The Dark Adapted Eye

Eyes must be dark-adapted to enable observers to see the majority of Deep-Sky objects: it takes a good ten minutes to dark-adapt your eyes. If the weather outdoors is a bit chilly, you can get your night eyes more comfortably by staying indoors with your eyes closed or in a dark room. Meanwhile, you have already set up the telescope and it too is acclimatising to the outside temperature. If you want to look at maps or notes outdoors, use a lamp or torch covered with a red filter.

Eye Position.

Your eye must not touch the eyepiece as this can cause vibration, but at the same time it must be centred on the emergent light beam. This is impossible to do when your eyes are not dark-adapted. After you get your night eyes, you will see that the sky appears in the telescope as a bright, luminous grey rather than black. Given this target, your eye will automatically centre on the eyepiece. Obviously, a low-power eyepiece is easier to use because it has a bigger exit pupil.

A second feature of proper eye position is that your eye must be at or near the exit pupil point. If you are too close, you will get a hit-and-miss shadow effect; if too far, you will lose valuable area in the field-of-view. High-power eyepieces always require a closer eye position than low-power ones.If possible, try to keep both eyes open as this is much less tiring than the usual one-eye squint.

If you wear glasses.

Take them off if you are far sighted. Your unaided eyes will then see distant objects clearly. Short-sighted people have to keep their glasses on to see distance. The best practical solution is to use a Barlow Lens to achieve higher magnifications as eyepieces below 12mm (1/2 inch) have too short an exit pupil point to allow spectacle wearers to see the entire field of view. Note, however, that even with Barlows, a long eye position means you will still see only a reduced field of view.

Telescope Mountings

There are two basic types of mounting, the altazimuth and the equatorial. The altazimuth is the simpler and cheaper. It has two axes that allow you to move the telescope up and down (altitude) and from side to side (azimuth). This mount is fine for daylight viewing and quite adequate for a beginner involved in basic astronomy.

The equatorial mount also has two axes at right-angles to each other, but one (the left and right axis) is tilted so that it can be set parallel to the Earth's axis - a north-orientated angle to the horizon, equal to the latitude of the observer. This polar or Right Ascension axis is aligned on the celestial pole, a point about 1/2º off the star Polaris – the Pole Star.

The other axis, which is aligned to the chosen object to be viewed is the Declination axis. The declination is the apparent height of an object above the observer's horizon.

By moving the telescope slowly round the polar axis, the rotation of the Earth, which causes the illusion of the movement of objects through the sky is counteracted and the observed object remains centred in view. This tracking motion can be easily motorised and automated to allow comfortable viewing during long periods of tracking.

Most refractors and Newtonian reflectors are mounted on a German-type equatorial, which incorporates a counterbalance. While this adds to the overall weight, and can be tricky to get the telescope in perfect balance, particularly when using heavy cameras or eyepieces, it does allow access to all parts of the sky.

Many Schmidt-Cassegrain telescopes are on fork mounts, which need no counterbalance but have the disadvantage that access to the region around the pole of the sky is restricted, particularly so if a camera is fitted. They can be used either as an altazimuth, or as an equatorial. In the latter mode, a wedge, normally supplied with the instrument, has to be fitted between the mount and the tripod to tilt the mounting to match the observer's latitude.

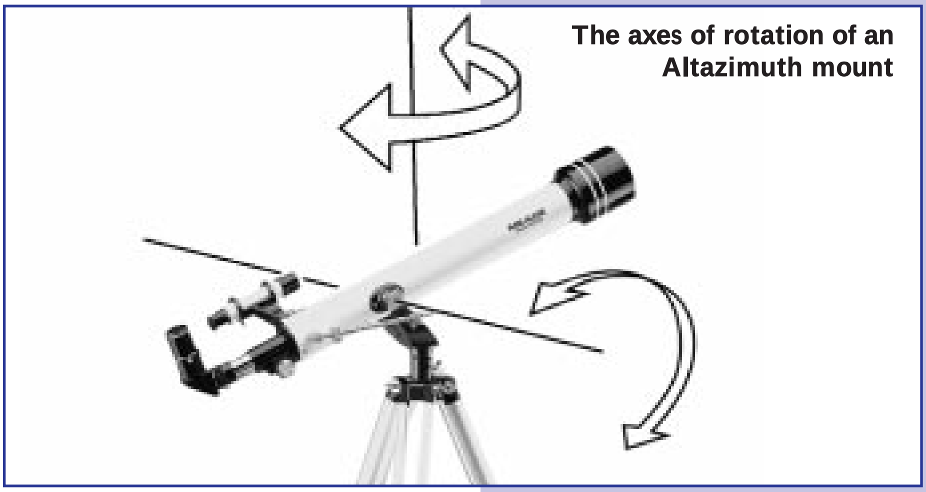
The base of the mount also usually houses a motor drive that allows the telescope to track an object in the field of view as it traverses the sky.

The Altazimuth Mount

The altazimuth mount allows the telescope to move in the vertical (altitude) and horizontal (azimuth) planes – hence alt–azimuth. It is the simplest type of telescope support and is the most frequently supplied mount for smaller, less expensive refractors and Newtonian reflectors. It is easy to use and with it the telescope can be aimed towards any part of the sky.

The mounting is usually fitted with slow motion controls which enable the user to move the instrument slowly up, down, left and right; essential for fine adjustment of the telescope once an object is selected for viewing.

The altazimuth mount does have a drawback that makes it unsuitable for supporting telescopes linked up for astrophotography or for extended observation. As the sky moves in relation to the earth's rotation, the telescope has to move to keep the object in view. At the North and South Poles objects appear to move in a circle at a constant altitude above the horizon; the tracking observer needs only move the telescope in a circle around the central pivot. However, at latitudes away from the Poles, the tilt of the Earth's axis causes celestial objects to appear to move in an arc, and there is quite a skill required to track an object across the sky as both controls have to be moved synchronously.


The axes of rotation of an Altazimuth mount

A variation on the altazimuth mounting is the **Dobsonian mounting**. Invented by an American amateur telescope maker, John Dobson to support his simple, large-aperture Newtonian reflectors. The simplicity of the mounting's design relies on super-smooth bearings using PTFE (better known under one of its trade names as Teflon) and melamine. Once the instrument is balanced in its mount, it can be moved easily and delicately in any direction.

Dobsonian mountings have the virtues of being cheap, compact, and are quick and easy to set up. They are also ideal for the DIY enthusiast to make.


Typical Altazimuth mount with slow motion controls


A Dobsonian Altazimuth mount

GO TO Features

The fork mountings on the Meade® ETX-90EC and the ETX-125EC models include high-torque DC motors on both axes, permitting electronic operation from the standard equipment plug-in hand controller.

With the telescope placed in the altazimuth mode, astronomical objects can be tracked using the directional pushbuttons of the hand controller.

Fully automatic astronomical tracking in the altazimuth mode can be achieved with the optional Autostar™ Computer Controller. Alternatively, the telescope may be mounted in the equatorial orientation, using either a Table Tripod or a Field Tripod, and the telescope can track celestial objects automatically at the sidereal rate.

One of the most important advances in telescope control in the past 25 years, the Meade® Autostar™ Computer Controller turns the ETX-90EC and the ETX125EC into an automatic celestial object locating system.

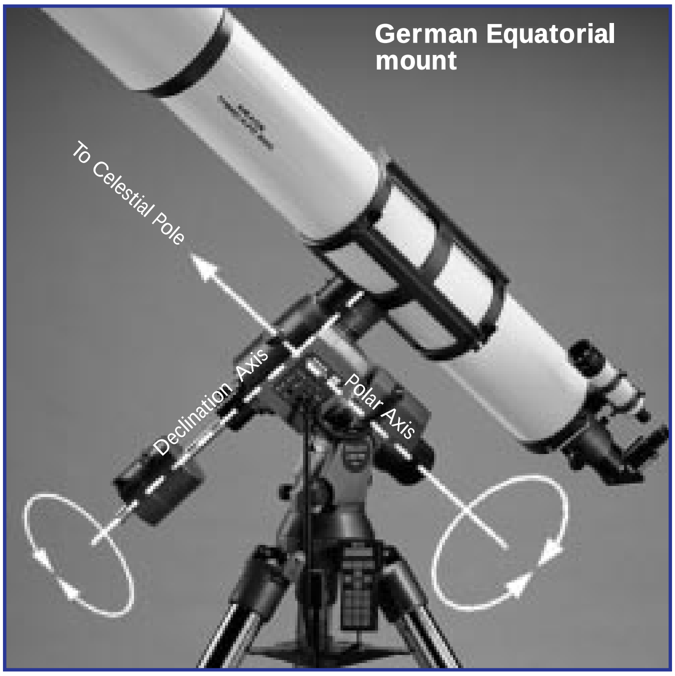
Best of all, the Meade® Autostar™ is easy to use. Even the most inexperienced observers will be able to locate dozens of fascinating celestial objects on their very first night out. From commonly observed objects such as the rings of Saturn, the satellites of Jupiter, or the Orion Nebula (M42) to more difficult objects such as the Ring Nebula (M57) in Lyra, the Spiral Galaxy (M33) in Triangulum, or the Sombrero Galaxy (M104) in Virgo.

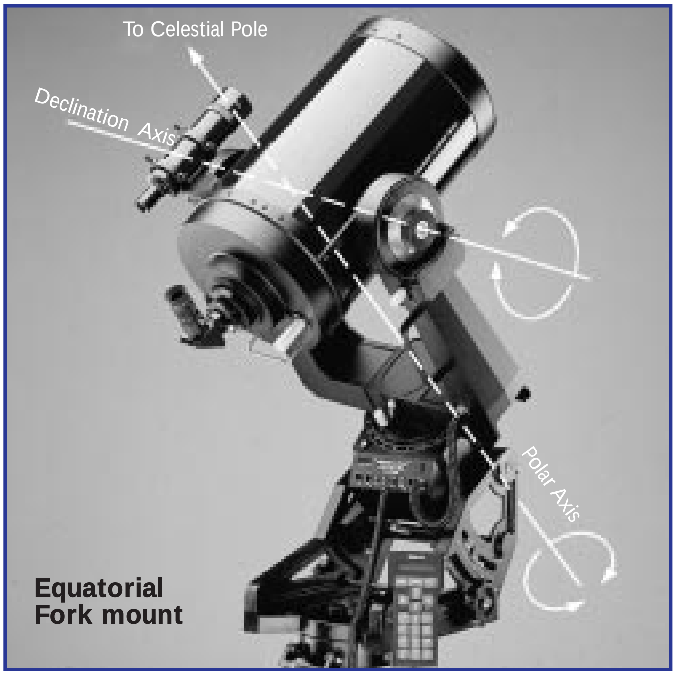
Any of Autostar's database objects can be called up and entered on the hand controller's display in seconds. Simply press the GO TO button and watch as the telescope automatically moves to the object and places it in the field of view. Autostar enables anyone to locate objects only previously observed by the most dedicated amateur astronomers.

The Computer Controller really does open up new and improved astronomical study for the casual and novice astronomer in a similar way that the Meade LX200 Schmidt-Cassegrains have for the advanced amateur.


An ETX90-EC Altazimuth mount with a GOTO

The Equatorial Mount





The equatorial mount is a refinement of the basic altazimuth mount designed to overcome the tilt and rotation of the Earth by aligning the axis of the instrument with the axis of rotation of the Earth – the polar axis. The Objects can be tracked accurately by rotating the telescope around this axis alone (called the Right Ascension), holding the object stationary in the telescope's field of view indefinitely.

Another advantage of the equatorial mount is that it can be motorised to follow an object automatically and near effortlessly.

An equatorial mounting is essential for any form of astrophotography and makes almost any serious observing so much easier.

There are two types of equatorial mountings available: Fork mountings and German mountings.

Fork mountings are ideal for Cassegrain telescopes and large Newtonians. The fork supports the telescope on bearings set between two short prongs that permit full movement in declination, while the base of the fork is on a circular base that rotates. When the whole assembly is tilted to align with the polar axis, the circular base gives movement in the right ascension.

Fork mountings are generally quite light in weight, compact and easily portable.

The German equatorial mount is shaped like a letter T with the telescope mounted on one end of the cross bar and a counterweight on the other. The pole axis (Right Ascension) is on the upright. This type of mount has been popular with many amateur astronomers and can accommodate longer-tube instruments more readily than the fork mounting. It is the only practical mounting for small refractors. Although it allows unhindered access to most parts of the sky, it cannot sweep continuously across the whole horizon. When it nears the meridian, it has to be moved to the opposite side of the mounting and realigned on the target object. While this drawback is merely inconvenient for normal observing it makes long exposure photography impossible as not only is exposure interrupted, but the image's orientation in the field of view is also rotated.

Polar Alignment

A telescope with an equatorial mount cannot effectively track an object unless the mount's polar axis is aimed towards the northern sky. As the Earth rotates, the sky appears to rotate in the opposite direction. The sky's pivot point is an imaginary spot called the north celestial pole, directly above the North Pole. (The star Polaris is used as the celestial pole target.) For a telescope to track properly it, too, must rotate around an axis aimed at this pole.Rigorous, time-consuming methods for precise alignment are necessary only for advanced astrophotgraphy where very long exposures are needed. For general observing and basic photography, an accuracy of within one or two degrees of the pole will be sufficient.The simple method is to set up the telescope on its mount and tripod so that it is reasonably level, adjust the angle of the altitude, or latitude setting on the wedge to match your latitude (the UK lies between 50º N and 60º N.) With the telescope's declination circle set at 90º,use the finder scope to locate and centre the pole. Do this by moving the whole tripod or by using the fine azimuth adjustments on the wedge. Do not alter the tube's declination or right ascension.