



Gemini Control Center

a Companion Application to
The Gemini Astronomical Positioning System

Users Manual

Michael Rudolph

Daniel Görlich

**Exploration is not a choice...
it's an imperative!**

Michael Collins, Gemini Astronaut

**GEMINI CONTROL CENTER
USERS MANUAL
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The Gemini Astronomical Positioning System**

by
**Michael Rudolph
and
Daniel Görlich**

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INTRODUCTION

The Gemini Control Center (GCC), developed and programmed by [Daniel Görlich](#)¹, provides almost complete remote control and automation of the Gemini Astronomical Positioning System. Its predecessor, the Gemini Control Program (GCP), was designed to control Gemini Levels 1 and 2 only. With the advent of Level 3, so many new features were introduced, that the software had to be completely rewritten; what resulted, was the Gemini Control Center.

The GCC does everything that the GCP did, and much more. Not only does it embrace the enhanced features of Gemini Level 3, it is backwards compatible to Levels 1 and 2, and adds new functionality of its own.



INTRODUCTION TO THE “FIRST” GEMINI CONTROL PROGRAM

The Gemini Astronomical Positioning System (Gemini) is a sophisticated computer-controlled servo system developed jointly by [Scott Losmandy](#)² and [René Görlich](#).³ It is currently available for the [Losmandy](#) G-8, G-11, and HGM-200 German Equatorial Mounts,⁴ for the [Mountain Instruments](#) MI-250,⁵ and also for the [Celestron](#) CI-700.⁶

A significant virtue of the Gemini is that it is fully functional in the field without the need of separate PC control, yet is also capable of being driven remotely by a P.C. using planetarium or other control software. While such third-party software is often able to perform the basic "Go-to" functions of slewing to and guiding on celestial objects, none is capable of remotely performing all of the functions of which the Gemini is capable. Consequently, despite such software's value in its area of specialty, the operator must, nevertheless, remain with his telescope.

The Gemini Control Program (GCP) developed by Daniel Görlich is a giant step toward complete remote control and automation. With it, the operator can set most of Gemini's parameters remotely, can access extended databases, and can program observing sequences through user-defined entries. Also, he or she is freed from having to scroll through multiple menus of the Hand Controller, and from the difficulty of having to accomplish everything through five buttons and an LED display. In short, the Gemini Control Program serves as both a user-friendly interface, and a customizable vehicle for operating a Gemini-connected telescope with control room comfort.

There are two exceptions to total remote control of a telescope. The first and most obvious is that, as in all equipment, the optical, mechanical and electrical components of a telescope system can fail and, when they do, on-site access is absolutely necessary. The second exception is that a telescope's polar and initial star alignment must be performed at the telescope, and must be periodically confirmed. The Gemini Control Program does not perform these functions, but does provide the most

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⁴ Losmandy Astronomical Products: <http://www.losmandy.com/eq-mounts.html>

⁵ Mountain Instruments: <http://www.MountainInstruments.com>

⁶ Celestron: <http://www.Celestron.com>

dependable, easy-to-operate remote control of the Gemini Astronomical Positioning System that there is.

INTRODUCING THE “NEW” GEMINI CONTROL CENTER

If the GCP was a “giant step toward complete remote control and automation,” the Gemini Control Center is a leap! While the full list of comparisons and enhancements is too extensive to be part of this Introduction, here is a sample to wet the appetite:

- All of the new features of Gemini Level 3 are incorporated into the GCC, not the least of which is that Gemini now starts up initially aligned so that your first slew to a star for further alignment and refinement of the pointing model can be performed using Gemini’s Go-to capability.
- The GCC’s Main Screen is now organized into menus and submenus, and conveniently has the ability to connect, disconnect, park and stop Gemini’s movement right from this most visible screen.
- The GCC has included the parameters of two new Losmandy mounts – the Titan 25, and the Titan 50.
- The GCC has an expanded Catalogs Screen with selectable panels for L3’s expanded list of Standard Catalogs, for user-defined Custom Catalogs, and for Bookmarks created by the user to record and save real-time positions of the telescope for future retrieval and Go-to.
- The GCC now has a Near Objects Screen for slewing to Solar System objects, and for calculating the phases of the Moon.
- The GCC now has a Synchronization Screen from where Gemini and the PC can accurately set their date and time from either a GPS receiver or from an Internet SNTP server. If a GPS receiver is used, Gemini can download its geographic coordinates automatically as well.
- The GCC now has a Configuration Screen with enhanced Session Profile capabilities.
- The GCC now has an Observation Schedules screen for automating the timed observation of multiple celestial objects.
- The GCC now has an Observation Diaries Screen that assists the user in interpreting Gemini’s Observation Log, and in creating and saving Diaries of the observation session’s activities in detail.
- The GCC now has a Precession Calculator Screen for easily converting RA and Dec coordinates from one Epoch to another.
- The GCC now has a Color Themes Screen for customizing the colors of the GCC’s display in order to accommodate both individual taste, as well as differences in the color rendition of different PC displays.
- In addition to the screens listed above, the GCC’s remaining screens that were formally part of the GCP, have been completely re-designed for ease of use. Every aspect of the GCC (including its visual presentation) is enhanced and improved, giving the user every feature and convenience that he might want for controlling the Gemini from either a near or remote location.

The authors sincerely hope that the descriptions, instructions and explanations contained in this Manual will greatly enhance the user’s pleasure and ease of operation, as he or she explores all of the wonderful capabilities of the Gemini Astronomical Positioning System.

ACKNOWLEDGEMENTS

Michael Rudolph wants to thank René Görlich for his sterling design of the Gemini Astronomical Positioning System, and for his assistance in providing detailed explanations of its operation during the writing of this manual. He also wants to thank Daniel Görlich, programmer and developer of the Gemini Control Center, for inviting him to write this manual and participate in beta-testing, and for patiently answering his myriad of questions regarding the GCC's multifaceted functionality as the work progressed. It has been an honor and a truly humbling experience to write for such creative men, and about such fine and important instruments for telescopic control. He also wants to thank his wife, Marie, his partner in astronomy, and in every other aspect of life.

Daniel and René Görlich wish to acknowledge the numerous contributions from beta-testers, customers and friends who have encouraged them and have helped improve the GCC's functionality, usability, and design. Their special thanks are due as well to Clemens Braný for his artwork, and to Prince, the Astro-Tomcat, for contributing his warmth to their feet on a number of starry but chilly nights.

FOR MORE INFORMATION

The most current information about the Gemini Control Center, its predecessor, the Gemini Control Program, and about the Gemini System, as well as updates and user catalogs, may be found on the Internet at

<http://www.DocGoerlich.com/GCC/>
<http://www.DocGoerlich.com/Rene.html>

Information on, and trial versions of the Gemini Control Program for Windows CE based PDAs, e.g. Pocket PCs and Handheld PCs, may be found at

<http://www.DocGoerlich.com/Daniel/Eingang/EnterGemini.html>

There are several electronic forums that are appropriate for general discussions about Losmandy telescope mounts, the Gemini System, and the Gemini Control software:

http://Groups.Yahoo.com/group/Losmandy_Users/
http://Groups.Yahoo.com/group/Gemini_Users/

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1. STRUCTURE AND GENERAL BEHAVIOR

The Gemini Control Center features a unique graphical interface. Being independent of Windows' themes and settings to a great extent, this interface is fully configurable without interfering with other applications. Several GCC-style controls are provided to achieve this, ranging from simple edit boxes to whole screens.

1.1. GCC-STYLE CONTROLS

Most GCC-style controls have “screen” drag'n'drop capability that lets you move a screen to any position. So, even when you left-click on a text or image, if you keep the mouse button pressed while moving the mouse, the entire screen will move with it; you can then place the screen at the desired position by releasing the mouse button.

HINT

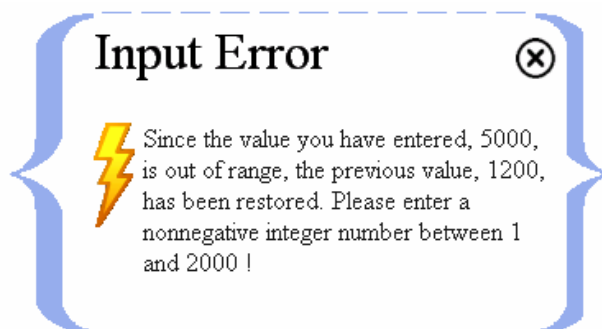
You cannot move a screen outside of the desktop; the screen will automatically dock to the desktop's border(s), so that it remains fully visible.

While most GCC-style controls have this capability, some of them must react on left-button mouse clicks. If you click into an edit box, for example, you don't expect the screen to move. Instead, the edit field becomes focused so you can either type in an entry at the cursor, or select all or part of an existing entry. Similarly, if you click an entry in a list and keep the mouse button pressed, the GCC will let you select a range of entries from the list rather than move the screen (provided, of course, that the list is one of those that allow the selection of multiple items).

Several GCC-style controls that are capable of input focus, share two features that I will call the “Object Transfer Feature” and the “Input Verification Feature.”

The Object Transfer Feature applies to edit boxes and lists that are mirrored on multiple screens. For example, RA and Dec coordinates can be entered on any one of several screens (e.g. for creating an entry in a Bookmark File or Custom Catalog, for manual slewing to a target coordinate, for precession calculation, etc.). The Object Transfer Feature will copy a coordinate entered into a coordinate box on one screen, to all concurrently open screens having a counterpart coordinate box. By this means, for example, you can select a Bookmark from a previously saved Bookmark File, and have it automatically copied to an already-open Observation Schedule Screen for inclusion in “tonight's” observation schedule.

The Input Verification Feature applies to edit boxes and all controls that represent certain settings of the Gemini System. The GCC automatically determines whether a value you enter, or a selection you make, is valid. For example, if you enter a Go-to Slewing Speed value of 5,000 (only values between 1 and 2,000 are allowed), the GCC will reject the entry, automatically restore the previous value, and show a warning like this one:



Similarly, the GCC always checks setting values that it sends to the Gemini System, in order to determine whether it was correctly adapted. After a few milliseconds, it asks the Gemini for the value of this setting, and compares it to the one just sent. If they are not the same, the GCC logs the failure

and displays Gemini's unchanged value (ignoring the one just sent), thus alerting the user that a problem has occurred.




Conversely, the GCC performs syntactical and semantic checks on values and information it retrieves from the Gemini System; it only accepts those whose formats are correct and "make sense." All incorrect responses and failures are saved to log files so that, in case of repeated erroneous communications or failures, you can (hopefully) find the problem by analyzing the three log files, "ErrorLog.log," "Traces.log," and "CommLog.log"; these are stored in the same directory as the GCC executable file, "Gemini.exe." All important GCC events and the complete record of communication between the GCC and the Gemini System are stored in these three log files.

Some features do not apply to a given type of control in all circumstances, but are only available in specific contexts. The grid control, being one of the GCC's more complex controls, is a good example. Single-column grids usually provide lists of applicable settings, files, database entries, etc. Multi-column grids (or tables) usually show properties of a number of items in a formatted or interpreted manner.

No.	Date	Time	Action	RA	Declination
16	Oct 17, 2003	11:39:20	Additional Align (Antares, 16:29:38	-26:45:04	
17		11:40:03	Goto (Antares, [SCD)	20:15:45	+90:00:00
18		11:40:35	Power Off	20:16:17	+90:00:00
19	Oct 18, 2003	18:01:07	Cold Start	14:42:16	+90:00:00
20		18:04:32	Goto (Altair, [AQL)	19:50:57	+08:52:41
21		18:06:20	Initial Alignment	19:50:57	+08:52:41

Setting	Value
Alarm Time	Alarm On
Alarm Time	20:30:40
Hand Controller	All Speeds
User Tracking Divisor	1000

In some lists, only one item can be selected; for example, only one Mount Type can be selected at a time. In other tables, however, you can select multiple items at once, as shown in the illustration on the right. You cannot, however, select non-contiguous items, but only a range of items. You can usually rearrange those items, however, using the move arrows described below. This would be useful, for example, in the case of the objects listed in a Custom Catalog.

The options available for a specific table are signaled by the icons embedded in the table's frame. To the right of the table are the up and down scroll buttons; the outer ones scroll the table to the first or last item respectively; the middle (double-arrow) buttons scroll up or down by ten items; the inner (single-arrow) buttons scroll up or down, one item at a time. At the bottom of the table, up to three buttons can be available. Those are the up  or down  "move" arrows and the delete mark . The "move" arrows move the currently selected item(s) up or down, thereby allowing you to rearrange the items in the table.

The functionality of the Delete button is, however, context-dependent. Of course, clicking the Delete button will delete the currently selected item(s) from the grid but, if the grid contains a list of files, clicking the Delete button will also delete the file(s) from the Windows folder where they are stored. Another example of context-dependence is that, if the last element of an Observation Diary is deleted, the Observation Diary Screen will close completely.

The exact ways that context-dependent functions work for specific grids are described in detail in each of their respective chapters of this manual.

1.2. SYNCHRONIZATION

The GCC always tries to keep itself synchronized with the Gemini System. When a connection between Gemini and the GCC is first established, the GCC immediately loads all of the Gemini's current settings and data. After that, the GCC continues to upload any changing data, such as the current pointing position.

You cannot change the GCC's settings while unconnected, thinking that you will establish the connection later. If you do, all the changes you made will be lost. However, you can preserve the new settings by saving them into a Session Profile (using the Configuration Screen) and then, after you have reconnected to Gemini, by loading and applying the saved Profile. All of the settings in the

saved Profile, including those you previously changed, will be downloaded to the Gemini, once more establishing a state of synchronization.

Also, any time you change a Gemini setting using the GCC, the GCC first sends the new setting down to the Gemini System, and then retrieves it, in order to verify that its value has been adjusted correctly. Furthermore, it retrieves data that might have changed in the process: For example, the GCC automatically reloads all Modeling Parameters after you have selected a new Mount Type.

The GCC does not know if and when you change a setting using the Hand Controller. The GCC is therefore designed so that you usually do not have to make use of the Hand Controller. If you do anyway, you may need to synchronize the GCC and the Gemini System manually using the Synchronization Screen.

1.3. WORKING IN TANDEM WITH OTHER CONTROL SOFTWARE

You may occasionally want to control the Gemini System simultaneously from both the GCC and from third-party software. To do this, a trick is needed. Since only one software application can access the active serial port at a time (the one used for communicating with the Gemini), the GCC has to free the port when you want the other software to take over; the same is true of the other software when you want the GCC to seize control again.

This is accomplished through a setting found on the Configuration Screen. Its use is described in detail in the chapter of this Manual entirely devoted to that screen.

2. THE GEMINI CONTROL CENTER

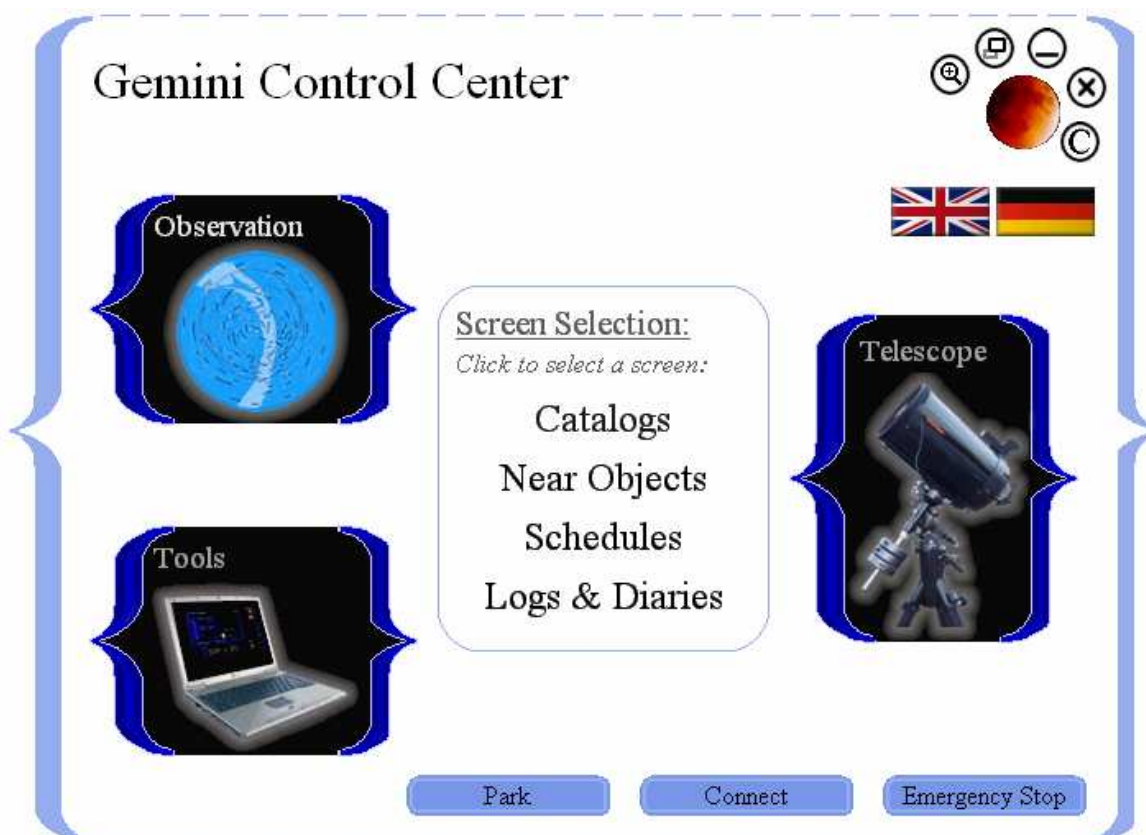
OVERVIEW

The Main Screen contains three kinds of structures – control buttons, menu icons, and function buttons. The control buttons are for reducing the screen’s resolution, making the screen’s wallpaper transparent, minimizing and closing the GCC, and displaying credits. A special button toggles between Day and Night Vision Mode, and the flag buttons allow you to select the language of each country whose flag is displayed. The three function buttons at the bottom of the screen can connect or disconnect the GCC from Gemini, park the telescope, and interrupt slewing movements in emergencies. Finally, hovering the mouse over any of the three large icons located near the center of the screen causes its respective menu to be displayed, and clicking on any menu item launches its respective screen.

The Real-time Status Screen is unique among the GCC screens in that it receives no inputs, and performs no functions other than to display important status data that the telescope operator may want to monitor continuously. It is complementary to the Main Screen in that together, they serve as the hub of operations for controlling the Gemini from a PC.

2.1. THE MAIN SCREEN

The Main Screen is launched whenever the GCC is opened. It is the screen from which all other GCC screens are launched, and the only screen from where the GCC can be closed. The Main Screen is truly the “switch round-house” of all Gemini Control Center operations.



2.1.1. THE CONTROL BUTTONS

In the top right corner of the Main Screen, you'll find several small round buttons encircling a larger moon button. The number of small buttons is either four or five, depending upon considerations described below. From left to right, they are:

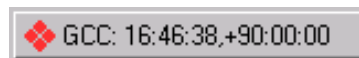
1. The Magnifier button. Clicking it toggles between the default screen resolution, and 1024 x 768. If 1024 x 768 is already the screen resolution when the GCC starts up, this button won't be visible at all.
2. Adjacent to the Magnifier button is the Transparency Mode button. Clicking it toggles the visibility of the GCC's background wallpaper. When the wallpaper is hidden, you can see Windows' desktop or other applications that have been hiding behind the GCC's screens.



HINT

Since the color themes apply to the GCC's screens only, other applications won't adapt them. In Night Vision Mode, you should therefore hide the Desktop and other applications, which might be much brighter than the GCC's screens.

3. The next button is the Minimize button. On other screens, clicking this button causes the screen to close, but it can be reopened it at any time; similarly, clicking this button on the Main Screen, minimizes the GCC and all its open screens to the taskbar, consolidating them all into an icon named "GCC." Clicking this icon restores the Main Screen and all the screens that were previously visible.



4. The Close button closes the GCC application, thereby breaking its connection to the Gemini System.

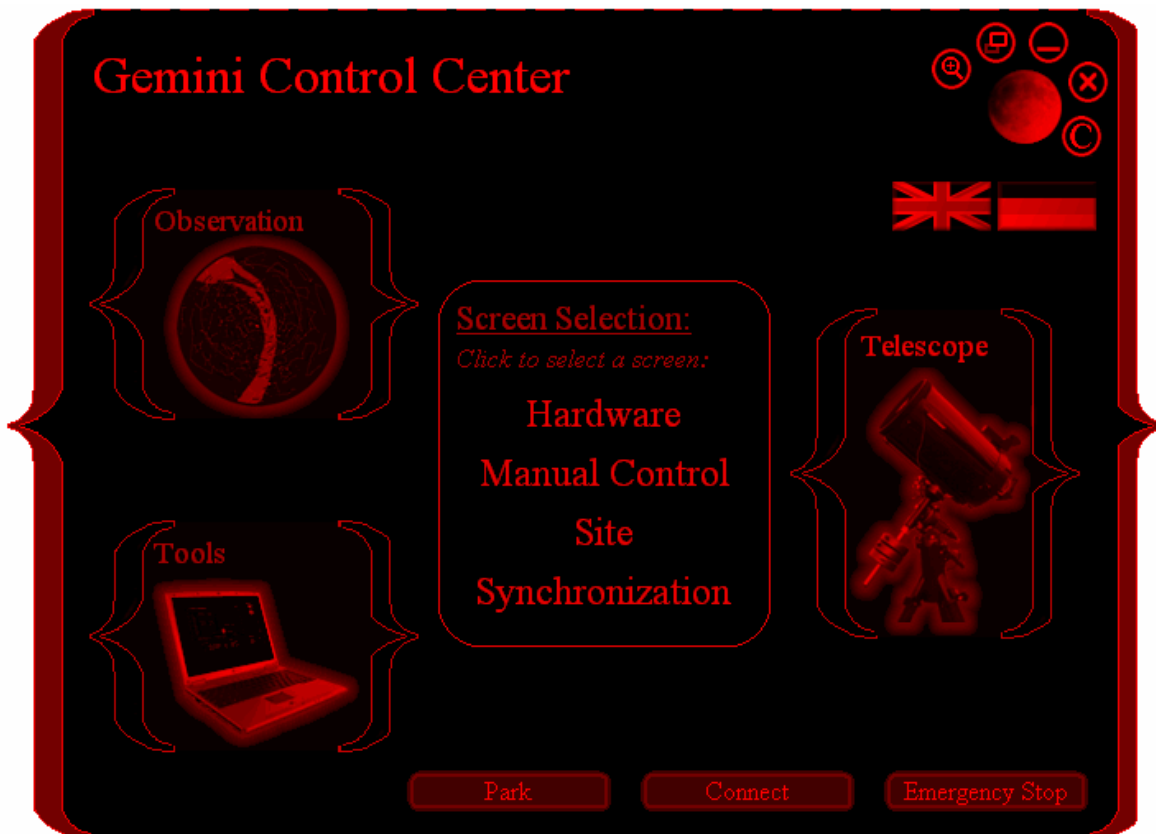
HINT

If you want to hide the Main Screen, type CTRL+M, or click the Transparency Mode button located on the Status Screen. In order to bring up the Main Screen again, repeat this operation.

5. The Copyright button opens the Gemini Credits Screen, which provides the e-mail address of the GCC's developer, and links to his website and to the support newsgroup.

By clicking the moon button, you can toggle between Daylight and Night Vision Mode. This is so even if you have previously loaded a Custom Color Theme.⁷

The following screenshot shows the GCC's Main Screen in Night Vision Mode:



Below the moon button are several countries' flags. By clicking on one of them, you apply the language of the country that owns the flag. If you click the British flag, for example, all the GCC's screens, messages, texts and so on, are presented in English; if you click the German flag, everything is presented in German.

2.1.2. THE MENU ICONS AND THEIR SCREENS



Screen Selection:

Click to select a screen:

Catalogs
Near Objects
Schedules
Logs & Diaries

There are three Menu Icons that surround a central box titled "Screen Selection." Allowing your mouse to hover over any of the icons causes the menu of that icon to be displayed in the box; each of the menus is a list of the screens that can be launched by merely clicking them.

Hovering the mouse over the Observation Menu Icon, displays the menu items:

⁷ For more information on how to create and load Custom Color Themes, refer to chapter 13: "The Themes Screen"

- Catalogs
- Near Objects
- Schedules
- Logs & Diaries

Hovering the mouse over the Telescope Menu Icon, displays the menu items:

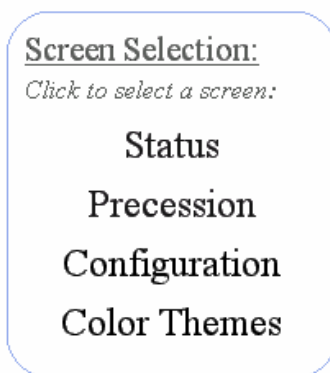
- Hardware
- Manual Control
- Telescope Site
- Synchronization



Hovering the mouse over the Tools Menu Icon, displays the menu items:

- Status
- Precession
- Configuration
- Color Themes

Information on the content of the screens and their use can be found in the sections of this Manual named after, and devoted to, each screen.



2.1.3. THE FUNCTION BUTTONS

There are three function buttons at the bottom of Main Menu Screen. The “Connect/Disconnect” button is a duplicate of the same button that is in the Manual Control Screen. Clicking the button while its label reads “Connect,” causes the GCC to search for an available serial port on the PC, thereby connecting the PC to the Gemini. Once connected, the button’s label changes to read “Disconnect”; clicking the button while it is in that condition, causes the PC and the Gemini to become unconnected once again. For a more detailed explanation of the Connect/Disconnect function, see “Connecting and Disconnecting” in The Manual Control Screen chapter of this Manual.

The “Park” and “Emergency Stop” buttons are also duplicates of buttons that are in the Manual Control Screen; they appear here as well for the user’s convenience. The “Park” button causes the telescope to return to its original start-up position, and the “Emergency Stop” button abruptly stops all slewing movement, even in the middle of a slew; an alternative way to stop all movement is to type Ctrl-S. For more information about these two functions, consult the Manual Control Screen section of this Manual.

2.2. THE REAL-TIME STATUS SCREEN

The Real-time Status Screen is launched whenever the GCC is opened because, together with the Main Screen, it is part of the GCC’s default configuration.

Gemini Real-Time Status					
Time Settings:		Position:		Gemini System Status:	
Gemini Local Time:	17:04:13	Right Ascension:	16h 46' 38"	Connection:	Online
Computer Civil Time:	21:30:30	Declination:	+90° 00' 00"	Motion:	Slewing
Computer UTC Time:	19:30:30	Initial Alignment:	Done	Brightness:	20 %
Sidereal Time:	13:48:19	Limit Reached:	No	Level:	3.10

The name of this screen accurately describes its purpose, which is to consolidate in one place, the most commonly needed real-time data that the user may want to continuously monitor, as he or she attends to the other tasks of astronomical observing.

2.2.1. TIME SETTINGS

When the GCC is not connected to the Gemini, only the PC's civil, UTC, and sidereal times are displayed. On most PCs, the clock is set by entering the local civil time and the time zone into Windows; the UTC and sidereal times are derived from them.

Upon connecting to the Gemini, all the other values in the Real-time Status Screen are immediately displayed. Completing the left-hand column of the screen is the "Gemini Local Time" display which ideally, should be identical to the PC's "Computer Civil Time." If it is not, Gemini's time can be synchronized to the PC, to the Internet, or to a GPS receiver via the Synchronization Screen, or to a GPS receiver via the Telescope Site Screen.

2.2.2. POSITION, ALIGNMENT, AND LIMIT REACHED INDICATOR

The center column of the Real-time Status Screen displays the telescope's position coordinates in right ascension (RA) and declination (Dec), Gemini's Initial Alignment status, and whether or not the telescope mount's previously-set RA limit has been reached.

Monitoring the telescope's position is both important and comforting because it assures the operator that something has not gone grossly wrong with Gemini's Go-to or tracking functions. The RA and Dec values displayed on the Status Screen do not change while the mount is tracking in sidereal mode because the telescope, although it is moving relative to the Earth, continues to point to the same place on the celestial sphere. The RA and Dec values do change, however, when the telescope is parked or set to terrestrial tracking. This is because, although the telescope is stationary relative to the Earth, the coordinates to which it points keep changing as the celestial sphere seems to pass overhead. The Status Screen is not the only place in the GCC that displays the telescope's RA and Dec position coordinates; the Manual Control Screen displays them as well.

Gemini Level 3 is initially aligned (at least approximately) the moment Gemini is powered on and started. The accuracy of this automatic initial alignment depends upon how accurately the mount is polar-aligned, and how accurately the telescope was placed in the standard start-up position prior to its being powered on. Gemini Levels 1 and 2 are not aligned when first powered on, and must be initially aligned manually. When a Level 1 or 2 Gemini is started and the GCC notices that no initial alignment has been performed, it launches an Initial Alignment Screen from where you can select and download a bright star for Gemini to align on.

HINT

An Initial Alignment Screen can be manually closed by the user, but can only be opened by the GCC automatically.

The Initial Alignment status indicator reminds the user whether or not the telescope has been initially aligned.

The Limit Reached indicator signals the user when the telescope has stopped moving in RA because a previously-set limit has been reached. RA limits protect the telescope and the mount from colliding with each other during tracking and slewing movements.

2.2.3. GEMINI SYSTEM STATUS

The right column of the Status Screen contains four important items related to Gemini's system status. "Connection" displays the status of Gemini's connection to the GCC. "Offline" is displayed if they are not connected to each other, "Online" if they are connected, and "Scanning" while the GCC is scanning the PC's serial ports for a Gemini device. Connecting and disconnecting are initiated either from the Main Screen or the Manual Control Screen.

The next item in the right column displays the telescope's current "Motion." If it is being guided, centered or slewed (manually or via Go-to), it displays "Centering," "Guiding," or "Slewing" respectively. If the telescope is moving at a tracking rate, it displays "tracking"; if it is parked or Gemini's tracking rate is set to "None/Terrestrial," it displays "Motionless." This same movement information is mirrored in the Manual Control Screen's "Status" display.

The last two items in the right column of the Status Screen are "Brightness," which is a display of the relative brightness of the Hand Controller's L.E.D., and "Level", which is the level of Gemini's upgrade. The Hand Controller display's brightness is set from the Manual Control Screen, and it can be monitored from there as well.

2.2.4. HIDING THE MAIN SCREEN

At the upper-right of the Real-time Status Screen, is a button that is similar in appearance to the Transparency Mode Button residing on the Main Screen. The two buttons' function are differently, however, for while the transparency button in the Main Screen alternately hides and displays the GCC's wallpaper, the button in this screen alternately hides and displays the Main Screen itself. This feature is useful for reducing clutter when several GCC screens are open at the same time.

HINT

Another way to hide the Main Screen to hide is to type CTRL-M.

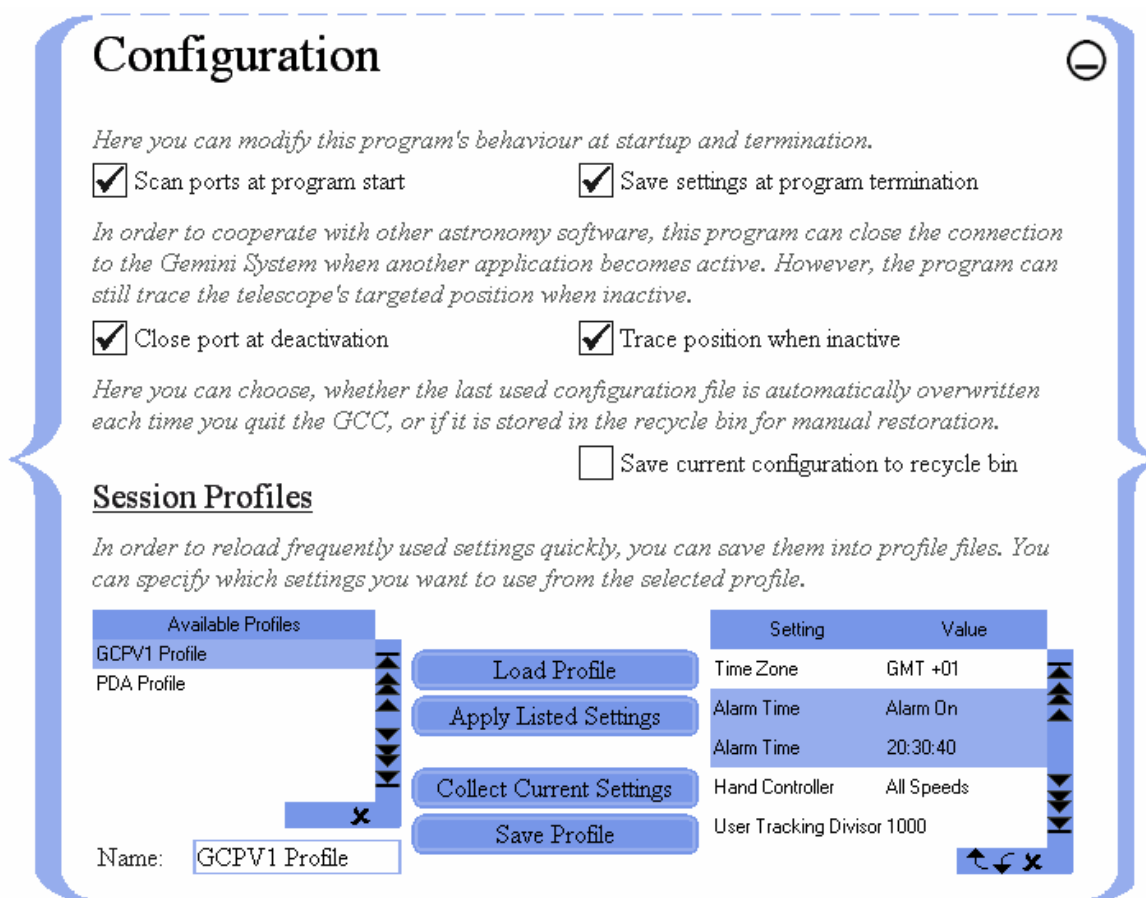
3. THE CONFIGURATION SCREEN

OVERVIEW

The Configuration Screen is launched from the Tools menu on GCC's Main Screen by clicking "Configuration."

This screen performs two basic functions; it (1) provides a place for setting GCC's connection parameters, and (2) it allows you to construct, save, retrieve, edit, and delete, Session Profiles.

Session Profiles are templates of all parameters to which the Gemini can be set. The GCC's ability to define, store and retrieve profiles is an immense timesaver because it enables the observer to preplan Gemini's settings for different kinds of observations, made at different geographic locations.



3.1. CONNECTION PARAMETERS

There are five connection parameters that can be set from this screen by placing checks in appropriate checkboxes.

When checked, "Scan ports at program start" causes the GCC to search the PC for an available serial port through which to connect with the Gemini. COM1 through COM8 are scanned, and the GCC connects to the first port that is not occupied, and on which a Gemini System is found. Leaving the box unchecked disables the GCC's automatic port scan at startup.

When checked, "Save settings at program termination" saves all GCC settings to a configuration file so that, when the program is restarted, the parameters previously defined do not have to be

reentered.⁸ This is time-saving when multiple observation sessions use the same or nearly the same parameters. Also, when the GCC is started up the next time, all those saved settings are restored so that, for example, all the screens that were previously visible automatically open at the same position as before.

Leaving the box unchecked results in a loss of currently saved settings because no new configuration file is created. Consequently, on starting up again, the settings revert to those previously saved or to the default configuration (i.e. as long as the box is unchecked, the GCC keeps starting up in the same configuration).

HINT

The created or updated configuration is stored in GCC's Databases subdirectory in a file named "GCC_Config.ini." Using Windows tools, you can save or back up this file with a different name at any time, and you can overwrite the current configuration file with a previously saved one in order to restore a desired configuration. Finally, you can reset the complete configuration by deleting the "GCC_Config.ini" file; this makes the GCC load the built-in default configuration the next time it starts.

When checked, "Close port at deactivation" makes the PC's port that was previously used by the GCC, available for other purposes.⁹ This allows several applications to control the Gemini almost synchronously (e.g. a planetarium program) because it forces the GCC to disconnect from Gemini as soon as you switch control to the other application. This is especially useful when the GCC and a planetarium program are both made visible by invoking the "transparency mode" from the Main Screen. It is also useful when you want to control the Gemini and one or more other serial devices from a PC that has a limited number of COM ports. To do this, you simply activate one control application at a time.

When checked, "Trace position when inactive" causes the GCC to update its knowledge of the telescope's position each time it reconnects to the Gemini. In this condition, Gemini's pointing position continues to be traced even when another application is focused (provided the other application is not itself connected to Gemini and taking up the port). Even when inactive, the GCC tries to connect to the Gemini every second for a few milliseconds; if it cannot, the telescope's position is not updated.

HINT

This feature should not be activated if it prevents other applications from connecting to the Gemini while Gemini is updating its data.

When "Save current configuration to recycle bin" is checked, the GCC's configuration file (GCC_Config.ini) is stored in Windows' recycle bin each time the GCC terminates. This setting is useful when you do not want to overwrite the previous configuration, but store it for later retrieval.

HINT

To restore a previous configuration, retrieve the configuration file from the recycle bin and paste it into GCC's Databases folder in place of the same-named file already there. Also, GCC_Config.ini can be deleted from the Databases folder entirely, thereby restoring all initial settings.

3.2. SESSION PROFILES

As previously explained, Session Profiles are templates of all parameters to which the Gemini can be set. Since there are differences in the various levels of Gemini as to which parameters can be set, the composition of the Session Profiles is also level-dependent.

⁸ When the GCC is started for the first time, it launches in the Daylight Vision Mode with only the Main and Real-time Status Screens displayed. This is the default configuration that results when no configuration file is found.

⁹ The GCC is deactivated by either minimizing it (i.e. clicking the (-) button located on the upper right side of the Main Screen) or by focusing another application that is running simultaneously.

3.2.1. CREATING PROFILES

To create a profile, enter the settings (parameters) you desire in the appropriate GCC screens. If you want your profile to include modeling parameters, also perform the requisite alignments and synchronizations described in the Gemini Users Manual. Now click “Collect Current Settings” and all of the parameter settings appropriate to your level of Gemini will appear in the list at the lower right of the Configuration Screen.

You can now save all of the collected parameters as a profile or you can delete some of them before saving. To select a single parameter for deletion, click on it in the list. To select a range of parameters for deletion, click on the first in the range, and shift-click on the last. The selected parameter or parameters can now be deleted by clicking the delete mark ✕.

3.2.2. SAVING AND DELETING PROFILES

When the parameter list is as you want it, enter a name for the profile in the “Name” box and click “Save Profile.” The saved Session Profile will appear in the list of “Available Profiles.”

To select a single profile for deletion, click on it in the list. To select a range of profiles for deletion, click on the first in the range, and shift-click on the last. The selected profile or profiles can now be deleted by clicking the delete mark ✕.

3.2.3. RETRIEVING AND APPLYING SAVED PROFILES

To retrieve a previously saved profile, select it from the list of “Available Profiles” and click “Load Profile.” The settings (parameters) of the profile and their respective values will appear in the list at the lower right corner of the screen.

If desired, one or a range of the retrieved parameters can now be deleted from the loaded profile. To select a single parameter for deletion, click on it in the list. To select a range of parameters for deletion, click on the first in the range, and shift-click on the last. The selected parameter or parameters can now be deleted by clicking the delete mark ✕.

Once you are satisfied with the retrieved profile’s settings, you can copy them to the appropriate screens of the GCC by clicking “Apply Listed Settings.” If a Gemini is connected at this time, the changes will immediately be downloaded to it as well. If a Gemini is not connected at this time but is connected later, the Synchronization Screen can be used to “Download to Gemini” in a subsequent step.

4. THE CATALOGS SCREEN

OVERVIEW

The Catalogs Screen is launched from the Observation menu on GCC's Main Screen by clicking "Catalogs."

This is one of the most useful screens of the GCC because it is the main repository of "Standard" deep sky objects, a source screen from which their coordinates (and user-input coordinates) can be transferred to other screens and a location from where current coordinates can be bookmarked and user-input coordinates stored. In addition, it is a screen from which one can slew to any stored celestial object by first selecting it, and then clicking the "Go-to" button that is located at the bottom of the screen.¹⁰

Also at the bottom of the Catalogs Screen are "Additional Align" and "Synchronize" buttons. They are placed there to assist the user in synchronizing targeted objects to the telescope's position, and for adding objects to Gemini's pointing model if desired. The Gemini Astronomical Positioning System Users Manual should be consulted for instructions on how to perform these functions.¹¹

The Catalogs Screen contains three panels that are accessed by clicking their respective tabs; they are the

- Standard Catalogs Panel
- Custom Catalogs Panel
- Bookmarks Panel

4.1. TRANSFERRING OBJECTS BETWEEN PANELS AND SCREENS

The panels of the Catalogs Screen are among those that are "object-transferable." Object-transferable panels and screens are capable of automatically transferring and/or receiving named objects and their coordinates to and from other panels and previously-opened screens. While the Custom Catalogs and Bookmarks Panels are fully object-transferable, the Standard Catalogs Panel can only transfer out; it cannot receive.

The transferring of an object occurs automatically whenever it is selected from an Object List or typed into an Object Coordinate Box. So, for example, selecting Dubhe from the Bright Star Catalog transfers Dubhe a UMa; 11h 03' 43"; +61° 45' 03" to the Object Coordinate Boxes of the other two panels, as well as to any other object-transferable screens that are open.

4.2. THE STANDARD CATALOGS PANEL

The Standard Catalogs Panel is the default panel that appears when the Catalogs Screen is first launched. It contains a list of approximately 40,000 deep space objects and their respective J2000.0 coordinates¹² stored in ten standard catalogs. These are the same standard deep space catalogs and objects resident in the Gemini.¹³

- Bright Star List
- Galactic and Planetary Nebulae
- Indexed Catalog

¹⁰ An error message appears if one attempts to slew to an object that is not visible to the telescope.

¹¹ The Gemini Astronomical Positioning System Users Manual can be downloaded from <http://www.DocGoerlich.com>.

¹² J2000.0 is the epoch to which the most recent star catalogs are standardized.

¹³ Although the Level 2 Gemini has fewer stored objects, the GCC, when used with Level 2, still has knowledge of all 40,000.

- Lynd's Bright Nebulae
- Lynd's Dark Nebulae
- Messier Catalog
- New General Catalog
- SAO Catalog
- Sharpless Catalog of HII regions
- Washington Double Star Catalog

Catalogs

Standard Catalogs Custom Catalogs Bookmarks

<input checked="" type="checkbox"/>	Bright Star List	168
<input checked="" type="checkbox"/>	Galactic & Planetary Nebulae	1143
<input checked="" type="checkbox"/>	Indexed Catalog	5437
<input checked="" type="checkbox"/>	Lynd's Bright Nebulae	1125
<input checked="" type="checkbox"/>	Lynd's Dark Nebulae	1787
<input checked="" type="checkbox"/>	Messier Catalog	110
<input checked="" type="checkbox"/>	New General Catalog	8290
<input checked="" type="checkbox"/>	SAO Catalog	17636
<input checked="" type="checkbox"/>	Sharpless Catalog of HII regions	313
<input checked="" type="checkbox"/>	Washington Double Star Catalog	3988

39997

Object	RA	Declination	Catalog
NGC318	00h 58' 05"	+30° 25' 32"	NGC
NGC319	00h 56' 57"	-43° 50' 21"	NGC
NGC320	00h 58' 46"	-20° 50' 27"	NGC
NGC321	00h 57' 39"	-05° 05' 11"	NGC
NGC322	00h 57' 09"	-43° 43' 39"	NGC
NGC323	00h 56' 41"	-52° 58' 35"	NGC

You cannot edit objects in the standard catalogs, but only in your own custom catalogs.

Go-to ... Additional Align Synchronize

To the left of each Standard Catalog is a check box. If the box is checked, its corresponding catalog is loaded, and all of its objects are displayed in the Object List below it. If the number of displayed objects from all the catalogs combined is inconveniently large, you can uncheck one or more of the catalogs, thereby causing them to unload.

HINT

Standard Catalog files are saved in the "Databases" folder with ".guc" extensions. Standard Catalogs can be added and deleted there, and can be overwritten by updated catalog files.

4.2.1. RETRIEVING AND SLEWING TO STANDARD CATALOG OBJECTS

As stated previously, to display the objects contained in a Standard Catalog, you enter a check in the adjacent checkbox; the contents of each checked catalog is then immediately visible in the Object List below. To slew to a cataloged item, simply select it from the Object List and click "Go-to."

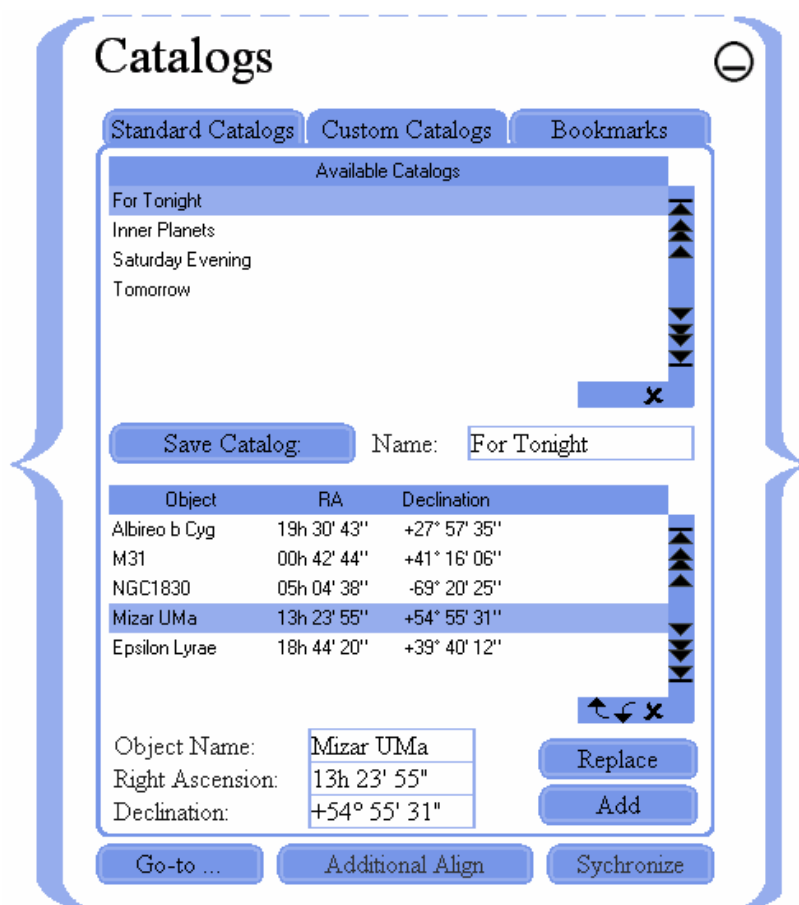
Since the objects contained in Standard Catalogs cannot be deleted, if only certain of the objects are needed for a night's observation, you may transfer them, along with their respective coordinates, to a Custom Catalog established for that purpose (see the procedure for transfer described in the section of this chapter entitled "Transferring Objects between Panels and Screens").

4.3. THE CUSTOM CATALOGS PANEL

This panel is analogous to the User Defined Database of the Gemini except for two differences: (1) here, there may be any number of Custom Catalogs stored for future use (Gemini has only one User Defined Database), and (2) here, all objects¹⁴ in a Custom Catalog must be stored with epoch J2000.0 or J2000.0-converted coordinates (Gemini's User Defined Database can store current coordinates as well, when Gemini's Epoch is set to "Equinox of the Date"). Unlike Standard Catalogs that cannot be edited, Custom Catalogs that you create can be edited and deleted at will.

HINT

As with the Standard Catalog files, Custom Catalog files are also saved in the "Databases" folder with ".guc" extensions.



The lower half of the Custom Catalogs Panel contains its Object List,¹⁵ and just below that is its Object Coordinate Box. The upper half of the Custom Catalogs Panel is its Catalog List containing the catalogs you have created.¹⁶ Just below the Catalog List are a Catalog Name Box and a "Save Catalog" button. The functions of these are clear – to save as a named Custom Catalog, the items appearing in the Object List below.

¹⁴ The term "J2000.0-converted" refers to objects that would not normally be cataloged with J2000.0 coordinates (e.g. planets), but whose coordinates have been mathematically converted to J2000.0 to be consistent with the other objects stored in Custom Catalogs. Unless this is done, Gemini will not slew to those objects accurately.

¹⁵ If you have not yet entered objects and their coordinates, then this space remains blank.

¹⁶ If none have yet been created, then this space remains blank.

HINT

Changes to the content of a Custom Catalog are not automatically saved when loading another Custom Catalog or when quitting the GCC. To save these changes you must click “Save Catalog.”

4.3.1. RETRIEVING AND SLEWING TO CUSTOM CATALOGED ITEMS

Custom Catalogs that have previously been saved, automatically appear in the Custom Catalog List when the Custom Catalogs Panel is open. To display the items contained in a Custom Catalog, select it; its contents will then immediately be visible in the Object List.

To slew to a cataloged item, simply select it from the Object List and click “Go-to.”

4.3.2. STORING NEAR OBJECTS IN A CUSTOM CATALOG

On occasion, an observer may want to include a near (e.g. solar system) object in a custom catalog for the purpose of observing it at a future date and time. This can best be accomplished as follows: (1) Open the Catalogs Screen and display the Custom Catalogs Panel; (2) Open the Near Objects Screen; (3) Select the near object of interest; (4) enter the expected date and time of observation in the Base Date Box and the Base Time Box; (5) Click “Copy Coordinates,”¹⁷ (6) Note that the object of interest with its J2000-converted coordinates has been accurately transferred to the Object Coordinate Box of the Custom Catalogs Panel; (7) Click “Add.”

The selected near object will appear in the Object List as a J2000-converted entry. After you are finished adding other desired objects, save the list as a Custom Catalog by naming it and clicking on “Save Catalog.”

A more lengthy method for storing near objects in a Custom Catalog involves the use of a planetarium program in combination with the GCC's Precession Calculator Screen. The planetarium program can predict the actual positions of objects at designated dates and times, and the Precession Calculator Screen can convert them to J2000.0. The near object with its converted coordinates can then be added to the Object List of the Custom Catalog Screen, and saved into a Custom Catalog.

4.4. THE BOOKMARKS PANEL

The Bookmarks Panel is unique in that it can record and store the coordinates of objects currently being observed. Bookmarks are therefore only valid for a limited period of time – until the object coordinates contained in them no longer reflect the true position of the object. Bookmarks created in the GCC are independent of those on the Gemini. They are not downloadable to the Gemini, nor are those created in the Gemini uploadable to the GCC. While the Gemini can retain only ten Bookmarks at a time, the number retainable in the Bookmarks Panel of the GCC is, for all practical purposes, unlimited. An additional virtue of the GCC Bookmarks Panel is that one can name and group Bookmarks, and store them as named Bookmark Files.

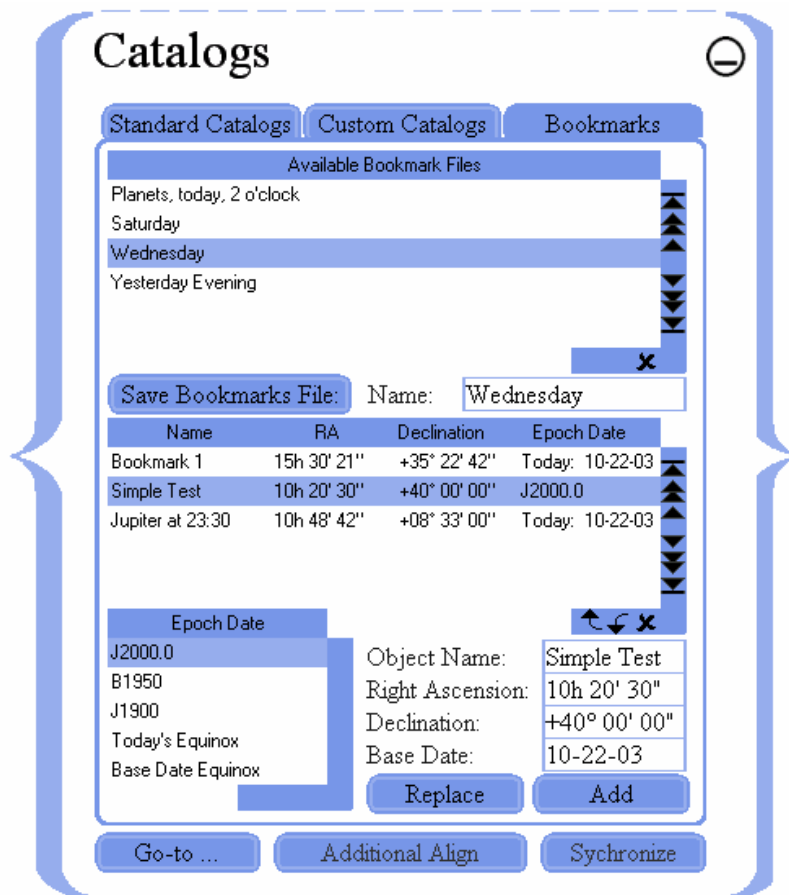
The lower half of the Bookmarks Panel contains a Bookmark/Object List,¹⁸ and just below that is an Object Coordinate Box. This box is alternatively used to display a selected Bookmark/object (when the Panel is in Edit Mode), or the telescope's current RA and Dec position (when the Panel is in Position Display Mode).¹⁹ Below the Object Coordinate Box is another box labeled “Base Date.”

¹⁷ It is unnecessary to click “Copy Coordinates” if the object is selected after the Base Date and Base Time are entered.

¹⁸ If you have not yet entered objects and their coordinates, then this space remains blank.

¹⁹ When the Bookmarks Panel is in Edit Mode, the Object Coordinate Box receives and transfers coordinate data from/to the other panels and open transferable screens; in this mode data can also be typed directly into the Object Coordinate Box. In contrast, when the Panel is in Position Display Mode, the coordinate fields of the Object Coordinate Box tracks and displays the current position of the telescope. <F2> toggles between Edit Mode and Position Display Mode.

This box is for inputting the observation date of any object to be bookmarked or otherwise stored. Although the date in this box defaults to the current date (mainly for bookmarks), it can be overwritten for occasions where you may want to store predicted coordinates for a future observing session.



The upper half of the Bookmarks Panel is a list containing the Bookmark Files you have created.²⁰ Below this are a Bookmark File Name Box and a “Save Catalog” button that function together to save as a named Bookmark File, the items in the Bookmark/Object List below.

HINT

Changes to the content of a Bookmark File are not automatically saved when loading another Bookmark File or when quitting the GCC. To save these changes you must click “Save Bookmark File.”

A Bookmark operation consists of slewing to either an object or a position in space, and then recording its current coordinates for short-term retrieval; consequently, true Bookmarks are always recorded according to the current date (Today).

Bookmark Files are more versatile than Custom Catalogs because they can contain and slew to both Bookmarks and non-Bookmark Objects, cataloged in any epoch. The Epoch Date Table positioned to the left of the Object Coordinate Box permits you to select any one of the following epoch dates for each object:²¹

- J2000.0
- B1950
- J1900

²⁰ If none have yet been created, then this space remains blank.

²¹ A discussion of epoch dates as applies to astronomical catalogs is beyond the scope of this manual; for an explanation of this subject, consult a basic astronomy textbook.

- Today
- Base Date Equinox

HINT

Epoch dates set in the Bookmarks Panel are independent of the Epoch Date setting in the Manual Control Screen.

4.4.1. CREATING BOOKMARKS

The first step in creating a Bookmark is to slew the telescope to the object or position to be bookmarked. Notice that the RA and Dec coordinates of the telescope's targeted position appears as gray text in the Object Coordinate Box. This is because the telescope's motion has placed the Bookmarks Panel in its Position Display Mode. Next, set the Epoch Date to "Today," and enter a name for the proposed Bookmark in the Object Name Box (If the slew was to a previously saved object, the object's name will already be there). Now click "Add," and the Bookmark will appear in the Bookmark/Object List, displaying its name, current coordinates, and its epoch date "Today." By repeating this procedure, you can create multiple Bookmarks that can be saved in a single Bookmark File.

HINT

When in Position Display Mode, the Object Coordinate Boxes are grayed out and cannot be edited, as can be seen on the following screenshot. If you want to switch to Edit Mode, press <F2> !

The screenshot shows a software interface with two main panels. On the left is the 'Epoch Date' panel, which is a list box containing the following options: J2000.0, B1950, J1900, Today's Equinox (highlighted in blue), and Base Date Equinox. On the right is the 'Object Coordinate Box', which contains the following fields: 'Object Name:' with the text 'Current Pos.'; 'Right Ascension:' with the value '16h 49' 04"'; 'Declination:' with the value '+90° 00' 00"'; and 'Base Date:' with the value '10-22-03'. Below these fields are two buttons: 'Replace' and 'Add'.

4.4.2. ENTERING NON-BOOKMARK OBJECTS

As previously stated, Bookmark Files can contain, and be used to slew to, both Bookmarks and non-Bookmark Objects cataloged in any epoch. For example, a single Bookmark File can contain a nebula book marked today, a star precessed to the equinox of next Thursday, a planet precessed to 3:00 A.M. next Friday, another star whose coordinates were listed in a 1970 publication (Epoch B1950), and still another star whose coordinates came from a recently published catalog (Epoch J2000.0). The GCC corrects for each of these situations, as necessary for accurate pointing.

The coordinates of a non-Bookmark Object are entered in the Object Coordinate Box either manually or by direct transfer from one of the "object-transferable" panels or screens. When entering coordinates manually, the Bookmarks Panel must be in its Edit Mode (the RA and Dec entry boxes not grayed). If it is not already in Edit Mode, pressing <F2> on your computer will place it there. After entering the requisite coordinates, click "Add," and the non-Bookmark Object will appear in the Bookmark/Object List along with all Bookmarks and other objects previously entered.

4.4.3. RETRIEVING AND SLEWING TO BOOKMARKS AND NON-BOOKMARK OBJECTS

Bookmark Files that have been previously saved automatically appear in the Bookmark File List whenever the Bookmarks Panel is open. To display the Bookmarks and other objects contained in a Bookmark File, select it; its contents will immediately be visible in the Bookmark/Object List.

To slew to a Bookmark or non-Bookmark Object, simply select the item from the Bookmark/Object List and click “Go-to.” The Bookmarks Screen immediately goes into its Position Display Mode, and the Object Coordinate Box displays the telescope's changing position as the telescope moves and comes to rest.

4.4.4. STORING NEAR OBJECTS IN A BOOKMARK FILE

On occasion, an observer may want to include a near (e.g. solar system) object in a Bookmark File for the purpose of observing it at a future date and time. This can best be accomplished as follows: (1) Open the Catalogs Screen and display the Bookmarks Panel; (2) Open the Near Objects Screen; (3) Select the near object of interest; (4) enter the expected date and time of observation in the Base Date Box and the Base Time Box; (5) Click “Copy Coordinates”; (6) Note that the object of interest with its J2000-converted coordinates has been accurately transferred to the Object Coordinate Box of the Bookmarks Panel (the Base Date does not transfer); (7) Name the Bookmark of the selected object; (8) Select Epoch Date J2000.0; (9) Click “Add.” The selected near object will appear in the Bookmark/Object List along with its J2000.0-converted coordinates. After you are finished adding other objects, save the list as a Bookmark File by naming it and clicking on “Save Bookmark File.”

5. THE NEAR OBJECTS SCREEN

OVERVIEW

The Near Objects Screen is launched from the Observation menu on GCC's Main Screen by clicking "Near Objects."

Near objects are those celestial objects that reside within our solar system; they include the sun, the nine planets and their moons, asteroids, etc. Because these objects are comparatively close to earth, their positions relative to the celestial sphere change more rapidly over short periods of time than those of deep space objects such as stars. For that reason, their RA and Dec positions are not included in standard catalogs but, where possible, are mathematically calculated for particular dates and times. The tabulated loci of these computed positions are known as ephemerides (singular: "ephemeris").

The Near Objects Screen provides a convenient way to locate and slew to the most common of the solar system objects – the sun, eight planets,²² and Earth's moon. Each of their coordinates can be computed to any date and time (hereinafter called "Base Date" and "Base Time") expressed in either local or UTC time.

	Right Ascension	Declination
Sun	13h 17' 07"	-08° 08' 48"
Mercury	12h 51' 00"	-03° 41' 33"
Venus	14h 15' 35"	-13° 03' 41"
Earth		
Moon	04h 21' 33"	+22° 51' 21"
Mars	22h 21' 24"	-14° 00' 46"
Jupiter	10h 47' 34"	+08° 39' 41"
Saturn	06h 56' 42"	+22° 03' 42"
Uranus	22h 06' 12"	-12° 30' 01"
Neptune	20h 51' 30"	-17° 38' 22"
Pluto	17h 10' 19"	-14° 03' 22"

Base Date: 10-14-03
Base Time: 15:31:54
 Entered as UTC time
Phase of the moon on Oct 14, 2003, 15:31: 83,9%

Current Date & Time Copy Coordinates Go-to ...

5.1. SETTING THE BASE DATE AND TIME

The Near Objects Screen contains a "Base Date" box, a "Base Time" box, and an "Entered as UTC time" checkbox. When the UTC checkbox is checked, the Base Date and Base Time must be entered in UTC. When unchecked, the Base Date and Base Time must be entered in local time. The importance of entering a correct Base Date and Time is that the coordinates of near objects change radically with time.

Any date and time (expressed in either local or UTC time) may be entered in the Base Date and Time boxes by merely typing them in (making sure that the UTC checkbox is checked or unchecked appropriately). This enables the observer to determine the expected position of any listed near object at a given date and time for future observations. The most common need, however, is to determine the position of an object at the very time of an observation. This can conveniently be accomplished by

²² Although Earth is listed among the near objects, its inclusion serves no function other than to complete the planet list.

clicking the button labeled “Current Date & Time.” When this is done, the current local date and time (according to the computer’s settings) appear in the Base Date and Base Time boxes, and the UTC checkbox is automatically unchecked.

5.2. DETERMINING AN OBJECT’S POSITION

Each listed object appears alongside a display of its RA and Dec coordinates. These coordinates are computed for whatever date and time appears in the Base Date and Base Time boxes.

When the Near Objects Screen is first opened, the displayed Base Date and Base Time conform to the PC’s current date and time. If you desire to know an object’s coordinate position at a date and time other than the current one, you can enter that date and time in the Base Date and Base Time boxes, thereby causing all listed ephemerides to instantly update. Once displayed, ephemerides do not update automatically, so you must click the “Current Date & Time” button each time an update is desired.

5.3. SLEWING TO A NEAR OBJECT

To slew to an object listed in the Near Objects Screen, select it from the object list, click the “Current Date & Time” button, and then click “Go-to.” The telescope will slew to the object’s current position provided the correct date and time have been entered.

5.4. COPYING COORDINATES TO OTHER SCREENS

To copy a near object's coordinates to one or more object-transferable screens of the GCC (those that contain Object Coordinate boxes), first open the screen or screens you wish to copy to and then select the near object in the Near Object Screen that you wish to transfer. The transfer will be instantaneous.

Alternatively, if the near object you wish to transfer is already selected but the screen or screens you wish to copy to are not yet open, you can open them and click “Copy Coordinates,” or select the near object a second time.

5.5. MOON PHASE DISPLAY

For convenience, this screen displays the phase of the moon both pictorially and numerically. To determine the phase of the moon on a given date, just enter the desired date in the Base Date box.

5.6. STORING NEAR OBJECTS IN CUSTOM CATALOGS, BOOKMARK FILES AND OBSERVATION SCHEDULES

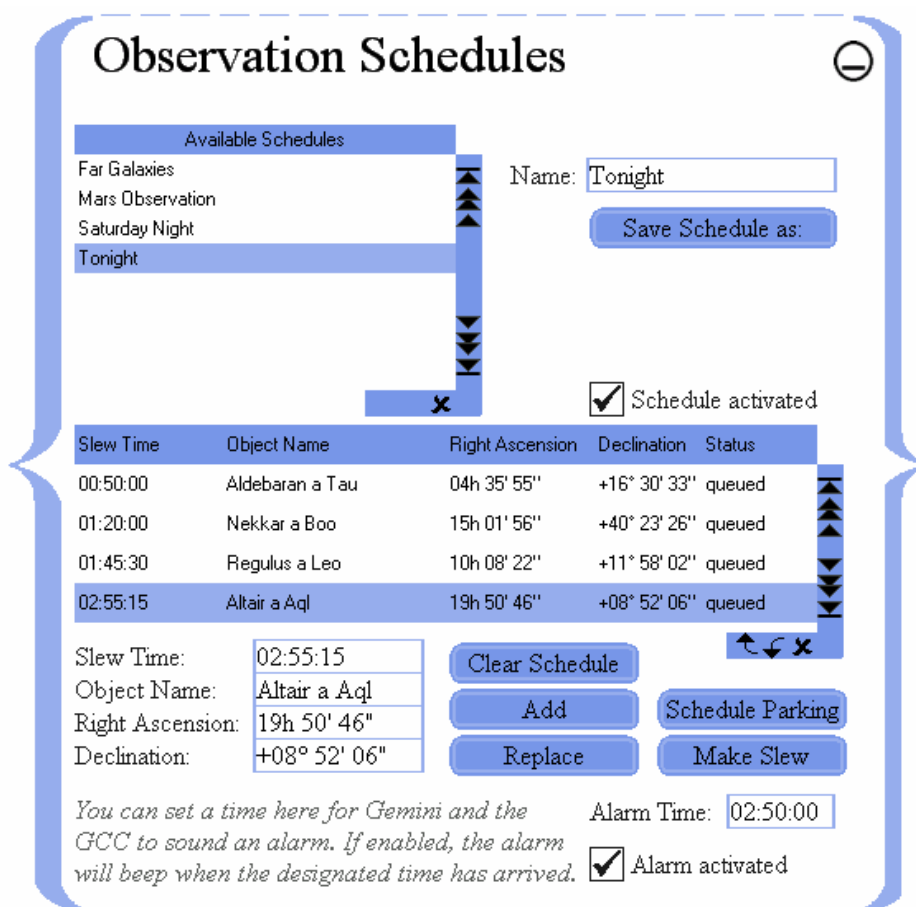
As already stated, near objects are not usually included in standard catalogs because of the date and time dependence of their coordinates. There are, however, times when it is useful to create temporary Custom Catalogs, Bookmark files or Observation Schedules that include one or more near objects. Such would be the case when planning for a particular evening’s observation at a predetermined time. For details on how to accomplish this, refer to the chapters of this manual entitled “The Catalogs Screen” and “The Observation Schedules Screen.”

6. THE OBSERVATION SCHEDULES SCREEN

OVERVIEW

The Observation Schedules Screen is launched from the Observation menu on GCC's Main Screen by clicking "Schedules."

The primary function of this screen is to allow the user to schedule a succession of automatic slews to designated celestial objects at specifically set times. This function, sometimes called "scripting," is particularly useful for imaging a succession of objects over the course of an evening when a telescope control operator is not in constant attendance. For convenience, a manual slew override and an audible time alarm are provided, and multiple schedules can be named, saved, and deleted.



6.1. CONSTRUCTING AN OBSERVATION SCHEDULE

An Observation Schedule consists of one or more Observation Events. An Observation Event, in turn, consists of a named object, its RA and DEC coordinates, the time that the telescope is programmed to slew to that object, and the status of the event. An object and its J2000.0 coordinates may either be typed directly into the boxes provided, or copied from other object-transferable screens. This is done by selecting the object in the other screen while the Observation Schedules Screen is open. The local time that the slew is to occur is then typed into the box labeled "Slew Time." Finally, the "Add" button is clicked, causing the Observation Event to be listed as a line in the Observation Schedule, and its status to be marked "queued." This procedure is repeated for each Observation Event listed in the Schedule.

Since scheduled or scripted slews typically occur when there is no control operator present, the last event entered in a schedule should park the telescope.²³ This is accomplished by entering the Slew Time for when parking should occur, and clicking “Schedule Parking.”

HINT

The Observation Schedule responds to the local time of the PC. Ideally, the PC’s and Gemini’s times are perfectly synchronized. This can be achieved using a GPS receiver or via SNTP on the Internet; for details, please see the chapter entitled “The Synchronization Screen.”

6.2. SAVING AN OBSERVATION SCHEDULE

An Observation Schedule does not have to be saved in order to be used. Nevertheless, advanced planning of automated slews is facilitated by being able to save one or more Schedules under separate names.

To save a list of Observation Events as an Observation Schedule, enter a name for the Schedule in the box labeled “Name” and click “Save Schedule as:” The named Schedule will be saved and appear in the list of Available Schedules.

6.3. EDITING AND DELETING OBSERVATION SCHEDULES

To edit a previously saved Observation Schedule, first select it from the list of Available Schedules. Any Observation Event within the selected Schedule can now be replaced by (1) entering a substitute object (name and coordinates) and Slew Time in their respective boxes, and (2) clicking “Replace.”

In addition to being replaced, Observation Events can be erased either singly or in groups. To select a single Event for deletion, click on it in the list. To select a range of Events for deletion, click on the first, and shift-click on the last. The selected Event(s) can now be deleted by clicking the delete mark ✕. Alternatively, all the Observation Events can be deleted at once by clicking the button labeled “Clear Schedule.”

Observation Schedules can be deleted either singly or in groups as well. To select a single Schedule for deletion, click on it in the list of Available Schedules. To select a range of Schedules for deletion, click on the first, and shift-click on the last. The selected Schedule(s) can now be deleted by clicking the delete mark ✕.

6.4. ACTIVATING AND DEACTIVATING AN OBSERVATION SCHEDULE

To activate an Observation Schedule, first select it and then enter a checkmark (by clicking) in the checkbox labeled “Schedule Activated.” When the time for an event arrives, the event line is marked “performed,” and the telescope slews to the designated object.²⁴ This is repeated for each Observation Event in the Schedule.

HINT

The Slew Time entered for each Observation Event corresponds to the PC’s local time as distinguished from Gemini’s local time. The reason for this is so that schedules can be set and tested in the GCC without having to be online with Gemini.

²³ Parking the telescope disables all tracking so that an unattended telescope will not collide with its mount.

²⁴ If the GCC’s connection to the Gemini is disabled when a slew is scheduled to occur, the GCC attempts to connect in order to fulfill the scheduled task.

If a slew cannot be performed at the time an observation is scheduled, the status of the Observation Event is marked “FAILED.” If two or more Observation Events are scheduled for the same time, only the first is executed; all others are marked “IGNORED.”

To deactivate the Observation Schedule at any time, uncheck the “Schedule Activated” checkbox.

6.5. PERFORMING UNSCHEDULED SLEWS

Any object listed in an Observation Schedule can be slewed to prematurely by first selecting the Schedule, then the Event within the Schedule, and finally clicking the button labeled “Make Slew.”

6.6. SETTING THE ALARM

The GCC provides the convenience of an audible time alarm to remind the observer when an event is about to occur or when some action has to be taken.

To set the alarm, type a local time into the “Alarm Time” input box and click the checkbox labeled “Alarm Enabled”; this causes a check mark to be displayed in the checkbox. When the alarm time is reached, a notification window appears, and Gemini emits one long beep while the GCC emits several short ones.²⁵

HINT

Although scheduling the alarm through the GCC requires that it be online with Gemini at the time it is set, it is Gemini’s alarm that is set; the consequence of this is that Gemini’s alarm will sound even if the GCC subsequently goes offline. To stop that from happening, the alarm must be separately disabled using Gemini’s Hand Controller. This feature is the reason that the alarm is set and responds to Gemini’s local time (as distinguished from the schedules that are set and respond to the PC’s local time).

²⁵ When using the alarm, set the PC’s audio volume “on.”

7. THE OBSERVATION LOGS SCREEN

OVERVIEW

The Observation Logs Screen is launched from the Observation menu on GCC's Main Screen by clicking "Logs & Diaries."

Gemini creates a coded log of the major actions it performs.²⁶ Each line of the log consists of the date and time of the action, a short description of it, and an RA and DEC coordinate where applicable (the GCC adds item numbers as well). Gemini's Log cumulates data, action-by-action, until it becomes filled, or the user clears it manually.

The GCC can upload, display, and save Gemini's Log to a named Log File for future retrieval and analysis. It can also create an Observation Diary, in plain-language text, that can be saved, and later retrieved and edited using a text editor or word processing software.

Observation Logs

The Gemini System keeps a log of important actions and events. Those logs can be uploaded to the GCC, saved to a file, and reloaded from this file at any time.

Clear Local Log

Clear Gemini's Log

Upload Gemini's Log

Save Local Log as:

Name: Last Weekend

Available Logs

- First Run
- Last Weekend
- Mars Observation
- Yesterday

No.	Date	Time	Action	RA	Declination
16	Oct 17, 2003	11:39:20	Additional Align (Antares, 16:29:38		-26:45:04
17		11:40:03	Goto (Antares, [SCD]	20:15:45	+90:00:00
18		11:40:35	Power Off	20:16:17	+90:00:00
19	Oct 18, 2003	18:01:07	Cold Start	14:42:16	+90:00:00
20		18:04:32	Goto (Altair, [AQL]	19:50:57	+08:52:41
21		18:06:20	Initial Alignment	19:50:57	+08:52:41

Create Observation Diary

7.1. GEMINI'S LOG AND THE GCC'S LOCAL LOG

To properly use the Observation Logs Screen, it is essential to distinguish between the terms "Gemini's Log" and "Local Log." Gemini's Log is the log code that Gemini generates internally, which can be uploaded to the GCC. Once uploaded and interpreted into plain language, it becomes known as Gemini's "Local Log."

²⁶ Log Files are generated by Gemini Level 2 and higher.

7.1.1. CLEARING AND UPLOADING GEMINI'S LOG

Since Gemini's Log cumulates data until it is cleared manually, if you want to start it from scratch, click "Clear Gemini's Log." Gemini's Log then grows, action-by-action; its data is not visible to you, however, until you upload it to the GCC.

To upload and display Gemini's Log interpreted into plain language (not in its abbreviated syntax), click "Upload Gemini's Log."²⁷ The uploaded log, now termed the "Local Log," appears in the "Local Log List" at the bottom of the screen; it is not, as of yet, saved to a Log File.

HINT

You should normally clear the Local Log before performing an upload. If you do not, Gemini's uploaded log will be appended to what is already in the list.

7.1.2. INSPECTING, SAVING, AND CLEARING THE LOCAL LOG

You can now inspect the Local Log (Gemini's uploaded Log) that is displayed in the Local Log List, and either clear it from the list or save it. The Local Log is easy to read because the GCC interprets Gemini's code, and displays its data in plain language under the captions "No." (item number), "Date" (UTC), "Time" (UTC), "Action," "RA," and "Declination."

To clear the Local Log, click "Clear Local Log"; to save it to a Log File, type a name for the file into the Name edit box, and click "Save Local Log as:" The saved Local Log will immediately appear in the Saved Logs List; now, if you clear the Local Log, Gemini's Log data that was saved in the Log File, will not be lost.

7.2. LOG FILES

7.2.1. RETRIEVING AND DELETING LOG FILES

A Log File is a saved Local Log. All saved Local Logs are stored in the GCC's Databases subdirectory as plain-text Log Files with ".log" extensions. From there, they may be opened, viewed, or printed, using a text editor or a word processor.

To retrieve a Log File, simply select it in the Saved Logs List; its contents are instantly displayed in the Local Log List. To delete a Log File, select it in the Saved Logs List, and click the delete mark ✕.

7.2.2. INTERPRETING LOG FILES

Gemini's Log is produced by the Gemini device itself; its syntax is:

yymmddhhmmss&hh:mm:ss±dd:mm:ss&#, where:

- yymmdd is the UTC date
- hhmmss is the UTC time
- \$ is a letter character representing one of the following Gemini operations:
 - A... Additional Align
 - C... Cold Start
 - D... Realign (first Initial Align after a Warm Restart)
 - G... Go-to operation
 - P... Primary (Initial) Align
 - O... Power Off

²⁷ Gemini's Log is not cleared by this upload procedure.

R... Warm Restart
s... Synchronize
S... Object Selection
W... Warm Start

- hh:mm:ss is Right Ascension (hours, minutes & seconds).
- \pm dd:mm:ss is Declination (\pm degrees, arc minutes, arc seconds).
- & is an object name up to 10 characters long (in S and G operations only).
"GCCGoto" identifies a slew to an unnamed destination via the Manual Control Screen.
- # is a line termination character.

When Gemini's Log is uploaded to the GCC's Local Log and then saved as a Log File, its terminology and syntax are preserved, but with some additions. Chief among these additions is "GCCGoto," a generic object name that is used when coordinates are entered by typing them, or when slewing to an unnamed destination using the Manual Control Screen.

The following is a typical Log File viewed with a text editor:

```
031111195052C12:04:46+90:00:00#
031111195151G12:06:01+90:00:00#
031111195443S12:08:53+90:00:00Dubhe a UMa#
031111195459G11:03:57+61:43:48Dubhe a UMa#
031111195701S11:03:43+61:45:02Phecda UMa#
031111195709G11:54:01+53:40:23Phecda UMa#
031111195826S11:54:01+53:40:23GCCGoto#
031111195828G11:54:01+54:40:23GCCGoto#
031111195848S11:54:00+54:40:23GCCGoto#
031111195904G11:54:01+80:40:23GCCGoto#
```

The following is the Local Log's display of the same data:²⁸

No.	Date	Time	Action	RA	Declination
1	Nov 11, 2003	19:50:52	Cold start	12h 04' 46''	+90° 00' 00''
2		19:51:51	Goto	12h 06' 01''	+90° 00' 00''
3		19:54:43	Object Selection [Dubhe	12h 08' 53''	+90° 00' 00''
4		19:54:59	Goto [Dubhe a UMa]	11h 03' 57''	+61° 43' 48''
5		19:57:01	Object Selection [Phecda	11h 03' 43''	+61° 45' 02''
6		19:57:09	Goto [Phecda UMa]	11h 54' 01''	+53° 40' 23''
7		19:58:26	Object Selection [GCCGo	11h 54' 01''	+53° 40' 23''
8		19:58:28	Goto [GCCGoto]	11h 54' 01''	+54° 40' 23''
9		19:58:48	Object Selection [GCCGo	11h 54' 00''	+54° 40' 23''
10		19:59:04	Goto [GCCGoto]	11h 54' 01''	+80° 40' 23''

The following is a line-by-line explanation of Gemini's actions that produced the above data:

- 1 At 19:50:52 UTC, Gemini was cold-started from the standard startup position.
- 2 At 19:51:51 UTC, the telescope was slewed in RA to 12h 06' 01'' by clicking the RA button in the Manual Control Screen.
- 3 At 19:54:43 UTC, Dubhe was selected in the Catalogs Screen. The advance in RA is due to sidereal tracking.
- 4 At 19:54:59 UTC, the Catalog Screen's Go-to button was clicked, slewing the telescope to Dubhe, at the coordinates indicated.
- 5 At 19:57:01 UTC, Phecda was selected in the Catalogs Screen.

²⁸ Notice that some of the Action entries are truncated due to a limitation in display space. This truncation also occurs in the Log Diary display that is described in the following section, but not in diaries that have been saved.

- 6 At 19:57:09 UTC, the Catalog Screen's Go-to button was clicked, slewing the telescope to Phecda, at the coordinates indicated.
- 7 At 19:58:26 UTC, a new declination of +54° 40' 23", was typed into the Manual Control Screen's Object Coordinate Box. The log does not reflect this because the telescope has not yet moved.
- 8 At 19:58:28 UTC, the Manual Control Screen's Go-to Destination button was clicked, slewing the telescope to declination +54° 40' 23".
- 9 At 19:58:48 UTC, a new declination was typed into the Manual Control Screen's Object Coordinate Box.
- 10 At 19:59:04 UTC, the Manual Control Screen's Go-to Destination button was clicked, slewing the telescope to declination +80° 40' 23".

7.3. OBSERVATION DIARIES

The Observation Diary Screen is launched from the Observation Logs Screen by clicking "Create Observation Diary." Immediately upon opening, an Observation Diary displays the same data that is contained in the Local Log.

Visually, Observation Diaries are very similar to Local Logs; their differences are: (1) comments can be added to, or deleted from, each diary entry; (2) diary entries can be rearranged, renumbered or deleted; (3) Observation Diaries are saved as plain language ASCII text files.²⁹

Observation Diary (X)

An observation diary has been created from the Local Log. In this diary, you can remove or re-arrange existing entries, and add a line of comment to each of them. You can also export the diary as a text file for further processing by a text editor or word processor. Please note that when you close this window, all changes you made that were not saved will be lost.

No.	Date	Time	Action	RA	Declination	Comment
1	Nov 11, 2003	19:50:52	Cold Start	12:04:46	+90:00:00	
2		19:51:51	Goto	12:06:01	+90:00:00	
3		19:54:43	Object Selection (Dubhe 12:08:53		+90:00:00	
4		19:54:59	Goto (Dubhe a UMa)	11:03:57	+61:43:48	Very nice view !!
5		19:57:01	Object Selection (Phecda:11:03:43		+61:45:02	
6		19:57:09	Goto (Phecda UMa)	11:54:01	+53:40:23	Ursa Major cluster. Revisit tomorrow !!
7		19:58:26	Object Selection (GCCG:11:54:01		+53:40:23	
8		19:58:28	Goto (GCCGoto)	11:54:01	+54:40:23	
9		19:58:48	Object Selection (GCCG:11:54:00		+54:40:23	

Comment:

When you're done editing the diary, you may save it into a plain text file. In order to do so, please enter the desired file name with extension and full path (e.g. C:\Diaries\Log123.txt) !

File Name:

File name validated. Click the button to save the diary!

Closing an Observation Diary causes it to be lost along with any changes that were made to it. Of course, Diary Files that are saved before the Diary is closed are preserved.

²⁹ Log Files are saved as lines of coded abbreviations, whereas Diary Files are saved in plain language and in ASCII text format. This makes them more intuitively comprehensible, and easier to edit with a text editor or word processor. Once in this format they cannot, however, be loaded or further processed by the GCC.

HINT




The Observation Diary Screen is not restored at startup the way the GCC's other screens are. Also, deleting the last entry from a Diary causes the screen to close automatically.

7.3.1. INITIAL EDITING AND DELETING OF DIARY ENTRIES

To add a comment to a Diary entry line, select the line, type your comment into the "Comment" edit box, and click "Set Comment." Your comment will be added to the end of the entry. To replace a comment with another, type the replacement into the "Comment" edit box and repeat the foregoing process. To delete a comment from an entry, select the entry line containing the comment to be deleted, clear the "Comment" edit box, and click "Set Comment." To delete all added comments, click "Delete All Comments."

HINT

The user can select multiple entries in the diary, and click "Set Comment" to append the same comment to all those entries at once!

Entire Diary entry lines can be rearranged, deleted, and renumbered. To move one or more Diary entry lines up or down on the list, select the line or lines to be moved, and then click the up  or down  "move" arrows until the selected line or lines are in the position desired. To delete an entry line (including its comments), select it and click the delete mark . Both of these procedures result in lines being out of numerical order so, to restore their numerical order, click "Renumber Entries." Finally, to cancel all changes made to a Diary and return it to its original state, click "Rebuild Diary."

HINT

Only one Observation Diary can be edited at a time.

7.3.2. SAVING AND EDITING DIARY FILES

After performing initial edits as described in the preceding section, the resulting Observation Diary can be saved as a plain language text file into any folder on your PC. To do so, enter a filename, a name extension (if desired), a complete path to the folder (e.g. "C:\Diaries\Log123.txt"), and then click "Export Diary."

HINT

Although any extension or no extension may be used for Diary Files, it is recommended that you not use extensions recognized by the GCC for other purposes. ".txt" is a useful extension to use because it is universally recognized to identify text files and, double-clicking a ".txt" file, will automatically launch your default text editor.

Once an Observation Diary has been saved, its file can be opened and fully edited by any text editor or word processor (but not by the GCC). This capability is particularly convenient when you need to reformat your Observation Log for publication or transmission to others. The following is an example of a Diary File, with comments added, and using the same observation data as previously presented:

Gemini Observation Diary

Created by user "Michael Rudolph" on "MY PC".
Date: Nov 14, 2003

Created by Gemini Control Center
Copyright (C) 2003 by Daniel Görlich
Contact: Daniel@DocGoerlich.com
Website: <http://www.DocGoerlich.com/Daniel/>

No.	Date	Time	Action	RA	DEC	Comment
1	Nov 11, 2003	19:50:52	Cold start	12h04'46"	+90°00'00"	
3		19:54:43	Object Selection [Dubhe a UMa]	12h08'53"	+90°00'00"	
4		19:54:59	Goto [Dubhe a UMa]	11h03'57"	+61°43'48"	Very nice
5		19:57:01	Object Selection [Phecda a UMa]	11h03'43"	+61°45'02"	
6		19:57:09	Goto [Phecda UMa]	11h54'01"	+53°40'23"	Revisit!!
9		19:58:48	Object Selection [GCCGoto]	11h54'00"	+54°40'23"	
10		19:59:04	Goto [GCCGoto]	11h54'01"	+80°40'23"	

Note to myself: Transparency was clear, and seeing was moderate to good. Equipment was 11-inch SC on Losmandy G-11 mount, with L3 Gemini. Lines 2, 7 and 8 of the diary were deleted as being uninteresting, and therefore unnecessary to preserve.

8. THE HARDWARE SCREEN

OVERVIEW

The Hardware Screen is launched from the Telescope menu on GCC's Main Screen by clicking "Hardware."

This screen allows entry of and displays six categories of hardware parameters; they are (1) mount related, (2) accessory encoder related, (3) movement related, (4) modeling related and (5) tracking divisors. The screen also includes a button for setting the mount's safety limits.

Settings in this screen are entered in several ways. The mount type, Hand Controller mode, accessory encoder usage and tracking speeds are selected from lists; the accessory encoders' resolutions, moving speeds (including TVC value entry) and tracking divisors are typed into edit boxes; the modeling parameters are either typed in, or are generated by a connected Gemini as a consequence of performing telescope alignments.

Each edit box is equipped with a "tool-tip" feature that displays the range of admissible values as you cause the mouse to hover over the box for approximately one second. For further information about level-dependency, the user is referred to Appendix A which contains all of the settings and values admissible for each level of Gemini.

The screenshot shows the 'Hardware' screen with the following sections:

- Mount:** A list of mount types including Losmandy G8, Losmandy G-11, Losmandy HGM200 / MI250, Celestron International 700, Losmandy Titan 25, and Losmandy Titan 50.
- Hand Controller:** A list of modes including Visual Mode, Photo Mode, and All Speeds.
- Accessory Encoder:** Input fields for RA Resolution (0) and Dec Resolution (0), and a Usage dropdown menu with options: Use Encoder, Test Encoder, and Ignore Encoder.
- Moving Speeds:** Input fields for Manual Slew (1200), Go-to Slew (1200), Centering (0), Guiding (0.2), and TVC Value (0). A Tracking Speed dropdown menu includes options: Sidereal, Adaptive King Rate, Lunar, Solar, None/Terrestrial, and Closed Loop.
- Modeling Parameters:** A text box explaining the internal modeling algorithm and a button 'Set Safety Limit Now !'. Below it are sections for:
 - Polar Misalignment:** Azimuth (0) and Elevation (0).
 - Non-Perpendicularities:** Pole (0) and Equator (0).
 - Index Error:** Hour Angle (0) and Declination (0).
 - Meridian Flip Error:** Hour Angle (0) and Declination (0).
 - Flexure:** Counterweight (0) and Tube (0).
 - Tracking Divisors:** User Tracking (30627) and DEC (0).

8.1. MOUNT TYPE AND HAND CONTROLLER MODE

The mount types selectable from the Hardware Screen are Losmandy G8, G11, HGM200, Titan 25 and Titan 50, Mountain Instruments MI250, and Celestron International 700.

HINT

When changing Mount Type, you should verify that the Gemini has recalculated the RA Tracking Divisor correctly for the new mount and the tracking speed. Unless the user wants to guide to near objects like comets and asteroids, he should not change the tracking divisors calculated by the Gemini System. This display is intended only for experienced users.

The Hand Controller mode is also selectable; the choices are Visual Mode, Photo Mode, or All Speeds Mode. Each mode causes the Hand Controller to behave differently when manually moving the telescope. Consult the Gemini Users Manual for an explanation of how each of the three Hand Controller Modes functions.

8.2. ACCESSORY ENCODER SETTINGS

Accessory RA and DEC encoders are sometimes installed to keep track of where the telescope is pointing when it is moved by hand after the mount's axis clutches are loosened. Encoders are designed to operate at specific resolutions (ticks per revolution) and, for the encoders to operate properly, Gemini must be informed of these resolutions by typing them into their respective edit boxes.³⁰

When first installing accessory encoders, it is useful to be able to test them by having their actual values displayed on Gemini's LED display. This may be accomplished by selecting "Test Encoders" from the encoder Usage list.

The other two selectable settings in the encoder Usage list are toggles of each other; selecting "Use Encoders" sets the encoders online, and selecting "Ignore Encoders" sets them offline and inoperative even though they remain electrically connected to the Gemini, and physically connected to the mount.

8.3. MOVING SPEEDS AND TVC VALUE

There are four selectable Moving Speeds; they are: Manual Slewing, Go-to Slewing, Centering, and Guiding. Although the selection of Moving Speed and the initiation of manual and Go-to movements of the telescope are performed in other screens, the rates of the Moving Speeds are set in the Hardware Screen.

HINT

The Manual Slewing Speed set in the Hardware Screen can be overridden in the Manual Control Screen.

TVC is short for "Time Variable Compensation." Setting its value properly is essential for eliminating the delay caused by a mount's gear backlash when the mount's direction of movement is changed in declination during guiding. When a value for TVC is entered in the appropriate edit box in the Hardware Screen, it defines the number of steps that are made at a higher speed to overcome the backlash quickly after a directional change.

HINT

TVC is only used for guiding speed in Photo Mode or All Speeds Mode. A TVC value is too high if you detect a jump while changing directions in DEC. To avoid spoiling an image, choose a slightly lower value.

8.4. TRACKING SPEEDS AND TRACKING DIVISORS

There are seven selectable Tracking Speeds; they are: Sidereal, Adaptive King Rate, Lunar, Solar, None/Terrestrial, Closed Loop, and Comet/User Defined. The Gemini Users Manual should be consulted for an explanation of how each is used. Also, for further information about level-dependency, the user is referred to Appendix A which contains all of the settings and values admissible for each level of Gemini.

³⁰ The RA and DEC encoders do not necessarily have the same resolutions.

Tracking Divisors define Comet/User Defined tracking rates.³¹ They are based on the RA timer running at 1.5 MHz (1,500,000 ticks per second), and they divide this rate down to the speed at which RA tracking must occur. Since each mount may have a different step size (e.g. the step size of the G-8, G-11, HGM-200, MI-250 and International 700 is 0.5625 arcsec/step whereas the Titan mounts are different), selecting one of the listed mounts automatically enters an RA Tracking Divisor that will cause that particular mount to track at the sidereal rate in RA; the DEC Tracking Divisor is set to 0 to prevent tracking in declination.³²

To calculate a mount's RA tracking divisor, multiply 1.5×10^6 ticks/second (the RA timer speed) by the mount's step size, and divide by 15.04106865 arcsec/second (the sidereal rate of the sky's movement). In the case of the above-mentioned mounts, this rounds to 56096 which is the RA tracking divisor that is displayed when you select any one of them. Then, if you change the RA tracking divisor,³³ Gemini changes its RA tracking rate accordingly, and displays "User Defined."

The DEC tracking divisor does not have its own timer, but is an inverse multiple of the mount's RA tracking steps. If the divisor is set to 0, no DEC tracking occurs. Setting it to 1 lets the mount track in DEC at the same speed as the RA. Setting it to 100 will give one DEC step per 100 RA steps; if, therefore, the RA tracking divisor is set to track at sidereal speed, DEC will track at 1/100 of the sidereal rate or 0.1504106865 arcsec/second.³⁴

HINT

Setting the DEC divisor to other than 0, causes Gemini to switch to "Comet Tracking."

8.5. SETTING SAFETY LIMITS

Gemini is capable of establishing right ascension safety limits to prevent the telescope from accidentally tracking or slewing into the mount. Briefly, you slew the telescope in RA to where you want to set each limit, and click "Set Safety Limit Now!" This sets the limit at the present pointing coordinate. If, at any time in the future, the telescope tracks or slews beyond that coordinate, and alarm will sound and all telescope movement will stop. Further details on safety limits can be found in the Gemini Users Manual.

8.6. MODELING PARAMETERS

The first time a star alignment is done,³⁵ a Gemini modeling algorithm initiates, and all internal modeling parameters are reset. After that, each subsequent star alignment ("Additional Align") contributes to the growing model, causing ever-increasing accuracy in Gemini's ability to point to given celestial objects or coordinates.

The following Modeling Parameters apply to Level 2 and higher:

- Polar Misalignment (Azimuth and Elevation)
- Non-Perpendicularities (Pole and Equator)
- Index Error (Hour Angle and Declination)
- Meridian Flip Error (Hour Angle and Declination)

³¹ Comet/User Defined tracking can also be established, via Gemini's Hand Controller, through a process of training or coordinate entry.

³² Selecting "None/Terrestrial" tracking causes the tracking divisor boxes to disappear and be replaced with the explanation: "No divisors are computed for this tracking speed."

³³ Manually increasing the tracking divisor leads to slower tracking.

³⁴ The sign of the DEC divisor determines the direction of DEC tracking.

³⁵ In Gemini Levels 1 and 2, the first alignment is the procedure known as "Initial Align." Beginning with Level 3, an initial alignment is done automatically when Gemini is powered on.

The following Modeling Parameters apply to Level 3 and higher:

- Flexure (Counterweight and Tube)

The Modeling Parameters are uploaded from the Gemini to the GCC automatically, where the result of each star alignment can be followed. They can also be edited in the GCC by typing in new values.

This manual cannot go further in explaining the significance of each Modeling Parameter; the user is therefore referred to the Gemini Users Manual for more information on modeling and on performing star alignments.

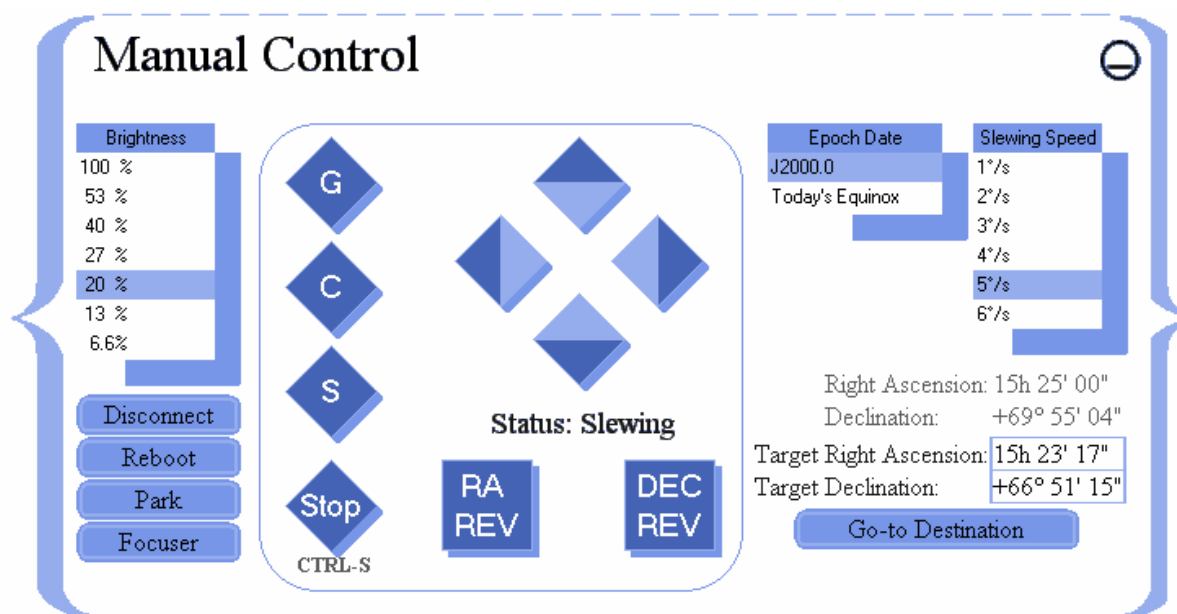
9. THE MANUAL CONTROL SCREEN

OVERVIEW

The Manual Control Screen is launched from the Telescope menu on GCC's Main Screen by clicking "Manual Control."

The Manual Control Screen can be thought of as the "Hand Controller" of the GCC. It has the same array of directional buttons as Gemini's Hand Controller, and can be used to manually move the telescope in Right Ascension and Declination at slewing, centering or guiding speeds. It also provides a means to reverse the direction of movement resulting from each button, stop all movement, and input and Go-to celestial coordinates expressed as either Epoch J2000.0 or as the equinox of the current date. In addition, this screen also contains an RA and DEC display of the telescope's current pointing position.

Because the user is likely to spend the majority of his or her observing time at this screen, other important functions are included here as well, including controls that enable you to set the slewing speed at increments, to park and focus the telescope, adjust the Hand Controller's LED brightness, and connect and disconnect the GCC from the computer's serial port. There is also a Status Display to assist the user in knowing the progress or status of an operation.



9.1. SETTING PARAMETERS

Several settings in the Manual Control Screen duplicate or override similar ones that appear elsewhere in the GCC.

9.1.1. EPOCH DATE

While epoch dates of Bookmarks are assigned in the Bookmarks Panel of the Catalogs Screen, one of two epochs is also set in the Manual Control Screen where the entry applies to all coordinates input for manual slewing. The two choices are J2000.0, and Today's Equinox (equinox of the current date).

The purpose of allowing this choice of Epoch Date is to facilitate Gemini in finding and accurately slewing to celestial objects that are manually input. For example, if a coordinate of interest is derived from a J2000.0 catalog, then the Epoch Date of the GCC should be set for J2000.0 before inputting and slewing to that coordinate. On the other hand, if the current coordinate of an object is known but

its J2000.0 coordinate is not (which might be the case if an object is newly discovered and yet uncataloged), then Today's Equinox should be entered.

It is important to note that the Epoch Date set in this screen affects input coordinates only. The coordinates of where the telescope is currently pointing is always displayed in the equinox of the current date.

9.1.2. SLEWING SPEED

Although the three moving speeds (slewing, centering and guiding) are pre-set in the Hardware Screen, the Manual Control Screen provides a slew speed override – a means for changing the speed of manual and Go-to slews initiated from this screen only.

Slewing speed selections can range between 1°/s and 6°/s of sidereal speed in degrees per second as follows:

$$n^{\circ}/s = (n * 240)x$$

where x is sidereal speed (15 arcsec/sec), and

n is an integer, $1 \leq n \leq 6$.

9.1.3. BRIGHTNESS

The control labeled "Brightness" enables the user to select an appropriate brightness for the Hand Controller's LED display from a maximum of 100% to a minimum of 6.6%. This is to allow ease of viewing in various lighting conditions.

9.2. TELESCOPE MOVEMENT

9.2.1. MOVING THE TELESCOPE MANUALLY

The telescope may be moved manually using the four diamond-shaped directional buttons. The horizontally placed buttons (left and right) move the telescope in right ascension, while the vertically placed buttons (upper and lower) move it in declination.

Each directional button consists of two halves. The outer half (white in color by default) operates in touch mode (press-to-move, release-to-stop). The inner half (blue in color by default) operates in toggle mode (press-to-move, press again to stop).

Two buttons are provided that reverse the direction of the telescope's movement caused by each of the directional buttons. Normally, as viewed from the south looking north, the left RA button moves the telescope counterclockwise in RA and the right RA button moves it clockwise. Similarly, the upper DEC button moves the telescope counterclockwise in DEC and the lower DEC button moves it clockwise. When depressed, the RA REV and DEC REV buttons reverse these directions respectively.

As the telescope is being moved, its changing position can be monitored by the Right Ascension and Declination read-out provided.

9.2.2. SLEWING TO A TARGET COORDINATE

In order to slew to a specified coordinate expressed in either J2000.0 or the equinox of the current date, first be sure that the Epoch Date is properly set. Then, input a right ascension value (hours, minutes and seconds) in the box labeled Target Right Ascension, and a declination value (+/- degrees, minutes and seconds) in the box labeled Target Declination. This may be done either by typing the coordinates directly into the Object Coordinate Box or by copying them from one of GCC's Object-

transferable screens. Pressing the Go-to Destination button will then cause the telescope to slew to the desired target location as confirmed by the Right Ascension and Declination position display provided.

9.2.3. SELECTING A MOVING SPEED

As has already been said, slewing, centering and guiding speeds are pre-set in the Hardware Screen. To select which of the three speeds will result from pressing a directional button, the Manual Control Screen provides three buttons labeled “S”, “C”, and “G”, for selecting slewing, centering, and guiding speeds respectively.

9.2.4. PARKING THE TELESCOPE

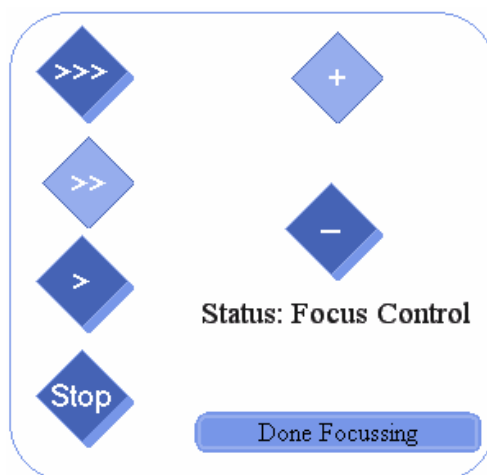
The Park function is available only for Gemini Level 3 and higher. When the Gemini is first powered up, it remembers the telescope’s initial start-up position that it assumes to be counterweight down, pointing north. Even if that is not the case, pressing the button labeled “Park” returns the telescope to its start-up position and turns off all tracking.

9.2.5. EMERGENCY STOPPING

Occasionally, it may be necessary to stop the telescope’s movement abruptly before it reaches its target. This may be accomplished by pressing the button labeled “Stop” or typing Ctrl-S on the computer’s keyboard; this latter method is effective regardless of which screen or input field is active.

9.3. THE FOCUS CONTROL MODE

The Focus function is available only for Gemini Level 3 and higher. Focusing, via certain 9 to 12 volt focusers (e.g. NGF focusers from JMI), is now possible if an accessory adapter board is connected to the Gemini. When the button on the Manual Control Screen labeled Focus is clicked, a Focus Panel appears consisting of six buttons arranged in two vertical columns.



The three buttons in the right column set the focuser’s speed. The button labeled “>>>” sets focus speed to its highest, the one labeled “>>” sets the focuser to a slower speed, and the one labeled “>” sets it slower still. In the left column, the buttons labeled “+” and “-” move the focuser either in or out, depending upon which focuser is being used. Movement occurs when the buttons are depressed, and stops when they are released. The button labeled “Stop” is provided for emergency use only; clicking on it causes all movement of the focuser to stop instantly.

To close the Focus Panel and resume manual control of the telescope, click the button labeled “Done Focusing.”

9.4. CONNECTING AND DISCONNECTING

The Manual Control Screen has a Connect/Disconnect button that toggles Gemini’s connection to the GCC as either “Online” or “Offline. The status of the connection is displayed both on the label of the connection button and in the Status Display.

HINT

“Disconnect” appearing on the button and “Online” appearing in the Status Display, means that Gemini is connected to the GCC. “Connect” on the button and “Offline” in the Status Display means that it is not connected.

To go online from an offline status (connect the Gemini to your computer), click “Connect.” The Gemini searches for and connects to the computer through the first available serial port. If Gemini is started (with Cold Start, Warm Start or Warm Restart) prior to your opening the GCC, the two will connect spontaneously and there will be no need to click any button.

If Gemini was not started prior to your opening the GCC, a Boot Mode window appears with three buttons that give the user a choice to “Cold Start,” “Warm Start,” or “Warm Restart.” Clicking any of these buttons causes the window to vanish, and Gemini’s Hand Controller to begin scrolling through the messages of its startup routine. When the routine is finished, the Status Display indicates “Online.”

To disconnect Gemini from your computer, click the button labeled “Disconnect.” The Status Display will respond by indicating “Offline.”

10. THE TELESCOPE SITE SCREEN

OVERVIEW

The Telescope Site Screen is launched from the Telescope menu on GCC's Main Screen by clicking "Site."

A "site" is a geographic location defined by its longitude and latitude. Multiple sites, each consisting of a country, a site name and the site's coordinate, can be entered and stored in this screen. Coordinates are either typed in manually, or entered automatically using a GPS receiver.

In addition to housing the telescope's geographic coordinates, this screen is also the repository of the current date, time, and time zone. For precision and convenience, the date and time of both Gemini and the PC can be synchronized to a GPS receiver. This function is available in the Synchronization Screen as well.

The screenshot shows the 'Telescope Site' interface. It features three scrollable lists: 'Countries' (with 'United States of America' selected), 'Locations' (with 'Los Angeles' selected), and 'Abb. Time Zone' (with '-07 MST Mountain Standard Time' selected). Below these lists are input fields for 'Site Name' (containing 'Los Angeles'), 'Longitude' (+117° 53'), and 'Latitude' (+34° 25'). A 'Save Site' button is positioned below the site name. To the right, there are fields for 'Gemini Local Date' (10-14-03) and 'Gemini Local Time' (22:28:22). At the bottom, there are buttons for 'Find Receiver', 'Sync Gemini', and 'Sync PC's Internal Clock'. A text box at the bottom provides instructions on using a GPS receiver to automatically determine position and UTC time.

Countries	Locations	Abb.	Time Zone
Turks and Caicos Islands	Anchorage	-06 CST	Central Standard Time
Tuvalu	Boise	-07 MST	Mountain Standard Time
Uganda	Chicago	-07 PDT	Pacific Daylight Time
Ukraine	Juneau	-08 YDT	Yukon Daylight Time
United Arab Emirates	Knox	-08 PST	Pacific Standard Time
United Kingdom	Los Angeles	-09 HDT	Hawaii Daylight Time
United States of America	Losmandy HGM	-09 YST	Yukon Standard Time
Uruguay	Louisville	-10 AHST	Alaska-Hawaii Standard Time

Site Name: Longitude: Gemini Local Date:
 Latitude: Gemini Local Time:

If you have a GPS Receiver connected to one of your computer's serial ports, the GCC can automatically determine the current position and UTC time. If successful, you can download this data to your Gemini System.

UTC Date & Time: Oct 14, 2003, 15:28:22
Current Location: 34° 25' North, 117° 53' West
GPS Protocol: NMEA 0183

10.1. COUNTRIES AND SITE LOCATIONS

The Telescope Site Screen contains a default list of countries, site locations (cities or other designations) within each country, and the longitude, latitude, and time zone of each location. Site locations can be added, deleted or edited, and countries can be either added or deleted.

10.1.1. ADDING A SITE LOCATION TO A PREVIOUSLY LISTED COUNTRY

To add a site location to a previously listed country, begin by selecting the country. Next, type a name for the site in the box labeled "Site Name," and select the site's time zone from the time zone list on the right side of the screen. The site name chosen can be anything – a city, a park, or just a personal description like "Home." Finally, enter the site's longitude and latitude in the boxes provided, and click "Save Site." The site you have chosen will appear in the Locations list whenever you select the site's country.

10.1.2. ADDING A SITE LOCATION AND A COUNTRY NOT PREVIOUSLY LISTED

To add a site location and a country that is not yet listed, first enter the site's longitude, latitude, and time zone. Next, type the site's name in the "Site Name" box followed by a comma, a space, and the country's name (e.g. "St. Peter's Basilica, Vatican"). Finally, click "Save Site"; the country, the site, and the site's parameters will be added and saved.

10.1.3. EDITING AND DELETING SITE LOCATIONS AND COUNTRIES

A previously saved site location can be edited by selecting it, changing any of its parameters (longitude, latitude or time zone, but not its name), and then clicking "Save Site." To delete a site location, select it and click the delete mark ✕. A country is automatically deleted when its last site location is deleted.

HINT

Site locations and their related countries are saved as lines of simple text in the "locations.gld" file of GCC's "Databases" subdirectory, from where they may be edited, deleted, or overwritten.

10.1.4. SETTING GEMINI'S GEOGRAPHIC COORDINATES AND TIME ZONES MANUALLY

Gemini must be told the longitude, latitude, and time zone of the telescope's location; this may be done in one of two ways. You may either select a previously saved site location (in which case the geographic coordinates and time zone of the site will be displayed) or, you can type the telescope's longitude and latitude into their respectively labeled boxes, and select the appropriate time zone from the Time Zone list located on the right side of the screen. Either method will instantly transfer the appropriate site parameters to the Gemini.

HINT

The GCC only stores a time zone's numerical value – not its name. That is why all time zones with the same value become highlighted when a site location is selected.

10.1.5. SETTING GEMINI'S DATE AND TIME MANUALLY

In order to point accurately, the Gemini must be told the correct time zone first, and then set to the correct date and time. To set Gemini's date and time manually from the GCC, simply type the current local date and time into the Telescope Site Screen's boxes labeled "Gemini Local Date" and "Gemini Local Time" respectively.³⁶ The date and time entries will be downloaded to the Gemini instantaneously.

HINT

Setting Gemini's time has no affect on the computer's time or visa versa. The computer's time can only be manually set from the Windows Control Panel or the time display embedded in the PC's System Tray.

³⁶ When Gemini's date and time are set from the GCC, it is "local" date and time – not UTC – that is entered. That is not the case when one enters the date and time directly from Gemini's Hand Controller.

10.1.6. SETTING GEMINI'S GEOGRAPHIC COORDINATES, DATE AND TIME FROM A GPS RECEIVER

An alternative way to set the Gemini's longitude, latitude and time is to download the information from a GPS³⁷ receiver.³⁸ In order for the GCC to receive its data, the GPS receiver must be visible to several satellites, and communicate by either "NMEA 0183" or "Garmin Textout" protocols at 4800 baud.

To accomplish this, connect a GPS receiver to any serial port on your computer,³⁹ and click "Find Receiver." After a few seconds of delay, if the GPS receiver is receiving sufficient satellite data, the UTC date and time, the telescope's geographic coordinates and the GPS receiver's communication protocol will be displayed at the bottom left of the screen;⁴⁰ at this point, nothing will have yet been downloaded to the Gemini.

Now, provided that the time zone has been properly set, clicking "Sync Gemini" will download the displayed UTC date and time to the Gemini, and Gemini's computed local date and time will promptly be displayed in the boxes labeled "Gemini Local Date" and "Gemini Local Time" respectively. Simultaneously, the displayed GPS geographic coordinates will be downloaded to the Gemini, and instantly mirrored in the boxes labeled "Longitude" and "Latitude."

If desired, the latitude, longitude and time zone set in this way can be given a site name and saved for future retrieval.

10.1.7. SYNCHRONIZING THE COMPUTER TO GPS TIME

Synchronizing Gemini to the GPS receiver's date and time does not automatically set the PC's internal clock. This may, however, be accomplished automatically as a separate step, by first downloading the GPS receiver's data as described in the preceding section, and then clicking "Sync PC's Internal Clock."⁴¹

³⁷ Global Positioning System

³⁸ This procedure can be done from the Synchronization Screen as well.

³⁹ See "Connecting a GPS Receiver" (Section 6.3) of the Gemini Users Manual for a description of how to wire your GPS receiver to your computer using a standard serial connector.

⁴⁰ As soon as the GCC has received sufficient data, it disconnects from the GPS receiver, thereby allowing it to be unplugged with no adverse consequence. It then continues to count the seconds that have passed since the last data retrieval.

⁴¹ Another way to automatically set the PC's internal clock is by synchronizing to an SNTP server via the Internet. This is described in the "Synchronization Screen" chapter.

11. THE SYNCHRONIZATION SCREEN

OVERVIEW

The Synchronization Screen is launched from the Telescope menu on GCC's Main Screen by clicking "Synchronization."

Synchronizations performed in this screen are of three kinds – (1) date and time via an SNTP Internet server, (2) date, time, and geographic location via a GPS receiver, and (3) an exchange of parameters between Gemini and the GCC via GCC's upload/download facility.

Synchronization

Internet Time

If you're online, you can synchronize your computer's internal clock with more exact clocks via Simple Network Time Protocol (SNTP). The clock error will indicate the deviation between your computer's time and the exact time (usually below 0.2 seconds).

Clocks synchronized. Clock error: 0.002 seconds
Server: tock.usno.navy.mil

Sync PC Sync Gemini

GPS

If you have a GPS Receiver connected to one of your computer's serial ports, the GCC can automatically determine the current position and UTC time. If successful, you can download this data to your Gemini System.

UTC Date & Time: Oct 14, 2003, 15:31:54
Current Location: 34° 25' North, 117° 53' West
GPS Protocol: NMEA 0183

Find Receiver Sync Gemini

Sync PC's Internal Clock

Settings

You can synchronize the GCC with the Gemini System by either uploading all settings from the Gemini Servo System to the GCC, or by downloading all settings from the GCC to the Gemini Servo System.

Upload from Gemini Download to Gemini

11.1. SETTING DATE AND TIME VIA AN SNTP INTERNET SERVER

To set the PC's date and time using an SNTP server,⁴² first connect your PC to the Internet, and then click "Sync PC." The GCC will search a list of time servers and, when one is found, the PC's clock will be set to that server. A message will then be displayed giving the server's Internet address, and the time difference (usually less than 0.2 seconds) between the PC's clock and the server's more accurate clock. You can now click "Sync Gemini" to transfer the PC's time to both the GCC and the Gemini.

11.2. SETTING DATE, TIME AND LOCATION VIA A GPS RECEIVER

Setting the PC's and the Gemini's date and time can also be accomplished by downloading them, via a GPS receiver,⁴³ from either this screen or from the Telescope Site Screen. Done in this way, you get the bonus of downloading the longitude and latitude of the telescope's position as well. The GCC can connect to any GPS receiver connected to the PC's serial port, provided that it communicates by either "NMEA 0183" or "Garmin Textout" protocols at 4800 baud.

⁴² Simple Network Time Protocol

⁴³ Global Positioning System

To initiate the download, click “Find Receiver.”⁴⁴ During a pause of several seconds, the message “Searching...” will appear. If the GCC finds and connects to the GPS receiver, the UTC Date & Time, the Current Location, and the GPS Protocol will be displayed.⁴⁵ Then, clicking “Sync Gemini” and “Sync PC’s Internal Clock,” in that order, will download the GPS receiver’s date, time, and location to the Gemini, and will also set the PC’s internal clock.

11.3. UPLOADING AND DOWNLOADING SETTINGS

Generally, it will not be necessary to synchronize the GCC and the Gemini in a separate operation. This is because, upon their connecting, all of Gemini’s settings will normally upload to the GCC automatically. Then, when any parameter is changed in either of them, the change is mirrored in the other.

That notwithstanding, there may be times (perhaps influenced by other control software running on the PC) when a complete synchronization does not occur as expected. In those cases, you can force a synchronization of all settable parameters by clicking either “Upload from Gemini” or “Download to Gemini.” In the former case, the GCC receives its settings from Gemini; in the latter case, Gemini receives them from the GCC.

HINT

If the GCC and Gemini are not connected and you wish to establish and store a set of parameters for download to the Gemini once a connection has been made, you may do so by creating a profile in the Configuration Screen.

ANOTHER HINT

The GCC was designed to control the Gemini without using the Hand Controller. The more the Hand Controller and the GCC are used concurrently, the more often it will be necessary to synchronize the Gemini and GCC. If the Hand Controller is not used at all, you will probably never need this functionality.

⁴⁴ The geographic time zone must have previously been set in the Telescope Site Screen.

⁴⁵ As soon as the GCC has received sufficient data, it disconnects from the GPS receiver, thereby allowing it to be unplugged with no adverse consequence. It then continues to count the seconds that have passed since the last data retrieval.

12. THE PRECESSION CALCULATOR SCREEN

OVERVIEW

The Precession Calculator Screen is launched from the Tools menu on GCC's Main Screen by clicking "Precession."

Precession is caused by a slow circular movement of the rotational axis of the Earth that must be accounted for when attempting to accurately point a telescope toward a celestial object. While a full discussion of precession is beyond the scope of this manual, the right ascension and declination data published in astronomical catalogs (of which several are resident in the Gemini and the GCC) must be adjusted for its affect, or Gemini will not point to the apparent position of the target.

The International Astronomical Union (IAA) defines a so-called "Standard Epoch" for astronomical catalogs. The current standard epoch is now J2000.0, meaning that coordinates in newer catalogs are now corrected to January 1st, 2000 at 12:00 o'clock UTC.

Gemini usually expects coordinates to be in the Standard Epoch J2000.0.⁴⁶ The permanently stored catalogs on-board Gemini are therefore based on J2000.0, and User Catalog items that are downloaded have to refer to this equinox also. The GCC's Precession Calculator Screen helps to convert coordinates based on other equinoxes to those of J2000.0.

The screenshot shows the "Precession Calculator" interface. It has a title bar with a minus sign icon. The interface is divided into two main sections: "Input" and "Results".

Input Section:

Epoch Date
J2000.0
B1950
J1900
Today's Equinox
Base Date Equinox

Below the input table, there are three input fields:

Right Ascension:	00h 58' 46"
Declination:	-20° 50' 27"
Base Date:	10-15-03

Results Section:

	RA	Declination
J2000.0	00h 58' 46"	-20° 50' 27"
B1950	00h 56' 19"	-21° 06' 37"
J1900	00h 53' 51"	-21° 22' 51"
Today's Equinox	00h 58' 57"	-20° 49' 13"
Base Date Equinox	00h 58' 57"	-20° 49' 13"

At the bottom right of the results section, there is a button labeled "Transfer Selected Result".

12.1. ENTERING COORDINATE DATA

Coordinates are entered in the Precession Calculator Screen in one of two ways. It is either typed into its Object Coordinate Box, or is copied in from other Object-transferable screens.⁴⁷ This is done by selecting the object in the other screen while the Precession Calculator Screen is open.

12.2. ENTERING THE INPUT EPOCH DATE

The input epoch date is selected from the "Input Epoch Date" list. J2000.0, B1950 and J1900 are the epochs of their respective years. "Today's Equinox" refers to noon of the current date (the date to which the PC is set), and "Base Date Equinox" refers to noon of the date entered in the box labeled "Base Date."

⁴⁶ Exceptions are the Manual Control Screen where coordinates can be input in "Today's Equinox," and the Bookmarks Panel of the Catalogs Screen where coordinates can be input in any equinox.

⁴⁷ The Catalogs Screen, Observation Schedules Screen, Manual Control Screen, and the Near Objects Screen.

12.3. CALCULATING AND TRANSFERRING THE RESULTS

The resulting epoch date is selected from the “Results” list. As with the “Input Epoch Date,” “Today’s Equinox” refers to noon of the current date, and “Base Date Equinox” refers to noon of the date entered in the box labeled “Base Date.” The resulting (corrected) right ascension and declination are displayed simultaneously for all the epoch dates listed. Any one of them can now be copied to other Object-transferable screens by selecting it and clicking “Transfer Selected Result” while the receiving screen is open.

13. THE COLOR THEMES SCREEN

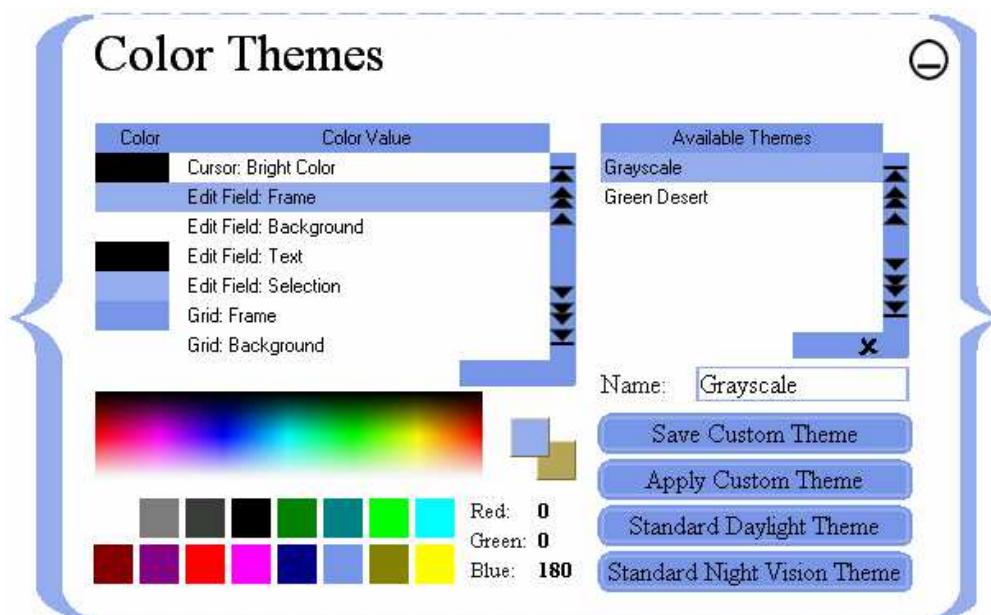
OVERVIEW

The Themes Screen is launched from the Tools Menu on GCC's Main Screen by clicking "Color Themes."

In addition to the two standard themes, the Daylight and Night Vision themes, this screen lets you create a virtually unlimited number of custom themes, and load previously saved ones.

HINT

Each theme is saved as a separate file in the GCC's "Databases" folder with a ".gcs" extension. Theme files can be added and deleted there, and can be overwritten by updated files. This allows the import of themes created by other GCC users.



13.1. DEFINING CUSTOM THEMES




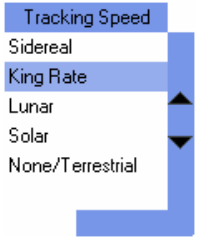
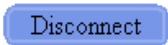
A color theme is defined by coloring the 33 elements listed on the left side of the Themes Screen (the "Colorable Elements List"). Below this list are a color map, a selection of predefined basic colors, and three edit boxes that let you select one specific color out of 16 million possibilities. This color is defined by the RGB model, which constructs every color by combining saturation levels of the three primary colors, red, green and blue. The admissible range for each saturation level is 0 to 255.⁴⁸


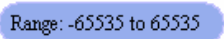
When you move the mouse over the color map or over one of the basic colors fields, the selected color will be shown in the upper-left of the two boxes to the right of the color map. Simultaneously, the color's red, green, and blue saturation values are displayed in their respective edit boxes. This helps you find and select a specific color; when you have found it, simply click on it and the color will be selected.

If you want to be even more specific, you can enter a color's red, green, and blue saturation values directly into their respective edit boxes, and press <RETURN>.

⁴⁸ A complete description of the RGB color model is beyond the scope of this manual. You can find detailed information about "RGB colors" on the Internet.

When you select a color, it is stored in the lower-right of the two boxes to the right of the color map. Then, if an item is selected in the Colorable Elements List, the selected color is automatically assigned to that item. You define a complete theme by assigning colors to all 33 colorable elements; those 33 elements are described below:

Color Value Name	Description
Background Frame Border Inner Frame	All of the GCC's screens have a black background by default. Each screen is surrounded by an accolade-like frame, which itself has a thin inner border. You can define the background's, the inner frame's, and the frame border's colors separately. 
Image Mask Color	In order to colorize icons and images, you must define a mask color that is applied to the original images using a bitwise AND operation. If the mask color is white, the original image is copied; if the mask color is black, the image won't be visible anymore. The Night Vision Mode, for example, colorizes all images red by setting the image mask color to red also. 
Window Title	Defines the color of all GCC screen titles.
Text Info Text	There are two types of text on the GCC's screens: <i>Here you can modify this program's behaviour.</i> <input checked="" type="checkbox"/> Scan ports at program start (1) normal text, and (2) hints, information, and help texts (printed in italics). The normal text's color is also applied to checkboxes, and headers.
Cursor: Main Color Dark Color Bright Color	The mouse cursor can look three-dimensional if its outermost part is darker, and its innermost part is brighter than the cursor's main color. Usually, three shades of a single color (e.g. red) should be used.  <p>HINT Not all versions of Windows support colored cursors!</p>
Edit Field: Frame Background Text Selection	You can define the frame, back-ground, and text colors for edit fields. Comment: Selected Text in Edit Box Selected text is marked by a special background color ("Selection"), while the rest of the edit field keeps the "Background" color. <p>HINT The description of an edit field is a normal text.</p>
Grid: Frame Background Text Selection	The GCC presents all lists and tables as rectangular grids with a frame, a header, and optional arrow and item control buttons. The items and the header share the same text color. The header's background color is always the same as the frame color, while the items' background color can be defined separately. Furthermore, the background color of selected items can be defined also. The buttons' color is defined by the Image Mask Color (see above). 
Button: Frame (Highlighted) Frame Background Text Text (Disabled)	All buttons have the same background color. A button's text color, however, depends on whether the button is enabled, or disabled. Also, the color of the button's frame depends on whether or not the button is highlighted.  <p>HINT The "Frame (Highlighted)" color also applies to area borders like that of the Focuser Panel on the Manual Control Screen.</p>

Color Value Name	Description
Manual Control: Pressed Key Released Key Pressed Lock Key Released Lock Key Shadow Text	<p>The Manual Control Screen features buttons that look similar to the ones on the original Gemini Hand Controller. These buttons always have a shadow when in their released condition, but not all of them have text printed on them. Most of them can only be pressed and released; the direction buttons for manual slewing in right ascension and declination, however, have an additional area that you can click on to “lock” the buttons until you release them by clicking a second time.</p>  <p>HINT It is highly recommended that you specify easily distinguishable colors for the click and lock areas, as well as for the two states (“pressed” or “released”) that each area can be in!</p>
Tool-Tip Hint: Border Text Gradient Color #1 Gradient Color #2	<p>Some of the edit fields and buttons of the GCC show tool-tip hint messages, when appropriate. These hints are presented in small tool-tip windows with a gradient color background, fading “Gradient Color #1” into “Gradient Color #2.” If you do not want a gradient background, specify the same color for those two items. Additionally, you must define the tool-tips’ border and text color.</p> 

13.2. APPLYING A THEME

When you have changed, created, or loaded a theme, it is not applied until you click “Apply Custom Theme.” As soon as you click this button, the GCC starts to colorize all elements of the program, which might take a few seconds; however, you don’t have to wait for the GCC to finish that process, but can use it as usual while it applies the theme.

If you want to return to the standard color themes, you can click the “Standard Daylight Theme,” or “Standard Night Vision Theme,” to switch back to Daylight, or Night Vision Mode, respectively.

13.3. SAVING, LOADING AND DELETING CUSTOM THEMES

When you have assigned colors to some or all of the items in the Colorable Elements List, you may want to save your newly created theme. In order to do that, simply enter the name you want to give this theme into the edit box below the Available Themes List. Then, click “Save Custom Theme” to save it. If a theme with the same name already exists, it will be overwritten.

Each newly saved theme will appear in the Available Themes List immediately. From this list, you can select any theme listed by simply clicking on it, or manually entering its name in the edit box below the list. When a theme is loaded, its 33 colorable items are loaded into the Colorable Elements List, where you can view or edit them.

If you want to delete a theme, select it in the Available Themes List, and click the delete mark ✕. The theme will be deleted immediately, but since it was loaded when you selected it, you can still view and edit its color values.

APPENDIX A: HARDWARE SETTINGS

This table lists the admissible values and ranges for settings editable on the Hardware Screen, for the major Gemini Levels 2 and 3. For Gemini Level 1, this Screen is not available.

Setting		Gemini Level 2	Gemini Level 3
Mount	Mount Types	G8 G-11 HGM200/MI250 CI700	G8 G-11 HGM200/MI250 CI 700 Titan 25 Titan 50
Accessory Encoder	RA Resolution Dec Resolution	-32768 to 32768 -32768 to 32768	-32768 to 32768 -32768 to 32768
Moving Speeds	Manual Slew Go-to Slew Centering Guiding TVC Value Tracking Speeds	1 to 2000 1 to 2000 1 to 255 0.2 to 0.8 0 to 255 Sidereal King Rate Lunar Solar None/Terrestrial	1 to 2000 1 to 2000 1 to 255 0.2 to 0.8 0 to 255 Sidereal Adapt. King Rate Lunar Solar None/Terrestrial Closed Loop Comet/User Def.
Modeling Parameters	Polar Misalignment Azimuth Elevation Non-Perpendicularities Pole Equator Index Error Hour Angle Declination Meridian Flip Error Hour Angle Declination Flexure Counterweight Tube	-65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535	-65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535 -65535 to 65535
Tracking Divisors	User Tracking Divisor Dec Tracking Divisor		256 to 65535 -65535 to 65535

NOTES