Computer Prior to Software Installation

Windows Operating Systems

If you connected your Ocean Optics OTS device to the computer prior to installing your 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 OTS 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.

Appendix A

Bulb Replacement

Overview

The OTS system contains the HL2000-HP-FSHA light source, which consists of a halogen bulb (Part No. HL-2000-HP-B), attenuator and TTL shutter. Specifications for this light source are as follows:

	HL-2000-FHSA-HP
Wavelength range	360 nm – 1700 nm
Stability	0.5 %
Drift	<0.1% per hour
Time to stabilize	Approximately 5 Minutes
Output to bulb	2V DC / 1,67A
Bulb life time	2000 h
Characteristic	Focused
Shutter	TTL max. 5Hz
DB-15 Connector	PIN 13: TTL PIN 10: Ground
Bulb color temperature	3.000K
Room temperature	5°C – 35°C
Humidity	5 - 95% at 40°C
Output	20W

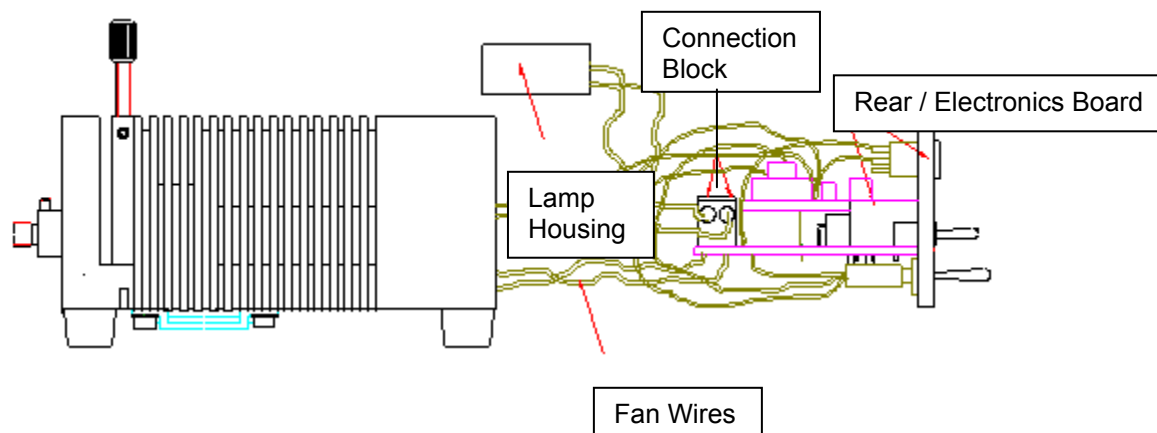
WARNING

Before replacing the bulb in the HL2000-HP-FHSA, disconnect the lamp from your power source and allow the unit to cool for at least twenty minutes, if necessary.

Replacing the Bulb

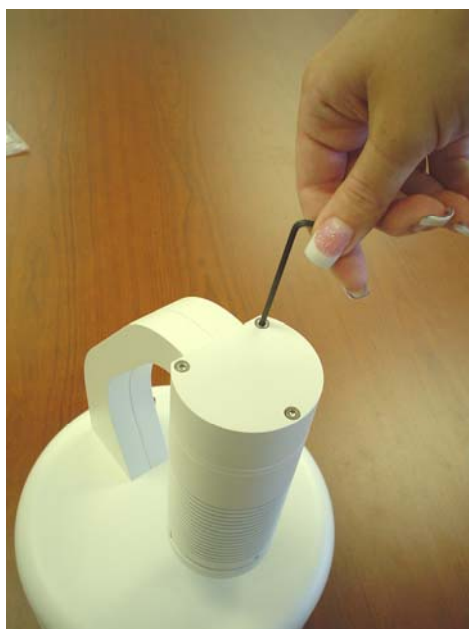
► Procedure

Refer to the following figure and perform the steps below to replace the bulb in the HL-2000-FHSA Light Source:



HL-2000-FHSA Bulb Replacement Diagram

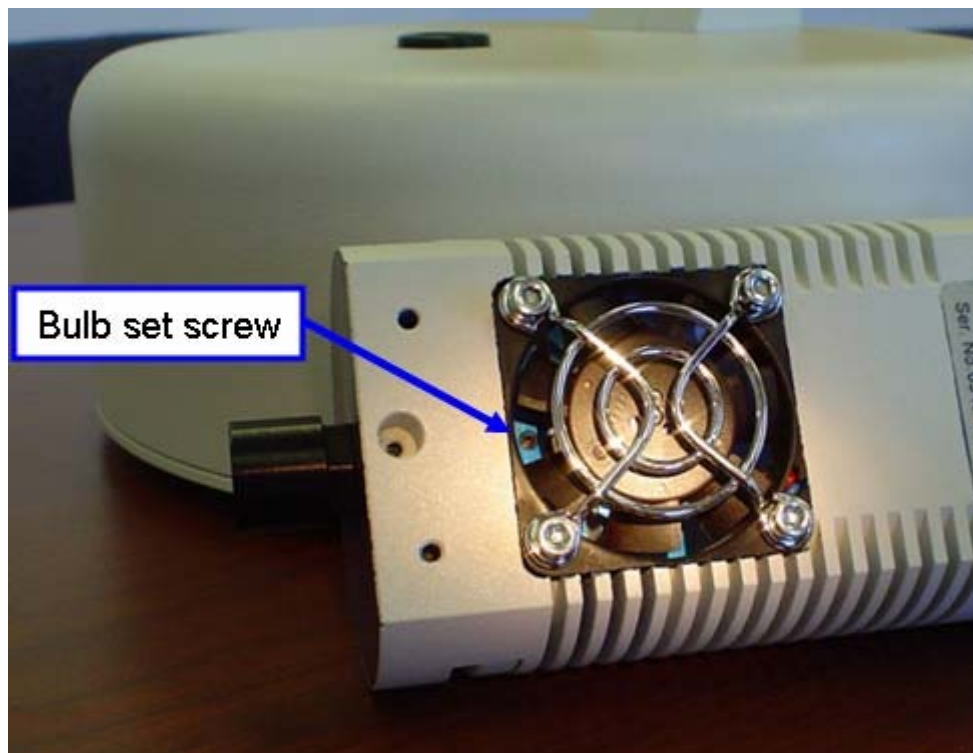
1. Unplug the power connector from the power socket on the back of the OTS unit.
2. While holding the light source, carefully remove the screws on the rear of the unit with the provided 2.5mm Allen wrench.



3. After removing the screws, lower the light source slightly until the connection wires are visible.
4. Carefully disconnect the 15-pin D-sub connector as well as the power connection from the top plate of the light source.



5. Remove the rear of the light source and remove the electronics mounting plate from the unit, taking particular care not to disconnect the fan wires.
6. Locate the set screw inside a small hole between fan blades. Loosen the set screw slightly with the provided 1.3mm Allen key, until the bulb is loose and can be pulled out (set screw need not be removed from light source body).



7. Remove the bulb from the light source.
8. Disconnect the wires from the connection block.

B: Specifications

9. Replace the bulb and reconnect the wires to the connection block.
10. Slide the lamp into the housing and secure the housing with the bottom screw.
11. Slide the electronics board back into the light source, taking particular care to ensure that the wires do not come into contact with the fan blades.
12. Reconnect the power connection and 15-pin D-Sub connector, taking care not to change the setting on the toggle switches on top of the unit. (The Power switch should be set to "ON" and the Shutter switch should be set to "TTL").
13. Secure the light source to the OTS using the 3 hex screws at the top of the instrument.

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