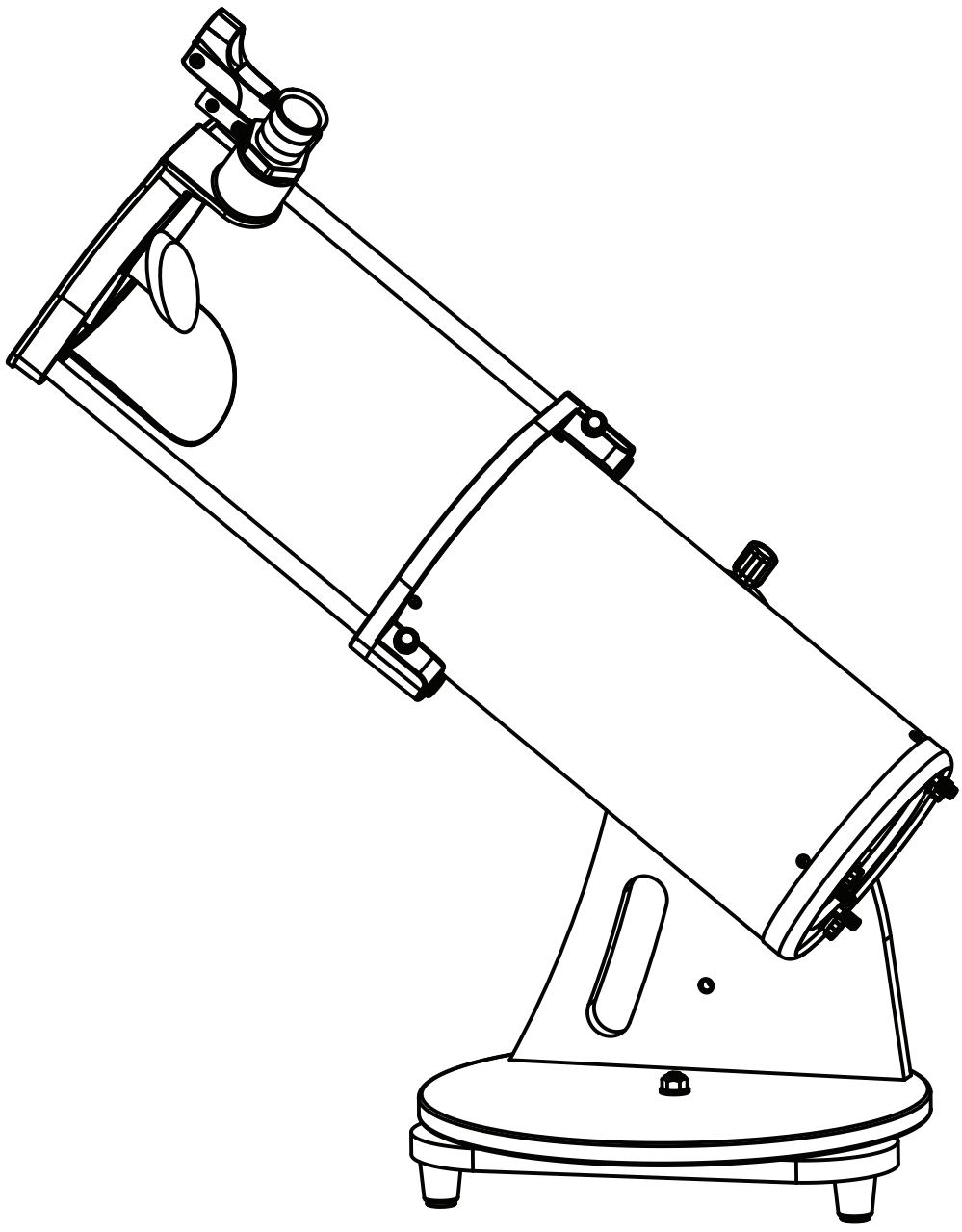
INSTRUCTION MANUAL

HERITAGE 150 P



200117-V1

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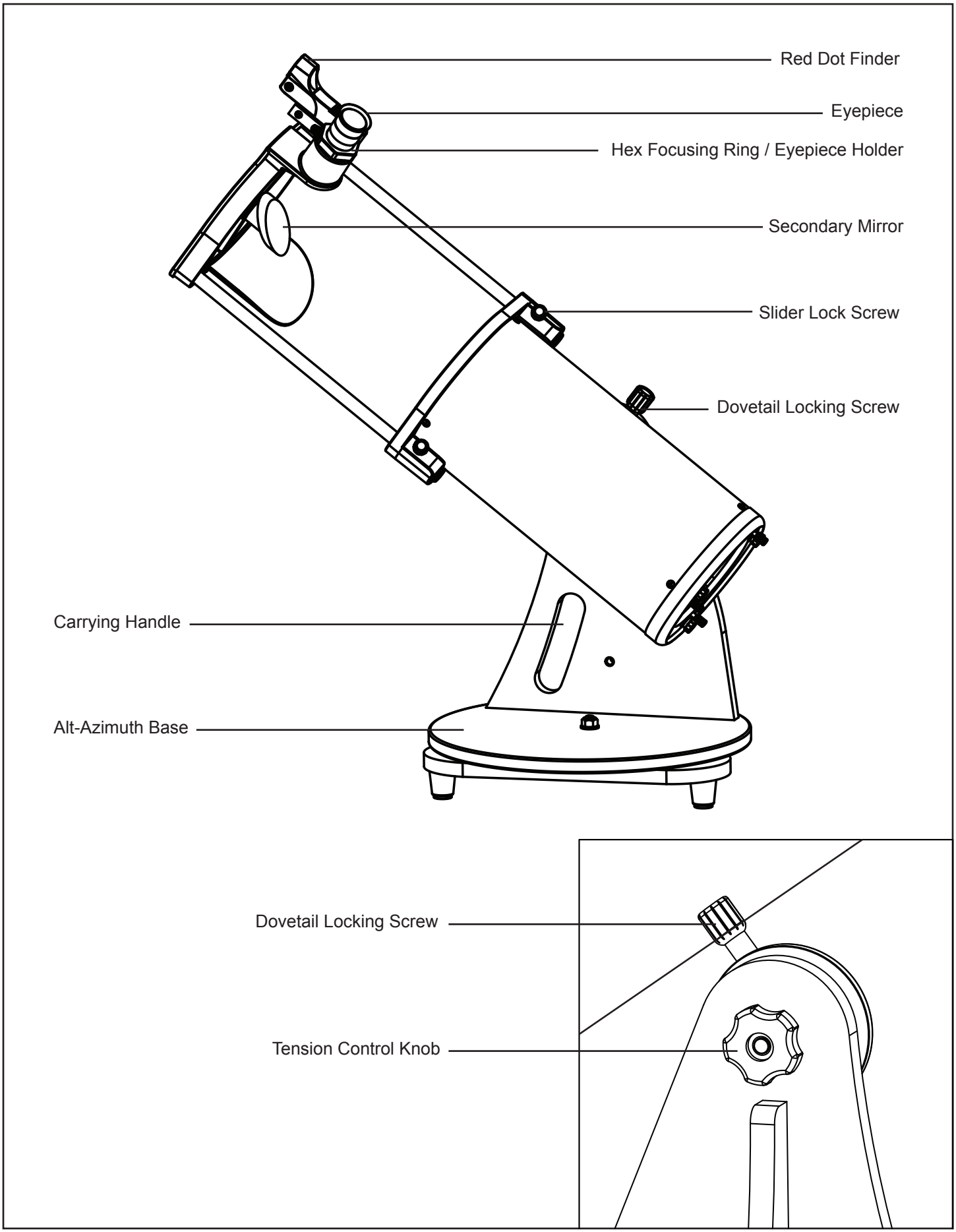
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Before you begin

Read the entire manual carefully before beginning. Your telescope should be assembled during daylight hours. Choose a large, open area to work to allow room for all parts to be unpacked.

Caution!

Caution! NEVER USE YOUR TELESCOPE TO LOOK DIRECTLY AT THE SUN. PERMANENT EYE DAMAGE WILL RESULT. THIS TELESCOPE CAN NEVER BE USED FOR SUN OBSERVATION, EVEN WITH A SOLAR FILTER. ITS OPEN TUBE CAN ALLOW DANGEROUS UNFILTERED SUNLIGHT ENTERING FROM ASIDE.


Red Dot Finder
Eyepiece
Hex Focusing Ring / Eyepiece Holder
Secondary Mirror
Slider Lock Screw
Dovetail Locking Screw
Carrying Handle
Alt-Azimuth Base
Dovetail Locking Screw
Tension Control Knob

TELESCOPE ASSEMBLY

1.Remove the telescope and accessories from the package. You will find the telescope itself, along with 2 eyepieces, a collimation cap and a red dot finder.
You will need a small Phillips head screwdriver to complete assembly of the telescope. This is not included in the package.

2. Slightly loosen the screws on the side of the red dot finder. (Fig. a)

3. Slide the red dot finderscope onto the connecting base near the front of the telescope (Fig. b) Tighten the screws to secure it in place. Do not over-tighten the screws. If the red dot finderscope does not slide onto the base easily, you may need to loosen the screws further.

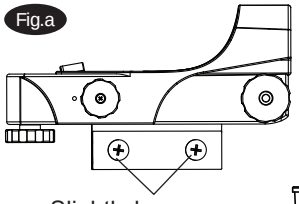
4. The telescope must be fully extended before it be can be used. If it is not extended, it will not work. Slightly loosen the two plastic slider locking screws in Fig.d Please note – you do not need to completely remove the screws. Extend the telescope tube as far as it will go. Re-tighten the two slider locking screws being careful not to over-tighten them.

5. Slightly loosen the screws on the eyepiece holder and put an eyepiece in the holder. Tighten the screws just enough to hold it in place, again being careful not to overtighten the screws. While you are learning to use your new telescope we suggest using the low power 25mm eyepiece, having the widest field of view.

6. Remove the dust cap from the front of the telescope. You're now ready to start exploring the night sky!

7. After use, simply loosen the screws on the tube and slide the telescope back down. Remember to replace the dust cap on the front of the telescope. This is also an ideal position to store your telescope.

Fig.a



Slightly loosen these screws

Fig.b

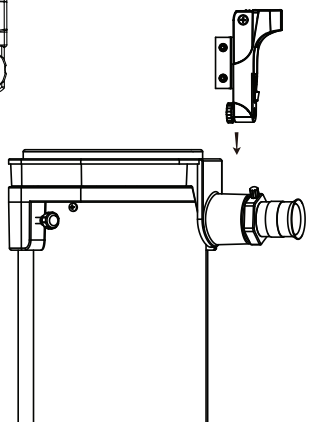


Fig.c

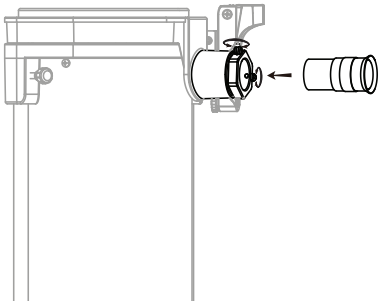
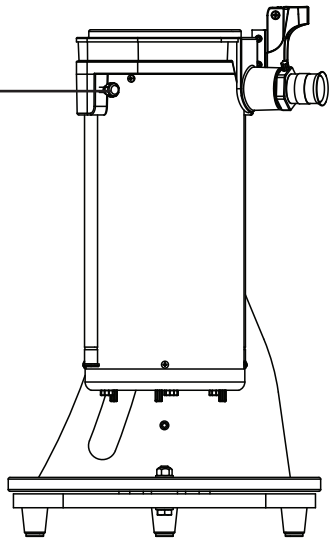


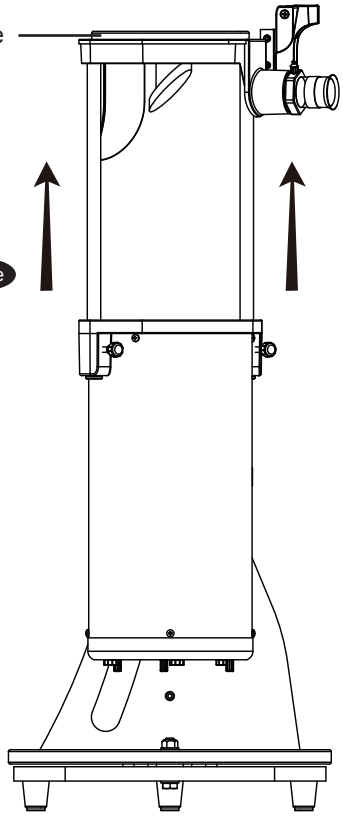
Fig.d

Loosen the two slider locking screws



Remove before viewing

Fig.e



OPERATING YOUR TELESCOPE

Positioning the telescope

To position the telescope to the desired angle, simply move the telescope tube up and down in altitude or swivel the telescope around the base in azimuth.(Fig.f)

Using the Tension Control knob

Loosen or tightend the tension control knob to add just enough friction to allow the tube to move easily when nudged but to stay in position when not. It may be necessary to re-adjust the tension control knob when accessories are added to, or removed from, the tube.

Fig.f

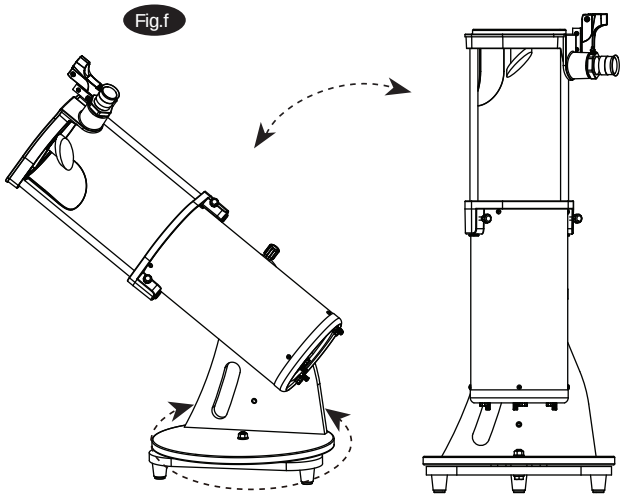
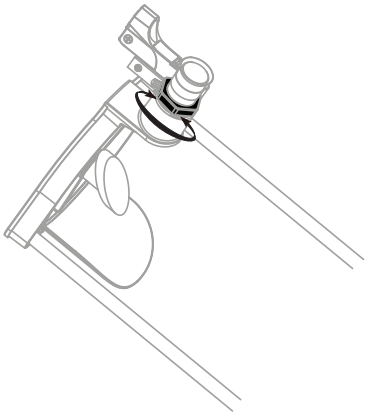


Fig.g



Focusing

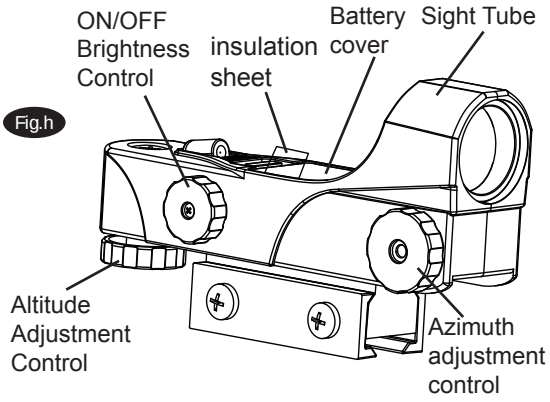
When you first put an eyepiece into your telescope, bright objects like the Moon will simply be a blur and bright pinpoint light from stars could be so spread out, they might even be invisible in the eyepiece. This is because you need to focus your telescope. Focusing with the hex focusing ring will move the eyepiece more in or out to make the image you see as sharp as possible. Slowly turn the hex focusing ring (Fig.g), one way or the other, until the image in the eyepiece is sharp.

You will often have to focus again during your observing session due to small variations caused by temperature changes, small movements in the telescope's tube etc. This happens more often with short focal ratio telescopes like the HERITAGE150P, particularly when they haven't yet reached outside temperature. You will almost always need to focus again when you change an eyepiece or add or remove a Barlow lens.

Using the Red Dot Finder

The Red Dot Finder is a zero magnification pointing tool that uses a coated glass window to superimpose the image of a small red dot onto the night sky. The Red Dot Finder is equipped with a variable brightness control, azimuth adjustment control, and altitude adjustment control (Fig.h).
The Red Dot Finder is powered by a 3-volt lithium battery located on top. To use the Finder, simply look through the sight tube and move your telescope until the red dot merges with the object. Make sure to keep both eyes open when sighting.

Fig.h



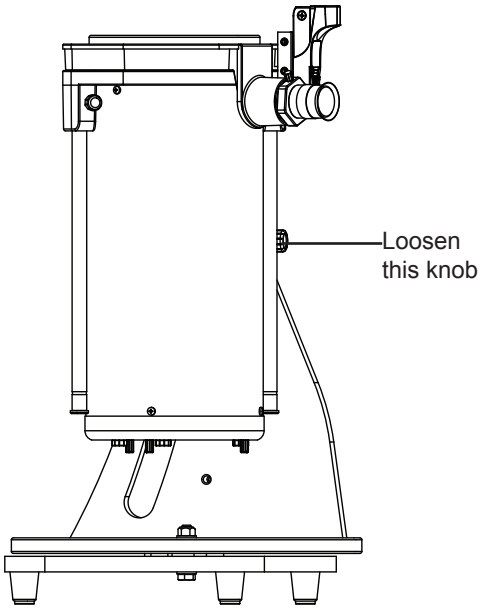
Aligning the Red Dot Finder

Like all finderscopes, the Red Dot Finder must be properly aligned with the main telescope before use. This is a simple process using the azimuth and altitude control knobs.
1. Please open the battery cover and remove the insulation sheet.
2. Turn on the Red Dot Finder by rotating the variable brightness control clockwise until you hear a “click”. Continue rotating the control knob to increase the brightness level.
3. Insert the 25mm eyepiece into the telescope’s focuser. Locate a bright object and position the telescope so that the object is in the centre of the field of view of the eyepiece.
4. With both eyes open, look through the sight tube at the object. If the red dot overlaps the object, your Red Dot Finder is perfectly aligned. If not, turn its azimuth and altitude adjustment controls until the red dot is merged with the object.

Removing the telescope tube

The telescope tube can be removed from the mount for storage. Hold the telescope tube in one hand while you loosen the dovetail locking knob with the other. Carefully slide the tube off the mount. The telescope tube can be installed on any telescope mount with a dovetail mounting system. You may also install a different short-tube telescope on this portable table-top Dobsonian mount.

Fig.i



Pointing the telescope

Pointing an altitude-azimuth (alt-az) mounted telescope, such as a Dobsonian, is relatively easy. With the mount level, you can swivel the telescope around on a plane parallel to your horizon and then tilt it up and down from there (Fig.f). You can think of it as turning your telescope in azimuth until it is facing the horizon below a celestial object and then tilting it up to the object’s altitude. However, the Earth rotates and therefore the stars are constantly moving, so to track with this mount you have to constantly nudge the optical tube in both azimuth and altitude to keep the object in the field.

Calculating the Magnification (Power)

The magnification produced by a telescope is determined by the focal length of the eyepiece that is used with it. To determine a magnification for your telescope, divide its focal length by the focal length of the eyepieces you are going to use. For example, the 10mm focal length eyepiece will give 75x magnification with this 750mm focal length telescope.

$$\text{Magnification} = \frac{\text{Focal length of the telescope}}{\text{Focal length of the eyepiece}} = \frac{750\text{mm}}{10\text{mm}} = 75\text{x}$$

When you are looking at astronomical objects, you are looking through a column of air that reaches to the edge of space and that column seldom stays still. Similarly, when viewing over land you are often looking through heat waves radiating from the ground, house, buildings, etc. Your telescope may be able to give very high magnification but what you end up magnifying is all the air turbulence between the telescope and the subject. A good rule of thumb is that the absolute maximum usable magnification of a telescope (to separate double stars for example) is about 2x per mm of aperture (= 300x with this telescope) under excellent sky conditions. For moon and planets, it is advised to magnify up to about 1x per mm of aperture (here 150x) under good sky conditions.

Calculating the Field of View

The size of the view that you see through your telescope is called the true (or actual) field of view. The apparent field of view of an eyepiece is the angle of view in degrees given by the manufacturer of the eyepiece. The true field of view produced by your telescope is calculated by dividing the eyepiece's apparent field of view by the magnification that you previously calculated for the combination. Using the figures in the previous magnification example, if your 10mm eyepiece has an apparent field of view of 52 degrees, then the true field of view is 0.69 degrees.

$$\text{True Field of View} = \frac{\text{Apparent Field of View}}{\text{Magnification}} = \frac{52^\circ}{75\text{x}} = 0.69^\circ$$

To put this in perspective, the moon is about 0.5° in diameter, so this combination would be fine for viewing the whole moon with a little room to spare. Remember, too much magnification and too small a field of view can make it very hard to find things. It is usually best to start at a lower magnification with its wider field and then increase the magnification when you have found what you are looking for. First find the moon then look at the shadows in the craters!

Calculating the Exit Pupil

The Exit Pupil is the diameter (in mm) of the narrowest point of the cone of light leaving your telescope. Knowing this value for a telescope-eyepiece combination tells you whether your eye is receiving all of the light that your primary mirror is providing. The average person has a fully dilated pupil diameter of about 7mm. This value varies a bit from person to person, is less until your eyes become fully dark adapted and decreases as you get older. To determine an exit pupil, you divide the diameter of the primary mirror of your telescope (in mm) by the magnification.

$$\text{Exit Pupil} = \frac{\text{Diameter of Primary mirror in mm}}{\text{Magnification}}$$

Here for example, the 150mm f=750mm telescope with a 40mm eyepiece would produce a magnification of 19x and an exit pupil of 8mm. This combination will make it impossible to receive all available light in your eye. The same telescope used with a 32mm eyepiece gives a magnification of about 23x and an exit pupil of 6.4mm which should be fine for most dark adapted eyes.

OBSERVING THE SKY

Sky conditions

Sky conditions are usually defined by two atmospheric characteristics, seeing, or the steadiness of the air, and transparency, light scattering due to the amount of water vapour and particulate material in the air. When you observe the Moon and the planets, and they appear as though water is running over them, you probably have bad “seeing” because you are observing through turbulent air. In conditions of good “seeing”, the stars appear steady, without twinkling, when you look at them with unassisted eyes (without a telescope). Ideal “transparency” is when the sky is inky black and the air is unpolluted.

Selecting an observing site

Travel to the best site that is reasonably accessible. It should be away from city lights, and upwind from any source of air pollution. Always choose as high an elevation as possible; this will get you above some of the lights and pollution and will ensure that you aren’t in any ground fog. Sometimes low fog banks help to block light pollution if you get above them. Try to have a dark, unobstructed view of the horizon, especially the southern horizon if you are in the Northern Hemisphere and vice versa. However, remember that the darkest sky is usually at the “Zenith”, directly above your head. It is the shortest path through the atmosphere. Do not try to observe any object when the light path passes near any protrusion on the ground. Even extremely light winds can cause major air turbulence as they flow over the top of a building or wall. If you try to observe on any structure, or even a sidewalk, movements you make may cause the telescope to vibrate. Pavement and concrete can also radiate stored heat which will affect observing.

Observing through a window is not recommended because the window glass will distort images considerably. And an open window can be even worse, because warmer indoor air will escape out the window causing turbulence which also affects images. Astronomy is an outdoor activity.

Choosing the best time to observe

The best conditions will have still air, and obviously, a clear view of the sky. It is not necessary that the sky be cloud-free. Often broken cloud conditions provide excellent seeing. Do not view immediately after sunset. After the sun goes down, the Earth is still cooling, causing air turbulence. As the night goes on, not only will seeing improve, but air pollution and ground lights will often diminish. Some of the best observing time is often in the early morning hours. Objects are best observed as they cross the meridian, which is an imaginary line that runs through the Zenith, due North-South. This is the point at which objects reach their highest points in the sky. Observing at this time reduces bad atmospheric effects, When observing near the horizon, you look through lots of atmosphere, complete with turbulence, dust particles and increased light pollution.

Cooling the telescope

Telescopes require at least 10 to 30 minutes to cool down to outside air temperature. This may take longer if there is a big difference between the temperature of the telescope and the outside air. This minimizes heat wave distortion inside telescope tube (tube currents).

Adapting your eyes

Do not expose your eyes to anything except red light for 30 minutes prior to observing. This allows your pupils to expand to their maximum diameter and build up the levels of optical pigments, which are rapidly lost if exposed to bright light. It is important to observe with both eyes open. This avoids fatigue at the eyepiece. If you find this too distracting, cover the non-used eye with your hand or an eye patch. Use averted vision on faint objects: The center of your eye is the least sensitive to low light levels. When viewing a faint object, don’t look directly at it. Instead, look slightly to the side, and the object will appear brighter.

PROPER CARE OF YOUR TELESCOPE

Collimation

Collimation is the process of aligning the mirrors of your telescope so that they work in concert with each other to deliver properly focused light to your eyepiece. By observing out-of-focus star images, you can test whether your telescope's optics are aligned. Place a star in the centre of the field of view and move the focuser so that the image is slightly out of focus. If the seeing conditions are good, you will see a central circle of light (the Airy disc) surrounded by a number of diffraction rings. If the rings are symmetrical about the Airy disc, the telescope's optics are correctly aligned (Fig. j).

If not, the two mirrors in the telescope are not properly aligned and collimation is needed. A collimation aid is supplied with the accessories. It is a plastic cap with a small hole in its centre, which fits the focuser of the telescope when the eyepiece is removed. Let's call it the collimation cap.

Collimation is a painless process and works like this:

Pull off the lens cap which covers the front of the telescope and look down the optical tube. At the bottom you will see the primary mirror held in place by three clips 120° apart, and at the top the small oval secondary mirror held in a support and tilted 45 toward the focuser outside the tube wall (Fig. k).

The secondary mirror is aligned by adjusting the three smaller screws surrounding the central bolt. The primary mirror is adjusted by the three adjusting screws at the back of your scope. The three locking screws beside them serve to hold the mirror in place after collimation. (Fig. l)

Aligning the Secondary Mirror

Point the telescope at a lit wall and insert the collimation cap into the focuser in place of a regular eyepiece. Look into the focuser through your collimation cap. You may have to twist the focus knob a few turns until the reflected image of the focuser is out of your view. Ignore the reflected image of the collimating cap or your eye for now, instead look for the three clips holding the primary mirror in place. If you can't see them, it means that you will have to adjust the three bolts on the top of the secondary mirror holder, with possibly an Allen wrench or Phillip's screwdriver. You will have to alternately loosen one and then compensate for the slack by tightening the other two. Stop when you see all three mirror clips (Fig. m and n), Make sure that all three small alignment screws are tightened to secure the secondary mirror in place.

Fig.j



Correctly aligned Needs collimation

Fig.k

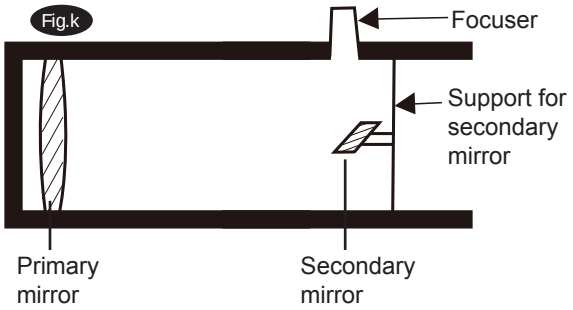


Fig.l

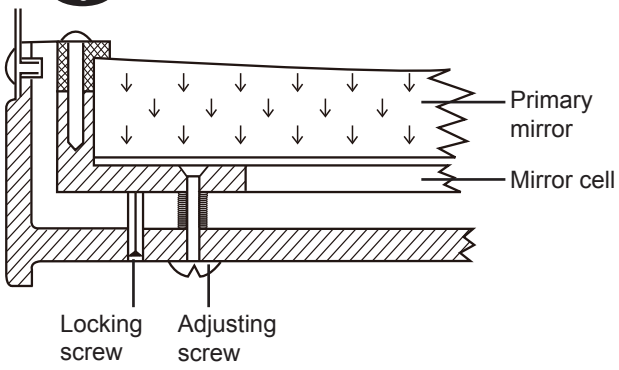


Fig.m

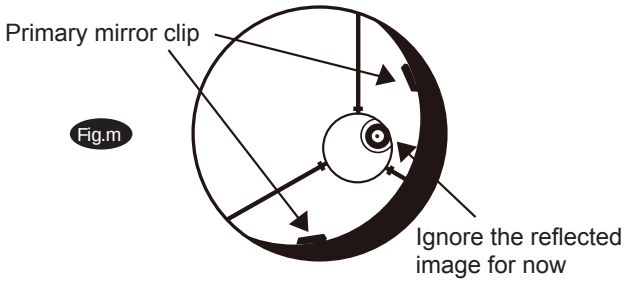
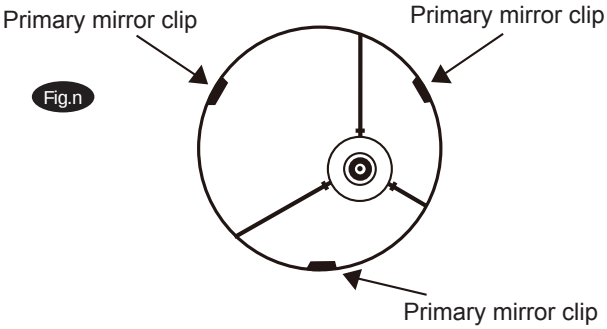


Fig.n



Aligning the Primary Mirror

There are 3 large bolts and 3 small screws at the back of your telescope. The large bolts are the adjusting screws and the small screws are the locking screws (Fig.o). Loosen the large bolts by a few turns. Now run your hand around the front of your telescope keeping your eye to the focuser, you will see the reflected image of your hand. The idea here being to see which way the primary mirror is defected, you do this by stopping at the point where the reflected image of the secondary mirror is closest to the primary mirrors' edge (Fig. p).

When you get to that point, stop and keep your hand there while looking at the back end of your telescope, is there an adjusting screw there? If there is you will want to loosen it (turn the screw to the left) to bring the mirror away from that point. If there isn't a adjusting screw there, then go across to the other side and tighten the adjusting screw on the other side. This will gradually bring the mirror into line until it looks like Fig.q. (It helps to have a friend to help for primary mirror collimation, Have your partner adjust the adjusting screws according to your direction while you look in the focuser.)

After dark go out and point your telescope at a bright star, and put the high power eyepiece (10mm) in the focuser. Keep that bright star well centred in the middle of the eyepiece image. Check now the collimation by looking at its airy disk as described (fig. j). If it is not symmetric, you can improve the symmetry by acting on the adjustment screws of the primary mirror in a similar way as what you did in daytime to achieve the symmetry of fig. q.
Once the symmetry is there, then collimation is done and the locking screws can be tightened to make the adjustment permanent.

Fig.o

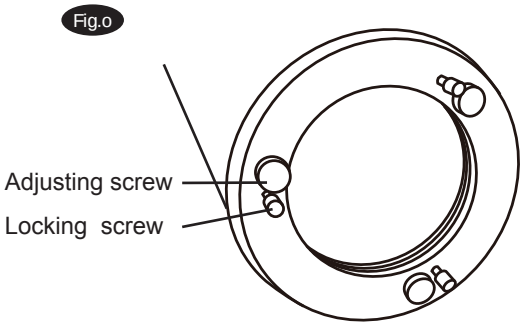


Fig.p

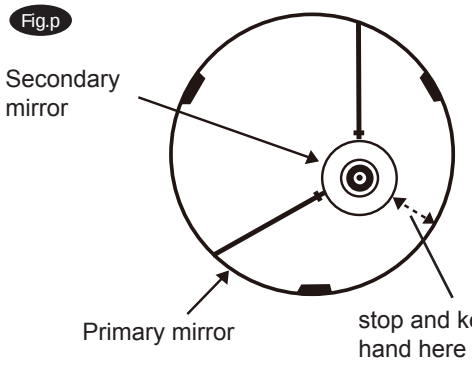
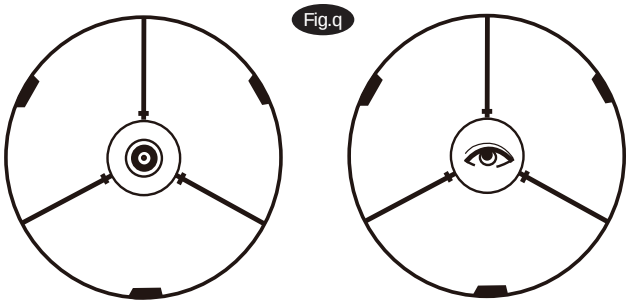


Fig.q



Both mirrors aligned with collimating cap in

Both mirrors aligned with eye looking in focuser

Cleaning your telescope

Replace the dust cap over end of telescope whenever not in use. This prevents dust from settling on mirror or lens surface. Do not clean mirrors unless you are familiar with optical surfaces. Clean finder and eyepieces with special lens paper only. Eyepieces should be handled with care, avoid touching optical surfaces.

Like any surface, your telescope's mirrors and eyepieces may attract dust and other particles over time. It's important to keep your telescope's optics clean, but we have found that very tiny amounts of dust particles will not effect your views of the night sky. Rigorous cleaning on the other hand may smear dust or stains further or even damage optic surfaces if incorrectly done.

Caution!

NEVER USE YOUR TELESCOPE TO LOOK DIRECTLY AT THE SUN. PERMANENT EYE DAMAGE WILL RESULT. THIS TELESCOPE CAN NEVER BE USED FOR SUN OBSERVATION, EVEN WITH A SOLAR FILTER. ITS OPEN TUBE CAN ALLOW DANGEROUS UNFILTERED SUNLIGHT ENTERING FROM ASIDE.