

Oriel® LCS-100™ Small Area Sol1A

**94011A
94011A-ES**



User's Manual

 **Newport®**

M94011A Rev D

TABLE OF CONTENTS

1 INTRODUCTION 4

2 SAFETY 6

 2.1 UV AND VISIBLE RADIATION 6

 2.2 LAMP EXPLOSION 6

 2.3 OZONE 7

 2.4 ELECTRICAL SHOCK 7

 2.5 EMI 8

 2.6 HEAT 8

 2.7 GENERAL WARNINGS 8

 2.8 GENERAL CAUTIONS 9

 2.9 WARNING SYMBOLS 9

3 UNPACKING AND ASSEMBLING THE SYSTEM 12

 3.1 MODEL 75 HEAVY DUTY MOUNTING ROD 12

 3.2 POST CLAMP AND ANGLE BRACKET 13

 3.3 ANGLE BRACKET MOUNTING TO BOTTOM OF LCS-100™ 13

 3.4 ROD ASSEMBLY 14

4 FILTER INSTALLATION / REPLACEMENT 15

5 LAMP INSTALLATION / REPLACEMENT 17

 5.1 ARC LAMPS 17

6 OPERATION 21

 6.1 FUSE CHANGE FOR 220VAC 21

 6.2 MOUNTING OPTIONS 22

 6.3 LAMP START 23

 6.4 SHUTTER 24

 6.5 IRRADIANCE ADJUSTMENT 25

7 TROUBLESHOOTING 26

8 SPECIFICATIONS AND CERTIFICATIONS 27

9 WARRANTY & SERVICE 30

 CONTACTING ORIEL® INSTRUMENTS 30

 REQUEST FOR ASSISTANCE / SERVICE 30

 REPAIR SERVICE 31

 NON-WARRANTY REPAIR 31

 WARRANTY REPAIR 31

 LOANER / DEMO MATERIAL 32

LIST OF TABLES

Typical Output Power from LCS-100™ Solar Simulator 28

LIST OF FIGURES

Figure 1: LCS-100™ Model 94011A shown with optional SA-12 Mount Plate and (4) 20-22-005 Leveling Feet 5

Figure 2: LCS-100™ Model 94011A-ES shown with optional SA-12 Mount Plate 5

Figure 3: Model 75 Rod Mounting 12

Figure 4: 90 Degree angle bracket to Post Clamp assembly 13

Figure 5: 90 Degree angle bracket assembly to bottom of unit..... 13

Figure 6: Rod assembly 14

Figure 7: Filter retention thumbscrews 15

Figure 8: Filter assembly insertion and removal..... 16

Figure 9: Filter assembly engagement 16

Figure 10: Lamp cage retention cover and thumbscrew 17

Figure 11: Lamp retaining clip and retaining posts..... 18

Figure 12: Lamp handling, insertion, and removal 18

Figure 13: Lamp seating..... 19

Figure 14: Lamp held while retaining clip engaged 19

Figure 15: Lamp connector engagement 20

Figure 16: Lamp mounted properly in its cage 20

Figure 17: Fuse replacement 21

Figure 18: 94011A Dimensions 22

Figure 19: 94011A-ES Dimensions 23

Figure 20: Manual Shutter Knob 24

Figure 21: Spectral output of LCS-100™ Solar Simulator with the AM1.5G filter 28

Figure 22: Spectral output of LCS-100™ Solar Simulator with AM0 filter in place of AM1.5G filter 29

Figure 23: Certification data from 94011A Solar Simulator showing the Class A spectral match 29

1 INTRODUCTION

The Oriel® LCS-100™ Small Area Sol1A Series is an integrated, compact, and easy to operate Solar Simulator.

The Oriel® LCS-100™ consists of:

- PN 603402: light source assembly containing:
 - Factory-preset power supply ignitor;
 - Lamp housing with a pre-aligned lamp mount;
 - Fan assembly with adaptive speed control for stable output;
 - Safety interlocks and thermal cutout protection.
- PN 90045340: mounted optics containing:
 - Beam homogenizer;
 - 90 degree beam turner, for downward, upward, and side directing.
- PN 81088A-LCS: AM1.5G Filter (AM0 or AM Direct filter optional accessories).
- PN 6252: 100W Ozone Free Xenon lamp with integral elliptical reflector.
- PN 75: Heavy Duty 14" Damped Rod for Working Distance adjustment, inch and metric mount.
- PN 370-RC: Post Clamp Assembly.
- PN 90056950: Oriel® 1.5" Series flange at input of 90 degree beam turner.
- PN 90-11-042 & 90-11-049: hex wrenches: 1/16", 3/16", respectively.
- Certificate of Compliance to IEC and ASTM Standards ABB rating.

All that is required is mounting the adjustable mounting rod, filter and lamp, plugging in the power cord, switching on the source and adjusting the Irradiance at the working height.

LCS-100™ Series Solar Simulators

94011A	LCS-100™ Solar Simulator, Manual Shutter only
94011A-ES	LCS-100™ Solar Simulator, Manual and Motorized Safety Shutter

Accessories

6252	Replacement 100 W Xenon lamp assembly
81011-LCS	2" Square AM0 Filter mounted in frame
81389-LCS	2" Square AM Direct Filter mounted in frame
SA2-11 (M-SA2-11)	12" x 12" (300 x 300mm) Solid Aluminum Plate
SA2-12 (M-SA2-12)	24" x 12" (600 x 300mm) Solid Aluminum Plate
20-22-005	LEVELER 1/4-20 X 1 Length Leveling foot for use with Inch Plate, 4 required
91150V	Reference Cell and Meter System
PVIV-1A	1 Amp I-V Measurement Source Meter, Software and Cables



Figure 1: LCS-100™ Model 94011A shown with optional SA-12 Mount Plate and (4) 20-22-005 Leveling Feet

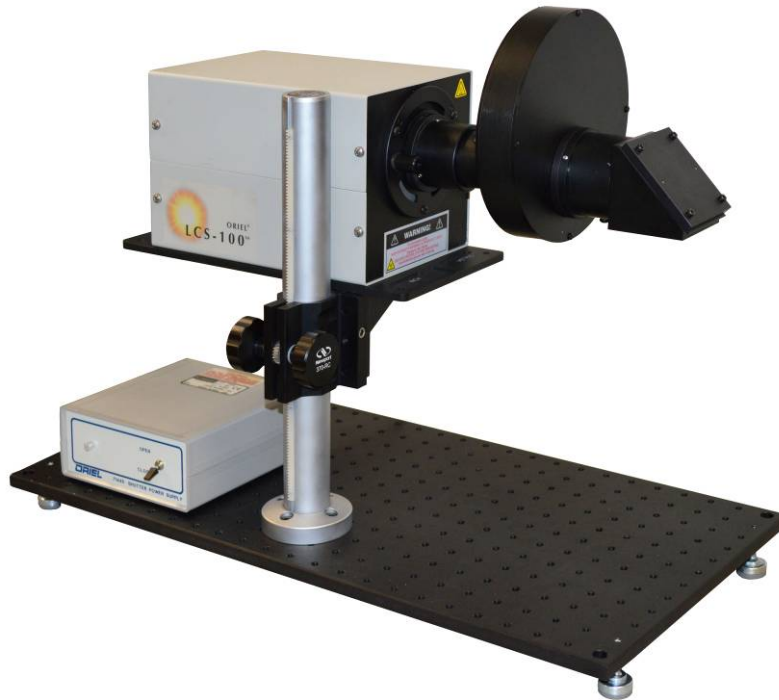


Figure 2: LCS-100™ Model 94011A-ES shown with optional SA-12 Mount Plate and (4) 20-22-005 Leveling Feet

2 SAFETY

SUMMARY OF HAZARDS

The hazards encountered in the operation of these illuminator systems are:

- Radiation
- Lamp explosion
- Ozone
- Electrical shock
- EMI
- Heat



The interlock system is designed for your safety. Do not defeat the interlocks.

2.1 UV AND VISIBLE RADIATION



The high intensity UV and VIS radiation of the lamp can permanently damage the cornea, lens, and retina of the eye, even causing blindness. This damage may not be immediately apparent. The deep UV is absorbed in the cornea or eye fluids; focused UV, VIS, and NIR can damage the retina. Normal blink reaction to visible light may not be adequate protection, and a beam of invisible UV or NIR (produced by spectral filtering) can be most dangerous, as the blink response is not induced. UV radiation can also cause painful sunburn, and with prolonged exposure, serious burns.

Recommendations:

1. Never look directly into the output beam from an arc lamp housing.
2. Do not look at the specular (mirror) reflection of the beam.
3. Always wear UV protective eyewear or facemask, and adequate protection for exposed areas of skin.

2.2 LAMP EXPLOSION

When Xenon, Mercury and Mercury-Xenon arc lamps are cold, they are under several atmospheres of pressure and may explode due to internal strains or physical abuse. When hot, all lamps are under a pressure of many atmospheres and the **possibility of violent explosion** exists. Fingerprints and other contaminants left on the lamp cause a deterioration of the envelope during operation and may lead to lamp explosion.

Recommendations:

1. Do not handle a bare arc lamp without safety goggles and adequate protection for exposed areas of skin.
2. Wear gloves when handling a lamp. Do not touch the lamp envelope with your fingers.

3. Clean the lamp envelope thoroughly with alcohol or a dilute solution of detergent and water if it comes in contact with skin.
4. Attach a cover plate over the output port of any illuminator that will be used without the output enclosed, before operation.

2.3 OZONE

Shortwave ultraviolet radiation photolyses oxygen to produce ozone - O₃. Relatively low concentrations of ozone can cause nasal dryness and a burning sensation in the throat, headaches, nausea, and irritation of the mucous membranes.

A 150 W UV arc lamp can contribute more than 1 part ozone per million to the cooling air system. This may be of little consequence in a well-ventilated area, but some people are very sensitive to ozone and long term effects are not well documented. Noticeable symptoms for most people appear at around 0.3 - 0.5 ppm.

Recommended maximum exposures are typically:
0.1 ppm for 8 hours exposure
2 ppm or a 2 hour exposure

Recommendations:

1. Use an ozone free lamp unless you need the shortwave UV.
2. Vent the cooling air stream to atmosphere (with a low resistance vent path). Do not vent ozone into a small, enclosed room.
3. Use an Oriol Ozone Eater™.

2.4 ELECTRICAL SHOCK



When the 94011A(-ES) is operated as intended, the interlock system and the package design eliminate risk of electrical shock.

Be aware that a high transitory voltage is used to ignite the lamp and, before ignition, the lamp terminals have a potential difference of up to 200 V. This voltage is dangerous. If there is any concern about the interlock system, great care is required.

Recommendations:

1. Disconnect the illuminator from the ac power mains before removing the cover or optics assembly.
2. Keep personnel clear of all exposed terminals.
3. Make sure all connections are securely made and check the polarity before starting a lamp.

4. Do not handle lamp leads during lamp ignition.

2.5 EMI

The 94011A(-ES) housing contains EMI (Electro Magnetic Interference) under normal operating conditions. However, ignition of an arc lamp requires high voltage pulses to break the lamp down and a high current dump (10's of Amps discharge) to sustain the arc. Arc lamp ignition creates significant electromagnetic energy. The high level of EMI integrity of the source contains most of this transient energy, but additional earthing, careful cable routing, and EMI shielding may be necessary to protect sensitive digital circuitry from these events.

Recommendations:

1. Start the arc lamp before powering nearby computer systems.
2. Keep the computer at least 2 feet away from the ignitor/power supply.
3. Use a different outlet and line for the computer and ignitor/power supply.

2.6 HEAT



The lamps become very hot during operation, and may remain so for many minutes after being shut off.

Recommendations:

1. The fan will remain On for 2 minutes after lamp turn off, after which the power cord can be removed. Wait at least 10 minutes after turning off the lamp before removing the housing top cover to access the lamp.
2. Approach the lamp as if it were hot under any circumstances.
3. Allow at least 2 inches of clearance near the fan opening and ventilation slots for adequate cooling of the lamp and power supply.

2.7 GENERAL WARNINGS

Observe these general warnings when operating or servicing this equipment:

- Heed all warnings on the unit and in the operating instructions.
- Do not use this equipment in or near water.
- This equipment is grounded through the grounding conductor of the power cord.

- Route power cords and other cables so they are not likely to be damaged.
- Disconnect power before cleaning the equipment. Do not use liquid or aerosol cleaners; use only a damp lint-free cloth.
- Lockout all electrical power sources before servicing the equipment.
- To avoid fire hazard, use only the specified fuse(s) with the correct type number, voltage and current ratings as referenced in the appropriate locations in the service instructions or on the equipment. Only qualified service personnel should replace fuses.
- To avoid explosion, do not operate this equipment in an explosive atmosphere.
- Qualified service personnel should perform safety checks after any service.

2.8 GENERAL CAUTIONS

Observe these cautions when operating or servicing this equipment:

- If this equipment is used in a manner not specified in this manual, the protection provided by this equipment may be impaired.
- Do not block ventilation openings.
- Do not position this product in such a manner that would make it difficult to disconnect the power cord.
- Use only the specified replacement parts.
- Follow precautions for static sensitive devices when handling this equipment.
- This product should only be powered as described in the manual.
- Aside from the lamp and filter holder, there are no operator serviceable parts inside - arc lamp maintenance is to be performed by a responsible body that has read, understands and follows the precautions in this manual.
- To prevent damage to the equipment, read the instructions in the equipment manual for proper input voltage.

2.9 WARNING SYMBOLS

The following terms and symbols are used in this documentation and also appear on the LCS-100™ Small area Sol1A where safety-related issues occur.

General Warning or Caution



The Exclamation Symbol in the figure above appears in Warning and Caution content throughout this document. This symbol designates a matter in which personal injury or damage to the equipment is possible.

Electric Shock



The Electrical Shock Symbol in the figure above appears throughout this manual. This symbol indicates a hazard arising from dangerous voltage. Any mishandling could result in irreparable damage to the equipment, and personal injury or death.

Caution, Hot Surface



The Caution, Hot Surface Symbol in the figure above appears on the 94011A(-ES) and throughout this manual. This symbol indicates a burn hazard arising from elevated temperatures.

European Union CE Mark



The presence of the CE Mark on Newport Corporation equipment means that it has been designed, tested and certified as complying with all applicable European Union (CE) regulations and recommendations.

Alternating voltage symbol



This international symbol designates an alternating voltage or current.

Waste Electrical and Electronic Equipment (WEEE)



This symbol on the product or on its packaging indicates that this product must not be disposed of with regular waste. Instead, it is the user responsibility to dispose of waste equipment according to the local laws. The separate collection and recycling of the waste equipment at the time of

disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For information about where the user can drop off the waste equipment for recycling, please contact your local Newport Corporation representative.

Protective Conductor Terminal



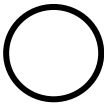
The protective conductor terminal symbol in the above figure identifies the location of the bonding terminal inside the unit, which is bonded to conductive accessible parts of the enclosure for safety purposes.

ON



The ON symbol in the above figure indicates the ON position of the power switch, which is located above the power cord.

OFF



The OFF symbol in the above figure indicates the OFF position of the power switch, which is located above the power cord.

3 UNPACKING AND ASSEMBLING THE SYSTEM

The optics beam turner output port was covered for its protection during transportation. Before operating, the plastic protector **must be removed**. Save the plastic protector in case you need to store or transport the unit in the future.

The preferred mounting configuration for the illuminator is mounted to an optical table or breadboard type of mount plate using the Newport Model 75 Mounting Rod. This rod has 4 mount holes that are spaced to be compatible with inch and metric (25mm) holes. This rod provides the quickest approach to fine-tune the height while maintaining rotational and planar alignment with the work plane. For additional mounting configurations, see Section 6.3.

3.1 MODEL 75 HEAVY DUTY MOUNTING ROD

Remove the Newport Model 75 Mounting Rod from its packaging. Use the (4) supplied 1/4 - 20 x 5/8" or (4) M6 x 16 screws to mount the Rod to a suitable location on an optical table or optional baseplate. Make sure the nylon rack is facing the operator position.

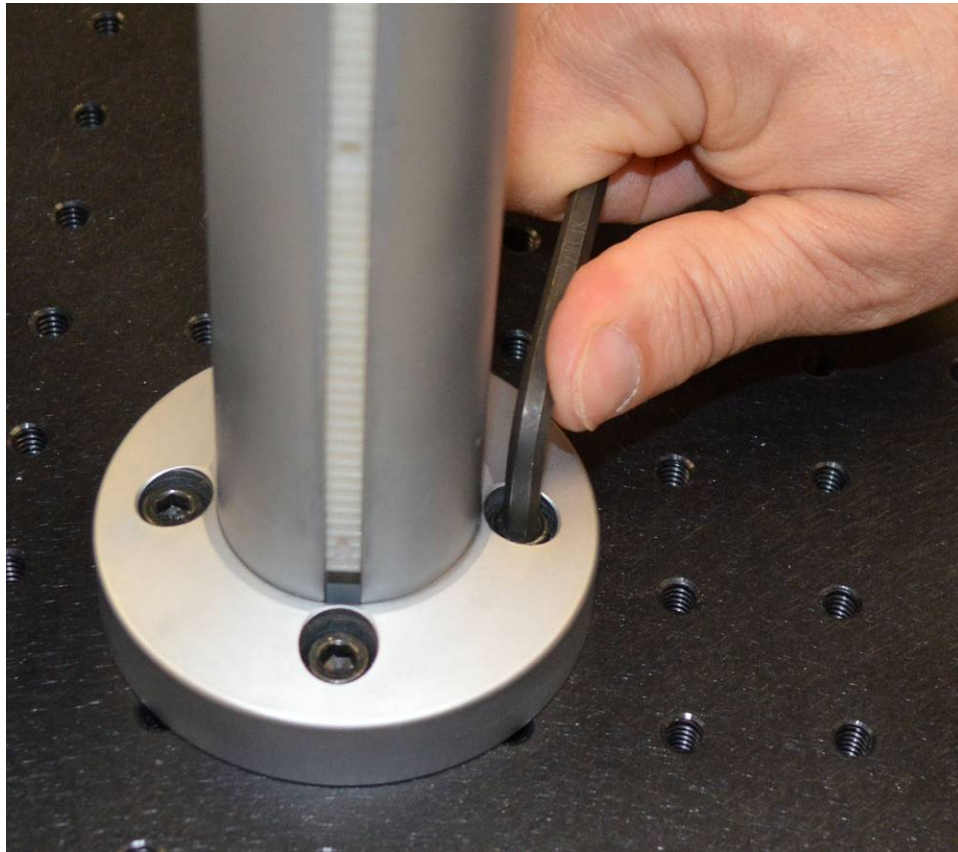


Figure 3: Model 75 Rod Mounting

3.2 POST CLAMP AND ANGLE BRACKET

Remove the Newport Model **370-RC** Post Clamp and **360-90** 90 Degree Angle Bracket from their packaging. Use the (4) supplied 1/4 - 20 x 5/8" screws, (4) split lock washers, and (4) flat washers to attach them as shown. The knob with the model number on it will be used to loosen the clamp. This works better for a right-handed person when it is on the right side, assembled as shown.



Figure 4: 90 Degree angle bracket to Post Clamp assembly

3.3 ANGLE BRACKET MOUNTING TO BOTTOM OF LCS-100™

Turn the **LCS-100™** unit upside down on a clean non-marring surface. Use the supplied 1/4 - 20 x 7/8" screws, 1 split lock washer, and 1 flat washer to attach them as shown. Note that if the user prefers, it can be mounted on the opposite side from that which is shown, if the nickel plated flat head screw is replaced by one of the 1/4 - 20 x 7/8" screws.

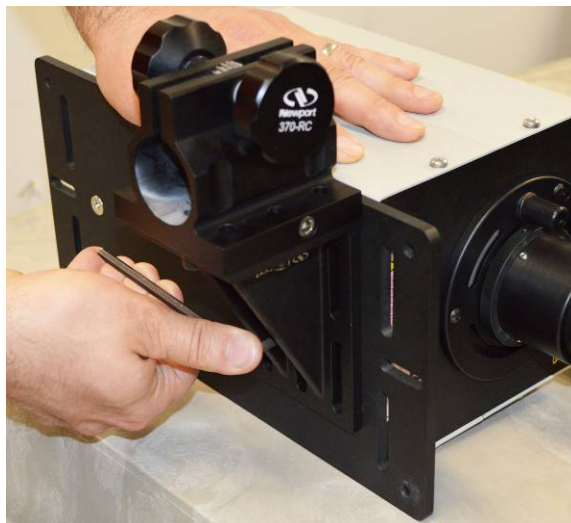


Figure 5: 90 Degree angle bracket assembly to bottom of unit

3.4 ROD ASSEMBLY

Loosen the Model **370-RC** Post Clamp. Hold the unit on the bottom in the area of the bracket near its center of mass. Slide it down the Model **75** Rod so that the rack lines up with the gear. Tighten the clamp knob.



Figure 6: Rod assembly

4 FILTER INSTALLATION / REPLACEMENT

The **94011A(-ES)** solar simulator includes an AM1.5G spectral correction filter. It shapes the light output to closely match the total (direct and diffuse) solar spectrum on the Earth's surface, at a zenith angle of 48.2° (ASTM 892). This provides a Class A irradiance spectrum suitable for Photovoltaic cell testing.

The filter is shipped in its own case. Note that the solar simulator should not be transported with the filter in place. Save this case for storage of the filter.

The coated side is mounted on the side with the screw heads showing, and must face the lamp, as shown.

Installation and replacement

1. Disconnect the LCS-100™ from the AC mains.
2. Remove the LCS-100™ top cover by removing the top 4 Phillips head screws only. Do not loosen or remove the bottom 4 Phillips head screws. Lift the top cover up straight to remove.
3. It is easier to remove and install the filter assembly without a lamp installed, and can avoid damage to the filter and lamp. This is recommended.
4. Remove the two thumbscrews as shown in Figure 7, and set aside.

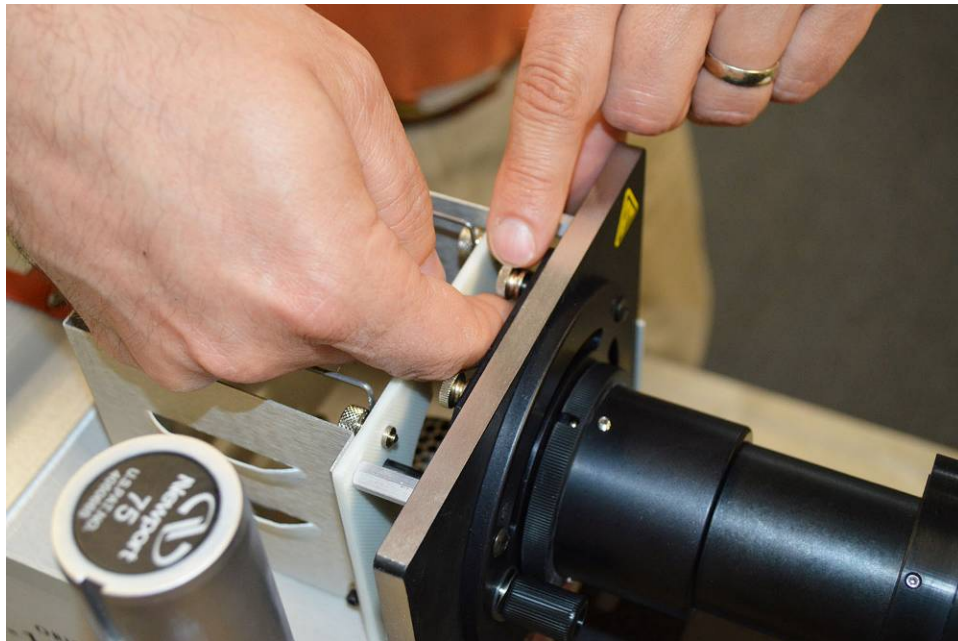


Figure 7: Filter retention thumbscrews

5. If a filter assembly is in place to be removed, slide it off the two retaining studs while grasping it as shown in Figure 8.
6. Lift it out slowly, being careful that the filter does not get scratched or dropped. Place it into protective packaging.

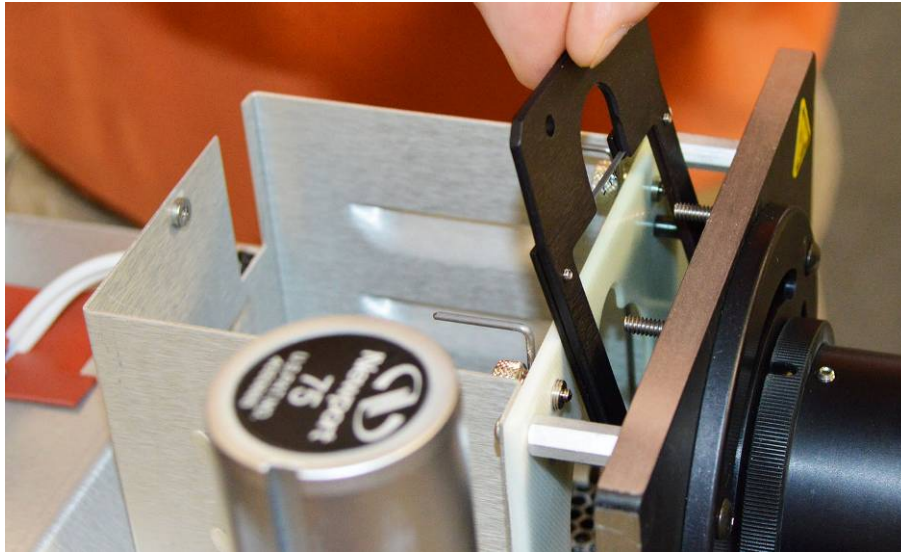


Figure 8: Filter assembly insertion and removal

7. If a filter assembly is to be installed, remove it from its packaging and orient it so that it is angled away from the lamp toward its bottom as shown in Figure 8.
8. Lower it slowly into place with a slight tilt to engage one of the holes with its corresponding retaining stud. Pivot the filter assembly to engage the other retaining stud as shown in Figure 9.

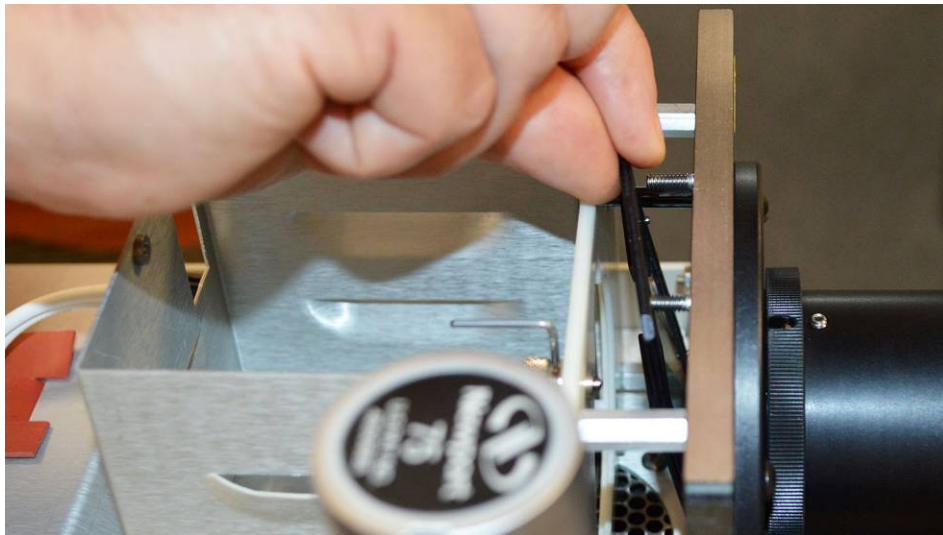


Figure 9: Filter assembly engagement

9. Replace the two thumbscrews, as shown in Figure 7.
10. If you want to install a lamp, proceed to Section 5 for instructions.
11. Install the LCS-100™ top cover with the grooved edge engaging the front panel, sliding it straight down. Replace the top 4 Phillips head screws, tightening securely.

5 LAMP INSTALLATION / REPLACEMENT

5.1 ARC LAMPS



Please review the safety precautions in sections:

- 2.2 LAMP EXPLOSION
- 2.4 ELECTRICAL SHOCK
- 2.6 HEAT
- 2.7 GENERAL WARNINGS
- 2.8 GENERAL CAUTIONS

Handle the lamp carefully. Do not put significant stress on the lamp envelope or connecting wires. Gloves and eye protection are recommended to be worn when handling an arc lamp.

The following are instructions for the responsible body that has read and follows all warnings stated in section II Safety when performing these maintenance activities. The responsible body is also responsible for ensuring that operators are adequately trained in the safe operation of this equipment.

Installation and replacement

1. Disconnect the LCS-100™ from the AC mains.
2. Remove the LCS-100™ top cover by removing only the top 4 Phillips head screws. Do not loosen or remove the bottom 4 Phillips head screws.
3. Remove the lamp cage connector retention cover by removing the thumbscrew and set aside, as shown in Figure 10.



Figure 10: Lamp cage retention cover and thumbscrew

4. If an old lamp is in place, make sure it has cooled at least 10 minutes. Disconnect the lamp connector from the power supply connector, being careful not to stress or excessively pull on the wires at the lamp ends.
5. Gently squeeze together the handles of the lamp retaining clip to disengage from the grooved

retaining posts, and let it pivot back to its open position, as shown in Figure 11.

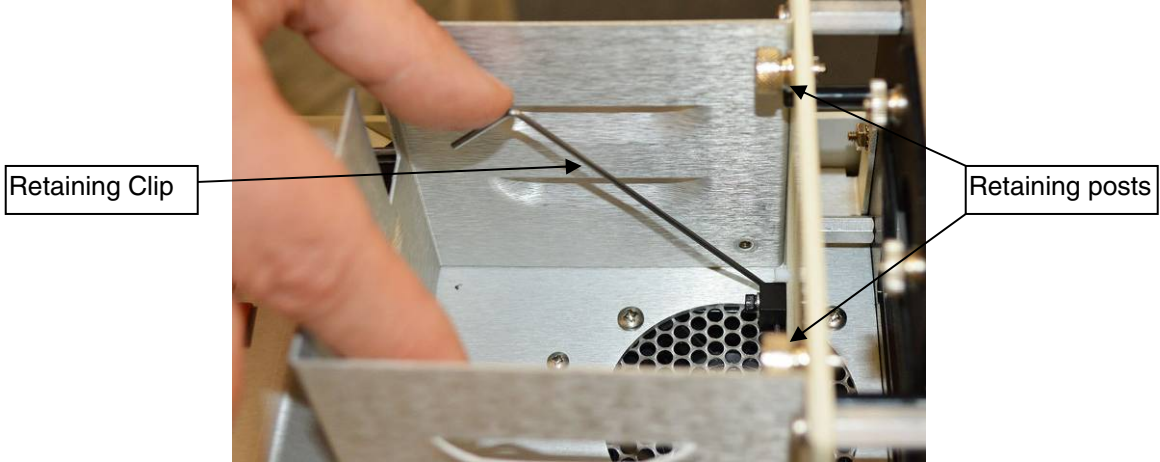


Figure 11: Lamp retaining clip and retaining posts

6. If an old lamp is in place, rotate it slightly and tilt it back so that the anode lead wire clears the lamp seating plate, then lift it out of the lamp cage slowly, and set it down gently. For best control, handle the lamp only by the ceramic mounting flange at the base of the reflector.
7. Remove the new lamp from its packaging. Grasp it by the ceramic base with the Anode wire oriented upward for best maneuvering, as shown in Figure 12.



Figure 12: Lamp handling, insertion, and removal

8. Gently lower the lamp into the lamp cage. Rotate it slightly and tilt it back so that the anode lead wire clears the lamp seating plate. Guide the reflector rim into the recessed lamp seat, using the two white pegs as rests for guiding the lamp into place. Make sure the Anode wire is centered within the cutout at the top of the lamp seating plate, as shown in Figure 13 and 14.

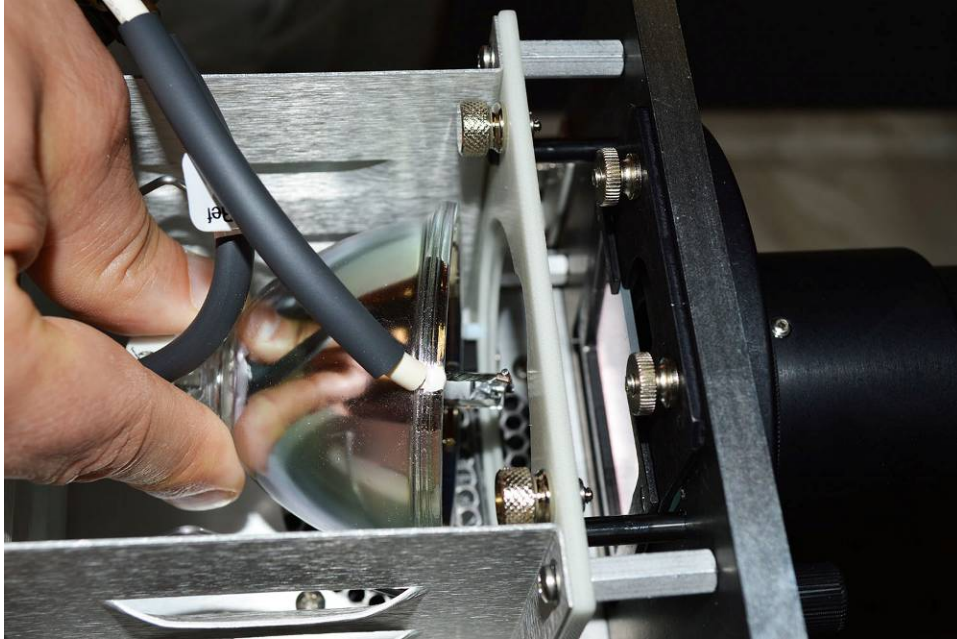


Figure 13: Lamp seating

9. Engage the lamp retaining clip over the back side of the reflector rim on either side, then within the grooved retaining post above it. Engage the other side similarly, so that the clip sits within the groove of the retaining post above it, as shown in Figure 14.

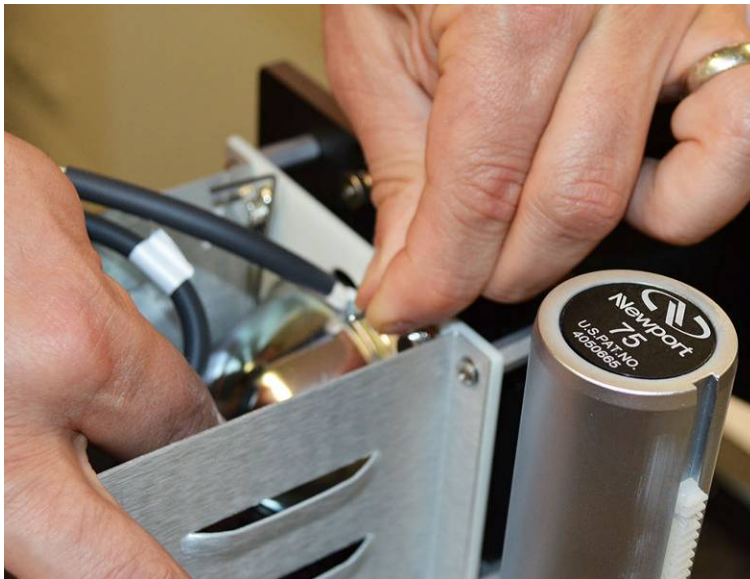


Figure 14: Lamp held while retaining clip engaged

10. While sliding the power supply connector into the cutout in the rear of the lamp cage, connect it to the lamp connector, being careful not to stress or excessively pull on the wires at the lamp ends, as shown in Figure 15. Note that the connector is keyed so that it may only engage with the proper polarity.



Figure 15: Lamp connector engagement

11. Replace the lamp cage connector retention cover and fasten the thumbscrew securely.
12. If bare skin has contacted the lamp bulb be sure to cleanse the envelope thoroughly (Section 2.2). Fingerprints – or any contaminant – can cause deterioration of the envelope during lamp operation and could lead to premature lamp failure or lamp explosion.
13. Replace the LCS-100™ top cover with the grooved edge engaging the front panel, sliding it straight down. Replace the top 4 Phillips head screws, tightening securely.



Figure 16: Lamp mounted properly in its cage

6 OPERATION

6.1 FUSE CHANGE FOR 220VAC

There are 2 fuses factory installed in the power cord jack at the rear panel, which are for 100 – 120VAC (nominal) operation. They are 1.5A type T (slo-blo).

For 200 – 240VAC (nominal) operation, you must replace these with the 0.8A type T (slo-blo) fuses that are supplied in a bag shipped with the unit, as follows:

1. Unplug the LCS-100™.
2. Use your finger or a small flat bladed screwdriver to slide out the fuse holder.
3. Flip down the outer wall a bit, which will raise the leading edge of the 2 fuses.
4. You may access the fuses with the aid of the screwdriver.
5. Replace them with the 0.8A type T (slo-blo) fuses that are supplied, flip the wall up and slide it into place until it is flush with the connector.

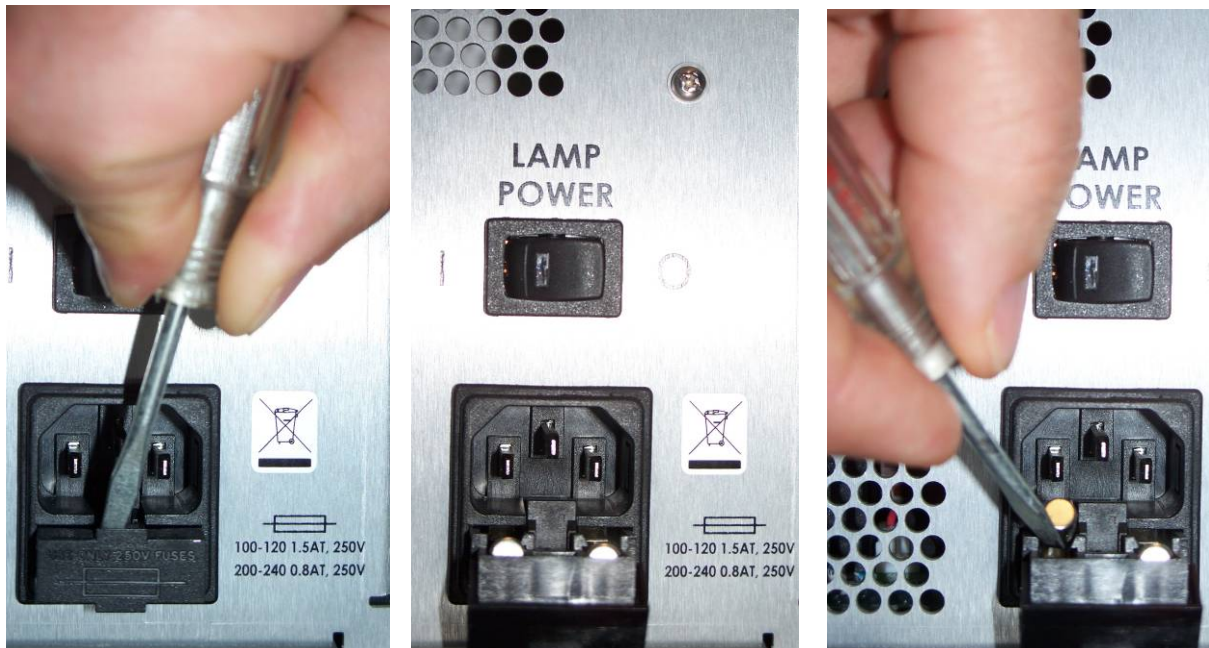


Figure 17: Fuse replacement

6.2 MOUNTING OPTIONS

The preferred mounting configuration for the illuminator is mounted to an optical table or breadboard type of mount plate using the Newport Model **75** Mounting Rod. This rod has 4 mount holes that are spaced to be compatible with inch and metric (25mm) holes. This rod provides the quickest approach to fine-tune the height while maintaining rotational and planar alignment with the work plane.

The 6" x 12" (152.4 x 304.8mm) integral baseplate has 1/4 - 20 mounting holes at the corners, spaced 5" x 11". These can be used to mount fixed length posts such as type **SP-6**, which may then be mounted within post holders such as type **VPH-6**, to provide height adjustment. If fixed posts are used, then it is recommended to adjust the target device (test cell) height, to provide the Irradiance adjustment. See Figures 18 and 19 for mounting dimension detail drawings.

For upward or side directing applications, the integral baseplate can be bolted to an inch or metric table. Use the 1/16 hex wrench to loosen and turn the 90° beam turner. Use a 90° block against the side of its housing to square it up before retightening. For forward directing of the beam, the beam turner may be removed (working distance from the tube end reference plane will then be 2.5" more). A **71260** Filter Holder may be used at this optical location for additional external filters. Use extra care in these configurations to prevent eye damage.

For proper operation, the 94011A(-ES) is to be mounted in a preferred orientation such that its electrode axis is within 15° of horizontal. This is important for the lamp life, as well as for proper airflow and thermal control.

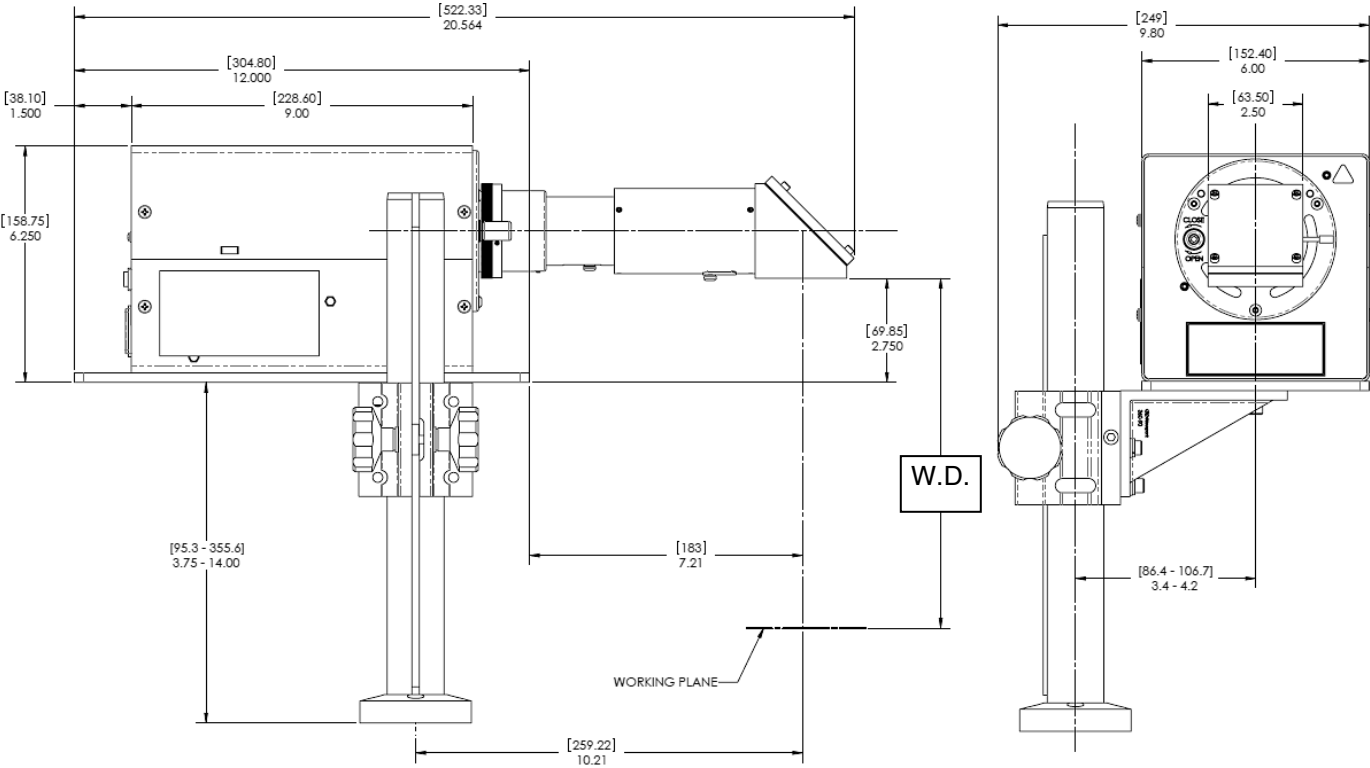


Figure 18: 94011A Dimensions

Do not position the 94011A such that it is difficult to operate the power switch or remove the power cord.

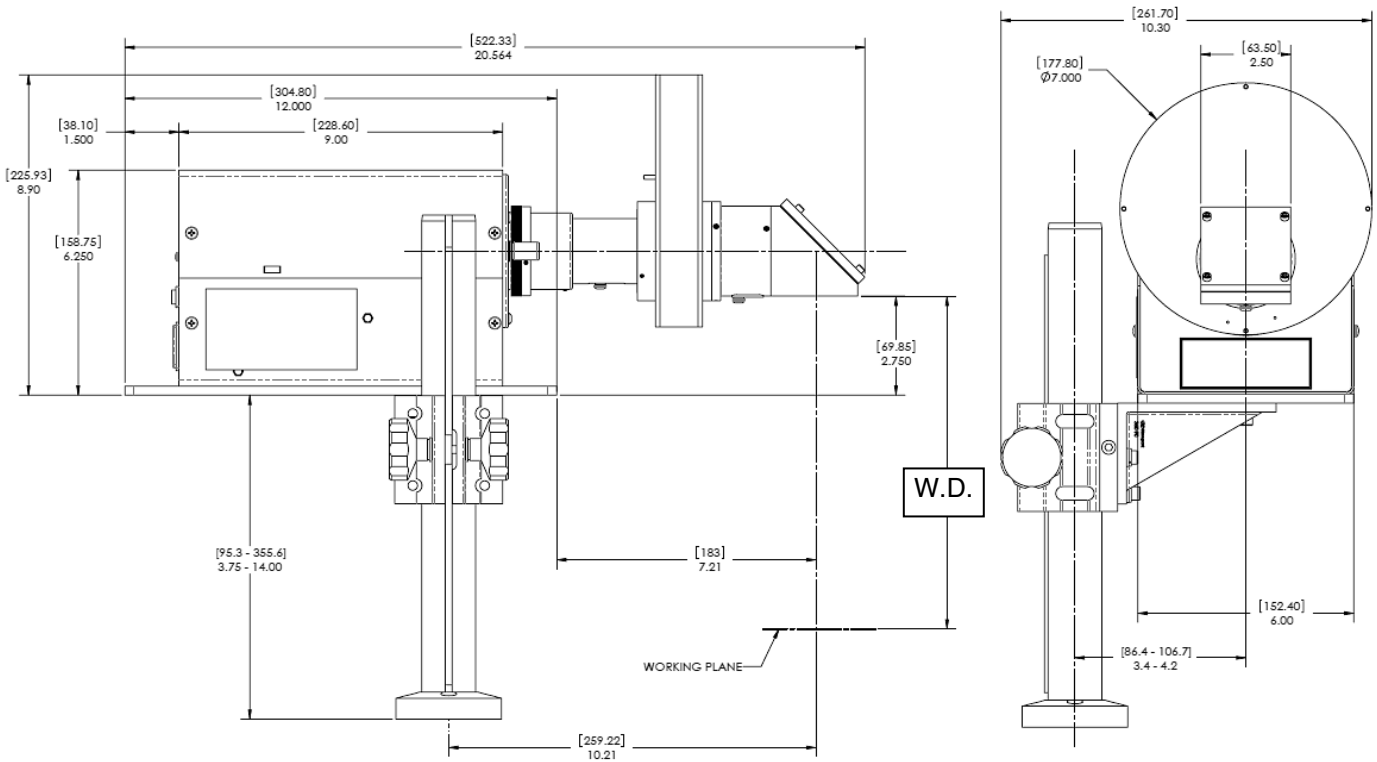


Figure 19: 94011A-ES Dimensions

6.3 LAMP START

1. Install the desired filter in the filter holder. See Section 4 for detailed instructions.
2. Install the lamp. See Section 5 for detailed instructions.
3. Connect the 94011A(-ES) to the AC mains.
4. Review the safety precautions of Section 2, especially Section 2.2. Make sure that the output beam is positioned as desired and all personnel are wearing appropriate safety apparel.
5. Turn on the power switch. The lamp will start within a few seconds. The fan will start in about 6 seconds.
6. The light output will be stable in less than 10 minutes.

6.4 SHUTTER

Open and close the shutter with the knurled knob (clockwise is open).

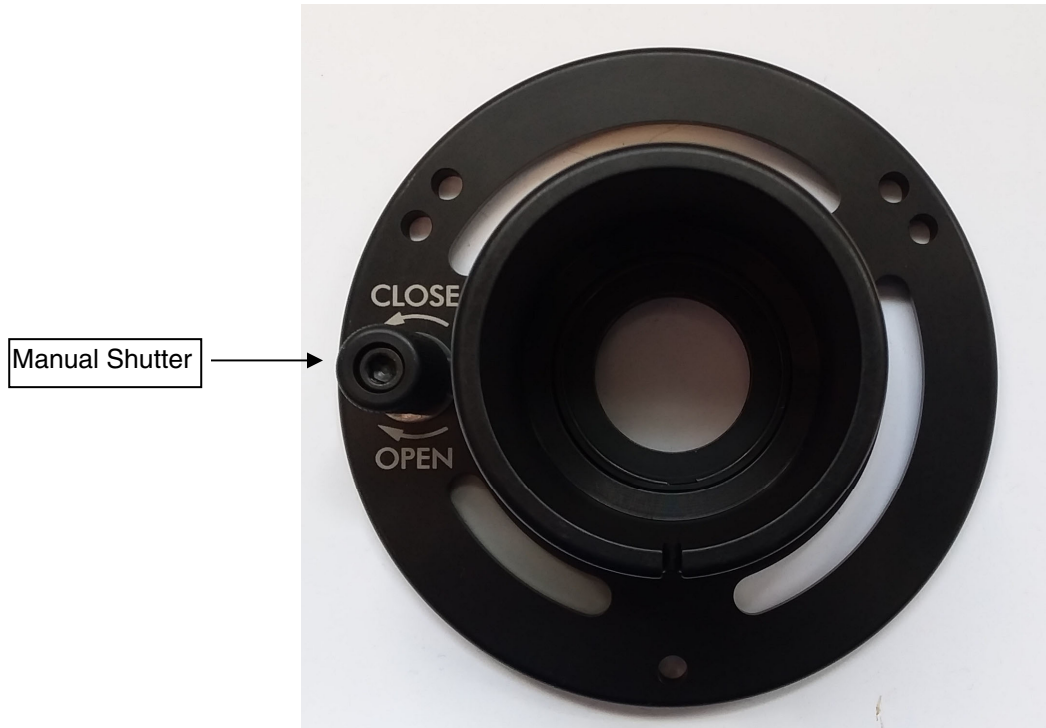


Figure 20: Manual Shutter Knob

The 94011A-ES additionally has a **71446** electronic safety shutter, complete with control box, interconnecting cable, and **71449** cable for controlling the shutter from a Keithley 2400 series SourceMeter when used in conjunction with PVIV 2.0 software. Refer to the M71445 and MPVIV Manuals for additional information.

6.5 IRRADIANCE ADJUSTMENT

There is one method of adjusting the irradiance. The lamp should be warmed up at least 10 minutes to be stable, and a detector such as the 91150V should be placed in the intended working plane to monitor the output adjustment.

Working Distance

Working Distance (W.D.) is defined as the distance from the output port bottom surface to the target plane. Since the output beam is slightly divergent, adjusting the W.D. has an inverse effect on the Irradiance. The LCS-100™ has been factory adjusted for best uniformity at the specified W.D. found in section 8, where it is certified. However, the uniformity is generally within Class B for W.D. within the range of 6 to 10 inches.

As the lamp ages, the W.D. will need to be reduced to maintain a 1 SUN output. This is accomplished by means of the mounting rod or target device height adjustment. The mounting rod is adjusted by the following means:

1. Grasp both of the mounting rod knobs, one in each hand.
2. Rotate the locking knob counterclockwise. This is the knob with the Model number **370-RC** engraved, generally on the right as shown in the photos.
3. To raise the LCS-100™, place that hand under the angle bracket mounted to the integral baseplate, and exert upward force while rotating the other knob counterclockwise. This knob has a gear that engages with the rack on the rod to move it up.
4. To lower the LCS-100™, slowly rotate the other knob clockwise. This knob has a gear that engages with the rack on the rod to move it down.
5. Rotate the locking knob clockwise to secure the clamp around the rod.

7 TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	ACTION
Lamp does not start	No power – blown fuse or power supply	Check that the power switch is turned ON and the orange light in the switch is lit brightly. Check that power cord is fully seated.
	Lamp not properly installed	Follow the lamp installation procedure carefully. Connections should be firm.
	Defective or marginal lamp	Repeat ignition sequence. Check that lamp has a starter wire. Replace lamp.
	Old lamp	Replace lamp.
	Lamp not installed	Install lamp.
	Insulation breakdown	Contact Oriel Instruments.
	Interlock fault	Ensure that the top cover is in place. Consult Oriel Instruments.
Lamp explodes	Defective lamp	Replace lamp.
	Old lamp	Replace lamp when stability becomes erratic, or output is < 60% of original.
	Contaminated lamp envelope	Do not handle inside of lamp reflector or lamp. Clean lamp if needed.
	Air vents blocked	Needs > 1” clearance, < 40°C ambient air
Shutter does not open	Damaged manual shutter, shutter mechanically jammed	Repair or replace shutter assembly.
	Defective 71446 shutter drive circuit	Contact Oriel Instruments.
Loss of power in output beam	Dirty optics	Clean optics.
	Damaged optics	Replace optical assemblies.
	Old lamp	Replace lamp.
Loss of beam uniformity	Dirty optics	Clean optics.
Output unstable	Old lamp	Replace lamp.

8 SPECIFICATIONS AND CERTIFICATIONS

PERFORMANCE SPECIFICATIONS	
Illumination Area (inches) [mm]	1.5 x 1.5 [40 x 40]
Maximum Angle of Incidence (°)	< +/- 6
Variable Output Control (Irradiance Adjustment)	Height: ~0.18 SUN/inch
Nominal Working Distance (inches) [mm]	7.0 [178]
Light Ripple:	<0.5% RMS
Lamp Type:	100 W, Ozone Free Xenon
Average Lamp Lifetime	~750 Hours
ELECTRICAL AND MECHANICAL SPECIFICATIONS	
Weight (94011A only) lbs. [kg]	23.4 [10.6]
Dimensions (without vertical stand) in. [mm]	
Height	6.3 [160]
Width	20.6 [520]
Depth	6.0 [150]
Operating Temperature Range (°C)	5 to 40
Humidity	<80%, Relative, Non-Condensing
Operating Environment	< 3,000 m Altitude, Indoor Use Only, Installation Category II, Pollution Degree 2
Power Requirements	100-240VAC, 47-63Hz, 130W
Line Regulation	0.03%
Fuses	1.5A T (slo-blo), 250V for 100/120VAC 0.8A T (slo-blo), 250V for 200/240VAC
ELECTRONIC SHUTTER MODEL 71445 SPECIFICATIONS	
Diameter	38.1 mm
Flange Series Size	1.5 in.
Light Leakage	< 0.001%
Minimum Exposure Time	0.2 s
Power Requirements	95-130VAC, 0.25 A Max., 190-260VAC 0.125 A Max.
CERTIFICATIONS	
CE Certification	
General Product Safety	Directive 2001/95/EC
RoHS- Restriction of Hazardous Substances	Directive 2011/65/EU
Spectral Irradiance Scan ¹	250-2700 nm at 1 SUN Without a Filter Installed and Subsequent Scan(s) with the Ordered Filter(s) Installed
Spectral Match Classification ²	A- IEC 60904-9 (2007), ASTM E927-10 (2015) C- JIS 8904-9 (2017)
Uniformity Classification ²	B- IEC 60904-9 (2007), ASTM E927-10 (2015) C- JIS 8904-9 (2017)
Temporal Stability Classification ²	B- IEC 60904-9 (2007), ASTM E927-10 (2015) C- JIS 8904-9 (2017)

Table 1: Specifications and Certifications

1. Provided with Class ABB test data on a USB thumb drive.
2. At conditions as reported in the test data.

Typical Output Power from LCS-100™ Solar Simulator

Working Distance from the output flange (inches)	Readings with AM0 Filter (mW/cm ²)	Readings with AM1.5G Filter (mW/cm ²)
6	247	161
7	184	119
8	151	100
9	126	82
10	105	69

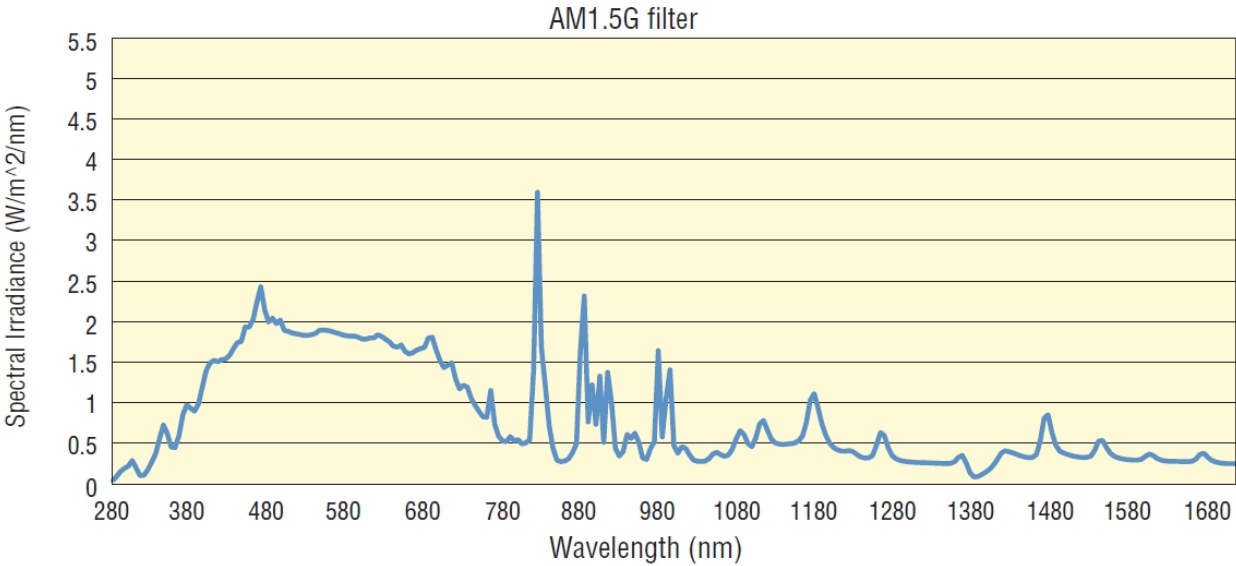


Figure 21: Spectral output of LCS-100™ Solar Simulator with the AM1.5G filter

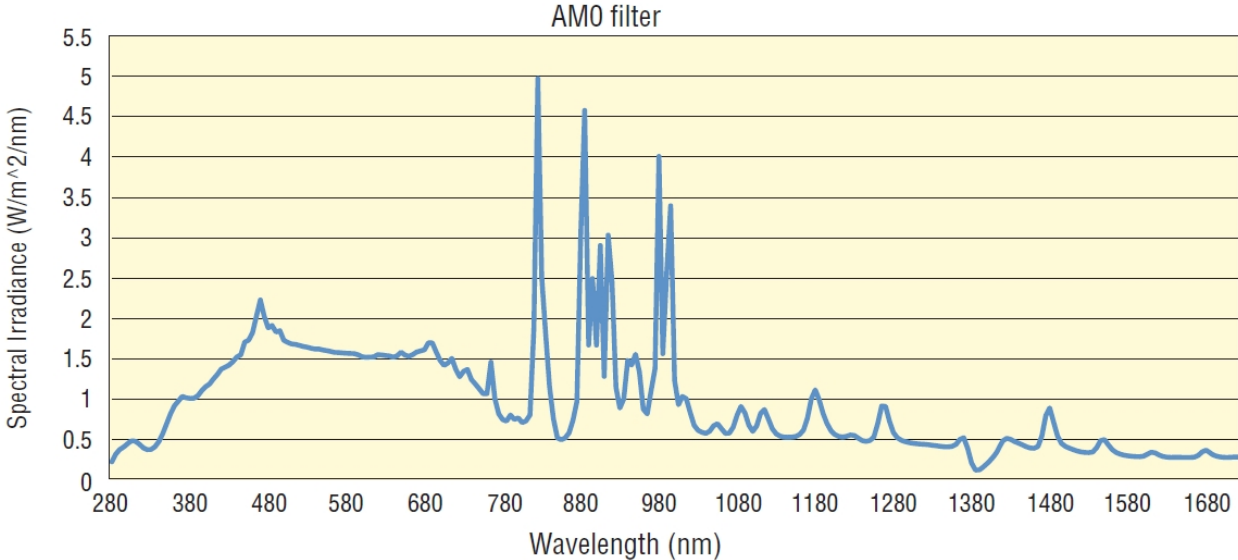


Figure 22: Spectral output of LCS-100™ Solar Simulator with AM0 filter in place of AM1.5G filter

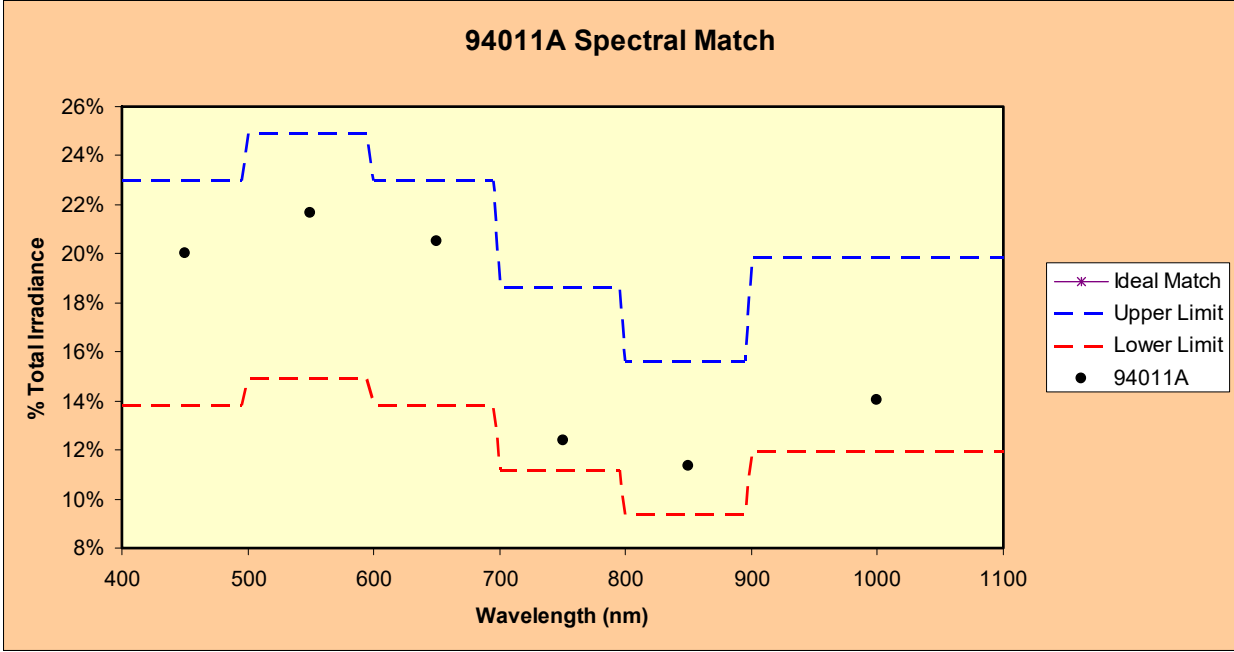


Figure 23: Certification data from 94011A Solar Simulator showing the Class A spectral match

9 WARRANTY & SERVICE

CONTACTING ORIEL® INSTRUMENTS

Oriël® Instruments belongs to Newport Corporation's family of brands. Thanks to a steadfast commitment to quality, innovation, hard work and customer care, Newport is trusted the world over as the complete source for all photonics and laser technology and equipment.

Founded in 1969, Newport is a pioneering single-source solutions provider of laser and photonics components to the leaders in scientific research, life and health sciences, photovoltaics, microelectronics, industrial manufacturing and homeland security markets.

Newport Corporation proudly serves customers across Canada, Europe, Asia and the United States through 9 international subsidiaries and 24 sales offices worldwide. Every year, the Newport Resource catalog is hailed as the premier sourcebook for those in need of advanced technology products and services. It is available by mail request or through Newport's website. The website is where one will find product updates, interactive demonstrations, specification charts and more.

To obtain information regarding sales, technical support or factory service, United States and Canadian customers should contact Oriël® Instruments directly.

Newport Corp.- Oriël® Instruments
31950 E. Frontage Rd.
Bozeman, MT 59715 USA

Telephone: (877) 835-9620(toll-free in United States)
(949) 863-3144
Fax: (949) 253-1680

Sales: orielPV.sales@newport.com
Technical assistance or repair service: orielPV.service@newport.com

Customers outside of the United States must contact their regional representative for all sales, technical support and service inquiries. A list of worldwide representatives can be found on Oriël's website: <http://www.newport.com/oriel>.

REQUEST FOR ASSISTANCE / SERVICE

Please have the following information available when requesting assistance or service:

1. Contact information for the owner of the product.
2. Instrument model number (located on the product label).
3. Product serial number and date of manufacture (located on the product label).
4. Description of the problem.

To help Oriël's Technical Support Representatives diagnose the problem, please note the following:

- Is the system used for manufacturing or research and development?
- What was the state of the system right before the problem?
- Had this problem occurred before? If so, when and how frequently?
- Can the system continue to operate with this problem, or is it non-operational?
- Were there any differences in the application or environment before the problem occurred?

REPAIR SERVICE

This section contains information regarding factory service for this product. The user should not attempt any maintenance or service of the system beyond the procedures outlined in this manual. This product contains no user serviceable parts other than what is noted in this manual. Any problem that cannot be resolved should be referred to Oriel® Instruments.

If the instrument needs to be returned for service, a Return Material Authorization (RMA) number must be obtained prior to shipment to Oriel® Instruments. This RMA number must appear on both the shipping container and the package documents.

Return the product to Oriel® Instruments, freight prepaid, clearly marked with the RMA number and it will either be repaired or replaced at Oriel®'s discretion.

Oriel® is not responsible for damage occurring in transit. The Owner of the product bears all risk of loss or damage to the returned Products until delivery at Oriel® 's facility. Oriel® is not responsible for product damage once it has left the facility after repair or replacement has been completed.

Oriel® is not obligated to accept products returned without an RMA number. Any return shipment received by Oriel® without an RMA number may be reshipped by Newport, freight collect, to the Owner of the product.

NON-WARRANTY REPAIR

For Products returned for repair that are not covered under warranty, Newport's standard repair charges shall be applicable in addition to all shipping expenses. Unless otherwise stated in Newport's repair quote, any such out-of-warranty repairs are warranted for ninety (90) days from date of shipment of the repaired Product.

Oriel® will charge an evaluation fee to examine the product and determine the most appropriate course of action. Payment information must be obtained prior to having an RMA number assigned. Customers may use a valid credit card, and those who have an existing account with Newport Corporation may use a purchase order.

When the evaluation had been completed, the owner of the product will be contacted and notified of the final cost to repair or replace the item. If the decision is made to not proceed with the repair, only the evaluation fee will be billed. If authorization to perform the repair or provide a replacement is obtained, the evaluation fee will be applied to the final cost. A revised purchase order must be submitted for the final cost. If paying by credit card, written authorization must be provided that will allow the full repair cost to be charged to the card.

WARRANTY REPAIR

If there are any defects in material or workmanship or a failure to meet specifications, notify Oriel® Instruments promptly, prior to the expiration of the warranty.

Except as otherwise expressly stated in Oriel®'s quote or in the current operating manual or other written guarantee for any of the Products, Oriel® warrants that, for the period of time set forth below with respect to each Product or component type (the "Warranty Period"), the Products sold hereunder will be free from defects in material and workmanship, and will conform to the applicable specifications, under normal use and service when correctly installed and maintained. Oriel® shall repair or replace, at

Oriël® 's sole option, any defective or nonconforming Product or part thereof which is returned at Buyer's expense to Oriël® facility, provided, that Buyer notifies Oriël® in writing promptly after discovery of the defect or nonconformity and within the Warranty Period. Products may only be returned by Buyer when accompanied by a return material authorization number ("RMA number") issued by Oriël®, with freight prepaid by Buyer. Oriël® shall not be responsible for any damage occurring in transit or obligated to accept Products returned for warranty repair without an RMA number. Buyer bears all risk of loss or damage to the Products until delivery at Oriël®'s facility. Oriël® shall pay for shipment back to Buyer for Products repaired under warranty.

WARRANTY PERIOD

All Products (except consumables such as lamps, filters, etc) described here are warranted for a period of twelve (12) months from the date of shipment or 3000 hours of operation, whichever comes first.

Lamps, gratings, optical filters and other consumables / spare parts (whether sold as separate Products or constituting components of other Products) are warranted for a period of ninety (90) days from the date of shipment.

WARRANTY EXCLUSIONS

The above warranty does not apply to Products which are (a) repaired, modified or altered by any party other than Oriël® ; (b) used in conjunction with equipment not provided or authorized by Oriël® ; (c) subjected to unusual physical, thermal, or electrical stress, improper installation, misuse, abuse, accident or negligence in use, storage, transportation or handling, alteration, or tampering, or (d) considered a consumable item or an item requiring repair or replacement due to normal wear and tear.

DISCLAIMER OF WARRANTIES; EXCLUSIVE REMEDY

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Persons receiving goods for demonstrations or temporary use or in any manner in which title is not transferred from Newport shall assume full responsibility for any and all damage while in their care, custody and control. If damage occurs, unrelated to the proper and warranted use and performance of the goods, recipient of the goods accepts full responsibility for restoring the goods to their original condition upon delivery, and for assuming all costs and charges.

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