Light sources for solar simulation

Solar simulator, 40 x 40 mm² field

- *1 sun irradiance for 40 x 40 mm² uniform field*
- *Compact size*
- *Air mass 1.5G or air mass 0 solar spectrum*
- *UV version available*

This solar simulator is a low-cost alternative to the fully-featured and more expensive simulators whenever only a small illuminated field is required. The optical system of this source produces a uniform, collimated output beam with a 40 mm² square field.

Compact design

One of the design criteria for this source was ease of use. We departed from our modular and flexible line of light sources and designed a completely integrated system. The lamp, electronics and condensing optics are in a single enclosure. The lamp is held in a pre-aligned base i.e. no need for lamp adjustments and no alignments for lamp replacement. The highly regulated power supply provides pre-set current to the Xenon lamp. You don't need to adjust the lamp current. Simply install the lamp, turn on the source and you are ready to begin working.

Three versions

We offer three solar simulator versions which differ in the filters being installed:
The version with AM 1.5G filter comes with N-BK7 optics and meets Class ABA according IEC and ASTM standards. The version with AM 0 filter (outer space spectrum) provides output from 250 - 2500 nm and reduces the intensity of the Xenon lines in the 0.8 to1μm region. Both simulators come with a 90° beam turner and Al-mirror. The beam turner can be rotated 360° about the optical axis to produce a horizontal or vertical beam only using an Allen wrench.
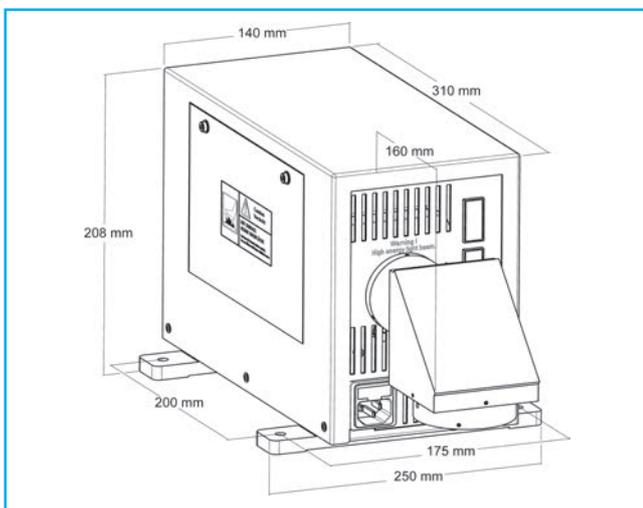

The UV source comes with a UVB/UVA dichroic mirror which turns the output by 90°. The mirror reflects 280 – 400 nm while reducing the VIS and IR output of the lamp to shape the spectral output. Optional UV blocking filters can be used behind the dichroic to further shape the spectral output, for example an atmospheric edge filter, which simulates the UV edge of the sun. For transmittance/reflectance curves of the optional UV filters go to www.lot-qd.com/lightsources ("Low cost solar simulator, up to 35 mm beam diameter").

Spectral match

High pressure Xe arc lamps are excellent artificial sources to simulate sun light. The color temperature of Xe arc lamp is a close match to the solar temperature which results in very similar spectra in the UV and VIS although there are some Xe emission lines in the near IR. No solar simulator accurately matches the sun's spectrum and the Xe lamp spectrum changes to some extend with lamp age. The terrestrial sun spectrum itself greatly varies with sun altitude and atmospheric constituents. Therefore reference standards have been established. Several spectral sets have been adopted by IEC and ASTM. The Xe lamp spectrum must be filtered to match various atmospheric conditions. Our solar simulator includes filters which give good matching to AMO and AM 1.5G standard spectra defined by IEC or ASTM.

Shutter options

The standard source comes with a variable attenuator to maintain constant light output during lamp life. The attenuator allows a wide range of reproducible irradiance settings and can also close off the beam, but is not intended to use as a shutter. We offer two shutter options: a manual slide shutter and an electro-

LOT Quantum Design
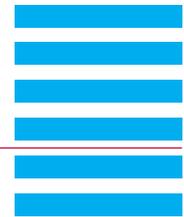
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Solar simulator, 40 x 40 mm² field

nic shutter. The shutters are integrated into the optical system. A stand-alone electrical shutter driver provides an open/close switch and a TTL input, allowing control from a computer or other source. As an option we offer a relais and control software to operate the shutter driver via USB.

Measurement of solar simulator radiation

For total power measurements a black body type detector is required, calibrated in power per unit area (W/m^2) whose response is essentially independent of wavelength. In practice a thermopile detector with quartz window is sufficient for simulator output measurements.

For solar cell testing the most straight forward method is to use a calibrated solar cell of the same general type as the cell being used. At best the measurement is made with a sensor of essentially the same spectral response as the test cell. This allows for variation in spectral output of the source without significant errors in the results.

For applications where only a part of the sun spectrum is active, greater accuracy results if only the spectral region of interest is measured. This corrects for the spectral difference between the simulated and the natural sun. Use a filter with a known spectral transmission in conjunction with a calibrated thermopile detector. We offer the ILT1400 handheld radiometer with a broadband thermopile detector with flat response measuring solar irradiance from 200 – 2100 nm. The ILT1400 is a versatile laboratory light meter which is completely flexible with plug-in "smart" detectors covering UV to IR wavelength, NIST traceable calibrated and displayed in correct optical units.

Specifications

Test plane size	40 x 40 mm²
Irradiance non-uniformity	5 %, class B[1][2]
Beam collimation	± 4° (envelope)
Working distance	170 mm (recommended)
Irradiance	1 sun (min.) @ working distance
Spectral match	Class A[1][2] with AM1.5G filter
UV system	UVB/UVA dichroic mirror, 280 - 400 nm
Temporal stability	Class A[1]
Lamp type	Xenon short arc, 100 W, ozone free, average life: 1000 h
AC Input	100 - 240 VAC (± 10%) , 50 - 60 Hz

[1] IEC (60904-9, 2007)
[2] ASTM (E927-05)

Solar simulator with shutter
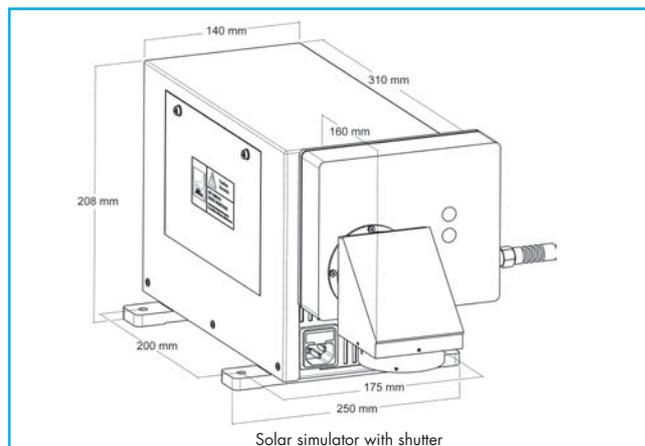
Ordering information full spectrum solar simulator

LS0500	Solar simulator with integrated AM 1.5G filter
LS0501	Solar simulator with integrated AM 0 filter
LS0Z158	Manual shutter option
LS0Z163	Electronic shutter option
Accessories	
LSZ165	Relais and control software for external control of electronic shutter via USB interface
LS0041	Calibrated Si reference cell, open version
LS0042	Calibrated Si reference cell, shunted version
ILT-ILT1400	Handheld radiometer
ILT-SEL623/ QNDS1/W	Solar thermopile detector 200 – 2100 nm

For specifications of the reference cell go to www.lot-qd.com/lightsources, „Solar simulators", „Reference solar cells", for specification of the radiometer got to www.lot-qd.com/lightmeters, „ILT 1400 USB".

Replacement lamp	
LSB51R	100 W Xe arc lamp, ozone free

Ordering information UV solar simulator

LS0505	UV solar simulator with UVB/UVA 90° beam turner
Filters for UV solar simulator	
LSZ176	Atmospheric edge filter, 290 - 4400 nm
LSZ177	VIS-IR blocking filter, 290 - 400 nm, 650 - 800 nm
LSZ178	UVC blocking filter, 280 - 4400 nm
LSZ179	UVB/C blocking filter, 320 - 480 nm, 700 - 4400 nm
LSZ323	Open filter holder for 50 mm square or diameter filters
Replacement lamp	
LSB51R	100 W Xe arc lamp, ozone free

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For your local contact click at: **www.lot-qd.com**

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