



# Telescope Mounts & Tripods

**The quality of your observing experience relies not just on your telescope but also the sturdiness of your tripod and mount.**

# Mount Terms

- **The Mount** holds the telescope and allows movement to point the telescope to any or almost any spot in the sky. *There are two major categories of mounts:*
  1. **Altitude-Azimuth (Alt-Az).** This is same as the mount used on binoculars at tourist sites. It tilts/angles up and down from the horizon to the top of the sky and rotates around to any compass point. **Dobsonians only use Alt-Az mounts.** The largest professional telescopes use computerized/motorized alt-az mounts.
  2. **Equatorial.** This types of mount mimics the movement of the stars in the sky. It has two axes. In the northern hemisphere, one axis points directly to the North Celestial Pole which is close to the star Polaris (this angle is the same as your latitude).
- **The Tripod, Pedestal, Stand or Pier** supports the mount, lifting the mount and telescope off the ground to a usable and/or comfortable height. Many tripods or pedestals have three legs, like a camera tripod, for stability. Piers are usually permanent and in “observatories, often a round column of metal to which the mount is attached.



# Tripods+



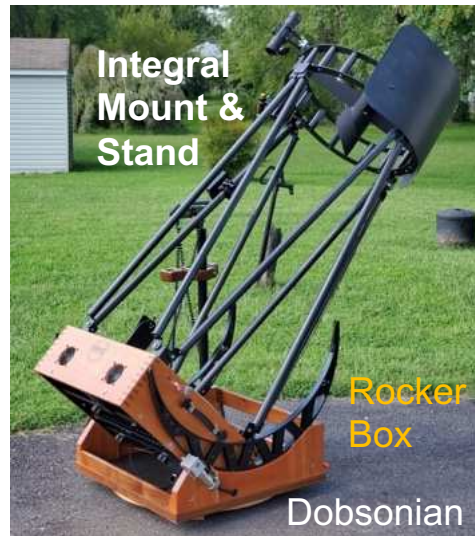
Common  
Tripod



Portable  
Pier Tripod



Pier  
Tripod



Rocker  
Box

Dobsonian



Dobsonian

Integral  
Mount &  
Stand



Wooden  
Tripod

# Attaching the Telescope to the Mount

## How are telescopes attached to the mount?

**1. Tube rings** are generally used to hold/attach a telescope to a plate. Smaller diameter telescope tubes often get 1 wide ring while bigger diameter tubes often get 2 rings.

2. Tube rings are often attached to a **dovetail PLATE** that slides into a **dovetail CLAMP** which is attached to a mount. Vixen and Losmandy dovetail plates are popular but they are not interchangeable.

**3. Balance.** Telescopes are usually "secured" by tube rings because the telescope tubes sometimes need to be slid forward or backward to achieve balance, especially when using a heavy eyepiece or other equipment.





# Alt-Az Mounts



Dobsonian  
Mount  
Integrated  
Mount and  
"Stand"



Dobsonian  
Rocker Box  
Integrated Mount  
and "Stand"



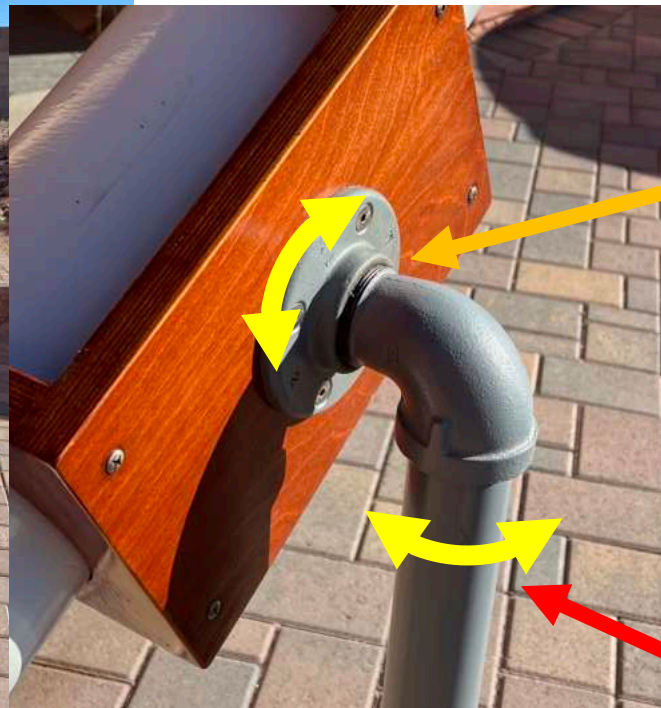
Motorized/  
Computerized  
Alt-Az mount



# Alt-Az Mount

My 6-inch Newtonian Reflector

Simple pipe mount



Altitude

Azimuth

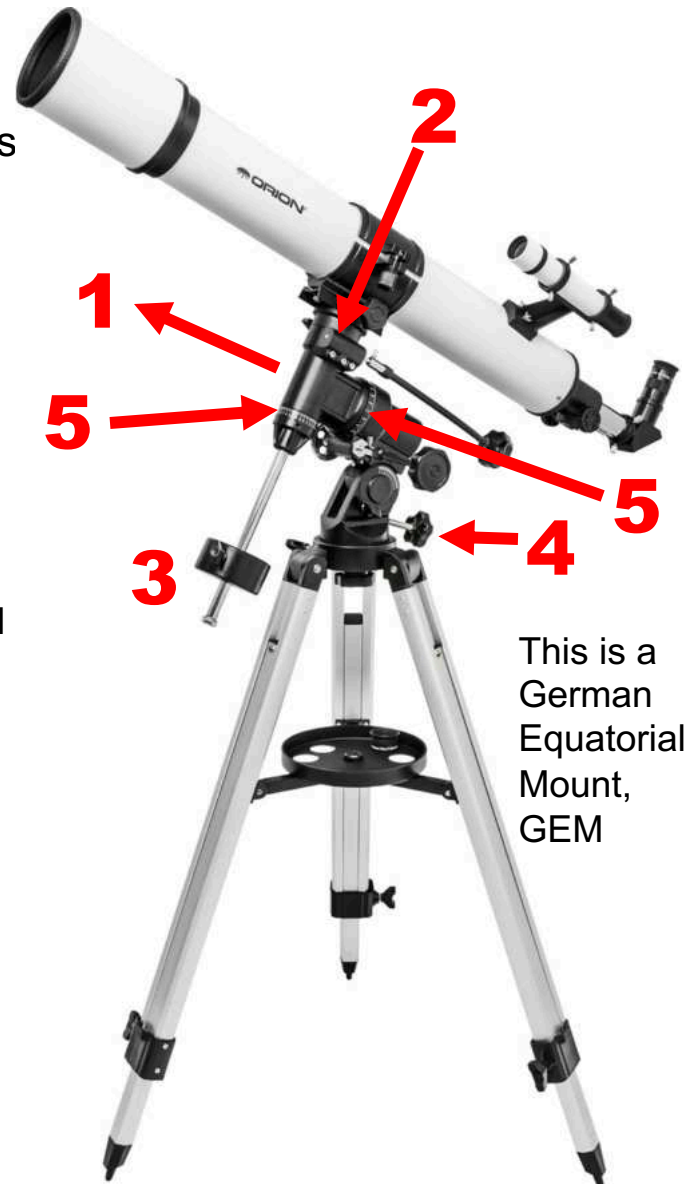
# Equatorial Mount Terms

**The Equatorial Mount** is versatile.

It works well manually or motorized because only one axis has to be rotated to keep an object in view. It is usually the choice for amateur astrophotography.

1. **Polar or Right Ascension\* Axis** needs to be pointed to the North Celestial Pole and angled accordingly (same angle as your latitude).
2. **Declination\* Axis**.  $90^\circ$  axis to the Polar Axis.
3. **Counterweights/shaft**. The telescope is on one side of the declination axis, so you need counterweights on the opposite side.
4. **Latitude Adjustment**. The height/angle of the North Celestial Pole above the horizon, which is very close to Polaris, is the same as your latitude—Tucson,  $32.25^\circ$
5. **Setting Circles**. Often, equatorial mounts have incorporated setting circle even though they are rarely used—in units of Right Ascension and Declination.
6. **Clutches (Not indicated)**. Most equatorial mounts have clutches on the two axes. These are knobs that are loosened to move the telescope about and tightened when in position.

\*Remember, **Right Ascension** and **Declination** are used as the coordinates of objects in the sky. Declination is equivalent to latitude and Right Ascension is equivalent to longitude.



This is a German Equatorial Mount, GEM



# German Equatorial Mount GEM

All  
Equatorial  
Mounts  
mimic the  
movement  
of the  
stars.

Manual  
**Slow  
Motion**  
knobs to  
center and  
follow  
objects

The German Equatorial is popular  
for amateur use because it  
provides access to the entire sky  
and it is necessary if you want to  
engage in astrophotography.

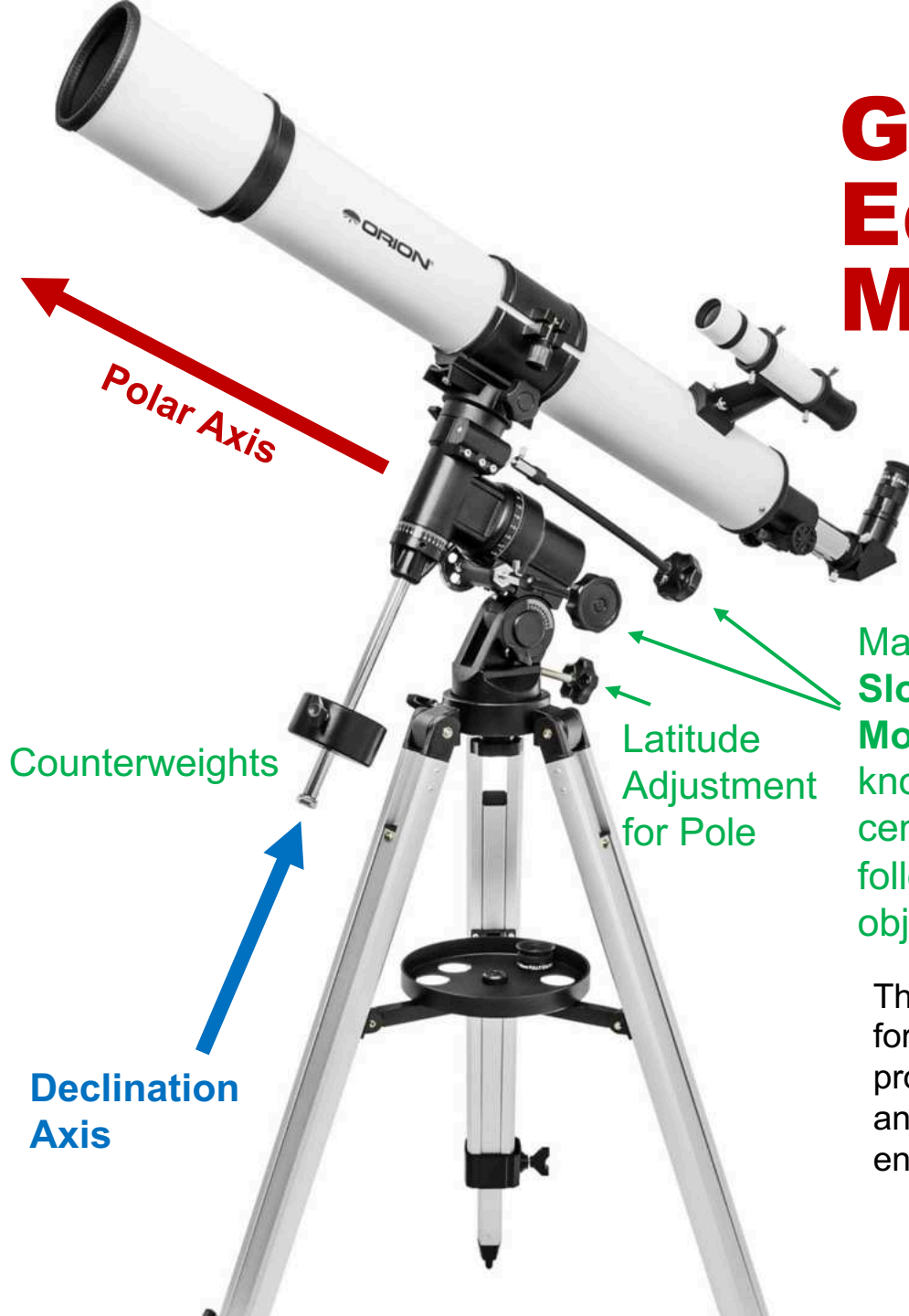
Points to  
**North  
Celestial  
Pole**  
(near Polaris)

**Polar Axis**

Counterweights

**Declination  
Axis**

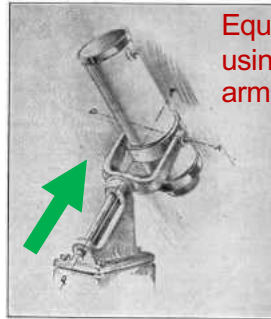
Latitude  
Adjustment  
for Pole



# Equatorial

Green Arrows point to  
North Celestial Pole

Equatorial  
using a two  
arm yoke.



German  
Equatorial  
(GEM). Has  
counterweight.

German  
Equatorial  
(GEM). Has  
counterweight.

Alt-Az  
converted  
to an  
Equatorial  
using a  
wedge.  
No counter-  
weights.

German  
Equatorial  
(GEM). Has  
counterweight.

German  
Equatorial  
(GEM). Has  
counterweight.



## **An original German Equatorial Mount**

**Berlin Royal  
Observatory  
1828/1829**

**Joseph von Fraunhofer  
(Telescope & Mount)**

Achromatic refractor  
9.6 inches diameter  
Focal Length 14 feet  
f/17.5



# Setting Circles

1. Setting Circles are **positional scales** of Right Ascension (RA) and Declination (Dec) that are sometimes seen/incorporated **on Equatorial mounts**, even cheap ones. They were used more frequently in the past to locate objects (before motorized/computerized telescopes) and to record the coordinates of objects.
2. The coordinate system used to indicate the position of celestial objects is similar to latitude and longitude. Declination is akin to latitude and uses a similar numbering system system ( $-90$  to  $+90$ ). Right Ascension is akin to Longitude but uses the 24 hours of a day for its increments, starting at the position of the Sun at the Vernal Equinox (in Pisces) and moving eastward.





# Digital Setting Circles

## Push-To your Object



1. Usually **used on manual mounts** to help locate celestial objects—Deep Sky Objects, planets and stars. Once located, you do have to push the scope to keep the object in view. Digital Setting Circles can be used on motorized mounts, too.
2. Digital Setting circles consist of a **hand controller** (with an accurate internal clock) and **special optical encoders** that are attached to the two axes of the mount. Inside an encoder is a round cylinder of lines (5 to 10 thousand) that are counted as the telescope is moved, which notes position.
3. Once you align your scope to 2 stars using the hand controller, you choose an object in its lists and the display shows you how much to move the telescope with arrows.
4. DSC were more common on many smaller Dobsonians (6 to 10 inches) in the past but this has become less common today.



### Encoder

Need two that are attached to the two mount axes. Round cylinder of lines inside.



# GOTO Mounts

1. GOTO or GO TO mounts are **motorized** and **computerized** mounts that, using a **hand controller**, will move to any selected object and then follow it through the sky.
2. GOTO can come with your scope or it can be a separate mount/stand.
3. GOTO mounts can be **either Alt-Az or Equatorial**. Celestron and Meade's SCTs are usually sold on Alt-Az GOTO mounts. Today, all professional telescopes at observatories use computerized Alt-Az mounts.
4. Most Alt-Az GOTO mounts **need to be aligned/calibrated to 2 or 3 stars** before the GOTO functions will work—the telescope/mount needs to know where it is. For equatorial mounts that are polar aligned, usually only 1 star is needed for calibration.
5. The **hand controllers have buttons and a display for input**. They have catalogues of thousands of Deep Sky Objects, planets and stars. Most have prompts to help you through the alignment process.



Alt-Az



GEM  
Equatorial

Sky-Watcher

A very popular GEM

# Motorized/Computerized SCT

Biggest bang for the buck.



Alt-Az  
converted  
to an  
Equatorial  
using a  
Wedge



Alt-Az



GEM

Celestron/Meade makes telescopes mounts/stands in a variety of configurations — all motorized and computerized to GOTO and track any object selected from the hand controller.

Overall, these telescopes represent the biggest bang for the buck because they include the tripod, GOTO mount and telescope.

Now, it does take some time to become familiar with the GOTO operation. It is not difficult but it can be a little tedious and for some GOTO mounts, you do need to be able to identify some of the brighter stars for the alignment process.



8-inch  
GOTO  
1-arm  
Alt-Az Fork  
\$1,600



11-inch  
GOTO  
2-arm  
Fork  
Alt-Az  
\$5,100



9.25-inch  
GOTO  
GEM  
Equatorial  
\$2,950



6-inch  
Newt  
GOTO  
GEM  
\$1,110

1. Celestron - NexStar 8SE Telescope, \$1,600
2. Celestron CPC Deluxe 1100 HD Computerized Telescope, \$5,100
3. Celestron Advanced VX 9.25" SCT GOTO EQ Telescope, \$2,950
4. Meade 6" Reflector on LX85 GOTO Equatorial Mount – 217003, \$1,110



# Few Comments

1. **Simple & Fast Alt-Az.** A manual Alt-Az mount is great for **quickly** finding/observing objects like the Moon, planets, double stars and brighter DSOs.
2. **To help Study objects.** A **motorized mount** (not necessarily GOTO and can be a German Equatorial) that follows objects is great to study details of objects, especially the Moon and planets.
3. **No hassle observing.** The GOTO mount is nice if you just want to observe and not worry about finding anything. The motorized mount follows any object and all you have to do is look! Remember, it can be somewhat of a hassle to set up a GOTO mount but once accomplished, they are nice to use. And, once you get use to the set-up process, this will make it less of a hassle. The biggest drawback to GOTO is that you cannot use the mount manually after alignment, but this is an infrequent complaint.



# Professional transition from **Equatorial** to **Alt-Azimuth**



**NEW!**

# German-type **Equatorial** without **Counterweights** Mount

## ZWO Harmonic Mount

Portable, precise and stable



## Harmonic Drive Strain Wave Gear Technology



**Strong load capacity**

Without counterweight: 8kg

With counterweight: 13kg



**Multi-function**

Equatorial mount  
Altazimuth mount



**Lightweight design**

No counterweight required

**Zero Backlash!**

Takahashi  
80mm  
3-inch  
\$690



**Orion Telescopes**  
**Sky-Watchers**  
**Celestron**  
**Meade**  
**Vixen**  
**Tele Vue**  
**Takahashi**  
**Explore Scientific**

**Starizona store in Tucson**

Classified in *Cloudy Nights*