

# Orion® TeleTrack AZ-G™ Altazimuth GoTo Mount

#9481



**Figure 1:** The TeleTrack AZ-G Altazimuth GoTo Mount

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*Congratulations on your purchase of a quality Orion product. Your new TeleTrack AZ-G Altazimuth GoTo Mount allows high performance support for terrestrial or astronomical observations. The TeleTrack AZ-G is an “altazimuth” type of mount which can move in both altitude (up and down) and azimuth (left and right) with respect to the ground. Designed for use during day or night, your TeleTrack AZ-G mount features a smooth altazimuth fork arm head, adjustable tripod, and multi-function hand controller for convenient operation.*

The TeleTrack AZ-G Altazimuth GoTo Mount is designed for small telescopes, spotting scopes and cameras. The weight of the instrument supported by the mount should not exceed 9 lbs. The mount will also work best with short tube optical systems no longer than 15" (380mm).

This precision mount will locate and automatically slew to thousands of fascinating celestial denizens including the planets of our solar system, our Moon, galaxies, nebulae, stars, and star clusters. With a little practice, you'll find that the TeleTrack AZ-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 TeleTrack AZ-G mount. Please read them over thoroughly before getting started. It may take a few observing sessions to become familiar with all the features of the TeleTrack AZ-G mount, so keep this manual handy until you have mastered your mount's operation.

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## 1. Parts List

Qty.	Description
1	Hand controller
1	Hand controller cable
1	Adjustable tripod
1	Fork arm
1	L-bracket with ¼"-20 adapter
1	Computer Interface cable
1	Hand controller bracket

## 2. Assembly

The TeleTrack AZ-G Mount comes partially assembled and can become operational in a matter of minutes. It is packaged in one reusable shipping carton. Remove all parts from the box. Make sure all the parts listed In Section 1 are present. Remember to save all the shipping containers so that they

can be used to transport the mount. In the unlikely event that you need to return the mount, you must use the original packaging.

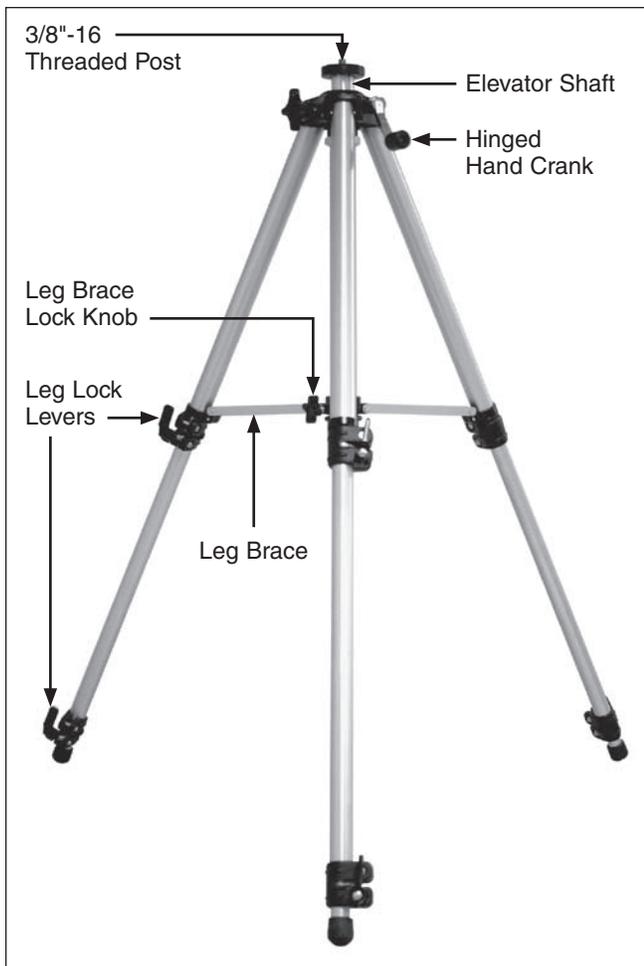
Refer to Figures 1, 2, and 3 during assembly.

1. Remove the tripod from its box. Note that each leg has two telescoping sections. To extend each leg, loosen the leg lock lever by rotating it counterclockwise, then extend the leg. When it has been extended to the desired length, rotate the leg lock lever clockwise until tight. Before placing an instrument on the mount, it is a good idea to press down on the tripod to make sure the legs are locked securely and will not give way under the instrument's weight.

2. The TeleTrack AZ-G's tripod has a wide stance for enhanced stability. The widest stance is achieved when the leg brace is as far down as it will go on the elevator shaft housing. The leg brace lock knob should be tightened to secure the stance.

If you are using the tripod in a confined space, the stance can be narrowed by loosening the leg brace lock knob and pushing the legs closer together. Re-tighten the lock knob to secure the legs in the new position. Be aware that the tripod will become more prone to tipping as its stance is narrowed. Be very careful when mounting an instrument with an offset, or unwieldy, center of gravity on the tripod, especially if it begins to approach the 9 lb. weight limit.

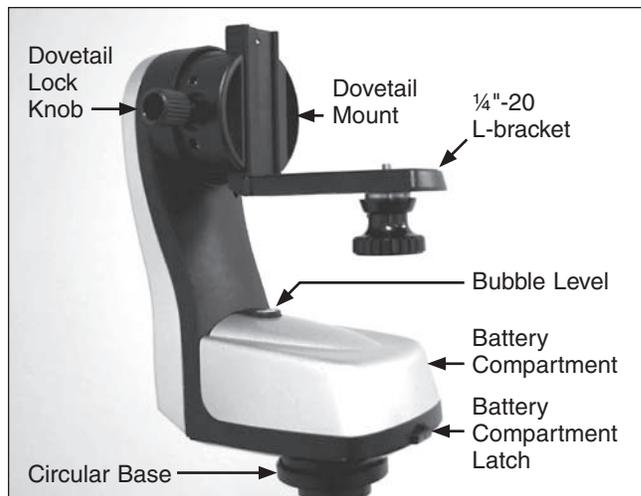
3. With the tripod secure, the fork arm can be easily attached using the 3/8"-16 threaded post on top of the tripod mounting platform. There is also a 3mm socket-head cap screw on the underside of the mounting platform that helps to lock the fork arm in place. Loosen, but do not remove, this allen-screw so that the fork arm will not contact the lock-screw while attaching the head. Hold the fork arm so its circular base is facing downward and place it on the 3/8"-16 threaded post gently. Rotate the entire fork arm



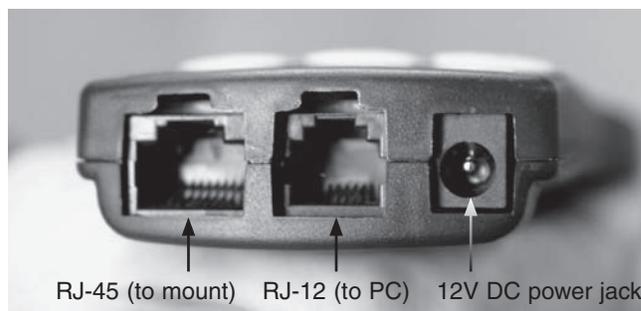
**Figure 2:** The TeleTrack AZ-G Tripod

assembly clockwise until it threads completely onto the tripod's 3/8"-16 threaded post, and rests securely on the tripod's mounting platform. Now tighten the lock-screw from underneath the mounting platform to provide extra stability to the assembly.

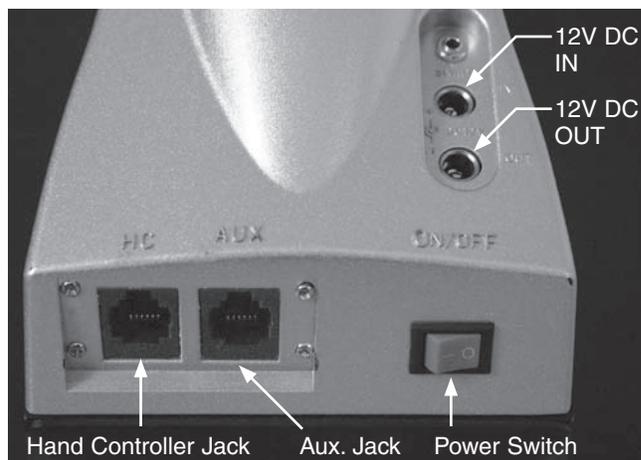
4. There is a bubble level at the base of the fork arm. To make the fork arm level, simply adjust each tripod leg up or down, one at a time, until the bubble rests in the central black circle of the level. Proper leveling of the tripod will maximize stability.
5. To raise or lower the TeleTrack AZ-G Mount's fork arm to a comfortable height, first loosen the elevator lock knob on the tripod, then use the hinged hand crank to move the elevator shaft up or down. Re-tighten the elevator lock knob to secure the instrument at the new height. The mount will be most stable when the elevator shaft is not extended.
6. The TeleTrack AZ-G hand controller cable has a large, modular connector (RJ-45) and a smaller, modular connector (RJ-12). First, plug the large modular connector of the hand controller cable into the corresponding jack on the hand controller (Figure 4a) until it clicks into place. The smaller jack is used to interface the TeleTrack AZ-G



**Figure 3:** The TeleTrack AZ-G GoTo Mount Fork Arm



**Figure 4a:** Hand controller outlets



**Figure 4b:** Connector Ports on the TeleTrack AZ-G GoTo Mount

hand controller with a computer running planetarium software (optional). The 12V power jack on the hand controller allows independent use of the TeleTrack AZ-G hand controller. This is helpful for users who wish to browse the object database or when performing firmware upgrades.

7. Attach the other end of the connector into the jack labeled "HC" on the TeleTrack AZ-G mount head (Figure 4b).

The TeleTrack AZ-G hand controller allows direct access to all of the user-friendly motion controls of the mount and

a database with a wide range of preset objects. The hand controller display is backlit for comfortable viewing. Make sure not to confuse the “HC” jack with the “AUX” jack. The “AUX” jack is not used for normal operation of the mount.

**Note: Do not attempt to reposition the altitude or azimuth of the mount by hand! Doing so can damage the gears and motors within the mount.**

### 3. Powering the TeleTrack AZ-G Mount

The TeleTrack AZ-G mount can be powered by 8 AA batteries, an optional 12V DC power supply, or an optional AC adapter.

#### Powering by AA Batteries

For maximum portability, the TeleTrack AZ-G mount features a battery compartment that holds eight (8) AA alkaline batteries (user supplied). To open the compartment, press down on the black battery compartment latch (see Figure 3) and gently lift the cover off. You will find two separate battery holders that hold 4 AA batteries each. For easiest installation, detach each battery holder and insert your AA batteries until each holder is full. Be sure to orient the batteries as indicated on the battery holder. Reattach the filled battery holders securely using the snap connectors and close the battery compartment by pressing its cover down gently until its latch clicks. Power the TeleTrack AZ-G on by pressing the red on/off switch to the “on” position.

#### Powering by External Power Source Portable Battery

For optimal results, we recommend using a portable rechargeable battery like the Dynamo Pro available from Orion. These 12V DC batteries will power the mount far longer than standard AA batteries. Make sure your rechargeable battery is tip positive and capable of producing continuous current with a minimum of 1 amp.

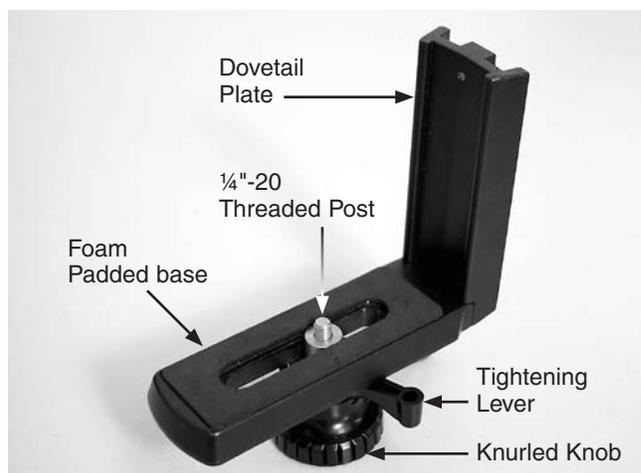
If you are using a portable battery like the Orion Dynamo Pro, use the Dynamo’s supplied 12V DC power cable (cigarette lighter plug on one end, standard 12V DC power plug on the other end) to connect the battery to the 12V “DC IN” (Figure 4b) power jack on the side of the mount. Make sure the Dynamo’s power switch is in the “off” position when connecting cables. Power the TeleTrack AZ-G on by pressing the red on/off switch to the “on” position

#### AC Adapter

In addition, the mount can be powered by an optional AC adapter rated at 12V DC, 1000mA, tip positive. Plug the adapter cord into the “DC IN” power jack for operation. Power the TeleTrack AZ-G on by pressing the red on/off switch to the “on” position.

#### Power Output

Unlike many mounts in its class, the TeleTrack AZ-G Mount will provide power output for accessories like digital cameras



**Figure 5:** The TeleTrack AZ-G GoTo Mount 1/4"-20 L-bracket

or camcorders. It accepts a DC power plug (tip positive) and provides 12V DC power output. To power a 12V accessory with the TeleTrack AZ-G, simply plug the accessory’s 12V DC power cable into the “DC OUT” (Figure 4b) jack on the side of the mount.

**Caution: Never plug an external power supply cord into the “12V DC OUT” jack accidentally. This may damage the AA batteries inside the battery compartment, and possibly damage the mount itself.**

### 4. Attaching a Telescope or Camera

#### USING THE L-BRACKET

Your TeleTrack AZ-G Mount comes with a convenient L-bracket (Figure 5) that provides coupling to the mount with the standard 1/4"-20 threaded hole found on most cameras, camcorders, and many telescopes.

#### Attaching an Instrument to the L-bracket

With the foam-padded base of the L-bracket facing upward, gently place the 1/4"-20 threaded hole in your optical instrument onto the 1/4"-20 threads on the L-bracket. Turn the black knurled knob so the 1/4"-20 threaded post completely engages the 1/4"-20 threaded hole in your telescope, spotting scope, or camera. Tighten by rotating the tightening lever on the underside of the L-bracket until secure.

#### Attaching the L-bracket to the Mount

The L-bracket has a short dovetail plate that slides into the corresponding dovetail mount on the fork arm. The other section of the L-bracket has a foam-padded base for your telescope or camera.

Insert the dovetail plate of the L-bracket into the dovetail mount, making sure that it is oriented as shown in Figure 3. Then tighten the dovetail lock knob until snug.



**Figure 6:** The TeleTrack AZ-G hand controller

## 5. The TeleTrack AZ-G Hand Controller

The TeleTrack AZ-G is a precision-engineered alt-azimuth mount that 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 TeleTrack AZ-G hand controller and internal dual-axis motors allow you to automatically point your telescope at a specific object, or tour the skies with push-button simplicity. The user-friendly menu allows auto-slewing to over 42,900 objects. Even inexperienced astronomers will find themselves quickly mastering the variety of features the TeleTrack AZ-G offers in just a few observing sessions.

### Functions of the Hand Controller

There are four main categories of control buttons on the hand controller (Figure 6):

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 display. 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 sub-menus in the menu tree, and to confirm certain functional operations.

The **SETUP** button is a quick hot key that takes you to the Setup submenu

#### Directional Buttons

The directional buttons allow the user to have complete control of the mount at almost any step in operation. These controls are locked out when the telescope is slewing to an object. The directional buttons are very helpful when initially aligning the TeleTrack AZ-G, centering objects in the eyepiece field of view, and manual guiding. The left and right directional buttons can also be used to move the text cursor when entering data on 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 that provides useful tools in configuring your mount.

**USER** button: Gives access to up to 25 user-defined coordinates

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

**NGC, IC, M, Planet,** and **Object** buttons: Allows direct access to database of over 42,900 objects.

#### Initial Setup

1. Turn on the power switch on the mount
2. The initial screen displayed on the hand controller is the Version Screen. Press **ENTER** to proceed.

**Note:** *The hand control's backlit display will become more dim and the illuminated buttons will turn off if left idle for 30 seconds. Pressing any button will illuminate the display.*

3. Enter the telescope's current latitudinal and longitudinal position using the numeric keypad and scroll buttons. First enter the longitudinal coordinate and hemisphere (W or E), followed by the latitudinal coordinate and hemisphere (N or S). If you do not know the latitude and longitude coordinate of your viewing location, consult an atlas or geographical map of your area. Press **ENTER** to confirm your coordinates.

**Note:** *Latitude and longitude 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. To do this simply multiply the decimal value by 60. If your viewing location is at latitude 36.95 N you would enter a latitude of 36°57' N [.95x60=57].*

6. Enter the time zone in which you are observing in hours (see Appendix A), using the scroll keys and numeric keypad (+ for east of Prime Meridian, - for west of Prime Meridian). Press **ENTER** to confirm your choice.
7. Enter the date in the following format mm/dd/yyyy using the numeric keypad. Press **ENTER** to confirm your choice.
8. Enter your current local time using the 24 hour time mode (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 to proceed to the next step.
9. Press **ENTER** if you are currently on Daylight Savings time. Use the scroll button to scroll down to "NO" and press **ENTER** if you are not on Daylight Savings Time.

The TeleTrack AZ-G is now ready to begin the alignment procedure.

**Note:** If a mistake was entered into the TeleTrack AZ-G hand control during the initial setup, press the ESC key to go back to the previous menu, and press ENTER to start again.

## 6. Aligning the TeleTrack AZ-G

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

There are two ways to align the TeleTrack AZ-G. If you are new to astronomy, we recommend that you begin with the Brightest-star Alignment. This method will help you to choose stars if you are not familiar with the night sky. The description below will lead you through a step-by-step procedure on how to perform this alignment.

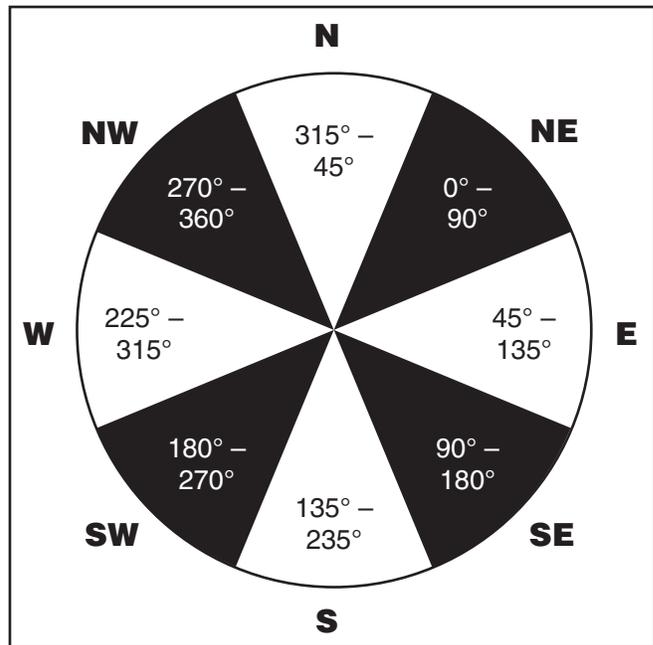
**Note:** Before performing any of the alignment methods, be sure that your finder scope is well aligned with the telescope tube

### Brightest Star Alignment

This method allows you to choose the brightest alignment star within a selected region of the sky. Even if you are not familiar with the names of stars in the sky, simply choose the direction of a visible bright star and the TeleTrack AZ-G can help you to identify it. This method can also be useful if your visibility is limited due to obstructions such as trees, hills, or buildings.

**Note:** Before beginning any alignment procedure be sure that your finder scope is correctly aligned with your telescope.

1. First select "Brightest Star" as your Alignment Method. Press **ENTER**.
2. The hand controller will prompt you to "Select Region". Choose the direction which corresponds with where you see the brightest star in the night sky. It may be helpful to have a compass for reference during this process. There are 8 regions to choose from (Figure 7). The direction you



**Figure 7:** Pie chart of 8 geographical directions.

- choose will only affect your alignment star selection; you will still be able to choose stars to view across the entire sky once the alignment is complete.
3. After you have selected the region of the sky with the brightest star, the hand controller will generate a list of the brightest stars (magnitude 1.5 or brighter) in that region. (If there are no suitable stars in the direction you have chosen, the text "No Star Found in the Region" will display. If this occurs, press **ENTER** or **ESC** and select another region of sky.) Now, use the Scroll keys to scroll through the list of bright stars. There will only be a few stars, at most, on the list, and sometimes only one star will be on the list. The hand controller will display the name and magnitude of the bright star on the first line, and the approximate position of the star (based on the time and date entered during the initial setup) on the second line. The first coordinate on the second line is an E-W coordinate, and the second coordinate on the second line indicates degrees above the horizon. These coordinates provide a simple way to identify the bright star you have chosen. When you are confident the hand controller is displaying the name of the bright star you wish to align on, press **ENTER**.
  4. The mount will not slew to the selected bright star automatically. Instead, the hand controller will direct you to manually slew the mount to the selected star. The mount will default to its fastest speed rate for quickest slewing. Slew the mount using the directional keys and center the star in the view of your finder scope or reflex sight. Press **ENTER**. The hand controller will now instruct you to center the star in your eyepiece. Once again, use the directional keys to do this. The mount will default to a slower speed rate to make it easier to center the star in the narrower field of view of the eyepiece. When the star is centered in the eyepiece, press **ENTER**.

5. The hand controller will now generate a list of stars to choose as your second alignment star. Scroll through the list using the Scroll keys (Figure 6) and press **ENTER** to choose a second alignment star. The mount will now automatically slew to the selected star and the star should be somewhere in the field of view of your finder scope. Next, center the star in your eyepiece with the directional keys and press **ENTER**.

The message “Alignment Successful” should display on the LCD. If so, you may now use your mount to locate stars in the TeleTrack AZ-G database. If the message “Alignment Failed” displays, it often means the star positions do not correspond with the location and date/time information input during setup. Please check your user input settings before starting again.

### Two-Star Alignment

Two-star alignment requires two known alignment stars. If you know some of the stars in the night sky, this will likely be the most used alignment method. The description below will lead you on a step-by-step procedure on how to perform the two-star alignment.

1. Complete the Initial Setup to access the display that states “Begin Alignment” and choose Yes.
2. The hand controller will provide a lists 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 not slew to the first alignment star automatically, use the directional buttons to manually slew the telescope to point to the star. The displayed coordinates will not change as the mount slews. Center the star in your finder scope and press **ENTER**.
3. The hand controller will prompt you to Center the object. The rate will automatically slow, allowing you to make fine adjustments. Movement of the mount will be imperceptible unless you are looking through the eyepiece. Center the star in your eyepiece and press **ENTER**.
4. The Hand controller will now provide you a list to choose a second alignment star. Use the scroll buttons to select a star and press **ENTER**. The mount will slew automatically to your selection and you will be prompted to center the star. As described above, the rate will slow so that movement of the mount can only be perceived through the narrow field of view of the eyepiece. Center the star using the direction keys and press **ENTER**.
5. Once the two alignment stars have been entered and alignment is complete the hand controller will display “Alignment Successful”.

### Features of the GoTo Database

Now that you have completed the alignment you are ready to access all of the advanced functions available in the TeleTrack AZ-G hand controller.

### Object Catalog

The TeleTrack AZ-G boasts a vast database of over 42,900 object coordinates and information. The database contains the following catalogs:

**Solar System:** The other 8 planets of our solar system, and our planets' Moon.

**Named Star:** A list of 100 popular known stars

**NGC:** 7,840 of the brightest deep sky objects from the Revised New General Catalog. (edited by Roger W. Sinnott, copyright by Sky Publishing Corp., used with permission).

**IC:** 5,386 of standard stars and deep sky objects from the Indexed Catalog.

**Messier:** Complete list of 110 Messier objects

**SAO Stars:** 29,523 stars

### Selecting an Object

Once the telescope has been aligned, you can access and view the 42,900 different objects in the TeleTrack AZ-G database. There are three methods of selecting a celestial object to view:

### SHORTCUT BUTTONS

**TOUR:** Takes you on a preset tour across the night sky. The brightest and most beautiful deep-sky objects will automatically be chosen by the TeleTrack AZ-G for your viewing pleasure. Use the down scroll button to view the different deep-sky objects that are available for viewing through the tour function. Choose the desired object by pressing **ENTER**. The hand controller will display the coordinate of the chosen object. Press **ENTER** once more to have the telescope slew to the object.

**M, NGC, IC:** These shortcut buttons give you access to the most popular celestial catalogs. Each catalog has a set number of objects to choose from. Use the numeric buttons to select an object by entering its number. Pressing **ENTER** will display its coordinate. Primary information such as size, magnitude, and constellation are obtained by pressing the scroll buttons. Press **ENTER** once more to have the telescope slew to the chosen object.

**PLANET:** This shortcut button takes you straight to the Planets submenu in the TeleTrack AZ-G database. Use the scroll buttons to scroll through the list of planets in our solar system. Press **ENTER** to display the chosen planet's coordinates, and press **ENTER** once more to have the telescope slew to the planet. If the planet you have chosen 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”).

### OBJECT BUTTON

You can choose to locate and slew to objects within a specific object-type catalog. The **OBJECT** button takes you to the Objects Catalog, where you have complete access to over 42,900 celestial objects in the database, categorized by object type. Simply scroll through the object-type categories using the scroll buttons and choose the category of object you want to view. Press **ENTER** to confirm your choice. Use the scroll buttons to choose an individual object within the category and press **ENTER** a second time to display the object's

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coordinate. Press **ENTER** once more to have the telescope slew to the chosen object.

## 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** key, this gives you complete access to the 42,900 celestial objects in the TeleTrack AZ-G database, categorized by object type.

## Other Functions

The TeleTrack AZ-G hand controller is equipped with a variety of additional functions that allow you to optimize performance and access other features of the system. Some functions allow you to re-enter portions of data to improve or correct operational flaws. Other functions give users the chance to identify unknown objects, interface the mount with a computer, and to use other equipment in conjunction with the TeleTrack AZ-G. You can even customize your own catalog of celestial objects!

## Utility Functions

Utility Functions are useful tools that provide simple, one-step processes to your TeleTrack AZ-G.

**Show Position:** This function displays the coordinates (Right Ascension and Declination) of the location where the telescope mounted on the TeleTrack AZ-G is currently pointing.

**Show Information:** This function displays setup information input by the user:

*Time:* Displays the current time and local sidereal time (LST).

*Version:* Displays the Hand Controller Firmware, Database, Hand Controller Hardware, and Motor Controller. (Motor Controller version only displays if the controller is connected to the mount). Use the scroll buttons to toggle through the list.

*Temperature:* Displays the internal operating temperature of the hand controller.

*Power Voltage:* Displays the input voltage to the hand controller. This can be used to check the status of your power supply.

**Park Scope:** Moves the telescope to the Home position or parks the telescope at the current position. Allows user to use star alignment from previous viewing session. (*Note: This is only for telescopes set up at permanent location. If the scope is moved the alignment procedure must be performed again.*)

**PAE:** Allows user to fine-tune star alignment based on region of the sky used during setup.

**GPS:** Allows you to obtain information from optional GPS module.

**PC Direct:** Allows you to bypass the hand controller and use a computer to access mount functions directly. (See Appendix B for RS-232 commands). Also, motor control board firmware upgrades (v. 2.0 or later)

## Pointing Accuracy Alignment (PAE)

Each of the two alignment methods described above will provide accurate alignment for most visual applications. If additional precision is needed for a particular region of the sky, the PAE function can be employed. Up to 85 regions can be selected to cover the entire sky. It should not be necessary to perform this function in the region where alignment stars have already been selected. Follow the steps below to perform PAE alignment:

1. Use the Direction Keys to center the most recent GoTo object selected.
2. Press, and hold down, the **ESC** key for 2 seconds. The hand control will display "Re-center" and the name of the object will blink 3 times.
3. Confirm the object is still centered in the eyepiece and press **ENTER**. The TeleTrack AZ-G hand controller will now recalculate the model of the sky based on the pointing inaccuracy. (Press **ESC** if you wish to back out of this operation.)

## Setup Functions

The Setup functions allow you to change any system variable or information regarding location, time, date, and alignment configurations. To access the Setup Functions, either press the **SETUP** button on the hand controller or scroll to **SETUP MODE** under the menu option using the scroll keys. The different types of functions available to you are listed below, along with their respective purposes.

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

**Time:** Allows you to change the current time.

**Observing site:** Allows you to change the current location setting.

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

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

**Alignment Stars:** Allows you to choose how alignment stars are displayed.

*Auto Select:* When selected the hand controller will filter out stars not available for selection.

*Sort By:* Generates a list of alignment stars sorted alphabetically or by magnitude.

**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 that the backlash value is set to be equal or greater than the actual amount of backlash between the gears. The default setting is 0° 00' 00" (degree, arcminute, arcsecond). To increase pointing accuracy the backlash value should be equal to or greater than the real amount of backlash. Use the numeric keys to set the values and press the right directional key to proceed to

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the next digit. First set the value for R.A. backlash, then press **ENTER** to set the value for DEC.

#### 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.

-*Stop Tracking*: Stops tracking.

**Set Slew Limits**: Allows you to set slewing limits of mount in altitude axis. This will prevent the optical tube from colliding with the mount while slewing to an object. The slew limit is dependent upon the optical tube installed on the mount

**Handset Setting**: Allows brightness control of LCD backlight, contrast setting of lettering, and beeper volume.

**Factory Setting**: Allows hand controller to be reset to factory default setting. (Will not delete PAE settings or User Defined objects).

#### Using the User Defined Database

The TeleTrack AZ-G allows you to save up to 25 objects in the User Defined Database. You can save currently unknown objects, unidentifiable objects, current comet and/or asteroid positions, or you can make a custom list of your favorite objects to view.

#### Saving an object to the database

1. Press the **USER** button or select "User Defined" under the object catalog menu. Press **ENTER**.
2. Choose "Input Coordinate" and press **ENTER** to confirm your choice.
3. You can enter the chosen object's location by its R.A. and DEC coordinates, or telescope altitude and azimuth coordinates. Press 1 (R.A. and DEC) or 2 (Altitude and Azimuth) to make your selection. The default setting of the TeleTrack AZ-G will display the current R.A./DEC or Alt/Az coordinates. Change the coordinates using the numeric buttons and scroll buttons. Press **ENTER** to save the chosen setting.
4. The TeleTrack AZ-G will prompt you to choose a number between 1 to 25 for your chosen object. Select the number you wish to represent the coordinate, using the scroll buttons. Press **ENTER** to confirm.
5. Once the object coordinate is represented by a number, the hand controller will display "View Object?". Press **ENTER** to slew the telescope to the coordinate. Press **ESC** to exit.

#### Selecting a user defined object

1. Press the **USER** button or select "User Defined" under the object catalog. Press **ENTER**.
2. Choose "Recall Object" and press **ENTER** to confirm.
3. Select the number representing the object you wish to view, using the scroll button. Press **ENTER** to display the object's coordinate. Press **ENTER** once more to choose the object.

4. The TeleTrack AZ-G will display "View Object?". Press **ENTER** to slew the telescope to the coordinate. Press **ESC** to exit.

#### Identifying an Unknown Object

The TeleTrack AZ-G has the ability to identify celestial objects that are unknown to you. To identify an object that the telescope is centered on, simply:

1. Press the **ID** key or scroll to "Identify" in the main menu and press **ENTER** to identify the object.
2. If the object is truly unknown (i.e. not listed in the TeleTrack AZ-G database), the hand controller will take you back to the "Identify" menu.
3. Press **ESC** to exit this function.

#### Linking with a Computer

The TeleTrack AZ-G can be connected to a computer via the supplied computer interface cable. Many commercially available planetarium softwares can utilize this function and be used to control the TeleTrack AZ-G. Look for software that is compatible with the Celestron NexStar5i/8i or NexStar GPS series, like Starry Night Pro. The description below will lead you through the procedure on how to connect and disconnect the TeleTrack AZ-G to a computer.

1. Align the mount as described previously (see "Aligning the TeleTrack AZ-G").
2. Connect the supplied computer interface cable to the smaller modular jack (RJ-12) on the hand controller (Figure 4a). Connect the other end of the cable to the COM port of your computer.
3. In the planetarium software of your choice, choose "Celestron NexStar5i/8i" or "Celestron 8/9/11 GPS" in the driver setup and follow the instructions provided by the program to connect the mount and computer. The TeleTrack AZ-G will be under the full control of your computer once the connection is successfully established.

#### Disconnecting from the computer

1. Follow the instructions provided by the planetarium software to close the connection to the mount.
2. On the TeleTrack AZ-G hand controller, press **ESC** to resume normal hand control operations.

**Note: Do NOT disengage the TeleTrack AZ-G unit before you close the connection in the planetarium program. Doing so may cause some programs to freeze.**

## 7. Care and Cleaning of the TeleTrack AZ-G Mount

If your TeleTrack AZ-G mount accumulates dew while operating, dry it completely with a soft cloth after use. Clean the mount with mild household detergent and a soft cloth. The jacks can be kept free of dust using a blower bulb or a canister of compressed air.

Keep the mount in a clean and dry environment when not in use. Do not store the mount outdoors.

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To prevent damage, we recommend removing your telescope or optical instrument from the mount when transporting.

## 8. Technical Specifications

Mount:	Altazimuth fork arm
Tripod:	Aluminum
Tripod height:	Folded height 20.5", maximum height 54.5"
Total weight:	9 lbs.
Motor drives:	Dual-axis GoTo computerized, internally housed
Operation:	Northern or Southern hemisphere
Power requirement:	12V DC 1 Amp (tip positive), can run off of 8x internal AA batteries
Motor type:	DC servo with optical encoders for altitude and azimuth axes
Motor resolution:	0.8923 arc sec (or 1,452,425 steps/rev)
Slew speeds:	Rate 0 = 1.0X Rate 1 = 2X Rate 2 = 16X Rate 3 = 32X Rate 4 = 50X Rate 5 = 200X Rate 6 = 400X Rate 7 = 600X Rate 8 = 800X Rate 9 = 1000X
Altitude slew limits:	+60° to -15° (default)
Tracking rates:	Sidereal (default), Lunar, Solar.
Alignment method:	Brightest Star, Two-Star
Database:	Over 42,900 objects including: Complete Messier & Caldwell catalogs, 7840 NGC objects, 5386 IC objects, 29523 SAO stars, 8 planets, moon, 212 named stars, 55 well-known double stars, 20 well-known variable stars, 25 user-defined objects.

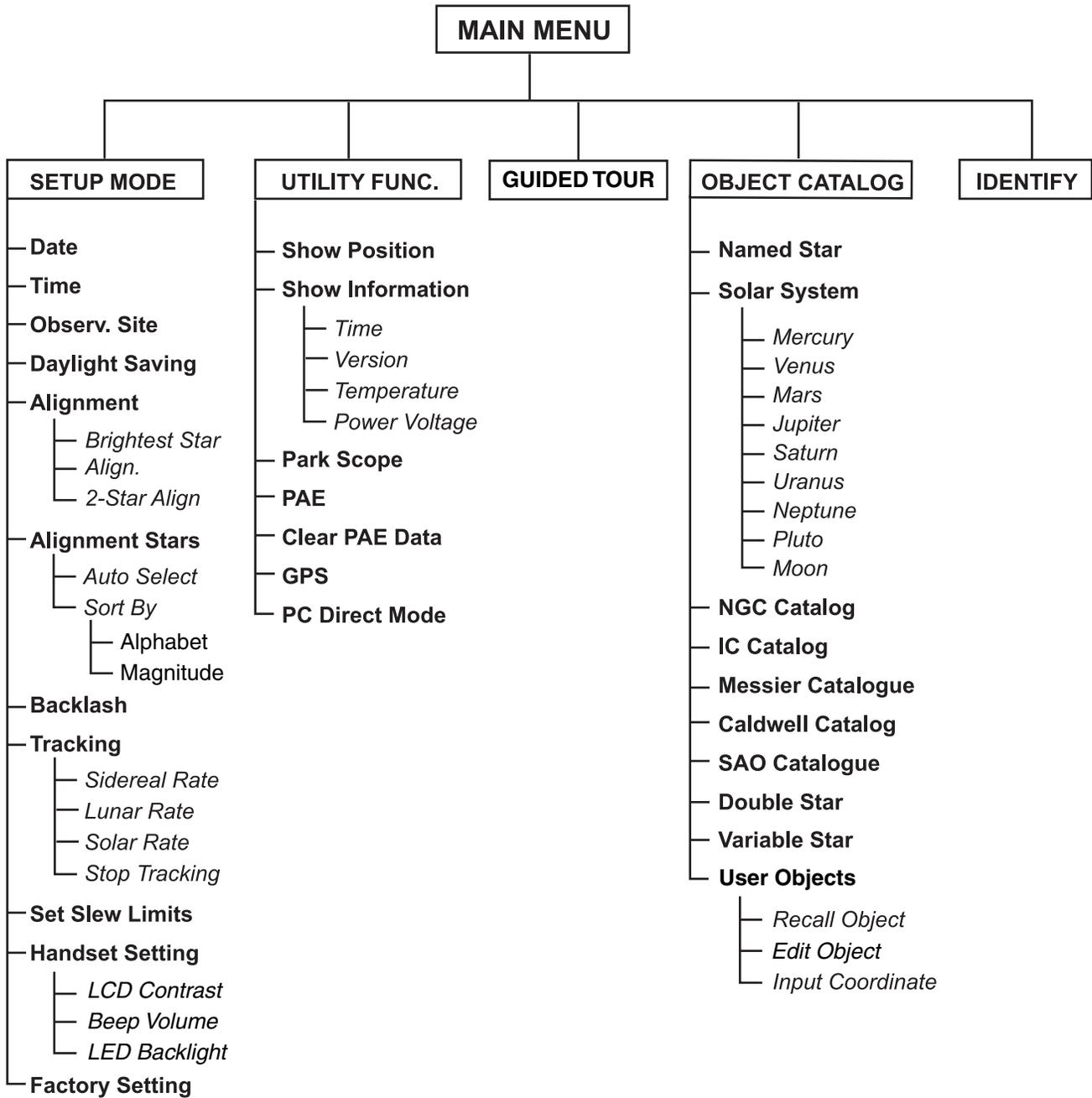
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

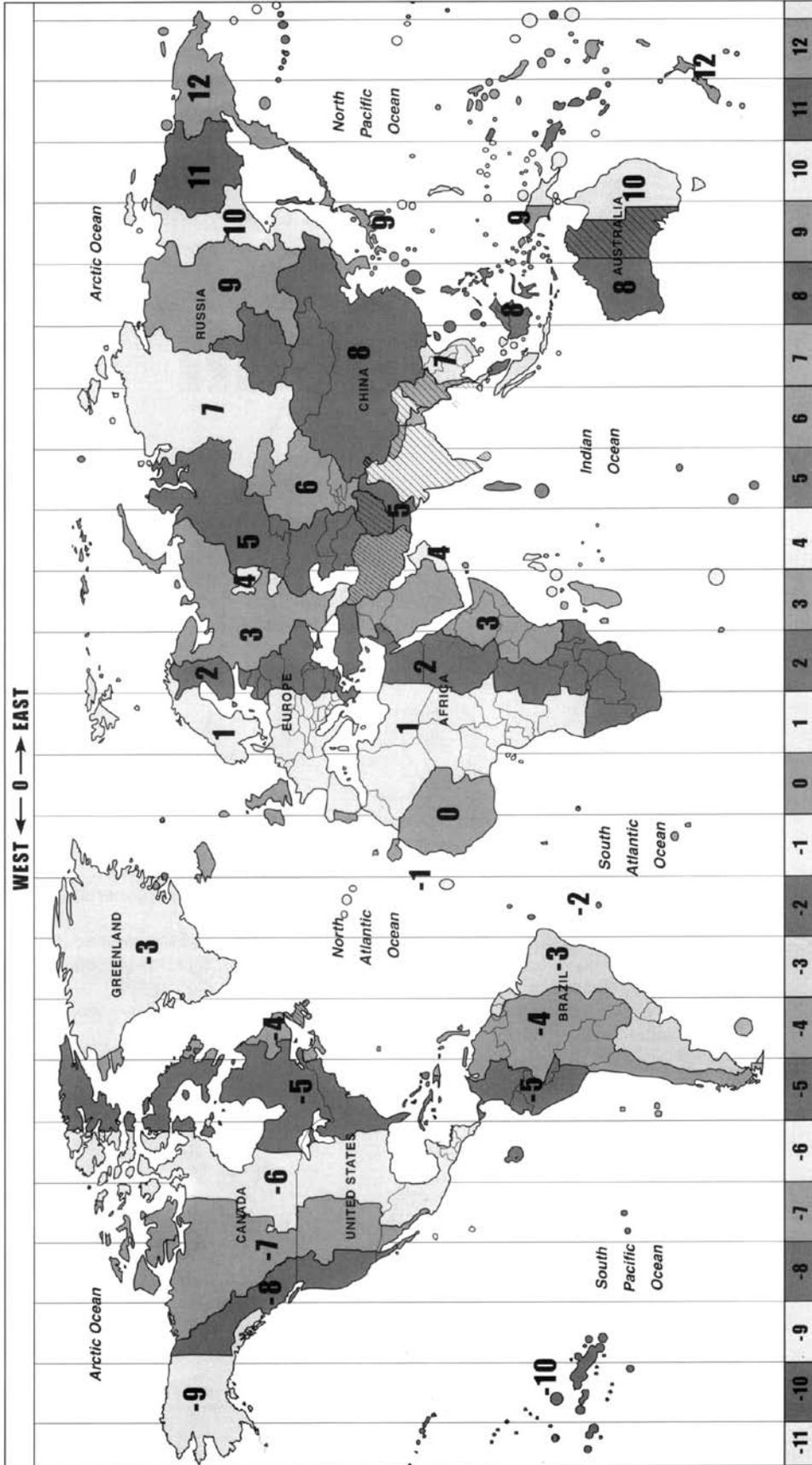
**Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can 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 not 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 is 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.

# TeleTrack AZ-G Menu Tree



# Appendix A: Time Zones of the World



## Appendix B: RS-232 Connection

The TeleTrack AZ-G Mount is 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.

Description	PC Command ASCII	Hand Control Response	Notes
Echo	Kx	X#	Useful to check communication
Goto Azm-Alt	B12AB, 4000	#	10 characters sent. B=Command, 12AB=Azm, comma, 4000=Alt. If command conflicts with slew limits, there will be no action.
Goto Ra-Dec	R34B, 12CE	#	Scope must be aligned. If command conflicts with slew limits, there will be no action.
Get Azm-Alt	Z	12AB, 4000#	10 characters returned, 12AB=Azm, comma, 4000=Alt, #
Get RA-Dec	E	34AB, 12CE#	Scope must be aligned.
Cancel Goto	M	#	
Is Goto in Progress	L	0# or 1#	0=No, 1=Yes: "0" is ASCII character zero
Is Alignment Complete	J	0# or 1#	0=No, 1=Yes
HC version	V	22	Two bytes representing V2.2
Stop/Start Tracking	Tx x= 0 (Tracking off) x= 1 (Alt-Az on) x= 2 (EQ-N) x= 3 (EQ-S)	#	Alt-Az tracking requires alignment
32-bit goto RA-Dec	r34AB0500,12CE0500	#	
32-bit get RA-Dec	e	34AB0500, 12CE0500#	The last two characters will always be zero.
32-bit goto Azm-Alt	b34AB0500,12CE0500	#	
32-bit get Azm-Alt	z	34AB0500, 12CE0500#	The last two characters will always be zero.

### Additional RS-232 Commands

#### Sending a Tracking Rate

- 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.
- Separate TRACKRATE into two bytes, such that (TRACKRATE = TrackRateHighByte\*256 + TrackRateLowByte). For example, if TRACKRATE = 480, then TrackRateHighByte = 1 and TrackRateLowByte = 224.

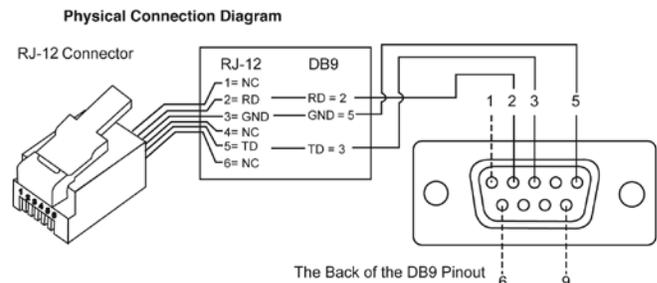
- To send a tracking rate, send the following 8 bytes:
  - Positive Azm tracking: 80, 3, 16, 6, TrackRateHighByte, TrackRateLowByte, 0, 0
  - Negative Azm tracking: 80, 3, 16, 7, TrackRateHighByte, TrackRateLowByte, 0, 0
  - Positive Alt tracking: 80, 3, 17, 6, TrackRateHighByte, TrackRateLowByte, 0, 0
  - Negative Alt tracking: 80, 3, 17, 7, TrackRateHighByte, TrackRateLowByte, 0, 0
- The number 35 is returned from the hand controller.

#### Sending a Slow-GoTo Command

- Convert the angle position to a 24 bit number. Example: if the desired position is 220, then POSITION\_24BIT =  $(220/360)*224 = 10,252,743$
- Separate POSITION\_24BIT into three bytes such that (POSITION\_24BIT = PosHighByte \* 65536 + PosMedByte \* 256 + PosLowByte). Example: PosHighByte = 156, PosMedByte = 113, PosLowByte = 199
- Send the following 8 bytes:
  - Azm Slow Goto: 80, 4, 16, 23, PosHighByte, PosMedByte, PosLowByte, 0
  - Alt Slow Goto: 80, 4, 17, 23, PosHighByte, PosMedByte, PosLowByte, 0
- The number 35 is returned from the hand controller.

#### Resetting the Position of Azimuth or Altitude

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



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## **One-Year Limited Warranty**

This Orion TeleTrack AZ-G Altazimuth GoTo 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.