

# Laser Power Measurement Spheres and Sensors

## Accurate and reproducible tools for hard to measure laser products

In various applications such as VCSEL-based LIDAR and facial recognition systems, the necessity arises to simultaneously assess multiple attributes of a laser beam, encompassing power, spectrum, and temporal pulse shape. Coping with the challenge of capturing and accurately measuring these collimated to divergent, continuous, and pulsed sources, can be highly intricate. Labsphere's assortment of multifunctional laser power integrating spheres and sensors offers an effective solution to surmount these difficulties.

Designed to excel in beam power measurement, Labsphere's laser power measurement integrating spheres and sensors establishes a dependable and precise methodology for quantifying the overall power emitted by a collimated or diverging laser source. These spheres are uniquely tailored for laser-oriented applications, providing an optimal means to gauge the total power from an optical beam of coherent light. The sphere's distinctive geometry ensures that beam power assessments remain unswayed by beam polarization and are impervious to beam alignment fluctuations. The inherent attenuation accompanying the sphere's throughput also mitigates detector saturation issues. These systems can be employed with an open port configuration and can be fitted with various optional fiber adaptors catering to optical fibers inputs or port reduction needs.

The advantage of accurate and reproducible measurements is attainable without the need for meticulous positioning and alignment protocols. Integrating sphere-based measurements for laser power eliminates polarization-related anomalies often linked with filter-based attenuation techniques. Labsphere's laser power measurement integrating spheres and sensors are available for applications spanning across the UV-VIS-NIR spectral realms.



The design offers flexibility, presenting choices ranging from standalone laser power measurement spheres to spheres coupled with post, post holders, and base assemblies, or complete laser power measurement integrating spheres and sensors, optionally with or without multi-wavelength calibrations.

An additional sensor port provides users the freedom to integrate extra detector assemblies for broader spectral sensitivity or to incorporate a spectrometer for spectral characterization. These systems provide a versatile solution for laser power measurement across the wavelength spectrum of 350 to 1700 nm, accommodating optical power levels from nanowatts to tens of watts. All calibrations for these systems are traceable back to the National Institute of Standards and Technology (NIST).

### Value:

- Ensure comprehensive power collection from a laser, regardless of divergent angle or polarization
- Efficiently attenuate high power to avert sensor saturation
- Incorporate the second detector port for spectral monitoring or expanded wavelength coverage
- Mitigate errors linked to the non-uniform response of sensor active areas in their bare state

### Applications:

- CW and Pulse measurements of Laser Products
- Lab and Production Testing
- Lens Alignment
- Laser Power Quality Assessment

# Power Meter Options with Laser Power Measurement Software

## LFPA-8-1CH High Precision Picoammeter



Labsphere's LFPA-8-1CH is an advanced picoammeter designed specifically for precise measurement of continuous low current signals originating photodiodes for radiometry and photometry of light sources. With its exceptional features, such as low noise, high dynamic range, and outstanding resolution, it offers unparalleled performance. The LFPA-8-1CH is capable of accurately measuring signals ranging from picoampere (pA) to milliampere (mA) levels.

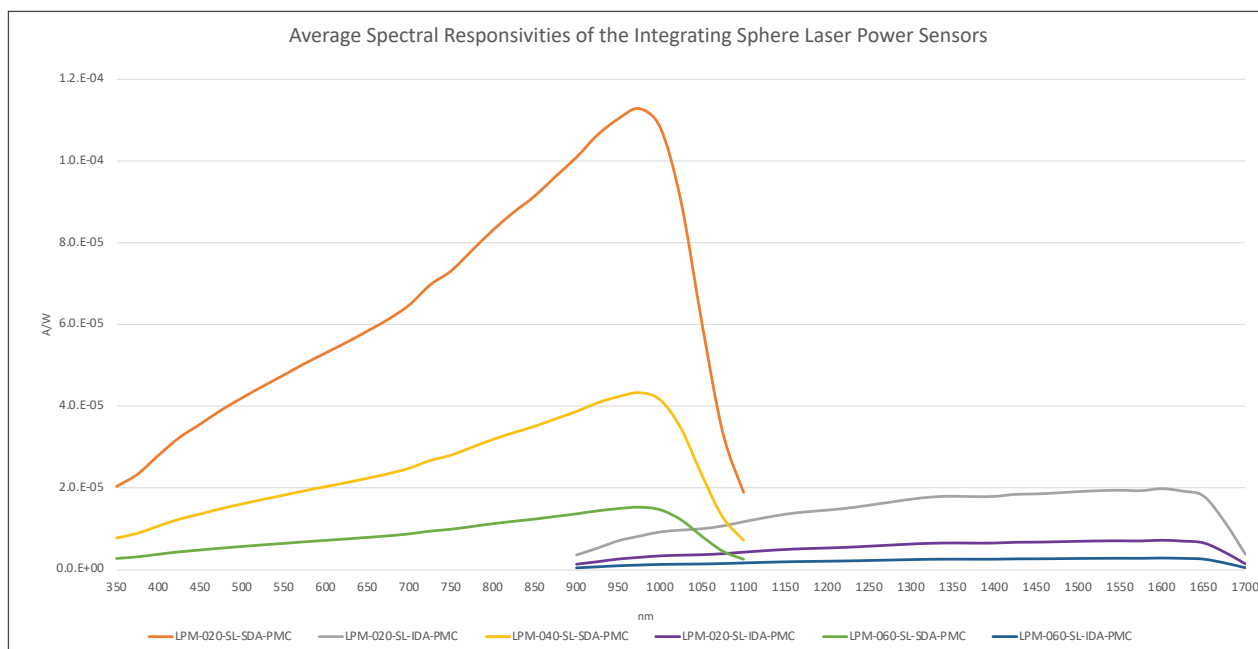
## LFPM-200K-2CH High Speed Pulsed Picoammeter



Labsphere's LFPM-200K-2CH is a high speed pulse measurement picoammeter that offers precise and programmable photodiode current measurement capabilities. Combined with an application-specific sensor it is designed to monitor various parameters such as flux, luminance, illuminance, and optical power. This versatile instrument finds extensive utility in both continuous and pulsed laser power measurement systems, serving the needs of research and development as well as production line applications.

## Laser Power Measurement Sphere Capabilities with Labsphere Picoammeters and Laser Power Software:

- Average Radiant Power at nth wavelength (CW)
- Average Peak Radiant Power at nth wavelength (pulsed)
- Detector Sampling Rate (Hz)
- Detector Scan Interval (sec)
- Laser Power Density: the instantaneous laser beam power per unit area.  $W/cm^2$  with option to beam area in  $cm^2$   
Require input of beam area
- Max Power (CW)
- Min Power (CW)
- Peak Radiant Power (Pulsed)
- Pulse width or interval of duration of a pulse
- Radiant Power Range (CW)
- Radiant Power (W)
- Repetition Rate/Frequency (Pulsed)
- Standard Deviation (CW)
- Total Pulses
- Wavelength (chosen by customer based on laser output and data table from calibration)



## For lower power VIS NIR lasers

Includes Spectral Responsivity Calibration from 350 to 1100 nm in 25 nm increments

Model Number:	LPM-020-SF-SDA-PMC	LPM-040-SF-SDA-PMC	LPM-060-SF-SDA-PMC
Order Number:	AA-01622-020	AA-01622-040	AA-01622-060
Sphere Material:	Spectrafect®	Spectrafect	Spectrafect
Sphere Diameter:	2 in (5.08 cm)	4 in (10.16 cm)	6 in (15.24 cm)
Sphere Entrance Port Dia.: (port frame)	0.5 in (1.27 cm)	1 in (2.54 cm)	1 in (2.54 cm)
Maximum Beam Divergence:	± 40° x ± 60°	± 40° x ± 60°	± 40° x ± 60°
Sphere Sensor Port: (nominal)	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames
Sensor: SDA-050-U-RTA-CX with cable	Silicon	Silicon	Silicon
Detector Cable:	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors
Spectrafect Spectral Range:	300 – 2400 nm	300 – 2400 nm	300 – 2400 nm
Integrating Sphere Time Constant:	~ 4 ns	~ 7 ns	~ 11 ns
Spectral Peak:	975 nm	975 nm	975 nm
Spectral Responsivity: (A/W)	6.19 E-05 @ 975 nm	7.64 E-05 @ 975 nm	8.83 E-06 @ 975 nm
Power Response Uncertainty:	350 nm to 380 nm <9% 390 nm to 470 nm <2% 480 nm to 950 nm <0.5% 960 nm to 1100 nm <3%	350 nm to 380 nm <9% 390 nm to 470 nm <2% 480 nm to 950 nm <0.5% 960 nm to 1100 nm <3%	350 nm to 380 nm <9% 390 nm to 470 nm <2% 480 nm to 950 nm <0.5% 960 nm to 1100 nm <3%
Minimum Power at 975 nm:	1.8 nW	7.0 nW	1.6 nW
Maximum Power* at 975 nm:	1.8 W	7 W	16 W
Post:	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length
Post Holder:	2 in (5.08 cm)	2 in (5.08 cm)	2 in (5.08 cm)
Base:	4 in x 4 in (10.16 cm x 10.16 cm)	4 in x 4 in (10.16 cm x 10.16 cm)	6 in x 6 in (15.24 cm x 15.24 cm)
Cooling:	Convection	Convection	Convection

## For lower power VIS NIR lasers

Spectral Responsivity Calibration not included

Model Number:	LPM-020-SF-SDA	LPM-040-SF-SDA	LPM-060-SF-SDA
Order Number:	AS-03235-020	AS-03235-040	AS-03235-060
Sphere Material:	Spectrafect	Spectrafect	Spectrafect
Sphere Diameter:	2 in (5.08 cm)	4 in (10.16 cm)	6 in (15.24 cm)
Sphere Entrance Port Dia.: (port frame)	0.5 in (1.27 cm)	1 in (2.54 cm)	1 in (2.54 cm)
Maximum Beam Divergence:	± 40° x ± 60°	± 40° x ± 60°	± 40° x ± 60°
Sphere Sensor Port: (nominal)	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames
Sensor: SDA-050-U-RTA-CX with cable	Silicon	Silicon	Silicon
Detector Cable:	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors
Spectrafect Spectral Range:	300 – 2400 nm	300 – 2400 nm	300 – 2400 nm
Integrating Sphere Time Constant:	~ 4 ns	~ 7 ns	~ 11 ns
Spectral Peak:	975 nm	975 nm	975 nm
Spectral Responsivity: (A/W)	1.13 E-04 @ 975 nm	4.33 E-05 @ 975 nm	1.53 E-05 @ 975 nm
Power Response Uncertainty:	350 nm to 380 nm <9% 390 nm to 470 nm <2% 480 nm to 950 nm <0.5% 960 nm to 1100 nm <3%	350 nm to 380 nm <9% 390 nm to 470 nm <2% 480 nm to 950 nm <0.5% 960 nm to 1100 nm <3%	350 nm to 380 nm <9% 390 nm to 470 nm <2% 480 nm to 950 nm <0.5% 960 nm to 1100 nm <3%
Minimum Power at 975 nm:	1.8 nW	7.0 nW	1.6 nW
Maximum Power* at 975 nm:	1.8 W	7 W	16 W
Post:	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length
Post Holder:	2 in (5.08 cm)	2 in (5.08 cm)	2 in (5.08 cm)
Base:	4 in x 4 in (10.16 cm x 10.16 cm)	4 in x 4 in (10.16 cm x 10.16 cm)	6 in x 6 in (15.24 cm x 15.24 cm)
Cooling:	Convection	Convection	Convection

\* Actual maximum power based on thermal limits of sphere coating and/or material. Contact our sales engineers for further information.



## For mid-power lasers in VIS NIR, more robust

Includes Spectral Responsivity Calibration from 350 to 1100 nm in 25 nm increments

	LPM-020-SL-SDA-PMC	LPM-040-SL-SDA-PMC	LPM-060-SL-SDA-PMC
<b>Model Number:</b>	LPM-020-SL-SDA-PMC	LPM-040-SL-SDA-PMC	LPM-060-SL-SDA-PMC
<b>Order Number:</b>	AA-01622-022	AA-01622-042	AA-01622-062
Sphere Material:	Spectralon®	Spectralon	Spectralon
Sphere Diameter:	2 in (5.08 cm)	4 in (10.16 cm)	5.3 in (13.5 cm)
Sphere Entrance Port Dia.: (port frame)	0.5 in (1.27 cm)	1 in (2.5 cm)	1 in (2.5 cm)
Maximum Beam Divergence:	± 40° x ± 60°	± 40° x ± 60°	± 40° x ± 60°
Sphere Sensor Port: (nominal)	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames
Sensor: SDA-050-U-RTA-CX with cable	Silicon	Silicon	Silicon
Detector Cable:	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors
Spectralon Spectral Range:	250 - 2500 nm	250 - 2500 nm	250 - 2500 nm
Integrating Sphere Time Constant:	~ 11 ns	~ 22 ns	~ 34 ns
Spectral Peak:	975 nm	975 nm	975 nm
Spectral Responsivity: (A/W)	2.17 E-05 @ 975 nm	7.96 E-06 @ 975 nm	3.08 E-06 @ 975 nm
Power Response Uncertainty:	350 nm to 380 nm <9% 390 nm to 470 nm <2% 480 nm to 950 nm <0.5% 960 nm to 1100 nm <3%	350 nm to 380 nm <9% 390 nm to 470 nm <2% 480 nm to 950 nm <0.5% 960 nm to 1100 nm <3%	350 nm to 380 nm <9% 390 nm to 470 nm <2% 480 nm to 950 nm <0.5% 960 nm to 1100 nm <3%
Minimum Power at 975 nm:	10 nW	28 nW	20 nW
Maximum Power* at 975 nm:	10 W	28 W	20 W
Post:	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length
Post Holder:	2 in (5.08 cm)	2 in (5.08 cm)	2 in (5.08 cm)
Base:	4 in x 4 in (10.16 cm x 10.16 cm)	4 in x 4 in (10.16 cm x 10.16 cm)	6 in x 6 in (15.24 cm x 15.24 cm)
Cooling:	Convection	Convection	Convection

## For mid-power lasers in VIS NIR, more robust

Spectral Responsivity Calibration not included

	LPM-020-SL-SDA	LPM-040-SL-SDA	LPM-060-SL-SDA
<b>Model Number:</b>	LPM-020-SL-SDA	LPM-040-SL-SDA	LPM-060-SL-SDA
<b>Order Number:</b>	AS-03235-022	AS-03235-042	AS-03235-062
Sphere Material:	Spectralon	Spectralon	Spectralon
Sphere Diameter:	2 in (5.08 cm)	4 in (10.16 cm)	5.3 in (13.5 cm)
Sphere Entrance Port Dia.: (port frame)	0.5 in (1.27 cm)	1 in (2.5 cm)	1 in (2.5 cm)
Maximum Beam Divergence:	± 40° x ± 60°	± 40° x ± 60°	± 40° x ± 60°
Sphere Sensor Port: (nominal)	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames
Sensor: SDA-050-U-RTA-CX with cable	Silicon	Silicon	Silicon
Detector Cable:	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors
Spectralon Spectral Range:	250 - 2500 nm	250 - 2500 nm	250 - 2500 nm
Integrating Sphere Time Constant:	~ 11 ns	~ 22 ns	~ 34 ns
Spectral Peak:	975 nm	975 nm	975 nm
Spectral Responsivity: (A/W)	1.98 E-05 @ 975 nm	7.27 E-06 @ 975 nm	2.82 E-06 @ 975 nm
Power Response Uncertainty:	350 nm to 380 nm <9% 390 nm to 470 nm <2% 480 nm to 950 nm <0.5% 960 nm to 1100 nm <3%	350 nm to 380 nm <9% 390 nm to 470 nm <2% 480 nm to 950 nm <0.5% 960 nm to 1100 nm <3%	350 nm to 380 nm <9% 390 nm to 470 nm <2% 480 nm to 950 nm <0.5% 960 nm to 1100 nm <3%
Minimum Power at 975 nm:	10 nW	28 nW	20 nW
Maximum Power* at 975 nm:	10 W	28 W	20 W
Post:	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length
Post Holder:	2 in (5.08 cm)	2 in (5.08 cm)	2 in (5.08 cm)
Base:	4 in x 4 in (10.16 cm x 10.16 cm)	4 in x 4 in (10.16 cm x 10.16 cm)	6 in x 6 in (15.24 cm x 15.24 cm)
Cooling:	Convection	Convection	Convection

\* Actual maximum power based on thermal limits of sphere coating and/or material. Contact our sales engineers for further information.



## For lower power NIR lasers

Includes Spectral Responsivity Calibration from 800 to 1700 nm in 25 nm increments

	LPM-020-SF-IDA-PMC	LPM-040-SF-IDA-PMC	LPM-060-SF-IDA-PMC
<b>Model Number:</b>	LPM-020-SF-IDA-PMC	LPM-040-SF-IDA-PMC	LPM-060-SF-IDA-PMC
<b>Order Number:</b>	AA-01622-021	AA-01622-041	AA-01622-061
Sphere Material:	Spectrafect	Spectrafect	Spectrafect
Sphere Diameter:	2 in (5.08 cm)	4 in (10.16 cm)	6 in (15.24 cm)
Sphere Entrance Port Dia.: (port frame)	0.5 in (1.27 cm)	1 in (2.54 cm)	1 in (2.54 cm)
Maximum Beam Divergence:	$\pm 40^\circ \times \pm 60^\circ$	$\pm 40^\circ \times \pm 60^\circ$	$\pm 40^\circ \times \pm 60^\circ$
Sphere Sensor Port: (nominal)	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames
Sensor: IDA-050-U-RTA-CX with cable	InGaAs	InGaAs	InGaAs
Detector Cable:	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors
Spectrafect Spectral Range:	300 – 2400 nm	300 – 2400 nm	300 – 2400 nm
Integrating Sphere Time Constant:	~ 4 ns	~ 7 ns	~ 11 ns
Spectral Peak:	1300 nm	1300 nm	1300 nm
Spectral Responsivity: (A/W)	9.43 E-05 @ 1300 nm	1.87 E-05 @ 1300 nm	1.05 E-05 @ 1300 nm
Power Response Uncertainty:	900 nm to 960 nm $\pm 2.8\%$ 970 nm to 1700 nm $\pm 3.6\%$	900 nm to 960 nm $\pm 2.8\%$ 970 nm to 1700 nm $\pm 3.6\%$	900 nm to 960 nm $\pm 2.8\%$ 970 nm to 1700 nm $\pm 3.6\%$
Minimum Power at 1300 nm:	10 nW	50 nW	100 nW
Maximum Power* at 1300 nm:	10 W	50 W	100 W
Post:	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length
Post Holder:	2 in (5.08 cm)	2 in (5.08 cm)	2 in (5.08 cm)
Base:	4 in x 4 in (10.16 cm x 10.16 cm)	4 in x 4 in (10.16 cm x 10.16 cm)	6 in x 6 in (15.24 cm x 15.24 cm)
Cooling:	Convection	Convection	Convection

## For lower power NIR lasers

Spectral Responsivity Calibration not included

	LPM-020-SF-IDA	LPM-040-SF-IDA	LPM-060-SF-IDA
<b>Model Number:</b>	LPM-020-SF-IDA	LPM-040-SF-IDA	LPM-060-SF-IDA
<b>Order Number:</b>	AS-03235-021	AS-03235-041	AS-03235-061
Sphere Material:	Spectrafect	Spectrafect	Spectrafect
Sphere Diameter:	2 in (5.08 cm)	4 in (10.16 cm)	6 in (15.24 cm)
Sphere Entrance Port Dia.: (port frame)	0.5 in (1.27 cm)	1 in (2.54 cm)	1 in (2.54 cm)
Maximum Beam Divergence:	$\pm 40^\circ \times \pm 60^\circ$	$\pm 40^\circ \times \pm 60^\circ$	$\pm 40^\circ \times \pm 60^\circ$
Sphere Sensor Port: (nominal)	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames
Sensor: IDA-050-U-RTA-CX with cable	InGaAs	InGaAs	InGaAs
Detector Cable:	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors
Spectrafect Spectral Range:	300 – 2400 nm	300 – 2400 nm	300 – 2400 nm
Integrating Sphere Time Constant:	~ 4 ns	~ 7 ns	~ 11 ns
Spectral Peak:	1300 nm	1300 nm	1300 nm
Spectral Responsivity: (A/W)	9.43 E-05 @ 1300 nm	1.87 E-05 @ 1300 nm	1.05 E-05 @ 1300 nm
Power Response Uncertainty:	900 nm to 960 nm $\pm 2.8\%$ 970 nm to 1700 nm $\pm 3.6\%$	900 nm to 960 nm $\pm 2.8\%$ 970 nm to 1700 nm $\pm 3.6\%$	900 nm to 960 nm $\pm 2.8\%$ 970 nm to 1700 nm $\pm 3.6\%$
Minimum Power at 1300 nm:	10 nW	50 nW	100 nW
Maximum Power* at 1300 nm:	10 W	50 W	100 W
Post:	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length
Post Holder:	2 in (5.08 cm)	2 in (5.08 cm)	2 in (5.08 cm)
Base:	4 in x 4 in (10.16 cm x 10.16 cm)	4 in x 4 in (10.16 cm x 10.16 cm)	6 in x 6 in (15.24 cm x 15.24 cm)
Cooling:	Convection	Convection	Convection

\* Actual maximum power based on thermal limits of sphere coating and/or material. Contact our sales engineers for further information.



## For mid-power lasers in NIR, more robust

Includes Spectral Responsivity Calibration from 800 to 1700 nm in 25 nm increments

	LPM-020-SL-IDA-PMC	LPM-040-SL-IDA-PMC	LPM-060-SL-IDA-PMC
<b>Model Number:</b>	LPM-020-SL-IDA-PMC	LPM-040-SL-IDA-PMC	LPM-060-SL-IDA-PMC
<b>Order Number:</b>	AA-01622-023	AA-01622-043	AA-01622-063
Sphere Material:	Spectralon	Spectralon	Spectralon
Sphere Diameter:	2 in (5.08 cm)	4 in (10.16 cm)	5.3 in (13.5 cm)
Sphere Entrance Port Dia.: (port frame)	0.5 in (1.27 cm)	1 in (2.5 cm)	1 in (2.5 cm)
Maximum Beam Divergence:	$\pm 40^\circ \times \pm 60^\circ$	$\pm 40^\circ \times \pm 60^\circ$	$\pm 40^\circ \times \pm 60^\circ$
Sphere Sensor Port: (nominal)	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames
Sensor: IDA-050-U-RTA-CX with cable	InGaAs	InGaAs	InGaAs
Detector Cable:	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors
Spectralon Spectral Range:	250 - 2500 nm	250 - 2500 nm	250 - 2500 nm
Integrating Sphere Time Constant:	~ 11 ns	~ 22 ns	~ 34 ns
Spectral Peak:	1600 nm	1600 nm	1600 nm
Spectral Responsivity: (A/W)	2.49 E-05 @ 1600 nm	9.16 E-06 @ 1600 nm	3.55 E-06 @ 1600 nm
Power Response Uncertainty:	900 nm to 960 nm $\pm 2.8\%$ 970 nm to 1700 nm $\pm 3.6\%$	900 nm to 960 nm $\pm 2.8\%$ 970 nm to 1700 nm $\pm 3.6\%$	900 nm to 960 nm $\pm 2.8\%$ 970 nm to 1700 nm $\pm 3.6\%$
Minimum Power at 1600 nm:	40 nW	109 nW	50 nW
Maximum Power* at 1600 nm:	40 W	109 W	50 W
Post:	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length
Post Holder:	2 in (5.08 cm)	2 in (5.08 cm)	2 in (5.08 cm)
Base:	4 in x 4 in (10.16 cm x 10.16 cm)	4 in x 4 in (10.16 cm x 10.16 cm)	6 in x 6 in (15.24 cm x 15.24 cm)
Cooling:	Convection	Convection	Convection

## For mid-power lasers in NIR, more robust

Spectral Responsivity Calibration not included

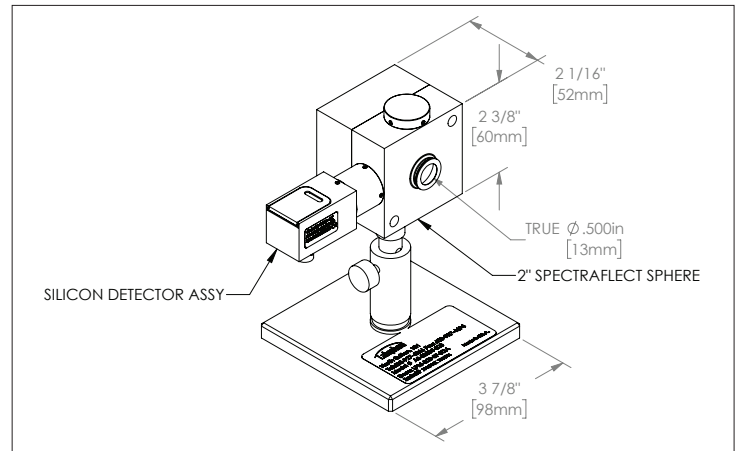
	LPM-020-SL-IDA	LPM-040-SL-IDA	LPM-060-SL-IDA
<b>Model Number:</b>	LPM-020-SL-IDA	LPM-040-SL-IDA	LPM-060-SL-IDA
<b>Order Number:</b>	AS-03235-023	AS-03235-043	AS-03235-063
Sphere Material:	Spectralon	Spectralon	Spectralon
Sphere Diameter:	2 in (5.08 cm)	4 in (10.16 cm)	5.3 in (13.5 cm)
Sphere Entrance Port Dia.: (port frame)	0.5 in (1.27 cm)	1 in (2.5 cm)	1 in (2.5 cm)
Maximum Beam Divergence:	$\pm 40^\circ \times \pm 60^\circ$	$\pm 40^\circ \times \pm 60^\circ$	$\pm 40^\circ \times \pm 60^\circ$
Sphere Sensor Port: (nominal)	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames
Sensor: IDA-050-U-RTA-CX with cable	InGaAs	InGaAs	InGaAs
Detector Cable:	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors	3 m Coax w/ BNC connectors
Spectralon Spectral Range:	250 - 2500 nm	250 - 2500 nm	250 - 2500 nm
Integrating Sphere Time Constant:	~ 11 ns	~ 22 ns	~ 34 ns
Spectral Peak:	1600 nm	1600 nm	1600 nm
Spectral Responsivity: (A/W)	2.49 E-05 @ 1600 nm	9.16 E-06 @ 1600 nm	3.55 E-06 @ 1600 nm
Power Response Uncertainty:	900 nm to 960 nm $\pm 2.8\%$ 970 nm to 1700 nm $\pm 3.6\%$	900 nm to 960 nm $\pm 2.8\%$ 970 nm to 1700 nm $\pm 3.6\%$	900 nm to 960 nm $\pm 2.8\%$ 970 nm to 1700 nm $\pm 3.6\%$
Minimum Power at 1600 nm:	40 nW	109 nW	50 nW
Maximum Power* at 1600 nm:	40 W	109 W	50 W
Post:	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length	1/4-20 2 in (5.08 cm) length
Post Holder:	2 in (5.08 cm)	2 in (5.08 cm)	2 in (5.08 cm)
Base:	4 in x 4 in (10.16 cm x 10.16 cm)	4 in x 4 in (10.16 cm x 10.16 cm)	6 in x 6 in (15.24 cm x 15.24 cm)
Cooling:	Convection	Convection	Convection

\* Actual maximum power based on thermal limits of sphere coating and/or material. Contact our sales engineers for further information.

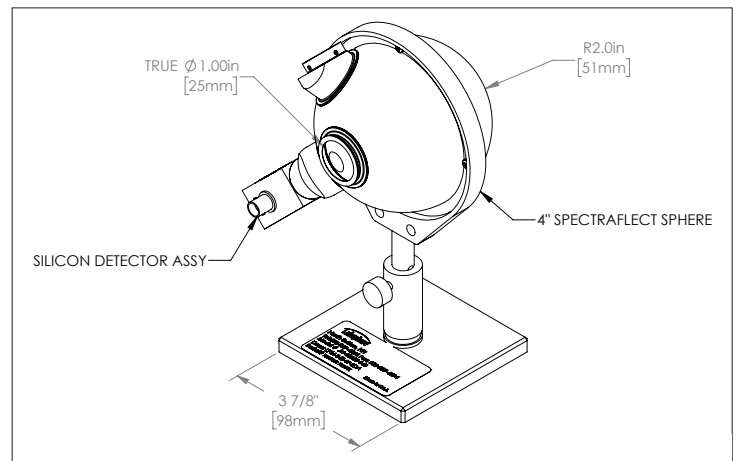
## CUDs

All of our laser power measurement spheres feature an input port designed to accommodate a beam of radiation. Adjacent to the entrance port, there is a detector positioned to observe the sphere wall. The detector's field of view is precisely tailored to confine the observed area, thus enabling the entry of highly divergent sources without compromising measurement precision.

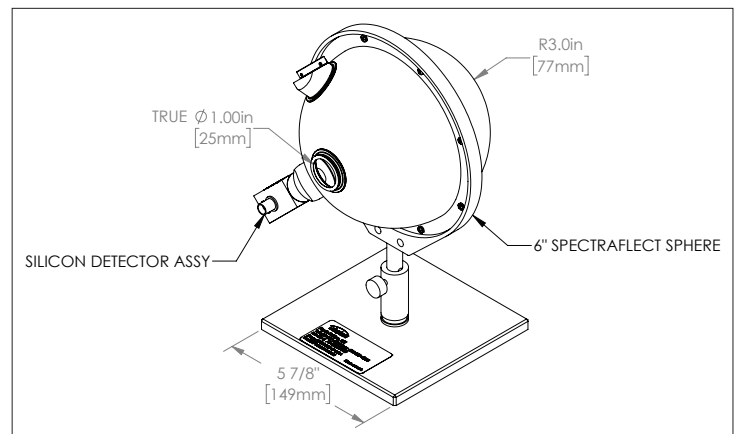
Our integrating spheres, available in 2, 4, or 6 inch diameters, are coated with Labsphere's Spectrafect, or our specialized material Spectralon known for its exceptional diffuse reflectivity, robustness, and tolerance to higher powers. Regardless of the chosen option, all of them exhibit robustness and remarkable stability over extended periods. The utilization of these internally diffuse reflective surfaces guarantees the accurate integration of light.



Example of 2 inch LPM-SF



Example of 4 inch LPM-SF



Example of 6 inch LPM-SF

# Ordering Information

Model Number	Description	Order Number
LPM-020-SF-SDA-PMC	Spectrafect 2 in (5.08 cm), 3 port sphere, Silicon detector, post, post holder, base. Includes calibration from 350 to 1100 nm in 25 nm increments.	AA-01622-020
LPM-020-SF-IDA-PMC	Spectrafect 2 in (5.08 cm), 3 port sphere, InGaAs detector, post, post holder, base. Includes calibration from 800 to 1700 nm in 25 nm increments.	AA-01622-021
LPM-020-SL-SDA-PMC	Spectralon 2 in (5.08 cm), 3 port sphere, Silicon detector, post, post holder, base. Includes calibration from 350 to 1100 nm in 25 nm increments.	AA-01622-022
LPM-020-SL-IDA-PMC	Spectralon 2 in (5.08 cm), 3 port sphere, InGaAs detector, post, post holder, base. Includes calibration from 800 to 1700 nm in 25 nm increments.	AA-01622-023
LPM-040-SF-SDA-PMC	Spectrafect 4 in (10.16 cm), 3 port sphere, Silicon detector, post, post holder, base. Includes calibration from 350 to 1100 nm in 25 nm increments.	AA-01622-040
LPM-040-SF-IDA-PMC	Spectrafect 4 in (10.16 cm), 3 port sphere, InGaAs detector, post, post holder, base. Includes calibration from 800 to 1700 nm in 25 nm increments.	AA-01622-041
LPM-040-SL-SDA-PMC	Spectralon 4 in (10.16 cm), 3 port sphere, Silicon detector, post, post holder, base. Includes calibration from 350 to 1100 nm in 25 nm increments.	AA-01622-042
LPM-040-SL-IDA-PMC	Spectralon 4 in (10.16 cm), 3 port sphere, InGaAs detector, post, post holder, base. Includes calibration from 800 to 1700 nm in 25 nm increments.	AA-01622-043
LPM-060-SF-SDA-PMC	Spectrafect 6 in (15.24 cm), 3 port sphere, Silicon detector, post, post holder, base. Includes calibration from 350 to 1100 nm in 25 nm increments.	AA-01622-060
LPM-060-SF-IDA-PMC	Spectrafect 6 in (15.24 cm), 3 port sphere, InGaAs detector, post, post holder, base. Includes calibration from 800 to 1700 nm in 25 nm increments.	AA-01622-061
LPM-060-SL-SDA-PMC	Spectralon 5.3 in (13.5 cm), 3 port sphere, Silicon detector, post, post holder, base. Includes calibration from 350 to 1100 nm in 25 nm increments.	AA-01622-062
LPM-060-SL-IDA-PMC	Spectralon 5.3 in (13.5 cm), 3 port sphere, InGaAs detector, post, post holder, base. Includes calibration from 800 to 1700 nm in 25 nm increments.	AA-01622-063
LPM-020-SF-SDA	Spectrafect 2 in (5.08 cm), 3 port sphere, Silicon detector, post, post holder, base. Calibration not included	AS-03235-020
LPM-020-SF-IDA	Spectrafect 2 in (5.08 cm), 3 port sphere, InGaAs detector, post, post holder, base. Calibration not included	AS-03235-021
LPM-020-SL-SDA	Spectralon 2 in (5.08 cm), 3 port sphere, Silicon detector, post, post holder, base. Calibration not included	AS-03235-022
LPM-020-SL-IDA	Spectralon 2 in (5.08 cm), 3 port sphere, InGaAs detector, post, post holder, base. Calibration not included	AS-03235-023
LPM-040-SF-SDA	Spectrafect 4 in (10.16 cm), 3 port sphere, Silicon detector, post, post holder, base. Calibration not included	AS-03235-040
LPM-040-SF-IDA	Spectrafect 4 in (10.16 cm), 3 port sphere, InGaAs detector, post, post holder, base. Calibration not included	AS-03235-041
LPM-040-SL-SDA	Spectralon 4 in (10.16 cm), 3 port sphere, Silicon detector, post, post holder, base. Calibration not included	AS-03235-042
LPM-040-SL-IDA	Spectralon 4 in (10.16 cm), 3 port sphere, InGaAs detector, post, post holder, base. Calibration not included	AS-03235-043
LPM-060-SF-SDA	Spectrafect 6 in (15.24 cm), 3 port sphere, Silicon detector, post, post holder, base. Calibration not included	AS-03235-060
LPM-060-SF-IDA	Spectrafect 6 in (15.24 cm), 3 port sphere, InGaAs detector, post, post holder, base. Calibration not included	AS-03235-061
LPM-060-SL-SDA	Spectralon 5.3 in (13.5 cm), 3 port sphere, Silicon detector, post, post holder, base. Calibration not included	AS-03235-062
LPM-060-SL-IDA	Spectralon 5.3 in (13.5 cm), 3 port sphere, InGaAs detector, post, post holder, base. Calibration not included	AS-03235-063



# Laser Power Measurement Spheres only

Post, Post Holder, and Base sold separately

<b>Model Number:</b>	<b>3P-LPM-020-SF</b>	<b>3P-LPM-040-SF</b>	<b>3P-LPM-060-SF</b>
<b>Order Number:</b>	<b>AS-02489-001</b>	<b>AS-02492-001</b>	<b>AS-02495-001</b>
Sphere Material:	Spectrafect	Spectrafect	Spectrafect
Sphere Diameter:	2 in (5.08 cm)	4 in (10.16 cm)	6 in (15.24 cm)
Sphere Entrance Port Dia.: (port frame)	0.5 in (1.27 cm)	1 in (2.54 cm)	1 in (2.54 cm)
Maximum Beam Divergence:	$\pm 40^\circ \times \pm 60^\circ$	$\pm 40^\circ \times \pm 60^\circ$	$\pm 40^\circ \times \pm 60^\circ$
Sphere Sensor Port: (nominal)	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames
Spectrafect Spectral Range: (nm)	300 - 2400 nm	300 - 2400 nm	300 - 2400 nm
<b>Model Number:</b>	<b>3P-LPM-020-SL</b>	<b>3P-LPM-040-SL</b>	<b>3P-LPM-060-SL</b>
<b>Order Number:</b>	<b>AS-02488-001</b>	<b>AS-02491-001</b>	<b>AS-02493-001</b>
Sphere Material:	Spectralon	Spectralon	Spectralon
Sphere Diameter:	2 in (5.08 cm)	4 in (10.16 cm))	5.3 in ( 13.5 cm)
Sphere Entrance Port Dia.: (port frame)	0.5 in (1.27 cm)	1 in (2.5 cm)	1 in (2.5 cm)
Maximum Beam Divergence:	$\pm 40^\circ \times \pm 60^\circ$	$\pm 40^\circ \times \pm 60^\circ$	$\pm 40^\circ \times \pm 60^\circ$
Sphere Sensor Port: (nominal)	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames	2, 0.5 in (1.27 cm) port frames
Spectralon Spectral Range: (nm)	250 - 2500 nm	250 - 2500 nm	250 - 2500 nm
<b>Model Number:</b>	<b>3P-LPM-020-IG</b>	<b>3P-LPM-040-IG</b>	<b>3P-LPM-060-IG</b>
<b>Order Number:</b>	<b>AS-02490-001</b>	<b>AS-02496-001</b>	<b>AS-02497-001</b>
Sphere Material:	Infragold®	Infragold	Infragold
Sphere Diameter:	2 in (5.08 cm)	4 in (10.16 cm)	6 in (15.24 cm)
Sphere Entrance Port Dia.: (port frame)	0.5 in (1.27 cm)	1 in (2.54 cm)	1 in (2.54 cm)
Infragold Spectral Range: (nm)	700 nm - 20 $\mu$ m	700 nm - 20 $\mu$ m	700 nm - 20 $\mu$ m