





# LED SOLAR SIMULATION

Class AAA Engineered Sunlight™ The World's Most Configurable Solar Replication

# CONTENTS

3	LED illumination
4	pico. small area solar simulator
6	pico. software
8	sunbrick. large area solar simulator
10	pico. specifications
12	sunbrick. specifications

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# BENEFITS OF



Minimal warm-up time





No explosive bulb failure



No manual calibration

LEDs are solid-state devices that require minimal maintenance, nor do they have the hazards related to pressurized gas lamps.

LED solar simulators provide enhanced functionality including dynamic output that enables a greater breadth of research capabilities in a wide variety of fields such as solar energy (photovoltaics), aerospace, photochemistry, material testing, wearables, and more.



# **pico.™** SMALL AREA **SOLAR SIMULATOR**

The Pico provides world-class controllable illumination, complete with software-controlled spectra and traceable calibration—all with no bulbs, filters, or moving parts.

The Pico can replicate the standard solar spectra including AM1.5G and AM0 – AM10 with the click of a button. It can also account for geography, season, and specific times of day with our One-Click Sun<sup>™</sup> proprietary software. Minimal warm-up time and long LED lifetimes mean the Pico is both nimble and built to last.



Directed Optics



Lambertian Optics

# CLASS AAA

The standards that govern solar simulation are JIS C 8904-9, IEC 60904-9, and ASTM-E927, and are used to determine the quality and accuracy of a solar simulator's illumination.



The spectral match is a measure of accuracy between the output of a solar simulator and a target spectra. It is evaluated using the amount of light produced within specific wavelength bands compared to the standard spectra and reported as a "spectral mismatch".

All G2V Pico models produce a AM1.5G spectral mismatch < 5%, exceeding the ASTM E927 Class A standard by a factor of 5x.





## **Class A Spatial Non-Uniformity**

Spatial non-uniformity describes the distribution and consistency of irradiance over an area. It is calculated from the difference of the maximum and minimum irradiance values in an area.

With a Pico, you receive one sun-equivalent irradiance with a spatial non-uniformity < 2% in a 2.5 cm x 2.5 cm square area.



### **Class A Temporal Instability**

Temporal instability measures the consistency of light output over a period of time. The Pico's short-term temporal instability (STI) (over 100 seconds) is < 0.1%, and its long-term temporal instability (LTI) (over 1000 hours) is < 2%, exceeding IEC 60904-9 Class A requirements for STI and LTI, as well as the general Class A temporal instability requirements of ASTM E927 and JIS C 8904-9.





# **SOFTWARE CONTROLLED** solar simulation for pico.



## IV UPGRADE MODULE

Offering plug-and-play power conversion efficiency measurement and report generation for solar cell characterization, the IV Module includes software as well as an integrated source-meter unit (providing between -13 V and +13 V with 16 bit resolution, and between -30 mA and +30 mA with 4  $\mu$ A resolution). The IV Module seeks measurement precision, as the module seeks your target voltage through an iterative process until converging and generating a high-accuracy IV pair. Automated analytical approximations fit the data and then report key solar cell parameters.





### LOW-RESOLUTION EQE UPGRADE MODULE

The low-resolution EQE provides wavelength-resolved measurements of your solar cell's performance under active conditions, with individual narrow-band LEDs providing arbitrary perturbation strength. Run with a low-noise variable-gain amplifier with variable integration time, the module can detect and amplify device currents over 16,000x.





Enables complete programmable intensity control with up to 32 tunable channels for arbitrary spectral design. Load programmable spectral presets from AM0-AM10, and AM1.5G. Enjoy the freedom to save, download, and load your own spectral functions.



One-Click Sun™ software enables users to replicate irradiance and spectrum based on geography, season, and time of day. Our software was crafted to be simple, accurate, and easily configurable. Select any point in the world to within 1° Latitude/Longitude, and let our software simulate a realistic day-night cycle, at up to 500x regular speed.

# Sunbrick. LARGE AREA SOLAR SIMULATOR

# THE SUNBRICK MAKES LARGE-AREA SOLAR SIMULATION **QUICK & EASY**

With world-class controllable illumination, softwarecontrolled spectra and traceable calibration—all with no bulbs or filters.

The Sunbrick can accommodate a wide range of applications with its modular design, allowing Sunbrick arrays to be mounted in a grid pattern to provide highquality solar replication over very large areas.

The Sunbrick outshines the competition through its exceptional light quality, durability, ease of use, and ability to integrate into the most advanced research.



## EXCEEDING CLASS A



Sunbrick offers users a high precision spectral mismatch of < 5%, exceeding the ASTM-E927 Class A standard by a factor of 5x.

### **MODULAR SCALABILITY**

With its innovative tileable design, the Sunbrick is scalable to whatever illumination area you require. Each brick illuminates a Class A uniform 20 cm x 20 cm area at a 50 cm working distance.

Multiple Sunbricks are easily mounted and networked together in arrays to provide illumination as large as required.

A 4-brick array (2x2) provides a solution for a 40 cm x 40 cm Class A area, with even larger custom configurations available.

### CUSTOM

Configurations available



# pico.<sup>™</sup>

### SPECIFICATIONS



SPECIFICATIONS	LAM-BASE	DIR-BASE	DIR-BASE-UV	DIR-BASE- UV-NIR	DIR-BASE-NIR		
ASTM E927 / IEC 60904-9 / JIS C 8904-9	Exceeds Class AAA Specifications						
Spectral Mis-match	<5%	<5%	<5%	<5%	<5%		
Spatial Non-uniformity	<2%	<2%	<2%	<2%	<2%		
Temporal Instability	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%		
Spectral Range (nm)	400 - 1100	400 - 1100	350 - 1100	350 - 1500	400 - 1500		
SKU Spectral Code	LMN	LMN	KLMN	KLMNO	LMNO		
Working Distance	1 cm	7 cm	7 cm	7 cm	7 cm		
Tuneable Channels	27	26	28	32	30		
Calibrated Output Irradiance (1.0 suns AM1.5G)	75.9	75.9	84.7	79.1	87.9		
GENERAL SPECIFICATIONS		VALUE		UNITS	NOTES		
Type of Solar Simulator	Steady-state			N/A	Uses continuous-wave LEDs		
Mounting Configuration	Two 1/4"-20-threaded holes separated by 100 m	separated by 4" (imperial mod nm (metric model). Arbitrary ori	el) or two M6-threaded holes entation is possible.	N/A			
Intensity Adjustment Range	0 - 110			%	0.1 - 1.1 suns AM1.5G in 0.1 increments		
Class A Illumination Area	2.5 x 2.5			cm			
Safe Operating Temperature	15 - 40			°C			
Angle of Emission	< 30 or < 120			0	Directed or Lambertian		
Size	(21.5 x 22.3 x 11.6) or (27.5 x 22.3 x 11.6)			cm	Directed or Lambertian		
Weight	2.2			kg	4.4 lbs (illumination head)		
Unit Lifetime	10,000			hours	LED lifetime ranges from 10,000 to 100,000		
Warranty	2			year	Optional extension available		
SKU LEGEND FOR SPECTRAL REGIONS							
Spectral Code	К	L	M	N	0		
Spectral Range (nm)	350 - 400	400 - 700	700 - 900	900 - 1100	1100 - 1500		

For more detailed, individual SKU specifications, contact sales@g2voptics.com



#### PICO - AM1.5G (KLMNO)



#### PICO - AM0 (KLMNO)



#### AVAILABLE UPGRADES



#### Variable Module

Enables control of up to 32 tunable channels and includes One-Click Sun™ Software as well as our Python API.



#### Low Resolution EQE Module

Provides wavelength resolved measurements of your device's quantum efficiency under active conditions.



#### IV Module

Power conversion efficiency measurement and report generation for solar cell characterization.



#### Support Stand

Strong aluminum structure that mounts your Pico with vertical alignment.





Note: Upgrade modules require USB keyboard, USB mouse, and HDMI-capable monitor for setup (not included with purchase). Connecting a Pico to a network allows access via browser by any computer on the network.

# sunbrick.<sup>™</sup>

### SPECIFICATIONS



SPECIFICATIONS	BASE	BASE - UV	BASE - NIR	BASE - NIR+			
ASTM E927 / IEC 60904-9 / JIS C 8904-9	Exceeds Class AAA Specifications						
Spectral Mis-match	<5%	<5%	<5%	<5%			
Spatial Non-uniformity	<2%	<2%	<2%	<2%			
Temporal Instability	<0.1%	<0.1%	<0.1%	<0.1%			
Spectral Range (nm)	400 - 1100	350 - 1200	350 - 1500	350 - 1500			
SKU Spectral Code	LMN	KLMN	LMNO	LMNO+			
Tuneable Channels	34	35	32	36			
Calibrated Output Irradiance (1.0 suns AM1.5G)	75.9	79.1	84.7	84.7			
GENERAL SPECIFICATIONS	VALUE			UNITS	NOTES		
Type of Solar Simulator	Steady-state			N/A	Uses continuous-w	ave LEDs	
Mounting Configuration	Vertical in stand			N/A			
Intensity Adjustment Range	0 - 110			%	0.1 - 1.1 suns AM1.5G in 0.1 increments		
Class A Illumination Area	20 x 20			cm	400 cm <sup>2</sup>		
Nominal Working Distance	50			cm	Coplanar with mirror edges		
Safe Operating Temperature	15 - 40			°C			
Angular of Emission	< 30			0			
Ambient %Relative Humidity	30 - 60			%			
Size	25 x 25 x 39			cm	Does not include mounting stand		
Weight	10			kg	Does not include mounting stand		
I/O Connectors	Micro USB B			N/A			
I/O Comm/Control Protocol	Serial			N/A			
Software Compatibility	Windows 7 or later			N/A			
Network Connector	D89, male			N/A			
Power Connector	D15, male			N/A			
Unit Lifetime	10,000			hours	LED lifetime ranges from 10,000 to 100,000		
Warranty	2			year			
SKU LEGEND FOR SPECTRAL REGIONS							
Spectral Code	K	L	M	N	0		
Spectral Range (nm)	350 - 400	400 - 700	700 - 900	900 - 1100	1100 - 1500		

For more detailed, individual SKU specifications, contact sales@g2voptics.com



# sunbrick.<sup>™</sup>

### SPECIFICATIONS

#### SUNBRICK - AM0 (LMNO+)



#### SUNBRICK - AM1.5G (LMNO+)



#### INCLUDED



#### Variable Module

Software enables control of up to 36 tunable channels and includes our Python API and LabView DLL.



Strong aluminum structure that supports your Sunbrick for optimal functionality.





The sun powers all of life on Earth. Engineering its energy and light to invent, test, and apply technology for the betterment of humanity is crucial.







G2V Optics (G2V) was founded to apply innovative technology and datadriven, collaborative design toward solutions for this generation's global issues. Starting with the highest precision spectral replication ever produced, G2V now provides a suite of advanced lighting products to push the boundaries of research in renewable energy, aerospace, material science, and aerospace.

Our software-controlled, adjustable-spectra LED solar simulators enable researchers to unlock the potential of tomorrow's solar-powered devices. Our highly-configurable lights accommodate a wide variety of test applications and setups by replicating geographic conditions of sunlight anywhere on Earth or beyond.

When spectral precision matters for your research, let G2V Engineer the Sun™.



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