

INSTRUCTION MANUAL

Orion® AstroView 100 EQ™

#9862 100mm Equatorial Refracting Telescope



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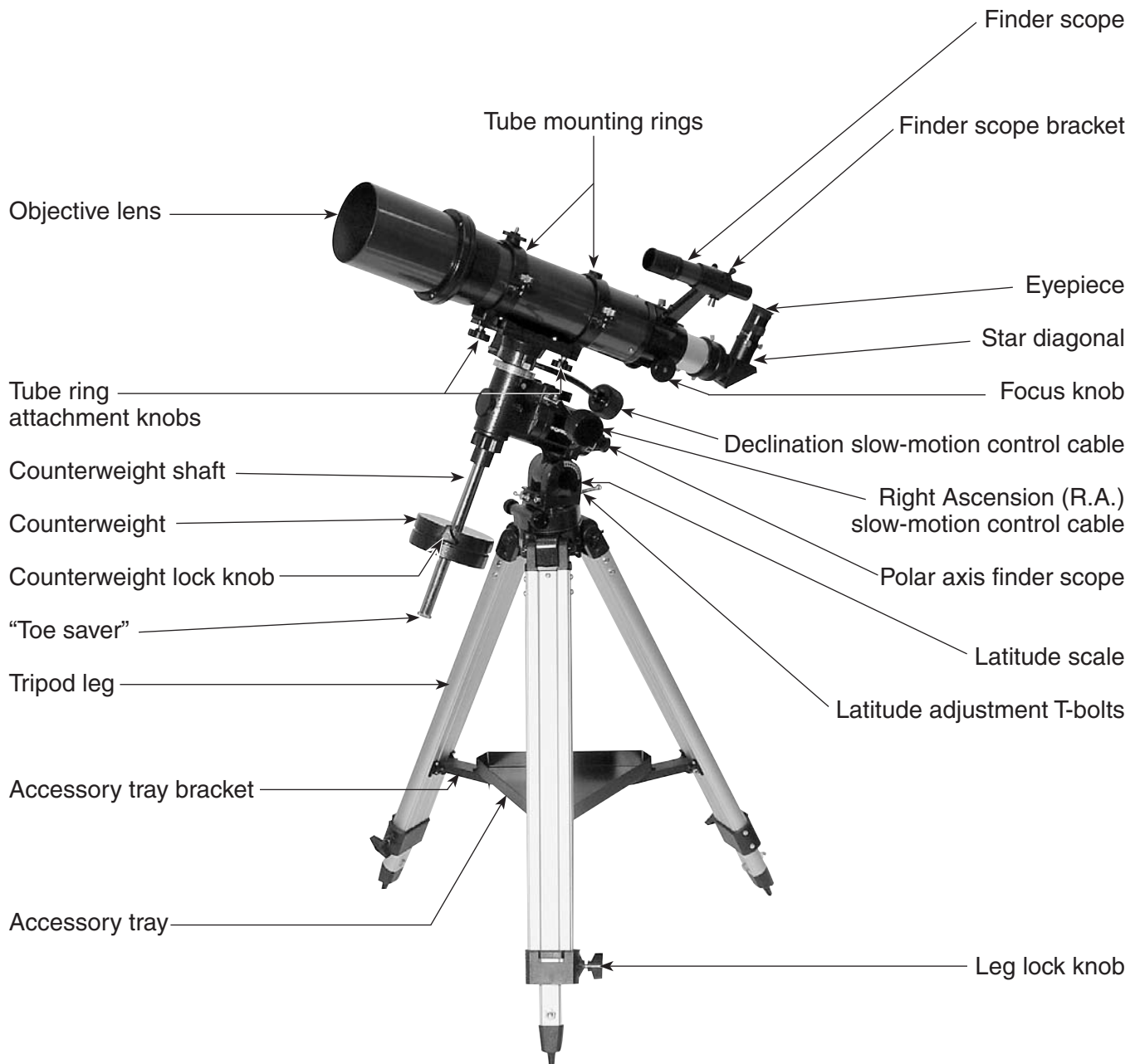


Figure 1. The AstroView 100 EQ Reflector.

Welcome to the exciting world of amateur astronomy! Your new AstroView 100 EQ Reflector is designed for high-resolution viewing of astronomical objects. With its precision optics and equatorial mount, you'll be able to locate and enjoy hundreds of fascinating celestial denizens, including the planets, Moon, and a variety of deep-sky galaxies, nebulas, and star clusters.

These instructions will help you set up, properly use, and care for your telescope. Please read them thoroughly before getting started.

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1. Parts List

- 1 Optical tube assembly
- 1 German equatorial mount
- 1 Counterweight shaft
- 1 Counterweight
- 3 Tripod legs with attached accessory tray bracket
- 3 Leg attachment screws with wingnuts and washers
- 3 Leg lock knobs
- 1 Accessory tray with mounting hardware
- 2 Slow-motion control cables
- 1 Polar axis finder scope
- 1 Plastic cover for polar axis
- 2 Tube mounting rings
- 2 Tube ring attachment knobs with washers
- 1 6x30 Achromatic crosshair finder scope
- 1 Finder scope bracket with O-ring
- 1 90° Star diagonal
- 1 25mm Sirius Plössl eyepiece
- 1 10mm Sirius Plössl eyepiece
- 1 Dust cap
- 1 Collimation tool

2. Assembly

Make sure all the parts listed in the Parts List are present and familiarize yourself with their features. Please keep the original shipping box and interior packaging. In the unlikely event that you should need to ship the original telescope back to Orion, you should use the original packaging.

Assembling the telescope for the first time should take about 30 minutes. No tools are needed other than the ones provided. All screws should be tightened securely to eliminate flexing and wobbling, but be careful not to over-tighten or the threads may strip. Refer to Figure 1 during the assembly process.

During assembly (and anytime, for that matter), do not touch the surfaces of the telescope objective lens, the lenses of the finder scope, or eyepiece lenses with your fingers. The optical surfaces have delicate coatings on them that can easily be damaged if touched inappropriately.

1. Lay the equatorial mount on its side. Attach the tripod legs one at a time to the mount using the leg attachment screws. Line up the holes in the top of the tripod leg with the holes in the base of the mount, and install the screw so it passes through the leg and the mount with one washer on both sides of the tripod leg. Tighten the wingnuts only finger-tight, for now.
2. Insert and tighten the leg lock knobs into the base of the tripod legs. For now, keep the legs at their shortest (fully retracted) length; you can extend them to a more desirable length later, after the scope is completely assembled.
3. Stand the tripod upright and spread the tripod legs apart as far as they will go, until the accessory tray bracket is taut. Attach the accessory tray to the bracket with the three wingnut screws already installed in the tray. Push the screws up through the holes in the bracket, then thread them into the holes in the tray.
4. Next, tighten the wingnuts at the top of the tripod legs, so the legs are securely fastened to the equatorial mount. Use the wrench and your fingers to do this.

Warning: Never look directly at the Sun through your telescope or its finder scope—even for an instant—without a professionally made solar filter that completely covers the front of the instrument, or permanent eye damage could result. Young children should use this telescope only with adult supervision.

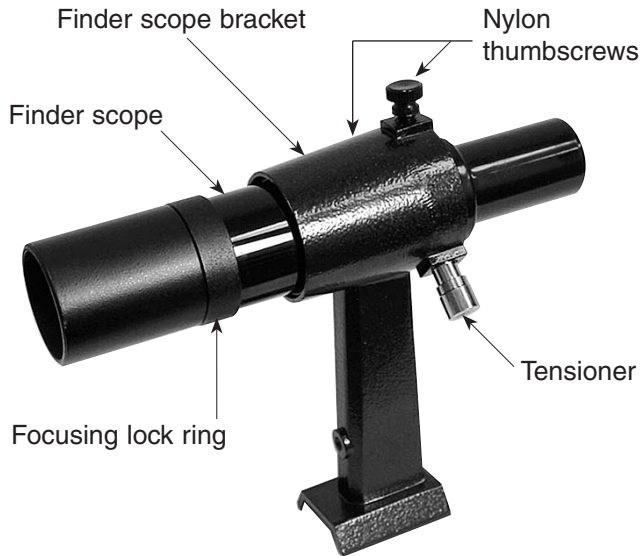


Figure 2a. The 6x30 finder scope

5. Orient the equatorial mount as it appears in Figure 1, at a latitude of about 40°, i.e., so the pointer next to the latitude scale is pointing to the line at “40”. To do this, loosen one of the latitude adjusting T-bolts and then tighten the other latitude adjusting T-bolt until the pointer and the “40” line up. The declination (Dec.) and right ascension (R.A.) axes may need re-positioning (rotation) as well. Be sure to loosen the RA and Dec. lock levers before doing this. Retighten them once the equatorial mount is properly oriented.
6. Thread the counterweight shaft into the equatorial mount at the base of the declination axis until tight. Make sure the casting at the top of the bar is threaded clockwise as far as it will go before attaching the shaft.
7. Remove the knurled “toe saver” retaining screw on the bottom of the counterweight shaft and slide the counterweight onto the shaft. Make sure the counterweight lock knob is adequately loosened so the metal pin inside the counterweight is recessed enough 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 toe saver on the end of the bar. The toe saver prevents the counterweight from falling on your foot if the lock knob happens to come loose.
8. Attach the two tube rings to the equatorial mount using the mounting ring attachment knobs. Place a lock washer, then a flat washer, on the shaft of each knob. With the washers attached, push the knob up through the holes in the top of the equatorial mount and rethread them into the bottom of the tube rings. Tighten the knobs securely. Open the tube rings by loosening the knurled ring clamps.
9. Lay the telescope optical tube in the tube rings. Position the optical tube in the rings so that the 1/4"-20 mounting block on the underside of the tube is centered relative to



Figure 2b. Pull-back on the tensioner and slide the finder scope into its bracket until the O-ring is seated in the bracket ring



Figure 3. The Focuser of the AstroView 100

the rings. Close the rings over the tube and tighten the knurled ring clamps finger-tight to secure the telescope.

10. Attach the two slow-motion control cables to the R.A. and Dec. worm gear shafts of the equatorial mount by positioning the small screw on the end of the cable over the indented slot on the worm gear shaft. Then tighten the screw. Use the short slow-motion control for the R.A. axis, it will stick out sideways from the mount. The longer slow-motion control moves the telescope on its Dec. axis and goes just under the optical tube, towards the focus wheels. See Part 4 for more information about the R.A. and declination axes.
11. Install the polar axis finder scope into its housing inside the R.A. axis of the equatorial mount. First loosen the three



Figure 4a.

Proper operation of the equatorial mount requires that the telescope tube be balanced on the R.A. axis. (a) With the R.A. lock lever released, slide the counterweight along the counterweight shaft until it just counterbalances the tube. (b) When you let go with both hands, the tube should not drift up or down. The telescope should be balanced in the Dec. axis already if you have properly centered the 1/4"-20 mounting block on the optical tube relative to the tube rings.



Figure 4b.

thumbscrews on the housing, which is located at the rear of the R.A. axis. Insert the front end of the polar finder (the end without the eyeguard) into the housing so only about 1" of the polar finder extends from the back of the housing. Do this slowly and with a twisting motion to prevent the internal O-ring from becoming unseated. If it does become unseated, you can remove the entire housing from the mount to locate the O-ring and reseal it. This is done by rotating the entire housing counterclockwise. Once the polar axis finder scope is in the housing, tighten the three thumbscrews. These thumbscrews will be used later to align the finder with the mount's R.A. axis.

Installing the Finder Scope

To place the finder scope in the finder scope bracket, first unthread the two black nylon screws until the screw ends are flush with the inside diameter of the bracket. Place the O-ring that comes on the base of the bracket over the body of the finder scope until it seats into the slot on the middle of the finder scope. Slide the eyepiece end (narrow end) of the finder scope into the end of the bracket's cylinder opposite the adjustment screws while pulling the chrome, spring-loaded tensioner on the bracket with your fingers (Figure 2b). Push the finder scope through the bracket until the O-ring seats just inside the front opening of the bracket cylinder. Now, release the tensioner and tighten the two black nylon screws a couple of turns each to secure the finder scope in place. Insert the base of the finder scope bracket into the dovetail slot on the top of the focuser. Lock the bracket into position by tightening the knurled thumbscrew on the dovetail slot.

Inserting the Eyepiece

Loosen the thumbscrew on the 1.25" eyepiece adapter (Figure 3) and insert the chrome barrel of the star diagonal into the adapter. Then, loosen the thumbscrews on the star diagonal

and remove the small dust cap. Then insert the 25mm Sirius Plössl eyepiece into the focuser and secure it with the thumbscrews.

Your telescope is now completely assembled and should appear as shown in Figure 1.

3. Getting Started

Balancing the Telescope

To ensure smooth movement of the telescope on both axes of the equatorial mount, it is imperative that the optical tube is properly balanced. We will first balance the telescope with respect to the R.A. axis.

1. Keeping one hand on the telescope optical tube, loosen the R.A. lock lever. Make sure the Dec. lock lever is locked, for now. 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 (Figure 4a). That's the point at which the shaft remains horizontal even when you let go with both hands (Figure 4b).
3. Retighten the counterweight lock knob. The telescope is now balanced on the R.A. axis.

The telescope should be balanced in the Dec. axis already if you have properly centered the 1/4"-20 mounting block on the optical tube relative to the tube rings.

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

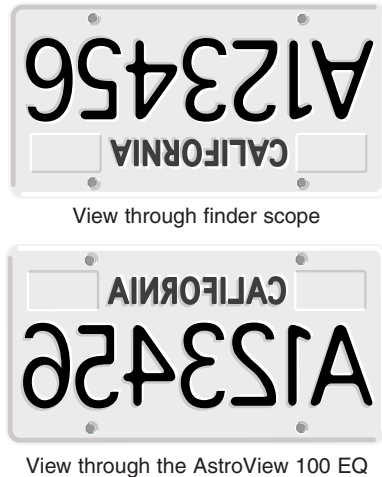


Figure 5. Images through the finder scope will appear upside-down and backwards (rotated 180°). Images through the AstroView 100 EQ with its diagonal in place will be reversed from left-to right.

Focusing the Telescope

You should now try to familiarize yourself with focusing the telescope. With the 25mm eyepiece inserted in the diagonal, point the telescope in the general direction of an object at least a 1/4 mile away. With your fingers, slowly rotate one of the focus knobs until the object comes into sharp focus. If the focuser motion is stiff, loosen the focus lock thumb screw (Figure 3) until it moves more smoothly. Go a little bit beyond sharp focus until the object starts to blur again, then reverse the direction of the focus knob, just to make sure you've hit the exact focus point.

NOTE: *The image in the telescope will appear reversed left-to-right. This is normal for astronomical refractor telescopes that use a star diagonal. The finder scope view will be rotated 180° (see Figure 5).*

If you have trouble focusing, rotate the focus knob so the drawtube is in as far as it will go. Now look through the eyepiece while slowly rotating the focusing knob in the opposite direction. You should soon see the point at which focus is reached. You will have to re-adjust the focus when aiming at subjects of varying distances, or after changing eyepieces.

Viewing with Eyeglasses

If you wear eyeglasses, you may be able to keep them on while you observe, if the eyepiece has enough "eye relief" to allow you to see the whole field of view. You can try this by looking through the eyepiece first with your glasses on, and then with them off, and see if the glasses restrict the view to only a portion of the full field. If they do, you can easily observe with your glasses off by just re-focusing the telescope the needed amount. If you suffer from severe astigmatism, however, you may find images noticeably sharper with your glasses on.

Aligning the Finder Scope

The AstroView 100 EQ comes with a 6x30 achromatic finder scope (Figure 2a). The number 6 means six-times magnifi-

cation and the 30 indicates a 30mm diameter front lens. The finder scope makes it easier to locate the subject you want to observe in the telescope, because the finder scope has a much wider field of view.

The AstroView 100 EQ's finder scope uses a spring-loaded bracket that makes alignment of the finderscope very easy. As you turn either of the thumbscrews, the spring in the bracket's tensioner moves in and out to keep the finder scope secure in the bracket.

The finder scope must be aligned accurately with the telescope for proper use. To align it, first aim the main telescope in the general direction of an object at least a 1/4 mile away—the top of a telephone pole, a chimney, etc. To aim the telescope, loosen the R.A. and Dec. lock levers and move it until it is pointing at the desired object. Sight along the tube for easiest aiming. Turn the focus knob until the object is properly focused. Center the object in the telescope's eyepiece by turning the R.A. and Dec. slow-motion controls.

Now look in the finder scope. Is the object visible? Ideally it will be somewhere in the field of view. If not, some coarse adjustment to the finder scope bracket's alignment thumbscrews will be needed until the object comes into the finder scope's field of view.

With the image in the finder scope's field of view, you can now fine-adjust the alignment thumbscrews to center the object on the intersection of the crosshairs. Adjust the aim of the finder scope by turning the thumbscrews, one at a time, until the object is centered.

The finder scope alignment needs to be checked before every observing session. This can easily be done at night, before viewing through the telescope. Choose any bright star or planet, center the object in telescope eyepiece, and then adjust the finder scope bracket's alignment thumbscrews until the star or planet is centered on the finder's crosshairs.

Focusing the finder scope

If, when you look through the finder scope, the images appear somewhat out of focus, you will need to refocus the finder scope for your eyes. Loosen the lock ring located behind the objective lens cell on the body of the finder scope (see Figure 2a). Back the lock ring off by a few turns, for now. Refocus the finder scope on a distant object by threading the objective lens cell in or out of the finderscope body. Precise focusing will be achieved by focusing the finder scope on a bright star. Once the image appears sharp, retighten the lock ring behind the objective lens cell. The finder scope's focus should not need to be adjusted again.

4. Setting up 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 6) is designed to compensate for that motion, allowing you to easily "track" the

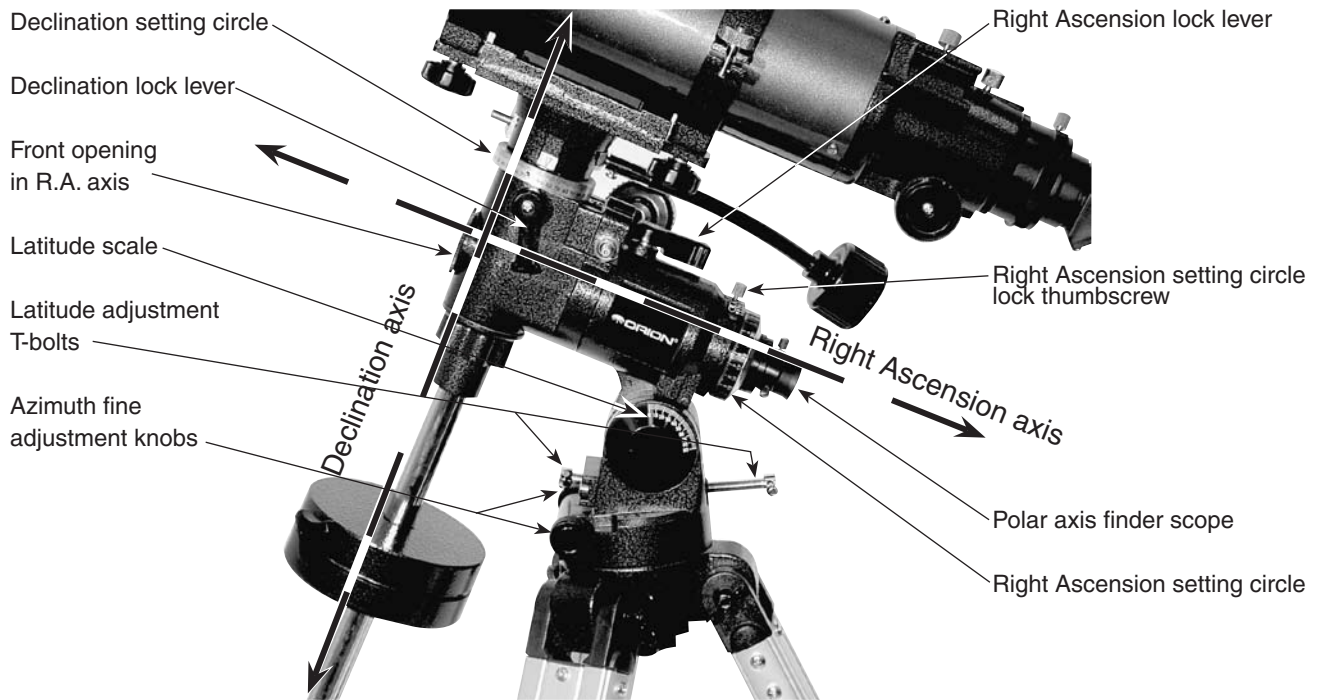


Figure 6. The equatorial mount of the AstroView 100 EQ.

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 Polaris.

To find Polaris in the sky, look north and locate the pattern of the Big Dipper (Figure 7). 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).

For general visual observation, an approximate polar alignment is sufficient:

1. Level the equatorial mount by adjusting the length of the three tripod legs.
2. Loosen one of the latitude adjusting T-bolts and tighten the other to tilt the mount until the pointer on the latitude scale is set at the latitude of your observing site. If you don't

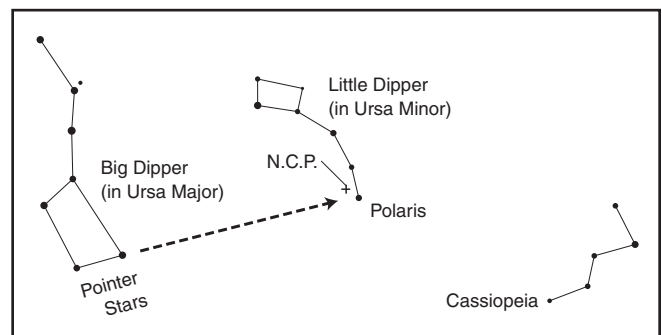


Figure 7. To find Polaris in the night sky, look north and find the Big Dipper. Extend an imaginary line from the two "Pointer Stars" in the bowl of the Big Dipper. Go about five times the distance between those stars and you'll reach Polaris, which lies within 1° of the north celestial pole (NCP).

know your latitude, consult a geographical atlas to find it. For example, if your latitude is 35° North, set the pointer to +35. 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 lever and rotate the telescope optical tube until it is parallel with the R.A. axis. The pointer on the Dec. setting circle should read 90°. Retighten the Dec. lock lever.
4. Move the tripod 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

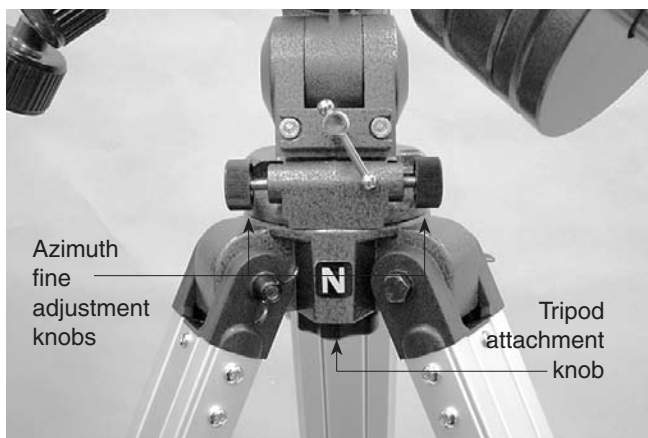


Figure 8. For polar alignment, position the tripod so that the “N” label at the base of the mount faces north. The two azimuth fine adjustment knobs above it are used to make small adjustments to the mount’s azimuth position.

tripod so the telescope points north. There is a label bearing a large “N” at the base of the equatorial mount (Figure 8). It should be facing north.

The equatorial mount is now approximately polar-aligned for casual observing. More precise polar alignment is required for astrophotography and for use of the manual setting circles.

From this point on in your observing session, you should not make any further adjustments to 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.

The Polar Axis Finder Scope

A feature of the AstroView 100 EQ is the polar axis finder scope housed inside the R.A. axis of the equatorial mount (see Figure 9). When properly aligned and used, it makes accurate polar alignment quick and easy to do. Alignment of the polar finder need only be done once, unless it gets bumped or otherwise shifts its position.

Remove the cover cap from the front opening in the R.A. axis of the mount (see Figure 6). Look through the polar finder at a distant object. Focus the polar finder so that the images and reticle are sharp by rotating the eyepiece end of the finder. Notice that the reticle pattern consists of a crosshair with a circle around the middle. On the circumference of this circle is a tiny circle; this is where Polaris will be placed for accurate polar alignment once the finder is properly aligned. Alignment of the polar finder is best done during the day, before going out into the field at night.

Aligning the Polar Axis Finder Scope

Aligning the polar axis finder scope so that it will accurately point at the true north pole is a two-step procedure. First, the polar finder must be rotated in its housing so that the small circle in which Polaris will be placed is in the proper initial position. Next, the polar axis finder must be adjusted so that it points directly along the mount’s R.A. axis.

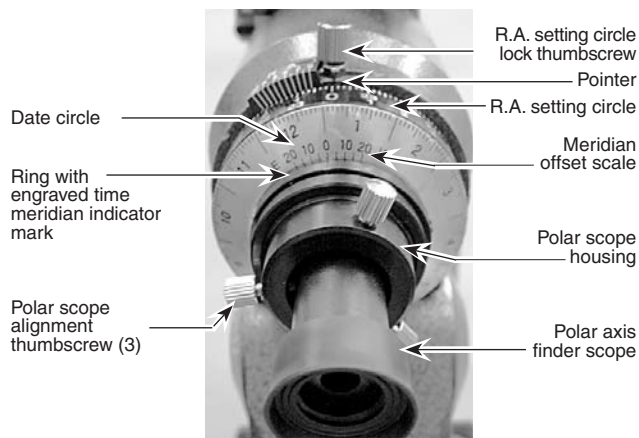


Figure 9. The polar axis finder scope installed in the right ascension (R.A.) axis of the mount.

We will start by aligning the polar finder rotationally. Refer to Figure 9.

1. Loosen the large thumbscrew just above the R.A. setting circle. Rotate the R.A. setting circle until the line above the “0” on the setting circle lines up with the pointed indicator that is cast into the mount (located directly below the large thumbscrew; see Figure 8). Retighten the thumbscrew.
2. Rotate the date circle until the “0” line on the meridian offset scale lines up with the time meridian indicator mark. The meridian offset scale is printed on the inner circumference of the date circle, and is labeled “E20” to “W20”. The time meridian indicator mark is an engraved line on the exterior of the polar finder’s housing. It is on the “ring” of the housing that is closest to the date circle.
3. The R.A. setting circle is labeled in hours, from “0” to “23” (military time). For Northern Hemisphere observers, refer to the top numbers on the setting circle. Each small line represents 10 minutes of R.A. The date circle is labeled from “1” to “12”, with each number representing a month of the year (“1” is January, “2” is February, etc.). Each small line represents a two-day increment.
4. Loosen the R.A. lock lever and rotate the mount about the R.A. axis until the March 1 indicating mark (the long line between the “2” and the “3”) on the date circle lines up with the 4 PM mark (the long line above the “16”) on the R.A. setting circle. You may find it convenient to remove both the counterweights and the telescope optical tube to do this.
5. Now, loosen the three thumbscrews on the polar finder housing and rotate the polar finder so the small circle where Polaris will be centered is located straight down from the intersection of the crosshairs. Retighten the thumbscrews.

The polar axis finder scope is now properly set in its initial position. Next, you must align it so that it is exactly parallel to the mount’s R.A. axis:

6. Look through the polar finder at a distant object (during the day) and center it in the crosshairs. You may need to adjust the latitude adjustment T-bolts and the tripod position to do this.

7. Rotate the mount 180° about the R.A. axis. Again, it may be convenient to remove the counterweights and optical tube first.
8. Look through the polar finder again. Is the object being viewed still centered on the crosshairs? If it is, then no further adjustment is necessary. If not, then look through the polar finder while rotating the mount about the R.A. axis. You will notice that the object you have previously centered moves in a circular path. Use the three thumbscrews on the housing to redirect the crosshairs of the polar finder to the apparent center of this circular path. Repeat this procedure until the position that the crosshairs point to does not rotate off-center when the mount is rotated in R.A. Once this is accomplished, retighten the thumbscrews.

The polar axis finder scope is now ready to be used. When not in use, replace the plastic protective cover to prevent the polar finder from getting bumped, which could knock it out of alignment.

Using the Polar Axis Finder

When using the polar finder in the field at night, you will need a red flashlight to illuminate the finder's reticle. Shine the flashlight at an angle into the front opening in the R.A. axis. Do not shine it directly into the opening, or the light will be too bright, and you will also obstruct the view of the polar finder. It may be helpful to have a friend hold the flashlight while you look through the polar finder.

For most accurate polar alignment, you will need to know the approximate longitude of your observing site. This information can be obtained by looking at a local map. Now, figure the difference between the longitude of your observing site and the closest standard time meridian. The standard time meridians are 75°, 90°, 105°, and 120° for the 48 continental states (150° and 165° for Hawaii and Alaska). Choose the standard time meridian that is closest in value to your local longitude, and then calculate the difference. If your local longitude has a value less than the closest standard time meridian, you are east of the standard time meridian by the calculated amount. If your local longitude has a value greater than the closest standard time meridian, you are west of the standard time meridian by the calculated amount. For example, if you are in Las Vegas, which has a longitude of 115°, the closest standard time meridian is 120°. The difference between these two numbers is 5°. Since Las Vegas' longitude value is less than the standard time meridian value, you are 5° east of the closest time meridian.

Take your calculated difference from the closest standard time meridian and rotate the date circle so that the meridian offset scale line that corresponds to your calculated difference lines up with the engraved time meridian indicator mark on the polar finder housing. Each line of the meridian offset scale represents 5° of longitude. Lines to the left of the "0" on the meridian offset scale indicate east of the closest standard time meridian, while lines to the right of the "0" indicate west of the closest standard time meridian.

Continuing with the prior example of observing in Las Vegas, you would rotate the date circle so that the first line to the left

of the "0" on the meridian offset scale lines up with the time meridian indicator mark.

Make sure that the "0" mark on the R.A. setting circle lines up with the pointed indicator cast into the mount, and that the large thumbscrew just above it is tightened. Now, rotate the mount about the R.A. axis until the line on the R.A. setting circle that corresponds to your current local time lines up with the line on the date circle that indicates the current date. If you are on daylight savings time, subtract one hour from your current local time. For example, if it was November 1 at 9 PM, standard time, you would rotate the telescope in R.A. until the line above the "21" (9 P.M.) on the R.A. setting circle lines up with the long line between the "10" and "11" on the date circle. The long line indicates the first day of the higher numbered month, i.e. the line between "10" and "11" marks November 1st.

Finally, look through the polar alignment finder scope while shining a red flashlight at an angle down the front opening of the R.A. axis, and center Polaris in the small circle. Adjust the tilt of the altitude up-or-down with the latitude adjustment T-bolts and use the azimuth fine adjustment knobs (Figure 8) for final positioning. To do this, you will first need to loosen the big tripod attachment knob directly underneath the base of the equatorial mount. The fine adjustment knobs work by loosening one and then tightening the other. When done, retighten the tripod attachment knob to firmly secure the mount and tripod. If the fine adjustment knobs do not allow the mount to move far enough to center Polaris, you will need to rotate the entire tripod left or right to get it within the fine adjustment's range.

Once Polaris is centered in the small circle, you are done. The telescope is now accurately polar aligned, and can be used for advanced observational applications, such as astrophotography or precise use of the manual setting circles. As mentioned before, only move the telescope along the R.A. and Dec. axes; if you move the tripod, or change the tilt of the equatorial mount, you will need to polar align again.

Remember, accurate polar alignment is not needed for casual visual observing. Most of the time, approximate polar alignment, as outlined previously, will suffice.

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. The Dec. slow-motion control is not needed for tracking. Objects will appear to move faster at higher magnifications, because the field of view is narrower.

Optional Motor Drive

Optional DC motor drive systems can be mounted on the AstroView 100 EQ's 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. A motor drive system is necessary for astrophotography.

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 R.A. setting circle is scaled in hours, from 1 through 24, with small marks in between representing 10 minute increments (there are 60 minutes in 1 hour of R.A.). The upper set of numbers apply to viewing in the Northern Hemisphere, while the numbers below them apply to viewing in the Southern Hemisphere. The location of the R.A. coordinate indicator arrow shown in Figure 5.

The Dec. setting circle is scaled in degrees, with each mark representing 2° 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 well polar aligned, and the R.A. setting circle must be calibrated. The Dec. setting circle has been 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 levers 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 levers. Center the star in the telescope's field of view with the slow-motion control cables.
4. Loosen the R.A. setting circle lock thumbscrew (see Figure 9); this will allow the setting circle to rotate freely. Rotate the setting circle until the arrow under the thumbscrew indicates the R.A. coordinate listed in the star atlas for the object. Do not retighten the thumbscrew when using the R.A. setting circles for finding objects; the thumbscrew is only needed for polar alignment using the polar axis finder scope.

Finding Objects With the Setting Circles

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

1. Loosen the Dec. lock lever 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 lever.
2. Loosen the R.A. lock lever 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 lever.

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.

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 1 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?

DO NOT make any adjustment to the latitude adjustment T-bolts. That will spoil 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 lever and rotate the telescope on the R.A. axis until the counterweight shaft is horizontal (parallel to the ground). Then loosen the Dec. lock lever and rotate the telescope until it is pointing straight overhead. The counterweight shaft is still horizontal. Then retighten both lock levers.

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 1. Again, you have to rotate the scope in R.A. so that 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 directly south, the counterweight shaft should again be horizontal. Then you simply rotate the scope on the Dec. axis until it points in the south direction.

To point the telescope to the east or west, or in other directions, you rotate the telescope on its R.A. and Dec. axes.



Figure 10 This illustration shows the telescope pointed in the four cardinal directions (a) North, (b) South, (c) East, (d) West. Note that the tripod and mount have not been moved; only the telescope tube has moved on the 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 10 illustrates how the telescope will look when pointed at the four cardinal directions: north, south, east and west.

The key things to remember when pointing the telescope are 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 1. In fact it almost never will!

5. Astronomical Observing

Site Selection

Pick a location away from streetlights and bright yard lighting. Avoid viewing over rooftops and chimneys, as they often have warm air currents rising from them, which distort the image seen in the eyepiece. Similarly, you should not observe through an open window from indoors. Better yet, choose a site out-of-town, away from any “light pollution”. You’ll be stunned at how many more stars you’ll see! Most importantly, make sure that any chosen site has a clear view of a large portion of the sky.

Cooling Your Telescope

As a general rule, telescopes should be allowed to “cool down” (or warm up) before they are used. If you bring optics from a warm air to cold air (or vice versa) without giving it time to reach “thermal equilibrium”, your telescope will give you distorted views. Allow your telescope 30 minutes to reach the temperature of the outdoors before using.

Seeing and Transparency

Atmospheric conditions play a huge part in quality of viewing. In conditions of good “seeing”, star twinkling is minimal and objects appear steady in the eyepiece. Seeing is best overhead, worst at the horizon. Also, seeing generally gets better after midnight, when much of the heat absorbed by the Earth during the day has radiated off into space. Typically, seeing conditions will be better at sites that have an altitude over about 3000 feet. Altitude helps because it decreases the amount of distortion causing atmosphere you are looking through.

A good way to judge if the seeing is good or not is to look at bright stars about 40° above the horizon. If the stars appear to

“twinkle”, the atmosphere is significantly distorting the incoming light, and views at high magnifications will not appear sharp. If the stars appear steady and do not twinkle, seeing conditions are probably good and higher magnifications will be possible. Also, seeing conditions are typically poor during the day. This is because the heat from the Sun warms the air and causes turbulence.

Good “transparency” is especially important for observing faint objects. It simply means the air is free of moisture, smoke, and dust. All tend to scatter light, which reduces an object’s brightness.

One good way to tell if conditions are good is by how many stars you can see with your naked eye. If you cannot see stars of magnitude 3.5 or dimmer then conditions are poor. Magnitude is a measure of how bright a star is, the brighter a star is, the lower its magnitude will be. A good star to remember for this is Megrez (mag. 3.4), which is the star in the “Big Dipper” connecting the handle to the “dipper”. If you cannot see Megrez, then you have fog, haze, clouds, smog, light pollution or other conditions that are hindering your viewing. (See Figure 11)

Let Your Eyes Dark-Adapt

Do not expect to go from a lighted house into the darkness of the outdoors at night and immediately see faint nebulas, galaxies, and star clusters - or even very many stars, for that matter. Your eyes take about 30 minutes to reach perhaps 80% of their full dark-adapted sensitivity. Many observers notice improvements after several hours of total darkness. As your eyes become dark-adapted, more stars will glimmer into view and you will be able to see fainter details in objects you view in your telescope. So give yourself at least a little while to get used to the dark before you begin observing.

To see what you are doing in the darkness, use a red light flashlight rather than a white light. Red light does not spoil your eyes’ dark adaptation like white light does. A flashlight with a red LED light is ideal, or you can cover the front of a regular flashlight with red cellophane or paper. Beware, too, that nearby porch and streetlights and automobile headlights will spoil your night vision.

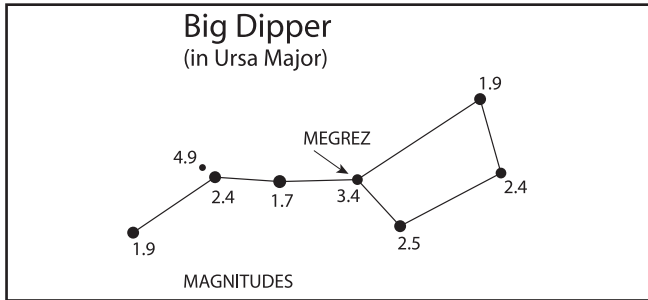


Figure 11. Megrez connects the Big Dipper’s handle to its “pan”. It is a good guide to how conditions are. If you can not see Megrez (a 3.4 mag star) then conditions are poor.

Calculating Magnification (Power)

To calculate the magnification, or power, of a telescope with an eyepiece, simply divide the focal length of the telescope by the focal length of the eyepiece:

$$\frac{\text{Telescope focal length}}{\text{Eyepiece focal length}} = \text{Magnification}$$

For example, the AstroView 100 EQ, which has a focal length of 600mm, used in combination with the included 25mm Sirius Plössl eyepiece, yields a magnification of:

$$\frac{600\text{mm}}{25\text{mm}} = 24\text{x}$$

It is desirable to have a range of eyepieces of different focal lengths to allow viewing over a range of magnifications. Your telescope comes with two high-quality Sirius Plössl eyepieces, a 25mm that yields 24x, and a 10mm that yields 60x. It is not uncommon for an observer to own five or more eyepieces. Orion offers many different eyepieces of varying focal lengths, so check the catalog or website for a wide selection of additional eyepieces to choose from.

Every telescope has a useful magnification limit of about 2x per millimeter of aperture (i.e. 200x for the AstroView 100 EQ). Claims of higher power by some telescope manufacturers are a misleading advertising gimmick and should be dismissed. Keep in mind that at higher powers, an image will always be dimmer and less sharp (this is a fundamental law of optics). The steadiness of the air (the “seeing”) can also limit how much magnification an image can tolerate.

Always start viewing with your lowest-power (longest focal length) eyepiece in the telescope. It’s best to begin observing with the lowest-power eyepiece because it will typically provide the widest true field of view, which will make finding and centering objects much easier. After you have located and centered an object, you can try switching to a higher-power eyepiece to ferret out more detail, if atmospheric conditions permit. If the image you see is not crisp and steady, reduce the magnification by switching to a longer focal length eyepiece. As a general rule, a small but well-resolved image will show more detail and provide a more enjoyable view than a dim and fuzzy, overmagnified image.

Use of 2" Eyepieces

A feature of the AstroView 100 EQ is its ability to use either 1.25" or 2" barrel-diameter eyepieces. At low magnifications, 2" eyepieces can give a wider field of view than standard 1.25" eyepieces. This is especially desirable for observing deep-sky objects, as many of them appear quite large, but faint. If you want to use 2" eyepieces, you will need to use a 2" star diagonal for refractors, or a 2" extension tube, so that the telescope will properly come to focus.

To use 2" eyepieces, simply loosen the two large thumbscrews on the 2" adapter that are just in front of the thumbscrew that holds the provided 1.25" star diagonal in place (see Figure 3). Once these thumbscrews are loosened, the entire back end of the focuser, including any 1.25" diagonal and eyepiece that may be attached, comes off, exposing the 2" diameter focuser drawtube. Now, insert your 2" star diagonal into the drawtube and secure with the two thumbscrews loosened previously. Insert a 2" eyepiece into the diagonal, secure it in place with the thumbscrew on the diagonal, and you’re ready to observe.

Note About Chromatic Aberration

Chromatic aberration literally means color distortion. Whenever light passes through one material to another, light of different wavelengths (color) is bent by different amounts. This is a problem that plagues refractor-type telescopes, since light passes through both air and glass to form an image. Most astronomical objects emit a spectrum comprised of many different wavelengths of light, so each wavelength will be bent by a slightly different amount when passing through a lens. This results in each color of light reaching precise focus at a slightly different point, which will provide unacceptable images.

Achromatic refractors, like the AstroView 100 EQ, are designed to minimize chromatic aberration to acceptable levels. The objective lens is actually comprised of two individual lenses, called elements, made of different materials, which bend light in slightly different ways. By precisely spacing and shaping the elements, the chromatic aberration incurred when light passes through air and the first glass element is reduced by the way the second element bends the light. The result is an image that is much better color corrected than a non-achromatic (one element) objective lens.

Even with the achromatic lens design, however, the AstroView 100 EQ will suffer a bit from chromatic aberration due to its relatively large aperture and short focal length. This will be noticeable, to some degree, on extremely bright objects, such as the Moon and bright planets. What you will notice is that the object, when focused, has a slight “purple-halo” around it. This will not present a problem for most observers, as the eye readily adapts to the view and is still able to distinguish fine details. Chromatic aberration will never inhibit deep sky observing, as deep sky objects are too faint to cause any noticeable color distortion.

Now that you are all set up and ready to go, one critical decision must be made: what to look at?

What to Expect

So what will you see with your telescope? You should be able to see bands on Jupiter, the rings of Saturn, craters on the moon, the waxing and waning of Venus, and possibly hundreds of deep sky objects. Do not expect to see as much color as you in NASA photos, since those are taken with long-exposure cameras and have “false color” added. Our eyes are not sensitive enough to see color in deep-sky objects except in a few of the brightest ones.

Remember that you are seeing these objects using your own telescope with your own eyes! The object you see in your eyepiece is in real-time, and not some conveniently provided image from an expensive space probe. Each session with your telescope will be a learning experience. Each time you work with your telescope it will get easier to use, and stellar objects will become easier to find. Take it from us, there is big difference between looking at a well-made full-color NASA image of a deep-sky object in a lit room during the daytime, and seeing that same object in your telescope at night. One can merely be a pretty image someone gave to you. The other is an experience you will never forget!

A. The Moon

With its rocky and cratered surface, the moon is one of the most interesting and easy subjects for your scope. The best time to view it is during its partial phases when shadows fall on the craters and canyon walls to give its features definition. While the full moon may look like a tempting target, it is actually the worst time for viewing! The light of a full moon is too bright and lacks any decent surface definition.

Use an optional Moon filter to dim the Moon when it is very bright. It simply threads onto the bottom of the eyepiece (you must first remove the eyepiece from the focuser to attach the filter). You’ll find the Moon filter improves viewing comfort, and helps bring out the subtle features in the lunar surface.

B. The Planets

The planets don’t stay put like stars do, so you will have to refer to charts published monthly on our website, telescope.com, or other astronomy references to locate them. Venus, Mars, Jupiter, and Saturn are the brightest objects in the sky after the Sun and the Moon. All four of these planets are not normally visible in the sky at one time, but chances are one or two of them will be. Other planets will also be visible at times, but will appear star-like when viewed through your telescope.

JUPITER The largest planet, Jupiter, is a great subject to observe. You can see the disk of the giant planet and watch the ever-changing positions of its four largest moons, Io, Callisto, Europa, and Ganymede. If atmospheric conditions are good, you may be able to resolve thin cloud bands on the planet’s disk.

SATURN The ringed planet is a breathtaking sight when it is well positioned. The tilt angle of the rings varies over a period of many years; sometimes they are seen edge-on, while at other times they are broadside and look like giant “ears” on each side of Saturn’s disk. A steady atmosphere (good seeing) is necessary for a good view. You may see a tiny, bright “star” close by; that’s Saturn’s brightest moon, Titan.

VENUS At its brightest, Venus is the most luminous object in the sky, excluding the Sun and the Moon. It is so bright that sometimes it is visible to the naked eye during full daylight! Ironically, Venus appears as a thin crescent, not a full disk, when at its peak brightness. Because it is so close to the Sun, it never wanders too far from the morning or evening horizon. No surface markings can be seen on Venus, which is always shrouded in dense clouds.

MARS If atmospheric conditions are good, you may be able to see some subtle surface detail on the Red Planet, possibly even the polar ice cap. Mars makes a close approach to Earth every two years; during those approaches its disk is larger and thus more favorable for viewing.

C. The Sun

You can change your nighttime scope into a daytime Sun viewer by installing an optional full-aperture solar-filter over the front opening of the AstroView 100 EQ. The primary attraction is sunspots, which change in shape, appearance, and location daily. Sunspots are directly related to magnetic activity in the sun and follow an 11 year cycle. Many observers like to make drawings of sunspots to monitor how the sun is changing from day to day.

Important Note: Do not look at the Sun with any optical instrument without a professionally made solar filter, or permanent eye damage could result. Also remember to cover or remove the finder scope before attempting to view the sun.

D. Stars

Stars will appear like twinkling points of light in the telescope. Even the largest telescopes cannot magnify stars to appear as anything more than points of light! You can, however, enjoy the different colors of the stars and locate many pretty double and multiple stars. The famous “Double-Double” in the constellation Lyra and the gorgeous two-color double star Albireo in Cygnus are favorites. Defocusing the image of a star slightly can help bring out its color.

E. Deep-Sky Objects

Under dark skies, you can observe a number of brighter deep-sky objects with your AstroView 100 EQ, including gaseous nebulae, open and globular star clusters, and the brighter galaxies. Most deep-sky objects are very faint, so it is important that you find an observing site well away from light pollution. Take plenty of time to let your eyes adjust to the darkness. As you become more experienced and your observing skills improve, you will be able to coax out more and more intricate details.

Finding Deep-Sky Objects: Starhopping

Starhopping, as it is called by astronomers, is perhaps the simplest way to hunt down objects to view in the night sky. It entails first pointing the telescope at a star close to the object you wish to observe, and then progressing to other stars closer and closer to the object until it is in the field of view of the eyepiece. It is a very intuitive technique that has been employed for hundreds of years by professional and amateur astronomers alike. Keep in mind,

as with any new task, that starhopping may seem challenging at first, but will become easier over time and with practice.

To starhop, only a minimal amount of additional equipment is necessary. A star chart or atlas that shows stars to at least magnitude 5 is required. Select one that shows the positions of many deep-sky objects, so you will have lots of options to choose from. If you do not know the positions of the constellations in the night sky, you will need to get a planisphere to identify them.

Start by choosing bright objects to view. The brightness of an object is measured by its visual magnitude; the brighter an object, the lower its magnitude. Choose an object with a visual magnitude of 9 or lower. Many beginners start with the Messier objects, which represent some of the best and brightest deep-sky objects.

Determine in which constellation the object lies. Now, find the constellation in the sky. If you do not recognize the constellations on sight, consult a planisphere. The planisphere gives an all-sky view and shows which constellations are visible on a given night at a given time.

Now, look at your star chart and find the brightest star in the constellation that is near the object you are trying to find. Using the finder scope, point the telescope at this star and center it in the crosshairs. Next, look again at the star chart and find another suitably bright star near the bright star currently centered in the finder. Keep in mind that the field of view of the finder scope is 7°, so you should choose another star that is no more than 7° from the first star, if possible. Move the telescope slightly, until it is centered on the new star.

Continue using the stars as guideposts until you are at the approximate position of the object you are trying to find (Figure 12). Look in the telescope's eyepiece, and the object should be somewhere in the field of view. If it's not, sweep the telescope carefully around the immediate vicinity until the object is found.

If you have trouble finding the object, start the starhop again from the brightest star near the object you wish to view. This time, be sure the stars indicated on the star chart are in fact the stars you are centering in the eyepiece.

6. Terrestrial Observing

The AstroView 100 optical tube can be used for long-distance viewing over land. We recommend using a 45° correct-image diagonal instead of the included 90° mirror star diagonal. The correct-image diagonal will yield upright, non-reversed images and provides a more comfortable viewing angle. An optional altazimuth mount or a sturdy camera tripod, as opposed to the AstroView equatorial mount, is recommended for terrestrial viewing. This is because the equatorial mount is designed for tracking the motion of stars, and is not very easy to aim at terrestrial objects. The AstroView 100 EQ's optical tube has a mounting block that will accept the 1/4"-20 threaded stud used on most camera tripods.

For terrestrial viewing, it's best to stick with low power eyepieces that yield a magnification of under 100x. At higher powers, images rapidly lose sharpness and clarity due to "heat waves" caused by Sun-heated air.

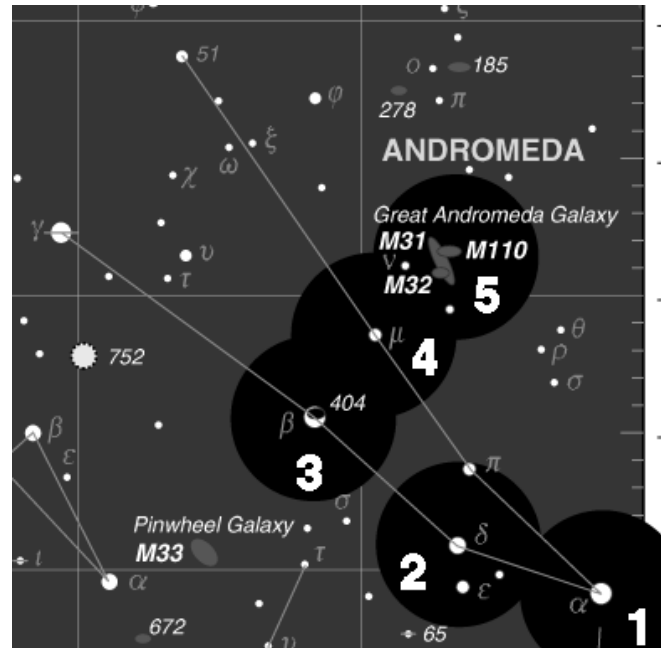


Figure 12. Starhopping is a good way to locate hard-to-find objects. Refer to a star chart to map a route to the object that uses bright stars as guideposts. Center the first star you've chosen in the finder scope and telescope eyepiece (1). Now move the scope carefully in the direction of the next bright star (2), until it is centered. Repeat (3 and 4). The last hop (5) should place the desired object in the eyepiece.

Remember to aim well clear of the Sun, unless the front of the telescope is fitted with a professionally made solar filter and the finder scope is covered by an opaque material or removed altogether.

7. Photography

When coupled to a 35mm single-lens reflex camera, the AstroView100 EQ becomes a telephoto lens. To attach a camera, you need only a T-ring for your specific camera model. The T-ring attaches to your camera and threads onto the AstroView 100 EQ's 1.25" eyepiece adapter (see Figure 3).

Use the camera's viewfinder to frame the picture. Use the telescope's focuser to focus the image. Tighten the focus lock thumbscrew in order to keep the telescope in focus. You may want to consider using a remote shutter release instead of the shutter release on the camera; touching the camera can vibrate the system and blur the resulting photographic image on the film.

If you would like to change the orientation of the camera relative to the telescope, do so by first loosening the thumbscrews on the 2" adapter. You can then rotate the camera (and 1.25" eyepiece adapter) to the desired orientation. Retighten the thumbscrews when done.



Figure 13. The collimating tool in the AstroView 100 focuser.

8. Collimation

The AstroView 100 EQ telescope has objective lens cell which incorporates a collimation adjustment; this helps to ensure peak optical performance. Collimation is the process of aligning the telescope's optics. In the case of the AstroView 100 EQ, collimation entails tilting the objective lens assembly so that the optical axis is precisely parallel to the telescope's focuser. The telescope has been collimated at the factory, so no adjustments to the lens cell are likely to be necessary. If you are unsure or uncomfortable about making collimation adjustments, we strongly recommend that you just leave it alone.

Your AstroView 100 EQ comes with a collimation tool. Figure 13 shows the collimation tool in place.

Use of the collimating tool is best done during the day, either outdoors or in a well-lit room. Point the telescope at a dark target of uniform brightness, like a painted wall or a black piece of construction paper. The distance of the target is unimportant. You will also need a 2.5mm hex key and a Phillips-head screwdriver.

Insert the collimating tool into the telescope's focuser. You will need to use the telescope's 1.25" adapter in the focuser. Secure the collimating tool in the focuser with the thumbscrew on the 1.25" adapter.

Look into the viewing hole of the collimating tool. You are now looking straight down the interior of the telescope tube at the objective lens.

Loosen the securing thumbscrew, and rotate the collimating tool until you can see the reflection of the tool's reflective ring in the objective lens. To do this, you will need to point the wide hole in the collimating tool's body toward a source of light. Ignoring the tiny central reflection, you should see two separate reflections of the ring in the objective lens. If you see only one reflection, then your telescope is already collimated.

Use the collimating screws in the lens cell to center the reflections on top of one another (Figure 14). There are three pairs of screws; each pair works together to tilt the lens. Using your



Figure 14. The lens cell of the AstroView 100. There are three pairs of collimating screws; each pair of screws work together to adjust the tilt of the lens.

2.5mm hex key and Phillips-head screwdriver, loosen one of the screws and then tighten the other in the pair. Look into the viewing hole of the collimating tool to see if the reflections have moved closer together or further apart. Once you get the reflections as close together as you can get with one pair of screws, move on to another pair.

Continue making adjustments to each pair of screws until the reflections are precisely centered on each other, which will give the appearance of one ring. Once only one circular ring is visible, no further collimation adjustments are needed.

Your AstroView100 EQ is now collimated. You should not need to align the optics again unless the telescope is roughly handled.

9. Care and Maintenance

If you give your telescope reasonable care, it will last a lifetime. Store it in a clean, dry, dust-free place, safe from rapid changes in temperature and humidity. Do not store the telescope outdoors, although storage in a garage or shed is OK. Small components like eyepieces and other accessories should be kept in a protective box or storage case. Keep the dust cover on the front of the telescope when it is not in use.

Your AstroView100 EQ requires very little mechanical maintenance. The optical tube is aluminum and has a smooth painted finish that is fairly scratch-resistant. If a scratch does appear on the tube, it will not harm the telescope. Smudges on the tube can be wiped off with a soft cloth and a household cleaner such as Formula 409.

Cleaning Lenses

Any quality optical lens cleaning tissue and optical lens cleaning fluid specifically designed for multi-coated optics can be used to clean the telescope's objective lens and the exposed lenses of your eyepieces or finderscope. Never use regular glass cleaner or cleaning fluid designed for eyeglasses

Before cleaning with fluid and tissue, blow any loose particles off the lens with a blower bulb or compressed air. Then apply some cleaning fluid to a tissue, never directly on the optics. Wipe the lens gently in a circular motion, then remove any excess fluid with a fresh lens tissue. Oily fingerprints and smudges may be removed using this method. Use caution; rubbing too hard may scratch the lens. On larger lenses, clean only a small area at a time, using a fresh lens tissue on each area. Never reuse tissues.

10. Specifications

Optical tube: Seamless aluminum
Objective lens: Achromatic, air-spaced
Objective lens coating: Fully multi-coated
Objective lens diameter: 100mm (3.9")
Focal length: 600mm
Focal ratio: f/6.0
Eyepieces: 25mm, 10mm Sirius Plössl, 1.25"
Magnification: 24x with 25mm, 60x with 10mm
Focuser: Rack and pinion, accepts 1.25" or 2" accessories and camera T-Ring
Diagonal: 90° Star diagonal, mirror type, 1.25"
Finder scope: 6x Magnification, 30mm aperture, achromatic, crosshairs, 7° field of view
Weight: 23.9 lbs.
Length: 24.5" (without eyepiece or diagonal attached)
Mount: AstroView, German equatorial
Tripod: Aluminum
Counterweight: 7.5 lbs.
Electronic drive: Optional

One-Year Limited Warranty

This Orion Product 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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