Aligning an Equatorial Mount for Observing

To counter the affect of the rotation of the Earth, a German Equatorial Mount (GEM) must be aligned with the axis of the Earth and rotate the telescope in the opposite direction to Earth's rotation. The North Celestial Pole (NCP) marks a place in the sky around which all stars viewed from Earth appear to rotate. The stars however do not rotate around this point as this is an illusion caused by the rotation of the Earth.

When aligned, a telescope rotated in the opposite direction and speed to the rotation of the Earth will enable accurate tracking of a celestial object by cancelling out the effect of the rotation of the Earth. To set up a German Equatorial Mount (GEM) we use the pole star which is just ¾ of a degree away from the NCP. As we all probably know Polaris the pole star is found at the end of the handle of Ursa Minor and is also indicated by the pointer stars in Ursa Major. If an equatorial mount is aligned correctly it will minimise the drift of an object away from the field of view whilst tracking with manual or motorised mounts.

Finderscope. The finderscope must be accurately adjusted ***to*** the view in the main telescope. It is best to check/adjust the finderscope in the day, before observing. Orient the finderscope to the side of the scope for easy access. Make sure it is aligned ***to*** the telescope by adjusting on a very distant object to avoid parallax errors. Finally, refine the adjustment on a star.

Setting up the Mount.

1. Adjust the legs to the length required. This may seem obvious but the height of any tripod needs to be decided at the start. A Newtonian telescope has the eyepiece set high on the scope, whereas a refractor has the eyepiece at the lower end. In addition the height of the observer needs to be taken into consideration as well as the height above the horizon the telescope will be pointing during use. The working height of the tripod therefore needs to be known from the start and the first few uses should be enough to give you a good idea for a starting point.

2. Place the mount in position. Once you have the mount height sorted it is time to place it on the selected observing point taking the view and any obstructions into consideration. The most straightforward way to set down a mount is to have it positioned so that one leg is pointing south with the line of the RA axis (the one without the weights) pointing north. The Society scope has north clearly labelled and this would be a good thing to do with any mounts that members have. Setting the mount down in this way greatly assists with levelling.

3. Settle the Mount. Before levelling on grass or other soft surface it is best to settle the scope into the surface by applying pressure to each of the tripod legs. This increases the firmness of the mount and minimises settlement as weight is added to it.

4. Levelling. In most cases the accessory tray on most scopes is pretty much level with the mount head. By placing a simple 2-way level on the tray with one of the phials aligned with the south leg it is very easy to see which legs need adjusting to attain a level mount.

5. Setting Latitude. An essential step in alignment is to set your latitude. This only needs to be done once unless you take the scope to a place significantly distant from the original set-up point.

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For Wadhurst it is 51^{o} N. To adjust use the locking levers, you need to un-screw one and screw-in the other to adjust. The RA axis is now roughly aligned to the NCP. Providing you have the mount pointing reasonably accurately north, I have found this is often all that is needed to allow for several minutes of tracking using just the RA control and an occasional tweak of the Dec control.

6. Balancing. Once the mount is aligned, remove the "Toe Saver" screw from the counter-weight shaft to slide on the weight. Move the weight close to the mount to prevent topple before the telescope is added. Put the weight on the shaft with the locking screw towards the top of weight. For safety replace the Toe Saver screw after the weight is on the shaft.

The Telescope Cradle should have the hinges at the bottom with the control handle towards the eyepiece end of the telescope. Carefully unlock the RA lock and slide the counterweight to balance the scope. Tighten the RA lock and then slide the scope in the cradle so that it also balances. Then with both Dec and RA locks off the scope should be able to be moved in any direction without falling to one or the other side. Check also the speed of movement to remove any fine balance bias.

You should now be polar aligned to an accuracy suitable for observing. If it has been done adequately you will be able to track any star or planet for several minutes with just the RA control. If the object does slowly drift out of the field of view, this can be corrected by slight use of the DEC control.

7. Observing Your Target Object. Once you reach this point you can select your target. For example if it is the Moon just unlock the RA & DEC locks and slew the telescope to the Moon. Then lock up the RA & DEC locks and home in with the use of the RA & DEC controls and the finderscope or a low power eyepiece.

Additional Alignment. If you want to align the mount more accurately and do not have a polar alignment scope there is a useful tip you can use to improve your alignment. Notice that when the telescope is looking north in the same direction of the RA axis the telescope body is clearly parallel to the RA axis.

If you now line up the telescope vertically & north in the DEC axis it should also be near to the pole star. If you look through the finderscope or use a low power eyepiece you can lock up the RA & DEC controls in this position and home in on the pole star using the mount fine adjustment horizontal and vertical adjustment. ***Tip***. A green laser can be used in conjunction with the polar scope to assist with alignment and this also saves back strain.

This will enable you to view and track stars with the minimum amount of DEC adjustment and ease the task of tracking stars to the sole adjustment of the RA control in manual and motorised mounts. The image will stay in view much longer before any DEC intervention is required so that the observer can concentrate on observing.

Even Better Alignment! For further accuracy in alignment there are other methods you can use including the Polar Alignment, Drift method and computer aided alignment but these methods are outside the scope of this guide and are usually only required for alignment critical pursuits for example long exposure astro-photography.

Happy Observing..... Phil Berry