



Keo *Alcor-RC*

Remote Controlled
Low Brightness Source

User Manual

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1 Introduction

Thank you for purchasing a Keo *Alcor-RC* Remote Controlled Low Brightness Source system from Keo Scientific. This remote controlled version of our 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-RC* 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.

All that is needed to communicate with and control the *Alcor-RC* LBS is a suitable computer with an available USB2 port.

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2 System Components

2.1 System Components Overview

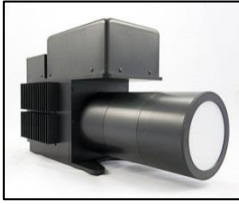
A standard *Alcor-RC* system consists of the following components:

- Alcor-RC head unit
- Alcor-RC power supply
- Agilent E3633A power supply
- Lamp power tether cable
- Remote control tether cable
- Agilent banana jumper cable
- Agilent RS232 cable
- USB A-A cable
- 2x AC power cords
- Diffuser screen wrench
- Tripod adaptor
- User manual
- Alcor-RC Documentation and Software CD



Figure 1: Typical System Components

2.2 Alcor-RC Head Unit



This is the main component of the *Alcor-RC* system. It consists of the lamp, aperture wheels, various diffusing elements, and electronics required to remotely control the system.

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-RC* 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-RC* back to Keo Scientific for lamp replacement and re-calibration.

2.2.2 Aperture Wheels

The *Alcor-RC* 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.

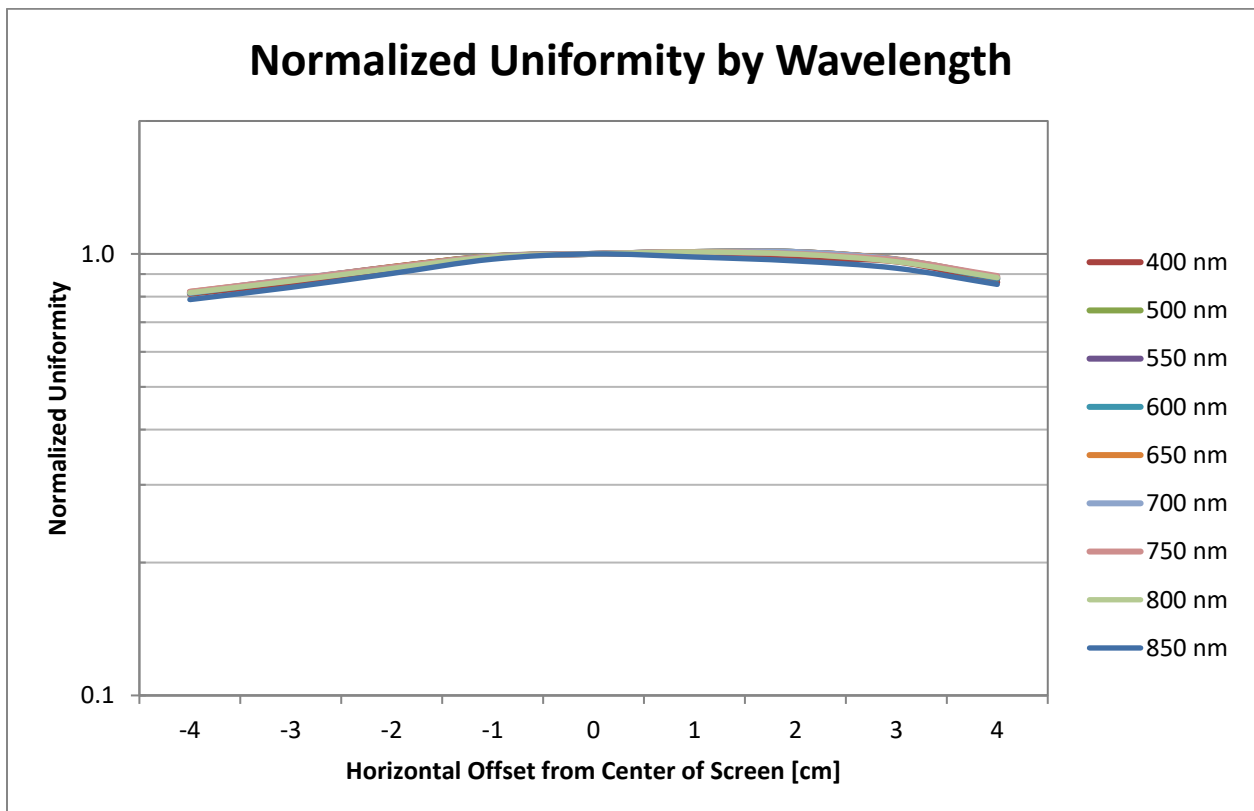


Figure 2: Sample Normalized Uniformity

2.3 Alcor-RC Power Supply



This component of the *Alcor-RC* system provides the power to the remote control system on the head unit. Power to the lamp is also passed through this power supply to enable accurate lamp uptime monitoring.

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: 150 W

Input: 100 – 240 VAC, 50/60 Hz

Output: 24 VDC @ 6.3A maximum

2.4 Agilent E3633A Power Supply



This component of the *Alcor-RC* system provides the power to the lamp in the head unit. The Agilent power supply is capable of providing the required current stability to reliably and consistently power the lamp.

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: 200 W

Input: 100 – 240 VAC, 50 – 60 Hz

Output: 20 VDC @ 10.0A maximum



Caution

The *Alcor-RC* lamp is only rated for 100W. The *Alcor-RC* Control Panel software will control the Agilent power supply to maintain 8.333A (@ ~12.0V) through the lamp. Putting more than the rated 100W through the lamp will damage it and invalidate any calibration of the device. It is highly recommended that you always use the provided *Alcor-RC* Control Panel software to control the Agilent and never manually apply power to the lamp.

2.5 Cables



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



Remote Control Tether Cable: The standard 7m (23') tether cable has D-Sub connectors that interconnect the head unit and power supply units. All power and communication for the remote control electronics and drive system is done through this cable.



Agilent Banana Jumper Cable: This standard 45cm (18in) long cable connects the Agilent power supply to the Alcor-RC Power Supply. This is required so that the lamp power can pass through the hour counter located in the Alcor-RC Power Supply.



Agilent RS232 Cable: This standard 45cm (18in) long cable connects the Agilent power supply RS232 port to the Alcor-RC Power Supply. This is required so that the Alcor-RC Control Panel software can communicate with and control the power to the lamp.



USB A-A Cable: This cable connects the host computer to the Alcor-RC Power Supply. All communication between the Alcor-RC Control Panel software application and the *Alcor-RC* system is done through this cable.

2.6 Accessories



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.

2.7 User Manual



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

2.8 Software



Alcor-RC Control Panel: The *Alcor-RC* system can be operated by using the Alcor-RC Control Panel software, Keo Scientific's Windows® software designed specifically for controlling the *Alcor-RC* system.

3 Installation Overview

The list below briefly describes the sequence of actions required to install and operate your *Alcor-RC* 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 power supplies.	Section 4.5.2, page 19
6. Verify the Agilent voltage selection switch is set to the correct voltage.	Section 4.2.2, page 17
7. Connect the required cables.	Section 4.5.3, page 19
8. If the device drivers are not already installed in the host computer, install them and connect USB cable to the host PC.	Section 4.6: Driver Installation, page 23
9. Install the Keo Alcor-RC Control Panel software application.	Section 4.7, page 24
10. Turn the power supplies ON.	Section 5, page 25
11. Turn on the computer and begin running the application software.	Section 5, page 25

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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-RC* system consists of four main hardware components:

- Alcor-RC Head Unit
- Alcor-RC Power Supply
- Agilent E3633A power supply
- Cables

All of the components and cables required to use the *Alcor-RC* are included with your shipment. Keep all of the original packing materials so you can safely ship the *Alcor-RC* 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 7.

Installation will consist of:

- Mounting the *Alcor-RC* in the desired location.
- Connecting various cables.
- Installing the required drivers and software.

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-RC Head Unit receives its power from the supplied Alcor-RC and Agilent power supplies which in turn plug into an AC power source.

Alcor-RC Power Supply

Input voltage range: 100 VAC to 240 VAC (50/60 Hz)

Input current: 5.0A

Agilent E3633A Power Supply

Input voltage range: 100VAC $\pm 10\%$ **OR** 230 VAC $\pm 10\%$

**Caution**

The Agilent E3633A power supply has a voltage selection switch located on the back of the device. It **MUST** be set to the correct input voltage selection otherwise damage may occur to the device.

This selection will have been made by Keo Scientific at the time of assembly based on the region to which the device was shipped. If the device will be used in a region with a different voltage range, please ensure the voltage selection switch is set correctly.

4.2.3 Mechanical Requirements

The Alcor-RC Head Unit requires either a sturdy location to place it or a tripod capable of supporting 10kg (22lb).

4.2.4 Host Computer

**Important Information**

Computers and operating systems all undergo frequent revision. The following information is only intended to give minimum computer requirements. Please contact Keo Scientific to determine your specific needs.

The *Alcor-RC* system needs a host computer to communicate with and control it. The Alcor-RC Control Panel software provided with your *Alcor-RC* system is only compatible with Windows XP or newer in both 32-bit and 64-bit environments. If you want to use the *Alcor-RC* with a non-Windows platform you will need to write your own control software. The *Alcor-RC* has an easy to use interface that is controlled with simple commands which are sent to its virtual serial port. Contact Keo Scientific for details on communicating with and controlling the *Alcor-RC* system.

4.3 Unpacking the System

While unpacking the *Alcor-RC*, 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.

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-RC*, please confirm that you have all of the parts required to set up the system. A complete system consists of:

- **Alcor-RC Head Unit**
- **Alcor-RC Power Supply**
- **Agilent E3633A Power Supply**
- **Lamp Power Tether Cable:** 7m (23ft) cable is standard.
- **Remote Control Tether Cable:** 7m (23ft) cable is standard.

- **Agilent Banana Jumper Cable:** 45cm (18in) cable is standard.
- **Agilent RS232 Cable:** 45cm (18in) cable is standard.
- **USB A-A Cable:** 1.83m (6ft) cable is standard.
- **2x AC Power Cords**
- **Diffuser Screen Wrench**
- **Tripod Adaptor**
- **Agilent E3633A User's Guide**
- **Alcor-RC System User Manual**
- **Alcor-RC Documentation and Software CD-ROM:** Includes user manuals, drivers, and Alcor-RC Control Panel software.

4.5 Setting up the System

4.5.1 Mounting the Alcor-RC Head Unit

The Alcor-RC 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 Supplies

The two system power supplies (Alcor-RC Power Supply and Agilent E3633A Power Supply) should be placed near the computer that will be used to remotely control the system. The tether cables that run from the Head Unit to the power supplies are 7m (23ft) long so that the Head Unit can be placed in a location a good distance away from the operating computer.



Figure 3: Stacked Power Supplies

The recommended configuration for the power supplies is to stack the Alcor-RC Power Supply on top of the Agilent E3633A Power Supply as shown in Figure 3. This allows for easy routing of the cables and keeps the system as compact as possible.

It is also possible to position the power supplies beside each other if there isn't enough room to stack them.

4.5.3 Connecting the Cables

There are several cables that need to be connected between the various components before you can power up the *Alcor-RC*.

4.5.3.1 Agilent Power Supply RS232 Cable

This cable allows the system to communicate with the Agilent E3633A power supply. Connect the Agilent RS232 Cable between the Agilent RS232 port on the Alcor-RC Power Supply and the RS232 port on the Agilent power supply as shown in Figure 4.



Figure 4: Agilent RS232 Cable Connection

4.5.3.2 Agilent Banana Jumper Cable

Power from the Agilent power supply must be routed through the Alcor-RC Power Supply so that we can detect when the lamp is powered. Connect the Output terminals on the front of the Agilent power supply to the Input terminals on the front of the Alcor-RC Power Supply with the Agilent Banana Jumper Cable. Use the red plugs for the '+' terminals and the black plugs for the '-' terminals.



Figure 5: Agilent Banana Jumper Cable Connection

4.5.3.3 Lamp Power Tether Cable

Power for the lamp in the head unit is transmitted using the Lamp Power Tether Cable which connects the Lamp Power Tether connector on the back of the Alcor-RC Power Supply to the corresponding connector on the side of the Alcor-RC Head Unit as shown in Figures 6 and 7.



Figure 6: Lamp Power Tether Cable Connection 1



Figure 7: Lamp Power Tether Cable Connection 2

4.5.3.4 Remote Control Tether Cable

The remote control tether cable is used to provide power and communications to the motors on the Alcor-RC Head Unit. Connect this cable between the Remote Control Tether port on the back of the Alcor-RC Power Supply and the corresponding port on the side of the Alcor-RC Head Unit.



Figure 8: Remote Control Tether Cable Connection

4.5.3.5 USB Cable



Important Information

If you are running Windows XP on your host computer, it is advisable to install the drivers prior to connecting the USB cable. This will minimize the amount of work required to manually install the drivers.

Connect the USB A-A cable between the USB port on the back of the Alcor-RC Power Supply and a suitable USB port on the host computer. At this point your host computer will start searching for drivers since it has detected a new device. If you have previously installed the drivers it will detect the device. If you have not installed the drivers, see Section 4.6 for details on how to do so.



Figure 9: USB Cable Connection

4.5.3.6 AC Power Cables

Connect the two provided AC Power Cords from the Alcor-RC Power Supply and Agilent Power Supply to a grounded (3-prong) AC outlet.

Your Alcor-RC is now ready for operation.

4.6 Driver Installation

The only driver that needs to be installed before you can start communicating with the Alcor-RC System is the FTDI Virtual COM Port (VCP) driver. The chipset used by the device is a 4 channel USB to RS232 module and as such will install 4 virtual COM ports on your host computer. Three of these ports are used by the *Alcor-RC* system.



Important Information

If you are running Windows 7 or Windows 8 on the host computer then the drivers should automatically install upon connecting the USB cable. If the automatic driver installation fails, follow the instructions below to manually install the drivers.



Important Information

If you have already connected the USB cable to the host computer and it has failed to install the drivers, the drivers will have to be manually installed for each of the four virtual COM ports it creates. It is recommended to install the drivers with the instructions below before attaching the USB cable for the first time.

1. Locate the device driver for the RS232 module.
 - a. Navigate to *Drivers\FTDI Virtual COM Port* on the documentation and utilities CD, or
 - b. Go to <http://www.ftdichip.com/Drivers/VCP.htm> to download the latest driver available for your operating environment.
2. Install the device driver. There are installation guides available from FTDI for the various different operating environments. <http://www.ftdichip.com/Support/Documents/InstallGuides.htm>
3. Connect the Alcor-RC Power Supply to the host computer using the provided USB cable. It will be detected and will install four virtual COM ports.

This will cause the *Alcor-RC* system to appear as four sequential COM ports available to your PC. Application software can access the device the same way it would access a standard COM port.

You can determine the COM port numbers assigned to your *Alcor-RC* system by navigating to the Windows Device Manager (*Start > Control Panel > Device Manager*) and then expanding the *Ports (COM & LPT)* section. There should be a series of four sequential COM ports that were added when the device was plugged into the computer. Depending upon the other devices installed in your system, there may be other USB Serial Ports listed also. In this case, locate the correct ports by trial and error.

The *Alcor-RC* system uses three of the four installed COM ports. For the purposes of this example, assume that the four ports installed are COM4, COM5, COM6, and COM7. The *Alcor-RC* system uses the ports as follows:

1. The lowest of the COM ports (COM4) is for the Alcor-RC Head Unit.
2. The next COM port (COM5) is for the Agilent Power Supply.
3. The next COM port (COM6) is for the elapsed time counter.

4. The highest COM port (COM7) is not used by the Alcor-RC system.

4.7 Software Installation

The *Alcor-RC* system is shipped with Keo Alcor-RC Control Panel software which can be used to control the system from a Windows based PC running Windows XP or newer. The software installer can be found in the *Alcor-RC Control Panel* folder on the documentation and utilities CD. Inside this folder you will find an executable named *Keo Alcor-RC Control Panel Setup-<VER>.exe* where <VER> is the version of the software. Run this executable to install the software.

5 Operation

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

Before powering up the *Alcor-RC* 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?
	VCP drivers installed on the host computer?
	Alcor-RC Control Panel software installed?

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

1. Flip the **Power** switch on the front of the Alcor-RC Power Supply to the ON position. The switch will light up.
2. Press the **Power** button on the front of the Agilent Power Supply. It will beep and the display will light up. Note that the Agilent power supply starts up with the outputs disabled so the lamp will not be illuminated yet.



Important Information

When the Alcor-RC Power Supply is turned on, the motors in the Head Unit are powered up and they start their initialization cycle. They rotate their wheels until they find their 'home' positions. This will normally only take a few seconds (<10 seconds).

3. Start the Alcor-RC Control Panel software on the host PC and ramp up the lamp.
 - a. Connect to the hardware first using the **Connect** button.
 - b. Then ramp up the lamp using the **Ramp Up** button.
4. Wait 5 minutes for the lamp to warm up and stabilize.
5. Select the wavelength of interest on the calibration data plot and choose an aperture wheel combination that provides the required output levels.
6. When finished with the system, disconnect from the hardware and power down both power supply units. A cool down period is not required for the power supply units.
7. Wait until the Head Unit has cooled prior to packing it in the storage case.

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6 Alcor-RC Control Panel Software

The Alcor-RC Control Panel software application can be used to control the *Alcor-RC* system. This software provides an easy to use interface for viewing and interacting with the calibration data of the *Alcor-RC* system.

6.1 GUI Overview

The main graphical user interface (GUI) is designed to allow the user to focus on what is important while operating the *Alcor-RC*. The main two items are the calibration plot and aperture selection regions.

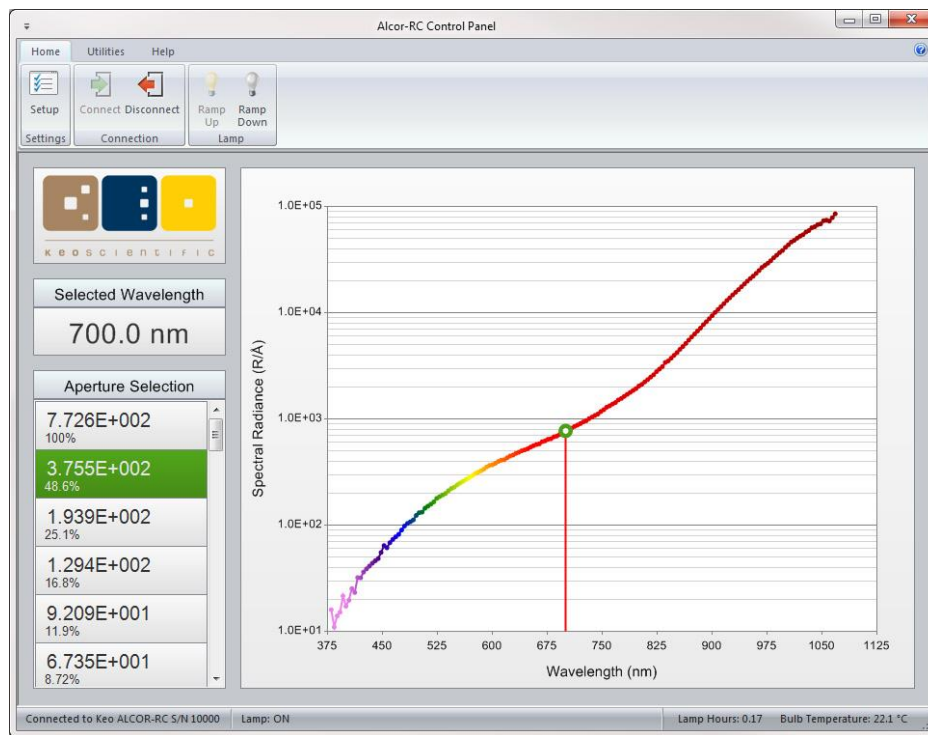


Figure 10: Control Panel Software GUI

6.1.1 The Ribbon Toolbar

At the top of the application is the ribbon toolbar. This toolbar consists of several tabs filled with a variety of buttons used to interact with the application. Further information about the different tab groups and buttons can be found in Section 6.2.

6.1.2 The Selected Wavelength

When a data point has been selected on the calibration data plot, the wavelength of this data point is displayed in this region of the GUI. This ensures that you are always aware of the wavelength for the current aperture data.

6.1.3 The Aperture Selection List

This list has an entry for each aperture wheel combination available on the *Alcor-RC*. The aperture signal ratio calibration data is used to sort this list from highest to lowest output. See Section 6.3 for more information about using the Aperture Selection list.

6.1.4 Calibration Data Plot

This plot shows the spectral radiance calibration data for the center of the output screen. Selecting a data point from this plot will update the Aperture Selection list with the calculated spectral radiance for each aperture combination. More details on the data plot can be found in Section 6.4.

6.2 The Ribbon Toolbar

The ribbon toolbar has three tabs: Home, Utilities, and Help. Each of these tabs has a variety of buttons that are grouped into display groups.

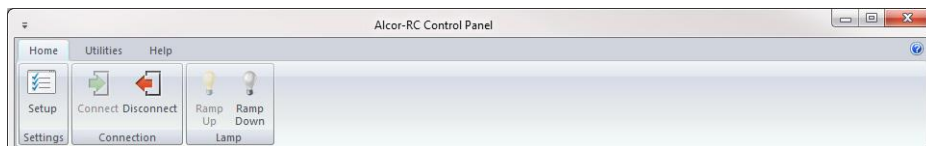


Figure 11: The Ribbon Toolbar

6.2.1 The Home Tab

The Home tab is the default tab where you can modify application settings, connect or disconnect from the *Alcor-RC* system, and ramp the lamp up or down.



Figure 12: The Home Tab

6.2.1.1 The 'Setup' Button

This button will launch the setup dialog where you can modify application and hardware settings. See Section 6.5 for more details.

6.2.1.2 The 'Connect' Button

This button will attempt to connect the software to the *Alcor-RC* system using the hardware settings defined in the setup dialog. If the application is already connected to the *Alcor-RC* system then this button will be disabled.

If this is the first time connecting to the *Alcor-RC* system then an additional step will be taken to download the calibration data from the *Alcor-RC* system. This data is then used to populate the calibration data plot.

6.2.1.3 The 'Disconnect' Button

This button will disconnect the software from the *Alcor-RC* system. If the application is not connected to the *Alcor-RC* system then this button will be disabled.

6.2.1.4 The 'Ramp Up' Button

This button ramps the lamp up to full operating current over a period of 15 seconds. If the lamp is already ramped up or if the software is not connected to the *Alcor-RC* system then this button will be disabled.

6.2.1.5 The 'Ramp Down' Button

This button ramps the lamp down from full operating current over a period of 10 seconds. If the lamp is not ramped up or if the software is not connected to the *Alcor-RC* system then this button will be disabled.

6.2.2 The Utilities Tab

The Utilities tab is where you will find several utilities for performing advanced functions with the software.

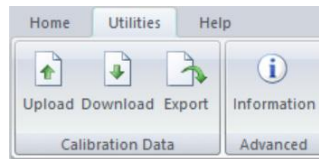


Figure 13: The Utilities Tab

6.2.2.1 The 'Upload' Button

This button allows you to upload new calibration data to the *Alcor-RC* system. Note that this will overwrite any existing calibration data in the unit and should therefore be used with utmost caution. Details on the format of the datafiles required for the upload can be found in Appendix B.

6.2.2.2 The 'Download' Button

This button will re-download the calibration data from the *Alcor-RC* system.

6.2.2.3 The 'Export' Button

This button will export the existing calibration data to a comma separated (CSV) file.

6.2.2.4 The 'Information' Button

This button will launch the Diagnostics Information dialog. This dialog displays some information that may be useful for fixing potential problems.

6.2.3 The Help Tab

This tab displays options related to getting help with the application.



Figure 14: The Help Tab

6.2.3.1 The 'Help' Button

This button launches the built in application help.

6.2.3.2 The 'About' Button

This button launches the About dialog which displays program version information.

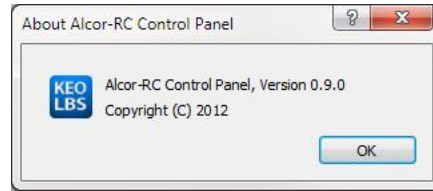


Figure 15: The About Dialog

6.3 Aperture Selection List

The aperture selection portion of the main GUI is where you can select the desired output levels for the device. Each entry in this list corresponds to a physical aperture wheel combination.

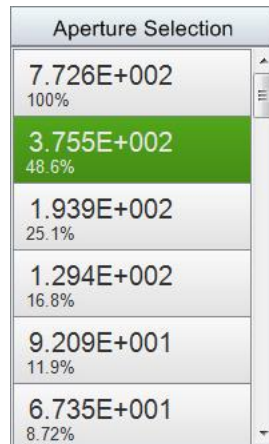


Figure 16: Aperture Selection List

Each item in this list displays two pieces of information: the output spectral radiance at the center of the screen for the selected wavelength (as selected on the calibration data plot, see Section 6.4 for more information) and the percent output for that aperture wheel combination. Selecting an item from the list will command the aperture wheels to move to the new position.

Note that the spectral radiance value displayed for each item is the spectral radiance at the selected wavelength (taken from the calibration data) multiplied by the signal ratio for that aperture wheel combination.

This list will be disabled if the software is not connected to the *Alcor-RC* system.



Important Information

The spectral radiance values displayed are valid only for the center of the output diffusing screen. If you would like to calculate the spectral radiance at a position offset from the center, the uniformity calibration data provided on the calibration data CD will be required.

6.4 Calibration Data Plot

The calibration data plot displays the spectral radiance calibration data for the center of the output diffusing screen. This calibration data is saved in your *Alcor-RC* system before it is shipped so that the software can download it at runtime.

When the user positions the mouse pointer over the plot, the nearest data point is selected and an overlay is displayed showing the value of that data point (as shown in Figure 17). Clicking at any point will select that data point and update the Selected Wavelength display box and Aperture Selection list with the new calibration data point.

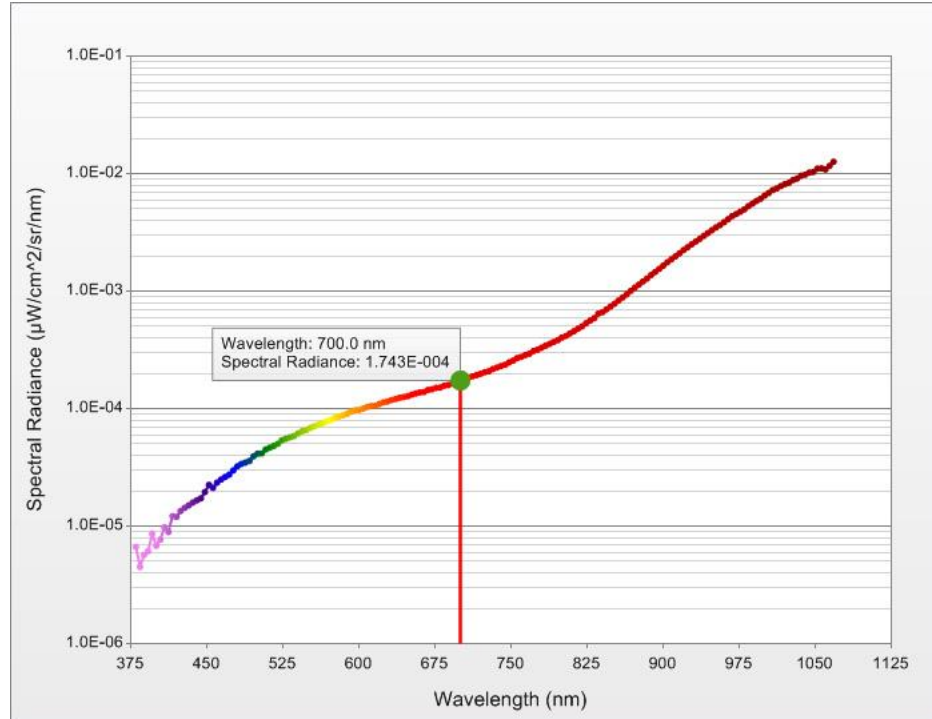


Figure 17: Spectral Radiance Calibration Data Plot

The color gradient of the plot line approximates the color of the light at the various wavelengths. This is for visual purposes only and is not an accurate determination of apparent light color.

The units for each axis can be changed in the application setup dialog (see Section 6.5 for details).



Important Information

The display units selected for the X-Axis and Y-Axis of the plot are used throughout the application for the wavelength and spectral radiance units. Any displayed spectral radiance values can be assumed to have the same units as the Y-Axis of this plot.

6.5 Setup Dialog

The setup dialog has two sections of settings: application settings and hardware settings. These are detailed in the following sections.

6.5.1 Application Settings

The application settings section of the setup dialog displays settings that affect the application.

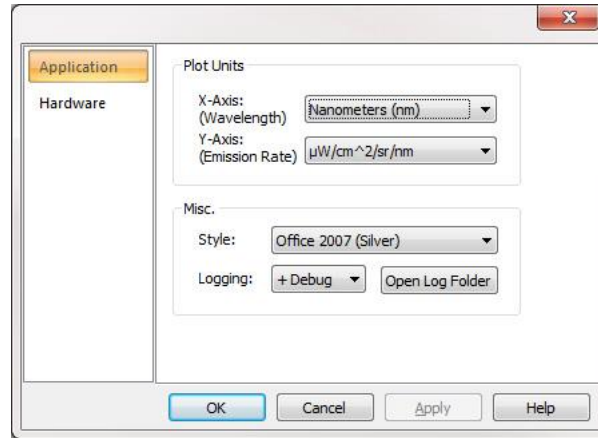


Figure 18: Application Settings

6.5.1.1 Plot Units

The plot units section of the application settings dialog allow the user to change the units used in the display of the calibration data on the plot. These units are also used globally to display wavelength and spectral radiance values.

6.5.1.2 Misc.

This section of the application settings dialog is for general application wide settings.

The **Style** selector lets you change the visual style of the application. Choose which ever style you like best.

The **Logging** selector lets you change the default level of logging for the application. For normal operation it is safe to set this option to **Normal**. Only change the logging level to **+ Debug** if you are experiencing issues or if you are instructed to do so by Keo Scientific.

The **Open Log Folder** button will open the folder where application logs are stored.

6.5.2 Hardware Settings

The hardware settings section of the setup dialog displays settings relevant to the various system components.

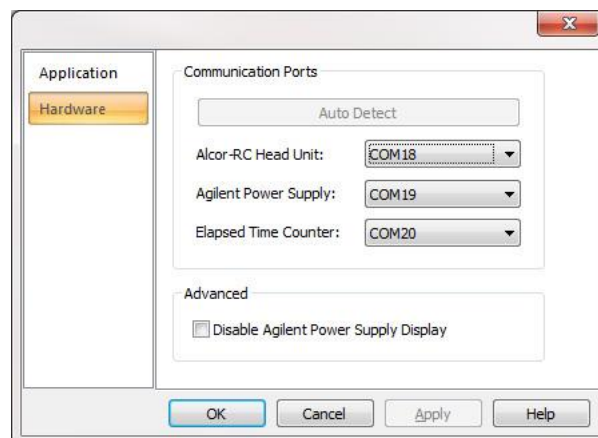


Figure 19: Hardware Settings

6.5.2.1 *Communication Ports*

This section of the hardware settings dialog allows you to select the RS232 port for each hardware component connection. When the drivers were installed for the system (see Section 4.6), there were four COM ports installed. Choose the lower three ports for the three respective hardware devices. See Section 4.6 for details on connecting devices to ports.

6.5.2.2 *Advanced*

This section provides some advanced settings to the user.

The **Disable Agilent Power Supply Display** check box will turn off the Agilent power supply display.

6.6 Keyboard Shortcuts

The arrow keys on the keyboard can be used to interact with the software.

Use the **UP** and **DOWN** arrow keys to change the aperture selection.

Use the **LEFT** and **RIGHT** arrow keys to change the currently selected wavelength on the calibration data plot.

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7 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.
190 – 221 19th ST SE
Calgary, AB T2E7M2
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 10.5" (H) 452mm (L) x 203mm (W) x 267mm (H)
Weight	Alcor-RC Head Unit: 8.5 kg (18.6 lb) Alcor-RC Power Supply: 3.5 kg (7.8 lb) Agilent Power Supply: 9.6 kg (21.2 lb)
Power Input	100 – 240 VAC; 50/60 Hz, 6.3A
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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Appendix B Uploading Calibration Data

New calibration data can be uploaded to the *Alcor-RC* system if you so desire. This would most commonly be done after calibrating or re-calibrating the system. To upload calibration, click the 'Upload' button on the Utilities tab in the Alcor-RC Control Software application. This will open a dialog like the one shown below in Figure 20.

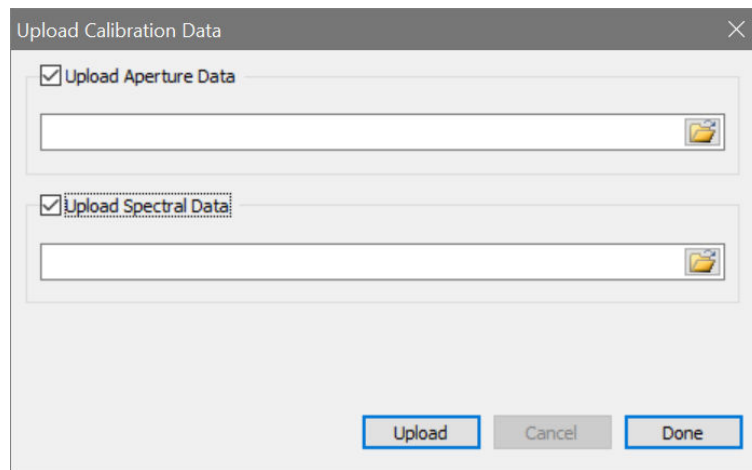


Figure 20: Upload Calibration Data Dialog

Simply use the check boxes to choose whether to upload the aperture and/or spectral data, use the file selection boxes to select the calibration data files for the aperture and/or spectral data, and click the Upload button to begin the transfer. The aperture data upload will complete fairly quickly but the spectral data may take a minute or so depending on the number of data points to transfer.

There are two types of calibration data required: aperture attenuation factor data and spectral response data.

Aperture Attenuation Factor Data Format

The aperture attenuation factor calibration data provides the relative throughput of each aperture combination. The 'wide-open' position (3,12) is considered to have 100% throughput and all other combinations are a fraction of that. A value of -1 indicates zero throughput (blocked position) which corresponds to all combinations with the 12-position wheel in position 1.

This data should be stored in a comma separated (CSV) file in the following format:

12,	3,	
1.00E+02,	1.00E+01,	1.00E+00
5.00E+01,	5.00E+00,	5.00E-01

2.50E+01,	2.50E+00,	2.50E-01
1.25E+01,	1.25E+00,	1.25E-01
6.25E+00,	6.25E-01,	6.25E-02
3.13E+00,	3.13E-01,	3.13E-02
1.56E+00,	1.56E-01,	1.56E-02
7.81E-01,	7.81E-02,	7.81E-03
3.91E-01,	3.91E-02,	3.91E-03
1.95E-01,	1.95E-02,	1.95E-03
9.77E-02,	9.77E-03,	9.77E-04
-1.00E+00,	-1.00E+00,	-1.00E+00

The first row contains 2 values: first the number of rows and then the number of columns of calibration data. These values should be 12 and 3 respectively for all Keo Alcor-RC low brightness sources.

Following that is a table containing the relative attenuation factors for each aperture combination. Position (3,12) is in the top left with positions decreasing as you move down and to the right. The bottom right position would be position (1,1).

Spectral Calibration Data Format

The spectral calibration data provides the spectral radiance at a series of wavelengths. These are used by the software to calculate the spectral radiance at a particular wavelength for each aperture combination.

This data should be stored in a comma separated (CSV) file in the following format:

380,	4.86E-07
384,	5.96E-07
388,	6.64E-07
392,	7.17E-07
396,	8.33E-07
400,	9.43E-07
...	...
...	...
...	...
1048,	3.28E-05
1052,	3.39E-05
1056,	3.31E-05
1060,	3.12E-05
1064,	3.36E-05
1068,	3.41E-05

Each row should contain two values: the wavelength followed by the spectral radiance in units of $W/sr/m^2/nm$. These measurements are assumed to be taken in the 'full open' position (3,12). The file

must contain no more than 2,048 lines. The default calibration provided by Keo Scientific typically contains approximately 172 calibration points.

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