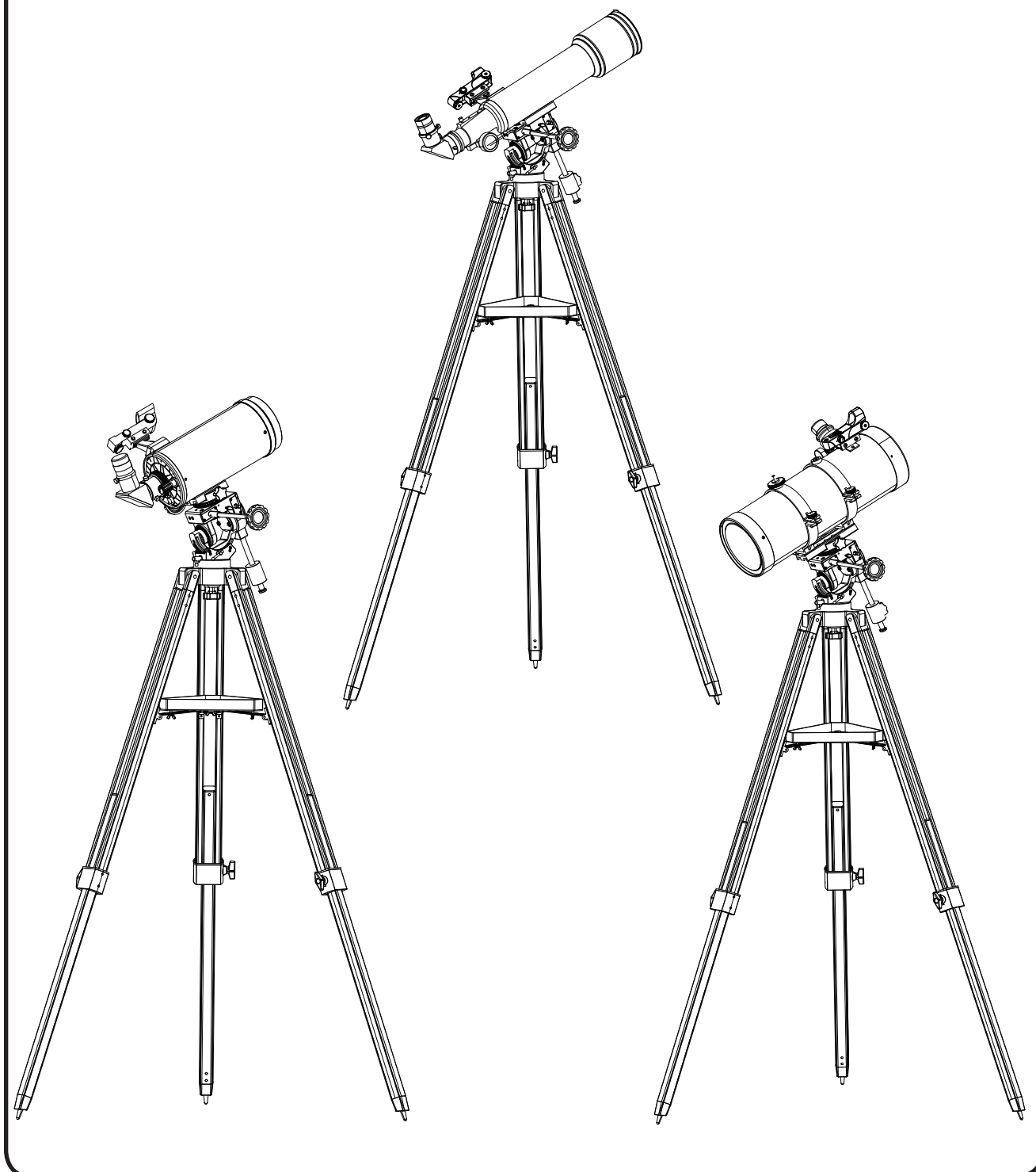
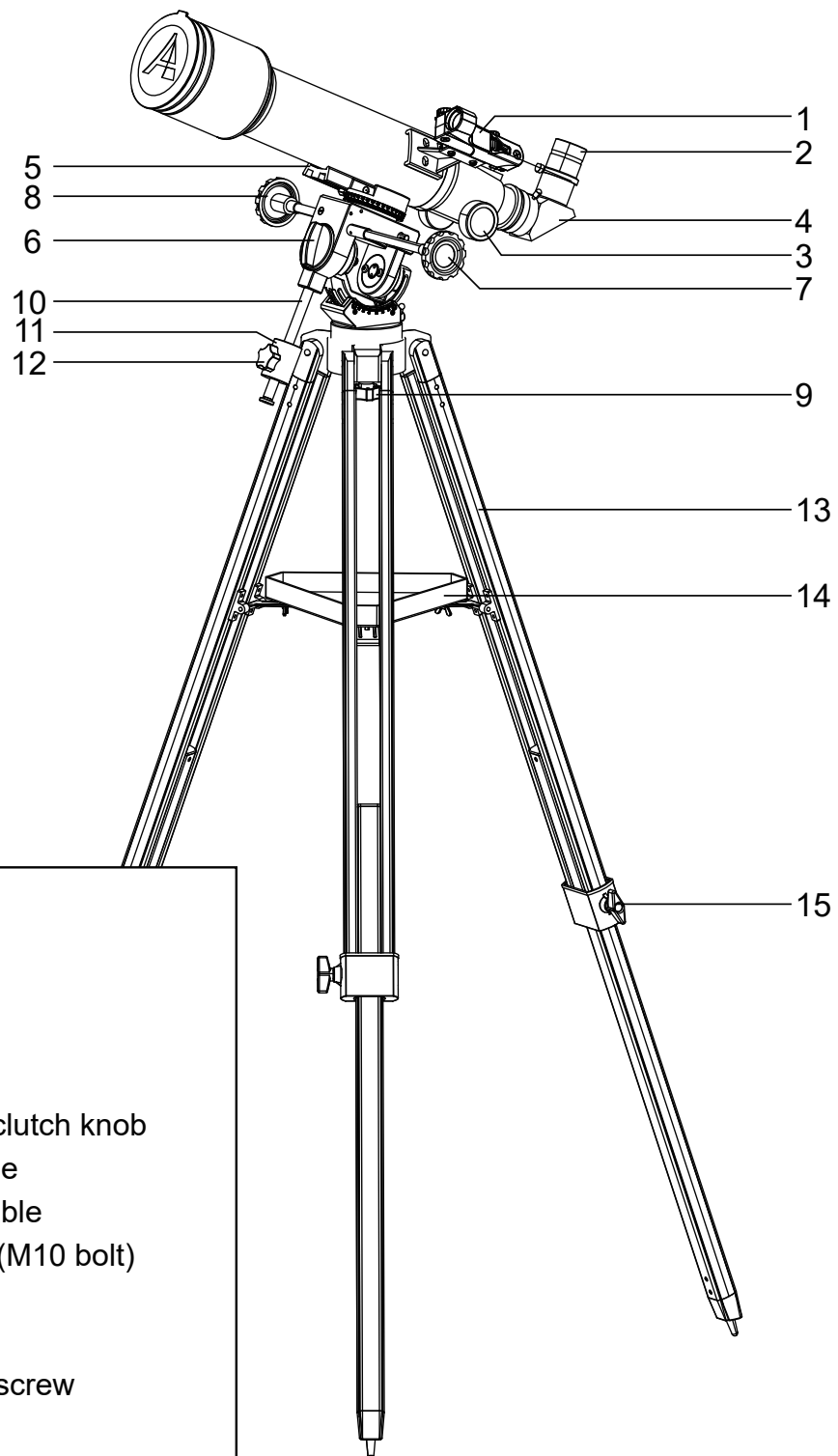


INSTRUCTION MANUAL

CQ40 TELESCOPES

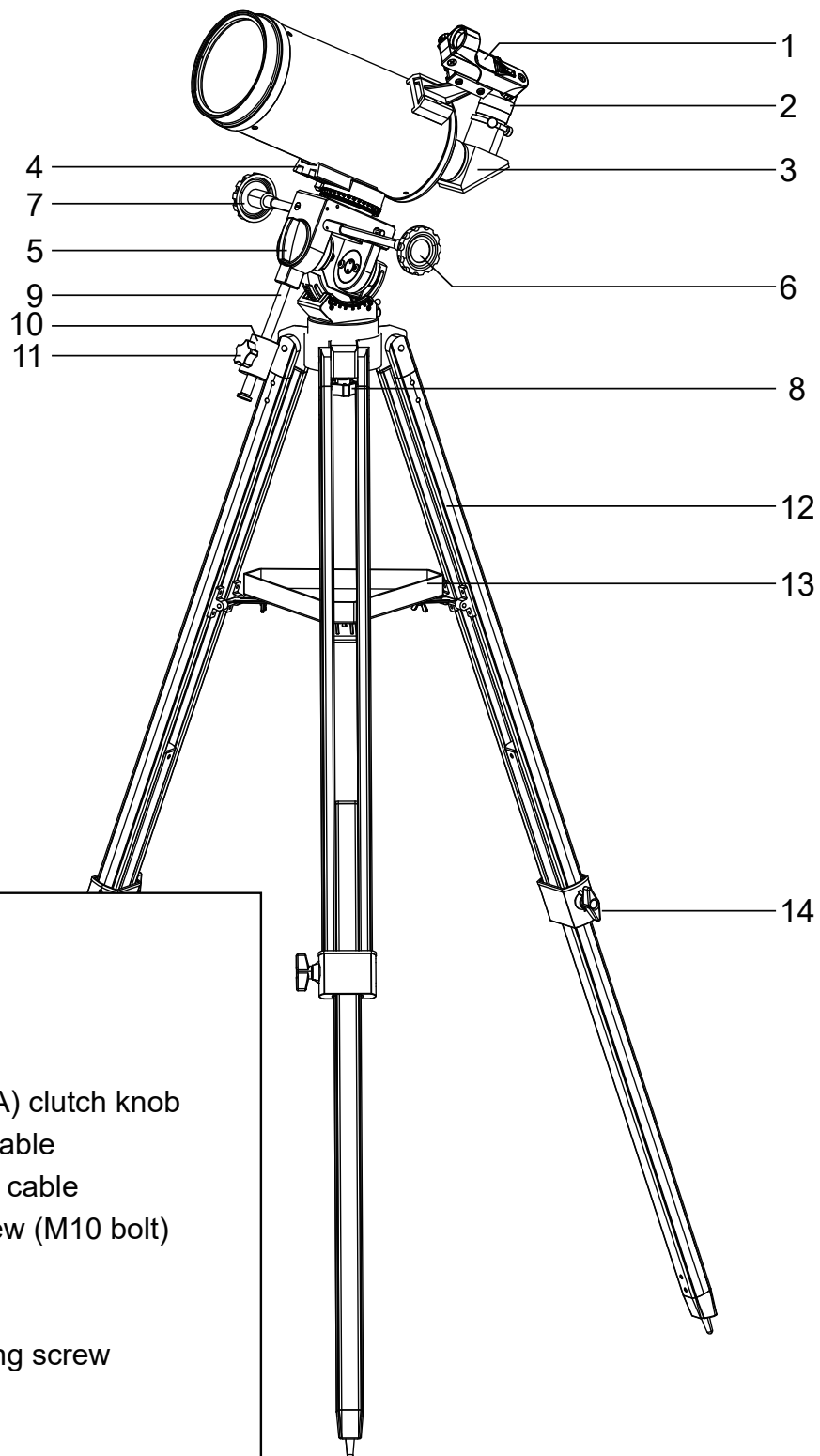


CQ40 REFRACTING TELESCOPE



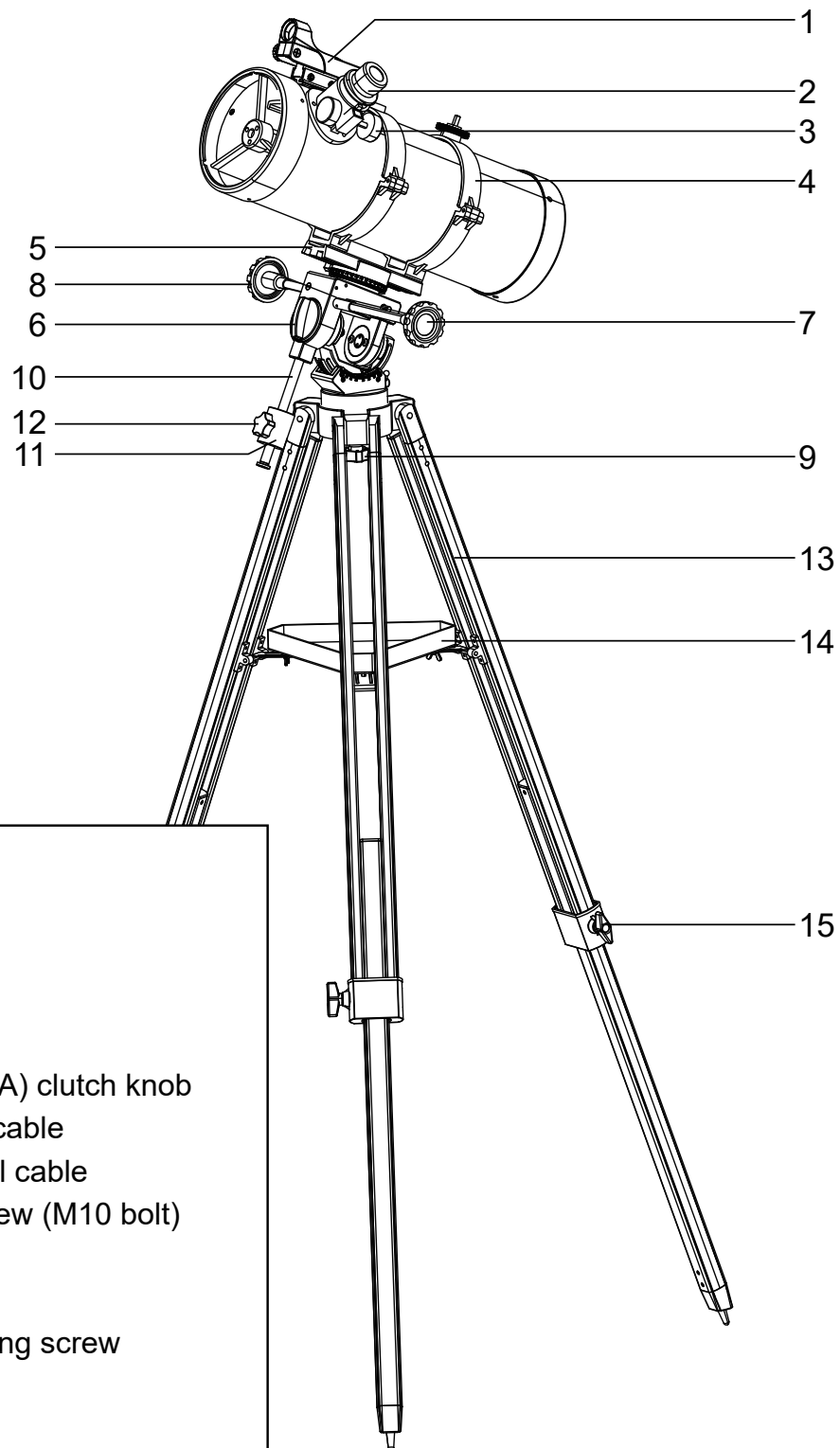
1. red dot finder
2. eyepiece
3. focus knob
4. diagonal
5. dovetail
6. Right Ascension (RA) clutch knob
7. RA flexible control cable
8. DEC flexible control cable
9. tripod clamping screw (M10 bolt)
10. counterweight bar
11. counterweight
12. counterweight locking screw
13. tripod leg
14. Accessory tray
15. tripod leg lock knob

CQ40 MAKSTOVTELESCOPE



1. red dot finder
2. eyepiece
3. diagonal
4. dovetail
5. Right Ascension (RA) clutch knob
6. RA flexible control cable
7. DEC flexible control cable
8. tripod clamping screw (M10 bolt)
9. counterweight bar
10. counterweight
11. counterweight locking screw
12. tripod leg
13. Accessory tray
14. tripod leg lock knob

CQ40 NEWTONIAN TELESCOPE



1. red dot finder
2. eyepiece
3. focus knob
4. tube rings
5. dovetail
6. Right Ascension (RA) clutch knob
7. RA flexible control cable
8. DEC flexible control cable
9. tripod clamping screw (M10 bolt)
10. counterweight bar
11. counterweight
12. counterweight locking screw
13. tripod leg
14. Accessory tray
15. tripod leg lock knob

TABLE OF CONTENTS

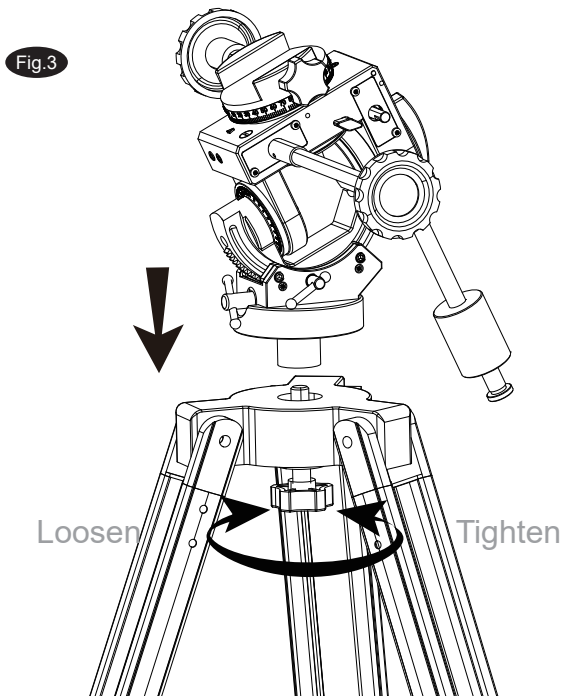
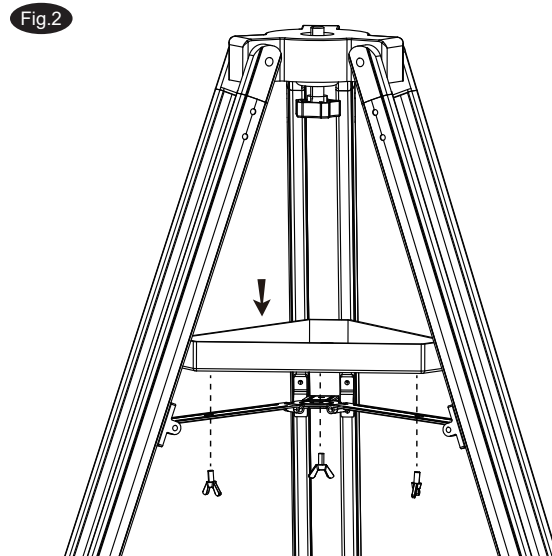
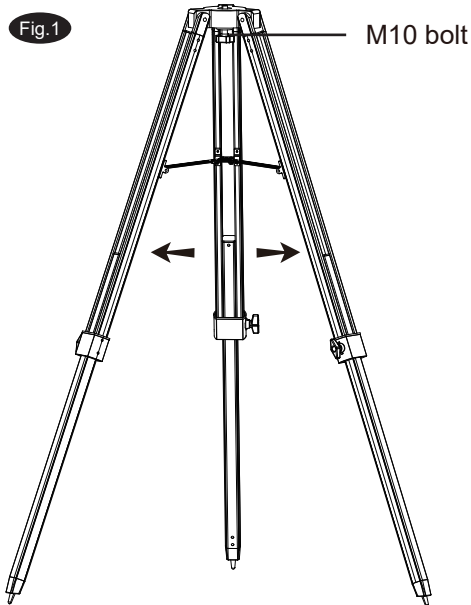
SETTING UP THE CQ40 MOUNT AND TRIPOD	6
INSTALLING THE TELESCOPE	8
Mounting the telescope accessories	8
Attaching the red dot finder	9
Aligning and using the Red Dot Finder	9
Operating the CQ40 mount	9
Movement examples of the CQ40equatorial mount	10
Focusing	13
Using the setting circles	13
Choosing the Appropriate Eyepiece	14
OBSERVING THE SKY	15
Sky Conditions	15
Selecting an Observing Site	15
Choosing the Best Time to Observe	15
Cooling the Telescope	15
Adapting Your Eyes	15
Cleaning your telescope	15

Before you begin

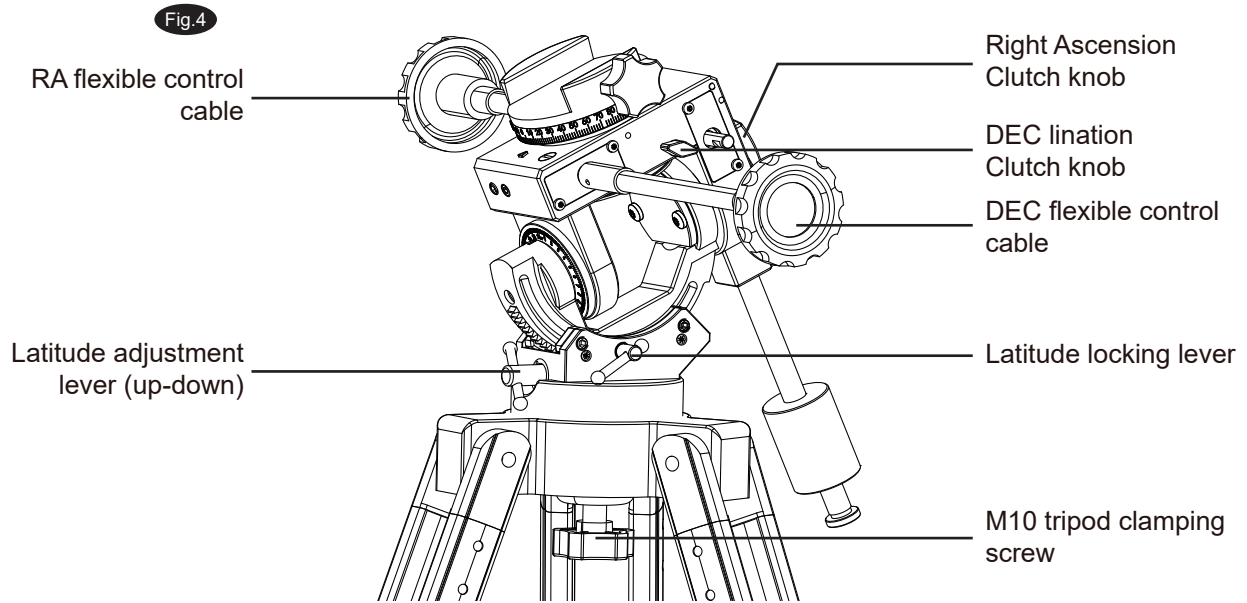
This instruction manual is applicable to 3 models. Take a moment to find the model of your telescope. Follow the instructions for your specific model in the manual. Read the entire instructions carefully before beginning. Your telescope should be assembled during daylight hours. Choose a large, open area to work to allow room for all parts to be unpacked.

SETTING UP THE CQ40 MOUNT AND TRIPOD

1. Fully expand the three legs of the standard tripod (Fig.1).
2. Install the accessory tray on the tripod as shown in (Fig.2).
3. Extend the legs to the desired height and, by adjusting each leg separately, make sure the tripod head is level. Align the M10 socket at the base of the mount with the M10 bolt on the tripod head. Lock the mount on the tripod by tightening the bolt (Fig.3).

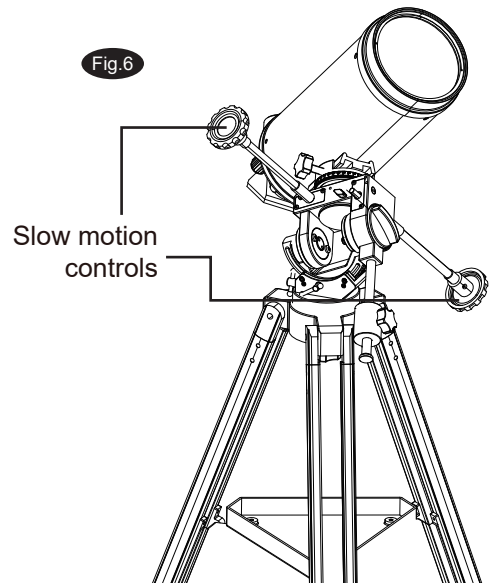
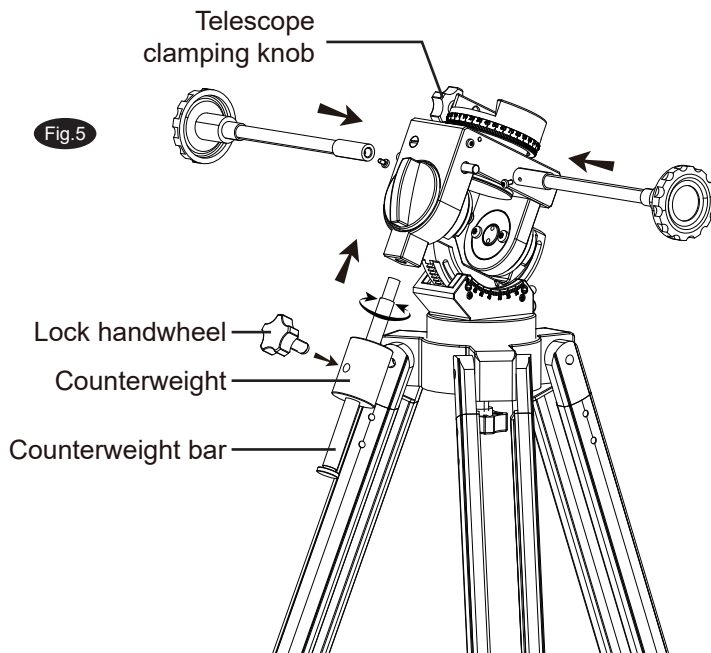


WARNING: The accessory tray of the standard tripod ensures that the tripod legs are firmly expanded, which prevents the tripod from accidentally tipping over. When using the CQ40 on the standard tripod, an accessory tray should always be used to ensure stability.



5. Slide the sleeve end of the RA and DEC flexible control cables over the nipples on the end of the worm gear axis. Fasten the flexible control cables using the set screw against the flat surface on the nipple (fig.5).
6. Screw the counterweight bar, with the counterweight already on the counterweight bar, in the mount see (fig.5). Lock the counterweight on the counterweight bar with the lock handwheel.

TIP: You can freely choose to attach the flexible control cables at one of the two nipple ends of the worm, in the direction which is more convenient, to have the slow motion controls in reach while observing through the telescope (fig.6).



INSTALLING THE TELESCOPE

The clutch knobs on the right ascension and declination axis must be turned to a tight lock before mounting a telescope.

Mount the telescope firmly onto the base using the telescope clamping knob (Fig.5 and 6).

Mounting the telescope accessories

Newton telescope type (fig.7):

1. Unscrew the thumbscrews on the end of the focus tube to remove the black plastic end-cap
2. Insert the desired eyepiece the re-tighten thumb screws to hold the eyepiece in place.

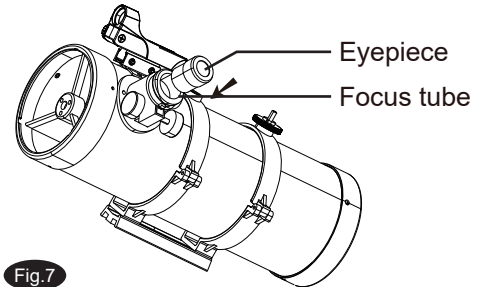


Fig.7

Refractor and Maksutov telescope type (fig.8 and 9):

1. Loosen the thumbscrew on the end of the focus tube.
2. Insert the diagonal into the focus tube and re-tighten the thumbscrew to hold the diagonal in place.
3. Loosen the thumbscrews on the diagonal.
4. Insert the desired eyepiece into diagonal and secure by re-tightening thumbscrews.

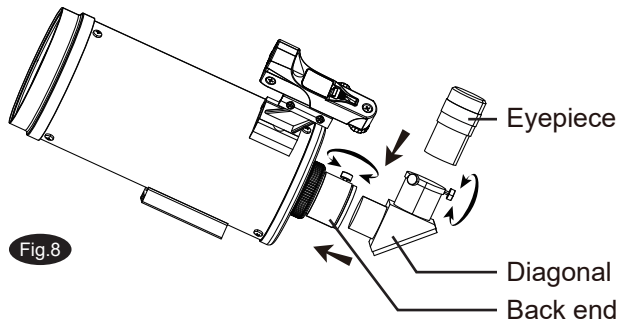


Fig.8

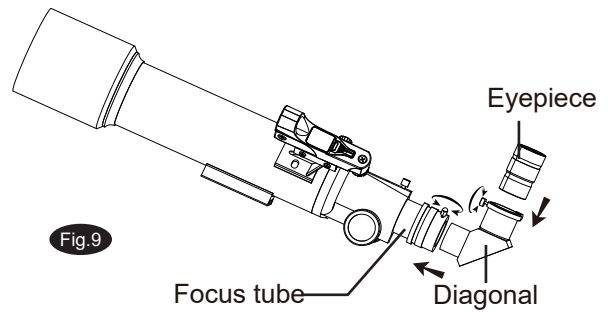


Fig.9

Focusing

Slowly turn the focus knobs under the focuser, one way or the other, until the image in the eyepiece is sharp. Refocusing is almost always necessary when you change an eyepiece (fig.10).

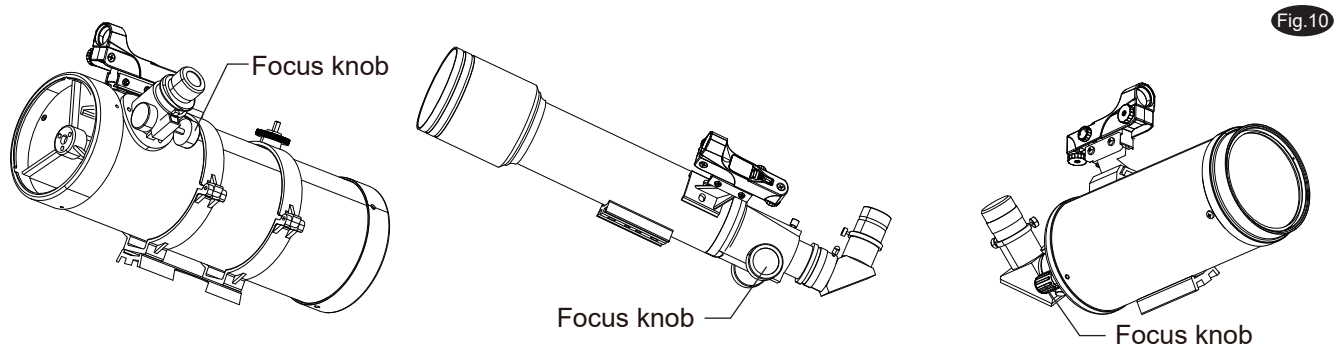


Fig.10

Attaching the red dot finder

Slide the red dot finder bracket into the rectangular slot and tighten the screw to hold the red dot finder in place (fig.11).

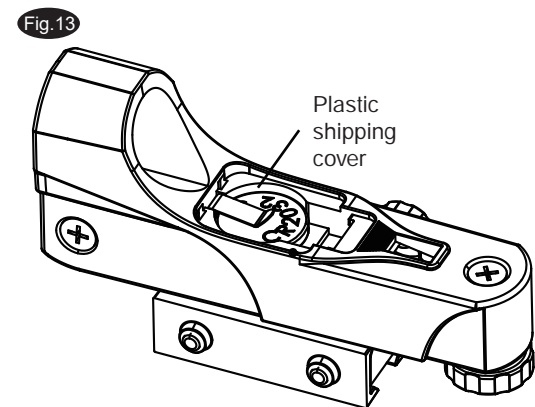
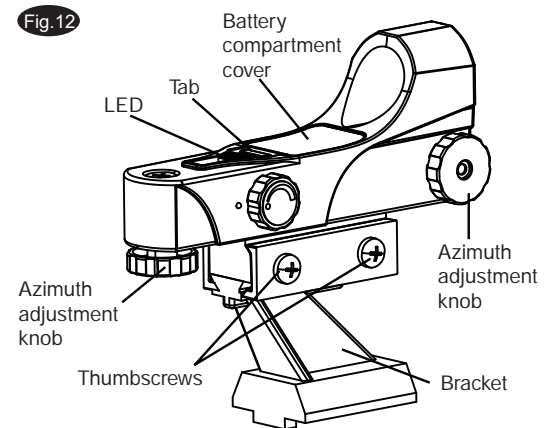
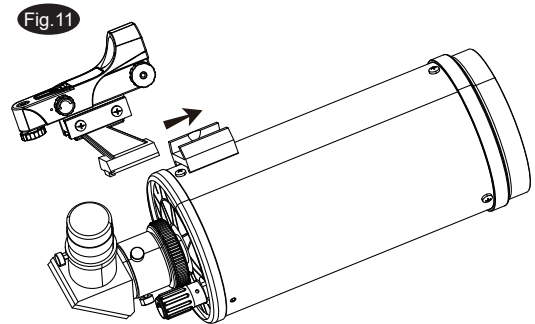
Aligning and using the Red Dot Finder

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.12). The Red Dot Finder is powered by a 3-volt lithium battery located underneath at the front. 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.

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. Open the battery cover by pulling it down (you can gently pry at the 2 small slots) and remove the plastic shipping cover over the battery (Fig.13).
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 a low power 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.
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.



Operating the CQ40 mount

The CQ40 mount is designed to be used in the Equatorial mode, which allows the user to take full advantage of the extra possibilities offered by this mode:

- The CQ40’s setting circles can be used to help finding objects invisible to the naked eye.
- It is easy to follow a celestial object once it is visible in the eyepiece. Turning only the RA axis flexible control cable will allow following.

The use in EQ mode requires the mount to be polar aligned. To reach this situation, the mount has to be oriented by horizontal rotation and vertical adjustment.

Horizontal rotation:

Rotate till the latitude adjustment lever points south (for NCP or Polaris alignment if you are observing in the northern hemisphere) or north (for SCP alignment in the southern hemisphere). Horizontal rotation is possible by just moving the tripod or slightly loosen the M10 bolt holding the mount on the tripod.

Vertical adjustment:

This is the role of the latitude adjustment lever. Loosen the latitude locking lever, adjust the height till the marker of the latitude scale indicates the latitude of your observing site, and lock the latitude locking lever again. The adjustments described to reach EQ mode orientation of the mount, can be done with or without the telescope attached. But be aware the weight of the counterweight and the telescope puts a heavy load on the latitude adjustment lever. Do not force on this lever, and help the rotation to reach the correct latitude, if needed. For further easy operation, once the telescope is attached, it needs to be balanced with the counterweight.

Adjust the balance of the telescope around the right ascension (RA) axis by loosening the right ascension clutch knob and shifting the counterweight to the position where a balanced situation is obtained (fig.5).

Movement examples of the CQ40 equatorial mount

A problem for many beginners is recognizing that a polar-aligned, equatorial mount acts like an alt-azimuth mount where the RA axis has been aligned to a celestial pole.

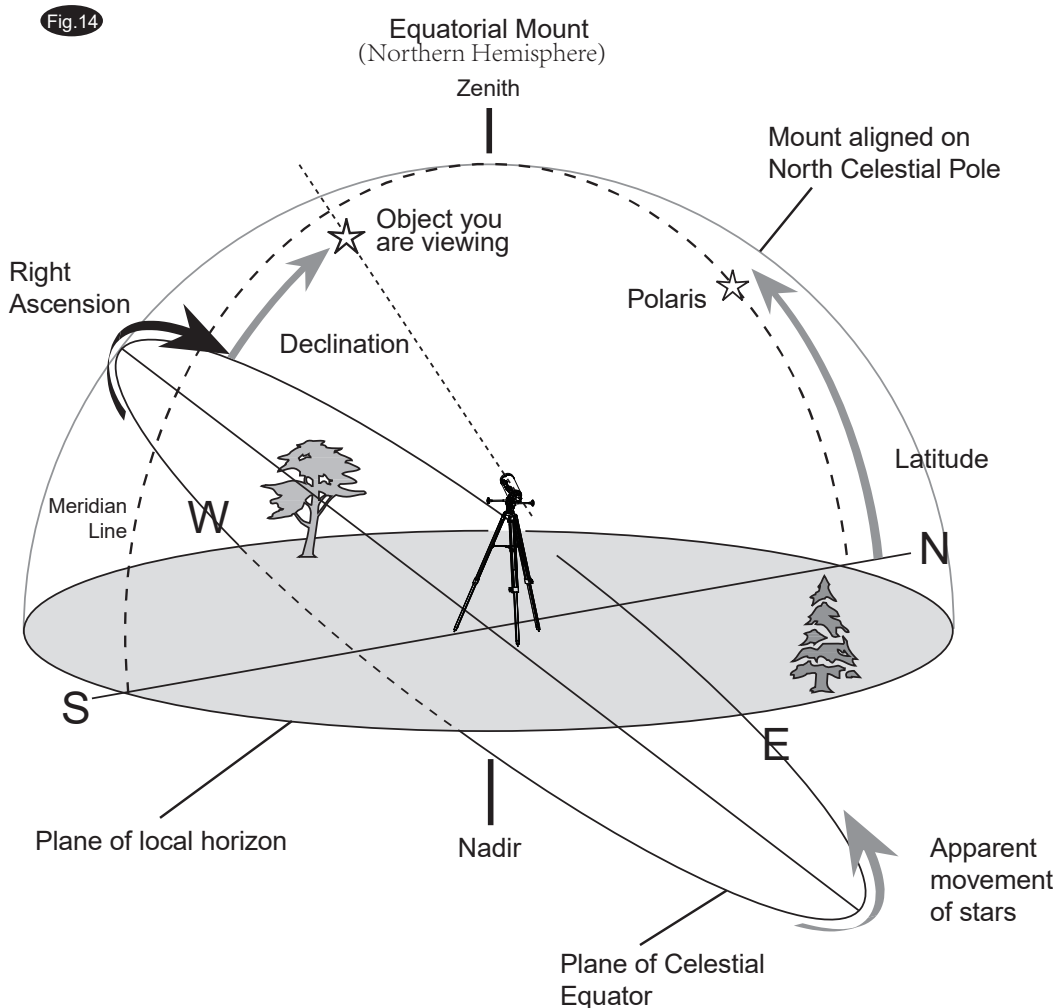
Once aligned The RA axis allows rotation as shown in fig.14 where it scans the “new horizon”.

That scanning movement is the Right Ascension (RA) movement.

Part of the new horizon is usually blocked by the Earth.

This “new horizon” is called Plane of Celestial Equator.

The other movement of the mount, square to this first movement, is the DEClination(DEC) movement.



Pointing to the North Celestial Pole (NCP):

For the following examples, it is assumed that the observing site is in the Northern Hemisphere. In the first case (Fig.15.2), 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.15.1), or clockwise (Fig.15.3).

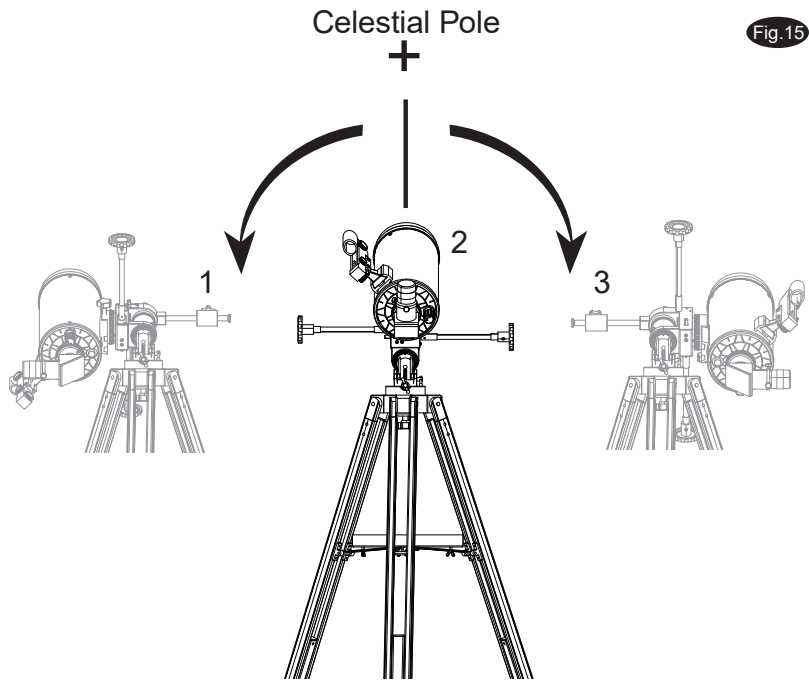


Fig.15

Pointing toward the western or eastern horizon:

Now, consider pointing the telescope to the western (Fig.16.1) or eastern (Fig.16.2) horizon. If the counterweight is pointing North, the telescope can be swivelled 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 (Fig.15).

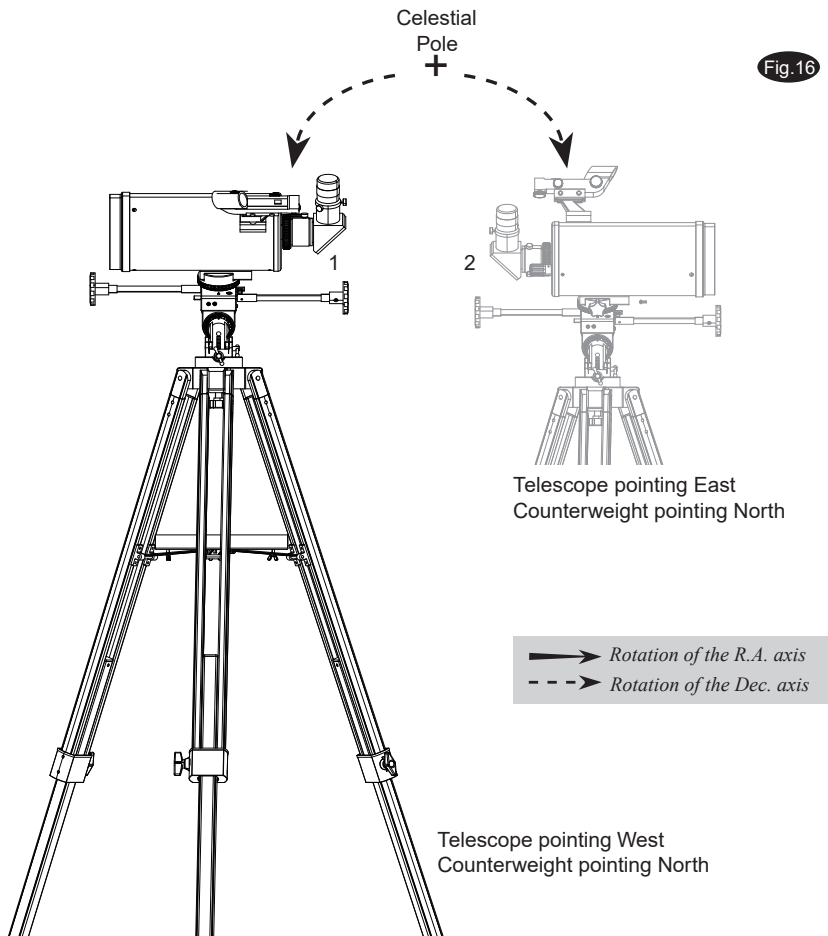
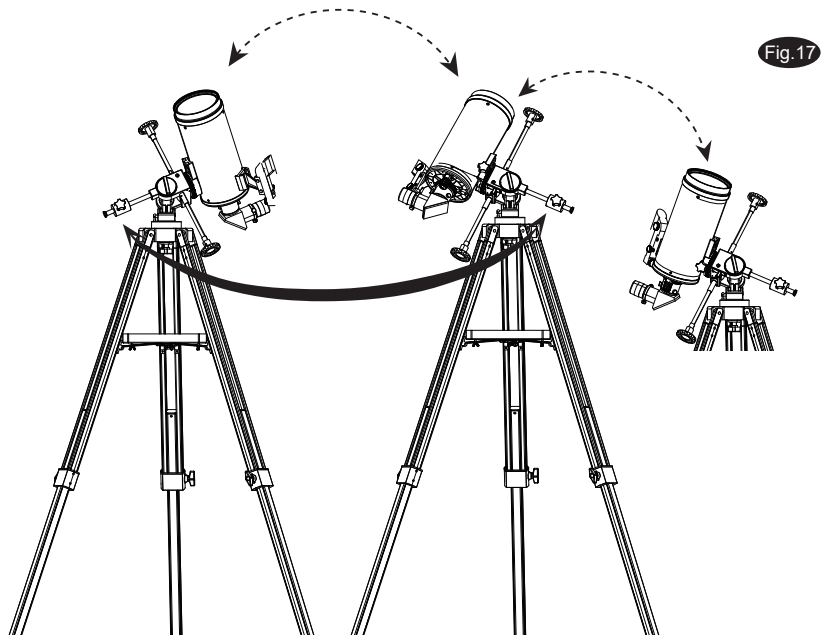


Fig.16

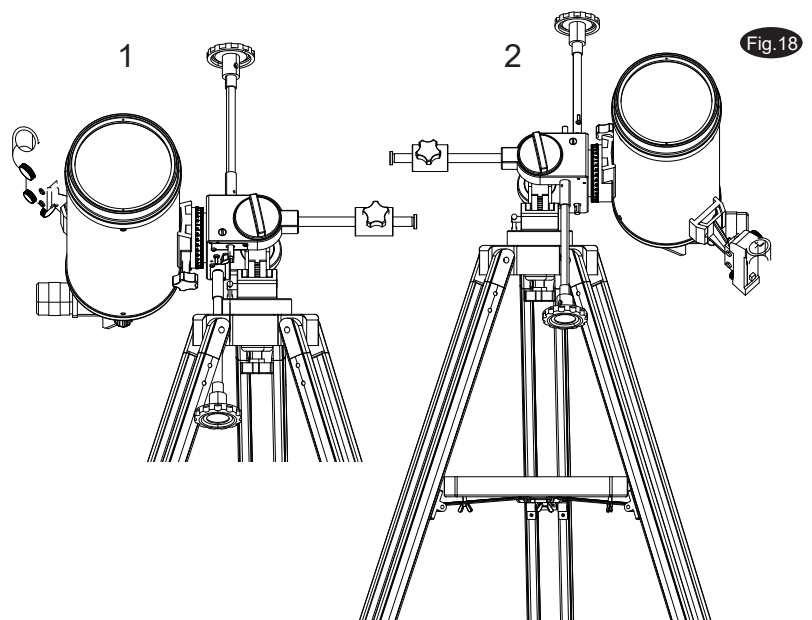
Pointing to directions other than due North:

Pointing in any direction other than due North requires a combination of R.A. and Dec positions (Fig.17). 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 clutch wheels and swivelling the mount around both axes until the object is centered in the eyepiece field. The swivelling 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 clutch wheels are both retightened to hold the object in the field and allow tracking by adjusting only in R.A. with the R.A. slow motion knob.



Pointing at an object:

Pointing at an object, for example to the South (Fig.18), 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.18.1) should be chosen in the Northern Hemisphere because tracking in R.A. will move it away from the mount's legs.

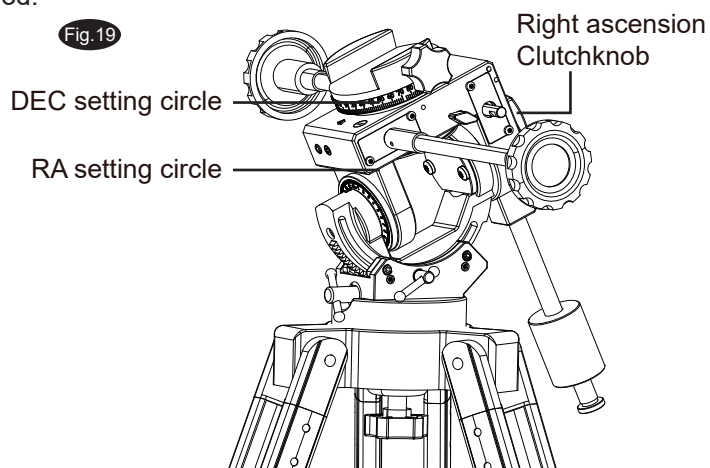


Using the setting circles

The quickest way to find objects is to learn the Constellations and use the Red Dot Finder for aiming. Downloading a star chart on a smartphone or tablet helps finding the position of faint objects which are not visible by the naked eye. Estimate their position compared to easily visible stars and aim there. Search with the low power eyepiece in that area. This is the so called “star hopping” method.

Another, more traditional approach, is using the setting circles on your mount. Setting circles enable you to locate celestial objects whose celestial coordinates 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.19).

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.

C

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.

$$\text{Magnification} = \frac{\text{Focal length of the telescope}}{\text{Focal length of the eyepiece}} = \frac{800\text{mm}}{10\text{mm}} = 80\text{X}$$

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 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.

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 of view 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 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 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.

$$\text{True Field of View} = \frac{\text{Apparent Field of View}}{\text{Magnification}} = \frac{52^\circ}{80\text{x}} = 0.65^\circ$$

To put this in perspective, the moon is about 0.5° or 3 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!

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.

OBSERNING 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.

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. 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.

Choosing the best time to observe

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 heatwave distortion inside telescope tube (tube currents). Allow a longer cooling time for larger optics. Use this time for polar alignment.

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.

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 mirror or lens unless you are familiar with optical surfaces. Clean eyepieces with special lens paper only. Eyepieces should be handled with care, avoid touching optical surfaces.

CAUTION!

NEVER USE YOUR TELESCOPE TO LOOK DIRECTLY AT THE SUN. PERMANENT EYE DAMAGE WILL RESULT. USE A PROPER SOLAR FILTER FIRMLY MOUNTED ON THE FRONT OF THE TELESCOPE FOR VIEWING THE SUN. WHEN OBSERVING THE SUN, PLACE A DUST CAP OVER YOUR FINDERSCOPE OR REMOVE IT TO PROTECT YOU FROM ACCIDENTAL EXPOSURE. NEVER USE AN EYEPiece-TYPE SOLAR FILTER AND NEVER USE YOUR TELESCOPE TO PROJECT SUNLIGHT ONTO ANOTHER SURFACE, THE INTERNAL HEAT BUILD-UP WILL DAMAGE THE TELESCOPE OPTICAL ELEMENTS.