General Information

Calibration standards are employed in determining the correlation between an input and an output quantity for all types of measurement instrumentation.
By supplying a signal of known quantity, the difference between the output signal of the test device and the calibration standard can be evaluated. From these differences calibration correction factors can be calculated allowing adjustment of the test device for absolute readings.
Transfer standards are used to transfer the values of the primary standard, often certified by a national calibration laboratory, to the secondary calibration facility. This fulfills the traceability requirement for an unbroken chain of transfer comparisons back to the national primary standard.
Calibration uncertainty depends on the calibration hierarchy of the standards employed and the technically competency of the calibration laboratory (see Calibration Chapter).
Proper care and use of the calibration standards is critical to long term success in the calibration transfer method.

Photometric and radiometric light measurement applications involve many different measurement quantities such as:

- Illuminance / Irradiance
- Luminance / Radiance
- Luminous Flux /Radiant Power
- Luminous Intensity / Radiant Intensity

Each quantity requires its own calibration standard.

For optical radiation calibration of light detectors calibration standards in the form of light detectors are used. Calibration is accomplished using the transfer method described previously. Absolute sensitivity is confirmed in a calibration certificate that includes other descriptive and procedural information .
A typical example of a detector based calibration is the spectral sensitivity calibration of photodiodes employing a tunable monochromatic light source with its output compared to the known spectral sensitivity of a standard detector.

For the calibration of light sources calibration standards in the form of light sources are used. Here reference standard light sources are used to calibrate the light measurement system which in turn is used to calibrate the unknown light source.
This method is used for the calibration of spectral radiometers with a spectral irradiance standard source for example.
In imaging applications the uniformity in sensitivity of the imaging detection system is very important. Light sources with a uniform light emitting area are needed as reference standards in this type of calibration to determine the non-uniformity of a lens system or imaging detection system. **Uniform light sources** built around integrating spheres are the best known solution for setting up uniform light sources.

Gigahertz-Optik offers a wide selection of calibration standards and uniform light sources.
For the measurement quantities of spectral sensitivity and spectral irradiance Gigahertz-Optik's calibration laboratory is ISO EN 17025 accredited.

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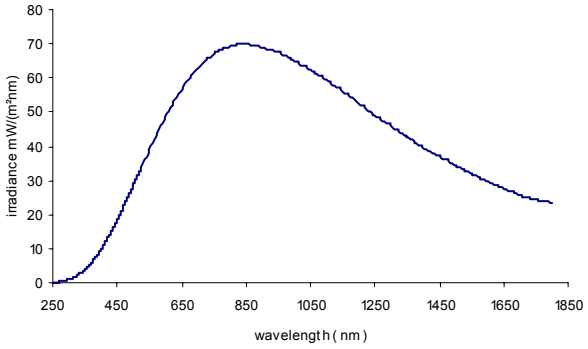
Gigahertz-Optik

Spectral Irradiance

BN-LH250: 250 W Spectral Irradiance Standard Lamp



Typical Spectral Irradiance at 3100 K

The **BN-LH250** spectral irradiance standard lamp is a precise transfer standard for spectral irradiance in the wavelength range from 250 to 2500 nm.
The lamp standard consists of a carefully selected 250 W tungsten halogen lamp with a diffuse quartz envelope and stable filament mounted into a ceramic lamp base to help with temperature equalization. The lamp base allows free standing and post mounted operation. The two banana sockets provided to supply power to the lamp are mounted so that they are shielded from light and heat irradiation by the lamp.
The **BN-LH250-BC** is qualified as a reference transfer standard. The BC version of the BN-LH250 undergoes a burn-in procedure where the lamp current, operating voltage and irradiance are documented during burn-in. The Gigahertz-Optik calibration engineers evaluate this data to decide if the lamp qualifies for use as a reference standard lamp. If the lamp qualifies a burn-in certificate that includes this data is issued.
Calibration of spectral irradiance is done using a double-monochromator spectral radiometer at a distance of 50 cm to the reference plane of the standard lamp. Description and specifications for this KLW-S1 spectral irradiance calibration procedure is listed in the *Calibration Service* chapter.

A BHO-10 carrying case is a required component for all BN-LH250 standard lamp deliveries.

To power the BN-LH250 and BN-LH250-BC lamps Gigahertz-Optik recommends the LPS-250 lamp power supply which is specially designed for the operation of light emitting standards.

LPS-250 Power Supply

LPS-250 in Bench-Top Housing BTH-19/2

The LPS-250 lamp power supply is specially designed for stable operation of lamps. It offers a maximum operating voltage of 26 V and a maximum lamp current of 15 A.
A high resolution 16 bit digital to analog converter provides a high level of lamp current control with a resolution of 0.3 mA at the nominal current of 15 A. The current stability is specified at 0.1×10^{-4} A at the nominal current within 8 hours. An on/off ramp function prevents lamp filament shock during the on/off procedure.

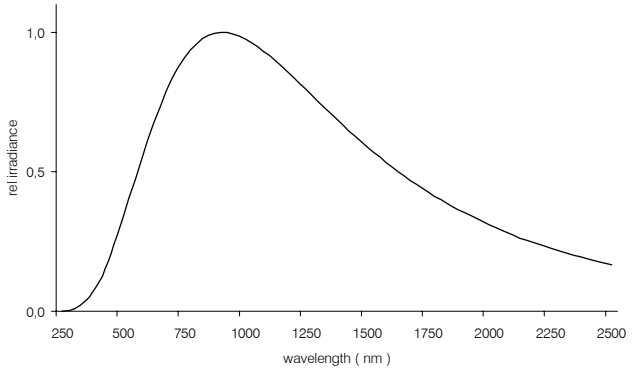
The RS232 or RS488 interface enables full remote control operation. In the manual control mode an alphanumerical four line display shows the set-up parameters. Manual set-up is accomplished via menu selection.
The power supply is offered in a 1/2-19" housing which allows rack-mounting. For laboratory use an optional bench top housing is offered. Full specifications are listed in the *Integrating Spheres* section.

Typical Specifications and Ordering Information:

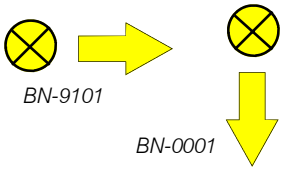
Model	Lamp				Spectral Irradiance at 50 cm in mW/(m² nm)			
	Type	Power	Voltage	Current	250 nm	1100 nm	1800 nm	Distance
		@ 3100 K						cm
BN-LH250	Halogen Lamp	250 W	~ 24 V	10.5 A	1.19 E-01	5.93 E+1	2.35 E+01	50
BN-LH250-BC	Halogen Lamp with Burn-in Certificate							
BHO-10	Hard case for up to 3 of BN-LH250. Required part for either BN-LH250 order.							
BPC-2	Banana-plug cable with 2 m length. Available in red, blue and black color							
LPS-250	Precise current controlled power supply. Current ramp function. RS232 or RS488 interface. 230 V / 50 Hz							
LPS-250A	Precise current controlled power supply. Current ramp function. RS232 or RS488 interface. 100 to 230 V / 50 to 60 Hz							
BTH—19/2	1/2 19" width bench top housing for LPS-250 and LPS-250A							
KLW-S1	Calibration of spectral Irradiance							

BN-9101 & BN-0001: 1000W Spectral Irradiance Standard Lamps

BN-9101 & BN-0001 spectral irradiance standard lamps are precise spectral irradiance transfer standards for use in the wavelength range from 250 to 2500 nm.
Both lamps feature a large diameter filament which is essential for a long operating life and stable irradiance. These 1000 W spectral irradiance standard lamps have been supplied and calibrated by the Gigahertz-Optik calibration laboratory for optical measurement quantities since 1991 and are in world wide use in industrial and metrological applications.
BN-9101: 1000 W FEL or Sylvania tungsten halogen lamp and precision lamp socket for horizontal light orientation..
BN-0001: 1000 W DXW tungsten halogen lamp mounted in a precision lamp socket for vertical light orientation.
Common features include hard-wiring of the leads to the lamp pins in order to reduce measurement error caused by voltage drops across the connections. Also lamp position is fixed in a temperature stable ceramic base.
An optional transparent window target marks the position on the filament used for the irradiance



Typical Spectral Irradiance at 3100 K



calibration. This allows precision alignment in the application or for re-calibration.
Each lamp undergoes a burn-in procedure with burn-in certificate. Several lamp parameters are documented by a on-line data logger. By examination of the burn-in data, only those lamps which display the expected trends are qualified to be used as reference standards. A burn-in certificate is supplied with each qualified lamp.


BN-0001

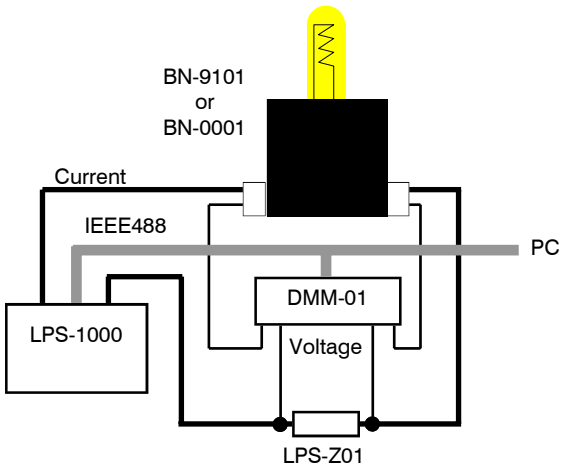
BN-9101

The BN-9101 is available in two versions:

- FEL type with filament support offers more intensity in the blue and UV spectral range than the Sylvania type
- Sylvania type is recommended for universal use due to its excellent long term stability.

Calibration of spectral irradiance with DKD certificate or traceable factory certificate is available through Gigahertz-Optik's DIN EN ISO/IEC 17025 accredited calibration laboratory. Descriptions and specifications of the KLW-S1 and KLD-S1 spectral irradiance calibrations is available in the *Calibration Service* section.

Set-up for Remote Control Operation



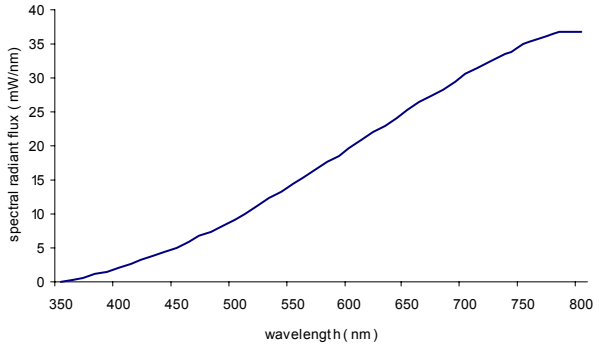
Typical Specifications and Ordering Information:

Model	Lamp with Burn-in Certificate				Spectral Irradiance at 70 cm in W/cm² nm-¹			
	Typ	Power	Voltage	Current	250 nm	1100 nm	2500 nm	Distance
		@ 3100 K						cm
BN-9101-1	Halogen Lamp FEL Type	1000 W	110 V DC	8.000 A	0.11 mW/m²	116 mW/m²	18 mW/m²	70
BN-9101-2	Halogen Lamp Sylvania Type	1000 W	101 V DC	8.100 A	0.07 mW/m²	96 mW/m²	16 mW/m²	70
BN-0001	Halogen Lamp DXW Type	1000 W	115 V DC	8.000 A	0.18 mW/m²	219 mW/m²	-	50
BN-9101Z-01 and BN-0001Z-01	Transparent cross-hair target for precise alignment onto the filament reference spot							
BHO-10	Hard case for up to (3) BN-9101 and (2) BN-0001. Required part for BN lamp orders.							
BPC-2	Banana-plug cable, 2 m length. Available in red, blue and black color							
LPS-1000	Precise current controlled 1000 W power supply. Current ramp function. IEEE488 interface. 230 V / 50 Hz							
LPS-Z01	High-power shunt resistor with DKD certificate for precise current measurements in combination with DMM-01							
DMM-01	High resolution digital multimeter with IEEE488 interface and input port multiplexer							
OS-LPS1000	Software to control and document BN-9101 & BN-0001 operation with LPS-1000, LPS-Z01 and DMM-01							
KLD-S1 & KLW-S1	Calibration of spectral Irradiance with DKD or traceable factory certificate							

Gigahertz-Optik

Spectral Radiant Power & Luminous Flux

BN-0104: Spectral Radiant Power and Luminous Flux Standard Lamps



Typical Spectral Radiant Power at 2856 K

The BN-0104 standard lamp is a precise transfer standard for the quantities of spectral radiant power and luminous flux.
Carefully burned-in tungsten halogen lamps are mounted into a UMLA-300 or UMLA-500 lamp adapter for use in the UMBB-300 and UMBB-500 integrating spheres (see *Integrating Spheres* section). The holder and lamp socket mounting plates are coated with barium sulfate (ODP-97) with 97 % reflectance. The UMLA lamp holder's PG type connector allows simple mounting and connection of the lamp to the UMLA-1.5B lamp adapter base.
The BN-0104 is available in three different power ranges.
Calibration of spectral radiant power in W/nm within the wavelength range from 400 nm to 1000 nm is supplied by Gigahertz-Optics calibration laboratory for optical radiation measurement quantities.
The standard lamps are supplied in a special carrying case which safely holds and protects the lamp and coated parts.

Carrying Case

To power the BN series lamps Gigahertz-Optik recommends the LPS-250 lamp power supply which is specially designed for the operation of light emitting standards.

LPS-250 Lamp Power Supply

The LPS-250 lamp power supply is specially designed for stable operation of lamps. It offers a maximum operating voltage of 24 V and a maximum lamp current of 13 A.
A high resolution 16 bit digital to analog converter provides a high level of lamp current control with a resolution of 0.3 mA at the nominal current of 13 A. The current stability is specified at 0.1×10^{-4} A at the nominal current within 8 hours. An on/off ramp function prevents lamp filament shock during the on/off procedure.
The RS232 or RS488 interface enables full remote control operation. In the manual control mode an alphanumerical four line display shows the set-up parameters. Manual set-up is accomplished via menu selection.
The power supply is offered in a 1/2-19" housing which allows rack-mounting. For laboratory use an optional bench top housing is offered. Full specifications are listed in the *Integrating Spheres* section.

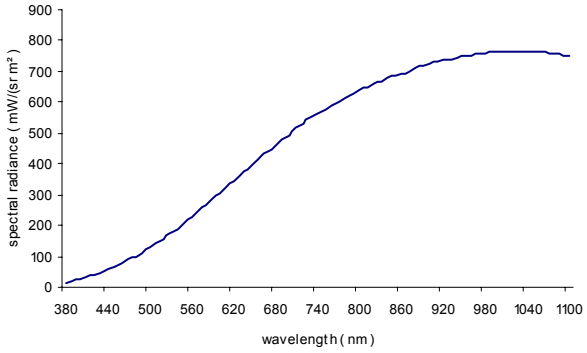
Typical Specifications and Ordering Information:

Model	Lamp				Spectral Radiant Power (mW/nm)			Luminous Flux (lm)
	Type	Power	Voltage	Current	400 nm	800 nm	1000 nm	
		@ 2856 K						
BN-0104-LH90 1)	Halogen Lamp	90 W	12 V DC	7.17 A	2	37	-	1100
BN-0104-LH50 1)	Halogen Lamp	50 W	12 V DC	4.16 A	1.11	20.55	-	550
BN-0104-LH35 1)	Halogen Lamp	35 W	12 V DC	2,91 A	0.78	14.38	-	370

1) Lamp supplied in special carrying case mounted on lamp holder UMLA-300 or UMLA-500 for use in UMBB-300 or UMBB-500

BPC-2	Banana-plug cable, 2 m length. Available in red, blue and black color
LPS-250	Precise current controlled 250 W power supply. Current ramp function. RS232 or RS488 interface. 230 V / 50 Hz
LPS-250A	Precise current controlled 250 W power supply. Current ramp function. RS232 or RS488 interface. 100 to 230 V / 50 to 60 Hz
BTH-19/2	19"/2 width bench top housing for LPS-250 and LPS-250A
KLW-S2	Calibration of spectral radiant power with calculated luminous flux

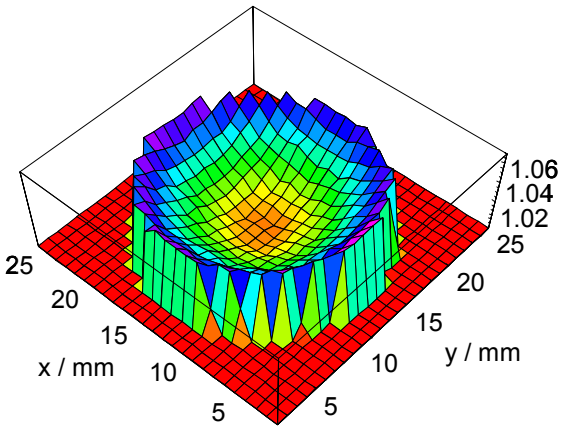
BN-0102: Compact Spectral Radiance Standard Source



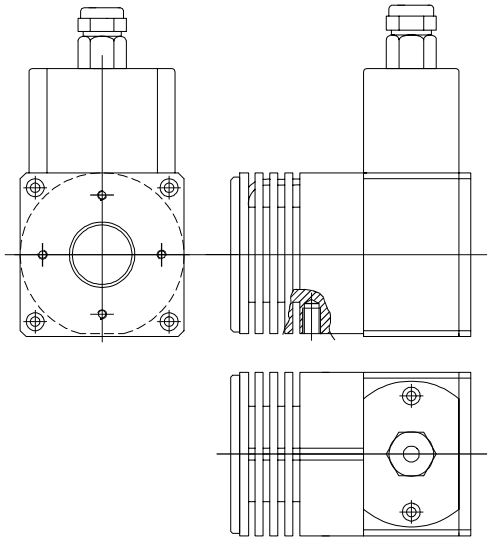
Typical Spectral Radiance

The BN-0102 standard source is a precise spectral radiance transfer standard. Its compact size makes it ideal in applications with limited space.
The unit is built around a small diameter OP.DI.MA.* integrating sphere with a symmetrical OP.DI.MA. baffle between lamp and light output port. This offers the best possible uniformity within the 20 mm diameter light emitting area.
The small diameter sphere in combination with the large diameter light port limits the use of the radiance standard to light detection systems having a narrow field-of-view.
OP.DI.MA. is a nearly perfect white diffuse reflecting plastic material with excellent long term stability.
A carefully burned-in 5 W tungsten halogen lamp operated in constant current mode functions as the light source.
The compact LCRT-2000 power supply is specially designed to run the BN-0102 lamp at a constant current.
Spectral radiance calibration is supplied by Gigahertz-Optik's calibration laboratory for optical radiation measurement quantities and supported by a factory calibration certificate.

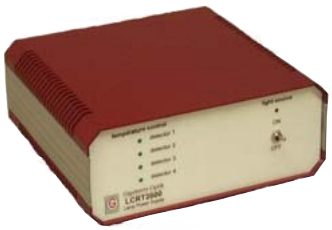
*Gigahertz-Optik's Optically Diffuse Material



Dimensions



LCRT-2000: Lamp Power Supply



The LCRT-2000 Lamp Power Supply is designed to operate lamps up to 10 W power. It can be operated in current controlled mode or light intensity controlled mode (requires a reference detector). The LCRT-2000 allows temperature stabilization of four external detectors at +40 °C to avoid drift effects due to ambient temperature instability. One of these detectors may be a reference detector for the light intensity control mode of the LCRT-2000. An additional output voltage for a cooling fan at the external lamp is available.

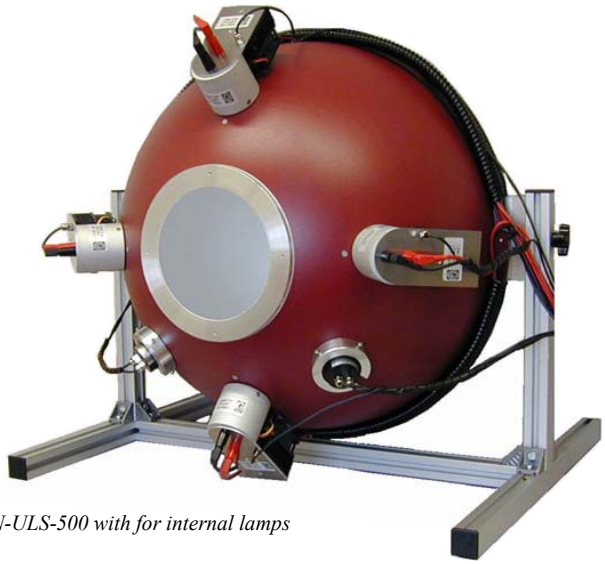
Typical Specifications and Ordering Information:

Model	Integrating Sphere		Lamp				Spectral Radiance (mW/m² sr nm)			Luminance
	Sphere	Port	Type	Power	Voltage	Current	350 nm	1100 nm	2500 nm	cd/m²
	Diameter (mm)			@ 2700 K						
BN-0102	40	20	Halogen Lamp	5 W	12 V DC	417 mA	6	750	-	16000
LCRT-2000	Lamp power supply									
KLD-S3	Calibration of spectral Radiance with traceable factory certificate									

Gigahertz-Optik

Spectral Radiance, Luminous and Uniformity

BN-ULS-M Series: Spectral Radiance, Luminance and Uniformity Standards



BN-ULS-500 with for internal lamps

The BN-ULS-M Series radiance, luminance and uniformity standards offer the utmost flexibility in constructing a system to individual customer requirements. The design concept is based on providing the highest possible level specifications without adding more than is needed. This modular approach gives the customer exactly what he requires without the added cost of unnecessary parts.

Integrating Spheres with different diameters from 4 in. (100 mm) up to 67 in. (1700 mm), form the base units for each set-up. The main selection criteria for determining the sphere size is how big the light emitting port must be. A rule of thumb for the maximum acceptable port diameter is no more than 5 % of the total sphere surface area including detector and lamp ports.

How high a luminance output is required is the only selection criteria for small diameter spheres.

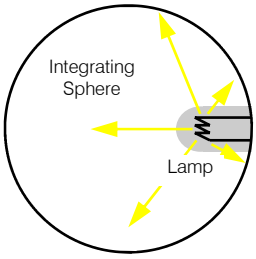
A wide range of **Sphere Accessory Components** support configuration of the basic sphere. In-stock status of all items limits the delivery time of the spheres to the time of assembly.

Standard bench-top **Sphere Stands** are constructed using modular aluminum rails that can be easily customized to the individual application.

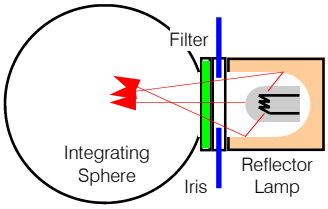
Port Frames with free aperture diameters from 0.5 in. (12.7 mm) up to 5 in. (127 mm) provide the foundation for all accessory components assembled to the sphere.

Two different kinds of light sources are available for assembly onto the port frames:

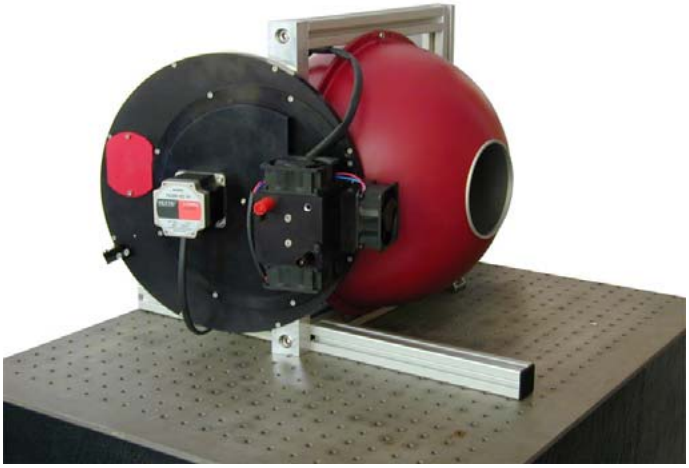
Internal Sources are positioned inside of the sphere. The advantage of this type of light source is that all of the luminous flux is emitted inside the sphere offering the highest possible light intensity. Baffles are required to block direct illumination of the light exit port by the internal lamp. The resulting losses in uniformity and acceptance angle can be reduced by the use of multiple internal lamps.



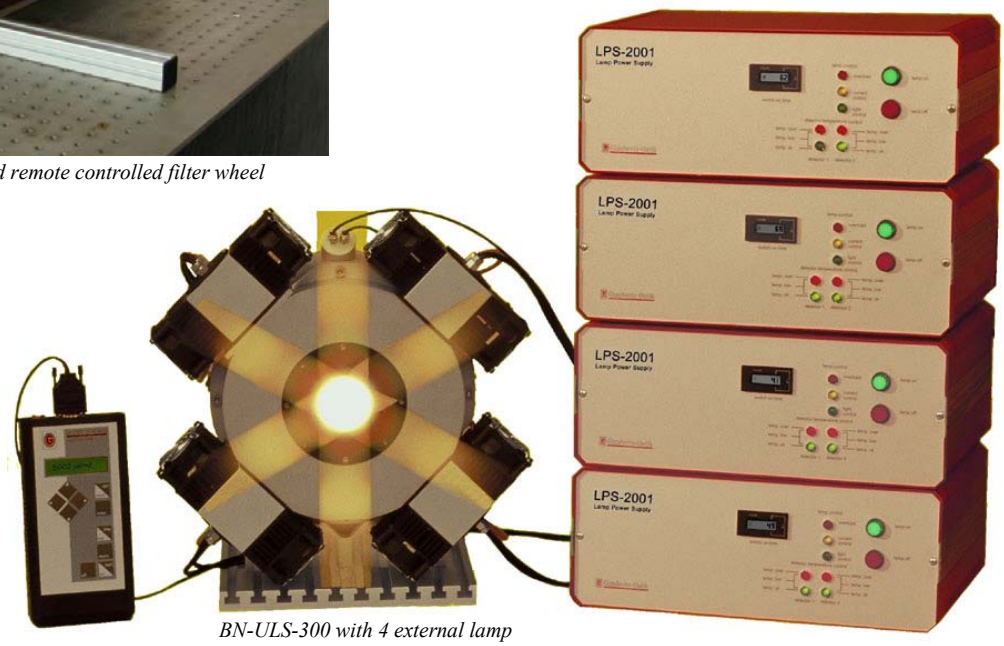
External Sources are directional lamps which transfer their luminous flux through a sphere port into the sphere. The advantage of this type of light source is the ability to place light manipulators like iris diaphragm attenuators, optical filters and fast shutters into the light beam. The restriction with this light source is the lower light intensity. Gigahertz-Optik's unique lamp design employing a diffuse reflector offers high luminous flux efficiency combined with a diffuse light input into the sphere. In combination with its diffuse-baffle, light uniformities equal to that of satellite sphere light sources are achieved at higher light intensities.



All **available components** for the construction of standard light source systems are described and specified in the *Integrating Spheres* section .

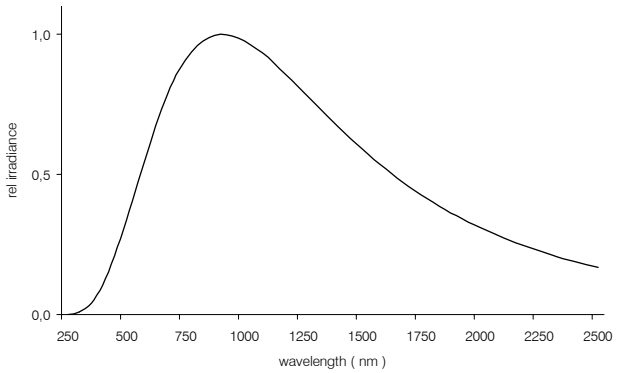


BN-ULS-300 with external lamp and remote controlled filter wheel



BN-ULS-300 with 4 external lamp

BN-USM Series: Unit Construction System



Typical Spectral Radiance

Halogen Lamps are similar in construction to conventional gas filled tungsten filament lamps except that a small trace amount of halogen is added. The addition of this halogen results in a regenerative cycle of the evaporated tungsten. These lamps exhibit:

- long operation time
- broad band spectral radiation ranging from the UV through IR
- stable light emittance characteristic

making them ideal for use as calibration standard lamps.
Gigahertz-Optik supplies halogen lamps with and without UV-blocking quartz envelopes. Note that lamps without UV blocking exhibit a substantially shorter life time.
The following table shows the lamp specifications in combination with different size Gigahertz-Optik integrating spheres and lamp housings.
For the precise operation of halogen lamps Gigahertz-Optik lamp power supplies are recommended.

Typical Lamp and Light Source Specifications:

Halogen Lamp					Inside Source				Outside Source			OS + Iris			
Model	Power	UV Blocker	Operation at		Sphere Diameter Depending Illuminance in klx . Sphere Diameter in mm 1)										
	W		V	K	150	300	500	T_C (K)	150	300	500	150	300	500	T_C (K)
LH-5	5	√	12	3100	13	3.3	1.2	2850	8.2	2	0.7	4.4	1	0.4	2800
LH-10	10	√	12	3100	21	5.1	1.9	2850	11	2.9	1	6.6	1.6	0.6	2800
LH-35	35	√	12	3100	97	24	8.9	2950	71	17	6.5	39	9.6	3.5	2900
LH-50	50	√	12	3100	156	38	14	2950	116	28	10	62	15	5.6	2900
LH-75	75	√	12	3100	248	61	22	2950	183	45	16	95	23	8.7	2900
LH-90	90	√	12	3100	315	77	28	2950	237	58	21	122	29	11	2900
LH-10-UV	10		6	3100	25	6.2	2.3	3050	16	4.1	1.5	9.9	2.4	0.9	3000
LH-50-UV	50		12	3100	190	46.6	17	3050	143	35	13	77	18	7	3000
LH-100-UV	100		12	3100	436	107	39	3050	333	81	30	179	44	16	3000
LH-250-UV	250		24	3100	-	-	-	-	On Request						

1) Typical values only. Illuminance (Luminance) may vary with port size and additional accessories. Please contact the company for more details

Light Detectors and Optometers

Gigahertz-Optik offers a wide range of light detectors and optometers which can be combined with the integrating sphere based light sources for precise radiance and luminance measurement.
Temperature stabilized TD-11 light detectors are the right choice to avoid drift in readings caused by changes in ambient temperature.
In applications that require long term stability of the emission spectra, **color temperature controlled operation** of the halogen lamp is possible using one of Gigahertz-Optik's luminous color detectors. The color temperature stabilization can be done by manual or remote control current variation of the LPS-250 lamp power supply. If the intensity variation in color temperature controlled mode is not acceptable, an iris diaphragm or motorized attenuator can be used to control the light output intensity. Complete remote controlled systems are offered by Gigahertz-Optik.
More information and specifications are available in the *Light Detectors* and *Optometers* sections.

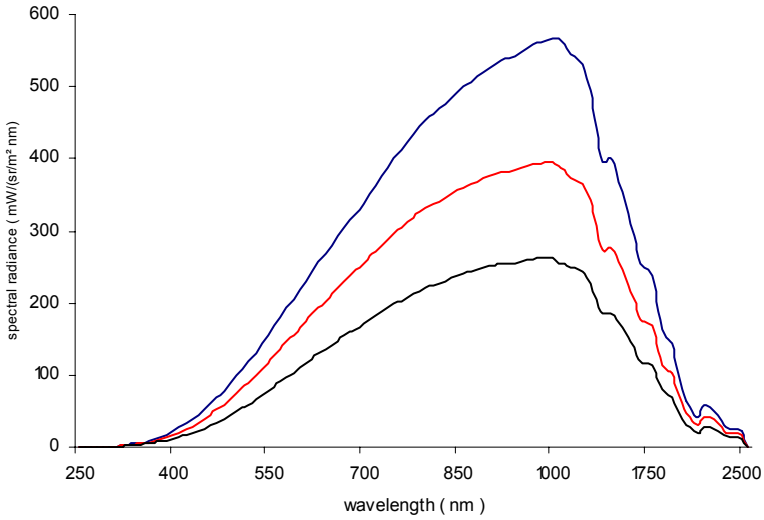
LPS-250 Lamp Power Supply

The LPS-250 lamp power supply is specially designed for the operation of halogen lamps. It offers a variable voltage from 0 to 24 V . A 16 bit digital to analog converter allows precise current set-up from 0 to 15 A with a resolution of 0.3 mA. The current stability is specified at 0.1×10^{-4} A at the nominal current over 8 hours. An on/off ramp function prevents shock of the lamp filament during the on/off procedure. RS232 or RS488 interface allows full remote control operation of single and multiple units.
The power supply is offered in a 1/2-19" rack-mount housing.
For laboratory use an optional bench top housing is available. Full specifications are shown in the *Integrating Spheres* chapter .

Gigahertz-Optik

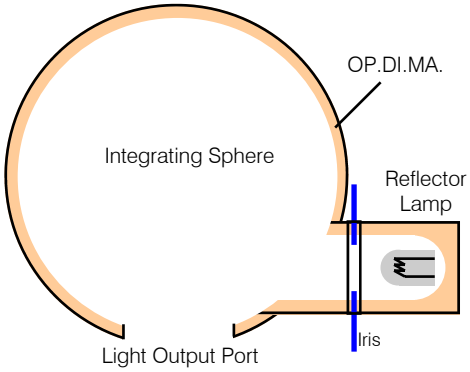
Spectral Radiance, Luminous and Uniformity

BN-ULS-K190: Spectral Radiance Standard



Typical Spectral Radiance at 100%, 75% and 50%

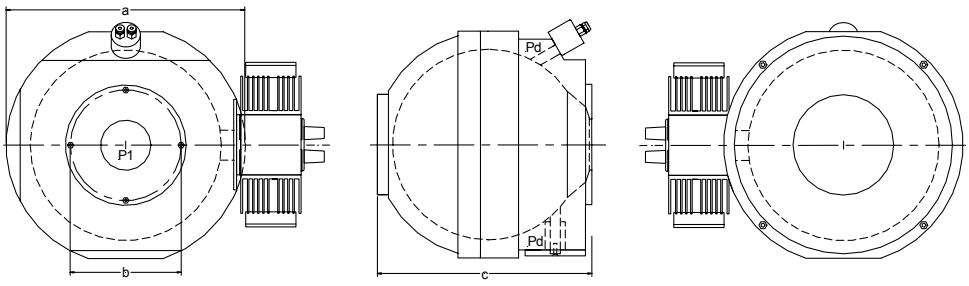
The **BN-ULS-K190** spectral radiance standard offers high and controllable intensity and a uniform radiant output from 300 to 2500 nm.
The BN-ULS-K190 is built around a compact precision machined aluminum housing featuring an inlet made out of Gigahertz-Optik's white diffuse plastic material, OP.DI.MA.
This material offers very good diffuse reflectance combined with high spectral reflectance from 250 to 2500 nm. In comparison to barium sulfate coatings OP.DI.MA. exhibits greater irradiation stability in the ultraviolet to infrared spectral ranges with better mechanical stability as well.
Another key feature is that the light source is externally positioned allowing the use of a variable attenuator mounted between the lamp and sphere. An adjustable shutter eliminates changes in color temperature as found with electronically controlled intensity methods.
To ensure high intensity output the halogen lamp is placed within a diffuse reflector for best flux coupling efficiency as well as diffuse sphere illumination for high radiance uniformity at the light output port.



A precise photometrically corrected reference detector is mounted to the integrating sphere for connection to a Gigahertz-Optik optometer to read out luminance values (see *Optometer* chapter).
The lamp is operated by the LPS-250 lamp power supply for high resolution lamp current control and long term stability (see *Integrating Spheres* chapter).
Calibration of spectral radiance at three different intensity levels is done by Gigahertz-Optics Calibration Laboratory and traceably confirmed in a factory calibration certificate.

Dimensions			
a	238	c	210
b	110		

Dimensions (mm):

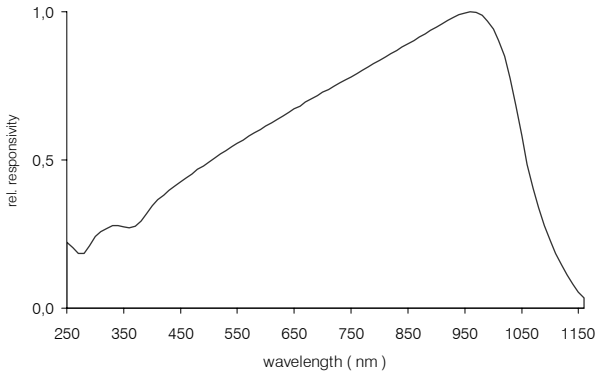


Typical Specifications and Ordering Information:

	Integrating Sphere		Light Source			Radiance in mW/(m² sr nm)				
	Sphere Ø	Port Ø	Power	Lamp	Source	Wavelength	Iris 100 %	Iris 75 %	Iris 50 %	CT
BN-ULS-K190-1	190 mm	50 mm	100 W	Halogen	LS-OK30	@ 1100 nm	1230	850	560	3050 K
BN-ULS-K190-2	190 mm	50 mm	50 W	Halogen	LS-OK30	@ 1100 nm	550	380	240	2800 K

Including LPS-250 power supply, VL-1101-2 light detector, P-9710-1 optometer, KLW-S3 calibration from 300 to 2500 nm at three different intensities (Iris 100%, 75% and 50% open) and luminance calibration of light detector.

BN-DSR-100 Spectral Radiant Power Sensitivity Standard Detector



Typical Spectral Sensitivity

The **BN-DSR-100** calibration standard detector is a precise transfer standard for spectral radiant power sensitivity in A/W in the wavelength range from 200 to 1160 nm.

It's 10 x 10 mm active area silicon photodiode is mounted in the 37 mm diameter MD-37 type detector housing. A machined V-groove and side M6 threaded hole are provided in the housing for detector mounting. See *Light detector* section for more details.
Photodiode linearity between incident light and photocurrent signal is up to 1 mA.
The spectral sensitivity range is 200 to 1160 nm.
A 2 m long coaxial cable with BNC connector enables the detector to be used with an optometer or signal amplifier. Alternatively a (type–2) calibration data connector or (type–4) connector for compatibility with Gigahertz-Optik's P-9710 or X1, X9 meters respectively are available.

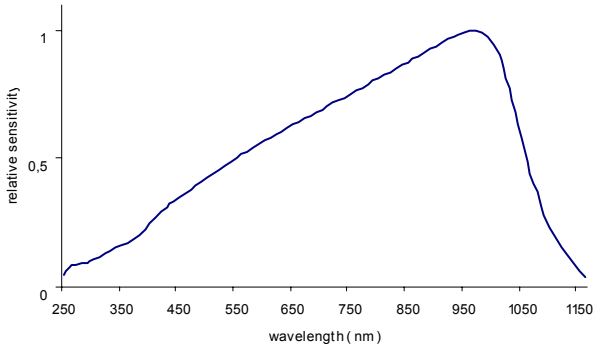
The BN-DSR-100 is available with either a DKD ISO-EN 17025 calibration from 248,4 to 1160 nm or with a factory calibration from 200 to 1100 nm. See *Calibration* chapter for more details.

Typical Specifications and Ordering Information:

Model	Photodiode			Detector		Calibration	
	Type	Area	Size mm	Aperture	Package	Wavelength Range	Unit
BN-DSR-100D	Si	100 mm²	10 x 10	10 x 10 mm	MD-37	1)	A/W nm
BN-DSR-100F	Si	100 mm²	10 x 10	10 x 10 mm	MD-37	200-1100 nm in 10 nm steps 2)	A/W nm

1) DKD calibration certificate . Calibration at 248.4; 265.3; 280.4; 289.4; 302.2; 313; 334.2; 366; from 380 to 1160 in 20 nm steps.
2) Factory calibration certificate

BN-DSI-33 Spectral Irradiance Standard Detector



Typical Spectral Sensitivity

The **BN-DSI-33** calibration standard detector is a precise spectral irradiance sensitivity [A/(W/m²)] transfer standard for the wavelength range from 250 to 1100 nm.
The 33 mm² active area silicon photodiode is mounted in a 37 mm diameter MD-37 type light detector housing. A machined V-groove and side M6 threaded hole allow mounting of the detector. The entrance window is composed of a spectrally neutral broadband 11 mm diameter RADIN* diffuser.
The photodiode linearity between incident and detector signal is up to 1 mA. The spectral sensitivity range is 250 to 1100 nm.
A 2 m long coaxial cable with BNC connector enables the detector to be used with an optometer or signal amplifier. Alternatively a (type–2) calibration data connector or (type–4) connector for compatibility with Gigahertz-Optik's P-9710 or X1, X9 meters respectively are available.

The BN-DSR-33 is available with a calibration of its spectral irradiance sensitivity from 250 to 1100 with a factory certificate. See *Calibration* chapter for more details.

* Gigahertz-Optik Radiation Integrator

Typical Specifications and Ordering Information:

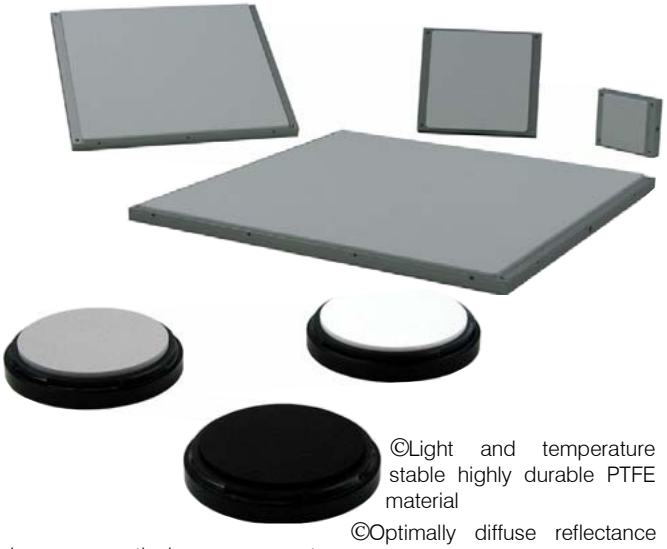
Model	Photodiode			Detector		Calibration 1)	
	Type	Area	Size mm	Aperture	Package	Wavelength Range	Unit
BN-DSI-33	Si+RADIN	33 mm²	5.6 x 5.6	11 mm ∅ RADIN	MD-37	250-1100 nm in 10 nm steps	A/(W/m²)

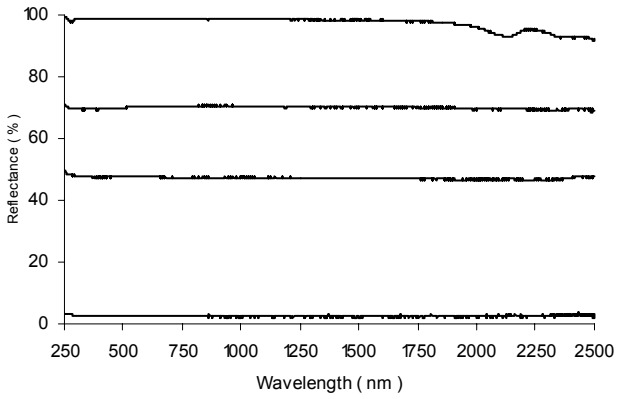
1) Relative spectral sensitivity absolute scaled at 555 nm

Gigahertz-Optik

Spectral Reflectance

BN-R: Spectral Reflectance Standards





Typical Spectral Reflectance of BN-R98, 70,50 and 03

In many optical measurement tasks, optically diffuse reflectors for system calibration and/or adjustment are required. These standards should exhibit a maximally diffuse pattern of reflection. Also, in applications involving spectrally broadband light sources and detectors the reflectance characteristic of the standard should be spectrally neutral across the entire spectral bandpass of interest. For calibration of spectrophotometers the absolute spectral reflectance of the standard must be known.

Gigahertz-Optik's BN-R Reflectance Standard fits this specification profile nearly perfectly.

The standard is made from OP.DI.MA. which stands for Optically Diffuse Material and features:

- ©Light and temperature stable highly durable PTFE material
- ©Optimally diffuse reflectance (Lambertian reflector)
- ©Different reflectance of 98 %, 50 % and 3 %
- ©Spectrally neutral reflectance of 98 % +/- 1 % from 400 to 800 nm.

Different Sizes of reflectance standards are offered.

T**he BN-Rxx-D2** offers a reflectance of 2 in. (50.8 mm) diameter. A screw top cover protects the reflectance surface during storage and transportation.

The BN-Rxx-SQ reflectance standards are available in 2 x 2 in. (50 x 50 mm) to 18 x 18 in. (457 x 457 mm) sizes. All standards are supplied with a removeable cap

Each BN-R98-S5C Reflectance Standard can be ordered with a calibration certificate that includes a plot of spectral reflectance and data-set. Data is supplied over the spectral range from 250 nm to 2500 nm in 50 nm increments. Optionally, finer wavelength resolution is available. Calibration is performed using 8°/hemispherical measurement geometry. Gigahertz-Optik calibrations employ transfer standards traceable to the NRC National Research Council of Canada and NIST National Insti-

BN-R50-SQ18, 18 x 18 inch reflectance

Typical Specifications and Ordering Information:

Model	Reflecting Area		Model 1)	Reflectance % @ 555 nm	Model 1)	Reflectance @ 555 nm	Model 1)	Reflectance @ 555 nm
	dimension							
	mm	in						
BN-R-D2	50.8 ∅	2 ∅	**BN-R98-D2**	98 +/- 1 %	**BN-R50-D2**	50 +/- 5 %	**BN-R02-D2**	3 +/- 1.5 %
BN-R-SQ50	50 x 50	2 x 2	**BN-R98-SQ50**		-		-	
BN-R-SQ100	100 x 100	3.9 x 3.9	**BN-R98-SQ100**		-		-	
BN-R-SQ200	200 x 200	7.9 x 7.9	**BN-R98-SQ200**		-		-	
BN-R-SQ300	300 x 300	11.8 x 11.8	**BN-R98-SQ300**		-		-	
BN-R-SQ5	129 x 129	5 x 5	**BN-R98-SQ5**		**BN-R50-SQ5**		**BN-R02-SQ5**	
BN-R-SQ12	305 x 305	12 x 12	**BN-R98-SQ12**		**BN-R50-SQ12**		**BN-R02-SQ12**	
BN-R-SQ18 2)	457 x 457	18 x 18	**BN-R98-SQ18**		**BN-R50-SQ18**		**BN-R02-SQ18**	

1) Add –C to the model for calibration of the 8/D hemispherical reflectance from 250-2500 nm in 50 nm steps

2) The reflectance plate is build by two halfs

Optional calibration available in 1 nm steps with data on disk