PLANNING

Reference Manual

Part Number 750-1-0028 Rev 1

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Chapter 1 Introduction

1.1 Congratulations!

Welcome to the Planning Reference Manual! This manual is designed to provide you with comprehensive information about your Planning software.

Planning is a powerful program which includes full-featured GPS post-processing, the flexibility to display and plot data in a variety of ways and the ability to export data in formats that are compatible with most industry-standard mapping and GIS packages. Planning is easy-to-use and learn, while still providing a wide range of features and flexibility.

1.2 Prerequisites

To run Planning, your personal computer must meet or exceed this minimum configuration:

- Microsoft Windows 9x or Windows NT user interface
- Pentium
- VGA display
- 16 MB RAM memory
- Hard disk with 64 MB free; extra space required for data storage
- Windows-compatible mouse or pointing device
- One serial port

Although previous experience with Windows is not necessary to use Planning software, familiarity with certain actions that are customary in Windows will assist in the usage of the program. This manual has been written with the expectation that you already have a basic familiarity with Windows.

1.3 How to Get Technical Support

Technical support for this product is available from the distributor where you purchased it. You also may contact one of the Sokkia subsidiaries listed below. POINT, Inc., welcomes written communications regarding its products; use the address on the back of the title page of this manual.

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Sokkia B.V.
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P.O. Box 1292, 1300 BG Almere
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1.4 Documentation Conventions

The following conventions are used in this manual:

Keys you are to press are enclosed in angle brackets, for example **<Alt>** and **<Page Up>**. If you are to press multiple keys to initiate an action, the combination will be shown with a plus sign between the keystrokes; for example, **<Alt>** + <↓>.

The return or enter key is called **<Enter>**.

A menu bar selection followed by a menu selection is shown in Title Case in the format Menu bar item | Menu item, like this example, Edit | Insert.

The term “Electronic Field Book” refers to the Sokkia (or Sokkisha / Lietz) SDR31 or SDR 33 models of electronic survey data collectors.

1.5 Using this Manual

Typefaces and icons are used in this manual as follows:

Main Menu .... Indicates field identifiers, menu options, unit names, variables, and functions.

| ..... This symbol is used to separate drop-down menu selections. Examples: File | Save, File | Exit

Prompt ..... Represents screen prompts and other information displayed on the screen.

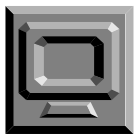
<KEY>..... Indicates a keyboard key that causes an immediate action. Examples: **<1>**, **<F1>**, **<ESC>**, **<Y>**, **<N>**

TEXT ..... Represents user-typed text, numeric or special character input (always followed by one of the action keys above).

`Print` ..... Represents reports or output to a printer.

✉ Indicates that adjoining text explains previous text.

Indicates that adjoining text is to be typed by the user.



Indicates that adjoining information is displayed on the computer screen.

Indicates that adjoining text is either a printed report or text from a disk file.

Indicates important information or warning information concerning adjoining text.

1.6 On-Line Help

You can get on-line information for many of the operations you perform using ***Planning***. Use the **Help** feature to complete your tasks without having to look further than the computer screen.

Chapter 2 Planning Basic Operations

2.1 Installing Planning

You must use the **SETUP** program on your CD to install the S*pectrum Planning* program correctly. Please refer to your CD for installation instructions.

2.2 Entering and Exiting Planning

To start *Planning*, you must have Microsoft Windows 9x or Windows NT running on your PC.

Starting Planning

If you accepted the default installation path, *Planning* can be started from the Windows Start menu, by selecting **Programs | Sokkia | Planning**. Otherwise, select the path where you installed *Planning.*

You will be presented with the *Planning* splash screen, followed by the *Planning* Main window and a Plan View sub-window.

Exiting Planning

To exit *Planning*, choose one of the following methods:

- Click the **<Exit>** button  in the upper right-hand corner of the main window
- Select **File | Exit** from the main menu
- Press **<Alt> + <F4>**

If a file is open and has been edited, you will be prompted to save the changes before closing the project file.

2.3 Quick Start

Planning provides you with a collection of tools to help you plan and organize your GPS data collection effort. For a given point and date, you can easily determine the best times during the day to collect data to benefit from a favorable distribution of satellites in the sky. Or, if the observation time is fixed, you can determine in advance which satellites will be visible from your point, where they will be in the sky, and what the Dilution of Precision (DOP) factors will be.

Planning is easy to use. These are the steps that you would typically take:

1. Transfer a recent almanac from the internet, a Radian receiver or a data collector to your PC. For additional information on receiving data from a device, refer to your *ProLINK* or *Spectrum Survey Reference Manual*.

✉ **Note:** You can obtain a Yuma almanac from ftp://ftp.navcen.uscg.mil/GPS/almanacs/yuma/.

2. Run *Planning*. Select **File | Almanac** from the main menu. Use the dialog to import the almanac (from Step 1 above).

3. Select **View | Plan View** to bring up a model of the globe. Rotate it by holding down the **<left>** key on the mouse, then moving the mouse. Zoom in on an area by selecting **View | Zoom In**, then clicking the **<left>** mouse button as you point to a location on the globe. Move the pointer to the approximate location where you wish to collect data. **<Right-click>** the mouse and select **Create point...** from the pop-up menu.

   Alternately, select **Edit | Points…** or **Edit | Control Points…**from the main menu. Use the dialog to define the point where you wish to collect data. From this dialog you can also launch an **Obstructions Editor**, which allows *Planning* to tailor its calculations to account for local obstructions. Repeat this for as many points as you desire to analyze.

4. If you wish to determine which satellites are simultaneously visible from multiple points, select the **multiple points** from the dialog invoked by choosing **Edit | Point Selection…** from the main menu.

5. Select **Edit | Parameters** from the main menu (or, **<right-click>** anywhere, other than on the world map, and select **Parameters...** from the pop-up menu). Use the dialog to enter when the data collection will occur, what the elevation mask angle is to be, what the time resolution of the results should be, and which satellites, if any, you would like excluded from the results.

6. Select **Tools | Options** from the main menu, and define your display and time settings.

7. From the main menu, select any of the options under ***Tools*** to view tables and charts relating to DOP factors, satellite visibility, etc. The results are for the selected time period and point, and take into account the preferences expressed.

Many other options and features are available, and these are explained in the following pages. Keep in mind that the options and features are included to let you customize *Planning*; as such, they are for your convenience only. You can use as many or as few as you like.

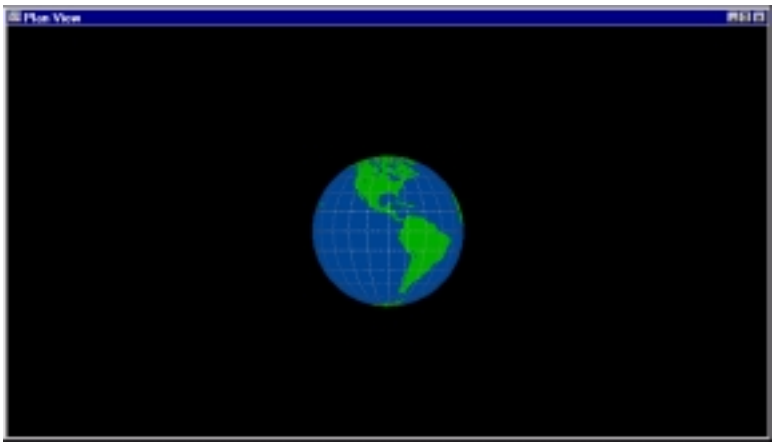
2.4 Viewing Screens and Menus

When you launch *Planning*, a Plan View window is created by default that shows a three-dimensional model of Earth. If it is not shown you can also select it by choosing **View | Plan View** from the menu. Menu selections show at the very top of the screen. Below the menu, a toolbar provides shortcuts to frequently used functions. At the bottom of the screen is a status bar, where various types of information appear at times. The toolbar and status bar can be displayed or hidden by selecting or deselecting the appropriate item under the ***View*** menu item. You can also customize the toolbar to contain only those buttons that you desire by selecting **Tools | Options | Toolbar**.

The following sections describe the plan view, the menu system, the toolbar, and the status bar.

2.4.1 Plan View

The plan view lets you see the three-dimensional model of Earth. You can use this to select one or more points for planning purposes. With a project loaded, select **View | Plan View** to cause the globe to appear:



Several selections are available under the ***View*** menu item that you can use:

Normal .....This option allows you to rotate the globe by holding down the left key on the mouse, then moving the mouse. If you have zoomed in on an area, or zoomed out of an area, then subsequently wish to rotate the globe again, you must first select View | Normal.

Select .....This option allows you to select one or more points and/or control points by clicking on them with the left mouse button.

Zoom In .....Increase the detail and resolution of an area by selecting View | Zoom In, then clicking the left mouse button as you point to a location on the globe. You can cancel this mode by selecting View | Normal.

Zoom Out .....Decrease the detail and resolution of an area by selecting View | Zoom Out, then clicking the left mouse button as you point to the globe. You can cancel this mode by selecting View | Normal.

Fit Data .....Select an optimal view that contains all of the points in the current project.

Fit World .....Select an optimal view that includes the entire globe.

Show Points .....Toggle the view of the globe to show or hide the points in the current project.

Show Control Points .Toggle the view of the globe to show or hide the predefined points.

2.4.2 Menus

Two types of menus are available:

- The ***main*** menu, accessed by selecting items at the top of the screen. The main menu layout depends on whether a project is

loaded, and if so, which view window is active. Menu layouts are listed under the section to which they refer.

- The ***shortcut*** menu, accessed by pressing the **right** button on your mouse while the pointer is over a display area. The contents of the shortcut menu vary, depending on the current display. Shortcut menu layouts are listed under the section to which they refer.

The following table shows the menu structure and the shortcut menu available when *Planning* first begins – when a project is open but there are no view windows active. Each menu item contains a drop-down list of options to aid you in processing your data.

File	**Edit**	**View**	**Tools**	**Receiver**	**Help**
New	Control Points	Plan View	Az/El Table	Edit Schedules	Contents
Open	Points	Status Bar	Visible SVs Plot	Edit Configurations	Search for Help on
Close	Point Selection	Toolbar	Number SVs Plot		Using Help
Save	Parameters		Polar Sky Plot		About
Save As	Mapping System		Rectangular Sky Plot		
Almanac Data			DOPs Plot		
Exit			Options		

Point Selection…
Almanac…
Parameters…
Save

The following table shows the main menu structure and the shortcut menu layout when a project is open, the Plan View is active and the cursor is over the world map. Each menu item contains a drop-down list of options to aid you in processing your data.

File	**Edit**	**View**	**Tools**	**Receiver**	**Window**	**Help**
New	Control Points	Obstructions	Az/El Table	Edit Schedules	Cascade	Contents
Open	Points	Normal	Visible SVs Plot	Edit Configurations	Tile	Search for Help on
Close	Point Selection	Select	Number SVs Plot		Arrange Icons	Using Help
Save	Parameters	Zoom In	Polar Sky Plot		Close All	About
Save As	Mapping System	Zoom Out	Rectangular Sky Plot		Minimize All	
Almanac		Fit Data	DOPs Plot		1 Plan View	
Project Archive		Fit World	Options			
Project Restore		Show Points				
Exit		Show Control Points				
		Status Bar				
		Toolbar				

Create Point…
Normal
Select
Zoom In
Zoom Out
Fit Data
Fit World
Show Points
Show Control Points

The following are the main and shortcut menu layouts when the active window is a Plot View.

File	Edit	View	Tools	Receiver	Window	Help
New	Control Points	Plan View	Az/El Table	Edit Schedules	Cascade	Contents
Open	Points	Obstructions	Visible SVs Plot	Edit Configurations	Tile	Search for Help on
Close	Point Selection	Status Bar	Number SVs Plot		Arrange Icons	Using Help
Save	Parameters	Toolbar	Polar Sky Plot		Close Window	About
Save As	Mapping System		Rectangular Sky Plot		Close All	
Almanac			DOPs Plot		1 Total Satellites Visible	
Print			Options			
Print Preview						
Print Setup						
Exit						

Parameters
Almanac…
Obstructions
Print…

The following are the main and shortcut menu layouts when no project is loaded (that is, when a project has been closed but you have not exited *Planning*).

File	Edit	View	Tools	Receiver	Help
New	Control Points	Status Bar	Options	Edit Schedules	Contents
Open	Mapping System	Toolbar		Edit Configurations	Search for Help on
Exit					Using Help
					About

New
Open…

2.4.3 Toolbar

The toolbar can be displayed or hidden; it is toggled by selecting **View | Toolbar** from the main menu. When visible, the toolbar is docked below the main menu. The status bar displays “tool tips” when the pointer is over a button on the toolbar. You can customize the toolbar’s content through the dialog encountered by selecting **Tools | Options | Toolbar** from the main menu. Only one toolbar is used throughout; if some features are not available, then the corresponding button is shown dimmed.

If all buttons were visible, the toolbar might look like this:

Following, is the meaning of each button:

Start a new project	Open an existing project	Save the current project to a file
Print the contents of the active view	Customize the datum and map projection	Edit control points
Select a new almanac file for the project	Create, edit or import a point	Change the computation parameters
Select a point(s) to be used in computations	Edit the settings	Plot the Dilution of Precision of satellites
Plot a graphic of the number of visible satellites	Plot a graphic of the visibility of satellites	Display an XY plot of the Az/El of satellites
Display a polar plot of the Az/El of satellites	Display the azimuth & elevation table	

2.4.4 Status Bar

The status bar can be displayed or hidden by toggling **View | Status Bar** from the main menu. The status bar is always docked to the bottom of the main window (under the map). It can display several types of information at any given time. The status bar displays menu

and tool tips when the pointer is positioned over certain parts of the window, temporarily hiding all other fields in the status bar. When no project is loaded, only tool tips are displayed.

An example of the status bar displaying a menu or tool tip:

An example of the status bar displaying information fields:

The last example shows the following fields:

Coordinate .....The contents of this field depend on the location of the pointer when it is over the world map. The field contains the pointer position in latitude and longitude (degrees-minutes-seconds format).

Point Name .....This field displays the name of the currently selected point. If more than one point is currently selected for the project, this field reads “Multiple Points”. Double-clicking on the field brings up a drop-down list of all points created, from which you may select a new point (or points). It is equivalent to choosing **Edit | Point Selection...** from the menu.

Almanac Name .....This field displays the file name of the currently loaded almanac file. Double-clicking on this field launches a dialog that lets you load a different almanac; it is the same as choosing **File | Almanac...** from the menu.

2.5 Printing

The contents of any *Planning* window, other than the Plan View window, may be printed. Plots are scaled to fill the entire available page area upon which they are to be printed. The Az/El table is generated with a format identical to that seen in its window. Printing a graphic never spans multiple pages; it is always performed in fit-to-page mode.

Keep in mind that the printed view may differ from the displayed view because the colors available on your printer may differ from those available on your computer monitor. If this is a problem, you can reduce the number of colors used by the program by means of the dialog reached by selecting **Tools | Options | General** from the main menu.

2.5.1 Print Setup

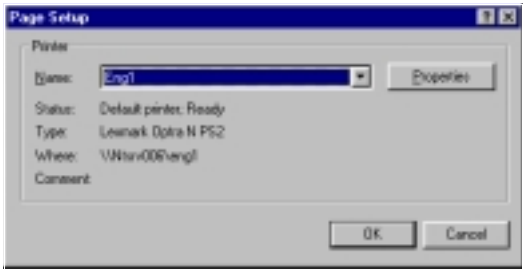
This dialog is invoked by selecting **File | Print Setup…** from the main menu. It allows you to set up your printing job.

In the ***Paper*** section are two drop-down list boxes that allow you to specify the size and source (tray) of the paper that is to be used in printing the current item(s).

In the ***Orientation*** section are two radio buttons labeled **Portrait** and **Landscape**. These buttons are used to specify the orientation of the items selected to be printed. Note that only one of these options (buttons) may be selected at once.

You may also specify the page margins in the ***Margins*** section.

Clicking on the **<Printer…>** button brings you to the second ***Print Setup*** dialog.

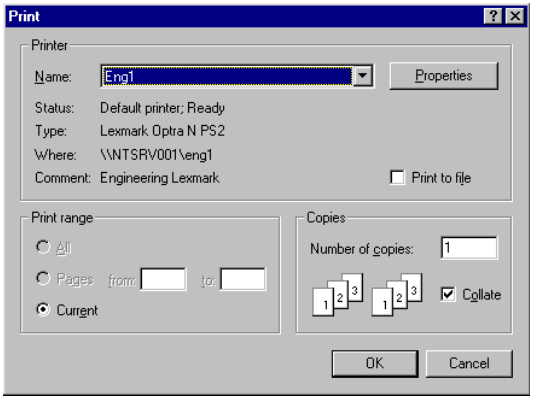


In the Printer section, there is a drop-down list box beside the ***Name*** field. Clicking on the arrow allows you to choose a printer from those that are available to your computer. Clicking on Properties allows you to customize the printer's settings.

There are two buttons at the bottom: **<OK>** and **<Cancel>**. Click on **<OK>** to close the dialog, saving all changes to the printer options that were made during its use. Click on **<Cancel>** to close the dialog, abandoning all changes to the printer options that were made during its use.

You will be returned to the first ***Print Setup*** page. If you are satisfied with the page setup click on **<OK>** or on **<Cancel>** to delete your changes.

2.5.2 Print



The ***Print*** dialog is invoked by selecting **File | Print** from the main menu, or by using the shortcut menu (**right-click**) when viewing any of the plots, or by clicking on the **<Print>** toolbar button.

In the ***Printer*** section, there is a drop-down list box beside the ***Name*** field. Click on the arrow to choose a printer from those that are available to your computer. Click on **Properties** to customize the printer's settings. The **Print to File** check box allows you to send the print information to a file in lieu of the selected printing device. The same print information that would have been sent to a printer port will instead be sent to a file; you are prompted for its name.

The ***Print Range*** section allows you to print all the pages (if applicable), or a certain range of pages (if applicable), or only the currently selected item.

The ***Number of Copies*** field is an edit box that controls the number of copies of the currently selected object(s) that will be printed.

The **Collate** check box (which only applies when multiple copies of a document are selected for output) is used to specify that documents should be printed in their entirety before starting a second print copy.

If the check box is de-selected when "x" copies of a document are selected to be printed, each page of the selected document is printed "x" times before the subsequent page of the document is printed.

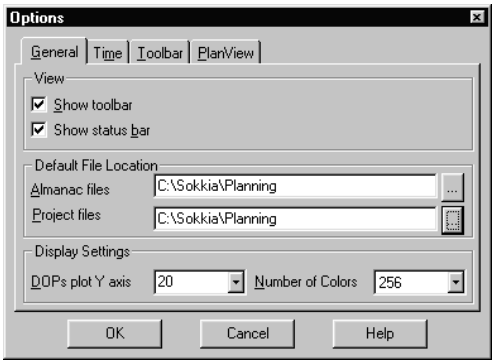
Once you click on **<OK>**, printing begins; you can abort the print job, if desired, from your ***Print Manager*** screen. Click on **<Cancel>** to return to the previous screen without initiating printing.

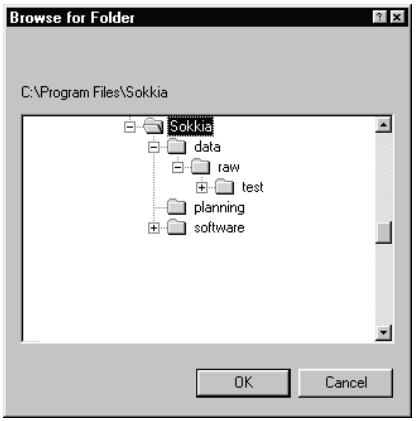
2.6 Customizing Planning

You can customize all of *Planning's* settings (for example, default directories, time zone, contents of toolbar) by selecting **Tools | Options** from the menu. The procedure is described below.

2.6.1 General

The ***Options*** dialog is accessed by selecting **Tools | Options** from the main menu, then choosing the ***General*** tab.





You can toggle the toolbar and status bar on or off from this dialog (which could also be done by selecting **View | Toolbar** or **View | Status Bar** from the main menu).

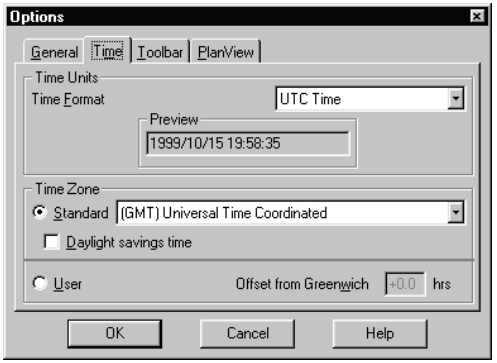
The Default File Location section allows you to specify a default directory for almanac data files. You can enter a location manually; when you click on **<OK>**, a search is made whether this directory exists and an error message appears if this directory does not exist. Alternately, you could select a directory using the ***Browse for Folder***

dialog that appears when you click on the ellipsis **<...>** button. Once you have selected a directory, select **<OK>** to return to the General Options tab.

In the Display Settings section, the DOPs Plot Y-axis field defines the scale of the vertical axis in the Dilution Of Precision plots. For example, if the value in this field is 5, then the scale on the vertical axis would range from 0 to 5. Only integer values are accepted. You can enter a value manually or select one from the list in the drop-down box. Also, the Number of Colors field specifies the number of colors that the program uses in graphical views; the only acceptable values are 2, 16 and 256.

2.6.2 Time

The ***Options*** dialog is accessed by selecting **Tools | Options** from the main menu, then choosing the ***Time*** tab.

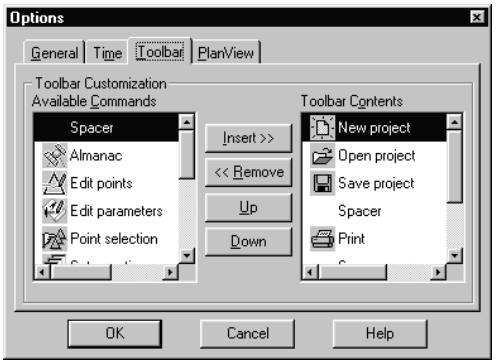


You can choose between GPS, UTC, and Local time formats by selecting an option from the **Time Format** drop-down box. The ***Preview*** field displays the selected format.

If you select the Local Time format, you can choose either a standard time zone (by clicking on the **<Standard>** radio button, then selecting one from the **Time Zone** drop-down list), or define your offset from GMT by clicking on the **<User>** radio button, then entering the offset (-12 to +12) directly. If your time zone is currently in Daylight Savings Time, you may wish to click on that check box.

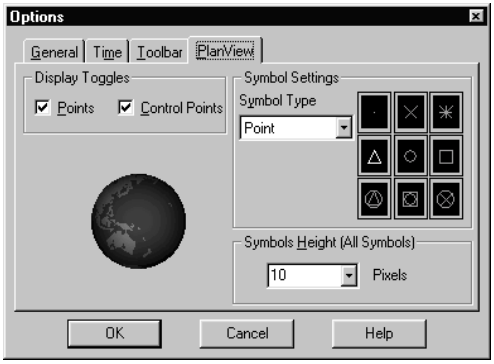
2.6.3 Toolbar

The ***Options*** dialog is accessed by selecting **Tools | Options** from the main menu, then choosing the ***Toolbar*** tab.



You can customize the toolbar by selecting the required operations on the left side of the screen in the **Available Commands** list box, then clicking on the **<Insert>>>** button. The command(s) are inserted into the **Toolbar Contents** list box, and can be re-positioned by clicking on **<Up>** or **<Down>**. To delete a button from the toolbar, select it in the **Toolbar Contents** list box, then click on **<<<Remove>**. Similarly, you can also insert or delete spacers between the buttons on the toolbar.

2.6.4 Plan View



The ***Options*** dialog is accessed by selecting **Tools | Options** from the main menu, then choosing the **Plan View** tab. It allows you to customize the graphic display.

The plan view refers to *Planning's* main window, which displays your data.

The **Display Toggles** check boxes specify which objects should be displayed graphically in the plan view – user-defined points and / or control points.

In **Symbol Settings**, you may change the plan view graphic associated with the ***Symbol Type*** (Point, Control Point) by clicking on one of the available representations in the selection array.

The **Symbol Height** box specifies the size of the symbols displayed in the project's plan view. The valid range of values for this field is 1 - 9999; you can also select one of the values in the list box (5, 10, 15, 20, or 30). The unit of measure for the value in the **Symbol Height** box is always pixels. The symbols remain the same size no matter what the plot scale.

2.6.5 Mapping System

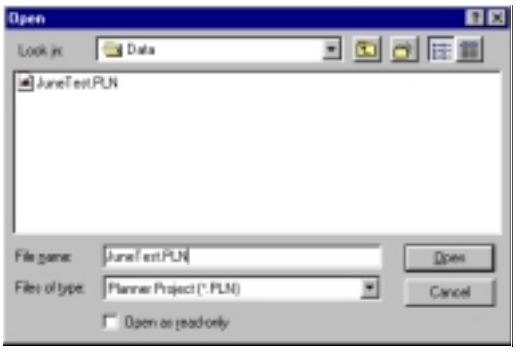
To customize the mapping system, select **Edit | Mapping System** from the menu to bring up the ***Mapping System Selection*** dialog. For a detailed description of the steps involved, please consult Appendix A, *Map Projections, Ellipsoids, & Datums.*

Chapter 3 Managing Data

Planning relies on projects to store the information required for each *Planning* session. After creating a project, you will select an almanac, identify one or more points for your intended destination and establish *Planning* parameters.

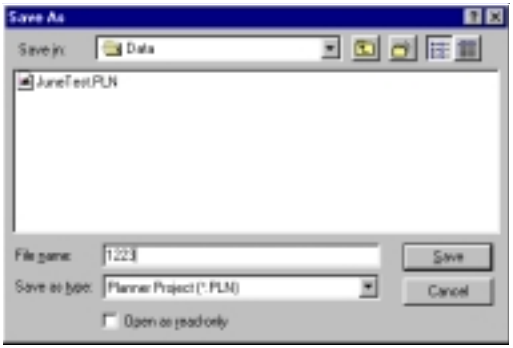
3.1 Planning Your Project

Planning identifies each planning session with a project. A project contains points, obstructions, setting values and an almanac. Only one project at a time can be active. A new project is automatically opened when *Planning* is run. To start additional new projects, select **File | New** from the main menu. If you are working on an existing project when you attempt to open another one, the existing one must first be closed before the next one can be created and loaded. You are prompted to save the existing project if it has been modified since the last time it was saved.



To open existing projects, use the ***Open*** dialog that appears when you select **File | Open** from the main menu. File filters “Planning Projects (*.PLN)” and “All Files (*.*)” are listed in the drop-down list box. *Planning* is backward compatible.

The first time you save a new project (by selecting **File | Save** from the menu) or when you wish to save an existing project under a new name (by selecting **File | Save As** from the menu), you would see the ***Save As*** dialog.



You are prompted for a name and location. Overwriting existing files is allowed but requires your confirmation. Only files of type “Planning Projects (*.PLN)” are listed in the dialog. File names entered without an extension are given a “.PLN” extension automatically. A saved project is tagged with the *Planning's* version information. You are given a confirming message when this operation is completed successfully.

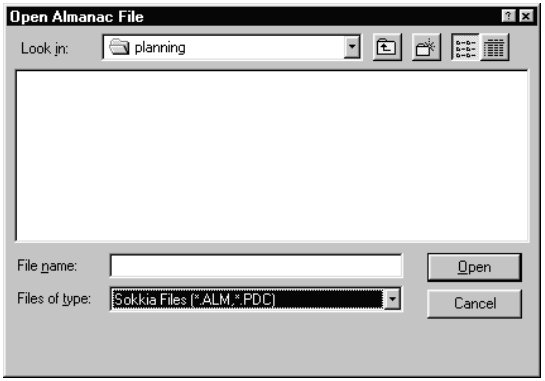
If you try to exit a project without first saving it, you will receive a prompt that states “The project has been modified. Would you like to save it?”. This prompt gives you the opportunity to save the file if you wish to do so.

3.2 Importing an Almanac

Before *Planning* can perform any computations, you must import a fairly recent receiver-generated almanac that you have stored on your PC. The almanac should be less than 30 days old, and a project can use only one almanac file at a time.

✉ **Note:** Almanac information is frequently stored within a GPS raw observable file on a receiver, or you can obtain a Yuma almanac from the internet at ftp://ftp.navcen.uscg.mil/GPS/almanacs/yuma/.

Select **File | Almanac** from the main menu to display the ***Open Almanac File*** dialog.



3.3 Creating a Point

A point is a geographic position, defined in three-dimensional space in a specific mapping or geographical system. This information is stored with the project for which the point was created. You are allowed to associate up to 5000 points with each project. From the number of points associated with a project, you can select one or more points for planning purposes by choosing **Edit | Point Selection...** from the menu.

Each project has its own points. When adding points to a project, you have the following options:

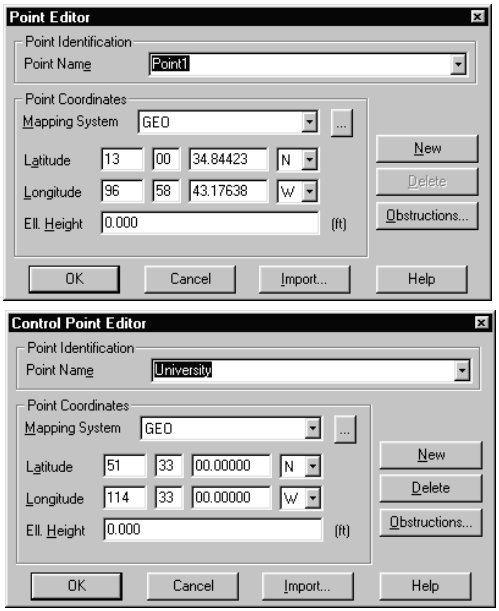
- define a new point
- define a control point
- import a point from the database of control points
- import a point from a *SPECTRUM SURVEY* project (*.SPR file extension)
- import a point from another *Planning* project (*.PLN file extension)

These options are described in the next sections.

3.3.1 Define a Point

Planning enables you to edit control points and points. The difference between a control point and a point is that a control point is a point who's position is 'known'. Because the position of a control point is known, the point can be used by multiple survey projects as a starting point. Most of the time control points are surveyed and published by a government agency. Survey projects can find and use control points because they are often permanently marked for identification (For example, a brass cap in the sidewalk). Identified control points are stamped with a number (it's ID) and either the agency that placed it there or the type of point it is (For example, Alberta Survey Control).

You can easily define a new point by **<right-clicking>** the mouse over a location on the world map, then selecting **Create Point….** Or, you could also select **Edit | Points…** or **Edit | Control Points…** from the main menu to display a blank template.



If you created the point by right-clicking the mouse over the map, the new point's coordinates are shown in the selected mapping system; the Ell. Height field (height above the ellipsoid) shows zero. If you created the point from a blank template, all editable fields initially appear as zeroes. In either case, all fields can be edited.

In the ***Point Name*** field, enter a unique point name of up to 16 characters, of which at least one must be non-blank; trailing and leading blanks are removed from point names. You cannot have two points with the same name; if you attempt to do so, you will receive the message "This point name is already used. Please select another one". By clicking on the arrow beside ***Point Name***, you can view (and edit) other points that you may have already created. Modifications made to a point's fields are kept when selecting a new point using the drop-down list.

When the mapping system is geographic ("GEO"), the edit controls are Latitude, Longitude and Ell. Height; otherwise they are X, Y and Ell. Height. When the mapping system used is geographic, the latitude and longitude are entered using three edit controls each for degrees, minutes and seconds and one drop-down for the hemisphere; only the seconds field allows decimals. If a negative value is entered for the degrees, it is automatically converted to a positive value, and the hemisphere is updated according to the standard convention of North and East being positive values.

✉ **Note:** Ellipsoidal height = geoidal height (undulation) + orthometric height (the height referenced to the geoid, which in turn is equivalent to mean sea level).

You can change the mapping system by selecting a different one from the drop-down list. If you do not find the one that you are looking for in this list, click on the ellipsis **<...>** button beside the ***Mapping System*** field. This button opens a series of dialogs that are explained in Chapter A, *Map Projections, Ellipsoids, & Datums*. If you select a new mapping system using the projection drop-down, the point coordinate is updated. If a projection cannot be applied to a point coordinate, an error message is displayed.

Click on the following buttons to manipulate points:

<New> ..... creates a new point by copying the current point's coordinates

<Delete> ..... removes the point name displayed from the current project

<Obstructions...> ..... defines obstructions at the proposed point (See Section 3.3.1.1, *Obstructions*, Page 3-7)

<OK> ..... adds the point to the project or accepts changes to an established point

<Cancel> ..... cancels updates to the project's points

<Import... > ..... imports a point from either a control point database, a *SPECTRUM SURVEY* project file or from another *Planning* file.

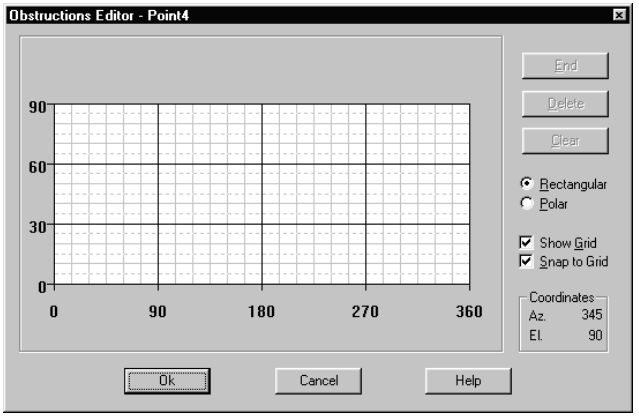
3.3.1.1 Obstructions

The geography of a point may include objects such as trees, mountains and houses that limit the view of the sky at that location. Obstructions cause poor reception of satellite signals during certain parts of their orbits. The fewer obstructions present, the better the point.

This function allows you to incorporate real-life, non-ideal situations into your planning. The obstructions that you enter for a point are used by *Planning* to evaluate their impact on satellite visibility. They can be enabled or disabled from the shortcut menus.

✉ **Note:** You can also set an elevation mask to account for all obstructions within a certain angle (See Section 3.4, *Planning Parameters*, Page 3-14).

Select **Edit | Points...** or **Edit | Control Points...** from the menu, then clicking on **<Obstructions>** to bring up the ***Obstruction Editor***:



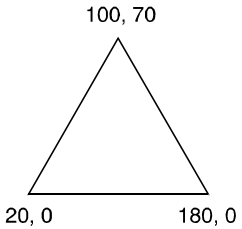
The screen displays a rectangular grid. The horizontal axis represents bearing, and is labeled 0 to 360 degrees, where 0° corresponds to North, 90° to East, 180° to South, and 270° to West. The vertical axis is labeled 0 to 90 degrees, where 0° corresponds to a point on the

horizon and 90° to a point directly overhead. This chart should reflect the skyline as you look in all directions from the specific point where you are collecting data.

An obstruction is defined by elevation and azimuth “coordinates”. As an example, these might be the coordinates of a mountain:

Azimuth	Elevation
20	0
100	70
180	0
20	0

These coordinate pairs are graphically displayed in a rectangular plot as this:



When defining obstructions for a point, certain rules apply:

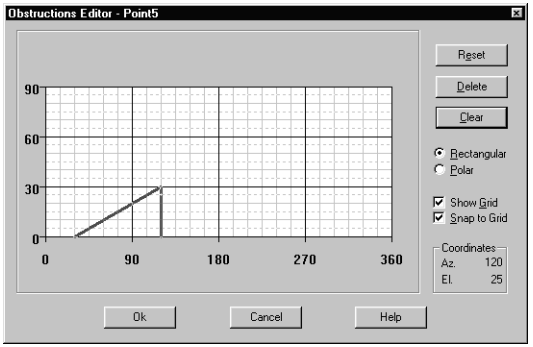
- An obstruction must be constructed as a closed polygon, with the points of the polygon defined by azimuth-elevation pairs.
- Each obstruction must start and end at elevation 0°.
- Polyline segments may not overlap and obstructions for a single point cannot overlap one another. To draw a polygon of obstructions that overlap each other, survey the skyline of the obstructions’ profile, and compile a single object with the azimuth-elevation angles of that profile.
- A single polygon in an obstruction list of a point cannot contain

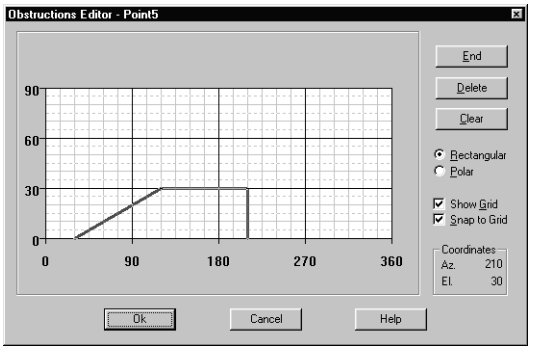
more than 50 azimuth-elevation points (nodes).

- A point can contain up to 20 different obstructions.
- Coordinates for azimuth and elevation values are rounded *down* to whole numbers (for example, 20.5° becomes 20°).

To enter an obstruction, position the pointer over the azimuth / elevation coordinate where the obstruction begins, and click; the coordinates of that point are displayed in a box in the lower right-hand corner. Then, move the pointer to the next point on the outline of the obstruction, and click again. Continue this until you have outlined the obstruction, at which point the shape is “filled in”. If you have multiple obstructions, do the same for each one.

Each obstruction must begin and end at the horizon. If you have multiple obstructions, you must complete one before beginning the next one, unless they are all connected together.



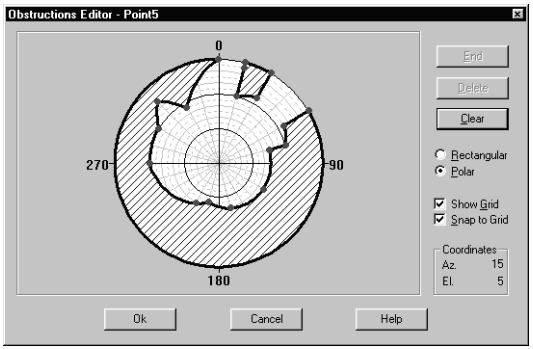


Note that as you begin to draw, the top button is labeled **<Reset>**; clicking on it allows you to delete the current obstruction without finishing it. As you continue to draw, the button's label changes to **<End>**; clicking on it at any point closes the polygon, at which point the shape is "filled in".

If you wish to remove a finished polygon, click anywhere on it and then click on **<Delete>**.

If you wish to clear all obstructions and start over, click on **<Clear>**. If you do so, the message "Clear all obstructions for this site?" will appear; enter your response at the prompt.

The default screen displays the obstructions in rectangular coordinates; if you prefer to view or edit them in polar coordinates, click on the **Polar** radio button to see a ***Polar Plot*** display. You can switch back and forth between rectangular and polar coordinates whenever you wish. Note that as each polygon is closed, its color and fill pattern change.

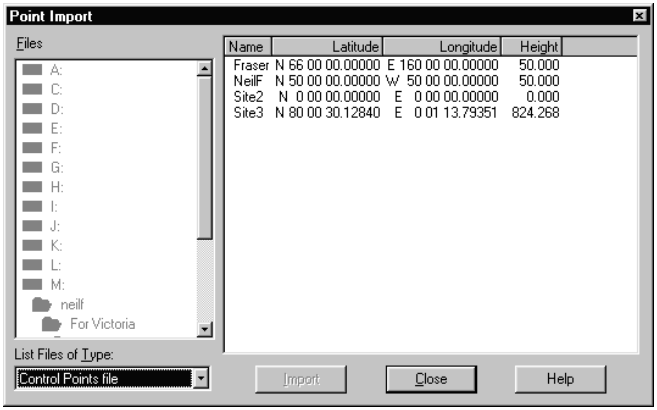


You can also enable or disable the grid itself by selecting or deselecting the **Show Grid** check box; the grid is only there if you find it convenient. If the grid is visible, you can select or deselect the **Snap to Grid** check box if you want the line to jump to the nearest grid intersection point when you click, or whether you wish to draw "freehand".

If you are satisfied with the obstructions that you have entered, click on **<OK>** to associate them with the point and return to the ***Point Editor*** dialog. If you wish to return to the ***Point Editor*** dialog without saving the obstructions, click on **<Cancel>**.

3.3.2 Import a Point

To import a point, select **Edit | Points...** or **Edit | Control Points...**, then click on **<Import>**.

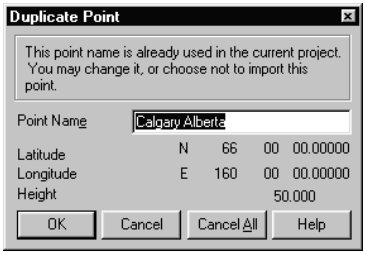


Under the **List Files of Type** drop-down list box in the lower left-hand corner, the Post-Processor File (*.SPR) file type appears by default. If you prefer to import points from a *Planning* project file, you could select a different filter (PLN file extension) from this list box. The other choice in the list box is Control Points File, which consists of Points you have created in the Point Editor dialog, see Section 3.3, *Creating a Point*, Page 3-3. Please note that you can open a control point directly from Planning by selecting **Edit | Control Points** from the menu.

With a project open, points can be imported from a specified location. Points are displayed in the right-hand list box, together with their WGS84 geographical coordinates (latitude and longitude only). Multiple points can be selected at a time. All column widths are manually resizable.

The **<Import>** button is enabled when at least one point has been selected. Choosing Import copies all selected points to the current project. The maximum number of points in a project is verified when importing points. Once the action has been performed, a confirmation message appears.

Duplicate point names are not allowed; if you are attempting to import a point to a project that already has that name in its local database, the ***Duplicate Point*** dialog appears. You can cancel importing the point with the duplicate name using **<Cancel>**, or cancel the Import command using **<Cancel All>**.



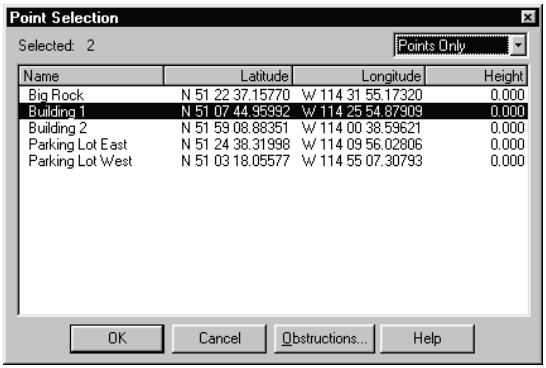
3.3.3 Editing the Control Point Database

You are able to edit the Control Point database by adding points, deleting points, and editing a point's coordinates and elevation data. Making changes to the control point database does not alter points that have already been imported to a project.

For more information see Section 3.3.1, *Define a Point*, Page 3-4.

3.3.4 Point Selection

When planning for data collection, you may wish to determine which satellites are simultaneously visible from all selected points. *Planning* allows you to select multiple points / control points from the dialog invoked by choosing **Edit | Point Selection...** from the main menu:



Use your mouse to select the points that you wish to analyze at the same time.

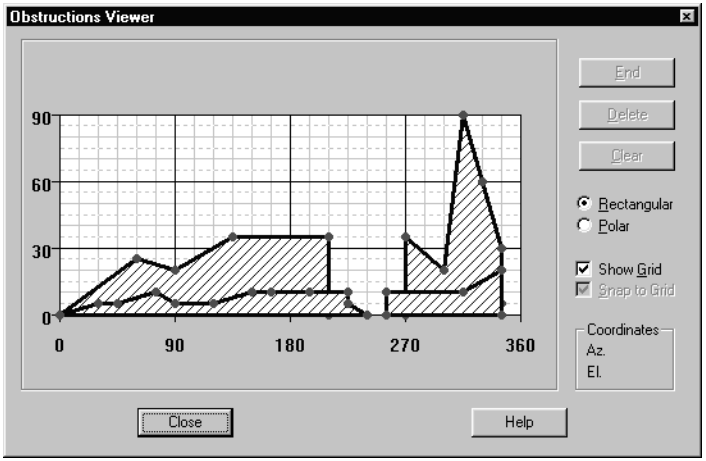
The way that *Planning* handles this task is to compute the location of a point whose coordinates are the average of those of the selected points (for example, average latitude, average longitude, average height). The obstructions of each point are added together to form a composite obstruction pattern, and then the analysis is performed. That is why the coordinates and obstructions of this “average” point are different from any of the ones of the selected points.

The combo box in the upper right corner allows you to view only the points that you have entered or included, or else the points that you have entered or included plus the control points. The control points are persistent. If you select a control point in one project, it will be "selected" in all projects.

Click on **<OK>** to use the selected point(s) for analysis purposes.

Click on **<Cancel>** to return to the previous dialog without using the selected point(s) for analog purposes.

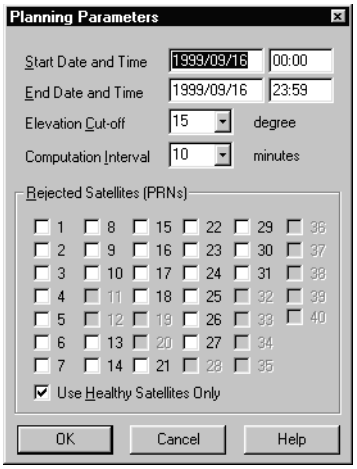
If you click on **<Obstructions>**, you will see (but will not be able to edit) the composite obstruction pattern of the "average" point:



3.4 Planning Parameters

Once an almanac has been imported and points have been selected, *Planning* is ready to perform various types of analysis based on default planning parameters. Should you wish to change any of these parameters, you could do so from the ***Planning Parameters*** dialog that appears when you select **Edit | Parameters…** from the main menu, or **Parameters…** from the shortcut menu.

✉ **Note:** If you have not yet opened an almanac, you will be prompted to load an almanac.



Start/End Date and Time .... The planning period, given by a starting and an ending date and time, cannot exceed 24 hours. The date and time follows the format currently in use in the *Planning* (set in **Tools | Options | Time**). Remember that each day, a particular configuration of GPS satellites is visible 4 minutes earlier than the day before. If you have made an error when entering information, you may see one or both of these messages:

- The total planning period can not exceed 24 hours
- Ending time cannot precede starting time

Elevation Mask ..... The elevation mask angle has a range of 0 - 90° (integer values only). You may enter a value directly or choose one from the drop-down list. This value might range from 5 - 10° on a flat prairie, to 25 - 35° in a forested area. A satellite “rises” when it goes above the elevation mask angle, and “sets” when it goes below the elevation mask angle.

Computational Interval ..... The computation interval defines the time resolution of the results, that is, the number of time segments into which the planning period is divided. The computation interval for the epoch has a range of 1 - 60 minutes (integer values only). You may enter a value directly or choose from a value in the drop-down list.

Rejected Satellites..... A check box is associated with each of the satellites contained within the project's current almanac. If a satellites' PRN is not present in the almanac, then its associated check box is disabled. If a satellite is set "Unhealthy", then its check box and its associated PRN number are highlighted in a different color.

Use Healthy Satellites Only If you select this check box, *Planning* does not use any satellites whose status is listed as "Unhealthy". The check boxes of unhealthy satellites would then be disabled.

Click on **<OK>** to save any changes. *Planning* then computes epochs, DOP factors (GDOP, PDOP, HDOP, VDOP and TDOP), and the rise/set times of each satellite. If a graphic view is open, it is refreshed with the new information.

Click **<Cancel>** to return to the previous dialog without having changed any of the settings.

Chapter 4 Analyzing Your Results

4.1 Examining the Analysis Results

Planning is able to perform six types of analysis with respect to the selected point(s):

- Print the Azimuth and Elevation data of satellites in table form
- For each satellite, show at which times during the planning period it will be visible
- At any time during the planning period, show how many satellites will be simultaneously visible
- Display the orbits of each satellite on a rectangular sky plot
- Display the orbits of each satellite on a polar sky plot
- Plot GDOP, PDOP, HDOP, VDOP and TDOP factors versus time

Each of these is described in further detail below.

You can use these to evaluate “What if...?” scenarios. For example, you could tell what impact varying the elevation mask angle would have on the data collection effort at a particular point. You could do this by changing the Planning Parameters. Or you could see what impact obstructions have by enabling or disabling them (either by selecting **View | Obstructions** on the main menu, or by selecting **Obstructions** from the shortcut menu).

If an almanac and at least one point are not selected, you may see these messages:

- A point must be selected before starting computation
- The current project does not have an almanac loaded

4.1.1 Menus

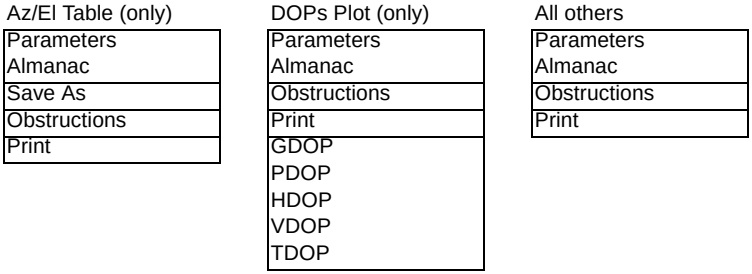
The following shows the menu structure associated with the main menu bar once a project is opened, an almanac imported, a point(s) selected, or an analysis option chosen. Each menu item contains a drop-down list of options to aid you in processing your data. Also shown is the shortcut menu available when the view window is active (all except “DOPs Plot”).

File	Edit	View	Tools	Receiver	Window	Help
New	Control Points	Obstructions	Az/El Table	Edit Schedules	Cascade	Contents
Open	Points	Status Bar	Visible SVs Plot	Edit Configurations	Tile	Search for Help on
Close	Point Selection	Toolbar	Number SVs Plot		Arrange Icons	Using Help
Save	Parameters		Polar Sky Plot		Close Window	About
Save As	Mapping System		Rectangular Sky Plot		Close All	
Almanac			DOPs Plot		(list of open windows)	
Print Print Preview Print Setup			Options			
Exit						

The tables below show the menu structure, associated with the menu bar, and the shortcut menu available when the view window is active for “DOPs Plot” only (same as menu above, except for the View menu item).

File	Edit	View	Tools	Receiver	Window	Help
		GDOP PDOP HDOP VDOP TDOP				
		Obstructions				
		Status Bar Toolbar				

The shortcut menus also change when you view a graphic window. Recall that a shortcut menu is invoked by right-clicking on any region of its associated graphic view:



4.1.2 Azimuth / Elevation Table

Selecting **Tools | Az/El Table** from the main menu displays ephemerides information for a specified location, mask angle, and time period. The ***Azimuth/Elevation Table*** consists of three sections:

- **The header section** containing information about *Planning* and the data used for computations (for example, which satellites, if any, have been excluded from these calculations).
- **The Rise/Set table** containing the time at which the satellites rise and set.
- **The actual Azimuth/Elevation table** containing, for each interval, the visible satellites with their azimuth and elevation.

A satellite, which rose above an elevation of 0 degrees at least once, but never exceeded the mask angle during the planning period, will still be shown in the Rise and Set table. However, its Rise, Set and In View entries will be labeled “none”.

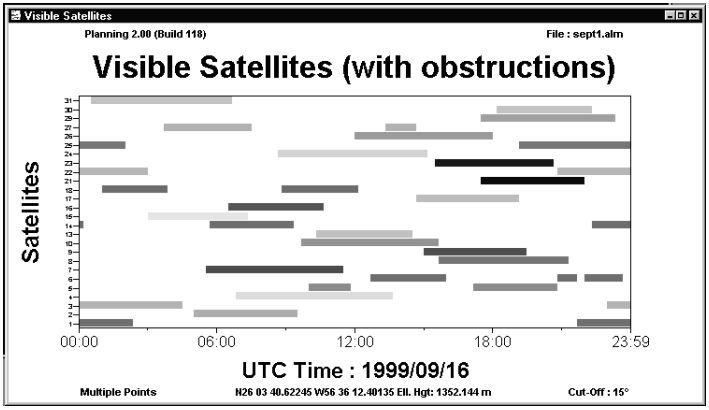
A partial printout of an Az / El table is shown following:

```
Planning 2.00
 Project:          C:\Sokkia\planning\almanac.PLN
 Almanac:          I:\Data\Raw\almanac\sept1.alm
 Date:             1999/09/16 (UTC)
 Time:             From 00:00 to 23:59
 Mapping System: GEO                        [Geographic]
 Datum:            NAD83 (US feet)
 Position:         N 33 00 00.00000, E 80 00 00.00000, 25.000
 SVs Disabled:    41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56
                  57 58 59 60
 SVs Visible:     1 2 3 4 5 6 7 8 9 10 13 14 15 16 17 18 21 22 23
                  24 25 26 27 29 30 31
 Mask Angle:      15 degree
 Obstructions Used: Yes
 PRN      |    1      2      3      4      5      6      7      8
 ---------+-------------------------------------------------------
 Rise:    | 08:50  16:10  12:00         05:50         17:20 04:40
 Azimuth  |  298    293    182           140           260    189
          |
 Set:     | 13:40  21:10  17:00  01:20  09:50  03:20  23:10 09:50
 Azimuth  |  189    183     72    124     47    227    152     79
          |
 In View: | 04:50  05:00  05:00  01:20  04:00  03:20  05:50 05:10
 ---------+-------------------------------------------------------
 Rise:    | 20:50               19:20  20:50  09:30
 Azimuth  |   60                 230    317    117
          |
 Set:     | 21:40                      23:40  12:40
 Azimuth  |   39                        247     40
          |
 In View: | 00:50               04:39  02:50  03:10
 ---------+-------------------------------------------------------
 Rise:    |                                   23:40
 Azimuth  |                                    316
          |
 Set:     |
 Azimuth  |
          |
 In View: |                                   00:19
 ---------------------------------------------------------------
 Time  N     1       2       3       4       5       6     7    8
 ---------------------------------------------------------------
 00:00   2     .     .     .   [102/44]<242/07>[313/22]    .    .
 00:10   3     .     .     .   [105/40]<240/04>[311/26]    .    .
 00:20   3     .     .     .   [109/36]<237/01>[309/29]    .    .
 00:30   3     .     .     .   [112/32]    .   [306/32]    .    .
 00:40   3     .     .     .   [114/28]    .   [302/35]    .    .
 00:50   4     .     .     .   [117/24]    .    298/37     .    .
```

You can save this table in ASCII format by selecting **File | Save As** from the main menu.

4.1.3 Visible Satellites Plot

Selecting **Tools | Visible SVs Plot** from the main menu displays the ***Visible Satellites*** window.



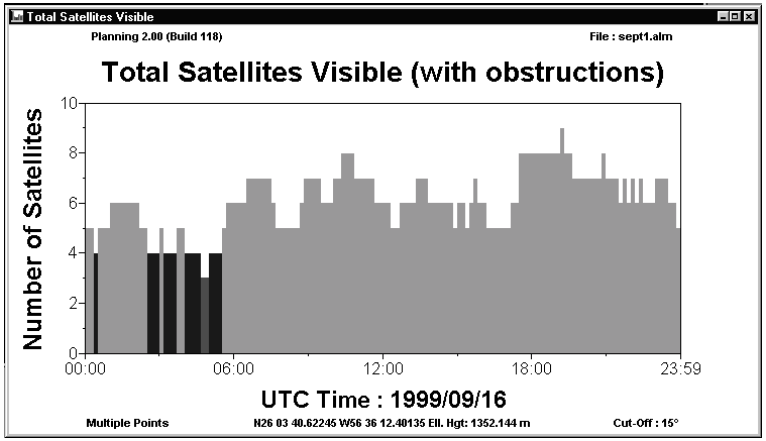
This visible satellites analysis shows the following:

- the identification of each satellite that is visible during the planning period; this allows you to perform data collection during times when certain satellites are in view. Each satellite's PRN is listed along the vertical axis, and the time is listed along the horizontal axis. The time notation follows the default format; select **Tools | Options | Time** to choose a different style.
- the name of the almanac file which was used
- whether or not obstructions were used in the analysis; you can enable or disable them either by selecting **View | Obstructions** on the main menu, or by selecting **Obstructions** from the shortcut menu.
- the planning period (date and time)
- the elevation mask angle
- whether the analysis is for one point or multiple points. If planning was done for only one point, its name and coordinates

are shown. If multiple points were selected, *Planning* computes the location of a point whose coordinates are the average of those of the selected points. The obstructions of each point are added together to form a composite obstruction pattern, and then the analysis is performed.

4.1.4 Number of Visible Satellites Plot

Selecting **Tools | Number SVs Plot** from the main menu displays the ***Total Satellites Visible*** window.



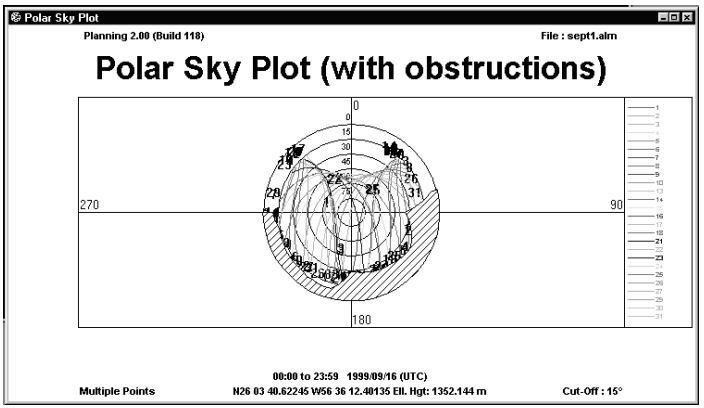
The total satellites visible analysis shows the following:

- the number of satellites that are visible at specific times during the planning period; this allows you to perform data collection during times when there are an optimal number of satellites in view – in other words, for the shortest possible point occupation. The number of satellites is listed along the vertical axis, and the time is listed along the horizontal axis. Different colors are used: green (if more than four satellites are visible at a time), blue (if exactly four satellites are visible at a time), and red (if less than four satellites are visible at a time). The time notation follows the default format; select **Tools | Options | Time** to choose a different style.
- the name of the almanac file which was used

- whether or not obstructions were used in the analysis; you can enable or disable them either by selecting **View | Obstructions** on the main menu, or by selecting **Obstructions** from the shortcut menu.
- the planning period (date and time)
- the elevation mask angle
- whether the analysis is for one point or multiple points. If planning was done for only one point, its name and coordinates are shown. If multiple points were selected, *Planning* computes the location of a point whose coordinates are the average of those of the selected points. The obstructions of each point are added together to form a composite obstruction pattern, and then the analysis is performed.

4.1.5 Polar Sky Plot

Selecting **Tools | Polar Sky Plot** from the main menu displays the ***Polar Sky Plot*** window.



The polar sky plot analysis shows the following:

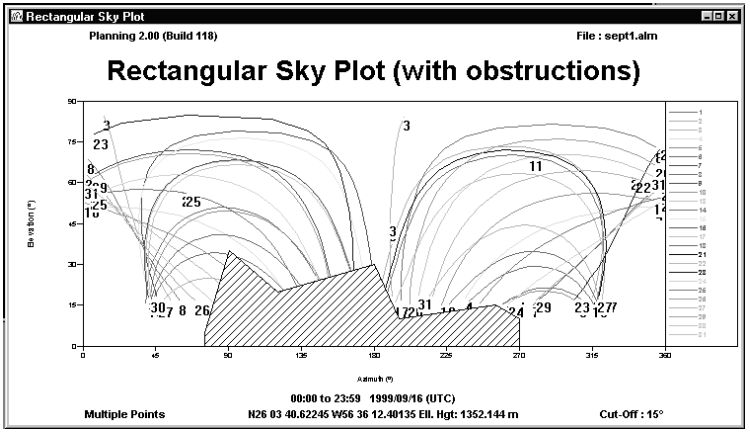
- the orbits of each visible satellite, in polar format. Each satellite's PRN, and the color assigned to it, are listed along the right-hand side of the plot. The circles represent the elevation (0-90 degrees), and the azimuth is shown from 0-360 degrees. For a given azimuth, then, you can tell how high in the sky each satellite will

rise. Or, for a given elevation angle, you could tell which satellites would rise that high. The time notation follows the default format; select **Tools | Options | Time** to choose a different style.

- the name of the almanac file which was used
- whether or not obstructions were used in the analysis; you can enable or disable them either by selecting **View | Obstructions** on the main menu, or by selecting **Obstructions** from the shortcut menu.
- the planning period (date and time)
- the elevation mask angle
- whether the analysis is for one point or multiple points. If planning was done for only one point, its name and coordinates are shown. If multiple points were selected, *Planning* computes the location of a point whose coordinates are the average of those of the selected points. The obstructions of each point are added together to form a composite obstruction pattern, and then the analysis is performed.

4.1.6 Rectangular Sky Plot

Selecting **Tools | Rectangular Sky Plot** from the main menu displays the ***Rectangular Sky Plot*** window.



The rectangular sky plot analysis shows the following:

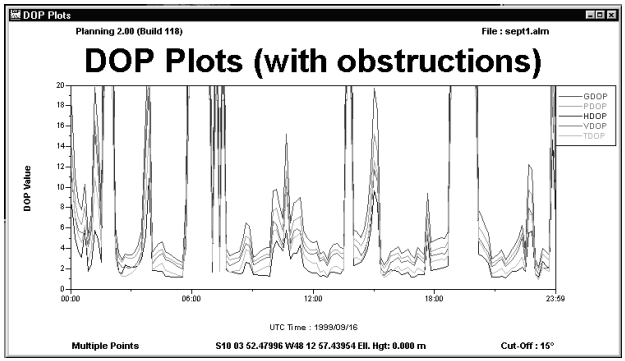
- the orbits of each visible satellite, in rectangular format. Each satellite's PRN, and the color assigned to it, are listed along the right-hand side of the plot. Elevation is listed along the left-hand vertical axis, and azimuth is listed along the horizontal axis. For a given azimuth, then, you can tell how high in the sky each satellite will rise. Or, for a given elevation angle, you could tell which satellites would rise that high. The time notation follows the default format; select **Tools | Options | Time** to choose a different style.
- the name of the almanac file which was used
- whether or not obstructions were used in the analysis; you can enable or disable them either by selecting **View | Obstructions** on the main menu, or by selecting **Obstructions** from the shortcut menu.
- the planning period (date and time)
- the elevation mask angle
- whether the analysis is for one point or multiple points. If planning was done for only one point, its name and coordinates are shown. If multiple points were selected, *Planning* computes the location of a point whose coordinates are the average of those of the selected points. The obstructions of each point are added together to form a composite obstruction pattern, and then the analysis is performed.

4.1.7 Dilution of Precision Plots

Dilution of Precision (DOP) parameters, values with no units, express the geometric strength of the current satellite geometry; the lower the value, the better. DOP values can be expressed in the following components, among others:

- **GDOP** - represents all parameters (latitude, longitude, height, time)
- **PDOP** - represents 3D parameters (latitude, longitude, height)
- **HDOP** - represents the 2D component (latitude, longitude)
- **VDOP** - represents only the height component
- **TDOP** - represents only the time component

Selecting **Tools | DOPs Plot** from the main menu displays the ***DOP Plots*** window.



The DOP plots analysis shows the following:

- how the various DOP parameters fluctuate with time; this allows you to perform data collection during times when DOP values are optimal (for example, suppose someone only wanted to collect data while DOP values were less than 3). The DOP value is listed along the left-hand vertical axis (recall that this scale can be modified from **Tools | Options | General** on the main menu), the time is listed along the horizontal axis, and the color assigned to each DOP parameter is listed on the right-hand side of the plot. You can have as many or as few of these DOP parameters displayed as you wish; this is controlled from the shortcut menu (right-clicking anywhere on the graphic), or from the ***View*** category on the main menu. The time notation follows the default format; select **Tools | Options | Time** to choose a different style.
- the name of the almanac file which was used
- whether or not obstructions were used in the analysis; you can enable or disable them either by selecting **View | Obstructions** on the main menu, or by selecting **Obstructions** from the shortcut menu.
- the planning period (date and time)
- the elevation mask angle
- whether the analysis is for one point or multiple points. If

planning was done for only one point, its name and coordinates are shown. If multiple points were selected, *Planning* computes the location of a point whose coordinates are the average of those of the selected points. The obstructions of each point are added together to form a composite obstruction pattern, and then the analysis is performed.

Chapter 5 Receiver Operations

Planning can communicate with receivers, such as Radian™, to establish two types of data collection options:

Configurations ... Receivers can collect several types of data. A configuration is a file that tells the receiver what type of data to collect, when the data should be collected and where the data should be stored (for example the PCMCIA card). Use the default POWERUP configuration for manual data collection and other configurations for associating with a schedule.

Schedules..... A schedule is user-defined setting that tells the receiver a specific time to start and end data collection. By associating a configuration with the schedule, you determine what types of data are collected during the scheduled time. This feature is helpful for collecting data even when you are absent.

These operations can be accessed from the Receiver menu. These operations, as well as receiver communications, are discussed in this chapter.

5.1 Receiver Configurations

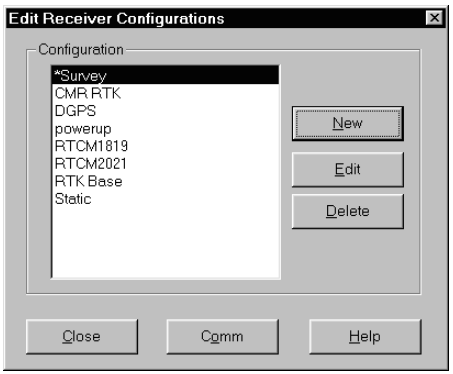
To schedule your Radian Receiver to automatically start logging data at a specific time, you must create a receiver configuration, include it in a session in a schedule and transfer it to the receiver. When configuring your receiver, you can define the configurations settings

to determine the type of information the receiver collects. These receiver configurations consist of the log type, the data destination, the interval and a description for each log within the configuration.

Configurations are transferred to the receiver by setting up sessions in a schedule (See Section 5.2, *Schedule Editor*, on Page 5-17 and Section 5.3, *Communication with a Receiver*, on Page 5-25). By default, a configuration called POWERUP already exists on your receiver (Please refer to your *Radian Operations Manual* for detailed information on the POWERUP configuration). The POWERUP configuration will override all schedules on your receiver when the receiver is first powered on. If you want the configurations in a schedule to start when the receiver is powered on, you must delete the POWERUP configuration from the Radian receiver.

✉ **Note:** If a POWERUP configuration and schedule both exist on your receiver, and the receiver is in sleep mode, waking up the receiver will not start the POWERUP configuration. The POWERUP configuration only overrides the schedule when the receiver is powered on.

To create new receiver configurations select **Receiver | Edit Configurations...** from the menu. The ***Edit Receiver Configurations*** dialog appears.



This dialog has a list box showing the names of all current configurations including configurations you defined as well as default configurations setup in the software. Notice that the preset *Survey configuration and Powerup configuration cannot be deleted from the software. These receiver configurations are setup to store necessary information to the PCMCIA card. All other preset configurations can be deleted from the software. For a list of default configurations, see Section 5.1.1, *Using Preset Receiver Configurations*, Page 5-3.

From the ***Edit Receiver Configurations*** dialog box, you can create new receiver configurations, edit or delete receiver configurations, close the window to return to the main *Planner* window, handle receiver communications setup (See Section 5.3, *Communication with a Receiver*, on Page 5-25) and access the *Planner* help files.

5.1.1 Using Preset Receiver Configurations

Your *Planning* software is setup to include several preset receiver configurations. The configurations allow you to quickly and easily setup schedules without worrying about which logs to include in each configuration. Simply decide what type of logging session you want, and then choose the appropriate configurations.

The list below outlines each of the preset configurations. The configuration name, the logs within the configuration and the interval options are displayed (See Section 5.1.6.2, *Edit Interval Information*, on Page 5-13).

Powerup.....Use this configuration in a schedule when you are working with a receiver that is an RTK base and you want to post-process the data. This configuration is also used for all manual data collection on the receiver.

Type of Information	Description
rged ontime 10.0	GPS data logged every 10 seconds
repb onchanged	ephemeris data logged every time it changes
rasb onchanged	almanac data logged every time it changes
rtcaobs ontime 1.0	reference station GPS data received every second
rtcaref ontime 10.0	reference station position received every 10 seconds
posave 0.025	the receiver will average its position for 0.025 hours (1.5 minutes) and then fix its position
The first three types of information (rged, repb and rasb) are typically used for post processing and are logged to the PCMCIA card. The last three (rtcaobs, rtcaref and posave) are typically used for an RTK base station and are transmitted out of COM port 2.	

Static Survey .....Use this configuration when collecting static and rapid static data. All data is stored on the PCMCIA card.

Type of Information	Description
rged ontime 10.0	GPS data logged every 10 seconds
repb onchanged	ephemeris data logged every time it changes
rasb onchanged	almanac data logged every time it changes

RTK Base.....Use this configuration when working with an RTK base receiver and post-processing is NOT required. All data is sent to COM port 2[1]

Type of Information	Description
rtcaobs ontime 1.0	reference station GPS data received every second
rtcaref ontime 10.0	reference station position received every 10 seconds
posave 0.025	the receiver will average its position for 0.025 hours (1.5 minutes) and then fix its position

CMR RTK Base.....Use this configuration when the receiver is an

1.The base station's coordinates must be entered or you must select the option for a base station's coordinates to be computed (based on meeting standard deviation or time interval criteria)

RTK base working with rover receivers that support the CMR format. All data is sent to the COM port 2[1]

Type of Information	Description
cmrobs ontime 1.0	Trimble format reference station GPS data received every second
cmrref ontime 10.0	Trimble format reference station position received every 10 seconds
posave 0.025	the receiver will average its position for 0.025 hours (1.5 minutes) and then fix its position

RTCM1819 Base .....Use this configuration when the receiver is an RTK base working with rover receivers that support the RTCM1819 format, including Sokkia GSR receivers. All datat is sent to COM port 2[1, 2]

Type of Information	Description
RTCM1819 ontime 1.0	RTK differential observations and positions received every second
RTCM3 ontime 10.0	RTK differential observations and positions received every 10 seconds
posave 0.025	the receiver will average its position for 0.025 hours (1.5 minutes) and then fix its position

RTCM2021 Base.....Use this configuration when the receiver is an RTK base working with rover receivers that support the RTCM2021 format, including Sokkia GSR receivers. All data is sent to COM port 2[1, 2]

Type of Information	Description
RTCM2021 ontime 1.0	RTK differential observations and positions received every second
RTCM3 ontime 10.0	RTK differential observations and positions received every 10 seconds
posave 0.025	the receiver will average its position for 0.025 hours (1.5 minutes) and then fix its position

2.You may have to modify the version of RTCM used to either version 2.1 or 2.2. The RTCM version can be modified through a terminal mode.

DGPS Base (RTCM) .....Use this configuration for a DGPS base receiver sending L1 code-only RTCM messages. All data is sent to COM port 2

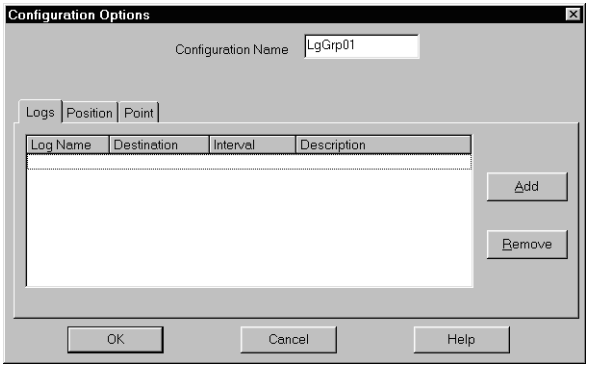
Type of Information	Description
RTCM1 ontime 1.0	RTK differential corrections received every second
posave 0.025	the receiver will average its position for 0.025 hours (1.5 minutes) and then fix its position

5.1.2 Creating Receiver Configurations

If the default configurations provided with the software are not appropriate for the logging session you wish to setup, you can create your own configuration.

✉ **Note:** The option to create new receiver configurations is intended for advanced users only.

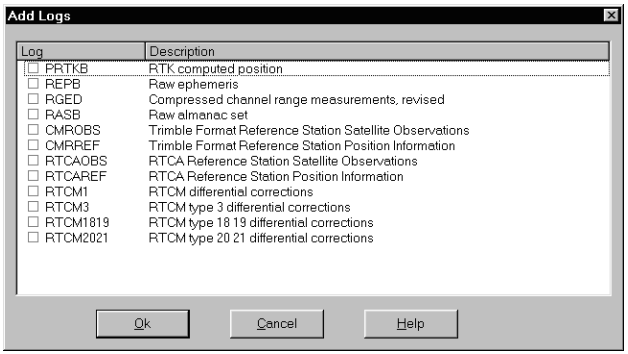
To create a new receiver configuration, click on **<New>**. The ***Configuration Options*** dialog appears.



A receiver configuration consists of information in three tabs: **Log** (See Section 5.1.6, *Edit Logs Tab*, on Page 5-11), **Position** (See Section 5.1.7, *Edit Position Tab*, on Page 5-14) and **Point** (See Section 5.1.8, *Edit Point Tab*, on Page 5-16).

The default **Configuration Name** is LgGrpX where X is the next possible number to make the name unique in the ***Edit Receiver Configurations*** dialog (For example, LgGrp01). The configuration name can be changed but must be unique. Configuration names can be up to eight characters long and the first character of the name can not be a number.

To add logs to the new receiver configuration, click on **<Add>**. The ***Add Logs*** dialog appears.



Select logs by clicking in their respective checkboxes. Deselect a log by unchecking its checkbox.

Click the **<OK>** button to save your changes or the **<Cancel>** button to discard your changes. Both buttons will return you to the ***Configuration Options*** dialog where all logs you have selected are displayed along with their descriptions, default destination and interval settings.

The destination and interval settings can be edited by clicking on a log's **Destination** or **Interval** values, respectively, in the ***Configuration Options*** dialog (See Section 5.1.6.2, *Edit Interval Information*, on Page 5-13 and Section 5.1.6.3, *Edit Destination Information*, on Page 5-14).

Once logs exist in the list box they can also be edited by using the **<Add>** button.

If you click on the **<Remove>** button, the highlighted log will be deleted from the list box immediately.

Click on **<OK>** to save all the changes you have made in the ***Configuration Options*** dialog or **<Cancel>** to discard your changes and return to the ***Edit Receiver Configurations*** dialog.

5.1.3 Deleting Receiver Configurations

Receiver Configurations can be removed from the ***Edit Receiver Configurations*** dialog by clicking on the configuration to highlight it and clicking **<Delete>**.

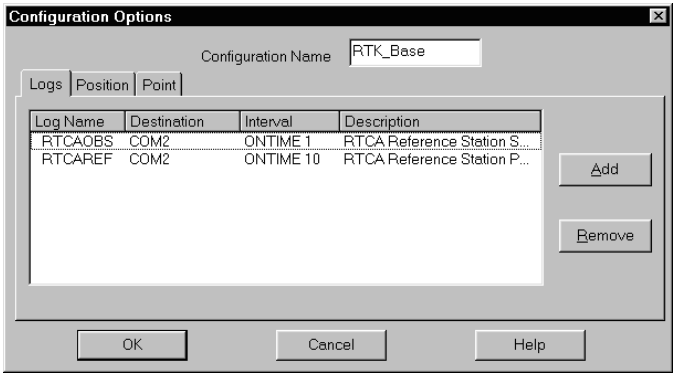
To clear a configuration stored on a receiver, use the **<Device Utilities>** option in your *Spectrum Survey* software. This option is accessed through Spectrum Survey by pressing the **<Device>** button in the dialog box invoked by selecting **File | Receive** from the main menu (For more information, refer to your *Spectrum Survey Reference Manual*).

Before the configuration is permanently deleted from the configuration window, you will be asked to confirm your decision.

Select **<Yes>** to delete the configuration or **<No>** to cancel the request and return to the ***Edit Receiver Configurations*** dialog box.

5.1.4 Editing Receiver Configurations

To edit any receiver configurations except the *Survey configuration, double-click on the configuration you wish to change (or highlight it and click on **<Edit>**). The ***Configuration Options*** dialog appears.



This dialog displays the name of the configuration selected in the **Configuration Name** edit box, from where you can change the name.

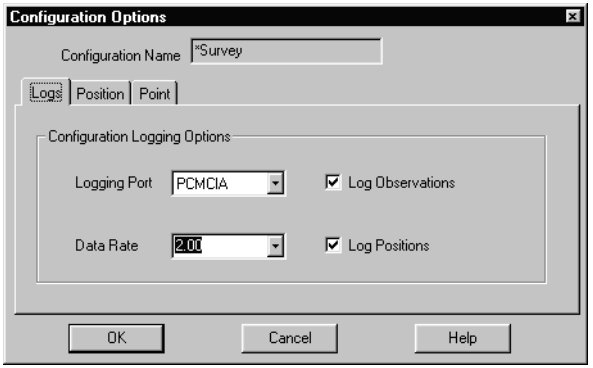
The first tab in the ***Configuration Options*** dialog box is the **Logs** tab which contains a list box that is split into four columns labeled **Log Name**, **Destination**, **Interval** and **Description**.

The **Log Name** and **Description** columns can not be edited directly.

To edit the **Interval** (See Section 5.1.6.2, *Edit Interval Information*, on Page 5-13) or **Destination** (See Section 5.1.6.3, *Edit Destination Information*, on Page 5-14), double click on the destination or the interval you want to edit and then make the changes in the dialog box presented.

5.1.5 Edit *Survey Configurations

To edit the *Survey configuration, double-click on it (or highlight it and click on **<Edit>**). A modified ***Configuration Options*** dialog appears.

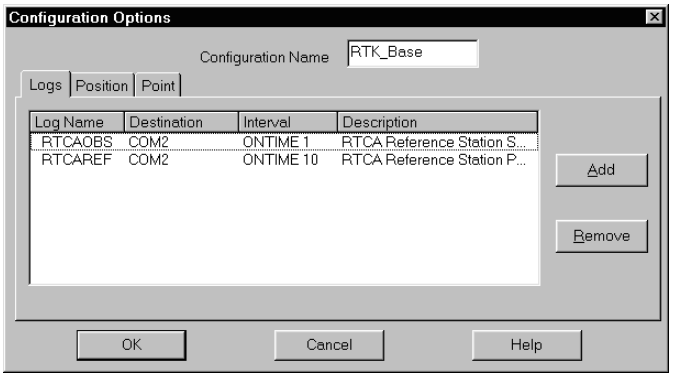


The first tab in the dialog is the **Logs** tab.

The amount of editing you can do to the *Survey configuration is limited. You can select a different data destination (For example, PCMCIA, COM1 or COM2) by clicking on the **Destination** drop down box, or a different data rate by clicking on the **Data Rate** drop down box, and toggle the logging of observation and position information in their respective checkboxes.

5.1.6 Edit Logs Tab

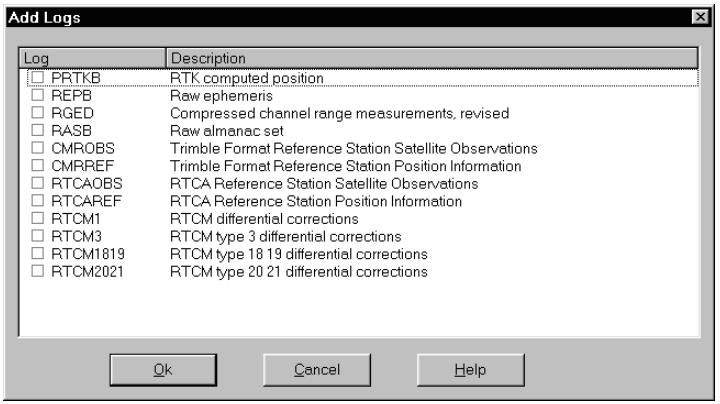
The first tab in the ***Configuration Options*** dialog box is the **Logs** tab.



This tab has a window that is divided into four columns: **Log Name**, **Destination**, **Interval** and **Description**. Logs selected for configurations will appear in this window and can be edited or removed using the **<Add>** or **<Remove>** buttons found on the right side of the window.

5.1.6.1 Add or Edit a Log Type

In general, to add or edit a log type, highlight its row in the **Logs** tab list box and click on **<Add>**. The ***Add Logs*** dialog appears.

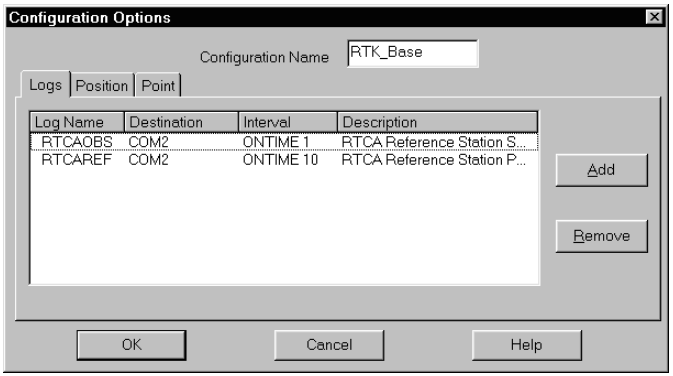


✉ **Note:** Editing in the ***Add Logs*** dialog box is for advanced users only.

All logs currently displayed in the list box of the ***Add Logs*** dialog have their checkboxes checked in this dialog. Select or deselect logs for your configuration by checking or unchecking their checkboxes respectively.

✉ **Note:** If a log is unchecked and then re-checked, the previous state of the log (destination and interval) is remembered and does not revert to the default values.

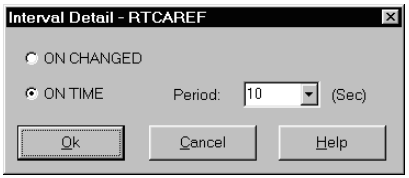
Click **<OK>** to save your changes or **<Cancel>** to discard your changes and return to the ***Configuration Options*** dialog. Any logs you save with a checked checkbox will appear in the **Logs** window of the ***Configuration Options*** dialog.



Each log is displayed separated into four columns: **Log Name**, **Destination**, **Interval** and **Description**. Only **Interval** (See Section 5.1.6.2) and **Destination** (See Section 5.1.6.3, *Edit Destination Information*, on Page 5-14) can be clicked on and edited.

5.1.6.2 Edit Interval Information

A log's interval information is what determines when and how often the Radian receiver will collect that logs information (For example, if the interval for the range measurements log (RGED) is set to ON TIME 2, the receiver will log range measurements every two seconds). To edit interval information in the **Logs** tab for a particular log, click in the **Interval** column on the Interval value of the log you want to edit. The ***Interval Detail*** dialog for the selected log appears.



Select an interval by clicking on one of the options:

On Changed ..... Choose this option if you want the information collected only if it changes. For example, if you select the almanac log (rasb), you can choose the On Changed option so when the schedule is run, the receiver will collect almanac information once and not again unless the almanac information changes.

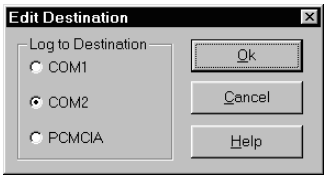
On Time ..... Choose this option if you want to specify when the receiver should collect the information. For example, if you specify On Time 5, the information is collected every 5 seconds.

On the right of the dialog is the **Period** drop down box. This option is grayed out unless the **ON TIME** radio button is selected. In this case you can enter or choose a time period between 0.25 and 3600.

Click **<OK>** to save your changes or **<Cancel>** to discard your changes and return to the ***Configuration Options*** dialog.

5.1.6.3 Edit Destination Information

To edit destination information for a particular log, click on the destination value of the log. The ***Edit Destination*** dialog appears.



Choose a destination from the **Log to Destination** options. If the configuration is intended for use with an unattached receiver, then the **<PCMCIA>** radio button should be chosen so that data file information can be saved (See Section 5.2, *Schedule Editor*, on Page 5-17).

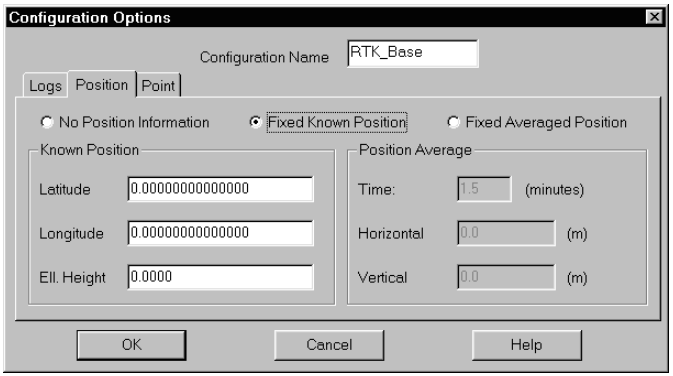
Click **<OK>** to save your changes or **<Cancel>** to discard your changes and return to the ***Configuration Options*** dialog.

5.1.7 Edit Position Tab

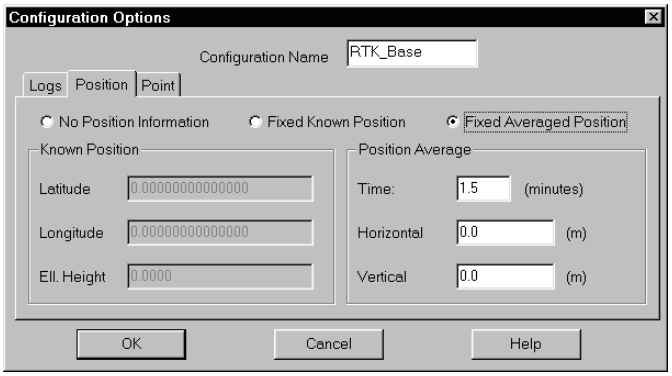
The second tab in the ***Configuration Options*** dialog is the **Position** tab. Click in one of the radio buttons that give you the option of having no position information, known fixed position information (a static point) or single-point averaging information.

If you choose **No Position Information** then the **Position** tab's left and right edit boxes are grayed out. Note that the *Survey group always has the **No Position Information** radio button selected and cannot be changed to the other options.

If you choose **Known Fixed Position** then you must enter position information (latitude, longitude and ellipsoidal height) on the left side of the **Position** tab.



For the **Fixed Averaged Position** option, the right side of the **Position** tab becomes editable.



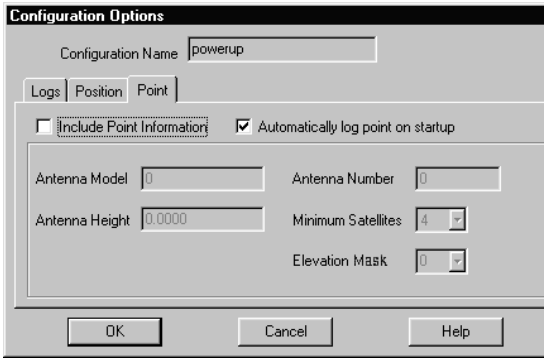
You can enter the criteria by which you would like the position averaging to stop.

Position averaging will stop either before a certain time period in minutes (a maximum of 60 and a minimum of 1.5 minutes), if the standard deviation for the horizontal axis (in meters) has been met, or if the standard deviation for the vertical axis (in meters) has been met.

The typical standard deviation range is from 10 cm (3.9 in) to 5 m (16.4 ft). The position will be fixed to the position averaged to that point.

5.1.8 Edit Point Tab

The **Point** tab is the third tab available in the ***Configuration Options*** dialog. It enables you to control whether point information is specified for points automatically logged on startup.



If you want to automatically log a point on startup without entering in your own point information then just check the **Automatically Log Point On Startup** checkbox. However, if you wish to enter specific point information, check the **Include Point Information** checkbox. The editable fields are:

Antenna Model .....Enter the model number for your antenna.

Antenna Height .....Enter the vertical antenna height above ground.

Antenna Number .....Enter your antenna's serial number.

Minimum Satellites ...Select a number from 1 to 9 in the drop down box.

Elevation Mask .....Choose a value for the elevation mask angle from the drop down box or enter an integer between 0 and 90.

In either / both cases the point name is generated automatically.

Click **<OK>** to save all the changes you have made in the ***Configuration Options*** dialog or **<Cancel>** to discard your changes and return to the ***Edit Receiver Configurations*** dialog.

5.2 Schedule Editor

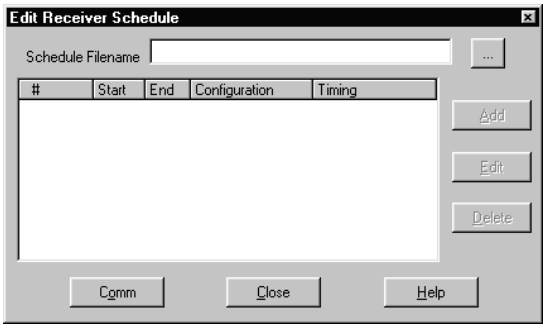
The ***Schedule Editor*** enables you to establish a data collection session on your receiver, much like scheduling a VCR to record when you are not there. After creating the schedule on the PC, you transfer it to the receiver. For more information, see Section 5.3, *Communication with a Receiver*, Page 5-25.

You can schedule up to seven days worth of data logging at a time, with up to 35 sessions per day. Start and stop times must be provided with a resolution of 1 minute. The minimum time interval per logging session is 5 minutes.

The scheduling feature is designed for use with receivers operating in stand-alone mode.

✉ **Note:** If you intend for your schedule to start as soon as you power on your Radian receiver, you will first have to delete the POWERUP configuration from the receiver. Please refer to your *Radian Operations Manual* for more information on schedules and the POWERUP configuration, and see Section 5.1.2, *Creating Receiver Configurations*, Page 5-6).

To schedule the logging of receiver configurations, select **Receiver | Edit Schedules...** from the menu; the ***Edit Receiver Schedule*** dialog appears.



From the ***Edit Receiver Schedule*** dialog you have access to several buttons that, when pressed, do the following:

<...>..... Create or open a schedule. You must perform this step before adding sessions.

<Add>..... Add a session to your schedule. This button is greyed out until a schedule is opened or created.

<Edit> ..... Edit a session in your schedule. This button is greyed out until a schedule is opened or created.

<Delete>..... Delete a session from your schedule. This button is greyed out until a schedule is opened or created.

<Comm> ..... Configure receiver communications (See Section 5.3, *Communication with a Receiver*, on Page 5-25) or access the *Planning* help files.

✉ **Note:** Because your schedule is automatically saved every time you make changes (For example, adding a new session), the current schedule configuration shown in the window of the ***Edit Receiver Schedule*** dialog is the schedule that will be transferred to your receiver.

<Close> ..... Closes the ***Edit Receiver Schedule*** dialog and returns you to the ***Plan View*** window.

<Help>..... Accesses the Planning help files.

The ***Edit Receiver Schedule*** dialog box has a window that is split into five columns. Following is an explanation of these columns:

..... Automatically generated number. The number of sessions per day cannot exceed 35. Click on the + sign to the left of the number to expand the session information. The + sign becomes a – sign. If you click on it, the expanded session information disappears, and it reverts back to a + sign.

Start ..... Displays the start time of the session.

End ..... Displays the end time of the session.

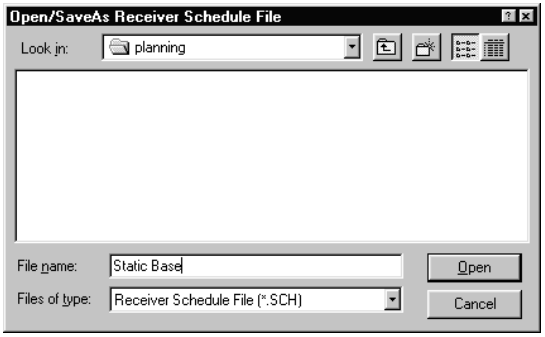
Configuration ..... Displays the name of the configuration used in the session. If the chosen configuration is *Survey then the name displayed in this column is Survey-X, where X is the selected data transfer rate. For example, if the data rate is 10 then Survey-10 will be displayed in this column.

Timing ..... Displays the days of the week chosen (See Table 2, *Weekday Abbreviations*, on Page 24). For example, if you choose to schedule logging on Mondays and Fridays then MF will be displayed in this column.

5.2.1 Add a Schedule

You can open a saved scheduled session or create a new scheduled session from the ***Edit Receiver Schedule*** dialog box.

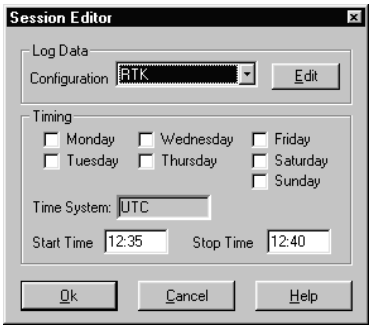
The **Schedule Filename** edit box, in the ***Edit Receiver Schedule*** dialog box, defaults to the path specified in the ***General*** tab of the dialog displayed when you select **Tools | Options** from the main menu. Click on the ellipsis **<...>** button next to the edit box to invoke a file browser in order to locate the destination of your saved schedule or to choose a destination path for your new schedule. The schedule filename defaults to a *.SCH extension.



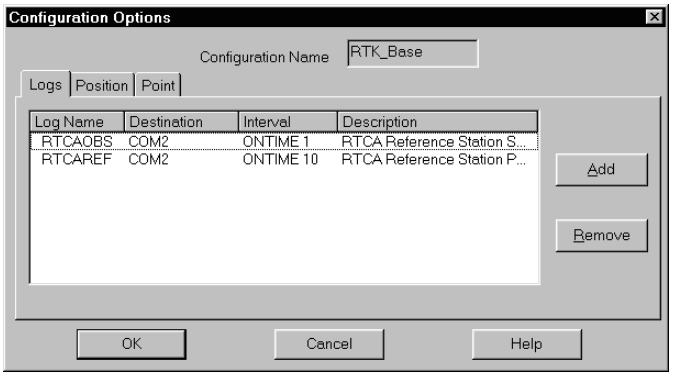
Once you have found the appropriate destination, click on the schedule you wish to open, or type the name of the new schedule in the **File Name** edit box. Click **<Open>** to open or create the schedule.

5.2.2 Add a Session

To add a new session to your schedule, click on **<Add>**. The ***Session Editor*** dialog appears.



Choose a configuration for your session by selecting one of your previously created or software preset configurations in the **Configuration** drop down box (For information on creating a configuration, see Section 5.1, *Receiver Configurations*, Page 5-1). To edit the options associated with the configuration, press the **<Edit>** button to bring up the ***Configuration Options*** dialog box.



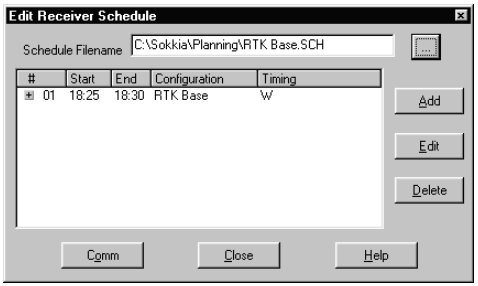
The **Configuration Name** field is not editable. To rename the configuration you must access it through the ***Edit Receiver Configurations*** dialog box (see Section 5.1, *Receiver Configurations*, Page 5-1). Other options (**Logs**, **Position** and **Point**) can be edited in the Configuration Options dialog box. When you are satisfied with the options chosen for the configuration, click **<OK>** to return to the **Session Editor** dialog box.

In the **Session Editor** dialog box, select the day and time options for the session. From the **Timing** section, choose which days you wish the chosen configuration to be logged by clicking on the **Monday** through **Sunday** checkboxes. You may check off multiple days.

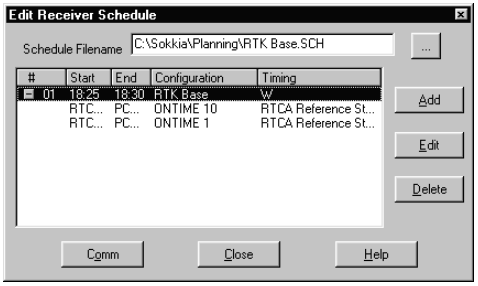
Once you have decided on the days for logging, the next step is to enter a start and stop time in the **Start Time** and **Stop Time** edit boxes respectively. The time system is based on that set in the ***Options*** dialog (**Tools | Options**) and is in HOURS:MINUTES format (For example, 09:29).

The **Time System** edit box is always greyed out. The purpose of this box is to display the currently selected time system as set in the **Time** tab of the dialog opened by selecting **Tools | Options** from the main menu. If the time set in ***Options*** is “Local Time” the box displays **LOCAL**, if the time set is “GPS” the box displays **GPS** and if the time set is “UTC” the box displays **UTC**.

Click **<OK>** to save your changes or **<Cancel>** to discard your changes and return to the ***Edit Receiver Schedule*** dialog.



To the left of each session added to the ***Edit Receiver Schedule*** dialog box, a plus sign indicates that configurations are stored within the session. Clicking on the plus sign will expand the view to display the session and all the logs within the session’s configuration.



Sessions selected in the ***Session Editor*** dialog box, and added to the ***Edit Receiver Schedule*** dialog box, are given an auto-generated filename (See Table 1, *Auto-Generated File Name Conventions*, on Page 23) using the following convention:

- The file name shall be composed of an eight-character base followed by a period and a three character extension.
- Characters 1 through 4 of the base shall be the last four digits of the Radian serial number.
- Characters 5 through 7 of the base shall be the UTC day-of-year (001 - 366).
- Character 8 of the base shall be the session id, an alphanumeric character in sequence 0, 1, 2, ..., 9, A, B, C, ..., Z, and starting with 0 for the first session of a UTC day.
- The file name extension shall be “PDC”.

Character 8 (the last character in the file name) is selected when the session is started by the software looking at the files which are already on the PCMCIA card and selecting the first character in sequence 0,1,2,...,9,A,B,C,...,Z that will produce a filename which does not already exist on the PCMCIA card (For example, if there are 10 scheduled sessions on a particular day, but you turn the receiver ON during the 7th session with a blank PCMCIA card, the last digit for the file created for this session will be 0.). If this procedure does not come up with an "available" file name, a completely random filename is generated.

Table 1: Auto-Generated File Name Conventions

Filename (####$$$%.PDC)	Comments
####	Last 4 digits of the Radian receiver’s serial number
$$$	UTC day of the year (001-366)
%	Log session index (0..9, A-Z)

For example, a Radian receiver might have a serial number such as CGN95450087. A date such as January 25 has a UTC day-of-year representation of 025. The 15^{th} saved schedule on the PCMCIA card would have an entry index of E. Thus, this file would have a name such as 0087025E.PDC.

In an exceptional case, a file-name conflict may occur that prevents the receiver from creating a file with the desired name. In that case, the receiver creates a file name whose first character is a tilde (“~”), followed by a 7-digit random number, and a *.PDC extension (For example, ~9368412.PDC).

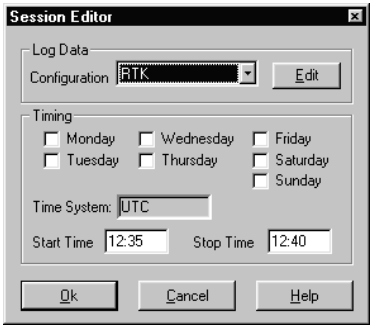
You may not specify overlapping time intervals. All scheduled entries rely on day of the week and UTC time references. Schedule entries assign a one-character code to each of seven days, as shown in Table 2, *Weekday Abbreviations.*

Table 2: Weekday Abbreviations

Weekday	Abbreviation
Sunday	U
Monday	M
Tuesday	T
Wednesday	W
Thursday	R
Friday	F
Saturday	S

5.2.3 Edit a Session

To edit a session in the ***Edit Receiver Schedule*** dialog, highlight it and click on **<Edit>**; the ***Session Editor*** dialog appears.



The details of the Session Editor dialog are described in Section 5.2.2, *Add a Session*, on Page 5-20.

Click **<OK>** to save your changes or **<Cancel>** to discard your changes and return to the ***Edit Receiver Schedule*** dialog.

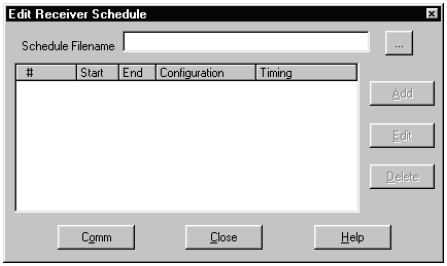
5.2.4 Delete a Session

To delete a session, click on it to highlight it in the ***Edit Receiver Scheduler*** dialog. Click on **<Delete>**.

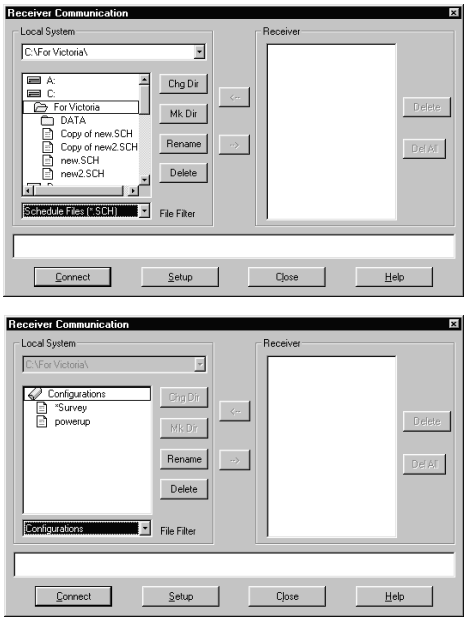
5.3 Communication with a Receiver

Connect your Radian receiver to your PC (refer to your *Radian Operations Manual* for instructions).

To transfer schedules or configurations to or from the receiver select **Receiver | Edit Schedules...** or **Receiver | Edit Configuration...** from the menu. The ***Edit Receiver Schedule*** dialog box or the ***Edit Receiver Configurations*** dialog box will appear, respectively.



Click on the **<Comm>** button to bring up the ***Receiver Communication*** dialog box.

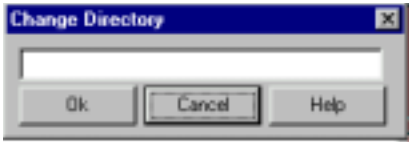


The ***Receiver Communication*** dialog box displays the current default schedule or configuration directory location on the PC in the left panel and the files stored on the connected receiver in the right panel. If the receiver is not connected, the right side is empty.

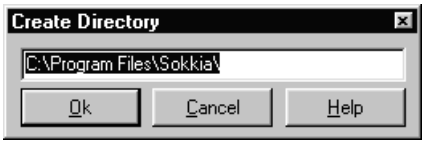
The schedules or configurations displayed in the **Local System** group box are dependant on the filter chosen in the **File Filter** drop down box. The **File Filter** drop down lists three choices: ***Schedule Files*** (*.SCH), ***Configurations*** and ***Show All***. The **Receiver** group box shows only the schedule and configurations stored on the connected receiver.

The ***Receiver Communication*** dialog box enables you to interact with configurations, schedules and directories on your PC by clicking any of the buttons to the right of the **Local System** list box. These buttons are described below:

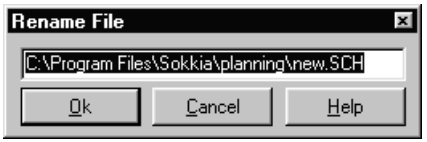
<Chg Dir>..... If you click on this button, a ***Change Directory*** dialog is shown. This button is disabled when the file filter ***configurations*** is selected.



<Mk Dir>..... If you click on this button, a ***Create Directory*** dialog is shown. This button is disabled when the file filter ***configurations*** is selected.



<Rename>..... If you click on this button, a ***Rename File*** dialog is shown. Note that the *Survey and powerup configurations cannot be renamed on the PC.



<Delete>..... If you click on this button, you will be prompted to confirm that you wish to delete the selected schedule or configuration before it is deleted. Note that the *Survey and powerup configurations cannot be deleted from the PC.

The ***Receiver Communication*** dialog box also enables you to delete schedules and configurations on your receiver using the **<Delete>** or **<Delete All>** buttons. These buttons are greyed out when the receiver is disconnected from the PC. The buttons are explained below:

<Delete>..... If you click on this button, the schedule or configuration selected will be deleted from the receiver.

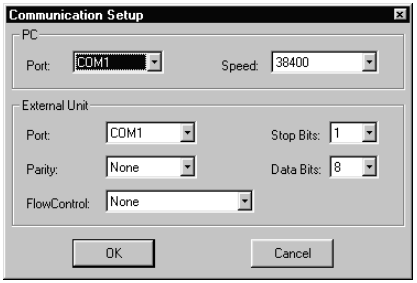
<Delete All>..... If you click on this button, all the schedules and configurations on the receiver will be deleted.

✉ **Note:** Configurations cannot be deleted from the receiver if being used by the current schedule.

The ***Receiver Configuration*** window has several buttons located at the bottom of the dialog box. They are explained below:

<Disconnect> ..... This button closes the current connection to the receiver. The **<Disconnect>** button then becomes a **<Connect>** button. **<Connect>** attempts to establish a new connection to the receiver.

<Setup> ..... This button brings up the ***Communication Setup*** dialog box. The ***Communication Setup*** dialog box has two sections: PC and External Unit.



- The **PC** section has a **Destination** drop down box that allows you to select the COM port where communications will occur, and it has a **Speed** drop down box where you can select the baud rate at which data will be transferred.
- The **External Unit** group box contains five drop down boxes where you can control the **Port**, **Parity**, **Flow Control**, **Stop Bits** and **Data Bits** of communications transfer.

<Close> ..... stops any current transfer or attempt to connect to the receiver, closes the ***Receiver Communication*** dialog and returns you to the ***Edit Receiver***

Schedules or ***Edit Receiver Configuration*** dialog

5.3.1 Transfer from the PC to the Receiver

To transfer schedules and configurations from your PC to a receiver, highlight the schedule or configuration from the **Local System** list box and click on the <⟶> button. The selected schedules and configurations are transferred to the receiver and may then be seen in the **Receiver** list box. The Radian receiver supports only one schedule file at a time (*.SCH), and no other file types can be transferred to the receiver. If you transfer a new schedule file from your PC to the receiver, the schedule file currently on your receiver will be overwritten.

✉ **Note:** Selecting the ***configurations*** heading and pressing <⟶> will transfer all configurations except the *Survey configuration. The *Survey configuration can only be transferred between the receiver and the local system by including it inside a schedule (See Section 5.2, *Schedule Editor*, on Page 5-17).

5.3.2 Transfer from the Receiver to the PC

To transfer schedules and configurations from the receiver to your PC, highlight the schedule or configuration from the **Receiver** list box and click on the <⟵> button. The selected schedule and configurations are transferred to your PC and may then be seen in the **Local System** list box on the left side of the dialog. A schedule file (*.SCH) may be transferred to the PC for editing, before being transferred back to the receiver, instead of creating a new schedule file.

✉ **Note:** Selecting the ***configurations*** heading and pressing <⟵> will transfer all configurations except the *Survey configuration. The *Survey configuration can only be transferred between the receiver and the local system by including it inside a schedule (See Section 5.2, *Schedule Editor*, on Page 5-17).

If, when you try to transfer a schedule to the PC, a schedule.sch file already exists in the directory on the PC, you will be prompted with the dialog ***File Already Exists.*** This dialog enables you to reply with the following options:

<Overwrite>..... this option enables you to replace the current schedule on the PC with the new schedule from the receiver

<Rename>..... this options enables you to give a different name to the schedule.sch that you are transferring to the PC

<Cancel> ..... this option cancels the schedule transfer to the PC

If the configuration you are transferring from the receiver to the PC already exists on the PC, you will be prompted with the dialog box ***Configuration Already Exists***. This dialog will ask if you want to overwrite the configuration and enables you to reply with the following options:

<Yes> ..... this option will tell the software to overwrite the configuration on the PC with the new configuration from the receiver

<Cancel> ..... this option will cancel the transfer of the configuration to the PC

<No>..... this option will tell the software not to overwrite the configuration on the PC with the new configuration from the receiver

The auto scrolling status window near the bottom of the screen displays the current state of the connection and/or transfer between the Radian receiver and the PC.

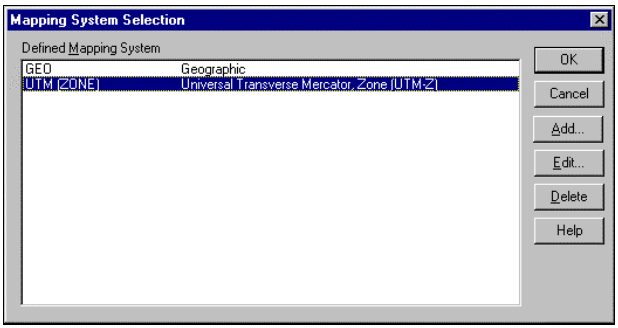
Appendix A Map Projections, Ellipsoids, & Datums

Before data can be displayed, a map projection must be defined. When you are consistently working in the same area, then this map projection need only be defined at the initial set-up. In Planning, data is stored in WGS84 format (latitude, longitude, and height). To view it, you will need to select a map projection. The map projection software which has been incorporated into *Planning* is designed to support 12 different map projections plus two State Plane Coordinate Systems (based on NAD27 and NAD83). Also included is a database of 62 datum templates based upon 23 pre-defined ellipsoids. Using this database, all map projections can be customized and given user-defined names except for State Plane Coordinate System projections. The map projection selected should be based upon the datum used in your area, and therefore may require customization to ensure an accurate graphical representation.

This appendix describes the steps involved in customizing the mapping systems aspect of your work environment. If you do not choose a mapping system, the default selection will be used.

A.1 Mapping System Selection

First, invoke the ***Mapping System Selection*** dialog to select or define a datum and map projection by selecting **Edit | Mapping System**.



From the ***Mapping System Selection*** dialog box, click one of the following buttons:

<OK> ..... after selecting a mapping system, to make the mapping system the new default

<Add> ..... if the list does not include the one mapping system you desire

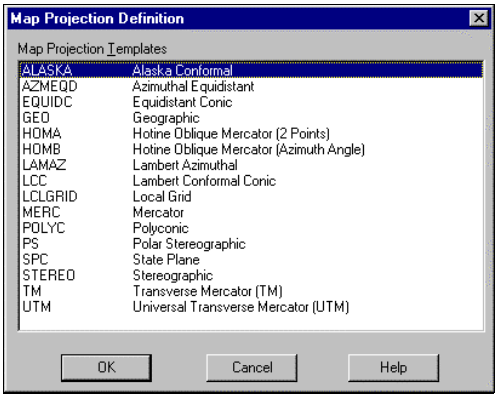
<Delete> ..... after selecting a mapping system, to remove the mapping system from the list

<Edit> ..... after selecting a mapping system, to edit the map projection; this action leads to the appropriate configuration dialog, where you can enter changes directly into the appropriate fields

Important: It is recommended that only advanced users edit these configurations.

You may add as many mapping systems as you want. When you set up customized datums, a USRDATUM.DAT file will be created. When you set up customized map projections, a USRPRJ.DAT file will be created. Without these files, GPS data cannot be displayed correctly. These two files can be found in the System subdirectory (For example, C:\Program Files\Sokkia\Planning\System). If you wish to add your new mapping system to the data collector, then you need to transfer to it these two files (Refer to your *Spectrum Survey Reference Manual* for information on transferring files).

If you clicked on **<Add>** in the ***Mapping System Selection*** dialog, the ***Map Projection Definition*** dialog will appear.



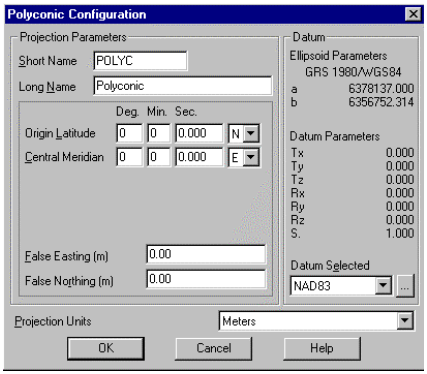
The supported map projections are described in Table 1.

Table 1: Supported Map Projections

Name	Description
Alaska	Alaska (Conformal Stereographic Modified)
AZMEQD	Azimuthal Equidistant
EQUIDC	Equidistant Conic (1 standard parallel)
GEO	Geographic
HOM A	Hotline Oblique Mercator (2 points)
HOM B	Hotline Oblique Mercator (Azimuth Angle)
LAMAZ	Lambert Azimuthal equal-area
LCC	Lambert Conformal Conic
LCLGRID	Local Grid
MERC	Mercator
POLYC	Polyconic
PS	Polar Stereographic
SPC	State Plane
STEREO	Stereographic
TM	Transverse Mercator (TM)
UTM	Universal Transverse Mercator (UTM)

A.1.1 Map Projection Templates

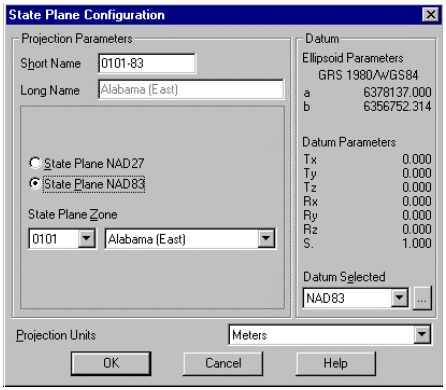
When you add a map projection template from the ***Map Projection Definition*** dialog, or edit a template from the ***Mapping System Selection*** dialog, the template's configuration editor dialog appears. The typical editor dialog will look something like the one for the ***Polyconic Configuration***, shown below, from which you can rename the projection, change the datum, change the projection units, and change certain other parameters.



However, there are three templates whose editors are completely different: SPC, UTM, and LCLGRID. These are briefly described below.

A.1.1.1 State Plane Template

If you choose the SPC (State Plane) template, the ***State Plane Configuration*** dialog appears. In the ***State Plane Zone*** fields, drop-down boxes allow you to choose the desired state plane either by its name or FIPS Zone number. For your convenience, all state plane zones are also listed in Appendix B, *State Plane FIPS Zone Numbers*. The example below shows the State Plane Zone for Alabama (East).



UTM Template

If you select the UTM (Universal Transverse Mercator) template, the ***UTM Configuration*** dialog will appear. There are three options labeled **Auto**, **Manual**, and **Zone**; clicking on each of these buttons will change the dialog. Note that if you click on the **<Zone>** radio button, you will need to enter a Zone Number. To compute the proper value, follow these steps:

1. Add 180° to your longitude (Lon) where (–180° < Lon < 180°)
2. Divide the result in #1above by 6
3. Round up the result in #2 above to the nearest whole number

Example:

If the longitude is -115°, adding 180° yields 65°; dividing by 6 yields 10.833; and rounding to the nearest whole number yields the value of 11.

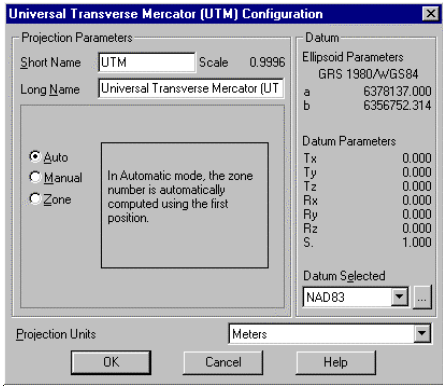


Figure A-1: UTM with Auto selected

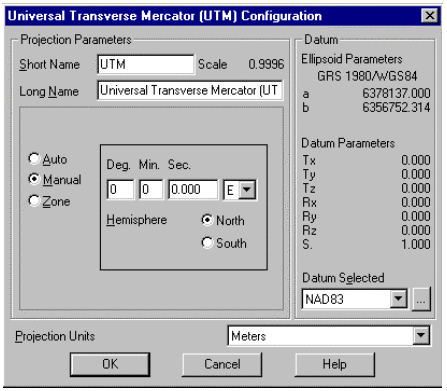


Figure A-2: UTRM with Manual selected

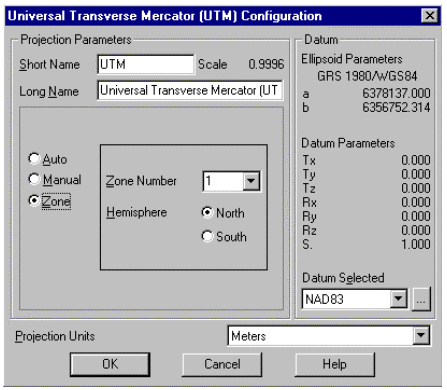
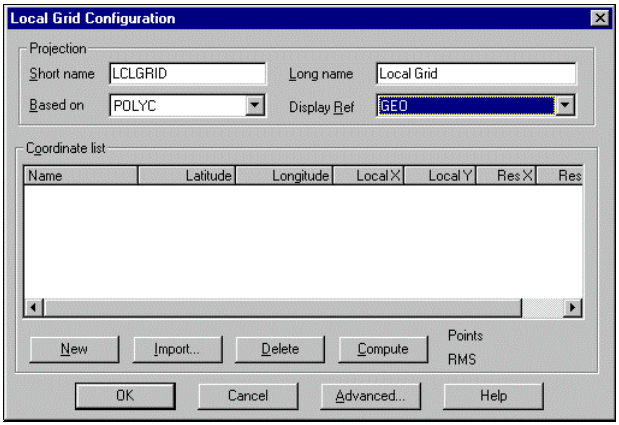


Figure A-3: UTM with Zone selected

A.1.1.2 Local Grid Template

If you select the LCLGRID (Local Grid) template, the **Local Grid Configuration** dialog will appear. This template allows you to work on a flat plane which can be translated, rotated and scaled in order to give you a new north reference from which to work.



First, choose the template you want your local grid to be based on. There is a drop down list, which includes your current templates. If you choose to use UTM, then its template must be set to Zone, which is explained in the previous section. The only template that cannot be used is GEO. Next, decide on a display reference. The ***Display Ref*** field also has a drop down list of your current templates but in this case it is permissible to choose GEO. The default is Same As 'Based On'.

The Coordinate List portion of the dialog consists of multiple rows for the following fields:

Name..... name of the point

Ref X ..... X reference of named point in the 'Based On' coordinate system (Note: depending on the selected map projection, this field may instead appear as Latitude)

Ref Y ..... Y reference of named point in the 'Based On' coordinate system (Note: depending on the selected

map projection, this field may instead appear as Longitude)

Local X ..... X coordinate of named point in you local grid

Local Y ..... Y coordinate of named point in you local grid

Res X ..... computed residual value or 'quality of fit' for your X coordinate

Res Y ..... computed residual value or 'quality of fit' for your Y coordinate

You cannot enter the Res X and Res Y values as these are computed after all your entries are filled in and you click on **<Compute>**. Note that these values will always be zero until a redundant number of points are available in the configuration (3 or more).

As an example, consider the map shown in Figure A-4. If we let the point named South be our (0,0) coordinate then we can draw a line through the point labeled CDC. This line (South → CDC) then becomes our local North (or Y) axis. A line drawn perpendicular to

the South → CDC line becomes our local East (or X) axis. Now we have a local grid from which to calculate all the coordinates of our other points.

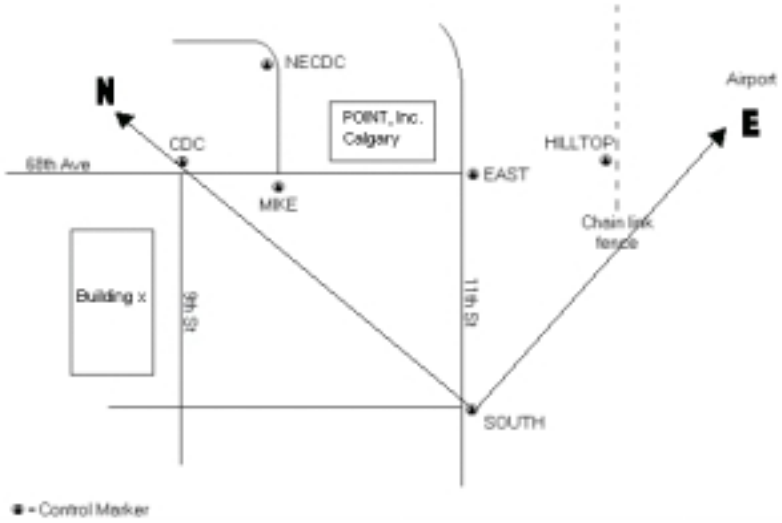
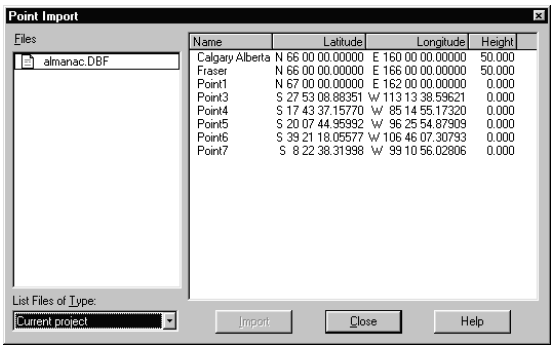


Figure A-4: Local Grid Example

The Ref X and Ref Y (or Lat / Long) coordinates can be worked out, or in this case imported from a previous survey. To import points and their X and Y reference coordinates click on **<Import...>** from the ***Local Grid Configuration*** dialog. The ***Point Import*** dialog appears.



In the ***List Files of Type*** field there are several choices (depending on which module you are in):

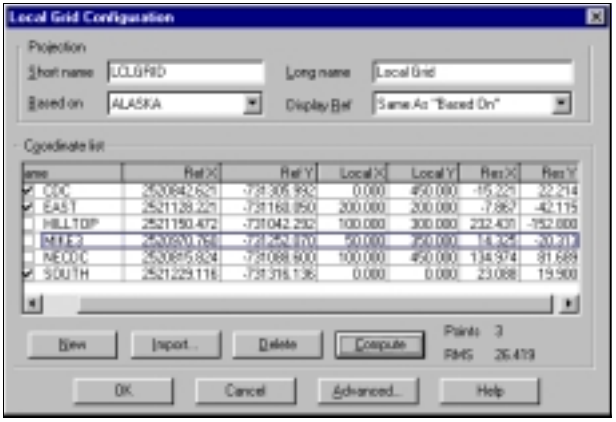
- Current project: lists points in the current project
- Control Points file: lists points in global database
- Planner file (*.PLN): lists points in a *PLANNER* project file
- Post-Processor file (*.SPR): lists points in a *Spectrum Survey* project file

Highlight the file you wish to use and import at least two points (to define the North axis).

In the ***Local Grid Configuration*** dialog, perform the following steps:

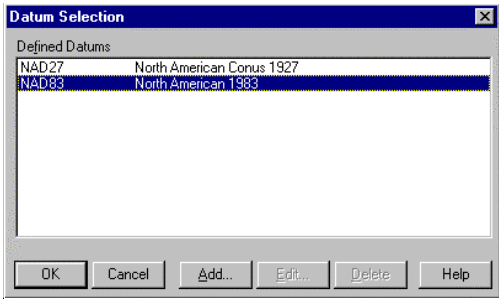
1. Fill in the Local X and Local Y values for each point that you imported. These are their new coordinates along the new axes.
2. Click on the little box beside each point's name to toggle a check mark on or off; those with a check mark will be used to define the grid, while the ones without the check mark will have their coordinates defined in terms of the grid.
3. When you have entered the required values in the Local Grid Configuration dialog, click on **<Compute>**. The local transformation parameters will be computed and the Res X and Res Y values for each point will be shown. These residual values provide a good estimate of the "fit" between your defined local grid system and the reference system. The RMS value reflects only those points that were used to define the grid.

Click on **<OK>** when you are satisfied; your local grid template is now ready to work with.

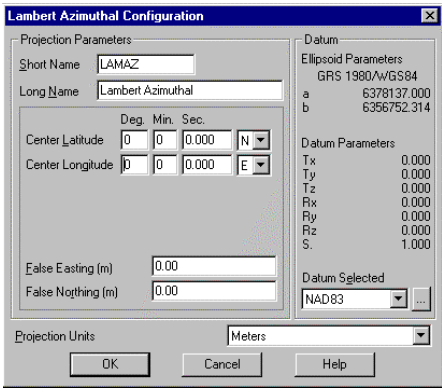


A.2 Datum & Ellipsoid Selection

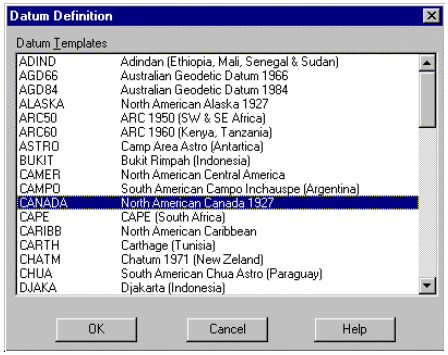
In each **Map Projection Editor** dialog (except for that of Local Grid), click on the ellipsis **<...>** button under the ***Datum Selected*** field to open the ***Datum Selection*** dialog.



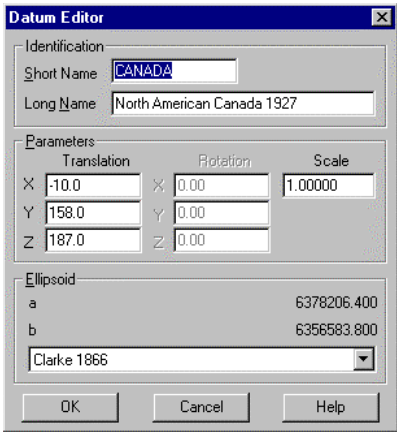
An example is shown below for the Lambert Azimuthal template.



If the desired datum does not appear, click on **<Add>** in the ***Datum Selection*** dialog to bring up the ***Datum Definition*** dialog.



The available datums are also listed in Table 2, *Datum Templates (Local Geodetic to WGS84)*, on Page 13. Selecting a new datum from the ***Datum Definition*** dialog brings up the ***Datum Editor*** dialog, which allows you to adjust various parameters; enter changes directly into the appropriate field.



Important: It is recommended that only advanced users edit these configurations.

The available ellipsoids are also listed in Table 3, *Pre-Defined Ellipsoids*, on Page 15.

Table 2: Datum Templates (Local Geodetic to WGS84)

Name	Description	Ellipsoid	DX	DY	DZ
ADIND	Adindan (Ethiopia, Mali, Senegal & Sudan)	Clarke 1880	-162	-12	206
ARC50	ARC 1950 (SW & SE Africa)	Clarke 1880	-143	-90	-294
ARC60	ARC 1960 (Kenya, Tanzania)	Clarke 1880	-160	-8	-300
AGD66	Australian Geodetic Datum 1966	Australian National	-133	-48	148
AGD84	Australian Geodetic Datum 1984	Australian National	-134	-48	149
BUKIT	Bukit Rimpah (Indonesia)	Bessel 1841	-384	664	-48
ASTRO	Camp Area Astro (Antarctica)	International 1924	-104	-129	239

Table 2: Datum Templates (Local Geodetic to WGS84)

Name	Description	Ellipsoid	DX	DY	DZ
CHATM	Chatum 1971 (New Zealand)	International 1924	175	-38	113
CARTH	Carthage (Tunisia)	Clarke 1880	-263	6	431
CAPE	CAPE (South Africa)	Clarke 1880	-136	-108	-292
DJAKA	Djakarta (Indonesia)	Bessel 1841	-377	681	-50
EGYPT	Old Egyptian	Helmert 1906	-130	110	-13
ED50	European 1950	International 1924	-87	-98	-121
ED79	European 1979	International 1924	-86	-98	-119
GUNSG	G. Segara (Kalimantan - Indonesia)	Bessel 1841	-403	684	41
GEO49	Geodetic Datum 1949 (New Zealand)	International 1924	84	-22	209
GRB36	Great Britain 1936 (Ordnance Survey)	Airy 1830	375	-111	431
GUAM	Guam 1963 (Guam Island)	Clarke 1866	-100	-248	259
HAWAII	Hawaiian Hawaii (Old)	International 1924	89	-279	-183
KAUAI	Hawaiian Kauai (Old)	International 1924	45	-290	-172
MAUI	Hawaiian Maui (Old)	International 1924	65	-290	-190
OAHU	Hawaiian Oahu (Old)	International 1924	56	-284	-181
HERAT	Herat North (Afghanistan)	International 1924	-333	-222	114
HJORS	Hjorsey 1955 (Iceland)	International 1924	-73	46	-86
HONGK	Hong Kong 1963	International 1924	-156	-271	-189
HUTZU	Hu-Tzu-Shan (Taiwan)	International 1924	-634	-549	-201
INDIA	Indian (India, Nepal, Bangladesh)	Everest (EA)	289	734	257
IRE65	Ireland 1965	Modified Airy	506	-122	611
KERTA	Kertau 1948 (West Malaysia and Singapore)	Everest (ED)	-11	851	5
KANDA	Kandawala (Sri Lanka)	Everest (EA)	-97	787	86
LIBER	Liberia 1964	Clarke 1880	-90	40	88
LUZON	Luzon (Philippines excluding Mindanoa Is.)	Clarke 1866	-133	-771	-51
MINDA	Mindanoa Island	Clarke 1866	-133	-70	-72
MERCH	Merchich (Morocco)	Clarke 1880	31	146	47
NAHR	Nahrwan (Saudi Arabia)	Clarke 1880	-231	-196	482
NAD83	N. American 1983 (Includes Areas 37-42)	GRS-80	0	0	0
CANADA	N. American Canada 1927	Clarke 1866	-10	158	187
ALASKA	N. American Alaska 1927	Clarke 1866	-5	135	172
NAD27	N. American Conus 1927	Clarke 1866	-8	160	176
CARIBB	N. American Caribbean	Clarke 1866	-7	152	178
MEXICO	N. American Mexico	Clarke 1866	-12	130	190

Table 2: Datum Templates (Local Geodetic to WGS84)

Name	Description	Ellipsoid	DX	DY	DZ
CAMER	N. American Central America	Clarke 1866	0	125	194
MINNA	Nigeria (Minna)	Clarke 1880	-92	-93	122
OMAN	Oman	Clarke 1880	-346	-1	224
PUERTO	Puerto Rica and Virgin Islands	Clarke 1866	11	72	-101
QORNO	Qornoq (South Greenland)	International 1924	164	138	-189
ROME	Rome 1940 Sardinia Island	International 1924	-255	-65	9
CHUA	South American Chua Astro (Paraguay)	International 1924	-134	229	-29
SAM56	South American (Provisional 1956)	International 1924	-288	175	-376
SAM69	South American 1969	S. American 1969	-57	1	-41
CAMPO	S. American Campo Inchauspe (Argentina)	International 1924	-148	136	90
SACOR	South American Corrego Alegre (Brazil)	International 1924	-206	172	-6
YACAR	South American Yacare (Uruguay)	International 1924	-155	171	37
TANAN	Tananarive Observatory 1925 (Madagascar)	International 1924	-189	-242	-91
TIMBA	Timbalai (Brunei and East Malaysia) 1948	Everest (EB)	-689	691	-46
TOKYO	Tokyo (Japan, Korea and Okinawa)	Bessel 1841	-128	481	664
TRIST	Tristan Astro 1968 (Tristan du Cunha)	International 1924	-632	438	-609
VITI	Viti Levu 1916 (Fiji Islands)	Clarke 1880	51	391	-36
WAK60	Wake-Eniwetok (Marshall Islands)	Hough 1960	101	52	-39
WGS72	World Geodetic System - 72	WGS72	0	0	4.5
WGS84	World Geodetic System - 84	WGS84	0	0	0
ZANDE	Zanderidj (Surinam)	International 1924	-265	120	-358

Table 3: Pre-Defined Ellipsoids

Name	Description	a (meters)	b (meters)
Airy 1830	Airy 1830	6377563.39600	6356256.910000
Australian National	Australian National	6378160.00000	6356774.719000
Bessel 1841	Bessel 1841	6377397.15500	6356078.962840
Clarke 1866	Clarke 1866	6378206.40000	6356583.800000
Clarke 1880	Clarke 1880	6378249.14500	6356514.869550
a = semi-major axis (in meters) b = semi-minor axis (in meters)			

Table 3: Pre-Defined Ellipsoids

Name	Description	a (meters)	b (meters)
Everest (BM)	Everest modified (Brunei & East Malaysia)	6377298.55600	6356097.550000
Everest (India 1830)	Everest (India 1830)	6377276.34520	6356075.413300
Everest (MS)	Everest modified (West Malaysia & Singapore)	6377304.06300	6356103.039000
GRS 1980/WGS84	GRS 1980/WGS84	6378137.00000	6356752.314140
Helmert 1906	Helmert 1906	6378200.00000	6356818.169000
Hough 1960	Hough 1960	6378270.00000	6356794.343479
International 1924	International 1924	6378388.00000	6356911.946130
International 1967	International 1967	6378157.50000	6356772.200000
Krassovsky	Krassovsky	6378245.00000	6356863.018800
Mercury 1960	Mercury 1960	6378166.00000	6356784.283666
Mercury 1968	Mercury 1968 modified	6378150.00000	6356768.337303
Modified Airy	Modified Airy	6377340.18900	6356034.448000
S. American 1969	South American 1969	6378160.00000	6356774.719000
South-East Asia	South-East Asia	6378155.00000	6356773.320500
Sphere	Sphere (Radius 6370997 meters)	6370997.00000	6370997.000000
Walbeck	Walbeck	6378137.00000	6356752.314245
WGS 66	WGS 66	6378145.00000	6356759.769356
WGS 72	WGS 72	6378135.00000	6356750.519915
a = semi-major axis (in meters) b = semi-minor axis (in meters)			

Appendix B State Plane FIPS Zone Numbers

These Zone Numbers are needed when you are editing the **State Plane Configuration** dialog (See Chapter A, *Map Projections, Ellipsoids, & Datums*).

Table 4: FIPS Zone Numbers

NAD27			NAD83		
5001	ALASKA ZONE NO. 1	H.O.M.	5001	ALASKA ZONE NO. 1	H.O.M.
5010	ALASKA ZONE NO. 10	L.C.C.	5010	ALASKA ZONE NO. 10	L.C.C.
5300	AMERICAN SAMOA	L.C.C.	301	ARKANSAS NORTH	L.C.C.
301	ARKANSAS NORTH	L.C.C.	302	ARKANSAS SOUTH	L.C.C.
302	ARKANSAS SOUTH	L.C.C.	401	CALIFORNIA I	L.C.C.
401	CALIFORNIA I	L.C.C.	402	CALIFORNIA II	L.C.C.
402	CALIFORNIA II	L.C.C.	403	CALIFORNIA III	L.C.C.
403	CALIFORNIA III	L.C.C.	404	CALIFORNIA IV	L.C.C.
404	CALIFORNIA IV	L.C.C.	405	CALIFORNIA V	L.C.C.
405	CALIFORNIAV	L.C.C.	406	CALIFORNIAVI	L.C.C.
406	CALIFORNIAVI	L.C.C.	502	COLORADO CENTRAL	L.C.C.
407	CALIFORNIAVII	L.C.C.	501	COLORADO NORTH	L.C.C.
502	COLORADO CENTRAL	L.C.C.	503	COLORADO SOUTH	L.C.C.
501	COLORADO NORTH	L.C.C.	600	CONNECTICUT	L.C.C.
503	COLORADO SOUTH	L.C.C.	903	FLORIDA NORTH	L.C.C.
600	CONNECTICUT	L.C.C.	1401	IOWA NORTH	L.C.C.
903	FLORIDA NORTH	L.C.C.	1402	IOWA SOUTH	L.C.C.
1401	IOWA NORTH	L.C.C.	1501	KANSAS NORTH	L.C.C.
1402	IOWA SOUTH	L.C.C.	1502	KANSAS SOUTH	L.C.C.
1501	KANSAS NORTH	L.C.C.	1601	KENTUCKY NORTH	L.C.C.
1502	KANSAS SOUTH	L.C.C.	1602	KENTUCKY SOUTH	L.C.C.
1601	KENTUCKY NORTH	L.C.C.	1701	LOUISIANA NORTH	L.C.C.
1602	KENTUCKY SOUTH	L.C.C.	1703	LOUISIANA OFFSHORE	L.C.C.
1701	LOUISIANA NORTH	L.C.C.	1702	LOUISIANA SOUTH	L.C.C.
1703	LOUISIANA OFFSHORE	L.C.C.	1900	MARYLAND	L.C.C.
1702	LOUISIANA SOUTH	L.C.C.	2002	MASSACHUSETTS ISLAND	L.C.C.
1900	MARYLAND	L.C.C.	2001	MASSACHUSETTS MAINLAND	L.C.C.
2002	MASSACHUSETTS ISLAND	L.C.C.	2112	MICHIGAN CENTRAL/L	L.C.C.
2001	MASSACHUSETTS MAINLAND	L.C.C.	2111	MICHIGAN NORTH	L.C.C.
2112	MICHIGAN CENTRAL/L	L.C.C.	2113	MICHIGAN SOUTH	L.C.C.
2111	MICHIGAN NORTH	L.C.C.	2202	MINNESOTA CENTRAL	L.C.C.
H.O.M. = Hotine oblique mercator, L.C.C. = Lambert conformal conic, T.M. = Transverse mercator, P = Polyconic					

Table 4: FIPS Zone Numbers

NAD27			NAD83		
2113	MICHIGAN SOUTH	L.C.C.	2201	MINNESOTA NORTH	L.C.C.
2202	MINNESOTA CENTRAL	L.C.C.	2203	MINNESOTA SOUTH	L.C.C.
2201	MINNESOTA NORTH	L.C.C.	2500	MONTANA	L.C.C.
2203	MINNESOTA SOUTH	L.C.C.	2600	NEBRASKA	L.C.C.
2502	MONTANA CENTRAL	L.C.C.	3104	NEW YORK LONG ISLAND	L.C.C.
2501	MONTANA NORTH	L.C.C.	3200	NORTH CAROLINA	L.C.C.
2503	MONTANA SOUTH	L.C.C.	3301	NORTH DAKOTA NORTH	L.C.C.
2601	NEBRASKA NORTH	L.C.C.	3302	NORTH DAKOTA SOUTH	L.C.C.
2602	NEBRASKA SOUTH	L.C.C.	3401	OHIO NORTH	L.C.C.
3104	NEW YORK LONG ISLAND	L.C.C.	3402	OHIO SOUTH	L.C.C.
3200	NORTH CAROLINA	L.C.C.	3501	OKLAHOMA NORTH	L.C.C.
3301	NORTH DAKOTA NORTH	L.C.C.	3502	OKLAHOMA SOUTH	L.C.C.
3302	NORTH DAKOTA SOUTH	L.C.C.	3601	OREGON NORTH	L.C.C.
3401	OHIO NORTH	L.C.C.	3602	OREGON SOUTH	L.C.C.
3402	OHIO SOUTH	L.C.C.	3701	PENNSYLVANIA NORTH	L.C.C.
3501	OKLAHOMA NORTH	L.C.C.	3702	PENNSYLVANIA SOUTH	L.C.C.
3502	OKLAHOMA SOUTH	L.C.C.	5200	PUERTO RICO AND VIRGIN ISLANDS	L.C.C.
3601	OREGON NORTH	L.C.C.	3900	SOUTH CAROLINA	L.C.C.
3602	OREGON SOUTH	L.C.C.	4001	SOUTH DAKOTA NORTH	L.C.C.
3701	PENNSYLVANIA NORTH	L.C.C.	4002	SOUTH DAKOTA SOUTH	L.C.C.
3702	PENNSYLVANIA SOUTH	L.C.C.	4100	TENNESSEE	L.C.C.
5201	PUERTO RICO AND VIRGIN ISLANDS	L.C.C.	4203	TEXAS CENTRAL	L.C.C.
3901	SOUTH CAROLINA NORTH	L.C.C.	4201	TEXAS NORTH	L.C.C.
3902	SOUTH CAROLINA SOUTH	L.C.C.	4202	TEXAS N. CENTRAL	L.C.C.
4001	SOUTH DAKOTA NORTH	L.C.C.	4205	TEXAS SOUTH	L.C.C.
4002	SOUTH DAKOTA SOUTH	L.C.C.	4204	TEXAS S. CENTRAL	L.C.C.
4100	TENNESSEE	L.C.C.	4302	UTAH CENTRAL	L.C.C.
4203	TEXAS CENTRAL	L.C.C.	4301	UTAH NORTH	L.C.C.
4201	TEXAS NORTH	L.C.C.	4303	UTAH SOUTH	L.C.C.
4202	TEXAS N. CENTRAL	L.C.C.	4501	VIRGINIA NORTH	L.C.C.
4205	TEXAS SOUTH	L.C.C.	4502	VIRGINIA SOUTH	L.C.C.
4204	TEXAS S. CENTRAL	L.C.C.	4601	WASHINGTON NORTH	L.C.C.
4302	UTAH CENTRAL	L.C.C.	4602	WASHINGTON SOUTH	L.C.C.
4301	UTAH NORTH	L.C.C.	4701	WEST VIRGINIA NORTH	L.C.C.
4303	UTAH SOUTH	L.C.C.	4702	WEST VIRGINIA SOUTH	L.C.C.
5202	VIRGIN ISLANDS ST. CROIX	L.C.C.	4802	WISCONSIN CENTRAL	L.C.C.
4501	VIRGINIA NORTH	L.C.C.	4801	WISCONSIN NORTH	L.C.C.
4502	VIRGINIA SOUTH	L.C.C.	4803	WISCONSIN SOUTH	L.C.C.
4601	WASHINGTON NORTH	L.C.C.	101	ALABAMA EAST	T.M.
4602	WASHINGTON SOUTH	L.C.C.	102	ALABAMA WEST	T.M.
4701	WEST VIRGINIA NORTH	L.C.C.	5002	ALASKA ZONE NO. 2	T.M.
4702	WEST VIRGINIA SOUTH	L.C.C.	5003	ALASKA ZONE NO. 3	T.M.
4802	WISCONSIN CENTRAL	L.C.C.	5004	ALASKA ZONE NO. 4	T.M.
4801	WISCONSIN NORTH	L.C.C.	5005	ALASKA ZONE NO. 5	T.M.

H.O.M. = Hotine oblique mercator, L.C.C. = Lambert conformal conic, T.M. = Transverse mercator, P = Polyconic

Table 4: FIPS Zone Numbers

NAD27			NAD83		
4803	WISCONSIN SOUTH	L.C.C.	5006	ALASKA ZONE NO. 6	T.M.
5400	GUAM ISLAND	P	5007	ALASKA ZONE NO. 7	T.M.
101	ALABAMA EAST	T.M.	5008	ALASKA ZONE NO. 8	T.M.
102	ALABAMA WEST	T.M.	5009	ALASKA ZONE NO. 9	T.M.
5002	ALASKA ZONE NO. 2	T.M.	202	ARIZONA CENTRAL	T.M.
5003	ALASKA ZONE NO. 3	T.M.	201	ARIZONA EAST	T.M.
5004	ALASKA ZONE NO. 4	T.M.	203	ARIZONA WEST	T.M.
5005	ALASKA ZONE NO. 5	T.M.	700	DELAWARE	T.M.
5006	ALASKA ZONE NO. 6	T.M.	901	FLORIDA EAST	T.M.
5007	ALASKA ZONE NO. 7	T.M.	902	FLORIDA WEST	T.M.
5008	ALASKA ZONE NO. 8	T.M.	1001	GEORGIA EAST	T.M.
5009	ALASKA ZONE NO. 9	T.M.	1002	GEORGIA WEST	T.M.
202	ARIZONA CENTRAL	T.M.	5101	HAWAII1	T.M.
201	ARIZONA EAST	T.M.	5102	HAWAII2	T.M.
203	ARIZONA WEST	T.M.	5103	HAWAII3	T.M.
700	DELAWARE	T.M.	5104	HAWAII4	T.M.
901	FLORIDA EAST	T.M.	5105	HAWAII5	T.M.
902	FLORIDA WEST	T.M.	1102	IDAHO CENTRAL	T.M.
1001	GEORGIA EAST	T.M.	1101	IDAHO EAST	T.M.
1002	GEORGIA WEST	T.M.	1103	IDAHO WEST	T.M.
5101	HAWAII1	T.M.	1201	ILLINOIS EAST	T.M.
5102	HAWAII2	T.M.	1202	ILLINOIS WEST	T.M.
5103	HAWAII3	T.M.	1301	INDIANA EAST	T.M.
5104	HAWAII4	T.M.	1302	INDIANA WEST	T.M.
5105	HAWAII5	T.M.	1801	MAINE EAST	T.M.
1102	IDAHO CENTRAL	T.M.	1802	MAINE WEST	T.M.
1101	IDAHO EAST	T.M.	2301	MISSISSIPPI EAST	T.M.
1103	IDAHO WEST	T.M.	2302	MISSISSIPPI WEST	T.M.
1201	ILLINOIS EAST	T.M.	2402	MISSOURI CENTRAL	T.M.
1202	ILLINOIS WEST	T.M.	2401	MISSOURI EAST	T.M.
1301	INDIANA EAST	T.M.	2403	MISSOURI WEST	T.M.
1302	INDIANA WEST	T.M.	2702	NEVADA CENTRAL	T.M.
1801	MAINE EAST	T.M.	2701	NEVADA EAST	T.M.
1802	MAINE WEST	T.M.	2703	NEVADA WEST	T.M.
2102	MICHIGAN CENTRAL/M	T.M.	2800	NEW HAMPSHIRE	T.M.
2101	MICHIGAN EAST	T.M.	2900	NEW JERSEY	T.M.
2103	MICHIGAN WEST	T.M.	3002	NEW MEXICO CENTRAL	T.M.
2301	MISSISSIPPI EAST	T.M.	3001	NEW MEXICO EAST	T.M.
2302	MISSISSIPPI WEST	T.M.	3003	NEW MEXICO WEST	T.M.
2402	MISSOURI CENTRAL	T.M.	3102	NEW YORK CENTRAL	T.M.
2401	MISSOURI EAST	T.M.	3101	NEW YORK EAST	T.M.
2403	MISSOURI WEST	T.M.	3103	NEW YORK WEST	T.M.
2702	NEVADA CENTRAL	T.M.	3800	RHODE ISLAND	T.M.
2701	NEVADA EAST	T.M.	4400	VERMONT	T.M.
2703	NEVADA WEST	T.M.	4901	WYOMING EAST	T.M.
2800	NEW HAMPSHIRE	T.M.	4902	WYOMING E. CENTRAL	T.M.

H.O.M. = Hotine oblique mercator, L.C.C. = Lambert conformal conic, T.M. = Transverse mercator, P = Polyconic

Table 4: FIPS Zone Numbers

NAD27				NAD83		
2900	NEW JERSEY	T.M.		4904	WYOMING WEST	T.M.
3002	NEW MEXICO CENTRAL	T.M.		4903	WYOMING W. CENTRAL	T.M.
3001	NEW MEXICO EAST	T.M.				
3003	NEW MEXICO WEST	T.M.				
3102	NEW YORK CENTRAL	T.M.				
3101	NEW YORK EAST	T.M.				
3103	NEW YORK WEST	T.M.				
3800	RHODE ISLAND	T.M.				
4400	VERMONT	T.M.				
4901	WYOMING EAST	T.M.				
4902	WYOMING E. CENTRAL	T.M.				
4904	WYOMING WEST	T.M.				
4903	WYOMING W. CENTRAL	T.M.				

H.O.M. = Hotine oblique mercator, L.C.C. = Lambert conformal conic, T.M. = Transverse mercator, P = Polyconic

Appendix C Definitions & Acronyms

2DRMS: twice distance RMS, that is, twice the RMS of the horizontal errors. For any GPS receiver in any environment, the circle with a radius equal to 2DRMS contains between 95 – 98 percent of the scatter. When HDOP is low, the percentage is closer to 98%; when HDOP is high, it is closer to 95%.

Active view: The active view is the one that currently has the input focus. This window is displayed with a caption of a different color. There can only be one active view at a time.

Almanac: Set of orbit parameters used to compute satellite approximate positions and velocities at specific epochs. It is collected from each satellite over the course of 12.5 minutes. It contains orbital parameter approximations for all satellites, GPS to universal time conversion parameters, and single-frequency ionospheric model parameters. Moreover, for each set, there is a flag indicating if these parameters are good or not (this flag is known as health parameter).

Ambiguity: The number of initial (often whole) cycles in a single or double difference observation.

Base: A point whose position is fixed for the purpose of generating a vector or a trajectory (collection of epoch vectors).

Carrier phase ambiguity (or sometimes ambiguity for short): The number of integer carrier phase cycles between the user and the satellite at the start of tracking.

Carrier phase measurements: These are "accumulated delta range" measurements. They contain the instantaneous phase of the signal (modulo 1 cycle) plus some arbitrary number of integer cycles. Once the receiver is tracking the satellite, the integer number of cycles correctly accumulates the change in range seen by the receiver. When a "lock break" occurs, this accumulated value can jump an arbitrary integer number of cycles (this is called a cycle slip).

CEP: Circular error probable; a circle's radius, centered at the true antenna position, containing 50% of the points in the horizontal scatter plot. Stated another way, the CEP is the radius of a circle, centered at your computed position, within which your true position will be located a minimum of 50 percent of the time. Note that CEP refers to horizontal position only.

Cycle Slip: When the carrier phase measurement jumps by an arbitrary number of integer cycles. It is generally caused by a break in the signal tracking due to shading or some similar occurrence.

Datum: In our context a datum could be defined as a set of parameters (translations, rotations and scale) used to establish the position of the reference ellipsoid with respect to the earth center.

Digitizer: A pointing device such as a mouse, pen, or finger on a touch screen.

Dilution of precision (DOP): DOP parameters are values with no units, which express the geometric strength of the current satellite geometry; the lower the value, the better. DOP can be expressed in the following components:

EDOP. represents only the longitude component

GDOP. represents all parameters (latitude, longitude, height, time)

HDOP. represents the 2D component (latitude, longitude)

NDOP. represents only the latitude component

PDOP. represents 3D parameters (latitude, longitude, height)

TDOP. represents only the time component

VDOP. represents only the height component

Discrete Ambiguities: Carrier phase ambiguities that are assumed to be members of a set of discrete numbers. The most common discrete ambiguities are integer ambiguities, where only integer values are allowed. Some linear combinations of integer ambiguities (such as in iono-free observations) also produce a set of discrete possible ambiguities, although they are no longer integers.

Double-Difference: A position estimation algorithm that uses observations that are differenced between receiver channels and between the reference and remote receivers.

Double-Difference Carrier Phase Ambiguity (or sometimes double difference ambiguity or ambiguity, for short): Carrier phase ambiguities that are differenced between receiver channels and between the reference and remote receivers. They are estimated when a double difference mechanism is used for carrier phase positioning.

Earth-Centered-Earth-Fixed (ECEF): A right-hand Cartesian co-ordinate system with its origin located at the center of the earth. This co-ordinate system is centered on the WGS84 reference ellipsoid, has the Z axis aligned with the Earth's spin axis (through the North Pole), the X axis runs through the intersection of the Prime Meridian (Greenwich) and the Equator, and the Y axis is in the equatorial plane rotated 90° east of the X axis about the

Z axis.

Edit box: Refers to a standard interface object used for entry or modification of data displayed in a dialogue box.

Ellipsoid: Spheroid which is defined by two parameters: the semi-major axis "a" and the semi-minor axis "b". This spheroid can be seen as a revolving ellipse. It is used to approximate the shape of Earth (the geoid). It is used as a reference surface for geodetic surveys.

Ellipsoidal height: The height relative to the ellipsoid; the sum of the geoidal height and the height relative to the geoid.

Ephemeris: A broadcast set of Keplerian orbital parameters used to compute satellite positions.

Epoch: Same as measurement time epoch. The local time at which a GPS receiver takes a measurement.

Epoch computation: Process that computes "Visibility Data" for each epoch of the planning time span (according to the computation interval).

FIPS. Federal Information Processing Standard (FIPS)

Fixed Ambiguity Estimates: Carrier phase ambiguity estimates that are set to a given number and held constant. Usually they are set to integers or values derived from linear combinations of integers.

Fixed Discrete Ambiguity Estimates: Carrier phase ambiguities which are set to values which are members of a predetermined set of discrete possibilities, and then held constant.

Fixed Integer Ambiguity Estimates: Carrier phase ambiguities that are set to integer values and then held constant.

Floating Ambiguity Estimates: Ambiguity estimates that are not held to a constant value, but are allowed to gradually converge to the correct solution.

Geoid: The shape of the earth if it were considered as a sea level surface extended continuously through the continents. The geoid is an equipotential surface coincident with mean sea level to which at every point the plumb line (direction in which gravity acts) is perpendicular. The geoid, affected by local gravity disturbances, has an irregular shape. It is approximated by mean sea level.

Geoidal height: The separation between the geoid and the ellipsoid; also called the "undulation".

GPS: Global Positioning System.

Integer Ambiguity Estimates: Carrier phase ambiguity estimates that are only allowed to take on integer values.

Iono-free Carrier Phase Observation: A linear combination of L1 and L2 carrier phase measurements which provides an estimate of the carrier phase observation on one frequency with the effects of the ionosphere removed. It provides a different ambiguity value (non-integer) than a simple measurement on that frequency.

Kinematic: The user's GPS antenna is moving. In GPS, this term is typically used with precise carrier phase positioning, and the term dynamic is used with pseudorange positioning.

L1: The primary frequency used by the GPS system, 1575.42 MHz.

L1 fixed: solution using L1-only carrier phase measurements; fixed ambiguities

L1 float: solution using L1-only carrier phase measurements; floating ambiguities

L2: The secondary frequency used by the GPS system, 1227.6 MHz.

L2 fixed: solution using L2-only carrier phase measurements; fixed ambiguities

L3 iono-free fixed: ionospheric-free solution using L1 & L2 carrier phase measurements; fixed ambiguities

L3 iono-free float: ionospheric-free solution using L1 & L2 carrier phase measurements; floating ambiguities

L4 fixed widelane: solution using the L1-L2 widelane carrier phase combination; fixed ambiguities

L5 fixed narrowlane: solution using the L1+L2 narrowlane carrier phase combination; fixed ambiguities

Lane: A particular discrete ambiguity value on one carrier phase range measurement or double difference carrier phase observation. The type of measurement is not specified (L1, L2, L1-L2, iono-free)

Local Observation Set: An observation set, as described below, taken by the receiver on which the software is operating as opposed to an observation taken at another receiver (the reference station) and transmitted through a radio link.

Local Tangent Plane: A coordinate system based on a plane tangent to the ellipsoid's surface at the user's location. The three coordinates are east, north and up. Latitude, longitude and height positions operate in this coordinate system.

Low-latency Solution: A position solution that is based on a prediction. A model (based on previous reference station observations) is used to estimate what the observations will be at a given time epoch. These estimated reference station observations are combined with actual

measurements taken at the remote station to provide a position solution.

Mapping system: Set of mathematical formulas used to transform a set of geographic co-ordinate (latitude, longitude, height) in rectangular co-ordinates (X, Y).

Matched Observation Set Pair: It contains observations from both the reference station and the local receiver which have been matched by time epoch, contain the same satellites, and are corrected for any known offsets.

Measurement Time Epoch: The local time at which a GPSCard takes a measurement.

MSL Height: Mean sea level height; see also "Geoid".

Narrowlane: A particular integer ambiguity value on one carrier phase range measurement or double difference carrier phase observation when the sum of the L1 and L2 measurements is used. It is a carrier phase observable formed by adding L1 and L2 carrier phase data: $\Phi' = \Phi_1 + \Phi_2$. The corresponding wavelength is 10.7 cm.

Network: Series of linked vectors.

Observation file: A binary file that contains raw satellite observations from a given receiver. This file will also contain information regarding when the receiver occupied a point and when it was roving.

Observation file ID: This is a unique ID message used to reference a specific observation file. The ID is derived from an observation file name without the path or file extension, and is shown in all caps. If necessary a 2-digit number in square brackets may be attached to the end of the message if files of the same name but different path are included in the same project. (For example, FILENAME[02]) Note that Observation File IDs for rover data files are also used as the "names" for rover objects in the project.

Observation set: A set of measurements taken at a given time which includes one time for all measurements, and the following for each satellite tracked: PRN number, pseudorange or carrier phase or both, lock time count, signal strength, and tracking status. Either L1-only or L1/L2 measurements are included in the set. The observation set is assumed to contain information indicating how many satellites it contains and which ones have L1-only and which ones have L1/L2 pairs.

Obstruction: Objects such as trees, mountains and houses limiting the sky visible at a point. The fewer obstructions are present, the better the point.

Occupation: Series of consecutive observations taken while located at a given point.

Orbit File: Refers to any ephemeris, precise clock, or precise orbit data file.

OTF: The "On-The-Fly" algorithm allows ambiguity resolution while the antenna is moving.

PC: IBM-compatible personal computer

Plan View: Graphic view used to represent geographic position (in 2D) of all points (using the user-defined mapping system) related to a specific project.

Pointer: Used to refer to the cursor on the screen representing the pointing device's position. The pointing device can be any type of device, but is generally a mouse or a pen.

Precise Orbits: Timed satellite precise positions used for polynomial generation of satellite positions.

Project: A series of data files organized in a data base as well as occupation definitions to link the observations to points and point definitions to link the occupations to an external reference and to items whose position is required.

PRN number: A number assigned by the GPS system designers to a given set of pseudorandom codes. Typically, a particular satellite will keep its PRN (and hence its code assignment) indefinitely, or least for a long period of time. It is commonly used as a way to label a particular satellite.

Pseudorange Measurements: Measurements made using one of the pseudorandom codes on the GPS signals. They provide an unambiguous measure of the range to the satellite including the effect of the satellite and user clock biases.

Pseudoranges (Raw): Solution using code measurements

Reference satellite: In a double difference implementation, measurements are differenced between different satellites on one receiver in order to cancel the clock bias effect. Usually one satellite is chosen as the "reference", and all others are differenced with it.

Reference station: The GPS receiver that acts as the stationary reference. It has a known position and transmits messages for the "remote" receiver to use to calculate its position.

Remote station: A point that will be used as the position to solve in a vector. It is the GPS receiver whose position is "unknown", and needs to receive measurements from a reference station to calculate differential GPS positions.

Residual: The difference between the observed and computed measurement

Rover station: A GPS receiver (assumed to be mobile) which generates a raw observation file. All raw observations are considered to originate from a rover, and can be processed accordingly.

RMS: Root-mean-square, the square root of the average of the squared errors. RMS may be considered essentially equivalent to one sigma (1 standard deviation).

Satellite primary position: A set of satellite positions computed along the orbital arc associated to the planning period. These positions are computed with an interval of 1 hour.

SEP: Spherical error probable; a sphere's radius, centered at the true antenna position, containing 50% of the points in a three-dimensional scatter plot.

Session Time: The time span that defines what data is accessible (editable, viewable, processable).

Point: A point is a named geographic position, defined in three-dimensional space. A point can have obstructions attached to it, describing the visible sky at that location. It could be defined in a spherical co-ordinate system (latitude, longitude, height) or in an ECEF co-ordinate system (X, Y, Z), or in a defined mapping system (x, y and H).

Static: The user's GPS antenna does not move.

SV: Space Vehicle ID, sometimes used as SVID; also used interchangeably with Pseudo-Random Noise Number (PRN).

Text box: Refers to a standard interface object used to display 'static' text in a dialogue box. The user may not modify the contents of a text box.

ToolTips: Small (one or two words) hints that are displayed in a floating rectangular box near the pointer when the cursor stays for a certain amount of time over an area of the application. Generally used for buttons on a toolbar.

Trajectory: A series of consecutive vectors between a base station (point occupation) and a rover over a given time span.

Trajectory name: A trajectory will have a name that is derived from its point and rover names with a hyphen separating them. The point name with its occupation number in brackets are first, followed by the rover name (For example, PointA (02)-RoverC [01].

Trajectory-trial: A trajectory can be processed in more than one way by using different parameters. A trial stores these different processing attempts by saving both the parameters and the results for each "try".

Undulation: See "Geoidal height".

Unhealthy: State in which a satellite is not used in "Visibility Data" computation.

Vector: A solution between two single observations (one epoch) from different observation files.

Vector name: A vector will have a name that is derived from the two point names with a hyphen separating them. The point names will appear alphabetically, and will include the point occupation number related to the vector in question.

Vector-occupation: A pair of simultaneous point occupations that define a vector.

Vector-trial: A vector-occupation can be processed in more than one way by using different parameters. A trial stores these different processing attempts by saving both the parameters and the results for each “try”.

Visibility data: Contains the epoch. For visible satellites, this data also contains the azimuth and elevation with respect to the selected point and the satellite’s Cartesian co-ordinates (X,Y,Z).

Zoom factor: Magnification factor giving the relation between logical units (such as device pixels) to real world units (such as meters). Does not bind physical units (screen pixels) to real world units directly.

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