COLEMAN® TELESCOPE

CDB1145EQ1

INSTRUCTIONS & OWNER'S MANUAL

Please retain the packaging and instructions for further reference, as they contain important information.

INTRODUCTION:

Congratulations on your purchase of the precision crafted CDB1145EQ1 COLEMAN telescope. With the proper care and handling of your telescope, you will enjoy years of viewing pleasure.

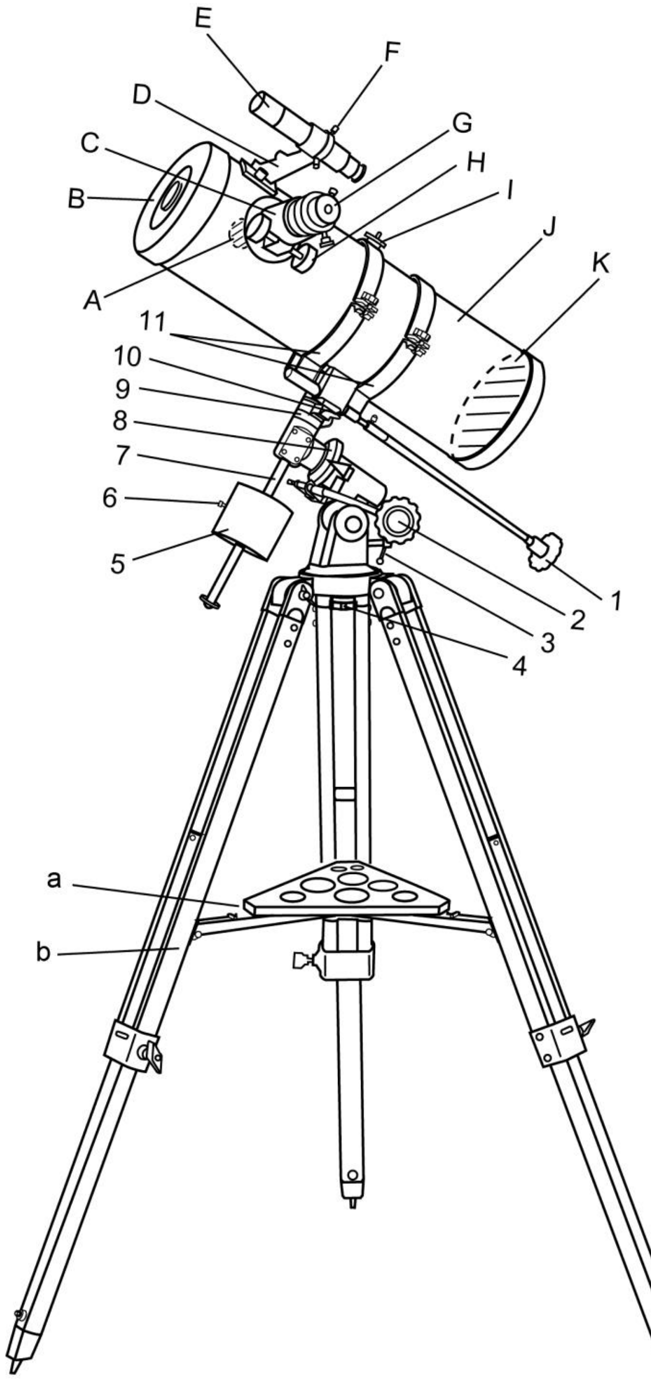
As an astronomical device, the CDB1145EQ1 telescope has been designed for both a beginner and advanced star gazer. It provides views of the moon and planets, as well as dozens of galaxies, star clusters, and nebulae.

As a terrestrial (land) telescope, the CDB1145EQ1 brings the world's natural wonders closer. It delivers superb scenic views and allows for observation of animals and landscapes from a distance. To obtain the best performance from your telescope, please carefully read this manual.

WARNING! DO NOT VIEW THE SUN THROUGH A TELESCOPE! SERIOUS INJURY TO THE EYES MAY OCCUR

For use by an adult or under the supervision of an adult

PARTS LIST FOR CDB1145EQ1 Telescope:



A. Secondary Mirror Position
B. Dust Cap / Mask
(Remove before Viewing)
C. Focus Tube
D. Fonderscope Bracket
E. 6x30 Finderscope
F. Finderscope Alignment Screws
G. Eyepieces (K10, K25), Eyepiece cases (2)
H. Focus Knob
I. Piggyback Bracket
J. Telescope Main Tube
K. Primary Mirror Position

1. Dec. Flexible Control Cable
2. R.A. Flexible Control Cable
3. Altitude Adjustment T-bolt
4. Azimuth Lock Knob
5. Counterweight
6. Counterweight Locking Thumb Screw
7. Counterweight Rod
8. R.A. Scale
9. Dec Scale
10. Dec. Lock Knob
11. Tube Rings
12. Moon Filter (Not Shown)

a. Accesory Tray
b. Tripod Leg

WARNING!

CHOKING HAZARD

8+ years

ASTM

CONFORMS TO EN71

0-3

Specifications, colors, packaging, and/or contents of this manual are subject to change without notice.

I. TRIPOD and EQ1 MOUNT ASSEMBLY:

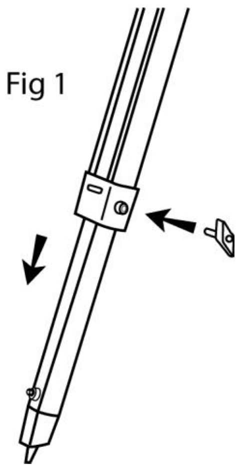
1) Carefully remove all parts from the cardboard cartons and lay them on a table, floor or other flat surface in order to take an inventory of all the pieces. Keep your box for storage or in case you ever need to ship your telescope.

2) Tripod Set Up:

A. Adjusting the Tripod Legs (See Figure 1)

1. Slowly loosen the height adjustment clamp and gently pull out the lower section of each tripod leg. Tighten the screws to hold the legs in place (see Figure 1).
2. Spread the tripod legs apart to stand the tripod upright.
3. Adjust the height of each tripod leg until the tripod head is properly leveled. Note that the tripod legs may not be at same length when the equatorial mount is level.

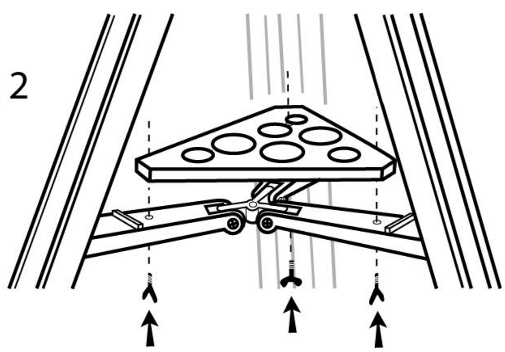
Fig 1



B. ATTACHING THE ACCESSORY TRAY (Fig. 2)

1. Align the accessory tray with the bracket, and secure from underneath (see Figure 2).

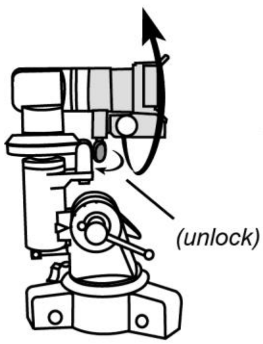
Fig 2



3) Preparing the EQ1 Mount for Assembly

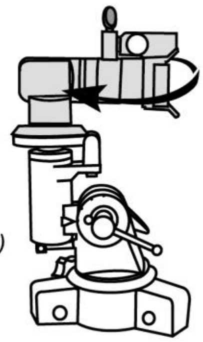
Reposition the Mount Head (See Figures 3.1 through 3.5).
Follow the diagrams to place the mount into an upright position.

Fig.3.1



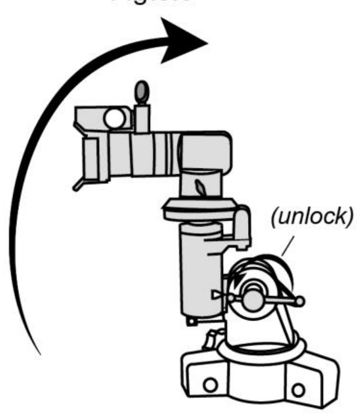
Unlock the DEC lock knob. Swivel 180°.

Fig.3.2



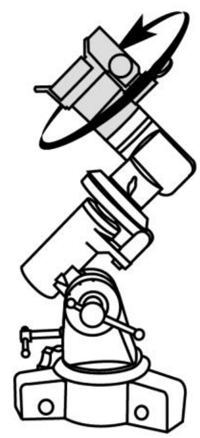
Unlock the R.A. lock knob on the other side. Swivel 180°.

Fig.3.3



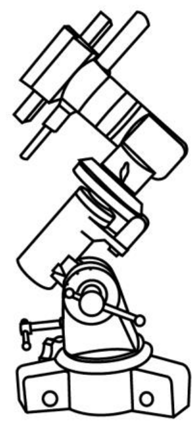
Unlock the altitude lock knob. Set the angle to local altitude.

Fig.3.4



Swivel 180°.

Fig.3.5

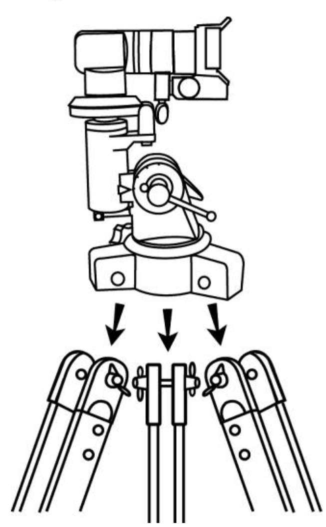


Tighten altitude, DEC and R.A. knobs.

4) Attaching the EQ1 Mount to the Tripod Legs

Position the EQ1 mount assembly collar in between the tripod legs as shown in Figure 4.
Secure in place with the included bolts and wing nuts.

Fig. 4



5) Installing the Counterweight (see Figure 5)

A. Slide counterweight halfway onto rod. Hold the counterweight with one hand and insert the counterweight rod into threaded hole on mount with the other hand. Tighten the counterweight rod onto the EQ1 mount.

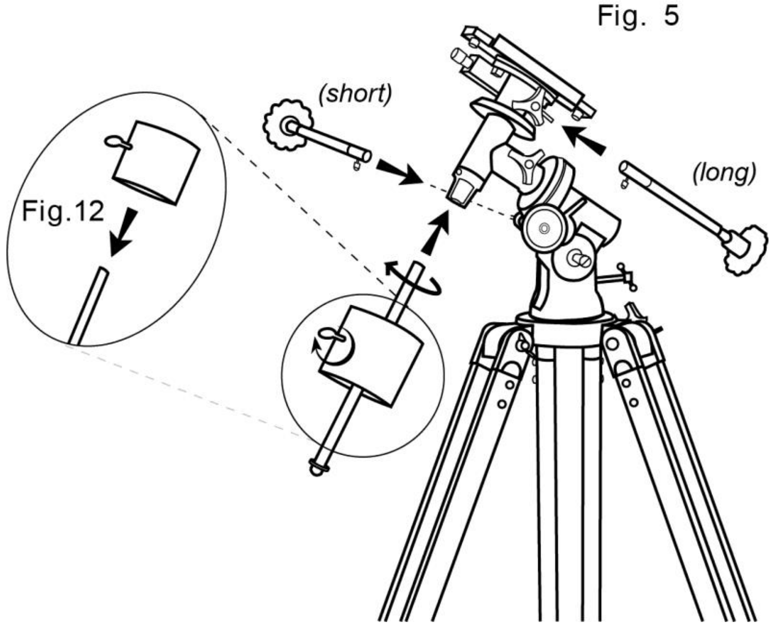
B. Tighten the thumbscrew to lock the counterweight in place.

6) Installing the Control Cables (see Figure 5)

A. Locate the control cables. The control cables have two different lengths. Although you can mount either cable to each directional axis, it is recommended that you mount the longer cable to the declination axis and the shorter cable to the right ascension axis (setting circle).

B. To install the control cables, slide the sleeve end of the cable over the nipple on the end of the worm gear. Tighten the cable using the set screw against the flat surface on the nipple.

Fig. 5



II. TELESCOPE ASSEMBLY

1) Attaching the Tube Rings to the EQ1 Mount (See Figures 6)

A. Remove the tube rings from telescope by releasing their thumb nuts and opening their hinges.

B. Place the tube rings on top of the tube ring mounting plate and bolt the tube rings to the mount by tightening the thumbscrews.

2) Attaching the Telescope Main Tube to the Tube Rings (see Figure 7)

A. Remove the telescope tube from the box.

B. Find the center of balance of the telescope tube. Place this point between the two tube rings. Close the hinges around the telescope and fasten securely by tightening the thumb nuts. DO NOT OVER-TIGHTEN.

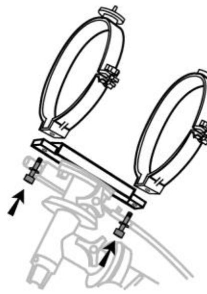


Fig.6

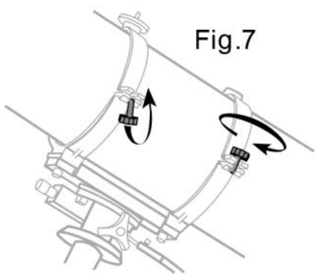


Fig.7

III. FINDERSCOPE ASSEMBLY

1) ATTACHING THE FINDERSCOPE (see Figure 8)

A. Locate the finderscope optical assembly.

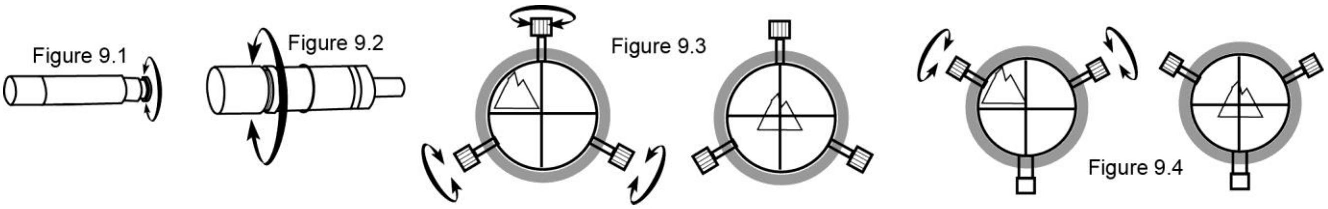
B. Remove the two knurled thumbscrews near the front of the telescope main body.

C. Position the finderscope bracket over the screws in the telescope main body.

D. Secure the finderscope assembly with the two knurled thumbscrews.


Fig.8

2) ALIGNING THE FINDERSCOPE (see Figure 9.1 to 9.4)



Fixed magnification scopes mounted on the telescope optical tube are very useful accessories. When they are correctly aligned with the telescope, objects can be quickly located and brought to the center of the field. Alignment is best done outdoors in daylight when it is easier to locate objects. If it is necessary to refocus your finderscope, sight on an object that is at least 500 yards (meters) away. This telescope includes a 6x30 finderscope. Loosen the locking ring by unscrewing it back towards the bracket. The front lens holder can now be turned in and out to focus. When focus is reached, lock it in position with the locking ring (Figure 9.2).

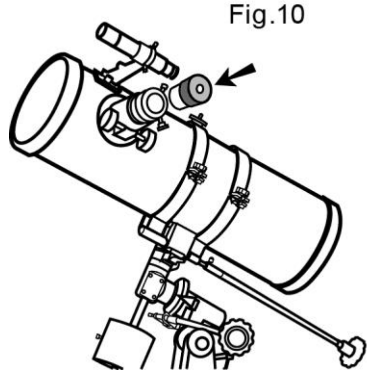
A. Choose a distant object that is at least 500 yards away and point the main telescope at the object. Adjust the telescope so that the object is in the center of the view in your eyepiece.
B. Check the finderscope to see if the object centered in the main telescope view is centered in the crosshairs of the finderscope.
C. For the included 6x30 finderscope with spring loading, adjust only the two small screws (Fig.9.4).

IV. EYEPIECE ASSEMBLY

1) Inserting the Eyepiece (see Figure 10)

A. Unscrew the thumbscrews on the end of the focus tube to remove the black plastic protective end-cap.
B. Insert an eyepiece. Re-tighten the thumbscrews to hold the eyepiece in place.

Fig.10



V. TELESCOPE BALANCING

The telescope should be balanced before each observing session. Balancing reduces stress on the mount and allows precise micro-adjustment control. A balanced telescope is especially critical when using the optional clock drive for astrophotography. The telescope should be balanced after all accessories (eyepiece, camera, etc.) have been attached. Before balancing your telescope, make sure that your tripod is in a balanced level and on a stable surface. For photography, point the telescope in the direction you will be taking photos before performing the balancing steps.

1) R. A. Balancing

A. For best results, adjust the altitude of the mount to between 15º and 30º if possible, by using the altitude adjustment T-bolt.

B. Slowly unlock the R.A. and Dec. lock knobs. Rotate the telescope until both the optical tube and counterweight rod is horizontal to the ground, and the telescope tube is to the side of the mount. (Fig.11)

C. Tighten the Dec. lock knob

D. Move the counterweight along the counterweight rod until the telescope is balanced and remains stationary when released.

E. Tighten the counterweight thumb screw to hold the counterweight in its new position

2) DEC. Balancing

All accessories should be attached to the telescope before balancing around the declination axis. The R.A. balancing should be done before proceeding with Dec. balancing.

A. For best results, adjust altitude of the mount to between 60º and 75º if possible.

B. Release the R.A. lock knob and rotate around the R.A. axis so that the counterweight rod is in a horizontal position. Tighten the R.A. thumbscrew.

C. Unlock the Dec. thumbscrew and rotate the telescope tube until it is paralleled to the ground.

D. Slowly release the telescope and determine in which direction it rotates. Loosen the telescope tube rings and slide the telescope tube forward or backward in the clamps until it is balanced.

E. Once the telescope no longer rotates from its parallel starting position, re-tighten the tube rings and the Dec. lock knob. Reset the altitude axis to your local latitude.

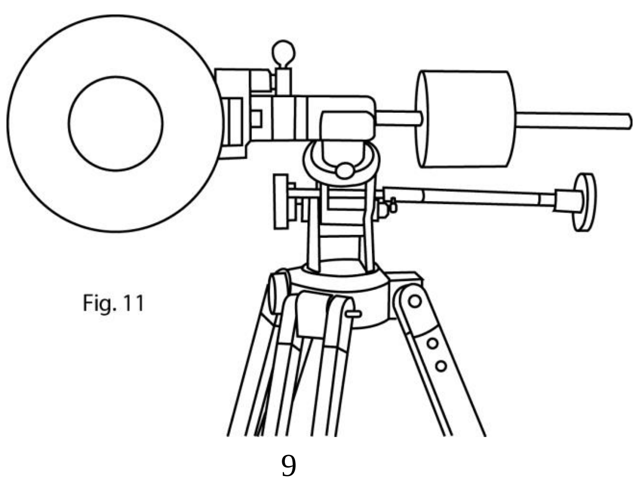


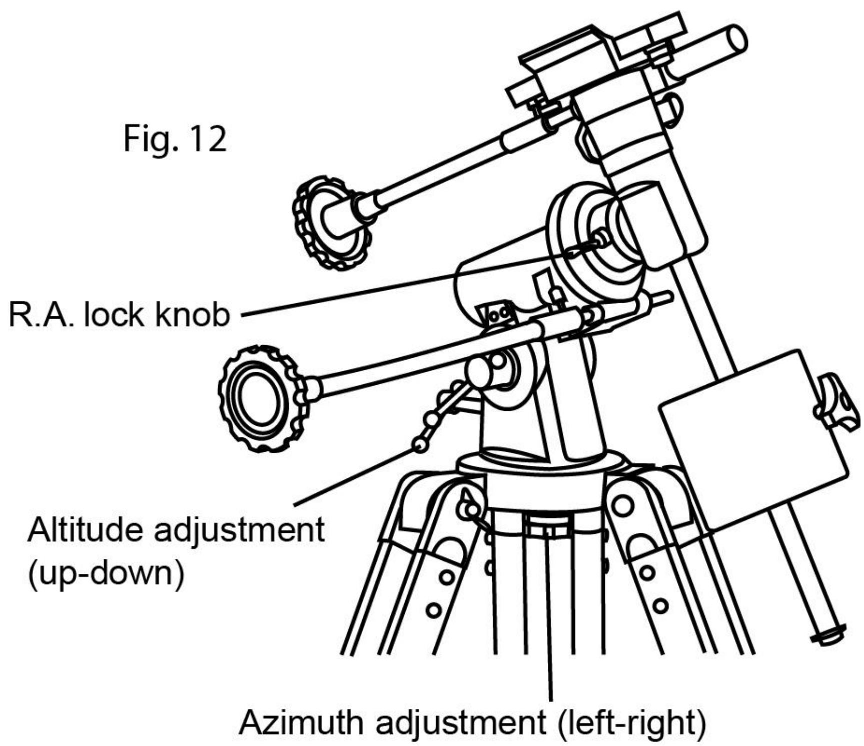
Fig. 11

VI. OPERATING THE EQ1 MOUNT

The EQ1 mount has controls for both conventional altitude (up-down) and azimuth (left-right) directions of motion. These two adjustments are suggested for large direction changes and for terrestrial viewing. Use the large knurled knob located underneath for azimuth adjustments. Loosen the knob and rotate the mount head around the azimuth axis. Use the altitude adjustment T-bolts for altitude adjustments (Fig. 12).

In addition, this mount has Right Ascension (hour angle) and declination direction controls for polar-aligned astronomical observing. Loosen the lock knobs to make large direction changes. Use the control cables for fine adjustment after the lock knobs have both been locked (Fig.d1). An additional scale is included for the altitude axis. This allows polar alignment for your local latitude. (Fig.12)

Fig. 12



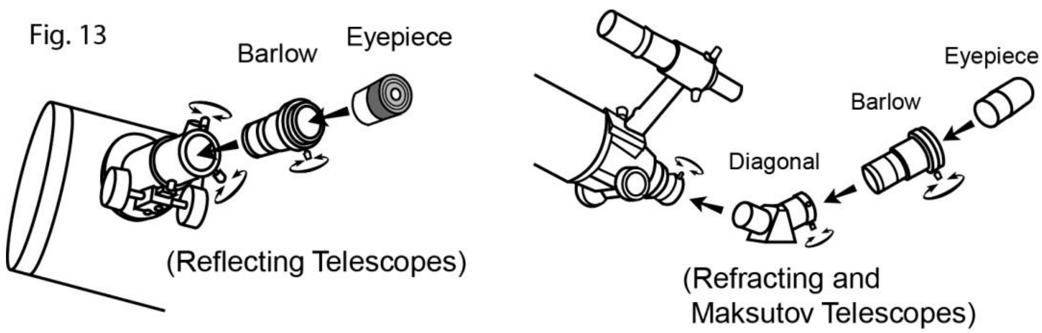
VII. USING THE OPTIONAL BARLOW LENS

A Barlow is a negative lens which increases the magnifying power of an eyepiece, while reducing the field of view. It expands the cone of the focused light before it reaches the focal point, so that the telescope's focal length appears longer to the eyepiece.

The Barlow is inserted between the focuser and the eyepiece in a reflector, and usually between the diagonal and the eyepiece in a refractor or a catadioptric (Fig. 13). With some telescopes, it can also be inserted between the focuser and the diagonal, and in this position it gives even greater magnification. For example, a 2X Barlow when inserted after the diagonal can become 3X when placed in front of the diagonal.

In addition to increasing magnification, the benefits of using a Barlow lens include improved eye relief, and reduced spherical aberration in the eyepiece. For this reason, a Barlow plus a lens often outperform a single lens producing the same magnification. However, its greatest value may be that a Barlow can potentially double the number of eyepiece in your collection.

Fig. 13



VIII. FOCUSING

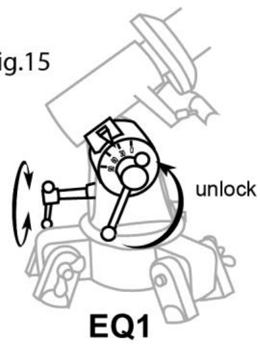
A Slowly turn the focus knobs under the focuser, one way or the other, until the image in the eyepiece is sharp (Fig.14). The image usually has to be finely refocused over time, due to small variations caused by temperature changes, flexures, etc. This often happens with short focal ratio telescopes, particularly when they haven't yet reached outside temperature. Refocusing is almost always necessary when you change an eyepiece or add or remove a Barlow lens.

IX. POLAR ALIGNMENT

In order for your telescope to track objects in the sky you have to align your mount. This means tilting the head over so that it points to the North (or South) celestial pole. For people in the Northern Hemisphere this is rather easy as there is a bright star very near the spot Polaris. For casual observing, rough polar alignment is adequate. Make sure your equatorial mount is level and the red dot finder is aligned with the telescope before beginning.

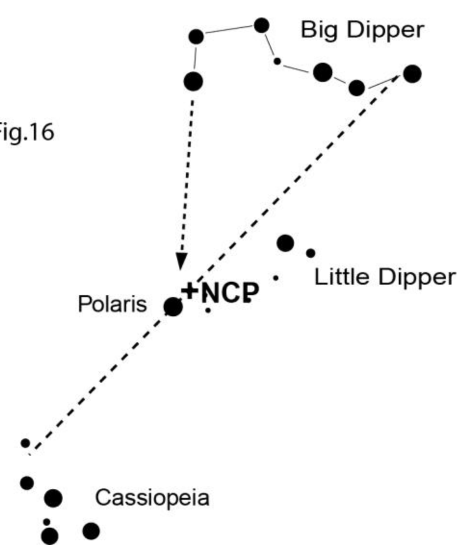
Look up your latitude on a map, road maps are good for this purpose. Now look at the side of your mount head, there you will see a scale running from 0-90 degrees. Unlock the hinge of the mount by gently pulling on the lock lever counter-clockwise. At the bottom of the head is a screw that pushes on a tongue under the hinge, changing the angle. Spin this until your latitude is shown on the scale by the indicator pin, then lock the hinge (Fig.15).

Fig.15



"Pole Star" is less than one degree from the North Celestial Pole (NCP). Because it is not exactly at the NCP, Polaris appears to trace a small circle around it as the Earth rotates. Polaris is offset from the NCP, toward Cassiopeia and away from the end of the handle of the Big Dipper (Fig.16).

Fig.16



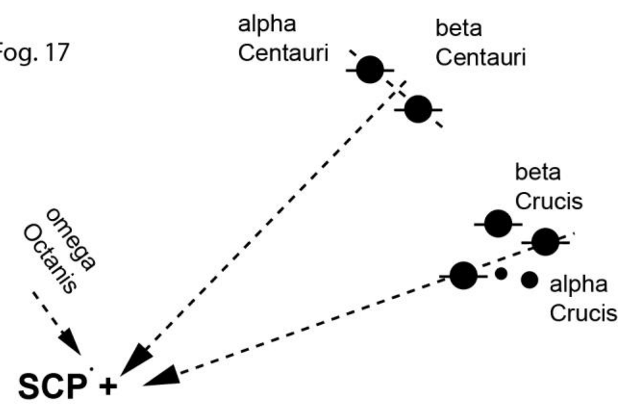
Unlock the DEC lock knob and rotate the telescope tube until the pointer on the setting circle reads 90°. Retighten the DEC lock knob. Loosen the azimuth lock knob and rotate the mount horizontally until the R.A. axis points roughly at Polaris. Retighten the azimuth lock knob. Look through the finderscope and center Polaris on the crosshairs by adjusting the azimuth and latitude settings if a more accurate polar alignment is desired.

After a while you will notice your target drifting slowly North or South depending on the direction of the pole relative to Polaris. To keep the target in the center of the view, turn only the R.A. slow-motion cable. After your telescope is polar aligned, no further adjustments in the azimuth and latitude of the mount should be made in the observing session, nor should you move the tripod. Only movements in R.A. and DEC axis should be made in order to keep an object in the field.

Southern Hemisphere

In the Southern Hemisphere you must align the mount to the SCP by locating it's position with star patterns, without the convenience of a nearby bright star. The closest star is the faint 5.5-mag. Sigma Octanis which is about one degree away. Two sets of pointers which help to locate the SCP are alpha and beta Crucis (in the Southern Cross) and a pointer running at a right angle to a line connecting alpha and beta Centauri (Fig17)

Fog. 17



Tracking Celestial Opjects

When observing through a telescope, astronomical objects appear to move slowly through the telescope's field of view. When the mount is correctly polar aligned, you only need to turn the R.A. slow-motion to follow or track objects as they move through the field. The DEC. slow-motion control is not needed for tracking. A R.A. motor drive can be added to automatically track celestial objects by counteracting the rotation of the Earth. The rotation speed of the R.A. drive matches the Earth's rotation rate for stars to appear stationary in the telescope eyepiece. Different tracking speeds are also available in some models. A second drive can be added to give DEC control which is very useful for doing astrophotography

X. USING THE SETTING CIRCLES

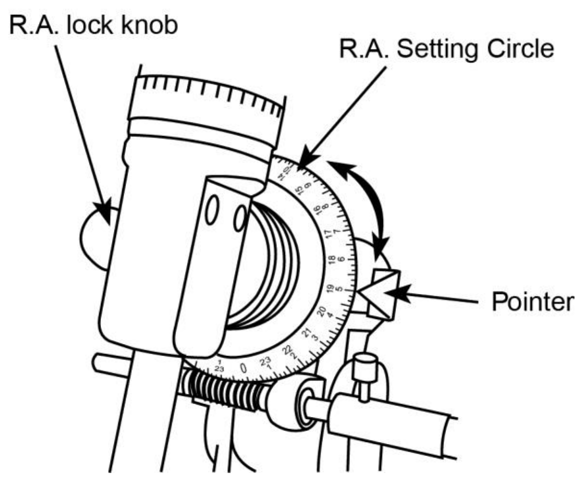
The quickest way to find objects is to learn the Constellations and use the Red Dot Finder, but if the object is too faint you may want to use setting circles on your mount. Setting circles enable you to locate celestial objects whose celestial co-ordinates have been determined from star charts.

Your telescope must be polar aligned and the R.A. setting circle must be calibrated before using the setting circles. The DEC. setting circle was set at the factory, and does not require calibrating the same manner as the R.A. setting circle.

Reading the R.A. setting circle

The telescope's R.A. setting circle is scaled in hours, from 1 through 24, with small lines in between representing 10 minute increments. The upper set of numbers apply to viewing in the Northern Hemisphere, while the numbers below them apply to viewing in the Southern Hemisphere (Fig.18).

Fig. 18 **EQ1**



Setting (calibrating) the R.A. setting circle

In order to set your Right Ascension circle you must first find a star in your field of view with known coordinates. A good one would be the 0.0 magnitude star Vega in the Constellation Lyra. From a star chart we know the R.A. coordinate of Vega is 18h 36m. Loosen the R.A. and DEC. lock knobs on the mount and adjust the telescope so that Vega is centered in the field of view of the eyepiece. Tighten the R.A. and DEC. lock knobs to lock the mount in place. Now rotate the R.A. setting circle until it reads 18h36m. You are now ready to use the setting circles to find objects in the sky.

Finding objects using the setting circles

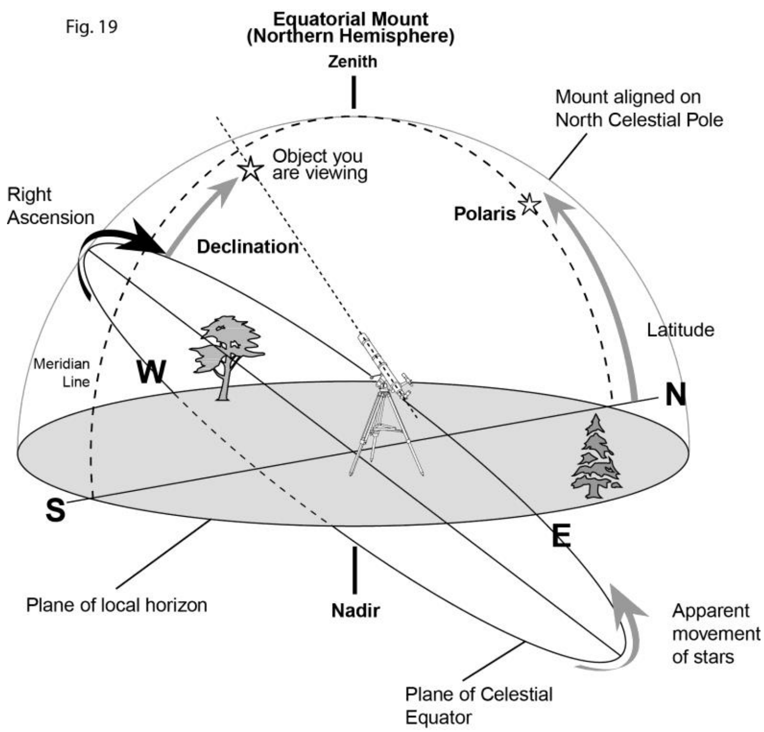
Example: Finding the faint planetary nebula M57; "The Ring" From a star chart, we know the coordinates of the Rings are Dec. 33º and R.A. 18h52m. Unlock the DEC lock knob and rotate your telescope in DEC until the pointer on the DEC setting circle reads 33º. Re-tighten the DEC lock knob. Loosen the R.A. lock knob and rotate the telescope in R.A. until the pointer on the R.A. setting circle reads 18h52m (do not move the R.A. circle). Re-tighten the R.A. lock knob. Now look through the Red Dot Finder to see if you have found M57. Adjust the telescope with R.A. and DEC. flexible cables until M57 is centered in the Red Dot Finder. Now look through the telescope using a low power eyepiece. Centre M57 in the field of view of the eyepiece.
The setting circles will get you close to the object you wish to observe, but are not accurate enough to put it in the center of your Red Dot Finder's/finderscope's field of view. The accuracy of your setting circles also depends on how accurate your telescope is polar aligned.

XI. POINTING YOUR TELESCOPE

A German Equatorial mount has an adjustment, sometimes called a wedge, which tilts the mount's polar axis so that it points at the appropriate Celestial Pole (NCP or SCP). Once the mount has been polar aligned, it needs to be rotated around only the polar axis to keep an object centered. Do not reposition the mount base or change the latitude setting. The mount has already been correctly aligned for your geographical location (ie. Latitude), and all remaining telescope pointing is done by rotating the optical tube around the polar (R.A.) and declination axes

A problem for many beginners is recognizing that a polar-aligned, equatorial mount acts like an alt-azimuth mount which has been aligned to a celestial pole. The wedge tilts the mount to an angle equal to the observer's Latitude, and therefore it swivels around a plane which parallels the celestial (and Earth's) equator (Fig.19). This is now its "horizon"; but remember that part of the new horizon is usually blocked by the Earth. This new "azimuth" motion is called Right Ascension (R.A). In addition, the mount swivels North(+) and South(-) from the Celestial Equator towards the celestial poles. This plus or minus "altitude" from the celestial equator is called Declination (Dec).

Fig. 19

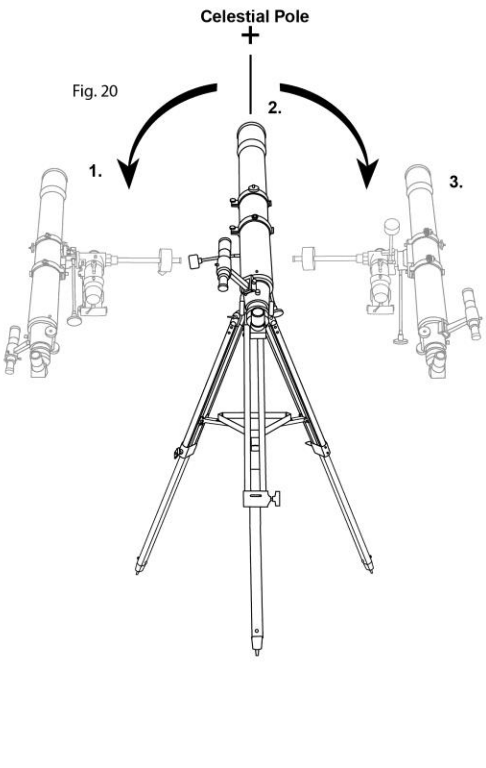


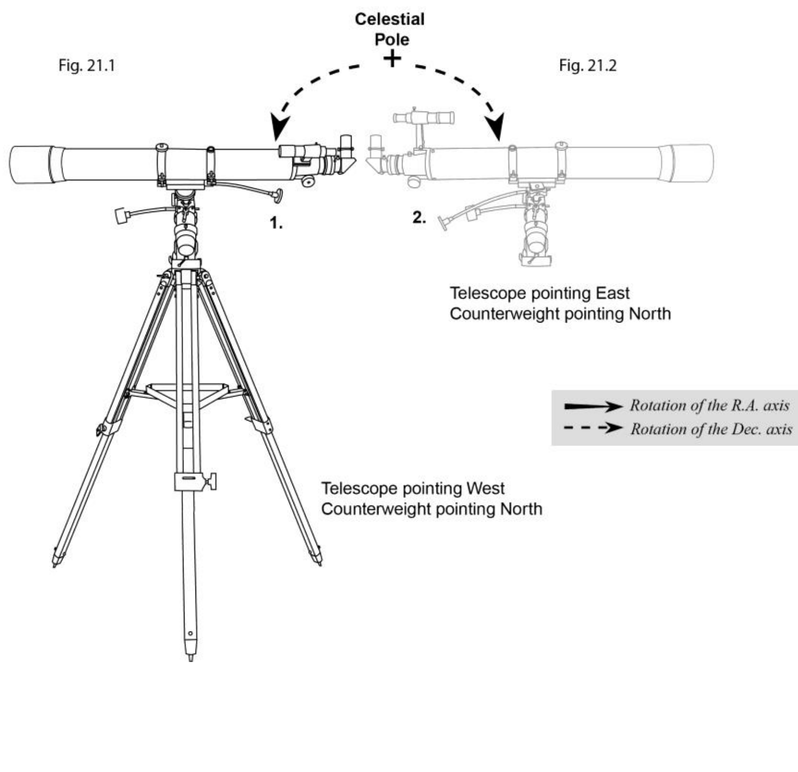
Pointing to the NCP

For the following examples, it is assumed that the observing site is in the Northern Hemisphere. In the first case (Fig.20.2), the optical tube is pointing to the NCP. This is its probable position following the polar-alignment step. Since the telescope is pointing parallel to the polar axis, it still points to the NCP as it is rotated around that axis counter-clockwise, (Fig.20.1) or clockwise (Fig.20.3).

Pointing toward the western or eastern horizon

Now, consider pointing the telescope to the western (Fig.21.1) or eastern (Fig.21.2) horizon. If the counterweight is pointing North, the telescope can be swiveled from one horizon to the other around the Dec axis in an arc that passes through the NCP (any Dec arc will pass through the NCP if the mount is polar-aligned). It can be seen then that if the optical tube needs to be pointed at an object north or south of this arc, it has to be also rotated around the R.A axis.

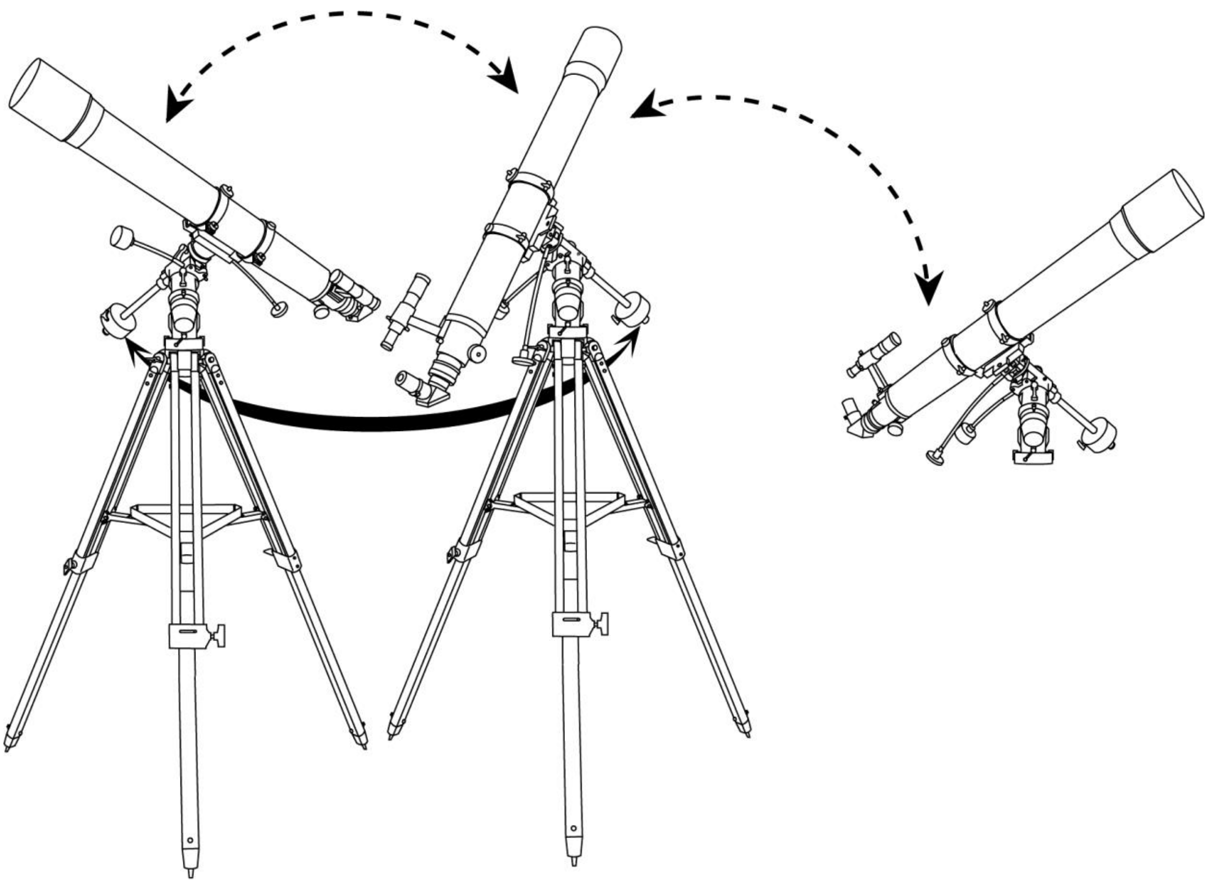




Pointing to directions other than due North

Pointing in any direction other than due North requires a combination of R.A. and Dec positions (Fig.22). This can be visualized as a series of Dec arcs, each resulting from the position of rotation of the R.A. axis. In practice however, the telescope is usually pointed, with the aid of a finderscope, by loosening both the R.A. and Dec locks and swiveling the mount around both axes until the object is centered in the eyepiece field. The swiveling is best done by placing one hand on the optical tube and the other on the counter-weight bar, so that the movement around both axes is smooth, and no extra lateral force is applied to the axis-bearings. When the object is centered, make sure the R.A and Dec locks are both re-tightened to hold the object in the field and allow tracking by adjusting only in R.A.

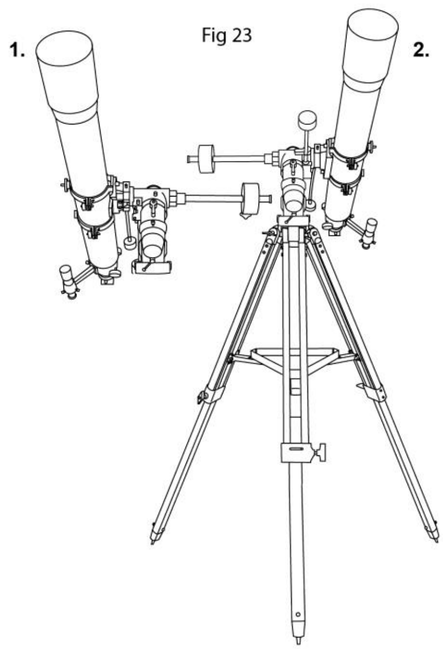
Fig. 22



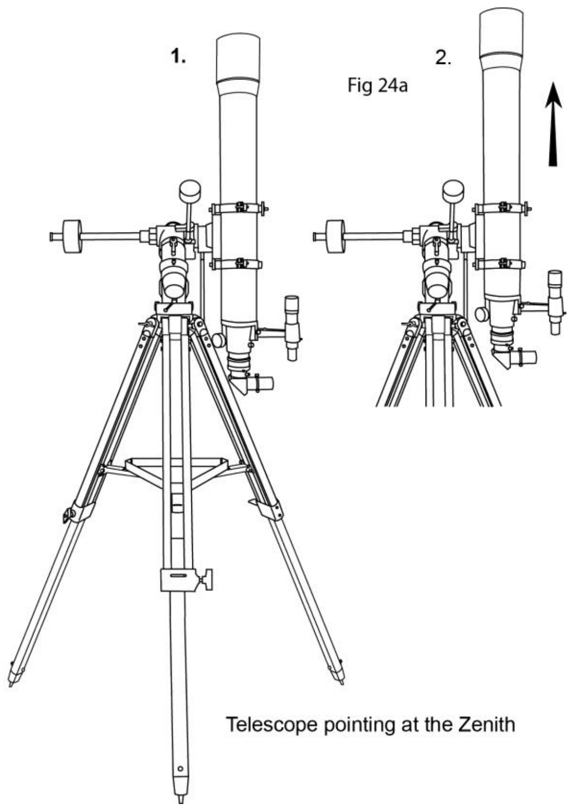
Examples of the telescope moved in R.A. and Dec

Pointing at an object

Pointing at an object, for example to the South (Fig.23), can often be achieved with the optical tube positioned on either side of the mount. When there is a choice of sides, particularly when there could be a long observing period, the East side (Fig.23.2) should be chosen in the Northern Hemisphere because tracking in R.A. will move it away from the mount's legs. This is particularly important when using an R.A motor, because if the optical tube jambs against the mount's legs, it can result in damage to the motor and/or the gears.



Telescope pointing South



Telescope pointing at the Zenith

Telescopes with long focal lengths often have a "blind spot" when pointing near the zenith, because the eyepiece-end of the optical tube bumps into the mount's legs (Fig. q1). To adapt for this, the optical tube can be very carefully slipped up inside the tube rings (Fig. q2). This can be done safely because the tube is pointing almost vertically, and therefore moving it does not cause a Dec-balance problem. It is very important to move the tube back to the Dec-balanced position before observing other sky areas

Something which can be a problem is that the optical tube often rotates so that the eyepiece, finderscope and the focusing knobs are in less convenient positions. The diagonal can be rotated to adjust the eyepiece. However, to adjust the positions of the finderscope and focusing knobs, loosen the tube rings holding the optical tube and gently rotate it. Do this when you are going to view an area for a while, but it is inconvenient to do every time you briefly go to a new area.

Finally, there are a few things to consider to ensure that you are comfortable during the viewing session. First is setting the height of the mount above the ground by adjusting the tripod legs. You must consider the height that you want your eyepiece to be, and if possible plan on sitting on a comfortable chair or stool. Very long optical tubes need to be mounted higher or you will end up crouching or lying on the ground when looking at objects near the zenith. On the other hand, a short optical tube can be mounted lower so that there is less movement due to vibration sources, such as wind. This is something that should be decided before going through the effort of polar aligning the mount.

Choosing the Appropriate Eyepiece

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, a 10mm focal length eyepiece will give 80X magnification with an 800mm focal length telescope.

$$\text{magnification} = \frac{\text{Focal length of the telescope}}{\text{Focal length of the eyepiece}} = \frac{500\text{mm}}{9\text{mm}} = 56\text{X}$$

When 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 turbulence between the telescope and the subject. A good rule of thumb is that the usable magnification of a telescope is about 2X per mm of aperture under good conditions

6) 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 and it is determined by the design of the eyepiece. Every eyepiece has a value, called the apparent field of view, which is supplied by the manufacturer. Field of view is usually measured in degrees and/or arc-minutes (there are 60 arc-minutes in a degree). 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 0.65 degrees or 39 arc-minutes.

$$\text{True Field of View} = \frac{\text{Apparent Field of View}}{\text{Magnification}} = \frac{52^\circ}{50\text{X}} = 0.93^\circ$$

To put this in perspective, the moon is about 0.5° or 30 arc-minutes 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!

7) 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 lens or 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 of your telescope (in mm) by the magnification.

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

For example, a 200mm f/5 telescope with a 40mm eyepiece produces a magnification of 25x and an exit pupil of 8mm. This combination can probably be used by a young person but would not be of much value to a senior citizen. The same telescope used with a 32mm eyepiece gives a magnification of about 31x and an exit pupil of 6.4mm which should be fine for most dark adapted eyes. In contrast, a 200mm f/10 telescope with the 40mm eyepiece gives a magnification of 50x and an exit pupil of 4mm, which is fine for everyone.

XII. OBSERVING THE SKY

1) 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.

2) 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.

3) 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.

4) 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). Allow a longer cooling time for larger optics. If you are using an equatorial mount, use this time for polar alignment.

5) 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.

6) What to Look For in the Night Sky

There is a whole universe of objects you could view at night, so where do you start? We recommend starting with the most prominent objects first.

The Moon

When the Moon is full, it bathes the night with a silvery light that washes the sky of all but the brightest objects. Therefore, the best time to view the moon is when it is less than half full. The dividing line between dark and light on the moon, called the terminator, shows the best detail in the craters and mountains. The included Moon Filter will thread directly onto the bottom of most eyepieces. Think of a Moon Filter like sunglasses for your telescope. Moon Filters cut down glare and bring out more surface detail and provide better contrast.

The Planets

The planets, our solar system companions, range in size and substance from moon-size rocky bodies to giant gas balls, which could hold Earth 1,000 times over. To find the planets, you will need information about their times of visibility. The included Astronomical Software CD or an astronomy magazine will give you the locations of the planets as they change position from month to month. The Internet is also an excellent source of information, offering star charts, maps, and more!

The popular and more familiar constellations often provide the easiest landmarks to help find the planet's locations and paths of orbit. Most people have looked up at the sky at night and seen some of the planets without even realizing it. A planet looks like a bright star but does not twinkle like a star does; it looks like a tiny ball. Venus, Mars, Jupiter, and Saturn are the easiest planets to view. Mercury is dimmer, usually below the horizon, and more challenging to find.

Each of the planets provides interesting views. Venus is covered with clouds so all that is visible is an extremely bright light, the brightest next to the moon. However, Venus, like the moon, goes through phases. As it travels around the sun, different areas of its surface are illuminated, producing crescent shapes of varying sizes. Mars is the red planet. When it is above the horizon, it is noticeably red and stands out like a beacon in the night sky. The apparent brightness of Mars varies as the planet orbits around the sun and throughout its period of visiblity, it will look brighter or dimmer depending on its distance from Earth.

Jupiter is the largest planet in our solar system and the second brightest next to Venus. Jupiter has many moons, four of which are often visible through your telescope when viewing conditions permit. As you watch them throughout the evening, you will see that they change position relative to each other and to Jupiter. It is possible with careful planning to actually see one of the moons disappear either in front of or behind Jupiter as it orbits around the planet. Another great feature of Jupiter is its cloud belt. Jupiter is alive with weather activity and its clouds have formed over time into belts visible through telescopes in the right atmospheric conditions.

Saturn, the second largest planet, is not as bright as Jupiter and so its moons are not as visible through small telescopes. The large rings that encircle Saturn are spectacular to observe, however. The planet and its rings appear pale yellow. The major division in the rings, the Cassini division, is possible to see if you keep the telescope firmly in position.

Uranus and Neptune are the last of the solar system's gas giants. They do not provide as spectacular a sight as Jupiter or Saturn, but are nonetheless rewarding to see.

Beyond our solar system there are many more objects to be found. Galaxies, nebulae, and star clusters abound!

7) About the Included Astronomy Software CD

Navigate the heavens like the professionals. TheSkyX First Light Edition makes an ideal companion to best enjoy your new telescope. Its intuitive user-interface always keeps you grounded while exploring the wonders of the night sky. Point and click to learn the names and coordinates of celestial objects. Quickly create observing lists of the interesting objects that are visible from your backyard with the What's Up? feature. Print finder charts to assist locating those faint, fuzzy objects in the eyepiece. Zoom in for up-close views of the planets, including the Moon, and Jupiter and Saturn's major moons. Watch animated tours demonstrating fascinating astronomical phenomena.

A descriptive digital user guide offers helpful tips, and in-depth descriptions on hundreds of celestial wonders offer hours of edutainment for you and your family.

XIII. USING YOUR TELESCOPE:

1) It is recommended to use your telescope outside or at times through open windows. Your view can be distorted by reflections in the glass of a closed window or at times by air currents of differing temperatures passing through an open window.

2) Let your telescope adjust to the outside temperature. Your telescope will perform much better if the temperature of the mirrors, eyepiece lenses, and the air inside the tube are the same as the outside temperature. It may take up to 30 minutes to equalize the temperatures when the difference in temperatures is extreme.

3) Find a location far from glaring light. If you live in an urban area, your viewing will probably improve the farther you move away from the city's lights. The sky glow of a town or city can dramatically reduce the telescope's performance and viewing capabilities.

4) Remove the dust cap from the end of the telescope. The open end of the optical tube should be pointed toward the subject you wish to observe.

5) Begin your viewing session by using only the S20 eyepiece. It will give you the widest angle and the brightest, sharpest views. Adjust the angle and position of the telescope as outlined in the previous sections.

6) When possible, avoid sudden temperature changes, as the moisture in the air will condense on the mirrors and eyepiece lenses. Should this occur after bringing your telescope indoors, remove the dust caps and allow the moisture to evaporate naturally. Point the telescope downward to minimize the collection of airborne dust. Once all of the moisture has evaporated, replace the dust caps.

7) **A NOTE ON TERRESTRIAL VIEWING:**
When viewing through a standard telescope, you may notice that when you observe a terrestrial *object on land or water, it appears upside down.*

To correct this, the COLEMAN CDB1145EQ1is equipped with an Erecting Image Diagonal Prism (I). This accessory is inserted in the eyepiece holder of the telescope between the eyepiece and the telescope. With the Erecting Image Diagonal Prism, objects will appear in their proper orientation for terrestrial and land observation.

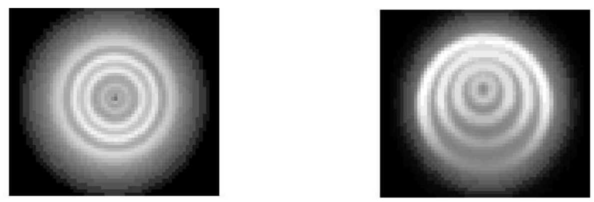
<u>**NOTE: The eyepieces must be used together with the Erecting Image Diagonal Prism.**</u>

XIV. PROPER CARE FOR YOUR TELESCOPE

CollimatIng a Newtonian

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 center 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 collimated (Fig.25).

Fig. 25



Correctly aligned — Needs collimation

If you do not have a collimating tool, we suggest that you make a "collimating cap" out of a plastic 35mm film canister (black with gray lid). Drill or punch a small pinhole in the exact center of the lid and cut off the bottom of the canister. This device will keep your eye centered of the focuser tube. Insert the collimating cap into the focuser in place of a regular eyepiece.

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 120º apart, and at the top the small oval secondary mirror held in a support and tilted 45º toward the focuser outside the tube wall (Fig.26).

Fig. 26

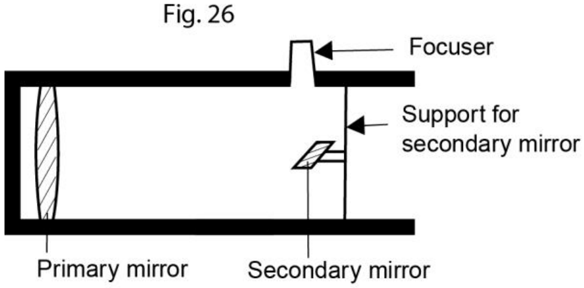
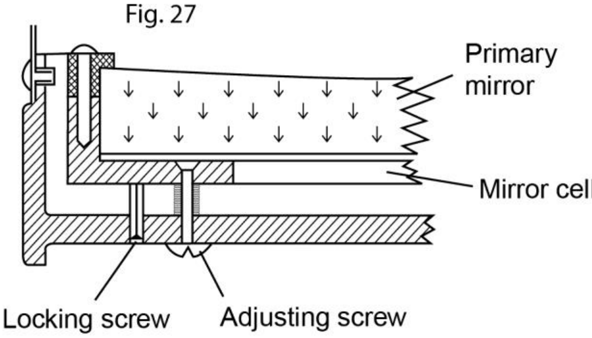


Fig. 27



The secondary mirror is aligned by adjusting the central bolt behind it, (which moves the mirror up and down the tube), and the three smaller screws surrounding the bolt, (which adjust the angle of the mirror). 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.27)

Aligning the secondary mirror

Point the telescope at a lit wall and insert the collimating cap into the focuser in place of a regular eyepiece. Look into the focuser through your collimating cap. You may have to twist the focus knob a few turns until the reflected image of the focuser is out of your view. Note: keep your eye against the back of the focus tube if collimating without a collimating cap. 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 (Fig.28), 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 or loosen one and then compensate for the slack by tightening the other two. Stop when you see all three mirror clips (Fig.29). Make sure that all three small alignment screws are tightened to secure the secondary mirror in place.

Fig. 28

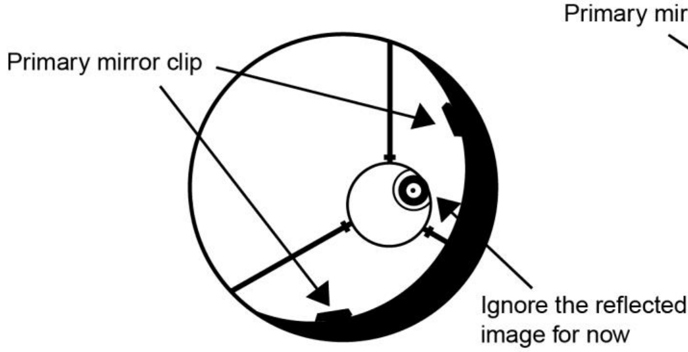
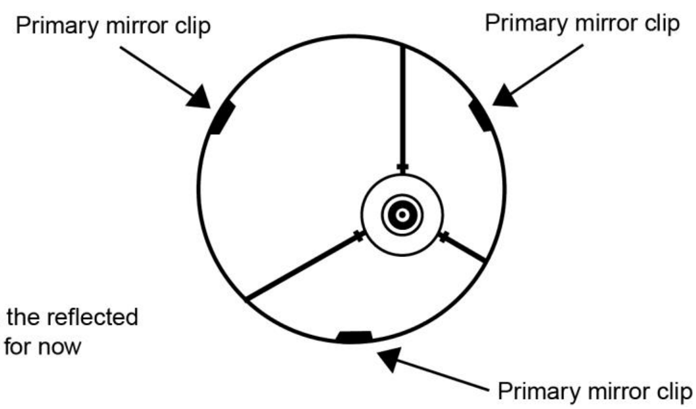


Fig. 29



Aligning the primary mirror

Find the three locking screws at the back of your telescope and loosen them by a few turns.

If you see 3 large nuts protruding from the back of your telescope and 3 small Phillip's-head screws besides them, the Phillip's-head screws are the locking screws and the large nuts are the adjusting screws. (See figure 30).

If you see 6 Phillip's-head screws but 3 protruding from the back of your telescope, the protruding screws are locking screws and the ones next to them are adjusting screws. (See figure 31).

If you see 3 hex bolts and 3 Phillip's head screws, the hex bolts are the locking screws and the Phillip's-head screws are the adjusting screws. You will need an Allen wrench to adjust the locking screws. (See figure 32).

Fig.30

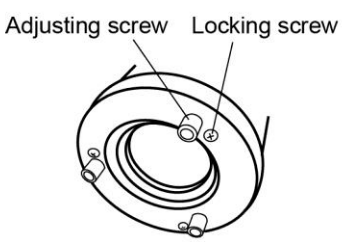


Fig.31

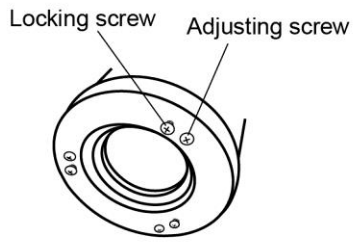
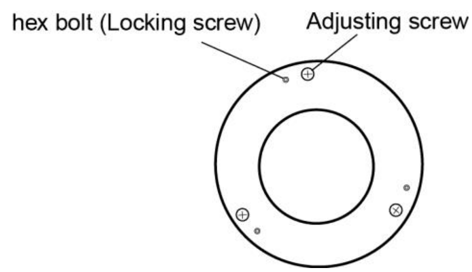


Fig.32



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 is 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 mirror's edge (see Figure 33). When you get to that point, stop and keep your hand there while looking at the back end of your telescope. Is there a adjusting screw there? If there is, loosen it to bring the mirror away from that point. If there is no adjusting screw, 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 see Figure 34. (It helps to have a friend help for primary mirror collimation. Have your partner adjust the adjusting screws according to your directions while you look in the focuser.)

After dark go out and point your telescope at Polaris, the North Star. With an eyepiece in the focuser, take the image out of focus. You will see the same image only now, it will be illuminated by starlight. If necessary, repeat the collimating process only keep the star centered while tweaking the mirror.

Fig 33.

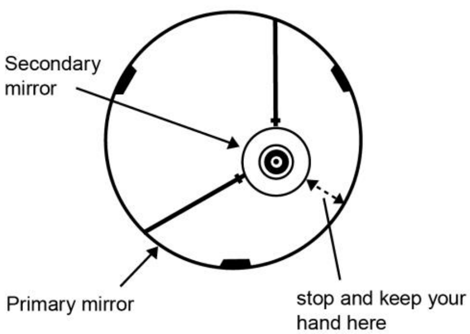
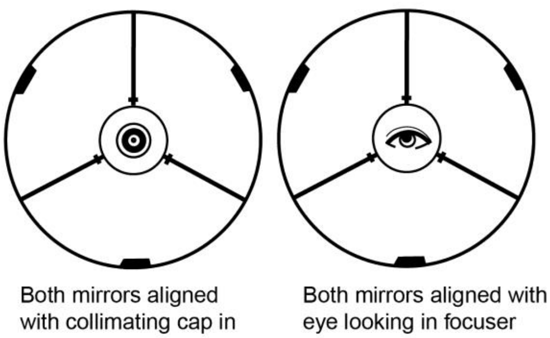


Fig. 34



XV. CARE AND CLEANING OF THE OPTICS:

1. The optical components of a telescope will get dirty over time. Dirt or dust on a lens should be removed with the utmost care. A considerable amount of dirt or dust would have to accumulate on the optical surface before your view would be compromised.

2. Keeping dust caps on during storage and transport will reduce dust collection.

3. Condensation may collect on the optical surfaces when the telescope is not in use. Remove the dust caps and allow the moisture to evaporate naturally. Point the telescope downward to minimize the accumulation of airborne dust.

4. Once all moisture has evaporated, replace the dust caps.

5. Filtered, compressed air may be used to remove surface dust from lenses and mirrors. Remove the dust cap. Once removed, point the can away from the lens and gently expel some air and any condensation or dust that has accumulated on the discharge tube. Spray the lens with short bursts of air to carefully remove the dust particles. Clean eyepieces and optical surfaces with special lens paper only. Eyepieces should be handled with care. Avoid touching optical surfaces.

DO NOT HOLD THE TRIGGER OF THE COMPRESSED AIR CAN FOR EXTENDED PERIODS. PROPELLANT MAY ESCAPE AND DAMAGE THE OPTICAL SURFACES.

If, after several attempts, you cannot remove the particles, take the telescope to an optical professional for cleaning.

If you keep the dust caps on your telescope when it is not in use and avoid handling the lenses or mirrors, only minimal optical maintenance of your telescope should be required. Extensive cleaning is usually only necessary every few years.

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XVI. FREQUENTLY ASKED QUESTIONS:

1) How far can I see?
If you stand outside and look up at the night sky on a clear evening, you can see hundreds of stars without the aid of your telescope. The telescope is a light-gathering instrument that magnifies the view—providing significantly more detail and unveiling more stars, nebulae, and celestial objects. With the aid of a telescope, you will be able to enjoy exciting views of Saturn's rings, Jupiter's major moons, the Orion Nebula, and much more.

2) Why can't I see anything through my telescope?
If you see only gray or black when looking through your telescope, even after searching for an object to view, it is very likely that you are using an eyepiece that is too powerful. To solve this problem always start with the lowest power eyepiece at first, and only insert the higher-power eyepiece after you have located an object.

3) When I use my high-power eyepiece, everything looks much darker. Why?
As magnification in a telescope increases, brightness diminishes. Conversely, brightness increases when magnification is reduced. If an image appears too dark or unclear, use a lower-powered eyepiece. Views of small, bright objects are superior to those of large, dark, or blurry ones! Atmospheric conditions, air currents, as well as light and air pollution also affect viewing quality.

4) As I look through my telescope, why do objects in the sky appear to move?

The constant rotation of the Earth makes things appear to move. Lower-power eyepieces will reduce this effect of movement considerably and allow you to observe an object for a longer duration before you have to readjust your telescope.

5) Whom do I contact for more information and product questions?
For any inquiries, parts, warranty or service information, please contact:

Phone: 800-441-1100 or 212-947-7100
e-mail: customerservice@elitebrands.com ***or*** support@elitebrands.com
Visit our website at www.colemanoptics.com

Elite Brands Inc.,
40 Wall Street, 61st Floor
New York, NY 10005
Tel: 1-800-441-1100

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