

## Manual

### LS60TH $\alpha$ Telescope with Pressure Tuner

Congratulations and thank you on your purchase of a Lunt Solar Systems solar telescope! 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!**

**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 telescope houses many optical elements that are all pre-aligned and fixed at the factory. There are no user serviceable parts inside the scope. The telescope 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 system 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 LS60TH $\alpha$ Telescope with Pressure Tuner**

Complete Solar Telescope with 60mm aperture and 500mm focal length. An internal etalon with new air-pressure tuning adjustment allows for a <0.7 Angstrom bandwidth. The "Pressure Tuner" system adapted the Etalon to varying altitudes and atmospheric pressures for always optimal performance. With the matched collimation lens set, the LS60TH $\alpha$  is fully corrected for on axis coma, astigmatism and de-centering aberrations and provides a full spherically corrected flat-field Solar-Telescope. Blocking filter is the B600 or the B1200, the B1200 is better for imaging. The star diagonal in which the blocking filter is installed, is equipped as standard for 1.25" eyepieces and with a T2 camera connection. Fine adjustment is achieved with a Crayford style focuser or with a Starlight Instruments Feather Touch focuser, both with 10:1 reduction.

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

- H-alpha telescope with 60mm aperture
- Internal Etalon with Pressure Tuner
- Blocking filter B600 or B1200 (not included at the OTA version)
- 2" Crayford style focuser or Starlight Instruments Feather Touch focuser
- Tube ring with 1/4"-20 connection for photo tripods
- 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)
- **Sol Searcher:** This attaches to the clamshell assembly and makes finding the Sun a lot easier.
- **Dovetail plate:** For using the scope on astronomical mounts.

## **Okay let's get started...**

### **Note:**

- The Telescope is shipped with the focus lock screw removed. This screw is included in the case near the eyepiece cutouts. The screw needs to be replaced into the base.
- Please check before the telescope is removed from the transport case that the locking of the blocking filter is applied. Maybe it can happen elsewhere, that when removing the telescope the block filter slip out of the focuser and fall off.

### **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 LS60THa setup on a tripod or mount. Let's take a look!

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

Pull the diagonal slide tube out about 25mm. Put the focus tube 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 objective cell against the clamshell. 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. Try to re-align the Sol Searcher and look again. After some trial and error the Sun should appear in the eyepiece. Once the Sun is centered now is a good time to adjust that Sol Searcher.

**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 using the larger silver knobs on either side of the focuser assembly. Fine focus is achieved with the 10:1 reduction (smaller black knob). The fine focus is often too fine for visual use, but comes in very handy if you are imaging. Focus so that the edge of the Sun is as sharp as possible.

**Tuning:** On the side of the scope is a large black cylinder. This cylinder is the tuning system for the H-alpha filter. Now we will describe how to bring 656.28nm wavelength on band. The black handle of the cylinder system has a 4 start thread attaching it to the brass cylinder body. Unscrew the black handle completely and carefully pull the piston from the cylinder. There may be some resistance and a faint pop as the air enters the cylinder. This is normal. This has reset the system for your altitude. Carefully re-thread the handle onto the body and engage the threads about one turn. While looking thru the eyepiece gently turn the black handle onto the cylinder body. There will be little resistance at first, but as the pressure in the cylinder builds the resistance will increase slightly. As you turn the cylinder you should see features come into view thru the eyepiece. Continued turning will result in the wavelength shifting thru 656.28nm and detail will begin to disappear. Fine-tune the cylinder for the best performance.

A few details regarding the pressure tune system. The amount of pressure being supplied to the etalon cavity is minimal. It is the equivalent of going from -150m below sea level to about 3,000m. Or around 0.1 Bar, there is no risk of explosion. We are dealing with only a fraction of 1 atmosphere. When not in use we recommend that you release the pressure by simply backing off the black handle from the cylinder body. If the system unthreads completely, simply thread it back on 1 turn. It is not necessary to re-set the system every time it is used. Re-setting may only be required if the system has been sitting for a long period of time.

**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 a 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 LS60THa with Pressure Tuner 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 an LS50FHa 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**

**Aperture:** 60mm  
**Focal Length:** 500mm  
**Bandwidth:** <0.7 Angstrom  
**Tuning:** air-pressure tuning system "Pressure Tuner"  
**Weight:** 3.6kg  
**Length:** 40cm

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