INSTRUCTION MANUAL

Orion® Atlas™ EQ-G

Equatorial Mount

#9996

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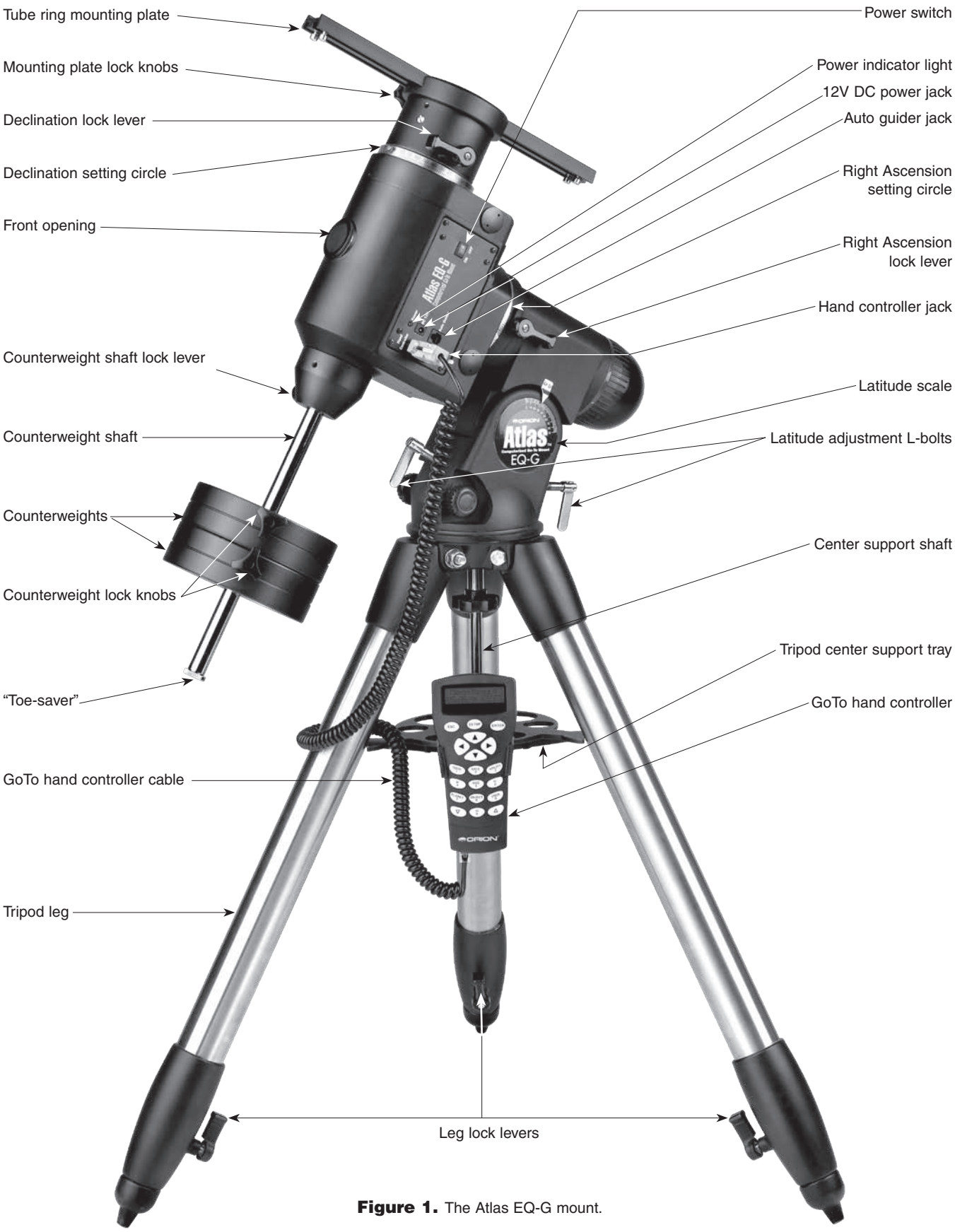


Figure 1. The Atlas EQ-G mount.

Congratulations on your purchase of a quality Orion mount. Your new Atlas EQ-G mount works with many different optical tubes. Designed for astronomical use, the Atlas EQ-G provides a solid, stable foundation for precise navigation of the night sky. The internally housed, dual-axis stepper motors provide smooth slewing and tracking of any celestial object. With a little practice, you'll find that the Atlas EQ-G 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.

Table of Contents

1. Unpacking

The entire mount will arrive in three boxes, one containing the tripod, one containing the equatorial mount, and one containing the hand controller. Be careful unpacking the boxes. We recommend keeping the boxes and original packaging. In the event that the mount needs to be shipped to another location, or returned to Orion for warranty repair, having the proper packaging will ensure that your mount will survive the journey intact.

Make sure all the parts in the Parts List are present. Be sure to check the box carefully, as some parts are small. If anything appears to be missing or broken, immediately call Orion Customer Support (800-676-1343) or email support@telescope.com for assistance.

2. Parts List

Box 1: Tripod

Qty.	Item
1	Tripod
2	Counterweights (11lbs. each)
1	Tripod center support tray

Box 2: Equatorial Mount

1	Equatorial mount
1	Tube ring mounting plate
1	12V DC Power cable

If you've purchased the #7945 Dual-Axis hand controller:

Box 3: Dual-Axis Hand Controller

1	Dual-Axis hand controller
2	Nylon hook-and-loop strips (1 hook strip, 1 loop strip)
1	Wire clip

If you've purchased the #7947 GoTo hand controller:

Box 3: GoTo Hand Controller

1	GoTo hand controller
1	GoTo hand controller cable for Sirius EQ-G
1	GoTo hand controller cable for Atlas EQ-G
1	GoTo hand controller bracket
1	Computer interface cable (RS-232)
1	Wire clip

3. Assembly

Refer to Figure 1 as needed during the assembly process.

1. Stand the tripod legs upright and spread the legs out as far as they will go. Make certain that the leg lock levers are tightened. Keep the tripod legs at their shortest (fully retracted) length, for now; you can extend them to a more desirable length later, after the mount is fully assembled.
2. Place the base of the equatorial mount onto the tripod head. Orient the equatorial mount so that the post on the tripod head lines up with the azimuth adjustment knobs on the equatorial mount (Figure 2). You may need to loosen the azimuth adjustment knobs on the equatorial mount in order to fit the mount onto the tripod head.

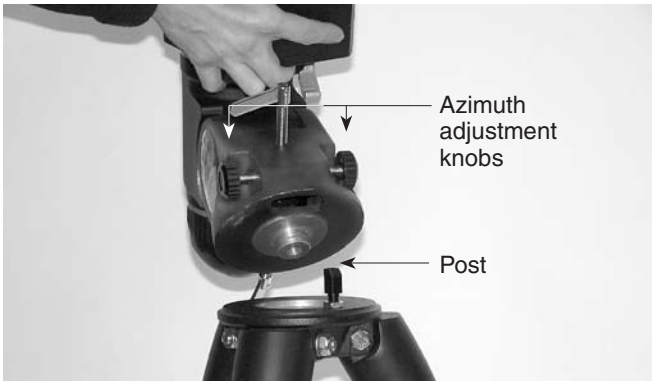


Figure 2. Orient the equatorial head so that the post on the tripod lines up with the azimuth adjustment knobs on the equatorial mount.

3. Thread the center support shaft up through the tripod head and into the bottom of the equatorial mount until tight. Use the upper knob on the center support shaft to do this. The equatorial mount should now be firmly connected to the tripod.
4. Remove the knob and washer from the bottom of the center support shaft. Slide the tripod support tray up the bottom of the central support shaft until the three tray arms are touching the legs of the tripod. The flat side of the support tray should be facing up. Make sure the "V" of each tray arm is against a tripod leg. Place the washer on the center support shaft against the tray, and follow it by threading the knob all the way up the center support shaft until it is tight against the tray. The tripod support tray provides additional stability for the tripod, and holds up to five 1.25" eyepieces and two 2" eyepieces.
5. Loosen the counterweight shaft lock lever and fully extend the counterweight shaft. Retighten the lock lever.
6. Remove the knurled "toe saver" retaining screw on the bottom of the counterweight shaft and slide both counterweights onto the shaft. Make sure the counterweight lock knobs are adequately loosened to allow the counterweight shaft to pass through the hole. Position the counterweights about halfway up the shaft and tighten the lock knobs. Replace the toe saver at the end of the bar. The toe saver prevents the counterweights from falling on your foot if the lock knobs happen to come loose.

Your Atlas EQ-G mount is now fully assembled and should resemble Figure 1 except for the hand controller, which will be installed and explained in Section 7 (Dual-Axis) or Section 8 (GoTo) of this manual.

4. Attaching a Telescope

The Atlas EQ-G equatorial mount is designed to hold telescope tubes weighing up to approximately 40 lbs. For heavier telescopes, the mount may not provide sufficient stability for steady imaging. Any type of telescope can be mounted on the Atlas EQ-G, including refractors, Newtonian reflectors, and catadiotropics, provided a set of tube rings is available to couple the tube to the mount. Orion sells a variety of telescope tube rings. Please visit our website at OrionTelescopes.com for details.

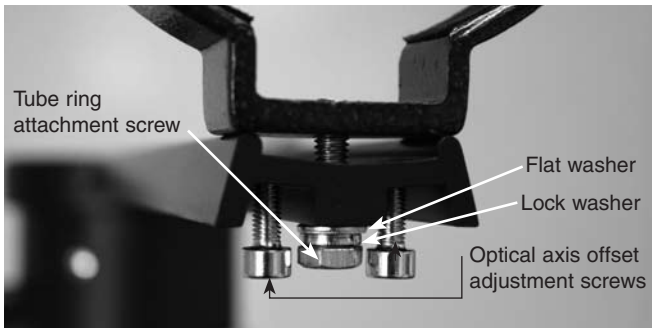


Figure 3. The tube ring mounting plate.

1. Attach the tube mounting rings to the tube ring mounting plate using the screws that come with the tube rings. The screws should go through the center holes in the ends of the mounting plate and rethread into the tube rings. Note that the side of the mounting plate with the central "groove" will be facing up (Figure 3). Use a small wrench to secure the tube rings to the mounting plate.

Note: The tube ring mounting plate included with the Atlas EQ-G includes four optical axis offset adjustment screws; these are the socket head cap screws located at each corner of the mounting plate. These adjustment screws will be explained further in Appendix A. For now, confirm that all four adjustment screws are sufficiently unthreaded so that the ends of their threaded shafts are flush with the top surface of the tube ring mounting plate.

Note: The optical axis offset adjustment screws should be oriented so that the threaded shaft extends upward through the top surface of the tube ring mounting plate. If the tube ring mounting plate arrives with the optical axis offset screws installed backwards, reverse their orientation before proceeding (Figure 3).

2. Loosen the black mounting plate lock knobs on the top of the equatorial mount. Place the mounting plate, with the tube rings attached, in the slot on top of the equatorial mount. Position the mounting plate so that it is centered in the slot. Re-tighten the mounting plate lock knobs until the plate is secure.
3. Open the tube rings and lay the telescope optical tube in the rings at about the midpoint of the tube's length. Rotate the tube so that the focuser is at a convenient height for viewing. Close the tube rings and tighten them.

Note: The Atlas EQ-G mount is very heavy. Alone it weighs 54 lbs. With a large optical tube and counterweights it can easily weigh over 100 lbs. Keep this in mind when moving the telescope even small distances, and use assistance when needed. It is best to remove the optical tube and counterweights when moving the mount.

Note: Some telescope optical tubes (specifically Schmidt-Cassegrains and Maksutov-Cassegrains) have a mounting plate connected directly to the tube. For these telescopes, optional tube rings are not required. Simply follow step 2 (above) to connect the telescope to the mount.

5. Balancing a Telescope

To ensure smooth movement of a 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 right ascension (R.A.) axis, then the declination (Dec.) 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 right ascension axis. Rotate it until the counterweight shaft is parallel to the ground (i.e., horizontal).

2. Now loosen both counterweight lock knobs and slide the weights along the shaft until they exactly counterbalance the telescope (Figure 4a). That's the point at which the shaft remains horizontal even when you let go with both hands (Figure 4b). If the telescope refuses to balance than you have either too much or too little counterweight. Remove a counterweight, or add optional counterweights if needed.
3. Retighten the counterweight lock knobs. The telescope is now balanced on the right ascension axis.
4. To balance the telescope on the declination axis, first tighten the R.A. lock lever, with the counterweight shaft still in the horizontal position.
5. With one hand on the telescope optical tube, loosen the Dec. lock lever. The telescope should now be able to rotate freely about the declination axis.
6. Loosen the knurled ring clamps on the tube rings a few turns, until you can slide the telescope tube forward and back inside the rings (this can be aided by using a slight twisting motion on the optical tube while you push or pull on it) (Figure 4c).
7. Position the telescope in the tube rings so it remains horizontal when you carefully let go with both hands. This is the balance point for the optical tube with respect to the Dec. axis (Figure 4d).
8. Retighten the knurled ring clamps.

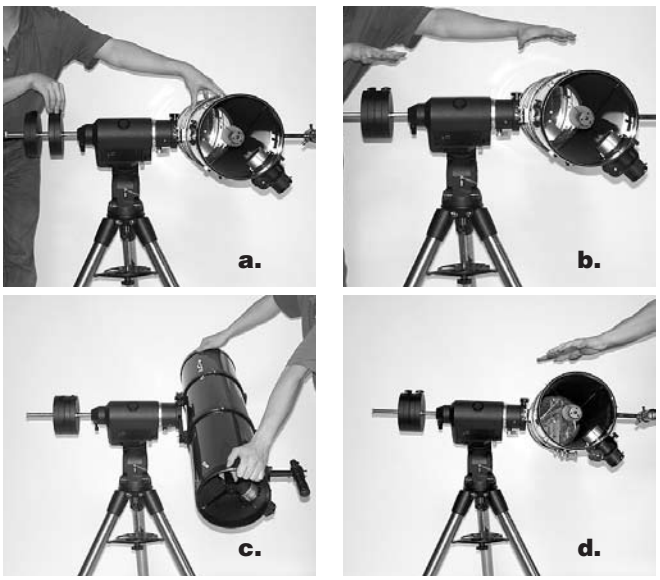


Figure 4a-d. Proper operation of the equatorial mount requires that the telescope tube be balanced on the R.A. and Dec. axes. (a) With the R.A. lock lever released, slide the counterweights down the counterweight shaft until they just counterbalance the telescope tube. (b) When you let go with both hands, the tube should not drift up or down. (c) With the Dec. lock lever released, loosen the tube ring lock clamps a few turns and slide the telescope forward or back in the tube rings. (d) When the tube is balanced about the Dec. axis, it will not move when you let go.

The telescope is now balanced on both axes. 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.

6. Setting Up and Using the Equatorial Mount

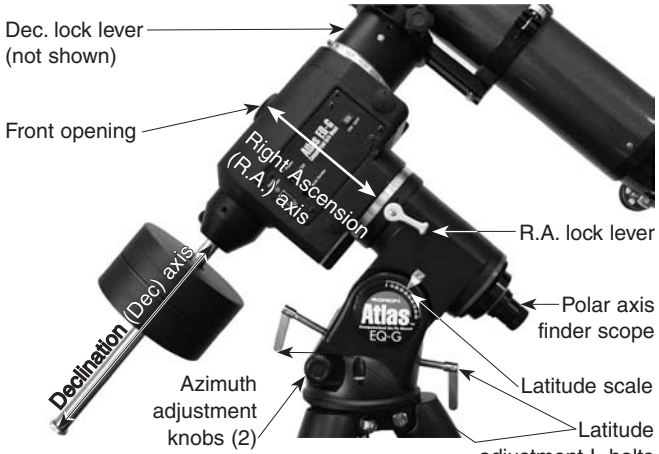


Figure 5. The Atlas EQ-G mount.

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 your 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 the built in motor drive. But first the R.A. axis of the mount must be aligned with the Earth's rotational (polar) axis—a process called polar alignment.

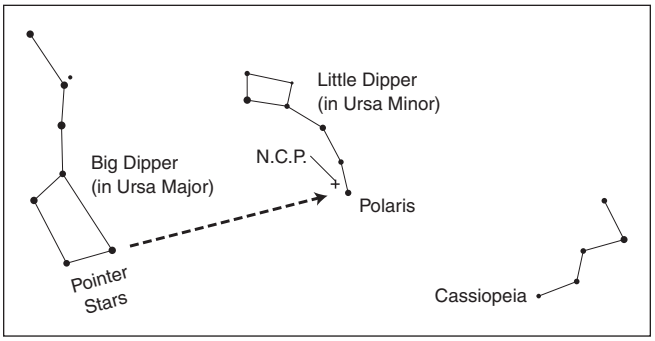


Figure 6. To find Polaris in the night sky, look north and find the Big Dipper. Extend an imaginary line from the two "Pointer Stars" in the bowl of the Big Dipper. Go about five times the distance between those stars and you'll reach Polaris, which lies within 1° of the north celestial pole (NCP).

Polar Alignment

For Northern Hemisphere observers, approximate polar alignment is achieved by pointing the mount's right ascension 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).

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. There are two latitude adjustment L-bolts (see Figure 5); loosen one while tightening the other. By doing this you will adjust the latitude of the mount. Continue adjusting 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 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's optical tube until it is parallel with the right ascension axis, as it is in Figure 5.
4. Move the tripod so the telescope tube and right ascension axis point roughly at Polaris. If you cannot see Polaris directly from your observing site, consult a compass and rotate the tripod so the telescope points north.

The equatorial mount is now polar aligned for casual observing. More precise polar alignment is recommended for astrophotography. For this we recommend using the polar axis finder scope.

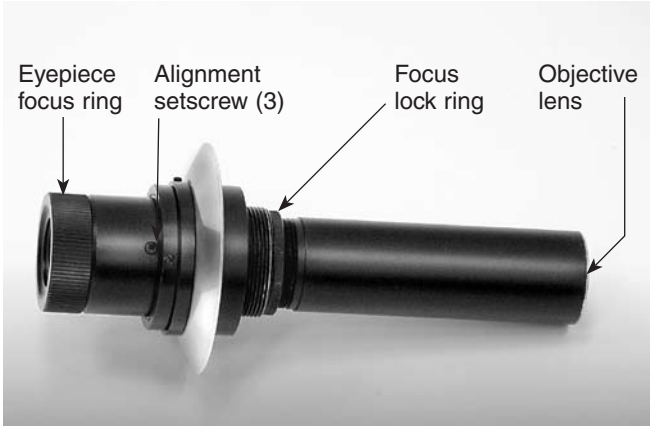


Figure 7. The polar axis finder scope.

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

The Atlas EQ-G mount comes with a polar axis finder scope (Figure 7) housed inside the right ascension axis of the mount. When properly aligned and used, it makes accurate polar alignment quick and easy to do. Unthread the cover at the rear of the mount's right ascension axis and remove the cap on the front opening of the equatorial mount (Figure 5) to view through the polar axis finder scope.

Alignment of the Polar Axis Finder Scope

1. Loosen the Dec. lock lever and rotate the optical tube about the declination axis until you have a clear view through the polar axis finder scope (Figure 8). Tighten the Dec. lock lever.
2. 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 L-bolts and the tripod position to do this. Focus the polar finder by rotating the eyepiece.
3. Rotate the mount 180° about the R.A. axis. It may be convenient to remove the counterweights and optical tube before doing this.
4. 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 alignment set-screws on the polar axis finder (Figure 7) to redirect the crosshairs of the polar finder to the apparent center of this circular path.
5. Repeat this procedure until the position that the crosshairs point to does not rotate off-center when the mount is rotated in R.A.

Figure 8. The optical tube must be rotated about the declination axis in order to view through the polar axis finder.

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.

Using the Polar Axis Finder Scope

The reticle of the polar axis finder scope for the Atlas EQ-G has a tiny star map printed on it that makes precise polar alignment quick and easy. To polar align the mount using the polar axis finder scope, follow these instructions:

1. Approximately polar-align the mount as outlined in the procedure above.
2. Loosen the Dec. lock lever and rotate the optical tube on the declination axis so the tube is at a 90° angle to the right ascension axis (Figure 8). Tighten the Dec. lock lever.
3. Focus the polar finder by rotating the eyepiece. Now, sight Polaris in the polar axis finder scope. If you have followed the approximate polar alignment procedure accurately, Polaris will probably be within the field of view. If not, move the tripod left-to-right, and adjust the latitude up-and down until Polaris is somewhere within the field of view of the polar axis finder scope.
4. The mount has a built-in illuminator that allows you to see the reticle pattern in the polar axis finder scope at night. Simply turn on the power switch on the Atlas EQ-G mount (see "Powering the Atlas EQ-G Mount") and the polar axis finder scope reticle will be illuminated. Note the constellation Cassiopeia and the Big Dipper in the reticle. They do not appear in scale, but they indicate the general positions of Cassiopeia and the Big Dipper relative to the north celestial pole (which is indicated by the cross at the center of the reticle). Rotate the reticle so the constellations depicted match their current orientation in the sky when viewed with the naked eye. To do this, release the R.A. lock lever and rotate the main telescope around the R.A. axis until the reticle is oriented with sky. For larger optical tubes, you may need to remove the tube from the mount to prevent it from bumping into the mount. Once the reticle is correctly oriented, use the right ascension lock lever to secure the mount's position.
5. Now use the azimuth adjustment knobs (Figure 2) and the latitude adjustment L-bolts (Figure 5) on the mount to position the star Polaris inside the tiny circle marked "Polaris" on the finder's reticle. You must first loosen the knob underneath the equatorial mount on the center support shaft to use the azimuth adjustment knobs. Once Polaris is properly positioned within the reticle, you are precisely polar aligned. Retighten the knob underneath the equatorial mount.

If you do not have a clear view of Polaris from your observing site, you will not be able to use the polar-axis finder to precisely polar align the telescope.

Note: 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 right ascension and declination axes.

Additional Note Regarding Focusing the Polar Axis Finder Scope

The polar axis finder scope is normally focused by simple rotation of the eyepiece focus ring. However, if after adjusting the focus ring you find that the image of the reticle is sharp, but the stars are out of focus, then you must adjust the focus of the polar axis finder's objective lens. To do this, first remove the polar axis finder from the mount by unthreading it. Look through the polar axis finder at a star (at night) or distant object at least 1/4 mile away (during daylight). Use the eyepiece focus ring to bring the reticle into sharp focus. Now, loosen the focus lock ring (Figure 7) and thread the entire objective end of the finder inward or outward until images appear sharp. Re-tighten the focus lock ring. Once the polar axis finder's objective lens is focused, it should not need to be adjusted again.

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 L-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 right ascension 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.

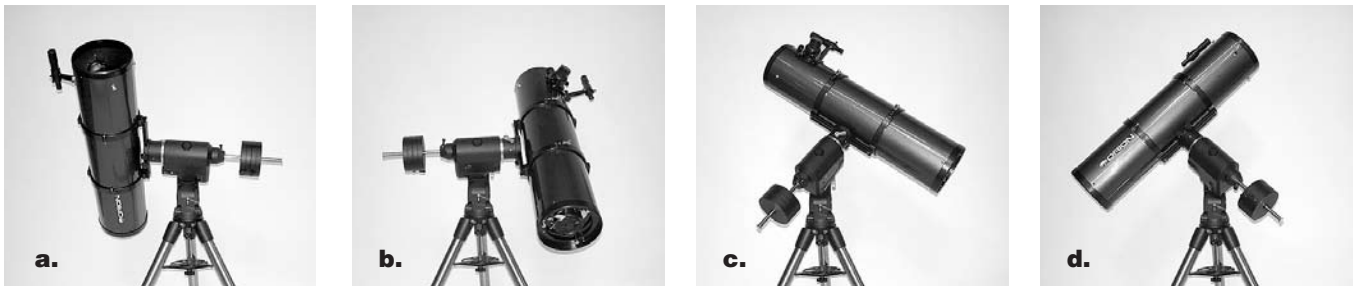


Figure 9a-d. These illustrations show the telescope pointed in the four cardinal directions. (a) north, (b) south, (c) east, (d) west. Note that the tripod and mount have not been moved; only the telescope has been moved on the its R.A. and Dec. axes.

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 counterweights down as pictured in Figure 1. Again, you have to rotate the scope in right ascension so that the counterweight shaft is positioned horizontally. Then rotate the scope in declination 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 declination 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 right ascension and declination axes. Depending on the altitude of the object you want to observe, the counterweight shaft will be oriented somewhere between vertical and horizontal.

Figure 9 illustrates how the telescope will look when pointed at the four cardinal directions: north (Figure 9a), south (Figure 9b), east (Figure 9c) and west (Figure 9d).

The key things to remember when pointing the telescope are that a) you only move it in right ascension and declination, 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!

7. The Atlas EQ-G Dual-Axis Controller

The Atlas EQ-G with dual-axis hand controller will track any celestial object as the Earth rotates. You can also use the controller's directional buttons to center objects within your telescope's finderscope or eyepiece. For imaging purposes, the controller provides several guide speed rates so a camera can be accurately guided during a long exposure.

Attaching the Dual-Axis Controller

The dual-axis controller has a cable with a large, serial connector (DB-9) on one end. Plug the serial connector into the jack on the faceplate of the mount (Figure 9.1). Use the captive screws to secure the serial connector in place.

The nylon hook-and-loop strips have been provided so the dual-axis hand controller can be placed in a convenient position on the mount when not in use. Place the "hooks" strip on the back of the dual-axis hand controller, and the "loops" strip on the mount in a convenient location. Make certain the location of the strip on the mount will not cause the dual-axis hand controller to interfere with the motions of the mount or telescope being used.

You can reduce the chances of getting your hand controller, power supply, or other cables tangled during use of the Atlas EQ-G by using the included wire clip. The clip also prevents mechanical strain on the cord when being used. The wireclip is adhesive backed for easy attachment to any convenient location on the mount.

Powering the Atlas EQ-G Mount

The Atlas EQ-G should be powered by a 12V DC power supply (tip-positive) capable of producing continuous current with a minimum of 2 amps. We recommend using a portable rechargeable battery, like the Dynamo or Dynamo Pro available from Orion.

If you are using a portable battery like the Orion Dynamo, use the supplied 12V DC power cable (male cigarette lighter plug on one end, standard 12V DC power plug on the other end) to connect the battery to the 12V DC power jack on the faceplate of the mount (Figure 9.1). Make sure the Dynamo's power switch is in the "on" position after connecting.

Functions of the Dual-Axis Hand Controller

There are three main categories of control buttons on the dual-axis controller (Figure 9.2).

1. **Speed buttons**
2. **Directional buttons**
3. **Set button**

The dual-axis hand controller is equipped with a red LED light in each button to indicate operation. An individual button's LED will illuminate when the button is pressed. If a button combination is entered, all LEDs will illuminate to indicate a successful operation.

Speed Buttons

The three buttons located near the top of the dual-axis hand controller (**Guide**, **Slow**, and **Fast**) are used to set the slewing and guiding speed of the mount.

Directional Buttons

The directional buttons allow complete control of the mounted telescope's position during slewing or tracking. The **Left** and **Right** directional buttons control movements about the right ascension (R.A.). axis. The **Up** and **Down** directional buttons control movements about the declination (Dec.) axis.

Set Button

The **Set** button is used to set the dual-axis hand controller to operate in either Northern or Southern hemisphere locations.

*Note: The **Go** button is not used in normal operation of the dual-axis controller.*

Tracking Objects with the Dual-Axis Hand Controller

In order for your Atlas EQ-G mount to accurately track celestial objects as they appear to migrate across the night sky, your mount must be properly polar aligned. For more details on polar alignment, please consult section 6 of this manual.

Once the power switch is turned on, the dual-axis controller begins to track by rotating the R.A. axis motor at the default (sidereal) rate. The Dec. axis motor will not rotate. As long as the mount has been properly polar aligned, it should not be necessary to adjust the Dec. axis for accurate tracking. If you notice a lack of tracking precision at the default (sidereal) rate,

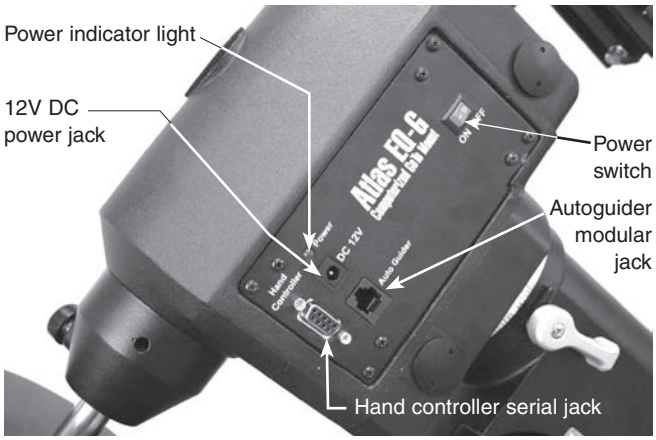


Figure 9-1. Atlas EQ-G mount faceplate.

Figure 9-2. The Atlas EQ-G Dual-Axis hand controller

consult section 6 of this manual and attempt to polar align the mount more accurately.

Tracking can be deactivated or activated at any time the Atlas EQ-G mount is receiving power. In order to deactivate tracking, simply press and hold the **Guide** button then press the **Slow** button on the controller. Pressing the same button combination will reactivate tracking at the default (sidereal) rate.

There are three tracking rates used by the dual-axis controller:

Sidereal rate tracking is the default tracking rate for the Atlas EQ-G mount. Celestial objects are tracked using this rate which is equivalent to the rate of the Earth's rotation.

Solar rate tracking is used to track the Sun over a long period of time. Solar rate tracking is activated by pressing and holding the **Slow** speed button, then the **Right** directional button.

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 aperture of the instrument, or permanent eye damage could result. Young children should use this telescope only with adult supervision.

Lunar rate tracking is used to track the Moon at its rate of apparent motion across the sky. Lunar rate tracking is activated by pressing and holding the **Slow** button, then the **Down** directional button.

*Note: Solar and Lunar tracking rates can only be used when the Atlas EQ-G has tracking activated. If tracking is deactivated, you must first activate tracking by holding the **Guide** button then pressing the **Slow** button.*

Setting the Slewing Speed

In order to conveniently center an object in your telescope's finderscope or eyepiece, you can set the speed rate at which the motors slew (move) the telescope when the directional buttons are pressed. The three speed buttons located near the top of the hand controller are used to set the slewing rates of the mount.

The slewing speed buttons each have two different speeds assigned to them. The slewing speed employed is dependent on whether or not the dual-axis controller has tracking activated or deactivated (by holding the **Guide** button then pressing the **Slow** button).

With tracking activated, the **Guide** button will slew the Atlas EQ-G mount at a very slow speed equal to 1.5x sidereal rate. This speed rate will generally be used to guide a telescope while imaging with a camera. You can also change the **Guide** button speed rate to be slightly faster or slower (see "Setting the Guiding Speed"). If tracking is deactivated, pressing the **Guide** button will set the Atlas EQ-G to slew at 32x sidereal rate; this speed is too fast for guiding during imaging.

By pressing the **Slow** button with tracking activated, the Atlas EQ-G will slew at 4x sidereal rate. With tracking deactivated, pressing the **Slow** button will set the Atlas EQ-G mount to slew at 64x sidereal rate.

With tracking activated, the **Fast** button will set the Atlas EQ-G mount to slew at 8x sidereal rate. If tracking is not activated, pressing the **Fast** button will set the Atlas EQ-G to slew at 800x sidereal rate; this is a very fast speed that can be used to slew the mount from object to object across the sky.

Speed Button	with Tracking activated	with Tracking Deactivated
Guide	Guiding Speed*	32x
Slow	4x	64x
Fast	8x	800x
* Guiding Speed equals 1.5x sidereal rate by default		

Changing the Guiding Speed

The dual-axis hand controller provides 4 different guiding speed settings: 2x, 1.75x, 1.5x (default), and 1.25x sidereal rate. If you change the guiding speed from the default setting of 1.5x sidereal rate, the controller will guide at the chosen speed until another guiding speed is selected.

In order to set the guiding speed of your Atlas EQ-G, use the button following button combinations:

- 2x sidereal rate: Hold the **Fast** button, then press the **Up** directional button.
- 1.75x sidereal rate: Hold the **Fast** button, then press the **Left** directional button.
- 1.5x sidereal rate: Hold the **Fast** button, then press the **Right** directional button.
- 1.25x sidereal rate: Hold the **Fast** button, then press the **Down** directional button.

Reversing the Directional Buttons

Celestial objects appear to move through the sky differently when viewed through telescopes and/or accessories of different designs. For example, if an object viewed through a *refractor* appears to migrate towards the left-hand side of an eyepiece's field of view, it will appear to migrate towards the right-hand side of an eyepiece's field of view in a *reflector* telescope.

In order to make viewing and tracking objects convenient, regardless of telescope design, the dual-axis controller features a "reverse" function which reverses the direction of the hand controller's directional buttons. This way you can match the directional button to the way the object actually moves in the telescope eyepiece.

To reverse the direction of the **Left** and **Right** directional buttons, press and hold the **Slow** speed button then press the **Left** directional button. To reverse the direction of the **Up** and **Down** directional buttons, press and hold the **Slow** button then press the **Up** directional button.

Once you have reversed the directional buttons, the dual-axis controller will save the reversed settings until it they are manually changed again. Turning the power off will not affect the directional button setting last entered.

Northern or Southern Hemisphere Operation

The dual-axis hand controller is capable of operating in either Northern or Southern Hemisphere viewing locations. The system is set up for Northern Hemisphere locations by default, so if you are viewing from a Northern Hemisphere location, it is not necessary to make any setting changes.

For the dual-axis controller to properly track celestial objects in the Southern Hemisphere, press and hold the **Down** directional button and then press the **Set** button while powering on the mount. Release the **Set** button after the mount has successfully powered on and the **Guide** button begins flashing. The controller will now operate properly in the Southern Hemisphere. You can switch back to Northern Hemisphere mode by using the same button combination. As long as the controller is operating in Southern Hemisphere mode, the **Set** button will illuminate.

Power Conservation

In the interest of conserving the amount of power drawn by the Atlas EQ-G mount, the Dec. motor will enter a "sleep" mode if left idle for a period of 15 seconds. In "sleep" mode, the Dec. motor stops completely and the amount of used power drops by about 40%. To reactivate the Dec. motor, press the **Up** or **Down** directional button.

Upgrading your Atlas EQ-G

While the dual-axis hand controller provides many useful functions such as celestial object tracking and motorized motion control, there is a GoTo hand controller for the Atlas EQ-G available from Orion. The features and functions of the GoTo hand controller are explained in the following section. If you are interested in upgrading your Atlas EQ-G to a GoTo system, call our Customer Service department at 800-676-1343 or visit our website at www.OrionTelescopes.com for more information.

Atlas EQ-G Dual-Axis Hand Controller Button Combination Quick Reference Chart		
Function	**Button Combination**	**Notes**
Activate/Deactivate tracking	**Guide** then **Slow**	sidereal rate tracking
Solar rate tracking	**Slow** then **Right**	tracking must be active
Lunar rate tracking	**Slow** then **Down**	tracking must be active
2x Guiding speed	**Fast** then **Up**	2x sidereal rate
1.75x Guiding speed	**Fast** then **Left**	1.75x sidereal rate
1.5x Guiding speed	**Fast** then **Right**	1.5x sidereal rate
1.25x Guiding speed	**Fast** then **Down**	1.25x sidereal rate
Reverse RA directional buttons	**Slow** then **Left**	
Reverse Dec directional buttons	**Slow** then **Up**	
Northern / Southern Hemishpere operation	**Set**	

8. The Atlas EQ-G GoTo Hand Controller

The Atlas EQ-G mount equipped with the GoTo hand controller provides easy, computerized location of thousands of night sky objects such as planets, nebulae, star clusters, galaxies, and more for viewing through your telescope. The GoTo hand controller and internal dual-axis motors allow you to automatically point your telescope at a specific object, or tour the skies with pushbutton simplicity. The user-friendly menu allows automatic slewing to over 13,400 objects. Even inexperienced astronomers will find themselves quickly mastering the variety of features the GoTo hand controller offers in just a few observing sessions.

Attaching the GoTo Hand Controller

The Atlas EQ-G GoTo hand controller comes with two cables; one for usage with the Atlas EQ-G mount, while the other is for use with the Sirius EQ-G mount. Feel free to discard the cable for the Sirius EQ-G, as it will not be needed.

The cable for the Atlas EQ-G mount has a large, serial connector (DB-9) on one end and a smaller, modular connector (RJ-45) on the other. Plug the modular connector of the hand controller cable into the hand controller (Figure 10). Push the connector into the jack until it clicks into place. Plug the serial connector into the mount (Figure 11). Use the captive screws to secure the serial connector in place.

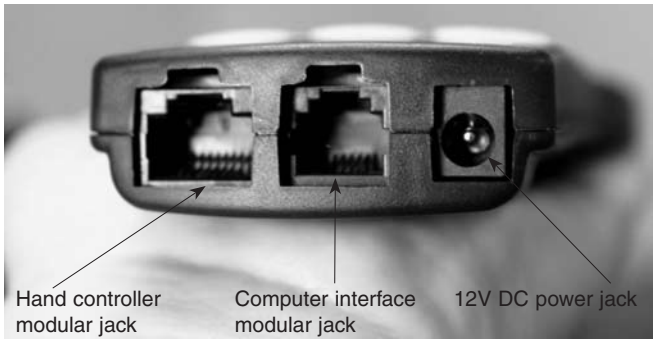


Figure 10. Hand controller jacks.

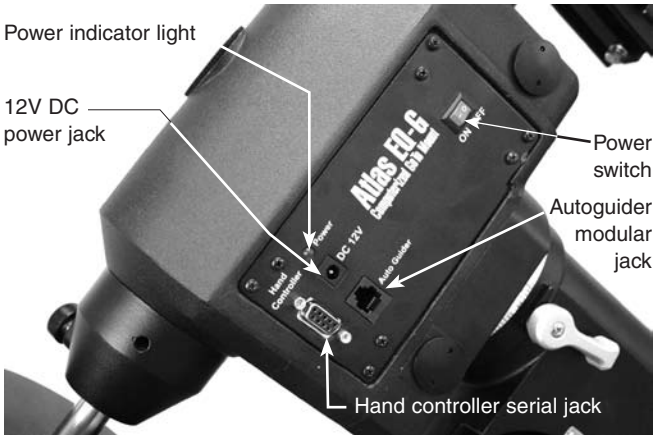


Figure 11. Atlas EQ-G mount faceplate.

The smaller modular jack on the hand controller (Figure 10) is used for RS-232 communications between the Atlas EQ-G mounts and a computer equipped with astronomy software like Starry Night Pro (see "Linking with a Computer"). The 12V DC power jack on the hand controller allows independent use of the GoTo hand controller for users who wish to browse the object database without connecting to the telescope mount (Figure 10). The power jack is also used when updating the firmware in the hand controller (see "Updating the GoTo Hand Controller's Firmware").

The included GoTo hand controller bracket attaches to the built-in notch in the tripod center support tray. To install the hand controller bracket, simply line up the tab on the back of the bracket with the notch in the tripod center support tray and slide the bracket forward until it clicks into place (Figure 12). You now have a place to put the GoTo hand controller while you are viewing.

You can reduce the chances of getting your hand controller cable tangled during use by installing the included wire clip. The clip also prevents mechanical strain on the hand controller cable when it is in use. The wire clip is adhesive backed for easy attachment to any convenient location on the mount.

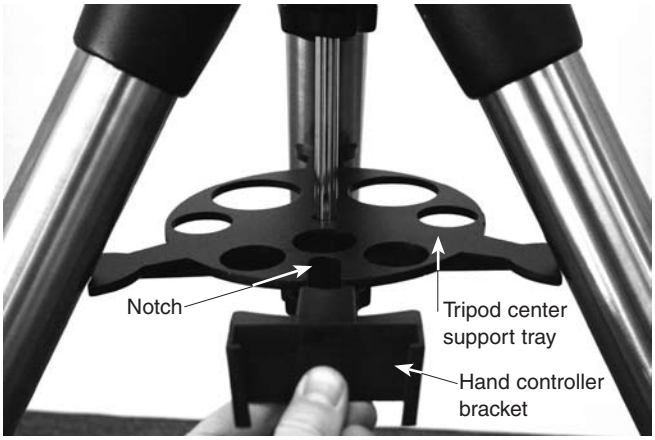


Figure 12. Installing the hand controller bracket.

Powering the Atlas EQ-G Mount

The Atlas EQ-G should be powered by an 11V to 15V DC power supply (tip positive) capable of producing continuous current of a minimum 2 amps. We recommend using a portable rechargeable battery, like the Dynamo or Dynamo Pro available from Orion.

If you are using a portable battery like the Orion Dynamo, use the 12V DC power cable supplied with your mount (male cigarette lighter plug on one end, standard 12V DC power plug on other end) to connect the battery to the 12V DC power jack on the mount (Figure 11). Make sure the Dynamo's power switch is in the "on" position after connecting. Then, to turn the mount (and GoTo hand controller) on, simply press the switch on the mount so it is in the "on" position.

Note: The power indicator LED on the mount (near the power switch) will begin to flash when the battery power is low. When the battery power is extremely low, the LED will flash rapidly. Recharge or replace the battery as needed.

Functions of the GoTo Hand Controller

There are four main categories of control buttons on the GoTo hand controller (Figure 13):

Figure 13. The GoTo hand controller.

1. Mode buttons
2. Directional buttons
3. Scroll buttons
4. Dual Purpose buttons

Mode Buttons

The three mode buttons are located at the top of the controller, directly below the LCD screen. They include the **ESC**, **ENTER**, and **SETUP** buttons.

The **ESC** button is used to escape from a certain command or go back a level in the menu tree.

The **ENTER** button is used to select the functions and submenus in the menu tree, and to confirm certain functional operations.

The **SETUP** button is a "hot key" that takes you to the Setup Menu.

Directional Buttons

The directional buttons allow the user to have complete motion control of the Atlas EQ-G mount at almost any step in operation. These controls are locked out when the mount is slewing to an object. The directional buttons are very helpful when initially aligning the mount, centering objects in the eyepiece field of view, and manual guiding. The directional buttons are typically used in conjunction with the **RATE** button. The left and right directional buttons can also be used to move the text cursor when entering data into the hand controller.

Scroll Buttons

The up and down scroll buttons allow you to scroll up and down within the menu tree or selections displayed on the hand controller screen.

Dual Purpose Buttons

The dual purpose buttons serve two distinct purposes. They are used for data entry and as quick reference keys.

TOUR button: Takes you on a preset tour of the best night sky objects visible

RATE button: Changes the speed of the motors when the directional buttons are pressed. There are 10 speeds to choose from, with 0 being the slowest and 9 being the fastest.

UTILITY button: "Hot key" access to the Utility Functions menu.

USER button: Enter or recall coordinates for up to 25 objects in the User Defined database.

ID button: Identifies the object the mount is currently pointing to.

NGC, **IC**, **M**, **Planet**, and **Object** buttons: Allow direct access to catalogs and databases of over 13,400 objects.

GoTo Hand Controller Operation

This section provides a guide for initial setup and alignment of the Atlas EQ-G mount with the GoTo hand controller.

Initial Setup

1. Perform the polar alignment using the procedure previously outlined in Section 6. A rough polar alignment will suffice, but an accurate polar alignment using the polar axis finder scope will increase tracking accuracy (and pointing accuracy for one-star alignments).
2. Rotate the telescope tube about the mount's declination axis so the tube is parallel with the mount's R.A. axis (and the front of the tube is pointed to the sky, not the ground). Rotate the mount's R.A. axis so the counterweight shaft is pointed straight down. The telescope and mount should now appear as shown in Figure 14. This will be called the "home" position of the mount.

Note: Once the mount is initially set to its "home" position, the mount should not be moved manually. Otherwise, the GoTo hand controller will lose track of the mount's position, and the alignment procedure will need to be performed again. Keep both the R.A. and Dec. lock levers engaged.

3. Turn on the power switch on the mount
4. The initial screen displayed on the hand controller is the version screen. Press **ENTER** to proceed.

Figure 14. The telescope and mount in their "home" position

5. The hand controller's LCD screen will show a safe solar viewing warning message. Press the **ESC** button to continue.

Note: The GoTo hand controller's LCD backlighting will become dim and the illuminated buttons will turn off if left idle for 30 seconds. Pressing any button will re-illuminate the hand controller.

6. Enter your observing site's longitude and latitude coordinates. First enter the longitude coordinate and hemisphere, followed by the latitude coordinate and hemisphere. Use the numerical keypad to enter the digits, and use the left and right directional buttons to move to the next digit. Use the scroll buttons to choose W or E (for longitude) and N or S (for latitude). If you do not know the longitude and latitude coordinates of your viewing location, consult an atlas or geographical map of your area. Press **ENTER** to confirm your coordinates.

Note: Longitude and latitude coordinates must be entered in degrees and arcminutes. If your map or atlas gives coordinates in decimal values (i.e. latitude = 36.95 N) you must convert into degrees and arcminutes (i.e. latitude 36.95 N = latitude 36°57' N).

Note: If a mistake is entered into the hand controller during the initial setup procedure, press the **ESC** *button to go back to the previous screen.*

7. Enter the time zone in which you are observing in hours (see Appendix D) using the scroll buttons (+ for east of Prime Meridian, - for west of Prime Meridian) and numeric keypad. Use the left and right directional buttons to move to the next digit. Press **ENTER** to confirm your choice.
8. Enter the date in mm/dd/yyyy format using the numeric keypad. Use the left and right directional buttons to move to the next digit. Press **ENTER** to confirm your choice.
9. Enter your current local time using the 24 hour clock format (example: 2:00PM = 14:00). Press **ENTER** to view the time you entered. If the time is incorrect, press **ESC** to go back to the previous screen. If the time is correct, press **ENTER** again.
10. If the date entered in step 8 falls between March and November, the hand controller will ask "DAYLIGHT SAVING?" on the LCD screen. Use the scroll buttons to select "YES" or "NO" to indicate if you are currently on Daylight Savings Time or not, and press **ENTER**.
11. The hand controller will now display "Begin Alignment?" Press **1** or **ENTER** to start the alignment procedure. Press **2** or **ESC** to skip the alignment and exit to the Main Menu.

You are now ready to begin the alignment procedure.

Alignment

In order for the GoTo hand controller to accurately locate and point to objects in the sky, it must first be aligned on known positions (stars). With the supplied information, the controller can replicate a model of the sky and the movements of astronomical objects.

There are three ways to align depending on your demand for accuracy. If you are using the GoTo controller for the first time, we recommend you begin with the three-star alignment. In most cases, a three-star alignment produces the most accurate alignment among the three methods. The description below will lead you through a step-by-step procedure on how to perform the three-star alignment.

Note: Before performing any of the alignment methods, be sure your finderscope is well aligned with the telescope tube.

Three-Star Alignment

1. From the alignment screen, select "3-Star Align" using the scroll buttons. Press **ENTER** to confirm your choice.
2. The hand controller will provide a list of stars available in your current sky for you to choose as the first alignment star. Choose a star you are familiar with using the scroll buttons. Press **ENTER** to confirm your choice. The mount will start slewing the telescope towards the chosen object. When the telescope stops slewing, adjust its position using the controller's directional buttons until the chosen star is centered on the crosshairs of the finderscope. Now look in the eyepiece and adjust the position of the telescope (again using the directional buttons) so the chosen star is centered in the field of view of the eyepiece. Press **ENTER** to confirm the star is centered .

*Note: The slewing speed can be adjusted by pressing the **RATE** button. Choose a desired rate between 0 (slowest) and 9 (fastest).*

*Note: The hand controller will make a "beep" sound once it has finished slewing to an object. Do not try to adjust the telescope before you hear the "beep" sound. The controller will only respond to the **ESC** button while slewing (which stops the slewing).*

3. The controller will provide a list of stars that can be used as the second alignment star. Choose a star using the scroll buttons and press **ENTER** to confirm your choice. Repeat the centering procedure for the second alignment star using the directional buttons and press **ENTER** to confirm alignment.
4. The controller will once again provide a list of stars that can be used as the third alignment star. Choose a star using the scroll buttons and press **ENTER** to confirm your choice. Once again, repeat the centering procedure for the third alignment star and press **ENTER** to confirm alignment.
5. Once the three alignment stars have been entered and alignment is completed, the hand controller will display "Alignment Successful." Press **ENTER** to access the Main Menu. Otherwise, "Alignment Failed" will be displayed, and the alignment procedure must be performed again. To do this, turn the mount's power switch off, then on again.

Two-Star Alignment

Two-star alignment requires only two alignment stars but may produce lesser pointing accuracy than the three-star alignment. The description below will lead you on a step-by-step procedure on how to perform the two-star alignment.

1. From the alignment screen, select "2-Star Align" using the scroll buttons. Press **ENTER** to confirm your choice.
2. The hand controller will provide a list of stars available in your current sky for you to choose as the first alignment star. Using the scroll buttons, choose a star you are familiar with and press **ENTER** to confirm your choice. The mount will start slewing the telescope towards the chosen star. When the telescope stops slewing, adjust its position with the controller's directional buttons until the star is centered on the crosshairs of the finderscope. Now look in the eyepiece and adjust the position of the telescope (again using the directional buttons) so the chosen star is centered in the field of view of the eyepiece. Press **ENTER** to confirm the star is centered.
3. The controller will provide a list of stars that can be used as the second alignment star. Choose a star using the scroll buttons and press **ENTER** to confirm your choice. Repeat the centering procedure for the second alignment star and press **ENTER** to confirm alignment.
4. Once the two alignment stars have been entered and alignment is complete, the hand controller will display "Alignment Successful." Press **ENTER** to access the Main Menu. Otherwise, "Alignment Failed" will be displayed, and the alignment procedure must be performed again. To do this, turn the mount's power switch off, then on again.

One-Star Alignment

One-star alignment is the simplest and quickest alignment method, as only one alignment star is required. Due to minimal data input, however, a one-star alignment will not yield optimal results unless polar alignment is very accurate, and any cone error is minimized (see Appendix A). The description below will lead you on a step-by-step procedure on how to perform the one-star alignment.

1. From the alignment screen, select "1-Star Align" using the scroll buttons. Press **ENTER** to confirm your choice.
2. The hand controller will provide a list of stars available in your current sky for you to choose as the first alignment star. Using the scroll buttons, choose a star you are familiar with and press **ENTER** to confirm your choice. The mount will start slewing the telescope towards the chosen star. When the telescope stops slewing, adjust its position with the controller's directional buttons until the star is centered on the crosshairs of the finderscope. Now look in the eyepiece and adjust the position of the telescope (again using the directional buttons) so the chosen star is centered in the field of view of the eyepiece. Press **ENTER** to confirm the star is centered.
3. Once the alignment star has been entered and alignment is complete, the hand controller will display "Alignment Successful". Press **ENTER** to access the Main Menu.

Tips for Choosing Alignment Stars

If possible, use the following tips when choosing alignment stars for best pointing accuracy.

<u>One-star alignment:</u> Choose a star close to the Celestial Equator (Dec close to 0°).

<u>Two-star alignment:</u> Choose two stars on the same side of the meridian, and at least 3 hours apart in right ascension and 3° apart in declination. If you suspect your polar alignment is poor, choose two stars that are 20° to 60° apart in declination.

<u>Three-star alignment:</u> For the first two stars, follow the tip above for two-star alignment. For the third alignment star, choose a star on the other side of the meridian. The first and third alignment stars should have declination coordinates between +30° and +70° or between -30° and -70°.

Pointing Accuracy Enhancement (PAE)

The three-star alignment should provide excellent pointing accuracy for visual observation. For other applications, such as CCD imaging, even better pointing accuracy can be obtained in a specific region of the sky by use of the Pointing Accuracy Enhancement (PAE) function. Perform the following procedure to use the PAE function.

1. Choose a bright star near the area of interest in the night sky. Consult a planisphere or software program to choose this bright star, if necessary.
2. Find this star in the hand controller's object database. This is easily done by pressing the **OBJECT** button, which will take you directly to the Named Star database. Press **ENTER** to access the list of named stars. Use the scroll buttons to peruse the list, and press **ENTER** to select the star. Press **ENTER** again, and the LCD will ask "View Object?" Press **ENTER** to issue a command to the mount to GoTo the star. If the mount is under the control of a computer running planetarium software, click on the star to slew the mount to it.
3. Use the directional buttons (and **RATE** button) to accurately center the star in a high-powered eyepiece (10mm or less focal length).
4. Press the **ESC** button, then press and hold the **ESC** button for 2 seconds. The hand controller LCD will read "Recenter", and the name of the chosen bright star will blink three times. If the GoTo command was sent by a computer running planetarium software, the LCD will read "Last goto object" instead of the star's name.
5. Make sure the chosen star is still centered in the eyepiece, and press the **ENTER** button. If you don't want to record the star position, press the **ESC** button to exit the PAE function.

After the PAE function is performed, the hand controller will recalculate its model of the sky. The pointing accuracy in the area of sky around the chosen bright star should now be improved. To improve pointing accuracy in another region of the sky, perform the PAE function again, this time choosing a bright star in the new region of interest.

Note: If the mount is "parked" before it is powered off (see "Utility Functions"), the star alignments and PAE corrections will remain stored in the hand controller. As long as the mount is not moved between usage, the alignment will not need to be performed again when the mount is subsequently powered on.

Object Catalog

The GoTo hand controller boasts a vast database of over 13,400 object coordinates and information. The database contains the following catalogs:

Named Star - A list of 212 well-known bright stars.

Solar System - The other 8 planets of our solar system, and the Moon.

NGC - 7,840 of the brightest deep sky objects from the NGC 2000.0 database (edited by Roger W. Sinnott, copyright by Sky Publishing Corp., used with permission).

IC - 5,386 objects from the Index Catalog.

Messier - Complete list of all 110 Messier objects. These are some of the most spectacular objects to view in the night sky.

Caldwell - Complete list of all 109 Caldwell objects.

Double Stars - Includes 55 of the best double stars to view.

Variable Stars - Includes 20 of the most well-known variable stars.

User Defined - Up to 25 objects can be saved in the User Defined database (see "Using the User Defined Database").

Selecting an Object

Once the telescope has been aligned, you can access and view the variety of different objects in the GoTo hand controller's database. There are three methods of selecting a celestial object to view.

1. Shortcut Buttons

TOUR: Pressing this button takes you on a preset tour across the night sky. The brightest and most beautiful deep-sky objects will automatically be chosen by the hand controller for your viewing pleasure. Use the scroll buttons to view the different deep-sky objects that are available for viewing through the tour function. Choose the desired object by pressing **ENTER**. The LCD screen will display the coordinates of the chosen object. Press **ENTER** again, and the hand controller will ask "View Object?" Press **ENTER** once more to have the telescope slew to the object.

M, **NGC**, **IC**: These shortcut buttons give you direct access to the most popular celestial catalogs. Use the numeric buttons to select an object by entering its catalog number. Pressing **ENTER** will display its coordinate. Primary information such as size, magnitude, and constellation are obtained by pressing the scroll buttons. Press **ENTER** again, and the hand controller will ask "View Object?" Press **ENTER** once more to have the telescope slew to the object.

PLANET: This shortcut button takes you straight to the Planets submenu in the hand controller's database. Use the scroll buttons to scroll through the list of planets (and the Moon) in our solar system. Press **ENTER** to display the chosen planet's coordinates. Press **ENTER** again, and the hand controller will ask "View Object?" Press **ENTER** once more to have the telescope slew to the object. If the planet you selected is currently below the horizon, the hand controller will prompt you to make another choice.

USER: This shortcut button will take you to the database that you have defined for yourself. You can enter a new location or recall the objects that have been previously saved (see "Using the User Defined Database").

2. Object Button

The **OBJECT** button takes you to the Objects Catalog, where you have complete access to all of the celestial objects in the database. Simply scroll through the object catalogs using

the scroll buttons and choose the catalog of objects you wish to view. Press **ENTER** to confirm your choice. Use the scroll buttons to choose an individual object within the catalog and press **ENTER** a second time to display the object's coordinate. Press **ENTER** again, and the hand controller will ask "View Object?" Press **ENTER** once more to have the telescope slew to the object.

3. Menu

You can also access the Objects Catalog through the Main Menu. In the Main Menu, scroll down to "Object Catalog" and press **ENTER**. Like the **OBJECT** button, this gives you complete access to the 13,400 celestial objects in the hand controller's database.

Other Functions

The GoTo hand controller is equipped with a variety of additional functions that allow you to optimize performance and access other features of the system.

Utility Functions

Utility Functions are useful tools that provide simple, yet handy, processes to enhance your observing experience.

Show Position: Displays the coordinates (right ascension and declination) of the location where the telescope is currently pointing.

Display Time: Displays the local time and local sidereal time.

Park Scope: Moves the telescope to the "home" position. This allows you to power off the Atlas EQ-G mount while saving alignment and PEC training data. When subsequently powered on, the initial setup information must again be entered (be sure to enter the current time accurately!), but the alignment procedure can be skipped.

Inquire Version: Displays the hardware, firmware, and database version of the GoTo hand controller. If the hand controller is connected to the mount, this will also display the firmware version of the motor control board. Use the scroll buttons to view the version numbers.

PEC Training: See Appendix B for information

LCD/LED Tuning: Allows adjustments of the LCD character contrast, the LCD backlighting, and the LED backlighting of the pushbuttons. Use the scroll buttons to select which of these you wish to adjust. Use the left and right directional buttons to increase or decrease the value.

Setup Functions

The Setup functions allow you to change any system variable or information regarding location, time, date, and alignment. To access the Setup functions, either press the **SETUP** button on the hand controller or scroll to "Setup Mode" from the Main Menu using the scroll buttons and press **ENTER**. The different types of functions available to you are listed below, along with their respective purposes.

Date: Allows you to change the date entered during the initial setup.

Time: Allows you to change the current time.

Observing site: Allows you to change the current location (longitude and latitude) setting.

Daylight Savings: Allows you to change the Daylight Savings option.

Alignment: Allows you to re-perform the star alignment, (see "Alignment").

Set Backlash: This function allows you to insert a value for each axis to compensate for slewing backlash experienced on that axis. Backlash is a delay in motorized motion of the mount due to slack between gears. Backlash is experienced when the slewing direction is reversed on one or both axes of motion. For improved pointing accuracy, it is important the backlash value is set to be equal or greater than the actual amount of backlash between the gears. The default value for the backlash compensation is 0° 10' 0" (0 degrees, 10 arcminutes, 0 arcseconds). Use the numeric pushbuttons to enter the desired backlash compensation value. First set the value for R.A. backlash compensation, then press **ENTER** to set the value for DEC. Press **ENTER** again to return to the Setup Menu.

Note: Backlash compensation is only active for computerized slewing, not for manual slewing with the directional buttons.

Set Tracking:

-Sidereal Rate: Activates tracking at sidereal rate. This is the default tracking rate.

-Lunar Rate: Activates tracking at lunar rate.

-Solar Rate: Activates tracking at solar rate.

-PEC + Sidereal: Activates sidereal rate tracking with Periodic Error Correction.

-Stop Tracking: Stops tracking.

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 aperture of the instrument, or permanent eye damage could result. Young children should use this telescope only with adult supervision.

Auto Guide Speed: When using an autoguider, this sets the guiding speed to 1.125x, 1.25X, 1.5X, 1.75X, or 2X sidereal rate.

Using the User Defined Database

The GoTo hand controller allows you to save up to 25 objects in the User Defined database. You can save unidentifiable objects, current comet and/or asteroid positions, or make a custom list of your favorite objects to view.

Saving an Object to the Database

1. Press the **USER** button. You can also select "User Defined" in the Object Catalog menu and then press **ENTER**.
2. Use the scroll buttons to select "Input Coordi." and press **ENTER**.

3. You can **ENTER** the object's location by its R.A. and Dec. coordinates, or its azimuth and altitude coordinates. Press **1** (RA-Dec) or **2** (AzAlt) to make your selection.
4. The default setting will display the R.A./Dec. or Az/Alt coordinates the telescope is currently pointed to. Therefore, if the telescope is pointing at the object you wish to save (i.e. the object is centered in the eyepiece), simply press **ENTER**. If the object you wish to save is at another location in the sky, enter its coordinates using the numeric keypad. When finished inputting the coordinates, press **ENTER**.

Note: If the coordinates entered do not exist, the hand controller will not respond when **ENTER** *is pressed. Check the coordinates for data entry mistakes, and re-enter the correct coordinates.*

5. The hand controller will then ask "Save?" If you do wish to save the entered object coordinates, press **ENTER**. Otherwise, press **ESC**.
6. The controller will now prompt you to choose a number between 1 and 25 for your chosen object. Using the scroll buttons, select a number you wish to represent the object, then press **ENTER**. Keep in mind that if the object is assigned a User Object number that is already in use, the hand controller will overwrite the previously saved coordinates.
6. The hand controller will now display "View Object?" Press **ENTER** to slew the telescope to the object, or press **ESC** to exit.

Recalling a User Defined Object

1. Press the **USER** button. You can also select "User Defined" in the Object Catalog menu and then press **ENTER**.
2. Choose "Recall Object" and press **ENTER**.
3. Select the User Object number representing the object you wish to view using the scroll buttons. Press **ENTER** to display the object's coordinate. Press **ENTER** again, and the hand controller will ask "View Object?" Press **ENTER** once more to have the telescope slew to the object. (If a vacant User Object number is selected, the hand controller will not respond.)

Note: If the recalled User Object is currently below the horizon, the controller will display "Below Horizon!! Try another obj." and will automatically return to "Recall Object".

Identifying an Unknown Object

The GoTo hand controller has the ability to identify celestial objects that are unknown to you. To identify an object the telescope is pointing at, simply press the **ID** button. You can also scroll to "Identify" in the Main Menu and press **ENTER** to identify the object. The hand controller will then show a list containing the close objects in the M, IC, NGC, and Named Star catalogs and their angular distance from the location where the telescope is pointed. Use the scroll buttons to view this list of objects. Press **ESC** when finished.

Linking with a Computer

The GoTo hand controller can be connected to a computer via the supplied computer interface cable. Many commercially available planetarium software programs can utilize this function and be used to control the Atlas EQ-G mount. Look for software that is compatible with the Celestron NexStar 5i/8i or NexStar GPS, like Starry Night Pro. The description below will lead you through the procedure on how to connect and disconnect the Atlas EQ-G to a computer.

1. Align the mount as described previously (see "Alignment").
2. Connect the supplied computer interface cable to the smaller modular jack (RJ-11) on the hand controller (Figure 10). Connect the other end of the cable to the COM port of your computer.
3. In the planetarium software of your choice, choose "Celestron NexStar 5i" or "Celestron 8/9/11 GPS" for the driver setup and follow the instructions provided by the program to connect the mount and computer through the hand controller. The mount will be under the full control of your computer once the connection is successfully established.
4. When finished observing, follow the software's instructions to close the computer connection to the hand controller.

See Appendix C for more information on computer interfacing.

Auto Guiding

For astronomical imaging, the Atlas EQ-G mounts have a designated autoguider jack (Figure 11). The pin-outs on the 6 pin modular jack are SBIG compatible and can be used with most autoguiders available. Refer to Figure 15 when connecting the autoguider cable to the mount and calibrating the autoguider. Autoguiding speed can be adjusted using the "Auto Guide Speed" function in the Setup Menu.

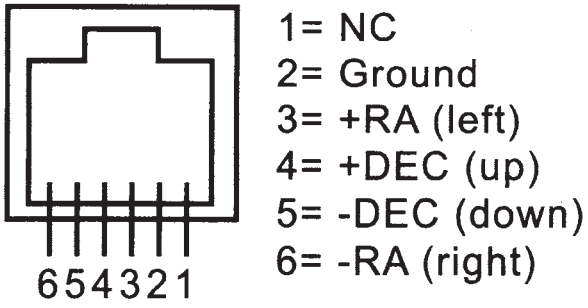


Figure 15. Pin diagram for the Atlas EQ-G autoguider jack.

Updating the GoTo Hand Controller's Firmware

From version 3.0 and up, the GoTo hand controller's firmware can be updated over the internet. Users can download firmware updates from Orion's website www.OrionTelescopes.com.

System Requirements

- GoTo hand controller version 3.0 or greater
- Windows95 or later

- An available RS-232 COM port on the PC
- Computer interface cable (supplied)
- DC power supply (7.5V to 15V @ 100mA or greater output with 2.1mm tip positive plug)

Preparing the Computer for the Update

1. Create a folder where you will store the files necessary for the update.
2. Go to the website www.OrionTelescopes.com, and access the support page for the Atlas EQ-G mount.
3. Download and save the Firmware Loader program to the folder you have created on your computer. You will need to download this program only once; after it is saved on your computer, only the firmware data file is needed for future updates.
4. Download and save the firmware update date file to the folder you created. The file will be named OrionVxxxxEQ.ssf, where xxxx indicates the version number of the firmware.

Updating the GoTo Hand Controller

1. Plug the modular plug end of the computer interface cable into the middle jack in the hand controller (Figure 10). Plug the serial connector end of the cable to the COM port on your PC.
2. Press and hold down the 0 and 8 numerical buttons simultaneously, then plug the power supply into the hand controller's DC power jack. The hand controller will beep and display "SynScan Update Ver. x.x" on the LCD screen.
3. Run the Firmware Loader program on your computer.
4. Click on the "Browse" box and select the OrionVxxxx.ssf file location where it was saved previously on your computer.
5. Click on the "Update" button, and the new firmware will begin loading into the hand controller. The Firmware Loader will show the progress of the update on your computer screen. It will usually take approximately 5 minutes for the new firmware to load into the hand controller. It may take significantly longer if a serial-to-USB adapter is employed on your computer.
6. When the download is complete, the Firmware Loader will display "Update Complete".

The firmware in the GoTo hand controller has now been updated. You can click on the "HC. Version" button to confirm the new version number of the firmware (and possibly the database, but the hardware version will not change with internet updates).

Note: If the error message "Can not connect to a SynScan hand control" appears on your computer, check all cable connections. Also, try closing all other computer programs that might be attempting to use the COM port.

Note: If the error message "Firmware update failed..." appears on your computer, remove the power plug from the hand controller, and then reconnect it. Now, repeat the firmware update procedure.

By default, the data communication rate between the GoTo hand controller and the computer is 115kbps. The RS-232 port on some PCs may not support this high data transfer rate. If the firmware update procedure fails after a few tries, try reducing the data transfer rate by pressing the SETUP button on the hand controller. This will reduce the data transfer rate to 9.6kbps. The controller's LCD screen will show "Lo" in the lower right hand corner to indicate the lower transfer rate setting. The firmware update procedure remains the same except it will take much longer for the firmware to load into the hand controller.

9. Technical Specifications

Mount:	German equatorial
Tripod:	Steel
Weight:	54lbs.
Counterweights:	Quantity 2, 11 lbs. each
Polar axis latitude adjustment:	10° to 65°
Polar axis finder scope:	Included, illuminator built into mount
Motor drives:	Dual-axis, GoTo computerized, internally housed
Operation:	Northern or Southern hemisphere
Power requirement:	12V DC, 2A (tip positive)
Motor type and resolution:	Microstep driven 1.8° stepper motors
Resolution:	0.144 arc sec (or 9,024,000 steps/rev)
Gear ratio:	705

#7795 Dual-Axis hand controller

Slew speeds:	Guiding speed
	4x
	8x
	32x
	64x
	800x
Guiding speeds:	2x / 1.75x / 1.5x / 1.25x sidereal rate
Tracking rates:	sidereal, lunar, solar
Tracking mode:	R.A. tracking

#7796 GoTo hand controller

Slew speeds:	Rate 0 = 1.5x
	Rate 1 = 2x
	Rate 2 = 8x
	Rate 3 = 16x
	Rate 4 = 32x
	Rate 5 = 64x
	Rate 6 = 400x
	Rate 7 = 500x
	Rate 8 = 600x
	Rate 9 = 800x (3.4°/sec)
Autoguiding rates:	2x / 1.75x / 1.5x / 1.25x sidereal rate
Tracking rates:	Sidereal (default), lunar, solar, PEC + sidereal
Tracking modes:	R.A. tracking
Alignment method:	One-star alignment, two-star alignment, three-star alignment
Database:	25 user-defined objects, complete M, NGC, and IC catalogs.
	Total 13,436 objects
Pointing accuracy:	Up to 1 arcminute with cone error calibration, up to 15 arcminutes without cone error calibration.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device nay not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

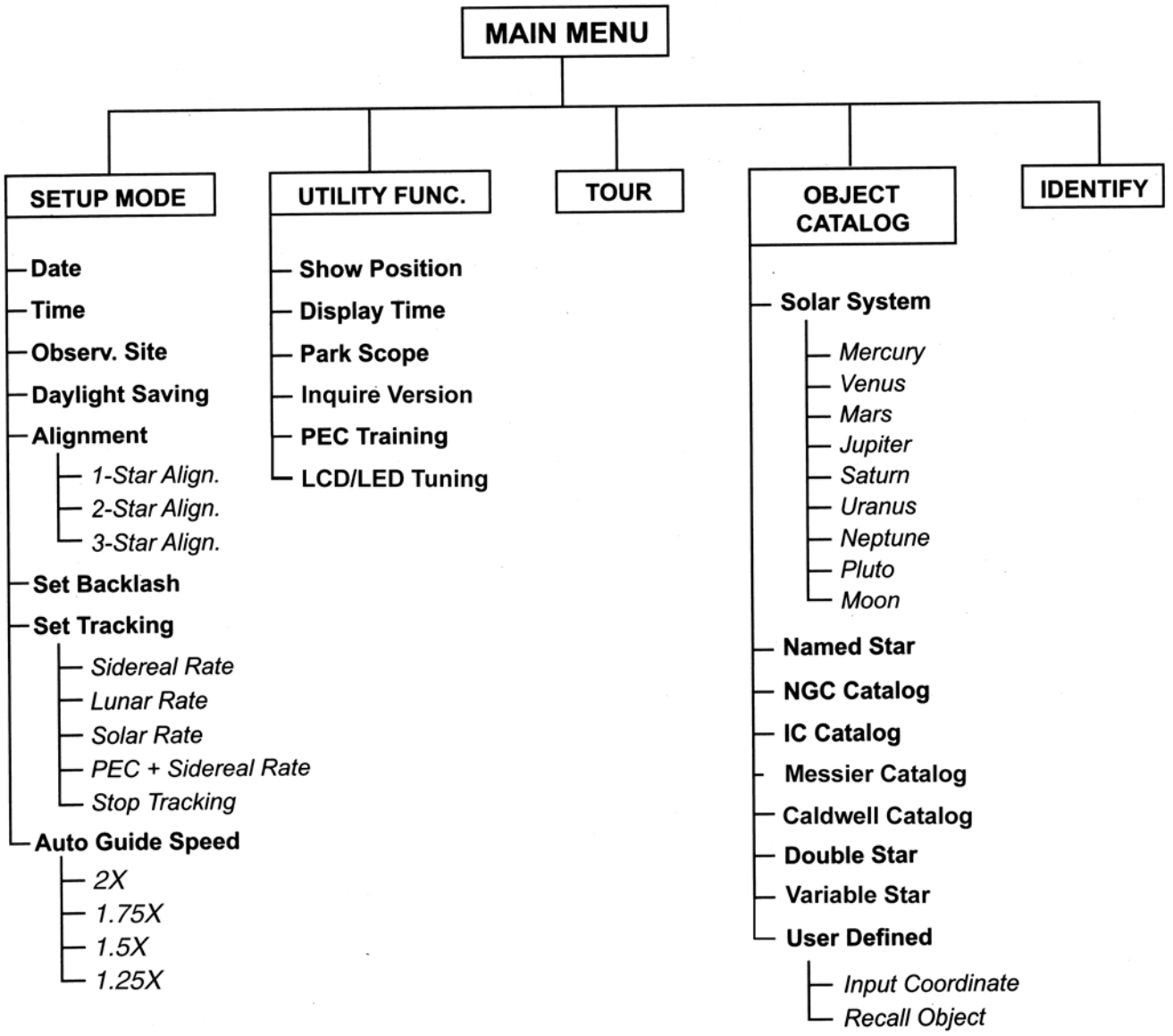
Changes of modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will no occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an output on a circuit different from that to which the receiver in connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

A shielded cable must be used when connecting a peripheral to the serial ports.

Atlas EQ-G GoTo
Hand Controller Menu Tree



Note: The following appendices apply to the Atlas EQ-G with GoTo hand controller only.

Appendix A: Enhancing the Pointing Accuracy

The Atlas EQ-G produces pointing accuracy and tracking accuracy adequate for most applications. If higher precision is required, "cone" error calibration may be necessary.

Cone Error Calibration

"Cone" error is a common inaccuracy found on all German equatorial mount designs. Cone error results from the optical axis of the telescope not being aligned to the R.A. axis of the mount. This affects the pointing accuracy of the Atlas EQ-G. Three-star alignment automatically compensates for some of the cone error, but pointing accuracy will be optimized by mechanically minimizing the cone error. The following calibration procedure should be performed before the initial use of the telescope and periodically thereafter to ensure peak accuracy.

Testing for Cone Error

This test is performed at night using two bright stars located on opposite hemispheres of the night sky. Confirm that the telescope is properly polar-aligned using the polar axis finder scope. Perform the one-star alignment using an eastern star as the alignment star (see "One-Star Alignment"). After completing the star alignment, choose a bright star in the western sky from the Atlas EQ-G object database and press **ENTER** to slew the telescope to the star. If the optical axis is perfectly aligned to the R.A. axis, the telescope will accurately put the star in the center of the eyepiece. This shows that there is no cone error in your telescope setup and you will not need to perform the calibration. It is acceptable if the star is slightly off-center as long as it appears in the eyepiece field of view and reasonable close to the center. Many factors determine the pointing accuracy of the Atlas EQ-G. Incorrect star alignment, loose R.A. or Dec. lock-knobs, or cone error. If the Atlas EQ-G puts the star outside the eyepiece field of view, you need to determine which of these factors is causing the pointing inaccuracy. To determine if the inaccuracy is caused by cone error, simply move the telescope about the R.A. axis by pressing the Left or Right direction button. If the star can be moved into the eyepiece field of view without adjusting the Dec. axis, it is likely that cone error exists in your telescope setup.

Calibration Procedure

1. Insert an illuminated reticle eyepiece (not supplied) into the focuser (or diagonal) of the telescope. Confirm the telescope is properly set up and balanced, and the finderscope is aligned with the optical tube of the telescope.

Note: Steps 2 to 4 are to identify R.A. and DEC movements in the reticle eyepiece. If you are already familiar with the movements, proceed to step 5.

2. Find a bright star and position the telescope so the star is centered in the eyepiece field of view.
3. Look into the eyepiece. Move the telescope about the R.A. axis using the R.A. direction buttons on the hand controller while carefully observing the movement of the star.
4. Keep moving the telescope about the R.A. axis back and forth to keep the star within the eyepiece field of view. Rotate the eyepiece in the focuser (or diagonal) until the movement of the star becomes parallel to one of the illuminated crosshairs (Figure 16). This crosshair will represent R.A. movement in the course of this procedure, and the perpendicular crosshair will represent Dec. movement. Tighten the set screws to secure the eyepiece in position. Make sure the eyepiece will remain stationary while the telescope is moved.

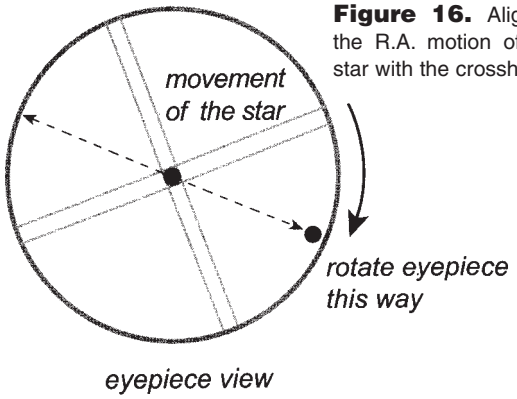


Figure 16. Aligning the R.A. motion of the star with the crosshairs.

5. Point the telescope North and set the latitude scale to your local latitude using the altitude adjustment L-bolts. Alternatively, place Polaris in the polar axis finder scope if your polar axis finder scope is accurately aligned with the mount.
6. Loosen the R.A. lock knob and rotate the telescope about the R.A. axis until the counterweight shaft is parallel to the ground (as shown in Figure 18a).
7. Using the Dec. direction button on the hand controller, adjust the telescope in Dec. so Polaris lies on the R.A. crosshairs of the illuminated reticle eyepiece (Figure 17).
8. Without moving the R.A. axis, adjust the azimuth control knobs (Figure 2) to orient Polaris in the center of the eye-

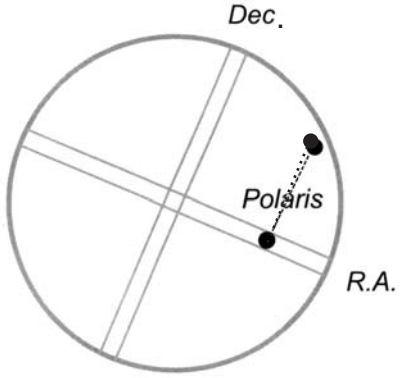


Figure 17. Adjust the telescope in Dec. (with the hand controller) to place the star on the R.A. crosshair.

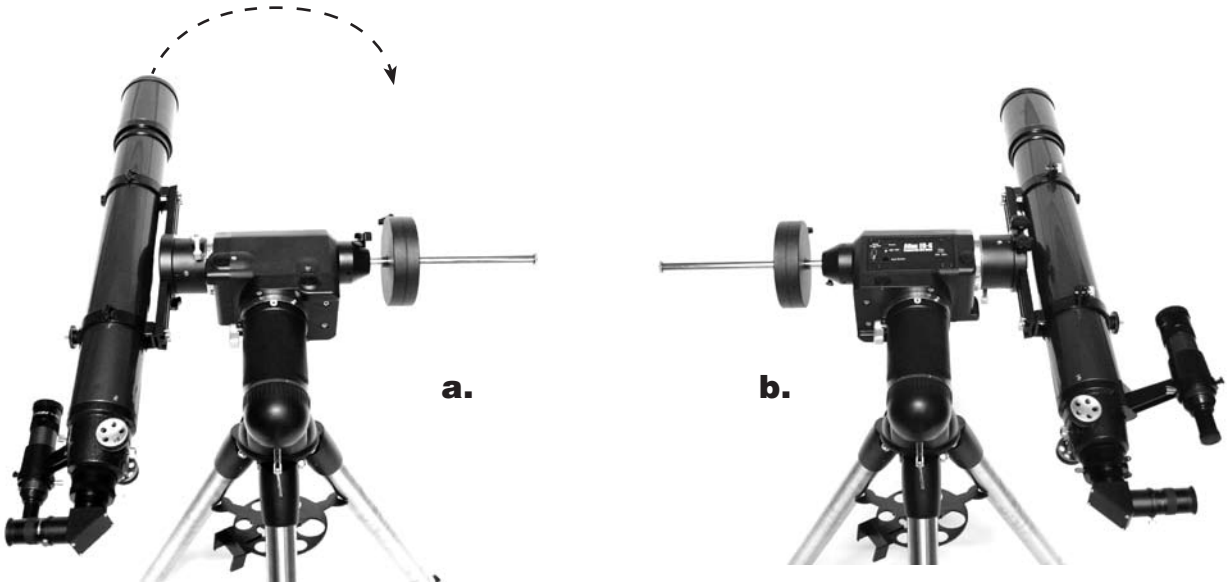


Figure 18a-b. Rotate the telescope 180° about the R.A.axis.

piece field of view. Adjustment in Dec. axis using the hand controller may be necessary.

9. Loosen the R.A. lock knob and carefully rotate the telescope 180° about the R.A. axis (Figure 18a &18b) This should be done as accurately as possible referencing the R.A. mechanical setting circle.
10. Adjust the position of the telescope in the Dec. axis so Polaris lies on the R.A. crosshairs of the illuminated reticle eyepiece (Figure 17).
11. Carefully push the telescope in horizontal motion while observing the movement of Polaris in the eyepiece field of

Figure 19. gently push the telescope horizontally to determine direction of optical axis offset.

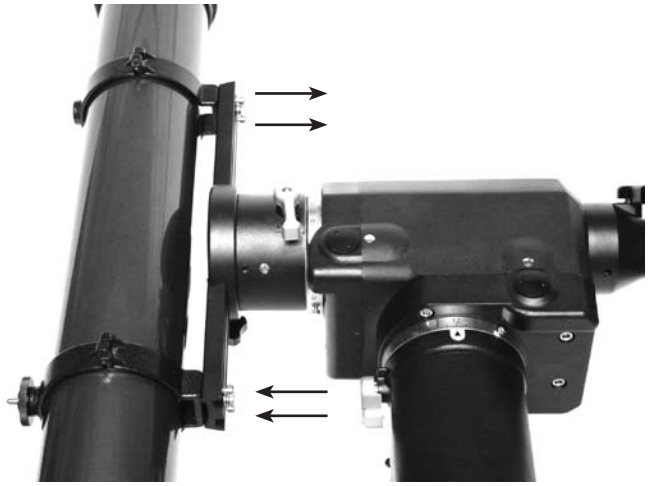


Figure 20a. Adjust the optical axis offset screws this way if Polaris moves toward the center of the eyepiece when the tube is pushed as in Figure 19.

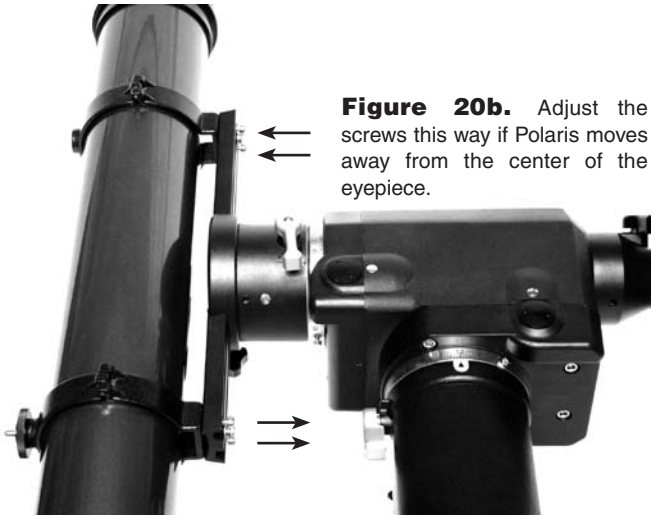


Figure 20b. Adjust the screws this way if Polaris moves away from the center of the eyepiece.

view (Figure 19). This will determine which direction (left or right) moves Polaris closer to the center of the eyepiece field of view.

12. Carefully and gently loosen both the tube ring attachment screws (Figure 3) by a couple of turns.

13. Make adjustments to the optical axis offset adjustment screws (the socket head cap screws located at each corner of the mounting plate, (Figure 3) according to the results of step 11. If Polaris moves toward the center when the telescope is pushed as indicated in Figure 19, loosen the adjustment screws near the front of the tube and tighten the adjustment screws closer to the back of the tube (Figure 20a). If Polaris moves away from the center when the telescope is pushed as in Figure 19, loosen the adjustment screws near the back of the tube and tighten the adjustment screws closer to the front of the tube (Figure 20b). Look into the eyepiece. Adjust the adjustment screws just enough to place Polaris HALF the distance back to the center of the illuminated reticle eyepiece (Figure 21).

14. Repeat steps 7 to 12 until Polaris remains in the center of the eyepiece field of view, or moves slightly around the center, when the mount is rotated about the R.A. axis.

Note: This calibration method can be applied to both refracting and reflecting telescope designs. Differences in the optical path of telescopes do not affect how the telescope tube and tube rings should be adjusted on the mounting plate.

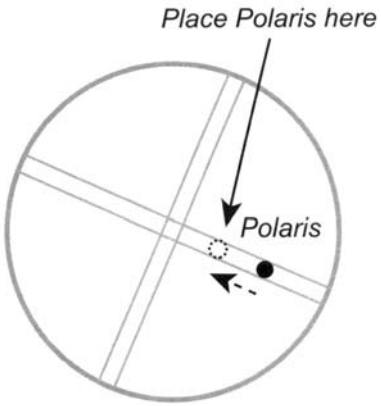


Figure 21. Using the optical axis offset screws move Polaris halfway to the eyepiece's center.

Appendix B: Periodic Error Correction (PEC)

Using the PEC functions requires an illuminated reticle eyepiece capable of producing at least 300X magnification when used with your telescope. For best results, the true field of view should not exceed 10 arcminutes.

Periodic errors are inherent in almost all worm gears due to slight eccentricities and misalignments. The PEC (Periodic Error Correction) Training function provides a manual correcting method to reduce the amplitude of the worm gear errors. By recording a full cycle of guiding actions, the Atlas EQ-G can compensate for drifting in the R.A. sidereal tracking caused by periodic errors. The following instruction will lead you on a step-by-step procedure for performing the PEC.

Note: The PEC training function is recommended for advanced users with interest in long-exposure astrophotography only. Careful guiding is required. Standard sidereal tracking is sufficient for all casual visual applications of the Atlas EQ-G, and PEC training is not required.

PEC Training

1. Perform an accurate polar alignment using the polar axis finder scope.
2. Manually point or electronically slew the telescope mounted on the Atlas EQ-G to a star with a small value Dec. coordinate (Dec. between +10° and –10°). This object will be used as the guide star.
3. Activate "Sidereal Tracking" from the Setup menu (see "Setup Functions"). Once tracking has initiated, press **ESC** to return to the Setup menu.
4. Rotate the reticle eyepiece in the focuser (or diagonal) until the R.A. movement of the star becomes parallel to one of the illuminated crosshairs
5. Move the guide star designated in step 2 to the center of the eyepiece field of view using the direction buttons.
6. On the hand controller, select "PEC Training" in the Utility Functions and press **ENTER**.

*Note: Utility Functions can be accessed by pressing the **UTILITY** quick rererence button on the hand controller.*

7. Select the R.A. guide speed for the PEC Training. You have two guide speed choices: 1) 0.25X and 2) 0.5X. Press the numeric button 1 to choose a guide speed of 1.25X or press 2 to choose a guide speed of 1.5X.
8. The Atlas EQ-G hand controller will display the current time once the guide speed has been selected, indicating the recording has begun.
9. Using the left or right direction button only, move the telescope so the guide star remains centered in the eyepiece field of view (Figure 21). Repeat as necessary.

The Atlas EQ-G hand controller will record the manual guiding actions for 8 minutes in order to characterize the periodic

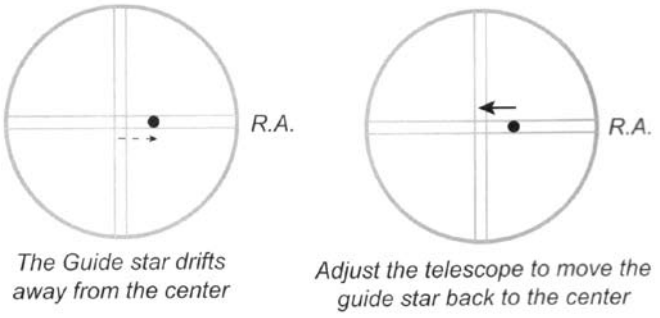


Figure 22. Drifting caused by periodic error.

errors. Pressing **ESC** will immediately stop the recording and exit from the PEC Training function.

Note: Guiding actions are recorded even when the PEC training is stopped midway. The PEC + sidereal tracking will not be accurate until a full cycle of the PEC Training is performed.

The Atlas EQ-G will emit a “beep” sound and display “Record completed” when the training time is up. Press any button to exit from the PEC Training upon completion.

Play Back the PEC Record

PEC tracking can be activated under the Setup menu or by pressing the **Setup** button when needed. In the Setup menu, choose “Set Tracking”, then “PEC + Sidereal”. The Atlas EQ-G will play back the corrections you made during the PEC training cycle and start tracking with periodic error compensated for.

Note: The Atlas EQ-G will continue to track in the PEC + sidereal mode until another tracking mode is selected. If the power is turned off while the Atlas EQ-G is in the PEC + sidereal mode, the hand controller loses synchronization with the R.A. worm gear and the PEC training will have to be repeated when the power is turned back on. To avoid this, be sure to return the telescope to its home position by selecting “Park Scope” in the Utility Functions before turning off the power.

Appendix C: RS-232 Connection

The Atlas EQ-G mounts equipped with the GoTo hand controller are designed to receive commands sent from a computer's RS-232 COM port (via the computer interface cable). The hand controller will communicate with the computer at 9600 bits/sec, no parity, no stop bit. All angles are communicated with 16 bits and communicated using ASCII hexadecimal. The chart below shows the ASCII commands from the PC, and what the hand controller's response will be.

Additional RS-232 Commands

Sending a Tracking Rate

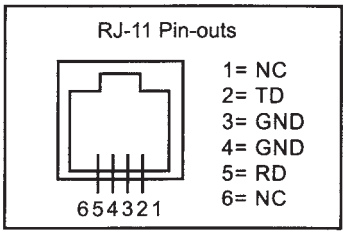
1. Multiply the desired tracking rate (arcseconds /second) by 4. For example: if the desired track rate is 120 arcseconds/second (approximately 8 times sidereal rate), then the TRACKRATE = 480.
2. Separate TRACKRATE into two bytes, such that (TRACKRATE = TrackRateHighByte*256 + TrackRateLowByte). For example, if TRACKRATE = 480, then TrackRateHighByte = 1 and TrackRateLowByte = 224.
3. To send a tracking rate, send the following 8 bytes:
   a. Positive Azm tracking: 80, 3, 16, 6, TrackRateHighByte, TrackRateLowByte, 0, 0
   b. Negative Azm tracking: 80, 3, 16, 7, TrackRateHighByte, TrackRateLowByte, 0, 0
   c. Positive Alt tracking: 80, 3, 17, 6, TrackRateHighByte, TrackRateLowByte, 0, 0
   d. Negative Alt tracking: 80, 3, 17, 7, TrackRateHighByte, TrackRateLowByte, 0, 0
4. The number 35 is returned from the hand controller.

Sending a Slow-GoTo Command

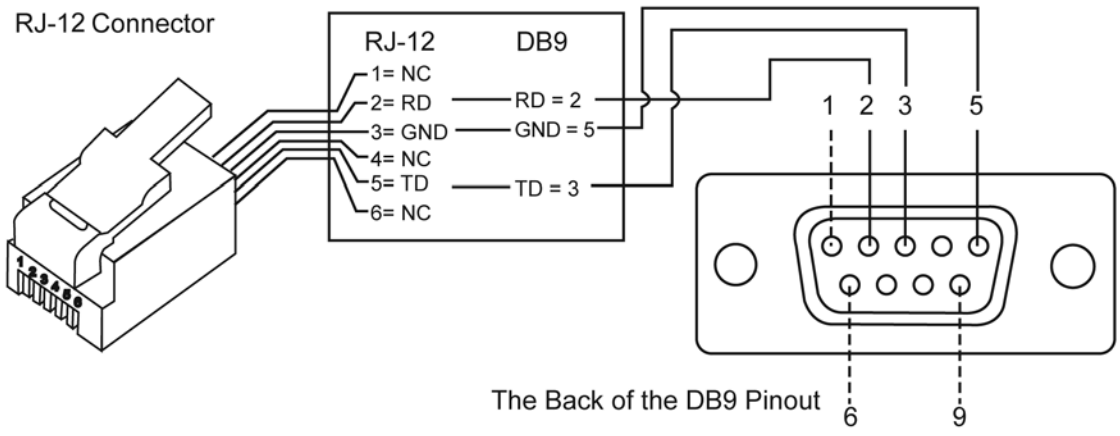
1. Convert the angle position to a 24 bit number. Example: if the desired position is 220, then POSITION_24BIT = (220/360)*224 = 10,252,743
2. Separate POSITION_24BIT into three bytes such that (POSITION_24BIT = PosHighByte * 65536 + PosMedByte * 256 + PosLowByte). Example: PosHighByte = 156, PosMedByte = 113, PosLowByte = 199
3. Send the following 8 bytes:
   a. Azm Slow Goto: 80, 4, 16, 23, PosHighByte, PosMedByte, PosLowByte, 0
   b. Alt Slow Goto: 80, 4, 17, 23, PosHighByte, PosMedByte, PosLowByte, 0
4. The number 35 is returned from the hand controller.

Resetting the Position of Azimuth or Altitude

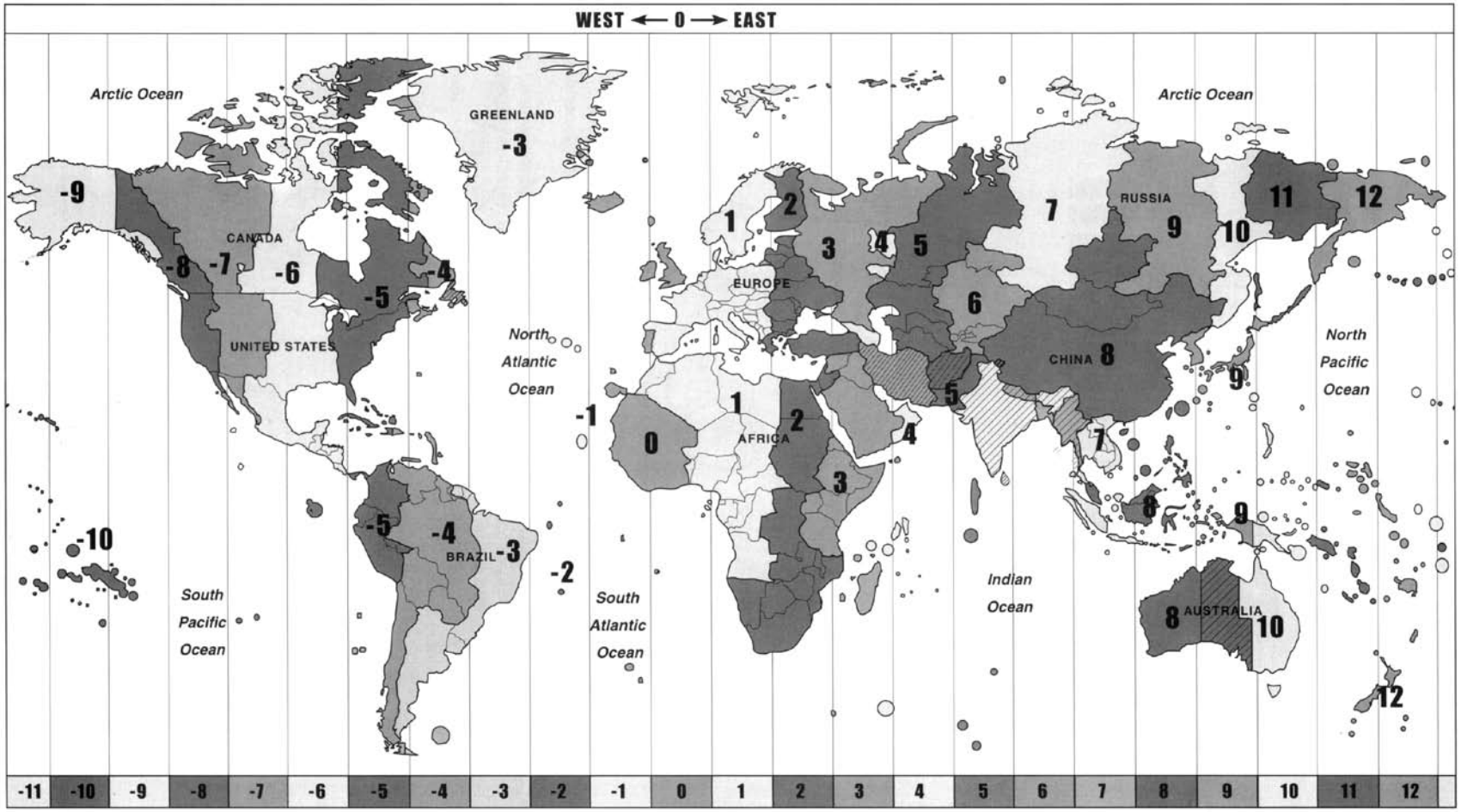
1. Convert the angle position to a 24bit number, same as Slow-Goto example.
2. Send the following 8 bytes:
   a. Azm Set Position: 80, 4, 16, 4, PosHighByte, PosMedByte, PosLowByte, 0
   b. Alt Set Position: 80, 4, 17, 4, PosHighByte, PosMedByte, PosLowByte, 0
3. The number 35 is returned from the hand controller.



Physical Connection Diagram



Appendix D: Standard Time Zones of the World



One-Year Limited Warranty

This Orion Atlas EQ-G 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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