Instructions Manual

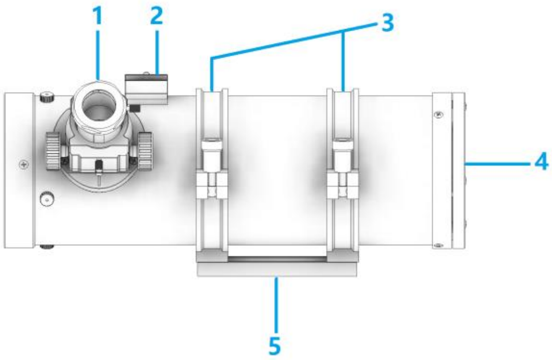
omegon

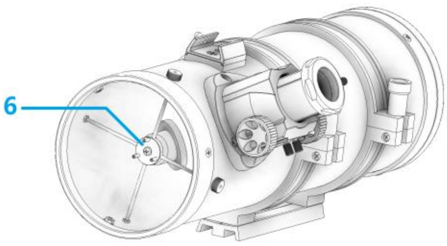
Omegon® Horizon OTA Reflector

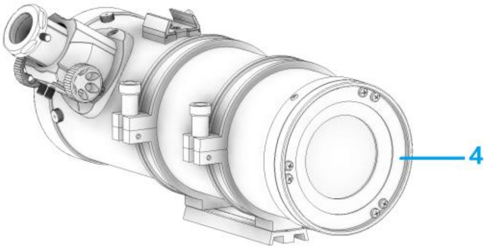
114/500, 115/900 and 130/650

English version 1.2026 Rev A

Congratulations on the purchase of one of the new Omegon® Horizon OTA Newton Reflector Line. Your OTA (optical tube assembly) can be the 114/500, 114/900 or the bigger 130/650 OTA. With a paraboloid primary mirror, the Horizon OTAs offer a superior performance than spherical optics and are a standard for the industry. The unique patented Crayford focuser offers a smooth focusing movement for perfect eyepiece focusing adjustment.







OTA parts

1 - Crayford Focuser;
2 - Finder shoe base;
3 - OTA rings;
4 - Primary mirror cell;
5 - Vixen-Style dovetail;
6 - Secondary mirror cell;

1. Understanding the OTA.

1.1. How does a Newtonian reflector work? The OTAs primary mirror captures the light from the object, being observed, reflecting it to the secondary mirror which deflects it to the side (to the focuser) to the eyepiece.

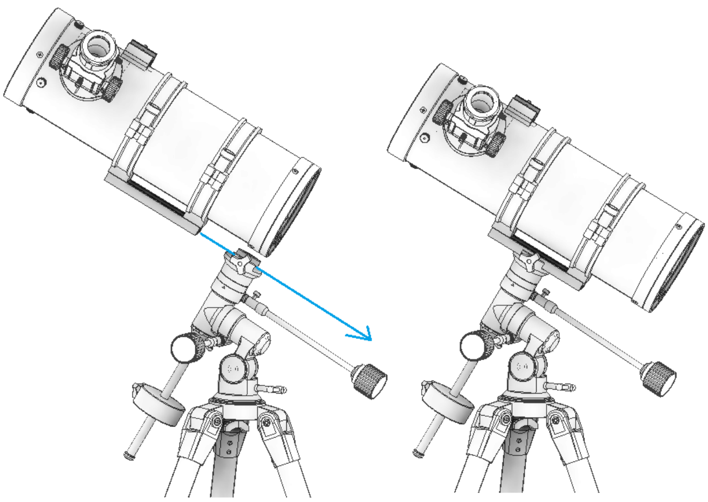
1.2. What is the compatibility of the Horizon OTA? The Horizon OTA line uses a modular system making it compatible with a variety of accessories and telescope mounts.

Eyepieces: any 1.25” eyepiece is in principle compatible (there are limitations, please read below)
Mounts: any mount using the Vixen-Style dovetail system.
Finder scope: any finder scope using the Vixen-Style dovetail system.

2. How to use the OTA?

For the purpose of this instruction manual, we will assume that the OTA is mounted to an Equatorial telescope mount.

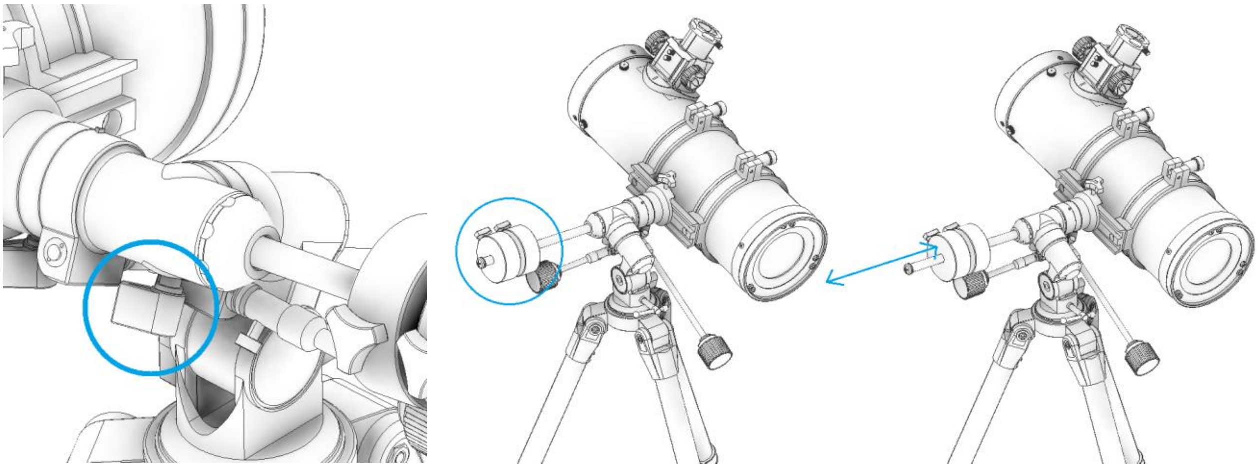
2.1. Fixing the OTA to the mount.
Release the mount’s dovetail fixing knob. Slide the OTA matching the dovetail to the mount’s dovetail holder. Fix the OTA in place.



2.2. Balancing the OTA.

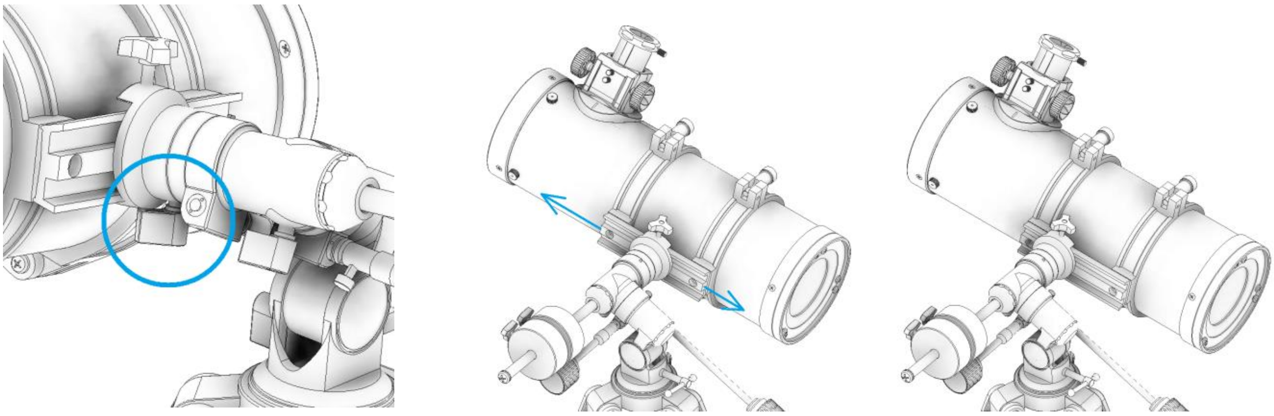
2.2.1. R.A. Balance.

Release the R.A. clutch so that the R.A. axis is loose. Make sure to firstly verify if the counterweights are installed to the mount. Slide the counterweights, along the counterweight shaft, so that the OTA is balanced and does not tilt to either side. Re-tighten the R.A. clutch.



2.2.2. Declination Balance.

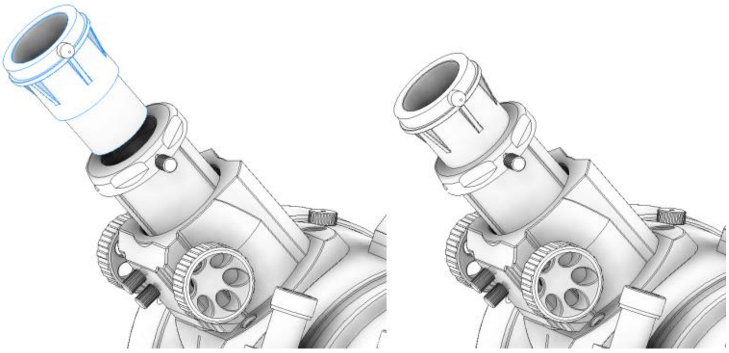
Release the Declination clutch. The tube needs to be balanced. Release the dovetail holder hand knob and slide the tube along the dovetail holder. Make sure the tube is not tilting to the front or the back. Re-tighten the Declination clutch.



It is very important the OTA to be balanced to the mount. An unbalanced OTA will tilt easily to the front or back (bad declination balance) or to the counterweight shaft or tube (bad R.A. balance). The fine adjustment movements will become very stiff and the mount will suffer irreparable mechanical damage.

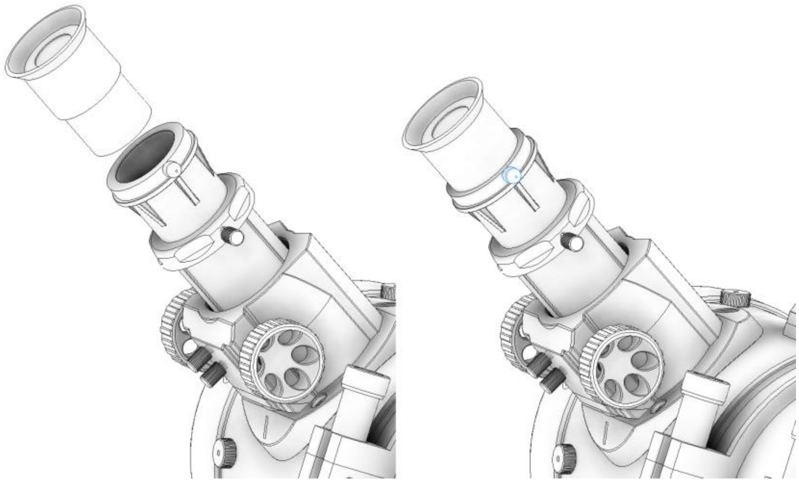
3. Preparing the first observation

3.1. Installing the extender. Start by sliding a 35mm extender into the focuser's drawtube (this extender is usually included with a set of accessories with your OTA). Make sure to slide it all the way in and tighten it securely using the focuser's fixing thumbscrew. The extender should remain in position for visual observation.



3.2. Placing the Eyepiece.

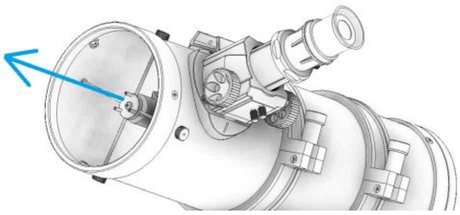
The eyepiece is an essential part of the telescope and it is through the eyepiece that objects are viewed. If more than one eyepiece is supplied with the OTA please select the eyepiece marked with the longest focal length (it is usually marked on the side) and proceed with installing it to the extender.



Make sure to use the extender's thumbscrew to fix the eyepiece in place.

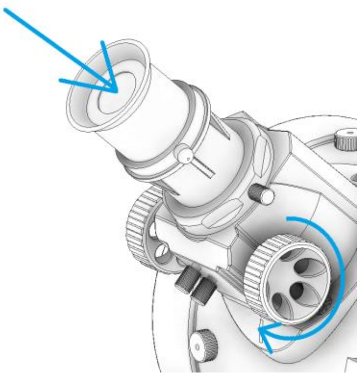
3.3. Learning to focus.

3.3.1. Pointing. Point the telescope to a land object. The object must be at a considerable distance (at least 800m). Make sure to use the aperture of the telescope to point to the object.



3.3.2. Focusing. With the highest focal length eyepiece (the one that magnifies the least), rack the eyepiece all the way in using the focuser's knobs. Slowly rack the eyepiece outwards until an image starts to appear. Move the telescope (using the fine adjustment controls) and locate a reference object. Centre this reference object in the centre of eyepiece (Centre of the field of view).

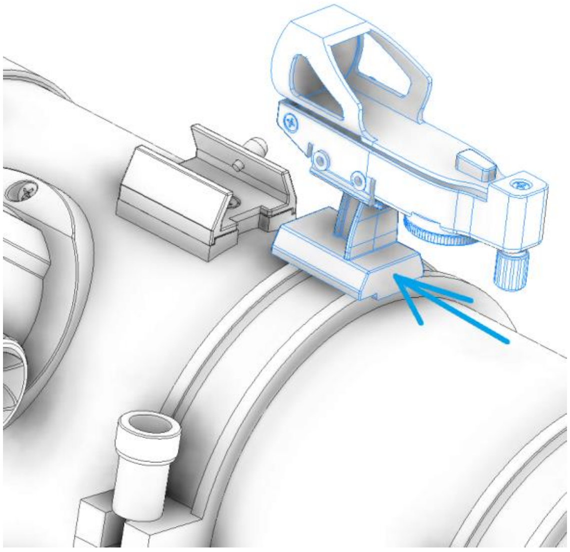
A reference object can be a distant distinct building like a water tower/deposit, an energy metal post, a church tower or others.

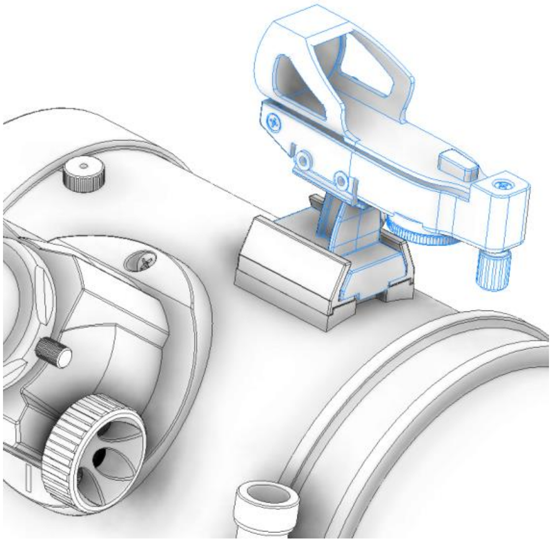


4. FINDERSCOPE

4.1. Installing and aligning the Finderscope #B

Slide the finderscope #B into the finderscope shoe #K. Secure using the side thumbscrew.

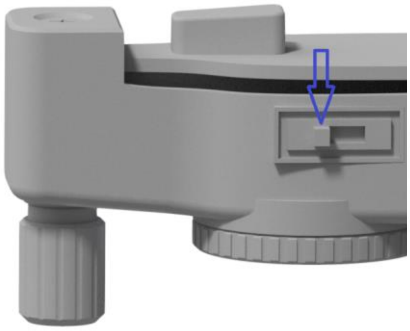


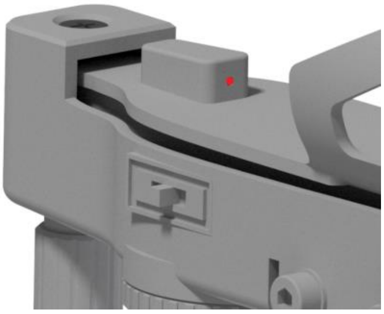


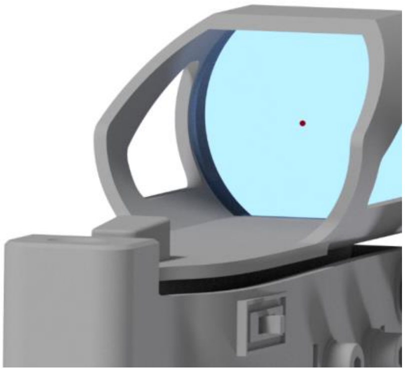
4.2. On/Off and Intensity Switch

Locate the side Switch. There are three positions.

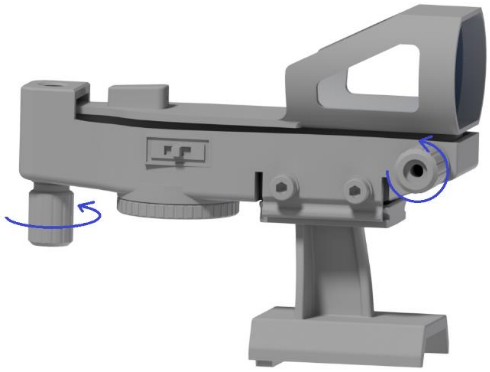
Off (as shown in the figure) and On, with two intensity positions. The two intensity positions project a tiny red point (Red-dot) on the finder scope optical window as show.







4.3. Aligning the Red-Dot to the telescope



The two thumbscrews allow adjusting the Red-dot position in relation to the eyepiece field of view (FOV).

The principle is that the Red-Dot must be at the centre of the FOV as seen through the eyepiece.

The thumbscrew on the back adjusts the Red-dot "up/down", also called altitude, while the one on the front to the "left/right" also called azimuth.

It is very important to correctly align the finderscope's red-dot to the center of the image, as seen through the eyepiece.

4.4. Finding a distant land-object.

A distant object is centred at the telescope's field of view. In this example, we have a house with a chimney. The chimney is the reference point to place at the centre of the field of view. We first look through the telescope with the lowest magnification possible (the supplied eyepiece with longer focal length), so we have the widest field of view possible.

4.5. Understanding aligning.

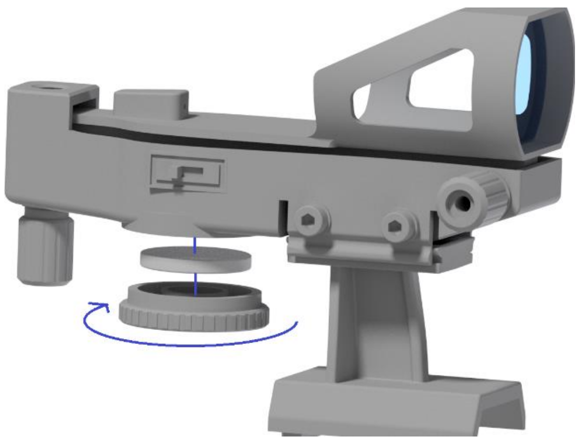
Looking through the finderscope (it should be powered ON) we see the same building, but in this case the red dot and chimney are not centered. We adjust the finderscope using the two altitude and azimuth knobs so that the finderscope red point moves slightly until it matches the chimney. This is enough to correct the objects position in the finderscope. Trial and error is required to get a satisfactory result.

4.6. Matching the red-dot.

After playing with the two findercope thumbscrews and some trial and error, we get the finderscope red dot close to the center (in this case the chimney). The finderscope is now ready to use!

4.7. Replacing the battery.

The red-dot needs to be bright enough to be seen during the observation. After some hours of use the brightness may dim until it no longer can be seen. The button battery (CR2032) needs to be replaced. Turn the switch to OFF. Now remove the battery cap and the battery from the battery compartment and replace with a new battery. Place the plastic battery cap back to protect the battery. Turn the switch to ON and check if the red-dot is brighter now. When not in use, the finderscope should always be powered OFF to prolong the battery's life.



5. What can be seen with a telescope?

Below you will find some examples of what you can expect to see when using this telescope.

5.1. The Moon is one of the most spectacular objects to be seen through a telescope. Even a small telescope will reveal high detail of the Moon's surface. You will be able to see the craters on the Moon's surface and other features like the Marea. The moon is a very bright object. It is better to observe it when the Moon is not full. Try the crescent Moon and look for features along the terminator (between illuminated and dark surfaces).

5.2. Jupiter is the biggest planet of our solar system. It is also one of the favourite targets for beginners. Galileo was able to discover that the four tiny dots that turn around the planet were in fact part of Jupiter's system of moons. With this telescope you will not only be able to see Jupiter's planet disc with its two major discernible bands, but also its biggest moons, Io, Europa, Ganymede and Calisto.

5.3. The "lord of the rings" of the night skies, Saturn is by far the most popular target for small telescopes. Saturn's rings are discernible even at 60x magnification. In a very good night, you will be able to discern the Cassini's division (the darker band on the Saturn's rings).

6. MATH BEHIND YOUR OTA.

6.1. Using the accessories, a bit of math to understand how all it works.

Using the accessories is easy and fun. To change magnification simply swap eyepieces. To get more magnification a Barlow lens 2x can be used. But how does all of this work?

Your telescope has a native focal length. This is approximately the distance between the telescope mirror to its focal point (very similar to the distance between the focus point of a loupe and the loupe lens). This is a very important feature, that allows determining several interesting facts such as magnification.

The telescope's focal length and the used eyepiece determine the magnification. You probably noticed that the two supplied eyepieces are 25mm Plössl Eyepiece and 10mm Plössl Eyepiece. This means that the first has a 25mm focal length and the second a 10mm focal length. To determine the magnification just divide the telescope's focal length by the eyepiece's focal length.

OTA model	Focal Length (mm)
114/500	500
114/900	900
130/650	650

Telescope focal length 500mm (example)
25mm Plössl Eyepiece
Magnification (Power) = Telescope focal length / Eyepiece focal length
Power = 500/25 = 20x

This means that the 25mm Plössl eyepiece provides a 20x power (magnification). This may seem low, but when you try it, you will see a bright image with some (very good) details, especially on the Moon and Planets.

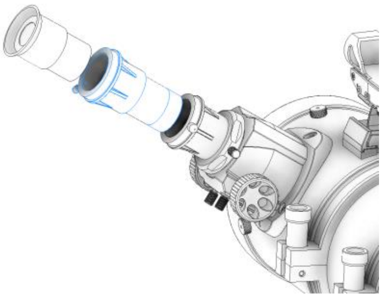
6.2. Barlow Lens 2x. The Barlow lens 2x is a very interesting device. A negative lens multiplies the telescope's focal length by two time. So, a 2x Barlow multiplies the original focal length by a factor of two, in this case $500mm\ x\ 2 = 1000mm$.

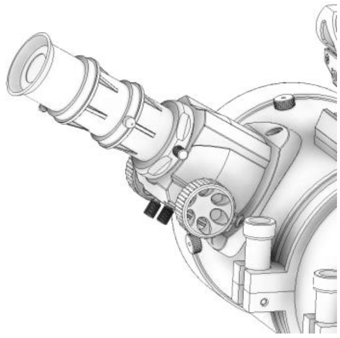
A 3x Barlow lens multiplies by 3x, etc.. Your telescope, however, is supplied with a 2x Barlow lens. When used with the 25mm Plössl Eyepiece you get 2x the power obtained with the eyepiece alone.

114/500 OTA (example)	Terrestrial View	Moon	Deep Sky	Jupiter and Saturn
Barlow Lens 2x				Yes
25mm Plössl Eyepiece			Yes	
10mm Plössl Eyepiece		Yes		Yes
Power	*Does not apply*	50x	*20x*	*80x*

10. How to install the Barlow lens?

10.1. The most usual way of using a Barlow lens is by placing it immediately below the eyepiece. The light, coming from the telescope's OTA passes through the Barlow and finally the eyepiece until reaching the observers eye. In this position, the Barlow's magnification is 2X.

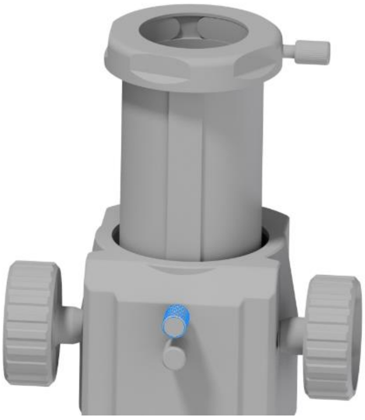


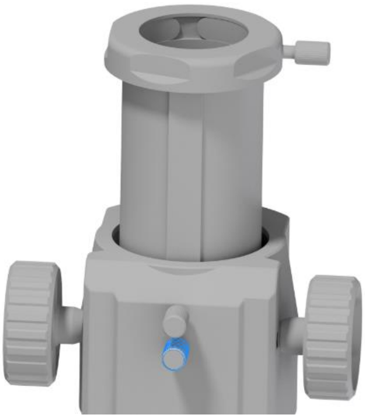


When using the Barlow bear in mind that:
The maximum magnification (power) for a telescope is around 2x its aperture in mm.
In this case, the aperture is 70mm which means that <u>140x</u> would theoretically be possible in a very calm and stable night while pointing near the Zenith. However, in reality it is not frequent to realistic achieve this number.

11. How does the Focuser work?

The focuser, as described before, allows displacing the eyepiece and reaching focus (a sharp image).
The two highlighted thumbscrews (as shown in the figure) are used for different purposes.

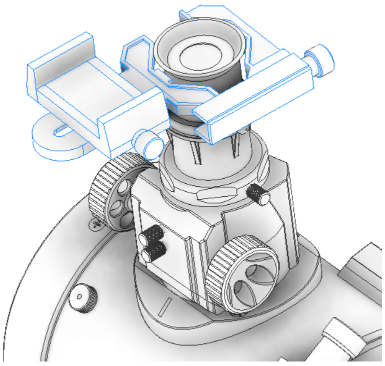




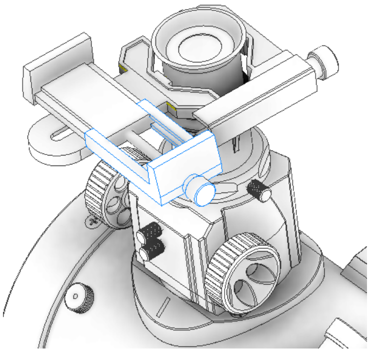
11.1 Top thumbscrew. The top thumbscrew is a locking screw. It is used to lock the focuser in position. When it is engaged, the focuser's drawtube no longer moves, even when rotating the focuser knobs.
11.2. Bottom thumbscrew. This thumbscrew allows to adjust the friction of the focuser. Tightening makes the focuser stiffer to movement, while releasing it makes the movement smoother.
The stiffer it gets the more weight it can hold. Do not overtighten as it may damage the focuser.

ATTENTION! Never look at the Sun through a telescope. Concentrated Sun light may cause serious eye injury. Children should use only with adult supervision

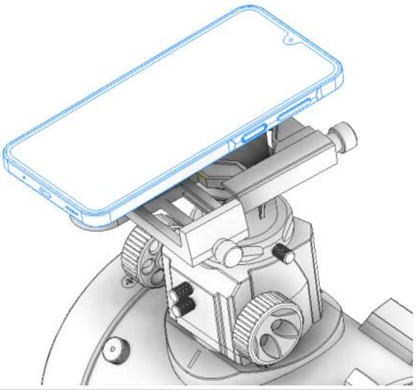
12. Using the Smartphone adapter to take photos.



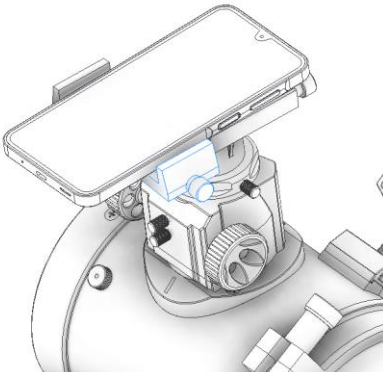
Place the smartphone adapter as shown. Make sure that the clamp is applying good pressure on the eyepiece metal barrel.



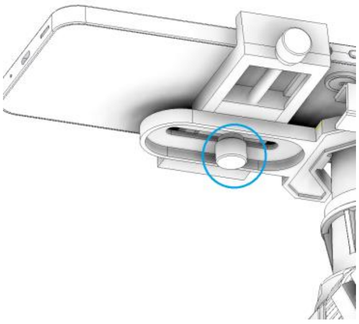
Release the smartphone holder clamp, as shown, so there is enough width to place the smartphone.



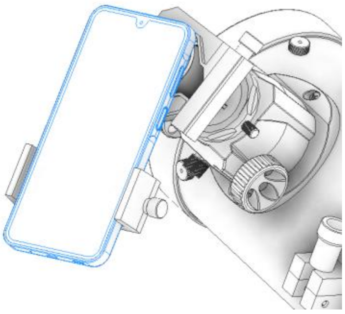
Place the smartphone as shown. The camera to the eyepiece side.



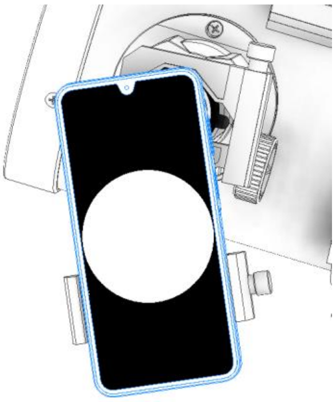
Fix the smartphone firmly, using the side thumbscrew.



Release the bottom thumbscrew so that the previous smartphone assembly can rotate and slide freely.



Rotate sideways and slide to the front and back as necessary so that the smartphone camera is centred with the eyepiece.



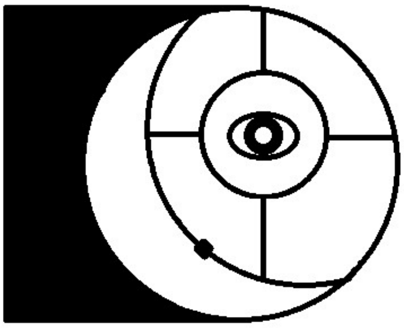
Open your favourite photography app and set it to macro mode. Use zoom if necessary. You are now ready to take photos of the Moon and the Planets.

13. Alignment of the optics and collimation.

Telescopes require periodical checking for the alignment of the optics. The optics should be aligned (or collimated) so that the telescope can achieve a good performance and deliver a sharp image. This is especially important for reflector telescopes (that use mirrors). First let’s start by checking collimation.

Look for a bright star in the evening sky and centre it in the eyepiece field of view. Some power is required to check alignment, make sure the star is focused. Now use the focuser knobs and rotate so that the star comes out of focus (defocused). You will be able to see a defocused star. It will appear as a series of rings. These are called diffraction rings and they will be important to determine how good (or how bad is the alignment – figure 23). If the optics are well aligned you will be able to see a defocused star similar to a series of concentric rings (1 in the figure), a poorly aligned telescopes will show a series of eccentric rings (2 in the figure).

The telescope is equipped with a set of collimation screws for both the secondary mirror and for the primary mirror . They can be used to adjust the tilt of both mirrors and to achieve alignment. This information is for your reference.



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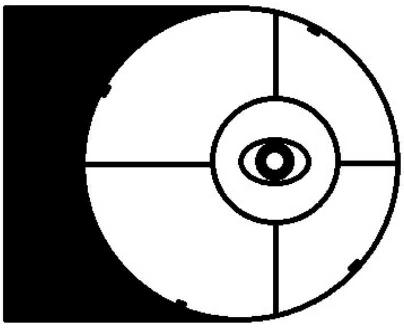

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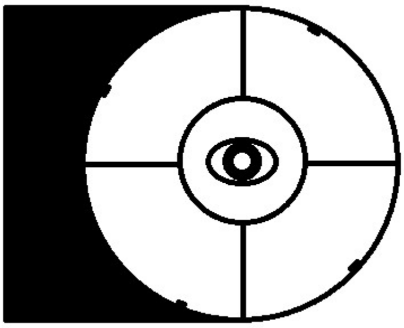

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13.1. Collimating the optics.

Remove the eyepiece from the telescope’s focuser. If look directly to the secondary mirror will see a reflection of your eye. The light is being reflected from the secondary mirror to the primary and back.

Figure 22 shows the different stages of collimation.

1- Telescope optics completely out of collimation. Adjustment is necessary both in the secondary as in the primary mirror.

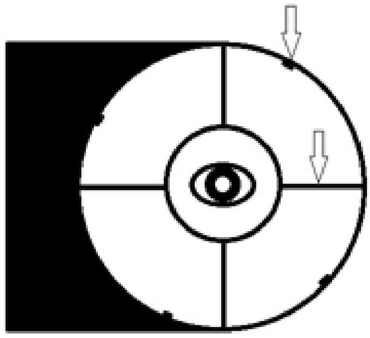
2- Secondary mirror is aligned but primary mirror needs adjustments.

3- Telescope´s optics are aligned and star test should show concentric rings. The telescope will perform at its best.

13.2. So how to get to good alignment?

Let’s start with the secondary mirror. Peeking at the focuser without the eyepiece and looking at the secondary mirror one can see the reflected eye. One can also see the telescope secondary spider vanes (4 vanes cross shaped) and the primary mirror’s holding pads.

13.3. Adjusting the secondary mirror.

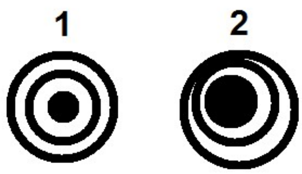


The secondary mirror can be adjusted by using the three grub screws (L hex key not supplied). Releasing all the three will cause the secondary mirror support to rotate. So make sure you only adjust a grub screw at a time to avoid it.
The secondary mirror should always show up as a circle and not an ellipse. Please make sure this is the case.
As soon as you get the primary mirror and the primary mirror pads centre, you are good to move to the next step.

13.4. Adjusting the primary mirror.

The primary mirror needs to be adjusted. Adjusting the primary mirror will move the secondary mirror reflection to the centre. Use the six screws on the back of telescope. Notice that three screws are used to adjust the tilt of the primary mirror while the three others are used to hold the tilt position. Adjust the primary mirror so that all the reflections are centred. Your telescope should now be collimated.

13.5. Verifying collimation



Check the diffraction rings and repeat if necessary.
1. Collimated (diffraction rings perfectly centered)
2. Collimation required.

End.