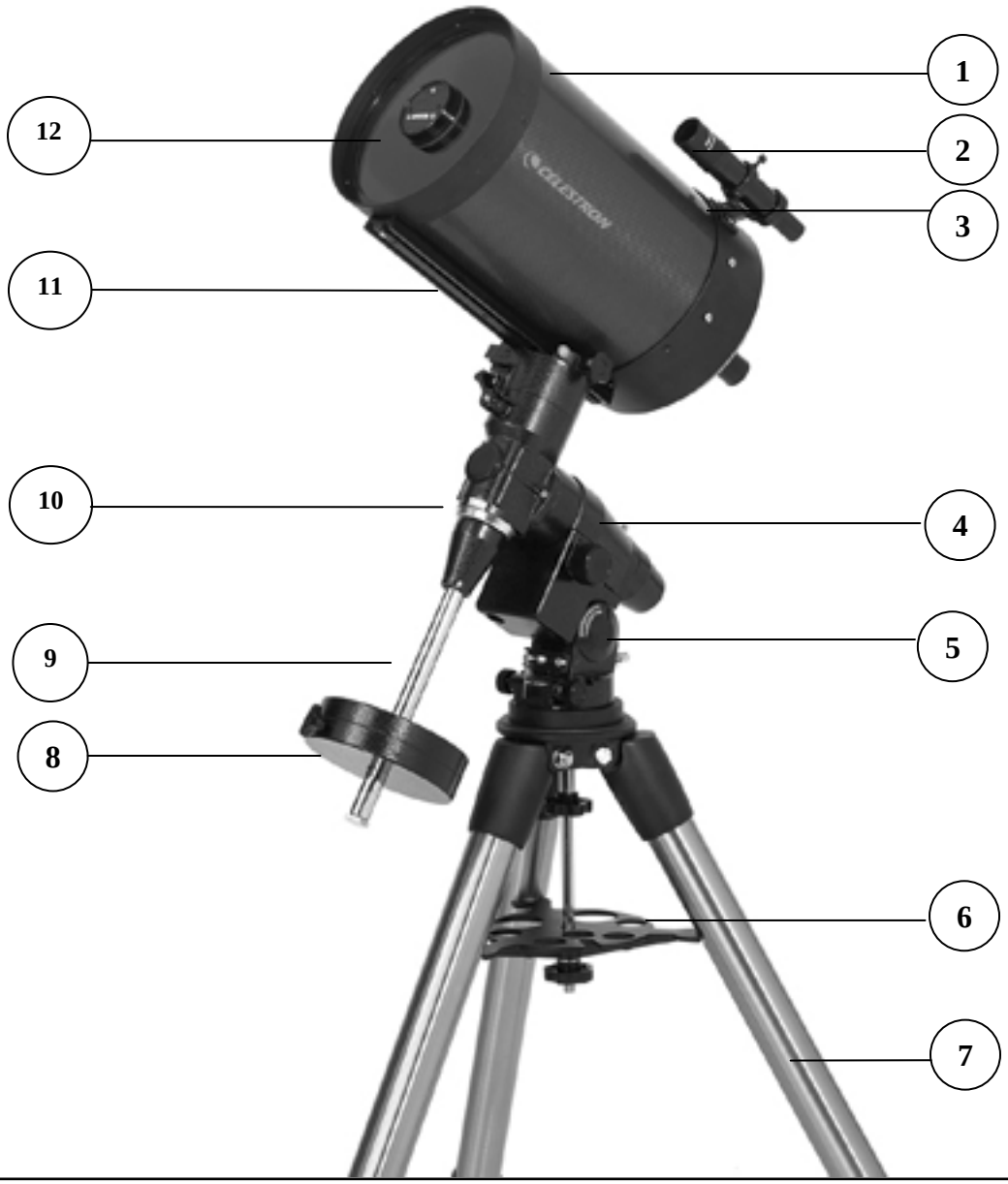
CELESTRON®

Advanced Series CG-5 & CG-5 GT

INSTRUCTION MANUAL

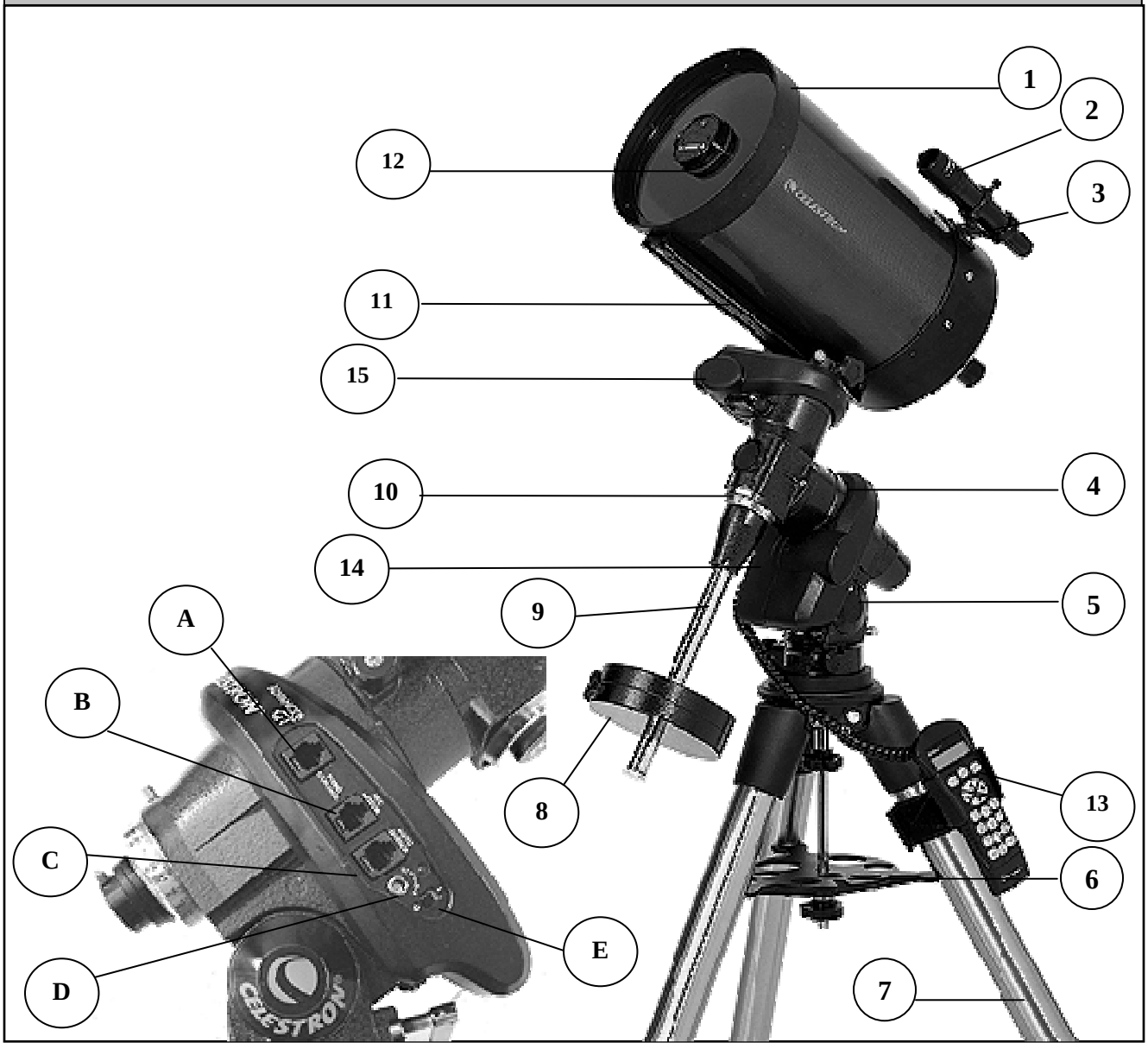
91517 • **91518**

Figure 2.1 – Advanced Series
(Advanced C8-S Shown)



1	**Optical Tube**	**7**	**Tripod**
2	**Finderscope**	**8**	**Counterweight(s)**
3	**Finderscope Bracket**	**9**	**Counterweight Bar**
4	**Equatorial Mount**	**10**	**Declination Setting Circle**
5	**Latitude Adjustment Scale**	**11**	**Dovetail Mounting Bar**
6	**Tripod Center Leg Brace/Accessory Tray**	**12**	**Schmidt Corrector Lens**

Figure 2.2 – Advanced Series GT
(Advanced C8-SGT Shown)



1	**Optical Tube**	**9**	**Counterweight Bar**
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3	**Finderscope Bracket**	**11**	**Dovetail Mounting Bar**
4	**Equatorial Mount**	**12**	**Schmidt Corrector Lens**
5	**Latitude Adjustment Scale**	**13**	**Hand Control**
6	**Tripod Center Leg Brace/Accessory Tray**	**14**	**R.A. Motor Drive / Control Panel**
7	**Tripod**	**15**	**Declination Motor Drive**
8	**Counterweight(s)**		
	CONTROL PANEL	**C**	**Autoguider Port**
A	**Hand Control Port**	**D**	**12v Output Jack**
B	**DEC Motor Port**	**E**	**On/Off Switch**

Assembly

This section covers the assembly instructions for your Celestron Advanced Series CG-5 mount. Your mount should come with all of the following:

CG-5 Mount	CG-5 GT Mount, Computerized
91517	**91518**
EQ Mount Head	EQ Mount Head
2" steel tripod	2" steel tripod
Counterweight Bar	Counterweight Bar
Counterweight Bar Coupling Screw	Counterweight Bar Coupling Screw
One- 11# Counterweight	One- 11# Counterweight
Accessory Tray/Leg Brace	Accessory Tray/Leg Brace
Central Rod with locking knob (attached to tripod)	Central Rod with locking knob (attached to tripod)
2- slow motion knobs (attached)	2- slow motion knobs (attached)
RA housing cover	RA housing cover
Mounting Adapter bar	Mounting Adapter bar
Instruction Manual	Instruction Manual
	Hand control
	Plastic hand control holder (2 pieces)
	Declination cable
	Car battery adapter

The Celestron Advanced Series telescopes are shipped in two boxes (three boxes for GT models). In separate boxes are the following:

- Optical Tube Assembly and Standard Accessories
- Equatorial Mount, Tripod, Hand Control, Counterweight(s) and Counterweight Bar (equatorial mount with motors comes in separate box for GT models)

Remove all the pieces from their respective boxes and place on a flat, clear work area. A large floor space is ideal. When setting up your Celestron telescope you must start with the tripod and work up from there. These instructions are laid out in the order each task must be performed.

Setting up the Tripod

The CG-5 tripod comes with an all metal center leg brace / accessory tray to give rock solid support to the mount.

The tripod comes fully assembled with a metal plate, called the tripod head, that holds the legs together at the top. In addition, there is a central rod that extends down from the tripod head that attaches the equatorial mount to the tripod. To set up the tripod:

1. Stand the tripod upright and pull the tripod legs apart until each leg is fully extended. The tripod will now stand by itself. Once the tripod is set up, you can adjust the height at which it stands.
2. Loosen the lever on the leg clamp so that the tripod leg can be adjusted.
3. Slide the center portion of the tripod leg away from the tripod head until it is at the desired height.
4. Tighten the levers on each leg clamp to hold the legs in place.

Attaching the Equatorial Mount

The equatorial mount allows you to tilt the telescope's axis of rotation so that you can track the stars as they move across the sky. The CG-5 mount is a German equatorial mount that attaches to the tripod head. On one side of the tripod head there is a metal alignment peg for aligning the mount. This side of the tripod will face north when setting up for an astronomical observing session. To attach the equatorial head:

1. Locate the azimuth adjustment screws on the equatorial mount.
2. Retract the screws so they no longer extend into the azimuth housing on the mount. **Do NOT remove the screws since they are needed later for polar alignment.**
3. Hold the equatorial mount over the tripod head so that the azimuth housing is above the metal peg.
4. Place the equatorial mount on the tripod head so that the two are flush.
5. Tighten the knob (attached to the central rod) on the underside of the tripod head to hold the equatorial mount firmly in place.

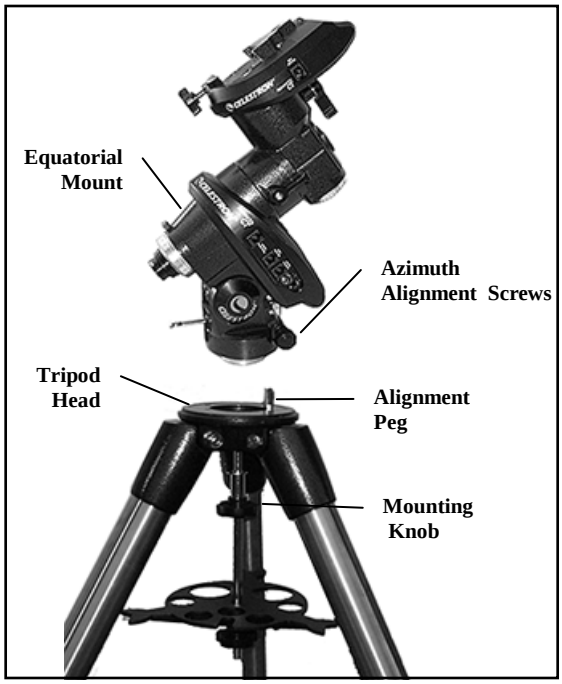


Figure 2-3
CG-5 Computerized Shown

Attaching the Center Leg Brace

1. Slide the accessory tray over the central rod so that each arm of the tray is pushing against the inside of the tripod legs.
2. Thread the accessory tray knob on to the central rod and tighten.

Figure 2-4

Installing the Counterweight Bar

To properly balance the telescope, the mount comes with a counterweight bar and one counterweight To install the counterweight bar:

1. Thread the counterweight bar lock nut onto the threaded end of the counterweight bar.
2. Locate the opening in the equatorial mount on the DEC axis
3. Thread the counterweight bar into the opening until tight.
4. Tighten the counterweight bar lock nut fully for added support.

Once the bar is securely in place you are ready to attach the counterweight.

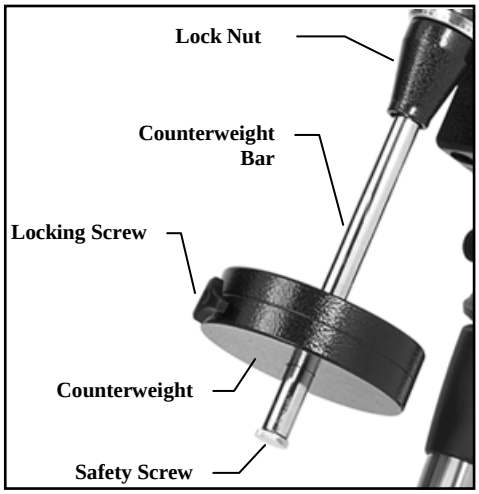


Figure 2-3

Since the fully assembled telescope can be quite heavy, position the mount so that the polar axis is pointing towards north before the tube assembly and counterweights are attached. This will make the polar alignment procedure much easier.

Installing the Counterweight

Depending on which AST telescope you have, you will receive either one or two counterweights. To install the counterweight(s):

1. Orient the mount so that the counterweight bar points toward the ground .
2. Remove the counterweight safety screw on the end of the counterweight bar (i.e., opposite the end that attaches to the mount).
3. Loosen the locking screw on the side of the counterweight.
4. Slide the counterweight onto the shaft (see Figure 2-5).
5. Tighten the locking screw on the side of the weight to hold the counterweight in place.
6. Replace the counterweight safety screw.

Attaching the Hand Control Holder (Advanced GT Models Only)

Figure 2-5

The Advanced GT telescope models come with a hand control holder to place the computerized hand control. The hand control holder comes in two pieces: the leg clamp that snaps around the tripod leg and the holder which attaches to the leg clamp. To attach the hand control holder:

1. Place the leg clamp up against one of the tripod legs and press firmly until the clamp wraps around the leg.
2. Slide the back of the hand control holder downward into the channel on the front of the legs clamp (see Fig 2-6) until it snaps into place.

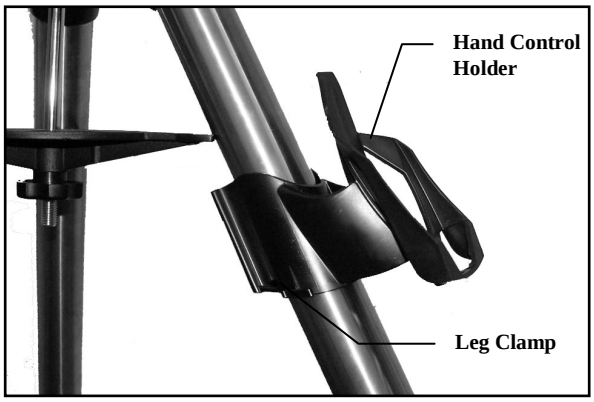


Figure 2-6

Attaching the Slow Motion Knobs (For Non-GT Models Only)

The Advanced Series (non-GT models) comes with two slow motion control knobs that allows you to make fine pointing adjustments to the telescope in both R.A. and Declination. To install the knobs:

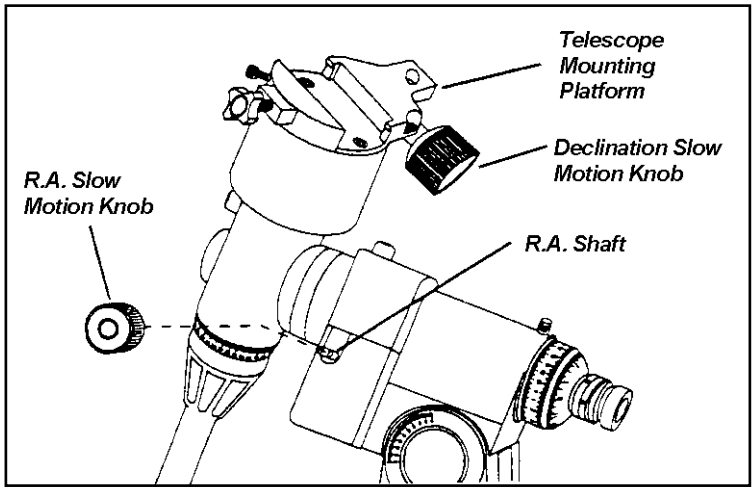


Figure 2-7

1. Locate the hard plastic shell under the R.A. shafts.
2. Remove either of the two oval tabs by pulling tightly.
3. Line up the flat area on the inner portion of the R.A. slow motion knob with the flat area on the R.A. shaft (see Fig 2-7).
4. Slide the R.A. slow motion knob onto the R.A. shaft.

   The knob is a tension fit, so sliding it on holds it in place. As mentioned above, there are two R.A. shafts, one on either side of the mount. It makes no difference which shaft you use since both work the same. Use whichever one you find more convenient. If, after a few observing sessions, you find the R.A. slow motion knob is more accessible from the other side, pull firmly to remove the knob, then install it on the opposite side.
5. The DEC slow motion knob attaches in the same manner as the R.A. knob. The shaft that the DEC slow motion knob fits over is toward the top of the mount, just below the telescope mounting platform. Once again, you have two shafts to choose from. Use the shaft that is pointing toward the ground. This makes it easy to reach while looking through the telescope, something which is quite important when you are observing.

Attaching an Optical Tube to the Mount

Advanced GT Users!

An optical tube attaches to the mount via a dovetail bar which mounts along the bottom of a telescope tube**.** The CG-5 mount comes with a mounting bar that mates to the mounting head of the mount. The mounting bar can be used to attached a desired telescope to the CG-5 mount. **Before you attach an optical tube, make sure that the declination and right ascension clutch knobs are tight.** This will ensure that the mount does not move suddenly while attaching the telescope. To mount the telescope tube:

In order for the GT computerized mount to function properly, before installing an optical tube, the mounting platform must be positioned so that the Declination Index Marks are aligned (see Fig 2-8).

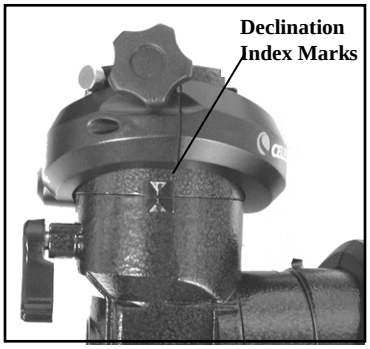


Figure 2-8

1. Loosen the mounting screw on the side of the telescope mounting platform. This allows you to slide the dovetail bar onto the mount.

2 Slide the dovetail bar on the telescope tube into the mounting platform of the mount.

3 Tighten the mounting screw on the side of the mounting platform to hold the telescope in place.

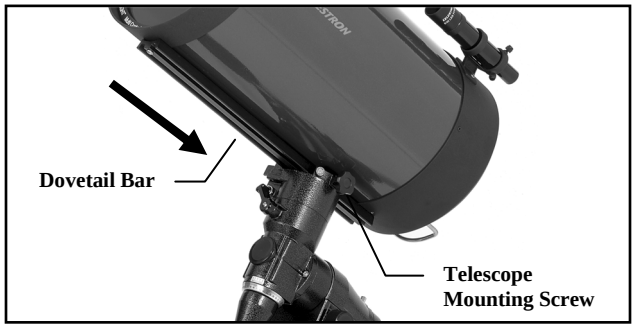
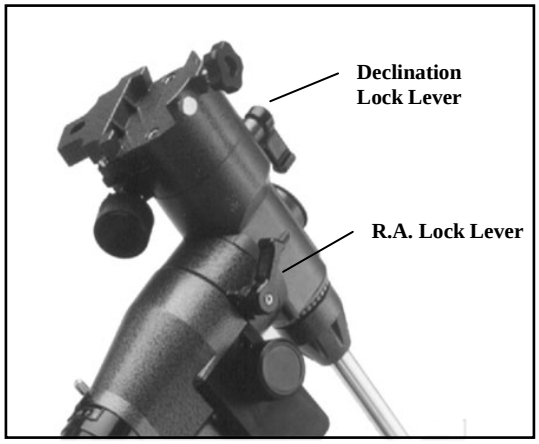


Figure 2-9

Moving the Telescope Manually

In order to properly balance your telescope, you will need to move your telescope manually at various portions of the sky to observe different objects. To make rough adjustments, loosen the R.A. and DEC clutch knobs slightly and move the telescope in the desired direction.

Both the R.A. and DEC axis have lock levers to clutch down each axis of the telescope. To loosen the clutches on the telescope, rotate the lock levers counterclockwise.



Balancing The Mount in R.A.

To eliminate undue stress on the mount, the telescope should be properly balanced around the polar axis. Proper balancing is crucial for

accurate tracking. To balance the mount:

1. Verify that the telescope is securely attached to the telescope mounting platform.

2. Loosen the R.A. lock lever and position the telescope off to one side of the mount. The counterweight bar will extend horizontally on the opposite side of the mount.

3. Release the telescope — GRADUALLY — to see which way the telescope "rolls."

4. Loosen the set screws on the side of the counterweight so it can be moved the length of the counterweight bar.

5. Move the counterweight to a point where it balances the telescope (i.e., the telescope remains stationary when the R.A. clutch knobs are loose).

Figure 2-12

6. Tighten the screw on the counterweight to hold it in place.

While the above instructions describe a perfect balance arrangement, there should be a SLIGHT imbalance to ensure the best possible tracking. When the scope is on the west side of the mount the counterweight should be slightly imbalanced to the counterweight bar side. And when the tube is on the east side of the mount there should be a slight imbalance toward the telescope side. This is done so that the worm gear is pushing against a slight load. The amount of the imbalance is very slight. When taking astrophotographs, this balance process can be done for the specific area at which the telescope is pointing to further optimize tracking accuracy.

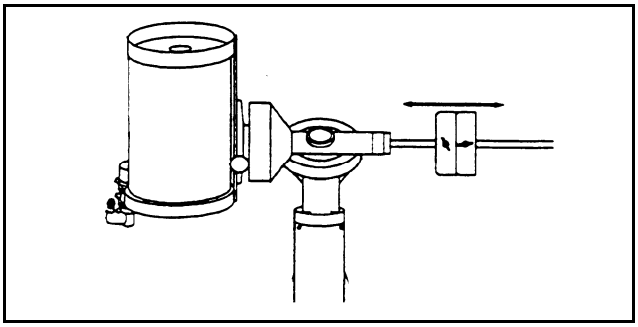


Figure 2-13

Balancing The Mount in DEC

Although the telescope does not track in declination, the telescope should also be balanced in this axis to prevent any sudden motions when the DEC lock lever is loose. To balance the telescope in DEC:

1. Loosen the R.A. clutch lock lever and rotate the telescope so that it is on one side of the mount (i.e., as described in the previous section on "Balancing the Mount in R.A.").

2. Tighten the R.A. lock lever to hold the telescope in place.

3. Loosen the DEC clutch lock lever and rotate the telescope until the tube is parallel to the ground.

4. Release the tube — **GRADUALLY** — to see which way it rotates around the declination axis. **DO NOT LET GO OF THE TELESCOPE TUBE COMPLETELY!**

5. Slightly loosen the knobs that holds the telescope to the mounting platform and slide the telescope either forward or backward until it remains stationary when the DEC clutch is loose. Do NOT let go of the telescope tube while the knob on the mounting platform is loose. It may be necessary to

rotate the telescope so that the counterweight bar is pointing down before loosening the mounting platform screw.

6. Tighten the knobs on the telescope mounting platform to hold the telescope in place.

Like R.A. balance, these are general balance instructions and will reduce undue stress on the mount. When taking astrophotographs, this balance process should be done for the specific area at which the telescope is pointing.

Adjusting the Mount

In order for a motor drive to track accurately, the telescope's axis of rotation must be parallel to the Earth's axis of rotation, a process known as polar alignment. Polar alignment is achieved NOT by moving the telescope in R.A. or DEC, but by adjusting the mount vertically, which is called altitude, and horizontally, which is called azimuth. This section simply covers the correct movement of the telescope during the polar alignment process. The actual process of polar alignment, that is making the telescope's axis of rotation parallel to the Earth's, is described later in this manual in the section on "Polar Alignment."

Adjusting the Mount in Altitude

- To increase the latitude of the polar axis, tighten the rear latitude adjustment screw and loosen the front screw (if necessary).

- To decrease the latitude of the polar axis, tighten the front (under the counterweight bar) latitude adjustment screw and loosen the rear screw (if necessary).

The latitude adjustment on the CG-5 mount has a range from approximately 30° going up to 60°.

It is best to always make final adjustments in altitude by moving the mount against gravity (i.e. using the rear latitude adjustment screw to raise the mount). To do this you should loosen both latitude adjustment screws and manually push the front of the mount down as far as it will go. Then tighten the rear adjustment screw to raise the mount to the desired latitude.

For Advanced GT users, it may be helpful to remove the front latitude adjustment screw completely. This will allow the mount to reach lower latitudes without the screw coming into contact with R.A. motor assembly. To remove the latitude screw, first use the rear screw to raise the mount head all the way up. Then remove the front latitude screw completely. Now you should be able to manually move the mount head all the way to it lowest latitude. Now, using only the rear screw, raise the mount to your desired latitude.

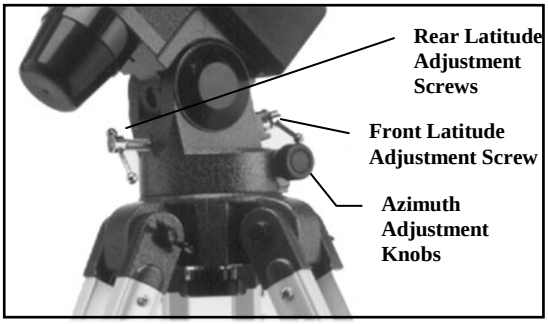


Figure 2-14

Adjusting the Mount in Azimuth

For rough adjustments in azimuth, simply pick up the telescope and tripod and move it. For fine adjustments in azimuth:

1. Turn the azimuth adjustment knobs located on either side of the azimuth housing. While standing behind the telescope, the knobs are on the front of the mount.

- Turning the right adjustment knob clockwise moves the mount toward the right.

- Turning the left adjustment knob clockwise moves the mount to the left.

Both screws push off of the peg on the tripod head, which means you may have to loosen one screw while tightening the other. The screw that holds the equatorial mount to the tripod may have to be loosened slightly.

Keep in mind that adjusting the mount is done during the polar alignment process only. Once polar aligned, the mount must NOT be moved. Pointing the telescope is done by moving the mount in right ascension and declination, as described earlier in this manual.

Attaching the Declination Cables (For GT Models Only)

The Advanced Series mount comes with a declination cable that connects from the R.A. motor drive electronic panel to the Dec motor drive. To attach the motor cables:

- Locate the Declination cable and plug one end of the cable into the port on the electronics panel labeled *DEC Port* and plug the other end of the cable into the port located on the declination motor drive (see Fig 2-15).

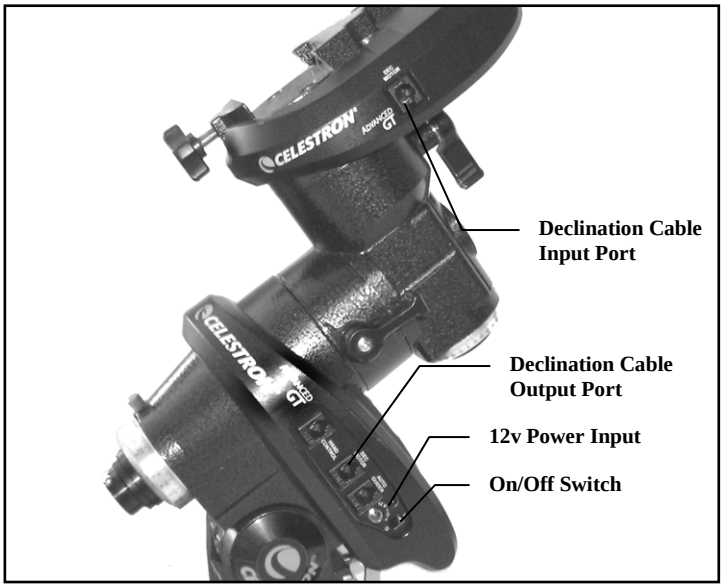


Figure 2-15

Powering the Telescope

The Advanced GT can be powered by the supplied car battery adapter or optional 12v AC adapter. Use only adapters supplied by Celestron. Using any other adapter may damage the electronics and will void your manufacturer's warranty.

1. To power the telescope with the car battery adapter (or 12v AC adapter), simply plug the round post into the 12v outlet on the electronic panel and plug the other end into your cars cigarette lighter outlet or portable power supply (see *Optional Accessories*). Note: to prevent the power cord from being accidentally pulled out, wrap the power cord around the strain relief located below the power switch.

2. Turn on the power to the telescope by flipping the switch, located on the electronics panel, to the "On" position.

CELESTRON Hand Control

The following is a supplemental addendum to the included instruction manual that explains the new features of Celestron's Advanced Series Telescopes. Please refer to this addendum for information concerning the new hand control features included with your telescope. Refer to the owner's manual for step-by-step instruction on assembling and using your telescope.

The Advanced Series GT, computerized version of each telescope has a hand controller designed to give you instant access to all the functions that your telescope has to offer. With automatic slewing to over 40,000 objects, and common sense menu descriptions, even a beginner can master its variety of features in just a few observing sessions. Below is a brief description of the individual components of the computerized hand controller:

1. **Liquid Crystal Display (LCD) Window:** Has a dual-line, 16 character display screen that is backlit for comfortable viewing of telescope information and scrolling text.
2. **Align:** Instructs the telescope to use a selected star or object as an alignment position.
3. **Direction Keys:** Allows complete control of the telescope in any direction. Use the direction keys to move the telescope to the initial alignment stars or objects in for centering the eyepiece.

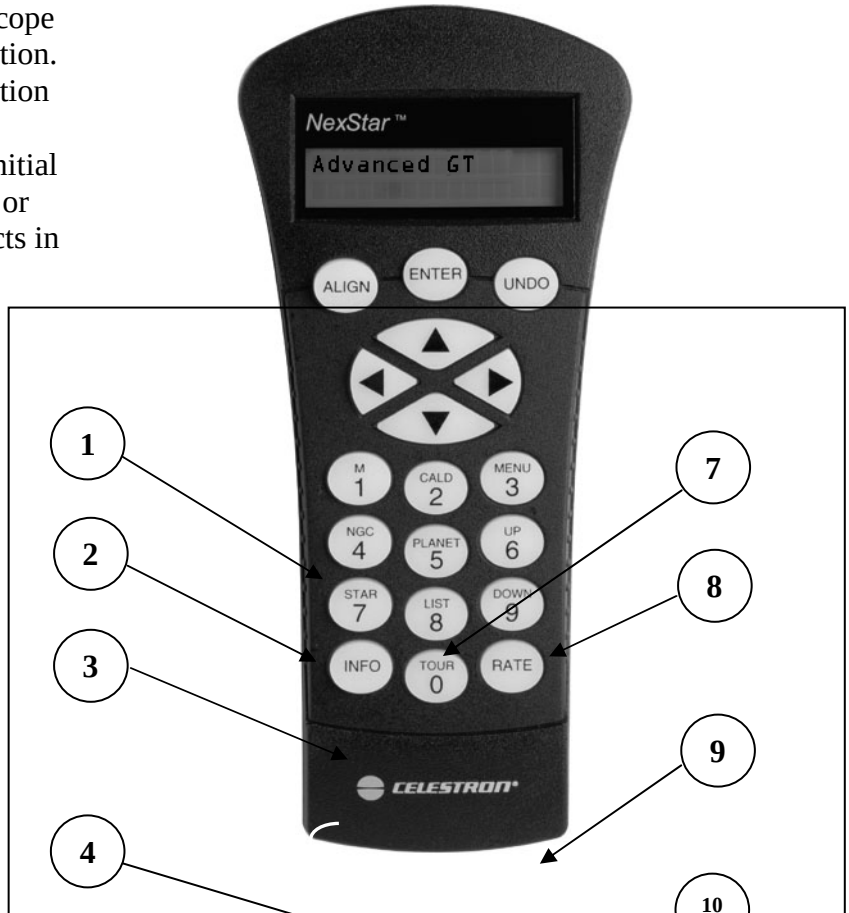


Figure 3-1
The Advanced GT Hand Control

4. **Catalog Keys:** The Advanced Series has keys on the hand control to allow direct access to each of the catalogs in its database. The hand control contains the following catalogs in its database:

   Messier – Complete list of all Messier objects.
   NGC – Complete list of all the deep-sky objects in the Revised New General Catalog.
   Caldwell – A combination of the best NGC and IC objects.
   Planets - All 8 planets in our Solar System plus the Moon.
   Stars – A compiled list of the brightest stars from the SAO catalog.
   List – For quick access, all of the best and most popular objects in the Advanced GT database have been broken down into lists based on their type and/or common name:

Named Stars	Common name listing of the brightest stars in the sky.
Named Objects	Alphabetical listing of over 50 of the most popular deep sky objects.
Double Stars	Numeric-alphabetical listing of the most visually stunning double, triple and

	quadruple stars in the sky.
Variable Stars	Select list of the brightest variable stars with the shortest period of changing magnitude.
Asterisms	A unique list of some of the most recognizable star patterns in the sky**.**
CCD Objects	A custom list of many interesting galaxy pairs, trios and clusters that are well suited for CCD imaging with the Advanced GT telescope.
IC Objects	A complete list of all the Index Catalog deep-sky objects.
Abell Objects	A custom list of the Abell Catalog deep-sky galaxies.
Constellation	A complete list of all 88 constellations.

5. **Info*:*** Displays coordinates and useful information about objects selected from the Advanced GT database.
6. **Tour:** Activates the tour mode, which seeks out all the best objects for the current date and time, and automatically slews the telescope to those objects.
7. **Enter:** Pressing *Enter* allows you to select any of the Advanced GT functions and accept entered parameters.
8. **Undo:** *Undo* will take you out of the current menu and display the previous level of the menu path. Press *Undo* repeatedly to get back to a main menu or use it to erase data entered by mistake.
9. **Menu:** Displays the many setup and utilities functions such as tracking rates and user defined objects and many others.
10. **Scroll Keys:** Used to scroll up and down within any of the menu lists. A double-arrow will appear on the right side of the LCD when there are sub-menus below the displayed menu. Using these keys will scroll through those sub-menus.
11. **Rate:** Instantly changes the rate of speed of the motors when the direction buttons are pressed.
12. **RS-232 Jack**: Allows you to interface with a computer and control the telescope remotely.

Hand Control Operation

This section describes the basic hand control procedures needed to operate the Advanced GT Series Telescopes. These procedures are grouped into three categories: Alignment, Setup and Utilities. The alignment section deals with the initial telescope alignment as well as finding objects in the sky; the setup section discusses changing parameters such as tracking mode and tracking rate; finally, the last section reviews all of the utilities functions such as calibrating your mount, polar alignment and backlash compensation.

Alignment Procedures

In order for the telescope to accurately point to objects in the sky, it must first be aligned with known positions (stars) in the sky. With this information, the telescope can create a model of the sky, which it uses to locate any object with known coordinates. There are many ways to align your telescope with the sky depending on what information the user is able to provide: **Two Star Align** uses the entered time/location information and allows the user to select which two alignment stars the telescope will automatically slew to. **One Star Align** uses the same time/location information but only uses one star for alignment. **Solar System Align** will display a list of visible daytime objects (planets and the moon) available to align the telescope. **Quick-Align** will ask you to input all the same information as you would for the other Alignment procedures. However, instead of slewing to the alignment stars for centering and alignment, the telescope bypasses this step and simply models the sky based on the information given. Finally, **Last Alignment** restores your last saved star alignment and switch position. Last Alignment also serves as a good safeguard in case the telescope should lose power.

Startup Procedure

Before any of the described alignments are performed, the telescope mount needs to be positioned so that the index marks are aligned on both the right ascension and declination axes (see Fig 2-8).
Once the index position has been set, the hand control will display the last entered date and time information stored in the hand control. Once the telescope is powered on:

1. Press ENTER begin the alignment process.
2. The hand control will ask the user to set the mount to its index position. Move the telescope mount, either manually or with the hand control, so that the index marked in both R.A. and Dec are aligned (see Fig 2-8). Press *Enter* to continue.
3. The hand control will then display the last entered local time, date, time zone, longitude and latitude.
    - Use the Up/Down keys (10) to view the current parameters.
    - Press ENTER to accept the current parameters.
    - Press UNDO to enter current date and time information into the hand control. The following information will be displayed:

Location - The hand control will display a list of cities to choose from. Choose the city from the database that is closest to your current observing site. The city you choose will be remembered in the hand controls memory so that it will be automatically displayed the next time an alignment is done. Alternatively, if you know the exact longitude and latitude of your observing site, it can be entered directly into the hand control and remembered for future use as well. To choose a location city:

- Use the Up and Down scroll keys to choose between *City Database* and *Custom Site. City Database* will allow you to select the closest city to your observing site from a

list of either international or U.S. location. *Custom Site* allows you to enter the exact longitude and latitude of your observing site. Select *City Database* and press ENTER.

- The hand control will allow you to choose from either U.S. or international locations. For a listing of U.S. locations by state and then by city, press ENTER while **United States** is displayed. For international locations, use the Up or Down scroll key to select **International** and press ENTER.

- Use the Up and Down Scroll buttons to choose your current state (or country if International locations was selected) from the alphabetical listing and press ENTER.

- Use the Up and Down Scroll buttons to choose the closest city to your location from the displayed list and press ENTER.

Time - Enter the current local time for your area. You can enter either the local time (i.e. 08:00), or you can enter military time (i.e. 20:00).

- Select PM or AM. If military time was entered, the hand control will bypass this step.
- Choose between Standard time or Daylight Savings time. Use the Up and Down scroll buttons (10) to toggle between options.
- Select the time zone that you are observing from. Again, use the Up and Down buttons (10) to scroll through the choices. Refer to Time Zone map in Appendix for more information.

Date - Enter the month, day and year of your observing session.

4. Select one of the alignment methods as described below.

Note: If incorrect information is entered into the hand control, the UNDO button acts like a back space button allowing the user to re-enter the correct data.

Two Star Align

Two-Star Align allows the user to select two stars on which to align the telescope. To align your telescope using the Two-Star Align method:

1. Select Two-Star Align from the alignment choices given. Based on the date and time information entered, the hand control will automatically select and display a bright star that is above the horizon.
   - Press ENTER to select this star as your first alignment star.
   - If for some reason the chosen star is not visible (perhaps behind a tree or building) press UNDO to have the hand control automatically select the next brightest star.
   - Or you can use the Up/Down keys to browse the entire Named Star list and select any one of over two hundred alignment stars.
   - The hand control will only display stars on one side of the Meridian. To display alignment stars on the opposite side of the

Mount Calibration

After a Two Star Alignment is successfully completed, the hand control will ask if you wish to add calibration stars.

Adding calibration stars is necessary to calculate and compensate for "cone" error inherent in all German equatorial mounts. Cone error is the inaccuracy that results from the optical tube not being exactly perpendicular to the mount's declination axis. The telescope is able to automatically determine the cone error value by always using calibration stars on the opposite side of the Meridian from the alignment stars. (see Figure 3-2)

Meridian, simply press the MENU button before selecting your first alignment star. By default, Meridian filtering is enabled with the side of the Meridian that has the largest number of stars above the horizon. Meridian filtering is indicated in the upper right hand corner of the LCD display with an "E" (East) or "W" (West). If nothing appears in the corner of the LCD, Meridian filtering is not enabled.

2. Once the telescope is finished slewing to your first alignment star, the display will ask you to use the arrow buttons to align the selected star with the cross hairs in the center of the finderscope. When centered in the finder, press ENTER.
3. The display will then instruct you to center the star in the field of view of the eyepiece. When the star is centered, press ALIGN to accept this star as your first alignment star.
4. After the first alignment star has been entered the hand control will automatically select a second alignment star and have you repeat this procedure for that star.

When the telescope has been aligned on both stars the display will ask you if you wish to add any additional calibration stars. Calibration stars are used to improve the pointing accuracy of your telescope by compensating for subtle optical-mechanical misalignments between the telescope optics and the mount. Therefore it is usually a good idea to add at least two additional calibration stasr to improve the telescope's all-sky pointing accuracy. If you choose not to add any additional calibration stars you can always add them later after a successful alignment has been completed (see Improving Pointing Accuracy section below).

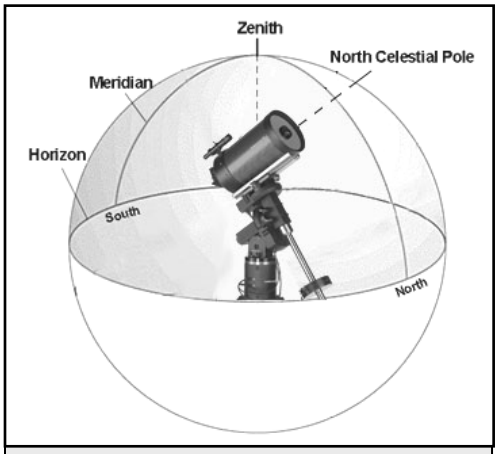


Figure 3-2
The Meridian is an imaginary line in the sky that starts at the North celestial pole and ends at the South celestial pole and passes through the zenith. If you are facing South, the meridian starts from your Southern horizon and passes directly overhead to the North celestial pole.

5. Press ENTER to select a calibration star. Select a star the same way you did with the first two alignments stars and press ENTER. You will notice that all the calibration stars displayed are located on the opposite side of the side of the sky (Meridian) as the original alignment stars. This is essential for an accurate calibration of the mount.

Finally you can choose to continue to add additional calibration stars or Press UNDO to complete the alignment.

Tips for adding calibration stars:

- *It is recommended that users add at least two calibration stars for optimal point accuracy.*
- *Calibration stars that are near the poles are intentionally filtered out because they can result in a less accurate calibration.*
- *Although it is not be necessary to use calibration stars if the telescope mount has not been moved since its original alignment/calibration, it may be necessary to add calibration stars if the optical tube has been removed for any reason.*

One Star Align

One-Star Alignment works much the same way as Two-Star Align but uses only a single star in the sky for alignment. This method of alignment is not as accurate as the two-star alignment and is recommended only for telescopes that are permanently and accurately polar aligned.

Solar System Align

Solar System Align is designed to provide excellent tracking and GoTo performance by using solar system objects (Sun, Moon and planets) to align the telescope with the sky. Solar System Align is a great way to align your telescope for daytime viewing as well as a quick way to align the telescope for nighttime observing.

Never look directly at the sun with the naked eye or with a telescope (unless you have the proper solar filter). Permanent and irreversible eye damage may result.

1. Select Solar System Align from the alignment options.
2. The SELECT OBJECT message will appear in the top row of the display. Use the Up and Down scroll keys (10) to select the daytime object (planet, moon or sun) you wish to align. Press ENTER.
3. Use the direction arrow buttons to carefully center the object in the finderscope. Press ENTER when centered.
4. Then, center the object in the eyepiece and press ALIGN.

Once in position, the telescope will model the sky based on this information and display **`Alignment Successful`**.

Tips for Using Solar System Align

- For safety purposes, the Sun will not be displayed in any of the hand control's customer object lists unless it is enabled from the Utilities Menu. To allow the Sun to be displayed on the hand control, do the following:

1. Press the UNDO button until the display reads "Advanced GT"
2. Press the MENU button and use the Up and Down keys to select the *Utilities menu*. Press ENTER.
3. Use the UP and Down keys to select *Sun Menu* and press ENTER.
4. Press ENTER again to allow the Sun to appear on the hand control display.

The Sun can be removed from the display by using the same procedure as above.

- To improve the telescope pointing accuracy, you can add alignment stars as described in the *Improving Pointing Accuracy* section below.

Quick-Align

Quick-Align uses all the date and time information entered at startup to align the telescope. However, instead of slewing to the alignment stars for centering and alignment, the telescope bypasses this step and simply models the sky based on the information given. This will allow you to roughly slew to the coordinates of bright objects like the moon and planets and gives the telescope the information needed to track objects in any part of the sky (depending on accuracy of polar alignment). Quick-Align is not meant to be used to accurately locate small or faint deep-sky objects or to track objects accurately for photography.

To use Quick-Align, simply select Quick Align from the alignment options and press ENTER. The telescope will automatically use the entered date/time parameters to align itself with the sky and display *Alignment Successful.*

NOTE: Once a Quick-Align has been done, you can add alignment and/or calibration stars to improve your telescopes pointing accuracy. See the Pointing Accuracy section below for details.

Last Alignment

The *Last Alignment* method will automatically recall the last stored index positions to continue using the alignment that was saved when the telescope was last powered down. This is a useful feature should your telescope accidentally lose power or be powered down.

NOTE: Just like with Quick-Align, you can use the Alignment Stars or Sync feature (see below) to improve your telescopes pointing accuracy after using the Last Alignment method. If the mount has not moved since the previous alignment then it is recommended to use Sync to improve the pointing accuracy of your mount. However, if the mount has been moved then changing alignment stars is the best way to re-align your mount.

To maintain a more accurate alignment over a series of observing sessions, use the *Hibernate* feature described later in this chapter.

Improving Pointing Accuracy

The Advanced Series telescopes have several options that allow you to improve the pointing accuracy of your mount in a variety of ways.

Alignment Stars:

Alignment stars allows you to replace any of the original alignment stars with a new star or celestial object. This can be useful if you have aligned your telescope using the Quick-Align method. You can add alignment st*ars* to align the telescope on actual objects in the sky. This will improve the pointing accuracy of your telescope without having to re-enter addition information.

To replace an existing alignment star with a new alignment star:

1. Select the desired star (or object) from the database and slew to it.
2. Once centered, press the UNDO button until you are at the main menu.
3. With `Advanced GT` displayed, press the ALIGN key on the hand control.
4. Use the Up/Down buttons and select the *Alignment S*tars option and press ENTER.
5. The display will then ask you which alignment star you want to replace. Use the UP and Down scroll keys to select the alignment star to be replaced and press ENTER. It is usually best to replace the star closest to the new object. This will space out your alignment stars across the sky.
6. Align the star in the center of the finderscope and press ENTER.
7. Carefully center the object in the center of the eyepiece and press ALIGN

Calibration Stars:

Calibration stars are used to improve the pointing accuracy of your telescope's mount by compensating for misalignments between the telescope optics and the mount
To add calibration stars:

1. Select the desired star (or object) from the database and slew to it.
2. Once centered, press the UNDO button until you are at the main menu.
3. With `Advanced GT` displayed, press the ALIGN key on the hand control.
4. Use the Up/Down buttons and select the *Calib Stars* option and press ENTER.
5. Align the object in the center of the finderscope and press ENTER.
6. Carefully center the object in the center of the eyepiece and press ALIGN.
7. Use the Up/Down arrow keys to assign a number for the star and press ENTER.

To add additional calibration stars, repeat steps 1-6 again.

Tips for adding calibration stars:

- Make sure that the calibration stars that you choose are on the other side of the meridian from the alignment stars that you used to align the telescope.

Sync:

The Sync feature can be used to improve pointing accuracy in a specific region of the sky. Sync is a very useful feature especially when used in conjunction with the Constellation tour and Identify feature in which you will be exploring smaller areas of the sky. To Sync on an object:

1. Select the desired star (or object) from the database and slew to it.
2. Once centered, press the UNDO button until you are at the main menu.
3. With `Advanced GT` displayed, press the ALIGN key on the hand control.
4. Use the Up/Down buttons and select the Sync option and press ENTER.
5. Align the Sync object in the center of the finderscope and press ENTER.
6. Carefully center the object in the center of the eyepiece and press ALIGN.

Your telescope's pointing accuracy will now be improved in that area of the sky.

NOTE: *Sync* can improve your telescope's pointing accuracy over a wide area or over smaller areas of the sky depending on the quality of the initial alignment, as well as where the telescope was pointing when the *Sync* was done.

Undo Sync:

Since doing a Sync can affect your pointing accuracy in other parts of the sky, it may be necessary to 'Un-Sync" your telescope when exploring other parts of the sky. Doing an Undo Sync will restore the pointing of your telescope to its original alignment. Additionally, if you wish to add calibration stars or re-alignment stars you will be asked to do an Undo Sync before you will be able to proceed

Object Catalog

Selecting an Object

Now that the telescope is properly aligned, you can choose an object from any of the catalogs in the telescope's extensive database. The hand control has a key (4) designated for each of the catalogs in its database. There are two ways to select objects from the database: scrolling through the named object lists and entering object numbers.

Pressing the LIST key on the hand control will access all objects in the database that have common names or types. Each list is broken down into the following categories: Named Stars, Named Object, Double Stars, Variable Stars, Asterisms and CCD Objects. Selecting any one of these catalogs will display a numeric-alphabetical listing of the objects under that list. Pressing the Up and Down keys (10) allows you to scroll through the catalog to the desired object.

Helpful Hint

When scrolling through a long list of objects, holding down either the Up or Down key will allow you to scroll through the catalog more rapidly by only displaying every fifth catalog object.

Pressing any of the other catalog keys (M, CALD, NGC, or STAR) will display a blinking cursor below the name of the catalog chosen. Use the numeric key pad to enter the number of any object within these standardized catalogs. For example, to find the Orion Nebula, press the "M" key and enter "042".

Slewing to an Object

Once the desired object is displayed on the hand control screen, choose from the following options:

- **Press the INFO Key**. This will give you useful information about the selected object such as R.A. and declination, magnitude size and text information for many of the most popular objects.
- **Press the ENTER Key**. This will automatically slew the telescope to the coordinates of the object.

Caution: Never slew the telescope when someone is looking into the eyepiece. The telescope can move at fast slew speeds and may hit an observer in the eye.

Object information can be obtained without having to do a star alignment. After the telescope is powered on, pressing any of the catalog keys allows you to scroll through object lists or enter catalog numbers and view the information about the object as described above.

Finding Planets

Your telescope can locate all 8 of our solar systems planets plus the Moon. However, the hand control will only display the solar system objects that are above the horizon (or within

its filter limits). To locate the planets, press the PLANET key on the hand control. The hand control will display all solar system objects that are above the horizon:

- Use the **Up and Down** keys to select the planet that you wish to observe.
- Press **INFO** to access information on the displayed planet.
- Press **ENTER** to slew to the displayed planet.

Tour Mode

The Advanced Series telescopes include a tour feature which automatically allows the user to choose from a list of interesting objects based on the date and time in which you are observing. The automatic tour will display only those objects that are within your set filter limits (see *Filter Limits* in the *Setup Procedures* section of the manual). To activate the Tour mode, press the TOUR key (6) on the hand control. The hand control will display the best objects to observe that are currently in the sky.

- To see information and data about the displayed object, press the INFO key.
- To slew to the object displayed, press ENTER.
- To see the next tour object, press the Up key.

Constellation Tour

In addition to the Tour Mode, your telescope has a Constellation Tour that allows the user to take a tour of all the best objects in each of the 88 constellations. Selecting *Constellation* from the LIST menu will display all the constellation names that are above the user defined horizon (filter limits). Once a constellation is selected, you can choose from any of the database object catalogs to produce a list of all the available objects in that constellation.

- To see information and data about the displayed object, press the INFO key.
- To slew to the object displayed, press ENTER.
- To see the next tour object, press the Up key.

Direction Buttons

The hand control has four direction buttons (3) in the center of the hand control which control the telescope's motion in Declination (north and south) and Right Ascension (east and west). The telescope can be controlled at nine different speed rates.

Rate Button

Pressing the RATE key (11) allows you to instantly change the speed rate of the motors from high speed slew rate to precise guiding rate or anywhere in between. Each rate corresponds to a number on the hand controller key pad. The number 9 is the fastest rate (3º per second, depending on power source) and is used for slewing between objects and locating alignment stars. The number 1 on the hand control is the slowest rate (.5x sidereal) and can be used for accurate centering of objects in the eyepiece and photographic guiding. To change the speed rate of the motors:

- Press the RATE key on the hand control. The LCD will display the current speed rate.
- Press the number on the hand control that corresponds to the desired speed. The number will appear in the upper-right corner of the LCD display to indicate that the rate has been changed.

The hand control has a "double button" feature that allows you to instantly speed up the motors without having to choose a speed rate. To use this feature, simply press the arrow button that corresponds to the direction that you want to move the telescope. While holding that button down, press the opposite directional button. This will increase the slew rate to the maximum slew rate.

The direction that a star moves in the eyepiece when a direction is pressed will change depending on which side of the Meridian the telescope tube is positioned. In order to change the direction of the arrow buttons, see *Scope Setup Features* later in this section.

1 = .5x	***6 = 64x***
2 = 1x (sidereal)	***7 = .5º / sec***
3 = 4x	***8 = 2º / sec***
4 = 8x	***9 = 3º / sec***
5 = 16x	
Nine available slew speeds	

Setup Procedures

The Advanced GT contains many user defined setup functions designed to give the user control over the telescope's many advanced features. All of the setup and utility features can be accessed by pressing the MENU key and scrolling through the options:

Tracking Mode This allows you to change the way the telescope tracks depending on the type of mount being used to support the telescope. The telescope has three different tracking modes:

EQ North Used to track the sky when the telescope is polar aligned in the Northern Hemisphere.

EQ South Used to track the sky when the telescope is polar aligned in the Southern Hemisphere.

Off When using the telescope for terrestrial (land) observation, the tracking can be turned off so that the telescope never moves.

Tracking Rate In addition to being able to move the telescope with the hand control buttons, your telescope will continually track a celestial object as it moves across the night sky. The tracking rate can be changed depending on what type of object is being observed:

Sidereal This rate compensates for the rotation of the Earth by moving the telescope at the same rate as the rotation of the Earth, but in the opposite direction. When the telescope is polar aligned, this can be accomplished by moving the telescope in right ascension only.

Lunar Used for tracking the moon when observing the lunar landscape.

Solar Used for tracking the Sun when solar observing with the proper filter.

View Time-Site - Displays the current time and longitude/latitude downloaded from the optional CN-16 GPS receiver. It will also display other relevant time-site information like time zone, daylight saving and local sidereal time. Local sidereal time (LST) is useful for knowing the right ascension of celestial objects that are located on the Meridian at that time. *View Time-Site* will always display the last saved time and location entered while it is linking with the GPS. Once current information has been received, it will update the displayed information. If GPS is switched off or not present, the hand control will only display the last saved time and location.

User Defined Objects - Your telescope can store over 100 different user defined objects in its memory (99 sky objects and 9 land objects). The objects can be daytime land objects or an interesting celestial object that you discover that is not included in the regular database. There are several ways to save an object to memory depending on what type of object it is:

GoTo Object: To go to any of the user defined objects stored in the database, scroll down to either **GoTo Sky Obj** or **Goto Land Obj** and enter the

number of the object you wish to select and press ENTER. The telescope will automatically retrieve and display the coordinates before slewing to the object.

Save Sky Object: Your telescope stores celestial objects to its database by saving its right ascension and declination in the sky. This way the same object can be found each time the telescope is aligned. Once a desired object is centered in the eyepiece, simply scroll to the "**Save Sky Obj**" command and press ENTER. The display will ask you to enter a number between 1-99 to identify the object. Press ENTER again to save this object to the database.

Save Database (Db) Object: This feature allows you to create your own custom tour of database objects by allowing you to record the current position of the telescope and save the name of the object by selecting it from any one of the database catalogs. These objects then can be accessed by selecting *GoTo Sky Object.*

Enter R.A. - Dec: You can also store a specific set of coordinates for an object just by entering the R.A. and declination for that object. Scroll to the "**Enter RA-DEC**" command and press ENTER. The display will then ask you to enter first the R.A. and then the declination of the desired object.

Save Land Object: The telescope can also be used as a spotting scope on terrestrial objects. Fixed land objects can be stored by saving their altitude and azimuth relative to the location of the telescope at the time of observing. Since these objects are relative to the location of the telescope, they are only valid for that exact location. To save land objects, once again center the desired object in the eyepiece. Scroll down to the "**Save Land Obj**" command and press ENTER. The display will ask you to enter a number between 1-9 to identify the object. Press ENTER again to save this object to the database.

To replace the contents of any of the user defined objects, simply save a new object using one of the existing identification numbers; the telescope will replace the previous user defined object with the current one.

Get RA/DEC - Displays the right ascension and declination for the current position of the telescope.

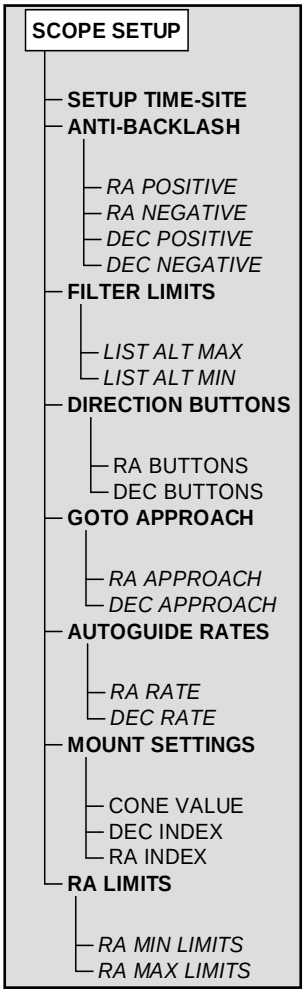
Goto R.A/ Dec - Allows you to input a specific R.A. and declination and slew to it.

Helpful Hint

To store a set of coordinates (R.A./Dec) permanently into the database, save it as a *User Defined Object* as described above.

Identify

Identify Mode will search any of the telescope's database catalogs or lists and display the name and offset distances to the nearest matching objects. This feature can serve two purposes. First, it can be used to identify an unknown object in the field of view of your eyepiece. Additionally, *Identify Mode* can be used to find other celestial objects that are close to the objects you are currently observing. For example, if your telescope is pointed at the brightest star in the constellation Lyra, choosing *Identify* and then searching the *Named Star* catalog will no doubt return the star Vega as the star you are observing. However, by selecting *Identify* and searching by the *Named Object* or *Messier* catalogs, the hand control will let you know that the Ring Nebula (M57) is approximately 6° from your current position. Searching the Double Star catalog will reveal that Epsilon Lyrae is only 1° away from Vega. To use the *Identify* feature:



- Press the Menu button and select the Identify option.
- Use the Up/Down scroll keys to select the catalog that you would like to search.
- Press ENTER to begin the search.

Note: Some of the databases contain thousands of objects, and can therefore take several minutes to return the closest objects.

Precise GoTo

The Advanced Series telescopes have a precise goto function that can assist in finding extremely faint objects and centering objects closer to the center of the field of view for astrophotography and CCD imaging. Precise Goto automatically searches out the closest bright star to the desired object and asks the user to carefully center it in the eyepiece. The hand control then calculates the small difference between its goto position and its centered position. Using this offset, the telescope will then slew to the desired object with enhanced accuracy. To use Precise Goto:

1. Press the MENU button and use the Up/Down keys to select *Precise Goto*.
   - Choose *Database* to select the object that you want to observe from any of the database catalogs listed or;
   - Choose *RA/DEC* to enter a set of celestial coordinates that you wish to slew to.
2. Once the desired object is selected, the hand control will search out and display the closest bright star to your desired object. Press ENTER to slew to the bright alignment star.
3. Use the direction buttons to carefully center the alignment star in the eyepiece.
4. Press ENTER to slew to the desired object.

Scope Setup Features

Setup Time-Site **-** Allows the user to customize the telescope's display by changing time and location parameters (such as time zone and daylight savings).

Anti-backlash – All mechanical gears have a certain amount of backlash or play between the gears. This play is evident by how long it takes for a star to move in the eyepiece when the hand control arrow buttons are pressed (especially when changing directions). The Advanced GT's anti-backlash features allows the user to compensate for backlash by inputting a value which quickly rewinds the motors just enough to eliminate the play between gears. The amount of compensation needed depends on the slewing rate selected; the slower the slewing rate the longer it will take for the star to appear to move in the eyepiece. There are two values for each axis, positive and negative. Positive is the amount of compensation applied when you press the button, in order to get the gears moving quickly without a long pause. Negative is the amount of compensation applied when you release the button, winding the motors back in the other direction to resume tracking. Normally both values should be the same. You will need to experiment with different values (from 0-99); a value between 20 and 50 is usually best for most visual observing, whereas a higher value may be necessary for photographic guiding.

To set the anti-backlash value, scroll down to the *anti-backlash* option and press ENTER. While viewing an object in the eyepiece, observe the responsiveness of each of the four arrow buttons. Note which directions you see a pause in the star movement after the button has been pressed. Working one axis at a time, adjust the backlash settings high enough to cause immediate movement without resulting in a pronounced jump when pressing or releasing the button. Now, enter the same values for both positive and negative directions. If you notice a jump when releasing the button, but setting the values lower results in a pause when pressing the button, go with the higher value for positive, but use a lower value for negative. The telescope will remember these values and use them each time it is turned on until they are changed.

Filter Limits – When an alignment is complete, the telescope automatically knows which celestial objects are above the horizon. As a result, when scrolling through the database lists (or selecting the Tour function), the hand control will display only those objects that are known to be above the horizon when you are observing. You can customize the object database by selecting altitude limits that are appropriate for your location and situation. For example, if you are observing from a mountainous location where the horizon is partially obscured, you can set your minimum altitude limit to read +20º. This will make sure that the hand control only displays objects that are higher in altitude than 20º.

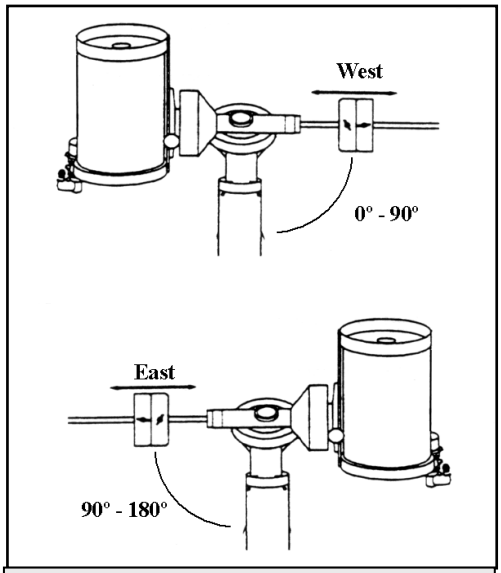


Fig 3-3 – R.A limits- This figure shows the full range of motion for the R.A. axis

Observing Tip!

If you want to explore the entire object database, set the maximum altitude limit to 90º and the minimum limit to –90º. This will display every object in the database lists regardless of whether it is visible in the sky from your location.

Direction Buttons **–**The direction a star appears to move in the eyepiece changes depending on which side of the Meridian the telescope tube is on. This can create confusion especially when guiding on a star when doing astrophotography. To compensate for this, the direction of the drive control keys can be changed. To reverse the button logic of the hand control, press the MENU button and select *Direction Buttons* from the Utilities menu. Use the Up/Down arrow keys (10) to select either the Declination (north and south) or Right Ascension (east and west) button directions and press ENTER. Select either positive or negative for both axes and press ENTER to save. Setting the azimuth button direction to positive will move the telescope in the same direction that the telescope tracks (i.e. towards the west). Setting the altitude buttons to positive will move the telescope counterclockwise along the DEC axis.

Goto Approach **-** lets the user define the direction that the telescope will approach when slewing to an object. This allows the user the ability to minimize the affects of backlash when slewing from object to object. Just like with *Direction Buttons*, setting *GoTo Approach* to positive will make the telescope approach an object from the same direction as tracking (west) for Right Ascension (RA) and counterclockwise in declination. Declination Goto approach will only apply while the telescope tube is on one side of the Meridian. Once the tube passes over to the other side of the Meridian, the Goto approach will need to be reversed.

Helpful Hint!

To change the Goto approach direction, simply choose *Goto Approach* from the *Scope Setup* menu, select either Altitude or Azimuth approach, choose positive or negative and press ENTER.

In order to minimize the affect of gear backlash on pointing accuracy, the settings for *Button Direction* should ideally match the settings for *GoTo Approach*. By default, using the up and right direction buttons to center alignment stars will automatically eliminate much of the backlash in the gears. If you change the Goto approach of your telescope it is not necessary to change the Button Direction as well. Simply take notice of the direction the telescope moves when completing it final goto approach. If the telescope approaches its alignment star from the west (negative azimuth) and clockwise (negative altitude) then make sure that the buttons used to center the alignment stars also move the telescope in the same directions.

Autoguide Rate – Allows the user to set an autoguide rate as a percentage of sidereal rate. This is helpful when calibrating your telescope to a CCD autoguider for long exposure photography.

Mount Settings- Once the mount settings have been calibrated (see Utilities section below) the values are stored and displayed in the hand control. It is not recommended that the calibration values be changed, however each setting can be changed if necessary to improve the performance of the telescope.

- **Cone Value** – This is the cone error value set when calibration stars are added
- **DEC Index** - This is the declination index error value set when calibrations stars are added.
- **RA Index** - This is the R.A. index error value set when Utilities / Calibrate Mount / R.A. Switch is carried out. This procedure records the offset of the RA index marker from the Meridian.

R.A. Limits - Sets the limits that the telescope can slew in Right Ascension (R.A.) The slew limits are set to 0º to 180º; with zero being the position of the telescope when the counterweight bar is extended out towards the west and 180º being the position when the counterweight bar is extended out toward the east (see Fig 3-3). However, the slew limits can be customized depending on your needs. For example, if you are using CCD imaging equipment that has cables that are not long enough to move with the telescope as it slews across the sky, you can adjust the R.A. slew limit on the side of the mount that is restricted by the cables. Using the example above, the user could slew the telescope in R.A. until it reaches the point that the cables are extended to their maximum. Then by displaying the telescopes R.A. in this position (by looking at *Get Axis Position* under the *Utilities* menu) you can determine the telescopes R.A. at its most extended position. Enter this azimuth reading for either the maximum or minimum azimuth slew limit to ensure that the telescope will not slew beyond this point.

Warning: In order for the telescope to be able to slew to a star from the direction that minimizes the amount of backlash in the gears, it may be necessary for the telescope to slew beyond the specified slew limit in order to approach the star from the correct direction. This can limit your ability to slew to an object by as much as 6º from the azimuth slew limit set in the hand control. If this proves to be a problem, the direction that the telescope takes to center an object can be changed. To change the telescopes slewing direction, see *Goto Approach* under the *Scope Setup* menu. In order to guaranty that the telescope will have a full range of motion in R.A. (azimuth), set the azimuth slew limits to 354 and 186. This will allow the mount to slew without regard to the slew limits.

Utility Features

Scrolling through the MENU (9) options will also provide access to several advanced utility functions within the Advanced Series telescopes such as; Calibrate Goto, Polar Alignment, Hibernate as well as many others.

Calibrate Mount - In order to optimize the performance and pointing accuracy of the Advanced mount, the mount has built-in calibration routines allowing it to compensate for mechanical variation inherent in every German equatorial mount. Each calibration is completely automatic and in most cases only needs to be performed once. It is highly recommended that you take a few minutes to go through the mount calibration procedures.

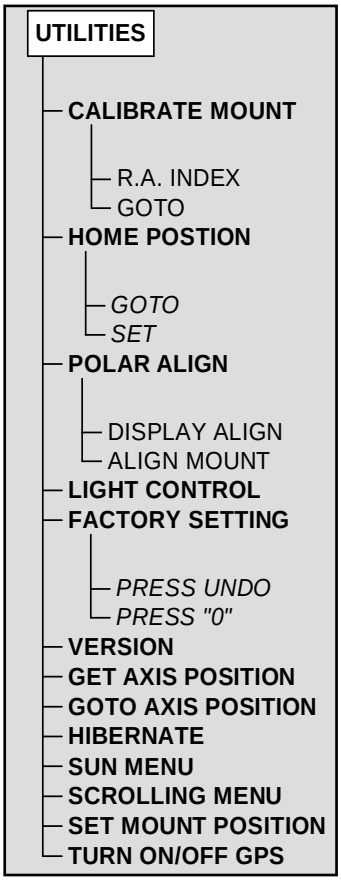
R.A. Index Calibration - This procedure records the offset of the RA index marker from the meridian. To perform an RA Index Calibration, the mount must be polar aligned and a two star alignment must have been performed with calibration stars.

- Calibrating the RA index will improve the pointing accuracy to the initial alignment stars when the mount has been polar aligned

To successfully calibrate the R.A. index of your telescope, you should follow a complete alignment process which includes the following:

- Complete a Two-Star alignment adding three calibration stars at the end. (See *Alignment Procedures* earlier in this section).
- Use the Polar Align Utility feature to polar align your telescope as described later in this section.
- Once polar aligned you must re-align your telescope using the Two-Star alignment method and adding calibration star as an option.
- Finally, use the Utility/Calibrate Mount/ R.A. Index feature to properly calibrate the R.A. axis of the mount.

- **GoTo Calibration –** Goto Calibration is a useful tool when attaching heavy visual or photographic accessories to the telescope. Goto Calibration calculates the amount of distance and time it takes for the mount to complete its final slow goto when slewing to an object. Changing the balance of the telescope can prolong the time it takes to complete the final slew. Goto Calibration takes into account any slight imbalances and changes the final goto distance to compensate.



Home Position – The telescope's "home" position is a user-definable position that is used to store the telescope when not in use. The home position is useful when storing the telescope in a permanent observatory facility. By default the Home position is the same as the index position used when aligning the mount. To set the *Home* position for your mount simply use the arrow buttons on the hand control to move the telescope mount to the desired position. Select the *Set* option and press Enter.

Polar Align

Display Align – the user can now display the polar alignment error in both the Azimuth and Altitude axes. These values can assist you in knowing the amount and direction of your error when polar aligning.

Align Mount- The Advanced GT has a polar alignment function that will help you polar align your telescope for increased tracking precision and astrophotography. After performing a two star alignment, the telescope will slew to where Polaris should be. By using the equatorial head to

center Polaris in the eyepiece, the mount will then be pointed towards the actual North Celestial Pole. Once *Polar Align* is complete, you must re-align your telescope again using any of the alignment methods described earlier. To polar align the mount in the Northern Hemisphere:

1. With the telescope set up and roughly positioned towards Polaris, align the mount using the *Two- Star Alignment* method.

2. Select *Polar Align* from the *Utilities* menu and press Enter.

   Based on your current alignment, the telescope will slew to where it thinks Polaris should be. Use the equatorial head latitude and azimuth adjustments to place Polaris in the center of the eyepiece. Do not use the direction buttons to position Polaris. Once Polaris is centered in the eyepiece press ENTER; the polar axis should then be pointed towards the North Celestial Pole.

Light Control – This feature allows you to turn off both the red key pad light and LCD display for daytime use to conserve power and to help preserve your night vision.

Factory Settings – Returns the Advanced GT hand control to its original factory settings. Parameters such as backlash compensation values, initial date and time, longitude/latitude along with slew and filter limits will be reset. The hand control will ask you to press the "0" key before returning to the factory default setting.

Version - Selecting this option will allow you to see the current version number of the hand control and motor control software. The numbers indicate the hand control software version. For the motor control, the hand control will display two sets of numbers; the first numbers are for R.A and the second set are for DEC.

Get Axis Positions - Displays the relative altitude and azimuth for the current position of the telescope.

Goto Axis Positions - Allows you to enter a specific relative altitude and azimuth position and slew to it.

Hibernate - Hibernate allows the telescope to be completely powered down and still retain its alignment when turned back on. This not only saves power, but is ideal for those that have their telescopes permanently mounted or leave their telescope in one location for long periods of time. To place your telescope in Hibernate mode:

1. Select Hibernate from the Utility Menu.
2. Move the telescope to a desired position and press ENTER.
3. Power off the telescope. Remember to never move your telescope manually while in Hibernate mode.

Helpf ..l

Once the telescope is powered on again the display will read Wake Up. After pressing Enter you have the option of scrolling through the time/site information to confirm the current setting. Press ENTER to wake up the telescope.

Pressing UNDO at the Wake Up screen allows you to explore many of the features of the hand control without waking the telescope up from hibernate mode. To wake up the telescope after UNDO has been pressed, select Hibernate from the Utility menu and press ENTER. Do not use the direction buttons to move the telescope while in hibernate mode.

Sun Menu

For safety purposes the Sun will not be displayed as a database object unless it is first enabled. The enable the Sun, go to the *Sun Menu* and press ENTER. The Sun will now be displayed in the Planets catalog as can be used as an alignment object when using the Solar System Alignment method. To remove the Sun from displaying on the hand control, once again select the Sun Menu from the Utilities Menu and press ENTER.

Scrolling Menu

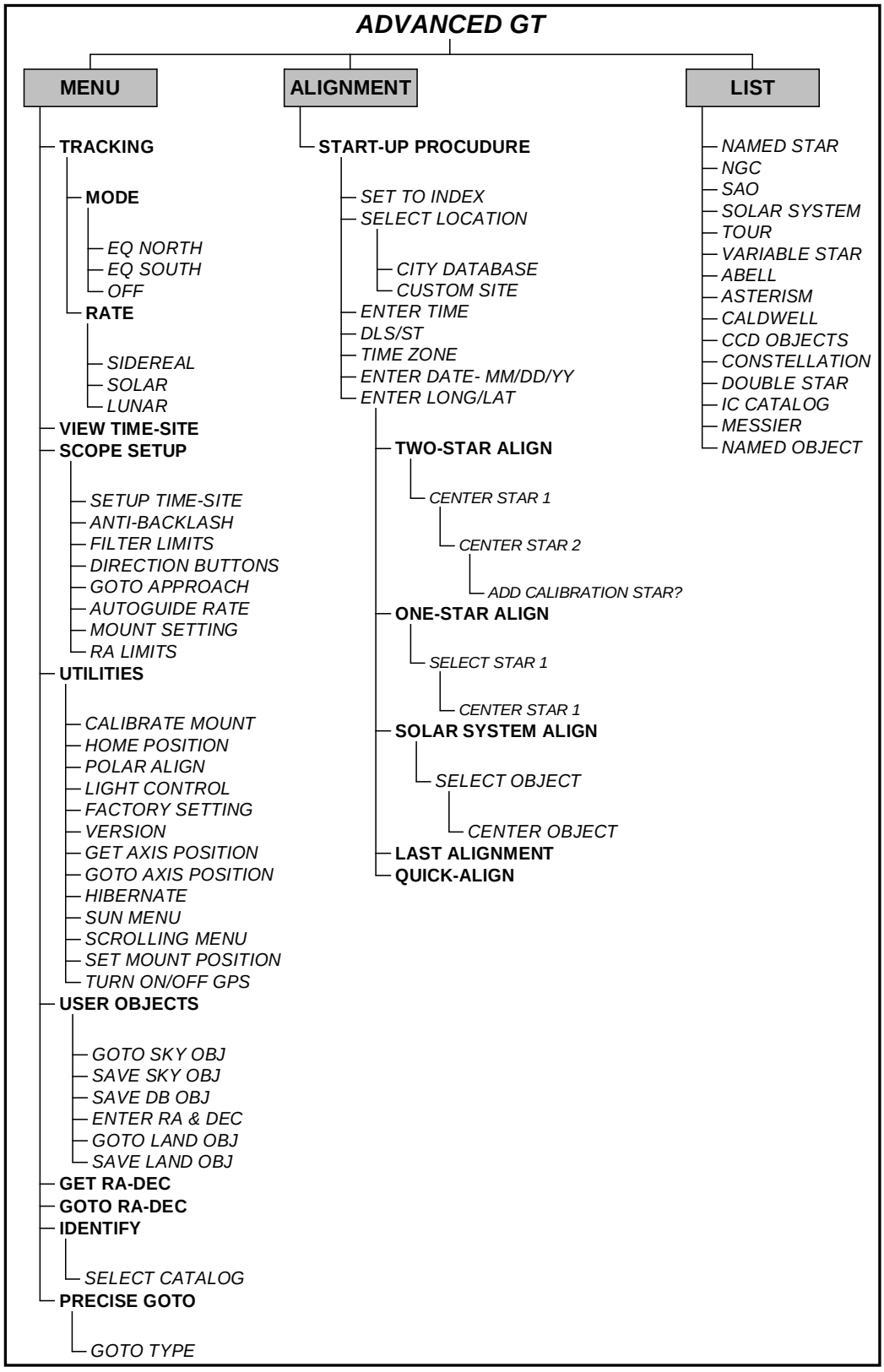
This menu allows you to change the rate of speed that the text scrolls across the hand control display.

- Press the Up (number 6) button to increase the speed of the text.
- Press the Down (number 9) button to decrease the speed of the text.

Set Mount Position

The Set Mount Position menu can be used to recover an alignment in cases where the clutches have been disengaged or similar situation. For instance, you might use this if you needed to rebalance the mount after having completed an alignment. Using this tool will invalidate the PEC index

Turn On/Off GPS **-** If using your Advanced GT telescope with the optional CN-16 GPS accessory (see *Optional Accessories* section of the manual), you will need to turn the GPS on the first time you use the accessory. If you want to use the telescope's database to find the coordinates of a celestial object for a future or past dates you would need to turn the GPS off in order to manually enter a time other than the present.


ADVANCED GT
MENU
ALIGNMENT
LIST
TRACKING
MODE
EQ NORTH
EQ SOUTH
OFF
RATE
SIDEREAL
SOLAR
LUNAR
VIEW TIME-SITE
SCOPE SETUP
SETUP TIME-SITE
ANTI-BACKLASH
FILTER LIMITS
DIRECTION BUTTONS
GOTO APPROACH
AUTOGUIDE RATE
MOUNT SETTING
RA LIMITS
UTILITIES
CALIBRATE MOUNT
HOME POSITION
POLAR ALIGN
LIGHT CONTROL
FACTORY SETTING
VERSION
GET AXIS POSITION
GOTO AXIS POSITION
HIBERNATE
SUN MENU
SCROLLING MENU
SET MOUNT POSITION
TURN ON/OFF GPS
USER OBJECTS
GOTO SKY OBJ
SAVE SKY OBJ
SAVE DB OBJ
ENTER RA & DEC
GOTO LAND OBJ
SAVE LAND OBJ
GET RA-DEC
GOTO RA-DEC
IDENTIFY
SELECT CATALOG
PRECISE GOTO
GOTO TYPE
START-UP PROCUDURE
SET TO INDEX
SELECT LOCATION
CITY DATABASE
CUSTOM SITE
ENTER TIME
DLS/ST
TIME ZONE
ENTER DATE- MM/DD/YY
ENTER LONG/LAT
TWO-STAR ALIGN
CENTER STAR 1
CENTER STAR 2
ADD CALIBRATION STAR?
ONE-STAR ALIGN
SELECT STAR 1
CENTER STAR 1
SOLAR SYSTEM ALIGN
SELECT OBJECT
CENTER OBJECT
LAST ALIGNMENT
QUICK-ALIGN
NAMED STAR
NGC
SAO
SOLAR SYSTEM
TOUR
VARIABLE STAR
ABELL
ASTERISM
CALDWELL
CCD OBJECTS
CONSTELLATION
DOUBLE STAR
IC CATALOG
MESSIER
NAMED OBJECT

Latitude Scales

The easiest way to polar align a telescope is with a latitude scale. Unlike other methods that require you to find the celestial pole by identifying certain stars near it, this method works off of a known constant to determine how high the polar axis should be pointed. The Advanced Series mount can be adjusted from 30 to 60 degrees (see figure 5-3).

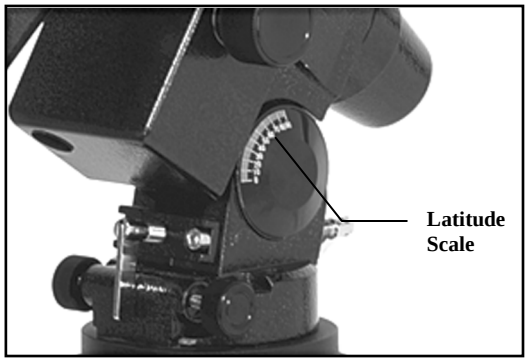


Figure 5-3

The constant, mentioned above, is a relationship between your latitude and the angular distance the celestial pole is above the northern (or southern) horizon; The angular distance from the northern horizon to the north celestial pole is always equal to your latitude. To illustrate this, imagine that you are standing on the north pole, latitude +90°. The north celestial pole, which has a declination of +90°, would be directly overhead (i.e., 90 above the horizon). Now, let's say that you move one degree south — your latitude is now +89° and the celestial pole is no longer directly overhead. It has moved one degree closer toward the northern horizon. This means the pole is now 89° above the northern horizon. If you move one degree further south, the same thing happens again. You would have to travel 70 miles north or south to change your latitude by one degree. As you can see from this example, the distance from the northern horizon to the celestial pole is always equal to your latitude.

If you are observing from Los Angeles, which has a latitude of 34°, then the celestial pole is 34° above the northern horizon. All a latitude scale does then is to point the polar axis of the telescope at the right elevation above the northern (or southern) horizon. To align your telescope:

1. Make sure the polar axis of the mount is pointing due north. Use a landmark that you know faces north.

2. Level the tripod. There is a bubble level built into the mount for this purpose.

NOTE: Leveling the tripod is only necessary if using this method of polar alignment. Perfect polar alignment is still possible using other methods described later in this manual without leveling the tripod.

3. Adjust the mount in altitude until the latitude indicator points to your latitude. Moving the mount affects the angle the polar axis is pointing. For specific information on adjusting the equatorial mount, please see the section "Adjusting the Mount."

   This method can be done in daylight, thus eliminating the need to fumble around in the dark. Although this method does **NOT** put you directly on the pole, it will limit the number of corrections you will make when tracking an object. It will also be accurate enough for short exposure prime focus planetary photography (a couple of seconds) and short exposure piggyback astrophotography (a couple of minutes).

Pointing at Polaris

This method utilizes Polaris as a guidepost to the celestial pole. Since Polaris is less than a degree from the celestial pole, you can simply point the polar axis of your telescope at Polaris. Although this is by no means perfect alignment, it does get you within one degree. Unlike the previous method, this must be done in the dark when Polaris is visible.

1. Set the telescope up so that the polar axis is pointing north.

2. Loosen the DEC clutch knob and move the telescope so that the tube is parallel to the polar axis. When this is done, the declination setting circle will read +90°. If the declination setting circle is not aligned, move the telescope so that the tube is parallel to the polar axis.

3. Adjust the mount in altitude and/or azimuth until Polaris is in the field of view of the finder.

4. Center Polaris in the field of the telescope using the fine adjustment controls on the mount.

Remember, while Polar aligning, do NOT move the telescope in R.A. or DEC. You do not want to move the telescope itself, but the polar axis. The telescope is used simply to see where the polar axis is pointing.

Like the previous method, this gets you close to the pole but not directly on it. The following methods help improve your accuracy for more serious observations and photography.

Finding the North Celestial Pole

In each hemisphere, there is a point in the sky around which all the other stars appear to rotate. These points are called the celestial poles and are named for the hemisphere in which they reside. For example, in the northern hemisphere all stars move around the north celestial pole. When the telescope's polar axis is pointed at the celestial pole, it is parallel to the Earth's rotational axis.

Many methods of polar alignment require that you know how to find the celestial pole by identifying stars in the area. For those in the northern hemisphere, finding the celestial pole is not too difficult. Fortunately, we have a naked eye star less than a degree away. This star, Polaris, is the end star in the handle of the Little Dipper. Since the Little Dipper (technically called Ursa Minor) is not one of the brightest constellations in the sky, it may be difficult to locate from urban areas. If this is the case, use the two end stars in the bowl of the Big Dipper (the pointer stars). Draw an imaginary line through them toward the Little Dipper. They point to Polaris (see Figure 5-5). The position of the Big Dipper changes during the year and throughout the course of the night (see Figure 5-4). When the Big Dipper is low in the sky (i.e., near the horizon), it may be difficult to locate. During these times, look for Cassiopeia

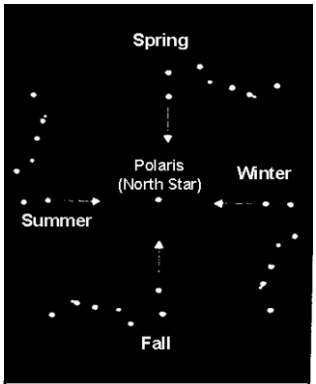


Figure 5-4 The position of the Big Dipper changes throughout the year and the night.

Definition

(see Figure 5-5). Observers in the southern hemisphere are not as fortunate as those in the northern hemisphere. The stars around the south celestial pole are not nearly as bright as those around the north. The closest star that is relatively bright is Sigma Octantis. This star is just within naked eye limit (magnitude 5.5) and lies about 59 arc minutes from the pole.

The north celestial pole is the point in the northern hemisphere around which all stars appear to rotate. The counterpart in the southern hemisphere is referred to as the south celestial pole.

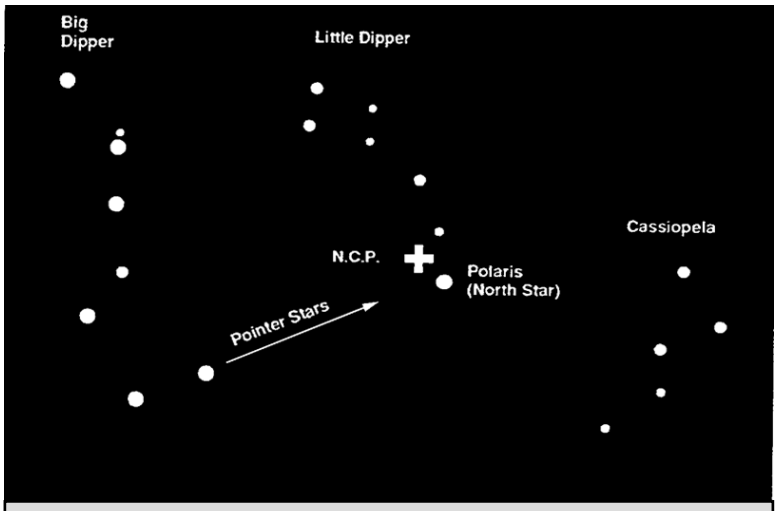


Figure 5-5
The two stars in the front of the bowl of the Big Dipper point to Polaris which is less than one degree from the true (north) celestial pole. Cassiopeia, the "W" shaped constellation, is on the opposite side of the pole from the Big Dipper. The North Celestial Pole (N.C.P.) is marked by the "+" sign.

Declination Drift Method of Polar Alignment

This method of polar alignment allows you to get the most accurate alignment on the celestial pole and is required if you want to do long exposure deep-sky astrophotography through the telescope. The declination drift method requires that you monitor the drift of selected stars. The drift of each star tells you how far away the polar axis is pointing from the true celestial pole and in what direction. Although declination drift is simple and straight-forward, it requires a great deal of time and patience to complete when first attempted. The declination drift method should be done after any one of the previously mentioned methods has been completed.

To perform the declination drift method you need to choose two bright stars. One should be near the eastern horizon and one due south near the meridian. Both stars should be near the celestial equator (i.e., 0° declination). You will monitor the drift of each star one at a time and in declination only. While monitoring a star on the meridian, any misalignment in the east-west direction is revealed. While monitoring a star near the east/west horizon, any misalignment in the north-south direction is revealed. It is helpful to have an illuminated reticle eyepiece to help you recognize any drift. For very close alignment, a Barlow lens is also recommended since it increases the magnification and reveals any drift faster. When looking due south, insert the diagonal so the eyepiece points straight up. Insert the cross hair eyepiece and align the cross hairs so that one is parallel to the declination axis and the other is parallel to the right ascension axis. Move your telescope manually in R.A. and DEC to check parallelism.

First, choose your star near where the celestial equator and the meridian meet. The star should be approximately within 1/2 an hour of the meridian and within five degrees of the celestial equator. Center the star in the field of your telescope and monitor the drift in declination.

- If the star drifts south, the polar axis is too far east.
- If the star drifts north, the polar axis is too far west.

Make the appropriate adjustments to the polar axis to eliminate any drift. Once you have eliminated all the drift, move to the star near the eastern horizon. The star should be 20 degrees above the horizon and within five degrees of the celestial equator.

- If the star drifts south, the polar axis is too low.
- If the star drifts north, the polar axis is too high.

Again, make the appropriate adjustments to the polar axis to eliminate any drift. Unfortunately, the latter adjustments interact with the prior adjustments ever so slightly. So, repeat the process again to improve the accuracy checking both axes for minimal drift. Once the drift has been eliminated, the telescope is very accurately aligned. You can now do prime focus deep-sky astrophotography for long periods.

NOTE: If the eastern horizon is blocked, you may choose a star near the western horizon, but you must reverse the polar high/low error directions. Also, if using this method in the southern hemisphere, the direction of drift is reversed for both R.A. and DEC.

CELESTRON TWO YEAR WARRANTY

A. Celestron warrants this telescope to be free from defects in materials and workmanship for two years. Celestron will repair or replace such product or part thereof which, upon inspection by Celestron, is found to be defective in materials or workmanship. As a condition to the obligation of Celestron to repair or replace such product, the product must be returned to Celestron together with proof-of-purchase satisfactory to Celestron.

B. The Proper Return Authorization Number must be obtained from Celestron in advance of return. Call Celestron at (310) 328-9560 to receive the number to be displayed on the outside of your shipping container.

All returns must be accompanied by a written statement setting forth the name, address, and daytime telephone number of the owner, together with a brief description of any claimed defects. Parts or product for which replacement is made shall become the property of Celestron.

The customer shall be responsible for all costs of transportation and insurance, both to and from the factory of Celestron, and shall be required to prepay such costs.

Celestron shall use reasonable efforts to repair or replace any telescope covered by this warranty within thirty days of receipt. In the event repair or replacement shall require more than thirty days, Celestron shall notify the customer accordingly. Celestron reserves the right to replace any product which has been discontinued from its product line with a new product of comparable value and function.

This warranty shall be void and of no force of effect in the event a covered product has been modified in design or function, or subjected to abuse, misuse, mishandling or unauthorized repair. Further, product malfunction or deterioration due to normal wear is not covered by this warranty.

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Some states do not allow the exclusion or limitation of incidental or consequential damages or limitation on how long an implied warranty lasts, so the above limitations and exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Celestron reserves the right to modify or discontinue, without prior notice to you, any model or style telescope.

If warranty problems arise, or if you need assistance in using your telescope contact:

Celestron
Customer Service Department
2835 Columbia Street
Torrance, CA 90503 U.S.A.
Tel. (310) 328-9560
Fax. (310) 212-5835
Monday-Friday 8AM-4PM PST

This warranty supersedes all other product warranties.

NOTE: This warranty is valid to U.S.A. and Canadian customers who have purchased this product from an Authorized Celestron Dealer in the U.S.A. or Canada. Warranty outside the U.S.A. and Canada is valid only to customers who purchased from a Celestron Distributor or Authorized Celestron Dealer in the specific country and please contact them for any warran

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