

## Manual

### LS60FH $\alpha$ Filter System

Congratulations and thank you on your purchase of a Lunt Solar Systems solar filter! The Lunt Solar systems are a new generation of solar viewing instruments utilizing the most current technologies to provide the highest quality contrast and resolution in their class.

#### Warning

There are inherent dangers when looking at the Sun thru any instrument. Lunt Solar Systems has taken your safety very seriously in the design of our systems. With safety being the highest priority we ask that you read and understand the operation of your telescope or filter system prior to use. Never attempt to disassemble the system. Do not use your system if it is in some way compromised due to mishandling or damage. Please contact our customer service with any questions or concerns regarding the safe use of your instrument.

**Never look at the Sun with your naked eye or with a telescope that is not specifically designed to do so. Permanent and irreversible eye damage may result!**

**Check that all filters are installed correctly** and are free of any surface contamination that may compromise performance and/or potentially damage the surface of the optic when exposed to the Sun. i.e.: fingerprints. Perform a routine safety check before each viewing session.

**Never leave the solar telescope unsupervised while pointed at the Sun. People who are not familiar with the correct operating procedures of the system may inadvertently replace the diagonal or remove the filter itself not being aware of the integrated safety features of each.**

**The Lunt Solar filter/telescopes are not interchangeable with competitor products.**

#### Handling

A Lunt Solar Systems solar filter houses many optical elements that are all pre-aligned and fixed at the factory. There are no user serviceable parts inside the filter. The filter should never be taken apart. This will not only void your warranty leading to costly repairs, it can only serve to further damage the instrument and compromise its safety.

Most Lunt Solar Systems filters and telescopes house a delicate optical element referred to as an Etalon. These Etalons are suspended in the filter housing in an effort to both protect it and isolate it from outside influences, which could de-tune the Etalon filter. Extensive research has been done to assure the best performance of what is essentially the "heart" of the system while protecting it from the day-to-day bumps, jarring, and vibrations of normal use.

However, the instrument should never be subjected to shock due to being dropped. Mishandling of the filters system will cause the Etalon to de-contact (not covered under warranty) and will render the instrument useless until repaired.

The instrument should be stored in its original case. As with any precision optical instrument it should be kept in as low a humidity area as possible.

With proper handling and care the filter should last a lifetime.

#### Cleaning

As with most telescopes and equipment there will be a build up of dust and debris on the lens and mechanical components after sitting out all day. For those who are familiar with cleaning telescopes we recommend you use the same techniques. For those who are new to the care of these instruments we can offer the following guidelines:

Blow off loose dust and dirt using a clean dry air source at low volume. Do not use shop compressed air, which contains oil and will further contaminate the instrument. Stubborn particulates can be brushed from the surface with a static free lens brush. Use gentle sweeping motions. Fingerprints and smudges can be removed using lens tissue or a Kleenex type tissue product. Fold the tissue or cloth to make a "pad", apply a cleaning product to the end of the pad dampening it evenly (do not apply solution to the lens), wipe in circular motion starting at the

center and working around the edge and off in one complete motion. Be firm, but do not rub. Blow lightly to help remove residual solution before it "spots" the surface. Residual dust from the cloth can be blown off. Consult your local dealer or call Lunt Solar Systems with any questions or concerns. Do not use Acetone or strong degreaser type products, household cleaning agents, paper towels, tissues with added scent or color (plain tissues only), or bleach or acidic products which will damage the anodized surfaces.

### **What am I looking at?**

The Sun is active on a daily basis. During solar maximum the Sun will put on awe inspiring displays that include x-class flares, prominences, surface filaments, etc...

**Prominences:** These look like eruptions from the disk (edge) of the Sun. Prominences can be small spiky looking details, or large cloud like detail with fine feather like internal features. They are, in fact, ionized hydrogen emissions being projected from the limb. Prominences are anchored to the Sun's surface in the mesosphere, and extend outwards into the Sun's troposphere.

**Filaments:** These are string like features on the surface of the Sun. At high resolution they take on a 3D effect due to the cooler aspect of the filament contrasted against the bright, hotter, Sun. They are actually prominences being viewed against the surface.

**Spicules:** A spicule is a dynamic jet of about 500km diameter on the Sun. It moves upwards at about 20 km/s from the photosphere. Father Angelo Secchi of the Vatican Observatory in Rome discovered them in 1877. The chromosphere is entirely composed of spicules. These features can be seen as "fur" around the edge of the disk.

**Plage:** This is a bright region in the chromosphere of the Sun, typically found in regions of the chromosphere near sunspots. The plage regions map closely to the faculae in the photosphere below, but the latter have much smaller spatial scales. Faculae have a strong influence on the solar constant, and the more readily detectable because chromospheric plage areas traditionally are used to monitor this influence.

**Solar Flares:** A solar flare is a violent explosion in the Sun's atmosphere. Solar flares take place in the solar corona and chromospheres, heating plasma to tens of millions of Kelvin and accelerating electron, protons, and heavier ions to near the speed of light. They produce electromagnetic radiation across the electromagnetic spectrum at all wavelengths from long-wave radio to the shortest wavelength gamma rays. Most flares occur in active regions around sunspots, where intense magnetic fields emerge from the Sun's surface into the corona. Flares are powered by the sudden (timescales of minutes to tens of minutes) release of magnetic energy stored in the corona.

**Chromosphere:** The chromosphere is a thin layer of the Sun's atmosphere just above the photosphere, roughly 10,000 kilometers deep (approximating to, if a little less than, the diameter of the Earth). The chromosphere is more visually transparent than the photosphere. The name comes from the fact that it has a reddish color, as the visual spectrum of the chromosphere is dominated by the deep red H-alpha spectral line of hydrogen.

### **The LS60FH $\alpha$ Filter**

Hydrogen-alpha filter system with 60mm aperture (no central obstruction) integrally tuned etalon for use on any refractor and many other telescopes. Because the LS60 has an estimated bandwidth of <0.7 Angstrom it is capable to providing high contrast views of both surface and edge detail. System includes a blocking filter standard (B600 can be used at telescopes up to 540mm focal length, B1200 up to 1080mm, B1800 up to 1620mm, and B3400 up to 3060mm). The blocking filter is installed in a 90° star diagonal for 1.25" or 2" focuser. This diagonal is equipped with a 1.25" eyepieces holder and a T2 camera connection. Only the B3400 is installed in a straight tube with 2" connection. Adding an additional available Double Stack Etalon system will reduce the bandwidth to ~<0.5 Angstrom (dependant upon scope).

### **What is delivered with the system?**

- LS60FH $\alpha$  Main Filter for front mounting
- A blocking filter, B600, B1200, B1800 or B3400 (not included at the LS60FH $\alpha$  double stack filter)
- A transport case with die cut foam insert
- Instruction manual

### **What accessories are recommended?**

- **Eyepieces:** Simple eyepieces with narrow field of view are recommended. (25mm thru 8mm)
- **Adapter plate:** To securely mount the LS60FH $\alpha$  to your scope.
- **Sol Searcher:** This makes finding the Sun much easier.

## Okay let's get started...

### **Safety First!**

- **Always check any telescope before use. Do not use any telescope or filter that appears to be damaged. Verify that all glass and filters are in place.**
- **The Blocking Filter diagonal or extension tube must always be used with the Lunt telescope or filter.**

So you have your LS60FHa filter set and your telescope.

Do not point your telescope at the sun until your filter set is fully mounted and secure on the telescope! If you have any questions about mounting or your filter set please contact our customer service.

Thread or slip on your Lunt Solar Systems adapter plate to the front of your telescope. If the adapter plate is a slip on make sure thumb screws have been tightened and are secure. Thread the Lunt Solar Systems front etalon into the adapter plate.



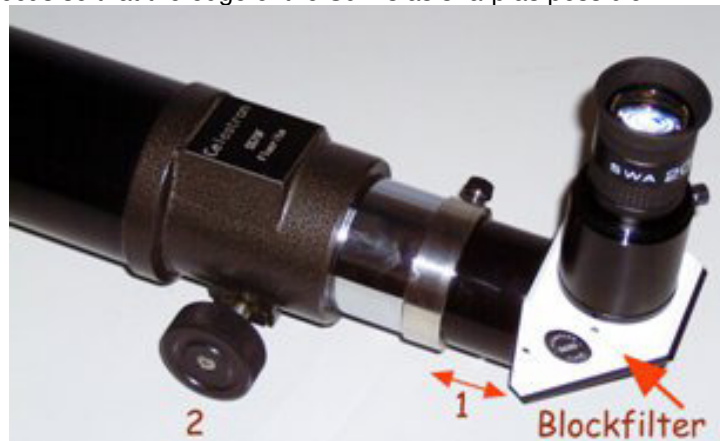
Slide the drawtube of the Lunt Solar Systems blocking filter into your focuser and tighten the retention system of your telescope.

Place a ~25mm eyepiece in the end so you have the largest field of view to look at.

Put the focus at about 50% of travel.

If you do not have a Sol Searcher you can use the shadow cast by the Sun on the front filter cell against the clamshell or mounting rings. Center one on the other and you should be close. Look thru the eyepiece. Do you see a fuzzy red ball? If not, make sure you have removed the dust cap from the front. After some trial and error the sun should appear in the eyepiece.

**Focus:** It is amazing how many people walk up to a solar telescope and take a quick look thru without ever focusing. Course focus is achieved by moving the diagonal drawtube in and out. Medium focus is achieved thru your focuser as usual. Focus so that the edge of the Sun is as sharp as possible.



**Tuning:** Here is where the magic begins. On the filter is a small brass wheel recessed into the filter housing. Move the knob all the way to the right when standing at the eyepiece end. Do not force the wheel. While looking thru the instrument slowly move the wheel to the left. After about 4-5 turns you should have seen the edge detail of the Sun come into view and then fade away again. Move the wheel back in the other direction until the prominences are most vivid. Moving the wheel from here in either direction should have little visual effect on the image but more or less surface detail may become apparent. Personal preference will specify where the tuning point is dependant upon what you like to observe. Once tuned, there should be no reason to re-tune during an observing session.

**Re-Focus:** When you feel you have tuned effectively, re-focus the telescope. The finer details should come into view. Try to relax the eye while observing and let the details come to you.

**Change the eyepiece:** When you have a good feel for observing at lower magnifications try to increase the magnifications in small steps. Place an interesting artifact in the center of the field. Replace the 25mm with an 8 - 12mm eyepiece. Look thru the eyepiece and re-focus carefully. The image has dimmed slightly due to higher magnification but the details should be easier to see. You can push the magnification as seeing conditions allow.

### **A few more definitions**

**Hydrogen-alpha:** The wavelength of light in the spectrum that these scopes allow you to look at. Centered at 656.28nm.

**Bandwidth:** The width of light at a given wavelength that is allowed to pass. The LS60FHa is <0.7 Angstrom. As bandwidth is reduced more surface detail of the Sun can be resolved. This can be accomplished thru double-stacking with a second LS60FHa Filter (<0.5 Angstrom).

**Angstrom:** The unit of measurement for light. 1 Angstrom = 0.1 nm.

**Etalon:** A resonating cavity produced thru the fabrication of highly precise optical surfaces.

### **Technical data**

<b>Filter aperture:</b>	60mm
<b>Bandwidth:</b>	<0.7 Angstrom
<b>Double stacked:</b>	<0.5 Angstrom
<b>Tuning:</b>	tiltable Etalon
<b>Housing diameter:</b>	95mm
<b>Length:</b>	85mm
<b>Front thread:</b>	M90mm x 1mm female thread
<b>Rear thread:</b>	M90mm x 1mm male thread
<b>Weight:</b>	0.85kg

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