Hubble Optics Ultra Portable UP12G GoTo Dobsonian instruction manual

Revision: 2.0 09-04-2023

Please read these instructions thoroughly before beginning assembly and subsequent use of the telescope.

WARNING: *Never look at the sun with your telescope without a professionally made solar filter. Permanent eye damage or blindness could result. Eye damage is often painless, so there is no warning until it is too late. Children should not be allowed to handle the telescope. Avoid using the type of solar filter that screws into an eyepiece. They are susceptible to cracking under the intense heat that builds up near the focus point, and could cause severe retinal damage. Use only the type of solar filter that covers the front of the telescope. Also, be sure to leave the cover caps on the finder scope when solar observing. Better yet, remove the finder scope altogether when viewing the sun.*

1. Unpacking

The telescope is packed in two shipping boxes, as described below.

Make sure all the parts in the Parts List are present. Be sure to check carefully, as some parts are very small. If anything appears to be missing or broken, immediately email Hubble Optics for assistance.

Box #1, The UP12G main structure

Please note that the luggage case shown in this manual is optional. The scope will be shipped in the luggage case only if you have selected that option.

Quantity	**Description**
1	Mirro Box/Rocker/Ground board
1	GoTo Controller (installed)
2	Motor Cables (installed)
1	Encoder DB9 Y cable (installed)
1	AZM encoder brackets (installed)
1	AZM encoder assembly (installed)
1	ALT encoder bracket (not installed))
1	ALT encoder assembly (installed)
1	GoTo Smart Hand Controller and RJ12 6P5C Cable
1	Upper ring with 2" 10:1 dual speed focuser
1	Secondary mirror with the diagonal holder
3	Plastic feet with wing nuts
4	M6 knob screws (20mm long) with wingnuts for the truss tube and upper ring connection
8	M6 knob screws for the truss tube and mirror box connection
1	Magic nylon tape to hold the sling
3	Brass wire to evenly separate cell support bars
1	Stainless Steel Cable Sling
6	Mirror Cell Support Pad

Box #2: The primary mirror

Qty.	Description
1	Primary Mirror

If the optional reusable foams are purchased, the UP12 will packaged as shown in the following pictures.

- One ALT bearing is stored in layer 1, and another is in layer 7
- You can cut off some foam to make room for additional accessories, such as eyepiece, finder scope etc.
- You will need to cut and trim the foams around if you want to use the foam to store the scope in a luggage case. A 29" Aluminum frame luggage case, one similar to the pictured (with an outside dimension of about 65 x 47 x 26 cm, handle and wheels are not included in the dimension) is recommended.


2


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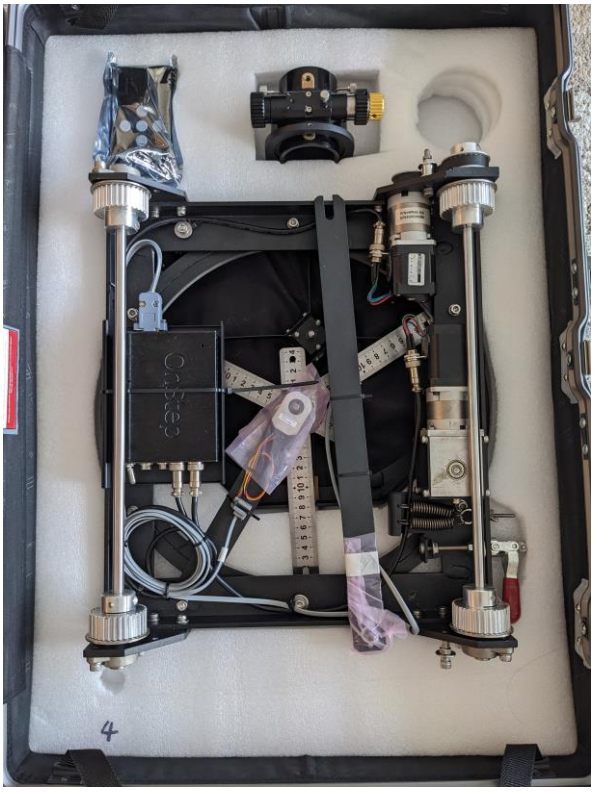
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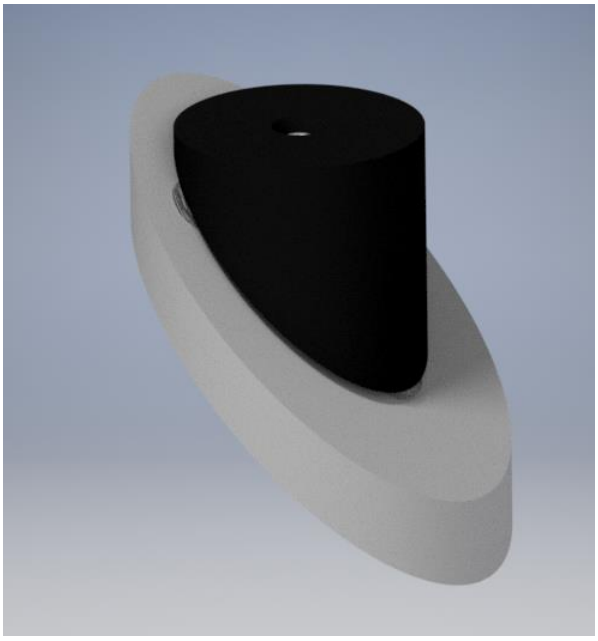
2. Assembly

Now that you have unpacked the boxes and familiarized yourself with all of the parts in front of you, it's time to begin assembly. You'll need a regular screwdriver, a Phillips screwdriver, a set of metric hex keys (1.5,2,2.5,3, 4, and 5mm), one 6-inch (150mm or smaller) adjustable crescent wrenches.

Tools Required (Not provided)

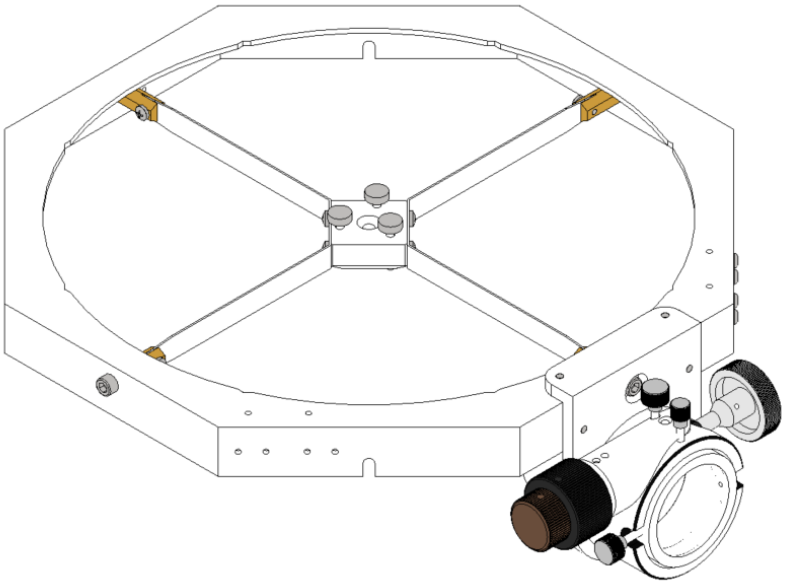
2.1 Install the Secondary Mirror

The secondary mirror is glued to the diagonal holder in the factory and is stored inside a plastic container for protection. You should remove the secondary with the holder from the scope after each usage and store it in the container for protection.

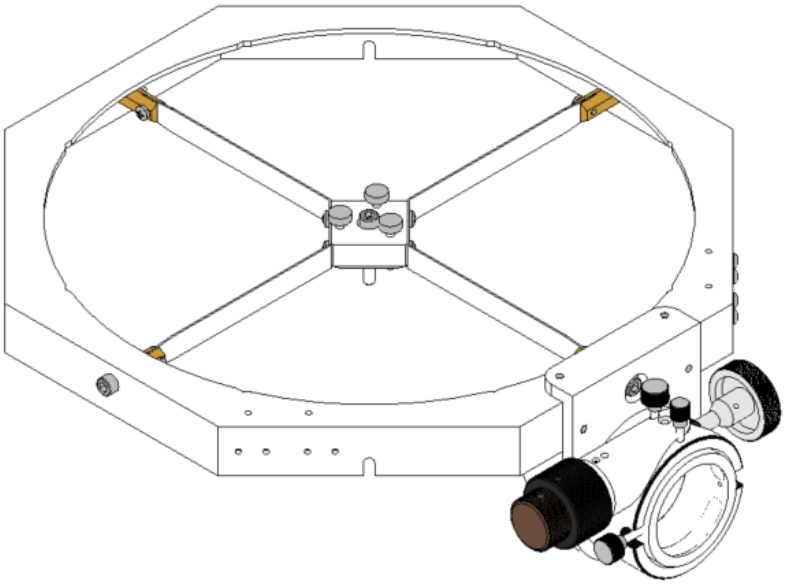


1. **Insert the Central M6 Screw**:
    - First, ensure that the 4 spider wings is securely mounted inside the upper ring.
    - Insert the M6 (35mm long) socket head screw into the spider's central stud.
2. **Attach the Secondary Holder**:
    - Attach the secondary mirror holder onto the M6 screw.
    - Ensure that the secondary mirror, which is already attached to its holder, faces the primary mirror and the focuser.
3. **Roughly Adjust the Secondary Mirror**:
    - Look through the focuser draw tube (without any eyepiece) from the back of the focuser.
    - **Center Bolt Adjustment**: This will move the secondary mirror closer or farther away from the primary mirror. Adjust it so that the secondary mirror's edge is roughly centered in the focuser, viewed from the draw tube without an eyepiece.
    - **Spider Wing Pulling Screws Adjustment**: Adjust these screws to move the secondary mirror left and right. The goal is to ensure that the secondary mirror is roughly centered in the focuser's view.
    - **Rotation of the Holder**: If needed, gently rotate the secondary mirror holder around the M6 screw to ensure that the reflective side of the secondary mirror faces the primary mirror.
    - **3 Collimation Screws Adjustment**: These screws allow you to tilt the secondary mirror in various directions. At this point, you're just aiming for a rough alignment where the primary mirror appears centered when viewed through the secondary mirror.
4. **Final Tightening**:
    - Once the secondary mirror is roughly centered and aligned, tighten the three collimation screws. Ensure you don’t overtighten them as this can strain the secondary mirror or its holder.
    - Tighten all 4 spider wing pulling screws. Again, avoid overtightening.

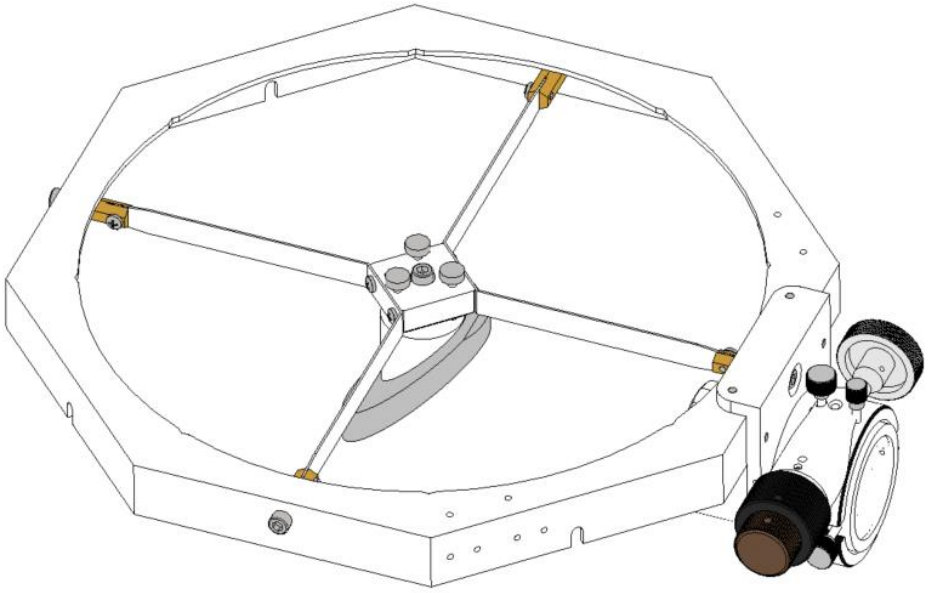
5. **Final Thoughts**:
    - After the initial installation and alignment, you'll likely need to fine-tune the collimation using a collimation tool, like a laser collimator or Cheshire eyepiece, especially if you're using the telescope for astrophotography or high-power visual observations.
    - Always handle the telescope components with care. Avoid touching the mirror surfaces directly, as this can introduce smudges or scratches that degrade optical performance.



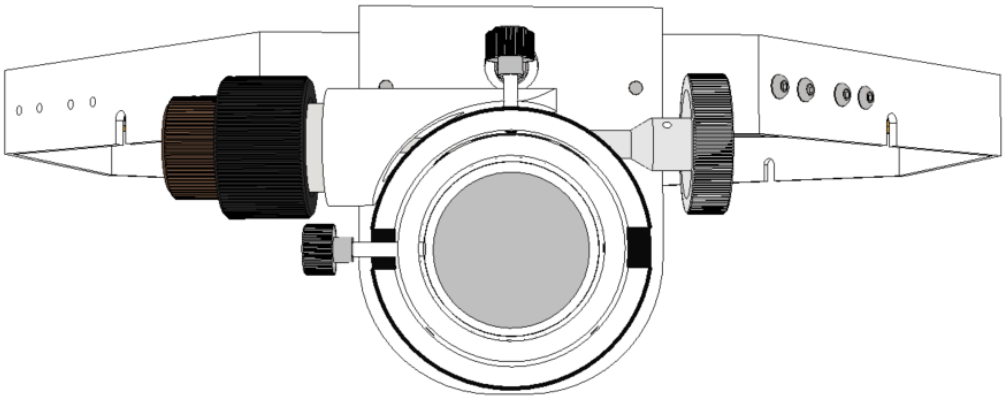
The upper cage without the Secondary Mirror



Insert the M6 central bolt is inserted



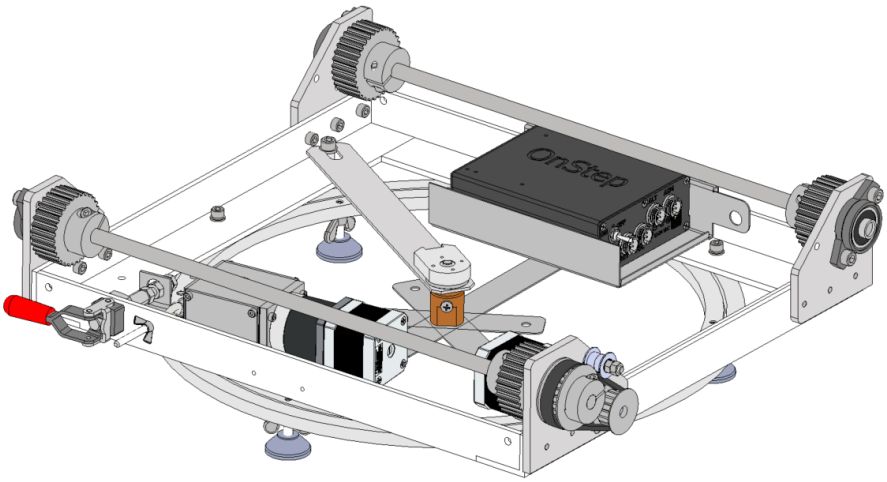
Attach the secondary mirror holder to the central bolt

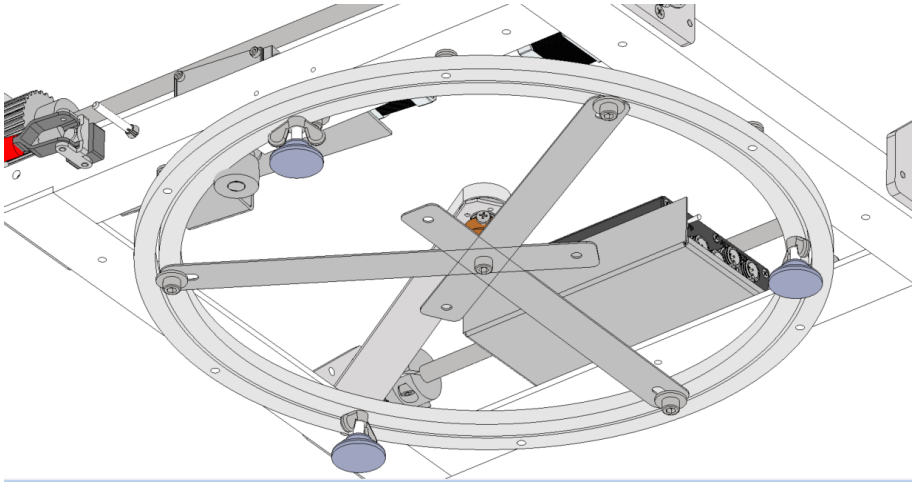


Center the Secondary Mirror in the focuser’s view

2.2 Assembly of the Dobsonian Rocker

The UP12G base is very much shipped assembled. The only thing you need to do is install the three plastic feet onto the inner race ring of the AZM bearing each time before usage. Make sure to use the wing nuts to lock the three feet firmly. Also, ensure you do not thread the foot too much, as the screws could cross over too much, which could hinder the Rocker's rotation





2.3 Assembly of the Mirror Box

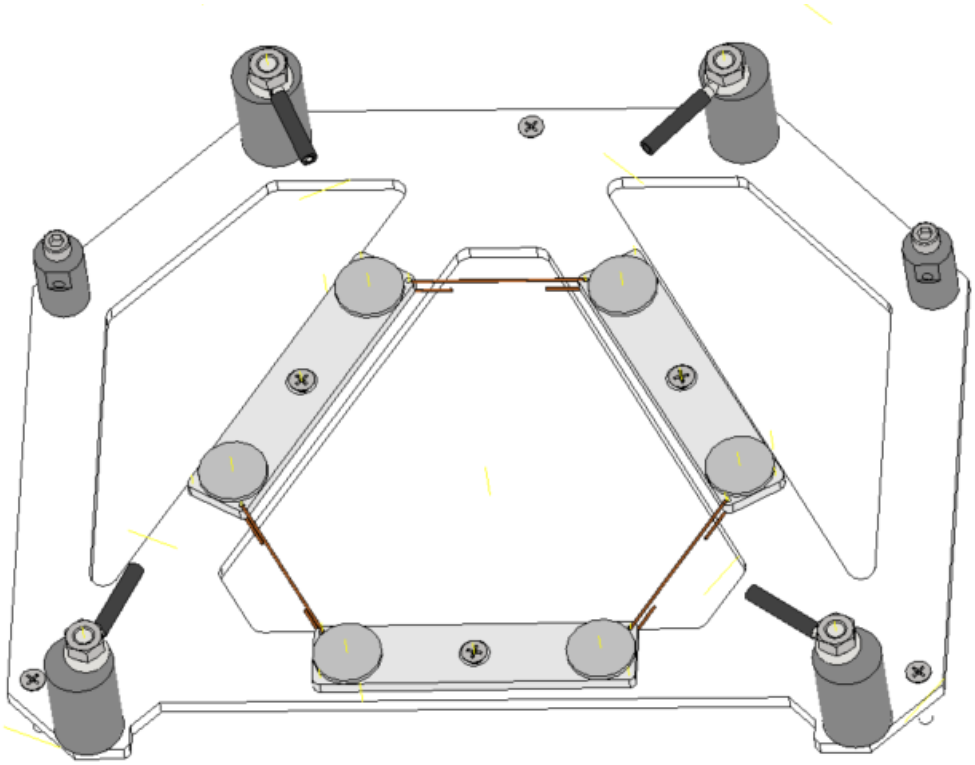
The primary mirror is shipped in its own box. Once the primary mirror is installed in the mirror box, there will be no need to remove it until cleaning is necessary. However, for shipping and long-term storage, the primary mirror should be packed tightly in its original packing.

The mirror box is mostly assembled already, but you do need to place the primary mirror into the mirror box.

2.3.1 Installation of the Pads and Brass Wires

Before installing the primary mirror, you need to perform the following tasks:

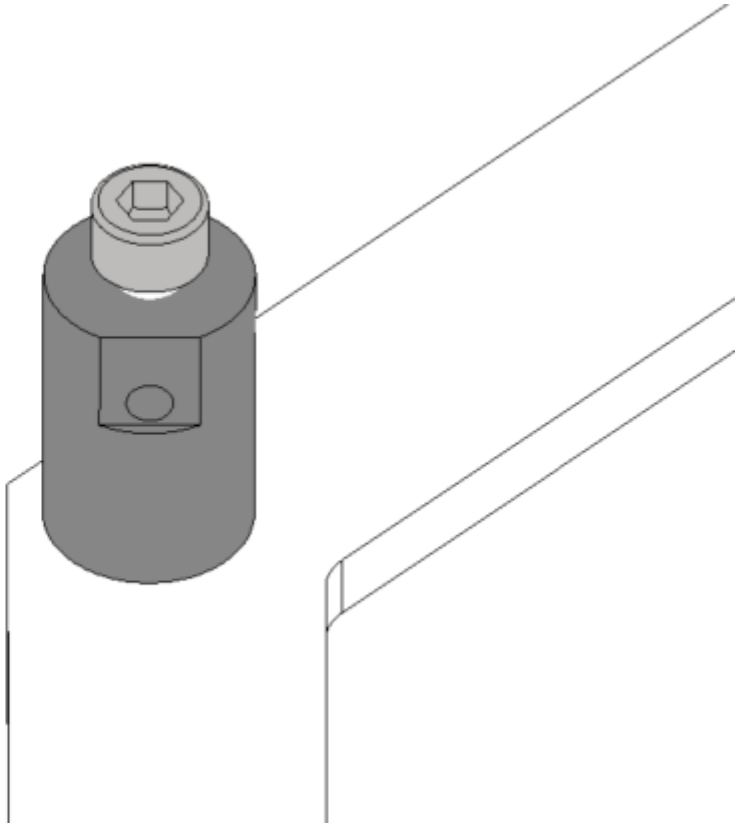
- Affix the 6 adhesive scratch protectors to the three support bars.
- Affix the three brass wires to regulate the support bars.



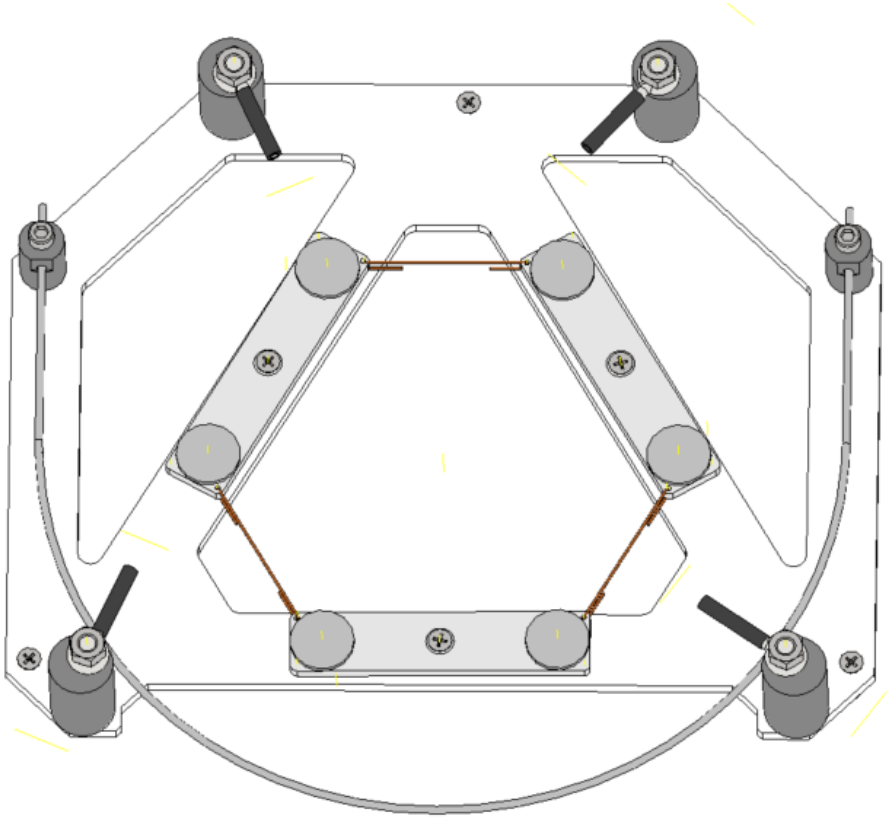
First bend the three brass wires into U shape, with the center portion about 55 mm (a bit longer is OK, but all three should be the same length, as much as possible).

Insert the brass wires into the small holes on the support bars, and then bend brass and twist the head portions to lock the cell bars in the position.

Push the brass wires outward into a slight curve to keep the support bars in position if needed.



The stainless steel cable anchor post and the top locking screw

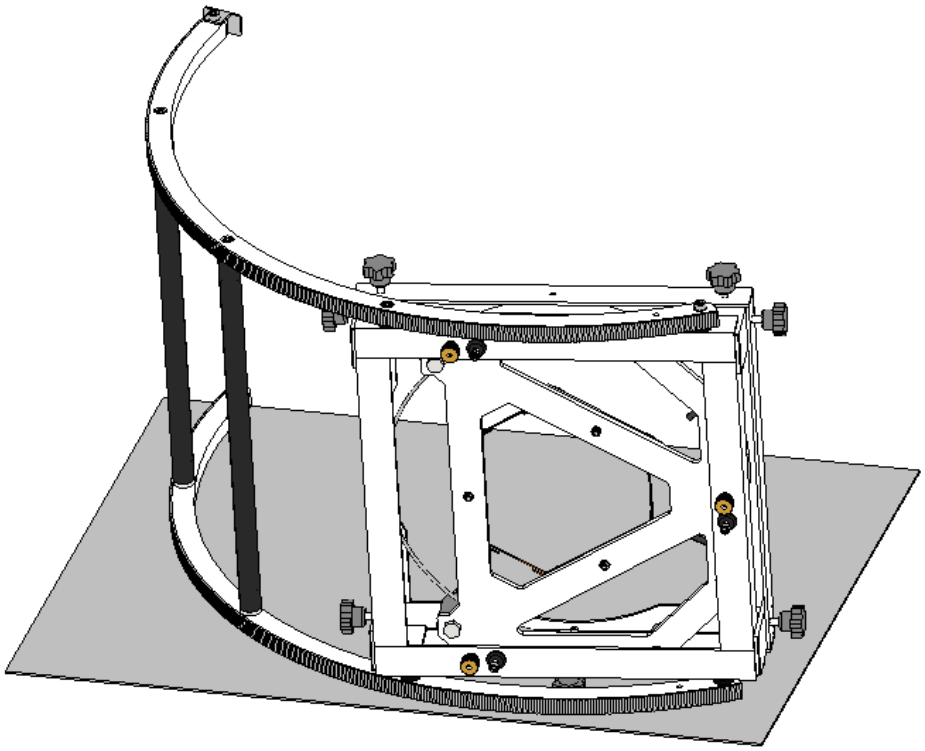


- Loose the two cable sling locking screws, and insert stainless cable sling into the anchor post feed hole and temperately tighten the locking screw to keep the cable sling in place.

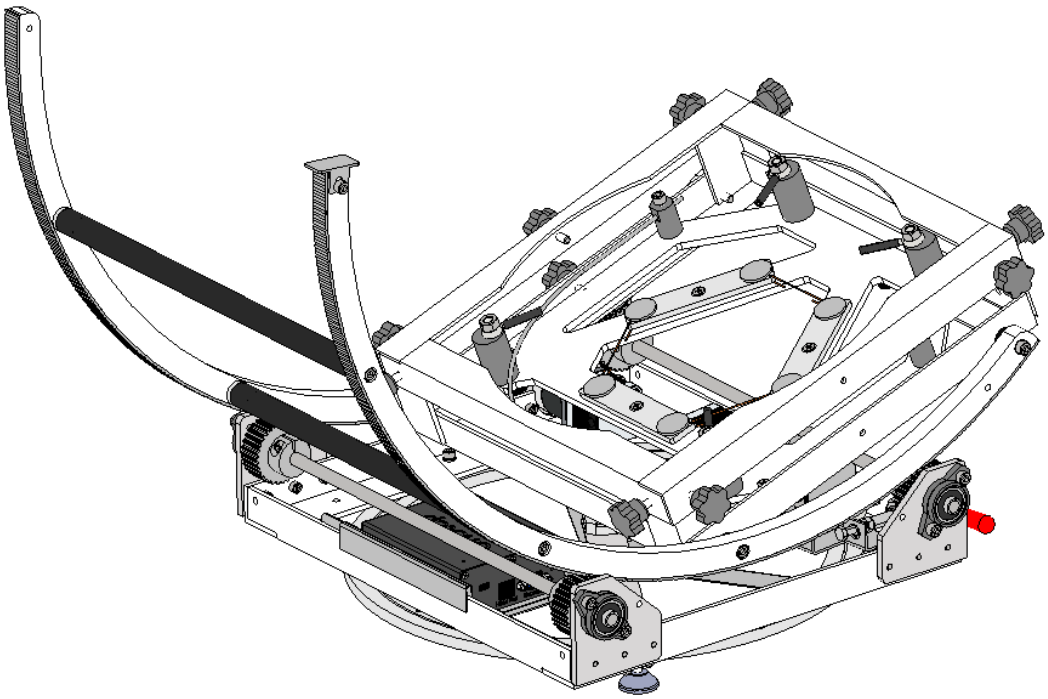
2.3.2 Installation of the ALT Bearing

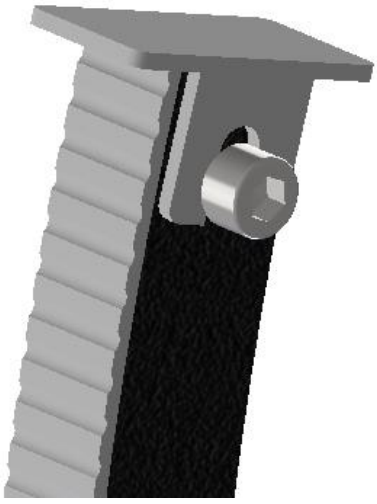
Rest the Mirror Box on a safe place, for example, the packing foam; and then install the two ALT bearing one at a time using the provided M6 blots (25 mm and 40 mm long each) as shown in the following pictures:

Note that you need place the left bearing on the left side and right bearing on the right side of the mirror box, with the side of the bearing with the welted spacers attached to the mirror box.



- Then rest the mirror box on the Rocker, and install the two ALT bearing limit blocks on one of the bearing.





The top ALT Bearing Limit Block

2.3.3 Installation of the Primary Mirror

Rotate the two eccentric side pins and arrange the cable sling to make room for the primary mirror. Loosen the locknuts on the top of the mirror clips and turn them aside.

You may tie the mirror box to the rocker with the provided strips for the safety for now.

Rotate the four eccentric side pin outwards to make room for the mirror. Make sure that the three mirror support bars are evenly placed in the cell. Pick up the mirror and place it into the mirror cell. Check that the mirror is centered in the cell. Wiggle it a bit to insure that the cell parts are moving freely and adjusted to the float of the mirror.

Next, lose the sling locking screw to adjust the length of the cable sling between the sling post to make sure the sling snuggly supports the mirror when the mirror is centered in the mirror cell; then tighten the locking screws to lock the sling.

The four side pins should not contact the mirror during observation.

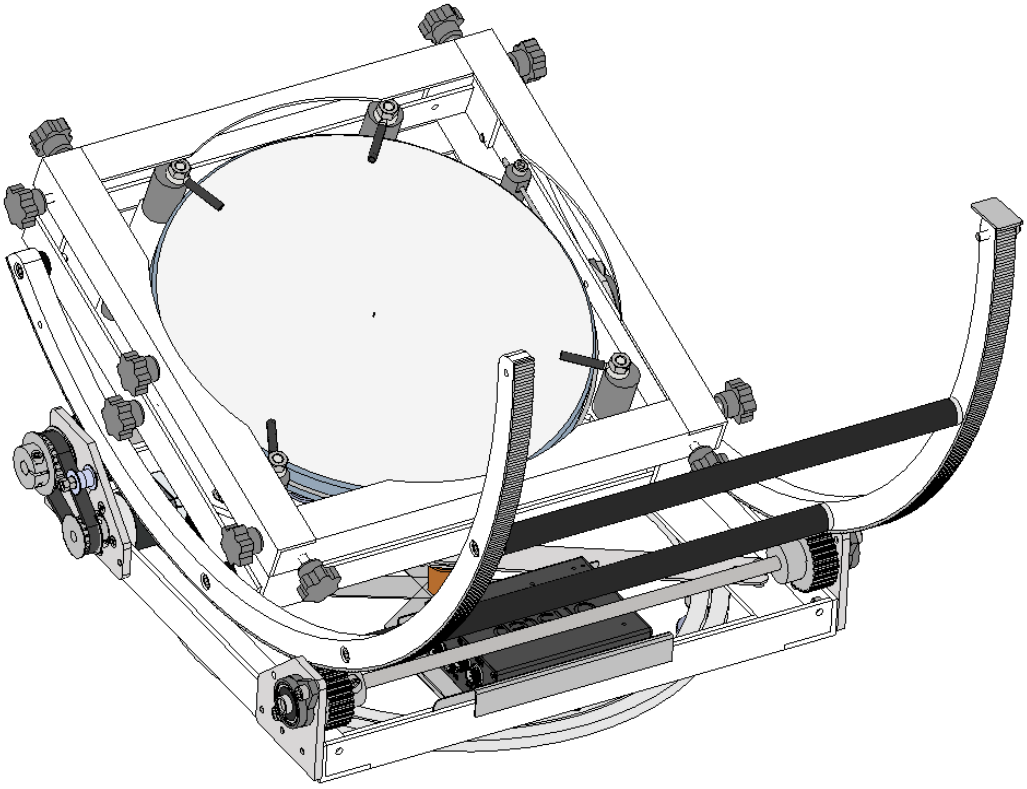
The mirror-protecting clips should not contact the mirror at all. Keep the clips about 3-6mm above the mirror surface. Place the mirror clips over the mirror and tighten the top lock nuts.

On the lowest part of the mirror, which will rest in the bottom of the sling, place a short piece of the provided Velcro (Magic Nylon tape)

Make sure the sling is in the middle of the mirror, so there is equal amount of glass above and below it. The magic tape will prevent the sling from slipping off the mirror when the telescope is pointed straight up. Now, leave the sling loose, you will adjust it after the telescope is fully assembled.

1. **Secure the mirror box to the Rocker with four supplied nylon strips**
2. **Make sure the 3 support bars are evenly positioned**
3. **Load the mirror into the cell**

Once the mirror is installed, you should use the square mirror cover (provided) to cover the mirror box to protect the mirror.

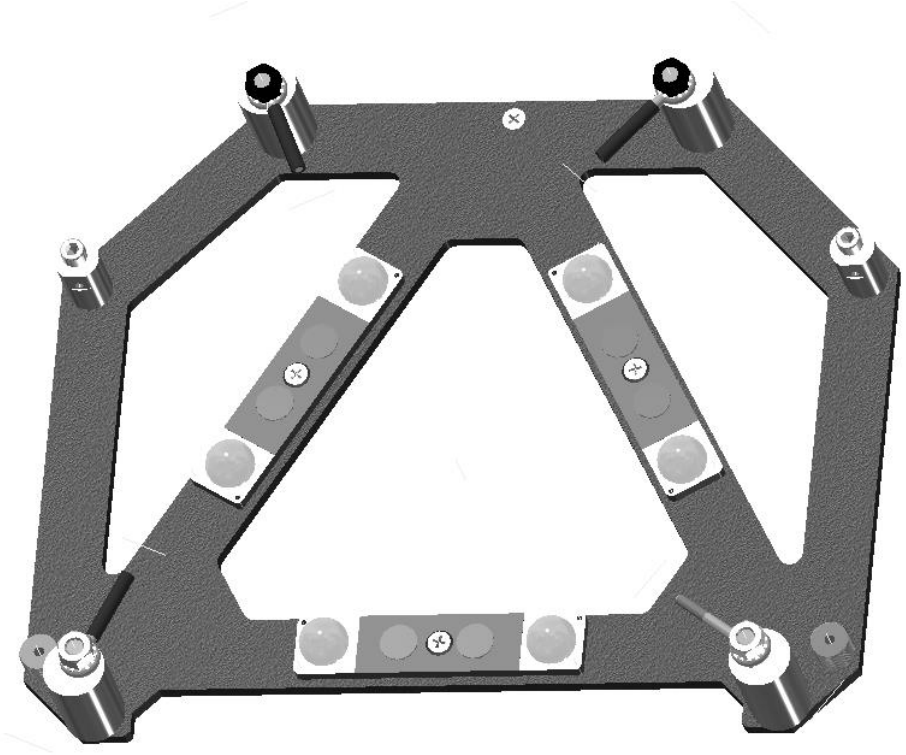


2.3.4 Glue the Primary Mirror For The Air Travel

If you intend to travel with your telescope via airline, it's highly recommended to secure the mirror to the mirror cell using silicone. Clear GE Silicone II or an equivalent product is advised. Before applying the silicone, you need to sand away any paint or finish from part of the support bars using a file, as silicone may not adhere well to painted surfaces.

1. Clean the back of the primary mirror and the mirror cell support bars using 95% or higher grade alcohol. Ensure you remove the pads and paint first.
2. Allow them to dry completely after cleaning.
3. Apply silicone to the flotation points on the pivoting bars. Endeavor to place six equally sized blobs of silicone on the flotation points. Each blob should be approximately 20mm in diameter and 10mm thick.
4. Set 6 coins (about 1.5mm thick) on the pivoting bars as spacers. Alternatively, you can use strips of sturdy cardboard or wooden ice cream bar handles as spacers. These spacers will need to be removed once the silicone has cured. Ensure there's sufficient space between the coins and the silicone blobs so the coins don't get adhered to the cell.
5. Level the mirror cell precisely.
6. Carefully set the mirror onto the mirror cell. Ensure the mirror is perfectly centered. Once positioned, try not to move the mirror on the silicone.
7. Confirm all the pivoting bars are appropriately positioned. Make slight adjustments if necessary, especially if the mirror has shifted.

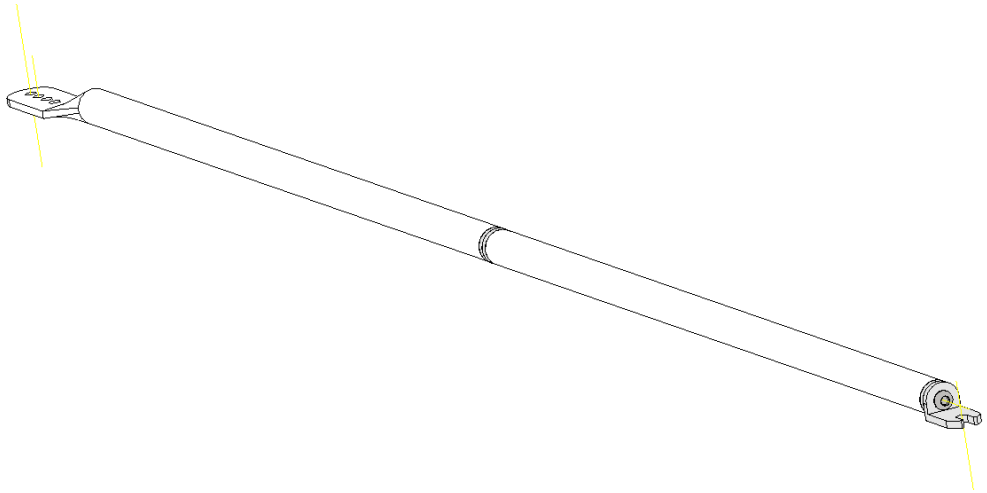
8. Recheck to ensure both the mirror and the mirror cell remain level.
9. Cover the mirror and allow it to sit undisturbed for 24 hours. After this period, remove all the spacers.
10. Wait an additional 48 hours or until the silicone is fully cured before moving or using the telescope.



Use 6 coins as the spacers

2.4 Install the Truss Tubes and Secondary Cage

1. Each full truss tube consists of two half sections: a top and a bottom section. Begin by threading each pair together to form a complete truss tube.
2. Once you've securely connected each pair, loosen the bottom truss angle. Adjust it to align the orientation of the angle with the top of the truss tube.
3. After aligning each truss tube pair, there's no need for realignment as long as you connect the same pair in the future.
4. Store the paired truss tubes next to each other in the truss tube organizer. This ensures that you use the same paired tubes the next time.



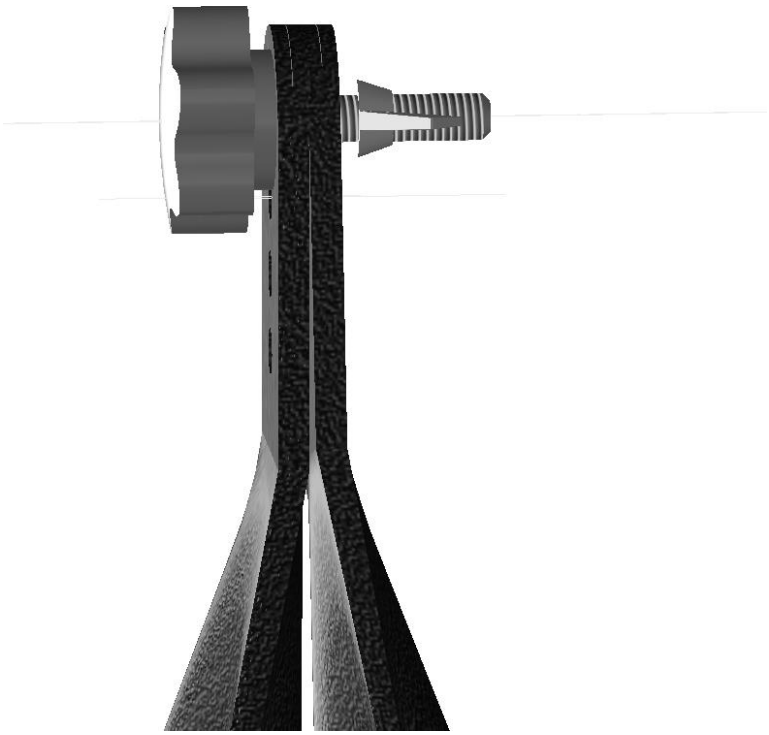
Truss tube aligned

2.4.1 Installation of the Truss Tubes

Protection First: Before starting, ensure the primary mirror is fully protected by placing the mirror box cover over it.

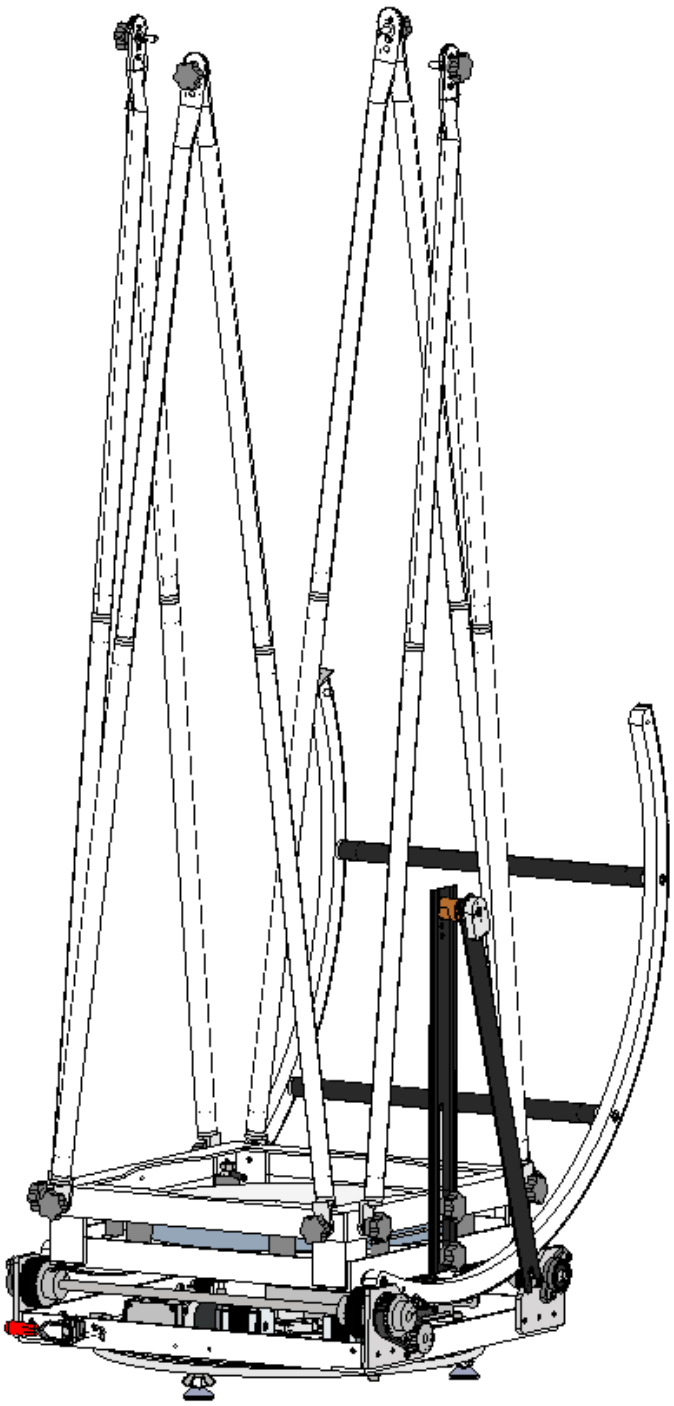
Connecting the Truss Tubes:

- The ends of the truss tubes have an asymmetric design. This is intended to avoid interference when connecting them.
- Begin by connecting two truss tubes using an M6 knob screw that is 35mm long. Fasten them at the multiple-hole side of the top end. An M6 wing nut should be used to secure the connection.
- The multiple holes are designed to allow for slight adjustments in the Optical Tube Assembly (OTA) length. This caters for minor variations in the focal length of the primary mirror.



Attaching the Truss Tubes to the Mirror Box:

After forming each pair of truss tubes, connect them to the mirror box. Use two M6 knob screws that are 15mm long for this attachment.



Tighten the knob screws

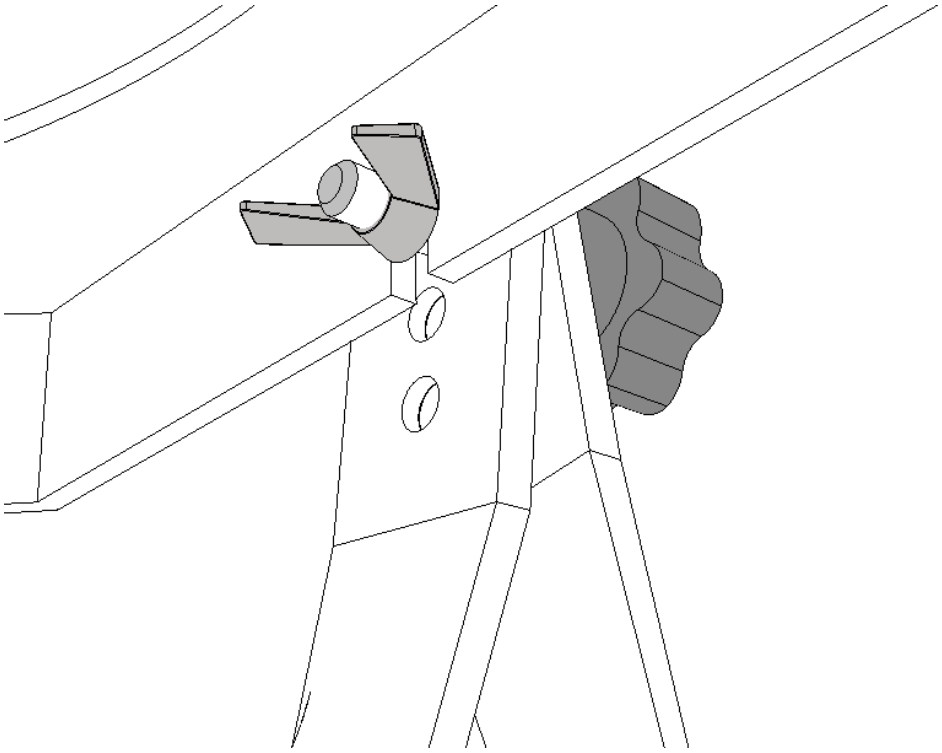
To ensure that the ALT encoder is accurately centered on the virtual ALT bearing axis, you must adjust the position of the ALT encoder bracket. Follow these steps to verify perfect centering of the ALT encoder:

1. Position the telescope so it points towards the zenith (directly upwards), and then adjust it to 45 degrees and 90 degrees orientations.

2. Observe the pivoting screw at the bottom of the ALT encoder assembly. When the ALT encoder is correctly centered, this screw should maintain the same relative position to the ALT encoder assembly throughout the adjustments.
3. If the ALT encoder assembly shifts up and down as you move the telescope, you need to adjust the encoder support bracket. Move the bracket up or down until the movement of the telescope no longer causes the ALT encoder assembly to shift.

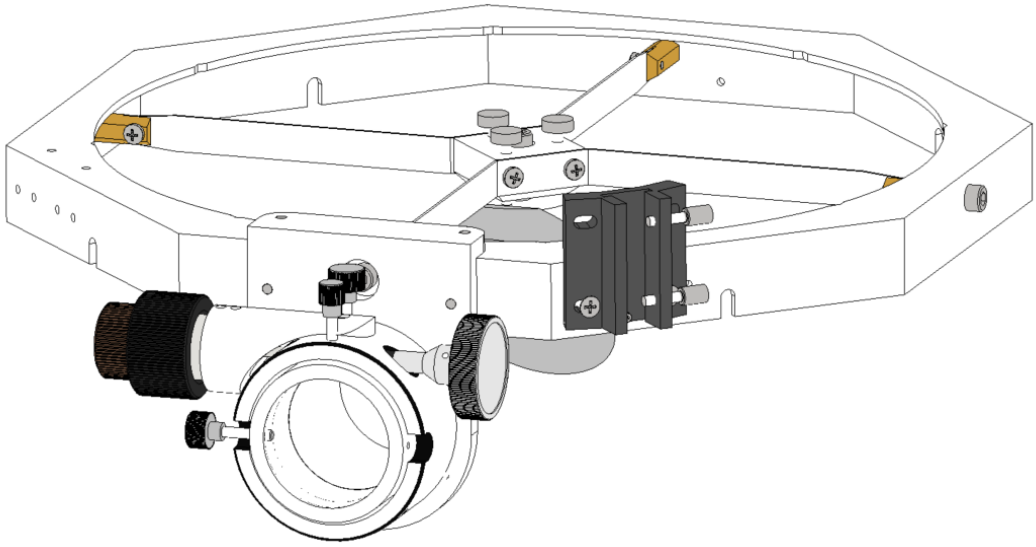
2.4.2 Installation of the Secondary Mirror Cage

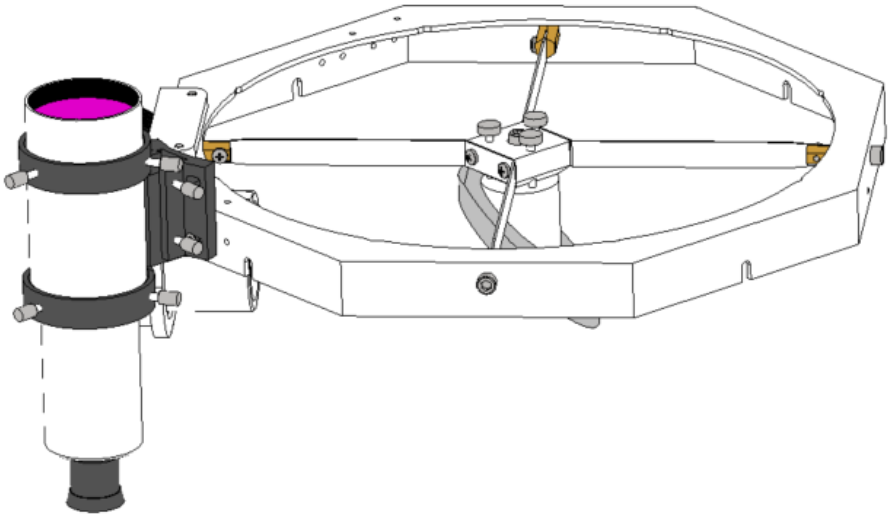
Installation Procedure for Attaching the Secondary Cage to Truss Tubes:
Protect the Primary Mirror: Before starting, ensure the primary mirror is covered and fully protected using a mirror cover. This will prevent any accidental damage or contamination.
Prepare the Knob Screws: Loosen the wing nuts on all the knob screws. Ensure they are as loose as possible without coming off the bolts. This will make it easier to slide the secondary cage into position.
Position the Secondary Cage: a. Hold the secondary cage with both hands. b. Begin by aligning one of the slots on the cage's upper ring with the top knob bolt of one truss pair. Ensure the slot slides in between the wing nut and the end of the truss tube. c. Next, align and slide an adjacent slot of the cage into the knob bolt of the neighboring truss pair. d. Simultaneously align and slide the remaining two slots onto the knob bolts of the final two truss pairs.
Secure the Secondary Cage: Once all the slots are in place, tighten each knob screw by turning the wing nuts clockwise. Ensure each connection is snug and secure to prevent any wobble or misalignment.



2.4.3 Installation of the Optional Finder Scope

Use 2 provided (hexagon or cross) socket sunk head screws to mount the finder scope via two of the four finder base mounting holes.





2.5 Adjust the Sling

After the UP12G is fully assembled, the sling must be adjusted to center the primary mirror.

2.6 Balancing The Scope

The UP12G telescope's ALT (altitude) bearing is engineered to self-balance the scope under typical payload conditions. This means that in most standard viewing scenarios, users won't have to add any counterweights to the mirror box to maintain balance. However, should you attach an unusually heavy payload to the focuser, additional counterbalancing might be necessary. It's worth noting that counterweights are not provided with the telescope, so users will need to source them separately if required.

4. Collimate the Optics

Collimating a telescope may initially seem daunting, but it quickly becomes a manageable routine with a bit of practice. It's important to regularly check your telescope's collimation, especially after transporting it, to ensure you're getting the best views of the night sky.

Preparation:

- During the first three steps of collimation, keep the primary mirror covered.
- Position the telescope approximately 60 degrees above the horizontal plane.
- Ensure collimation remains consistent at various altitudes by securely tightening all nuts and screws along the optical path. This includes:
    - The focuser and its base.
    - The rotator and upper ring connections.
    - All spider vanes to the spider hub and upper ring.
    - Secondary mirror collimation screws post-adjustment.
    - Truss tubes' knob screws.
    - Primary mirror locking screws.

For added collimation stability, especially under heavy loads, mount the focuser directly atop the side Truss Tubes, despite having two mounting positions for convenience.

Step 1: Center the secondary mirror along the axis of the focuser drawtube.

For this step, use a simple collimation cap (or sight tube). Insert the cap into the focuser and look through the peephole of the sight tube at the secondary mirror. If you don't have a collimation cap or sight tube, you can approximate by eyeballing from a distance, positioning your eye centered with the drawtube.

The secondary mirror should appear round and be exactly centered within the sight tube. If it is, then Step 1 is complete. If not, adjustments might be needed for either the secondary holder, the focuser, or both.

Begin by checking and adjusting the secondary holder. If the error is vertically up or down, adjust the central bolt that connects the holder to the spider hub.

If the discrepancy is to either side of the focuser (perpendicular to the optical axis), examine if the secondary holder is centered within the upper ring. If it's off-center, adjust the spider wing's pulling screws until it's centered.

Step 2: Adjust the tilt of the secondary mirror to direct the focuser's axis toward the center of the primary mirror. To start, remove the cover from the primary mirror.

For this step, you'll need a laser collimator. Insert the laser collimator into the focuser tube. Adjust the three secondary mirror collimation screws until the laser beam is centered on the primary mirror's center spot.

A slight misalignment in the secondary mirror is typically not problematic. As long as the pointing error remains within 1 or 2 percent of the main mirror's diameter, it won't cause any noticeable differences.

Step 3: This step is crucial. Here, you'll adjust the tilt of the primary mirror to ensure the returning laser beam centers on the centre of the laser collimator.

Manipulate the three primary collimation screws and their adjacent locking screws to align the laser's returning beam with the collimator's faceplate.

Figure 1:The primary mirror is not yet collimated.

Figure 2:The primary mirror is perfectly collimated by laser collimator.

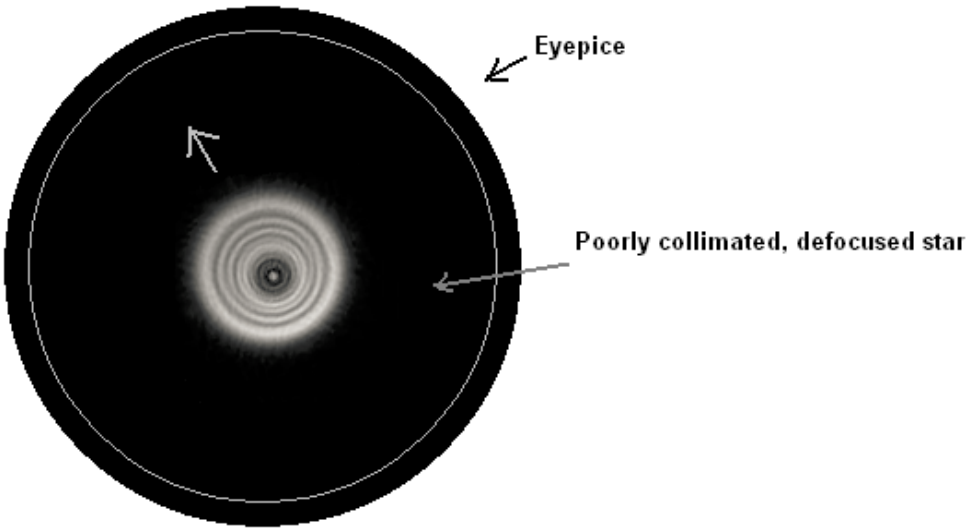
Step 4: Star-Testing Your Collimation

To accurately collimate your telescope, the star test is an effective method. Here's how to do it:

1. **Selecting a Star**: Choose a moderately bright star for this test.
2. **Aiming the Telescope**: Point your telescope at the selected star.
3. **Defocusing the Star**: Slowly defocus the telescope until the star forms a distinct 'donut' shape. This shape is a ring of light with a central dark spot, which is the shadow of the secondary mirror.
4. **Analyzing the Donut Shape**: Observe the donut. A perfectly collimated telescope will show a centered dark spot. If the central spot is off-center, it indicates misalignment.
5. **Adjusting the Primary Mirror**: If the donut's hole is not centered, gently adjust the primary mirror's collimation screws. Make small adjustments: tighten one screw while slightly loosening the opposite screw to maintain even pressure. Aim to move the defocused star image towards the thicker side of the donut.
6. **Re-centering the Star**: After each adjustment, re-center the star in your telescope's field of view by re-aiming the telescope. The position of the star may shift slightly with each collimation adjustment.

7. **Repeating the Process**: Continue this process - adjusting, re-centering, and observing the defocused star - until the donut shape appears symmetrical with the central hole perfectly centered.
8. **Final Symmetry Check**: Once the donut appears symmetrical, fine-tune your focus to check the concentric rings around the star. Proper collimation is indicated by centered and symmetrical rings.

Remember, atmospheric conditions can affect the appearance of the star's image. Conduct this test on a night with stable and clear atmospheric conditions for the best results.



It's advisable to carry out this procedure at the onset of each observing session. Additionally, you should check the collimation sporadically throughout the night. This is crucial because factors like temperature variations or routine handling could cause shifts in your telescope's components, potentially affecting the collimation.

4. Care and Maintenance

4.1 Scope and Mirror Storage

The UP12G should be stored in a clean, dry, dust-free place, safe from rapid changes in temperature and humidity. Do not store the telescope outdoors. The scope is best stored in our optional luggage case.

4.2 Mirror Cleaning

You should not have to clean the mirror often. The best thing you can do to your mirror is to prevent it from getting dirty in the first place! A simple air-blow cleaning, using an optical air dust blower is the next best thing you can do.

5. Specifications

Optical design : Reflector
Optical diameter : 304.8mm
Focal length : 1372mm
Focal ratio : f/4.5
Optics type : Parabolic
Eyepieces: Not included
Optical quality : Diffraction limited++ (Strehl 0.95+ for the Primary, 1/10 lambda or for the secondary mirror)
Focuser : 2" low profile 10:1 dual-speed linear bearing Crayford focuser
Secondary mirror obstruction : 60 mm
Secondary mirror obstruction by diameter : 19.7%
Secondary mirror obstruction by area : 3.9%
Mirror coatings/over-coatings : 96% Semi-Enhanced Aluminum coating on the primary and 96% Enhanced coating on the secondary mirror
Materials : Aluminum Alloy (T6063-T6) tube with black knob screws, T6061-T6 structure.
Weight, fully assembled : ~45lbs (Base: 15 lbs, OTA:30 lbs)
State-of-art GoTo with Nuilt in WiFi and Bluetooth support
Optional accessories : 8x50 Illuminated Finder Scope, Red Dot Finder Scope, Shroud, Vinyl foam Cushioned Grips
Other features : Stainless Steel Cable Sling lateral support and deluxe push-pull brass knob collimation screws, two of them are front accessible.

6. Limited Warranty

Hubble Optics (Optel Engineering Group Inc.), Seller, warrants to the original purchaser only, that goods sold will be free of material defects in design, materials and workmanship for a period of one year following the date of shipment by Seller to Buyer. Seller will repair or replace, or refund the purchase price as to, goods that do not conform to the foregoing warranty, provided the cause of the nonconformity does not arise from or relate to modification, misuse, or abuse by the customer, and provided a warranty claim, stating in writing and with reasonable particularity the claimed nonconformity, and the goods, are delivered to Seller within the one year period. Repair or replacement of the product or refund of the purchase price, at Seller's sole option, shall be the Buyer's exclusive remedies. Seller shall not be responsible for any indirect, special or consequential damages arising from use of the products. This warranty is given in lieu of any other warranties, express or implied, including of performance, merchantability, fitness for particular purpose, or arising from course of dealing or usage of trade. Goods subject to this warranty must be

shipped postage pre-paid by Buyer to the Seller. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

7. Technical Support

Hubble Optics (Optel Engineering Group Inc.) will provide the support for the basic operations outlined in this document by email. You will receive a response, generally within 24 hours.