



Keo Alcor

Low Brightness Source

User Manual

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1 Introduction

Thank you for purchasing a Keo *Alcor* Low Brightness Source system from Keo Scientific. This Low Brightness Source (LBS) provides a lightweight, portable means of calibrating low-light-level devices such as airglow and auroral imagers and photometers as well as other night-vision devices. Its compact size makes it particularly useful for instruments that must be calibrated in situ, such as may be found mounted on aircraft, manned spacecraft, or used in field environments.

The Keo *Alcor* LBS consists of a 100W precision quartz tungsten-halogen bulb mounted in a thermally controlled enclosure. The unit contains a sophisticated system of holographic attenuators, high-grit ground glass, and opal diffusing screens.

With the opal output diffusing screen in place, the unit serves as a calibrated standard of spectral radiance and as a luminance standard. With the screen removed, the unit can be used as a standard of spectral irradiance and as an illuminance standard.

Conventional incandescent lamps decline as much as 30% in light output during their lifetime, primarily due to bulb darkening from evaporated tungsten deposits. Consequently, a tungsten-halogen was chosen for this LBS which maintains over 95% of initial light output throughout its rated lifetime. The spectral distribution from the filament through the quartz envelope in the UV and Visible is essentially the same as a Black Body radiator at the lamp's apparent color temperature of 2,990K.

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2 System Components

2.1 System Components Overview

A standard Keo Alcor system consists of the following components:

- Alcor head unit
- LabSphere LPS-100 power supply
- Lamp power tether cable
- Fan power adaptor
- 2x AC power cords
- Front protective cap
- Diffuser screen wrench
- Tripod adaptor
- User manual
- Alcor documentation CD



Figure 1: Typical System Components

2.2 Alcor Head Unit



This is the main component of the *Alcor* system. It consists of the lamp, aperture wheels, and various diffusing elements.

This component will be referred to as the *Head Unit* throughout the remainder of this manual.

2.2.1 Lamp

The device uses a precision, quartz-halogen 100 watt lamp that provides a 2,990K color temperature and 2,000 hour life. This lamp is field replaceable although it is recommended that you send the *Alcor* system back to Keo Scientific when service is required.



Caution

During operation the lamp and surrounding enclosure get very hot (>50 °C). Please allow the device to cool before moving it or packing it in its storage case.

Never attempt to replace the lamp without first consulting Keo Scientific (lamp replacement instructions are available upon request).

Replacing the lamp requires opening the device and exposing electronics which could be dangerous.



Important Information

Replacing the lamp will invalidate the calibration of the unit. It is recommended that you send your *Alcor* back to Keo Scientific for lamp replacement and re-calibration.

2.2.2 Aperture Wheels

The *Alcor* is equipped with two aperture wheels that are used to attenuate the light output of the device. These two wheels, the 'primary' and 'secondary' aperture wheels, have a series of precisely sized holes that provide a combined 100,000:1 dynamic range.

The primary aperture wheel has three positions: A, B, and C, with A being the lowest light output and C being the highest light output. Each position has ~10x higher output than the previous position.

The secondary wheel has 12 positions: 1 through 12, with 1 being no light output, 2 being the lowest light output and 12 being the highest light output. Each position has a ~2x higher output than the previous position.

In the remainder, of this manual a combination of aperture positions will be represented by the following notation: (B,3) where the first value is the primary position, and the second value is the secondary position.

The optional calibration provided with your device includes a table of aperture signal ratios. This calibration defines the (C,12) position as being 100% light output and the remaining aperture combinations a ratio of that output. An example of this calibration data is shown below in Table 1.

Table 1: Sample Aperture Signal Ratios

		Primary Aperture Wheel Position		
		C	B	A
Secondary Aperture Position	12	1.00E+00	1.67E-01	1.81E-02
	11	4.86E-01	8.72E-02	9.57E-03
	10	2.51E-01	4.42E-02	4.88E-03
	9	1.19E-01	2.25E-02	2.49E-03
	8	6.01E-02	1.15E-02	1.26E-03
	7	2.98E-02	5.74E-03	6.37E-04
	6	1.52E-02	2.93E-03	3.28E-04
	5	7.89E-03	1.53E-03	1.71E-04
	4	4.33E-03	8.40E-04	9.43E-05
	3	2.28E-03	4.41E-04	5.02E-05
	2	1.43E-03	2.76E-04	3.33E-05
	1	2.31E-06	1.48E-06	1.23E-06

2.2.3 Front Diffusing Screen

By using an Eastman Kodak opal flashed front diffusing screen, the LBS can achieve a highly uniform Lambertian output. See Figure 2 below for a sample uniformity plot.

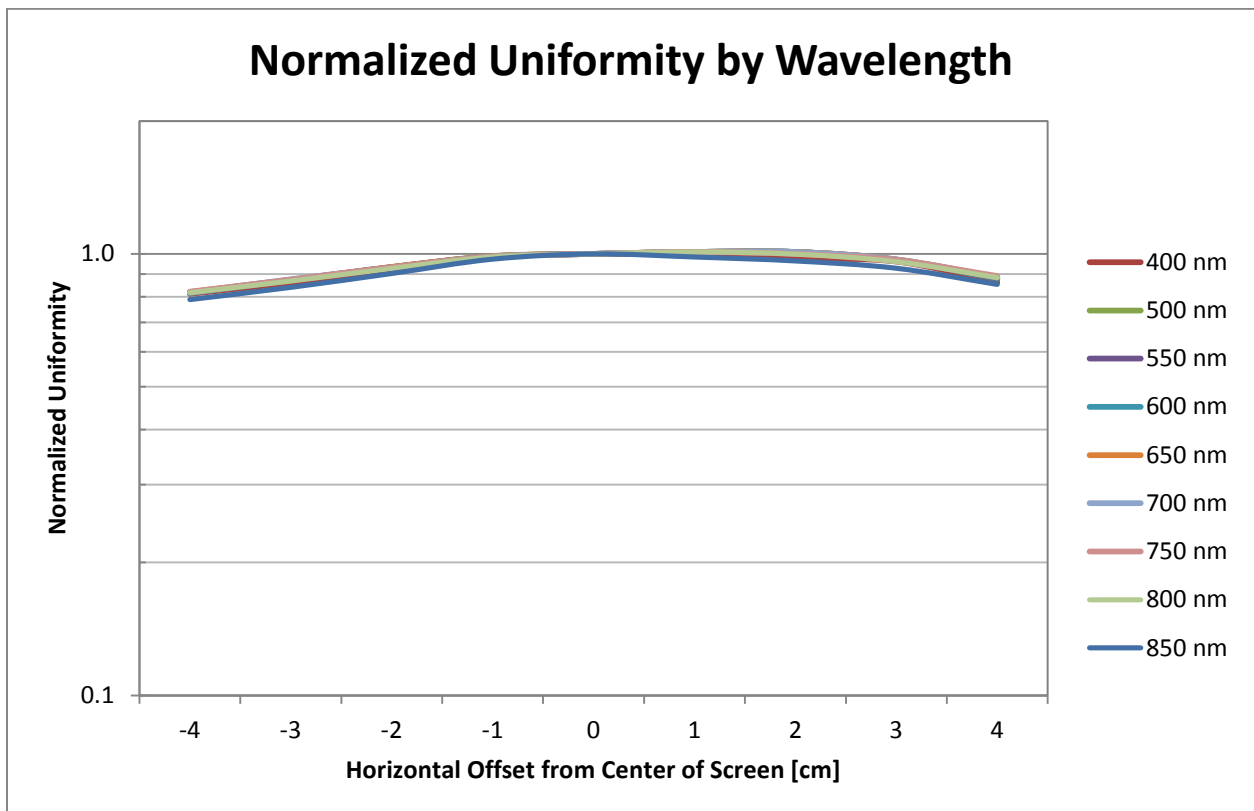


Figure 2: Sample Normalized Uniformity

2.3 LabSphere LPS-100 Power Supply



This component of the *Alcor* system provides the power to the lamp in the Head Unit and keeps track of lamp hours.

The AC line-voltage line cord supplied with your system should be compatible with the region to which the system was shipped. If the line cord is incompatible, please contact Keo Scientific for a replacement.

Maximum Power Output: 100 W

Input: 100 – 220 VAC, 50 – 60 Hz

Output: 8.33A

2.4 Cables



Lamp Power Tether Cable: The standard 7m (23') tether cable has LEMO connectors that interconnect the Head Unit and power supply. This tether provides power to the lamp.



Fan Power Adaptor: This power transformer is used to power the fans located on the Head Unit.

2.5 Accessories



Front Protective Cap: This threaded cap is used to protect the front diffusing screen while it is not in use.



Diffuser Screen Wrench: This wrench tool is used to tighten and loosen the retaining ring holding the output diffusing screen in place.



Tripod Adaptor: This adaptor allows for mounting the Head Unit on a variety (1/4-20, 3/8-16, and M6x1) of tripod studs.

2.6 User Manual



Alcor User Manual: This manual describes how to install and use the *Alcor* system components. A PDF version of this manual is provided on the Documentation CD.

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3 Installation Overview

The list below briefly describes the sequence of actions required to install and operate your *Alcor* system. Refer to the indicated references for more detailed information.

Action	Reference
1. If the system components have not already been unpacked, unpack them and inspect their carton(s) and the system components for in-transit damage.	Section 4.3: Unpacking the System, page 18
2. Verify that all system components have been received.	Section 4.4: Equipment and Parts Inventory, page 18
3. If the components show no signs of damage, verify that the appropriate power cord has been supplied with the power supply.	Section 4.2.2: Power Requirements, page 17
4. Securely mount the Head Unit in a suitable location.	Section 4.5.1, page 19
5. Setup the LabSphere power supply.	Section 4.5.2, page 19
6. Connect the required cables.	Section 4.5.3, page 19
7. Turn the power supply ON.	Section 5, page 21
8. Ramp up the power supply.	Section 5, page 21

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4 System Setup



Caution

To minimize the risk to users or to the system equipment, turn the system **OFF** before any cables are connected or disconnected.

4.1 Introduction

The Keo *Alcor* system consists of three main hardware components:

- *Alcor* Head Unit
- LabSphere LPS-100 power supply
- Cables

All of the components and cables required to use the *Alcor* are included with your shipment. Keep all of the original packing materials so you can safely ship the *Alcor* system to another location or return it for service if necessary. If you have any difficulty with any step of the instructions, contact Keo Scientific support. For support contact information, refer to Section 6.

Hardware installation will consist of:

- Mounting the *Alcor* in the desired location.
- Connecting various cables.

4.2 System Requirements

4.2.1 Environmental Requirements

Storage temperature: $\leq 80^{\circ}\text{C}$

Operating environmental temperature: $+5^{\circ}\text{C}$ to $+70^{\circ}\text{C}$

Relative humidity: $\leq 30\%$; non-condensing

4.2.2 Power Requirements

The *Alcor Head Unit* receives its power from the supplied LabSphere LPS-100 power supply which in turn plugs into an AC power source.

LabSphere LPS-100 Power Supply

Input voltage range: 100 VAC to 220 VAC (50/60 Hz)

4.2.3 Mechanical Requirements

The *Alcor* Head Unit requires either a sturdy location to place it or a tripod capable of supporting 5kg (11lb).

4.3 Unpacking the System

While unpacking the *Alcor* system, check the system components for possible signs of shipping damage. If there are any, notify Keo Scientific immediately.

The system is shipped in a Pelican™ case for maximum protection. The case can also be used to store the device while it is not in use. Please save the case so that it can be used to ship the device to a new location or to return it to Keo Scientific for repairs if necessary.



Figure 3: Shipping Case

All of the components except the head unit can be simply lifted out of the shipping case. To remove the Head Unit you will first need to lift up and remove the top layer of foam in the case. Then you can lift the Head Unit out of the case and place it on a clean flat surface.

4.4 Equipment and Parts Inventory

Upon receiving the Keo *Alcor* LBS, please confirm that you have all of the parts required to set up the system. A complete system consists of:

- **Alcor Head Unit**
- **LabSphere LPS-100 power supply**
- **Lamp Power Tether Cable:** 7m (23ft) cable is standard.
- **Fan Power Adaptor**
- **2x AC Power Cords**

- **Front Protective Cap**
- **Diffuser Screen Wrench**
- **Tripod Adaptor**
- **Alcor System User Manual**
- **Alcor Documentation CD-ROM**

4.5 Setting up the System

4.5.1 Mounting the Alcor Head Unit

The Alcor Head Unit can either be placed directly on a clean, flat, sturdy surface or mounted on a tripod capable of supporting ~5 kg (11 lbs) with the provided tripod adaptor.

4.5.2 Setup the Power Supply

The LabSphere LPS-100 power supply can be placed on any clean flat surface. The tether cable that runs from the Head Unit to the power supply is 7m (23ft) long so that the Head Unit can be placed in a location a good distance away from the power supply.

4.5.3 Connecting the Cables

There are only a few cables that need to be connected between the various components before you can power up the Alcor.

4.5.3.1 Lamp Power Tether Cable

Power for the lamp in the Head Unit is provided using the Lamp Power Tether Cable which connects the **Lamp Output** connector on the back of the LabSphere Power Supply to the corresponding connector on the side of the Alcor Head Unit as shown in Figures 4 and 5.



Figure 4: Lamp Power Tether Cable Connection 1



Figure 5: Lamp Power Tether Cable Connection 2

4.5.3.2 Fan Power Adaptor

The fan power adaptor is used to provide power to the fans on the Head Unit. Connect the power adaptor to the fan power connector on the side of the Head Unit as shown in Figure 6.



Figure 6: Fan Power Connection

4.5.3.3 AC Power Cables

Connect the two provided AC Power Cords from the LabSphere LPS-100 Power Supply and Fan Power Adaptor to a grounded (3-prong) AC outlet.

4.5.4 Remove the Front Protective Cap

The red cap on the front of the *Alcor* Head Unit can now be removed. Simply rotate it counter-clockwise until it comes off and place it in a safe place.



Figure 7: Remove the Front Cap

Your *Alcor* is now ready for operation.

5 Operation

Once the *Alcor* system has been installed as explained in the preceding chapters, operation of the system is very straightforward.

Before powering up the *Alcor* system for the first time, please ensure that all items in the below checklist have been completed.

☑	Item
	Head Unit is securely mounted?
	All cable connections are made?

Assuming the above items are completed, it is now time to power up the system.

1. Ensure the **Output Switch** is in the **OFF** position.
2. Flip the **Power Switch** on the front of the LabSphere LPS-100 Power Supply to the ON (|) position. The light beside the switch will light up and the fan in the power supply will turn on.
3. Flip the **Output Switch** upwards to the **LOCAL** position. This will start to ramp up the bulb. Anytime the **LAMP POWERED** light on the front of the power supply is illuminated, the *Alcor* lamp is receiving power.

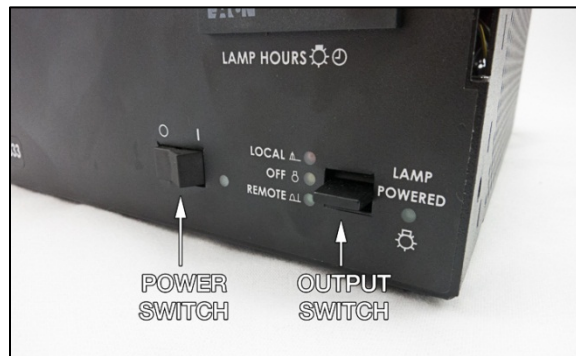


Figure 8: Power Supply Switches

4. Wait 5 minutes for the lamp to warm up and stabilize.
5. Now select the desired aperture combination.
 - a. Remove the top cover from the Head Unit.
 - b. Rotate the wheels to the desired positions.
 - c. Replace the top cover back on the Head Unit.



Figure 9: Top Lid Being Removed

6. When finished using the system, flip the **Output Switch** to the **OFF** position and then flip the **Power Switch** to the **OFF (O)** position. A cool down period is not required for the power supply unit.
7. Replace the front cap on the front of the device to protect the opal diffusing screen.
8. Wait until the Head Unit has cooled prior to packing it away in the storage case.

6 Warranty & Service

3 Year Limited Warranty

Keo Scientific Ltd. (Keo) warrants this product (see Exclusions below) with a 3 year Keo Scientific Warranty. The product is warranted to meet published functional specifications and to be free of defects in materials and workmanship as defined in the specifications for 3 years from the date of original shipment from Keo. During this time, Keo will arrange to have the product repaired or replaced without charge to you. The instrument must be returned to Keo for inspection and assessment. You are only responsible for shipping costs to return the product.

Exclusions

1. Damage resulting from accident, misuse, abuse, lack of reasonable care, subjecting the product to any but the specified electrical service, other than normal and ordinary use of the product, subjecting the product to abnormal working conditions or any other failure not resulting from defects in materials or workmanship.
2. Damage resulting from modification, tampering with or attempted repair by anyone other than Keo.
3. Quartz-Halogen lamp is not covered under warranty.
4. Re-calibration of the device is not covered under warranty.

Shipping Damage

Any damage occurring to the instrument while in transit from Keo to the customer must be reported to the shipping company or courier company immediately upon receipt of goods. Shipments are separately insured, and such damage is covered by such insurance. Please thoroughly inspect the instrument upon arrival.

How to Make a Warranty Claim

1. Contact Keo by telephone or email to obtain support under warranty.
2. Deliver, mail, or ship the product to Keo's main office.

You must pay any postage, shipping charges, insurance costs, and other expenses to return the product to Keo Scientific, Calgary, AB. However, if the necessary repairs are covered by the warranty, Keo will pay the return shipping charges to the original destination.

The product must be shipped back to Keo in the original shipping container.

Contact Information

Keo Scientific's main office is located at the following address:

Keo Scientific Ltd.
Suite 404, 1300 – 8th Street SW
Calgary, AB T2R1B2
Canada

Tel: +1.403.452.7222
Fax: +1.403.206.7680
Email: support@keoscientific.com

An up-to-date list of addresses and telephone numbers is available on our website at www.keoscientific.com/contact.php

Technical Support

In the event that you need technical support to troubleshoot a problem with your product, please don't hesitate to contact us at support@keoscientific.com.

Appendix A Specifications

Basic

Dimensions	17.8" (L) x 8.0" (W) x 8.8" (H) 452mm (L) x 203mm (W) x 222mm (H)
Weight	<i>A/cor</i> Head Unit: 5.0 kg (11 lb) LabSphere LPS-100 Power Supply: 2.9 kg (6.5 lb)
Power Input	100 – 220 VAC; 50/60 Hz
Mounting	Desktop mount or Tripod mount with provided adapter. 1/4-20, 3/8-16, and M6 tripod threads supported.
Storage Temperature	≤80°C
Operating Environmental Temperature	+5°C to +70°C
Relative Humidity	≤30%; non-condensing

Lamp

Voltage	12V
Wattage	100W
Lumens	2,275 ± 15%
Color Temp	2,990K
Life, Hours	2,000

Optical

Attenuator Dynamic Range	100,000:1
Front Diffuser	Opal Flashed

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