

**INSTRUCTION MANUAL**

# **Orion® Tabletop Equatorial Mount**

**#9055**



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Congratulations on your purchase of a quality Orion product. Your new Tabletop Equatorial Mount is extremely portable and can be taken with you conveniently wherever you go to observe. The tabletop mounting system allows easy attachment of a wide variety of different telescope optical tubes. With its precision equatorial head, you'll be able to easily track astronomical objects over time so that they remain within your eyepiece's field of view. The setting circles will help locate hundreds of fascinating celestial objects, including galaxies, nebulas, and star clusters. With a little practice and a little patience, you'll find that your Tabletop Equatorial Mount is an invaluable tool for getting the most out of your astronomical observing sessions.

These instructions will help you set up and properly use your equatorial mount. Please read them over thoroughly before getting started.

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## 1. Parts List

- 1 German equatorial mount
- 2 Slow-motion control cables
- 1 Counterweight shaft
- 1 Counterweight
- 3 Tripod legs
- 1 1/4"-20 adapter
- 1 Small crescent wrench

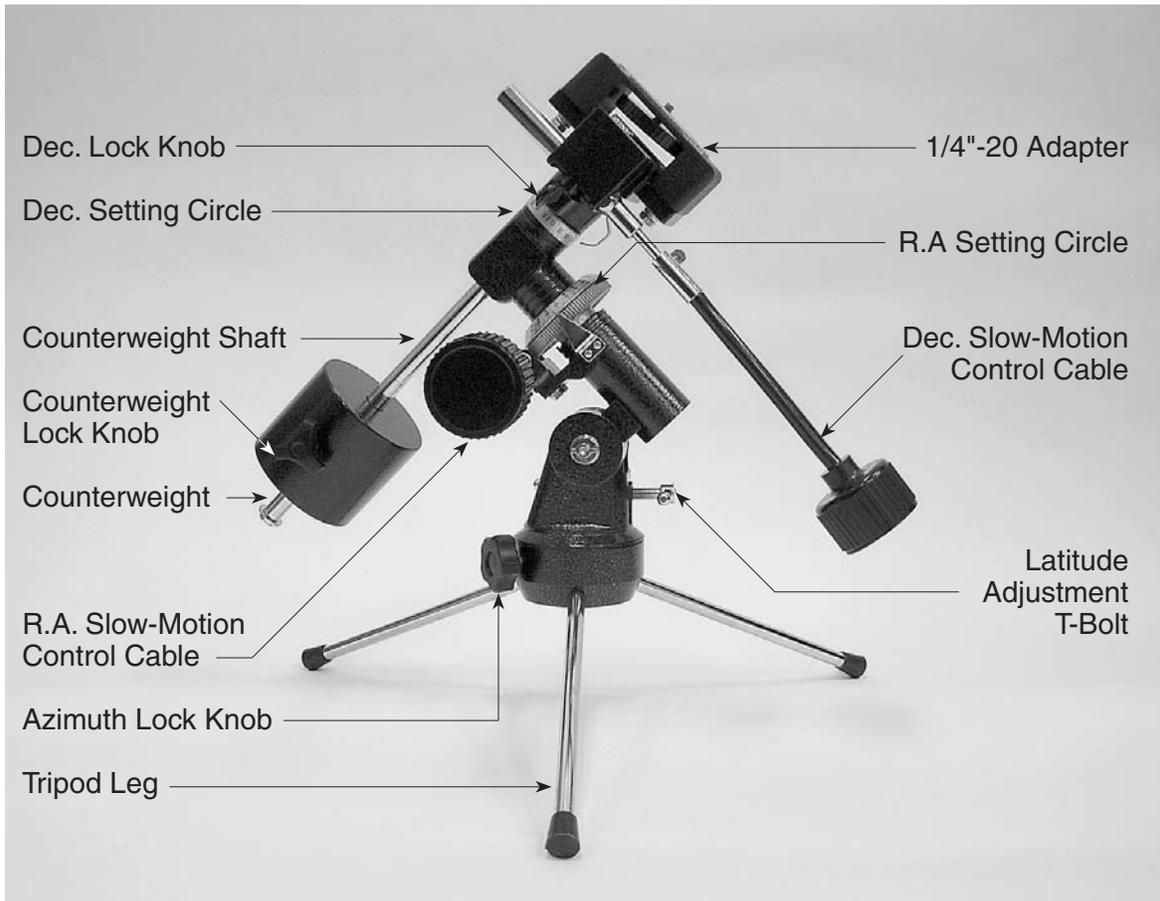


Figure 1. The Tabletop EQ Mount

## 2. Assembly

Carefully remove all of the items from the shipping box. Make sure all the parts listed in Section 1 are present. Save all boxes and packaging material. In the unlikely event that you need to return the mount, you must use the original packaging.

Assembling the mount for the first time should take about 5 minutes. You will need the small provided crescent wrench and a Phillips head screwdriver. Refer to Figures 1 and 5 during the assembly process.

1. Lay the equatorial mount on its side. Attach the tripod legs, one at a time, by threading them into the holes at the base of the mount.

2. With the tripod legs now attached to the equatorial mount, stand the mount upright.

3. Orient the equatorial mount as it appears in Figure 1, at a latitude of about  $40^\circ$ , i.e., so the pointer next to the latitude scale is pointing to the hash mark at "40." To do this, loosen the latitude lock t-bolt, and turn the latitude adjustment t-bolt until the pointer and the "40" line up. Then retighten the latitude lock t-bolt. The declination (Dec.) and right ascension (R.A.) axes may need re-positioning (rotation) as well to resemble Figure 1. Be sure to loosen the R.A. and Dec. lock knobs before doing this. Retighten the R.A. and Dec. lock knobs once the equatorial mount is properly oriented.

4. Thread the counterweight shaft into the equatorial mount at the base of the declination axis until tight.

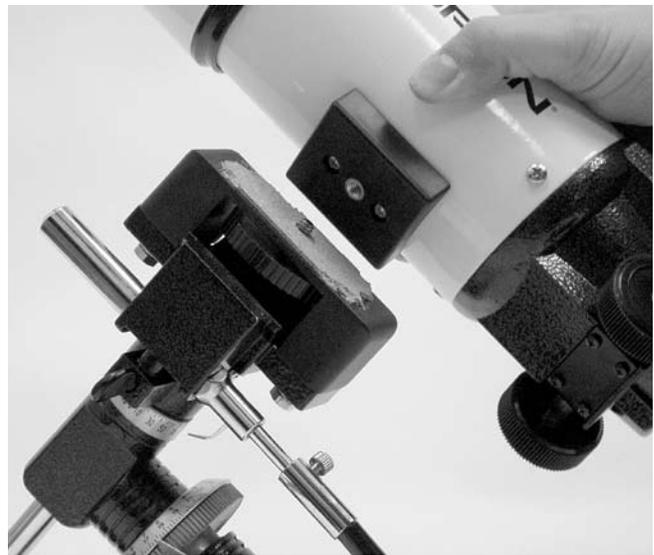
5. Remove the screw and washer on the bottom of the counterweight shaft and slide the counterweight onto the shaft. Make sure the counterweight lock knob is adequately loosened to allow the counterweight shaft to pass through the hole. Position the counterweight about halfway up the shaft and tighten the lock knob. Replace the screw and washer on the end of the shaft.

6. Attach the 1/4"-20 adapter to the top of the mount with the provided hex head screws. Place the adapter on top of the mount with its cork side facing up. Line up the threaded holes in the adapter with the holes in the top of the mount. Push the screws up through the holes in the mount and thread them into the adapter. Tighten with the crescent wrench.

7. Now attach the two slow-motion control cables to the R.A. and Dec. slow motion control shafts (see Figure 1) of the equatorial mount by positioning the thumb screw on the end of the cable over the indented slot on the shaft, then tightening the thumb screw. A cable can be attached to either end of the R.A. worm gear shaft, whichever is most convenient for you.

## 3. Attaching a Telescope

The Tabletop Equatorial Mount is designed to hold short telescopes of no greater than 90mm aperture. This includes such telescopes as the Orion ShortTube 80, 90 and Apex 90. For heavier telescopes, the mount may not provide sufficient sta-



**Figure 2:** Attaching a telescope with the 1/4"-20 adapter.



**Figure 3:** Tabletop EQ Mount with telescope attached.

bility for steady imaging. 35mm cameras can also be attached to the mount.

To mount a telescope with the adapter, the telescope should have a 1/4"-20 mounting block. To attach the telescope to the mount, line up the telescope's 1/4"-20 mounting block with the 1/4"-20 adapter on the mount as shown in Figure 2. Then rotate the large knurled ring on the adapter to thread it into the mounting block until it is finger tight. Once finished, the telescope and mount assembly should resemble Figure 3.

Telescopes can be attached to the mount using optional tube rings instead of the 1/4"-20 adapter. The 1/4"-20 adapter must first be removed and the tube rings put in its place.

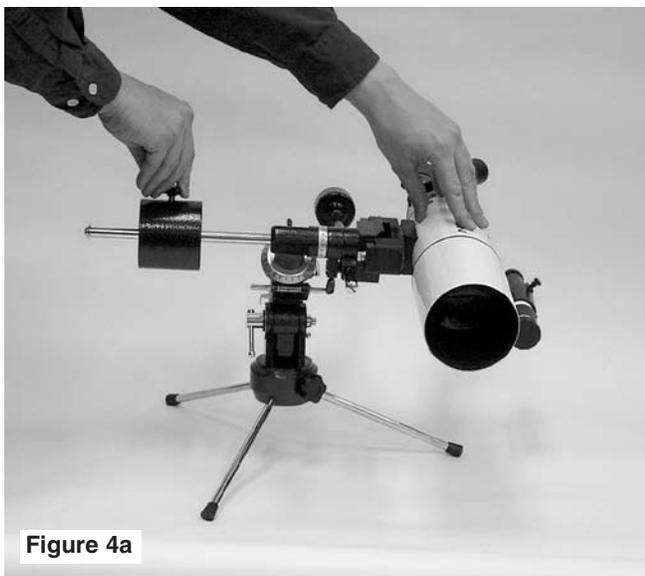


Figure 4a

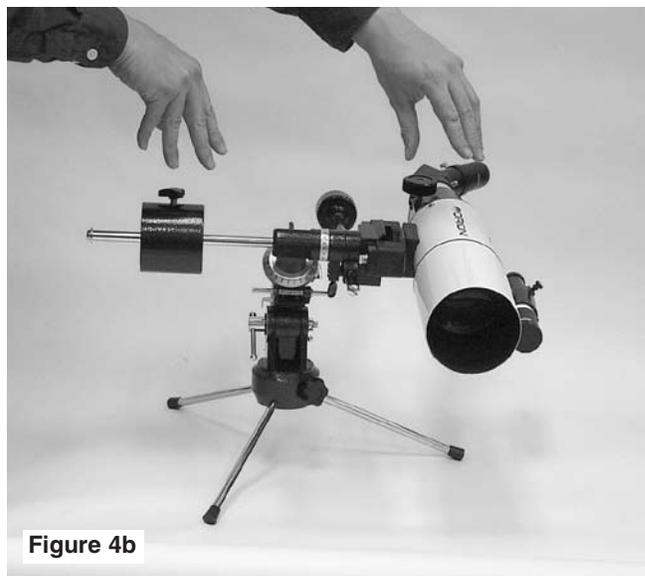


Figure 4b

**Figure 4a, 4b:** Proper operation of the equatorial mount requires that the telescope be balanced in the R.A. axis. a) With the R.A. lock knob released, slide the counterweight along the counterweight shaft until it just counterbalances the telescope tube. b) When you let go with both hands, the tube should not drift up or down.

## 4. Balancing the Telescope

Once the telescope is attached to the equatorial mount, the next step is to balance the telescope on the mount's R.A. axis. Proper balance is required to insure smooth movement of the telescope on the equatorial mount.

1. Keeping one hand on the telescope optical tube, loosen the R.A. lock knob. Make sure the Dec. lock knob is locked tight. The telescope should now be able to rotate freely about the R.A. axis. Rotate it until the counterweight shaft is parallel to the ground (i.e., horizontal).

2. Now loosen the counterweight lock knob and slide the weight along the shaft until it exactly counterbalances the telescope (see Figure 4a). That's the point at which the shaft remains horizontal even when you let go of the telescope with both hands (see Figure 4b). Retighten the counterweight lock knob. The telescope is now balanced on the R.A. axis.

It is not possible to adjust the telescope's balance about the mount's Dec. axis using the 1/4"-20 adapter. Usually, the telescope will be balanced naturally about the Dec. axis due to the placement of the 1/4"-20 mounting block at the balance point of the telescope.

Now that the telescope is properly balanced, when you loosen the lock knob on one or both axes and manually point the telescope, it should move without resistance and should not drift from where you point it.

## 5. Aligning and Using the Equatorial Mount

When you look at the night sky, you no doubt have noticed that the stars appear to move slowly from east to west over

time. That apparent motion is caused by the Earth's rotation (from west to east). An equatorial mount (Figure 5) is designed to compensate for that motion, allowing you to easily "track" the movement of astronomical objects, thereby keeping them from drifting out of the telescope's field of view while you're observing.

This is accomplished by slowly rotating the telescope on its right ascension (R.A.) axis, using only the R.A. slow-motion cable. But first the R.A. axis of the mount must be aligned with the Earth's rotational (polar) axis—a process called polar alignment.

### Polar Alignment

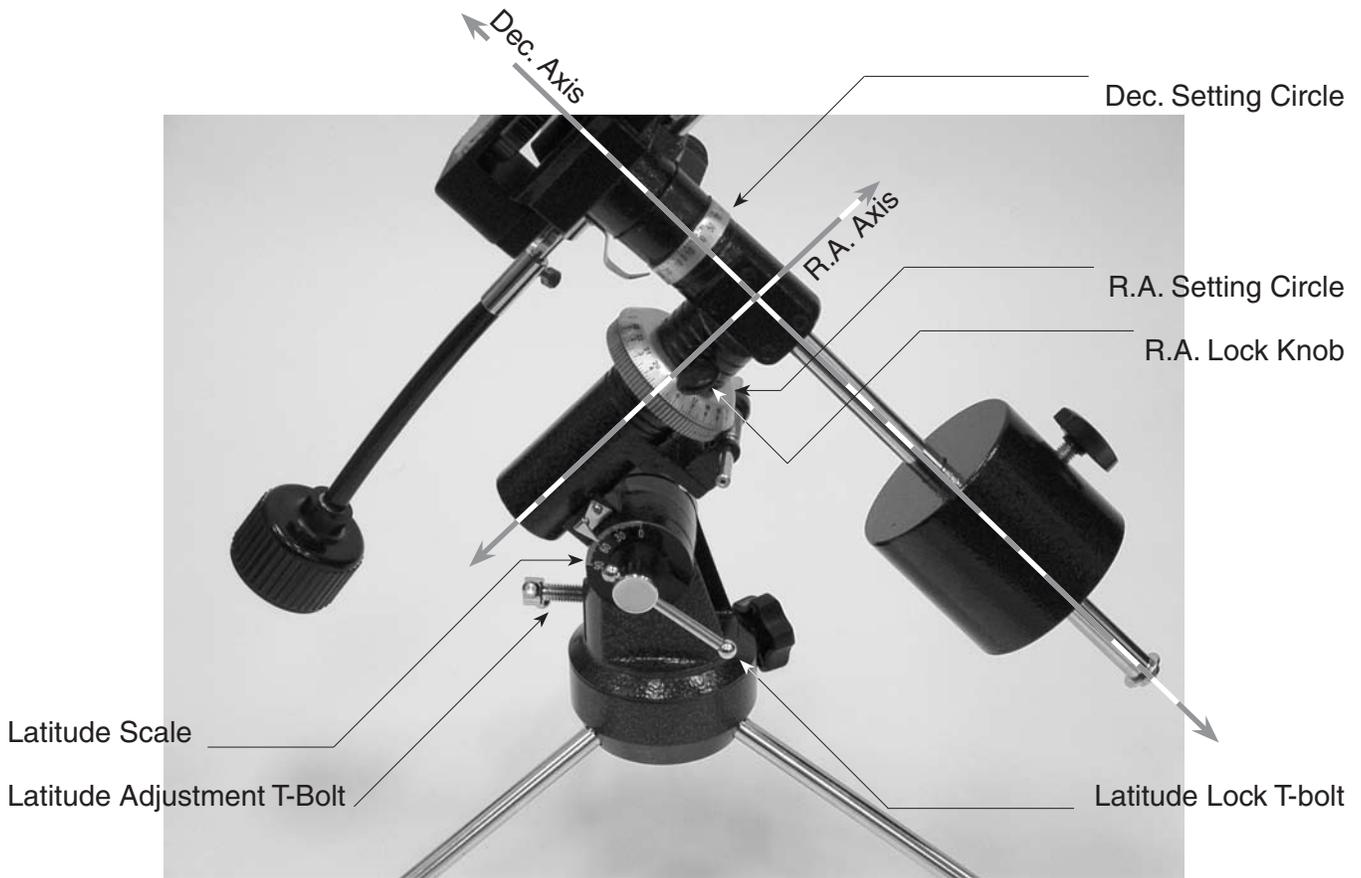
For Northern Hemisphere observers, approximate polar alignment is achieved by pointing the mount's R.A. axis at the North Star, or Polaris. It lies within 1° of the north celestial pole (NCP), which is an extension of the Earth's rotational axis out into space. Stars in the Northern Hemisphere appear to revolve around the NCP.

To find Polaris in the sky, look north and locate the pattern of the Big Dipper (Figure 6). The two stars at the end of the "bowl" of the Big Dipper point right to Polaris.

Observers in the Southern Hemisphere aren't so fortunate to have a bright star so near the south celestial pole (SCP). The star Sigma Octantis lies about 1° from the SCP, but it is barely visible with the naked eye (magnitude 5.5).

To polar-align the table top EQ mount:

1. Make certain the mount is on level surface.
2. Loosen the latitude lock t-bolt. Turn the latitude adjustment T-bolt and tilt the mount until the pointer on the latitude scale is set at the latitude of your observing site. If you don't know your latitude, consult a geographical atlas to find it. For exam-



**Figure 5:** The equatorial mount

ple, if your latitude is 35° North, set the pointer to 35. Then retighten the latitude lock t-bolt. The latitude setting should not have to be adjusted again unless you move to a different viewing location some distance away.

**3.** Loosen the Dec. lock knob and rotate the telescope optical tube until it is parallel with the R.A. axis, as it is in Figure 3. The pointer on the Dec. setting circle should read 90°. Retighten the Dec. lock knob.

**4.** Loosen the azimuth lock knob at the base of the equatorial mount and rotate the mount so the telescope tube (and R.A. axis) points roughly at Polaris. If you cannot see Polaris directly from your observing site, consult a compass and rotate the mount so the telescope points North. Retighten the azimuth lock knob.

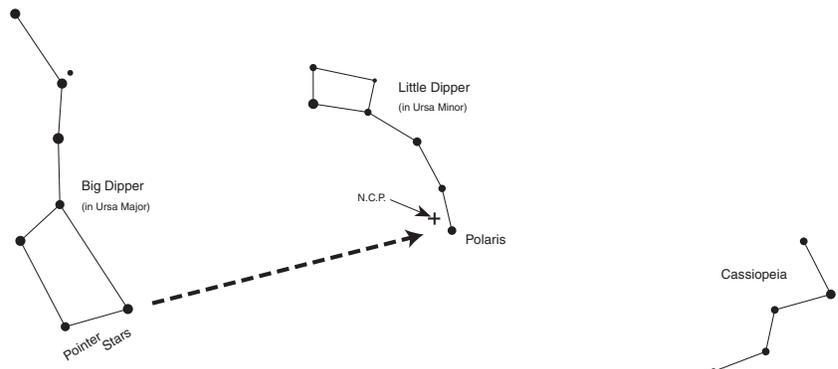
The equatorial mount is now polar aligned.

From this point on in your observing session, you should not make any further adjustments in the azimuth or the latitude of the mount, nor should you move the tripod. Doing so will undo the polar alignment. The telescope should be moved only about its R.A. and Dec. axes.

### Use of the R.A. and Dec. Slow-Motion Control Cables

The R.A. and Dec. slow-motion control cables allow fine adjustment of the telescope's position to center objects within the field of view. Before you can use the cables, you must manually "slew" the mount to point the telescope in the vicinity of the desired target. Do this by loosening the R.A. and Dec.

**Figure 6.** To find Polaris in the night sky, look north and find the Big Dipper. Extend an imaginary line from the two "Pointer Stars" in the bowl of the Big Dipper. Go about five times the distance between those stars and you'll reach Polaris, which lies within 1° of the north celestial pole (NCP).



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lock knobs and moving the telescope about the mount's R.A. and Dec. axes. Once the telescope is pointed somewhere close to the object to be viewed, retighten the mount's R.A. and Dec. lock knobs.

The object should now be visible somewhere in the telescope's finder scope. If it isn't, use the slow-motion controls to scan the surrounding area of sky. When the object is visible in the finder scope, use the slow-motion controls to center it. Now, look in the telescope's eyepiece. If the finder scope is properly aligned, the object should be visible somewhere in the field of view. Once the object is visible in the eyepiece, use the slow-motion controls to center it in the field of view.

The Dec. slow-motion control cable can move the telescope a maximum of 25°. This is because the Dec. slow-motion mechanism has a limited range of mechanical travel. (The R.A. slow-motion mechanism has no limit to its amount of travel.) If you can no longer rotate the Dec. control cable in a desired direction, you have reached the end of travel, and the slow-motion mechanism must be reset. This is done by first rotating the control cable several turns in the opposite direction from which it was originally being turned. Then, manually slew the telescope closer to the object you wish to observe (remember to first loosen the Dec. lock knob). You should now be able to use the Dec. slow-motion control cable again to fine adjust the telescope's position.

### **Tracking Celestial Objects**

When you observe a celestial object through the telescope, you'll see it drift slowly across the field of view. To keep it in the field, if your equatorial mount is polar aligned, just turn the R.A. slow-motion control cable clockwise. The Dec. slow-motion control cable is not needed for tracking. Objects will appear to move faster at higher magnifications, because the field of view is narrower.

### **Optional Motor Drives for Automatic Tracking**

An optional DC motor drive can be mounted on the R.A. axis of the tabletop equatorial mount to provide hands-free tracking. Objects will then remain stationary in the field of view without any manual adjustment of the R.A. slow-motion control.

### **Understanding the Setting Circles**

The setting circles on an equatorial mount enable you to locate celestial objects by their "celestial coordinates". Every object resides in a specific location on the "celestial sphere". That location is denoted by two numbers: its right ascension (R.A.) and declination (Dec.). In the same way, every location on Earth can be described by its longitude and latitude. R.A. is similar to longitude on Earth, and Dec. is similar to latitude. The R.A. and Dec. values for celestial objects can be found in any star atlas or star catalog.

The mount's R.A. setting circle is scaled in hours, from 1 through 24, with small marks in between representing 10-minute increments. The numbers closest to the R.A. axis gear apply to viewing in the Southern Hemisphere, while the num-

bers above them apply to viewing in the Northern Hemisphere.

The Dec. setting circle is scaled in degrees, with each mark representing 2.5° increments. Values of Dec. coordinates range from +90° to -90°. The 0° mark indicates the celestial equator. When the telescope is pointed north of the celestial equator, values of the Dec. setting circle are positive, while when the telescope is pointed south of the celestial equator, values of the Dec. setting circle are negative.

So, the coordinates for the Orion Nebula listed in a star atlas will look like this:

**R.A. 5h 35.4m Dec. -5° 27'**

That's 5 hours and 35.4 minutes in right ascension, and -5 degrees and 27 arc-minutes in declination (there are 60 arc-minutes in 1 degree of declination).

Before you can use the setting circles to locate objects, the mount must be correctly polar aligned, and the R.A. setting circle must be calibrated. The Dec. setting circle has been permanently calibrated at the factory, and should read 90° whenever the telescope optical tube is parallel with the R.A. axis.

### **Calibrating the Right Ascension Setting Circle**

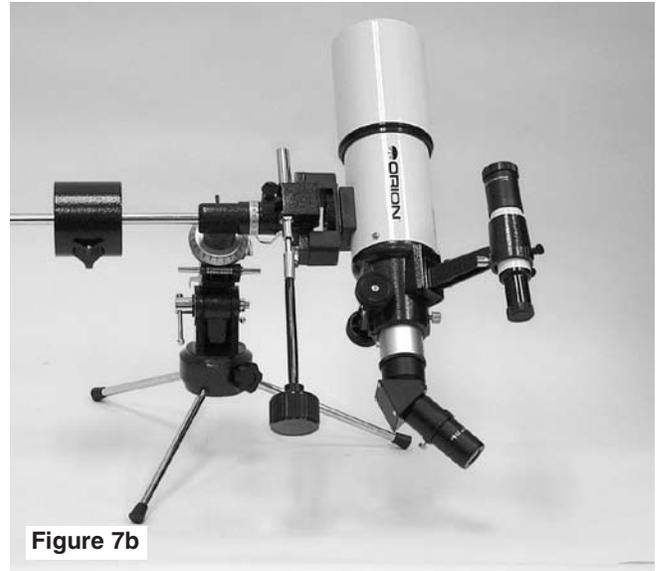
1. Identify a bright star in the sky near the celestial equator (Dec. = 0°) and look up its coordinates in a star atlas.
2. Loosen the R.A. and Dec. lock knobs on the equatorial mount, so the telescope optical tube can move freely.
3. Point the telescope at the bright star whose coordinates you know. Lock the R.A. and Dec. lock knobs. Center the star in the telescope's field of view with the slow-motion control cables.
4. Rotate the setting circle until the metal arrow indicates the R.A. coordinate listed in the star atlas for the object.

### **Finding Objects With the Setting Circles**

Now that the setting circles are calibrated, look up in a star atlas the coordinates of an object you wish to view.

1. Loosen the Dec. lock knob and rotate the telescope until the Dec. value from the star atlas matches the reading on the Dec. setting circle. Remember that values of the Dec. setting circle are positive when the telescope is pointing north of the celestial equator (Dec. = 0°), and negative when the telescope is pointing south of the celestial equator. Retighten the lock knob.
2. Loosen the R.A. lock knob and rotate the telescope until the R.A. value from the star atlas matches the reading on the R.A. setting circle. Remember to use the upper set of numbers on the R.A. setting circle. Retighten the lock knob.

Most setting circles are not accurate enough to put an object dead-center in the telescope's eyepiece, but they should place the object somewhere within the field of view of the finder scope, assuming the equatorial mount is accurately polar aligned. Use the slow-motion controls to center the object in the finder scope, and it should appear in the telescope's field of view.



**Figure 7a, 7b, 7c, 7d:** The Tabletop Equatorial Mount with telescope pointing a) north, b) south, c) east d) west.

The R.A. setting circle must be re-calibrated every time you wish to locate a new object. Do so by calibrating the setting circle for the centered object before moving on to the next one.

**Confused About Pointing the Telescope?**

Beginners occasionally experience some confusion about how to point the telescope overhead or in other directions. In Figure 3 the telescope is pointed north, as it would be during polar alignment. The counterweight shaft is oriented downward. But it will not look like that when the telescope is pointed in other directions. Let's say you want to view an object that is directly overhead, at the zenith. How do you do it?

One thing you DO NOT do is make any adjustment to the latitude adjustment t-bolt. That will nullify the mount's polar alignment. Remember, once the mount is polar aligned, the telescope should be moved only on the R.A. and Dec. axes. To point the scope overhead, first loosen the R.A. lock knob and rotate the telescope on the R.A. axis until the counterweight shaft is horizontal (parallel to the ground). Then loosen the Dec. lock knob and rotate the telescope until it is pointing straight overhead. The counterweight shaft is still horizontal. Then retighten both lock knobs.

Similarly, to point the telescope directly south, the counterweight shaft should again be horizontal. Then you simply

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rotate the scope on the Dec. axis until it points in the south direction.

What if you need to aim the telescope directly north, but at an object that is nearer to the horizon than Polaris? You can't do it with the counterweight down as pictured in Figure 3. Again, you have to rotate the scope in R.A. so the counterweight shaft is positioned horizontally. Then rotate the scope in Dec. so it points to where you want it near the horizon.

To point the telescope to the east or west, or in other directions, you rotate the telescope on its R.A. and Dec. axes. Depending on the altitude of the object you want to observe, the counterweight shaft will be oriented somewhere between vertical and horizontal.

Figure 7 illustrates how the telescope will look pointed at the four cardinal directions—north, south, east, and west

The key things to remember when pointing the telescope is that a) you only move it in R.A. and Dec., not in azimuth or latitude (altitude), and b) the counterweight and shaft will not always appear as it does in Figure 3. In fact, it almost never will!

## 6. Specifications

Mount: German-type equatorial.

Tripod: Aluminum with plastic feet.

Height: 15"

Weight: 10lbs. 6 oz.

Counterweight: 5.25 lbs.

Setting circles: RA scaled in 10-minute increments, Dec. scaled in 2.5° increments.

## One-Year Limited Warranty

This Orion Tabletop Equatorial Mount is warranted against defects in materials or workmanship for a period of one year from the date of purchase. This warranty is for the benefit of the original retail purchaser only. During this warranty period Orion Telescopes & Binoculars will repair or replace, at Orion's option, any warranted instrument that proves to be defective, provided it is returned postage paid to: Orion Warranty Repair, 89 Hangar Way, Watsonville, CA 95076. If the product is not registered, proof of purchase (such as a copy of the original invoice) is required.

This warranty does not apply if, in Orion's judgment, the instrument has been abused, mishandled, or modified, nor does it apply to normal wear and tear. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state. For further warranty service information, contact: Customer Service Department, Orion Telescopes & Binoculars, 89 Hangar Way, Watsonville, CA 95076; (800) 676-1343.

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