OceanOptics

OCEAN NR SERIES

High Resolution Spectrometers

Installation and Operation Manual

Locations

Americas

Manufacturing & Logistics
3500 Quadrangle Blvd.,
Orlando, FL 32817, USA

Sales: info@oceanoptics.com
Orders: orders@oceanoptics.com
Support: support@oceanoptics.com

Phone: +1 727-733-2447
Fax: +1 727-733-3962

www.oceanoptics.com

Europe, Middle East & Africa

Sales & Support
Geograaf 24, 6921 EW Duiven,
The Netherlands

Logistics
Maybachstrasse 11,
73760 Ostfildern,
Germany

Email: emeasales@oceanoptics.com

Netherlands: +31 26-319-0500
Netherlands Fax: +31 26-319-0505
Germany: +49 711-341696-0
UK: +44 1865-819-922
France: +33 442-386-588

Asia

Ocean Optics China
3F, Building 16, No. 155
Yuanke Road, Minhang District
Shanghai 200336
People's Republic of China

Email: asiasales@oceanoptics.com

China: +86 21-6295-6600
China Fax: +86 21-6295-6708
Japan & Korea: +82 10-8514-3797
Ocean Optics India: +91 81 7847-0108
Prestige Shantiniketan, Gate No. 2,
Tower C, 7th Floor, ITPL Main Road,
Whitefield, Bengaluru, Karnataka 560 048, India

Table of Contents

Before You Get Started

Warnings & Cautions

Caution: Read this manual thoroughly before using and operating this equipment.

Caution: Do not let contaminants get into the bench. Keep the protective cap on the slit aperture when not connected to an accessory, probe or fiber.

Caution: Only change the slit aperture in a clean environment where contaminants including dust cannot enter the bench during the procedure.

Caution: Substitution of a component or accessory different from that supplied may result in measurement error, equipment damage, increased radio-frequency emissions or decreased immunity from electrical disturbances.

Caution: Repairs should be undertaken only by personnel trained or authorized by Ocean Optics. The device does not contain any user serviceable parts.

Caution: Do not immerse the device in any fluid, place fluids on top of or attempt to clean with liquid detergents or cleaning agents. This may cause an electrical hazard. Use a clean linen cloth to wipe the equipment. Do not use if accidental wetting occurs.

Caution: Do not remove any covers. Doing so may increase the risk of electrical shock or compromise the integrity of the optical components.
Caution: Do not gas sterilize or autoclave this device.

Caution: Consult local codes and ordinances for proper disposal of equipment and other consumable goods.

Caution: The device and/or accessories may not operate correctly if used or stored outside the relevant temperature and humidity ranges described in the Technical Specifications.

Caution: Do not use if device is dropped and/or damaged. Have an authorized service representative check the device before using again.

Caution: Be sure to install any software BEFORE connecting the spectrometer to your PC or host system. The software installs the drivers required for spectrometer installation. If you do not install the software first, the system may not properly recognize the spectrometer.

Caution: The user of this spectrometer shall have the sole responsibility for any malfunction that results from improper use, faulty maintenance, improper repair, damage or alteration by anyone other than Ocean Optics or their authorized service personnel.

Warranty

For the most current warranty information, please visit www.oceanoptics.com.

Certifications and Compliance

Warning

This is an FCC Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

Warning

The authority to operate this equipment is conditioned by the requirement that no modifications will be made to the equipment unless the changes or modifications are expressly approved by the manufacturer.

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which the user will be required to correct the interference at his own expense.

FCC Compliance

The WEEE symbol on the product indicates that the product must not be disposed of with normal household waste. Instead, such marked waste equipment must be disposed of by arranging to return to a designated collection point for the recycling of waste electrical and electronic equipment. Separating and recycling this waste equipment at the time of disposal will help to conserve natural resources and ensure that the equipment is recycled in a manner that protects human health and the environment.

CE **Warning**	This device has been tested and complies with the following standards: Electromagnetic Compatibility Directive – 2004/108/EC EN 61326-1:2013 Basic Level EN 55011:2009 w/A1:2010 Group 1 Class A
RoHS Compliant	This device complies with RoHS materials standards.
ISO Certification	Ocean Optics, the applied spectral knowledge company, has been certified for ISO 9001:2015 certification applicable to the design and manufacture of electro-optical equipment.

Introduction

Product Description

A high-performance optical bench, low-noise electronics and various grating options make Ocean NR Spectrometers the best choice for modular NIR spectroscopy. This small footprint, near infrared spectrometer is available in several different models that cover various wavelength ranges between 900 nm and 2500 nm. Ocean NR spectrometers are built using industry leading manufacturing techniques that help deliver high thermal stability and low unit-to-unit variation without compromising the flexibility and configurability that are the hallmark of the design. Features such as interchangeable slits, indicator LEDs and simple device connectors deliver more freedom and flexibility.

Features

- Plug-and-play capability via the USB-C connection.
- User-interchangeable slit.
- LEDs show power and data transfer status.
- 4 GPIO pins through the Ocean Optics standard 16 pin connector.

Items Included with Shipment

- Ocean NR Spectrometer
- +5VDC Power Supply
- Standard 15-Pin Accessory Cable
- USB Type-A to Type-C Cable
- Wavelength Calibration Data Sheet
- Linearity Calibration Data Sheet

(Please save Calibration sheets for future reference)

Installation and Setup

Software Installation

Consult the Ocean Optics Software Download web site for desired application.

Use OceanView version 2.0.15 or later for Ocean NR. You can use OceanView on the following operating systems:

Windows			Mac
8	8.1	10	OS X Version 10.5 or later on Intel processor

*Software may run with previous operating systems but Ocean Optics does not actively support these installations.

Hardware Setup

The Ocean NR Spectrometer connects to a computer via the USB port or the optional RS-232 serial port. The use of the serial port requires the use of the optional Accessory Cable (not included).

Consult the OceanView manual for computer hardware requirements.

When connected with the USB port, the Ocean NR Spectrometer can be used with OceanView software. If you have followed the previous steps and started your spectroscopy application, the spectrometer is already acquiring data. Even with no light source to 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, indicating that the software and hardware are correctly installed.

USB Mode

Follow the steps below to connect the Ocean NR Spectrometer to a computer via the USB port:

1. Install the spectroscopy application onto the destination computer, and then reboot the system.
2. Plug the +5VDC supply adapter into an electrical outlet, then connect the power cord with the 2.5 mm power plug into the power jack on the rear of the Ocean NR Spectrometer.
3. Insert the Type-C end of the USB cable (USB-CBL-2.0.6) into the rear of the Ocean NR Spectrometer, and then insert the rectangular end into the USB port of the computer.
4. Connect any spectroscopy accessories. To find operating instructions for Ocean NR-compatible products (such as light sources, sampling chambers, and probes), consult the Ocean Optics website at OceanOptics.com.
5. Attach the light source fiber to the fiber optic connector on the spectrometer.

Serial Port Mode

Follow the steps below to connect the Ocean NR Spectrometer to a computer via the Serial port. Note that an optional interface cable (not included) will need to be used. Ocean Optics does provide cable **CBL-ISDF-DB9** as an option for this.

1. Install the spectroscopy application onto the destination computer, and then reboot the system.
2. Plug the +5VDC supply adapter into an electrical outlet, then connect the power cord with the 2.5 mm power plug into the power jack on the rear of

the Ocean NR Spectrometer.

3. Install the optional ISDF-to-Serial interface cable between the 16-bit I/O Connector and the Host computer.
4. Connect any spectroscopy accessories. To find operating instructions for Ocean NR-compatible products (such as light sources, sampling chambers, and probes), consult the Ocean Optics website at Oceanoptics.com.
5. Attach the light source fiber to the fiber optic connector on the spectrometer.

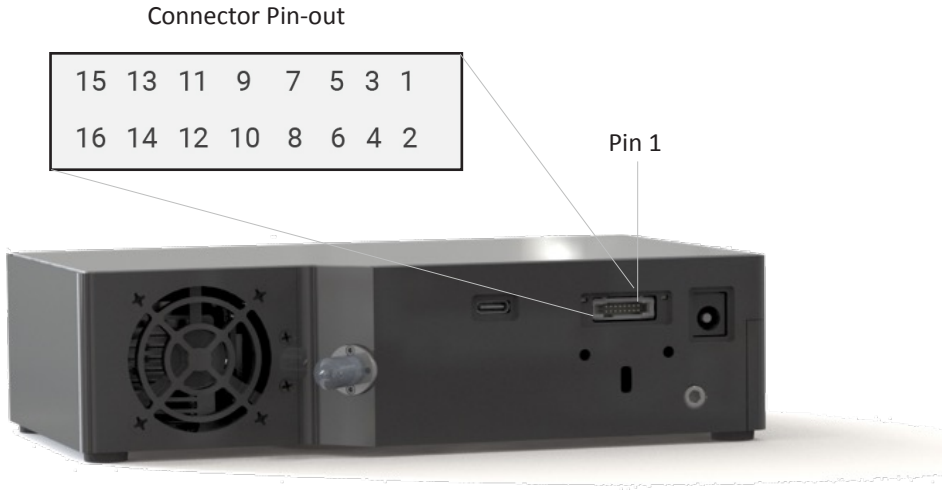
Hardware Features

NOTE

The OceanView software does not support this serial mode.

16 Pin IO Connector

This port allows the spectrometer to be connected to a host, Ocean Optics light sources and other external equipment via the connector signals shown in the following table. Note that an optional interface cable will need to be used.



PIN	Function	Description
1	RS-232-TX	NR transmit to host
2	RS-232-RX	NR receive from host
3	GND	Ground
4	RSTn	External reset input
5	LampEnable	Output
6	ExtTrigIn	External trigger input
7	SingleStrobe	Single strobe output
8	ContStrobe	Continuous strobe output

PIN	Function	Description
9	GPIO.0	General purpose I/O
10	GPIO.1	General purpose I/O
11	GPIO.2	General purpose I/O
12	GPIO.3	General purpose I/O
13	Reserved	
14	Reserved	
15	Reserved	
16	GND	Ground

NOTE: Use cable **CBL-ISDF-DB15** for the following light sources: DH-3Plus, DH-2000, HPX(US), HL-2000-FSHA, HL-3P, DH-MINI.
Use cable **CPL-ISDF-PX-DB15** (not included) for the following light sources: PX-2.

External Reset Input Pin

The Ocean NR Spectrometer can reset itself via an external reset pin. Applying a logic low input to the **RSTn** pin places the NR into a hardware reset condition and will remain in reset until the input is brought high again. Note that this is a full hardware reset, all operating parameters are also reset to defaults which can be restored by re-initializing via software commands.

RS-232 Interface

The spectrometer supports an optional RS-232 interface for communication as an alternative to USB. Refer to the Serial Communications Protocol Technical Note available on our website for details on how to connect to and use the RS-232 interface.

Status Indicator LEDs

The Ocean NR features two indicator lights that operate as shown:

LED	Steady	Flashing
Red	Unit is ON	N/A
Green	N/A	Transmitting Data

NOTE

LEDs can be turned off in OceanView or by using a software API command in OmniDriver or Ocean Direct.

Troubleshooting

Sometimes things do not go according to plan. If not, do not hesitate to contact us and our Tech Support team will leap into action. Some typical questions are answered here. For more information, consult the FAQs on the Ocean Optics website.

Ocean NR Connected to Host Prior to Application Installation

Windows Operating Systems

If you connected your Ocean NR device to the computer prior to installing your spectroscopy application (OceanView) 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: **www.oceanoptics.com.**

Remove the Unknown Device from Windows Device Manager

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). Rightclick 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 Ocean NR spectrometer from your computer.
6. Re-plug the Ocean NR spectrometer into your computer.

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

Apple Mac OSX Operating Systems

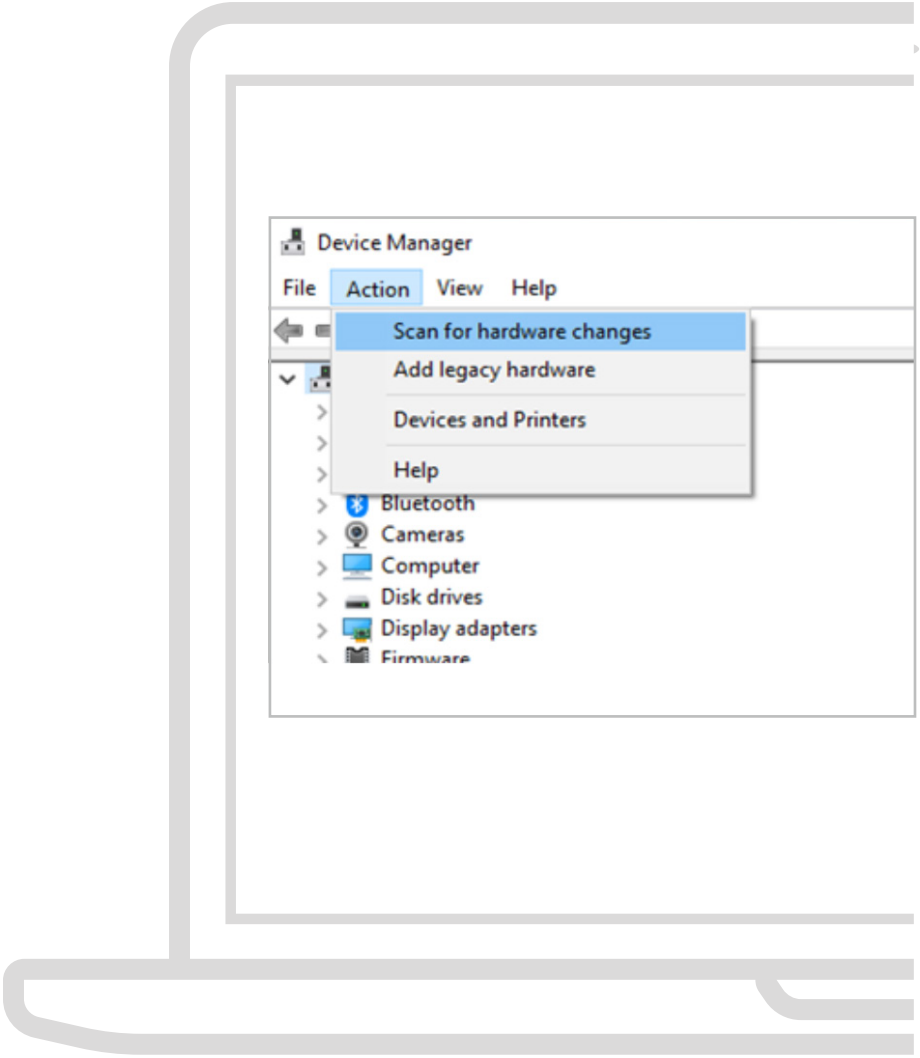
Since there are no device files for the Ocean NR Spectrometer in a Mac operating system, you should not encounter any problems if you installed the spectrometer before the operating software.

Frequently Asked Questions

I connected the USB cable and started OceanView but I don’t see my spectrometer attached.

Use the “Action -> Scan for hardware changes” selection in the Device Manager to rescan for attached devices.

I am having trouble installing the drivers, what should I do?



Hardware device driver installation is usually seamless on Microsoft Windows operating systems and should happen in the background when you connect your spectrometer to a computer with the software installed. However, some Windows systems require a bit more care when connecting your spectrometer for the first time.

If your spectrometer is not recognized by OceanView on your computer, you need to manually install the spectrometer drivers. See your OceanView

manual for this procedure. Also consult the Correcting Device Driver Issues document on www.oceanoptics.com

How do I know my spectrometer has power?

The red LED on the spectrometer should be constantly on if the unit is receiving power.

How do I know my spectrometer is transmitting data?

The green LED on the spectrometer flashes when transmitting data.

I connected the Ocean NR to the computer before installing my spectroscopy operating software to install the drivers. What do I do now?

As detailed below, the steps to take to resolve this issue differ, depending on your computer's operating system.

How do I check the configuration of my spectrometer?

Check the label on the bottom of your spectrometer. You can also check your configuration using OceanView by opening the Schematic window and double-clicking the spectrometer icon.

Repairs

Sometimes accidents happen! If you need to return your Ocean Optics product for repair, here is what to do:

1. Contact us to evaluate and diagnose the problem. If it is determined that the product must be returned, the representative will issue an RMA number.
2. Package your product, ideally in the original packaging, and return it to Ocean Optics, along with the RMA number that you received.

Upon careful examination, we'll advise you with an estimate. When your product is ready, it will be returned to you.

NOTE

For RMA returns under warranty we will organize and pay for shipping both ways. For accidental damage, you pay only to have the product shipped to your closest Ocean Optics or distributor office

Servicing

To keep your instrument in tip-top shape we recommend yearly wavelength recalibration. You can do this yourself if you have appropriate tools or we can do this for you. Contact your local representative to find out more about service availability and cost. We offer the following services:

- Wavelength Calibration
- Absolute Irradiance Calibrations

Technical Specifications

	Ocean NR 1.7	Ocean NR 1.7 HGM	NR 2.2 SGM	NR 2.2 HGM
DETECTOR				
Pixels:	512			
OPTICAL BENCH				
Design:	f/3, symmetrical crossed Czerny-Turner			
Shutter activation time:	11 ms			
Entrance Aperture (Standard)	25 µm			
Entrance Aperture (Custom)	10 µm, 50 µm, 100 µm, 200 µm [or no slit]			
Grating Options (Standard)	NIR3, 150 l/mm, 900-1700 nm		NIR1, 75 l/mm, 900-2500 nm	
SPECTROSCOPIC				
Wavelength range:	900-1650 nm		900-2120 nm	
Optical resolution (FWHM)[1]:	2.85 nm		4.8 nm	
SNR full signal ratio (Int=10ms)[2]:	10000:1	2800:1	9700:1	2788:1
A/D resolution:	16 bits			
Dark noise:	3.5 RMS	5.4 RMS	3.3 counts	5.7 counts
Dynamic range (single scan)[3]:	21000:1	12000:1	17510:1	10323:1
Dynamic range (system)[4]:	2.94E8	2.28E7	TBD	TBD
Scan rate[5]:	275 Hz		242 HZ	
Integration time:	1ms – 120s		1ms – 120s	

Technical Specifications

	Ocean NR 1.7	Ocean NR 1.7 HGM	NR 2.2 SGM	NR 2.2 HGM
Corrected linearity:	99.80%	99.60%	99.90%	99.50%
ELECTRICAL				
Power:	+5VDC, 3.5A maximum			
Power-up time:	3s			
USB Type-C Ratings (VCC):	Minimum 4.75V, Nominal 5V, Maximum 5.25V			
I/O Connectors:	USB Type-C, SMA, 16 pin Samtec TFM			
I/O Standard:	3.3V CMOS (all inputs are +5V compatible)			
Host Interface:	USB 2.0 High Speed; RS-232 (2-wire) @ 115.2Kbaud			
Strobes:	Single and Continuous modes			
Triggering:	Software, External rising edge, External level			
External Triggering Jitter:	10ns maximum			
PHYSICAL				
Dimensions (mm):	182 x 110 x 47			
Weight (kg):	1.18 (w/o power supply)			

Technical Specifications

	Ocean NR 1.7	Ocean NR 1.7 HGM	NR 2.2 SGM	NR 2.2 HGM
ENVIRONMENTAL				
Temperature (Storage):	-30°C to 70°C			
Temperature (Operation):	10°C to 35°C			
TEC range[6]:	40°C below ambient			
TEC stability:	±0.5°C of set temperature in <1 minute; typical long-term stability ±0.1°C			
Humidity[7]:	0-85% non-condensing			
Altitude (Operation):	Up to 2000m			
Pollution Degree	2			

1. Optical resolution (FWHM) depends on grating and slit selection.
2. Measurements based on integration time of 10ms. SNR will decrease at longer integration times.
3. Dynamic range for a single acquisition is a measure of the ratio of full signal to noise.
4. Dynamic range of the system is the range of the detectable light level and can be thought of as the maximum detectable light level at the minimum integration time divided by the minimum detectable light level at the maximum integration time.
5. Scan rate is dependent on factors external to the spectrometer. This figure was obtained using Omnidriver and OceanDirect API's.
6. The TEC range is only guaranteed when the unit is within the specified Operating Temperature. For example, the unit may operate fine at temperatures outside of the specified operating range, but the TEC range may be reduced.
7. Condensation can occur if the dew point of the environment is met. This must be taken into consideration when selecting the appropriate TEC setpoint of the detector which could manifest this condition.

Powering the Spectrometer

The Ocean NR is a high-performance spectrometer that requires 5VDC power to be supplied via the 2.5mm DC power jack and communication to be established with a host computer via the USB-C connector. Although the connection sequence is unimportant, the spectrometer will not fully boot until 5VDC is detected at the 2.5mm DC power jack. This will be indicated by the red LED flashing on and off at a 1 second interval, if only the USB-C interface is connected. Once 5VDC is detected, the device will complete the boot process and the LED will be set to a solid red color. At this point, the spectrometer will require a brief warm-up period to achieve its optimal thermal setpoint where best performance is attained. Ocean Optics software will provide indication to the user when the thermal setpoint is achieved and the spectrometer is ready for use.

If power is removed from the 2.5mm DC power jack at any time during operation, the spectrometer will restart the boot process under USB-C power and wait for 5VDC to again appear at the 2.5mm DC power jack before the boot process can be completed. Once again, a brief warm-up period will be required for the spectrometer to reach its optimum thermal setpoint. Similarly, if the ambient temperature surrounding the spectrometer changes suddenly, time is required for the device to reach its new thermal setpoint for optimum performance.

Timing Signals

The spectrometer supplies two strobe output signals to allow the user to synchronize external devices to trigger events and integration time. Each strobe signal can be independently enabled or disabled. The following subsections define the Single Strobe and Continuous Strobe Output signals. The Single and Continuous Strobe signals are accessible on the 16 Pin IO Connector..

Single Strobe Output

Synchronization of external devices to the spectrometer's Trigger Event can be accomplished with the Single Strobe output. The Single Strobe output is an active-high programmable pulse that occurs at a user-defined time during each acquisition cycle. The Single Strobe output has two user configurable settings; Single Strobe Delay and Single Strobe Width.

The timing of the Single Strobe output signal is referenced from the Trigger Event. The Single Strobe Delay (t_{SSDLY}) defines the time from the Trigger Event until the rising edge of the Single Strobe output. After the Single Strobe Delay has elapsed and the Single Strobe output has gone high, it will remain active for a duration equal to the Single Strobe Width (t_{SSH}). The Single Strobe output will return to a low or inactive state at the end of the Single Strobe Width.

Note that there is a delay from the Trigger Event until the start of integration. So, if the Single Strobe Delay is less than the Integration Delay, then the Single Strobe will assert before the start of integration. Also note that if the Single Strobe output is configured for a longer period than the integration time, it will reset to its inactive state at the end of the integration time. Refer to the timing diagrams later in this section for more information on the Single Strobe Timing.

Continuous Strobe Output

The Continuous Strobe output signal is a periodic signal with a 50% duty cycle that occurs during the integration time of each acquisition cycle. The Continuous Strobe output has a user configurable Continuous Strobe Period (t_{CSPER}). The Continuous Strobe signal is only valid during the integration time (t_{INTEG}).

When operating in Software Trigger or External Edge Trigger modes, the Continuous Strobe signal is only exercised if it can complete a full period within the integration period. For the continuous Strobe signal to be fully realized for at least one period,

the integration time must be greater than the Continuous Strobe Period. If there are multiple Continuous Strobe periods within an integration period, only full periods are generated. This means the time between the last Continuous Strobe period and the end of integration time (t_{CSOFF}) is between 0 and t_{CSPER}.

When operating in External Level Trigger mode, the Continuous Strobe output will return to a low logic level at the end of the integration time. This may truncate any Continuous Strobe period in progress, resulting in a partial period.

Refer to the timing diagrams later in this section for more information on the Continuous Strobe timing.

Trigger Timing

A Trigger Event is an action that causes the spectrometer to start an acquisition cycle. An acquisition cycle can be broken up into 3 sections. The first section is a delay, the second is the integration time, and then lastly a busy time. A Trigger Event can be driven by a command from software, or the External Trigger input signal located on the 16 Pin IO Connector.

There are several triggering modes for the spectrometer, and they have specific timing requirements. In addition, the Single Strobe and Continuous Strobe output behavior are directly related to the trigger modes. This section will define and describe the overall function of the trigger modes and strobe signals.

Acquisition Delay

The Acquisition Delay is a user programmable time that delays the start of integration from the Trigger Event. Note that the start of the Continuous Strobe output signal is tied to the beginning of integration, so the Acquisition Delay will also delay the start of the Continuous Strobe output. The Single Strobe is relative to the Trigger Event, so it is not affected by the Acquisition Delay. The Acquisition Delay does not affect the length of integration, it only delays the start of integration relative to the Trigger Event.

Refer to the timing diagrams later in this section for more information on the Acquisition Delay timing.

Trigger Modes

The spectrometer supports three trigger modes, which are set with the Trigger Mode command. Detailed information of each trigger mode follows.

The 3 trigger modes are:

Software Trigger: A trigger is initiated internal to the spectrometer with a command from software. The integration time is set by software configuration.

External Edge Trigger: A trigger is initiated by the rising edge of the External Trigger input signal on the 16 Pin IO Connector. The integration time is set by software configuration.

External Level Trigger: A trigger is initiated by the rising edge of the External Trigger input signal on the 16 Pin IO Connector. The integration time is determined by the pulse width of the External Trigger input.

Software Trigger

The default triggering mode is for a software trigger. A software trigger may be initiated by either OceanView, Omnidriver, or OceanDirect software. Once a command is sent to the spectrometer, an internal trigger is generated which begins

an acquisition cycle. The moment that the spectrometer recognizes a software trigger is called a Trigger Event. Note that there is some latency between the software on the host computer and the Trigger Event; this latency varies between computer systems.

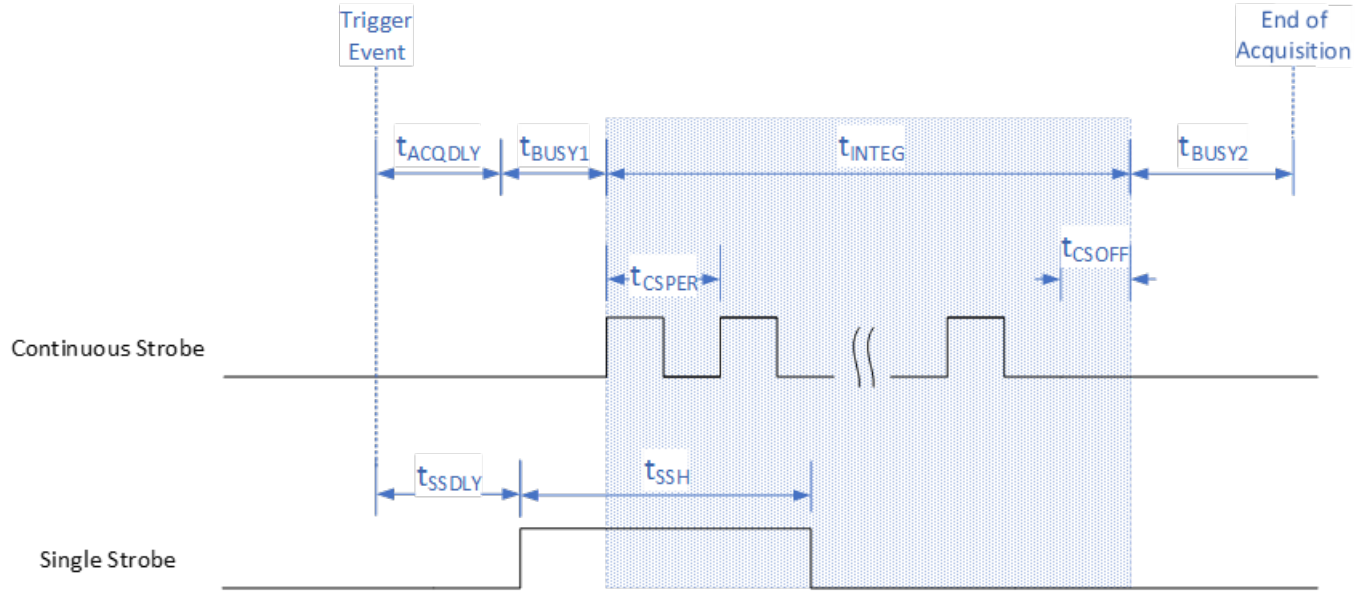
There is a delay between the Trigger Event and the start of integration time. This delay is the sum of the user defined acquisition delay (t_{ACQDLY}) and a fixed delay (t_{BUSY1}).

The integration time (t_{INTEG}) is user defined in software. This is the time that the detector is collecting spectra data.

There is another delay (t_{BUSY2}) after the integration time completes until the end of the acquisition cycle. After the acquisition cycle completes, the spectrometer transfers data to the host computer and is then ready for another trigger.

The Single Strobe timing is relative to the Trigger Event. The Single Strobe has a configurable delay defined as t_{SSDLY}. The Single Strobe is a single pulse that goes high at the end of t_{SSDLY} and stays high for a specified time of t_{SSH}. The values for the Single Strobe delay and pulse width are set by the user in software.

The Continuous Strobe signal is a series of pulses with a user specified period that starts with the beginning of the integration time (t_{INTEG}). The pulses have a 50% duty cycle and only full periods are exercised during the integration time. If a subsequent Continuous Strobe period cannot be completed before the end of the integration time, the continuous strobe signal is turned off and set to 0.



Software Trigger characteristics are defined in the table below.

Table 1. Ocean NR Software Trigger Timing Characteristics

Symbol	Description	Time			Notes
		min	typ	max	
t_{ACQDLY}	Acquisition Delay	0 µs	--	335,500 µs	User specified, 1µs resolution
t_{BUSY1}	Initial Busy	--	1094 µs	--	Constant at 1094 µs
t_{INTEG}	Integration Time	6 µs	--	120 s	User specified, 1 µs resolution
t_{BUSY2}	Final Busy	--	1038 µs	--	Constant at 1038 µs
t_{SSDLY}	Single Strobe Delay	0 µs	--	--	User specified, 1 µs resolution. Single Strobe returns low at the end of integration time.
t_{SSH}	Single Strobe Width	0 µs	--	--	User specified, 1 µs resolution. Single Strobe returns low at the end of integration time.
t_{CSPER}	Continuous Strobe Period	0 µs	--	t_{INTEG}	User specified, 1 µs resolution. Should be less than Integration Time.
t_{CSOFF}	Continuous Strobe Off Time	0 µs	--	t_{CSPER}	

External Edge Trigger

The External Edge Trigger mode for the spectrometer uses a rising edge on the External Trigger input signal from the 16 pin IO connector as the source for a Trigger Event. The External Trigger signal must have a minimum high time of at least 10 ns. There is a short delay ($t_{ETRGDLY}$) between the external signal rising edge and Trigger Event where the acquisition cycle begins.

For the case of an External Edge Trigger, T0 is defined as the moment the external trigger signal goes from low to high. After the External Edge Trigger Delay ($t_{ETRGDLY}$), there is the integration delay (t_{BUSY1} + t_{ACQDLY}), followed by the integration time (t_{INTEG}), then finally the last busy time (t_{BUSY2}).

The Single Strobe signal for the case of an edge trigger event is similar to a software trigger. The Single Strobe Delay is relative to the Trigger Event. The Single Strobe Width defines the pulse width of the Single Strobe output signal.

Also, the Continuous Strobe signal function while in External Edge Trigger mode is the same as that of the software trigger. The Continuous Strobe output signal starts with the start of the integration time. Only full periods of the Continuous Strobe are exercised during integration time.

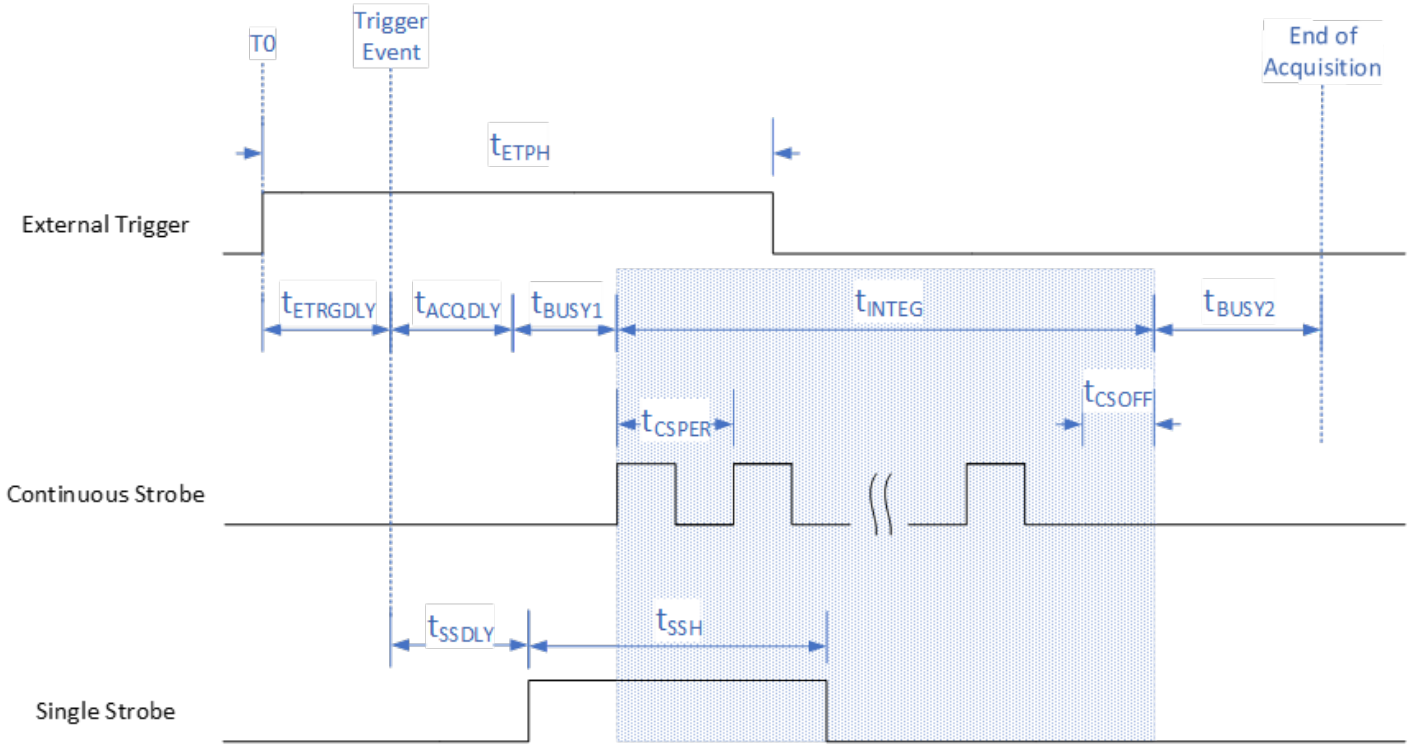


Table 2. External Edge Trigger Timing Diagram

External Edge Trigger timing characteristics are defined in the table below.

Table 3. Ocean NR External Edge Trigger Timing Characteristics

Symbol	Description	Time			Notes
		min	typ	max	
t_{ETPH}	External Edge Trigger Pulse Width	10 ns	--	--	
$t_{ETRGDLY}$	External Edge Trigger Delay	20 ns	--	30 ns	Time from External Trigger rising edge to Trigger Event
t_{ACQDLY}	Acquisition Delay	0 µs	--	335,500 µs	User specified, 1µs resolution
t_{BUSY1}	Initial Busy	--	1094 µs	--	Constant at 1094 µs
t_{INTEG}	Integration Time	6 µs	--	120 s	User specified, 1 µs resolution
t_{BUSY2}	Final Busy	--	1038 µs	--	Constant at 1038 µs
t_{SSDLY}	Single Strobe Delay	0 µs	--	--	User specified, 1 µs resolution. Single Strobe returns low at the end of integration time.
t_{SSH}	Single Strobe Width	0 µs	--	--	User specified, 1 µs resolution. Single Strobe returns low at the end of integration time.
t_{CSPER}	Continuous Strobe Period	0 µs	--	t_{INTEG}	User specified, 1 µs resolution. Should be less than Integration Time.
t_{CSOFF}	Continuous Strobe Off Time	0 µs	--	t_{CSPER}	

External Edge Trigger

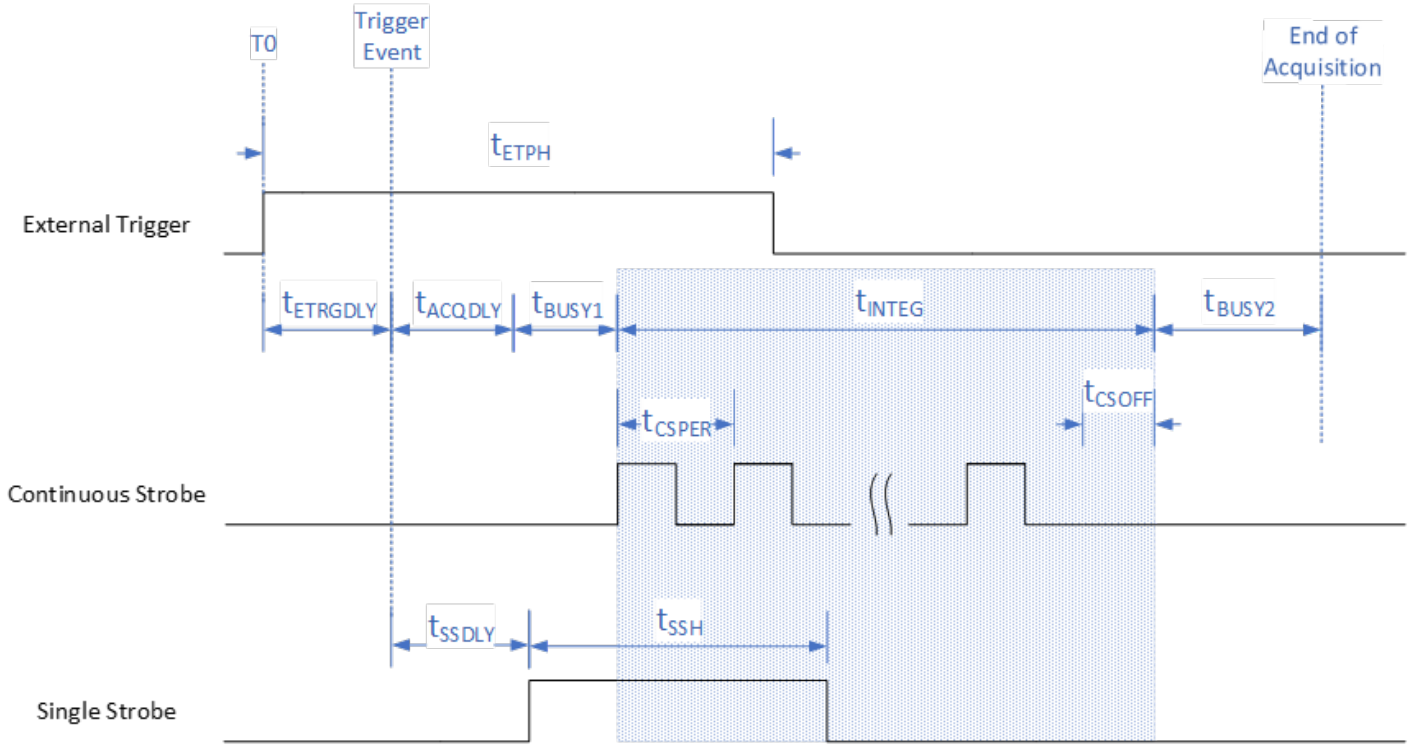
The External Edge Trigger mode for the spectrometer uses a rising edge on the External Trigger input signal from the 16 pin IO connector as the source for a Trigger Event. The External Trigger signal must have a minimum high time of at least 10 ns. There is a short delay ($t_{ETRGDLY}$) between the external signal rising edge and Trigger Event where the acquisition cycle begins.

For the case of an External Edge Trigger, T0 is defined as the moment the external trigger signal goes from low to high. After the External Edge

Trigger Delay ($t_{ETRGDLY}$), there is the integration delay (t_{BUSY1} + t_{ACQDLY}), followed by the integration time (t_{INTEG}), then finally the last busy time (t_{BUSY2}).

The Single Strobe signal for the case of an edge trigger event is similar to a software trigger. The Single Strobe Delay is relative to the Trigger Event. The Single Strobe Width defines the pulse width of the Single Strobe output signal.

Also, the Continuous Strobe signal function while in External Edge Trigger mode is the same as that of the software trigger. The Continuous Strobe output signal starts with the start of the integration time. Only full periods of the Continuous Strobe are exercised during integration time.



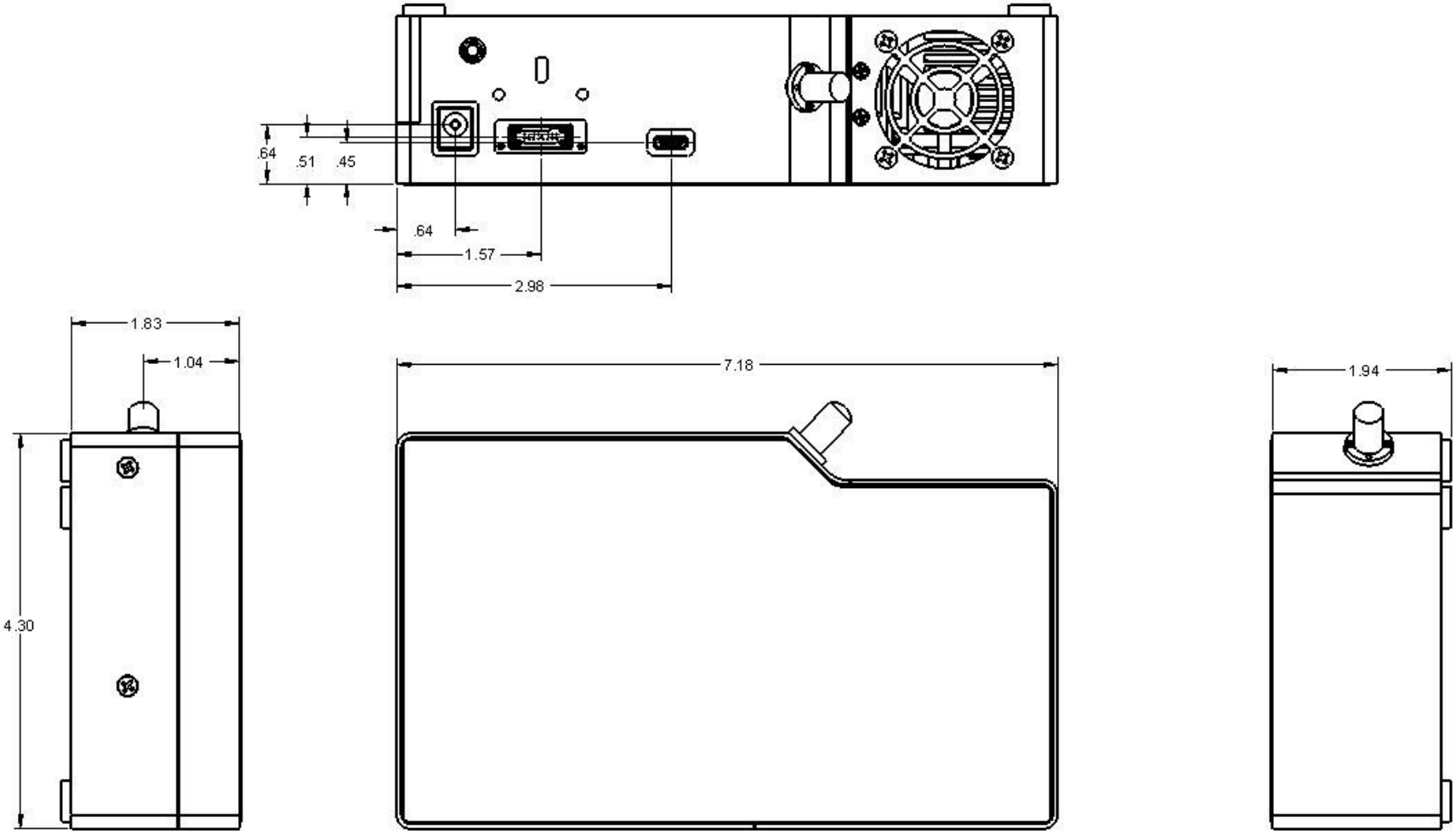
External Level Trigger timing characteristics are defined in the table below.

Table 6. Ocean NR External Level Trigger Timing Characteristics

Symbol	Description	Time			Notes
		min	typ	max	
t_{TLPUL}	External Level Trigger Pulse Width	6 µs	--	10 s	Integration time is equal to tTLPUL
$t_{ETRGDLY}$	External Edge Trigger Delay	20 ns	--	30 ns	Time from External Trigger rising edge to
t_{ACQDLY}	Acquisition Delay	0 µs	--	335,500 µs	Trigger Event
t_{BUSY1}	Initial Busy	--	1094 µs	--	User specified, 1 µs resolution
t_{INTEG}	Integration Time	6 µs	--	120 s	Constant at 1094 µs
t_{BUSY2}	Final Busy	--	1038 µs	--	Constant at 1038 µs
t_{SSDLY}	Single Strobe Delay	0 µs	--	--	User specified, 1 µs resolution. Single Strobe returns low at the end of integration time.
t_{SSH}	Single Strobe Width	0 µs	--	--	User specified, 1 µs resolution. Single Strobe returns low at the end of integration time.
t_{CSPER}	Continuous Strobe Period	0 µs	--	t_{INTEG}	User specified, 1 µs resolution. Continuous Strobe negates at end of integration time.

Mechanical Dimensions

Note: Dimensions are in inches.



Calibration

Each Ocean NR contains wavelength calibration coefficients, linearity coefficients, and a serial number unique to each spectrometer. The spectroscopy 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.

Wavelength Calibration

Each spectrometer is calibrated before it leaves Ocean Optics, however the wavelength for all spectrometers will drift slightly as a function of time and environmental conditions.

For instructions on how to calibrate the OCEAN NR, visit www.oceanoptics.com.

Irradiance Calibrations

Irradiance calibrations and relative irradiance calibrations are about quantifying the spectra, by translating the signal (incident number of photons) to a calibration. This can be either absolute (an atomic emission light source of known output power) or relative (corrected for instrument response function but not absolute units). It can be considered a measurement technique and is used widely in remote sensing, light metrology and anywhere where you wish to characterize the incident light source. Irradiance calibrations are not required for many techniques because these measure the relative signal changes with respect to the sample and not the light source.

You can find out more about irradiance calibration techniques www.oceanoptics.com.

OceanView has wizards that will step you through absolute irradiance and relative calibrations. More information on these is located in the OceanView website.

Questions?

Chat with us at www.oceanoptics.com.
info@oceanoptics.com

US +1 727-733-2447
EUROPE +31 26-3190500
ASIA +86 21-6295-6600

Unlock the Unknown

Ocean Optics exists to end guessing. We equip humanity with technology and data to make precisely informed decisions providing transformational clarity for human advancement in health, safety, and the environment.