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Find the *Mikropack DH-2000* at our website: ***Click HERE***

light sources







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Overview: Light Sources

Sources for Illumination, Excitation, Calibration



The introduction of Ocean Optics miniature fiber optic 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 complemented by the best light sources for spectroscopy that our vendor partners can provide.

Sources for illumination cover various wavelength ranges to enable absorbance, reflectance and fluorescence measurements from the deep UV to the NIR. Compact light-emitting diodes produce output for fluorescence measurements. For fast, reliable spectrometer wavelength calibrations, we offer Mercury and Argon sources. Design features such as built-in filter slots, combined with optional accessories such as direct-attach cuvette holders, make sampling simple.

Ocean Optics Modular Light Source Options

Deuterium Light Sources: Used most often for UV absorbance and reflectance measurements.

Combination Deuterium and Tungsten Light Sources: Used as single illumination sources for measurements across broad wavelength ranges.

Pulsed Xenon Lamps: Used as long-life sources for absorbance, reflectance and fluorescence measurements, and for measuring optically or thermally labile samples.

Tungsten Halogen Light Sources: Used most often as standard VIS-NIR light sources for absorbance, reflectance of solid objects, and color measurement.

Lasers: Used as high-power excitation sources for emission and scattering applications. Output power is higher and spectral width is narrower than with LEDs.

Light-emitting Diodes: Used as excitation sources for fluorescence. Feature minimal warm-up and high stability. Power is lower and spectral width is wider than with lasers.

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 a spectrophotometric systems. Mercury Argon source is for UV-NIR and the Argon source for NIR.

Type	Product	Wavelength Range	Output	Measurement Type	Page
Deuterium Tungsten Halogen	DH-2000-BAL DH-2000	~215-2000 nm	Continuous	Absorbance, Reflectance, Fluorescence, Transmission	106 107
Miniature Deuterium Tungsten Halogen	DT-MINI DT-MINI-GS	~200-2000 nm	Continuous	Absorbance, Transmission, Reflectance	108
Deuterium	D-2000	~215-400 nm	Continuous	Absorbance, Reflectance, Fluorescence, Transmission	109
Lasers	DLZ-series DPSS-series	635, 650, 660 nm 532, 785 nm	Continuous	Fluorescence	115
Xenon	PX-2 HPX-2000	220-750 nm 185-2000 nm	Pulsed Continuous	Absorbance, Reflectance, Fluorescence, Transmission	114
LEDs	LEDs (several wavelengths)	380, 395, 470, 475, 518, 590, 640 and 450-630 nm	Pulsed or Continuous	Fluorescence	112-113
Tungsten Halogen	LS-1 HL-2000	360-2000 nm 360-2000 nm	Continuous	Absorbance, Reflectance, Transmission	110 111
Calibrated Deuterium Tungsten Halogen	DH-2000-CAL	~215-1050 nm	Continuous	Calibration (Radiometric)	116
Calibrated Tungsten Halogen	LS-1-CAL HL-2000-CAL	300-1050 nm 300-1050 nm	Continuous	Calibration (Radiometric)	117
Mercury Argon	HG-1 CAL-2000	253-1700 nm 253-1700 nm	Continuous	Calibration (Wavelength)	118
Argon	AR-1	253-1700 nm	Continuous	Calibration (Wavelength)	119

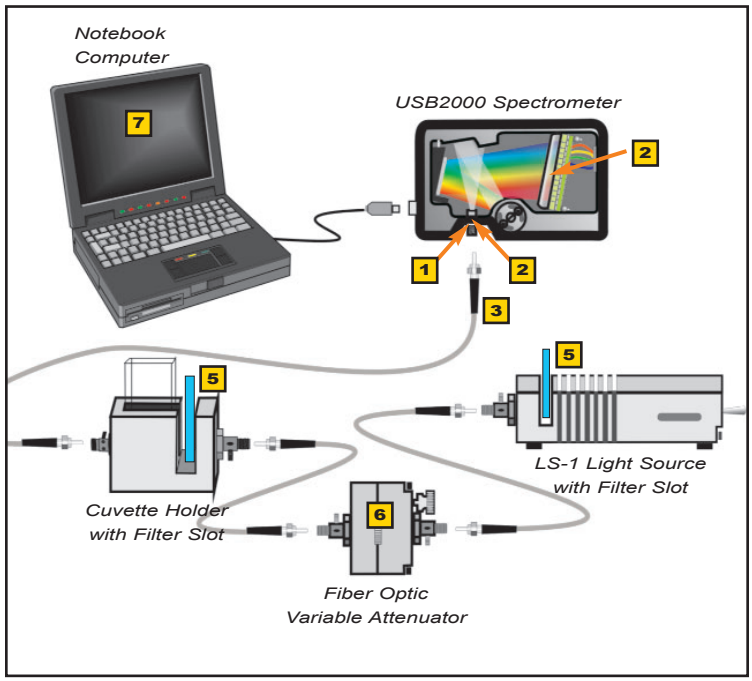
Overview: Light Sources

Ways to Modify Light

Our products provide you with many options for modifying the light transmitted to the spectrometer's detector. The illustration here is a fabricated configuration -- as few would have a setup exactly like it -- to demonstrate several ways in which you can modify light.

For high-intensity light-level applications such as laser characterization, more light will reach the spectrometer than likely can be detected successfully by the high-sensitivity CCD-array detector used in most of our spectrometers. Also, some absorbance experiments may require signal attenuation; too much light can saturate the reference measurement.

In some instances, saturation is avoided by using a different grating, changing the optical bench entrance aperture or adding neutral-density filters to the optical path. Another option is to adjust (via software) the spectrometer integration time to limit the interval during which the detector collects light.

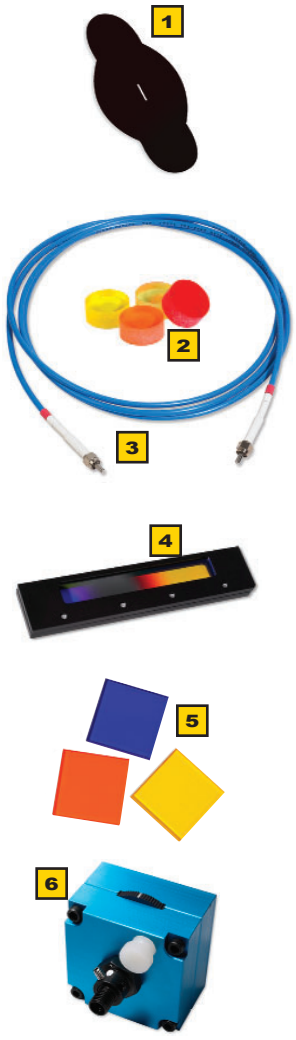


1 **Entrance Aperture: Slit**
An installed slit acts as the entrance aperture to the optical bench and regulates the amount of light entering the optical bench. The slit size, and whether or not it is included, are determined by the user. Slit sizes range from 5 µm to 200 µm. See page 34 for details.

2 **Installed Filters**
In addition to the variable longpass OFLV Filter -- an order-sorting filter applied to the detector's window (see page 35 for details) -- we offer both bandpass and longpass blocking filters to restrict radiation in certain wavelength regions. For more on installed filters, see page 35.

3 **Optical Fiber**
Our optical fibers are available from 8 µm to 1000 µm in diameter. If you need a great deal of light for your application, you should select a large diameter fiber. Also, in the absence of a slit, the fiber connected to the spectrometer acts as the optical bench entrance aperture. See pages 123-125 for details.

4 **Linear Variable Filters**
Our high-pass, low-pass and adjustable-bandpass filters have excellent blocking characteristics and resistance to heat, making these filters ideal for spectrally shaping the light emitted from broadband sources. See page 80 for more.

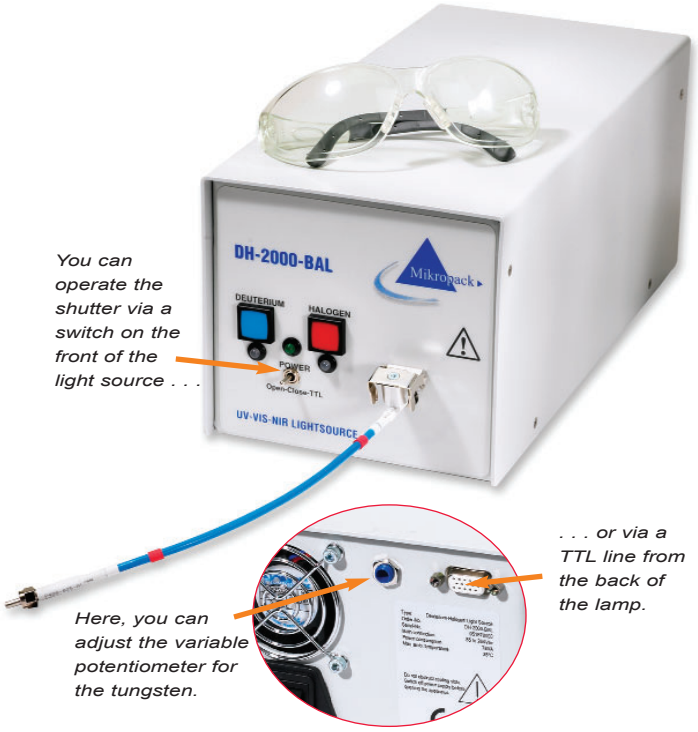


5 **Loose Filters**
Our loose filters fit into our light sources, cuvette holders and in-line filter holders. High-pass Filters eliminate second- and third-order effects, test for stray light, and block excitation energy. Balancing Filters absorb energy in some regions while transmitting in others. Bandpass Filters pass energy in one region and block light above and below that region. See page 146 for more on the filter options available.

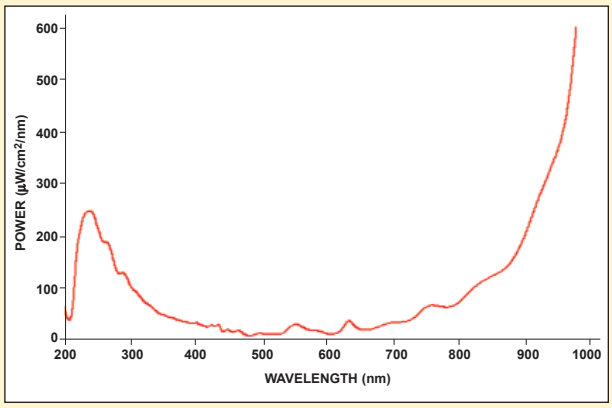
6 **Fiber Optic Variable Attenuator**
The FVA-UV Fiber Optic Variable Attenuator is an opto-mechanical device that helps control the amount of light transmitted between two fibers. The FVA-UV attenuates light uniformly at all wavelengths from the ultraviolet through the near-infrared. See page 91 for details.

7 **Integration Time**
Integration Time is a setting in our software and is specified by the user. The integration time of the spectrometer is analogous to the shutter speed of a camera. The higher the value specified for the integration time, the longer the detector "looks" at the incoming photons. For more information about integration time, see any of our software manuals.

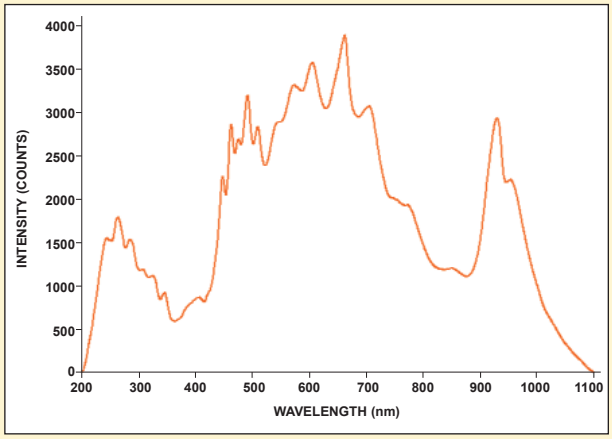
Balanced Deuterium Tungsten Halogen Source



DH-2000-BAL Spectral Output



DH-2000-BAL with HR4000-CG



A Scope Mode spectrum of the DH-2000-BAL obtained with an HR4000CG shows balanced response across the UV-VIS-NIR.

UV-NIR Spectral Range with Balanced Output

We've applied our expertise in patterned dichroic filters to an innovation in light source technology to create the only combined-spectrum illumination source available that eliminates saturation and signal-to-noise problems associated with the D-alpha line in the deuterium source. The DH-2000-BAL Deuterium Tungsten Halogen Light Source combines deuterium and tungsten halogen light sources in a single optical path, producing 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 sharp peak in the visible portion of the spectrum, that produces "unbalanced" output in the deuterium and tungsten halogen sources. Correcting for this peak -- a sharp spectral feature near 655 nm -- is difficult. For example, if you adjust spectrometer integration time to reduce the intensity of this saturated peak, the efficiency of the system at ultraviolet wavelengths drops significantly, compromising the signal-to-noise of the spectrum. Also, spectrometer efficiency is typically greatest in the same general 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 (page 80), the DH-2000-BAL:

- balances the intensity of the deuterium and tungsten halogen sources;
- eliminates the D-alpha, D-beta and Fulcher lines;
- eliminates problems associated with saturation; and
- produces a "smoother" spectrum across the entire wavelength range.

Optical Fibers

We recommend using our solarization-resistant optical fibers with the DH-2000-BAL. See pages 123 and 125 for details.

DH-2000-BAL

Specifications	
Dimensions:	150 mm x 135 mm x 319 mm
Weight:	3.8 kg
Power consumption:	25 W (deuterium); 20 W (tungsten halogen)
Wavelength range:	215-400 nm (deuterium); 360-2000 nm (tungsten halogen)
Humidity:	5-95% non-condensing at 40 °C
Lamp voltage:	Ignition 350 V/20°
Tungsten bulb voltage:	Adjustable from 4.5 to 11.5 volts
Lamp current:	Operating 85 V/0.3A
Lamp lifetime:	1,000 hours
Current voltage drift:	<0.01% per hour
Voltage stability:	<5 x 10^{-6} peak-to-peak (0.1-10.0 Hz)
Operating temperature:	5 °C - 35 °C
Power requirements:	85-264 V 50/60 Hz
Power consumption:	190 W maximum
Warm-up time:	40 min. (deuterium); 20 min. (tungsten halogen)
Electronic certifications:	CE; VDI/VDE 0160; EN 61010

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Deuterium Tungsten Halogen Sources

UV-NIR Spectral Range

The DH-2000 Deuterium Tungsten Halogen Light Source combines the continuous spectrum of deuterium and tungsten halogen light sources in a single optical path. The combined-spectrum light source produces a powerful, stable output from 215-2000 nm. In addition, deep-UV versions of the DH-2000 are available, with a 190-2000 nm range.

Adjustable Power

All versions of the DH-2000 have a potentiometer on the back of the light source to adjust the intensity of the tungsten halogen output. This potentiometer allows you to adjust the optical power of the tungsten halogen light from 10-100%.

Options & Accessories: Shutter & Filter Holder

Integrated shutters are available and can be driven either by a switch or by a TTL signal. Another option is to include a filter holder with the source (see inset), which accepts filters up to 4 mm in thickness and as large as 25-mm square or 20-mm round in diameter. All versions of the DH-2000 have an SMA 905 Connector for easy coupling to our spectrometers and accessories via optical fiber.

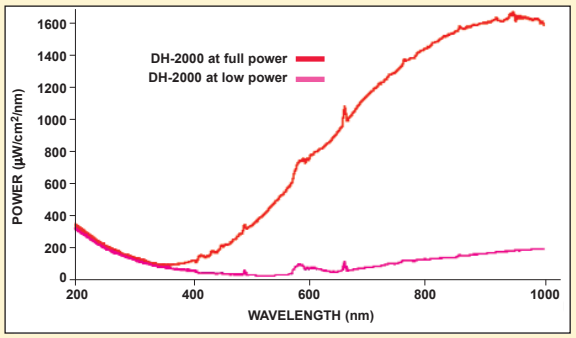
Optical Fibers

We recommend using our solarization-resistant optical fibers with all versions of the DH-2000. See pages 123 and 125 for details.

DH-2000



DH-2000 Spectral Output



The spectral output of the DH-2000 at full power is in red and the tungsten halogen bulb at low power is in pink.

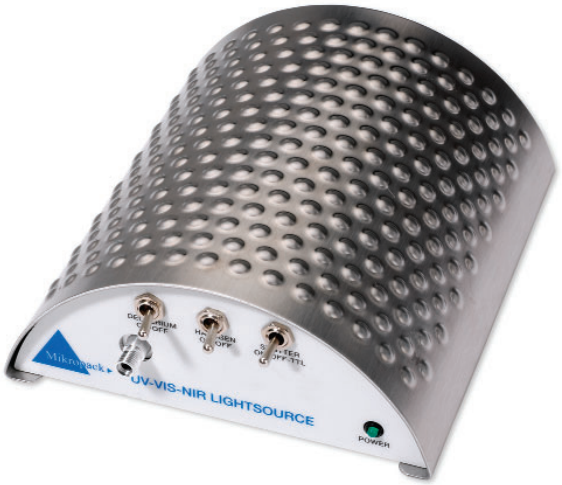
Additional DH-2000 Light Sources and Accessories

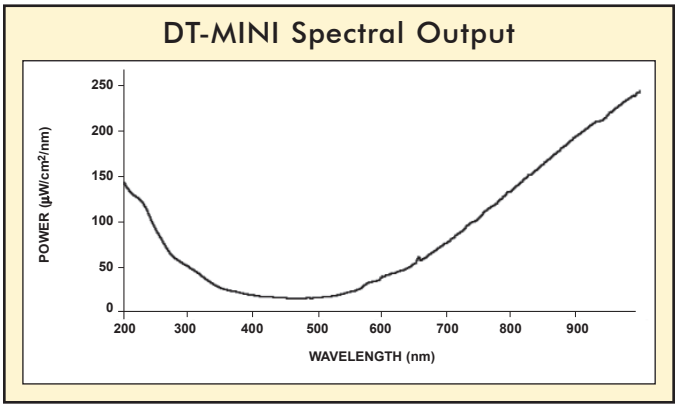
Item	Description
DH-2000-DUV	Uses a deep-UV deuterium bulb, which provides a 190-2000 nm wavelength range
DH-2000-S	Comes with a shutter controlled via a TTL signal or a manual switch up to 5 Hz
DH-2000-S-DUV	Uses a deep-UV deuterium bulb, which provides a 190-2000 nm wavelength range and comes with a shutter (controlled via a TTL signal or a manual switch up to 5 Hz)
DH-2000-FHS	Comes with a filter holder for filters up to 25-mm square or 20-mm round and 4 mm thick
DH-2000-FHS-DUV	Uses a deep-UV deuterium bulb, which provides a 190-2000 nm wavelength range, and comes with a filter holder for filters up to 25-mm square or 20-mm round and 4 mm thick
DH-2000-S-DUV-TTL	Uses a deep-UV deuterium bulb, which provides a 190-2000 nm wavelength range and comes with a shutter (controlled via an included external TTL line)
DH-2000-BH	Replacement tungsten halogen bulb for all versions of the DH-2000
DH-2000-BD	Replacement deuterium bulb for DH-2000, DH-2000-S, DH-2000-FHS
DH-2000-DUV-B	Deep-UV replacement deuterium bulb for DH-2000-DUV, DH-2000-S-DUV, DH-2000-FHS-DUV

Specifications			
Dimensions:	150 mm x 135 mm x 319 mm	Current voltage drift:	<0.01% per hour
Weight:	6 kg	Current voltage stability:	<5 x 10^{-6} peak-to-peak (0.1-10.0 Hz)
Power consumption:	25 W (deuterium); 20 W (tungsten halogen)	Lamp current:	Operating 85 V/0.3A
Wavelength range:	190-2000 nm (deep-UV deuterium bulb & tungsten halogen bulb) or 215-2000 nm (standard deuterium bulb and tungsten halogen bulb)	Lamp lifetime:	1,000 hours
		Lamp voltage:	Ignition 350 V/20°
		Tungsten bulb voltage:	Adjustable from 4.5 to 11.5 volts
Aperture:	0.5 mm	Power requirements:	85-264 V 50/60 Hz
Operating temperature:	5 °C - 35 °C	Total power:	100 W
Humidity:	5-95% without condensation at 40 °C	Power consumption:	190 W maximum
Electronic certifications:	CE; VDI/VDE 0160; EN 61010	Warm-up time:	40 minutes deuterium; 20 minutes tungsten halogen

Mini Deuterium Tungsten Halogen Sources







~200-2000 nm Spectral Range

The DT-MINI Deuterium Tungsten Halogen Light Sources combine the continuous spectrum of RF-excited deuterium light sources and tungsten halogen light sources in a single optical path. The combined-spectrum sources produce stable spectral output from ~200-2000 nm in a compact package.

Shutter Version

The DT-MINI-GS Deuterium Tungsten Halogen Light Source (lower left) 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 on and off, and one for turning the tungsten halogen on and off.

Rack-mount Version

The R-DT-MINI is a rack-mount version of the DT-MINI. This source can be hard-wired to a spectrometer channel and racked into a Dual Box, Rack Box or Desktop Box with other accessories. For information about rack-mount systems and enclosures, see page 48.

Low Power: Just 350 mA

The DT-MINI light sources are compact and consume very little power, operating on just 350 mA. As low-power sources, the DT-MINIs are typically limited to solutions absorbance applications. Before ordering, consult with an Ocean Optics Applications Scientist to discern which source is appropriate for your measurement. A regulated power supply (WT-12V) is included with each source.

DT-MINI
R-DT-MINI
DT-MINI-GS
DT-MINI-B Bulb

Specifications

	DT-MINI	DT-MINI-GS
Dimensions:	153.4 mm x 104.9 mm x 40.9 mm	140 mm x 50 mm x 125 mm
Weight:	330 g	475 g
Power consumption:	350 mA @ 12 VDC	350 mA @ 12 VDC
Spectral range:	200-410 nm (deuterium); 360-2000 nm (tungsten halogen)	200-410 nm (deuterium); 360-2000 nm (tungsten halogen)
Ignition delay:	<2.0 seconds (delay for cold start-up may be longer)	<2.0 seconds (delay for cold start-up may be longer)
Warm-up time:	10 minutes (deuterium); 1 minute (tungsten halogen)	10 minutes (deuterium); 1 minute (tungsten halogen)
Lamp power:	3.8 watts (deuterium); 1.2 watts (tungsten halogen)	3.8 watts (deuterium); 1.2 watts (tungsten halogen)
Bulb lifetime:	~800 hours (deuterium); 2,000 hours (tungsten halogen)	~800 hours (deuterium); 2,000 hours (tungsten halogen)
Stability:	0.3% peak-to-peak (over 4 hours) after 30-minute warm-up	0.3% peak-to-peak (over 4 hours) after 30-minute warm-up
Connector:	SMA 905	SMA 905

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D-2000 Deuterium Light Sources

UV Range + Great Performance

The D-2000 Deuterium Light Source produces a powerful, stable output from 215-400 nm. A deep-UV version is available for wavelength coverage of 190-400 nm. The D-2000 is an extremely stable source, with peak-to-peak stability of <0.005% and drift of only ±0.5% per hour.

Options and Accessories

All versions of the D-2000 have an SMA 905 Connector for easy coupling to our spectrometers and fiber optic accessories, as well as safety goggles and a cover for blocking the light when the fiber is not attached. The 1,000-hour deuterium bulb used in the D-2000 can be replaced easily.

Shutter Option

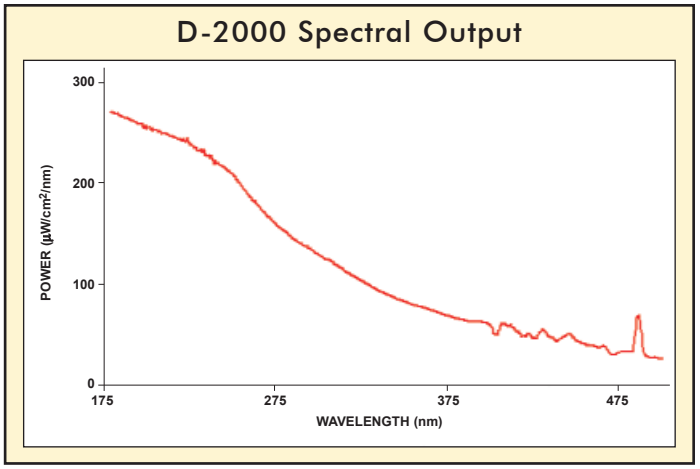
The D-2000 is available with an optional integrated shutter. You can operate the shutter via a manual switch on the front of the lamp. In addition, you can control the shutter electronically via software or a TTL signal from an output port on the back of the lamp.

Optical Fibers

We recommend using our solarization-resistant optical fibers with all versions of the D-2000. See pages 123 and 125 for details.

D-2000





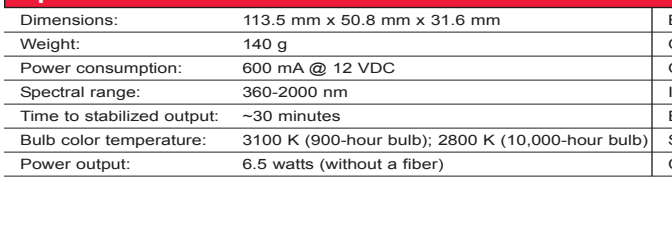
Additional D-2000 Light Sources and Accessories

Item	Description
D-2000-DUV	Uses a deep-UV deuterium bulb, which provides a 190-400 nm wavelength range
D-2000-S	Comes with a shutter (controlled via a TTL signal or switch)
D-2000-S-DUV	Uses a deep-UV deuterium bulb, which provides a 190-400 nm wavelength range, and comes with a shutter (controlled via a TTL signal or switch)
DH-2000-BD	Replacement deuterium bulb for the D-2000 and the D-2000-S
DH-2000-DUV-B	Replacement deuterium bulb for the D-2000-DUV and the D-2000-S-DUV

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

LS-1 Tungsten Halogen Light Sources





360-2000 nm Spectral Range

The LS-1 Tungsten Halogen Light Source is a versatile white-light source useful for absorbance, reflectance and color measurements for the VIS-NIR (360-2000 nm). The lamp offers high color temperature and an efficient output.

Rack-mountable

Install sources with spectrometers and other devices into a Rack Box or Desktop Box. For details, see page 48.

Long Life

The LS-1 comes with a 900-hour bulb. Also available is the LS-1-LL, which comes with a 10,000-hour bulb for extra-long life bulb performance. LS-1 Light Sources come with a 12 VDC power supply (WT-12V).

Color-correcting & Signal-attenuating Accessories

The LS-1 and LS-1-LL come with two accessories for modifying the light output:

- a 12.7-mm diameter color-correcting filter that can be installed into the light source to enhance the signal in the blue and NIR regions
- three PTFE discs of various thickness to create a diffuse source -- by attenuating the light 50%, 75% or 99% -- when spectrometer saturation is an issue

Maximum Flexibility

The LS-1 has an SMA 905 Connector for easy coupling to our spectrometers and accessories, including optical fibers, cuvette holders and probes. What's more, a built-in slot accepts optical filters up to 3 mm in thickness.

LS-1

LS-1-LL

Additional LS-1-series Light Sources and Accessories

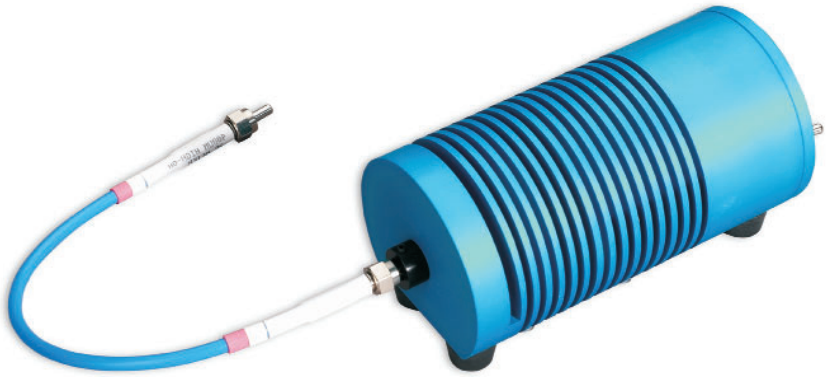
Item	Description
R-LS-1	Rack-mounted LS-1 with color-correcting filter and diffusers
R-LS-1-LL	Rack-mounted LS-1-LL with color-correcting filter and diffusers
LS-1-B	900-hour replacement bulb for LS-1
LS-1-LL-B	10,000-hour replacement bulb for LS-1-LL
OF2-LS	Additional filter set for use with LS-1 includes BG 34, GG 395 and OG 550 filters, as well as PTFE diffusing discs

Specifications			
Dimensions:	113.5 mm x 50.8 mm x 31.6 mm	Bulb life:	900 hours (LS-1); 10,000 hours (LS-1-LL)
Weight:	140 g	Output to bulb:	5 volts/1.3 amps
Power consumption:	600 mA @ 12 VDC	Output regulation:	0.2% voltage
Spectral range:	360-2000 nm	Internal filter accessory:	BG34 balancing filter
Time to stabilized output:	~30 minutes	External filter slot:	Accepts filters up to 3-mm thickness
Bulb color temperature:	3100 K (900-hour bulb); 2800 K (10,000-hour bulb)	Spectral attenuation:	50%, 75% and 99% with PTFE disc accessories
Power output:	6.5 watts (without a fiber)	Connector:	SMA 905

HL-2000 Halogen Light Sources

Great Versatility

The HL-2000 Tungsten Halogen Light Sources are versatile sources optimized for the VIS-NIR (360-2000 nm). The lamps feature adjustable focusing of the SMA 905 Connector to maximize light coupling into a fiber. A fan keeps the light sources cool and stable.



Long-lifetime Option

The HL-2000 comes with a 1,500-hour bulb. A 10,000-hour long-life version is also available.

Filter Slot

A built-in filter slot on all standard HL-2000s accepts optical filters up to 25.4-mm round or up to 50.8-mm square and 3 mm thick. The HL-2000-LVF-HP also accepts our LVF Linear Variable Filters (see page 80.)

High-power Version

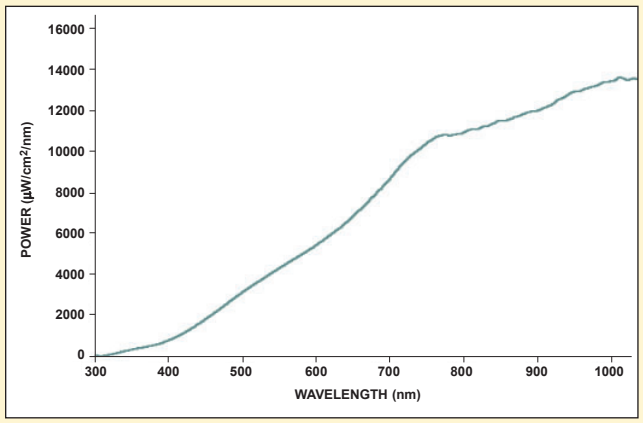
For applications requiring large-diameter optical fibers or fiber and probe bundles, a special high-power version of the HL-2000 is available. The bulb used in the HL-2000-HP is a 20-watt bulb. We recommend 1000 µm diameter optical fiber for use with the HP versions of the HL-2000.

Attenuator & Shutter Option

The HL-2000-FHSA version of the HL-2000 includes a shutter and an attenuator that allows you to control the intensity of the light source from 0-100%. A blocking screw allows you to manually fix the intensity position for the long term. In addition, you can opt to control the attenuator and the shutter via RS-232 with the HL-2000-HP-232.

HL-2000

HL-2000 Spectral Output



Additional HL-2000 Light Sources & Bulbs

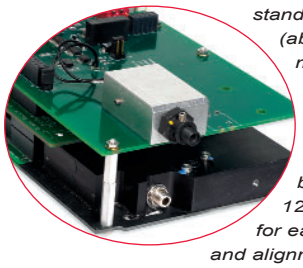
Item	Description
HL-2000-LL	Long-life version (10,000-hour)
HL-2000-FHSA	Includes filter holder, attenuator and shutter
HL-2000-HP	High-powered, 20 W version
HL-2000-HP-FHSA	High-powered, 20 W version with filter holder, attenuator and shutter
HL-2000-HP-232	High-powered, 20 W version with RS-232 control
HL-2000-LVF-HP	High-powered, 20 W version with filter slot for LVFs
HL-2000-B	Spare 1,500-hour bulb
HL-2000-LL-B	Long-life 10,000-hour spare bulb
HL-2000-HP-B	High-power spare bulb

Specifications

	HL-2000	HL-2000-LL	HL-2000-HP	HL-2000-HP-RS-232
Dimensions:	62 mm x 60 mm x 150 mm	62 mm x 60 mm x 150 mm	62 mm x 60 mm x 150 mm	70 mm x 100 mm x 160 mm
Weight:	500 g	500 g	500 g	600 g
Output:	7 watts	7 watts	20 watts	20 watts
Output to bulb:	1.4 A @ 5 VDC	0.970 A @ 5 VDC	1.6 A @ 24 VDC	1.6 A @ 24 VDC
Wavelength range:	360-2000 nm	360-2000 nm	360-2000 nm	360-2000 nm
Stability:	0.5%	0.5%	0.5%	0.5%
Drift:	<0.3% per hour	<0.3% per hour	<0.3% per hour	<0.3% per hour
Time to stabilize:	~5 minutes	~5 minutes	~5 minutes	~5 minutes
Bulb lifetime:	1,500 hours	10,000 hours	2,000 hours	2,000 hours
Bulb color temperature:	2,960 K	2,800 K	3,000 K	3,000 K
Temperature:	5 °C - 35 °C	5 °C - 35 °C	5 °C - 35 °C	5 °C - 35 °C
Humidity:	5-95% at 40 °C	5-95% at 40 °C	5-95% at 40 °C	5-95% at 40 °C

LED Light Sources





Choose your LED in a standalone housing (above) or rack-mounted with a spectrometer and other accessories (left). We also sell the LEDs listed below alone in a 12.7-mm barrel (right) for easy installation and alignment.



Excellent Excitation Sources for Fluorescence

Our LED Light Sources produce either pulsed or continuous output for high-sensitivity fluorescence measurements. They were designed for use with our fluorescence spectrometers (pages 32-33), sensors and other accessories.

Software Operation & Synching with Detector

The LED Sources can be turned on/off through manual or software operation. Or, configure lamp pulse rates via jumper blocks on the lamp or on the circuit board of the S2000 Spectrometer (page 40).

Standalone and Rack-mount Versions

Each LED Source connects to a spectrometer via an interface cable. First, choose if you want an LED in its own standalone housing (see top left) or if you want the LED racked with a spectrometer (see inset). Then, choose the LED to install in the housing. For those with limited space, we can install two LEDs on one rack-mount card. You can also purchase LEDs alone; they come in easy-to-install barrels.

LED with Housing
LED Rack-mounted
LED Bulb alone

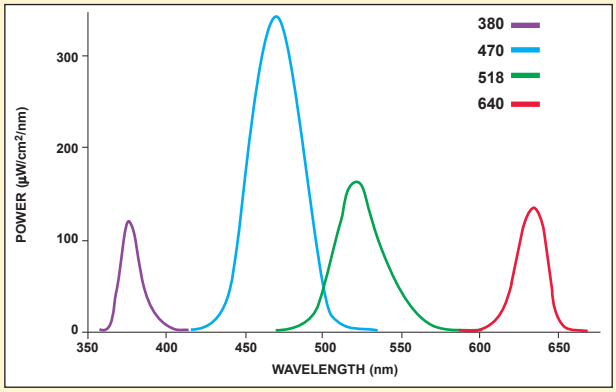
Additional LED Light Sources

You can order one of the LEDs listed below, either alone or in a housing/rack mount. We offer seven LEDs that can be used in the same housing. All LEDs can be used in pulsed or continuous mode through manual or software operation.

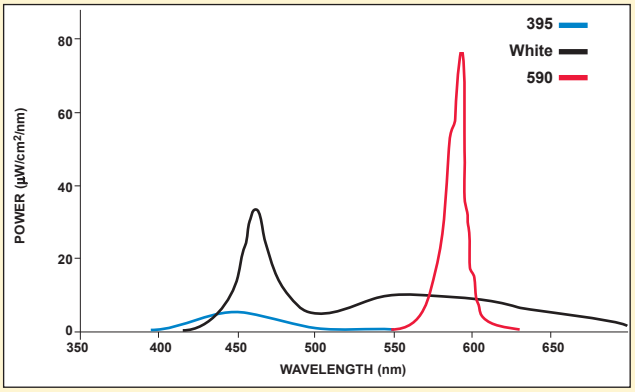
Item	Description	Color	Power*
LED-380	380 nm wavelength UV LED	UV	45 µW
LED-395	395 nm wavelength VIS LED	Light Blue	25 µW
LED-470	470 nm wavelength VIS LED	Blue	35 µW
LED-518	518 nm wavelength VIS LED	Green	35 µW
LED-590	590 nm wavelength VIS LED	Yellow	40 µW
LED-640	640 nm wavelength VIS LED	Red	50 µW
LED-WHITE	450-630 nm wavelength VIS LED	White	50 µW
LED-KIT	Set of 6 LEDs: LED-380, LED-395, LED-518, LED-590, LED-640, LED-WHITE	Mixed	Mixed

** Power into a 600 µm Patch Cord Optical Fiber Assembly*

Spectral Output for LED Bulbs: 380 nm, 470 nm, 518 nm and 640 nm



Spectral Output for LED Bulbs: 395 nm, White, 590 nm

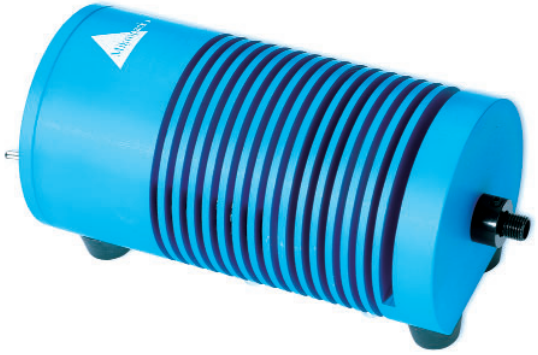


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Pulsed Blue LED Light Source

Lamp Available for All Spectrometers

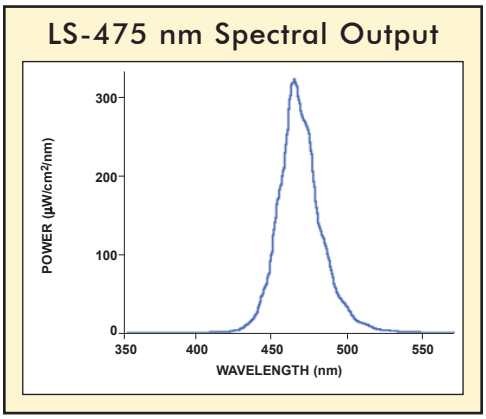
The LS-475 Blue LED Light Source produces pulsed or continuous spectral output centered at 475 nm. The LS-475 is designed as an excitation source for fluorescence measurements. The LS-475 often is paired with one of our preconfigured fluorescence spectrometers (page 33).



High-stability & Fan-cooled

The LS-475 has a very stable output and keeps cool with a built-in fan. The lamp provides better than ±1.0% drift after a 2-minute warm-up time. It has an SMA 905 Connector for coupling to optical fiber assemblies and a filter slot that accepts 25.4-mm round or 50.8-mm square filters up to 3-mm thick. An 800 mA, 12 VDC power supply comes with the unit.

LS-475



Specifications	
Dimensions:	62 mm x 60 mm x 150 mm
Wavelength range:	460-490 nm
Power consumption:	25 mA @ 12 VDC
LED output:	50 µW with a 600 µm optical fiber
Stability:	±1.0% drift after 2-minute warm-up
Connector:	SMA 905

Direct-attach LED Light Source

Direct-attach Lamp for USB2000 Spectrometer

The USB-LS-450 Pulsed Blue LED Light Source is designed as a direct-attach excitation source for the USB2000 Spectrometer. The USB-LS-450 is an LED that produces either pulsed or continuous output centered at 470 nm -- the blue region -- for fluorescence measurements. It connects to the spectrometer via a 10-pin connector. The spectrometer provides power to the LED and also enables synchronization functions. (See page 33 and 38 for more on the USB2000.)



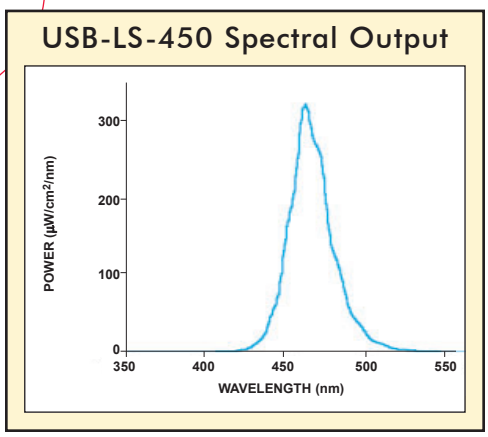


Benefit for FOXY Users

The USB-LS-450 features a built-in, 24-bit analog-to-digital converter that is configured for a 100 ohm platinum temperature probe (USB-LS-450-TP). The USB-LS-450's on-board memory can be programmed to store temperature and oxygen calibration coefficients.

USB-LS-450

USB-LS-450-TP



Specifications	
Dimensions:	89 mm x 57 mm x 34.5 mm
Weight:	120 g
Wavelength range:	460-490 nm
Power consumption:	60 mA @ 5 VDC
Power output:	60 µW (minimum) into a 600 µm optical fiber
Stability:	±1.0% drift after 2-minute warm-up period

Xenon Sources

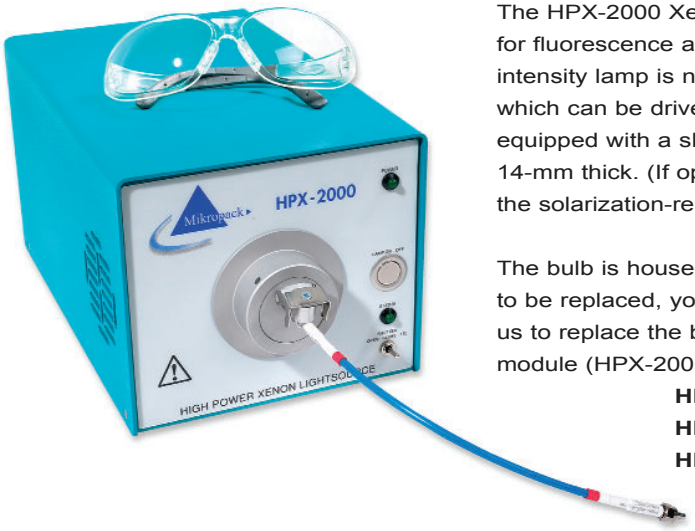
Pulsed & Continuous Xenon Light Source



The PX-2 Pulsed Xenon Lamp is a high flash rate, short-arc xenon lamp from 220-750 nm. The PX-2 is a great source for applications requiring absorbance, reflectance or fluorescence measurements, and especially for measuring optically or thermally labile samples. The PX-2 is a low-power lamp with excellent pulse-to-pulse stability. It provides two trigger modes for software control of the flash rate. It comes with a regulated power supply and an interface cable to connect to the spectrometer.

PX-2
PX-2-B Bulb
USB-ADP-PX2

High-powered Continuous-wave Xenon Source

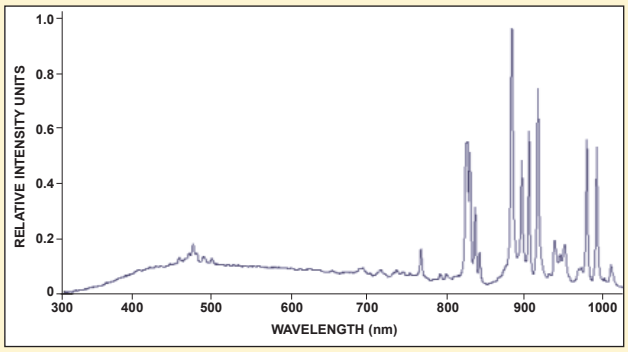


The HPX-2000 Xenon Light Source (185-2000 nm) is especially useful for fluorescence applications, and for other applications where a high-intensity lamp is necessary. The HPX-2000 has an integrated shutter, which can be driven either by a switch or by a TTL signal. It also comes equipped with a slot for filters up to 25-mm diameter or square, and up to 14-mm thick. (If operating the HPX-2000 for ultraviolet applications, use the solarization-resistant fiber described on pages 123 and 125.)

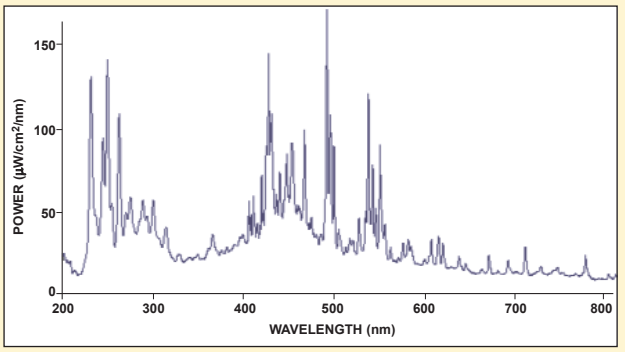
The bulb is housed in an easy-to-remove bulb module. If your bulb needs to be replaced, you have two options. You can send the module back to us to replace the bulb (HPX-2000-B), or you can order another bulb module (HPX-2000-BM).

HPX-2000
HPX-2000-B
HPX-2000-BM

HPX-2000 Spectral Output



PX-2 Spectral Output



Specifications

	HPX-2000	PX-2
Dimensions:	145 mm x 165 mm x 260 mm	153.4 mm x 104.9 mm x 40.9 mm
Weight:	5 kg	370 g
Power consumption:	60 W AC	1 A @ 12 VDC
Spectral range:	185-2000 nm	220-750 nm
Power output:	35 watts	45 microjoules per pulse maximum; 9.9 watts average power; 220 Hz pulse rate maximum
Trigger input:	External TTL positive pulse via 15-pin connector (shutter)	External TTL positive pulse via 15-pin connector
Pulse duration:	Not applicable	5 microseconds (at 1/3 height of pulse)
Lifetime:	1,000 hours minimum; 2,000 hours typical	10^9 pulses (estimated 230 days continuous operation at 50 Hz pulse rate)
Connector:	SMA 905	SMA 905
Timing signals:	Not applicable	Multiple mode available from S2000 -- up to 220 Hz; single mode available from S2000 -- varies with scan rate

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Lasers for Spectroscopy

Excitation Energy for a Variety of Measurement Techniques

We offer a variety of lasers as excitation energy sources for spectroscopic measurement techniques such as laser-induced breakdown spectroscopy, Raman spectroscopy and most commonly, fluorescence spectroscopy.



DLZ-635-4 Laser Diode Module

Low-power Laser Diodes

Our long-life DLZ-series Laser Diode Modules are very efficient and have low power output (3 milliwatts). We offer 635 nm, 650 nm and 660 nm wavelength lasers.

High-power Laser Diode

The DLZ-785-500 is a high-powered version of the DLZ-series Laser Diodes. It has a 500-milliwatt output.



DLZ-785-500 Laser Diode Module

Solid-state Lasers

Our DPSS-series Lasers are high-power diode-pumped solid-state lasers. Our DPSS-532 lasers are 532 nm lasers; one has a 25-milliwatt output and the other a 50-milliwatt output.

Additional Features

All DLZ and DPSS lasers are continuous-wave sources with TTL options for pulsed operation. Each is equipped with a 74-UV Collimating Lens, an SMA 905 Connector and a power supply.

DLZ-635-4
DLZ-650-4
DLZ-660-4
DLZ-785-500
DPSS-532-25
DPSS-532-50



DPSS-532-25 Diode-pumped Solid-state Laser

Specifications

	DLZ-635-4	DLZ-650-4	DLZ-660-4	DLZ-785-500	DPSS-532
Dimensions (mm):	33 x 33 x 110	33 x 33 x 110	33 x 33 x 110	184 x 53 x 76.6	184 x 53 x 76.6
Weight:	100 g	100 g	100 g	270 g	270 g
Input power*:	120 VAC, 60 Hz	120 VAC, 60 Hz	120 VAC, 60 Hz	120 VAC, 60 Hz	120 VAC, 60 Hz
Output power**:	3 mW	3 mW	3 mW	500 mW	25 mW or 50 mW
Lasing wavelength:	635 nm (±5.0 nm)	650 nm (±5.0 nm)	660 nm (±5.0 nm)	785 nm (±5.0 nm)***	532 nm (±0.2 nm)
Pulse width:	Continuous wave	Continuous wave	Continuous wave	Continuous wave	Continuous wave
External modulation:	10 kHz digital TTL	10 kHz digital TTL	10 kHz digital TTL	2 MHz analog or digital	10 kHz digital TTL
Power stability:	<5% rms over 1 hour	<5% rms over 1 hour	<5% rms over 1 hour	<5% rms over 1 hour	<10% rms over 1 hour
Operating Temp.:	20 °C to 30 °C	20 °C to 30 °C	20 °C to 30 °C	20 °C to 30 °C	20 °C to 30 °C
Beam delivery:	600 µm core fiber	600 µm core fiber	600 µm core fiber	600 µm core fiber	600 µm core fiber or freespace

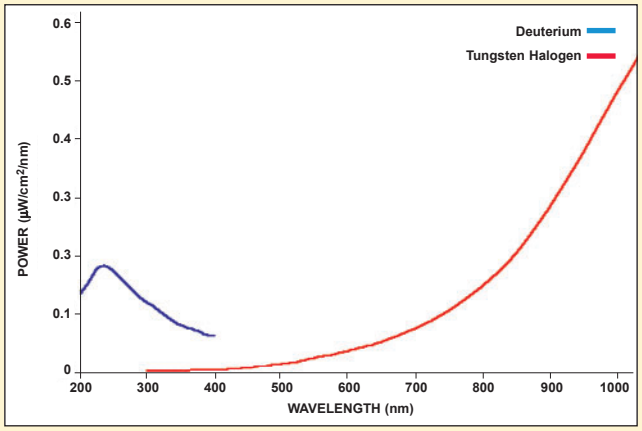
** International power sources are available.*
*** All lasers are available with higher output powers.*
**** A narrow linewidth version is available.*

Radiometric Calibration Standards: UV-NIR



The DH-2000-CAL is calibrated for use with either a CC-3 Cosine Corrector or with an optical fiber. The lamp comes with a CC-3.

DH-2000-CAL Spectral Output



These spectral output graphs were taken separately for the deuterium (200-400 nm) and the tungsten halogen bulbs (400-1100 nm) to avoid a sharp line spectrum >400 nm in the deuterium trace.

ORDERING TIP

Radiometric Calibration Sources are **not** illumination sources for spectroscopic measurements. Use the DH-2000-BAL (page 106) for illumination.

UV-NIR 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 our OOIIrrad-C Irradiance Software, you can determine known absolute intensity values at wavelengths from 210-1050 nm.

Calibrated for a Bare Fiber and Cosine Corrector

DH-2000-CAL is specifically calibrated for use with optical fibers or a cosine corrector; the calibration data includes absolute intensities for wavelengths between 210-1050 nm at the fiber entrance port for both a bare fiber and an included CC-3-UV Cosine Corrector (page 93).

NIST-traceable Calibration Certificate

The DH-2000-CAL is calibrated with a NIST-traceable standard. The DH-2000-CAL comes with a calibration certificate and a diskette with a data file compatible with our software. The calibration data -- absolute spectral intensity values in $\mu W/cm^2/nm$ measured at the fiber port -- is provided for use with our OOIIrrad-C Irradiance Software (not included, see page 67).

Recalibration of Your DH-2000-CAL

The DH-2000-CAL typically provides 50 hours of operation before recalibration is necessary. We recalibrate these lamps in-house. (For more information on the DH-2000-RECAL service, contact an Applications Scientist.)

DH-2000-CAL
DH-2000-RECAL

In-house Calibration

Also, you don't need a DH-2000-CAL to take advantage of our in-house SPEC-CAL-UV radiometric calibration service for UV spectrometers. The calibration is good for about one year, provided the optical fiber is not removed from the setup, as the system is calibrated for use with a specific fiber.

SPEC-CAL-UV

Specifications

Dimensions:	150 mm x 135 mm x 319 mm	Current voltage drift:	<0.01% per hour
Weight:	6 kg	Current voltage stability:	<5 x 10^{-6} peak-to-peak (0.1-10.0 Hz)
Power consumption:	25 W (deuterium); 20 W (tungsten halogen)	Operating temperature:	5 °C - 35 °C
Calibrated range:	210-1050 nm	Humidity:	5-95% without condensation at 40 °C
Calibration accuracy:	±5%	Total power:	100 watts
Calibration valid for:	50 hours	Max. power consumption:	190 watts
Lamp current:	Operating 85 V/0.3A	Warm-up time:	40 minutes (deuterium)
Lamp voltage:	350 V		20 minutes (tungsten halogen)
Power requirements:	85-264 V 50/60 Hz	Electronic certifications:	CE; VDI/VDE 0160; EN 61010

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Radiometric Calibration Standards: VIS-NIR

Calibrated with Fiber & Cosine Corrector

The LS-1-CAL is designed for calibrating the absolute spectral response of a complete system consisting of a spectrometer and an optical fiber and/or a CC-3-UV Cosine Corrector (page 93). The HL-2000-CAL is designed for calibrating a system consisting of a spectrometer and a cosine corrector (included). The calibration data for both the LS-1-CAL and the HL-2000-CAL includes absolute intensities for wavelengths between 300-1050 nm.



The LS-1-CAL is calibrated for use with a fiber and/or a CC-3 Cosine Corrector (not included).

Calibrated for Use with Integrating Sphere

The LS-1-CAL-INT is designed for calibrating the absolute spectral response of a system that uses the FOIS-1 Fiber Optic Integrating Sphere (page 94) as the sampling optic. The LS-1-CAL-INT comes with a diffuser plug that fits into the sample port of the FOIS-1 to measure absolute spectral intensities of LEDs and other emission sources. 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 (page 94) as your sampling optic.



The LS-1-CAL-INT is calibrated specifically for use with the FOIS-1 Integrating Sphere. Notice the PTFE diffuser plug that's seated where an SMA 905 Connector is usuallnstalled. This plug fits snugly into the sample port of the FOIS-1.

What's Included

Each of these radiometric sources comes with a regulated 12 VDC power supply. Also included is a calibration certificate and a diskette with data files for use with OOIIrrad-C Irradiance Software (page 67). The HL-2000-CAL comes with a cosine corrector.

Recalibrating Your Source

These calibrated sources provide 50 hours of operation before an in-house recalibration (called the LS-1-RECAL and HL-2000-RECAL) of these lamps is necessary.

LS-1-CAL
LS-1-CAL-INT
LS-1-RECAL
HL-2000-CAL
HL-2000-CAL-ISP
HL-2000-RECAL



The HL-2000-CAL is used for calibrating most radiometric systems and comes with a CC-3-UV Cosine Corrector, while the HL-2000-CAL-ISP is used with ISP Integrating Spheres.

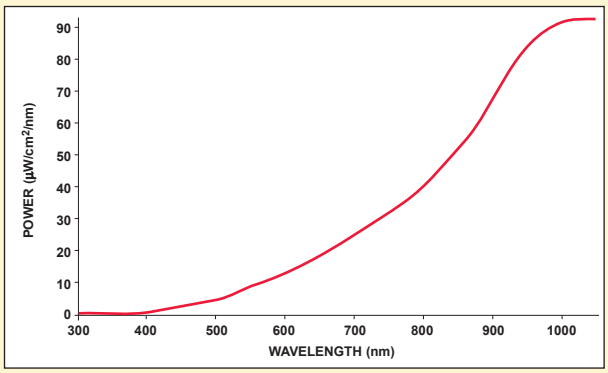
In-house Calibration

If you do not want to purchase one of these calibration sources, we offer the SPEC-CAL-VIS in-house radiometric calibration service for VIS spectrometers.

SPEC-CAL-VIS

Specifications	
Power consumption:	600 mA @ 12 VDC
Spectral range:	300-1050 nm (calibrated)
Power output:	6.5 watts
Recalibration:	Required after 50 hours of operation
Bulb color temperature:	3100 K
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

LS-1-CAL Spectral Output



Above is the typical calibration output when using the LS-1-CAL or HL-2000-CAL with a CC-3 Cosine Corrector.

Wavelength Calibration Standard for UV-VIS

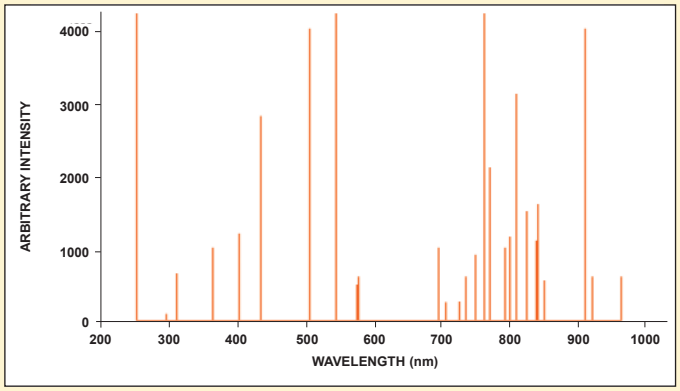


The HG-1.



The CAL-2000.

HG-1 & CAL-2000 Spectral Output



Mercury emission lines are <600 nm. Argon emission lines are >600 nm, and are shown on an exaggerated amplitude scale.

Wavelength Calibration Sources

The HG-1 and CAL-2000 Mercury Argon Calibration Sources are spectral wavelength calibration sources for spectrometer systems. The HG-1 and the CAL-2000 produce low-pressure mercury and argon atomic emission lines from 253-1700 nm for use in performing fast, reliable spectrometer wavelength calibrations. A list of mercury and argon spectral emission lines is printed on each lamp's housing.

Drift Occurs in all Spectrometers

Our spectrometers are carefully calibrated as part of our standard quality assurance process. However, as is the case with all optical benches, slight drifts in wavelength occur due to time and environmental conditions. If wavelength accuracy is an important part of your application, consider including calibration spectra with every experiment.

Convenient Operation

Wavelength calibration with the HG-1 or the CAL-2000 requires a power supply (included) and an optical fiber to connect from the source to your spectrometer.You will need a spreadsheet program such as Microsoft Excel or a calculator that performs third-order polynomial regressions.

Convenient Portability

Both calibration sources operate with a 12 VDC power supply (included) or a 9V battery (not included) for field use. Both sources feature an SMA 905 Connector for interfacing to optical fiber assemblies and have bulbs with a 3,500-hour lifetime. (You can replace the bulb in the CAL-2000, but not in the HG-1.)

HG-1
CAL-2000
CAL-2000-B Bulb

Specifications

	HG-1	CAL-2000
Dimensions:	125.7 mm x 70 mm x 25.8 mm	130 mm x 125 mm x 50 mm
Weight:	40 g	410 g
Power consumption:	250 mA @ 12 VDC	250 mA @ 12 VDC
Spectral range:	253-1700 nm	253-1700 nm
Power requirements:	12 VDC wall transformer (included) or 9 VDC battery (not included)	12 VDC wall transformer (included) or 9 VDC battery (not included)
Internal voltage:	600 volts at 30 kHz	600 volts at 30 kHz
Bulb lifetime:	~3,500 hours (at 20 mA)	~3,500 hours (at 20 mA)
Stabilization:	1 minute	1 minute
Connector:	SMA 905	SMA 905

ORDERING TIP

For only $300 per spectrometer channel, you can purchase the ASP Annual Service Package, which entitles you to a yearly inspection, wavelength calibration, optical alignment, linearity calibration, signal-to-noise analysis and much more. See page 169 for more.

Wavelength Calibration Standard for NIR

Calibration Source for NIR Spectrometers

The AR-1 Argon Calibration Source is a spectral wavelength calibration source specifically designed for NIR spectrometers like our NIR256 and NIR512 (see page 47). The AR-1 produces low-pressure argon atomic emission lines from 696-1704 nm for use in performing fast, reliable spectrometer wavelength calibrations. The spectral emission lines are printed on the lamp's housing.



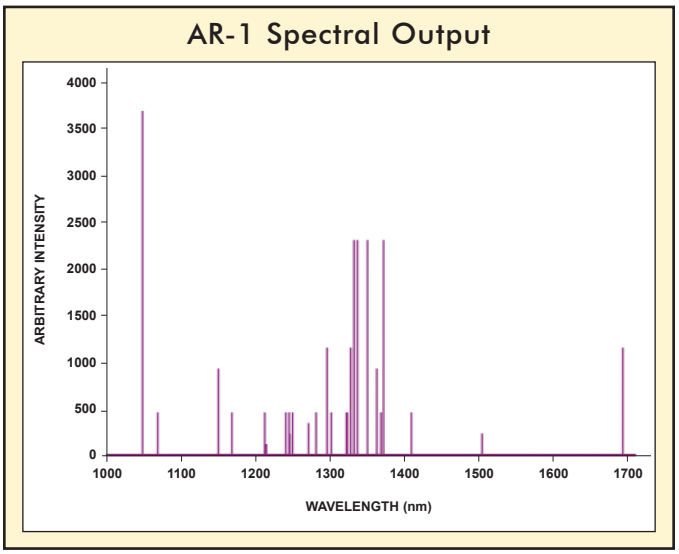
Convenient Operation

Our spectrometers are carefully calibrated as part of our standard quality assurance process. However, as is the case with all optical benches, slight drifts in wavelength occur due to time and environmental conditions. With the AR-1, you can recalibrate your spectrometer using a spreadsheet program such as Microsoft Excel or a calculator that performs third-order polynomial regressions.

Conveniently Portable

The AR-1 operates with a 12 VDC power supply (included) or a 9V battery (not included) for field use. Both sources feature an SMA 905 Connector for interfacing to optical fiber assemblies.

AR-1

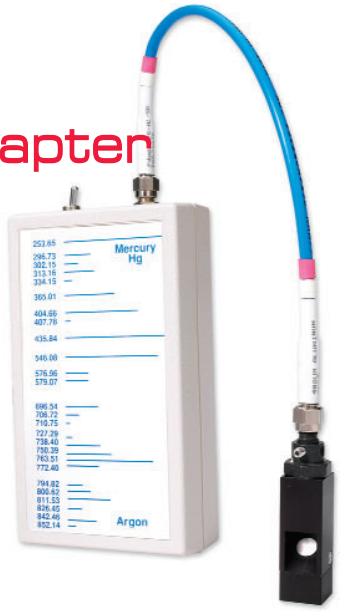


Specifications	
Dimensions:	125.7 mm x 70 mm x 25.8 mm
Weight:	40 g
Power consumption:	250 mA @ 12 VDC
Spectral range:	696-1704 nm
Power requirements:	12 VDC wall transformer (included) or 9 VDC battery (not included)
Internal voltage:	600 volts at 30 kHz
Bulb lifetime:	~3,500 hours (at 20 mA)
Amplitude stabilization:	~1 minute
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 HG-1 Mercury Argon Calibration Standard and the AR-1 Argon Wavelength Calibration Standard via optical fiber. (Neither Wavelength Calibration Standard nor optical fiber is included). The adapter is designed for performing a wavelength calibration for a Palm-SPEC Spectrophotometer or for a USB2000 Spectrometer and a direct-attach sampling system. However, the adapter could be used with any spectrometer and 1-cm cuvette holder system, whether it's designed by Ocean Optics or another manufacturer.

PS-HG1-ADP



The 1-cm square PS-HG1-ADP adapter, along with a fiber and the HG-1 or the AR-1, can be used with any spectrometer/ 1-cm cuvette holder system.

Bulbs, Power Supplies & Accessories

Spare Power Supplies

Item	Description
WT-12V	Standard regulated 12-volt power supply for 110 and 220 outlets (220 users need a 110-to-220 adapter)
WT-12V-E	European 12-volt power supply for 220 outlets only
WT-12V-R-E	European regulated 12-volt power supply for 220 outlets only



WT-12V-E European Power Supply

Bulbs for Ocean Optics Light Sources

Item	Description
DH-2000-BD	Spare or replacement deuterium bulb for D-2000, DH-2000 and DH-2000-BAL sources
DH-2000-DUV-B	Spare or replacement deep-UV deuterium bulb for D-2000-DUV and DH-2000-DUV sources
DH-2000-BH	Spare or replacement tungsten halogen bulb for DH-2000 and DH-2000-BAL sources
DT-MINI-B	Spare or replacement bulb unit for DT-MINI
HL-2000-B	Spare or replacement tungsten halogen bulb for the HL-2000 (1,500-hour, 2,960 K)
HL-2000-LL-B	Spare or replacement long-life tungsten halogen bulb for the HL-2000-LL (10,000-hour, 2,800 K)
HL-2000-HP-B	Spare or replacement tungsten halogen bulb for all HL-2000-HP high-power sources
HPX-2000-BM	Spare or replacement xenon bulb module for the HPX-2000
HPX-2000-B	Spare or replacement xenon bulb for the HPX-2000
LED-380	Interchangeable, 380-nm LED for LS-450
LED-395	Interchangeable, 395-nm LED for LS-450
LED-518	Interchangeable, 518-nm LED for LS-450
LED-590	Interchangeable, 590-nm LED for LS-450
LED-640	Interchangeable, 640-nm LED for LS-450
LED-WHITE	Interchangeable, white LED for LS-450
LED-KIT	LED kit with 380-nm, 395-nm, 518-nm, 590-nm, 640-nm and white LEDs, for LS-450
LS-1-B	Spare or replacement tungsten halogen bulb for the LS-1 (900-hour, 3100 K bulb)
LS-1-LL-B	Spare or replacement long-life tungsten halogen bulb for the LS-1 or LS-1-LL (10,000-hour, 2800 K bulb)
PX-2-B	Spare or replacement xenon bulb for the PX-2
USB-ISS-UV-B	Spare or replacement deuterium and tungsten bulb for USB-ISS-UV source
USB-ISS-VIS-B	Spare or replacement tungsten bulb for the USB-ISS-VIS source
D-1000-B	Spare or replacement deuterium bulb for the D-1000
D-1000-REM-B	Spare or replacement bulb for D-1000-REM systems
DT-1000-B	Spare or replacement deuterium bulb for the DT-1000
DT-1000-BT	Spare or replacement tungsten halogen bulb for the DT-1000
DT-1000-REM-B	Spare or replacement bulb for DT-1000-REM systems
DT-1000-BT-CE	CE-certified tungsten halogen bulb for the DT-1000

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



The CAL-2000-B.





The DH-2000-BH tungsten halogen bulb used in all DH-2000s.



Bulb for the HL-2000.



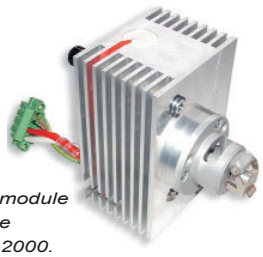
The DT-MINI-GS bulb.



The LS-1-B replacement bulb for the LS-1.

Other Light Source Accessories

Item	Description
CBL-PX-2	Cable for connecting PX-2 to S2000 Spectrometer
FCBARREL	6.35-mm OD stainless steel barrel threaded for FC connectors that inserts into our 74-series Collimating Lenses
FOT-SMA WRENCH	SMA wrench for easily attaching Laboratory-grade optical fibers to SMA 905 Connectors on Ocean Optics products



Bulb module for the HPX-2000.

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