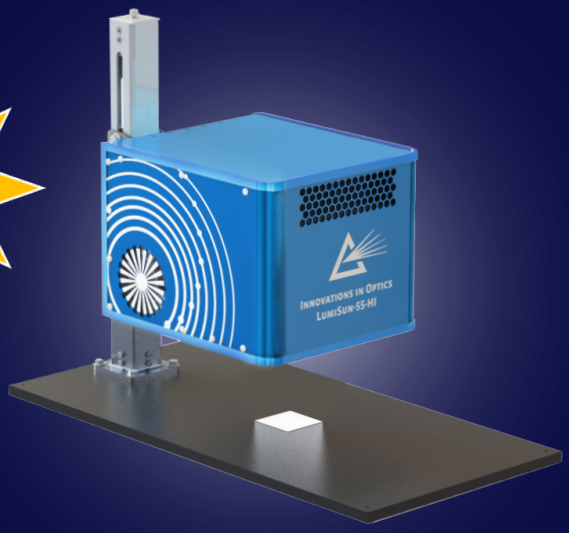
INNOVATIONS IN OPTICS

Class A+A+A+ HIGH SUNS
LED Benchtop Solar Simulator

LumiSun-55-HI™



*Patent Pending

Features

- IEC Class A+A+A+ compliant
- 55 x 55mm highly uniform area (also for individual λ's)
- 1 to 20 Suns irradiance
- Compact, low cost
- Spectral range 350-1350nm
- 37 λ individually controlled
- Spectral deviation < 9% 400nm - 1100nm
  < 12% 350nm - 1250nm
  < 15% 300nm - 1200nm
- AM0 and AM1.5G superior spectral matching
- Long LED Lifetime >20,000 hours
- User-friendly GUI allows individual control of each λ
- RS485 & USB computer connection (Modbus RTU)
- Pre-programmed & user-defined adjustable spectra
- TEC for superior spectral intensity stability
- Steady state or pulsed modes
- LED current closed loop control

Applications

- Accelerated Testing
- PV Cell Testing & Research
- Photochemisty
- Biological
- Phototherapy Research
- Photodynamic Therapy Research
- Materials Degradation Testing
- Weathering Tests
- Test Machine Vision sensors
- Multispectral, Hyperspectral

Push your testing further with LumiSun-55-HI™.

20 Suns accelerates insights, speeds up qualification, and simulates extreme conditions with precision.

The LumiSun™ series now includes 20 Suns capability in a compact benchtop LED solar simulator that meets IEC 60904-9 and 60904-3 Class A+A+A+ requirements for spectral match, nonuniformity of irradiance, and temporal stability over a 55mm x 55mm area with low spectral deviation. Output power is adjustable from 1 to 20 Suns to support accelerated aging and reliability testing, thermal stress studies, and performance characterization. An advanced GUI allows users to adjust individual wavelengths for spectral customization. Remote digital control is available via an RS-485 interface using Modbus RTU protocol.

LumiSun-55-HI™ incorporates the same proprietary Innovations in Optics, Inc. (IOI) technology found in our large-area versions and OEM solar simulators, deployed in the thousands by leading PV manufacturers. IOI's patent-pending light collection optics and thermal management system ensure superior temporal stability and uniformity - both across the full spectrum and for individual wavelengths. The LED light source is thermoelectrically cooled and housed in a compact, air-cooled enclosure with a rotatable illumination plane for directional flexibility.

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LumiSun-55-HI™ Solar Simulator Pre-programmed Spectrum

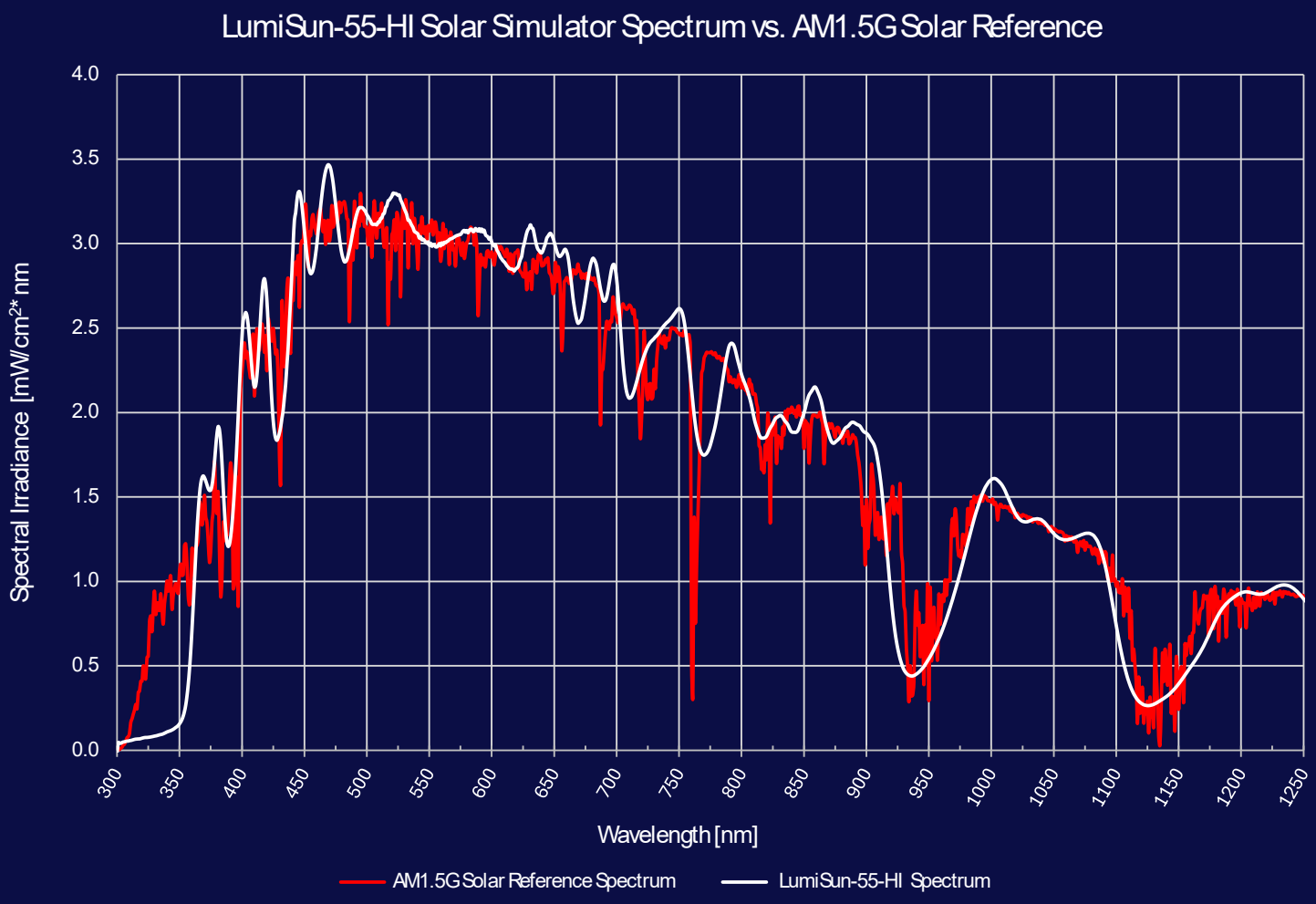

Table 1: Spectral Match Values

Wavelength Range (nm)	Percentage of Total Irradiance (%)	Spectral Match to Spectral Bins (%)
300 - 470	16.61	87.5 - 112.5
470 - 561	16.74	87.5 - 112.5
561 - 657	16.67	87.5 - 112.5
657 - 772	16.63	87.5 - 112.5
772 - 919	16.66	87.5 - 112.5
919 - 1200	16.69	87.5 - 112.5

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LumiSun-55-HI™ Specifications

NOTE: Unless otherwise specified, measurement methods are according to IEC 60904-9 edition 3

Description	Value	Units	Comments
Illumination Area	55 x 55	mm	
Spectral Active Area	350 - 1350	nm	Future expansion to 1600nm
Spectral Match (IEC binning, Class A+)	See Table 1		
Spectral Deviation[1], 350 - 1350nm	<13	%	
Spectral Deviation[1], 400 - 1100nm	<9	%	
Spectral Deviation[1], 300 - 1200nm	<15	%	
Spectral Deviation[1], 730 - 800nm	<12	%	Perovskite bandgap
Spectral Deviation[1], 800 - 855nm	<12	%	Cadmium-Telluride bandgap
Spectral Deviation[1], 1000 - 1100nm	<12	%	Silicon bandgap
Minimum Intensity	1	Suns[2]	On the Coupon
Maximum Intensity	20	Suns[2]	On the Coupon
Spectral Coverage[3], 350 - 1350nm	>95	%	For Reference
Non-Uniformity 55x55mm	<1	%	Class A+
Instability (16 hours @ 1 Sun[2])[4]	<1	%	Class A+
Temporal Instability (STI)[4]	<0.1	%	50Hz sampling over 3s; Exceeds A+
Temporal Instability (LTI, 1000hrs)[4]	<1	%	Class A+
LED PCB Lifetime	>36,000	Hrs	
Depth of Focus	+/-1mm	mm	0.5% change in intensity
Working Distance	123.7	mm	Lens Output to Image Plane
Operating Temperature Range	20-30	°C	Local temp at illuminator module
Temperature Control of Light Source	YES		With TEC module
Electrical Input Voltage	48	V	+/-5%
PC Communication	RS485 and USB		
RS485 Communication Protocol	Modbus RTU		19.2kBd - 230.4kBd
RS485 Connector	Dual RJ45		1 GRN, 1 YEL LED each
USB Communication Protocol	Modbus RTU		Via COM port redirection
USB Connector	USB Type C		
Over Temp Response			Controlled by software
Maximum on-pulse duration	Continuous		
Minimum on-pulse duration	<200	µs	
Maximum trigger frequency	>10	kHz	
Maximum rise time	<100	µs	Time to stable output from trigger
Maximum Time to Stable Output	<10	ms	With changes to intensity set point
Maximum Noise Level	<65	dBA	

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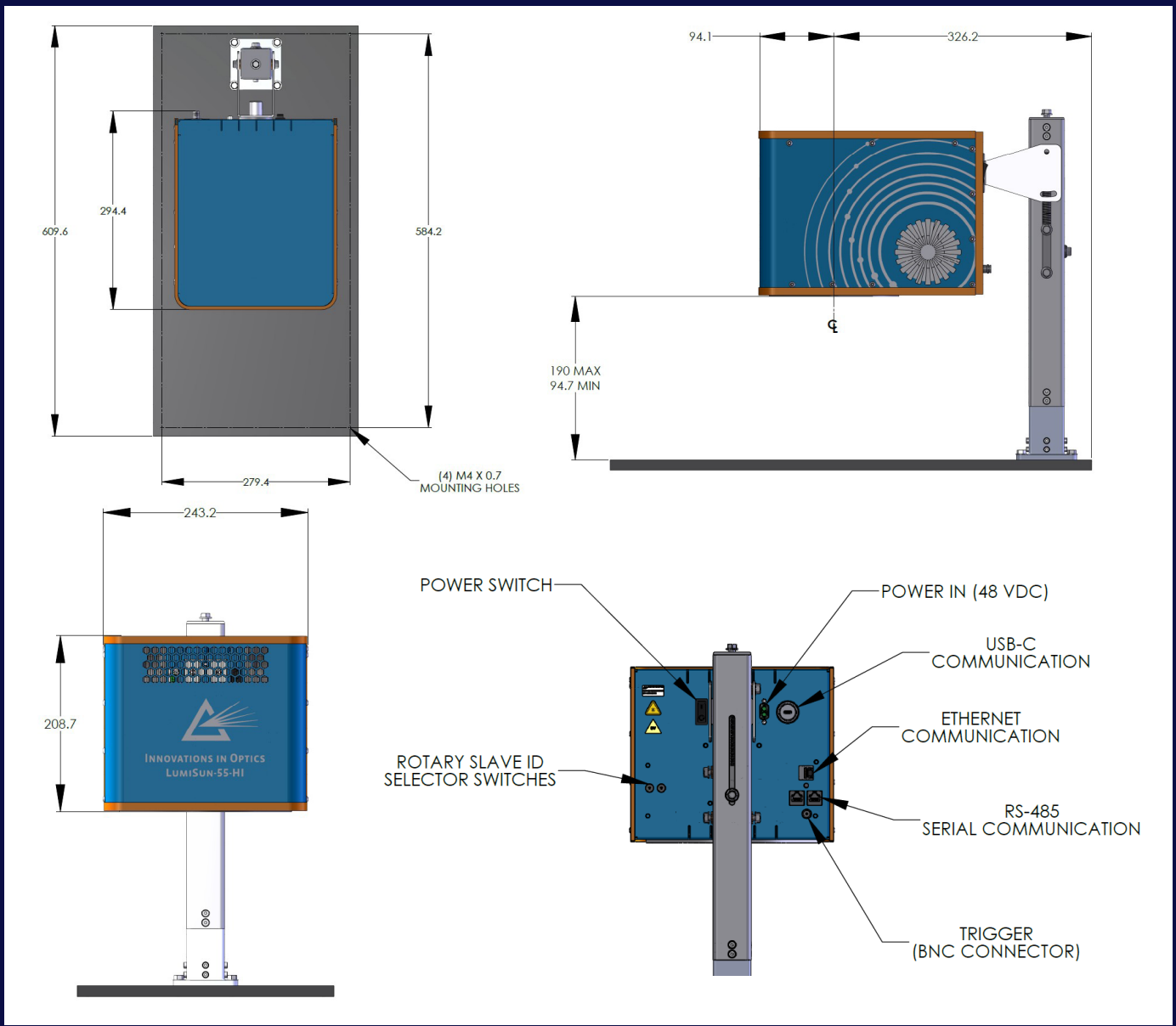
LumiSun-55-HI™ Specifications (cont.)

1. Spectral deviation relative to AM1.5 calculated according to formulas stated in IEC 60904-9 edition 3, section 3.13, and process in section 5.6, replacing wavelength range for that in specification description. Δλ to be 1nm for these calculations

2. Intensity value in suns calculated according to IEC 60904-3 ed. 4 solar AM1.5 Global spectral intensity integrated over the relevant spectral band as defined by specification #2, with 1 sun having an equivalent total integrated power over that spectral band to the reference solar spectrum

3. Spectral Coverage relative to AM1.5 calculated according to formulas stated in IEC 60904-9 edition 3, section 3.12, and process in section 5.5, replacing wavelength range for that in specification description. Δλ λ to be 1nm for these calculations

4. Instability calculated based on IEC 60904-9 ed. 3 formula as (max-min)/(max+min)



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LumiSun-55-HI™ Uniformity

0.999	0.999	0.999	0.998	0.998	1	0.999	0.998
0.999	0.997	0.997	0.996	0.996	0.997	0.997	0.999
0.998	0.996	0.995	0.994	0.994	0.996	0.997	0.999
0.999	0.996	0.994	0.991	0.992	0.994	0.997	0.999
0.999	0.996	0.995	0.992	0.992	0.994	0.997	1
1	0.996	0.995	0.994	0.993	0.995	0.997	0.997
0.999	0.998	0.997	0.997	0.996	0.997	0.997	0.999
0.999	1	0.999	0.999	0.999	1	0.999	0.999

Class A+ non-uniformity over entire illumination field

Also excellent for each wavelength independently

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