



# Light Sources

Our line of cleverly designed light sources covers the entire UV-NIR wavelength range and combines innovation with reliability to give you serious performance and precision.

These low-cost, modular light sources feature SMA 905 connectors for quick and easy connection.

From design features like built-in filter slots to optional accessories such as direct-attach cuvette holders, nothing is more convenient and simple to use than Ocean Optics light sources.



## Tip

For long bulb life and accurate results, always allow your Ocean Optics light source to warm up for the recommended amount of time prior to use.

# Light Sources

## Sources for Illumination, Excitation and Calibration

The development of Ocean Optics miniature spectrometers created the need for comparably sized and priced accessories, including light sources. Since no such sources existed, we developed our own – compact, modular sources for illumination, excitation and calibration.

Our light sources for illumination cover various wavelength ranges to enable absorbance, transmission and reflectance measurements from the deep UV to the mid-IR. Light-emitting diodes produce output for fluorescence measurements. For fast, reliable spectrometer wavelength calibrations, we offer a range of options. Design features such as built-in filter slots, combined with optional accessories such as direct-attach cuvette holders, make sampling simple.



### Modular Light Source Options

#### UV Light Sources

We offer deuterium sources for UV absorbance and reflectance measurements. Our pulsed xenon lamps are long-life sources for absorbance, reflectance and fluorescence measurements, and for measuring optically or thermally labile samples.

#### Combination Deuterium and Tungsten Light Sources

Used as single illumination sources for UV-NIR measurements.

#### VIS-IR Light Sources

Tungsten halogen sources are standard VIS-NIR light sources for absorbance, reflectance of solid objects, and color measurement. Our Cool Red source has response into the mid-IR.

#### High-Powered LEDs

Used as excitation sources for fluorescence. Feature minimal warm-up and high stability. Power is lower and spectral width is wider than with lasers. We offer a full range of options for UV-NIR. LEDs are available individually and with rugged housings.

#### Radiometrically Calibrated Light Sources

Used to calibrate the absolute spectral intensity of a system in irradiance applications.

#### Wavelength Calibration Sources

Used to calibrate the wavelength of spectrophotometric systems. We offer a full range of options for your UV-VIS needs.

Type	Product	Wavelength Range	Output	Measurement Type
Deuterium Tungsten Halogen	DH-2000-BAL DH-2000	~230-2000 nm	Continuous	Absorbance, Fluorescence, Reflectance, Transmission
Miniature Deuterium Tungsten Halogen	DT-MINI-2-GS	~200-2000 nm	Continuous	Absorbance, Reflectance, Transmission
Deuterium	D-2000	~215-400 nm	Continuous	Absorbance, Fluorescence, Reflectance, Transmission
Xenon	PX-2 HPX-2000	220-750 nm 185-2000 nm	Pulsed Continuous	Absorbance, Fluorescence, Reflectance, Transmission
LEDs	Various	Many options from 240 nm-white	Pulsed or Continuous	Fluorescence
Tungsten Halogen	HL-2000	360-2000 nm	Continuous	Absorbance, Reflectance, Transmission
Silicone Nitride Emitter	COOL-RED	~1000-5000 nm	Continuous	Absorbance, Reflectance, Transmission
Calibrated Deuterium Tungsten Halogen	DH-2000-CAL	~220-1050 nm	Continuous	Calibration (Radiometric)
Calibrated Tungsten Halogen	HL-2000-CAL	300-1050 nm	Continuous	Calibration (Radiometric)
Mercury Argon	HG-1	253-1700 nm	Continuous	Calibration (Wavelength)
Argon	AR-1	700-1700 nm	Continuous	Calibration (Wavelength)
Neon	NE-1	540-754 nm	Continuous	Calibration (Wavelength)
Xenon	XE-1	916-984 nm	Continuous	Calibration (Wavelength)
Krypton	KR-1	427-893 nm	Continuous	Calibration (Wavelength)

## Modifying Light

Ocean Optics products give you countless options for modifying the light transmitted to your spectrometer's detector.

Depending on your application needs, we provide a number of methods for changing the way light interacts and, ultimately, your results. For high-intensity applications such as laser characterization, steps must be taken to avoid detector saturation. In other cases, changing the fiber size or adding mirrors to your spectrometer bench may increase light collection efficiency.

## Entrance Aperture: Slit

An installed slit acts as the entrance aperture to the optical bench and regulates the amount of light that enters. You specify the slit size. Options range from 5 to 200  $\mu\text{m}$ .



## Installed Filters

In addition to the variable longpass filters (order-sorting filters applied to the detector's window), we offer optional bandpass and longpass blocking filters that restrict radiation in certain wavelength regions.



## Optical Fiber

Our optical fibers are available in diameters ranging from 8  $\mu\text{m}$  to 1000  $\mu\text{m}$ . If you require more light for your application, you'll want a larger diameter fiber. In the absence of a slit, the fiber connected to the spectrometer acts as the optical bench's entrance aperture.



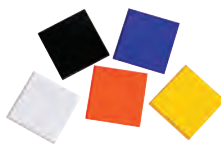
## Linear Variable Filters

Our high-pass, low-pass and adjustable bandpass filters have excellent blocking characteristics and resistance to heat. They are ideal for spectrally shaping the light emitted from broadband sources.



## Loose Filters

Our loose filters fit into our light sources, cuvette holders and in-line filter holders. High-pass filters eliminate second- and third-order effects, test for stray light and block excitation energy. Balancing filters absorb energy in some regions while transmitting in others. Bandpass filters pass energy in one region and block light above and below that region.



## Fiber Optic Variable Attenuator

Our FVA-UV Fiber Optic Variable Attenuator is an opto-mechanical device that helps control the amount of light transmitted between two fibers. This attenuates light uniformly at all wavelengths from the ultraviolet through the near-infrared.

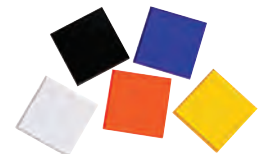


## Integration Time

This software setting is similar to the shutter speed of a camera. The higher the value specified, the longer the detector "looks" at incoming photons. Using our companion software, you can adjust this setting to suit different applications.

## Neutral Density Filters

With a neutral density filter installed at your light source or sampling device, you can reduce the intensity of light that reaches the detector across all wavelengths. Filters are 2-mm thick and 8 mm in diameter and come in optical density levels of 0.6 (~25% transmission), 1.0 (~10%) and 2.0 (~1%).



## Gershun Tube Kits

Gershun Tube Kits are ideal for solar irradiance measurements and feature an SMA 905-terminated barrel that attaches to a fiber or the spectrometer. This provides control of the aperture size. Simply select one of the interchangeable aluminum apertures to adjust the field of view of the device from 1° to 28°.



# DH-2000-BAL

## Balanced Deuterium Tungsten Halogen Light Source

We've applied our expertise in patterned dichroic filters to create the only combined-spectrum illumination source available that eliminates saturation and signal-to-noise issues associated with the D-alpha line in deuterium sources. Our DH2000-BAL Deuterium Tungsten Halogen Light Source combines deuterium and tungsten halogen light sources into a single optical path that produces a powerful, stable output from 215-2000 nm.

### About the D-alpha Line

All deuterium-tungsten halogen sources have a D-alpha line, revealed as a jagged peak in the visible portion of the spectrum, that produces "unbalanced" output in the deuterium and tungsten halogen sources. Correcting for this deuterium line – a sharp spectral feature near 655 nm – is difficult.

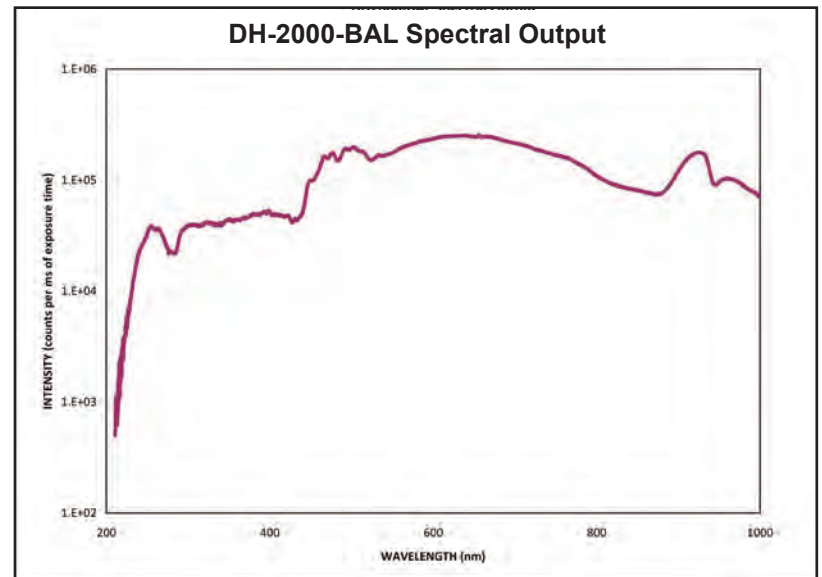
For example, if you adjust spectrometer integration time to reduce the intensity of this saturated spectral line, the efficiency of the system at UV wavelengths drops significantly, compromising signal-to-noise performance. Also, spectrometer efficiency is greatest at about the same spectral range as the 655 nm line, exaggerating its effects.

### Proprietary Filtering Technology

Using the same high-precision patterned dichroic filter technology that distinguishes our Linear Variable Filters, the DH-2000-BAL balances the intensity of the deuterium and tungsten halogen sources, producing a "smoother" spectrum across the entire wavelength range and eliminating problems associated with saturation. By comparison, most combination UV-NIR sources can be adjusted for relative intensity only.



Specifications	
Dimensions:	150 mm x 135 mm x 319 mm
Weight:	3.8 kg
Wavelength range:	210-400 nm (deuterium); 360-1500 nm (tungsten halogen)
Power consumption:	25 W (deuterium); 20 W (tungsten halogen); 190 W maximum
Power requirements:	85-264 V 50/60 Hz
Voltage:	Ignition 350 V/20°; tungsten bulb voltage is adjustable from 4.5 to 11.5 volts
Current:	Operating 85 V/0.3A
Stability:	<5 x 10 <sup>6</sup> peak-to-peak (0.1-10.0 Hz)
Drift:	<0.01% per hour
Time to stable output:	40 minutes (deuterium); 20 minutes (tungsten)
Bulb life:	1,000 hours
Operating temperature:	5 °C - 35 °C
Humidity:	5-95% non-condensing at 40 °C
Electronic certifications:	CE; VDI/VDE 0160; EN 61010



Measured with HR2000+ with 25  $\mu$ m Slit and 400  $\mu$ m Optical Fiber



### Technical Tip

Ultraviolet radiation below 300 nm degrades transmission in silica fibers, resulting in solarization (increased light absorption in the UV fiber that can invalidate data). For applications using the DH-2000 Light Sources at <300 nm, we recommend solarization-resistant assemblies. See Page 135 for details.

# DH-2000

## Deuterium Tungsten Halogen Light Source

Our DH-2000 Deuterium Tungsten Halogen Light Source combines the continuous spectrum of deuterium and tungsten halogen light sources into a single optical path for powerful output from 215-2000 nm. In addition, Deep-UV versions of our DH-2000 are available with a 190-2000 nm range.

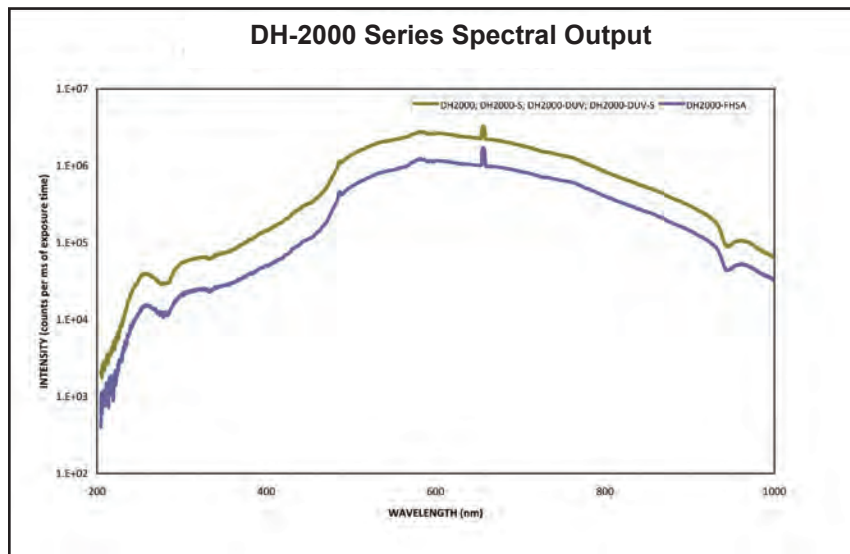
### Options and Accessories: Shutter and Filter Holder

Integrated shutters are available for your DH-2000 and can be driven by either a switch or a TTL signal.

You can also include a filter holder with the source that accepts filters up to 4 mm in thickness and as large as 25 mm square or 25 mm round in diameter. The DH-2000 has an SMA 905 connector for easy coupling to our spectrometers and accessories via the optical fiber.

### Adjustable Power

The DH-2000 has a potentiometer that adjusts the intensity of the tungsten halogen output. This allows you to adjust the optical power of the light source from 10-100%.



Measured with HR2000+ Spectrometer with 25 μm Slit and 400 μm Optical Fiber

Item Code	Description
DH2000-DUV	Uses a Deep-UV deuterium bulb that provides 190-2000 nm wavelength range
DH2000-S	Includes shutter control via a TTL signal or manual switch up to 5 Hz
DH2000-S-DUV	Uses a Deep-UV deuterium bulb that provides a 190-2000 nm wavelength range; Includes shutter control via a TTL signal or manual switch up to 5 Hz
DH2000-FHS	Includes a filter holder for filters up to 25 mm square or 25 mm round and 4 mm thick
DH2000-FHS-DUV	Uses a Deep-UV deuterium bulb that provides 190-2000 nm wavelength range; includes a filter holder for filters up to 25 mm square or 25-mm round and 4 mm thick

Specifications	
Dimensions:	150 mm x 135 mm x 319 mm
Weight:	3.5 kg
Power consumption:	25 W (deuterium); 20 W (tungsten halogen)
Wavelength range:	190-400 nm (deep-UV deuterium bulb) 215-2000 nm (standard deuterium and tungsten halogen bulbs)
Humidity:	5-95% without condensation at 40 °C
Lamp current:	Operating 85 V/0.3A
Lamp lifetime:	1,000 hours
Lamp voltage:	Ignition 580 V @20°C
Current voltage drift:	<0.01% per hour
Current voltage stability:	<5 x 10 <sup>6</sup> peak-to-peak (0.1-10.0 Hz)
Operating temperature:	5 °C - 35 °C
Power requirements:	85-264 V 50/60 Hz
Radiation characteristic:	Aperture 0.5 mm, numerical aperture 26° (13°); focused Total power: 100 W
Power consumption:	Approximately 78VA
Warm-up time:	40 minutes (deuterium); 20 minutes (tungsten halogen)
Markings:	CE; VDI/VDE 0160; EN 61010

# DT-MINI-2-GS

## Mini Deuterium Tungsten Halogen Light Source



### ~200-1100 nm Spectral Range

The DT-MINI-2-GS Deuterium Tungsten Halogen Light Source combines the continuous spectrum of an RF-excited deuterium UV light source and a tungsten halogen VIS-NIR light source in a single optical path.

The combined-spectrum sources produce stable spectral output from ~200-2000 nm in a compact package.

### Powerful Output – 0.5 mm Aperture

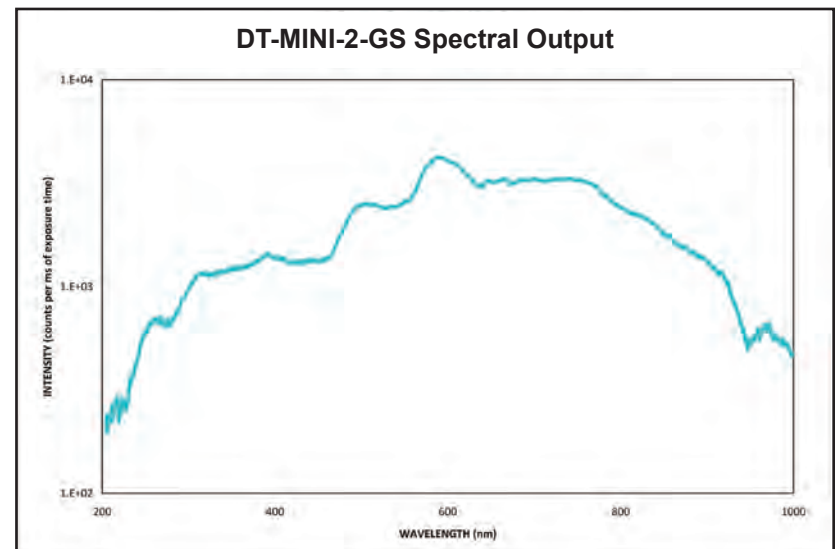
The DT-MINI-2-GS Deuterium Tungsten Halogen Light Source also utilizes a bulb with a 0.5-mm diameter aperture. It also has a shutter for blocking the light path, which can be controlled via a manual switch or TTL.

There is also a switch for turning the deuterium source on and off, and one for turning the tungsten halogen source on and off; each switch can be used independently of the other.

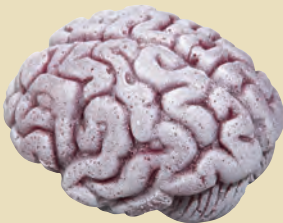
#### Specifications

Dimensions:	140 mm x 50 mm x 125 mm
Weight:	475 g
Wavelength range:	200-410 nm (deuterium); 360-2000 nm (tungsten halogen)
Power consumption:	350 mA @ 12 VDC
Output:	3.8 watts (deuterium); 1.2 watts (tungsten halogen)
Stability:	~1.0% peak-to-peak (over 4 hours) after 30-minute warm-up
Time to stable output:	10 minutes (deuterium); 1 minute (tungsten halogen)
Bulb life:	~1500 hours (deuterium); 1500 hours (tungsten halogen)
Ignition delay:	<2.0 seconds (delay for cold start-up may be longer)
Connector:	SMA 905

Note: Use item code DT-MINI-2-B when ordering replacement bulbs for the DT-MINI series miniature deuterium tungsten halogen light sources.



Measured with HR2000+ Spectrometer with 25  $\mu$ m Slit and 400  $\mu$ m Optical Fiber



#### Technical Tip

The DT-MINI-2-GS is your go-to choice for application setups requiring UV and VIS-NIR illumination.

However, we also offer our USB-DT, which can be used as a standalone source, stacked atop a USB2000+ or USB4000 Spectrometer or connected to your HR- or QE- spectrometer using a breakout box. The latter allows you to control multiple functions through software.

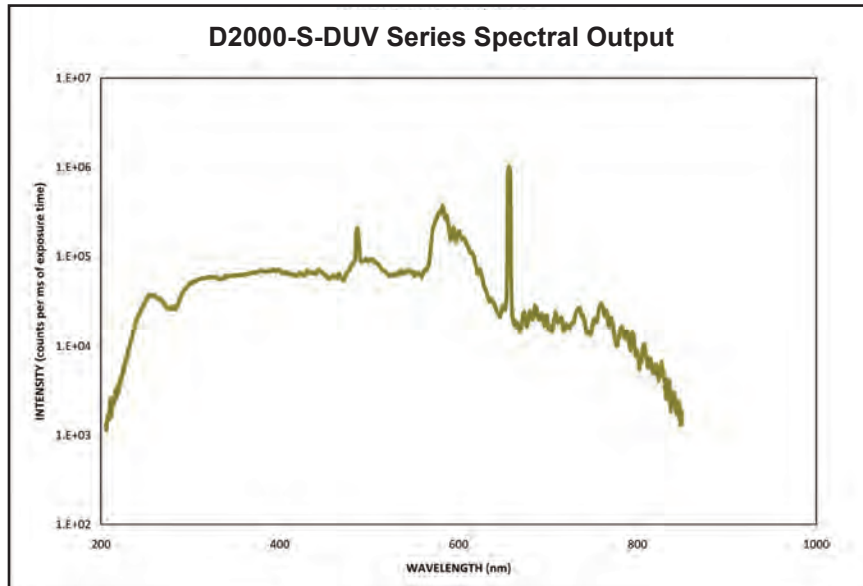
For assistance in selecting the optimum miniature deuterium tungsten halogen light source for your application, please contact an Ocean Optics Applications Scientist.

# D-2000

## Power, Stable Deuterium Source for UV Applications

### Deuterium Light Source

The D-2000 Deuterium Light Source delivers robust, even output from 210-400 nm with peak-to-peak stability of less than 0.005% and drift of only +/-0.5% per hour. D-2000 is also available in a Deep-UV configuration that provides you a wavelength range of 190-400 nm.



Measured with HR2000+ Spectrometer with 25  $\mu$ m Slit and 400  $\mu$ m Optical Fiber



### Options and Accessories

Integrated shutters are also available with the D-2000 and can be driven by a TTL signal. All versions of the D-2000 have an SMA 905 Connector for easy coupling to our spectrometers and fiber optic accessories, a safety shutter for blocking the light when the fiber is not attached, and safety goggles. The 1,000-hour deuterium bulb used in the D-2000 can be replaced easily.

Specifications	
Dimensions:	150 mm x 135 mm x 319 mm
Weight:	5.35 kg (without power cord)
Power consumption:	830 mA @ 230 VDC or 1660 mA @ 115 VDC
Wavelength range:	215-400 nm (standard bulb); 190-400 nm (deep-UV bulb)
Peak-to-peak stability:	<0.005% at 250 nm
Drift:	+/-0.5% per hour at 250 nm
Warm-up time:	40 minutes
Voltage and current:	Ignition 350V/20° operating 85 V/0.3A
Bulb lifetime:	1,000 hours for standard or deep-UV bulb
Operating temperature:	5 °C - 35 °C
Humidity:	5-95% without condensation at 40 °C
Radiation characteristic:	Aperture 0.5 mm, numerical aperture 26° (13°)
Power requirements:	85-264 V 50/60 Hz
Markings:	CE; VDI/VDE 0160; EN 61010
TTL-shutter input:	Up to 5 Hz maximum (shutter versions only)
Shutter speed:	10 ms minimum

Ordering Information	
Item	Description
D2000	Deuterium light source, 215-400 nm
D2000-DUV	D-2000 configured with a Deep-UV deuterium bulb that provides a 190-400 nm wavelength range
D2000-S	D-2000 configured with a shutter (controlled via a TTL signal or switch)
D2000-S-DUV	D-2000 configured with Deep-UV deuterium bulb that provides a 190-400 nm wavelength range and includes a shutter (controlled via a TTL signal or switch)
DH2000-BD	Replacement deuterium bulb for the D-2000 and the D-2000-S
DH2000-DUV-B	Replacement deuterium bulb for the D-2000-DUV and the D-2000-S-DUV



### Technical Tip

Ultraviolet radiation below 300 nm degrades transmission in silica fibers, resulting in solarization (increased light absorption in the UV fiber that can invalidate data). For applications using the D-2000 Light Sources, we recommend solarization-resistant assemblies. See Page 135 for details.

# HPX-2000

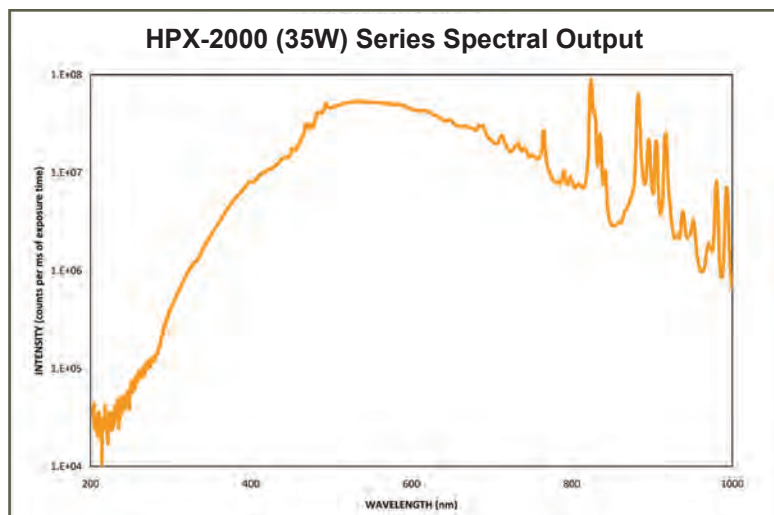
## High-Powered Continuous Wave Xenon Light Source

### High Power Output

The HPX-2000 Xenon Light Source is a high-power source that is a brilliant companion for fluorescence applications and for other applications where a high-intensity lamp is necessary. The 35-watt, short-arc lamp supplies a continuous spectrum from the UV through the NIR (185-2200 nm). The HPX-2000 features an integrated shutter that can be controlled via switch or TTL signal.

### Integrated Shutter

The HPX-2000 features an integrated shutter that can be triggered by either a switch or by a TTL signal. The HPX-2000 also comes equipped with a slot for filters up to 25 mm in diameter or 25 mm square and up to 14 mm thick.



Measured with HR2000+ Spectrometer with 25  $\mu$ m Slit and 400  $\mu$ m Optical Fiber

### Specifications

Dimensions:	145 mm x 165 mm x 260 mm
Weight:	5 kg
Power consumption:	60 W AC
Wavelength range:	185-2200 nm
Power output:	35 watts
Trigger input:	External TTL positive pulse via 15-pin connector (shutter)
Bulb lifetime:	1,000 hours minimum; 2,000 hours typical
Connector:	SMA 905



### Ordering Information

Item	Description
HPX-2000	35-watt, continuous-wave xenon light source (185-2200 nm)

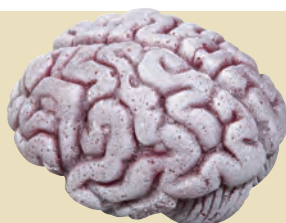


### Replacing the Bulb

With typical lab use, the HPX-2000 will last for several thousand hours. However, there may be cases where prolonged use will require bulb replacement.

In those instances, please contact an Applications Scientist for assistance.

Bulb replacement (HPX-2000-BM) is not easily handled in the field, which is why we require you to contact us for replacement by one of our trained light source technicians. This will ensure that bulbs or other components aren't damaged.



### Technical Tip

If you're using a Jaz spectrometer in your setup, consider the Jaz-PX for your pulsed xenon source needs. The Jaz-PX (see Jaz section) is a high-performance source that installs directly into the Jaz stack providing a convenient alternative to a standalone source.

# PX-2

## Pulsed Xenon Light Source

The PX-2 Pulsed Xenon Lamp is a high flash rate, short-arc xenon lamp for the UV (220-750 nm). It's great for applications requiring absorbance, reflection, fluorescence and phosphorescence measurements, and especially for measuring optically or thermally labile samples. The PX-2 operates at speeds up to 220 Hz, offers excellent pulse-to-pulse stability, and has two trigger modes for software control of the flash rate.

### About the PX-2

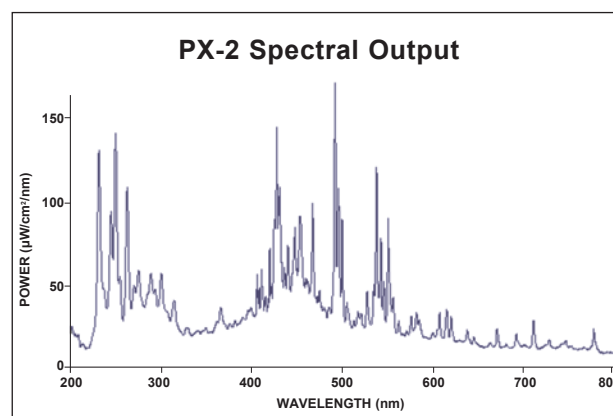
Any external TTL positive pulse can be used to trigger the PX-2. With the PX-2 coupled to a USB Series spectrometer, you can easily synchronize operation of both the light and detector. The spectrometer sampling can be altered so that a variable number of flashes are observed during each integration period.

The multiple mode of light source operation is especially useful for absorbance and reflection applications, as it ensures steady, consistent light exposure for each integration period.

In the Single mode of PX-2 operation, a single flash occurs during each integration period. The flash rate is modified by changing the integration period. Because it produces a pulsed signal, the PX-2 is less likely to contribute to solarization in optical fiber assemblies, which can occur when fibers are illuminated with signal <260 nm.



Specifications	
Spectral range:	220-750 nm
Approximate dimensions:	140 mm x 105 mm x 40 mm (LWH)
Power input:	1.3 A @ 11V @ 220 Hz 100 mA @ 12V @ 10Hz
Trigger input:	external TTL positive pulse via 15-pin connector
Output:	45 microjoules per pulse maximum 9.9 watts average power from bulb (not the same as power coming out of fiber; see graph at right) 220 Hz pulse rate maximum
Pulse duration:	5 microseconds (at 1/3 height of pulse)
Lifetime:	10 <sup>9</sup> pulses (estimated 230 days continuous operation at 50 Hz pulse rate)
Aperture:	3 mm
Connector:	SMA 905
Timing signals available:	Multiple mode: up to 220 Hz (varies with A/D sampling frequency); Single mode: varies with scan rate



### Ordering Information

Item	Description
PX-2	Miniature pulsed xenon light source for UV-VIS (220-750 nm)
PX-2-B	Spare bulb for PX-2

# HL-2000

## Tungsten Halogen Light Source



The HL-2000 Tungsten Halogen Light Sources are versatile lamps that are optimized for the VIS-NIR (360-2000 nm) range. Their unique lamps feature adjustable focusing of the SMA 905 connector for maximizing light coupling into the fiber. A fan keeps the HL-2000 cool and stable while the built-in filter slot accepts optical fibers up to 25.4 mm round or up to 50.8 mm square.

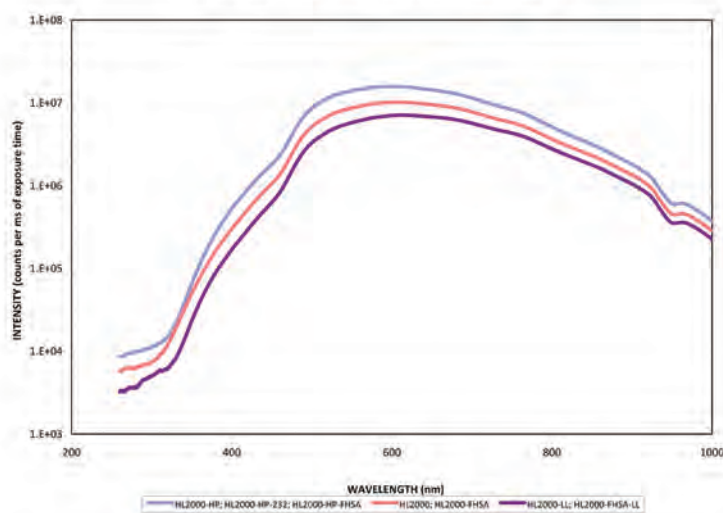
### Smart Features

- Available with 10,000-hour, long-life bulb
- High-power version available that doubles your output power
- Fan cooled with shutter, TTL and manual attenuator functions
- RS-232 interface option to access shutter and attenuator

### High-power Version

For applications requiring strong VIS-NIR output and using large-diameter optical fibers or fiber and probe bundles, a special high-power version of the HL-2000 is available. The bulb used in the HL-2000-HP is a 20-watt bulb. In addition, you can opt to control the intensity of the HL-2000-HP via an RS-232 module.

**HL2000 Series Spectral Output**



Measured with HR2000+ Spectrometer with 25  $\mu$ m Slit and 400  $\mu$ m Optical Fiber

Item	Description
HL-2000	Tungsten halogen light source, 1,500-hour bulb
HL-2000-LL	Long-life version (10,000-hour)
HL-2000-FHSA	Includes filter holder, attenuator and shutter
HL-2000-FHSA-LL	Long-life version (10,000-hour); includes filter holder, attenuator and shutter
HL-2000-HP	High-powered, 20 W version
HL-2000-HP-FHSA	High-powered, 20 W version with filter holder, attenuator and shutter
HL-2000-HP-232R	High-powered, 20 W version, rack-mounted, with RS-232 control
HL-2000-B	Spare 1,500-hour bulb
HL-2000-B-LL	Long-life 10,000-hour spare bulb
HL-2000-HP-B	High-power spare bulb

### Specifications

#### HL-2000, HL-2000-LL Standard Sources

Dimensions (mm):	62 x 60 x 150
Weight:	500 g
Output:	7 watts
Output to bulb:	1.4 A @ 5 VDC
Wavelength range:	360 nm-2000 nm
Stability:	0.5%
Drift:	<0.3% per hour
Time to stabilize:	~5 minutes
Bulb lifetime:	1,500 hours
Bulb color temperature:	2,960 K
Temperature:	5 °C - 35 °C
Humidity:	5-95% at 40 °C

#### HL-200-HP, HL-200-HP-RS-232 High-Power Sources

Dimensions (mm):	62 x 60 x 150
Weight:	500 g
Output:	20 watts
Output to bulb:	1.2 A @ 24 VDC
Wavelength range:	360 nm-2000 nm
Stability:	0.5%
Drift:	<0.3% per hour
Time to stabilize:	~5 minutes
Bulb lifetime:	2,000 hours
Bulb color temperature:	3,000 K
Temperature:	5 °C - 35 °C
Humidity:	5-95% at 40 °C

# Cool Red

## Infrared Light Source



The Cool Red works beautifully as a complement to mid-infrared analyzers or in any spectroscopy application where high-intensity infrared light is required.

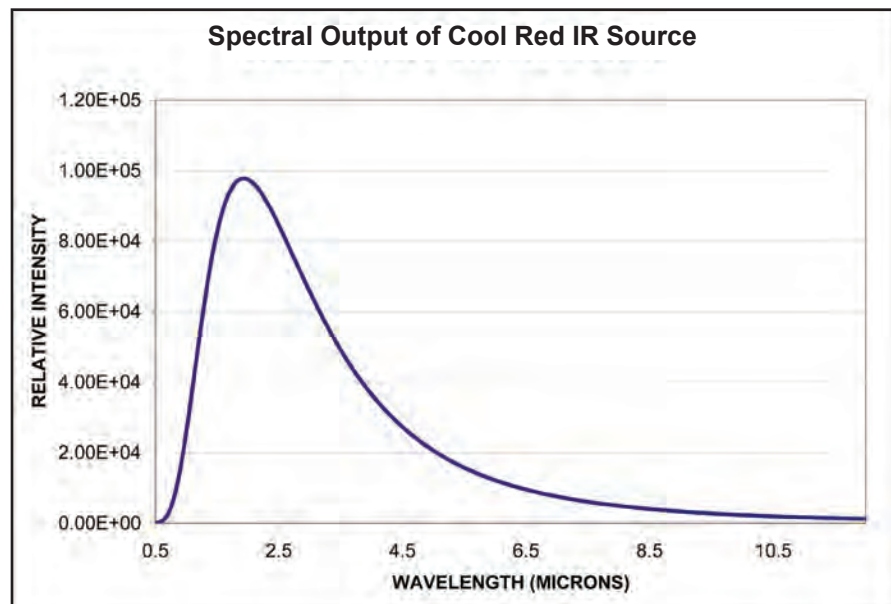
Cool Red is especially useful for applications in the region from 1000-5000 nm. For systems that require optical modulation, an integrated optical shutter can be modulated at frequencies of up to 200 Hz.

The shutter can be driven externally through a 15-pin digital interface. If no external drive is available, the shutter can be driven internally by an integrated adjustable square wave generator.

Frequency can be continually adjusted through the control knob on the front panel from 0.5 Hz to 200 Hz. The digital output for this signal can be taken from the same 15-pin interface and used to synchronize other devices.

### Specifications

Lamp	
Material:	Silicon Nitride (Si <sub>3</sub> N <sub>4</sub> )
Temperature:	1500 °K
Lifetime:	2,000 hours
Warm-up time:	12 seconds
Power:	50 Watts
Shutter	
Shutter frequency:	200 Hz
Additional Information	
Replacement lamps:	CR-Lamp-50W
Power Supply Requirements	
5 amps, 24 volts	
5.5 mm OD/3 mm ID	
Universal input power supply included	
Dimensions	
127 mm x 127 mm x 114.3 mm	



## We're Not Afraid of Commitment

Our 3-Year Warranty is truly an industry exclusive. No other manufacturer of spectrometers offers a warranty as comprehensive or solid. Your Ocean Optics spectrometer, light source or sampling accessory is guaranteed to be without manufacturing defects for a full 3 years. We also cover your optical fiber or probe a full 12 months.

This means that you can rely on your sensing solution from Ocean Optics to provide years of reliable, worry-free results.

Ask an Ocean Optics Applications Scientist for the details or visit us online.



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Annual Service Plans also available.

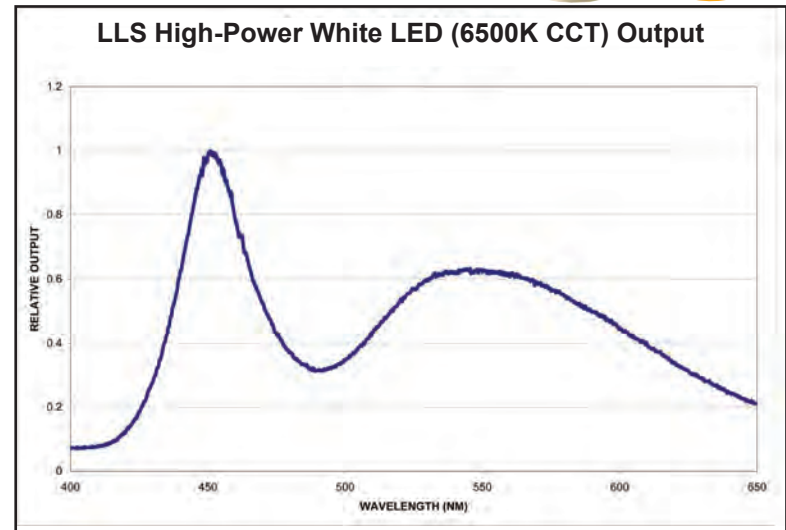
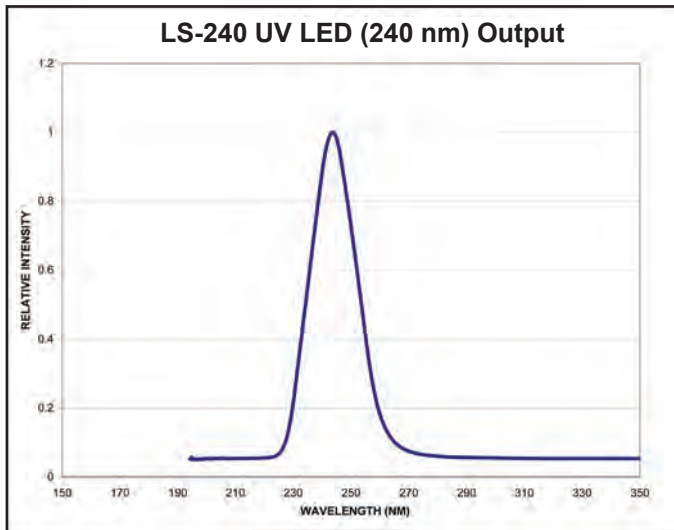
# LLS Series

## High-Performance UV and VIS LEDs

Our line of fiber-coupled LED light sources are ideal for fluorescence, spectroscopy and general fiber illumination applications. The LLS Series has a proprietary electronics design that provides stable high-current operation and allows the LEDs to run at high peak currents when in external trigger mode.

The Ultra LED high power light sources can be operated in continuous or external trigger modes. Included are the UVTOP® LEDs, which cover wavelengths from 240-400 nm.

LLS LEDs are available in nearly 50 different wavelength options. A partial listing of models is shown in the table below.



### A Partial Listing of Available Models

Part #	Wavelength	FWHM	Min Power coupled into a 600 $\mu\text{m}$ .22 NA fiber	Maximum Drive Current CW	Maximum Drive Current Pulsed	Maximum Duty Cycle in Pulsed Mode
LLS-240	240 nm	11 nm	2 $\mu\text{W}$	30 mA	200 mA	1%
LLS-250	250 nm	12 nm	5 $\mu\text{W}$	30 mA	200 mA	1%
LLS-270	270 nm	12 nm	15 $\mu\text{W}$	30 mA	200 mA	1%
LLS-290	290 nm	12 nm	15 $\mu\text{W}$	30 mA	200 mA	1%
LLS-310	310 nm	12 nm	15 $\mu\text{W}$	30 mA	200 mA	1%
LLS-325	325 nm	12 nm	15 $\mu\text{W}$	30 mA	200 mA	1%
LLS-345	345 nm	12 nm	20 $\mu\text{W}$	30 mA	200 mA	1%
LLS-365	365 nm	9 nm	1 mW	500 mA	1000 mA	50%
LLS-385	385 nm	10 nm	1 mW	500 mA	1000 mA	50%
LLS-405	405 nm	14 nm	750 $\mu\text{W}$	500 mA	1000 mA	50%
LLS-455	455 nm	20 nm	1 mW	1500 mA	3000 mA	50%
LLS-470	470 nm	25 nm	1 mW	1500 mA	3000 mA	50%
LLS-505	505 nm	30 nm	1 mW	1500 mA	3000 mA	50%
LLS-530	530 nm	35 nm	750 $\mu\text{W}$	1500 mA	3000 mA	50%
LLS-590	590 nm	14 nm	750 $\mu\text{W}$	700 mA	1400 mA	50%
LLS-617	617 nm	20 nm	750 $\mu\text{W}$	700 mA	1400 mA	50%
LLS-627	627 nm	20 nm	750 $\mu\text{W}$	700 mA	1400 mA	50%
LLS-Warm White	VIS 3000K CCT	NA	1 mW	1500 mA	3000 mA	50%
LLS-Neutral White	VIS 4100K CCT	NA	1 mW	1500 mA	3000 mA	50%
LLS-Cool White	VIS 6500K CCT	NA	1 mW	1500 mA	3000 mA	50%

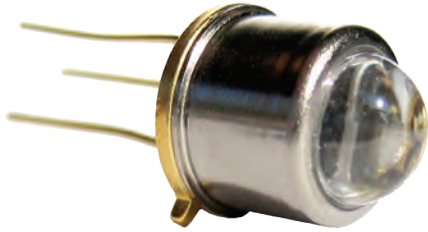
# LEDs

## Small, Powerful, Reliable

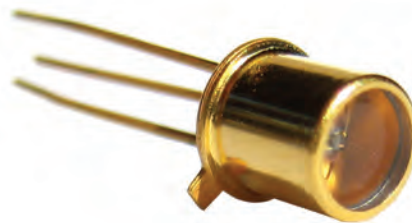
Our Deep UV LEDs are available in a wide range of wavelengths and package sizes. These devices are manufactured using AlGaIn/GaN technology that enables a new generation of High Band-Gap Energy opto-electronics devices with output to 240 nm.

These small UV LEDs consume significantly less power than comparable UV technologies and come in several standard configurations. The Ball Lens is ideal for applications that require a small or focused spot of UV light. Flat and hemispherical lens options are also available.

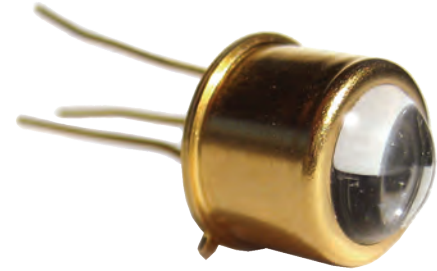
**Ball Lens**



**Flat Lens**



**Hemispherical Lens**



Please contact an Ocean Optics Applications Scientist for ordering information and item codes.

Electro-optical characteristics (UVTOP-280, Ta = 25 °C, Research Grade)						
Parameter	Symbol	Unit	Minimum	Typical	Maximum	Condition
Forward voltage	VF	V	5.5	7.5	9	IF=20 mA
Reverse current	IR	µA	100	VR=5V		
Output UV power	Pout	mW	0.5			IF=20 mA
Peak wavelength	λp	nm	-10 nm	specified	+10 nm	IF=20 mA
Spectrum half width	HW	nm	12	20	30	IF=20 mA

Parameter	Unit	Max rated Value	Ambient Temp
Power dissipation, DC	mW	150	25 °C
Forward current, DC	mA	30	25 °C
Pulse forward current	mA	200	25 °C
Reverse voltage	V	6	25 °C
Storage temperature	°C	- 30 °C - +100 °C	- 30 °C - +100 °C

# MCLS

## Multi-Channel LED Light Source



Our Multi-Channel LED Light Source is designed to power up to four LED modules. The constant current drivers can each drive up to 2 amps continuously or 4 amps at 50% duty cycle. The user changeable LED modules are automatically recognized and the drive current is adjusted accordingly. This light source can work along with or be controlled through its USB interface.

The MCLS has a powerful integrated timing controller that provides synchronization among the different channels. External events can be adjusted with a resolution of up to 10 ns. The duty cycle and pulse width of the LEDs can be programmed with great precision up to pulse widths of several seconds. Each LED channel has its own timer and the off time and on time of each channel is independently controlled.

Variable triggering modules can be easily configured with Timing Genie Software. Once the timing setups are configured, you can store them onto your MCLS without the need for a computer.

The MCLS can support standalone, master or slave operation.

Specifications	
Dimensions:	3"x3"x11.75" (76.2 mm x 76.2 mm x 298.5 mm)
Weight:	1.5 lb. (680.4 g)
Software:	Timing Genie for Windows and Java compatible SDK
PC interface:	USB 2.0
Trigger modes:	External, internal and free-running
Timing resolution:	10 ns
Drive capability per channel:	2.0 amps continuous or 4 amps at 50% duty cycle
LED modes:	Sequential, synchronized and free-running
Analog control resolution:	12 bit

# DH-2000-CAL

## UV-NIR Radiometric Calibration Source

The DH-2000-CAL Deuterium Tungsten Halogen Calibration Standard is a UV-NIR light source used to calibrate the absolute spectral response of a radiometric system. With the DH-2000-CAL and SpectraSuite Software, you can determine known absolute intensity values at wavelengths from 220-1050 nm.

The DH-2000-CAL is specifically calibrated for use with optical fibers or a cosine corrector; the calibration data includes absolute intensities for wavelengths between 220-1050 nm at the fiber entrance port for both a bare fiber and a CC-3-UV Cosine Corrector.

### Features

- UV-NIR Calibration Source. For use in performing fast, radiometric calibrations from 220-1050 nm
- NIST-traceable Calibration from 220-1050 nm. Provides absolute spectral intensity in  $\mu\text{W}/\text{cm}^2/\text{nm}$  at the fiber port
- Calibration Certificate. Calibration data is provided in paper and electronic formats for use with SpectraSuite Software

### Included with the Lamp

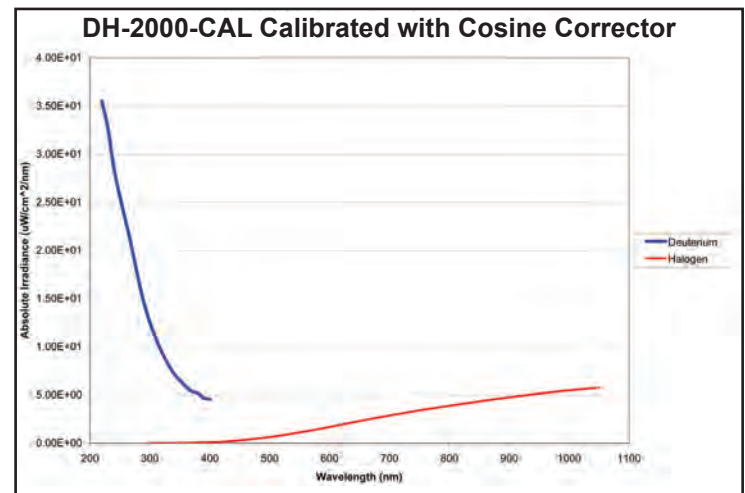
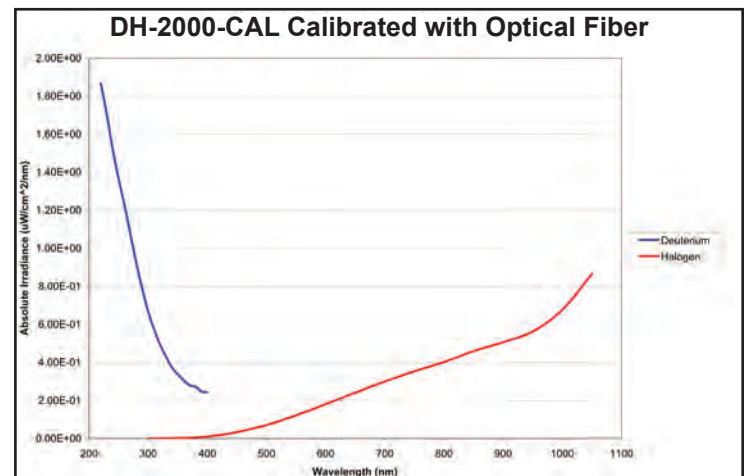
The DH-2000-CAL comes with the CC-3-UV Cosine Corrector. Also included are a calibration certificate and a diskette with a data file for use with our SpectraSuite Software.

### Other Calibration Services

The DH-2000-CAL typically provides about 50 hours of operation before recalibration is necessary. Ocean Optics recalibrates these lamps in-house. Also, by using our SPEC-CAL-UV in-house calibration service, it is possible to have your UV spectrometer radiometrically calibrated without purchasing a DH-2000-CAL.

The calibration is typically good for about one year, provided the optical fiber is not removed from the setup, as the system is calibrated specifically for use with a fiber.

Specifications	
Dimensions:	150 mm x 135 mm x 319 mm
Weight:	6 kg
Power consumption:	25 W (deuterium); 20 W (tungsten halogen)
Calibrated range:	220-1050 nm
Calibration accuracy:	+/-5%
Calibration valid for:	50 hours
Lamp current:	Operating 85 V/0.3A
Lamp voltage:	350 V
Power requirements:	85-264 V 50/60 Hz
Current voltage drift:	<0.01% per hour
Current voltage stability:	<5 x 10 <sup>6</sup> peak-to-peak (0.1-10.0 Hz)
Humidity:	5-95% without condensation at 40 °C
Operating temperature:	5 °C - 35 °C
Total power:	100 W
Power consumption:	190 W maximum
Warm-up time:	40 minutes (deuterium); 20 minutes (tungsten halogen)
Markings:	CE; VDI/VDE 0160; EN 61010



### Models Available

DH2000-CAL	NIST-traceable UV-NIR (220-1050 nm) calibration source
DH2000-RECAL	Recalibration service from 220-1050 nm
DH2000-CAL-EXT	Upgrade for extended range from 1050-2200 nm
DH2000-RECAL-EXT	Upgrade recalibration service from 1050-2200 nm

# HL-2000-CAL

## VIS-NIR Radiometric Calibration Source



The HL-2000-CAL Calibrated Tungsten Halogen Light Source can calibrate the absolute spectral response of a spectroradiometric system.

With this NIST-traceable light source and SpectraSuite software, you can determine known absolute intensity values at wavelengths from 300-1050 nm.

### Features

- NIST-traceable calibration from 300-1050 nm. Provides absolute spectral intensity in  $\mu\text{W}/\text{cm}^2/\text{nm}$  at the fiber port
- Multiple calibration options. Source can be calibrated specifically for a bare fiber, a fiber plus cosine corrector, or an integrating sphere
- Calibration certificate. Calibration data is provided in paper and electronic formats, for use with SpectraSuite

### Calibrated for Use with Fiber and Cosine Corrector

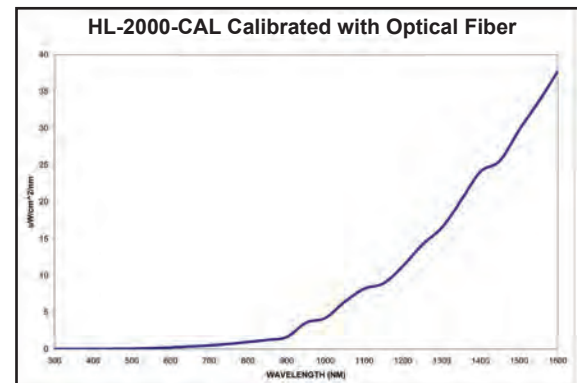
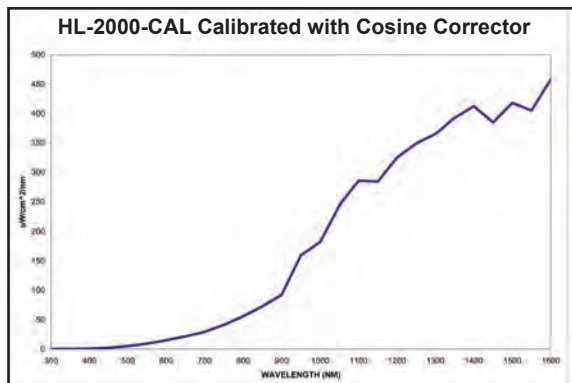
The HL-2000-CAL is designed for calibrating a system consisting of a spectrometer and an optical fiber or cosine corrector as the sampling optic. The calibration data for the HL-2000-CAL includes absolute intensities for wavelengths between 300-1050 nm.

### Calibrated for Use with Integrating Spheres

The HL-2000-CAL-ISP is designed for calibrating the absolute spectral response of your system when using the ISP-50-8-I Integrating Sphere as your sampling optic.

### Included with the Lamp

The HL-2000-CAL comes with a regulated 12 VDC power supply. Also included is a calibration certificate and a diskette with data files for use with our irradiance software. A cosine corrector is available for an additional charge.



Specifications	
Spectral range (calibrated):	300-1050 nm (calibrated)
Power consumption:	600 mA @ 12 VDC
Power output:	6.5 watts
Bulb life:	900 hours (recommend recalibration after 50 hours of use)
Recalibration:	Required after ~50 hours of operation
Bulb color temperature:	3100 K
Output to bulb:	5 volts/1.3 amps
Output regulation:	0.2% voltage
Time to stabilized output:	~30 minutes
Connector:	SMA 905 for fiber; 6.35-mm barrel for cosine corrector; PTFE plug for integrating sphere

We also carry a high-power version for all your spectroscopy needs.

HL-2000-HP-CAL  
Radiometrically Calibrated  
HL-2000 High Power,  
20W, 350-1050 nm

# Spectrometer Wavelength Calibration Sources

## Full Range of Emission Sources for Application Needs

We offer gas-discharge emission sources for spectrometer wavelength calibration that cover wavelengths ranging from ~250-2000 nm. With five different options – Mercury-Argon (HG-1), Krypton (KR-1), Neon (NE-1), Argon (AR-1) and Xenon (XE-1) – you can select a source with an optimum number of emission lines in your spectral region of interest. With more emission lines, correcting for baseline drift and related phenomena inherent to all spectrometers is more easily and reliably achieved. Also, many of the most intense emission lines are conveniently printed on each calibration source label.

**Table of Emission Lines for Spectrometer Wavelength Calibration Sources**

Peak	Lamp	Peak	Lamp	Peak	Lamp	Peak	Lamp	Peak	Lamp
253.652	Hg	480.702	Xe	692.947	Ne	892.869	Kr	1362.266	Ar
296.728	Hg	482.971	Xe	703.241	Ne	904.545	Xe	1363.422	Kr
302.150	Hg	484.329	Xe	717.394	Ne	912.297	Ar	1365.706	Xe
313.155	Hg	491.651	Xe	724.512	Ne	916.265	Xe	1367.855	Ar
334.148	Hg	492.315	Xe	733.930	Xe	922.450	Ar	1371.858	Ar
341.790	Ne	503.135	Ne	738.600	Xe	935.422	Ar	1382.572	Ar
342.391	Ne	503.775	Ne	739.379	Xe	965.779	Ar	1390.748	Ar
344.770	Ne	508.038	Ne	740.040	Xe	978.450	Ar	1409.364	Ar
345.076	Ne	511.367	Ne	743.890	Ne	979.970	Xe	1414.244	Xe
345.419	Ne	511.650	Ne	747.244	Ne	992.319	Xe	1442.679	Kr
346.052	Ne	540.056	Ne	748.887	Ne	1047.005	Ar	1473.281	Xe
346.658	Ne	546.074	Hg	753.577	Ne	1067.357	Ar	1473.444	Kr
347.257	Ne	556.222	Kr	754.404	Ne	1083.837	Xe	1504.65	Ar
349.806	Ne	557.029	Kr	755.979	Xe	1107.887	Ar	1517.269	Ar
350.121	Ne	576.441	Ne	758.468	Xe	1117.752	Ne	1520.310	Kr
351.519	Ne	576.960	Hg	758.741	Kr	1144.183	Ar	1532.934	Ar
352.047	Ne	579.066	Hg	760.155	Kr	1148.811	Ar	1537.204	Kr
359.353	Ne	582.015	Ne	764.391	Xe	1152.275	Ne	1541.839	Xe
360.017	Ne	585.249	Ne	768.525	Kr	1166.871	Ar	1598.949	Ar
363.366	Ne	587.096	Kr	769.454	Kr	1171.949	Ar	1605.328	Xe
365.015	Hg	588.189	Ne	780.265	Xe	1181.938	Kr	1620.872	Kr
368.573	Ne	594.483	Ne	785.482	Kr	1211.233	Ar	1647.29	Xe
370.122	Ne	597.553	Ne	788.132	Xe	1213.974	Ar	1656.023	Xe
404.656	Hg	602.000	Ne	791.343	Kr	1220.353	Kr	1672.815	Xe
407.783	Hg	607.433	Ne	796.734	Xe	1234.339	Ar	1689.676	Kr
431.958	Kr	609.616	Ne	805.726	Xe	1243.932	Ar	1694.058	Ar
435.833	Hg	612.884	Ne	805.950	Kr	1248.766	Ar	1704.288	Ar
436.264	Kr	614.306	Ne	806.134	Xe	1262.339	Xe	1755.350	Kr
437.612	Kr	616.359	Ne	810.436	Kr	1270.228	Ar	1763.882	Xe
439.997	Kr	621.728	Ne	819.006	Kr	1273.342	Ar	1785.738	Kr
445.392	Kr	626.649	Ne	823.163	Xe	1280.274	Ar	1790.45	Xe
446.369	Kr	630.479	Ne	826.324	Kr	1295.666	Ar	1800.223	Kr
450.235	Kr	633.442	Ne	826.652	Xe	1300.826	Ar	1809.09	Xe
452.186	Xe	638.299	Ne	829.811	Kr	1317.741	Kr	1816.733	Kr
462.420	Xe	640.225	Ne	837.761	Ne	1322.811	Ar	1832.53	Xe
466.849	Xe	650.653	Ne	849.536	Ne	1322.811	Ar	1959.94	Xe
469.097	Xe	653.288	Ne	866.794	Ar	1327.264	Ar	1984.638	Xe
469.804	Xe	659.895	Ne	877.675	Kr	1331.321	Ar	2190.851	Kr
473.415	Xe	667.828	Ne	878.375	Ne	1336.711	Ar		
479.262	Xe	671.704	Ne	881.941	Xe	1350.419	Ar		

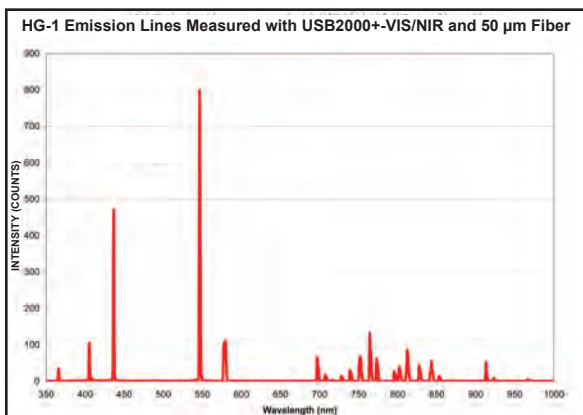
# Spectrometer Wavelength Calibration Sources

## Compact Sources and Adapters



### HG-1 Mercury Calibration Source

Our compact, low-cost HG-1 Mercury Argon Calibration Source is a spectral wavelength calibration source for UV-VIS-Shortwave NIR spectrophotometric systems. The HG-1 produces first order mercury and argon spectral lines from 253-922 nm and second order argon lines to 1700 nm for use in performing fast, reliable spectrometer wavelength calibrations. Easily identifiable mercury and argon spectral emission lines are printed on the HG-1 housing.



Output:	Low-pressure gas discharge lines of mercury
Spectral range:	253-1700 nm
Dimensions (in mm):	125.7 x 70 x 25.8
Power consumption:	250 mA at 12 VDC
Power requirements:	12 VDC wall transformer (included) or 9 VDC battery (additional)
Internal voltage:	600 volts at 30 kHz
Bulb life:	~ 3,500 hours (at 20 mA)
Amplitude stabilization:	~1 minute
Aperture:	3 mm
Connector:	SMA 905

### Cuvette Wavelength Calibration Adapter

The PS-HG1-ADP Wavelength Calibration Adapter is a 1-cm square fixture that fits into a 1-cm pathlength sample chamber and connects to the AR-1 via optical fiber. (Neither wavelength calibration standard or fiber is included).

The adapter is designed for performing a wavelength calibration for any spectrometer and 1-cm cuvette holder system, whether it's designed by Ocean Optics or another manufacturer.

Item Code: PS-HG1-ADP

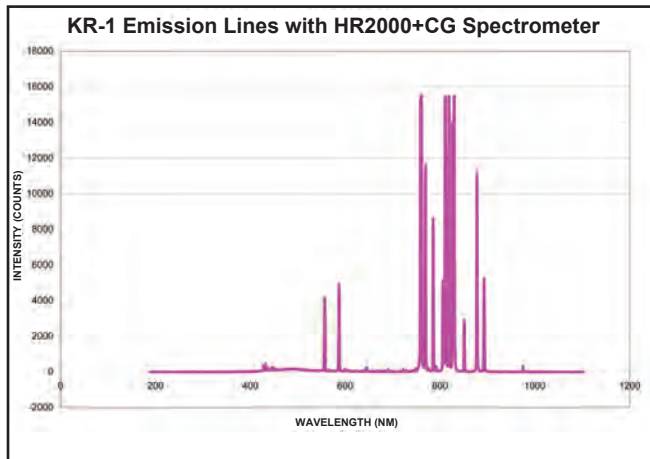


# Spectrometer Wavelength Calibration Sources

## Compact Sources Have Well-Defined Emission Lines

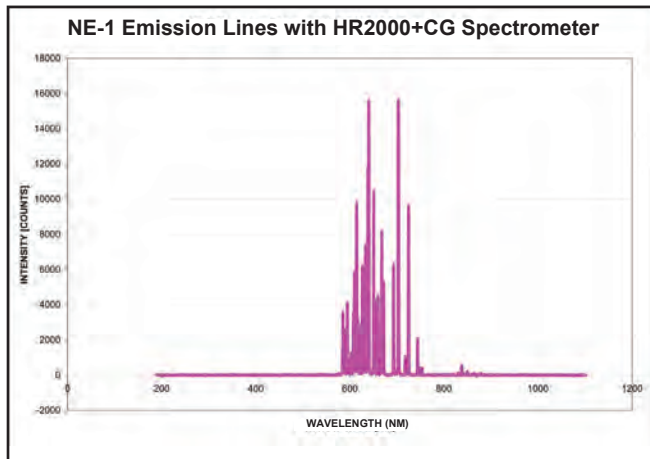
Our spectrometer wavelength calibration sources are available in more models covering more wavelengths than ever before. Those extra emission lines let you calibrate your spectrometer wavelength with greater precision and reliability. Also, unlike radiometric sources that require NIST certification, these sources have atomic emission lines that are determined by quantum mechanics. Another thing to consider is there are more emission lines for each source than may be printed on the product label.

### KR-1 Krypton Calibration Source



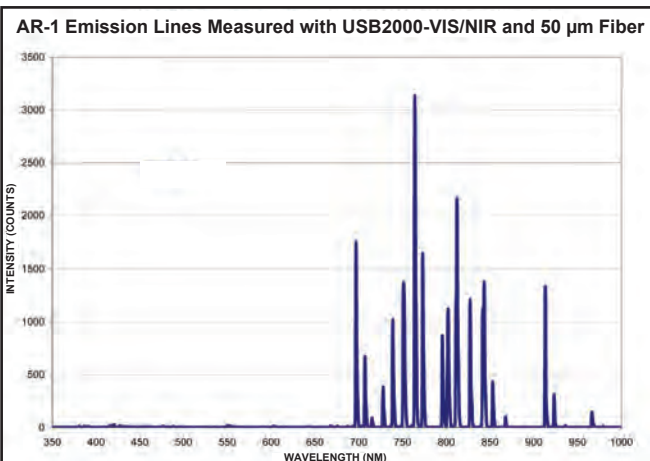
Output	Low-pressure gas discharge lines of Krypton
Spectral range:	427-893 nm
Dimensions (in mm):	125.7 x 70 x 25.8
Power consumption:	250 mA at 12 VDC
Power requirements:	12 VDC wall transformer (included) or 9 VDC battery (optional)
Bulb life:	Approx. 3500 hours (at 20 mA)
Internal voltage:	600 volts at 30 kHz
Aperture:	3 mm
Amplitude stabilization:	~ 1 minute
Connector:	SMA 905

### NE-1 Neon Calibration Source



Output	Low-pressure gas discharge lines of Neon
Spectral range:	540-754 nm
Dimensions (in mm):	125.7 x 70 x 25.8
Power consumption:	250 mA at 12 VDC
Power requirements:	12 VDC wall transformer (included) or 9 VDC battery (optional)
Bulb life:	3500 hours (at 20 mA)
Internal voltage:	600 volts at 30 kHz
Aperture:	3 mm
Amplitude stabilization:	~ 1 minute
Connector:	SMA 905

### AR-1 Argon Calibration Source

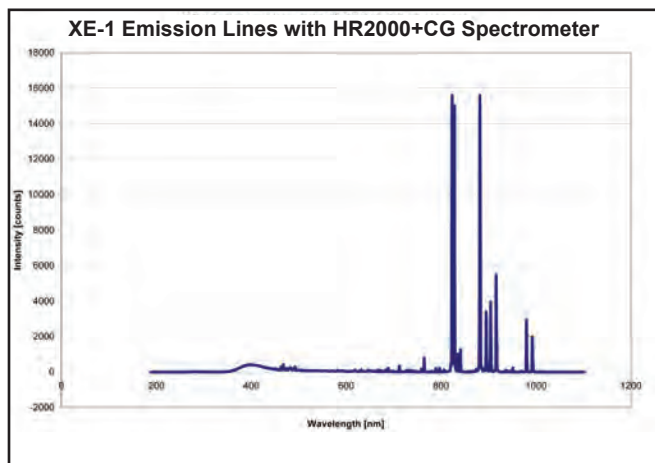


Output:	Low-pressure gas discharge lines of Argon
Spectral range:	696-1704 nm
Dimensions (in mm):	125.7 x 70 x 25.8
Weight:	40 g
Power consumption:	250 mA at 12 VDC
Power requirements:	12 VDC wall transformer (included) or 9VDC battery (optional)
Bulb life:	~ 3,500 hours (at 20 mA)
Internal voltage:	600 volts at 30 kHz
Aperture:	3 mm
Amplitude stabilization:	~1 minute
Connector:	SMA 905

# Spectrometer Wavelength Calibration Sources

Compact Sources with Well-Defined Emission Lines

## XE-1 Xenon Calibration Source



Output	Low-pressure gas discharge lines of Xenon
Spectral range:	916-1984 nm
Dimensions (in mm):	125.7 x 70 x 25.8
Power consumption:	250 mA at 12 VDC
Power requirements:	12 VDC wall transformer (included) or 9 VDC battery (optional)
Bulb life:	Approx. 3500 hours (at 20 mA)
Internal voltage:	600 volts at 30 kHz
Aperture:	3 mm
Amplitude stabilization:	~ 1 minute
Connector:	SMA 905



### Technical Tip Recalibration of Spectral Instruments

Proper analytical procedures require the use of standards or reference materials for performance monitoring of any spectral instrument. If such monitoring shows that the instrument is not performing according to its designed parameters, the instrument needs to be recalibrated to bring it back to peak performance and ensure good measurements and reliable results.

In electronic-based instruments, special software programs take care of the recalibration. These programs use sometimes complex mathematical algorithms to transform the actual measurements into standardized results by making minor adjustments to the electronics gain and baselines, data collection rates, power conditioning and other factors inherent to the instrument.

In simple terms, the recalibration is telling the instrument to go back to its original factory settings or at least to certain values considered to be part of the tolerances of the device. However, recalibration can only do so much. If this procedure fails, the instrument will need major adjustments that generally require the use of specialized tools and trained personnel.

With spectrometers, wavelength monitoring and recalibration requires the use of a reference light source that emits well-defined wavelengths. High purity gas or vapor lamps (light sources) are the primary standards recommended for testing wavelength accuracy. Light sources such as a mercury vapor lamp are recommended by testing organizations such as ASTM (E275-01 and E925-02), United States Pharmacopoeia (USP) and British Pharmacopoeia (V.6.19).

Low-pressure mercury vapor lamps have a number of intense, narrow and well identified emission bands that cover the UV-VIS spectral range. Argon-filled and other similar lamps are used for monitoring and calibrating in the NIR spectral range. It is also common to use a combination of gases in order to manufacture reference light sources to cover extended spectral ranges.

A highly recommended practice before taking a measurement using a spectrometer is to first measure the reference light source. If the emission lines are detected at their specified wavelength, the actual experiment can follow. If there is drift between the expected values and the results, the instrument must be recalibrated and the calibration confirmed by measuring the reference source (monitoring again) with the spectrometer in Acquisition mode.

If the monitored results are satisfactory, it is recommended that the experimental measurements be taken relatively soon after the recalibration. Depending on the required accuracy of the results, the calibration step might be postponed or programmed to occur on a regular basis after developing a calibration procedure based on statistical data and method development for the application.

# Light Source Accessories

## Parts and Replacement Items

Item code	Description
DH-2000-BD	Deuterium Bulb for D-2000 and DH-2000, 210-400 nm, 1000 hrs
DH-2000-BH	Halogen Bulb for all DH-2000s, 360-2000-nm, 900 hrs, 3100K
DH-2000-DUV-B	Deep UV Deuterium Bulb, 190-2000 nm, 1000 hrs
DT-MINI-2-B	Bulb for DT-MINI-2 & DT-MINI-2-GS Light Source
DT-MINI-B	Bulb for DT-MINI Light Source
HL-2000-B	Bulb for HL-2000, HL-2000-FHSA, 1500 hrs (red/black)
HL-2000-B-LL	Bulb for HL-2000-LL, 10,000 hrs
HL-2000-HP-B	Bulb for HL-2000-HP
LS-1-B	Bulb for LS-1, 900 hrs, 3100K
LS-1-LL-B	Bulb for LS-1-LL, 360-2000 nm, 10,000 hrs, 2800K
PX-2-B	Bulb for PX-2 Lamp
ZGOGGLES	UV Goggles
WT-12V	12-Volt Power Supply 800 milliamps (for Americas and Japan)
WT-12V-R	12-volt Power Supply 2.5 Amps (for Americas and Japan)
WT-12V-E	12-Volt Power Supply 800 milliamps (for Europe)
WT-12V-R-E	12-volt Power Supply 2.5 Amps (for Europe)
WT-24V	24-Volt Power Supply 2.5 Amps (For Americas and Japan)



Bulb for the HL-2000



The DH2000-BH tungsten halogen bulb used in all DH2000s



The DH2000-BD deuterium bulb used in all D-2000s and DH-2000s



WT-12V-E European Power Supply

## ensure absolute irradiance

### with Professional Radiometric Calibration Services

To certify that the absolute irradiance of your Ocean Optics emission source is correct, turn to radiometric calibration services from the most trusted professionals in the industry.

- Traceable to either NIST or NPL radiometric standards
- Wavelength calibration from 210-2400 nm
- Certification and companion CD with calibration files
- Calibrated light sources and other standards

Use your calibrated emission source to keep your Ocean Optics spectrometer performing absolute irradiance measurements accurately and reliably. Contact us for details.



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