Redstone™ OSA305, Optical Spectrum Analyzer

Quick Start Guide

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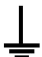
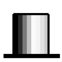
Chapter 1 Warning Symbol Definitions

Below is a list of warning symbols you may encounter in this manual or on your device.

Symbol	Description
	Direct Current
	Alternating Current
	Both Direct and Alternating Current
	Earth Ground Terminal
	Protective Conductor Terminal
	Frame or Chassis Terminal
	Equipotentiality
	On (Supply)
	Off (Supply)
	In Position of a Bi-Stable Push Control
	Out Position of a Bi-Stable Push Control
	Caution: Risk of Electric Shock
	Caution: Hot Surface
	Caution: Risk of Danger
	Warning: Laser Radiation
	Caution: ESD Sensitive Components

Chapter 2 Safety

All statements regarding safety of operation and technical data in this instruction manual will only apply when the unit is operated correctly.

SHOCK WARNING

High voltage inside. To avoid electrical shock, prior to powering on the unit, make sure that the protective conductor of the 3-conductor power cord is correctly connected to the protective earth contact of the socket outlet. Improper grounding can cause electric shock, resulting in severe injury or even death. Do not operate without the cover installed.

CAUTION

This unit must not be operated in explosive environments. If purging gas other than dry air is used, make sure that the environment for the operator is well ventilated since the gas will leak out from the instrument. This product is for indoor use only. To prevent potential fire or shock hazard, do not expose the unit to any source of excessive moisture. Only use the instrument standing on its feet.

WARNING

The Redstone OSA305 includes a red laser and an infrared laser. The classification of these lasers follows the European Standard IEC 60825-1:2014.

Viewing the laser output with telescopic optical instruments (for example, telescopes and binoculars) close to the aperture may pose an eye hazard! Using the instrument in combination with collimating optics may have an impact on the assigned laser classification. The safety of any system incorporating the equipment is the responsibility of the assembler of the system.

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Chapter 3 Using the OSA

3.1. Introduction

The Redstone Optical Spectrum Analyzer (OSA) is a general-purpose spectrum analyzer for optical research and production applications. It has a user-friendly Graphical User Interface (GUI) and can be controlled from a Windows®10 PC via a High-Speed USB 3.0 port. It is equipped with an FC/PC fiber input receptacle and a free-space input window for collimated beams up to Ø10 mm; however, special designs with other input receptacles are available on request. The frequency-locked reference laser can be accessed via the FC/APC connector on the front panel. The instrument is designed for measurements of continuous-wave (CW) light sources but works in some applications where pulsed light is used. Please contact Technical Support at techsupport.se@thorlabs.com to discuss your application if you have a pulsed source.

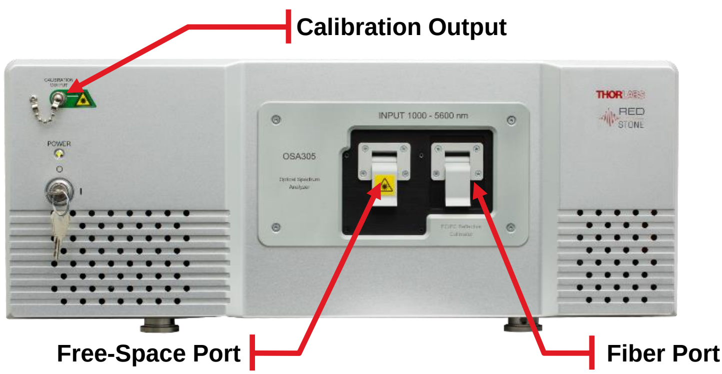


Figure 1 Front View of the Redstone OSA305

3.1.1. Software

The Redstone OSA305 is shipped with the software package pre-installed on the laptop computer that is included with the purchase of this instrument. The software has a customizable GUI for acquiring, inspecting, manipulating, and analyzing spectra and interferograms. The software makes it easy to locate and track spectral peaks or valleys, measure the optical input power over any wavelength range, calculate an absorption spectrum in real-time, or track a large number of parameters over time.

For usage with other computers the software is downloadable from the webpage.

3.2. Setup and Installation

Place the OSA on a flat and stable surface, and if the free-space input is to be used, it is recommended to use two Thorlabs CF175 clamping forks on the mounting feet to secure the OSA to an optical table, as shown in Figure 2. This will lock the interferometer to the optical table and reduce any vibrations that might interfere with the measurements.

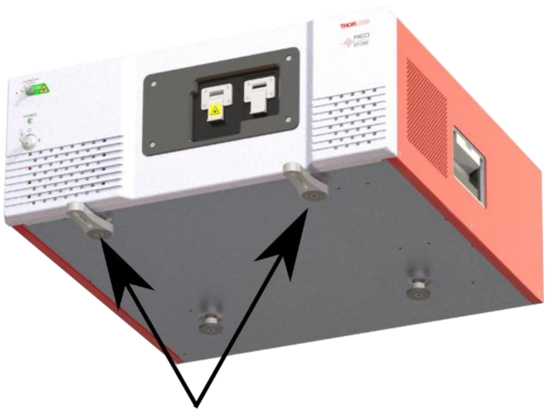


Figure 2 Using two CF175 clamping forks (marked with arrows), the Interferometer Assembly can be Locked to the Table

Once the OSA is placed correctly on the table, attach the power cable and connect the OSA to the computer with the OSA software installed (make sure that the software is installed on the computer before connecting the OSA), using an available USB 3.0 port on the PC and the included USB cable. After connecting the instrument to the PC, the operating system will load the appropriate USB drivers for the OSA. Please wait for this procedure to finish before doing anything else.

3.2.1. Starting the Application

Start the application “Thorlabs Redstone OSA.” When the Thorlabs OSA application starts, it will automatically detect all Thorlabs Redstone Optical Spectrum Analyzers connected to the PC. A list of all connected OSAs can be seen by clicking the button “Devices” found under the Instrument menu.

3.2.2. Overview: Software Interface

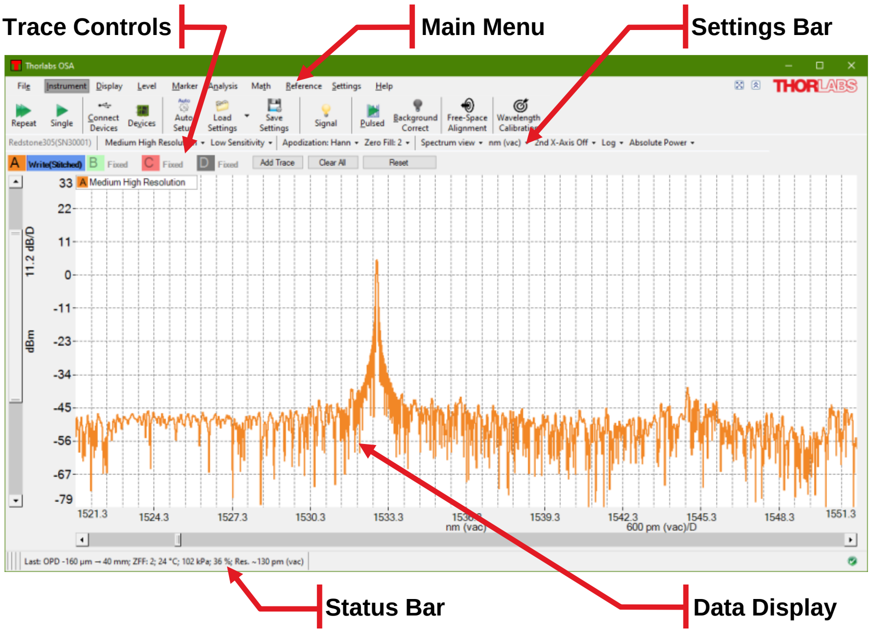


Figure 3 The main software interface with different menu selections marked with arrows, as well as the Status bar and Data display window

The Main menu (see Figure 3) contains all the common commands, from starting a measurement to analysis of the spectrum and mathematical operations. The Settings bar is located below the Main menu, providing easy access to common instrument settings and settings for the axes, 2nd x-axis etc. By clicking a Trace label, the Trace drop down menu is shown, where one can select input source, load a spectrum, clear the data, display trace data, and more. The bulk of the window is made up of the Data display area, where the spectra are plotted. The Status bar, indicating if the instrument is performing a measurement and information about the last successful measurement, is shown at the very bottom.

3.3. Optical Alignment

When using the fiber input port, no further alignment is necessary; an internal reflective collimator will collimate the beam and redirect it into the interferometer. However, when using the free-space port, it is important to ensure good alignment. This document will give some general tips; for more details, please see the "Free-space Alignment Tutorial", which can be opened by clicking the "Help" button in the Help menu.

Please ensure that the optical power of the input light does not exceed the maximum allowed power of 10 mW.

3.3.1. Optical Setup

To simplify the alignment, two mirrors in kinematic mounts should be used between the test source and the OSA, where one mirror is close to the source and the other is close to the OSA free-space port. Please see Figure 4 and Figure 5 for suggestions of mirror placement. If the beam height of your experimental setup is not consistent with the free-space input, the two mirrors and the distance between them make it possible to adjust the beam height to that of the OSA's input. Note that there is no need to keep the optical path parallel to the optical table until after the mirror closest to the OSA.

3.3.2. Initial Visual Alignment

Use the mirror closest to the test source to center the input beam on the OSA input. A viewing card, such as Thorlabs Item #s VRC2 or VRC6S, and/or an alignment plate, such as Thorlabs Item # CPA2, can be used to aid in the alignment. Then, open the "Free-space Alignment" window from the Instrument menu, activate the alignment beam, and use the mirror closest to the OSA to point the alignment beam at the center of the input source. Repeat adjusting the two mirrors in turn until both conditions are fulfilled; the two beams then overlap over the entire beam path. To further optimize the alignment, the DC signal value of the detectors are shown whenever the alignment beam is active. Maximizing these values will most often lead to good interferometric signal values.

3.3.3. Final Alignment using the OSA

Once the system is roughly aligned, deactivate the alignment beam in order to see a spectrum in the main software window. Change the settings to Low Resolution and Low Sensitivity and start a continuous measurement. Use the "Free-Space Alignment" window to adjust the gain levels. First, adjust the gain levels until the signal values lie between about 10% to 80%. Note that if the source is weak, the sensitivity may need to be increased, as this enables higher gain levels for some detectors. However, this will also slow down the measurements. If the source is strong, the attenuation filters can be activated through the "Free-Space Alignment" window.

To optimize the alignment, there are several software analysis tools that can be used. In addition to the signal values in the "Free-Space Alignment" window, it is recommended to survey the detected optical power by using the Power tool (under the Analysis menu) and to observe either the interferogram or spectrum. A time series measurement of the signal and/or power can be started via the "Long-Term" functionality (see Section "Long-Term Analysis" in the manual) to get a reading of how these values change as you adjust the two mirrors.

Once the desired software tools are selected, repeat the alignment procedure described above but utilize the OSA readings instead of the viewing card to optimize the alignment. Remember to decrease the gain level and/or activate the attenuation filter if any detector gets close to saturation.

When the “Free-space Alignment” window is closed, and whenever necessary during normal operation such as when the input source conditions have changed considerably, the autogain algorithm will run a series of short sweeps to determine optimal gain and offset settings. An overlay window will appear during this time advising the user to wait for optimization to complete.

3.3.4. Example setups

Figure 4 and Figure 5 display two common scenarios involving the free-space input port.

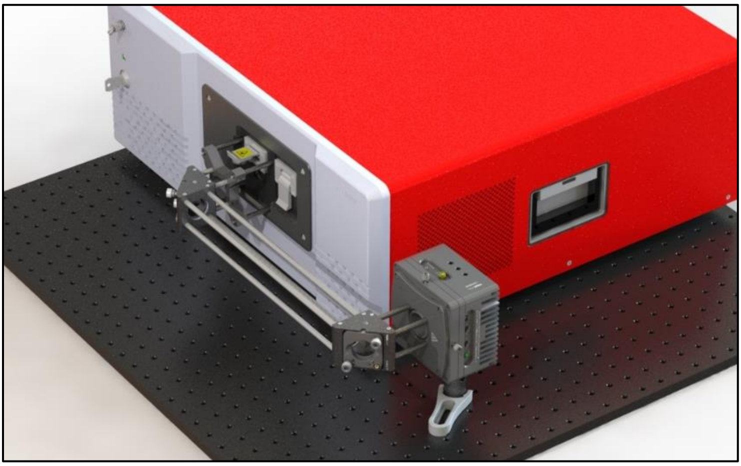


Figure 4 Free-Space setup suitable for a Collimated Source, using a Laser Diode mounted in a Thorlabs LDM56 Laser Diode Mount. Two mirrors are used to facilitate the Alignment Process and to adjust beam height.

Figure 5 Free-Space setup suitable for a Broadband Divergent Source, in this case illustrated with Thorlabs SLS203L Stabilized Light Source. The source is kept at a short distance from the OSA to minimize input losses.

3.4. Starting a Measurement

Once the OSA is connected to the PC, the OSA name will appear to the left on the Settings bar. It can also be found in the list of available devices shown by clicking the “Devices” button, found under the Instrument menu.

The GUI can assist with selecting acquisition settings suitable for the input source. Clicking the “Auto setup” button under the Instrument menu will start an automated process, which will try to determine the nature of the input source and apply suitable settings.

A measurement is started by clicking the “Single” or “Repeat” buttons under the Instrument menu, see Figure 3. Information such as gain level etc. is displayed in the Status bar at the bottom of the screen.

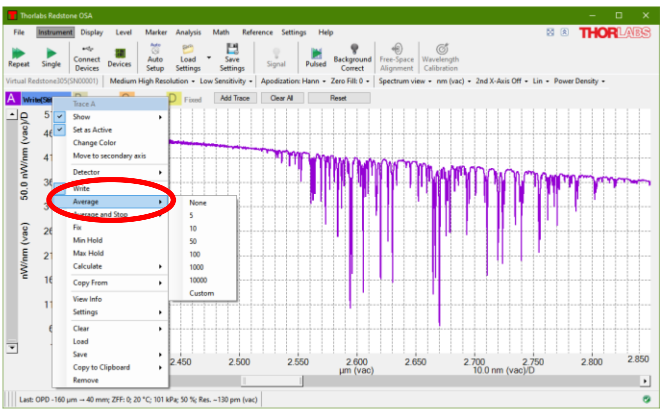


Figure 6 The Trace Drop Down menu, with the Average option marked

It is possible to average multiple spectra, which normally reduces noise levels of the measurement. It can therefore be beneficial to average a few spectra if the intensity of the incoming light is low. The averaging is selected under the Trace drop down menu (see Figure 6); here it is also possible to select the number of sweeps to include in the average.

3.4.1. Sensitivity and Resolution

The Redstone OSA305 instrument can be set to one of four resolution settings: High, Medium High, Medium Low, or Low, which correspond to resolutions of 2.0 GHz (0.0625 cm^{-1}), 7.5 GHz (0.25 cm^{-1}), 30 GHz (1.0 cm^{-1}), and 120 GHz (4.0 cm^{-1}), respectively. The available sensitivity settings are High, Medium, and Low, corresponding to different speeds of the moving mirror inside the instrument and controls the number of available detector gain levels. The trade-off is between higher measurement update frequency, and higher resolution and increased sensitivity. It is recommended to start in Low Resolution and Low Sensitivity to find coarse settings of the trace followed by higher resolution measurements, if needed.

3.4.2. Saving Your Data

The data can be saved by selecting the File menu (see Figure 7) or by opening the Trace drop down menu. Saving in Thorlabs' OSA file format, .spf2 / .spf2x, allows for easy loading and post-processing using the OSA software. A variety of other file formats are also available for export including .csv, .txt, .m, and more.

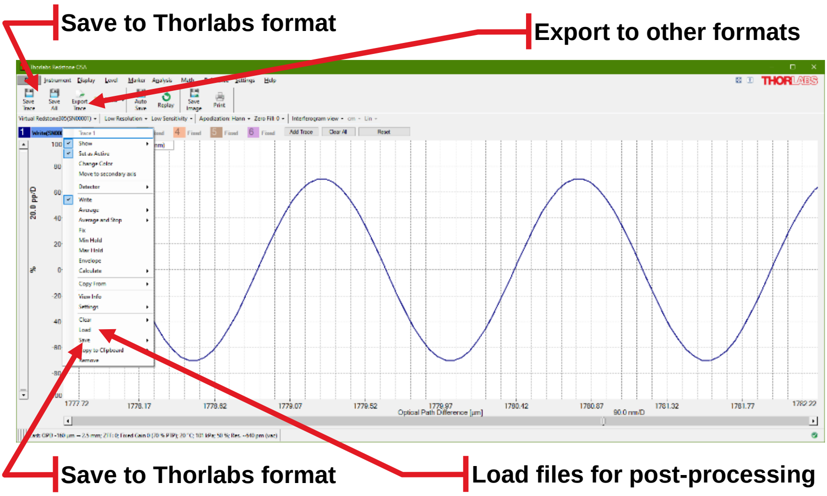


Figure 7 It is possible to save the data after a performed measurement in several ways.

3.5. Functions and Appearance

3.5.1. Interferogram View vs Spectrum View

The OSA GUI can either display the interferogram or the spectrum. To switch between the views, use the quick-switch button found in the Settings bar. Regardless of which view that is displayed, data for both spectrum and interferogram is still collected. Note that the Interferogram View is disabled for Basic level users. Open the Settings dialog and switch to Advanced level for access to interferograms.

For both views, only the analysis tools and math tools available for that particular view (Spectrum or Interferogram) are enabled.

3.5.2. Using Markers

The movable markers (see Figure 8) can be moved by placing the mouse cursor over the marker, where the mouse cursor changes into a double arrow. Press and hold the left mouse button to drag the movable marker to the desired position.

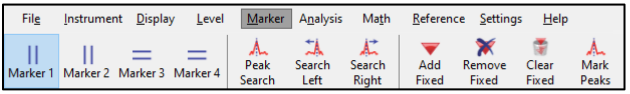


Figure 8 Marker Menu

As long as any movable marker is enabled, the Movable Markers dialog box will be shown either as a floating window or docked to the main window. The dialog box shows the position of each enabled line marker, the value of the active trace at the position of the line marker(s), and the level of each enabled level marker. If both line markers are enabled, the distance between them and the difference in value of the active trace at the two positions is shown. If both level markers are enabled, the difference or quotient between them will be displayed. Which value to be shown can be changed by clicking the Settings icon displayed above the marker values.

3.5.3. Analysis Tools

A variety of analytical tools is available under the Analysis menu, such as the Peak Track and Valley Track (see Figure 9), Curve Fit, Statistics, and more.

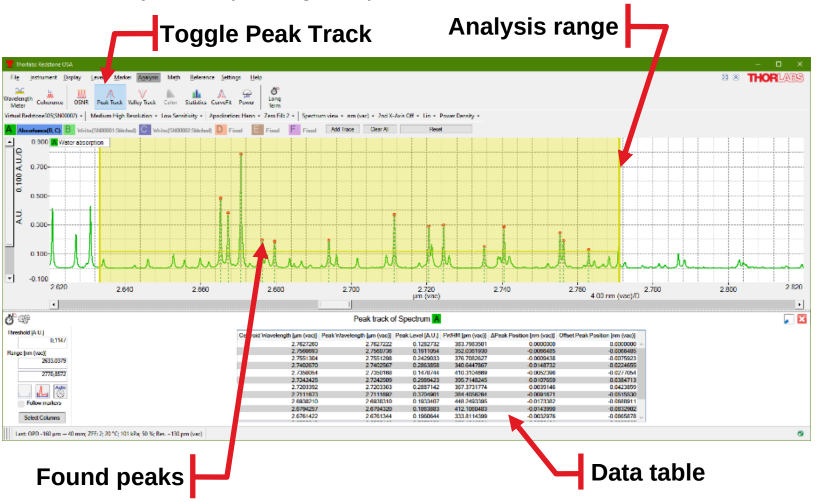


Figure 9 Peak Track Tool, used on water absorption seen in a broadband spectrum

3.5.4. Trace appearance

If the color of the trace needs to be changed, this can be done under the Trace drop down menu, followed by the "Change color" option. The thickness of the traces can also be changed, under the "Display" tab in the "Settings" dialog.

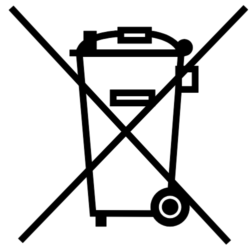
The order of the traces can be altered by a simple drag-and-drop procedure.

Chapter 4 Regulatory

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return “end of life” units without incurring disposal charges.

This offer is valid for Thorlabs electrical and electronic equipment:

- Sold after August 13, 2005
- Marked correspondingly with the crossed out “wheelie bin” logo (see right)
- Sold to a company or institute within the EC
- Currently owned by a company or institute within the EC
- Still complete, not disassembled and not contaminated



Wheelie Bin Logo

As the WEEE directive applies to self-contained operational electrical and electronic products, this end of life take back service does not refer to other Thorlabs products, such as:

- Pure OEM products, that means assemblies to be built into a unit by the user (e.g. OEM laser driver cards)
- Components
- Mechanics and optics
- Left over parts of units disassembled by the user (PCB’s, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

Waste Treatment is Your Own Responsibility

If you do not return an “end of life” unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

Ecological Background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of life products will thereby avoid negative impacts on the environment.

Chapter 5 Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.

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