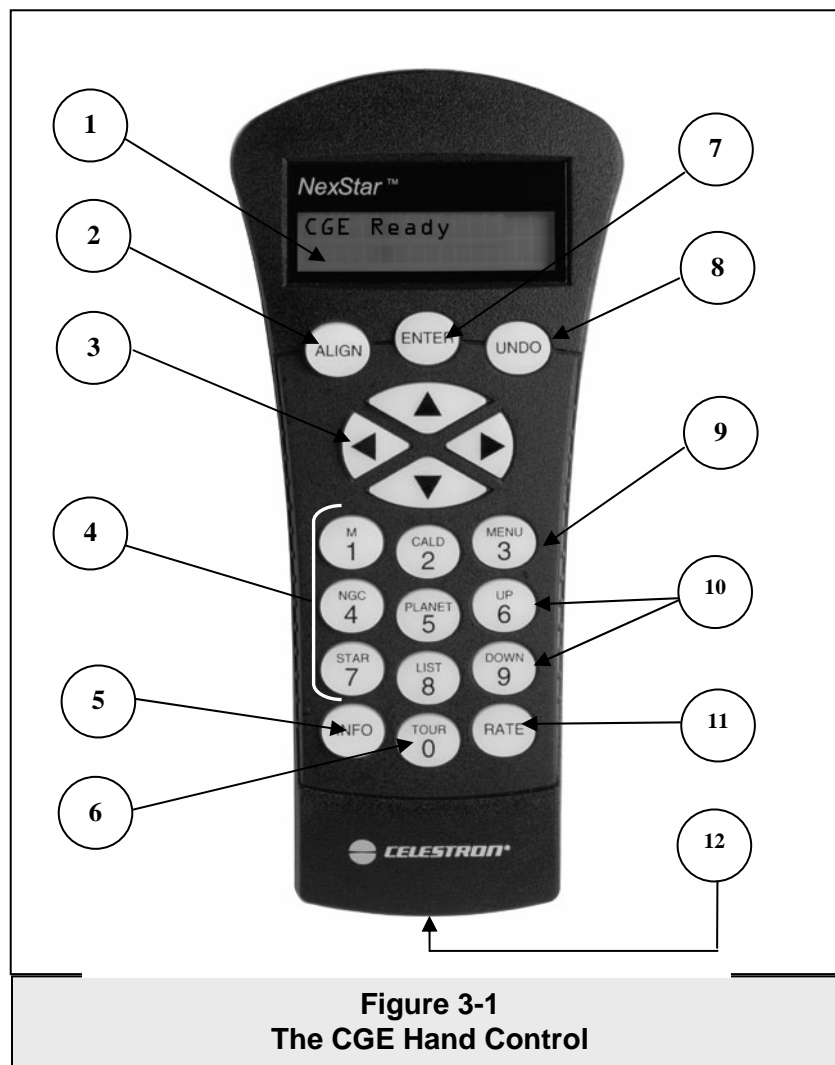# CELESTRON®
Hand Control

The following is a supplemental addendum to the included instruction manual that explains the new features of Celestron's CGE 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 CGE Series 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:

Figure 3-1
The CGE Hand Control

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 for centering objects in the eyepiece.

4. **Catalog Keys:** The CGE 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 CGE 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 CGE 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 CGE 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 CGE 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 CGE 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 CGE needs to first index its switch position so that each axis has an equal amount of travel to move in either direction. 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. Press ENTER again to set the telescopes switch position. Press UNDO if you would like to manually move the telescope to a different switch position. This is useful if using your scope with additional equipment attached and its range of motion is limited. 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:
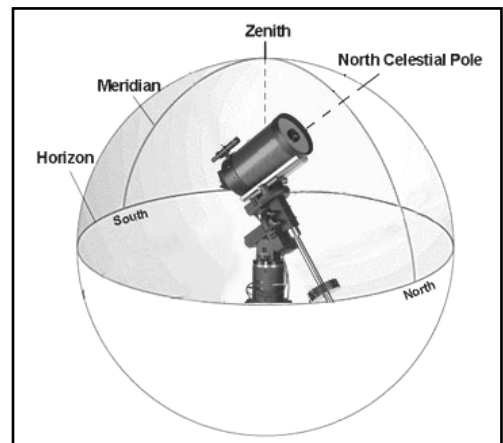
1. Select Two-Star Align from the alignment choices given. Based on the date and time information entered, the hand control will automatically select and display a bright star that is above the horizon.
   - Press ENTER to select this star as your first alignment star.
   - If for some reason the chosen 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 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.

> ### 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)

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 "CGE Ready"
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 switch 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 CGE 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 `CGE Ready` 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 `CGE Ready` 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 CGE Ready 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 CGE 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 (3° 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 = .5°/ sec*
3 = 4x	*8 = 2°/ sec*
4 = 8x	*9 = 3°/ sec*
5 = 16x	
Nine available slew speeds	

Setup Procedures

The CGE 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.

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

Helpful Hint

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.
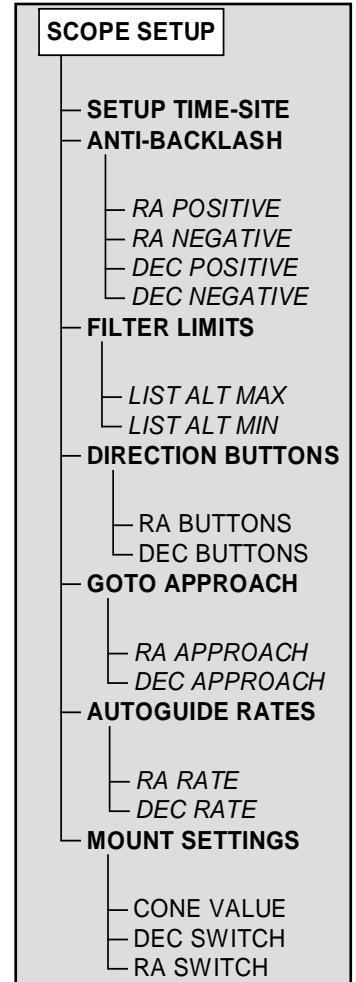
Precise GoTo

The CGE 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).

SCOPE SETUP
— **SETUP TIME-SITE**
— **ANTI-BACKLASH**
— *RA POSITIVE*
— *RA NEGATIVE*
— *DEC POSITIVE*
— *DEC NEGATIVE*
— **FILTER LIMITS**
— *LIST ALT MAX*
— *LIST ALT MIN*
— **DIRECTION BUTTONS**
— RA BUTTONS
— DEC BUTTONS
— **GOTO APPROACH**
— *RA APPROACH*
— *DEC APPROACH*
— **AUTOGUIDE RATES**
— *RA RATE*
— *DEC RATE*
— **MOUNT SETTINGS**
— CONE VALUE
— DEC SWITCH
— RA SWITCH

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 CGE 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.

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.

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 Switch** - This is the declination index error value set when calibrations stars are added.
- **RA Switch** - 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 switch from the Meridian.

Utility Features

Scrolling through the MENU (9) options will also provide access to several advanced utility functions within the CGE Series telescopes such as; Calibrate Goto, Polar Alignment, Hibernate as well as many others.
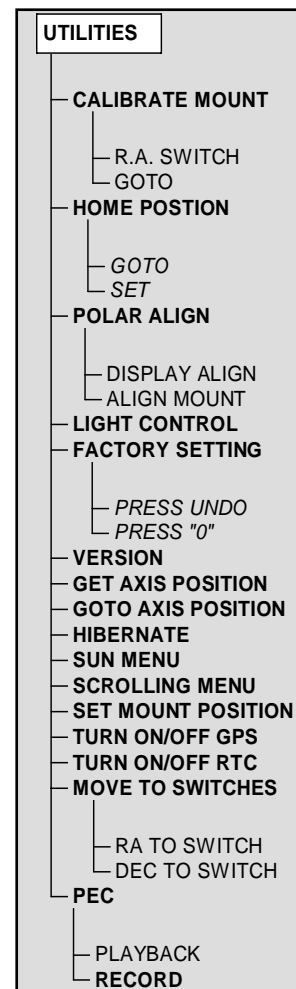
Calibrate Mount - In order to optimize the performance and pointing accuracy of the CGE mount, the mount has built-in calibration routines allowing it to compensate for mechanical variation inherent in every German equatorial mount. Each calibration is completely automatic and in most cases only needs to be performed once. It is highly recommended that you take a few minutes to go through the mount calibration procedures.

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

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

  To successfully calibrate the R.A. switch 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. Switch 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.

```
UTILITIES

─ CALIBRATE MOUNT

   ├ R.A. SWITCH
   └ GOTO
─ HOME POSTION

   ├ GOTO
   └ SET
─ POLAR ALIGN

   ├ DISPLAY ALIGN
   └ ALIGN MOUNT
─ LIGHT CONTROL
─ FACTORY SETTING

   ├ PRESS UNDO
   └ PRESS "0"
─ VERSION
─ GET AXIS POSITION
─ GOTO AXIS POSITION
─ HIBERNATE
─ SUN MENU
─ SCROLLING MENU
─ SET MOUNT POSITION
─ TURN ON/OFF GPS
─ TURN ON/OFF RTC
─ MOVE TO SWITCHES

   ├ RA TO SWITCH
   └ DEC TO SWITCH
─ PEC

   ├ PLAYBACK
   └ RECORD
```

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 switch 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 CGE 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 CGE 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.

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.

Helpful Hint

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 CGE 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.

Turn On/Off RTC **-** Allows you to turn off the telescopes internal real time clock. When aligning the telescope using AutoAlign, the CGE still receives time information from the RTC. If you want to use the CGE database to find the coordinates of a celestial object for a future or past dates you would need to turn the RTC off in order to manually enter a time other than the present.

Move to Switch – Slews the telescope to locate either its R.A. or declination switches.

Periodic Error Correction (PEC) - PEC is designed to improve photographic quality by reducing the amplitude of the worm gear errors and improving the tracking accuracy of the drive. This feature is for advanced astrophotography and is used when your telescope is accurately polar aligned. For more information on using PEC, see the section on "Celestial Photography" in your owner's manual.

CGE READY

MENU

- **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 RATES*
  - *MOUNT SETTINGS*
- **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*
  - *TURN ON/OFF RTC*
  - *MOVE TO SWITCH*
  - *PEC*
- **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*

ALIGNMENT

- **START-UP PROCUDURE**
  - *SET TO SWITCH*
  - *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**

LIST

- *NAMED STAR*
- *NGC*
- *SAO*
- *SOLAR SYSTEM*
- *TOUR*
- *VARIABLE STAR*
- *ABELL*
- *ASTERISM*
- *CALDWELL*
- *CCD OBJECTS*
- *CONSTELLATION*
- *DOUBLE STAR*
- *IC CATALOG*
- *MESSIER*
- *NAMED OBJECT*