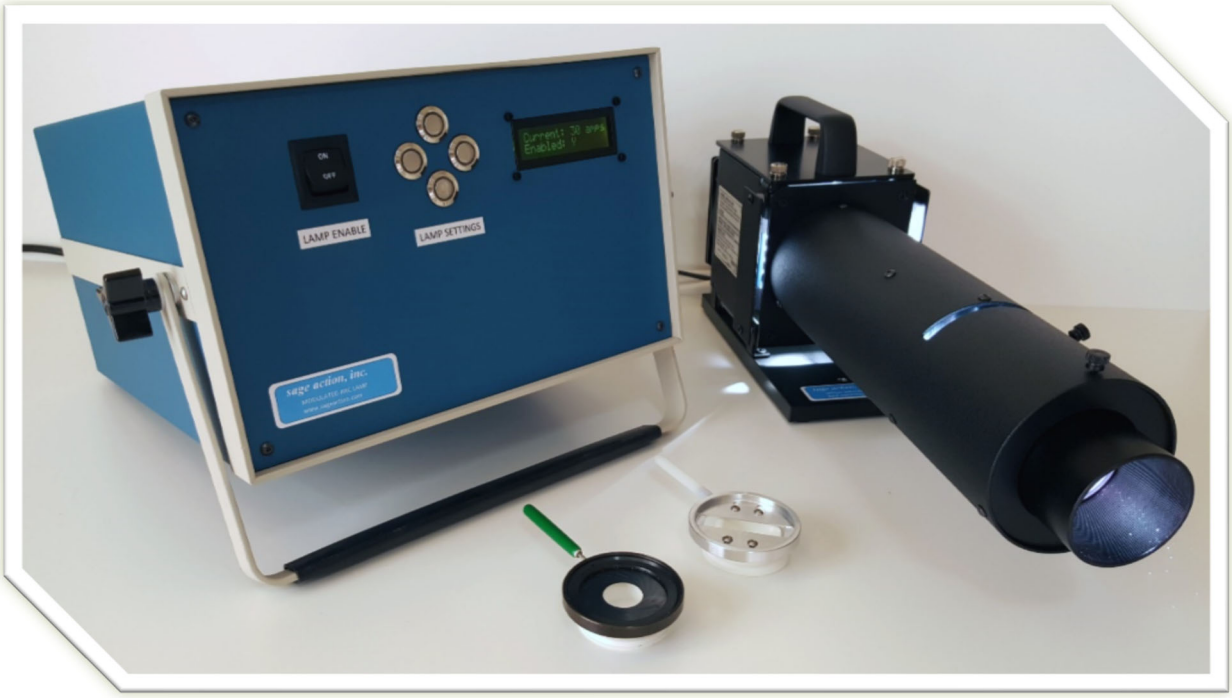


SAI ALS3-400W

Power Supply with Optical Shroud

DESCRIPTION AND OPERATING INSTRUCTIONS

WARNING: This equipment involves the use of high voltage and gas under high pressure. It is a bright, intense light source. Read ALL of the instructions completely before operating and follow them carefully. Note: For use with 110/220Vac, 50/60 Hz Power.

Apache Junction, AZ
(607) 280-2936
www.sageaction.com

sai™ *MODULATED ARC LAMP SYSTEM FOR AIRFLOW VISUALIZATION*

What Is a Cermax® Xenon Lamp?

This light system uses Cermax high-intensity arc lamps. They are rugged and compact xenon short-arc lamps with fixed internal reflectors. They are based on patented technology and the name "Cermax" is a registered trademark of Excelitas Technologies.

Their primary distinguishing characteristics are focused output, extremely high brightness, and safe operation. Cermax Xenon lamps also provide broadband and stable output spectra. Their high brightness makes them ideal for applications such as flow visualization, video projection systems and analytical instruments. Except for some specialized low-wattage high-pressure mercury lamps, Cermax Xenon lamps provide greater brightness levels than any other commercially available incoherent light source and, in some cases, replace lasers. The mechanical integrity of Cermax lamps far exceeds that of any other type of short-arc lamp.

Key Features:

Superior Lighting – The light provides an intense light beam of uniform intensity which can be modulated if needed over a wide range of frequencies and provide a lamp brightness of up to 5500 lumens with a lamp life of 1000 hours.

Ease of Operation – This ALS3 power supply has been designed for ease and simplicity of operation. Intuitive momentary buttons allow for quick adjustment of the lamp current and frequency.

Safe Operation - The power supply, lamp igniter and modulator are packaged into a single enclosure limiting the exposure to high voltage cables.

Quality of Construction - Quality components assure high reliability and durability.

TABLE OF CONTENTS

DESCRIPTION & COMPONENTS

The SAI™ ALS3-400 was developed as part of a system for both visualization and measurement of complex airflows with small, neutrally-buoyant soap bubbles. It provides an intense, collimated light beam of uniform intensity which can be modulated over a wide range of frequencies. With light modulation, the bubble velocity can be measured from as low as 2 fps to speeds as high as 200 fps. For different flow situations, the beam can be readily modified to optimize the lighting. The system consists of a power supply, lamp igniter, lamp & lamp holder, modulator, optical shroud, and two light apertures.

The ALS3-400 is designed for use with a 400-watt Cermax Lamp. This unique lamp is a xenon-filled, short-arc lamp containing an integral reflector. The Cermax Lamp is housed in a PerkinElmer HX10 Frame and powered by the ALS3 laboratory power supply.

The Optical Shroud is used to focus the beam emitted by the lamp. It contains five elements: (i) condensing lens, (ii) special aperture cradle (iii) iris aperture (iv) slit aperture and (v) projection lens assembly. The condensing lens serves to redistribute the light emitted by the lamp more uniformly, and the apertures are used to change the cross-section shape and size of the beam. The projection lens assembly focuses the aperture image at the desired distance from the system. A handle on the aperture extends outside the Optical Shroud for insertion, removal, and adjustment.

The Lamp Holder is attached at the end of the Optical Shroud and powered by the high voltage cables that connect it to the power supply. A handle is provided on top of the lamp holder to carry and position the light. The bottom base has rubber feet for general support on any flat surface and a ¼-20 threaded hole for mounting the shroud on a heavy-duty tripod.

The maximum output power for this power supply is rated at 650 Watts. The unit can be driven off line voltages between 100VAC to 240VAC. The ALS3 is capable of operating Cermax short-arc lamps of 300, 400 or 500 Watts.

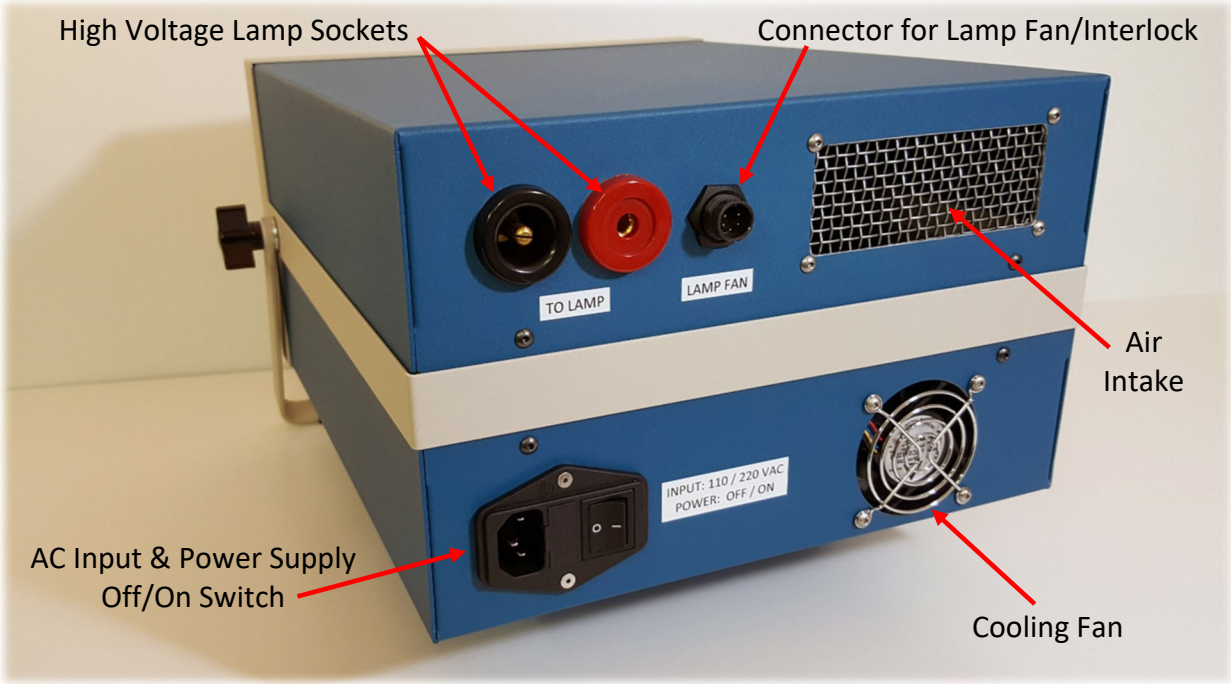
The internal igniter module provides the 40kV pulse required to break down the Xenon gas and facilitate ignition. In standard configurations, the pulse is applied through the positive output to the lamp anode. The main power supply chassis provides the power to the lamp module. Internal circuitry in the igniter module senses the presence of the high voltage arc and briefly disables operation in the main power supply chassis to minimize damage from high voltage noise.

The LCD Display is 2 lines x 16 characters wide which displays two different color backgrounds that indicate whether the light is continuously on or being modulated. The Display is easy to work with, not only in viewing the lamp status but in setting the modulation timing as well.

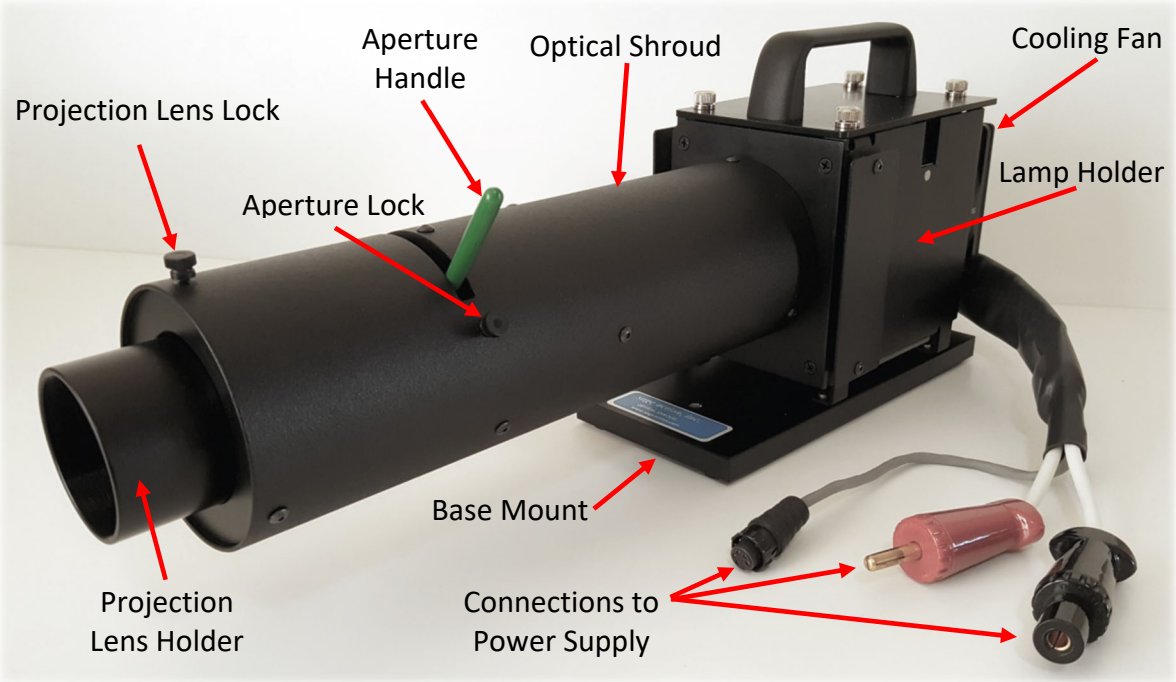
The four Momentary Buttons and Lamp Enable switch on the control panel allow for easy operation of the lamp. The top and bottom buttons are used to set the lamp mode as well as the current and "On and Off" time duration of the lamp. The left and right buttons move the blinking cursor from field to field on the display. Once the lamp settings are achieved, the light is turned on with the Lamp Enable switch.

Sage Action, Inc. has worked cooperatively with a group of specialized suppliers to configure this unique light source and believes our customers will find that it will make an excellent tool for visualizing and quantitatively measuring airflow with SAI Helium-Filled Bubbles.

GENERAL LAYOUT / POWER SUPPLY



GENERAL LAYOUT / OPTICAL SHROUD

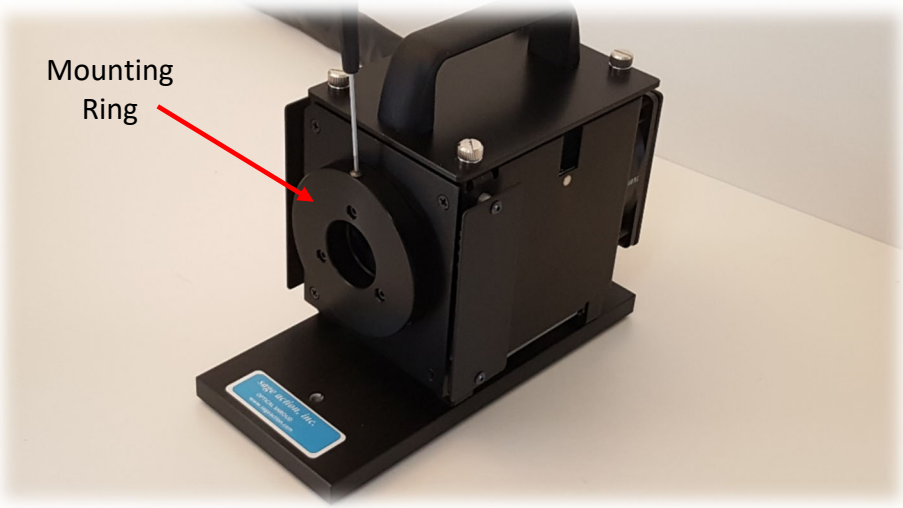


SETUP & OPERATION

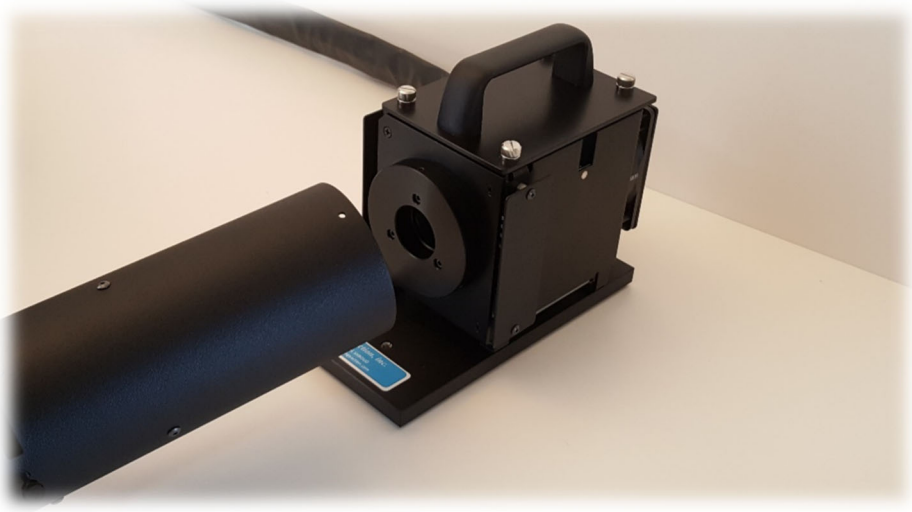
1. Take time to become familiar with all the components included with the light system before you proceed. Attach the Adjustable Handle to the power supply if desired. The nylon washer

slides on the Handle Lock screw first, then the handle, and then the metal washer. Move the handle to the desired position and lock in place.

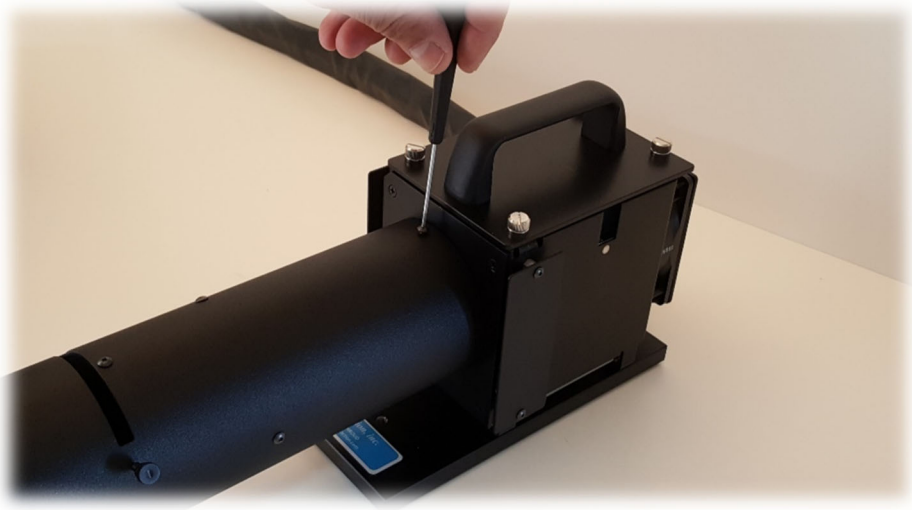
2. Attach the Optical Shroud to the lamp holder with the three 6-32 Button Head Screws. These screws are stored on the mounting ring of the lamp holder. Remove the screws.



3. Slide the shroud on to the mounting ring.

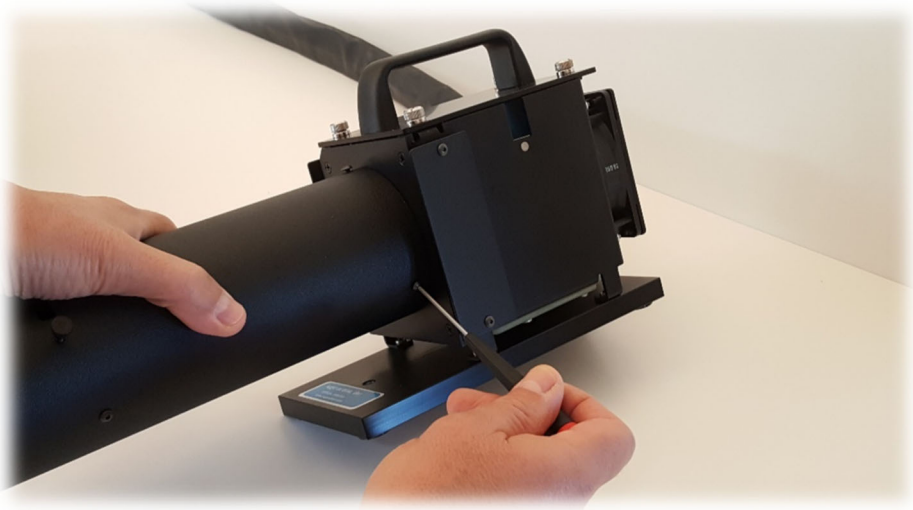


4. Install the top screw first. Tighten ¼ turn when the screw head contacts the shroud surface.

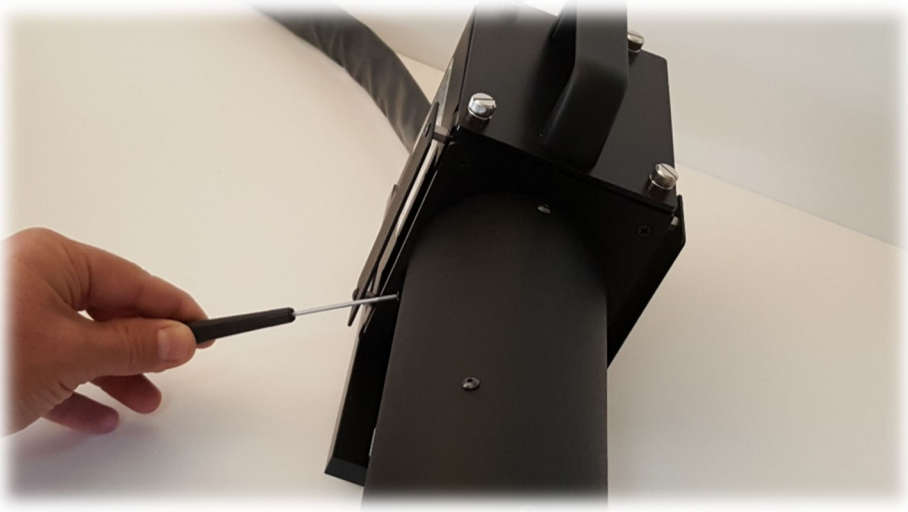


5. Repeat this process for the two remaining screws.

6. Install second screw.

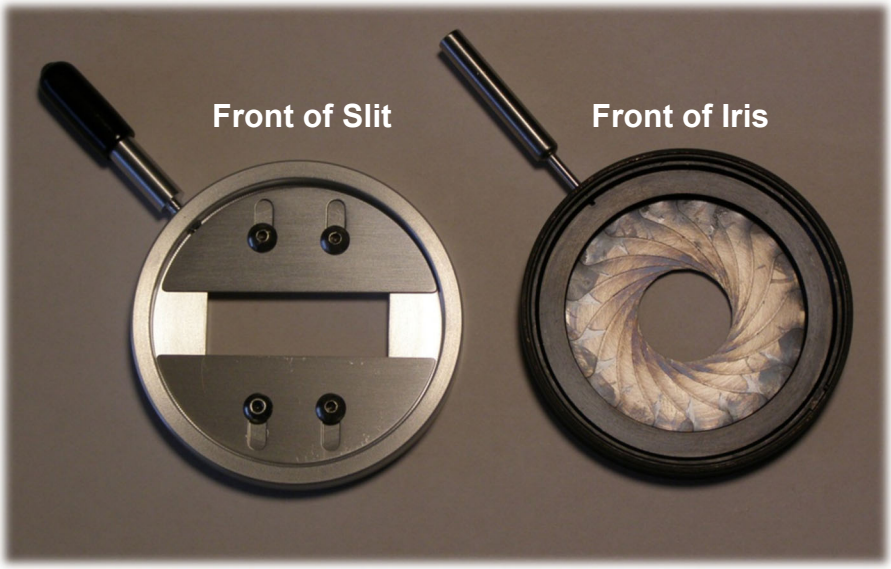


7. Install third screw.



8. Next mount and position the optical shroud such that it is secure and level. When it is mounted to a stand or heavy-duty tripod it should always remain fairly level. ***Important! The light should not be operated at an angle of more than 30 degrees from level. Doing so will not allow the lamp to cool properly and this can shorten lamp life or lead to a lamp failure***.

9. Decide which aperture is better for the current application and install it. Both an Adjustable Slit and an Iris Aperture are included with this unit. The adjustable slit provides a rectangular

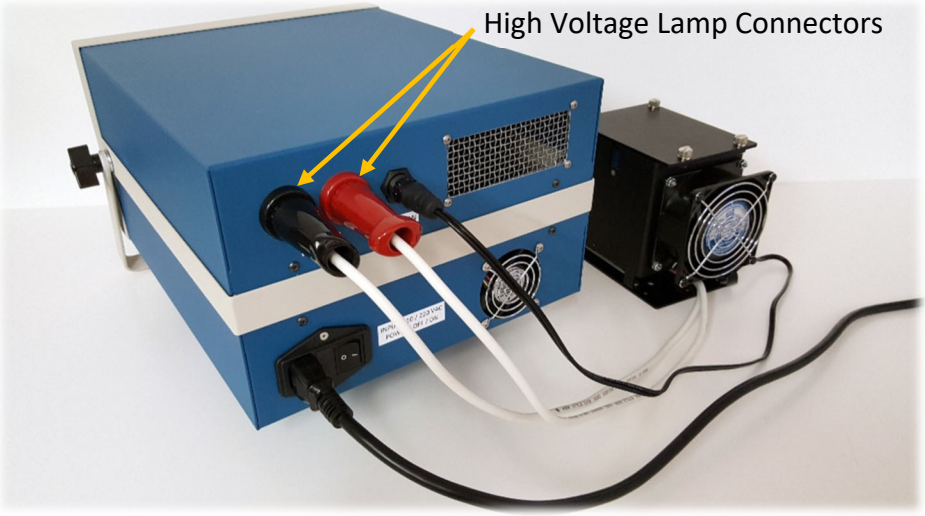


beam or "slab" of light varying in width. This is particularly helpful to visualize 2-D airflows or to study 2-D sections of a complex 3-D airflow. To adjust the width of the slit, loosen the four button head hex socket screws that hold the two leaves and reset as desired. The orientation of the slit may be adjusted by rotation of the handle through an arc up to 90º. The adjustable Iris Aperture provides a round beam varying in diameter. This is useful for examination of axisymmetric airflows or the overall examination of any airflow. When the iris diaphragm is placed into the Optical Shroud, it should be inserted in the slot with the iris fully open. This will permit full travel of the handle to open and close the iris. To decrease the beam diameter, simply move the handle across the slit opening.

10. Install the chosen aperture through the slot with the front side facing toward the projection lens. Once it is fully seated in the holder, tighten the thumbscrew ¼ turn from the point it first touches the aperture. ***NOTE: Excessive tightening of the thumbscrew will deform the shape of the iris and make it difficult to open and close. CAUTION! During normal use the apertures will get extremely hot. Allow them to cool before attempting to handle them or use cotton gloves for protection.***

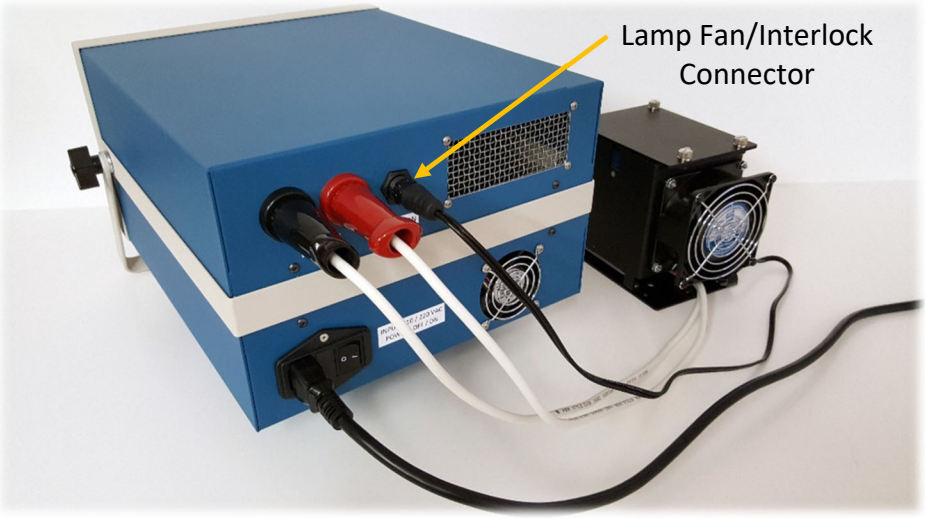
11. Remove the protective Projection Lens Cover on the end of the Optical Shroud if it is in place.

12. Plug the black and red high voltage lamp connectors from the lamp holder cable into the



mating black and red high voltage sockets on the back of the power supply.

13. Plug in and secure the lamp fan/interlock connector from the lamp holder into the mating socket on the back of the power supply.



14. Connect the female end of the AC power cord to the back of the Power Supply and plug the male end into a 3-wire **grounded** wall receptacle. **DO NOT** use an ungrounded outlet at any time. Turn the "Power OFF/ON" switch to the ON position. The fans for the power supply and lamp holder will turn on and the LCD Display will illuminate. If any of the fans are not working, turn OFF the power supply and resolve the problem before continuing.

15. To operate the light in continuous mode, push the Lamp Enable switch to "ON". There will be a pause while the lamp ignites. The display will change to a yellow background and the "Enabled: N" field in the display will now read "Enabled: Y", indicating yes, the light is enabled

in a continuous "On" mode. Here the lamp is on in continuous mode with yellow background in the display.

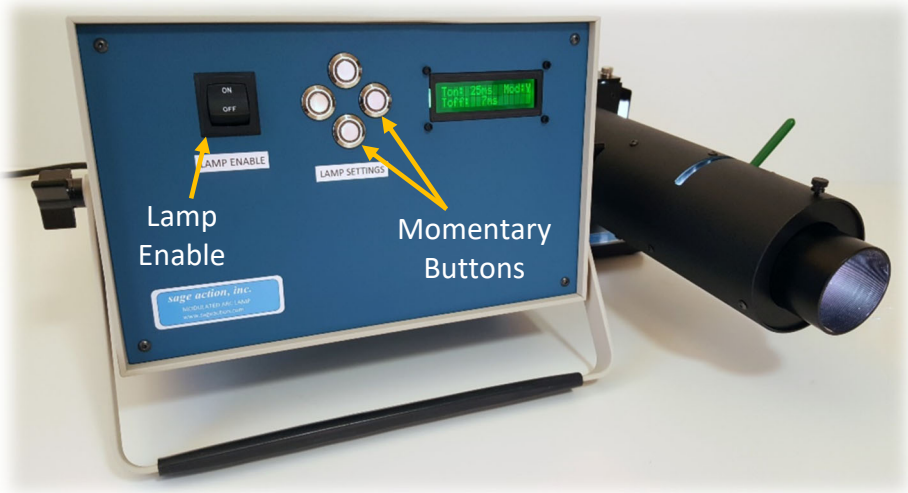
16. To modulate the lamp, push the “Lamp Enable” switch to the “OFF” position. The display will turn back to blue and the curser will be blinking in the “Current:” field. Push the right Momentary Button once to display the settings for lamp modulation.

17. With the blinking cursor in the “Ton:” field, use the top or bottom Momentary Button to increase or decrease the length of time for the light to be on.

18. Once set, push the right button once to advance to the “Mod:N” field. Set this value to “Y” by pushing either the top or bottom button once.

19. Push the right Momentary Button once again to proceed to the field labeled “Toff:” this field represents the length of time the lamp is off. Use the top and bottom Momentary Buttons to set the length of time for the light to be off. In general, longer lamp life is achieved when “Toff:” is limited to approximately 20% of whatever “Ton:” is set for.

20. To ignite the lamp with the desired settings, push the “Lamp Enable” switch to “ON”. There will be a brief pause while the lamp ignites. The display will change to a green background with listing the lamps “On” and “Off” times.

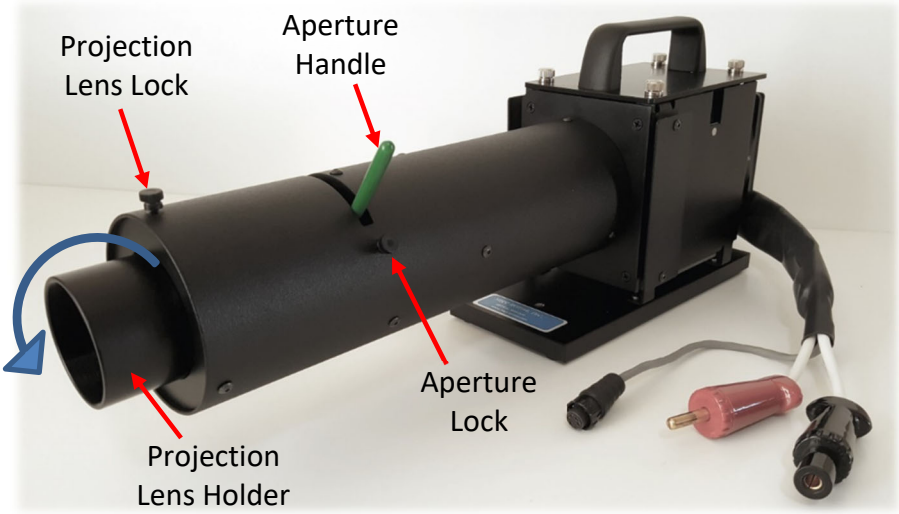


21. To stop the lamp modulating, turn the “Lamp Enable” switch off.

22. To turn the lamp back on with no modulation, push the “Lamp Enable” switch on again. Or, to turn the lamp back on with modulation, use the Momentary Buttons to reset “Mod:N” back to “Mod:Y”, and push the “Lamp Enable” switch to “ON”.

23. Align the light beam to illuminate the desired test area of the flow but with minimal light on the background. This will give the maximum contrast between the bubbles and the background, or intensity of the bubble streaks. At the same time, position the light as close as possible so the beam just fills the viewed area with the aperture completely open. In wind tunnel testing it is usually better to mount the light upstream or downstream of the model with its essentially aligned with the test section axis. This arrangement permits viewing from either side or from top and bottom.

24. To focus the beam, loosen the Projection Lens Thumbscrew and rotate the Projection Lens Holder counter-clockwise for a distance that is closer than 1.5 meters, for a distance greater than 1.5 meters rotate the projection clockwise until it stops. Tighten the thumbscrew ¼ turn from the point it first touches projection lens holder, *see page 13.*



25. Observe the length of the bubble streaks, or "dashes", at various points in the flow against some known length or scale within the field of view. Any reasonable streak length may be used; however, it is best to adjust the "On" time until the length for some reference velocity at a certain point is 1" long. Adjust the corresponding "Off" time so that it is still about 20% of the "On" time. ***Note:*** *Operate the lamp in modulation mode only as necessary to avoid excessive lamp wear.*

26. Once a 1" bubble streak length is achieved in a region of the flow, the Velocity U can be calculated from the following equation:

    U = 1 / (12T)

    where U is in fps and T is the "On" time in seconds. Since the local velocity everywhere is proportional to the dash length, the local velocities at all other points can be scaled accordingly. For example, if T equals 10 ms, we find U = 8.33 fps. If a dash is 2" long, then the local velocity at that point would be 16.7 fps. In other words, an instantaneous velocity map of the whole flow can virtually be "seen".

27. When finished with the light, push the "Lamp Enabled" button to "OFF". Then allow the system fans to cool the power supply and lamp for 3-4 minutes. To turn off the system fans push the "OFF/ON" Switch located on the back of the power supply, *see page 3.*

SUGGESTIONS

1. Start a flow visualization test by setting the lamp in continuous mode. This makes it easier to examine the overall area of interest first and determine what characteristics of the airflow are most important. It also helps to determine the best orientation of the light. Operating the lamp in continuous mode also avoids excessive lamp wear.

2. Make background areas flat black to diffuse stray light. This will improve the contrast of the bubbles and make them more visible. All model parts receiving direct illumination should be glossy black. If a surface reflects light directly back, then use flat black on that surface.

3. Make the room or test environment as dark as reasonable. This will greatly improve the contrast between the bubble and the background.

4. Aligning the light beam with the general direction of the flow or the bubble motion will help to increase the intensity of the bubble trace. That is, the two highlights of the bubble trace will thus travel over the same path for the most part and form a brighter trace.

5. If a beam pattern other than rectangular or circular is required, a metal cutout of the appropriate shape can be made and suitably attached to the adjustable slit in place of the leaves.

6. Maximum visibility of the flow is obtained by aiming the beam at a 90° angle from the direction of view. This keeps light from reflecting off the background of the object being studied or any clear window for viewing purposes in the foreground.

7. For applications where variation in the height of the light is necessary use a heavy-duty tripod with a base plate. ***Important! The light should not be operated at an angle of more than 30 degrees from level. Doing so will not allow the lamp to cool properly and this can shorten lamp life or lead to a lamp failure.***

8. If the light is used in a wind tunnel, it should be located downstream of the point where bubbles are implanted and positioned somewhat above or below this point, or slightly off to either side. This will minimize buildup of bubble residue on the projection lens.

MAINTENANCE

1. Clean the front surface of the projection lens to remove any dust and/or bubble film solution. Accumulation of deposits on the lens will cause diffusion of the light beam and result in poor illumination of the bubbles. Care must be taken when cleaning the lens since it is coated to provide maximum transmission of visible light. Simply wiping with damp microfiber cloth will remove most major deposits of bubble film solution. Commercial optical cleaning fluids and a soft haired brush may be used to remove any additional dust or deposits, if necessary. No detergents or ordinary glass cleaning solutions should be used. Preform all maintenance ONLY when the Light is UNPLUGGED and COOL.

2. If the Iris Diaphragm does not open and close smoothly use a small amount of a graphite lubricant on the leaves.

3. Remove any dust buildup from the outside surfaces light system with a damp microfiber cloth.

SAFETY & PRECAUTIONS

- This is a **bright, intense light source. NEVER** look directly at the operating lamp or into the light beam.
- Avoid operating the light with the iris or slit near their minimum settings for more than 5 minutes. ***CAUTION! During normal use the apertures will get extremely hot. Allow them to cool completely before handling and use cotton gloves for protection.***
- After shutting the power supply off, let it continue to cool down for 10 minutes before storing.
- **NEVER** operate the light with the enclosure panels off to avoid electrical exposure of the lamp wiring.
- **To avoid fire or other damage**, take care that the light is not too close to any material which is readily combustible since the radiant beam heat is very hot. Keep the minimum distance to 1 meter or greater.
- The light should be positioned so that the fan and vents are free from obstruction. A minimum clearance of at least 15 cm is needed. Always check that the fans are running before and after lamp ignition. **The Power Supply should be shut off immediately if any of the fans stop operating. DO NOT try to restart until the problem is resolved.**

SPECIFICATIONS

Power Supply Dimensions: 28 cm W x 19 cm H x 34 cm D

Power Supply Weight: 6.35 Kg

Lamp wattages which can be configured: 300W, 400W and 500W Cermax Lamps

Input Voltage: 100-240VAC

Ignition Voltage: Up to 45Kv

Operating Current: 25 to 32 amps

Average Lamp Life: 1000 Hrs

Time Range for Modulation On Time "Ton:" 1.0 ms to 50 ms

Time Range for Modulation Off Time "Toff:" 1.0 ms to 50 ms

Operating Temperature: 0 to 40 °C

Cooling: Forced Convection

Storage: 0 to 60 °C

Optical Shroud Dimensions: 48.5 cm L x 13 cm W x 20 cm H

Optical Shroud Weight: 3.63 Kg

Adjustable Slit Width: 2 mm – 11 mm

Adjustable Iris Diaphragm Diameter: 4 mm – 38 mm

Rectangular Light Beam at 2 m: 48 cm x 10 cm to 48 cm x 16 cm

Circular Light Beam at 2 m: 15 cm to 140 cm

Focusing Range: 1 m - Infinity

Projection Lens Focal Length (Each): 160 mm