Smarter than the Average Spectrometer

Meet the Jaz Modular Sensing Suite

We designed Jaz® to incorporate a number of autonomous modules that share common networking and electronics. Because of its modular design, high-performance spectrometer, Ethernet connectivity, battery operation and PC-free performance, Jaz is nimble in a virtually endless array of applications.

And, since your Jaz can operate independently of your computer, there's no limit to where it can take you.

Customize your Jaz modules to include light sources, multiple channels and more. The choices are only limited by your imagination.

Make Jaz Your Own

Imagine having all the gear needed for optical sensing in one, convenient form. That's what we've done with Jaz while blending the functionality of all its parts into a single, seamless instrument.

A basic Jaz includes the spectrometer module and onboard DPU. All other modules are optional so you can mix and match for the configuration that best handles your application. Jaz has a home in the lab, the field, the process line and anywhere you need reliable, accurate optical sensing.

Operating software and development packages are available separately.

In the Lab

Jaz's Ethernet connectivity and battery operation make it a brilliant lab companion – perfect for remote sensing and sharing data across your network. Mix and match Jaz modules to optimize setups for absorbance, reflectance and emission applications.

In the Field

With Jaz's onboard display and microprocessor, you're free to roam! Ideal for field analysis, Jaz does its processing in a convenient, handheld modular stack – storing data to an SD card and processing spectra through its powerful onboard DPU.

Multichannel Sampling

With Jaz, you can add up to eight spectrometer modules for the most simple and convenient multichannel analysis ever. Jaz's spectrometers are incredibly robust for demanding environments and even temperatures of -10 °C to +55 °C.

Jaz Modules

Here's How it Breaks Down

Jaz Spectrometer Module
- Benchmarked to the performance standards of the USB2000+ Spectrometer
- 200-1100 nm Sony ILX511B CCD array detector
- Multiple gratings available

Jaz DPU Module
- 128 x 64 OLED display
- Choice of two screen/button orientations
- Embedded microprocessor for data processing
- Custom programmable scripting

Jaz Ethernet Module
- 100 Mbps, IEEE 802.3 compliant connectivity
- SD card slot
- Enables remote access via any computer on the same network
- Single-cable solution that provides PoE

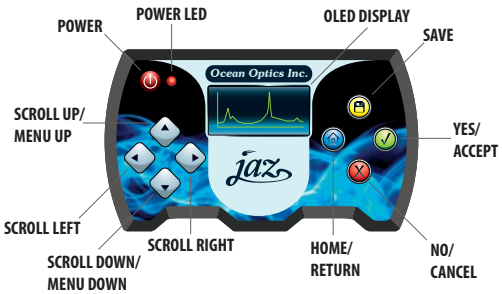
Jaz Industrial Module
- Communicates with RS-232 and RS-485
- Provides analog and digital inputs/outputs

Jaz Battery Module
- Lithium-Ion battery for up to 8 hours of use
- Rechargeable from Ethernet, USB or external power supply
- 2 SD card slots for memory and other functions

Jaz Light Source Modules
- VIS-NIR Tungsten Halogen
- UV-VIS Deuterium-Tungsten Halogen
- Pulsed Xenon
- LED options

Jaz Side Mount Module
- Lets you affix Jaz to tripod, breadboard and more
- Has ¼"-20 threaded mounts on three sides of the module

* Illustration only - your configuration may vary.



Have it your way

In Jaz, modularity takes on a new dimension – the "z" dimension. Our configuration stacks modules vertically, with each layer adding more functionality. The drawing above conveys all the options available for making spectral measurements. Toward the bottom of the stack you'll notice the NeoFox Sport. NeoFox is its own instrument – the detector part of our optical oxygen sensor systems – and wouldn't appear in a stack like this, but we included it here to demonstrate that the Jaz architecture can be engineered into other types of monolithic, portable sensing devices. For more on NeoFox, see page 164.

Under the Hood

Mix and match Jaz modules to create a smart, reliable system specifically for your own application.

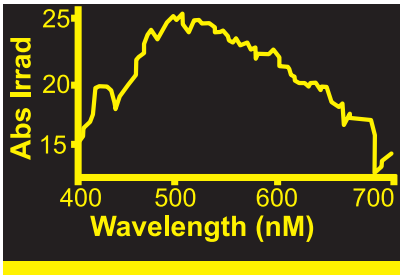
Not sure which configuration best suits your application? Contact an Ocean Optics Applications Scientist or visit us online at www.oceanoptics.com.

Spectrometer	
Physical:	109.2 mm x 63.5 mm x 57 mm LWH; 352 g (JAZ-COMBO only)
Detector:	Sony ILX511B linear silicon CCD array (200-1100 nm)
Wavelength range:	Grating dependent (extended-range grating available for 200-1025 nm coverage)
Optical resolution:	~0.3-10.0 nm FWHM
Signal-to-noise ratio:	250:1 (at full signal)
A/D resolution:	16 bit
Dark noise:	50 RMS counts
Dynamic range:	8.5 x 10^7 (system); 1300:1 for a single acquisition
Integration time:	870 µs to 65 seconds (20 s typical maximum)
Stray light:	<0.05% at 600 nm; <0.10% at 435 nm
Sensitivity:	75 photons/count at 400 nm; 41 photons/count at 600 nm
Fiber optic connector:	SMA 905 to 0.22 numerical aperture optical fiber
Electronics connector:	19-pin MHDMI connector; use ADP-MHDMI-RS232 adapter to interface to RS-232
Channels supported:	Up to 8 spectrometers
OEM integration supported:	Yes
Power options:	Wall transformer (+5VDC); Power over Ethernet (Class III PoE provides 12 Watts); USB; integrated battery module (JAZ-B); Solar charger and external batteries
Inputs/Outputs:	Yes, 4 onboard digital user-programmable GPIOs
Communications and Software	
Computer interface:	Onboard Blackfin® microprocessor
Operating systems:	Windows XP, Vista (32/64 bit), Windows 7 (32/64 bit); OS X and Linux when using the USB interface on PCs
Ethernet Module (optional)	IEEE 802.3-compliant 10/100; includes 2 GB SD card
Industrial Communications Module (optional):	Interfaces (RS-232, RS-485); 4 analog I/O, 8 digital I/O
Trigger modes:	Normal (free-running), Software, Synchronization and External Hardware
Strobe functions:	Continuous, Single, Lamp Enable
Operating software:	Basic Jaz software (included) operates from DPU interface; SpectraSuite (separate purchase) acquires data from USB or Ethernet connection; Overture software also available
Applications software:	Irradiance measurement and other options available; application is loaded to an SD card and operates from DPU interface
Development software:	Scripting program and API option for writing your own applications
Battery Options	
JAZ-B Module (optional integrated battery):	Rechargeable Lithium-Ion; lifetime depends on number of modules (~8 hours for JAZ-COMBO only)
Rechargeable battery accessories:	Lithium-Polymer solar battery, ~12 hours lifetime w/JAZ-COMBO; Lithium-Ion external battery, 21 hours lifetime w/JAZ-COMBO
SD card storage:	JAZ-B module includes (2) 2-GB SD cards
Light Source Options	
JAZ-UV-VIS (optional module):	Deuterium-Tungsten Halogen (210-1100 nm); lifetime is ~1,500 hours (recommended for UV absorbance)
JAZ-PX (optional module):	Pulsed Xenon (190-1100 nm); lifetime is 4 x 10^8 flashes to 50% of initial intensity
JAZ-VIS-NIR (optional module):	Tungsten Halogen (360-1100 nm); lifetime is 500-10,000 hours depending on power setting
LEDs (optional module w/replace-able bulbs):	365 nm, 405 nm, 470 nm, 590 nm, 640 nm and White wavelength options
Compliance	
CE mark:	Yes (all modules)
RoHs:	Yes (all modules)

Preconfigured Jaz Systems

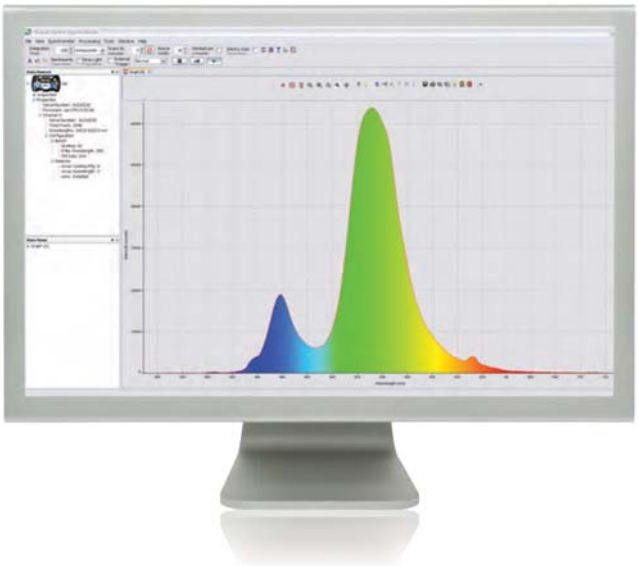
Portable Setups for Field and Beyond

At the heart of the Jaz-ULM-200 is a spectroradiometrically calibrated spectrometer with built-in microprocessor and display. Also in the instrument stack is an Ethernet module for remote measurements, a battery module for handheld or field operation and a mounting fixture for orienting the system in different positions. Additional components include SD cards for data storage, a direct-attach cosine corrector for collecting radiation within a 180° Field of View, and both soft-sided and Pelican-brand carrying cases.



Special Software for Calculating Irradiance Values

With its Jaz-A-IRRAD irradiance software, the Jaz-ULM-200 allows users to capture, process and store full spectra without a PC. Jaz-A-IRRAD is stored on an SD card and loaded to the system. In just three simple clicks, the software collects spectral irradiance information from the selected light source. This data can be processed to give the intensity parameter of choice, including µW/cm²/nm, lumens, lux, PAR or any other light intensity parameter. The system's three-button wizard simplifies operation so that even non-spectroscopy experts are able to perform fast and accurate measurements. More detailed analysis can be performed using SpectraSuite software on a PC.



Advantages of the Jaz-ULM-200

- All-in-one system with everything you need for irradiance measurements
- Simple calculation of key irradiance parameters in a single device
- Capture and storage of spectral characteristics right on the unit
- Lightweight, portable system convenient for lab, process or field
- Remote access and networking capability with built-in Ethernet

About the Applications

The Jaz-ULM-200 setup is an ideal solution for spectral irradiance applications such as process control in LED sorting systems, monitoring of LED output in greenhouse and other operations and quality control analysis of UV curing sources. The system is also conveniently appointed for solar irradiance measurements.

Preconfigured Jaz Systems

Portable Setups for Field and Beyond

Thanks to its small footprint, built-in computing power and onboard display, Jaz is an excellent option for field applications of all types. Build your own Jaz setup or select from one of these fully integrated, application-ready options:

Jaz-EL Spectrometers

We offer three versions of a lightweight, portable spectrometer system complete with integrated Lithium-Ion battery, SD card storage of your spectra and software for post-processing of data back in the lab. Each option is available with our standard line of Jaz accessories.

- JAZ-EL200 is for UV-VIS measurements from 200-850 nm
- JAZ-EL350 is for VIS-NIR measurements from 350-1000 nm
- For extended-range coverage, the JAZ-EL200-XR1 is responsive from 200-1025 nm

SpectroClip-JAZ-TR

This fully integrated system comprises the SpectroClip sampling optic, a two-channel Jaz spectrometer (each channel covers 350-1000 nm), a VIS-NIR light source, Ethernet and battery modules, three optical fibers, a reflection standard and a carrying case. Also included is a software script for optimizing the two-channel Jaz spectrometer setup. The SpectroClip-TR has two integrating spheres to collect light transmitted through the sample and reflected from the sample. SpectroClip-JAZ-TR is ideal for diffuse transmission/reflection measurements of flat samples such as leaves and other biological materials. There's additional information on SpectroClip on the next page.

Jaz Field System Specifications

Features	JAZ-EL200	JAZ-EL200-XR1	JAZ-EL350	SPECTROCLIP-JAZ-TR
Spectometer module:	Single channel	Single channel	Single channel	Two channel
Preconfigured spectral range:	200-850 nm	200-1025 nm	350-1000 nm	350-1000 nm (both channels)
Ethernet module:	Optional	Optional	Optional	Included
Battery module:	Included	Included	Included	Included
Light source module:	Optional; recommend UV-VIS source or Pulsed Xenon module	Optional; recommend UV-VIS source	Optional; recommend VIS-NIR source	Included (VIS-NIR source)
Optical fibers:	Optional	Optional	Optional	Included (3x 1-meter length QP-600-VIS-NIR patch cords)
Accessories:	Optional	Optional	Optional	Included (SpectroClip-TR) and reflection standard
Software:	Jaz Standard Operating Software and SpectraSuite Operating Software	Jaz Standard Operating Software and SpectraSuite Operating Software	Jaz Standard Operating Software and SpectraSuite Operating Software	Jaz Standard Operating Software and custom SpectroClip software script
Carrying case:	Optional; recommend Jaz-Pack-S shoulder holster	Optional; recommend Jaz-Pack-S shoulder holster	Optional; recommend Jaz-Pack-S shoulder holster	Included (Pelican case)
Spectrometer				
Entrance aperture:	25 µm width slit	25 µm width slit	25 µm width slit	25 µm width slit
Gratings:	Grating #1 (200-850 nm)	Grating #31 (200-1025 nm)	Grating #2 (350-1000 nm)	Grating #2 (350-1000 nm) (both channels)
Detector collection lens:	Yes, L2	Yes, L2	Yes, L2	Yes, L2
UV enhanced window:	Yes, installed with detector	Yes, installed with detector	No	No
Order sorting options:	200-850 nm filtering installed at the detector	200-850 nm filtering installed at the detector	350-1000 nm filtering installed at the detector	350-1000 nm filtering installed at the detector
Optical resolution:	~1.3 nm (FWHM)	1.7 nm (FWHM)	~1.3 nm (FWHM)	~1.3 nm (FWHM)

Jaz SpectroClip and Field Accessories

Convenient Tools for Jaz Field Analysis

We offer several handy tools for your Jaz field work, including extra battery power options, sampling devices and carrying cases. Thanks to its small size, built-in computing power and monolithic design, Jaz is ideal for applications requiring portability and reliability.

Jaz SpectroClip

SpectroClip is the perfect handheld device for measuring thin materials and other samples in the field and is especially suited to chlorophyll analysis in leaves and other plants. With SpectroClip and a suitable Jaz or other Ocean Optics spectrometer, you can easily measure diffuse flat objects in both transmission and reflection simultaneously. Samples with maximum thickness of 1 mm can be measured.

Two integrating spheres function as SpectroClip's collection probes and can be connected to any Ocean Optics spectrometer for acquiring data. The top integrating sphere also includes an input port for a fiber-coupled light source to illuminate your sample. SpectroClip's integrating spheres capture diffuse reflected or transmitted light more efficiently than lens-based collection optics. Indeed, SpectroClip is ideal for transmission measurements of very diffuse samples such as leaves, where scattering makes the use of collimating lenses impractical.

SpectroClip can be purchased as part of a fully integrated Jaz system (SpectroClip-Jaz-TR) or in one- or two-integrating sphere versions:

- **SpectroClip-R** has one integrating sphere to collect reflected light from your sample.
- **SpectroClip-TR** has two integrating spheres that collect both transmitted light through your sample and reflected light from the sample.

Jaz Field Accessories

Extra Power Options and Carrying Packs

Jaz Pack

Our Jaz Pack is the rough and tumble Jaz accessory made from lightweight, water-resistant fabric that stretches to hug your Jaz safely and securely. Its unique flip-top helps you see your OLED display in the brightest of sunshine and its adjustable fit easily accommodates your configuration.

Jaz Pack Shoulder Strap Item Code - JAZ-PACK-S

Jaz Pack Waist-belt Item Code - JAZ-PACK-W

Jaz Solar Pack

Harness the power of the sun when you're in the field! The Jaz Solar Pack is the handy accessory that powers and recharges your Jaz battery module via its mini-USB cable. The Jaz Solar Pack recharges itself through the sun or electrical socket and can independently power your Jaz for up to 4 hours.

Item Code - JAZ-SOLAR

Jaz External Battery

The Jaz External Battery Pack is a multipurpose, rechargeable Lithium-Ion battery that connects directly to the 5V power connection on the DPU module of your Jaz. This powerful accessory is ideal for remote sensing and field applications and can triple the operating lifetime of your Jaz unit.

Item Code - JAZ-EXT-BP-50WH

About the Applications

With add-on software such as SpectraSuite-PAR, users can turn Jaz into a tool for calculating Photosynthetically Active Radiation (PAR). PAR is important in evaluating the effect of light on plant growth. It is defined as the integral over the range 400-700 nm of the absolute irradiance spectrum (the spectrum of light incident on the plants), which is then converted from µW/cm^2 to µmol/m^2/s.

The Jaz Spectrometer

Smart Design Makes all the Difference

We took a page from our USB2000+ miniature spectrometer and built the Jaz spectrometer module to be just as powerful and just as accurate. The system's 2048-pixel, Sony ILX511B linear silicon CCD array detector delivers outstanding performance and -- though Jaz's Czerny-Turner optical bench may be familiar -- the rest of the Jaz spectrometer module is anything but ordinary.

L2 Detector Collection Lens

Jaz's cylindrical lens ensures aberration-free performance and is fixed to the detector's window to focus light onto the shorter detector elements. It increases light-collection efficiency by 5x and reduces stray light.

Replaceable Slits

Unlike the fixed slits in most spectrometers, Jaz allows you to change your entrance aperture to suit your application. Most Jaz slits are 1 mm tall and come in various widths from 5 to 200 µm.

Slit	Description	Pixel Resolution
INTSMA-005	5 µm wide x 1 mm high	~3.0 pixels
INTSMA-010	10 µm wide x 1 mm high	~3.2 pixels
INTSMA-010S	10 µm wide x 50 µm high	~3.2 pixels
INTSMA-025	25 µm wide x 1 mm high	~4.2 pixels
INTSMA-050	50 µm wide x 1 mm high	~6.5 pixels
INTSMA-100	100 µm wide x 1 mm high	~12.0 pixels
INTSMA-200	200 µm wide x 1 mm high	~24.0 pixels

Grating and Wavelength Range

Choose from multiple gratings for each Jaz spectrometer channel. Your choice of grating groove density helps to determine optical resolution, spectral range and blaze wavelength.

Grating Number	Intended Use	Groove Density	Spectral Range	Blaze Wavelength	Best Efficiency (>30%)
1	UV	600	650 nm	300 nm	200-575 nm
2	UV-VIS	600	650 nm	400 nm	250-800 nm
3	VIS-Color	600	650 nm	500 nm	350-850 nm
4	NIR	600	625 nm	750 nm	530-1100 nm
5	UV-VIS	1200	300 nm	Holographic UV	200-400 nm
6	NIR	1200	200-270 nm	750 nm	500-1100 nm
7	UV-VIS	2400	100-140 nm	Holographic UV	200-500 nm
8	UV	3600	50-75 nm	Holographic UV	290-340 nm
9	VIS-NIR	1200	200-270 nm	Holographic VIS	400-800 nm
10	UV-VIS	1800	100-190 nm	Holographic UV	200-635 nm
11	UV-VIS	1800	120-160 nm	Holographic VIS	320-720 nm
12	UV-VIS	2400	50-120 nm	Holographic VIS	260-780 nm
14	NIR	600	625 nm	1000 nm	650-1100 nm
31	UV-NIR	500	200-1025 nm	250 nm	250-450 nm

Longpass Absorbing Filter

We offer longpass absorbing or blocking filters – each with a transmission band and a blocking band to restrict radiation to a certain wavelength region. This helps to eliminate second- and third-order effects. These filters are installed permanently between the slit and the clad mode aperture in the bulkhead of the SMA 905 connector.

Item	Description
OF1-WG305	Transmits light >305 nm
OF1-GG375	Transmits light >375 nm
OF1-GG475	Transmits light >475 nm
OF1-OG515	Transmits light >515 nm
OF1-OG550	Transmits light >550 nm
OF1-OG590	Transmits light >590 nm

Collimating and Focusing Mirrors

You can replace standard aluminum-coated reflective mirrors with our proprietary, UV-absorbing SAG+ Mirrors. These special mirrors increase reflectance in the VIS-NIR and increase the sensitivity of your Jaz. SAG+ Mirrors can be specified for fluorescence. These mirrors also absorb nearly all UV light to reduce the effects of excitation scattering in fluorescence measurements.

Detector Accessory Options

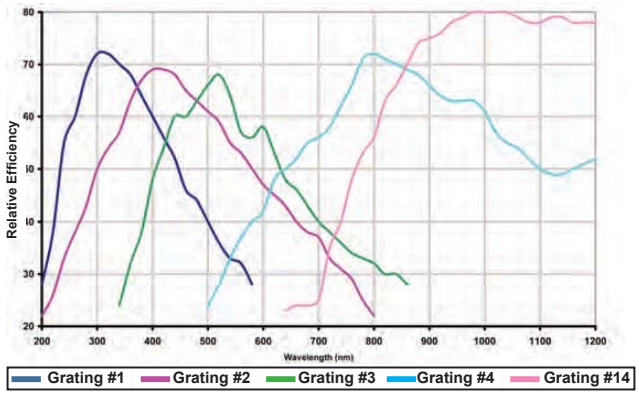
Detector	Description
DET2B-200-850	Sony ILX511B detector, installed, w/200-850 nm variable longpass filter and UV2 quartz window; best for UV-VIS systems configured with Grating #1 or #2
DET2B-350-1000	Sony ILX511B detector, installed, with 350-1000 nm variable longpass filter; best for VIS system configured with Grating #2 or #3
DET2B-UV	Sony ILX511B detector, installed, with UV2 quartz window; best for systems configured for <360 nm
DET2B-VIS	Sony ILX511B detector, installed, with VIS BK7 window; best for systems configured for >400 nm
DET2B-200-1100	Sony ILX511B detector, installed, w/200-850 nm variable longpass filter and UV2 quartz window; best for XR grating #31

The Jaz Spectrometer

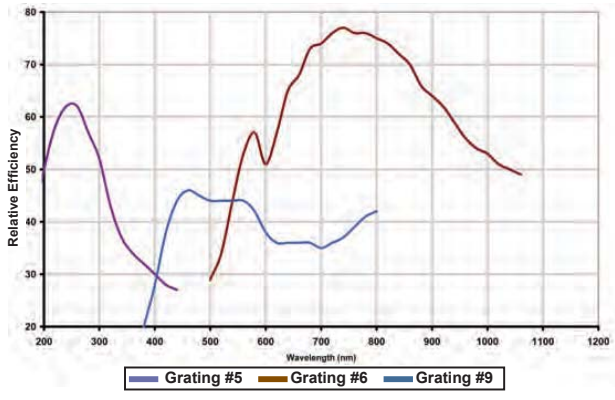
Optical Bench Options: Gratings

The graphs below are grating efficiency curves for gratings with groove densities of 500, 600, 1200, 1800 and 2400 mm^{-1}. Additional information is available at www.oceanoptics.com/Products/bench_grating_usb.asp.

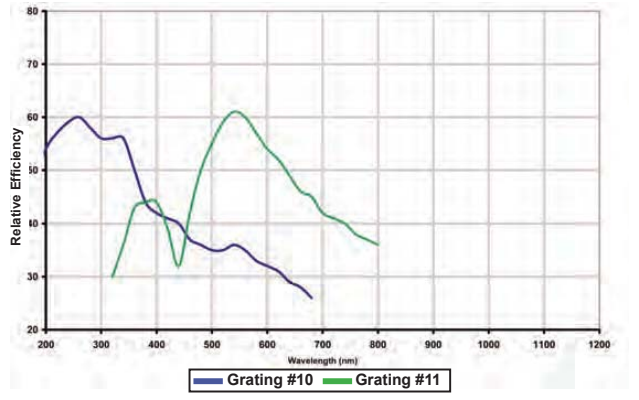
Groove Density of 600 mm^{-1}



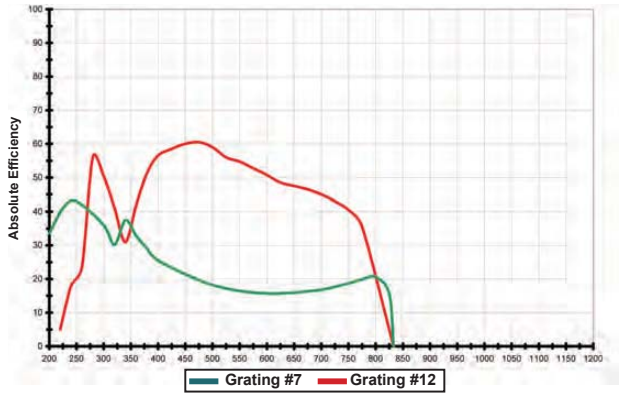
Groove Density of 1200 mm^{-1}



Groove Density of 1800 mm^{-1}



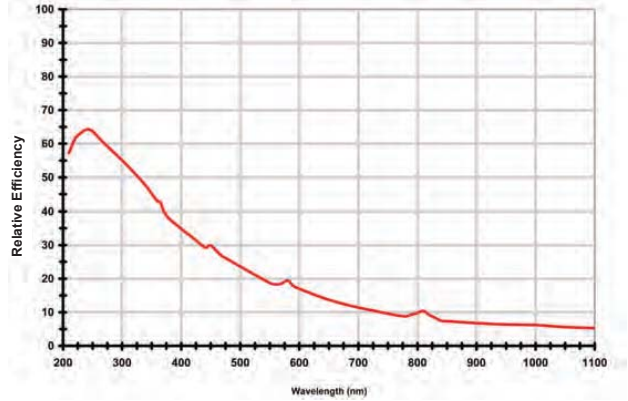
Groove Density of 2400 mm^{-1}



Grating Selection Tips:

- You must specify a grating for each Jaz spectrometer channel.
- These efficiency curves relate only to the grating. System response is affected by a number of variables, including detector response.
- Grating selection often involves trade-offs. For example, gratings with very high groove density (mm^{-1}) allow greater optical resolution but at the expense of a truncated spectral range. If the user is characterizing two or three closely aligned laser wavelengths, such a trade-off of resolution for range might be acceptable. For other applications, a wider range with good resolution would make better sense.
- The XR grating (#31) is a good option for broad spectral coverage (200-1025 nm) without sacrificing optical resolution (~2.0 nm FWHM with a 25 µm slit).

Groove Density of 500 mm^{-1}



Jaz DPU and Microprocessor Module

The Brains of the Operation

Jaz DPU Module

The Jaz DPU module combines a powerful onboard microprocessor and 128 x 64 OLED display that delivers clear and vivid viewing of spectra in real time. This clever user interface features an intuitive menu-driven system and touchpad and is available in two orientations to ensure convenient operation. Its embedded microprocessor provides quick and reliable data processing and easily orchestrates up to 8 spectrometer modules for multipoint sampling.

Item Codes: JAZ-DPU-GPIO-2, JAZ-DPU-GPIO-R

JAZ-DPU-GPIO-2, JAZ-DPU-GPIO-R	
Module dimensions:	109.2 mm x 63.2 mm x 14.2 mm
Module weight:	90.72 g
Display:	OLED
Area:	128 x 64 pixels; orientation can be rotated 180º
Display lifetime:	55,000 hours
Keypad:	Push-button function
	Available in 180º orientation versions (standard and reversed)
	Power and charging indicator
	Contact switches lifetime of 200,000 contacts (minimum)
	Anti-glare ethyl-butyl-acrylate overlay material
	RoHS compliant
	Temperature range: -40 °C - +70 °C (storage) and 0 °C - +50 °C (operating)
Microprocessor	Blackfin® embedded microprocessor with data processing and storage capability
SDRAM:	64 MB
Power consumption:	~1-2 Watts

Jaz Ethernet Module

Connectivity and More for Your Jaz

The Jaz Ethernet Module turns your Jaz spectrometer system into a powerful network appliance. Use it to power your Jaz over Ethernet connectivity, access Jaz remotely or share data with others on your network. The 100 Mb/S Ethernet connection is a single-cable solution that powers the system and enables remote access by any node on your network or via the Internet. The Jaz Ethernet Module also includes a 2 GB SD card slot for instant data storage.

A Jaz stack with an Ethernet Module has both USB and Ethernet port connectors, to connect the spectrometer to a computer via a USB port or to a network via a connection from the Ethernet port. This port connects to a Power over Ethernet (PoE) bridge or a switch to the network (e.g., a network hub). Your Jaz stack receives power from either connection, and both connections enable Jaz to be recognized by our software. Spectral acquisition time in a Jaz system with an Ethernet Module – 100 scans per second – is identical to the acquisition time using USB.

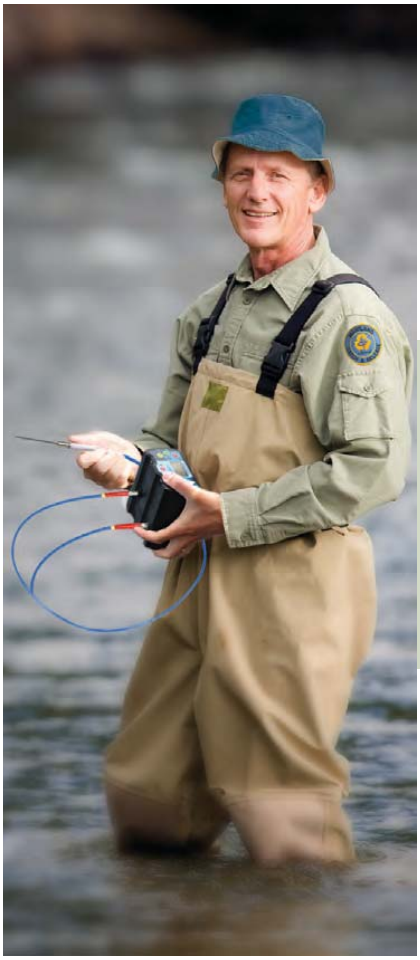
The Ethernet Module is a Class III PoE device that provides 12 watts of power and can recharge a JAZ-B Battery Module in approximately four hours (longer if the Jaz is in operation). The latter is particularly handy for a Jaz setup that's used as a handheld device in the lab or in the field.

Item Code: JAZ-E

JAZ-E Ethernet Module	
Dimensions:	109.2 mm x 63.2 mm x 20.8 mm
Weight:	90.72 g
Data transfer rate:	100 Mbps
Power over Ethernet (PoE) standard:	IEEE 802.3-compliant 10/100
Data storage:	2 GB SD card (stores up to 100,000 spectra)
Ethernet cable:	14 ft. length, ferrite bead included for electronic noise suppression
PoE adapter (not included):	Recommend D-Link DWL-P50 or equivalent

Jaz Battery and Memory Modules

Because You Need to Stay Mobile



JAZ-B Battery Module

The Jaz Battery and External Memory Module is built on a rechargeable Lithium-Ion battery that provides up to 8 hours battery life. It allows autonomous data collection with power-conserving sleep mode for long-term measurements. The Jaz Battery Module also includes two SD card slots for memory, applications and data storage. High-capacity SD cards (>2 GB) are not compatible with the battery module.

Item Code: JAZ-B

Jaz Solar Battery Supply

The Jaz Solar Pack is a handy accessory that powers and recharges your Jaz unit via its mini-USB cable. Jaz Solar Pack recharges itself through sun or socket and can independently power your Jaz for up to four hours.

Item Code: JAZ-SOLAR

JAZ-EXT-BP-50WH External Battery

This external battery pack connects to the 5V power connection of the Jaz DPU module and extends the charge of your Jaz by up to 3x. The JAZ-EXT-BP-50WH is a multipurpose, rechargeable Li-Ion battery rated at 50 watt-hours. It comes with an AC wall charger, a car charger and its own holster and belt clip.

Item Code: JAZ-EXT-BP-50WH

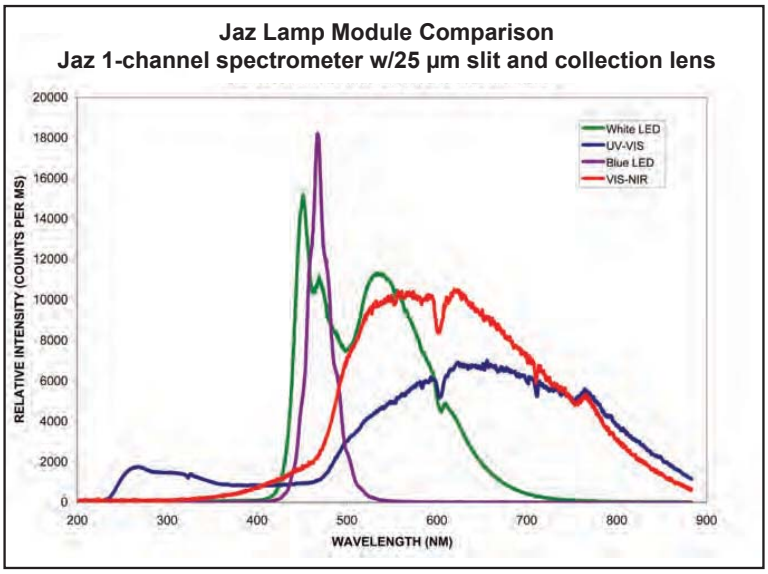
Jaz Battery Options	JAZ-B Battery Module	JAZ-SOLAR Solar Charger	JAZ-EXT-BP-50WH External Battery
Battery type:	Lithium-Ion	Lithium Polymer	Lithium-Ion
Rechargeable:	Yes (via wall power or PoE)	Yes (service lifetime minimum 500 full charges)	Yes (includes Quick AC charger and car kit charger)
Charging time:	When Jaz is off, 8 hours via USB and 4 hours via wall power and PoE	4 hours via USB; 2-3 hours via PoE; 2-3 hours via 12 VDC wall power	3 hours (from fully discharged) via PoE; 3 hours via 12 VDC wall power
Charging current:	~4A @ 5V maximum w/wall plug adapter or 0.5A @ 5V through the USB port	360 mA	2000 mA
Capacity:	14.8 Watt hours	~7-10 Watt hours	50 Watt hours
Lifetime when combined w/ JAZ-COMBO (DPU + single-channel spectrometer):	~8-10 hours	3-5 hours standard; ~12 hours w/ JAZ-B battery module	21 hours standard; 28 hours w/ JAZ-B battery module
Lifetime when combined w/ JAZ-COMBO and Light Source:	2 hours	~3 hours w/JAZ-B battery module	8.5 hours standard; 10.5 hours w/ JAZ-B battery module
Data storage via (2) SD card slots:	Yes	No	No
SD cards included:	Yes (2)	No	No

Jaz Light Sources

An Illuminating Difference

Whether your work takes you to the lab, the field or the process line, you can make the most of your Jaz modular sensing suite with the addition of an optional light source, optimized for your application needs.

These compact, low-cost, modular light sources fit directly into the Jaz stack of appliances and feature outstanding bulb life as well as lower power consumption than comparable sources.



For spectral output of Jaz PX, see page 73.

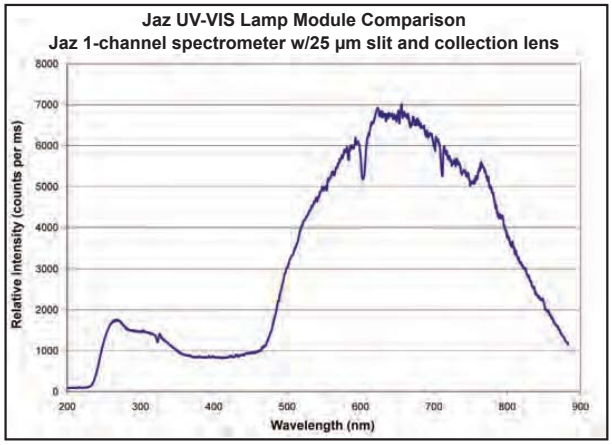
	Jaz-PX	Jaz-VIS-NIR	Jaz-UV-VIS	Jaz-LED
Dimensions:	109.2 mm x 63.5 mm x 31.8 mm	109.2 mm x 63.5 mm x 29.5 mm	109.2 mm x 63.5 mm x 26.7 mm	109.2 mm x 63.5 mm x 28.58 mm
Type:	Pulsed Xenon	Tungsten Halogen	Deuterium Tungsten Halogen	LED
Wavelength range:	190-1100 nm	360-1100 nm	210-400 nm (deuterium); 400-1100 nm (tungsten)	365 nm - White
Best for:	Absorbance, transmission, fluorescence and UV-VIS biore-flectance	Absorbance, transmission and reflection	Absorbance and transmission only	Excitation source for fluores-cence, luminescence
Stability:	<1% flash to flash	Decay rate is ~0.01%/hour @ power setting of 1024 and 0.1%/hour at setting of 4095	After 30-minute warm-up, 0.3% peak to peak over 4 hours	+/-0.5% (typical short-term) after warm-up
Time to stable output:	10 flashes	~20 minutes	10 minutes (deuterium); 1 minute (tungsten halogen)	~30 minutes (~5 minutes for <3% drift for 470 nm LED)
Lamp life:	4 x 10^8 flashes to 50% of initial intensity	>10,000 hours @ 1024 power setting; 500 hours @ 4095 power setting	~1500 hours (deuterium); 1500 hours (tungsten halogen)	>25,000 hours to 70% of initial intensity
Operating life in typical field setup:	~3 hours w/JAZ-COMBO and battery module	~6 hours w/JAZ-COMBO and battery module	~2 hours w/JAZ-COMBO and battery module	~25,000 hours to 70% of initial intensity (battery has negligible effect on LED life)
Power consumption:	4.5W	1W	7W	<0.2W
Operating tempera-ture:	0 °C-+55 °C	0 °C-+55 °C	0 °C-+55 °C	-10 °C-+55 °C
Storage temperature:	-20 °C-+60 °C	-20 °C-+60 °C	-20 °C-+60 °C	-20 °C-+60 °C
Connector:	SMA 905	SMA 905	SMA 905 (recommended for use with 200 µm-600 µm fibers)	SMA 905
Certification:	CE Mark/RoHS	CE Mark/RoHS	CE Mark/RoHS	CE Mark/RoHS

Jaz UV-VIS Light Source

Useful for UV Absorbance

The JAZ-UV-VIS is a unique deuterium-tungsten halogen source with combined output from 210-1100 nm. The JAZ-UV-VIS is a continuous light source that is most effective for absorbance measurements in the deep UV and is not recommended for reflection measurements. For reflection and fluorescence measurements, the Jaz-PX (see below) is a far superior option.

Item code: JAZ-UV-VIS



Jaz-UV-VIS	
Dimensions:	109.2 mm x 63.5 mm x 26.7 mm
Type:	Deuterium Tungsten Halogen
Wavelength range:	210-400 nm (deuterium); 400-1100 nm (tungsten halogen)
Best for:	Absorbance and transmission
Stability:	After 30-minute warm-up, 0.3% peak to peak over 4 hours
Time to stable output:	10 minutes (deuterium); 1 minute (tungsten halogen)
Lamp life:	~1500 hours (deuterium); 1500 hours (tungsten halogen)
Operating life in typical field setup:	~2 hours w/JAZ-COMBO and battery module
Power consumption:	7W
Operating temperature:	0 ºC - +55 ºC
Storage temperature:	-20 ºC - +60 ºC
Connector:	SMA 905 (recommended for use with 200 µm-600 µm fibers)
Certification:	CE Mark/RoHs

Pulsed Xenon Light Source for Jaz

High Intensity, Low Power, Versatility

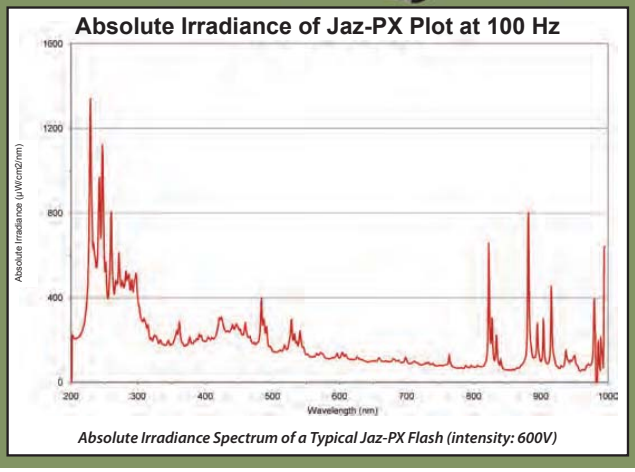
The Jaz-PX is a pulsed xenon light source for your Jaz modular sensing system. It features a pulsed, short-arc xenon lamp that is especially useful for UV-VIS applications such as absorbance, bioreflectance, fluorescence and phosphorescence. The Jaz-PX's lamp has a specified pulse frequency of 200 Hz (maximum 500 Hz) and spectral response from 190-1100 nm.

Jaz-PX operates in both free-running and triggered modes, which allows its pulses to be coordinated with other devices in your Jaz stack.

The Jaz-PX has an SMA 905 connector that couples to other Ocean Optics accessories, including optical fibers, cuvette holders, probes and other sampling optics.

Because of its pulsed signal, the Jaz-PX is less likely to cause solarization in optical fiber assemblies that can occur when fibers are illuminated with signals <360 nm.

Item Code: JAZ-PX



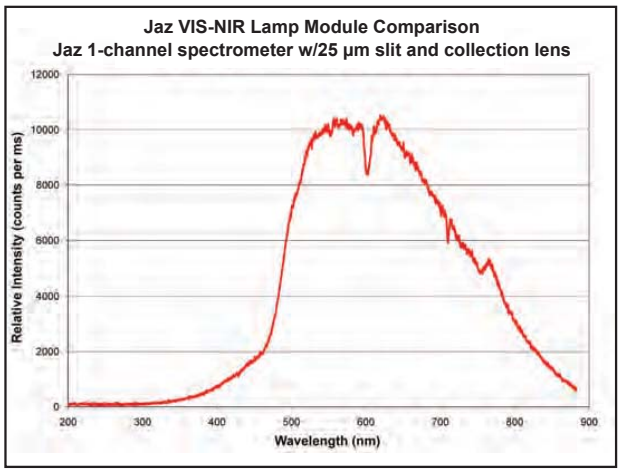
Absolute Irradiance Spectrum of a Typical Jaz-PX Flash (intensity: 600V)

Jaz VIS-NIR Light Source

Strong Output from 360-1100 nm

The JAZ-VIS-NIR Light Source is a Tungsten Halogen source that provides reliable coverage of 360-1100 nm and requires little power to operate. This small, lightweight source is perfect for absorbance, transmission and reflection. Additionally, it provides up to 10,000 hours of lamp life.

Item code: JAZ-VIS-NIR



Jaz-VIS-NIR	
Dimensions:	109.2 mm x 63.5 mm x 29.5 mm
Type:	Tungsten Halogen
Wavelength range:	360-1100 nm
Best for:	Absorbance, transmission and reflection
Stability:	Decay rate is ~0.01%/hour @ power setting of 1024 and 0.1%/hour at setting of 4095
Time to stable output:	~20 minutes
Lamp life:	>10,000 hours @ 1024 power setting; 500 hours @ 4095 power setting
Operating life in typical field setup:	~6 hours w/JAZ-COMBO and battery module
Power consumption:	1W
Operating temperature:	0 ºC-+55 ºC
Storage temperature:	-20 ºC-+60 ºC
Connector:	SMA 905
Certification:	CE Mark/RoHS

Questions? If you're not sure which Jaz Light Source is the best for your application, contact an Ocean Optics Applications Scientist at info@oceanoptics.com. We'll help you find the source that's the perfect match.

Jaz LED Modules

Convenient and Simple

LED Modules	
Wavelength range options:	365 nm, 405 nm, 470 nm, 590 nm, 640 nm and White
Power consumption:	<0.2W
Power requirements:	5V @ 50 mA (maximum)
Stability:	+/-0.5% (typical short-term) after warm-up
Drift:	Typically <0.1% drift/hour after 30-minute warm-up (at constant temperature)
Time to stable output:	~30 minutes (~5 minutes for <3% drift for 470 nm LED)
Bulb life:	>25,000 hours to 70% of initial intensity
Bulb aperture (typical):	5 mm diameter with 12-20º viewing angle
Replaceable bulb assembly*:	Yes
Operating temperature:	-10 ºC-+55 ºC
Humidity:	0-95% non-condensing
Connector:	SMA 905
Certification:	CE Mark/RoHS

* Available by request

The Jaz LED modules allow you to switch out LED bulbs more quickly and easily. Instead of having to replace the entire module, simply replace the LED assembly – a small fixture with only three screws to manage. Your Applications Scientist can provide all the details.

Item Codes:

JAZ-INTLED-365	Interchangeable 365 nm LED module
JAZ-INTLED-405	Interchangeable 405 nm LED module
JAZ-INTLED-450	Interchangeable 470 nm LED module
JAZ-INTLED-590	Interchangeable 590 nm LED module
JAZ-INTLED-640	Interchangeable 640 nm LED module
JAZ-INTLED-WHITE	Interchangeable White LED module

Jaz Industrial Communications Module

Multifunctional Tool for Process and Lab

- Experiments connect directly to Indy module for analog and digital I/O (8 I/Os available)
- Enables Jaz to communicate with other devices via RS-232/RS-485 interfaces
- Provides measurement and control for portable, laboratory and "light-industrial" setups
- Installs in Jaz stack and can be mounted to DIN rail or a wall (with special accessories) or anywhere with ¼"-20 mount

The Jaz Indy is a multifunction module that allows the Jaz system to interface to industrial applications – in particular, RS-232 and RS-485 – and provides both analog and digital inputs/outputs. When combined with triggering capabilities and multichannel capacity, the Indy module makes Jaz an attractive optical-sensing option for multipoint sampling, reference monitoring and other applications in process and lab environments.

Item Code: JAZ-INDY

RS-232 connectivity:	300-115K Baud, +/-5V
RS-485 connectivity:	300-8M Baud
Analog inputs:	4 single-ended or 2 differential pairs
	+/-5V (single-ended) or 10V (differential pairs)
Analog outputs:	4
	+/- 5V (software configurable to 0-5V)
	16-bit (0.15mV/bit)
Digital I/O:	8
	Source 5V, TTL compatible
Current loop:	1 x 4-20 mA current loop, 2-wire Transmit
	1 x 4-20 mA current loop, 2-wire Receive
4-20 mA transmitter:	14 bit A/D resolution; can accept supply voltage of 8.5-35 V
4-20 mA receiver:	14 bit A/D resolution; over-current protected receiver capable of supplying 10-20 V
Enclosure:	Integrated into Jaz stack; optional DIN 3 rail mount available
Environment (use):	-10°C - +55°C, 0-95% humidity (non-condensing)
Environment (storage):	-40°C - +55°C, 0-95% humidity (non-condensing)
Certification:	CE Mark
Certification:	RoHS
Certification:	FCC Part 15, Class A

Technical Tip: Sample JAZ-INDY Application

In a demo setup we configured for a recent trade show, the JAZ-INDY used analog voltage output to control a voltage-controllable LLS Series LED Light Source (see Light Sources section). Using optical fibers, the LED transmitted light through a filter holder and back to the Jaz spectrometer. The unit's control logic was designed to increase the voltage to the LED if the peak intensity of the spectrum, as measured by the Jaz, fell below a certain level and to decrease the voltage if the intensity went above that level. This way the amount of light getting to the spectrometer remained constant. There were no changes to integration time, so auto-integration was not employed.

In the live demonstration, we put a neutral density filter in the filter holder, to simulate a sort of process change, and the light source would greatly increase in brightness to compensate.

Similar principles could apply to a process flow scenario. For example, consider a process in which a thin film is applied to glass. The spectrometer could observe the transmission of light through the glass and make small adjustments to the sputter electrode, via the Jaz Indy, to keep the optical density always in check.

We used the Jaz messaging system for the demonstration application, but our OmniDriver development platform also supports the Indy. In fact, the Jaz Indy has been added to the wrapper class as a feature. Contact an Applications Scientist for additional information.

Jaz Software Options

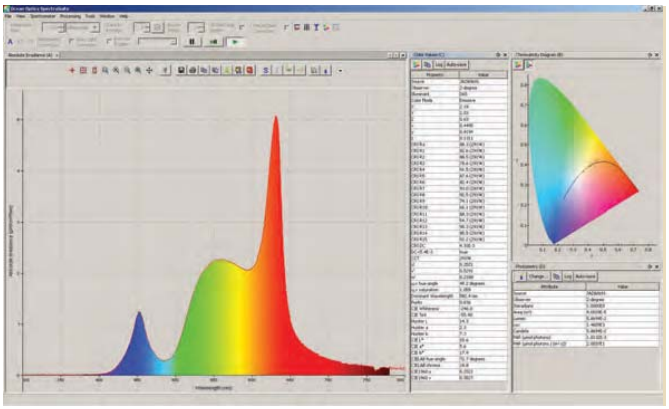
Get the Most out of Your Data

Although Jaz comes with its own basic software, additional processing power and functionality are available via several options:

- **SpectraSuite Spectrometer Software.** Our standard spectrometer operating software is ideal for post-acquisition processing of spectral data. For example, the user can capture data in Jaz software and save it to an SD card in the field, and then transfer the data to a PC in the lab for post-processing with SpectraSuite. This allows for more detailed analysis of your results. Included with every Jaz is Overture, a software program that provides basic spectroscopy functions such as absorbance, transmission and emission.

- **Applications Software.** Jaz applications are pre-loaded on an SD card and let you perform application-specific calculations on the Jaz display itself. The JAZ-A-IRRAD irradiance measurement application is a good example. Its post-processing mode can be manipulated to display parameters such as lumens, lux, PAR (Photosynthetically Active Radiation) and watts.

- **Development Software.** Much like our other spectrometers, Jaz can be used with software that you develop. Development tools range from a relatively simple but useful scripting tool conceived for non-programmers to a powerful application programming interface (API)



recommended only for experienced C developers with a background in spectroscopy or who attend a Jaz API training session.

- **Jaz Scripting Language.** The Jaz Scriptor provides both programmers and non-programmers with an accessible, intuitive interface to Jaz spectroscopy functions. A script is simply a text file containing a sequence of operations to be performed. Some scripts relate to controlling data acquisition from Jaz, while others provide for analysis, transformation and presentation of spectroscopy data. With the Scriptor, you can automate basic tasks such as obtaining a spectrum, controlling a light source and spectrometer in the Jaz stack, manipulating spectral data and saving spectral data to a file for further analysis.

- **Jaz API.** The API is a sophisticated developer's tool conceived for use by experienced C programmers seeking to develop customized Jaz software for OEM and other applications. The API makes available a large number of commands for each device in the stack and enables interaction among those devices. A sample application is included. Consultation with an Applications Scientist and specialized training are required.

Type	Description	How Delivered?	Operation
Standard operating:	Handles basic spectroscopic functions	Preloaded to your Jaz unit	From DPU interface onboard the Jaz
SpectraSuite and Overture:	Spectrometer operating software for data processing and analysis; add-on products	Deployed separately on CD for installation on the PC you connect your Jaz unit to	Acquires data from the Jaz via the USB connection on the DPU or an optional Ethernet module
Application programs:	Application-specific programs for irradiance (JAZ-A-IRRAD) and other measurements	Application is loaded to an SD card	From DPU interface onboard the Jaz; requires an SD card slot (Ethernet or Battery module)
Scripting program:	Jaz-specific tool (JAZ-SPL) for writing your own applications	Deployed separately on CD for installation on your PC for writing and testing scripts. Scripts are then transferred to SD card	From a PC remotely controlling an Ethernet-equipped Jaz or from the DPU interface onboard the Jaz
API:	Jaz-specific Advanced Programming Interface (JAZ-API) for writing your own applications	Deployed separately on CD for installation on Linux system for writing and testing scripts. Scripts are then transferred to SD card	From DPU interface onboard the Jaz; requires an SD card slot (Ethernet or Battery module)

Jaz Electronic Accessories

Cables, Power Supplies and More

We offer a variety of interace cables, adapters and power supplies for use with your Jaz system. These accessories make it easier to operate Jaz through serial port, RS-232 and more.

Item Code: ADP-MHDMI-RS232

Item	Description
JAZ-CBL-DB15	Jaz DB15 Accessory Cable This 1-foot-length MHDMI cable runs from the 19-pin connector on the JAZ-DPU to any external device with a DB-15 electrical connector. With the JAZ-CBL-DB15 in place, you can integrate Jaz functions with operation of external devices such as light sources.
ADP-MHDMI-RS232	Adapts Jaz module to RS-232 communications protocol. Includes JAZ-CBL-DB15 and DB15M-TO-DB9F serial port cable.
INTERNET-CBL	14' Ethernet cable with a ferrite bead to suppress noise
JAZ-PS-ETHERNET	Jaz Power Over Ethernet Adapter 802.3af compliant power over Ethernet with adjustable output power
USB-CBL-PS-JAZ-STACK	5V Universal 30 Watt Power Supply (International adapters are included)

Jaz Fixtures for Industrial Applications and More

Convenient Tools for Mounting Your Jaz

Jaz Side Mount

The aptly named Jaz Side Mount is precisely that – an integrated Jaz module with ¼"-20 threaded mounts on three sides of the module. This lets you attach your Jaz stack to a breadboard, tripod or other fixture. Also, you can use the in-the-stack Jaz Side Mount with the external mounting accessories to expand your range of positioning options.

Item Code: JAZ-MOUNT

Jaz Rail Mount

Conceived for use with standardized 35 mm DIN rails, this clever adapter for your Jaz securely holds up to three Jaz modules (excluding the DPU and end modules) for incredible convenience.

JAZ-MNT-DIN3

Wall Mount

With this easy-to-install bracket, mount your Jaz setup to any solid or hollow wall.

Item Code: JAZ-MNT-WALL

Application Notes

Using the Jaz-PX for Bioreflectivity and Color

Analysis of UV-VIS reflectance and reflected color of biological subjects – birds, insects, fruits, vegetables and more – is conveniently achieved with a Jaz® modular sensing system. Considerations such as instrument footprint, light source requirements and power needs are resolved using a Jaz configured for field portability.

Introduction

Various biological samples exhibit UV-VIS reflectivity and color characteristics of interest to researchers. Applications are diverse: For example, among some species of birds, insects and reptiles, UV reflectance and color play a role in mating behavior, recognizing species and assessing predator risk. Color as an indicator of fruit and vegetable ripening is significant; also, chlorophyll distribution in crops, measured using reflectance, can tell growers something about optimum fertilizer amounts. Many more similar applications, both in the field and in the lab, can be classified as bioreflectance applications.

Jaz provides a particularly compelling option for bioreflectance applications in the field, where portability, flexibility and ease of use are critical. Jaz is a modular spectrometer-based system that integrates into a single stack those components that otherwise would have to be handled separately: the spectrometer, microprocessor with low-power display (in place of a PC), light source, battery pack and even Ethernet capability for remote measurements. Reflection probes and other sampling optics connect easily to the Jaz, keeping the overall system footprint compact and manageable.

Experimental Conditions

A typical Jaz configuration for portable UV-VIS reflectance comprises the Jaz spectrometer set from 200-850 nm, with a 25 µm slit and L2 detector collection lens. Also installed in the Jaz stack is the Jaz-B battery module, which has two slots for SD card data storage, and the Jaz-PX, a high-intensity pulsed xenon light source with up to four hours battery life on a single charge. SpectraSuite spectrometer operating software is also recommended. Depending on experiment considerations, other options to consider are the Jaz-E Ethernet module and the SpectraSuite-PAR add-on software application, which is used to calculate Photosynthetically Active Radiation (PAR) values of horticultural samples.

Most bioreflectance applications involve diffuse reflection of solid surfaces. Our fiber optic reflection/backscattering probes can measure diffuse or specular reflectance from a surface; a good choice for most UV-VIS bioreflectance applications is our QR600-7-SR-125F, a premium-grade probe with 600 µm core diameter in a six-around-one fiber configuration. Also, the probe is solarization-resistant and has a 1/8" ferrule.

Results

Bioreflectance setups using miniature portable spectroscopy have become so simple to perform that even high school science students have little problem with such setups. In one example, a student measured the reflection at 90° of philodendron plant leaves, theorizing that reflectance values could be correlated to fertilizer levels. The results suggested that plant reflectance at wavelengths >700 nm was insensitive to the stress of over-fertilization (at 4x the recommended amount of fertilizer), while the peak within the 530-630 nm range was noticeably sensitive (i.e., had greater reflectivity) to stress. The increased reflectivity related to a decrease in chlorophyll and to the effects of osmosis. Water collected between the leaf cell membrane and the cell wall and exposed more of the leaf surface, which increased reflectivity.

Conclusions

The inherent flexibility of the Jaz sensing system can be exploited for a number of UV-VIS bioreflectance applications simply by mixing and matching Jaz modules and selecting sampling optics most appropriate for your application. A high-intensity, low-power pulsed xenon source and various options for meeting your system power requirements make Jaz an extremely reliable choice for field and other applications.