Sun 2000 Solar Simulators
Cost effective and versatile UV to IR sources

Abet Technologies Model 11048-1 3 kW multi-sun UV solar simulator, customer reconfigurable to a full spectrum 2 suns 300x300 mm field simulator.

Abet Technologies’ Sun 2000 family of solar simulators, characterized by Class B irradiance uniformity performance, covers wide range of illuminated field sizes, 55x55 mm through 400x400 mm, square or rectangular. One sun and High Output models are offered. AM 1.5G spectrum models are complemented by a variety of other spectral offerings: AM 0, AM 1D, AM 1.5 D, AM 2D, Atmospheric UV Edge, and UV C, UV B/C, and UV A/B/C blocked, full spectrum, UV only and spectrum switchable models.
Innovative and complete

The Abet Gen II optical design dramatically increases the percentage of photons reaching the work plane. This higher optical efficiency allows the use of lower power lamps to illuminate a given size field, e.g. more than one AM 1.5G sun is achieved with a 550 W lamp over a 160x160 mm field.

All electronics are packaged in the lamp house – no clutter of high power cables to deal with. A digital shutter timer allowing both manual and external control is included with every unit.

Standard maintenance, lamp or filter replacement, does not require any tools.

Locking indicator dials on all the system controls provide for a reproducible and stable setup.

Most units come with a built-in beam imaging accessory to assist in system alignment.

Clean Cooling

Any dust or dirt particles introduced into an optical system can degrade system performance and shorten the life of critical optical components. Sun 2000 sources utilize a HEPA filtered cooling air to extend the life of the delicate optical components.

Adaptable

Abet Technologies offers a number of spectral and field size options to match your application. The Sun 2000 family standard offerings range from 55x55 mm to 400x400 mm one sun or more uniformly illuminated field versions for Photovoltaic and UV applications.

Standard High Output models offer over 20 AM 1.5G Suns. Higher irradiances are available from concentrated models.

Square and rectangular illuminated field models to match device shapes and sizes.

Up-pointing and horizontal output direction models complement the standard down pointing ones.

Long working distances allow easy interface to glove boxes.

The compact design of the systems, combined with the long working distance optics, leaves the space below these instruments wide open for any sample positioning or testing equipment.

Beyond the standard AM 1.5 and AM 0 filters many other filters are offered to fine tune the spectral characteristics of the source for your particular application.
## Sun 2000 Solar Simulator Specifications, 1 sun models

<table>
<thead>
<tr>
<th>Model #</th>
<th>Field size (mm)</th>
<th>Stability (%)</th>
<th>Uniformity (%)</th>
<th>Lamp (W)</th>
<th>Ozone free</th>
<th>Lamp life (hours)</th>
<th>Working distance (mm typ.)</th>
<th>Irradiance AM 1.5G suns (max. typ.)</th>
<th>AM 1.5G spectral match</th>
</tr>
</thead>
<tbody>
<tr>
<td>11000</td>
<td>55x55</td>
<td>1</td>
<td>5</td>
<td>150</td>
<td>✓</td>
<td>1500</td>
<td>125±25</td>
<td>1.3</td>
<td>A</td>
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<tr>
<td>11016</td>
<td>100x100</td>
<td>1</td>
<td>5</td>
<td>550</td>
<td>✓</td>
<td>1500</td>
<td>100±50</td>
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<td>A</td>
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<tr>
<td>11018</td>
<td>160x160</td>
<td>1</td>
<td>5</td>
<td>550</td>
<td>✓</td>
<td>1500</td>
<td>200±50</td>
<td>1.3</td>
<td>A</td>
</tr>
<tr>
<td>11044</td>
<td>203x203</td>
<td>1</td>
<td>5</td>
<td>1000</td>
<td>✓</td>
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<td>A</td>
</tr>
<tr>
<td>11046</td>
<td>254x254</td>
<td>1</td>
<td>5</td>
<td>1400</td>
<td>✓</td>
<td>1500</td>
<td>200±50</td>
<td>1.3</td>
<td>A</td>
</tr>
<tr>
<td>11047</td>
<td>100x250</td>
<td>1</td>
<td>5</td>
<td>1000</td>
<td>✓</td>
<td>1500</td>
<td>200±50</td>
<td>1.3</td>
<td>A</td>
</tr>
<tr>
<td>11048</td>
<td>300x300</td>
<td>1</td>
<td>5</td>
<td>2000</td>
<td>✓</td>
<td>2000</td>
<td>400±75</td>
<td>1.3</td>
<td>A</td>
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</table>

The Sun 2000 models listed above are most popular with our customers. They deliver around one sun irradiances and limit UV exposure by utilizing an N-BK7 condenser lens. However, if your test needs require a multi-sun level of irradiance see page 11 in this brochure. For systems with UV content matching AM0 or terrestrial atmospheric UV edge see page 12. Pages 14-17 offer similar systems in the Abet Technologies Sun 3000 Class AAA family of Solar Simulators. The above are the most popular field size models. Please let us know if your needs require a different one – many additional square and rectangular shaped field size systems can easily be manufactured.

### Certified

Each Sun 2000 Solar Simulator for which standards exist ships with a performance certificate according to the customer selected standard: ASTM, IEC or JIS.

### Available Options

All models listed above include an AM 1.5G filter for ordering convenience. Other filter options can be substituted or added at the time of ordering. Working distances listed above are typical – many additional solutions are available. In particular, the up-pointing and horizontal output models are often shipped with longer working distances to accommodate a glove box or more complex test bench requirements. The 11088 Photofeedback option can be added to any system to deliver 0.5% stability performance. The 11075 Attenuator Set allows great flexibility in irradiance control for 150-550 W systems.

See the ordering information on page 13 for a list of standard options. Please contact Abet if you need something different.
Sun 2000 Solar Simulators, High Output models

<table>
<thead>
<tr>
<th>Model #</th>
<th>Field size (mm)</th>
<th>Stability (%)</th>
<th>Uniformity (%)</th>
<th>Lamp (W)</th>
<th>Ozone free</th>
<th>Lamp life (hours)</th>
<th>Working distance (mm typ.)</th>
<th>Irradiance AM 1.5G (max. typ.)</th>
<th>AM 1.5G spectral match</th>
</tr>
</thead>
<tbody>
<tr>
<td>11014</td>
<td>55x55</td>
<td>1</td>
<td>5</td>
<td>550</td>
<td>✓</td>
<td>1500</td>
<td>125±25</td>
<td>7</td>
<td>A</td>
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<tr>
<td>11038</td>
<td>55x55</td>
<td>1</td>
<td>5</td>
<td>1000</td>
<td>✓</td>
<td>1500</td>
<td>125±25</td>
<td>12</td>
<td>A</td>
</tr>
<tr>
<td>11040</td>
<td>100x100</td>
<td>1</td>
<td>5</td>
<td>1000</td>
<td>✓</td>
<td>1500</td>
<td>100±50</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>11042</td>
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<td>1500</td>
<td>200±50</td>
<td>2</td>
<td>A</td>
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<tr>
<td>11048</td>
<td>300x300</td>
<td>1</td>
<td>5</td>
<td>3000</td>
<td>✓</td>
<td>1500</td>
<td>400±75</td>
<td>2.1 (3.2)†</td>
<td>A</td>
</tr>
</tbody>
</table>

† With the 14205 field reducer option

The Sun 2000 models listed above are most popular with our customers. They deliver multi-sun irradiances and limit UV exposure by utilizing an N-BK7 condenser lens. For systems with UV content matching AM0 or terrestrial atmospheric UV edge see page 12. Pages 13-16 offer similar systems in the Abet Technologies Sun 3000 Class AAA family of Solar Simulators.

Many other combinations of lamp power levels and field sizes can be easily assembled without any additional engineering charges. For field sizes up to 254x254 mm any of the standard lamps, 150W, 300W, 550W, 1000W, or 1400W can be used, when matched to the appropriate power supply selection, to obtain a wide variety of irradiance levels.

Certified

Each Sun 2000 Solar Simulator for which standards exist ships with a performance certificate according to the customer selected standard: ASTM, IEC or JIS.

Available Options

All models listed above include an AM 1.5G filter for ordering convenience. Other filter options can be substituted or added at the time of ordering.

Working distances listed above are typical – many additional solutions are available. In particular, the up-pointing and horizontal output models are often shipped with longer working distances to accommodate a glove box or more complex test bench requirements.

The 11088 Photofeedback option can be added to any system to deliver 0.5% stability performance.

See the ordering information on page 13 for a list of standard options. Please contact Abet if you need something different.
Sun 2000 Solar Simulators, Full Spectrum and UV models

<table>
<thead>
<tr>
<th>Model #</th>
<th>Spectrum (nm)</th>
<th>Field size (mm)</th>
<th>Stability (%)</th>
<th>Uniformity (%)</th>
<th>Lamp (W)</th>
<th>Ozone free</th>
<th>Lamp life (hours)</th>
<th>Working distance (mm typ.)</th>
<th>Irradiance UV suns (max. typ.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12060-1</td>
<td>280-400</td>
<td>160x160</td>
<td>1</td>
<td>5</td>
<td>1400</td>
<td>✔</td>
<td>1500</td>
<td>200±50</td>
<td>6</td>
</tr>
<tr>
<td>12060-2</td>
<td>280-2500</td>
<td>160x160</td>
<td>1</td>
<td>5</td>
<td>1400</td>
<td>✔</td>
<td>1500</td>
<td>200±50</td>
<td>6</td>
</tr>
<tr>
<td>12060-3</td>
<td>Switchable</td>
<td>160x160</td>
<td>1</td>
<td>5</td>
<td>1400</td>
<td>✔</td>
<td>1500</td>
<td>200±50</td>
<td>6</td>
</tr>
</tbody>
</table>

Any of the SUN 2000 models on the previous and following pages can be ordered as Full Spectrum, UV, or Switchable by adding a -1, -2, or -3 suffix to its model number as shown in the example above. All of these systems are equipped with a Fused Silica condenser lens. The “-1” units replace one of the mirrors with a 280-400 nm Dichroic Reflector to allow accelerated UV aging tests without excessive heating of the test devices. The “-2” Full Spectrum (280-2500 nm) units are often used with an AM 1.5G or AM 0 filter. The “-3” systems allow operation in either mode – full spectrum or 280-400 nm by a simple swap of frame mounted reflectors. This option can be customer added to either “-1” or “-2” models when the need arises.

Certified
Each Sun 2000 Solar Simulator for which standards exist ships with a performance certificate according to the customer selected standard: ASTM, IEC or JIS.

Spectrally corrected
A number of filter options are available for these systems to match their performance to the test requirements: AM 0 filter for extraterrestrial cells, Atmospheric Edge (AE) filter for terrestrial cells with response below 360 nm and for life sciences, UVC, UVB/C, and UVA/B/C blocking filters for material and life sciences.

Available Options
Many combinations of lamp power levels and field sizes can be easily assembled without any additional engineering charges. For field sizes up to 254x254 mm any of the standard lamps, 150W, 300W, 550W, 1000W, or 1400W can be used, when matched to the appropriate power supply selection, to obtain a wide variety of irradiance levels. High UV output “-1” 280-400 nm models are often used for accelerated UV damage testing.

See the ordering information on page 13 for a list of standard options. Please contact Abet if you need something different.
Sun 2000 Specifications

Illumination field……………………………………..55x55 to 400x400 mm
Irradiance……………………………………………….1 to 20 suns
Spectral Match with AM 1.5G, AM 0, AM 1.5D Filters
ASTM……………………………………………………Class A
IEC……………………………………………………..Class A
JIS……………………………………………………..Class A
Temporal Stability
ASTM……………………………………………………Class A
IEC……………………………………………………..Class A
JIS……………………………………………………..Class A
Irradiance uniformity
ASTM……………………………………………………Class B
IEC……………………………………………………..Class B
JIS……………………………………………………..Class B
Ozone-free Xe Arc Lamp (included) …………150 to 3000 W
Typical life ..................................................1500 hours
HEPA filtered cooling fan included
Elapsed Time Meter (included)
Universal Input 90-250V, 50-60Hz, power supply included
Standard Output Direction………………….Down pointing

Abet Technologies regularly continues to upgrade our products, therefore all specifications are subject to change without notice.

Accessories and options
11054 AM 0 filter, 2x2 in.
11056 AM 1.5G filter, 2x2 in.
11058 AM 1.5D filter, 2x2 in.
11057 AM 1D filter, Ø 3 in.
11059 AM 2D filter, Ø 3 in.
11060 UVA/B/C Blocking Filter, Ø 3 in.
11063 AE filter (Atmospheric Edge), Ø 3 in.
12163 AE filter for 300x300 mm systems
11064 UVC Blocking Filter, Ø 3 in.
11065 UVB/C Blocking Filter, Ø 3 in.
11051 Replacement HEPA filter
11068 Beam Attenuator - 21%
11069 Beam Attenuator - 33%
11070 Beam Attenuator - 50%
11071 Beam Attenuator - 60%
11072 Beam Attenuator - 67%
11073 Beam Attenuator - 77%
11075 Attenuator Set - All Six Attenuators
11088 Photofeedback option, 0.5% stability
14205 Field reducer assembly, 300x300 to 200x200 mm
11051 HEPA Filter
12185 System Elevator, Adjustable Height Mount
13014 150 W Xenon Arc Lamp
13020 300 Watt Xenon Arc Lamp, OF
13021 550 Watt Xenon Arc Lamp, OF
13024 1kW Xenon Arc Lamp, OF
13025 1.4kW Xenon Arc Lamp, OF
13026 2.0kW Xenon Arc Lamp, OF
13027 3.0kW Xenon Arc Lamp, OF

Ordering Information

All standard Sun 2000 Solar Simulators include a Lamp, a Universal Input 90-250V Power Supply, an AM 1.5G Filter and a N-BK7 condenser lens. Add “-2” for a Fused Silica condenser lens, “-1” for a 280-400 nm dichroic option, “-3” for a Full Spectrum/280-400 nm convertible unit; add “U” for up-pointing option, “H” for horizontal output.

11000 55x55 mm, 150 W
11014 55x55 mm, 550 W
11038 55x55 mm, 1000 W
11016 110x110 mm, 550 W
11040 110x110 mm, 1000 W
11018 160x160 mm, 550 W
11042 160x160 mm, 1000 W
12060 160x160 mm, 1400 W
11044 203x203 mm, 1000 W

Non-uniformity map of an Abet Technologies model 11016 Solar Simulator, 110x110 mm, 3%.