

PC-GPS Reference Guide

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PC-GPS Reference Guide

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Foreword about PC-GPS versions

This reference guide covers PC-GPS, PC-Mapper and CMT-Survey. The core software functions are similar in these products. However, please note that some enhancements are available only in certain software products or versions. For example, the ability to capture a geo-referenced image from Google Earth is provided in PC-GPS 07, but not in PC-GPS 05 and earlier software versions.

General Overview

PC-GPS combines CMT's proven **GPS project management** utilities with **powerful mapping** functions. You can use PC-GPS as part of a complete system with a CMT GPS data collector or as a stand-alone resource-mapping program. With PC-GPS, you have the tools to:

“Build” Maps

PC-GPS allows you to create electronic map files (.Map or .FMP) using data from a variety of sources including: GPS Feature files, Raster Images, BaseMaps, ArcView Shape files, DXF files, ASCII files and database files. Coordinate positions may also be manually added. You can also create new points by using coordinate geometry functions. In the coordinate system of your choice, display “Features” (Points, Lines or Areas) tied to their precise geographic positions. Descriptive information, Attributes and Values, for each Feature is displayed in spreadsheet form for quick reference and editing. By attaching photos or video clips to the Features, you can get a complete picture of the map.

Organize Feature Data into Topics

PC-GPS organizes your geographic and image data into “Topics” or layers to facilitate map viewing and data management. For example, one Map may contain Topics for: 1) Vegetation;

2) Animal Life; and 3) Water Samples. Once Features are organized into Topics, you can quickly analyze your data using powerful Search, Classify, and Filter functions.

Manage your GPS Data Collection

PC-GPS incorporates many of CMT's traditional GPS pre-processing and post-processing utilities such as: Satellite Mission Planning, Differential Correction, and Feature List creation. You can also measure distances, compute areas and lengths and even join Features together.

Overlay your Feature data upon Raster Images

PC-GPS supports Geotiff files, MRSID® format images, GeoJPEG and JPEG2000 image formats. Non-referenced images can be imported and georeferenced to your Map using control points. New features can be created from the image using “heads-up digitizing”.

Exchange Data between PC-GPS and your Database

PC-GPS supports ODBC, the current Microsoft database interface standard, which allows you to export data from PC-GPS to an extensive set of database systems, including Access, dBASE, and FoxPro. After the data has been managed and processed in these database systems, it can be imported back into your PC-GPS Map.

Export Data to GIS Systems

PC-GPS has many powerful functions, however a complete GIS package may be required for some of the heavy-duty processing or data compiling. In this case, PC-GPS can be used to export your coordinate and Feature data directly to the most popular GIS applications - AutoCAD (DXF file); ArcView (Shape file).

Section 1: Getting Started with PC-GPS

1.1 Hardware and Software Requirements

To effectively operate PC-GPS the following configuration is suggested:

- a) IBM PC or compatible with a Pentium or faster processor.
- b) Microsoft Windows® 98, Windows® 2000 or Windows® XP.
- c) A minimum of 256 Megabytes of RAM (512 Megabytes RAM or more recommended)
- d) Mouse (keyboard functions are available but as with any Windows application a mouse is recommended).
- e) At least 100 Megabytes of free hard disk space is required for differential correction operations.
- f) Additional RAM and free hard disk space are required to process large background map images.

1.2 Installing PC-GPS on your PC under Windows

Before installing PC-GPS, please do the following:

- 1. Uninstall any previously installed PC-GPS software from your PC. To do so, click on the “Start” button in Windows then select “Programs”. Click on the PC-GPS program name then select the option to uninstall the program.
- 2. Make sure that no other applications are open, including Microsoft Office.
- 3. If you are re-installing PC-GPS, click on the “Start” button in Windows then select Settings\Control Panel\Fonts. Then delete any font files (*.ttf) that start with “cmt”. Reset your PC then run the Setup program. This will permit the font files to be properly updated.

To install PC-GPS on your PC, please follow these steps:

- 1. Do not connect the USB hard key to your PC yet.
Insert the CD-ROM with the PC-GPS software into your CD-ROM drive.
- 2. The installation should automatically start. If it does not, click Start and then click the Run option. In the Run dialog box, enter the appropriate CD-ROM drive designation and “Setup” in the “Command Line:” or “Open:” field and click on the OK button. (Example: D:\SETUP)
- 3. Follow the installation instructions provided by the PC-GPS Install program. The Installation program will automatically install PC-GPS on your hard disk and create a program group and icon in Windows.
- 4. Insert the USB hard key into one of the USB ports on your PC.
- 5. If your copy of PC-GPS came with a set of BaseMap CDs, please copy the BASEMAP folder from each CD to the C: drive of your PC (to create and overwrite C:\BASEMAP).

1.3 Starting PC-GPS from Windows

After PC-GPS has been installed, PC-GPS is ready to use.

In Windows, use the Start button and then look under the Programs option, select the PC-GPS listing. Select the software to execute: PC-GPS, PC-MAPPER or CMT-SURVEY.

Immediately after you select the PC-GPS program the PC-GPS Map window will be displayed. The main window provides access to all of the PC-GPS functions and options.

You can also double-click the PC-GPS icon on your desktop to start PC-GPS.

1.4 Software security keys (GPS-KEYPRO)

PC-GPS is security protected. Your software is supplied with a "Hardware Key". The hardware key (or "hard key") is required to run the software and must be installed in your PC. Please see the instructions included with the hard key for proper installation directions.

The hard key is also useful if you need to run PC-GPS on your PC in the office during the day and on your laptop at home during the night.

For each PC-GPS license that you own, one hardware key is supplied. The CMT part number for the hard key is GPS-KEYPRO.

The hard key supplied with your CMT Software is required to run the software.

Should your hard key get damaged, please provide the PC-GPS version number and serial number when requesting information about ordering a replacement hardware key. The original hard key will need to be returned to CMT.

1.5 Getting Help in PC-GPS

PC-GPS provides context-sensitive Help messages as well as an on-line manual.

1.5.1 Context-Sensitive Help

For a brief instruction for a given dialog box or option, simply click on the Help icon to display the Help question mark:



Then click on a menu option, a dialog box or an area of the Map document with which you need assistance. A description of the item will be provided in the Help screen.

To see a list of all the context-sensitive help topics, click on the **Help** menu item, then click on **Help Topics** to display the "Help Topics: PC-GPS Help" dialog. Select an item of interest then click on the "Display" button to see the associated help message.

1.5.2 On-Line Manual

The **Help/Online Manual** option contains the complete PC-GPS User's Manual. You may access detailed information about PC-GPS operations with this manual. The Index button in the Help/Online Manual listing allows you to search for a particular topic. A description of the item or an example will then be provided.

1.5.3 PC-GPS Version Number

To find out which version or revision of PC-GPS you have, click on the **Help** menu item then click on **About PC-GPS**.

1.6 Using this Reference Guide

This Reference Guide serves as an introduction to PC-GPS operations. It does not cover all of the functions of PC-GPS. Full descriptions of functions and operations are available in the Online Manual, which is accessed using the **Help/Online Manual** function. Please also keep in mind that the program screens and dialog boxes may be different among the various versions of PC-GPS.

Some sections of this Reference Guide list instructions for locating Help information.

For example, Help references will be written as follows:

Your PC-GPS software package includes a special set of functions such as the **Forester's Toolkit**. Use **Help/Online Manual** to obtain detailed descriptions of these functions.

1.7 Technical Support

If you have used the Help facilities provided with the software but still have a question, technical assistance for PC-GPS operations is available via email or World Wide Web:

- Web site: <http://www.cmtinc.com>
- Email: support@cmtinc.com

1.8 Training CDs

A few training CDs are available from CMT. These contain detailed voice-based instructions and examples, and guide you from GPS data collection through GIS mapping to printing a finished map.

CMT GPS/GIS Training CD is for the MARCH-II-E, MC-GPS and ALTO-G12 users.

CMT GIS Training CD is for the PDA users running the CMT Field CE Software.

CMT Timber Cruising Training CD covers the functions in the CMT Timber Cruising Software.

Section 2: PC-GPS Fundamentals

In this chapter, the basic terminology and major concepts behind PC-GPS are presented. It is highly recommended you read through this chapter thoroughly for a clear understanding of the fundamental concepts. The ideas and examples presented will be used and built upon in subsequent chapters.

2.1 PC-GPS Definitions

In this section, definitions of the terms used in PC-GPS will be presented. It is recommended that you read these definitions thoroughly.

2.1.1 Spatial Data

PC-GPS Map files (.FMP) can be created using both **spatial** and **non-spatial** data. **Spatial** data is tied to a specific location defined by a set of coordinates (e.g. Latitude, Longitude and Altitude). Non-spatial data included in the Map file is not related to a specific location. Non-spatial data is used to enhance the appearance of the Map file.

In many cases, spatial data in a Map file is collected with a GPS/GIS data collector and transferred to PC-GPS. Spatial data can also be created within PC-GPS by manually entering coordinate information.

Spatial data includes coordinates as well as descriptive Geographic Information Systems (GIS) terms such as Features, Attributes, and Values.

Features, Attributes and Values:

A **Feature** is a GIS term used to describe an object. A Feature is tied to a specific coordinate position or a set of coordinates and therefore is spatial data. For example, a Feature could be a Tree at a specific coordinate location.

Three Feature types can be defined in PC-GPS. Feature types include: **Point** Features, **Line** Features and **Area** Features. A Point Feature is an object with one associated coordinate position such as a tree. A Line Feature is an object associated with a series of coordinates connected together such as a stream. An Area Feature is an object associated with a series of coordinates connected together to form a closed area such as the boundary of a parcel of land.



Features can be further described with **Attributes** and **Values**. An Attribute is a specific descriptor such as Species. The Value quantifies or qualifies the Attribute. The Attribute can be considered the question with the Value of the Attribute as the answer.

Example: A fir tree may be recorded as follows:

Feature: Tree ●
Attribute: Species
Value: Fir
Coordinates: 44 33 46 N
123 15 45 W

2.1.2 Non-Spatial Data

Non-spatial data is used to enhance the Map. Non-spatial data includes text, graphics, and other objects placed on the Map to further label and describe the Map. Non-spatial data is not tied to a specific coordinate location. In addition, non-spatial items are not associated with Feature, Attribute and Value data.

Several types of non-spatial data can be used:

SHAPES: The PC-GPS Tool Palette can be used to create shapes for the PC-GPS Map. Shapes may be used to graphically describe items in the Map which do not need to be tied to specific coordinates. Shapes can also be used to enhance or highlight particular areas of the Map.

LABELS - The PC-GPS Tool Palette can be used to label your map. Click on the Palette icon to display the Tool Palette. Select the "A" icon for the text tool. Place the cross-hairs of the text tool on the Map View and draw a "rubberband box" with the mouse. When you release the mouse button, the "Text Set Up" dialog box will be displayed. In the Text Set Up screen, type-in the label name. Labels can also be assigned to Features using the **Topic/Autolabel** menu option. **In PC-GPS 07 and later versions, the Feature labels are saved in the same Topic as the corresponding Features.** These Feature Labels will tag along when the **Field CE 07** users transfer the .PMP job file to their PDA.

OBJECTs - PC-GPS takes full advantage of the Microsoft Object Linking and Embedding (OLE) specification, allowing you to include a variety of multi-media and special applications in your Map. Common OLE Objects used with PC-GPS may include: a media view clip, audio segment or some other picture or document. In general, any OBJECT or application which conforms to the OLE standard can be inserted in your Map.

- For further information, use Help/Help Topics and search on "Insert Object".

2.1.3 Data Organization- Features & Topics

Data in PC-GPS Map files is organized into **Topics**. A Topic is a group of Features which are defined by the same Attributes. A Map file may contain a number of different Topics. Several organizational rules define a Topic:

1. **A Topic is a grouping of one or more Features which are defined by a common set of Attributes.**
2. **Features grouped together in a Topic should be of the same Feature Type: Point, Line or Area.**
3. **Features which are not described by the same set of Attributes are assigned to separate Topics.**

4. **Separate Topics will be created for Features of same Feature name which are described by different Attributes.**
5. **The Feature name is used as the Topic name by default.**

One special Topic, called “Non-Spatial Data” does not adhere to the general rules provided above.

NON-SPATIAL DATA Topic

Each PC-GPS Map file contains a Non-Spatial Data Topic. This topic should not be deleted from a Map file. Non-spatial data such as shapes and labels are usually assigned to this Topic. However, non-spatial items can be assigned to other types of topics as well.

2.2 Data Organization

For the optimal use of PC-GPS, it is recommended that you spend time organizing data collection **BEFORE** using the GPS/GIS data collector (CMT Field unit) in the field.

There is no right or wrong way to organize your data. Your application is unique and your data collection goals are different from those of another user. Ideal data organization for your purposes may be a matter of trial and error. However, time invested in planning and studying how your data should be organized beforehand will be extremely worthwhile.

2.2.1 Benefits of Data Organization

Data organization is very important for the optimal use of PC-GPS. It is also important to understand how data organization affects the performance of PC-GPS. Listed below are the main benefits of data organization:

1. Maximization of powerful PC-GPS tools: If your data is not well organized, PC-GPS will perform slower and less efficiently.
2. Effective use of the PC-GPS classification function: Features assigned to one Topic can be categorized into separate classifications based upon the descriptive Attributes. Only Features in the same Topic can be classified together.
3. Full utilization of the PC-GPS Open DataBase Connectivity function: All of the Open DataBase Connectivity (ODBC) utilities can be easily accessed and used if data is pre-defined and well organized.
4. Pre-definition of all data you would like to extract from the data collection process; Pre-definition helps ensure that you will be able to perform desired data analysis functions within PC-GPS and other programs.

2.2.2 General Data Organization Suggestions

Provided below are some general suggestions for the process you might use to organize your data. As mentioned above, there are no hard and fast rules, however, these guidelines should be helpful.

1. Experiment with your data organization.

Try a couple of organization schemes before fully implementing a complete system. Analyze any existing data structure for GIS data collection.

2. Avoid describing a Feature using the Feature name alone.

3. Pre-plan in detail how the data should be organized and then subsequently collected in the field for each data collection job.

- a. Examine any existing GIS and database structures covering similar data collection jobs.
- b. Decide what type of data needs to be extracted from the data collection session for GIS mapping and data analysis. This applies to both Feature and Attribute data.
- c. Organize Features, Attributes, Values.
- d. Group similar Features described by common Attributes into Topics. Features which you want to classify together in the future will need to be grouped in the same Topic.

4. Create Feature List according to your data organization plan

- a. Design the Feature List such that it can be used easily by the field person.
- b. Limit the amount of data (Features/Attributes/Values) you enter “on the fly” in the GPS/GIS data collector. Data which is manually entered rather than entered via the Feature List may conflict with your data organization plan. Consider using the Feature Check, Attribute Check, and Value Setting functions described in Section 4.10 of this manual.

5. Use the Feature List for field data collection.

- a. Data which is manually entered rather than entered via the Feature List may conflict with your data organization plan.
- b. Remember the importance of accurate, organized field data entry. Time invested in the field on organized data collection will save considerable office time later.
- c. Avoid describing and storing a Feature with the Feature name only.

6. If field data is collected in a less organized manner than desired for PC-GPS and GIS purposes, the data can usually be re-organized using PC-GPS.

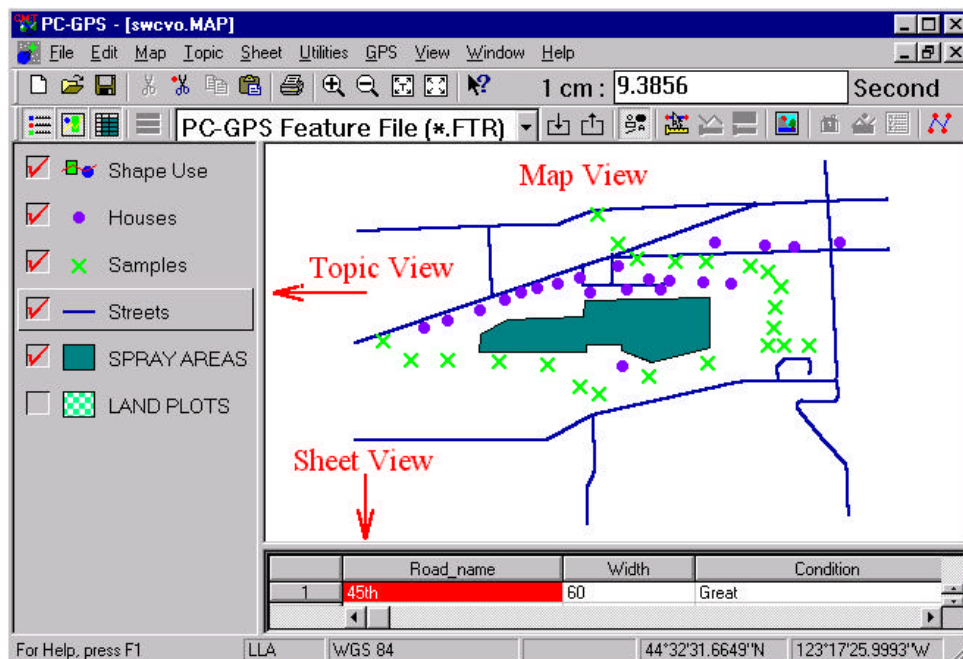
This is a time-consuming process that should be avoided if possible.

- a. Modify the data structure for your Topics using the Sheet/Setup/Modify Structure functions.
- b. Export the data to an ODBC data source then combine.
- c. Values stored accidentally stored in the attribute field cannot be re-organized in PC-GPS.

Please Note: The “Features” in the Feature List corresponds to the “Topics” in your map.

2.3 Working with PC-GPS Tools and Menus

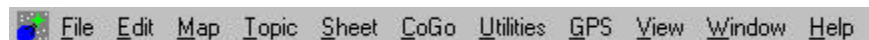
The main PC-GPS screen is shown below. The menus and tool bars are labeled. The Map file in this example is SWCVO.MAP.



Please note: This PC-GPS screen shows the Sheet View toggled ON. As the default when you open a Map, the Sheet View is OFF.

2.3.1 Menu Bar

The Menu Bar is located across the top of the main PC-GPS window.



The Menu Bar provides access to all of the active PC-GPS commands. These menu options can be activated by first clicking with the mouse on the menu option to pull down the option list, and then clicking on the desired selection.

Please note: In this manual the convention "Menu option/Submenu option" will be used. For example, "File/New" means you should pull down the Menu option "File" and then click on "New".

2.3.2 Tool Bar

The Tool Bar (Version Dependent) is located directly below the Menu Bar.



It contains standard Windows button icons for quick access to PC-GPS functions. Tool Bar functions can be activated by clicking the mouse once on an active icon. Buttons with inactive functions have icons that appear dull and gray. Simply click on an active button icon to access the associated PC-GPS function.

A brief description of an icon's function will be displayed next to the button when the mouse pointer is placed on the associated button.

2.3.3 Map Bar

Many of the options available via the Menu Bar can also be activated via the PC-GPS Map Bar. The Map Bar is the second tool bar in the PC-GPS screen.















In the Map Bar, PC-GPS functions are represented by button icons. These icons offer quick one-button access to active PC-GPS functions. Buttons with active functions have dark icons. Buttons with inactive functions have icons that appear dull and gray. Simply click on an active button icon to access the associated PC-GPS function.

A brief description of an icon's function will be displayed next to the associated button when the mouse pointer is placed on it.

Tool Palette

The Tool Palette provides access to a number of drawing tools for shapes and labels. The icon for the Tool Palette is located on the Map Bar. The functions of the Tool Palette are shown below.

 **Tool Palette Functions**

| | | | |
|-----------------|---|---------------|---|
| undo selection |  | line |  |
| line with arrow |  | solid square |  |
| rectangle frame |  | solid circle |  |
| circle frame |  | solid polygon |  |
| polyline |  | solid shape |  |
| text tool |  | mesh shape |  |

2.3.4 Map Scale

The Map Scale box is located at the end of the Tool Bar. The current Map display scale is listed in this box.

1 in : 2276.4975 Feet

To change the scale of the Map display, click in the Map Scale box, and enter a new display scale. After you enter a new display scale, press the ENTER key. The Map View will immediately change to reflect your designation. **Note:** If you would like to view a particular area of the Map at your selected scale, first set the scale and then use **View/Panoramic View**.

Scale units:

The scale units correspond to the unit setting in the Map/Coordinate System dialog box.

- If the units are set to Feet, the scale will be IN:FEET or IN:MILES
- If the units are set to Meters, the scale will be CM:METERS or CM:KILOMETERS

Please note: If you are using LLA as the coordinate system, the scale will be in reference to Seconds. The scale will be either IN:SECONDS or CM:SECONDS

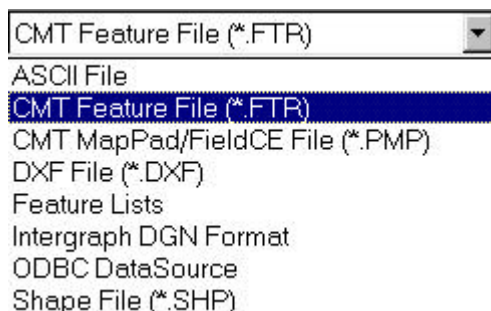
2.3.5 Status Bar

The Status Bar is located along the bottom of the PC-GPS screen. Messages on the current status of PC-GPS will be displayed in this area. In particular, the progress of opening, saving, importing or exporting files will be represented in the Status bar. In addition, the current coordinate location of the mouse pointer in the Map will be displayed in the Status Bar.

LLA WGS 84 44°33'02.868574 123°17'52.164513

2.3.6 Data Source Box: for Import and Export

The Data Source box located along the Tool Bar is used to specify a data source for PC-GPS importing and exporting functions.

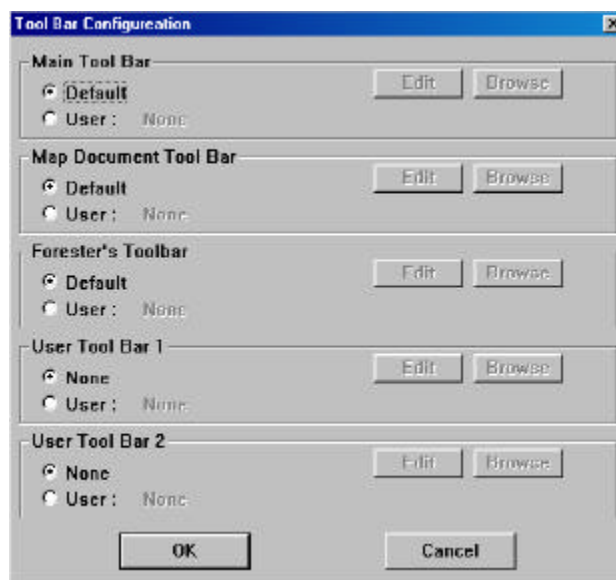


To select a Data Source, click on the pull-down arrow next to the data source field. The list of data sources will be displayed as shown above. Click on the data source you wish to use. The data source name will be highlighted. Once the data source is selected, you may use the export and import functions. PC-GPS 07 and later versions will let you import/export from/to a Microsoft® Excel file or a Microsoft® Access database.

2.3.7 Customizing PC-GPS tool bars

PC-GPS lets you create your own custom toolbars and also customize existing toolbars to fit your application. This function is very useful because you can get rid of unused icons on specific toolbars and create your own specific version of PC-GPS based on the functions you use.

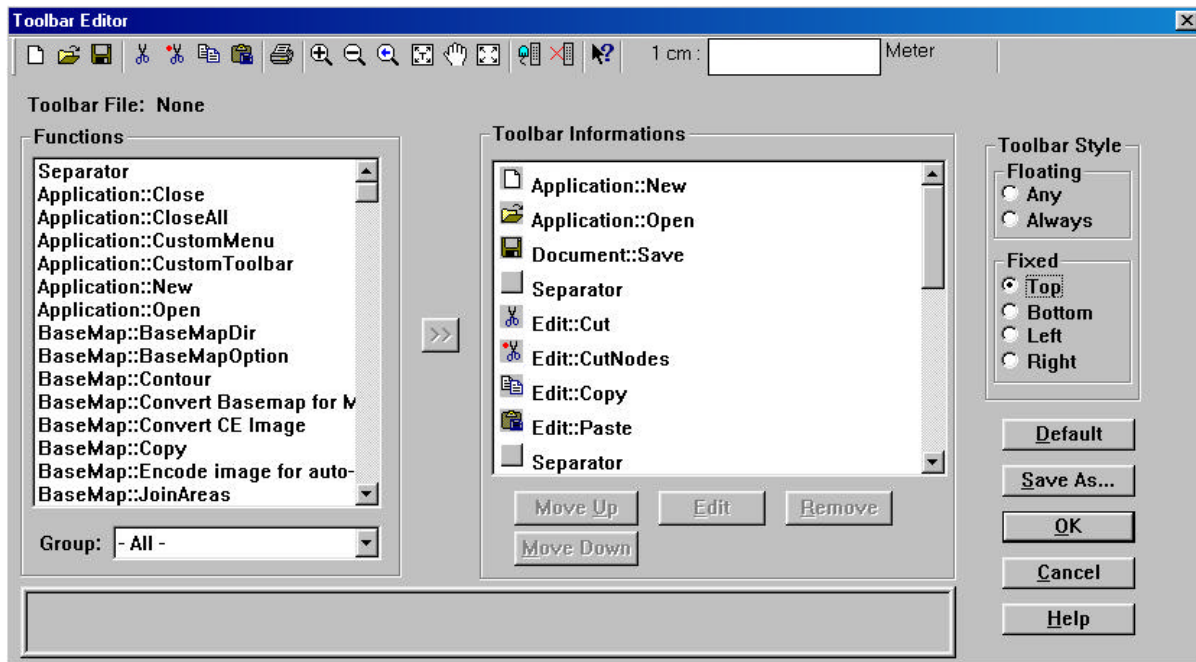
When you select View/Customize Toolbar, the following dialog is presented:



The three main toolbars in PC-GPS are listed along with two user-defined toolbars. The current display status of each toolbar is listed below the toolbar name. When **Default** is selected, the original specified PC-GPS toolbar would be used by the program. Select **User** to modify the existing toolbar and create your own. When the “**User**” option is selected, the **Edit** and **Browse** buttons become active for that toolbar.

Newly created toolbar files carry the file extension *.CGT (PC-GPS User Tool File). Use the **Browse** button to find any previously defined .CGT files for the specified toolbar. This allows you to have an unlimited amount of toolbar configurations for each toolbar.

Click on the **Edit** button to call up the tool bar editor screen:



A view of the existing toolbar is displayed at the top of the dialog window. All PC-GPS functions are listed to the left of the window. The current functions on the toolbar are displayed on the right side of the window. Use the >> button to move functions into the list of current functions. Those functions that are not currently assigned an icon will appear with a gray box next to them. Use the edit button to choose bitmap images to assign to the icon toolbar.

Any newly defined toolbars may be saved using the **Save As** button.

Using the **Move Up** or **Move Down** buttons can change the order of the icon arrangement. Remove unwanted functions with the **Remove** button.

Use the **Group** pull-down menu to quickly view and select groups of functions that are listed under the same function grouping.

Toolbar Styles

Floating:

Any - Sets the current toolbar to be floating, but it can also be mounted.

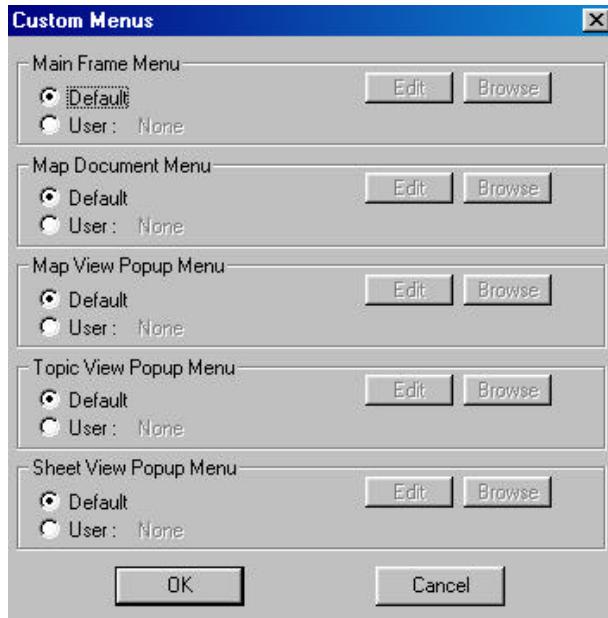
Always - Sets the current toolbar to be always floating. It cannot be mounted.

Fixed:

A fixed toolbar may be placed along the top, bottom, right or left edge of the PC-GPS software.

2.3.8 Customizing the PC-GPS Menus

PC-GPS also lets you customize the menu items to fit the needs of your application. When you select View/Customize Menu, the following dialog is presented:

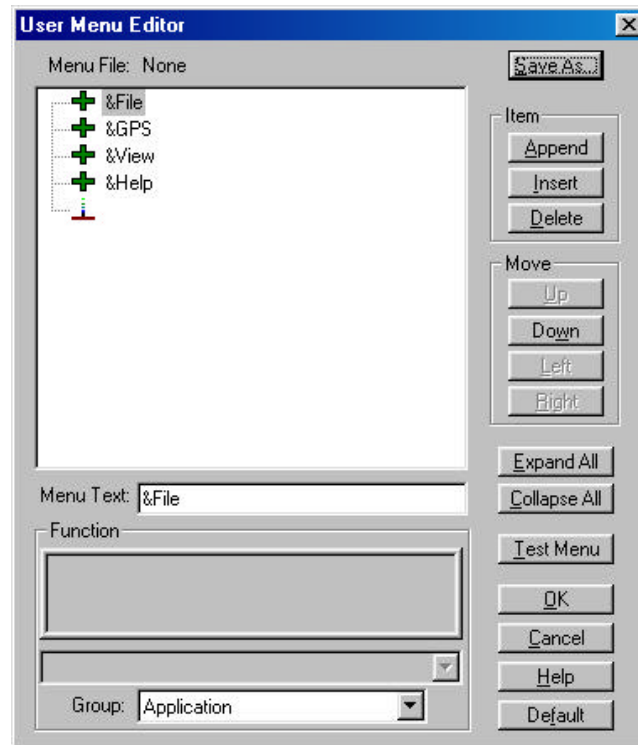


The menu items available for editing are the main menus for overall customization, the Map menu, the Map View menu (normally accessed by right-clicking on the Map View), the Topic menu and the Sheet menu.

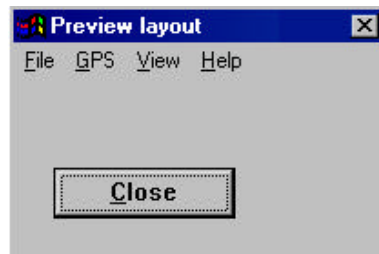
The current display status of each menu is listed below the toolbar name. When **Default** is selected, the original default PC-GPS menu is used by the program. Select **User** to modify the existing menu and customize it. When the **User** option is selected, the **Edit** and **Browse** buttons become active for that menu.

Newly created menu files carry the file extension *.CGM (PC-GPS User Menu File). Use the **Browse** button to find any previously defined *.CGM files for the specified menu. This allows you to have an unlimited amount of menu configurations for each menu.

Click on the **Edit** button to call up the menu editor screen:

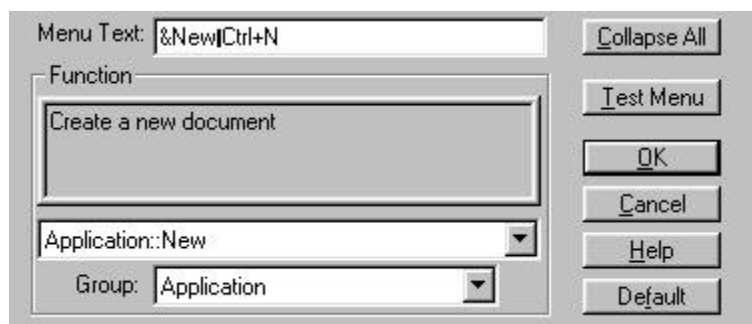


A sample view of the existing menu configuration can be displayed by clicking on the **Test Menu** button. A sample menu is shown:



Use the **Expand All** button to display all menu functions listed under the menu headings. Use the **Collapse All** button to minimize all menu functions and only display menu headings.

Click on a menu function to begin editing. The current menu text and a description of the function is displayed at the bottom of the editor screen to help identify the function:



The menu text may be edited. Take extra care when choosing the text because the menu text entered here will be used as the text in the pull-down menu. Place the “&” symbol in front of the character that will serve as the shortcut key for the function. The control character sequence such as “Ctrl+N” are hardwired and may not be changed by you. For example, the menu text “&New|Ctrl+N” will display as “New”. The function will be activated when you press “N” in the File menu or when you hold down the Ctrl key and press “N” in the Map View.

Again, use the **Test Menu** button to see a sample of what the menu and text will look like.

Moving Menu items

Use the **Up**, **Down**, **Left** and **Right** buttons to change the order and also the hierarchy structure of the current menu item.

Items listed next to the + or – are considered menu headings. These items are at the top of the hierarchy structure and may not be moved further left.

Menu headings may be moved up or down. This will affect the location of the items on the menu bar. Menu headings listed first will be shown at the far left of the actual menu. Menu headings may also be moved to the right which reduces their status to a menu item/function rather than a menu heading. Moving the menu headings further right will continue to reduce their status to sub-menu and finally sub-sub-menu. It is not recommended to move menu heading items to a sub-menu status because all functions listed under the menu heading are only accessible by first accessing the sub-menu which can be time consuming.

Menu functions may also be moved up or down to change their respective position in the list of functions on the pull-down menu. Menu functions may also be moved left and right to change their hierarchy.

New functions can be added using the **Insert** or **Append** buttons. The **Insert** button will insert a new menu item above the location of the current selection. The **Append** button will add a new menu item at the end of the list. Be sure to note at what level you are adding the new menu item: menu heading or menu function or sub-menu, etc. Remove unwanted functions with the **Delete** button.

When adding a new menu function or changing the existing menu function, you can use the pull-down list of existing functions to select a new one. Use the pull-down menu for the **Group** to simplify this process. Selecting a specific group will minimize the time spent searching for the desired function. For example, to add a “copy” function, first choose the Group item: “Edit”. Then, choose from the list of available functions to find the entry: “Edit::Cut”. Notice that the only available functions listed for selection originate from the Edit menu. However, you are not limited to only using “Edit” functions for the “Edit” menu item.

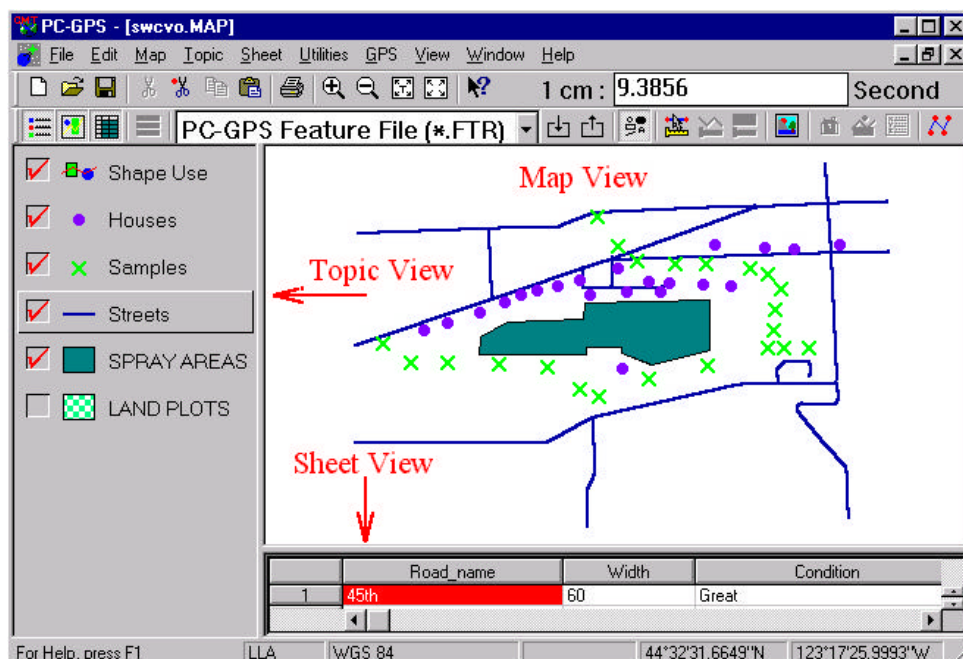
Any newly defined menus may be saved using the **Save As** button. Saved files will carry the file extension *.CGM (PC-GPS User Menu File) .

Choose **OK** to return to the Menu dialog window. If changes were not saved, you will be prompted to save changes in a new file. Click **Cancel** to abort any changes and return to the user Menu dialog window.

Click on the **Default** button to abort any changes and reset the menus back to their original default configuration.

2.4 View Modes

Data in the Map file can be viewed and edited using three different view modes. Each of these modes is represented by a “view mode window” located within the main PC-GPS window. The three View modes are shown below:



Example: The Map View, Topic View and Sheet View are shown above.

Map View - The Map View provides a graphic representation of your Map file. The Map View window is the major window inside the main PC-GPS window as indicated above. The Map View can be toggled ON or OFF by clicking on the Map View icon in the Map Bar:



Topic View - The Topic View provides a listing of your Map file Topics. The Topic View window is located along the left side of the main PC-GPS window as indicated above. The Topic View can be toggled ON or OFF by clicking on the Topic View icon in the Map Bar:



Sheet View - The Sheet View provides a spreadsheet style listing of the Attributes and Values for each Feature in your Map. The Sheet View window will be displayed along the bottom of the main PC-GPS window when it is toggled ON. The Sheet View can be toggled ON or OFF by clicking on the Sheet View icon in the Map Bar:



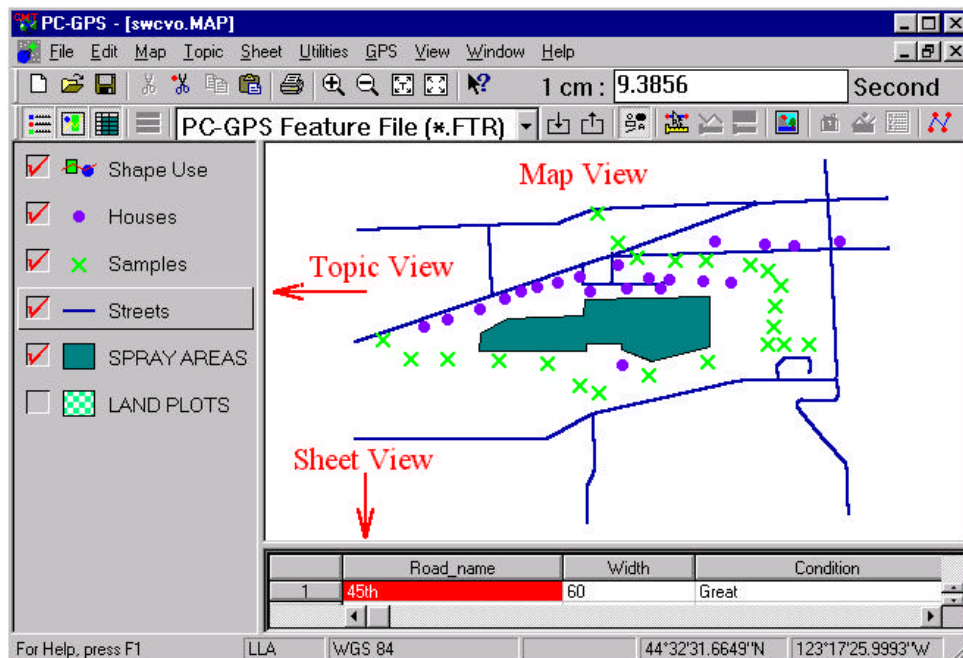
To edit value data in the Sheet View, click in the corresponding cell and type-in the new value.

Additional Information about the three View modes:

- You can change the display size of each View Mode by using the mouse to pull the edge of the View mode horizontally or vertically. For example, if you wish to temporarily increase the size of the Sheet View, click on the upper edge of the Sheet View, hold down the mouse button and then drag the mouse up across your PC screen.
- The three View Modes are interactive. Action in one mode will affect the display of data in the other modes. For example, when you select a Feature using the Map View, the corresponding Attribute and Value data will be displayed and highlighted in the Sheet View.
- View mode interaction also applies to PC-GPS editing functions. For example, if you delete a Topic from the Topic View, the associated Features will be deleted from the Map View and all of the corresponding Attribute and Value data will be deleted from Sheet View.

2.4.1 Map View

The Map View provides a graphic representation of the Map file. Both spatial data (Features) and non-spatial data (Shapes, OLE Objects and Labels) are represented in the Map View. The Map View is located in the center of the PC-GPS main window.




Example: In our example map, SWCVO.MAP, the Map View shows the Features individually: Houses, Samples, Streets, and Spray Areas. As reflected by the Topic order, the Houses, Samples, Streets and Spray Areas are overlaid upon the Land Plot Features. The Land Plot Topic is toggled OFF.

Displaying Data in the Map View:

Features and non-spatial data are displayed in the Map View according to the rules below. When you first open your Map file or Feature file, the default symbol or pattern will be used.

Point Features:  (Default Symbol)

A Point Feature, such as a House, is represented in the Map View by a small colored circle as shown above. A Point Feature can be selected from the Map View by clicking on the map representation of the individual Point Feature.

Line Features:  (Default Pattern)

A Line Feature, such as a Stream, is represented in the Map View by solid line as shown above. The line will be connected via all of the nodes (coordinates) within the Line Feature. A Line Feature can be selected from the Map View by clicking on the map representation of the individual Line Feature.

Area Features:  (Default Pattern)

An Area Feature, such as a Land Plot, is represented in the Map View by a solid “area” in the shape of the Feature bounded by a thin black border. An Area Feature can be selected from the Map View by clicking on the map representation of the individual Area Feature.

Shapes: 

A Shape, created with the Tool Palette, is represented by a drawing of the created shape. The Shape can be selected by clicking the mouse on the surface of the Shape. The location and size of the Shape can be redefined using the mouse once the Shape is selected. The default color for all shapes is light gray.

Labels: 

Labels are represented by text in the Map View. Labels are used to describe Topics with Feature and Attribute data. A label can be selected by clicking directly on the label text. The text and style of the label may be edited by double-clicking on the label itself.

Symbols and Patterns for your Features:

A number of different symbols and patterns can be used for the Map View and Topic View representation of your Points, Lines, and Areas. PC-GPS offers a number of standard point symbols, line styles and area patterns. In addition, point symbols and area patterns can be customized and stored in library files.

- For information on using symbols and patterns, see Section 3.4 in this manual.

2.4.2 Topic View: Topic Order

Features in your Map are organized into Topics or layers. The Topics in the Map are listed in the Topic View, along the left side of the main PC-GPS window. The order in which Topics are listed in the Topic View directly affects the display of Features in the Map View.

In general, Topics should be arranged by type and size. Point Topics and Line Topics should be listed first. Small or medium size Area Topics should be listed next. Large Area Topics should be listed last. (An Area Topic on top of a Point Topic may prevent you from seeing the Points.)

You can **change the order** of the Topic View by clicking on the desired Topic name, and, while holding the mouse button down, **dragging** the Topic to a different location in the Topic List.

Marking Topics for Display in the Map View

The mark box to the left of each Topic name listed in the Topic View is used to specify which Topics are displayed in the Map View. When you first open your Job file or Map file, all of the Topics in the Topic View will be marked with a check and all of the Features assigned to that Topic will be displayed in the Map View.



Houses Topic toggled ON



Houses Topic toggled OFF

You can toggle the display of a Topic ON and OFF by clicking on the mark box. Toggling the Topic mark box OFF will hide the Features of the Topic in the Map View. You may **right-click** once in the Topic View and then select the option to turn all Topics on or the option to turn all Topics off.

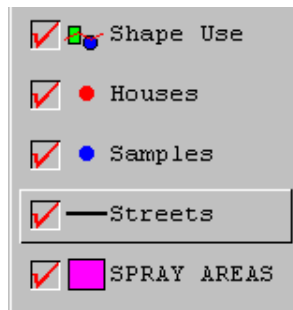
Making a Topic Active

Topics can be made active by clicking the mouse on the associated Topic name in the Topic View. Editing functions for the Topic View and the Sheet View apply to the active Topic. Once a Topic is made active, the corresponding Sheet View for all of the Features within the Topic is displayed at the bottom of the main PC-GPS window, if the Sheet View is toggled ON.

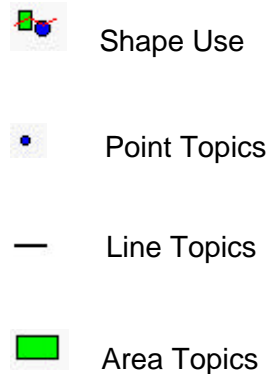
Topic Icons

A Topic icon, describing the Feature type, is located to the left of each Topic name. The default icons for Point Topics, Line Topics, Area Topics and Shape Topics, are shown below.

Icons as shown in the Topic View:



Icon Definitions:



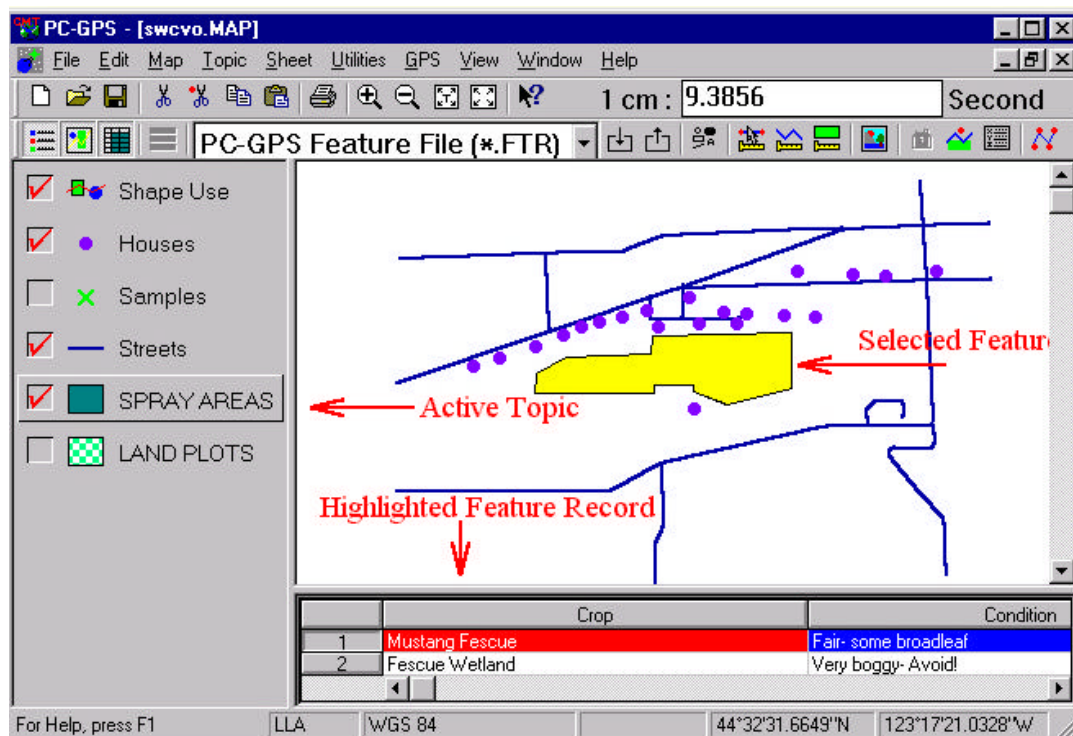
Please note: Topic View icons will reflect specific symbols or patterns used for Features.

2.4.3 Sheet View

The Sheet View provides a spreadsheet-style listing of the Attributes and Values for each Feature in the active Topic. The Sheet View is located at the bottom of the PC-GPS main window, directly below the Map View. You can activate the Sheet View by using the View/Sheet or clicking on the Sheet View icon in the Map Bar.

The Feature records in the Sheet View correspond to the Features in the active Topic.

Each row in the Sheet View represents an individual Feature record - the Attribute Values for a specific Feature. Topic Attributes are listed as the column headings.



Example: The Map file SWCVO.MAP is displayed. The Spray Areas Topic is the active Topic. The Feature records, with Attributes and Values, for Spray Areas Features 1-2 are listed in the Sheet View. Feature record number 1 is highlighted.

The Feature records in the Sheet View for the active Topic will be numbered beginning with number one (1). The Feature number, displayed to the left of each Feature record, is for reference only. The Feature number represents the current order of the Features in the active Topic. The order of Features in a Topic may be changed using the Map/Object functions.

- For information on changing the Feature order, use Help/Help Topics and search on "Map/Object".

Please note: The Non-Spatial Data Topic does not have a corresponding Sheet View. Non-spatial items usually do not have Attribute data.

Section 3: Working with Your Feature Data

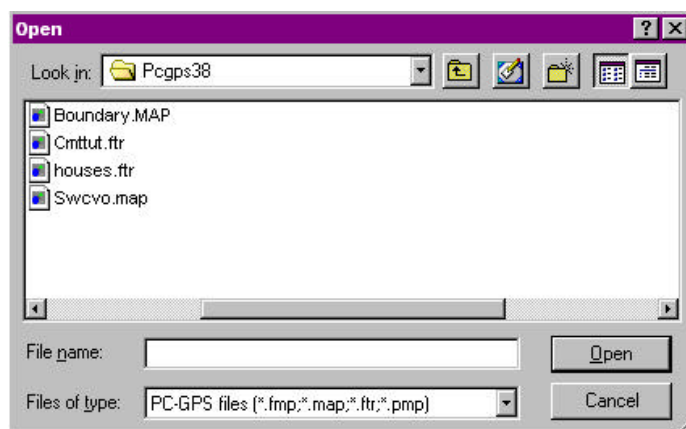
Many useful functions for working with your Feature data are presented in this section. Examples are provided where applicable. The Map used for the examples in this section is SWCVO.MAP. The SWCVO.MAP file should be listed in the PCGPS directory of your PC. All of the sample files required are provided with the PC-GPS program.

Map Files and Feature Files:

Feature data can be stored in a Map file (*.FMP), Feature file (*.FTR) or Field CE GIS files (*.PMP). The Job files collected on your CMT GPS unit are in Feature file format. The Feature file or GPS Job file only contains Feature data. Feature files do not support non-spatial data such as labels, shapes, and images. Map files, on the other hand, can be enhanced with many different types of non-spatial data. In this manual, reference is made most often to Map files. The main exception to this convention is in the GPS section (Section 4).

3.1 Opening your Map file

The **File/Open** option is used to open an existing Map File or Feature file (Job file). Once this option has been selected, the File Open dialog box will be displayed as follows:

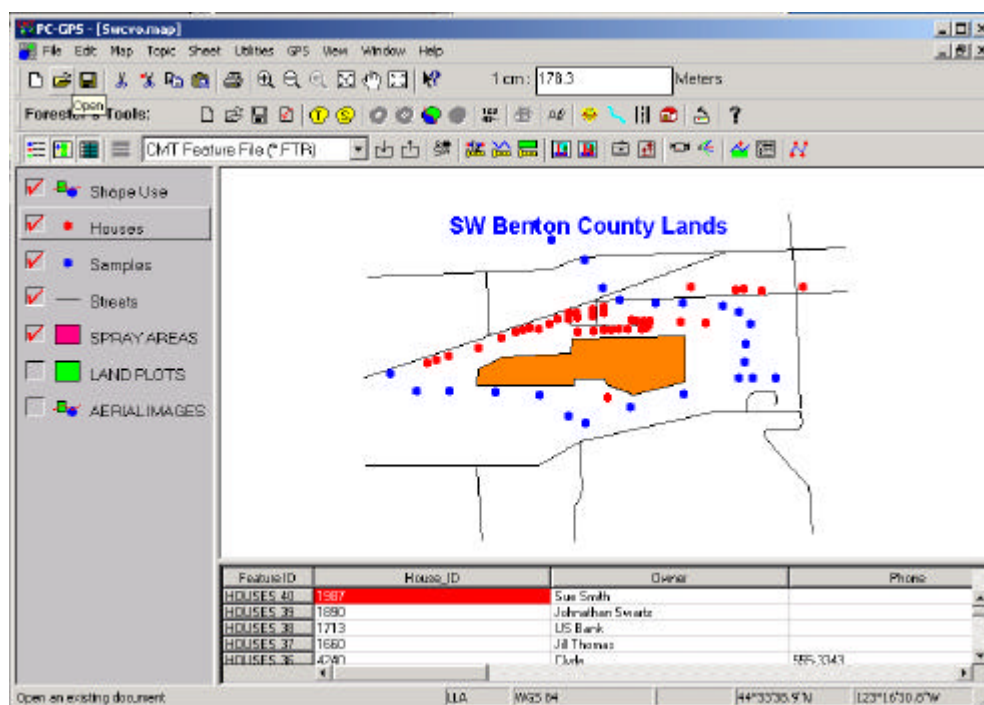


Select a file to open by either entering the file name in the File Name box or by double-clicking with the mouse on the appropriate file name listed in the File Name column.

If the file you wish to use is not listed under the current directory, you may want to check other directories on your PC. Double-click on the root to view a listing of all of the available directories. Next, double-click on the associated icon of the directory you wish to search. All of the .MAP, .FMP, .FTR and .PMP (from Field CE or MapPad) files in the selected directory will be listed in the File Name column. Also, files collected with SA3 or SA2 that have the .PSA extension or .FLD can only be opened in CMT Survey (.FLD files will prompt you to specify the coordinate system of the data upon opening the file).

Please note: You may also access files using the "File List" at the bottom of your File menu. The file names of the four most recently opened files will be listed and numbered. Click on the number or the name that matches the file you wish to open.

The following main PC-GPS window is displayed when you open a Map file:



Example: The main PC-GPS window for the Map file SWCVO.MAP is displayed above. The example above shows the SWCVO.MAP with the Land Plots Topic toggled OFF. The Sheet View is toggled ON.

3.1.1 Opening Your Feature File

The files downloaded from a CMT Field unit are in PC-GPS Feature file format. The file extension is *.FTR. You may open your Feature file using the **File/Open** option discussed above. Files downloaded from mobile devices (e.g. Field CE, MapPad or SA3) will have a different file extension (e.g. .PMP or .PSA).

3.1.2 Loading a Background Map

PC-GPS comes with the ability to display background maps (in .MAP or .FMP format). The background map can be used as a backdrop for your current job to help identify locations of features to be mapped and to easily see which features have been mapped in previous jobs.

The background map to be loaded must be in .FMP or .MAP format and, once loaded, will be treated as an image or a “picture” of the map in the background. Features contained in the background map may not be selected to obtain feature properties. However, you may specify the layering order and turn on/off specific topics for viewing that are contained in the background map.

Steps for loading a background map:

1. Load the background map by choosing **File/Background Map/Load Background Map**. After choosing this option, the **Open File** dialog is displayed.
2. Select the .MAP or .FMP file of interest in select it by double-clicking on it or choosing the **Open** button.
3. The Job will be loaded and displayed in the background along with your current map. After the background map is loaded, it may be toggled ON and OFF using the **File/Background Map/Background Map OFF** option (the word OFF will change to ON automatically if the Background Map has already been toggled off).

Topics listed in the background maps may be viewed, reordered and turned ON/OFF under the **View/Background Map Option** menu. When this option is selected a floating Topic View panel will be displayed on top of the original Topic View. This floating panel is titled **Background Map Topics** and may be moved, resized or closed. Only one background map at a time may be loaded and used with your current PC-GPS Map.

3.2 Saving your Data

Data in your PC-GPS Map file can be saved using the **File/Save** or **File/Save As** option. The standard Windows Save dialog box will be displayed. Your file can also be saved to different file formats using the **File/Export** option.

- Please see Section 6.3 for information on exporting to other file formats.

3.3 Selecting Data for Edits and other Operations

In order to edit a Feature or a group of Features, the Feature(s) must first be selected. The method used to select data varies according to data type and View Mode. Provided below are some general guidelines on the requirements for editing:

General Guidelines:

- If you wish to perform edits on an individual Feature, that Feature must be selected before the editing function can be used.
- If you wish to perform edits on more than one Feature simultaneously, all of the Features must be selected before the editing function can be used.
- If you wish to perform edits on a specific Topic, the Topic must be made active before the editing function is used. A Topic can be made active by clicking on the Topic name. A shadow box will highlight the active Topic name in the Topic View.

Please note: When a Topic is made active, the Features in the Topic are not necessarily selected.

- If you wish to perform edits on all of the Features within a specific Topic, the Features must first be selected before the editing function is used. A double click on the Topic name in the Topic View will simultaneously select all of the Features assigned to a specific Topic.

Data selection methods for each View Mode are discussed in the following sections.

3.3.1 Selecting Data in the Map View

Features can be easily selected from the Map View using the methods described below.

Individual Features: An individual Feature can be selected by clicking the mouse once on the associated Map View representation. The Feature selected will be displayed in orange.

Multiple Features: Multiple Features can be easily selected by drawing a “rubberband” box around Features in the Map View. The Features selected will be displayed in orange.

Multiple Features can also be selected using the Shift key. Select the first Feature by clicking once on its Map View representation, as indicated above. Select an additional Feature by holding down the SHIFT key and then clicking on its map representation.

All Features: All features in the Map View can be selected by using the **Edit/Select All** option.

You may un-select a Feature by clicking on the background of the Map View.

When a Feature is selected, the Map View representation of that Feature (Point, Line or Area) will be highlighted in orange. Simultaneously, the associated Topic will be made active in the Topic View. If the Sheet View is ON, the record for the selected Feature will be highlighted in red.

Please note: Orange is the default selection color for Features in the Map View. The selection color can be changed using the **View/Selection Color** option.

3.3.2 Selecting Non-Spatial Data

Non-spatial data can be selected in the Map View with a single click on the associated shape, label or object. When a non-spatial item is selected, the item will be surrounded by a grid of boxes for sizing

and relocation. The mouse can be used to drag the item to a different location or to adjust the item size. If you wish to edit the non-spatial item, first select the item and then use the **Edit/Properties** function.

Please note: Non-spatial data is usually assigned to the Shape Use Topic.

3.3.3 Selecting Features in a Topic using the Topic View

All of the Features within a Topic can be simultaneously selected by double clicking on the Topic name. All of the Features of the active Topic will be displayed in the selection color on the Map View. Additionally, the corresponding Feature records will be displayed and highlighted in black in the Sheet View.

3.3.4 Selecting Features using the Sheet View

Features can also be selected using the Sheet View. The Sheet View can be used to select individual Features and multiple Features.

An individual Feature can be selected using the Sheet View by clicking once on the Feature number in the first column of the Sheet View. To select additional Features, simply click successively on the respective Feature numbers.

To de-select a Feature or Features from the Sheet View, simply click either on a single cell or on the Map View background.

3.3.5 Selecting Features from the Classification Legend

If a Topic in your Map has been classified (**Topic/Classify**), you can use the Classification Legend to select all of the Features, which belong to a specific class. The Classification Legend in the Topic View shows the Class icons and associated class definitions. You may double-click on the class description in the Topic View to select all of the Features in the Topic, which match that description.

- Please refer to Section 5.2 for information on the **Topic/Classify** function.

3.3.6 Selecting Features using the Search Function

If you wish to select Features with specific Attributes and Values, you may use the **Topic/Search** function. The Search function allows you to create search sets based upon Attributes and Values. When a search is executed, all of the Features, which match your search set, will be selected from the Map file.

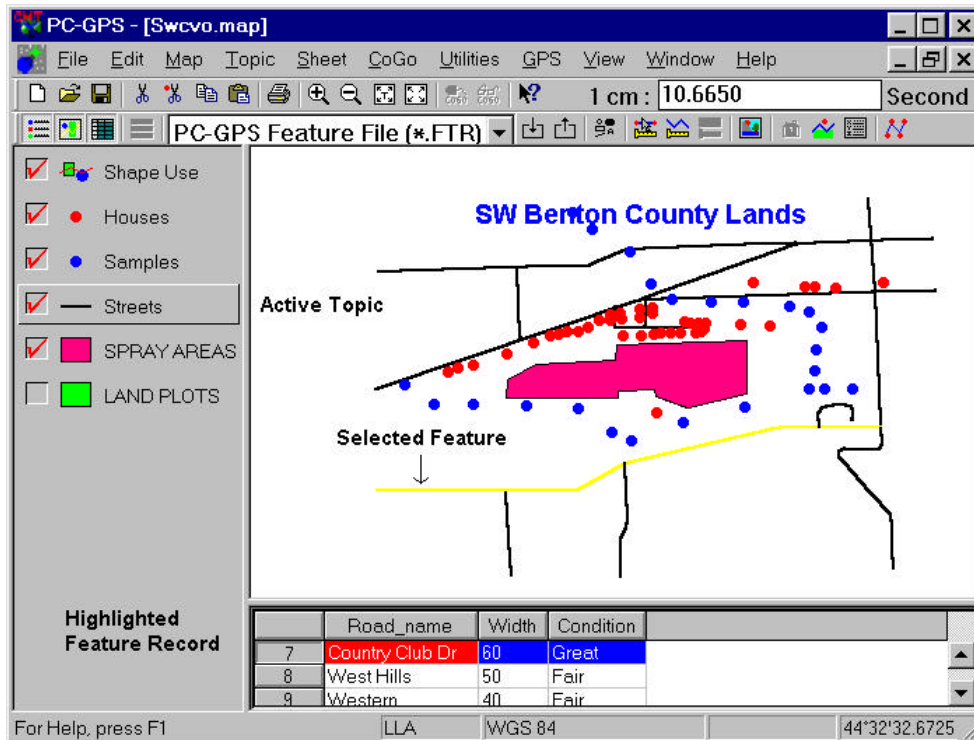
- Please refer to Section 5.4 for information on the **Topic/Search** function.

3.3.7 Example of View Mode Interaction

The Map View is interactive with both the Topic View and the Sheet View. A Feature selection affects the display of all three View modes.

When a Feature is selected from the Map View, Sheet View or the Topic View:

- The Feature is displayed in the selection color on the Map View.
- The Topic the Feature is assigned to will be made active in the Topic View. A shadow box will be drawn around the active Topic name.
- The Sheet View for the active Topic will be displayed. The Feature record for the selected Feature will be highlighted in black.



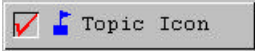

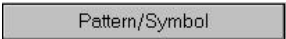
Example: In the SWCVO.MAP file above all three Views - Topic View, Map View and Sheet View are displayed. The selected Feature is shown in each of these views.

3.4 Using Feature Symbols and Patterns

Features in your Map can be displayed in a variety of symbols and patterns. PC-GPS provides multiple libraries of point symbols for Point Features, a library of line styles for Line Features and a library of fill patterns for Area Features. PC-GPS 3.8 and PC-MAPPER let you use any character or symbol in any existing font file as your point symbol. It also offers advanced editing functions for customizing symbols and patterns.

Assigning Symbols and Patterns:   

The chart below summarizes three different methods for assigning symbols and patterns to your Features. When you use any of these methods, the Shape Properties dialog box for your Points, Lines or Areas will be displayed. From the Shape Properties dialog box, you may select a symbol or pattern, a display color and a symbol size or pattern width.

| Method: | Action to display Shape Properties: | Symbols Displayed For: |
|--|---|---|
| 1) Topic Icon:  | Double-click on Topic icon in Topic View. The Shape Properties dialog for the Feature Type will be displayed. | <ul style="list-style-type: none"> • All Features in Topic • Topic Icon |
| 2) Symbol Icon:  | First, select the Features you wish to change. Next, click on the Symbol icon on the Map Bar. The Shape Properties dialog for your Feature type will be displayed. | <ul style="list-style-type: none"> • Selected Features Only • Topic Icon if one of the selected Features is the first in the Topic. |
| 3) Feature Properties:  | First, select the Features you wish to change. Next, use the Edit/Properties menu option. In the Feature Properties dialog, click on the Pattern/Symbol button. The Shape Properties dialog will be displayed. | <ul style="list-style-type: none"> • Selected Features Only • Topic Icon only if one of the selected Features is the first Feature in the Topic. |

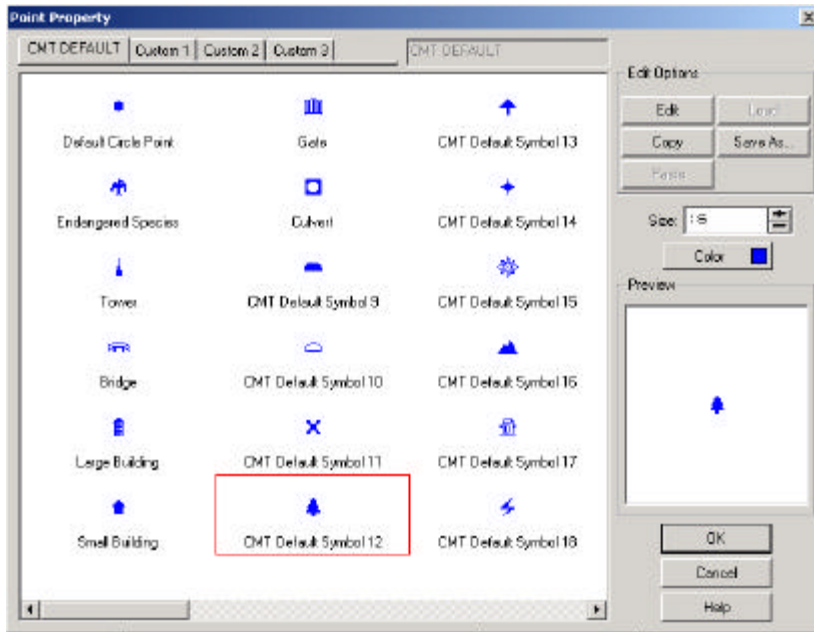
Summary of Steps for selecting symbols or patterns from Shape Properties dialog:

1. Use one of the methods described above to select your Feature set and display the Shape Properties dialog box.
2. From the Shape Properties dialog box, click on the symbol you wish to use. The selected symbol will be highlighted by a selection box. For points symbols and line patterns, the selected shape will also be displayed in the editing grid.
3. Click on the Color button to select a symbol display color.
4. Specify symbol or pattern size. For Point symbols, input a size value between 8 and 128.
Hint: The default Point size is 16. For Line patterns, you may input a value for pen size, mark size or mark distance, depending upon the patterned selected.
5. Click on the OK button in the Shape Properties dialog box.

Please note: If the Topic is either toggled OFF or does not contain Features, the Shape Properties dialog box will not be displayed when you double-click on the Topic Icon.

3.4.1 Symbols for Point Features

When the Features you have selected are Points, the following Point Property dialog box will be displayed when you double-click on the Topic icon or use the Symbol icon/button:



Size: To change the size of the symbol, click on the "+" or "-" button, or enter a value into the Size box.

Color: Click the color button to change the color of the selected symbol.

Copy: Copy the selected symbol to scrap area.

Paste: Overwrite the selected symbol with the symbol in the scrap area.

OK: Save the changes and return to the Feature Properties dialog or the Map View.

EDIT: Perform advanced editing in the Edit or Combine Point Symbol Dialog.

To select a symbol: From the Point Property dialog, you may select the appropriate page of symbols to use with your job files. The first page is named the CMT DEFAULT. You may change the names of the other three pages to suit your application needs. A red frame highlights the currently selected symbol.

Except for a few fixed symbols on the CMT DEFAULT page, you may replace any of the displayed symbols with another symbol. For example, you may select a symbol from the third page, use the COPY button to copy that symbol, and then go to the second page and use the PASTE button to place it at the desired position on the second page.

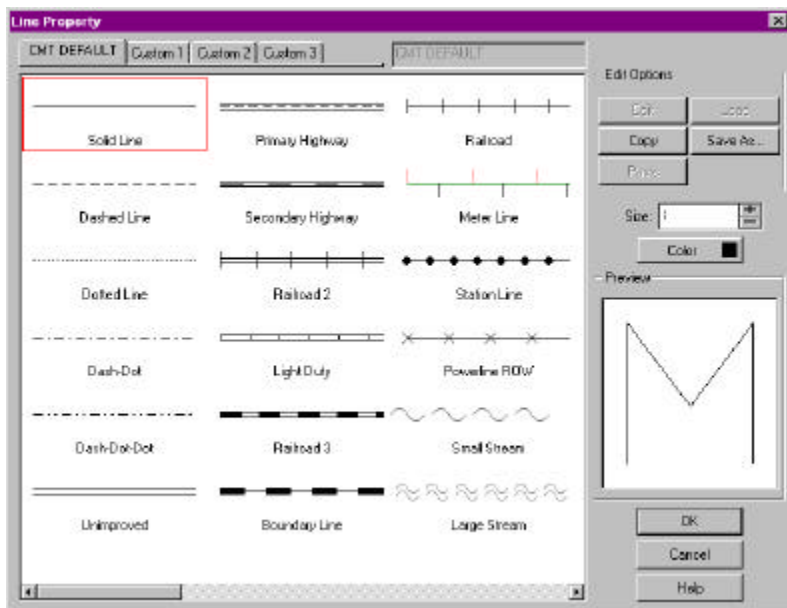
If you wish to revert to the original CMT DEFAULT page, then delete CMT PNT00.LIB in the program directory. (See Note at the end of this section.) If you are using a mobile device running CMT MapPad or CMT Field CE, then delete \program files\CMTApp\MPADP00.lib from the mobile device to restore the original symbols page..

To edit a symbol: Click on the symbol you wish to edit. The selected symbol will be displayed in the editing grid. Click on the EDIT button and edit the symbol to reflect the image you want. The modified symbol will replace the original symbol. Click on the OK button to return to the Map View.

If you wish to save the edited symbol for future use, click the **Save Custom** button to save the current symbol palette to a symbol library file (*.sym).

3.4.2 Patterns for Line Features

When the Features you have selected are Lines, the following Line Property dialog box will be displayed when you double-click on the Topic icon or use the Symbol icon or Symbol button:



Options for Lines:

Edit: Edits the line pattern in the Line Editor.

Copy: Copies the selected line type.

Paste: Pastes the line type.

Load: Loads a new line library.

Save As: Saves the existing library.

Size: change the thickness of the displayed line feature, click on the "+" or "-" button, or enter a value.

Color: change the color of the selected line style.

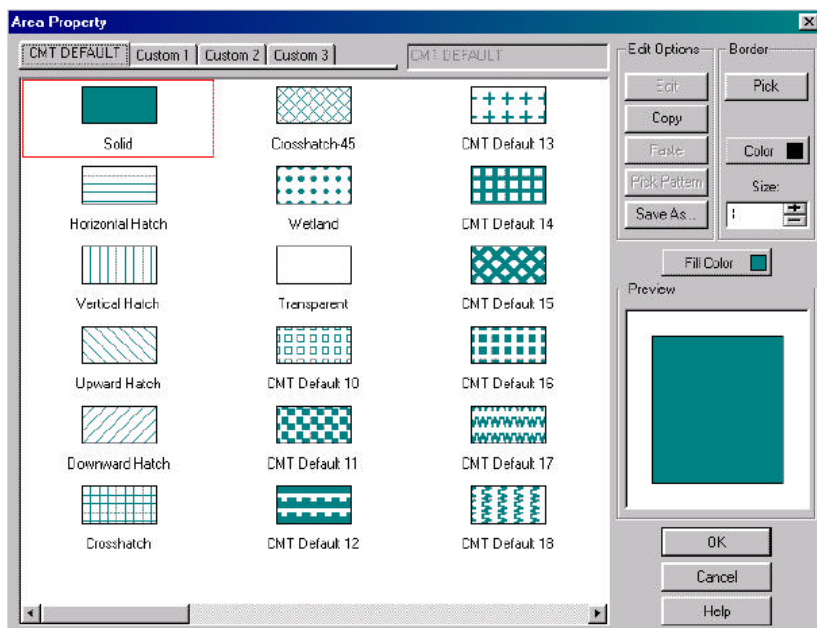
To select a pattern: Click on the pattern you wish to use. The selected pattern will be indicated by a selection square. If desired, click on the Color button to assign a different display color to the selected pattern. Click on the OK button in the Shape Properties dialog box to save your selection and return to the Map View.

Three custom line style library pages are provided. These are intended for storing the line styles that you may wish to design. You may change the names of these pages to suit your application needs.

Please note: The first five line patterns listed in the first column of the CMT DEFAULT page are locked and may not be edited in the Line Editor Dialog.

3.4.3 Patterns for Area Features

When the Features you have selected are Areas, the following Area Property dialog box will be displayed when you double-click on the Topic icon or use the Symbol icon/button:



Size: change the thickness of the border of the selected area feature

Color: change the color of the border of the selected area pattern.

FILL COLOR: change the color of the selected area pattern.

COPY: copy an area pattern from one location on the displayed library page to another location on the same page or on another page.

PASTE: place a copy pattern to the desired target location.

CANCEL: abandon the changes and return to the Feature Properties dialog.

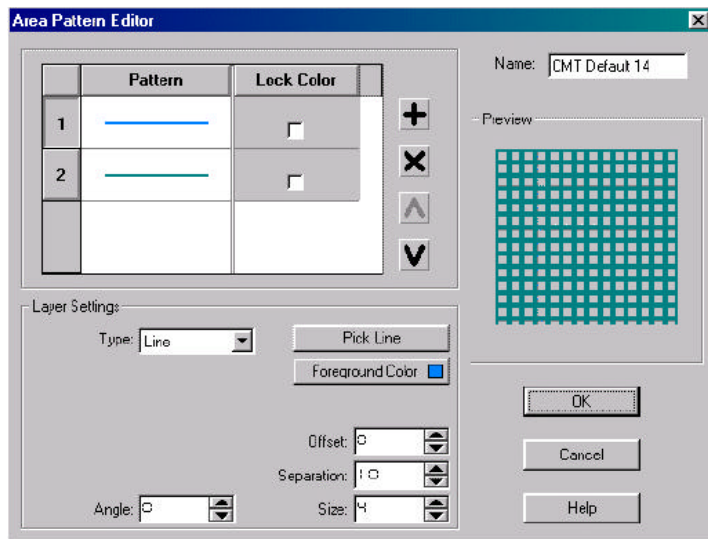
OK: save the changes and return to the Feature Properties dialog.

Click the **Pick** button to display the Line Property Dialog and select a line style for the boundary of the selected area feature. Choose the **Color** button to change the color of the border of the area pattern.

To select a pattern: Click on the pattern you wish to use. The selected pattern will be indicated by a selection square. The selected pattern will also be displayed in the Preview grid. If desired, click on the Color button to assign a different display color to the pattern. Some patterns are transparent while others are opaque. Click on the OK button to save your selection and return to the Map View.

Three custom area pattern library pages are provided. These are intended for storing the area patterns that you may wish to design. You may change the names of these pages to suit your application needs.

To edit a pattern: When you select an editable area pattern in the Area Property dialog and click on the Edit button, the following dialog will be displayed:



- Button to add an area pattern component.
- Button to delete a displayed layer.
- Button to move up to the previous layer.
- Button to move down to the next layer.

Foreground Color: change the color of the area fill pattern.

Angle: change the orientation of the fill pattern elements, click on the "+" or "-" button, or enter a value.

Offset: offset the selected layer.

Separation: increase or decrease the size of the separation between selected layers.

Size: change the size of the fill pattern elements, click on the "+" or "-" button, or enter a value.

Angle: rotate the selected layer.

You may use this dialog to edit or design an area pattern for Area features. Except for a few pre-defined area patterns, you may select a displayed area pattern and modify it. The changes are reflected in the Preview box.

To add a new pattern: When you add a completely new pattern, one of the existing patterns will be replaced in your BRUSH.USR file. First, select a pattern to "forfeit" from the pattern palette. The selected pattern will be displayed in the preview grid. Click on the OK button to save your new pattern and return to the Map View.









3.5 Editing Data in the Map View

The properties of Features, Shapes, and Text can be easily modified using the methods described in the following sections.

3.5.1 Feature Properties: Checking & Changing

The properties of your Features can be viewed and modified using the functions of the Feature Properties dialog box. **Most of the Feature property functions are also available via a Map Bar icon.** The table below summarizes the methods for accessing Feature property functions. Note that some of the functions may be used to view or change the properties of multiple Features simultaneously. When multiple Features are used with a Color, Pattern, or Symbol function, your color,

pattern or symbol choice will be applied to all of the selected Features. When multiple Features are used with the Area or Length function, the Area or Length reported will be a total calculation for all of the selected Features.

| Feature Property Function | Methods for Accessing Function: | Map Bar icon: | Multiple or Single Features: |
|-------------------------------|--|---|------------------------------|
| Color | <ul style="list-style-type: none"> Feature Properties: Color button Map Bar Icon |  | Multiple Features |
| Pattern | <ul style="list-style-type: none"> Feature Properties: Pattern button Map Bar Icon |  | Multiple Features |
| Symbol | <ul style="list-style-type: none"> Feature Properties: Symbol button Map Bar Icon |  | Multiple Features |
| Area | <ul style="list-style-type: none"> Feature Properties: Area button Map Bar Icon |  | Multiple Features |
| Length | <ul style="list-style-type: none"> Feature Properties Length button Map Bar Icon |  | Multiple Features |
| Offset | <ul style="list-style-type: none"> Feature Properties: Offset button | No Icon | Single Feature |
| Coordinate Information | <ul style="list-style-type: none"> Feature Properties: Coordinate Information button Map Bar Icon |  | Multiple Features |
| Link/View Photo | <ul style="list-style-type: none"> Feature Properties: Photo button Map Bar Icon |  | Single Feature |
| Link/Play Video Clip | <ul style="list-style-type: none"> Feature Properties: Link Object button Map Bar Icon |  | Single Feature |

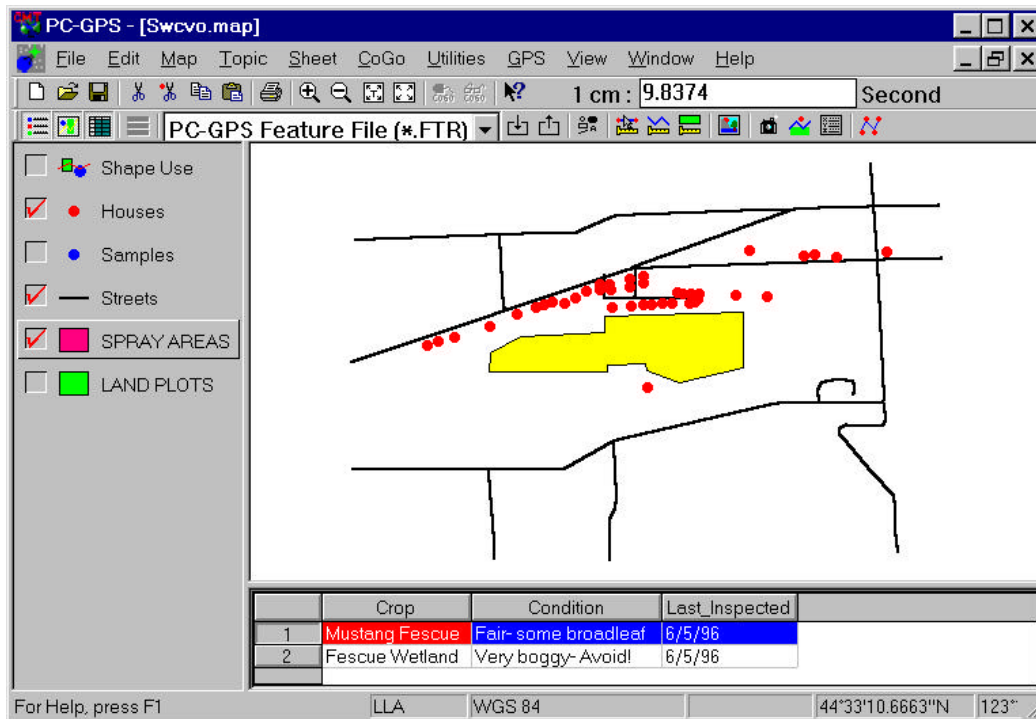
Using a Map Bar icon:

In order to use one of the Map Bar icons, a Feature or group of Features must first be selected. You may use any one of the selection methods outlined in Section 3.3. Once your Features are selected, click on the Map Bar icon which corresponds to the function you wish to use.

Using a Feature Properties button:

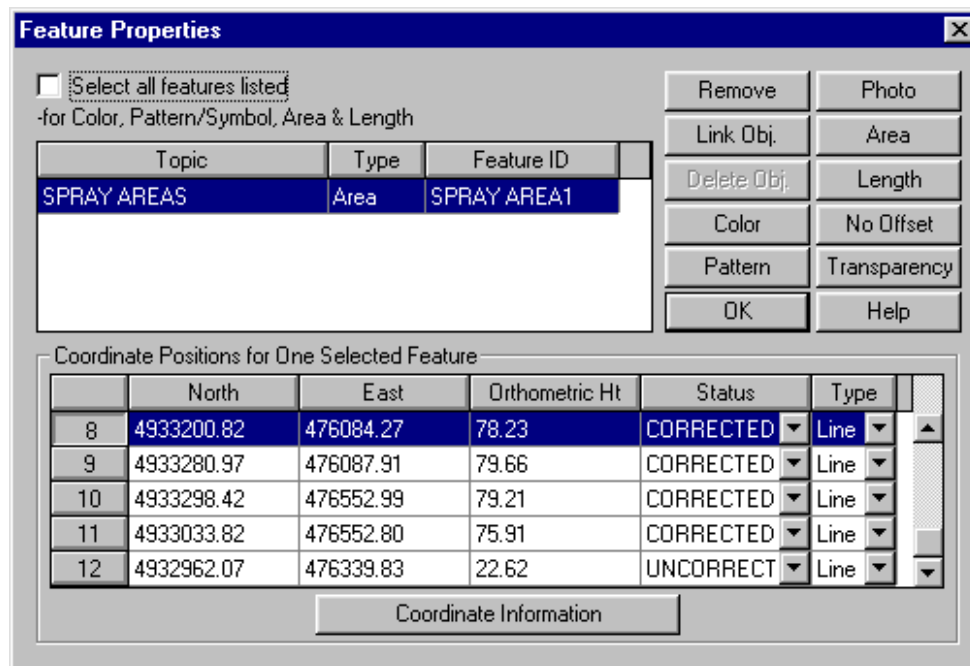
The Feature Properties dialog box can be accessed by double-clicking on a Feature in the Map View. You may also access the Feature Properties dialog box by first selecting a Feature from the Map View and then choosing the **Edit/Properties** function.

An example of this process is provided on the following page. The file for this example is SWCVO.MAP.



Example:

The example file SWCVO.MAP is displayed above. A Spray Area Feature is selected. When the **Edit/Properties** function is used the Feature Properties dialog box for the selected Spray Area Feature will be displayed as follows:



The Topic name and Feature type are listed in the Topic and Type fields. If you have selected more than one Feature, only one of the Features will be highlighted under Topic. Feature property functions will apply to the highlighted Feature only.

If you wish to apply a Feature property function to all the listed Features, click on the “Select All Features Listed...” mark box. The Color, Pattern/Symbol, Area and Length buttons will then apply to each Feature listed in the Selected Shape column.

Feature Coordinates: X,Y,Z

The coordinates of the selected Feature are listed in the coordinate position fields shown above. For a Point Feature only one coordinate position will be listed. For a Line or Area Feature the coordinates of each node will be listed. To edit a coordinate position, click the mouse in the respective coordinate field, type-in a new coordinate and press the ENTER key.

Feature Status

This field is available in some versions of PC-GPS to show the differential correction status of a point or a node.

Feature Style

This field is available in PC-GPS to facilitate the formation of circular arcs. You may change the style of any three consecutive nodes from “Line” to “Arc” and produce a segment of arc as a result.

Please note: If you mark the “Select All Features Listed...” option, the coordinate fields will not be displayed.

Feature Area:  **Area Icon:** 

The area of an Area Feature can be checked using the either Area button in the Feature Properties dialog box or Area Icon on the Map Bar. The results are shown in Acres, Hectares, Meters², Feet². The area calculation cannot be modified.

Feature Length:  **Length Icon:** 

The length of a Line Feature or the perimeter of an Area Feature can be checked using either the Length button in the Feature Properties dialog box or the Length icon on the Map Bar. The results are shown in Meters, Kilometers, Feet, and Miles. The length calculation cannot be modified.

Feature Color:  **Shape Properties Icon:** 

The display color of a Feature or drawing Shape can be modified using either the Color button in the Feature Properties dialog box or the Shape Properties icon on the Map Bar. When this option is used, the standard color dialog box is displayed. Click on the color and click on OK.

Feature Pattern/Symbol:  **Shape Properties Icon:** 

The pattern of a Line Feature, Area Feature or drawing Shape, or the symbol of a Point Feature can be modified using either the Pattern/Symbol button in the Feature Properties dialog box or the Shape Properties icon on the Map Bar. Please refer to Section 3.4.1 for an example of Point symbols, Section 3.4.2 for an example of Line patterns or Section 3.4.3 for an example of Area patterns. For

line and frame drawing Shapes, the Shape Properties dialog box for line patterns will be displayed. For solid drawing Shapes, the Shape Properties dialog box for area patterns will be displayed.

Feature Transparency:

Transparency

Shape Properties Icon:



With PC-GPS 07 and later versions also provide a button for adjusting the transparency of an Area Feature

Feature Offset:

Offset

The Offset of Features can be viewed and modified using the Offset button. When the Offset function is used in the field, the position of the actual Feature is calculated based upon a distance, slope and azimuth from the GPS receiver. Offsets are used when the GPS receiver cannot be placed at the actual location of the Feature due to blockage of GPS reception.

The Offset dialog box is shown as follows.

Type: Offset by Point, Left or Right

Distance: Distance from current position or original position of receiver.

Azimuth: Azimuth from current position or original position of GPS receiver.

Slope: Slope distance from current or original position of receiver.

Offset of a Point: Select Point as the offset type and enter the appropriate values in the distance, azimuth and slope fields.

Left/Right Offset of a Line or Area: Select Left or Right as the offset type and enter the appropriate values in the distance and slope fields. Example: If your Line proceeds North and you would like to move it to the West you would select “Left” as the offset direction.

Directional Offset of a Line or Area: Select Point as the offset type. Enter the appropriate values for distance and slope. For the azimuth, input 0 for North, 90 for East, 180 for South, 270 for West.

- For further information, use Help/Help Topics and search for “Feature Offset”.

Coordinate Information:

Coordinate Information

Map Bar Icon:



The coordinate information for a Feature or a node can be viewed using the Coordinate Information button in the Feature Properties dialog or the Coordinate Information icon on the Map Bar. The Coordinate Information dialog box will be displayed. Detailed information on the correction status, DOPs, session time, and the number of satellites tracked, etc. is provided.

- For further information, see Section 4.8 in this manual.

3.5.2 Inserting Nodes

Use the Edit/Insert Node function to insert new nodes into an existing Line or Area feature.

You can define the location of each new node by mouse-click or based on existing Point features. To display an indicator for the direction of the Line or Area Feature, select View/Configure then mark the Show direction of Line/Area checkbox.

To insert a node into a line or area:

1. Select the Line or Area Feature to highlight it then click Insert Node in the Edit menu.
2. Select the location of the new node. Choose **After** if you want to place the new node after an existing node. Choose **Before** to place the new node before an existing node
3. Click the existing node in the Map View to be used as the reference node.
4. Select **by cursor** to define the location of the new node by mouse-click. Select **by point feature** to define the location of the new node based on an existing Point feature.
5. Click the location of the new node in the Map View. **You can insert multiple nodes between two existing nodes.**
6. Click the **OK** button to close this window or click the **Reset** button to redo the whole Insert Node process.

3.6 Editing Shape or Text Properties

The properties of a non-spatial item such as a Shape or a Text label can be changed using the **Edit/Properties** function. You may edit the properties of a Shape or Text label by selecting the item from the Map View and using the **Edit/Properties** menu option. You may also access the editing functions by double-clicking on the Shape or Text label in the Map view.

Shapes: When the **Edit/Properties** function is used with Shapes, the Shape Properties dialog box will be displayed. The color, line style or hatch pattern may be modified using the functions of the Shape Properties dialog box. For line and frame drawing Shapes, the Shape Properties dialog box for line patterns will be displayed (Section 3.4.2). For solid drawing Shapes, the Shape Properties dialog box for area patterns will be displayed (Section 3.4.3).

Text: When the **Edit/Properties** function is used with Text Labels, the Text Setup dialog box will be displayed. The font, color, orientation, and size of a text label can be modified using functions of the dialog box. The Text Setup dialog box is shown in Section 5.3.1.

- For further information on Labeling Features, see Section 5.3 in this manual.

3.7 Mapping Utilities

PC-GPS utilities can be used for measuring distances, joining Features, averaging Features and closing Lines. These options are discussed in the sections below.

3.7.1 Closing Line Features into Area Features

The **Utilities/CloseLine** function is used to create a new Area Feature from an existing Line Feature. The last node on the line will be connected to the first node on the line, creating the closed area. The perimeter of the new Area Feature will have the same coordinates as the selected Line Feature.

To close a Line Feature into an Area Feature, first select the Line Feature, which you wish to close. The selected Line Feature will be highlighted in the Map View. Select the **Utilities/CloseLine** menu option. Select a Topic for the result Area Feature and click OK. A new Area Feature will be created and added to the selected Topic. A blank Feature record will be added to the Sheet View of the selected Topic. Please refer to Section 3.9.2 on completing the Feature record.

- For further information, use Help/Online Manual and search on “CloseLine”.

3.7.2 Averaging Coordinate Points

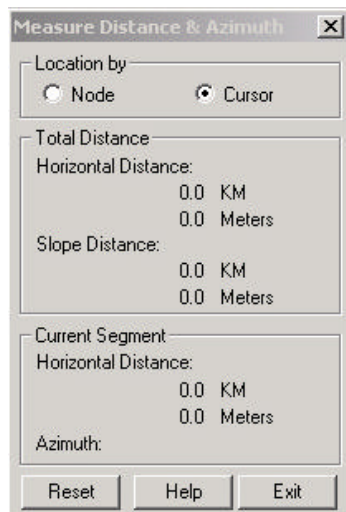
The **Utilities/Average** function allows you to average the coordinate locations of two or more Point Features. PC-GPS will create a new Point Feature at the averaged coordinate location.

To use the Average function, first select the Points you wish to average. Next, if you wish to add the new Point Feature a different Topic, make that Topic active by clicking on the Topic name in the Topic View. Click on the **Utilities/Average** menu option. The new averaged Point will be created automatically and added to the active Topic. The new Point will be displayed in both the Map View and the Sheet View. A blank Feature record for the new Point Feature will be appended to the Sheet View of the active Topic.

- For further information, use Help/Online Manual and search on “Averaging Points”.

3.7.3 Measuring Map Distances

The **Utilities/Measure** function allows you to measure the direct distance and azimuth between locations. When you use **Utilities/Measure**, the Distance and Azimuth dialog box will be displayed:



Location By: Measure by Cursor or by Node

Horizontal Distance: Direct distance in Feet, Miles, Meters and KM.

Slope Distance: Slope Distance in Feet, Miles, Meters and KM.

Azimuth: Azimuth between locations

Reset: Clear Measurement result

Location by Cursor: Select this option to measure the distance between locations as indicated by your mouse cursor. First, click your mouse on the location representing the “measurement start”. A crosshair will be displayed at the location of your mouse click. Then click on the “measurement end”. Immediately the distance between the two locations will be displayed in the dialog box. You may continue to click on additional locations if you wish to see a cumulative measurement.

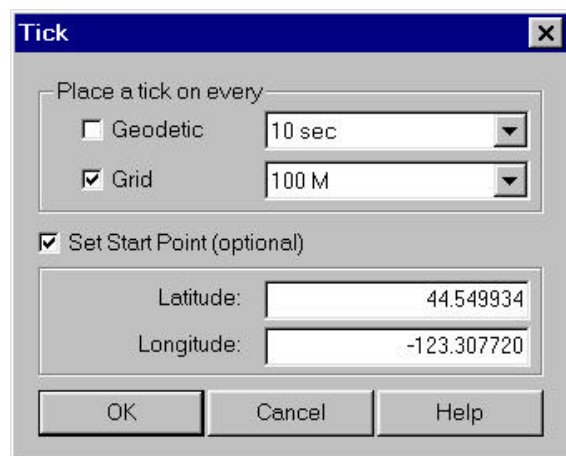
Location by Node: Select this option to measure the distance between nodes. Click the mouse on a node, which represents the “measurement start”. A crosshair will be displayed on the selected node. Then, click the mouse on the ending node. Immediately the distance between the two nodes will be displayed in the dialog box. You may continue to click on additional nodes if you wish to see a cumulative measurement.

Please note: For cumulative measurements, the distance reported is the distance between the first location and the last location. In contrast, the azimuth reported is the azimuth between the last two locations.

Also note: After you click on the first location, you will see a real-time azimuth and distance displayed in the status bar originating from the starting point.

3.7.4 Displaying Grid or Geodetic Ticks

The **View/Show Tick** option can be used to display geodetic or grid ticks on the Map View. When this option is selected, the following Tick dialog box is displayed:



Geodetic: Default interval is 10 seconds

Grid: Default interval is 10 M or 10 Feet

Mark: either Grid or Geodetic and select the desired interval using the pull-down arrow to the right of the tick unit field.

Set Start Point: Mark this option if you wish to set a starting coordinate location for the display of the ticks. To set the starting coordinates, you may either click on the location in the Map View or manually enter the coordinates in the respective coordinate fields.

Select the tick type and the interval you wish to use for the ticks. You may also set the starting coordinate location for the tick display using the Set Start Point option. Once you have selected the tick type and interval, click on the OK button. The ticks will be displayed on the Map View. To remove Ticks from the Map View, use **Grid/View Tick** menu option again and un-mark the selected tick option. Click on the OK button to exit the dialog box and return to the Map View.

Please note: Ticks displayed in the Map View will be plotted when the **File/Plot Preview** or **File/Plot** function is used.

3.7.5 Joining Features

The **Utilities/Join** option allows you to join Features together. **The Join process creates a new Feature from two or more existing Features.** Points can be joined into Lines or Areas. Lines also can be joined into Lines or Areas. In addition, Area Features can be joined together to create new Areas.

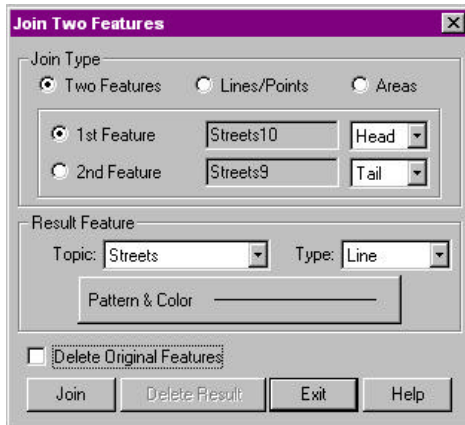
Please note: If you wish to close a Line Feature into an Area, use **Utilities/Close Line**.

When you click on the **Utilities/Join** menu option, the Join Lines/Points dialog box will be displayed. Two join options are available: **Join Lines/Points** and **Join Two Features**. The option you use will depend upon the type of Feature you are using:

| If your Original Features are: | Join Option to Use: | Notes: |
|--------------------------------|--|--|
| Points | Join Lines/Points | |
| 2 Lines | Join Two Features or Join Lines/Points | With the Join Two Features option you must indicate head or tail nodes. |
| More than 2 Lines | Join Lines/Points | Lines will be joined together by “nearest node”. |
| Areas | Join Two Features | Areas must have a common boundary |

Join Two Features Option

The **Join Two Features** option is used to join two Line or Area Features together. A new Feature will be created as a result of the Join process. You may assign the new Feature to a specific Topic in your Map file by using the “Topic” option. If you wish to delete the original two Features used for the join, you may mark the Delete Original Features option.



1st Feature: Click on the first Feature to join and select Head or Tail.

2nd Feature: Click on the second Feature, and select Head or Tail.

Result Topic: Select a Topic for the new Feature.

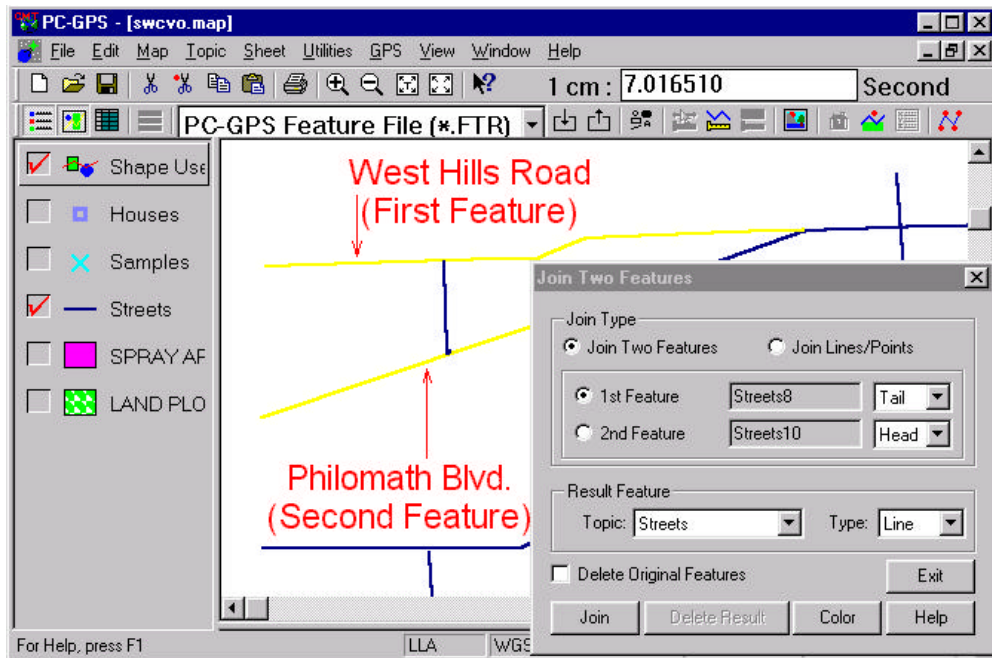
Result Type: Select Line or Area Feature.

Delete Original Features: Mark this option if you wish to delete the two original Features.

Once you have selected the Features, join direction, result Topic and Feature type, the Join button can be used to complete the join process. Immediately, the two Features selected will be joined, and the results will be displayed in the Map View. In addition, a blank Feature record will be appended to the Sheet View of the (Result) Topic.

Please note: **Head** indicates the first node in the Line or Area. **Tail** indicates the last node in the Line or Area. In the example above, the Tail of the first Feature will be joined with the Head of the second Feature. The “direction” of a Line or Area Feature can be checked turning on the “Show direction for Line/Area” checkbox in the Custom Configuration dialog box (**View/Configure**).

Join Two Lines Example: Open the SWCVO.MAP Map file. Toggle OFF the display of all of the Topics except the Streets Topic. Then click on the **Utilities/Join** menu option and mark the “Join Two Features” checkbox. The Map file and the **Join Two Features** dialog box will be displayed as shown below. Move the dialog box to the lower right hand side of the display, so you can view the Features you will be joining in the Map View.

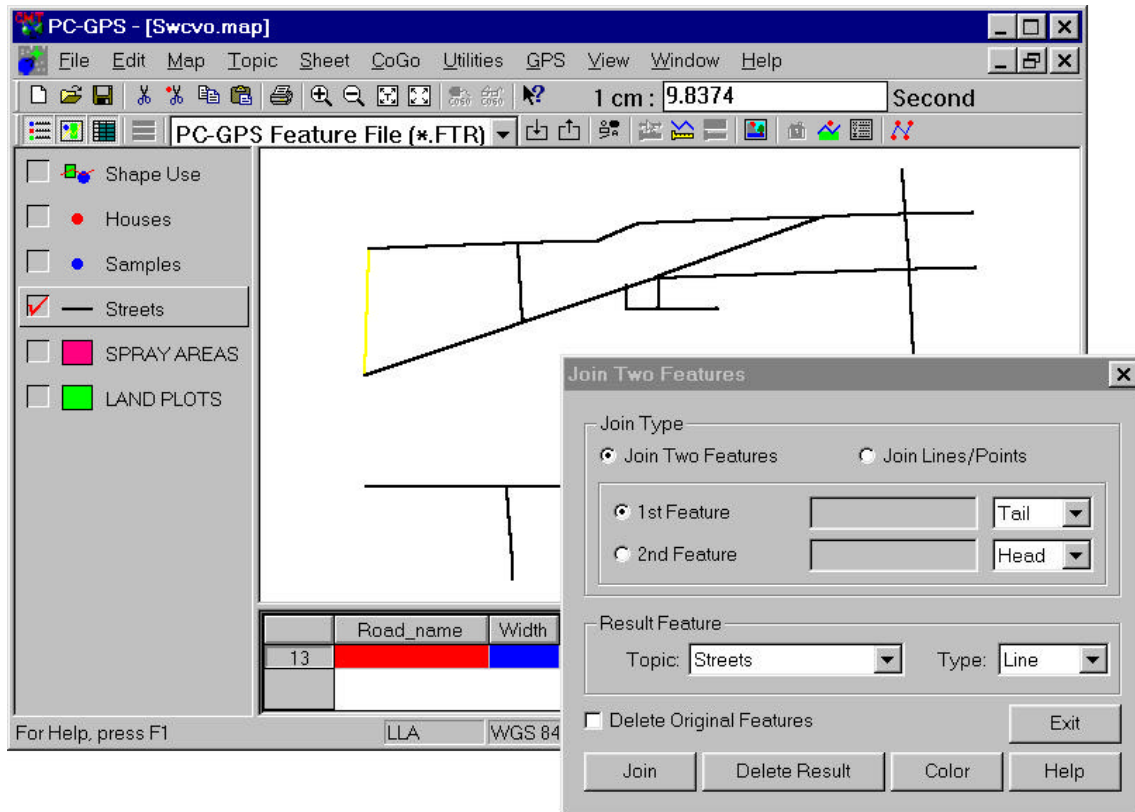


The objective of this example is to join West Hills Road to Philomath Blvd to form a single Line Feature. The streets are labeled above.

Once the Join Two Features dialog box is displayed, as shown on the previous page, you may select the “1st Feature” by clicking on the West Hills Road Feature. Immediately, “Streets8” will appear in the First Feature field of the Join Two Features dialog box. Make sure that the selection box to the right of 1st Feature displays “Tail”.

Next, select the “2nd Feature” by clicking on the Philomath Blvd Feature. Immediately, “Streets10” will appear in the 2nd Feature field of the Join Two Features dialog box. Make sure the selection box to the right of 2nd Feature displays “Head”. In the Result Feature fields, select Streets for Topic and Line for Type.

Finally, click on the Join button to create the new Line Feature. You should see the new Streets Feature displayed in the Map View as follows:

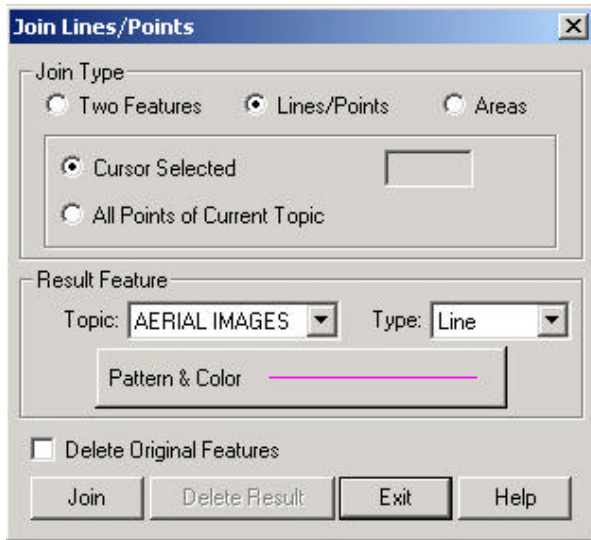


Join Result: The new Line Feature is displayed in the Map View and a new Feature record is added to the Streets Topic. The two original Line Features used to create the new Street Feature are retained, since the Delete Original Features option was not marked. Click on the Exit button to return to the main PC-GPS window. If you want to delete the new Street Feature, click on the Delete Result button and then click on the Exit button.

Join Lines/Points Option

The **Join Lines/Points** option allows you to join multiple Line Features and/or Point Features together to form a new Line Feature or Area Feature. The new Feature may be assigned to a specific Topic in your Map file by using the Result Topic option. In addition, if you wish to delete the original Line or Point Features, you may mark the Delete Original Features option.

There are two methods for Joining Features - **Cursor Selected** or **All Points of Current Topic**. The **Cursor Selected** method allows you to select Features using the mouse cursor. The order in which you select the Features will determine the order in which the Features are joined. The **All Points of Current Topic** method joins all of the Features in the active Topic. The Features will be joined together based on the Sheet View order.



Cursor Selected: Click on individual Point Features or Line Features, which are to be joined together.

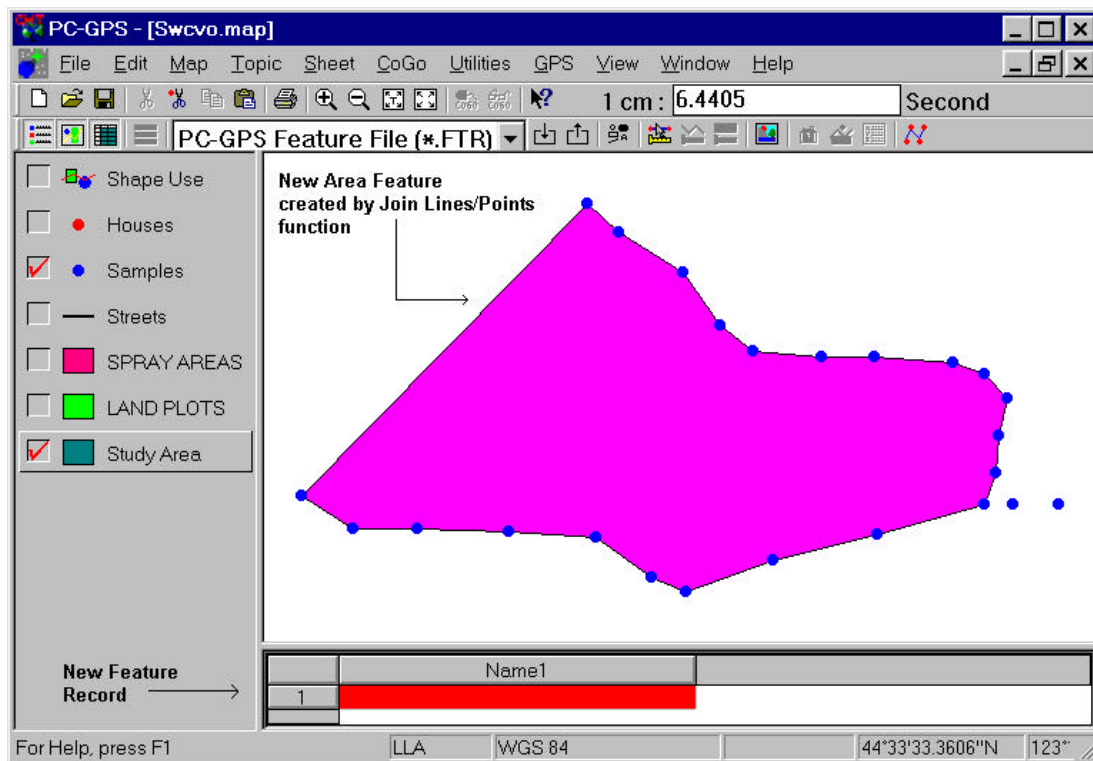
All Points of Current Topic: All Points of the active Topic will be joined together. (Lines can also be joined.)

Result Topic: Select a Topic for the new Feature.

Result Type: Choose Line or Area Feature type

Delete Original Features: Mark this option if you wish to delete the original Point or Line Features

The example screen below shows a new Area Feature created using the Join Lines/Points function. Twenty-two Points in the Samples Topic were joined using the “Cursor Selected” method. The Area created was assigned to a new Topic called “Study Area” Topic.



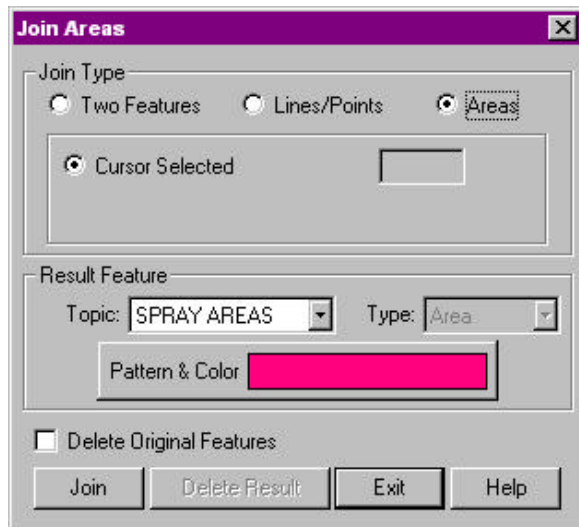
- For further information, use Help/Help Topics and search on “Join Points”.

Note about New Topics: You may create a new Topic using the **Topic/New Topic** function discussed in Section 5.1. You can create the Topic before or after the Join process. To move the Feature to a different Topic after it has been created, use the **Edit/Cut** and **Edit/Paste to Topic** functions.

Join Areas Option

The **Join Areas** option allows you to join two or more Area Features to form a new Area Feature. The new Feature may be assigned to a specific Topic in your Map file by using the Result Topic option. In addition, if you wish to delete the original Area Features, you may mark the Delete Original Features option.

There is one method for Joining Area Features - **Cursor Selected**. The **Cursor Selected** method allows you to select Features using the mouse cursor.



Cursor Selected: Click on individual Area Features to be joined together.

Result Topic: Select a Topic for the new Feature.

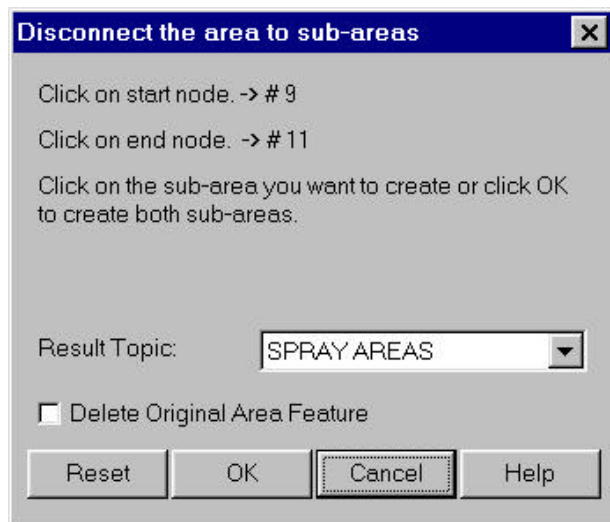
Pattern & Color: Set the color and pattern for the result Area Feature.

Delete Original Features: Mark this option if you wish to delete the original Area Features

3.7.6 Disconnecting an Area Feature

The **Utilities/Disconnect Area** functions are used to create one or more new Point, Line or Area Features based on the nodes of an Area Feature. The new Features may be assigned to a specific Topic in your Map file by using the "Select Result Topic" option. In addition, if you wish to delete the original Area Feature, you may mark the Delete Original Area Feature option. To disconnect your Area Feature, first select the Area Feature from the Map View. Then choose one of the Utilities/Disconnect Area functions. One of the following dialog boxes will be displayed:

Disconnect Area/to Sub Areas



Start Node: Click the Area's node that will begin the split.

End Node: Click the Area's node that will end the split.

Click on the Sub-Area: Click one of the new sub-areas that were created by splitting the original area or click OK to create both sub-areas.

Result Topic: Select a Topic for the new Area(s).

Delete Original Area Feature: Mark this option if you wish to delete the original Area Feature.

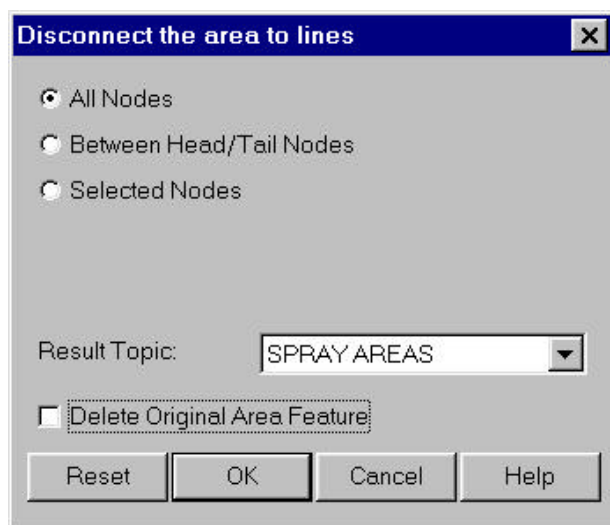
Select the line that will split the Area into two sub-Areas by clicking the Start Node and the End Node you wish to use.

Click on the new sub-Area that you want to create. If you want to create both sub-Areas, skip this step.

Select a Topic for the new Area(s). Mark "Delete Original Area Feature" only if you would like to remove your Area Feature from the Map after the disconnect procedure. Note: The original Area Feature can be retrieved using Edit/Undelete.

Click on the OK button to disconnect the Area. Immediately, one or both sub-Area Features will be created from the original Area. The new Feature record(s) will be added to the Sheet View of the Topic selected under the Result Topic option. Please refer to Section 3.9.2 for information on completing the Feature record for the new Feature.

Disconnect Area/to Lines



All Nodes: A Line will be created between each node.

Between Head/Tail Nodes: Area will be disconnected between the first and last node. A perimeter line will be created.

Selected Nodes: Click on each of nodes in the Area you wish to disconnect. A Line will be created between each node selected.

Result Topic: Select a Topic for the new Line(s).

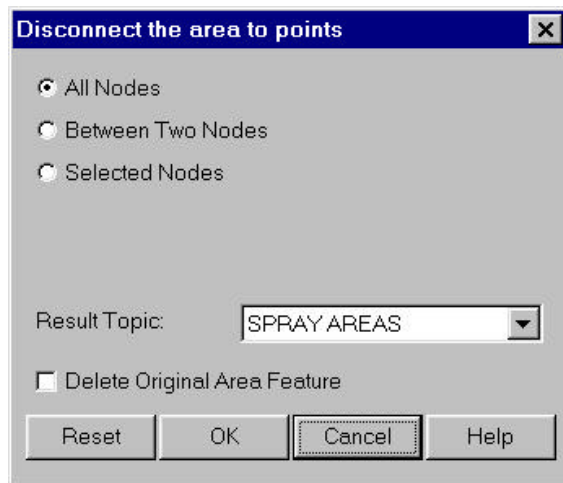
Delete Original Area Feature: Mark this option if you wish to delete the original Area Feature.

Select the disconnect option you wish to use: Between All Nodes, Between Head/Tail Nodes or Between Selected Nodes. If you choose “Between Selected Nodes”, you will need to click on the nodes you wish to disconnect. (A line will be created between each of the selected nodes.)

Select a Result Topic for the new Lines. Mark “Delete Original Area Feature” only if you would like to remove your Area Feature from the Map after the disconnect procedure. Note: The original Area Feature can be retrieved using Edit/Undelete or by Joining the resulting Lines back into an Area.

Click on the OK button to disconnect the Area. Immediately, one or more Line Features will be created from the perimeter of the selected Area. The new Feature record(s) will be added to the Sheet View of the Topic selected under the Result Topic option. Please refer to Section 3.9.2 for information on completing the Feature record for the new Feature.

Disconnect Area/to Points



All Nodes: A Point will be created at each node in the Area.

Between Two Nodes: Click on the Start Node and End node. A Point will be created at the Start and End nodes and each node between the two selected nodes.

Selected Nodes: Click on all desired nodes of the Area. A Point will be created on each node selected.

Result Topic: Select a Topic for the new Point(s).

Delete Original Area Feature: Mark this option if you wish to delete the original Area Feature.

Select the disconnect option you wish to use: Between All Nodes, Between Two Nodes or Between Selected Nodes. If you choose “Between Selected Nodes”, you will need to click on the nodes you wish to disconnect (a Point will be created at each of the selected nodes). If you choose “Between Two Nodes”, you will need to click on the Start and End nodes between which you wish to disconnect (a Point will be created at the Start and End nodes and between the two selected nodes).

Select a Result Topic for the new Point(s). Mark “Delete Original Area Feature” only if you would like to remove your Area Feature from the Map after the disconnect procedure. Note: The original Area Feature can be retrieved using Edit/Undelete or by Joining the resulting Points back into an Area.

Click on the OK button to disconnect the Area. Immediately, one or more Point Features will be created from the perimeter of the selected Area. The new Feature record(s) will be added to the Sheet View of the Topic selected under the Result Topic option. Please refer to Section 3.9.2 for information on completing the Feature record for the new Feature.

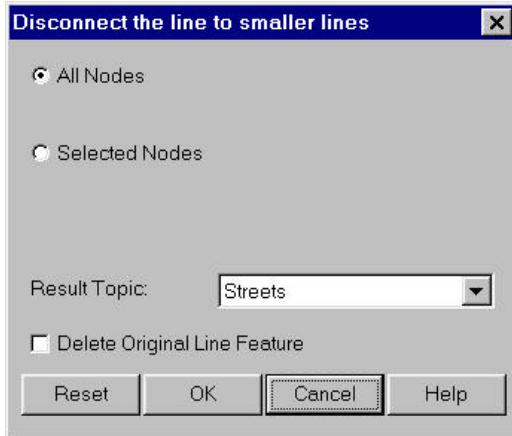
- For further information, use Help/Help Topics and search on “Disconnect Area”.

3.7.7 Disconnecting a Line Feature

The **Utilities/Disconnect Line** functions

are used to create **one or more new Point or Line Features** based on the nodes of a Line Feature. The new Features may be assigned to a specific Topic in your Map file by using the “Select Result Topic” option. In addition, if you wish to delete the original Line Feature, you may mark the Delete Original Line Feature option. To disconnect your Line Feature, first select the Line Feature from the Map View. Then choose one of the **Utilities/Disconnect Line** functions. One of the following dialog boxes will be displayed:

Disconnect Line/to Smaller Lines



All Nodes: A Line will be created between each node.

Selected Nodes: Click on each of nodes in the Line you wish to disconnect. A Line will be created between each node selected.

Result Topic: Select a Topic for the new Line(s).

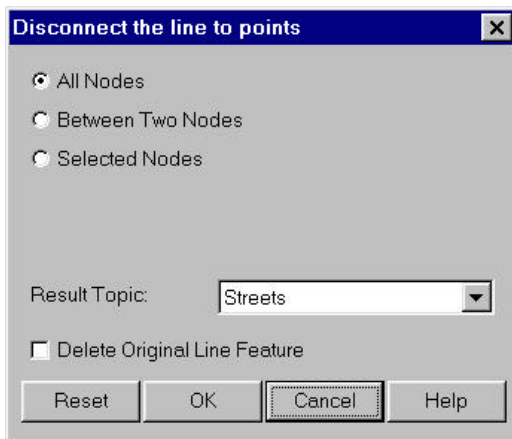
Delete Original Line Feature: Mark this option if you wish to delete the original Line Feature.

Select the disconnect option you wish to use: Between All Nodes or Between Selected Nodes. If you choose “Between Selected Nodes”, you will need to click on the nodes you wish to disconnect. (A line will be created between each of the selected nodes.)

Select a Result Topic for the new Lines. Mark “Delete Original Line Feature” only if you would like to remove your Line Feature from the Map after the disconnect procedure. Note: The original Line Feature can be retrieved using Edit/Undelete or by Joining the resulting Lines back into the original Line.

Click on the OK button to disconnect the Line. Immediately, one or more Line Features will be created from the nodes of the selected Line. The new Feature record(s) will be added to the Sheet View of the Topic selected under the Result Topic option. Please refer to Section 3.9.2 for information on completing the Feature record for the new Feature.

Disconnect Line/to Points



All Nodes: A Point will be created at each node in the Line.

Between Two Nodes: Click on the Start Node and End node. A Point will be created at the Start and End nodes and each node between the two selected nodes.

Selected Nodes: Click on all desired nodes of the Line. A Point will be created on each node selected.

Result Topic: Select a Topic for the new Point(s).

Delete Original Line Feature: Mark this option if you wish to delete the original Line Feature.

Select the disconnect option you wish to use: Between All Nodes, Between Two Nodes or Between Selected Nodes. If you choose “Between Selected Nodes”, you will need to click on the nodes you wish to disconnect (a Point will be created at each of the selected nodes). If you choose “Between Two Nodes”, you will need to click on the Start and End nodes between which you wish to disconnect (a Point will be created at the Start and End nodes and between the two selected nodes).

Select a Result Topic for the new Point(s). Mark “Delete Original Line Feature” only if you would like to remove your Line Feature from the Map after the disconnect procedure. Note: The original Line Feature can be retrieved using Edit/Undelete or by Joining the resulting Points back into a Line.

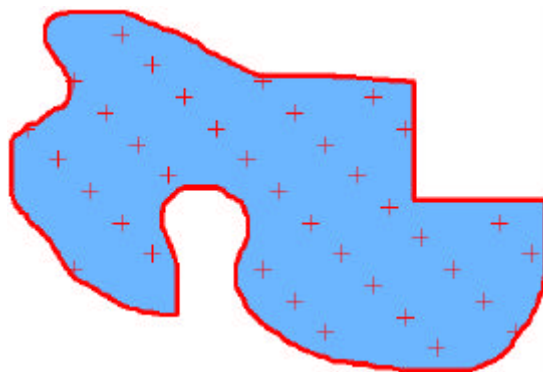
Click on the OK button to disconnect the Line. Immediately, one or more Point Features will be created from the nodes of the selected Line. The new Feature record(s) will be added to the Sheet View of the Topic selected under the Result Topic option. Please refer to Section 3.9.2 for information on completing the Feature record for the new Feature.

- For further information, use Help/Help Topics and search on “Disconnect Line”.


3.7.8 Creating a Grid or Cruising Grid

The **Utilities/Create Grid** function is a valuable tool for timber cruising applications or any other grid sampling application where a grid needs to be created and overlaid within a specified area feature.

This powerful and friendly tool lets you select single or multiple area features to create your own user-defined grid at specified interval spacing for either timber cruising or other grid sampling applications. Adjust the size and color of the grid points as well as the angle of orientation for the grid. Built-in coordinate geometry lets you get the angle of orientation by clicking on any two points in the map. Now you can align your grid to roads or streams very easily. As a final step in the grid creation process, you can create point or line features on the grid for further coordinate information or to load this information to your GPS unit for navigation and guidance to the plot center points in the field.




Steps for creating a grid

1. Select the area feature in your map that you will be used for the grid creation so it is highlighted. Choose **Utilities/Create Grid** or click on the **Create Cruising Grid** icon found in the Forester's Toolbar . A default grid will be displayed over the selected Area. The grid is automatically created and stored in the Non-Spatial Data Topic. The properties of the grid can be modified in the Grid Property dialog box. The Grid Property dialog is automatically displayed at the time of grid creation. The **Grid Property** dialog is shown:

2. Use the **Grid Property** dialog box to edit the parameters of your sampling grid. The Start Point box lets you view and edit the coordinates of the origin of the grid. You may specify the starting point of the grid by one of the following methods:

- a) Type the correct coordinates into the Lat and Lon (or N: and E:) fields.
- b) Click the **Get Start Point by Mouse** button to select the coordinate origin of the grid with your mouse in the Map View. When this option is selected, your mouse pointer will turn into a crosshairs to enable you to select the location in your map.

The starting point will be shown in the Map View as a small red triangle . Place a check mark in the **Offset** box to specify a X and Y-Offset from the starting point. The X-Offset and Y-Offset fields are used to specify the offset distance along the grid directions when the grid is to be offset from the known Start Point. For example, if you selected a known control point as the Start Point but really want the grid 30 ft to its right, then you would specify an X-Offset of 30 ft.

3. Specify the angle of orientation for the grid in the **Orientation** field. This setting controls the angle at which the grid will be displayed. Type the desired orientation directly into this field.

Alternatively, if the orientation is not known, you may specify the grid orientation by selecting an existing line segment (such as a road or creek) by clicking on the **By Segment** button and then selecting the correct line segment in the Map View.

Orientation may also be specified using point features or nodes when no line segment is available. To do so, select the **By 2 Nodes** button to select two point features or nodes of an area feature in

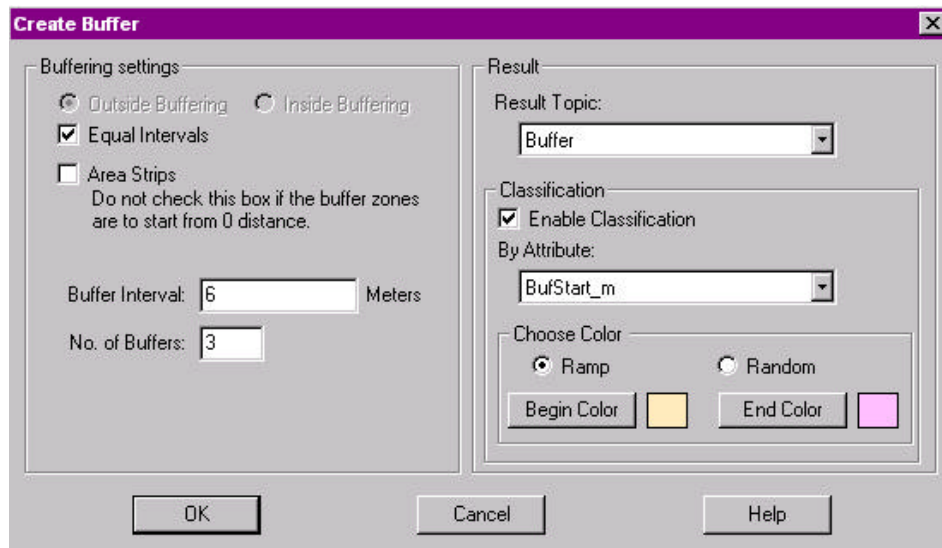
your Map View. The horizontal angle between the two selected points will automatically be calculated and input for you into the Orientation field.

4. Select the **Grid Nodes** option if you wish to have the grid represented by the grid nodes (points). Select the **Lines** option if you wish to have the grid represented by grid lines.
5. The **Scale** field lets you set the distance between grid nodes. Type the desired distance directly into this field. Scale fields are provided for the x and y directions so you may create rectangular instead of square grids. The unit of measure can be changed using the Unit option under Map/Coordinate System.
6. Specify the **Cross Size** (in terms of pixels) by typing the desired cross size directly into this field.
7. The **Boundary Nodes** field is displayed for your reference only and displays the number of nodes that define the boundary of the grid. The "**Fixed on Map**" option lets you prohibit the movement of the grid shape with the mouse in the Map View. If this option is checked off, you can drag the grid in the Map View. The **Transparent** option lets you specify that the grid will have a transparent background. In this case, Features behind the grid shape will still show through. If this option is checked off, the grid background will be white and other Features will not show through.
8. Click the **Grid Color** button is used to change the pattern and color of the crosses. If Lines mode is selected, you will have the option of selecting the color for lines in both the X and Y directions.
9. You may check the "**Create points from grid**" box if you wish to have Point Features created from the grid nodes. If you have the Line mode selected, you may click the "**Create lines from grid**" check box to have Line Features created from the grid lines. Specify the Topic in which to put the point or line features.

Click the **Apply** button to apply the changes you have made or click the **OK** button to exit this dialog box.

3.7.9 Creating Buffer Zones

The PC-GPS Buffer option lets you create buffer zones for Feature. Use the Create Buffer function to form special areas around an existing Point, Line or Area Feature. To access the Buffering function, first select the Feature in your Map and then choose **Utilities/Create Buffer**. The following dialog is displayed:



Outside Buffer refers to a buffer zone outside the feature to be buffered. You may create an outside buffer around an existing Point, Line or Area Feature. For example, to create no-cut zones along a river, you would select Outside Buffer.

Inside Buffer refers to a buffer zone within the boundary of the feature to be buffered. Inside buffers only apply to Area Features. For example, to indicate the plow zone for field burning, you would create an inside buffer for the grass seed farm.

By default, buffer zones are placed under the Buffer topic. If you wish, you may select another existing topic for the Result Topic box.

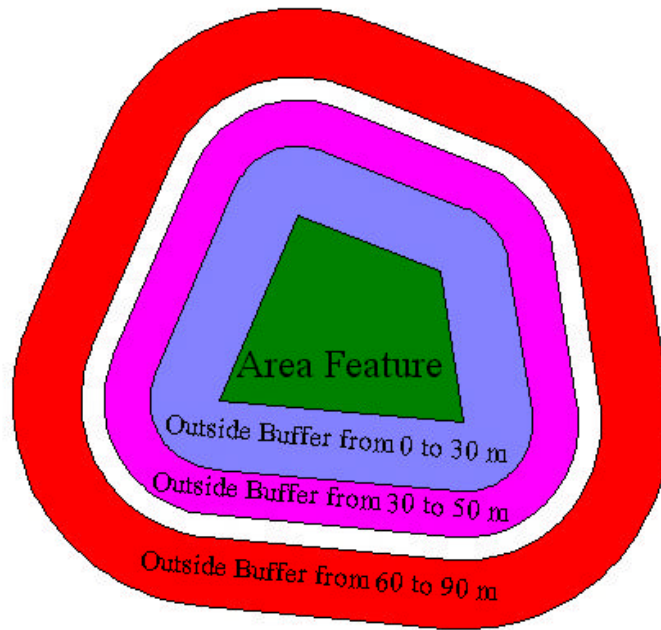
Check the **Equal Intervals** box if you wish to create multiple buffers at equal intervals. Enter the desired distance interval and the number of buffers to be created.

The **Area Strips** option lets you designate whether or not a newly created buffer zone will start right next to an area feature or another buffer area. Do not check this box if the buffer zones are to start from 0 distance, i.e. at the border of the area feature.

Specify the starting and ending distances for a buffer zone in the columns titled **Buffer Start** and **Buffer End**, respectively. Press the Tab key to advance to the next field or to add a new buffer record. Press the Delete key to delete a buffer record. Press the Clear button to delete all the displayed records. Enter positive values for both the Inside Buffers and the Outside Buffers.

If the Area Strips box is not checked, the Buffer Start value for all buffer records is set to 0 and may not be changed. In this case, all buffers created start from the border of the area feature. If the Area Strips box is checked, then you may enter values for both the Buffer Start and the Buffer End fields.

If the Buffer Start value of a buffer strip is greater than the Buffer End value of the previous buffer record, then there will be a gap between the two buffers, as illustrated in the following diagram:



If the active distance unit is meters, the Buffer Start and Buffer End values are stored as the BuffStart_m and BuffEnd_m attributes, respectively. If the active distance unit is feet, then these attributes are named BuffStart_ft and BuffEnd_ft, respectively.

You may have the buffer zones classified by the Buffer Start values, Buffer End values, buffer feature ID's (Feature ID) or the feature ID's of the source features (SRC_Feat_ID).

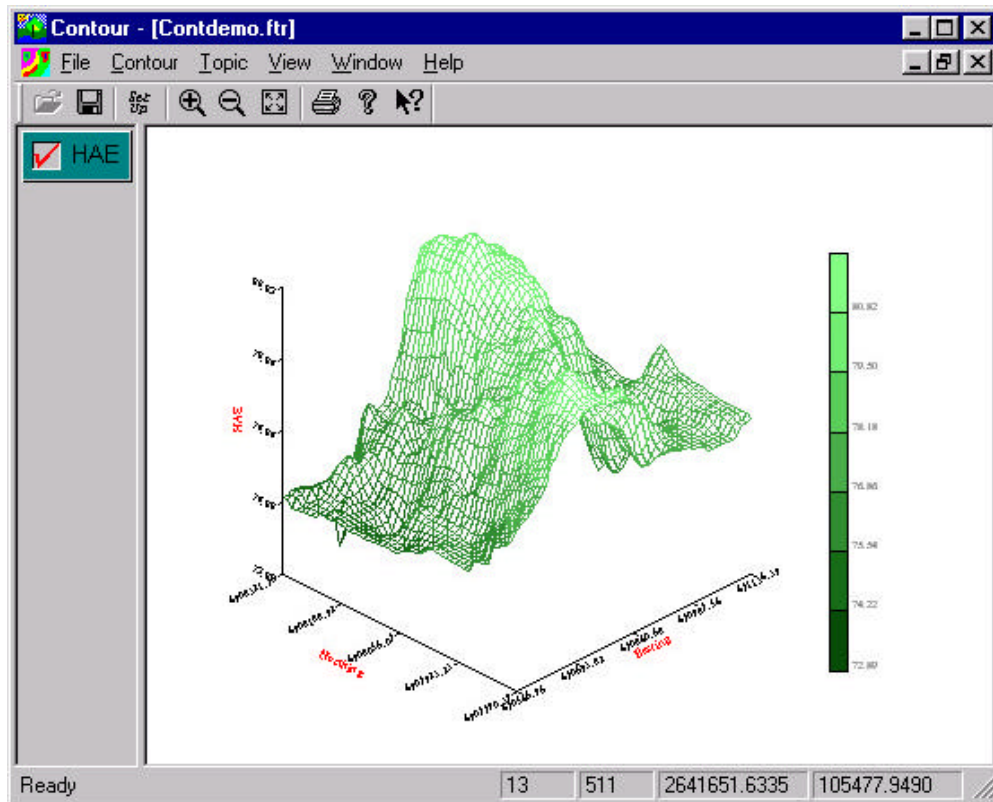
Please Note: The buffer boundary attributes (e.g. BuffStart_m, BuffEnd_m) for the Inside Buffers are displayed as negative values.

3.7.10 Contour Topic (Version dependent)

The **Utilities/DEM/CDM/Profile/Contour/Contour Topic** is used to create a 2-Dimensional Contour Plane or a 3-Dimensional Grid Surface (relief map) from an existing topic. The XYZ data in the topic may consist of coordinate points in a GPS Feature file, with X and Y representing the geographic location of each point in the horizontal plane and Z representing the altitude of the point. The XYZ data may also be a collection of data points that express the relationship among three different variables. For example, divide your state map into 10 equal sections horizontally; then divide it into 10 equal sections vertically. Each rectangle may be represented by a pair of XY coordinate values. Now, count the number of people who live within each rectangular region and assign the population figures to the Z variable. Just as a relief map of a Feature file lets you readily see the differences in altitude at various locations, so a Grid Surface map of the above example will give you a good idea of the distribution of population in your state at a glance.

A fundamental concept in presenting data in the 2-D Contour Plane or 3-D Grid Surface format is that the resulting map is an approximation of the original data. The construction of the 2-D Contour Plane and 3-D Grid Surface is based on regularly spaced X and Y values which form a grid. On the other hand, your data points may or may not have regularly spaced X and Y values. Even if your data points correspond to a regular array of X and Y values, the grid used to represent the data points may be finer (to effect a smoother appearance) or coarser (to save computer memory space).

An example of a 3-D Grid Surface is shown:



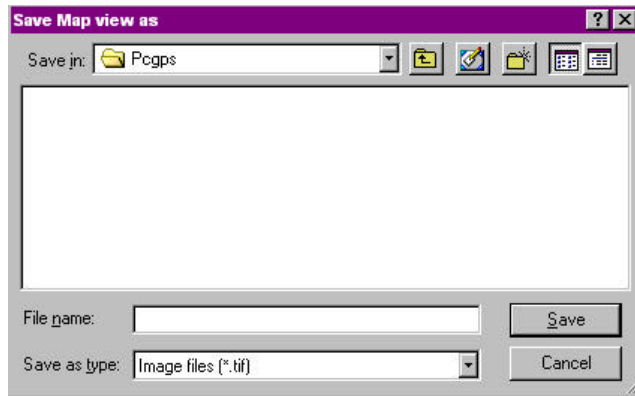
Therefore, an essential step in the contouring process is to compute from the given data points the Z value at each grid node (intersection of an X grid line and a Y grid line). Depending on the gridding method and the grid size used, the resulting Z values could be a crude, fair or excellent approximation to the original data.


When you open a file in CONTOUR, CONTOUR generates from the original data points a set of transformed data points based on a default grid density. Once the mathematical formulas have been applied and the transformation has taken place, CONTOUR can produce a variety of 2-Dimensional Contour Plane and 3-Dimensional Grid Surface displays and perform volume calculations. You may save the transformed data as a PC-GPS Job file (*.ftr), an ASCII file (*.dat or *.csv), an Excel worksheet (*.xls) or a bitmap file (*.bmp).

For more information on Contouring and the other Contour options available please see the Online Manual.

3.7.11 Save to Registered Image

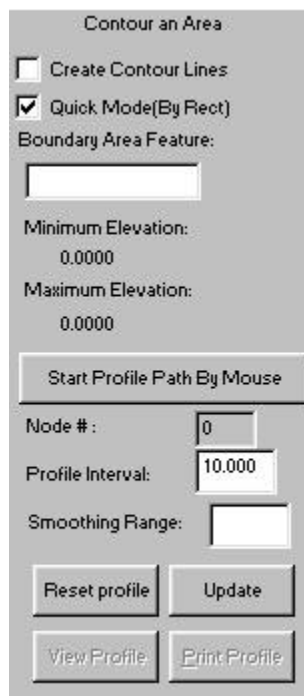
The **Utilities/Geo-Image/Save to Registered Image** is used to save the currently active Map View as a registered image. If you collect GIS data at different times of the year for the same general job location, you could build a complete map, save it as a registered image and use it as a backdrop for all the data collected for that region. Upon selecting this function, the following dialog will be displayed:



File Name: Fill in the appropriate file name. Please note that this file will be saved to the current directory. You can change the directory to which this file is saved by using the Directories column. Click on **Save** to save the Map View to the named TIF file in the current directory. Click on **Cancel** to exit the dialog box without saving the Map View to a Registered Image. Such images may be loaded into another map by using the Load Registered Photo/Image command .

3.7.12 Creating Contour Lines for Area Features

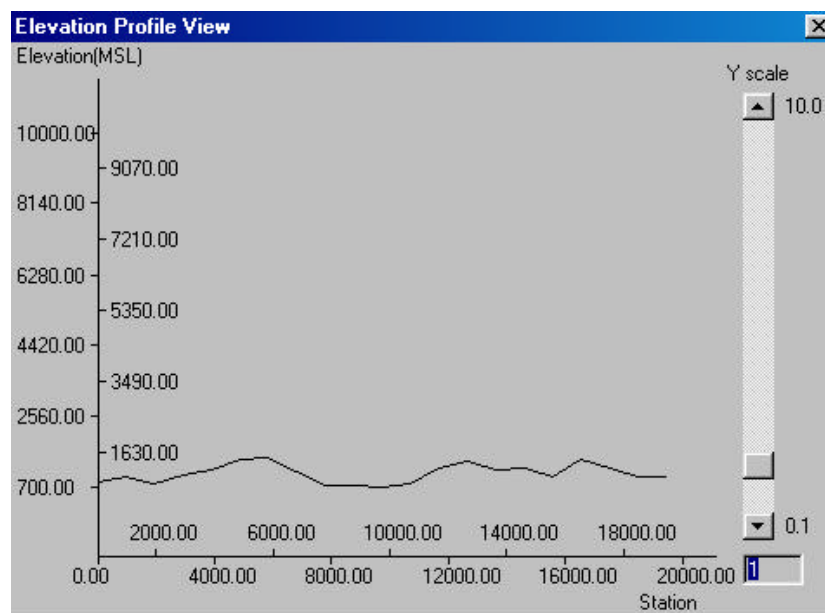
PC-GPS will allow you to create contour lines for selected area features by using any point, line or area data found within the selected area. In the Utilities menu, select DEM/CDM/Profile/Contour then select the **Utilities/ Contour Area** option. The following dialog panel is displayed:



Steps:

1. Select the area feature in your Map View by clicking on it. The FeatureID of the area is displayed in the **Boundary Area Feature** box.


2. The selected area feature is highlighted to indicate the extent of the area to be contoured; the elevations of its boundary are not used for contouring. Any enclosed point, line or area features will participate in generating the contour lines in the next step. The minimum and maximum elevations are calculated and displayed for your reference. By default, the **Quick Mode (By Rect)** checkbox is marked and the contour lines will be generated for a rectangular area covering the selected area. Uncheck this box if you do not wish to have the contour lines extend outside the selected area. With this option unchecked, it will take longer to generate the contour lines.
3. Check the box for **Create Contour Lines** to create the contour lines for the area feature. The contour lines are shown in the Map View and a new line topic called: Contour_Line is generated which contains the newly created contour lines. Alternatively, you may check the box for **Create Contour Lines** prior to selecting the area feature to be contoured. You may add or remove data to be used for contour line generation by turning on/off topics that fall within the specified area. Use the **Update** button to regenerate the contour lines.
4. An elevation profile can be created by using your mouse to draw a transect line across the area feature. Click on the **Start Profile Path By Mouse** button to activate this feature. As soon as this feature is activated, your mouse pointer will turn into a crosshairs. Digitize a transect line across the contoured area feature. Right-click to end the transect or click on the **Stop the Profile** button. Click on the "Reset Profile" button to erase the transect and start over.
5. To see the Elevation Profile, click on the **View Profile** button. A sample is shown:




6. Alternatively, click on the **Print Profile** button to get a textual listing of the interval, x, y and z data (in both HAE and MSL). A sample text printout for the previous example is displayed:

| Elevation Profile Print | | | | |
|----------------------------|-----------|---------|-----------|-----------|
| File Print Help | | | | |
| EXIT ? | | | | |
| Elevation Profile Printout | | | | |
| Station | X | Y | HAE | MSL |
| 0.0000 | -123.2947 | 44.6349 | 794.0443 | 867.7804 |
| 500.0000 | -123.2963 | 44.6343 | 787.6717 | 869.0927 |
| 1000.0000 | -123.2979 | 44.6336 | 881.1846 | 998.3576 |
| 1500.0000 | -123.2974 | 44.6320 | 936.6209 | 957.3472 |
| 2000.0000 | -123.2987 | 44.6309 | 879.6516 | 940.2868 |
| 2500.0000 | -123.3004 | 44.6301 | 929.0996 | 985.8904 |
| 3000.0000 | -123.3020 | 44.6294 | 966.8330 | 1040.3523 |
| 3500.0000 | -123.3036 | 44.6286 | 1064.6156 | 1128.6067 |
| 4000.0000 | -123.3054 | 44.6285 | 1137.7916 | 1230.9687 |
| 4500.0000 | -123.3068 | 44.6273 | 1394.6987 | 1384.5117 |
| 5000.0000 | -123.3083 | 44.6265 | 1439.6626 | 1502.2936 |

You may send the printout to a printer or print directly to a file.

Use the  button to close the Contour Area panel.

3.7.13 Voice Recording

The "Record Sound" tool  is for recording sounds or voice messages to be linked with the currently active Feature.

The recording begins immediately after you click the "Record Sound" tool icon. Click the END button to end the recording. The audio files will be saved in the .WAV format.

To play back the recording, double-click the Feature to which the audio files are linked, then click the "Play object" button.

3.7.14 Google Earth Interface

Google Earth - Launching

Launch the Google Earth program on the Internet. You may use Google Earth to save the coordinates into a .kml file, which may be imported into the active map. You may also export the PC-GPS map features to a .kml file and have them displayed in Google Earth.

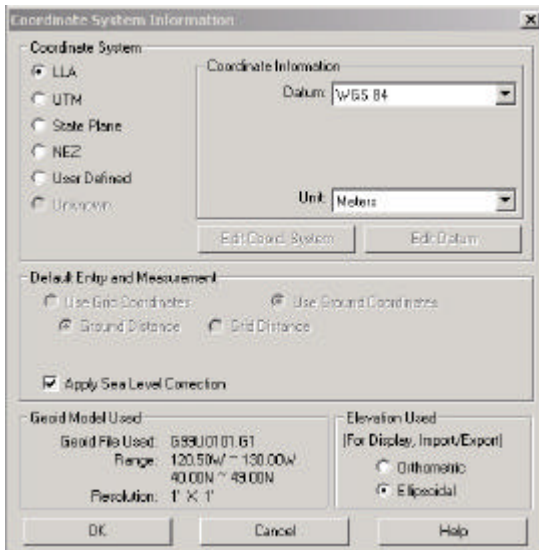
Google Earth - Capture Image

Use this function to capture a geo-referenced image from Google Earth and save it to a file. To do so, first launch Google Earth. Zoom in to the area of interest, then click on the Utilities/Google Earth/Capture Image function .

3.8 Map Coordinate System: Changing Your Coordinate System

The **Map/Coordinate System** option is used to change the coordinate system and datum in which your Map is displayed and stored. When the **Map/Coordinate System** option is selected, the following Coordinate System Information dialog box will be displayed:

To change the coordinate system of your Map, simply select the coordinate system, datum and unit of measure you wish to use. After you click on the OK button, your Map will be transformed into the coordinate system, datum and unit of measure of selected.



Coordinate System: PC-GPS offers five coordinate system options: **LLA** (Latitude, Longitude, Altitude); **UTM** (Universal Transverse Mercator); **SPC** (State Plane); **NEZ**, or **User Defined**.

Please note: The default coordinate system/datum and unit of measure can be changed under the **View/Configure** menu option.

LLA: Select this option if you wish to use the Latitude, Longitude, Altitude (LLA) coordinate system. Specify the Datum and Unit of measure in the corresponding LLA Coordinate Information fields.

UTM: Select this option if you wish to use the Universal Transverse Mercator (UTM) coordinate system. Specify the Datum, False Northing, False Easting, Zone and Unit of measure in the corresponding the UTM Coordinate Information fields.

State Plane: Select this option if you wish to use the State Plane Coordinate (SPC) system. Specify the Datum, State, Region, Zone, and Unit of measure in the corresponding State Plane Coordinate Information fields.

- For further information, use Help/Help Topics and search on “Coordinate System”.
- For information on Distance options, use Help/Help Topics and search on “Distance Measurement” or “Sea Level”.

NEZ: The NEZ coordinate system option allows you to establish a local Northing, Easting, Z-value plane, as often used in surveying work.

- For further information on NEZ, see Section 3.8.1 or “NEZ” in Help/Online Manual.

User Defined Coordinate System: The User Defined option allows you to establish and use a user-defined coordinate system or datum.

- For information, use Help/Online Manual and search on “User Defined Coordinate System.”

PC-GPS provides two additional sections in the Coordinate System Information Dialog:

The **Elevation Used** section lets you specify whether to use MSL or HAE when displaying, importing or exporting coordinate data.

The **Geoid Model Used** section displays the Geoid Model being used for calculating orthometric height (MSL) from the ellipsoidal height (HAE). This section is displayed only when Elevation Used is set to MSL.

For more information on other settings found on the Coordinate System screen, please see the Online Manual.

Steps for converting the Coordinate System, Datum, and Unit of Measure:

1. Open your Map file or Job file using the File/Open option.
2. Use the **Map/Coordinate System** menu option. The current Coordinate System, Datum and Unit of the Map will be shown in the Coordinate System dialog box.
3. Select a different Coordinate System by clicking on the selection circle to the left of the Coordinate System name. If you select SPC or UTM, you will also need to enter the corresponding SPC or UTM Zone in the Coordinate Information Zone field.
4. Select a different Datum by pulling down the arrow to the right of the Datum field and clicking on the Datum name.
5. Select a different Unit of Measure by pulling down the arrow to the right of the Unit field and clicking on the Unit desired. PC-GPS supports US Survey Feet, International Feet, Meters, Miles, and Kilometers.
6. Click on OK button to convert your Map to the selected Coordinate System, Datum and Unit of Measure.

Please note: When you export data from PC-GPS into another file format, the coordinates will be exported in the Coordinate System, Datum, and Unit of Measure indicated in the **Map/Coordinate System** dialog box.

3.8.1 NEZ Planes for your Map

The Map/Coordinate System **NEZ** option is used to define a local plane that allows you to work in an XY plane instead of latitude, longitude. NEZ planes are supported by the CMT CMT-Z33 dual frequency system. NEZ planes can be created in PC-GPS or on the Field 4.x unit.

Please Note: If a Job is collected using an NEZ plane on the Field 4.x unit, the plane information will be sent to PC-GPS when the Job is downloaded.

The process for creating an NEZ plane in PC-GPS is described below. For information on NEZ Calibration on the Field 4.x unit, please refer to the CMT-Z33 Operator's Manual.

Creating an NEZ Plane in PC-GPS:

When you select the **Map/Coordinate System** menu option, the Coordinate System dialog box shown in Section 3.8 will be displayed. Click on the NEZ selection circle to choose the NEZ Coordinate System. A NEZ Plane field will then be displayed at in the lower left hand corner of the dialog box.

Click on the Edit NEZ Plane button to create or edit NEZ Plane parameters.

The screenshot shows the 'Edit NEZ Coordinate System' dialog box. The 'NEZ Plane' dropdown is set to 'BIRDIE'. The 'Pick GPS Point for' section has 'Reference' and 'Control' buttons. The 'Reference' section includes 'GPS' coordinates (LAT: 44 33 0.5014, LON: 123 17 57.5282, Height: 177.8808) and 'NEZ' coordinates (Y: 1000.0000, X: 1000.0000, Z: 0.0000). The 'Control' section has radio buttons for 'by Control Point' and 'by Input' (selected), with input fields for 'Angle: 0.000000' and 'Scale: 1.0000000000'. The bottom row contains buttons for 'OK', 'Cancel', 'New Plane', 'Delete', 'Update', and 'Help'.

Example: The NEZ Coordinate System dialog box for a NEZ Plane called “BIRDIE” is displayed above. The Control Point method used is By Input.

The Edit NEZ Coordinate System dialog box has a section for the NEZ Plane Reference and a section for NEZ Plane Control. There are two options for establishing the Control - **By Input** or **By Control Point**. The By Input option is the default. By Input uses the Angle and Scale factors to characterize your local plane with respect to the WGS84 datum. The By Input option is described below.

Steps for Creating an NEZ Plane in PC-GPS “By Input”:

1. Open your Map file or Job file using the **File/Open** option.
2. Use the **Map/Coordinate System** menu option. The current Coordinate System, Datum and Unit of the Map will be shown in the Coordinate System dialog box.
3. Click on the NEZ selection circle and then click on the Edit NEZ Plane button. The dialog box shown above will be displayed.
4. Click on the New Plane button and then enter a Plane name in the NEZ Plane field at the top of the dialog box.
5. Enter the GPS Reference coordinates in the Latitude and Longitude fields. Make sure to indicate North or South for the Latitude and East or West for the Longitude.

(**Note:** You also click on the **Pick Reference** button and then use the mouse to click on the Point Feature in your file which represents the Reference point.)

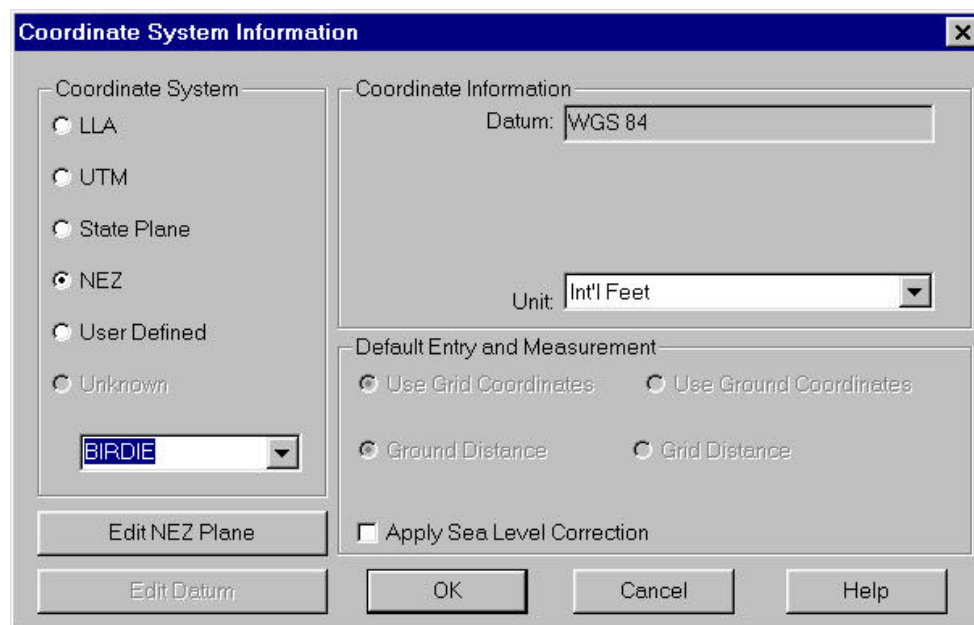
6. Enter the NEZ coordinate origin in the NEZ Y: X: Z: fields.
7. Select the Control By Input option and enter the Angle and Scale factors.
8. Click on the Update button to save the parameters for the new NEZ Plane.
9. Click on the OK button to exit the dialog box.

Please note: The datum for all NEZ planes is WGS84.

- For information on the By Control Point option, use Help/Online Manual and search on “NEZ Coordinate System”.

Selecting an NEZ Plane from the Coordinate System dialog box:

To select an NEZ plane, first use the **Map/Coordinate System** option. The Coordinate System Information dialog will be displayed. Click on the NEZ selection circle. A pull-down selection field will be displayed. Use the pull-down arrow to view the list of established NEZ planes. Select one of the available planes by clicking on the plane name. The selected plane will be highlighted in blue. Click on the OK button to return to the Map View.



3.9 Adding Features to Your Map

The functions of the **Map/Add Feature** option are used to add new Features to the current Map file. You can add a new Point, a new Line or a new Area Feature.

3.9.1 Adding Point Features

The **Map/Add Feature by Mouse/Add Point** option is used to add a new Point to the Map. There are three sub-options: **No Snap**, **Snap to Node** and **Snap to Line**. The No Snap option lets you indicate the coordinates of the new Point by clicking your mouse cursor anywhere on the map.

When adding features or “digitizing” data using the **No Snap** option, you can either use the “point-per-click” method where each left mouse click inserts one point or node along your line or area boundary. Alternatively, you can use the “continuous digitizing” feature for quickly digitizing the desired line or area feature. To access the continuous digitizing mode, click and hold the left mouse button down while moving the mouse along the desired boundary. Nodes will automatically be created as you draw and continue to hold the left mouse button down.

The Snap to Node option lets you choose a node in a Line or Area as the location for the new Point. The Snap to Line option lets you click anywhere on a Line or Area as the location for the new Point.

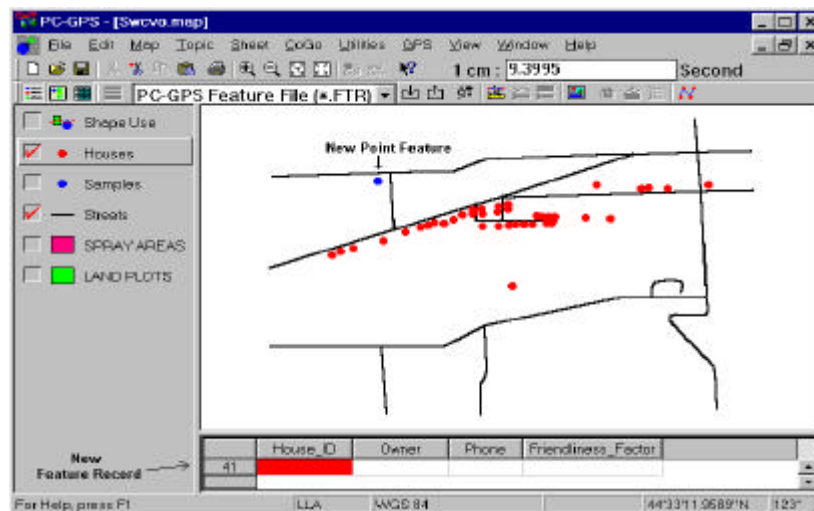
Steps for the Add Feature by Mouse/Add Point function:

1. Select a Topic for the new Point and make the Topic active by clicking on the Topic name.
2. Use the **Map/Add Feature by Mouse/Add Point** and choose **No Snap**.
3. Click the mouse at the location for the new Point.
4. Click the right mouse button to de-activate this function.

Immediately, your Map file will be changed in three ways:

- 1) A new Point will be displayed at the coordinates of the mouse click in the Map View.
- 2) A blank Feature record will be appended to the Sheet View for the Feature.
- 3) The new Feature will be added to the active Topic.

An example of the Add Point function is shown:



Example: A new House Feature has been added to the House Topic in the example SWCVO.MAP. A new Feature record has been added to the Sheet View.

3.9.2 Completing the new Feature Record in the Sheet View

The Feature record for each Feature in the Map can be viewed in the Sheet View. The Sheet View can be toggled ON using the Sheet View icon or the View/Sheet option.

When a new Feature is added to the Map file, a blank record is appended to the Sheet View of the active Topic. To complete the Feature record, click on each cell of the Feature record and enter the appropriate Value.

3.9.3 Adding Line Features and Area Features

The **Map/Add Feature by Mouse/Add Line** and **Map/Add Feature by Point List/Add Line** options are used to add a new Line Feature to the Map file. The **Map/Add Feature by Mouse/Add Area** and **Map/Add Feature by Point List/Add Area** options are used to add a new Area Feature.

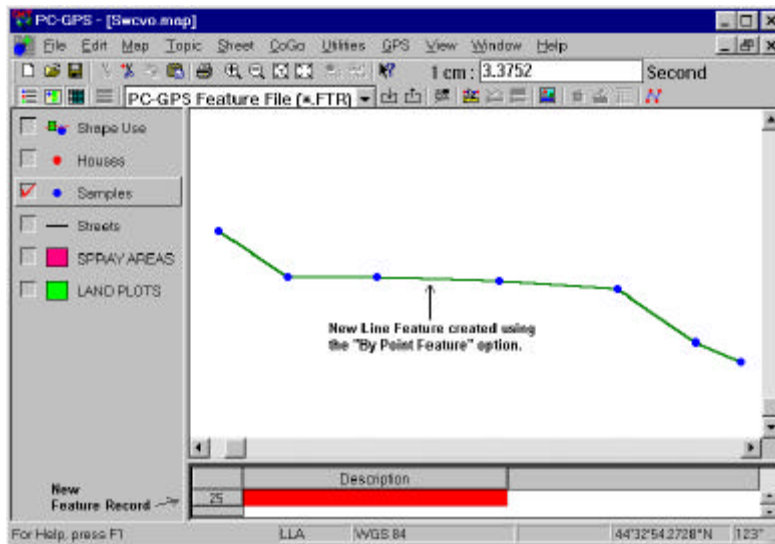
There are two methods that can be used to add either new Line or new Area Features:

- **By Mouse** allows you to define coordinates for the new Feature using your mouse. This option is used when “heads-up digitizing” Features from an aerial photo. It is similar to the **Map/Add Feature by Mouse/Add Point** function except there is an added option: Include Line/Area Boundary. This feature lets you quickly incorporate an existing line or area boundary. Click on the “Show Tips” option for more information.
- **By Point List** lets you specify a list of Feature IDs of the points making up the Line or Area.

The procedure for adding a Line Feature using the By Mouse option is outlined below. For information on the By Point List option, use Help/Online Manual and search on “Add Feature by Point List”.

Steps for the Add Feature by Mouse/Add Line function:

1. Select a Topic for the new Line and make the Topic active by clicking on the Topic name.
2. Use **Map/Add Feature by Mouse/Add Line** and choose **No Snap**.
3. Click the mouse on the starting position of the Line or Area in the Map View, then move the mouse cursor to each subsequent coordinate position and again click the left mouse button.
4. At the last coordinate position, click the **right mouse button** to end the Line Feature.



Example: In the above example map, SWCVO.MAP, a Line Feature has been added to the Samples Topic. This Line Feature was added using the “By Point Feature” option. A blank record has been appended to the Sheet View.

Regardless of which method is used to add a new Feature, the Map is changed in three ways:

- 1) A new Line or Area Feature will be created based on your selection of points or nodes.
- 2) A blank Feature record will be appended to the Sheet View for the new Feature.
- 3) The new Line or Area Feature will be assigned to the active Topic.

Complete the Feature record for the new Feature as described above in Section 3.9.2.

- For further information, use Help/Online Manual and search on “Adding Features”.

3.10 Copying, Cutting or Deleting Features from Your Map

Features can be copied, cut or deleted from the Map file using the functions under the Edit menu. In order to copy, cut or delete a Feature, first select the Feature from the Map View or the Sheet View. Next, use one of the **Copy**, **Cut** or **Delete** options or icons. If you use the Cut or Delete option, the Feature will be removed from the Map View and the Sheet View.

Please note: If you are using the **Delete** function, you will not be able to recover the Features using the **Edit/Paste** option. You can, however, use the **Edit/Undelete** Feature to recover any data which has been mistakenly deleted.

3.11 Pasting Features to your Map

Features can be easily copied from one Map file and pasted into another Map file. First, select a Feature from a Map file and use the **Edit/Copy** or **Edit/Cut** function. Next, open a different Map file

and use the **Edit/Paste** function. The Feature(s) will be pasted to the Map View and appended to the Sheet View and Topic View.

3.12 Moving Features to another Topic in your Map

Features can be moved between Topics using the **Edit/Paste to Topic** function. First, select a Feature from the Map file and use either the **Edit/Copy** or **Edit/Cut** function. Next, make the destination Topic active and choose the **Edit/Paste to Topic** option. The selected Feature will be appended to the active Topic.

Please note: The Feature record will also be appended to the active Topic. However, if the Attributes and Attribute order of the destination Topic are different, the Feature values will not match the Attribute headings.

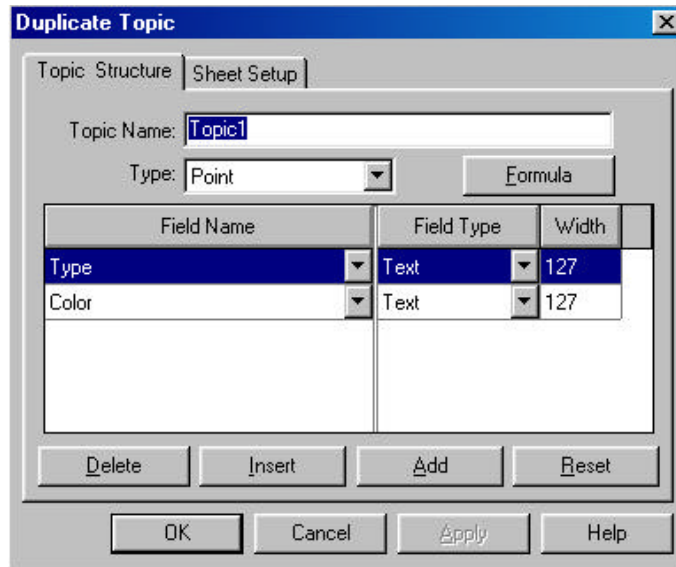
3.13 Copying or Deleting Topics from your Map

Topics can be copied or deleted from the Map file using the functions under the Topic menu. In order to copy or delete a Topic, first make the Topic active by clicking on the Topic name in the Topic View. Next, use the **Topic/Copy Topic** or **Topic/Delete Topic** function. If you use the **Topic/Delete Topic** option, the Topic and all of the Features in the Topic will be removed from the Map View, and Sheet View. In addition, the Topic will no longer be listed in the Topic View.

3.13.1 Duplicating Topics

Use the Topic/Duplicate Topic function to duplicate a topic and its attribute structure. This function helps you quickly set up a topic that has the same or similar attribute/value structure as an existing topic. This function does not copy the Features in the original Topic to the new Topic.

To create a new topic with the same attribute structure as an existing topic, first select the existing topic in Topic View then select the Topic/Duplicate Topic command. The duplicate topic menu is presented:



This dialog window is the same as the Topic/New Topic function. Rename “Topic1” to the desired topic name then click **OK** to save this new topic.

3.14 Pasting Topics to Your Map

Topics can be easily copied from one Map file and pasted into another Map file. First, make the Topic active in one Map file and use the **Topic/Copy Topic** function. Next, open a different Map file and use the **Topic/Paste Topic** function. The Topic will be appended to the Topic View. The Features of the Topic will be displayed in the Map View and the Sheet View.

3.15 Combining Feature Files using the Import function

PC-GPS Feature files can be combined together using the **File/Import** function. To use the Import method, first open one of your Feature files, select PC-GPS Job file from the Data Source box and then use the **File/Import** function to bring additional Feature files into the current file. Multiple Feature files may be selected for import. To select multiple feature files, simply click on the first file and then hold the “Ctrl” button down and select the other Feature files to be imported. The data imported will be displayed in the Map View, Sheet View and Topic View.

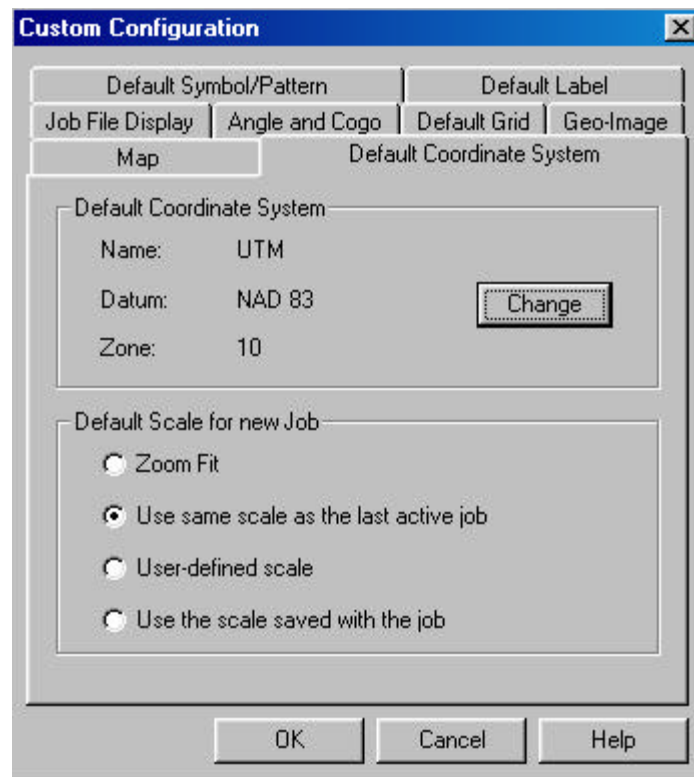
- For further information, use Help/Online Manual and search on “Combining Job Files”.

3.16 Map Display Options

Several options are available for viewing data. These options include: default coordinate system, selection color, and the display of coordinate nodes.

3.16.1 Default Map Options

The options under the **View/Configure** menu can be used to change various PC-GPS settings. When the **View/Configure** option is selected, the Custom Configuration dialog box is displayed.



The dialog box is divided into eight pages - **Map**, **Default Coordinate system**, **Default Symbol/Pattern**, **Default Label**, **Job File display**, **Default Grid**, **Geo-Image** and **Angle and Cogo**. The options for each page are discussed on the following page.

Map Options:

Zoom Factor: The default zoom factor is 2.00. To change the default, input a different zoom factor and click on OK. The Zoom factor affects zoom-in and zoom-out operations.

Number of Decimal Digits: The default number of digits is 4. To change the default, input a new number and click on OK. The number of decimal digits specified in this field affects the number of decimal places reported for coordinate positions in the Feature Properties dialog box, the Status Bar, the Image Shape Property dialog, and Coordinate System settings.

Unitless Map Scale: Click on this option to show the map scale in Unitless format.

Duplicate Feature IDs: The setting under Duplicate Feature IDs refers to the Feature ID number, which is assigned to Features during Job collection. For example, if you collect 10 Tree Features, the Feature ID for the 10th Feature would be TREE10.

Within a single Job file, the Feature ID numbers will be unique. However, if you combine Job files in PC-GPS, there is a possibility that some Feature ID numbers may be duplicated. Normally this does not cause any problems.

However, if you are using the Cogo Functions, it is recommended that you set this option to “Automatically create new Feature IDs”.

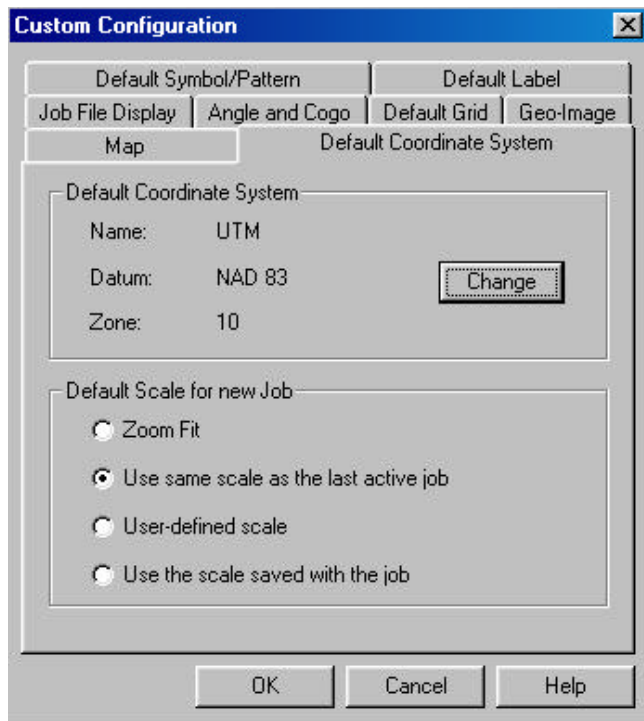
Show Direction for

Line/Area: If this box is marked, all Line and Area Features will display a red arrow over their first node indicating the direction of the Feature. This is useful when using the **Edit/Insert Node** menu option.

Show Feature Ids: Mark this option if you want all features in your Map to have the Feature ID automatically displayed next to the associated feature. This feature is available in CMT Survey 6.5 only.

Default Coordinate System Options:

The Default Coordinate system page of the **Custom Configuration** dialog box allows you to define the coordinate system for new Map files. When you first install PC-GPS, the default coordinate system is set to LLA/WGS84. You may have noticed that when you open a new Map file, the coordinate system is automatically set to LLA/WGS84. If you only use UTM or the State Plane Coordinate system, it may make sense to change the default to match the system you normally work in. In this same page, there is also an option to specify export and import elevation values.



Default Coordinate System: The default is LLA/WGS84. Click on the Change button to access the Coordinate System box.

Default Scale for new Job: Choose from one of the four options discussed below.

Zoom Fit: Zooms to the extents of the spatial data in the job.

Use same scale as the last active job: Will zoom to the last used scale of the active job (this includes any open job, even if there is no data in the job)

User-defined scale: Specify a scale to use when creating new jobs.

Use the scale saved with the job: Use the same scale that was saved with the job.

Example: The default Coordinate System and datum are set to LLA/WGS84 or UTM/NAD83. To change the default, click on the Change button to display the Coordinate System dialog box. Select a different Coordinate System and Datum from the Coordinate System dialog box and click on the **OK** button. The Configure dialog box will display your selections for the new default Coordinate System.

Please note: Changing the default Coordinate System does not change the Coordinate System of the current Map. This function only affects new files.

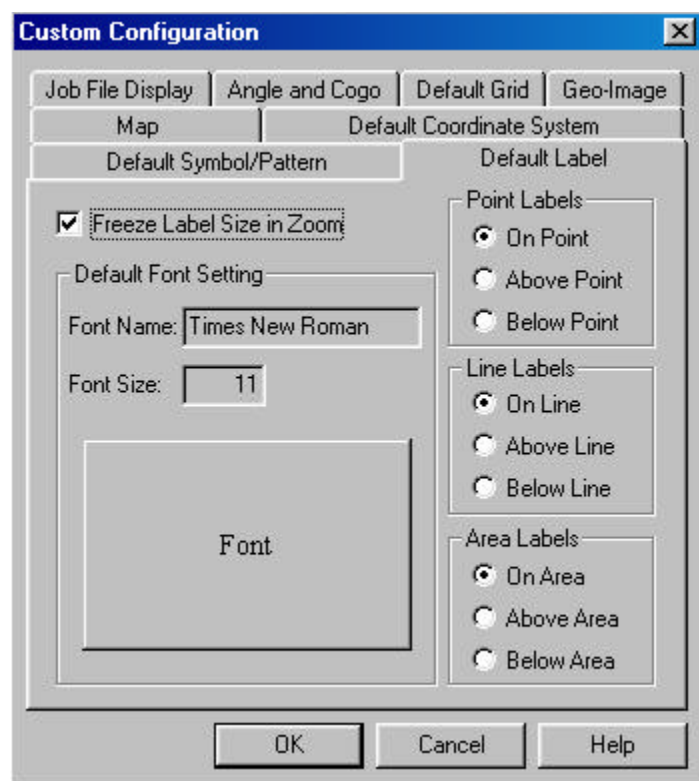
Default Symbol/Pattern Options:

The Default Symbol/Pattern page of the **Custom Configuration** dialog box allows you to define the default symbol/pattern for new Point, Line and Area Features. You can also specify the default Symbol and Pattern library files to use. Click the Change button next to any option to make a change.

PC-GPS will let you create and edit a set of predefined topic symbols or patterns under **Custom Configuration**. It provides an option to apply these predefined symbols and patterns to newly imported feature data.

Default Label Options:

The Default Label page of the **Custom Configuration** dialog box allows you to define the default font settings for new text that is added to your Map. You can also specify the default location for labels associated with spatial data.



Freeze Label Size in Zoom: Mark this box to hold the font size of text labels constant when you zoom in or out of your Map.

Default Font Setting: The default is Times New Roman, regular style, size 11. Click the Change button to select a different font.

Point/Line/Area Labels: The default location is on the Point, Line or Area Feature. Mark the desired circle to change the location.

Job File Display Options:

The Job File Display page of the **Custom Configuration** dialog box allows you to specify display settings for Feature files (*.FTR). There are three options:

Display Nodes when files are opened: Mark this box if you want to automatically display the Nodes of Features whenever a .FTR file is opened.

Uncorrected Coordinates Prompt: Mark this box if you want to be prompted to perform a conditional cut whenever a .FTR file that contains uncorrected coordinates is opened.

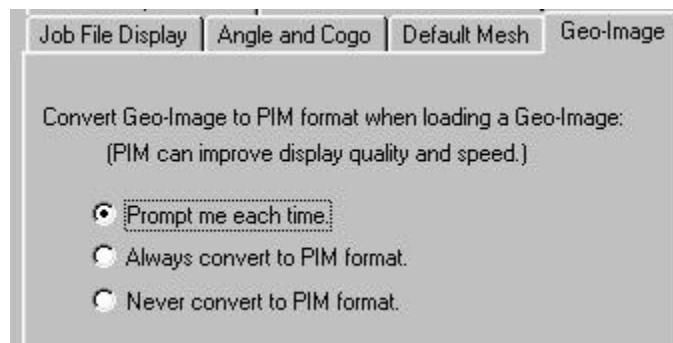
Display Point symbols when nodes are displayed: Mark this box if you want PC-GPS to display Point symbols along with Nodes for Point Features.

Angle and Cogo Options:

The Angle and Cogo options are used to set various defaults for Cogo functions. Please see the Online Manual or Section 11.3 for more information about specific options.

Geo-Image Options:

Set the defaults for georeferenced image conversion to .PIM format using the View/Configure menu option and then clicking on the **Geo-Image** tab. The following menu is displayed:



This dialog is used to control the defaults for conversion of your georeferenced images to the .PIM format. It is recommended to convert your images to the .PIM format to improve image display quality and speed of loading. The options are explained as follows:

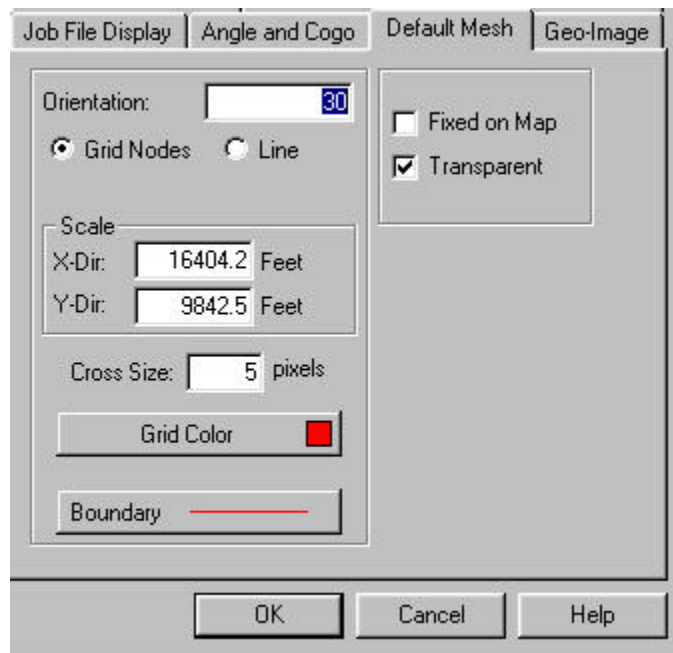
Prompt me each time: PC-GPS will prompt you each time you load a georeferenced image and ask you whether or not you would like to convert the image to .PIM format. If the image has already been converted to .PIM format, then PC-GPS will not display the prompt for conversion to .PIM format.

Always convert to PIM format: PC-GPS will not prompt you when loading a georeferenced image and will always convert the image to .PIM format. The conversion to .PIM format will be skipped if the selected image is already a .PIM image or if the image has already been converted to .PIM format.

Never convert to PIM format: PC-GPS will not prompt you when loading a georeferenced image and will never convert the image to .PIM format.


Default Grid Options:

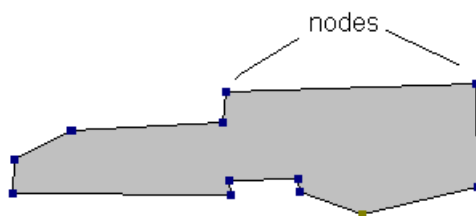
Set the defaults for the “Grid” or “Mesh” under the View/Configure menu option and then clicking on the **Default Mesh** tab. The following menu is displayed:



These settings will be used by default and displayed when using the Utilities/Create Grid function.

3.16.2 Viewing the Coordinate Nodes

Use the  icon or the View/Display Nodes option to toggle ON and OFF the display of coordinate nodes in the Map View. Each coordinate node is displayed as a small box.



Example - Coordinate Nodes ON

Example - Coordinate Nodes OFF

The default is for the coordinate nodes to be OFF. When coordinate nodes are ON, there will be a selection mark to the left of the Display Nodes label in the View menu.

For Line and Area Features, each coordinate node represents a coordinate fix. Line Features and Area Features consist of a number of nodes or coordinate fixes linked together to form the Line or Area. A Point Feature has a single node, representing a number of averaged coordinate fixes. Individual nodes are represented by small squares of red, yellow, blue or black:

Yellow or **gold** nodes represent **uncorrected** coordinates. Uncorrected coordinates have not been corrected via the PC-GPS differential correction utility.

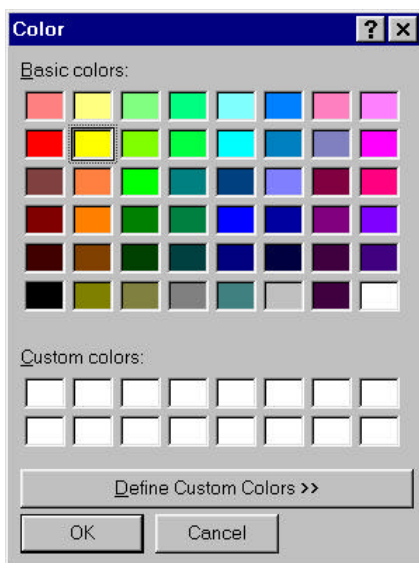
Blue nodes represent **corrected** coordinates. Corrected coordinates have been corrected via the PC-GPS differential correction utility.

Red nodes represent the original coordinates of **offset** positions. Offset positions are Point Features or Line/Area nodes which were collected using the offset function on the GPS/GIS data collector. (In other words, the red node is the actual location of the GPS/GIS data collector when an offset position was collected.)

Black nodes represent coordinates from non-GPS data sources.

3.16.3 Changing the “Selection Color”

The **View/Selection Color** option is used to change the default Map View selection color. When a Feature on the Map View is selected by using a single mouse click, the map representation of that Feature (Point, Line or Area) will be displayed in the selection color. The default selection color is yellow. When the **Selection Color** option is selected, the color dialog box is displayed as shown below:



Select the color you wish to use by clicking on the associated color square.

Click on the **Define Custom Colors** button to create new colors to add to your palette.

Click on the **OK** button to save your selection and exit the dialog box.

3.16.4 Map Background Color

The **View/Paper Color** option is used to choose a display color for the background of the Map View. The default color is white. When **Paper Color** is selected, the standard color window is displayed as shown in the above section. The color chosen for the Map background will be used in the plot of your Map.

3.17 Deed Calls

Use the Utilities/Create Deed Call function to input calls from a legal metes and bounds description, title deed or other text description of a parcel of land to map out the boundary and create an area feature in your map.

This function has two purposes: a) create the text description of bearings and distances for a specified boundary or b) create an area feature in your map by entering in the description of bearings and distances into the Calls menu.

3.17.1 Creating calls from an existing area feature

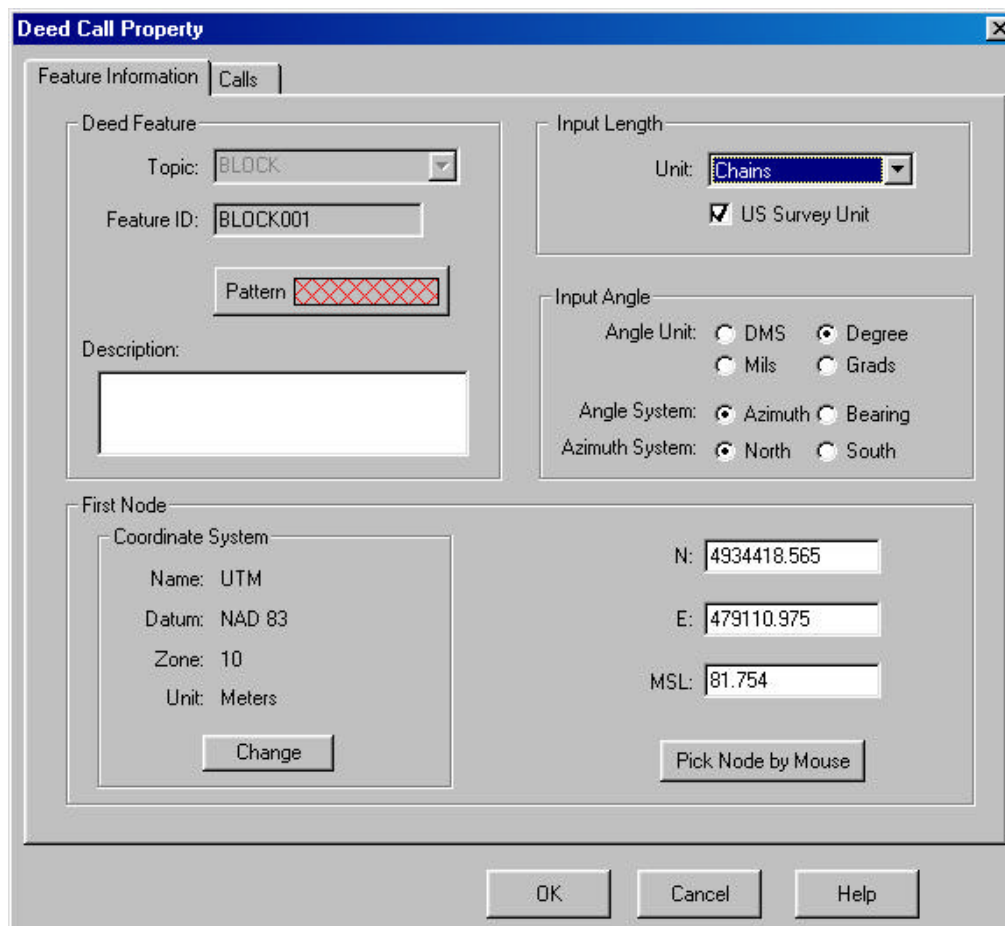
This section describes the procedure for selecting an existing area feature in your map and creating the bearing and distance calls for each segment of the area.

Please Note: This function only works for area features.

The following example illustrates creating the text description of bearings and distances for the “Block001” feature found in the CMT tutorial file: cmttut.ftr.

Steps:

1. In the map view, click on the area feature you wish to create calls for (i.e. the Block001 area feature) so it is highlighted.
2. Select Utilities/Create Deed Call. The following dialog window is displayed:



The image shows a software dialog box titled "Deed Call Property". It has two tabs: "Feature Information" and "Calls", with "Feature Information" currently selected. The dialog is divided into several sections:

- Deed Feature:** Contains a "Topic" dropdown menu with "BLOCK" selected, a "Feature ID" text box with "BLOCK001", and a "Pattern" button with a red cross-hatch icon.
- Description:** A large empty text box for entering the deed description.
- Input Length:** Contains a "Unit" dropdown menu with "Chains" selected and a checked checkbox for "US Survey Unit".
- Input Angle:** Contains radio buttons for "Angle Unit" (DMS, Degree, Mils, Grads) with "Degree" selected, and "Angle System" (Azimuth, Bearing) with "Azimuth" selected. Below these are radio buttons for "Azimuth System" (North, South) with "North" selected.
- First Node:** A section containing a "Coordinate System" box with fields for Name (UTM), Datum (NAD 83), Zone (10), and Unit (Meters), and a "Change" button. To the right of this box are three text boxes for coordinates: "N: 4934418.565", "E: 479110.975", and "MSL: 81.754". Below these is a "Pick Node by Mouse" button.

At the bottom of the dialog are three buttons: "OK", "Cancel", and "Help".

3. The Feature Information screen is presented. The topic, FeatureID and the area pattern are displayed for your reference.
4. A text description may be entered in the **Description** box (up to 64 characters) to help describe the deed call feature.
5. The coordinate system may be changed to view the coordinates of the first node of the selected feature for confirmation. This is an optional step.
6. Specify the units of measurement for the length information using the pull-down menu. If using U.S. units of measurement, be sure to check the box **US Survey Unit**. This option is selected for you by default.
7. Specify the desired Angle method for the calls. Available choices for **Angle System** include: Azimuth or Bearing. If Azimuth is chosen, also specify the Azimuth System: North or South. Also specify the **Angle Unit** with choices of: DMS, Decimal Degrees (Degree), Mils or Grads.
8. Next, click on the **Calls** tab to see the call descriptions. The following dialog is shown:

Deed Call Property

Feature Information | **Calls**

| | Azimuth | Horizontal Distance | | |
|---|-------------|---------------------|--|--|
| 1 | 020.215105° | 4.916 | | |
| 2 | 290.709902° | 3.591 | | |
| 3 | 198.749438° | 4.965 | | |
| 4 | 109.943343° | 3.464 | | |

Buttons: Load, Save As, New Calls for New Feature, Recreate Calls from Feature, Clear All, Create/Update Feature

Buttons: Add, Insert, Delete

Segment Type: Line Segment

Horizontal Distance: 4.916

Azimuth: 020.215105°

Summary:

Y-Error: 0.0000 US Ch

X-Error: 0.0000 US Ch

Area: 17.4211 Sq.Ch (1.7421 Ac)

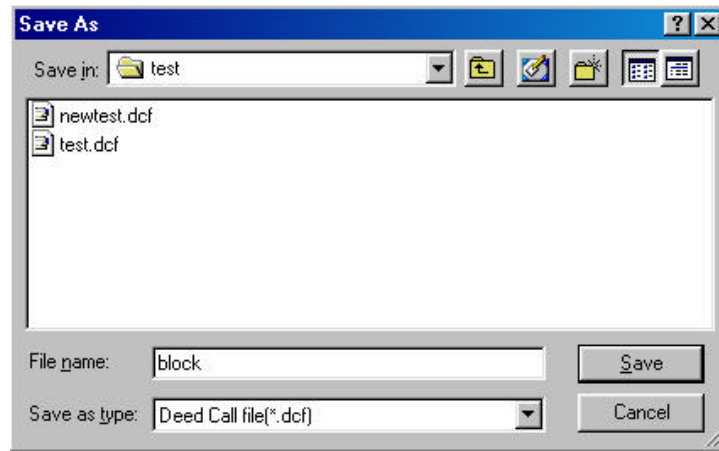
Graphical representation of the calls showing a closed polygon.

Buttons: OK, Cancel, Help

9. The calls are displayed in the upper left corner table for your reference. A graphical representation of the calls is displayed in the lower right corner. A brief summary of the total area and any **errors** (i.e. differences between the starting and ending points) in the X and Y directions are shown for your reference. Edits may be made to the calls by clicking on the row number of the line segment and then editing the data in the **Horizontal Distance** and **Azimuth/Bearing** fields. Additionally, segment type may be changed from a straight line (line segment) to a curve by using the pull-down

menu. The currently selected segment is highlighted in red in the graphical view. Zoom tools are available for your convenience to zoom in or zoom out to portions of the graphical view.

10. If no further changes are desired, then click on the **Save As** button to call up the following dialog:



11. Specify the folder and the file name to save the deed calls. The file extension will be ***.DCF (Deed call file)**. This is an ASCII text file which may be opened and viewed with any text editor. Click on the **Save** button to save the file. The following is a sample output of the DCF file for the above 'Block' example:

```
[Location]
File: Cmttut.ftr
Topic: BLOCK
Feature_ID: BLOCK001
Description: This is a block.

[Coordinate_System]
// Coordinate System and the First Node
Coordinate_System: UTM
Datum: NAD_83
Zone: 10
First_Node_Unit: Meters
First_Node_Loc: 479110.975 4934418.565 81.754
[Record_Unit]
Length_Unit: US_Chains
Angle_Unit: Deg
Angle_System: Azimuth
Azimuth_System: North

[Records]
020.240608° 4.879
290.133602° 3.523
199.646803° 4.842
110.736373° 3.473

[Summary]
X-Error: 0.0000 US Chains
Y-Error: 0.0000 US Chains
Area: 17.0026 Sq.Ch (1.7003 Ac)
```

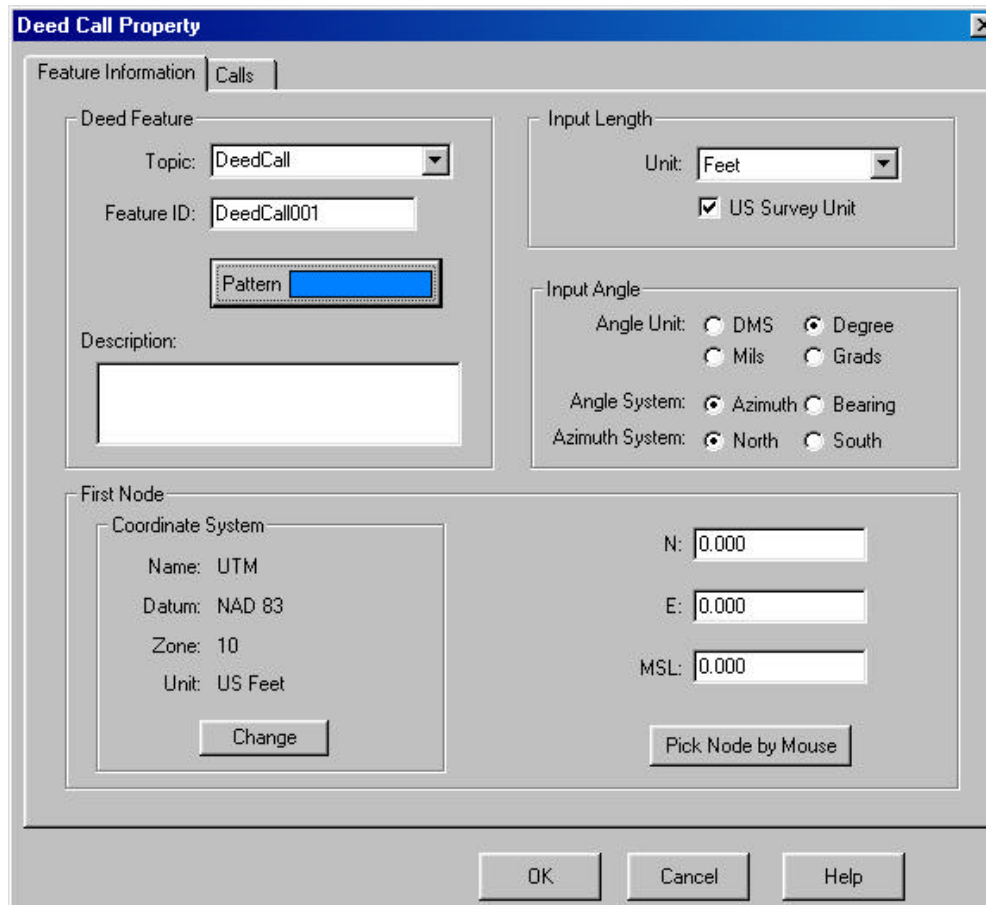

12. The Records section of the text may be further edited to complete the deed call description.

3.17.2 Creating an area feature from a set of deed calls

This section describes the procedure for inputting bearing and distance calls for each segment of an area feature to create the area feature in your map view.

Steps:

1. In a blank or existing map file, select **Utilities/Create Deed Call**. The following dialog window is displayed:



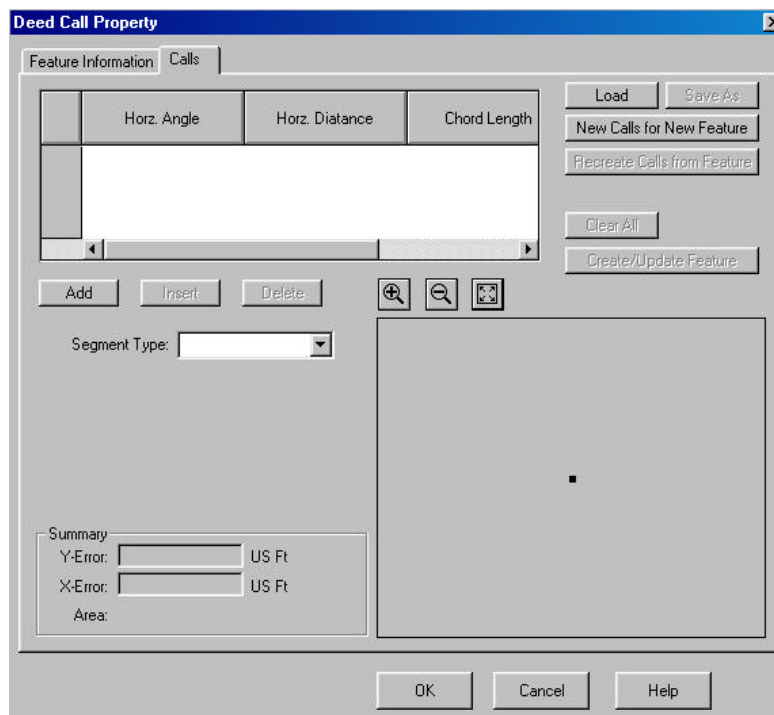
The image shows the 'Deed Call Property' dialog box with two tabs: 'Feature Information' and 'Calls'. The 'Feature Information' tab is active. It contains several input fields and sections:

- Deed Feature:**
 - Topic: A dropdown menu showing 'DeedCall'.
 - Feature ID: A text field containing 'DeedCall001'.
 - Pattern: A blue rectangular button.
 - Description: A large empty text area.
- Input Length:**
 - Unit: A dropdown menu showing 'Feet'.
 - ☒ US Survey Unit
- Input Angle:**
 - Angle Unit: Radio buttons for DMS, Degree (selected), Mils, and Grads.
 - Angle System: Radio buttons for Azimuth (selected) and Bearing.
 - Azimuth System: Radio buttons for North (selected) and South.
- First Node:**
 - Coordinate System: A box containing 'Name: UTM', 'Datum: NAD 83', 'Zone: 10', and 'Unit: US Feet', with a 'Change' button below it.
 - N: A text field with '0.000'.
 - E: A text field with '0.000'.
 - MSL: A text field with '0.000'.
 - A 'Pick Node by Mouse' button.

At the bottom of the dialog are three buttons: 'OK', 'Cancel', and 'Help'.

2. If you are using an existing file, select the topic that you want to create the new area feature in. If you are not using an existing file, then it is recommended to choose the 'DeedCall' topic. The FeatureID and topic will automatically be created for you upon creation of the feature.
3. Enter an optional text description (up to 64 characters) to help describe the deed call feature.
4. Choose the Coordinate System, datum and units of measurement for the first node of the call.
5. Specify the units of measurement for the input length. US Survey feet is the default selection.

6. Specify the Input Angle method: either Azimuth or Bearing and also choose between DMS, Decimal Degrees (Degree), Mils or Grads.
7. Type in the coordinates for the first node or select the location by clicking on a location in the map with your mouse. To pick a location on the map with your mouse, click on the **Pick Node by Mouse** button. After selecting this button, you will be taken to the Map View and your mouse pointer will turn into a crosshairs. Click on an existing node or point feature to select those coordinates. An existing node or point feature must be selected with your mouse (you cannot select a floating location) to establish the starting point. After selecting the point, you will be returned to the Feature Information dialog and the coordinates of the selected point will be displayed for you.
8. Once the beginning point has been established, click on the **Calls** tab to begin inputting the call information. The following screen is shown:



9. Click on the **Add** button to enter a new call record into the fields shown:

Segment Type:

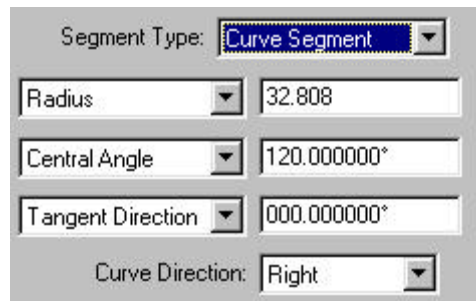
Horizontal Distance:

Horizontal Angle:

For segment type, choose between options of **line segment** for straight lines, or **curve segment** to define a curve. Type in the horizontal distance from the starting point and also specify the angle using the angle system specified (from Step 6).

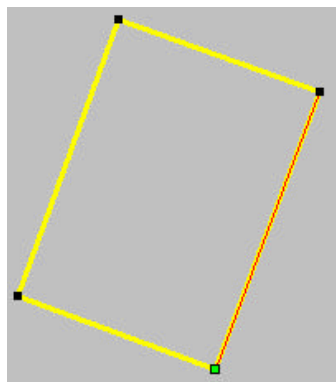
For curves, specify the size and length of the curve by inputting a combination of: radius, arc length, chord length, and/or central angle. The tangent direction of the curve (right or left) should also be specified at this time along with the direction angle of the curve from the last node. Select the

continuous option if the new section is to continue in the direction of the last defined curve or line segment.



| | |
|-------------------|---------------|
| Segment Type: | Curve Segment |
| Radius | 32.808 |
| Central Angle | 120.000000° |
| Tangent Direction | 000.000000° |
| Curve Direction: | Right |

A preview of the calls is shown in the lower right corner of the Calls dialog window:



10. After all calls have been entered, you may choose to create the deed call feature in the existing map, or you can save it for addition to a different map at a later time.

To create the deed call feature in the existing map, click on the **Create/Update Feature** button. If the feature does not exist in the current map, it will automatically be created for you and placed in the topic specified in Step 2. Also use the **Create/Update Feature** button if any changes have been made to the deed calls. Upon clicking on this button, you will be prompted if you want to “Recreate the Area Feature?” Choose **Yes** to update and overwrite the existing feature or **No** to abort the update.

To save the deed call feature, click on the **Save As** button. Specify the folder and the file name to save the deed calls. The file extension will be ***.DCF (Deed call file)**. This is an ASCII text file which may be opened and viewed with any text editor. Click on the **Save** button to save the file. The saved deed call feature may be accessed from different maps and loaded by clicking on the **Load** button and then selecting the desired *.DCF file.

Click on the **Clear All** button to clear all existing deed calls from the list and start a new deed call feature. Alternatively, click on the **New Calls for New Feature** button to accept changes and update/create the deed call feature and start the next deed call entry using the same specified topic (the FeatureID will automatically be incremented). If changes have been made or the deed call feature has not yet been saved or created in the map, you will be prompted to update/create the area feature or to save changes before proceeding.

Section 4: GPS Functions

The GPS Menu options allow you to manage your GPS data collection jobs. Options are available for File Transfer, Job Setup, Differential Correction, Conditional Cut, Feature Lists, Mission Planning, and Real-Time Navigation. In this section, reference is made to both Job files and Map files.

Please note: Differential correction functions apply only to GPS Job files (Feature files).

4.1 File Transfer

The functions of the **Utilities/Transfer** for PC-GPS or PC-Mapper allow you to transfer files between your CMT Field unit and PC-GPS. There are two file transfer modes: Auto Transfer and Manual Transfer. Each of these modes is discussed in the following sections.

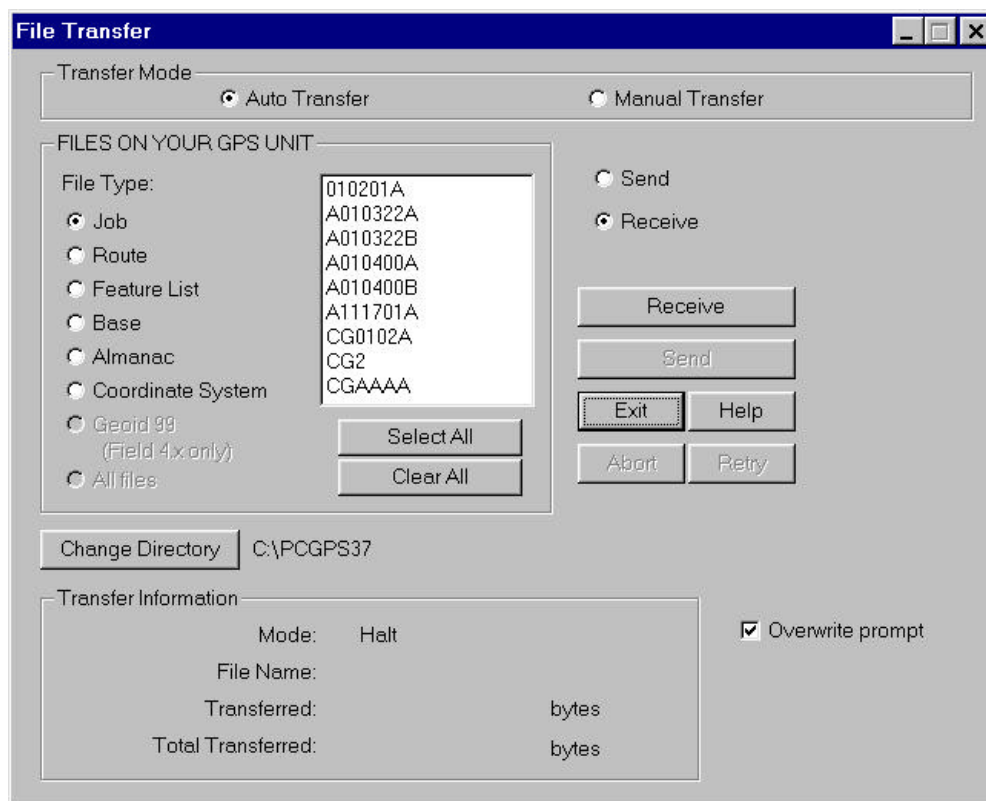
4.1.1 Auto File Transfer

When you click the **Utilities/Transfer** option, PC-GPS will enter Auto File Transfer mode by default and attempt to establish communication with your CMT Field unit. The Auto Transfer Initialization dialog box shown below will be displayed:



Be sure your CMT Field unit and PC are connected using the correct cables.

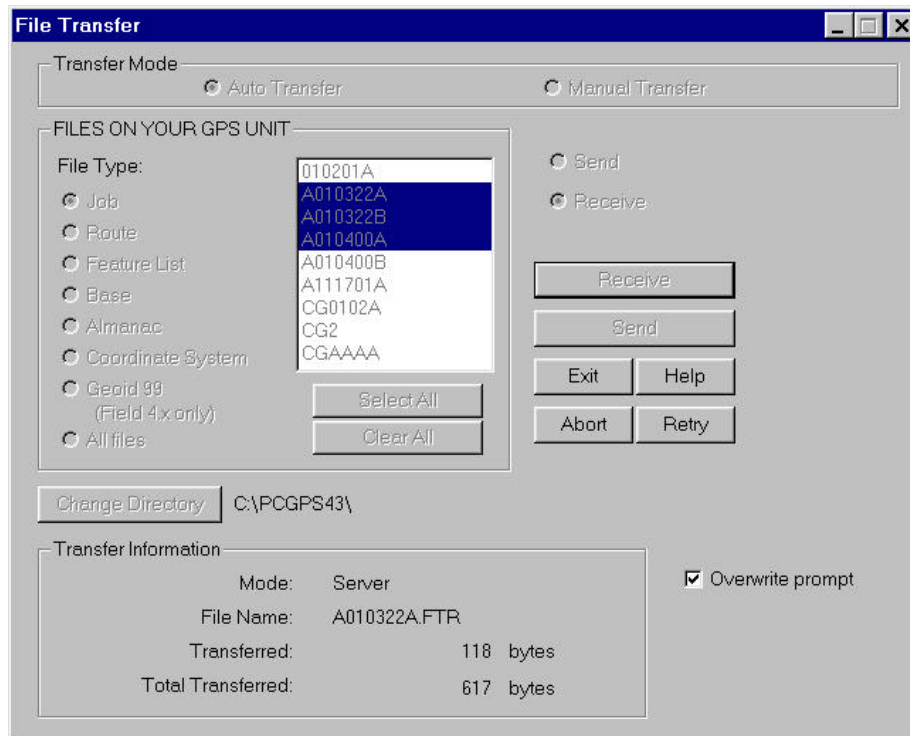
Select the "Transfer Files" option in the Main Menu of your CMT Field software and press the Enter key. Once the connection is established, the File Transfer dialog box shown on the following page will be displayed:



Please note: If your CMT Field unit is running Field 3.8 or Field 4.2, you will see the item “Transfer Files” in the Main Menu. If your unit is running an earlier version of CMT Field, you will need to use the Manual File Transfer mode discussed in Section 4.1.2.

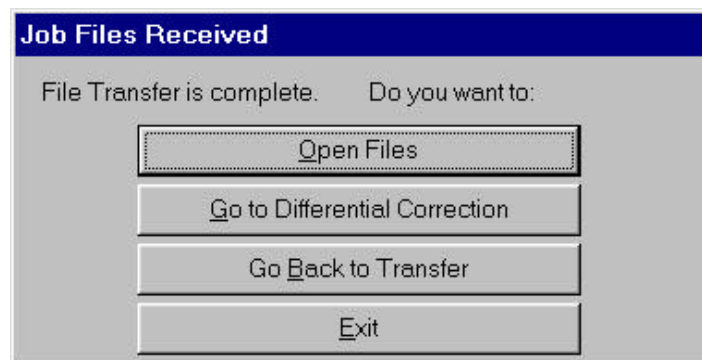
4.1.1.1 Receiving Files in Auto Transfer Mode

Once the File Transfer dialog box is displayed in Auto Transfer mode, you can begin transferring files from the CMT Field unit to PC-GPS. By default, the File Type will be set to Job, the transfer direction will be set to Receive, and all the Job files present on the CMT Field unit will be displayed in the FILES ON YOUR GPS UNIT box. Click the Job file(s) you would like to receive (or click the **Select All** button to select all listed files) and then click the **Receive** button to initiate the transfer.



All selected Job files will be transferred to the directory displayed to the right of the **Change Directory** button. If you wish to transfer the Job files to a different directory, click the **Change Directory** button and select the desired directory before clicking the **Receive** button.

When the file transfer is complete, the Job Files Received dialog box shown below will be displayed. Click the button that corresponds with your desired option.



If you are transferring files of a type other than Job, the following dialog box will be displayed instead:



GPS Job Files

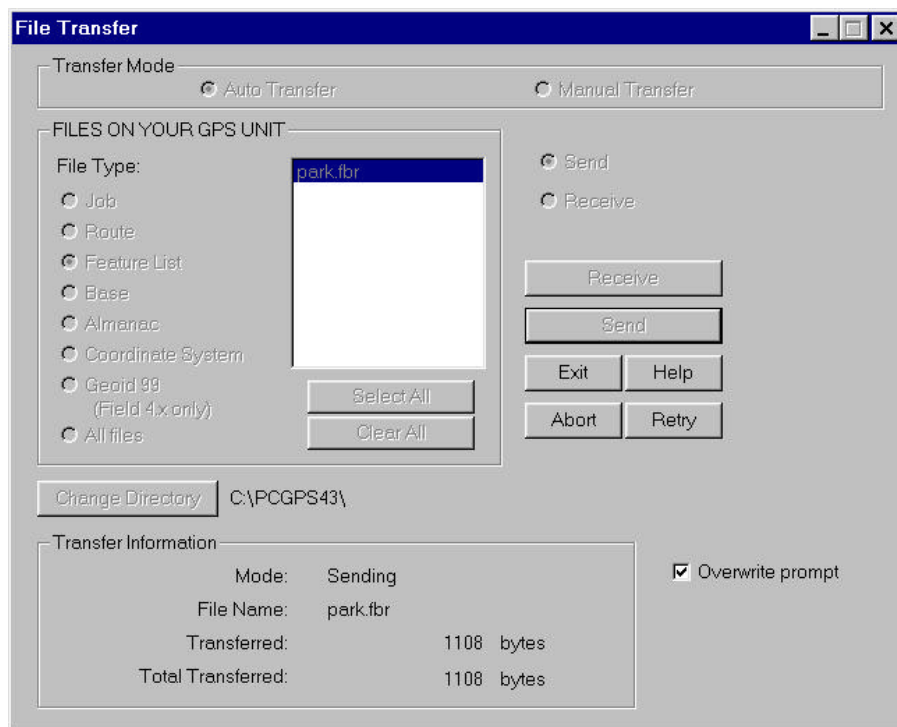
When you download a GPS Job file from the CMT Field unit, three files will be sent. The file extensions are: *.DEF, *.RAW, *.FTR. Each of these files is necessary for differential correction. The DEF file contains GPS Job header information. The RAW file contains the raw data collected by the GPS receiver during the GPS Job. The FTR file contains the Feature coordinate positions, Feature names, Attributes and Values, which were “stored” in the GPS Job.

Other File Types

In addition to Job files, you can download Route files (*.PAT), Feature List files (*.FBR), Base files (*.DIF), Almanac files (ALM.*) and User-defined coordinate system files (Coordinate System--USER_COR.SYS, Datum--USER_DAT.SYS, NEZ Plane--USER_PLA.SYS) from the CMT Field unit. The procedure is similar to downloading Job files. Simply select the desired file type from the **File Type** list and all files of the selected type present on the CMT Field unit will be displayed.

4.1.1.2 Sending Files in Auto Transfer Mode

Once the File Transfer dialog is displayed in Auto Transfer mode, you can begin transferring files from PC-GPS to the CMT Field unit. Click the **Send** option (not the Send button) to set the transfer direction to Send. By default, the File Type will be set to Feature List and all the Feature List files present in the current directory will be displayed in the FILES ON YOUR PC box. If you would like to send a different type of file, click the desired type from the **File Type** list. Click the file(s) you would like to send (or click the **Select All** button to select all listed files) and then click the **Send** button to initiate the transfer. If you wish to send files from a different directory, click the **Change Directory** button and select the desired directory before clicking the **Send** button.



Sending Map Files

If you wish to send a Map file to the CMT Field unit, you first need to save the Map file as a Feature file (PC-GPS Job file). You may either use the **File/Save As** option or **File/Export** option to save the Map file in a Feature File format. When using the **File/Export** option, make sure that PC-GPS Job File is selected as the format in the Data Source box.

When a Map file is saved in the Feature file format, two files will be created: a .FTR file and a .DEF file. (The .DEF file contains the data collection parameters established using the GPS/Job Setup options.) **Both the .FTR file and the .DEF file will be downloaded to the CMT Field unit. The .DEF file is automatically sent with the .FTR file.**

Sending User-Defined Coordinate Systems, Datums and NEZ Planes

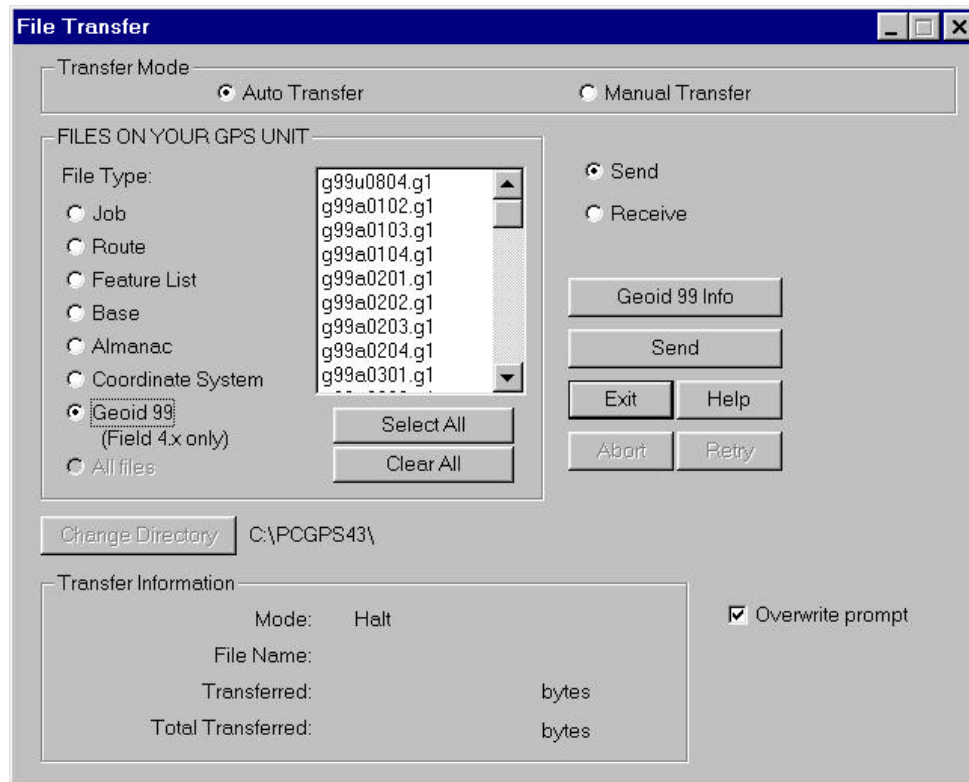
PC-GPS allows you to define custom coordinate systems, datums and NEZ planes for your Maps (Section 3.8). If you wish to work with these coordinate systems, datums and NEZ planes on the CMT Field unit, you need to send the definition files from PC-GPS. Select **Coordinate System** from the File Type list and then click the appropriate file(s):

| | |
|-------------------|--------------|
| Coordinate System | USER_COR.SYS |
| Datum | USER_DAT.SYS |
| NEZ Plane | USER_PLA.SYS |

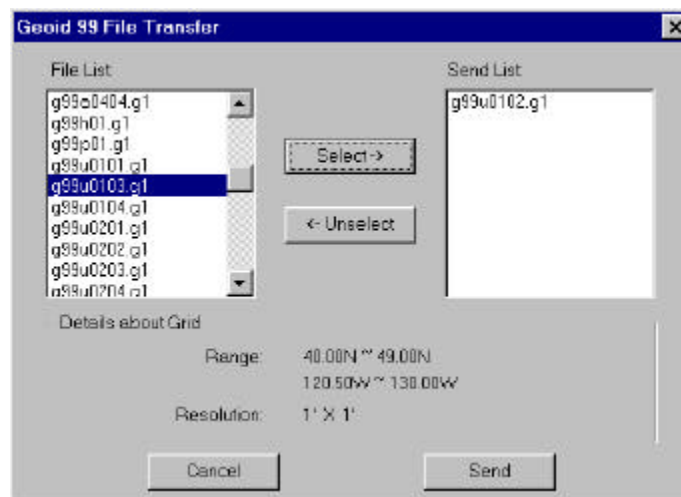
Sending Geoid 99 Files

If you have Field 4.x on your CMT Field Unit, you can take advantage of the NGS Geoid 99 model to get precise orthometric (MSL) elevations in the field. The Geoid 99 model covers the entire United States and its territories and has a resolution of 1' X 1' (1 minute X 1 minute). Due to the large amount of data present in this model, it has been broken up into individual files, each covering approximately 9° of latitude and 9.5° of longitude. Each Geoid 99 file has a **g1** extension (e.g., g99a0101.g1).

To send the appropriate Geoid99 file to the CMT Field Unit, select the **Geoid 99** option from the File Type list. The Receive button will change to a **Geoid 99 Info** button.



Click the **Geoid 99 Info** button to display the Geoid 99 File Transfer dialog box shown below.

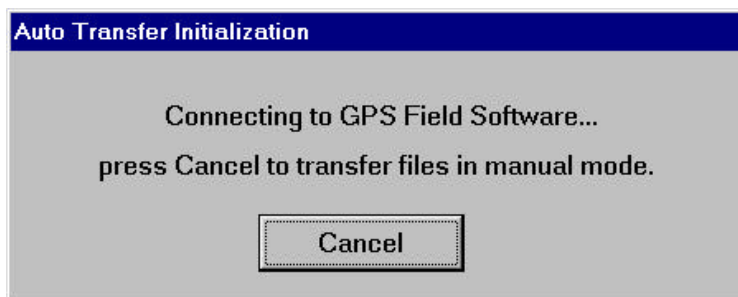


Click any file in the File List to see the range it covers. Once you have selected the file that covers the desired range, click the **Select** button to move it to the Send List. If your range requires more than one Geoid 99 file, select additional files using the same procedure. When all desired files are displayed in the Send List, click the **Send** button to download the files to the CMT Field Unit.

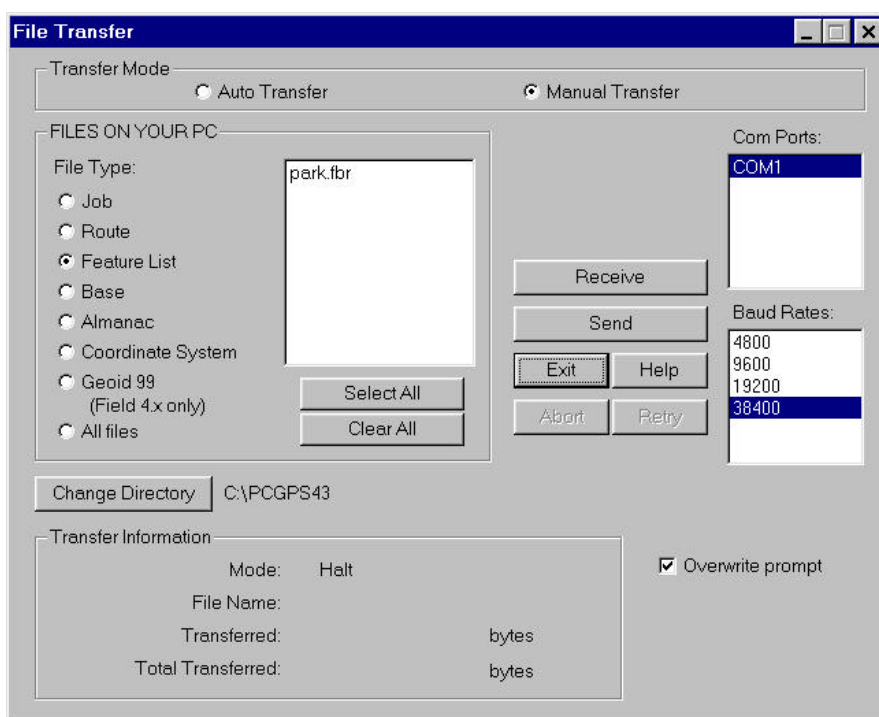
4.1.2 Manual File Transfer

If your CMT Field unit is running Field 4.0, Field 3.6, or earlier, you will need to use the Manual File Transfer mode to transfer files between the CMT Field Unit and PC-GPS. When you click the

GPS/Transfer option, PC-GPS will enter Auto File Transfer mode by default and attempt to establish communication with your CMT Field unit. The Auto Transfer Initialization dialog box shown below will be displayed:



Click the **Cancel** button to enter Manual File Transfer mode. The File Transfer dialog box shown below will be displayed:



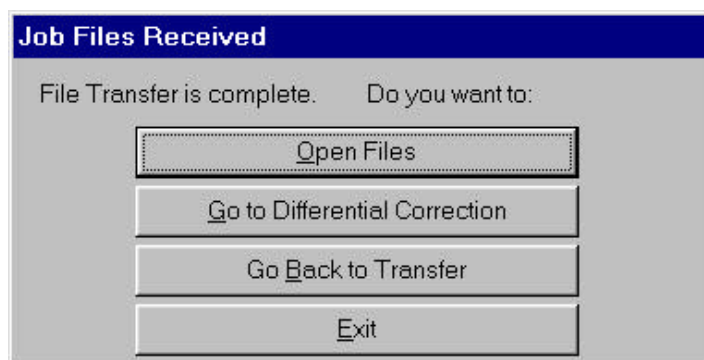
Please note: If your CMT Field unit is running Field 3.8 or Field 4.2, you will see the item "Transfer Files" in the Main Menu. You should use the Auto File Transfer mode discussed in Section 4.1.1.

4.1.2.1 Receiving Files in Manual Transfer Mode

Before attempting to receive files in PC-GPS, you should check the **Com Ports** and **Baud Rates** settings in the File Transfer dialog box. The Com Ports setting should match the Com Port on your PC that will be connected to the CMT Field unit (usually COM1). The Baud Rates setting should match that of the CMT Field unit. In addition, you will need to connect your PC and CMT Field unit using the correct cables. Once you have verified the settings, click the **Receive** button to initiate the file transfer process in PC-GPS.

To initiate the file transfer process on the CMT Field unit, go to the File Transfer screen by selecting XFER (F4) from the Main Menu. From the File Transfer screen, select the file TYPE (F1) and the file you wish to send. Next, select SEND (F3) as the transfer direction from the CMT Field unit's File Transfer screen. The name of the file currently being transferred will be displayed in the File Name field in the PC-GPS File Transfer dialog box.

If you are transferring Job files, the Job Files Received dialog box shown below will be displayed when the file transfer is complete. Click the button that corresponds with your desired option.



If you are transferring files of a type other than Job, the following dialog box will be displayed instead:



Please note: Files sent from the CMT Field unit will be transferred into the directory displayed to the right of the Change Directory button. If you wish to transfer the files to a different directory, click the **Change Directory** button to specify the desired directory before clicking the Receive button.

4.1.2.2 Sending Files in Manual Transfer Mode

Before attempting to send files in PC-GPS, you should check the **Com Ports** and **Baud Rates** settings in the File Transfer dialog box. The Com Ports setting should match the Com Port on your PC that will be connected to the CMT Field unit (usually COM1). The Baud Rates setting should match that of the CMT Field unit. In addition, you will need to connect your PC and CMT Field unit using the correct cables.

Once you have verified the settings, you can select the file(s) you wish to send. By default, the File Type will be set to Feature List and all the Feature List files present in the current directory will be displayed in the FILES ON YOUR PC box. If you would like to send a different type of file, click the desired type from the **File Type** list. Click the file(s) you would like to send (or click the **Select All** button to select all listed files) and then click the **Send** button to initiate the transfer. If you wish to

send files from a different directory, click the **Change Directory** button and select the desired directory before clicking the **Send** button.

To initiate the file transfer process on the CMT Field unit, go to the File Transfer screen by selecting XFER (F4) from the Main Menu. From the File Transfer screen, select the file TYPE (F1) and the file you wish to receive. Next, select RECV (F4) as the transfer direction from the CMT Field unit's File Transfer screen. The name of the file currently being transferred will be displayed in the File Name field in the PC-GPS File Transfer dialog box. When the file transfer is complete, the following dialog box will be displayed:



Sending Map Files

If you wish to send a Map file to the CMT Field unit, you first need to save the Map file as a Feature file (PC-GPS Job file). You may use either the **File/Save As** option or **File/Export** option to save the Map file in a Feature File format. When using the **File/Export** option, make sure that PC-GPS Job File is selected as the format in the Data Source box.

When a Map file is saved in the Feature file format, two files will be created: a .FTR file and a .DEF file. (The .DEF file contains the data collection parameters established using the GPS/Job Setup options.)

Both the .FTR file and the .DEF file will be downloaded to the CMT Field unit. The .DEF file is automatically sent with the .FTR file.

Sending User-Defined Coordinate Systems, Datums and NEZ Planes

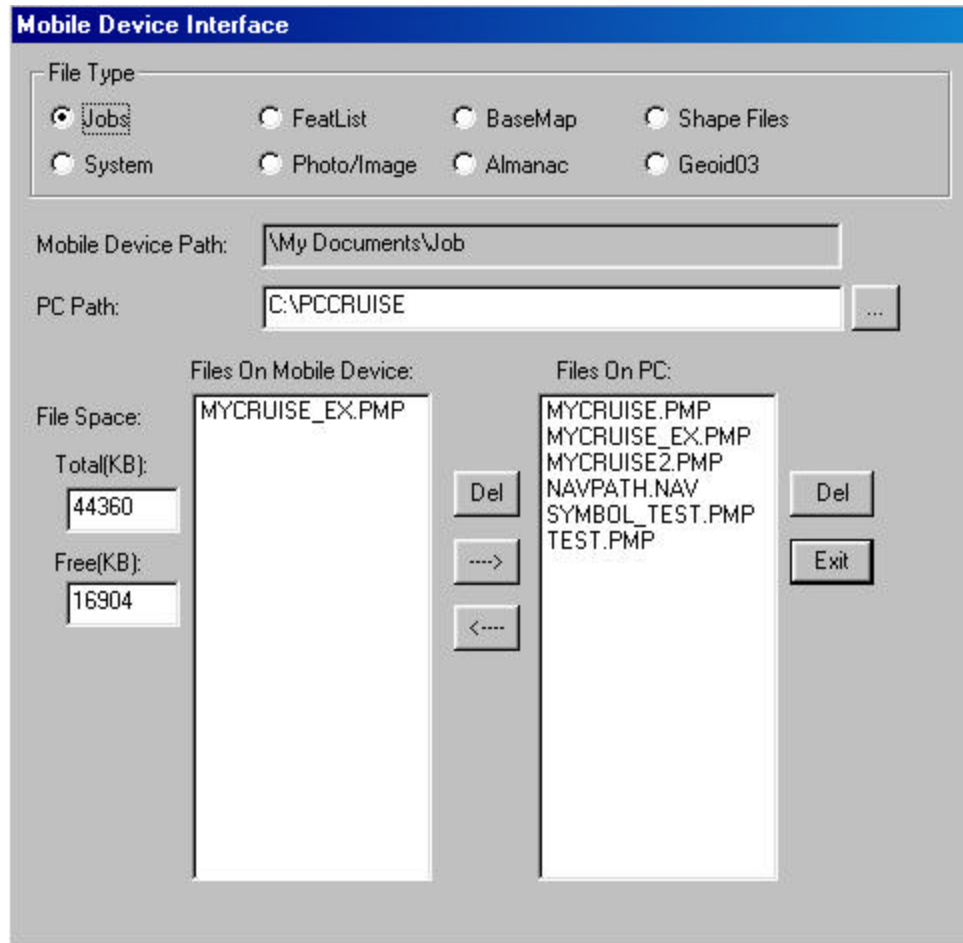
PC-GPS allows you to define custom coordinate systems, datums and NEZ planes for your Maps (Section 3.8). If you wish to work with these coordinate systems, datums and NEZ planes on the CMT Field unit, you need to send the definition files from PC-GPS. Select **Coordinate System** from the File Type list and then click the appropriate file(s):

| | |
|-------------------|--------------|
| Coordinate System | USER_COR.SYS |
| Datum | USER_DAT.SYS |
| NEZ Plane | USER_PLA.SYS |

4.1.3 Mobile Device Interface

This function provides an interface between the CMT MapPad or CMT Field CE GIS Windows CE programs and PC-GPS, PC-MAPPER, CMT-SURVEY or PC-GIS.

To view the data files stored in your mobile device or to transfer various types of files, select **Utilities/ Mobile Device Interface/Conversion/Mobile Device Interface** to display the following dialog:



Specify the appropriate folders on the PC and the Mobile Device.

Select the appropriate file type, highlight one or more files, then click on → or ← to transfer the files in the corresponding direction.

Photo/Image option

The Photo/Image option under the Mobile Device interface has been improved in PC-Mapper to provide support for the image formats *.PIM and *.SID to be easily selected and sent over to your Mobile Device from the PC and vice versa.

System option

Previously listed as “Coordinate System” in the Mobile Device Interface dialog, the System option now includes support for the following formats:

- a) User-defined coordinate systems
- b) Symbol/Pattern libraries

4.2 GPS/Job Setup

The **GPS/Job Setup** function is used to configure a Job, which can be downloaded to your CMT Field unit. The Job Setup function establishes field data collection parameters for a specific GPS Job. The

data collection parameters for a Job can also be accessed on the CMT Field unit itself. The Job Setup function also can be used to check or verify the setting of a GPS Job.

- For further information, use Help/Help Topics and search on “Job Set Up”.

Please note: If you intend to download the file to the CMT Field unit, the file must first be saved in the PC-GPS Job file format (*.FTR) using the **File/Save As** function.

4.3 Viewing Coordinate Nodes: Uncorrected vs. Corrected Nodes

The coordinate nodes of your Features can be viewed using the **View/Display Nodes** option. Each coordinate fix or Point Feature is represented by a colored node. **Yellow** or **gold** nodes represent uncorrected coordinates, **blue** nodes represent corrected coordinates, **red** nodes represent offset coordinates, and **black** nodes represent non-GPS coordinates.

- For further information, see Section 3.16.2 in this manual or use Help/Online Manual and search on “Display Nodes”.

4.4 GPS Edits: Conditional Cut

The **GPS/Conditional Cut** utility allows you to cut coordinates from your file based upon conditional parameters. This procedure is usually performed after differential correction to remove uncorrected coordinates or coordinates with high DOP/Residual values. When coordinates are cut from a Feature, the graphical representation of that Feature will change. If all of the coordinates in a Feature are cut, the entire Feature will be cut from the Map View and the Sheet View.

When you select the **GPS/Conditional Cut** menu option, the dialog box shown on the following page is displayed:

| Cut Conditions | |
|--|---|
| Residual > | 2 |
| PDOP > | 6 |
| # of SVs < | 4 |
| Quality (Dual Freq. Only) > | |
| <input type="checkbox"/> Cut All 2D | |
| <input type="checkbox"/> Cut All UnCorrected | |
| <input checked="" type="checkbox"/> Cut by Topic (optional) | |
| Topic Name | |
| <input checked="" type="checkbox"/> Houses | |
| <input type="checkbox"/> Samples | |
| <input type="checkbox"/> Streets | |
| <input checked="" type="checkbox"/> SPRAY AREAS | |
| <input type="checkbox"/> LAND PLOTS | |
| <input type="button" value="Preview"/> <input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Help"/> | |

Residual: Input upper limit for Residual

PDOP: Input Upper limit for PDOP

of SV: Select lower limit for the number of satellites tracked

Quality: Upper limit on Quality (Carrier Phase/Dual Frequency)

Cut all 2D: Cut all 2D coordinates

Cut Uncorrected: Cut Uncorrected coordinates

Cut by Topic Option: Select this option if you wish to apply the conditional cut **only** to specific Topics in the Map file. When you select this option, all of the Topics will be listed under the Topic name column. Mark only the Topics you wish to use for the Conditional Cut operation.

Example: The dialog box is shown above with several parameters established for the Conditional Cut. The Cut by Topic option is selected. The Houses and Spray Areas Topic are marked. The Conditional Cut operation will only apply to the Features of the Houses and Spray Area Topic.

Enter parameters for the conditional cut in the appropriate fields. One parameter or multiple parameters may be used. When multiple parameters are used, the conditional statement will be executed for Condition 1 OR Condition 2 OR Condition N... Click on the Preview button to preview the Conditional Cut. Click on the OK button to execute the Conditional Cut. If necessary, the **Edit/Undelete** option can be used to recover coordinates which have been cut.

- For further information on Conditional Cuts, use Help/Online Manual and search for "Conditional Cut". Refer to Section 4.8 in this manual for further information on Coordinate Information and DOP/Residual ranges.

4.5 GPS Edits: Cutting Individual Nodes

Individual nodes or Point Features can be manually cut from your file using the **Cut Nodes** icon on the Map Bar. This procedure is useful when you want to trim "outlier" positions from your Line or Area Features. First, toggle ON the display nodes using the **View/Display Nodes** option. Differentially corrected nodes will be displayed in blue, and uncorrected nodes will be displayed in yellow or gold. Next, click on the Cut Nodes icon on the Map Bar. The mouse cursor will turn into a pair of scissors. Hold down the mouse button and draw a "rubberband" box around the nodes you wish to cut. When you release the mouse button, the nodes will be removed from your file. Click on the right mouse button to de-activate the function.

Please note: If you cut a Point Feature, the entire Feature will be removed from the Map View and the Sheet View. You may use the **Edit/Undelete** function to recover the nodes or Points have been inadvertently cut.

4.6 GPS/Mission Planning

The **GPS/Mission Planning** option can be used to plan and optimize your data collection missions. Mission Planning is a tool specifically for "viewing" the locations of GPS satellites at a given time. Mission Planning simply provides graphical plots and reports which assist you in determining optimal data collection conditions.

- For further information, use Help/Online Manual and search on "Mission Planning".

4.7 GPS/Differential Correction: Correcting your GPS Job

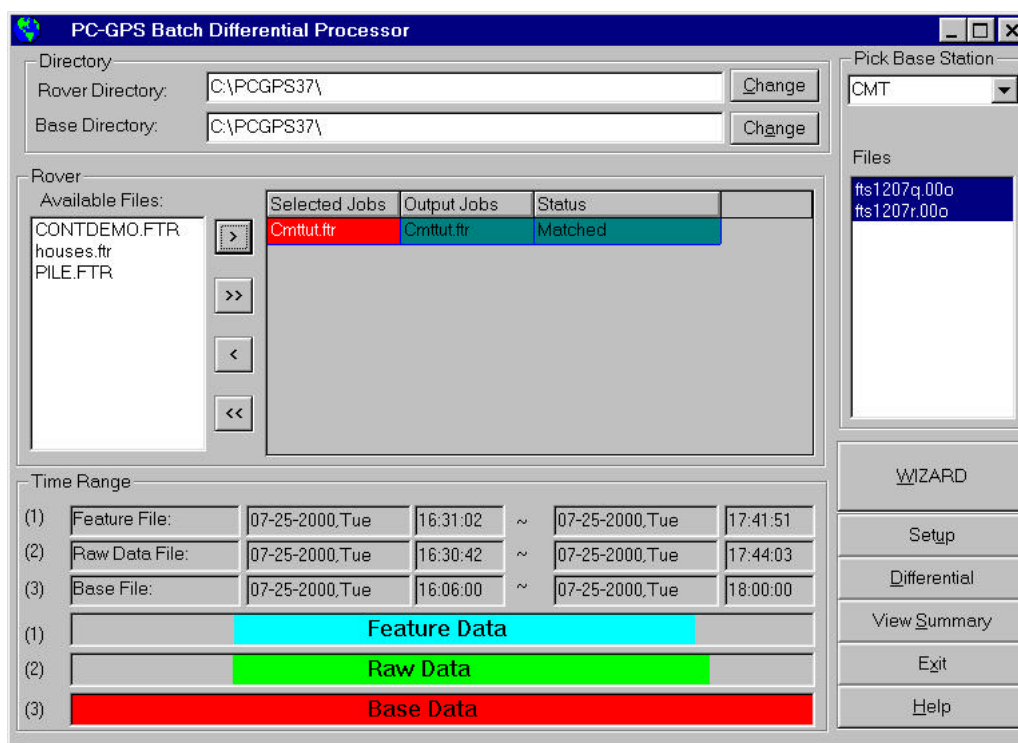
The **GPS/Differential** functions allow you to differentially correct your GPS data. Differential correction improves the accuracy of GPS data by correcting field data against data from a base station at a known location.

There are five differential correction options - **C/A Code Wizard**, **C/A Code**, **Carrier Phase**, **OTF Phase**, and **Vector Net**. The option you choose depends upon the model of your GPS unit and the type of GPS Job you collect. Please reference the chart below to determine which option to use:

| Model of GPS unit: | Type of Job collected: | Differential Option you use: |
|---|---|---|
| MARCH, MC-GPS, HP-GPS-L4, ALTO-G12, GPS-HP-Z33 | <ul style="list-style-type: none"> C/A code Job (not carrier phase) | Differential/CA Code (4.7.1.) Or Differential/CA Code Wizard |
| MARCH- CM , MC-GPS- CM , HP-GPS-L4, ALTO-G12, GPS-HP-Z33 | <ul style="list-style-type: none"> Carrier Phase Job | Differential/Phase (Section 4.7.2) |
| GPS-HP-Z33 | <ul style="list-style-type: none"> Quick Static Job (Dual Frequency only) | Differential/OTF Phase (4.7.3) (Version dependent) |
| GPS-HP-Z33 | <ul style="list-style-type: none"> Vector Net Job (Dual Frequency only) | Differential/Vector Net (See OnLine Manual) (Version dependent) |

4.7.1 Differential/CA Code

When you select the **GPS/Differential/CA Code** menu option, the Batch Differential dialog box will be displayed as shown on the following page. The Batch Differential screen allows you to differentially correct multiple GPS Jobs in one corrections session. The Batch Differential processor also provides functions to automatically match and process your GPS Jobs.



Summary of Steps for C/A Code Differential Correction:

1. Download your GPS Job from the CMT Field unit to a directory on your PC. Each Job consists of three files with the extensions of *.DEF/*.FTR/*.RAW. Each of these files is needed for differential correction.
2. Obtain the base station files which match the exact time range your Job was collected. Copy the base files to a directory on your PC. **Alternatively**, you can skip this step and NGS CORS base files can be automatically downloaded from the CA Code Batch Differential Processor after Step 7.
3. Select **GPS/Differential/CA Code**. The Batch Differential dialog box will be displayed.

Please note: If you are using NGS CORS base files for differential correction, you do not have to enter the NGS CORS base station location in the Differential Setup screen. The correct base location will be entered automatically during differential correction.

4. In the **Pick Base Station** field in the upper right corner of the dialog box, click on the pull-down arrow to the right of the field to view a list of base stations. Select the base station you plan to use. Click the Setup button to verify the base station coordinates and other Differential Setup parameters. (If you need to modify the base coordinates, use the Base Management button in the Setup screen.) After you verify the Setup, click the OK button to return to the Differential screen.
5. From the Differential dialog box, select Rover directory that contains your GPS Job files and the Base directory that contains the Base station files. To browse your directories, click on the Change button. GPS Job files in the specified Rover directory will be listed in the Available Files column. Base station files in the specified Base directory will be in the Base Files column.
6. In the list of Available Files, highlight the Job files you wish to correct. Select the highlighted files by clicking on the > button. The selected files will be “moved” to the Selected column. (**Note:** If you wish to process all of the available job files use the >> button).
7. The selected Job files will be matched with the appropriate Base files. Click the **Differential** button to initiate the Differential Correction process.
8. If there are no matching base files, the “Warning: There are no matching base files...” dialog box will appear. Select the “Default” option and click OK to automatically download base station files and initiate the differential corrections process.
9. Once the Differential Correction process is complete, you may click the Summary button to view a summary report for the Differential Correction session. If there are any uncorrected coordinates in your jobs, you may click on Troubleshooting to attempt to re-process those coordinates with different settings.

Output Files:

The corrected Job file will have the same name as the original Job file unless the name in the Output column has been deliberately changed. The corrected Job file can be opened and viewed using the **File/Open** function. The original uncorrected Job files (*.FTR and *.DEF) will be “backed up” and saved with the file extensions of *.FBK and *.DBK. If your corrected Job file contains static Points, a *.FIX file will be generated during the corrections. The *.FIX file is used by the PC-GPS Spread function.

Batch Differential Function Descriptions:

Wizard: The Wizard button initiates the Batch Differential Wizard, a helpful 3-step utility for downloading base files from the internet and post-processing your Jobs. This utility is great for users new to Differential Correction.

Differential: The Differential button initiates the Differential Correction process for the selected Job (rover) files and the corresponding base files. If the current Base Directory does not contain matching base files, a dialog will be displayed to allow you to download the required base files.

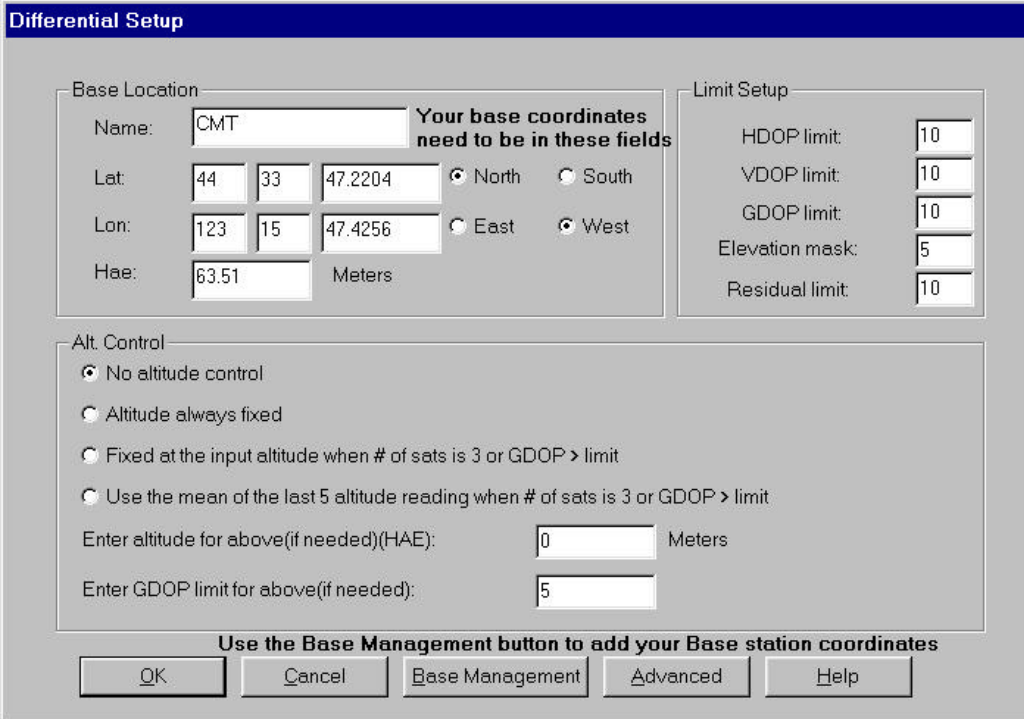
View Summary: The View Summary button is used to display a summary report for the Differential Correction session. The summary reports the total number of coordinates and the number of corrected coordinates. For each static Point, the summary also lists the session number and the total number of corrected fixes.

Setup: The Setup button is used to display the Differential Setup screen. The processing parameters for the Differential Corrections session are defined in the Setup screen. The Setup options are covered Section 4.7.1.1 below.

- For further information, use Help/Online Manual and search on “Differential Correction”.

4.7.1.1 Differential Setup for C/A Code Differential

Prior to initiating the differential correction process, you should check the Differential Correction parameters listed in the Differential Setup dialog box. Errors in the setup will cause errors in the correction process, and may even cause the corrections to fail. The Differential Setup dialog box can be accessed by clicking on the Setup button in the Batch Differential screen. The Differential Setup dialog box is displayed as follows:



The image shows a screenshot of the "Differential Setup" dialog box. It has a title bar "Differential Setup" and a grey background. The dialog is divided into several sections:

- Base Location:** Contains fields for Name (CMT), Lat (44, 33, 47.2204), Lon (123, 15, 47.4256), and Hae (63.51 Meters). There are radio buttons for North, South, East, and West. A note says "Your base coordinates need to be in these fields".
- Limit Setup:** Contains five spinners for HDOP limit (10), VDOP limit (10), GDOP limit (10), Elevation mask (5), and Residual limit (10).
- Alt. Control:** Contains four radio buttons: "No altitude control" (selected), "Altitude always fixed", "Fixed at the input altitude when # of sats is 3 or GDOP > limit", and "Use the mean of the last 5 altitude reading when # of sats is 3 or GDOP > limit". Below these are two input fields: "Enter altitude for above(if needed)(HAE):" with value 0 and "Enter GDOP limit for above(if needed):" with value 5.
- Buttons:** At the bottom are buttons for OK, Cancel, Base Management, Advanced, and Help. Above the buttons is a text prompt: "Use the Base Management button to add your Base station coordinates".

The parameters in this dialog box control the differential correction process.

Elevation Mask: The Elevation Mask field allows you to specify an elevation angle in degrees above the horizon. GPS data from satellites that fall below the elevation angle will not be used in the differential correction process. If you wish to use all of the satellites the base station was tracking, select the default (5.0 degrees).

Alt. control: The Altitude Control field allows you to differentially correct marginal GPS (2D or high DOP positions) positions by using an altitude which is manually entered or has been previously computed. You should be aware that if an incorrect altitude is used, significant error can be added to your GPS positions (approximately 30% of any vertical error introduced by an incorrect altitude is translated into horizontal error). Select altitude control from the following options:

No altitude control - altitude is not controlled. When No Altitude Correction is selected, those features or coordinates with only 2D precision or high DOP values will not be corrected. This is the default. You should not select another option unless you are aware of both the potential ramifications and benefits of using Altitude Control.

Altitude Always fixed - altitude is always fixed at the value input in the "Enter altitude for above (if needed)" field. This option can work very well if you know the Height Above Ellipsoid (HAE) in meters.

Fixed at the input altitude when # of sats is 3 or GDOP > limit - If only 3 satellites are being tracked, or if GDOP is greater than the GDOP limit, PC-GPS will force the altitude of the position to the altitude in the "Enter altitude for above (if needed)" field.

Use the mean of the last 5 altitude readings when # of sats is 3 or GDOP > limit - If only 3 satellites are being tracked, or if GDOP is greater than the GDOP limit, the altitude will be fixed to the mean (average) of the last 5 differentially corrected altitude readings. Note that MC-GPS will ignore the "Enter altitude for above (if needed)" field if this option is used.

Enter altitude for above - Input the fixed altitude if needed. The default entry is 0. This number is HAE altitude in Meters. This field is only used when you are using altitude control.

Enter GDOP limit for above – Input the GDOP limit if needed. Valid entries are 1-20. This field is only used when you are using altitude control.

Base position: The Base Position field displays the base station coordinates that will be used for the Differential Correction process. These coordinates need to be precise. If you need to change the base station coordinates or add base station locations, click the Base button to go to the Base Locations dialog box. The Base Locations dialog box allows you to create a library of base stations. You may Add a new base station, or select an existing base station from the Base list.

Please note: If you are using NGS CORS base files for differential correction, you do not have to enter the NGS CORS base station location in the Differential Setup screen. The correct base location will be entered automatically during differential correction. An

ASCII file named base.loc contains all of the NGS CORS base station sites and resides in the PC-GPS folder. This file may be edited to include new NGS CORS stations as they come online.

HDOP limit: The HDOP Limit field allows you to establish an upper allowable HDOP (Horizontal DOP) for a Feature or node to be differentially corrected.

VDOP limit: The VDOP Limit field allows you to establish an upper allowable VDOP (Vertical DOP) for a Feature or node to be differentially corrected.

GDOP limit: The GDOP Limit field allows you to establish an upper allowable GDOP (Geometric DOP) for a Feature or node to be differentially corrected.

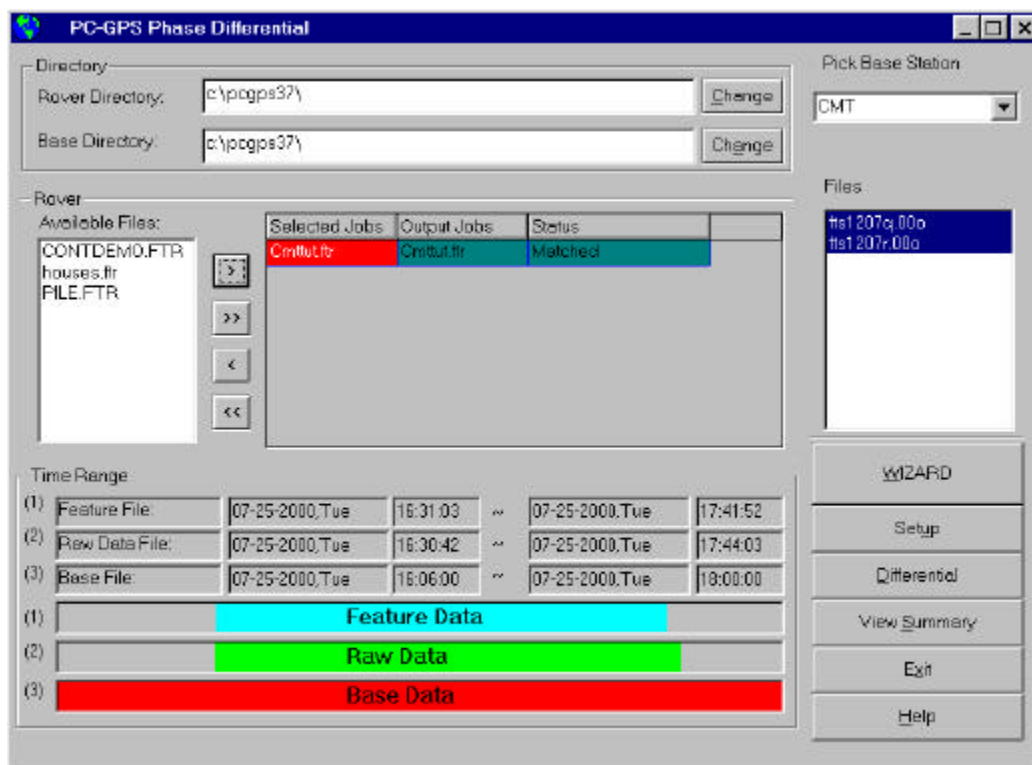
Please Note: Generally, the DOP limits for data collection are controlled by the data collector in the field. The DOP limits in the Differential Setup dialog box are useful if you want to change the limits "after the fact". These settings allow you to filter out poor quality fixes during the differential process (i.e. DOPs greater than 6). PC-GPS DOP limits can improve the overall accuracy of a STATIC point as the less accurate fixes from the averaging process are eliminated.

Residual limit: The Residual Limit field allows you to establish an upper allowable Residual for a Feature or node to be differentially corrected. When more than 4 satellites are used for a position fix, PC-GPS will compute a Residual (Residual Error). Residual is an indication of positional error that the differential correction process cannot remove. One example of this type of error is Multipath error. The residual for each coordinate is displayed in the FEATURE PROPERTIES\COORDINATE window (If it is N/A, that means that only 3 or 4 satellites were used for the position). The maximum residual limit allowed by PC-GPS is 20. If you want to use only the higher quality positions, you can enter a lower residual limit such as 5, 3 or even lower.

Click on the **OK** button to save the **Differential Setup** and return to the **Batch Differential** screen.

4.7.2 GPS/Differential Correction for Carrier Phase

The GPS/Differential/Phase function allows you to correct your Carrier Phase GPS Job using Carrier Phase post-processing. This Carrier Phase option should only be used if you have collected a Carrier Phase Job using a GPS unit equipped with the Carrier Phase option.



Summary of Steps for Carrier Phase Differential Correction:

1. Download your GPS Job from the CMT Field unit to a directory on your PC. Each Job consists of three files with the extensions of *.DEF/*.FTR/*.RAW. Each of these files is needed for differential correction.
2. Obtain the base station files that match the exact time range your Job was collected. Copy the base files to a directory on your PC.
3. Select **GPS/Differential/Phase**. The Phase Processor dialog box will be displayed.
4. In the **Pick Base Station** field in the upper right corner of the dialog box, click on the pull-down arrow to the right of the field to view a list of base stations. Select the base station you plan to use. Click the Setup button to verify the base station coordinates and other Differential Setup parameters. (If you need to modify the base coordinates, use the Base Management button in the Setup screen.) After you verify the Setup, click the OK button to return to the Phase Processor screen.
5. From the Phase Processor dialog box, select the Rover directory that contains your GPS Job files and the Base directory that contains the Base station files. To browse your directories, click on the Change button. GPS Job files in the specified Rover directory will be listed in the Available Files column. Base station files in the specified Base directory will be in the Base Files column.
6. In the list of Available Files, highlight the Job files you wish to correct. Select the highlighted files by clicking on the > button. The selected files will be “moved” to the Selected column. (**Note:** If you wish to process all of the available job files use the >> button).
7. The selected Job files will be matched with the appropriate Base files. Click the Differential button to initiate the Differential Correction process.

8. Once the Differential Correction process is complete, you may click the Summary button to view a summary report for the Differential Correction session. If there are any uncorrected coordinates in your jobs, you may click on Troubleshooting to attempt to re-process those coordinates with different settings.

Output Files:

The corrected Job file will have the same name as the original Job file unless the name in the Output column has been deliberately changed. The corrected Job file can be opened and viewed using the **File/Open** function. The original uncorrected Job files (*.FTR and *.DEF) will be “backed up” and saved with the file extensions of *.FBK and *.DBK.

Phase Processor Function Descriptions:

Wizard: The Wizard button initiates the Batch Differential Wizard, a helpful 3-step utility for processing your Jobs. This utility is great for users new to Phase Differential Correction.

Differential: The Differential button initiates the Differential Correction process for the selected Job (rover) files and the corresponding base files.

View Summary: The View Summary button is used to display a summary report for the Differential Correction session. The summary reports the total number of coordinates and the number of corrected coordinates. For each static Point, the summary also lists the session number and the total number of corrected fixes.

Setup: The Setup button is used to display the Differential Setup screen. The processing parameters for the Differential Corrections session are defined in the Setup screen.

- For further information, use Help/Help Topics and search on “Carrier Phase Differential”.

4.7.2.1 Carrier Phase Differential Setup

For Carrier Phase differential, most of the setup options are the same as those discussed in Section 4.7.1.1 for C/A Code. There are some options specific to Carrier Phase. Each of these options is discussed in the section below.

Differential Setup

Base Location

CMT Antenna height: 0 Meters

Lat: 44 33 47.2204 North South

Lon: 123 15 47.4256 East West

Hae: 63.51 Meters

☐ Check here and enter coordinates below if first static point is known

Lat: 0 0 0 North South

Lon: 0 0 0 East West

Hae: 0 Meters

Elevation Mask: 10

Quality limit: 5

Data Type

☒ L1 only

☐ WIDE LANE

☐ IONO-FREE

Ratio cutoff: 2 (Default=2.0)

Satellites to exclude

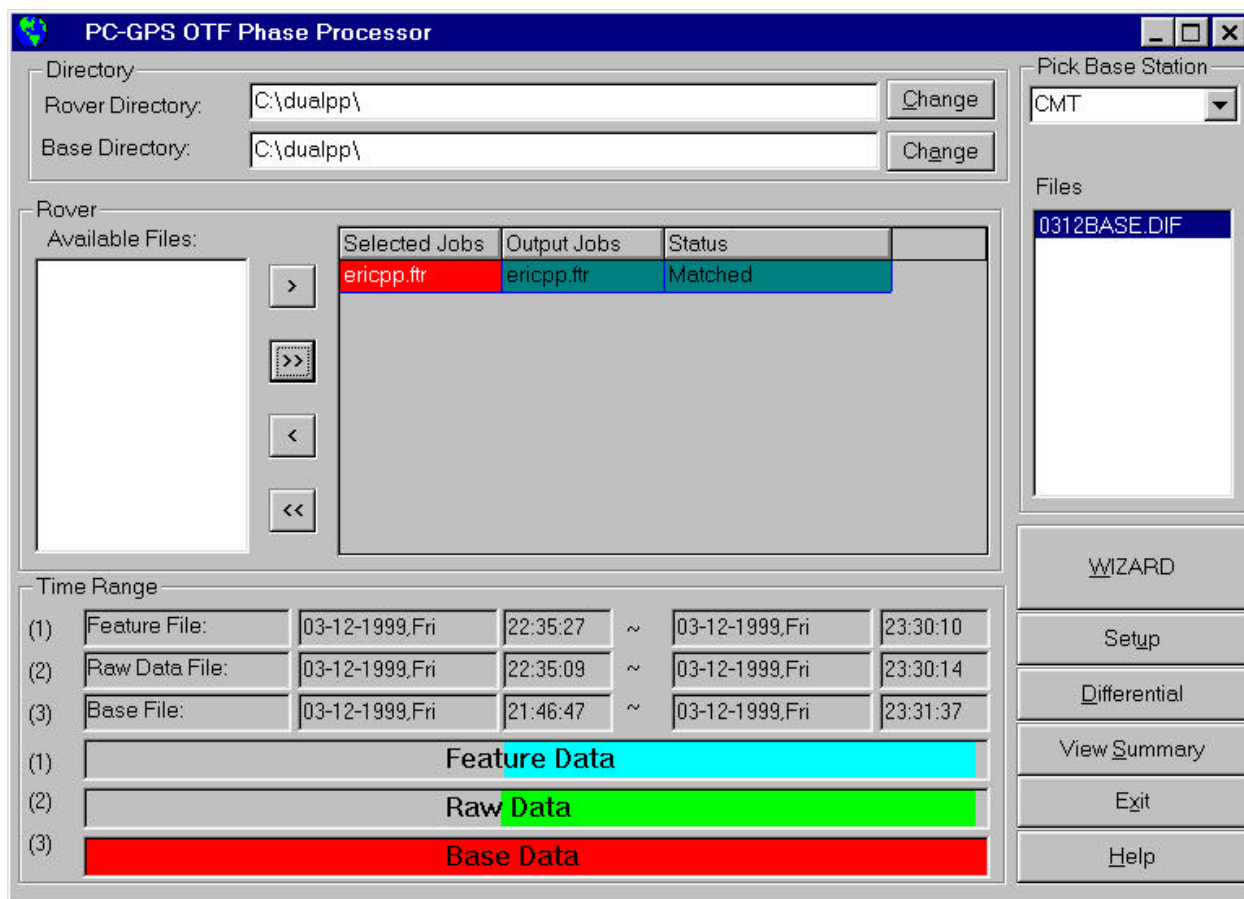
SV#: 0 (Default = 0, i.e. no satellite rejected)

OK Cancel Base Management Known Help

- First Static Point Known:** If you are starting your Carrier Phase GPS Job on a known point, mark this box and input the coordinates of the known point. Starting on a known point will significantly reduce the occupation time required to initialize the Carrier Phase unit. **You can also enter a known location from the library of base stations by clicking on the Known button.** Select the known location just as you would select a base station location.
- Elevation Mask:** The minimum elevation mask you should use for carrier phase differential is 10 degrees.
- Quality Limit:** Quality is a statistical indicator of the Carrier Phase position quality. Points that exceed the quality limit will not be corrected. The recommended setting for the Quality Limit field is 5. You may adjust this limit to find the setting which best fits your application.
- Data Type:** You can select the type of GPS data to use for differential correction.
Select **L1 Only** if you would like to use only L1 data for the corrections process. You should check this option when the baseline (distance between base station and rover) is short (<10 KM). Select **WIDELANE** if you would like to use the Widelane (L2 – L1) data for the corrections process. Select **IONO-FREE** if you would like to use both the L1 and L2 data for the corrections process. You should check this option when the baseline (distance between base station and rover) is long (>10 KM).
- Ratio Cutoff:** You can set a minimum acceptable ratio of the variance of the second best solution to the variance of the best solution when more than one integer ambiguity is determined in a fixed solution. For example, a ratio of 2 means that the variance of the second best solution is equal to twice the variance of the best solution. The higher this ratio is, the more confidence the Phase processor has that it has fixed the correct integer ambiguity. The recommended setting for the Ratio Cutoff is 2.
- Satellites to Exclude:** You can exclude data from any one or two GPS satellites from the correction process. Type the desired Satellite Numbers in the **SV#:** box.
- For further information, use Help/Online Manual and search on “Phase Differential Setup”.

4.7.3 Differential/OTF Phase

The **Differential/OTF Phase** option (Version dependent) is used to correct a Quick Static Dual Frequency Job collected using a CMT-Z33 (Field 4.x) GPS unit. When this option is selected, the Differential Correction dialog box shown below will be displayed.



Summary of Steps for OTF Phase Differential Correction:

1. Download your GPS Job from the CMT Field unit to a directory on your PC. Each Job consists of three files with the extensions of *.DEF/*.FTR/*.RAW. Each of these files is needed for differential correction.
2. Obtain the base station files that match the exact time range your Job was collected. Copy the base files to a directory on your PC.
3. Select **GPS/Differential/OTF Phase**. The OTF Phase Processor dialog box will be displayed.
4. In the **Pick Base Station** field in the upper right corner of the dialog box, click on the pull-down arrow to the right of the field to view a list of base stations. Select the base station you plan to use. Click the Setup button to verify the base station coordinates and other Differential Setup parameters. (If you need to modify the base coordinates, use the Base Management button in the Setup screen.) After you verify the Setup, click the OK button to return to the OTF Phase Processor screen.
5. From the OTF Phase Processor dialog box, select the Rover directory that contains your GPS Job files and the Base directory that contains the Base station files. To browse your directories, click on the Change button. GPS Job files in the specified Rover directory will be listed in the Available Files column. Base station files in the specified Base directory will be in the Base Files column.

6. In the list of Available Files, highlight the Job files you wish to correct. Select the highlighted files by clicking on the > button. The selected files will be “moved” to the Selected column. (**Note:** If you wish to process all of the available job files use the >> button).
7. The selected Job files will be matched with the appropriate Base files. Click the Differential button to initiate the Differential Correction process.
8. Once the Differential Correction process is complete, you may click the Summary button to view a summary report for the Differential Correction session. If there are any uncorrected coordinates in your jobs, you may click on Troubleshooting to attempt to re-process those coordinates with different settings.

Output Files:

The corrected Job file will have the same name as the original Job file unless the name in the Output column has been deliberately changed. The corrected Job file can be opened and viewed using the **File/Open** function. The original uncorrected Job files (*.FTR and *.DEF) will be “backed up” and saved with the file extensions of *.FBK and *.DBK. If your corrected Job file contains static Points, a *.FIX file will be generated during the corrections. The *.FIX file is used by the PC-GPS Spread function.

OTF Phase Processor Function Descriptions:

Wizard: The Wizard button initiates the Batch Differential Wizard, a helpful 3-step utility for processing your Jobs. This utility is great for users new to OTF Phase Differential Correction.

Differential: The Differential button initiates the Differential Correction process for the selected Job (rover) files and the corresponding base files.

View Summary: The View Summary button is used to display a summary report for the Differential Correction session. The summary reports the total number of coordinates and the number of corrected coordinates. For each static Point, the summary also lists the session number and the total number of corrected fixes.

Setup: The Setup button is used to display the Differential Setup screen. The processing parameters for the Differential Corrections session are defined in the Setup screen. Please refer to Section 4.7.3.1 for information on the Dual Frequency Differential Setup.

For further information, use Help/Online Manual and search on “Dual Frequency Corrections”.

4.7.3.1 Differential Setup for OTF Phase processing

The parameters for the OTF Phase Differential process (Version dependent) may be established in the Setup screen. To access the Setup screen, use the **GPS/Differential/OTF Phase** menu option and click on the Setup button in the Differential Correction dialog box. The Setup screen shown on the following page will be displayed.

- Elevation Mask:** The default setting is 13 degrees. If you find that some of your data does not correct, you can either raise or lower the elevation mask and it may make a difference.
- Base Location:** If you need to change the base station coordinates, click the Base Management button to go to the Base dialog box. Use the Add button in Base screen to add the base position
- Use L1 Data Only:** Mark this option if you would like to use only L1 data for the corrections process. This is recommended when the baseline (distance between base and rover) is short (<5 KM)
- Quality Limit:** The Quality Limit field allows you to establish an upper allowable Quality value for a Feature or node to be differentially corrected. The default limit is 5, with lower values indicating more accurate data.
- For additional information on Dual Frequency processing and setup, please refer to the CMT-Z33 Operator's Manual.

4.7.4 Differential/Vector Net

The Vector Net Differential interface (Version dependent) is beyond the scope of this manual. For further information, use Help/Online Manual and search on "Vector Net Differential".

4.8 Coordinate Information

Coordinate Information for GPS Features can be viewed by using the Coordinate Information icon or the Coordinate Information button in the Feature Properties dialog box.

To use the Coordinate Information icon, first highlight one or more Feature in the Map View, then click on the icon.

To view the Feature Properties screen, select a Feature from the Map View and use **Edit/Properties** or double-click on the Feature in the Map View.

- For information on changing Feature properties, see Section 3.5.1 in this manual.

| Topic | Type | Feature ID |
|-------------|------|-------------|
| SPRAY AREAS | Area | SPRAY AREA1 |

| | Latitude | Longitude | Ellipsoidal Ht | Status | Type |
|---|----------|-----------|----------------|-----------|------|
| 1 | 44.6 | -123.3 | 54.2 | CORRECTED | Line |
| 2 | 44.6 | -123.3 | 54.6 | CORRECTED | Line |
| 3 | 44.6 | -123.3 | 57.8 | CORRECTED | Line |
| 4 | 44.6 | -123.3 | 55.3 | CORRECTED | Line |
| 5 | 44.6 | -123.3 | 53.9 | CORRECTED | Line |

Example: Open the SWCVO.MAP file and double-click on the Spray Area Feature. The Feature Properties dialog box will be displayed as shown above. One of the coordinate nodes of the selected Feature will be highlighted in the Coordinate List.

To view the coordinate information for the highlighted coordinate node, click on the Coordinate Information button. The Coordinate Information dialog box will be displayed as shown on the following page.

Coordinate Information

LLA Coordinates

Latitude: 44 33 0.5014 ☒ N ☐ S

Longitude: 123 17 57.5282 ☐ E ☒ W

Height

Orthometric: 76.9190 Meters

Ellipsoidal: 54.2182 Meters

Date: 2-24-1996 UTC Time: 18:39:12

3D Corrected Average Residual: 0.46

PDOP: 2.4 HDOP: 1.5 VDOP: 1.9 Session: 60

Satellites used: 6

OK Cancel Prev Next Spread Help

Example: The Coordinate Information dialog box is displayed above. The position and properties of the coordinate fix are listed. In this case, the coordinate node is a corrected, 3D coordinate fix, with PDOP of 2.4, HDOP of 1.5, and VDOP of 1.9. In addition, the number of satellites used was 6, the calculated average residual for the position is 0.46 and the session time was 60 seconds.

The coordinate information is displayed for an individual coordinate node or Point Feature. The coordinate information for a Point Feature is the average of all of the GPS fixes which were stored for the Point. Information for individual GPS fixes of the Point Feature is available under the **Spread** function. (Refer to Section 4.9 for information on the Spread function.)

Date/ UTC Time: The date and UTC time the coordinate position was computed is listed.

Coordinates: The coordinate information based upon the Coordinate System selected under **Map/Coordinate System** will be listed in this section.

2D/3D: If 2D is displayed, it is a two-dimensional coordinate position. This indicates that fewer than four satellites were used to compute the coordinate position. A 2D coordinate position will not correct in the differential correction process unless Altitude Control is used. (See Section 4.7.1.1.)

If 3D is displayed, it is a three-dimensional coordinate position. This indicates that at least four satellites were used to compute the coordinate position.

Corrected/Uncorrected: The coordinate position will be marked as either Corrected or Uncorrected. Corrected means that the coordinate position was corrected by the Differential Correction process. Uncorrected means that the coordinate position was not corrected by the Differential Correction process.

The values for **DOPs**, **Average Residual** and **# Satellites Used** are important quality indicators.

DOP stands for Dilution of Precision. DOP is an indicator of the quality of the GPS position based upon the geometry of the satellite constellation. Lower DOP values indicate more favorable satellite-constellation geometry. (The term satellite constellation refers to the group of satellites tracked by the GPS receiver.) In general, we have more confidence in the accuracy of positions with lower DOP values. (Please see Section 4.8.1.)

PDOP: Positional dilution of precision is used as a general measure of the quality of coordinate fix. The PDOP is derived from the HDOP and the VDOP:

$$PDOP = \sqrt{HDOP^2 + VDOP^2}$$

HDOP: Dilution of precision in the horizontal axis.

VDOP: Dilution of Precision in the vertical axis.

Session: The number of GPS fixes used to compute the coordinate value. If the Feature is a static Point, the number of fixes are averaged to compute the coordinate position.

Satellites Used: The number of satellites tracked.

Average Residual: A residual value is computed for a corrected position with more than four satellites. The residual is an indicator of error that could not be corrected during differential correction. Lower residual values indicate a smaller degree of uncorrectable error. (See Section 4.8.1) **Note:** The residual will be reported as “N/A”, if there were only 4 satellites tracked for the position.

Please note: If you have collected a **Carrier Phase** or **OTF Phase** GPS Job, there will be additional indicators for Quality, Fixed, Floating or Cycle Slip.

4.8.1 Estimated Quality Indicators for Coordinates (C/A Code Jobs)

These general guidelines can be used:

| Indicated “Quality” | Average Residual | PDOP | DOP & Residual are independent indicators. |
|---------------------|------------------|-------|--|
| Very Good | < .5 | 1 - 3 | |
| Good | .5 - 1 | 3 - 5 | |
| Fair | 1 - 2 | 5 - 6 | |
| Suspect | > 2 | >6 | |

Please note: The **Spread** function is also a useful tool for evaluating corrected static points.

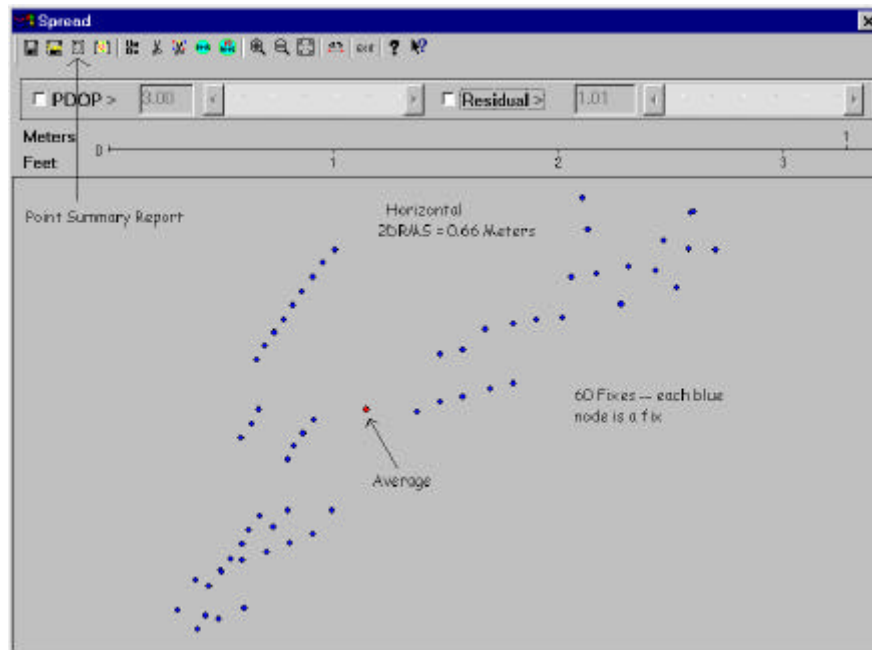
To check the Residual or PDOP of a coordinate in your Job, double-click on the Feature or node and then click on the Coordination Information button in the Feature Properties screen. The Coordinate Information dialog box as shown in Section 4.8. If your coordinate has high Residual or PDOP values, you may want to consider using the **GPS/Conditional Cut** function. The Conditional Cut function can be used to remove positions based on correction status, DOPs, and Residuals.

4.8.2 Quality Indicators for Carrier Phase and Dual Frequency Jobs

For Carrier Phase Jobs, there is an additional indicator called QUALITY. During the Phase Differential process, all corrected coordinates are tagged with a QUALITY indicator between 1 and 15. The lower the number the greater the probability the coordinate position is correct to within the stated accuracy for your unit. (Please refer to CMT Field unit User's Manual for further information on Quality, Fixed, Floating, and Cycle Slip.)

4.9 Coordinate Information Spread Function for Points











The Spread function of the Coordinate Information dialog box allows you to view and edit the GPS coordinate positions of **corrected GPS Point** Features. To access the Spread function for a particular Point Feature, first double-click on the Point Feature in the Map View to view the Feature Properties dialog box. From the Feature Properties dialog, click on the Coordinate Information button and then click on the Spread button in the displayed Coordinate Information screen. The Spread dialog is displayed as follows:



The Spread dialog graphically displays the “spread” of GPS coordinate fixes. Each coordinate **fix** is represented by a small **blue** point. For example, if you collected a 60-second Static Point, the 60 **fixes** of the Point will be shown as **blue** points. The **averaged coordinate position** for the Point Feature is represented by the one small **red Point**. Note that the number of coordinate fixes displayed, before editing, will be equal to the Session Time in the Point’s Coordinate Information screen.

Coordinate information for an individual fix can be accessed by double-clicking on the fix in the Spread dialog. A coordinate information screen, as in Section 4.8, will be displayed for the selected fix.

The icons on the Spread tool bar offer several functions:

- | | |
|--|--|
|  Save - Save editing changes to the FIX file. Refer to Section 4.9.3 for information. |  Cut - Cut selected fixes. Refer to Section 4.9.2 for information. |
|  Save Job Summary – Save Summary Report. Refer to Section 4.9.3 for information. |  RMS Cut - Cut fixes which fall outside of the cubic 1DRMS for the averaged Point. |
|  Summary - View Summary Report. Refer to Section 4.9.1 for information. |  2DRMS Cut - Cut fixes which fall outside of the cubic 2DRMS for the averaged Point. |
|  Plot - Plot the graphical spread. Refer to Section 9 for information. |  Measure - Measure distances. Refer to Section 3.7.3 for information. |
|  Undo - Reverses the last deletion. Use this icon to restore deleted fixes. |  Conditional Cut - Use the Conditional Cut function. Refer to Section 4.9.2. |

Please note: The Spread function utilizes the *.FIX file generated by the PC-GPS Differential Correction process. Therefore, in order to use the Spread function, you must first correct your data using PC-GPS. If you have renamed your Feature file or if you have saved your Feature file as a Map file, the Open dialog box will be displayed when you click on the Spread button, and you will need to select the *.FIX file which was generated by the Differential Correction.

4.9.1 Spread Summary Report

A summary report for the current Point can be viewed using the Summary icon from the Spread dialog box. The summary includes detailed RMS and 2DRMS statistics as well as position information for each fix. A partial example is below:

Feature Name: HYDRANT001

Datum: WGS 84

Units: Meter

Session time: 147

Start Time: 13:04:05 UTC

Start Date: 10-15-1997 UTC

Horizontal RMS (using 108 nodes): 0.217579M 0.713843FT

Horizontal 2DRMS (using 140 nodes): 0.435159M 1.427687FT Horizontal 2DRMS statistic is often used

Vertical RMS (using 108 nodes): 0.252517M 0.828469FT to evaluate a point's spread.
 Vertical 2DRMS(using 136 nodes): 0.505035M 1.656938FT

| FIX# | Latitude | Longitude | MSL | HAE | PDOP | HDOP | VDOP | Res. | SVs |
|--------------|----------------|----------------|----------|----------|------|------|------|------|-----|
| 00001 | 48 11 14.1000N | 15 01 12.3555E | 420.1109 | 464.5109 | 2.4 | 1.0 | 1.8 | 1.02 | 8 |
| 00002 | 48 11 14.1001N | 15 01 12.3555E | 420.1095 | 464.5095 | 2.4 | 1.0 | 1.8 | 1.02 | 8 |
| 00003 | 48 11 14.0996N | 15 01 12.3579E | 420.1068 | 464.5068 | 2.4 | 1.0 | 1.8 | 1.04 | 8 |
| 00004 | 48 11 14.0978N | 15 01 12.3556E | 420.2466 | 464.6466 | 2.4 | 1.0 | 1.8 | 1.05 | 8 |
| 00005 | 48 11 14.1008N | 15 01 12.3534E | 420.3435 | 464.7435 | 2.4 | 1.0 | 1.8 | 1.05 | 8 |
| (cont.) | | | | | | | | | |
| ===== | | | | | | | | | |
| AVE | 48 11 14.0679N | 15 01 12.3595E | 421.5210 | 465.9210 | 2.3 | 1.2 | 1.6 | 0.76 | 7 |

The summary is displayed in the Print Preview dialog box. The summary can be sent to your printer using the **Print/Print Out** option from the Print Preview dialog box. The summary report for this Point can be saved as a text file using the **File/Save As** option from this Print Preview dialog box.

4.9.2 Cutting Coordinate Fixes from your Point

The Spread function provides several methods for removing coordinate fixes from a selected Point. These methods include including **Cut with Mouse**, **Conditional Cut**, **RMS Cut**, **2DRMS Cut** and **Quality Bar Cut**. Each of these methods is briefly discussed below.

After coordinate fixes have been removed, the averaged coordinate position will be recalculated and the graphical spread will be redrawn. In addition, the summary report for the Point will be updated. After coordinate fixes have been cut, you will notice that the reported session time, RMS, and 2DRMS will reflect your edits.

Coordinate fixes that have been cut may be restored by using the **Undo** icon from the Spread screen.

Cutting Fixes with the Mouse:

The **Cut** option can be used to cut selected fixes from the Point. First, select one or more fixes from the Spread screen using the mouse. Next, click the Cut icon. Immediately, the selected fixes will be cut and the averaged coordinate position for the Point will be recalculated.

- Refer to Section 3.3.1 in this manual for guidelines on selecting data.

Conditional Cut:

The **Conditional Cut** option allows you to cut fixes based on Residuals, PDOP value, and the number of satellites (# of SV). When this option is selected, the Conditional Cut dialog box is displayed. You may enter upper limits for the Residual and PDOP and a lower limit for # of SVs in the associated fields. Click on the OK button in the Conditional Cut dialog box to remove all fixes which fall outside of the established limits. The averaged coordinate position for the Point will be recalculated based on the remaining coordinate fixes.

- Refer to Section 4.4 in this manual for more information on the Conditional Cut function.

2DRMS Cut:

The **2DRMS Cut** option allows you to cut all fixes which fall outside of the cubic 2DRMS. When you select the **2DRMS Cut** option, the averaged coordinate position for the Point will be recalculated using only those fixes which are within the original 2DRMS.

RMS Cut:

The **RMS Cut** option allows you to cut all fixes which fall outside of the cubic 1DRMS. When you select the **RMS Cut** option, the averaged coordinate position for the Point will be recalculated using only those fixes which are within the original 1DRMS.

Please Note: The 2DRMS and RMS cuts are based upon the **cubic** 2DRMS and **cubic** 1DRMS respectively. It is important to note that a fix which falls within the Horizontal 2DRMS or 1DRMS **may or may not** fall within the associated **cubic** 2DRMS or 1DRMS.

Quality Bar Cut

The Quality Bar allows you to cut all fixes which fall outside of a specified **PDOP** and/or **Residual** limit. A Quality Bar cut is similar to a Conditional Cut, except it provides the following advantages:

- You can easily determine the minimum and maximum PDOP and Residual for all fixes
- You can make slight adjustments to the specified PDOP and/or Residual cutoffs and see how it will affect the cut

To activate the Quality Bar, mark the PDOP and/or Residual checkbox. Select a cutoff value in the **PDOP>** or **Residual >** box by using the scroll bar or keyboard. All fixes that exceed this cutoff value will be highlighted. If both options are used, all fixes that meet either condition will be highlighted. Click the **Cut** icon to cut the highlighted fixes.

4.9.3 Saving from the Spread screen

There are three different “save” functions, which can be accessed from the Spread screen. The **Save** option is used to update the coordinate information in the *.FIX file and *.FTR file or the *.MAP file. The **Save Job Summary** option is used to save the summary report for *all Points in the Job* to one text file with the extension of *.SUM. The **File/Save As** function from the Point Summary report is used to save the summary report for the individual Point to a text file with the extension of *.SUM.

4.10 GPS Feature Lists

The **GPS/Feature List** function allows you to set up a "point and shoot" database structure for your Features, Attributes and Values. Use of a Feature List simplifies field data collection and promotes sound data organization. The Feature List can be easily downloaded to the CMT Field unit. The file created by the Feature List function has the file extension .FBR.

When you click on the **GPS/Feature List/Open** menu option, the Open dialog box will be displayed. **To edit a Feature List**, double-click on the file name in the Open dialog box. **To create a new**

Feature List, click on the **GPS/Feature List/New** menu option. If you choose to create a new Feature List, a blank Feature List screen will be presented. The Feature List screen for the file SWCVO.FBR is shown on the following page:

Feature List

List Name: C:\PCGPS37\Swcvo.FBR ☒ Feature Lock

| Feature | Collect Mode | Type | D/S | Intvl/Sess | Distance |
|-------------|--------------|-------|---------|------------|----------|
| Houses | Time | Point | Static | 20 | 1.00 |
| Samples | Time | Point | Dynamic | 1 | 1.00 |
| Streets | Time | Line | Dynamic | 1 | 1.00 |
| SPRAY AREAS | Time | Area | Dynamic | 1 | 1.00 |
| LAND PLOTS | Time | Area | Dynamic | 1 | 1.00 |

Buttons: Add, Open, Insert, Save, Delete, Save As, Print, Import, OK, Help, Cancel

| Attribute | Lock |
|---------------|-------------------------------------|
| Land_Category | <input checked="" type="checkbox"/> |

| Value |
|-------------|
| Wetland |
| AG Land |
| Residential |
| Commercial |
| City |
| Golf Course |

Options: ☐ Default, ☐ Minimum, ☐ Maximum, ☒ None

There are eight major columns labeled Feature, Collect Mode (Version dependent), Type, D/S, Intvl/Sess, Distance (Version dependent), Attribute and Value in the Feature List dialog box. A complete Feature entry will include Feature name, Type, D/S, and Interval. Attributes and Values for the Feature are optional.

Please Note: The Feature name is used as the Topic name when the Feature file is opened in PC-GPS.

The **Feature**, **Attribute** and **Value** have a hierarchical relationship. Each Feature may have several associated Attributes. Similarly, for each Attribute, there may be several Values.

In the Feature List screen above, the “Land Plots” **Feature** has one **Attribute** called “Land Category”. The Land Category Attribute has six **Values** listed: Wetland, AG Land, Residential, Commercial, City and Golf Course.

Please refer to Section 2.1.1 for a discussion of Features, Attributes and Values. For data organization suggestions, please see Section 2.2 or OnLine Help Topic “Data Organization”.

Feature Type:

Features may be Points, Lines or Areas.

Collect Mode (Version dependent):

Point Features may be collected by Time or by Distance mode. If Time mode is selected, the **Intvl/Sess** field will be active to allow you to enter the session time for the Point Feature. If Distance mode is selected, the **Distance** field will be active to allow you to enter the distance interval for collecting Point Features.

- For additional information on Distance collection mode, please refer to the CMT-Z33 Operator's Manual.

D/S:

Features may be collected in Static or Dynamic mode. Point Features are always static. Line Features and Area Features may be collected in either mode. In Dynamic mode, GPS fixes for the Feature are taken while the GPS receiver is moving. In Static mode, GPS fixes for the Feature are taken while the GPS receiver is stationary.

Interval for Dynamic mode or Session for Static mode:

The **Interval** is the number of seconds between GPS fixes in Dynamic mode. For example, an Interval of 5 would mean that a GPS position fix would be stored once every 5 seconds for the Line or Area you collect. The **Session** time is the number of fixes that will be stored for Static Features. A GPS position fix will be stored each second.

4.10.1 Adding a Feature entry to the Feature List

To add a Feature entry to a new Feature List, click in the first row in the Feature column, and type in a Feature name. After you enter the Feature name press the keyboard, ENTER key. Select the Feature type (Point, Line or Area), Mode, and input the Interval or Session time in seconds. Click in the first blank field of the Attribute column for the Feature. Enter the Attribute name and then press the keyboard ENTER key. You may press the down-arrow to move to a second Attribute field. To enter Values for your Attribute, highlight the Attribute and then click on the Value field.

To append a Feature, Attribute, or Value, simply place the cursor in the last entry of the respective column and press the down arrow key. A blank row will be appended.

Duplicating Features in a Feature List

Features contained in a new or existing feature list may be quickly duplicated to save time. There is a **Duplicate** button found on the Feature List editor dialog window. This function is very helpful for creation or updating feature lists for features, which contain many attributes and values. The duplicate function will create an exact copy of the selected feature including the attribute and value structure.

Click on the desired feature to be duplicated and then click on the **Duplicate** button. The duplicated feature will be created underneath the existing feature and will be automatically selected for editing. All attributes and values for that feature will also be duplicated (eliminating the need to re-type them each time you add a new feature). Simply click on the feature, attributes or values to edit them and change the names, add or delete records. PC-GPS does not allow duplicate feature names, so the newly duplicated feature must be renamed before saving the updated feature list.

To delete a Feature, Attribute or Value, click on the record you wish to delete, and then click on the Delete button.

To exit the Feature List, click on the OK button. The Feature List will automatically be saved.

4.10.2 Feature List Error Checking

There are three options for error checking: Feature Lock, Attribute Lock, and Value Check.

The **Feature Lock** box is located in the top right corner of the dialog box. When the Feature Lock is toggled ON, users will not be able to store Features that are **not on the Feature List**.

The **Attribute Lock** box is located to the right of each Attribute. When the Attribute Lock is toggled ON, users will not be able to store Values, which are **not listed** in the Feature List for the corresponding Attribute.

The **Value Checking** options allow you to specify a default Value or a range of Values for your Attributes. To assign a default Value, highlight one of the Values and then click on the Default mark box. Alternatively, you may establish a range of acceptable numerical Values by designating one Value as the minimum Value and another Value as the maximum Value in a similar fashion.

4.10.3 Importing Feature records to your Feature List

The Import button in the Feature List screen allows you to import Features, Attributes, and Values into the Feature List. The data can be in either an ASCII format (*.FAS file) or a DBF format. The imported file may contain one Feature record with multiple Attributes and Values.

- For further information, use Help/Online Manual and search on “Feature List”.

Please note: You may create a Feature List using the Feature data in your Map file. For information, use Help/Online Manual and search for “Feature List Export”.

4.10.4 Saving your Feature List

After you have entered the Feature, Attribute, Value records into your Feature List, you may save the Feature List by clicking on the **OK** button, the **Save** button, or the **Save As** button. The **Save As** function allows you to save the Feature List under a different file name.

4.10.5 Downloading the Feature List to the CMT Field Unit

Once you have established a Feature List, the list can be downloaded to your GPS unit to facilitate field data collection. The Feature List can be attached to a Feature file via the **GPS/Job Setup** option and downloaded automatically with the Feature file. Feature Lists can also be downloaded to the GPS unit separately.

- For further information, see Section 4.1.2 in this manual, or use Help/Help Topics and search on “File Transfer”.


4.11 GPS/Navigate


The **GPS/Navigate** function (Version dependent) uses your real-time GPS position to help you navigate to a target Feature location in the currently active map.

Before issuing this command, you must make sure that a compatible CMT Field unit or GPS receiver is turned on and is sending out the required data. In addition, you must use the GPS/Activate GPS Receiver command select the correct GPS receiver type and set up the proper COM port baud rate.

For example, to set your CMT Field unit to output NMEA strings from the COM1: port, use the Setup/RS-232 Input/Output option and set COM1: to NMEA, TYPE: to GGA and the BAUD to 19200. Connect your CMT serial cable to the COM1: port of your CMT Field unit. Plug the serial cable into one of the COM ports on your PC or laptop. In PC-MAPPER or CMT-SURVEY, select the GPS/Activate GPS Receiver command. For the COM port setting, select the PC or laptop COM port you are using. Make sure Baud Rates: is set to 19200. Click the OK button to save the settings and return to the Map View.

Once your GPS unit is tracking satellites, the GPS tracking status, the PDOP and the GPS position will be shown in the Navigation Status Bar. The current position and direction of motion of your GPS unit

will be indicated in the Map View. The red arrowhead  will represent a meaningful direction only if your GPS receiver is moving at a significant speed (such as 15 MPH). Recently occupied positions will be represented as dots “trailing” the navigation marker. This information will be updated once per second.

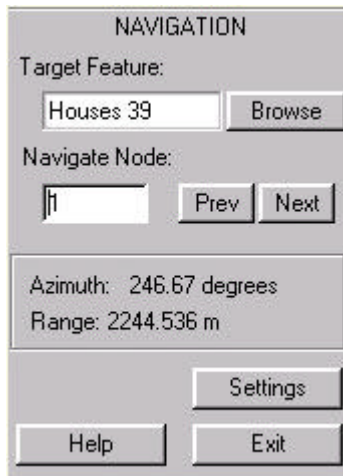
Now, when you select the GPS/Navigate function or click the Navigate icon  in the GPS Toolbox, the Navigation Panel will be displayed and the Toggle Mouse for Data Input Panel and Disable Data Input icons will become active.

To turn off the Navigation function, click the Exit button in the Navigation Panel.

Please Note: The GPS position output device will need to be tracking satellites (N3DX or F3DX) and sending out position information for the Navigate function to work.

4.11.1 Navigation Panel

Select a target feature or waypoint and then use the displayed distance and direction information as a guide in moving toward the target.



Please Note: While the Toggle Mouse for Data Input Panel icon is ON, you may use the mouse to select features for the data input fields in the Navigation Panel. To return the mouse to its normal functionality without exiting the Navigation Panel, click the Toggle Mouse for Data Input Panel icon to turn it OFF.

Target: Used to specify the current target feature or waypoint. Click this box to display a pull-down list of Feature IDs in the current topic. Select the Feature ID of your desired Target from the pull-down list or click the desired Target in the Map view.

Node#: Used to select which node of a line or area you would like to navigate to. By default, Node #1 will be selected. Click the Next button to select the next node or type in the desired Node # with your keyboard.

Azimuth: Represents the azimuth between your GPS receiver and your target waypoint (in degrees from north). This value will be updated continually as your position changes relative to the waypoint.


Range: The horizontal distance between your GPS receiver and your target waypoint (units are based on current coordinate system). This value will be updated continually as your position changes relative to the waypoint.

Cut/Fill: The vertical (elevation) distance between your GPS receiver and your waypoint (units are based on current coordinate system). This value will be updated continually as your position changes relative to the waypoint.

Cut means that your elevation is greater than the elevation of the waypoint.

Fill means that your elevation is lower than the elevation of the waypoint.

Click the Settings button to set the mark color for the receiver position, the zoom mode to use and the signals to alert you when you approach your target. Once a target has been selected, a helpful

indicator will be displayed on top of the navigation arrowhead marker . This blue arrow will always point toward the direction of the target. To reach the target, move in a direction so that the red and blue arrows are aligned.

Click the **Exit** button or the Disable Data Input icon to close the Navigation Panel.

4.12 GPS/Stakeout

Stakeout (Version dependent) is the process of approaching a target location, placing a marker at or near the target and recording the location of the marker. The GPS/Stakeout command provides functions for Point Stakeout, Line Stakeout, Offset Stakeout and Slope Stakeout using real-time GPS position data.

For detailed information use Help/Online Manual and search for "GPS/Stakeout".

4.13 Forbidden Areas

Use the GPS/Forbidden Areas (Version dependent) command to call up the Forbidden Areas dialog:



You may designate selected areas as forbidden areas and set up the program to alert you whenever you enter such areas while navigating, collecting data or staking out in real-time.

To designate an area feature as a forbidden area, click on the Append button and then click on the area feature in the Map View. You may designate one or more area features as forbidden areas.

If you wish to see a message flash near the bottom of the screen when you are inside a forbidden area, then enter the message in the data cell in the Warning Message column and mark the Warning Message check box described below.

Mark the "Display the forbidden area" check box to highlight the forbidden areas while the Forbidden Areas dialog is active.

Warning Message: Mark this check box to have the Warning Message flash near the bottom of the screen whenever you are inside a forbidden area.

Warning Beep: Mark this check box to have warning beeps issued whenever you are inside a forbidden area.

Flash the area: Mark this check box to flash a forbidden area when you are inside that forbidden area.

Section 5: Topic & Feature Management

5.1 Creating New Topics

The Features in your Map are organized into Topics. New Topics can be created for the Map file using the **Topic/New Topic** option:

| Field Name | Field Type | Width |
|-----------------|------------|-------|
| Description | Text | 23 |
| Wetland Class | Text | 23 |
| Est. Value/Acre | Decimal | -1 |
| Name1 | Text | 23 |

Example: The New Topic dialog box for a new Topic called Wetland is displayed above. The Attributes are "Description", "Wetland Class" and "Est. Value/Acre". Description and Wetland Class are Text Attributes. Est. Value/Acre is a decimal (real number) Attribute. The highlighted entry "Name1" is the default Attribute which is displayed when you click on the Append button. You may replace this "Name1" Attribute with your own description by typing over the current text.

Assigning a Topic Name and Topic Type

Type a name for the New Topic in the name field. Select a Topic type by clicking the pull-down arrow at the right side of the Topic Type field. The choices listed are: Shape Only, Point, Line, and Area. Choose the Type that matches the type of Feature which will be assigned to this new Topic.

Please note: The Non-Spatial Data Topic is used for Labels, Shapes, Images and other non-spatial items.

Adding Attributes to the New Topic

Click on the Add button to add an Attribute for the new Topic. A default Attribute entry will be displayed in the dialog box. The default Attribute entry lists "Name1" in the Field Name column, "String" in the

Field Type column, and “23” in the Width column. These entries can be edited and changed as desired.

To edit the Attribute name, click in the Field Name field, enter a new name and then press the keyboard ENTER key.

To select a different Attribute type, use the pull-down arrow to the right of the Field Type box.

The choices for Attribute type are: String, Short Int., Long Int., Float, and Double. Only the width of the String Attribute can be modified. The definitions are as follows:

- | | |
|-----------------|--|
| Text: | A collection of characters. The default field width is 23 characters. The field width may be modified. |
| Integer: | A whole number. The field width is fixed. |
| Decimal: | A real number. The field width is fixed. |

Please note: In order to change the characteristics of an Attribute (name or type) after the Topic has been added, use **Sheet/Setup/Topic Structure** menu.

To add the new Topic, click on the OK button. The new Topic will be appended to the Topic View. The new Topic will be active. In addition, you will see that the Sheet View for the new Topic will be blank. Since Features have not yet been assigned to the new Topic, there are no corresponding records in the Sheet View. The Map View will be unchanged.

Adding Features to a New Topic

Once a new Topic has been added to the Map file, new Features may be assigned to the Topic. Features can be added to the Topic manually using the **Map/Add Feature** functions. Features can also be copied to the new Topic from another Topic or Map File. For information on copying Features between files and Topics, please see Sections 3.10 through 3.12.

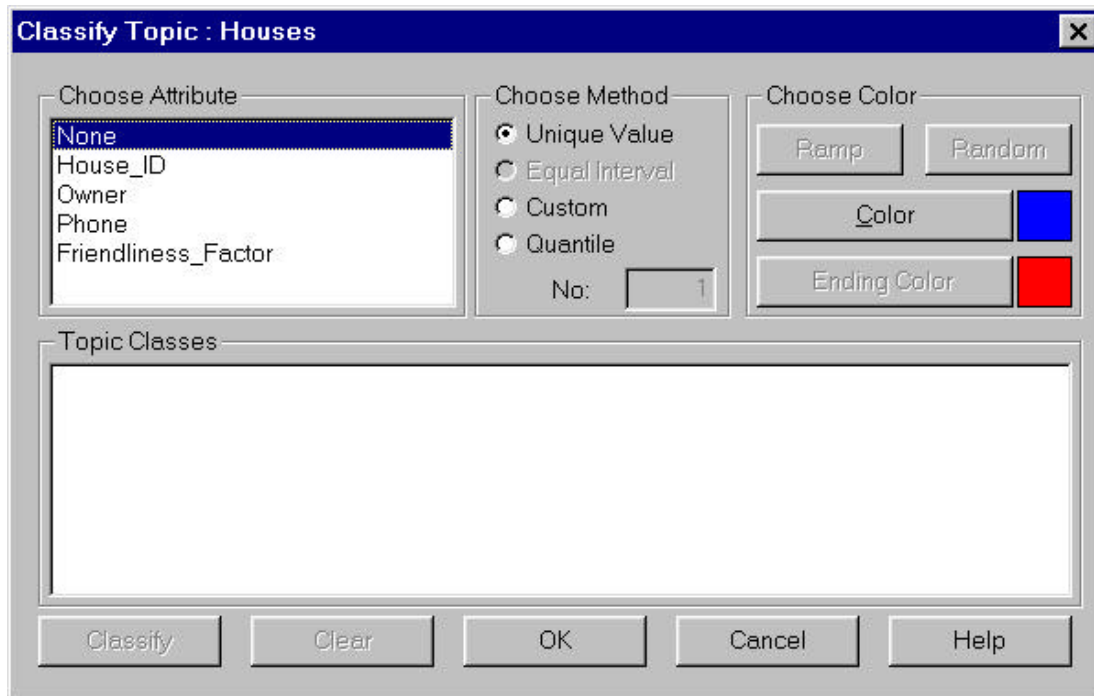
Making Modifications to the Topic After the Topic is added

If you need to make any changes to the Topic Structure after you add the Topic to your Map file, you may use the **Sheet/Setup/Topic Structure** option. The Topic Structure option allows you to change the Topic name, add or delete attributes, and change the attribute type. In the Topic Structure screen, there is also an option for pre-defined Attributes like Feature Area and Feature Length.

- For further information on editing Topics, see Section 5.5 in this manual.

5.2 Classifying Topics

The **Topic/Classify** option is a powerful tool for classifying your Features into sub-groups. Features in a Topic can be classified according to the Values for a particular Attribute. The classify dialog box is as displayed below:



Example: The Classify Topic dialog box for the Houses Topic in the SWCVO.MAP example file is displayed above. The Attributes for the Houses Topic are listed in the Attribute column of the dialog box. The Topic can be classified using any one of the listed Attributes. In this case, the Topic has not been classified.

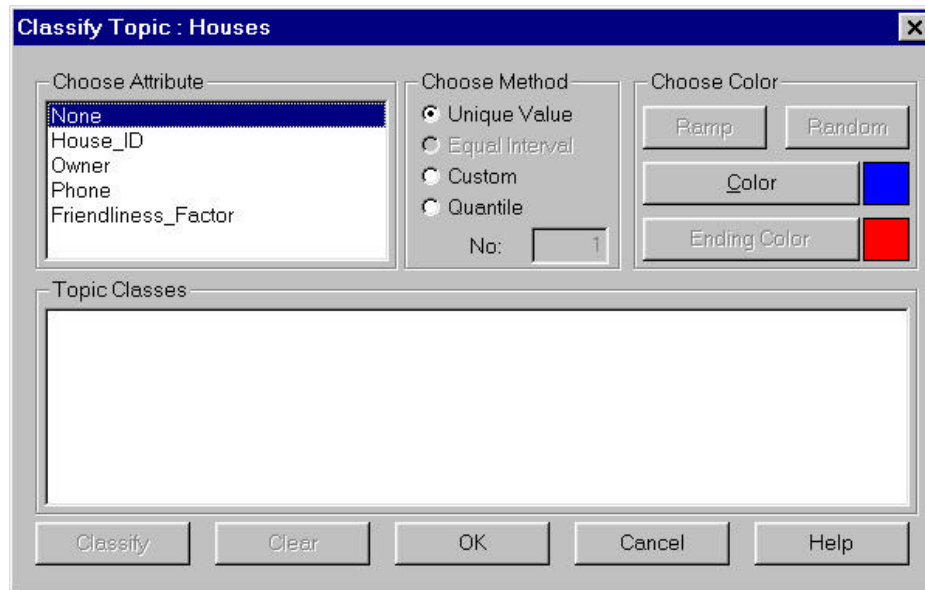
A few examples of classification are: height classification for trees, length classification, species classification, and condition rating classification. Once a Topic is classified, display colors can be assigned to specific classes.

There are four methods for classification: **Quantile**, **Equal Interval**, **Unique Value** and **Custom**. These methods are defined in the sections below. The classification method used depends, in part, upon the Attribute type. Attributes can be strings, integers or real numbers. For “string” Attributes, the Unique Value classification may be preferable. For real number or integer Attributes, any classification scheme may be used. The Equal Interval classification cannot be used with string Attributes.

Please note: Features collected with a CMT GPS data collector have string Attributes. In order to classify these Features using the Equal Interval scheme, the user will need to change the Attribute type to either integer or real number using the **Sheet/Setup/Topic Structure** menu option. For information on changing Attribute types, see Section 5.5.2 in this manual.

5.2.1 Using Topic Classification

First, make the Topic you wish to classify active by clicking on the Topic name. Use **Topic/Classify** to display the Classify Topic dialog box as below:



Example: The Classify Topic dialog box for the Houses Topic of the example SWCVO.MAP file is displayed above. You may choose the attribute, classification method, number of classes and the class colors from this dialog box. A summary of steps is provided below.

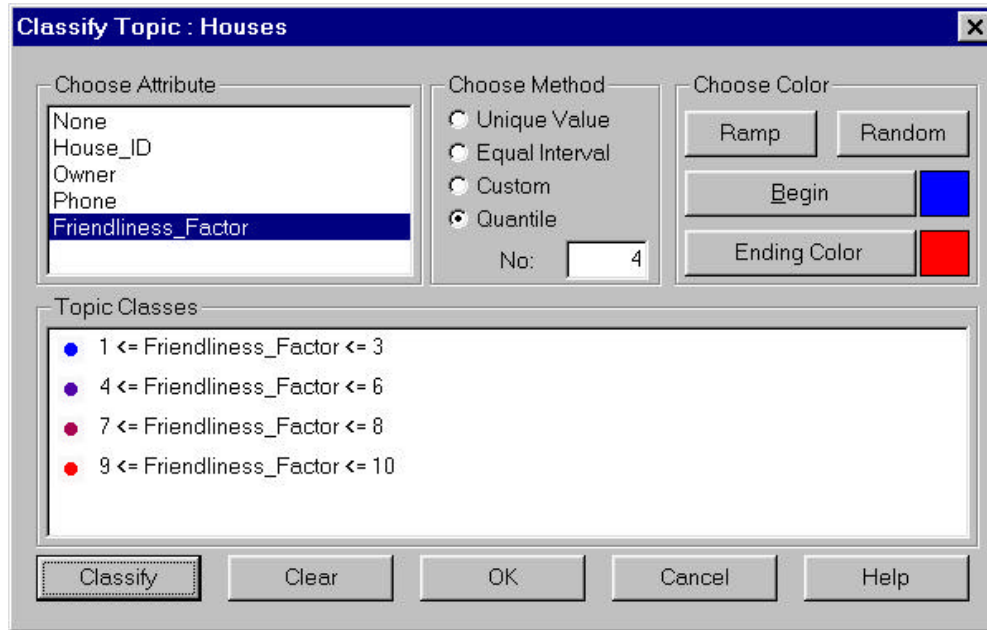
Summary of Classification Steps:

1. Make the Topic to be classified active by clicking on the Topic name in the Topic View.
2. Use the **Topic/Classify** menu option.
3. Select an Attribute from the Attribute list in the Classify dialog box.
4. Select a Classification method.
5. Enter a number of classes in the No: field, unless you are using Unique Value classification.
6. Choose either the Ramp or Random color option. If you choose Ramp, click on the Beginning Color and Ending Color buttons to select the starting and ending colors.
(See **Assigning Colors to Classes** below for more information.)
7. Click on the Classify button to view the results in the Topic Classes column. (If you are using Custom classification, see Section 5.2.5)
8. Click on the OK to exit the dialog box. The classification results will be displayed in the Map View. The classification legend, reflecting the Topic Classes, will be displayed in the Map View.

Please note: The Equal Interval classification cannot be used with string Attributes. The Attribute type must be changed to either integer or real number using the **Sheet/Setup/Topic**

Structure menu option. For information on changing Attribute types, see Section 5.5.2 in this manual.

An example of the Classify Topic dialog box for the Quantile classification is displayed below:



Example: The Attribute used is Friendliness Factor, and the number of classes selected is 4. Features in the first class have Values between 1 and 3. Features in the second class have Values between 4 and 6. Features in the third class have Values between 7 and 8. Features in the fourth class have Values between 9 and 10.

Assigning Colors to Classes

There are three methods for assigning display colors to different classes: Ramp, Random, and "selection by class". For the Ramp and Random, use the buttons in the Classify dialog box.

Ramp Color Option:

Color is distributed through the classes according to the selections under "Begin" color and "Ending Color". The Begin color is used for the first class and the End color is used for the last class. Click on the Ramp button to choose this color option and then choose colors for both the Begin and End. The icons in the Class Column for each class will be displayed in the assigned colors.

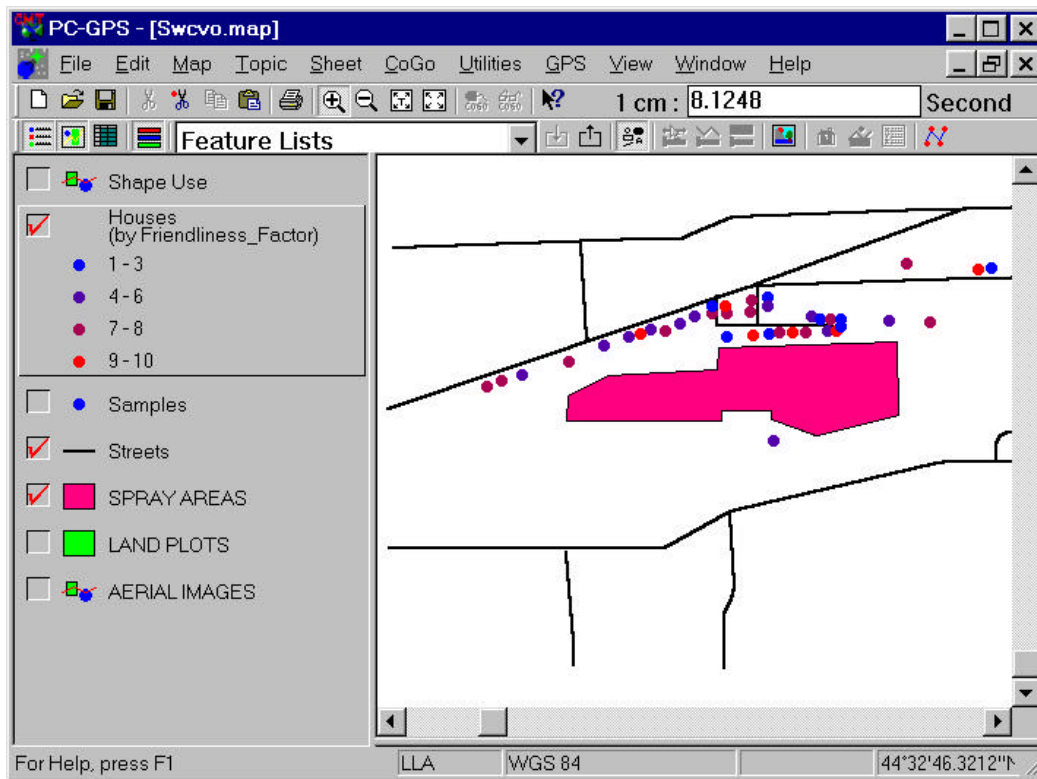
Random Color Option:

The Random button is used to randomly assign classification colors to the different classes. Simply click on the Random button and the colors for each class will be generated randomly. The icons in the Class Column for each class will be displayed in the assigned colors.

Selection by Class for Colors and Symbols:

If you wish to assign a specific display color or display symbol to one or more of your Topic classes, you may double-click on the associated Class icon displayed in either the Classify Topic dialog box or

the Classification Legend. When you double-click on the class icon, the Shape Properties dialog box will be displayed. Select a display color and/or a display symbol and click on the OK button to return to the Classify Topic screen.



Example: The SWCVO.MAP file above shows the results of a House Topic classification for "Friendliness Factor". The classification Legend is displayed in the Topic View. The Topic was classified using the Quantile method with 4 classes.

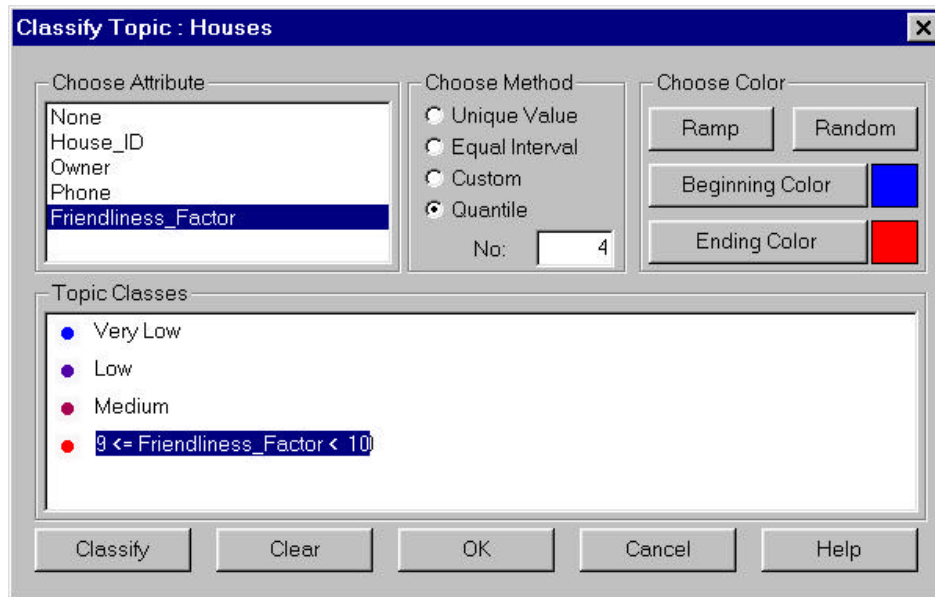
Each Feature in the classified Topic will be displayed on the Map View in the color of its associated class as shown above. In the Topic View, the Classification Legend will be displayed. In the Legend, the class names and colored class icons will be displayed. The Attribute used for classification will be listed in parentheses below the Topic Name. The Classification Legend can be toggled ON and OFF using the **Topic/Show Topic Classes** option.

Selecting Features from the Classification Legend

All of the Features which belong to a specific class can be selected by double-clicking on class description in the Legend. For example, if you wanted to select all of the House Features that were in the 1 - 3 class in the above classification example, all you would need to do is double-click on the 1 - 3 description in the Classification legend.

Editing the "Topic Class" Description

As discussed above, each class is defined and described by a range of Attribute Values. The class description can be modified to be more relevant to your specific application. The modification can be made before or after the classification method is used.



Example: The Quantile classification for the Houses Topic in the example file SWCVO.MAP is displayed above. The first three class descriptions have been edited.

First, make the Topic you wish to work with active. Choose the **Topic/Classify** menu option. In the Classify Topic dialog box, click on the class description you wish to edit. Enter the new class description and press the ENTER key. The new class description will be listed in the Class Column. Click on the OK button to save your new class name.

Please note: Changing the class description does not modify the allocation of Features between classes. The allocation of Features is determined by the range of Attribute Values, the classification scheme and the number of classes.

Removing the Classification from your Map

After you have classified a Topic, you may remove the classification by clicking the Clear button. Make your Topic active, click the **Topic/Classify** option and click on **Clear** in the Classify dialog.

5.2.2 Quantile Classification

The Quantile classification method is used to create a number of classes, each with an equal number of Features. The number of classes is defined by the user. The Quantile classification method is defined by the following equation:

$$\frac{\text{No. of Features in the Topic}}{\text{No. of Classification Classes}} = \text{No. of Features per Class}$$

Features are distributed between the established classes according to the range of numerical Attribute Values. Features are allocated in ascending order - Features with the lowest Values are assigned to the first class.

- For further information, use Help/Online Manual and search on “Quantile Classification”.

5.2.3 Equal Interval Classification

The Equal Interval classification for integers and real numbers categorizes the Features into classes of equal Value intervals. In other words, each class has an equal range of Values. The number of classes is defined by the user. The Equal Interval method is defined by the following:

$$\frac{\text{Maximum Value} - \text{Minimum Value}}{\text{Number of Classes}} = \text{Equal Interval of Values}$$

Please note: The Equal Interval classification cannot be used with string Attributes. The Attribute type must be changed to either integer or real number using the **Sheet/Setup/Topic Structure** menu option.

- For further information, use Help/Online Manual and search on “Equal Interval Classification”.

5.2.4 Unique Value Classification

The Unique Value classification creates an individual class for each unique Attribute Value. This classification method can be used with all Value types: string, integer and real number. The number of classes is determined by the number of unique Attribute Values. The Unique Value method is defined with the following equation:

$$\text{Number of Unique Values} = \text{Number of Classes}$$

Features are assigned to a unique class according to their corresponding Value.

- For further information, use Help/Online Manual and search on “Unique Value Classification”.

5.2.5 Custom Classification Option

The Custom classification option allows you to create user-defined classes. This classification method can be used with all numerical Value types: string, integer and real number. The number of classes and the minimum and maximum values for each class can be defined by the user. When this option is selected a Custom dialog box will be displayed. You may enter a minimum and a maximum for each class in this screen. Once you have defined each custom class, click on the OK button to save your entries and return to the Classify Topic dialog box.

- For further information, use Help/Online Manual and search on “Custom Classification”.

5.3 Labeling Features

PC-GPS provides two labeling options. The first option is the **Text Label** function which is available on the Tool Palette. The second option is the **Topic/Autolabel** function. The **Text Label** option allows you to place “floating” user-defined labels on the Map. The **Topic/Autolabel** option is used to label all of the Features assigned to a particular Topic. Features in a Topic can be labeled by the Topic name only, by Value only or by a Topic name and Value combination.

Auto Labels can be turned off by marking the "**Hide Labels**" checkbox.

Text Labels are assigned to the Shape Use Topic. The display of the labels can be turned OFF by toggling OFF the Shape Use Topic.

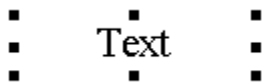
5.3.1 Text Labels

The **Text Label** option is used to create floating labels. The text tool is available on the Tool Palette. Toggle the Tool Palette ON using the Palette icon and select the text tool.

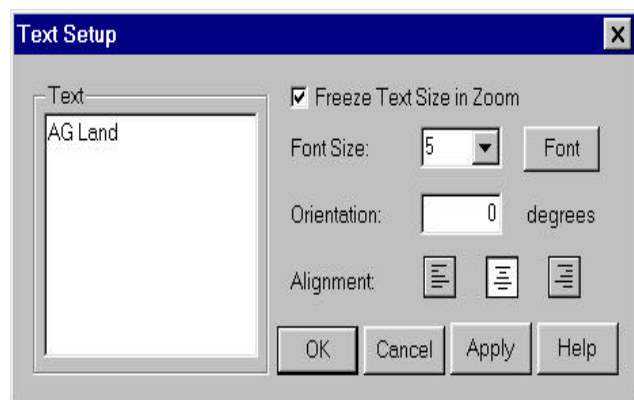
Tool Palette: 

Text Tool: 

After you select the text tool, mouse cursor will be displayed as a crosshair. Use the mouse to draw a text box for your label. Click and hold down the left mouse button while dragging the mouse horizontally. When you release the mouse button, a text box with a default “TEXT” label will be displayed as shown:



At the same time, the Text Setup dialog box will be displayed in the upper left area of your Map file. Enter the text for your label in the Text field.



Text: Enter the text for your label in this field.

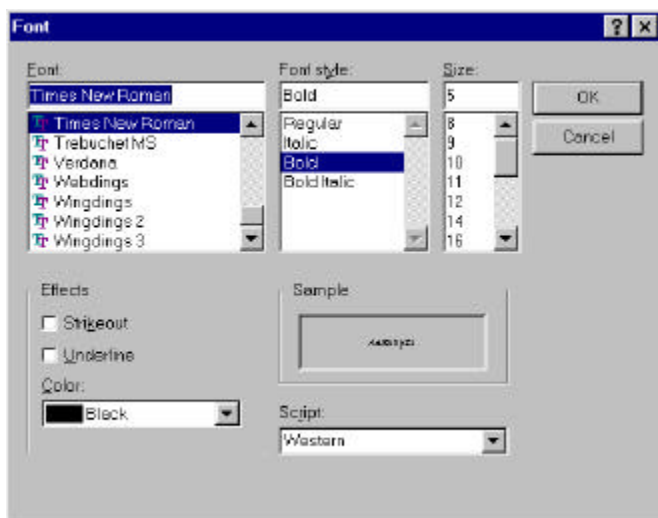
Freeze Text Size in Zoom: Mark this option to keep the font size constant when you zoom in or out.

Font: Click this button if you wish to select the font size, style, and color.

Orientation: If you wish to change the orientation of your label, input a value in this field. The default orientation of 0 is horizontal.

Alignment: Select left, center or right justified.

The default label font is Times Roman. If you wish to change the font, you can do so by clicking on the Font button. The Font dialog box will be displayed as shown:



Font: Select the font type from this column.

Font Style: Select the style from this column.

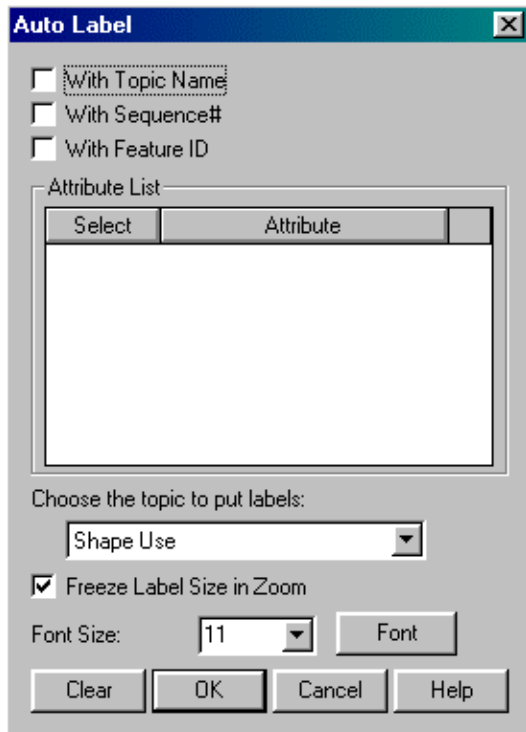
Size: Select a font size from this column.

Color: Select a display color from this column.

After you make your selections for the Font options, click on the OK button. The Text Setup dialog box will again be displayed. Click on the OK button in the Text Setup screen to save your changes and exit the dialog box. The text of the label you've created can be edited at any time by double-clicking on the label itself.

5.3.2 Topic Autotags

The **Topic/Autotag** function can be used to assign specific labels to all the Features within a Topic. First, make the Topic you wish to label active. Choose the **Topic/Autotag** menu option. The Auto Label dialog box will be displayed as follows:



With Topic Name: To label your Features using the Topic name, select the mark box to the left of this option. The label for Features in the Topic Land Plot would be “Land Plot”.

With Sequence #: To label Features using the sheet view order number, select With Unique Number. For example, for the third Tree in a Topic the label would be “3”.

With Feature ID: To label your Features using the ID number, click on the selection box to the left of this option. Each Feature in the Topic will be labeled by Topic Name and order number.

For example, for the third Tree in the Tree Topic, the label would be “TREE3”.

Labeling using an Attribute Value

If you wish to label the Topic by Attribute Value, click on mark box to the left of the Attribute.

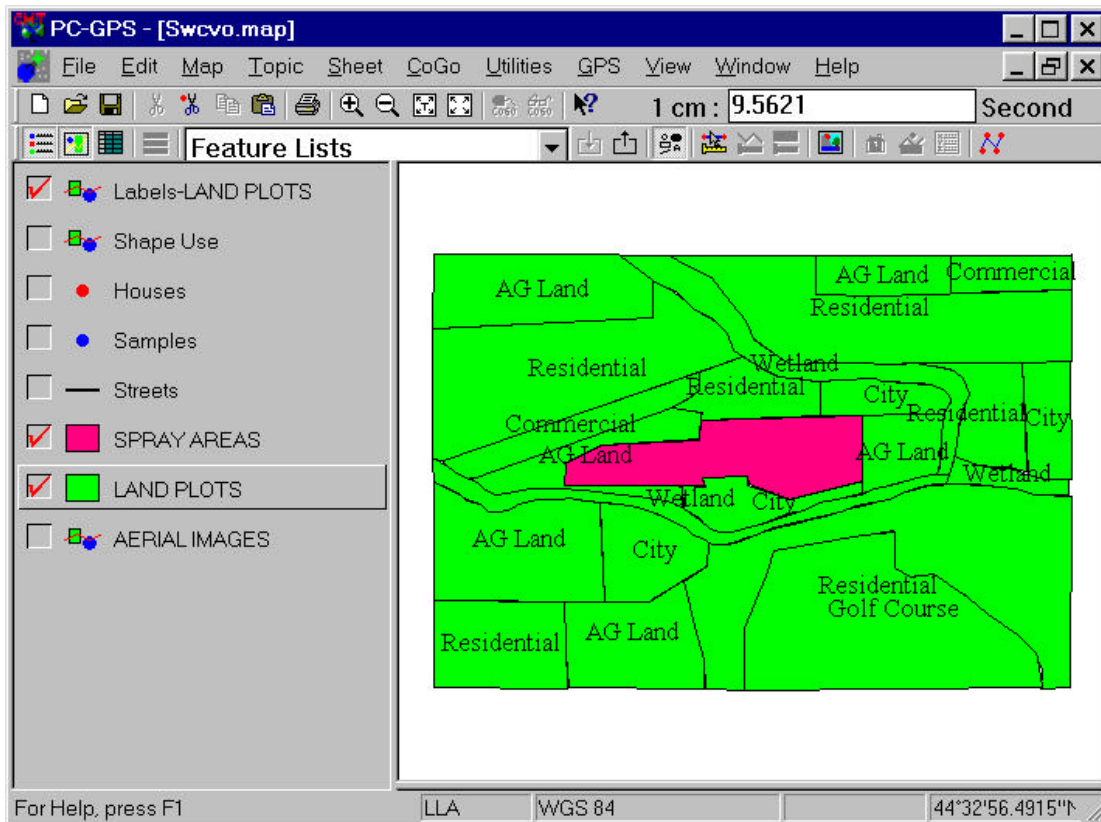
Font: Click on the Font button and then the Font button to select font, font size and color. The font dialog box shown in Section 5.3.1 is shown.

Note: Default is Times Roman, 11 pt, Black.

Note About Freeze Label Size in Zoom: The Freeze Label Size in Zoom option serves to “freeze” your labels in the font size selected. When Freeze Label Size in Zoom is ON, label display size does not change when you use the Zoom-In or Zoom-Out tools. In addition, labels cannot be manually re-sized using the mouse when Freeze Label Size in Zoom is ON. The Freeze Label Size in Zoom property also affects the size of plotted labels. If you are going to plot your Map with either Text Labels or Autolabels, you will need to toggle Freeze Label Size in Zoom OFF to ensure the labels will be printed in the correct Font size.

Display of Autolabels in the Map View

After you use the Autolabel function, labels will be displayed on the Map View as follows:



Example: In the example file SWCVO.MAP, the Land Plot Topic has been labeled by Land Category.

If you would like to change labeling options for a Topic, make the Topic active and then use the **Topic/Autolabel** function to display the Autolabel dialog box. Modify your labeling selections in the Autolabel dialog box and click on OK to save your changes.

Please Note: The labels are normally assigned to the Shape Use topic. You may turn the display of labels ON or OFF by toggling the Shape Use Topic ON or OFF.

5.3.3 Changing the Label Font

The default label font is Times New Roman. If you would like to use a different font, double-click on the label. The Text Setup dialog box will be displayed. Click on the Font button. The Font dialog box will be displayed. Select the desired font options from the Font dialog box.

Please note: If you want to change the font of your Autolabels, you may use the Font button in the Autolabel dialog box.

5.3.4 Moving and Re-sizing Labels

The location and size of individual Topic Labels can be changed. Select the label you wish to modify by clicking on the label name in the Map View. The selected label will be surrounded by a grid box.

To move the label, click inside the grid box, hold the mouse button down and drag the label to a new location.

To re-size the label, click on the upper right corner of the grid box, hold the mouse button down and drag the corner in one direction or another:

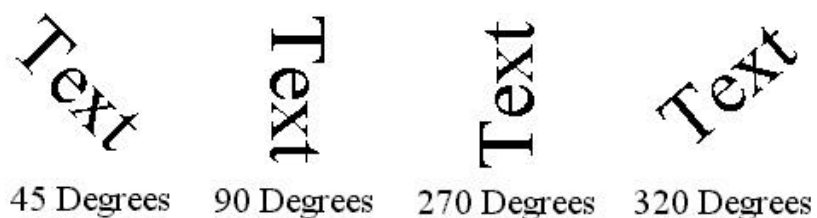
- Dragging the upper right corner directly to the right or left increases or decreases the width of the label, respectively.
- Dragging the upper right corner up or down increases or decreases the height of the label, respectively.
- Dragging the upper right corner to the upper right or the lower left increases or decreases both the height and the width of the label respectively.

Please note: If Freeze Text Size in Zoom is selected in the AutoLabel or Text Setup dialog box, a label cannot be re-sized using the mouse.

5.3.5 Changing the Orientation of Labels

The orientation of individual Topic labels can be changed using the Text Set Up option. Double-click on the label you wish to modify, and input an orientation value. The default orientation of 0 is horizontal. Click on the OK button to save your changes.

Example of Label Orientation:



- For further information, use Help/Online Manual and search on "Labels".

5.4 Searching for Features

The **Map/Search** Function is used to search for Features which match specific Attributes and Values. A search "set" can be created using one "search criterion" or multiple "search criteria". In addition, search sets can be combined or intersected. A search can be applied to the entire map or to a specific user-defined area.

When you use the **Map/Search** function, the following search dialog box will be displayed:

Search

☒ Entire Map ☐ User-Defined Area

Search Condition

| Topic | Attribute | Type | OP | Value |
|------------|---------------|--------|----|-------------|
| LAND PLOTS | Land_Category | String | == | Residential |

Result: Searched #: 100 Selected #: 6

Topic: Select the Topic to search.

Attribute: Select the Attribute for the criterion.

OP: Select an Operator for the criterion.

Value: Select a value for the criterion.

AND/OR: Add a criterion to current search set. (Section 5.4.2)

Delete: Delete highlighted criterion.

Search: Initiate search as New Set.

Add to Set: Add current search set to previous set and initiate search. (5.4.3)

Intersect with Set: Intersect current set with previous set and initiate search.

Example: The Search dialog box for the Topic Land Plots in the example file, SWCVO.MAP, is displayed above. This criterion means "Search for all Features in the Land Plot Topic with Land Category equal to Residential".

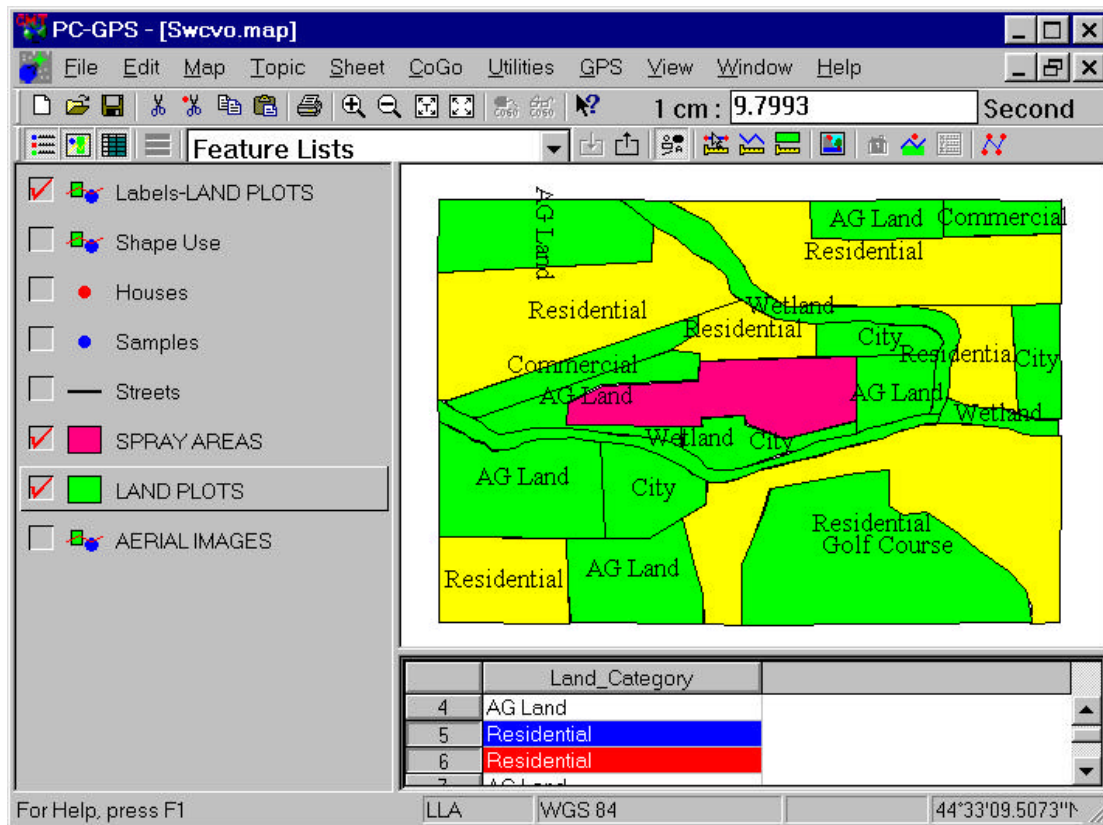
Once the first search criterion has been established, additional criterion can be added to the set or the search can be executed. A "set" is defined by one or more search criteria. To execute the search, click on the Search button. The results of the search will be highlighted in the Map View and the Sheet View.

Steps for Establishing a Search Set using Entire Map Option:

1. Use the **Map/Search** function and select the Entire Map option.
2. Choose the Topic you wish to search.
3. Choose an Attribute from the Attribute column.
4. Choose an operator from the OP column.
5. Select a Value in the Value column.
6. Click on the Search button to initiate the Search.
7. Click on the Exit button to exit the dialog box. The Features matching the search will be highlighted in Map View and the Sheet View.

Please note: String Attributes are interpreted differently than integer Attributes. For example, the House Attribute of Friendliness Factor contains Values ranging from 1 to 10. When

Friendliness Factor is defined as a String type Attribute, the results of a Search for Friendliness Factor Less than 7 would include the Value of 10. However, when Friendliness Factor is defined as an integer type, the results will be correct.



Example: The results of the Search established above for the Land Plot Topic (Land Category = Residential) are displayed in the Map View and the Sheet View. In the Map View and Sheet View, the matching records are highlighted.

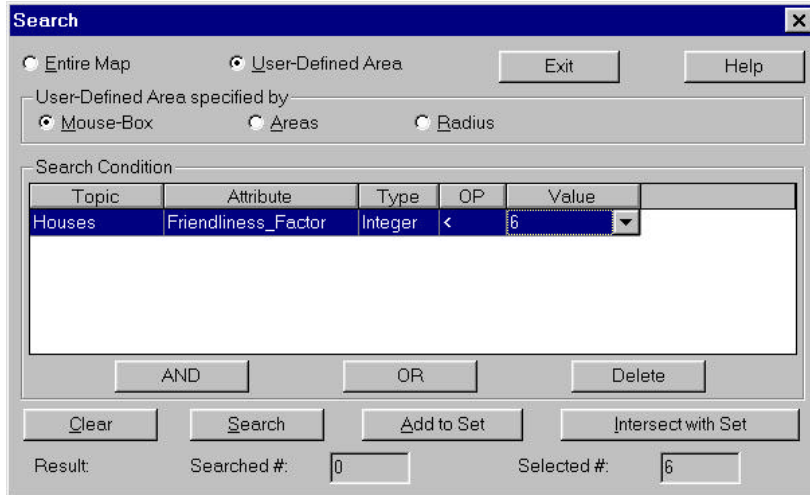
5.4.1 Searching a User-Defined area

The User Defined Area option is used to apply the search operation to a specific geographic area in your Map file. When you use the **Map/Search** function and click on the User Defined Area selection circle, the dialog box on the following page will be displayed.

Summary of Steps for Establishing a Search Set using User Defined Area:

1. Use the **Map/Search** menu option and select the User Defined Area option.
2. Under "User Defined Area specified by", choose By Mouse Box, By Radius or By Areas.
3. Define the area on the Map View for the search. (See next page for descriptions)
4. Choose the Topic you wish to search.
5. Choose an Attribute from the Attribute column.
6. Choose an operator from the OP column.

7. Select a Value in the Value column.
8. Click on the Search button to initiate the Search.
9. Click on the Exit button to exit the dialog box. The Features matching the search will be highlighted in Map View and the Sheet View.



| Topic | Attribute | Type | OP | Value |
|--------|---------------------|---------|----|-------|
| Houses | Friendliness_Factor | Integer | < | 6 |

Topic: Select the Topic to search.

Attribute: Select the Attribute for the criterion.

OP: Select an Operator for the criterion.

Value: Select a value for the criterion.

AND/OR: Add a criterion to current search set. (Section 5.4.2)

Delete: Delete highlighted criterion.

Search: Initiate search as New Set.

Add to Set: Add current search set to previous set and initiate search. (5.4.3)

Intersect with Set: Intersect current set with previous set and initiate search.

Defining the Geographic Area for the Search

By Mouse-Box: Select this option to define your geographic search area using a mouse-drawn “rubberband” box. After you select this option, use the mouse cursor to draw a rubberband box around the geographic area on Map View you wish to search. A cross-hatched grid will be displayed over the area defined by the mouse box.

By Radius: Select this option to search within a specific radius of a Point Feature or coordinate location. After you select this option, click the mouse cursor on the search origin point. (The search origin point may be a Point Feature or a coordinate location.) Next, pull the mouse cursor outwards from the origin. As you pull the mouse cursor, the radius of the circle will be reported near the origin. Release the mouse cursor when the reported radius matches the radius you wish to search. A cross-hatched circle will be displayed over the area defined.

By Areas: Select this option to search selected Area Features. After you mark this option, click on one or more Area Features in the Map View. A cross-hatched grid will be displayed over the selected Areas. This option is useful for locating Points or Lines that fall within the selected Area Features.

5.4.2 Using more than one Criterion in a Search Set

The search examples in the previous sections used single criterion search sets. In some cases, you may wish to use more than one criterion in your search. Additional search criteria may be added to your search set using either the AND or OR buttons in the Search dialog box. When you click on the AND or OR button, a blank criterion row will be inserted or appended to current search set in the Search dialog box. You may complete the criterion entry as described in steps 2 - 5 in Section 5.4.

Please note: When you have two adjacent criterion in the Search dialog both Criterion 1 **AND** Criterion 2 must be met in order for a Feature to be selected. Therefore, **if you wish to search for Features in two separate Topics, you must use the OR operator between the two criterion.**

- For further information, use Help/Online Manual and search on “Multiple Search Criteria”.

Search Using the OR Operator

The OR operator can also be used to build a multiple criteria set.

When the OR operator is used it is not necessary for each search criterion to be met in order for a Feature to be selected. If there are two criteria in the set, either Criterion 1 **OR** Criterion 2 may be met.

When you wish to search for Features in two separate Topics, you will need to use the OR operator between to the two search criterion.

Please note: The OR operator is related to the two search criteria between which it is placed. If there are three search criteria in a set with OR between Criterion 2 and Criterion 3 it will be read as: Match Criterion 1 **AND (either** Criterion 2 **OR** Criterion 3.)

- For further information, use Help/Online Manual and search on “Search Using OR”.

5.4.3 Combining Search Sets

There are two options for combining search sets - **Add to Set** and **Intersect with Set**. A brief definition of each option is presented below.

Add to Set

The Add to Set function is used to add the current set to the set or sets used previously. The combined set will be interpreted as follows:

The Feature must match: Set 1 **OR** Set 2

- For further information, use Help/Online Manual and search on “Add to Set Search”.

Intersect with Set

The Intersect with Set function is used to intersect the current set with the set or sets used previously. The intersected set will be interpreted as follows:

The Feature must match: Set 1 **AND** Set 2

For further information, use Help/Online Manual and search on “Intersect with Set”.

5.5 Editing Your Topics

The structure of Topics in the Map file can be modified using the Sheet Setup options. Several of these editing options are discussed below.

5.5.1 Adding Attributes to a Topic

The **Topic Structure** function of the **Sheet/Setup** option can be used to add Attributes to the Sheet View of the active Topic. The Attribute type and field length can also be modified. First, toggle the Sheet View ON and make the Topic you wish to work with active. Next, use the **Sheet/Setup** menu option. The **Topic Structure** screen will be displayed as shown below:

| Field Name | Field Type | Width |
|---------------------|------------|-------|
| House_ID | Text | 23 |
| Owner | Text | 23 |
| Phone | Text | 23 |
| Friendliness_Factor | Text | 23 |

Example: The Topic Structure for the Land Plots Topic in the example file, SWCVO.MAP, is displayed above. The Attributes of “Est Value/Acre” and Area (Acres) have been added. The Area (Acres) Attribute is a pre-defined Attribute.

Adding Attributes to the Topic

Click on the Append button to add an Attribute for the new Topic. A default Attribute entry will be displayed in the dialog box. The default Attribute entry lists “Name1” in the Field Name column, “String” in the Field Type column, and “23” in the Width column. These entries can be edited and changed as desired. For the Attribute name, you may either your own Attribute description or use a pre-defined Attribute.

To use a pre-defined Attribute, use the pull-down arrow on the right-hand side of the Field Name column. The following list of Attribute options will be displayed:

Length: Choose this option for Line or Area Topics. Unit matches **Map/Coordinate System** selection.

Area (Acres): Choose this option for Area Features. Unit is Acres.

Area (Ha.): Choose this option for Area Features. Unit is Hectares.

Date: This is the date the Feature was collected.

Time: This is the UTC time the Feature was collected.

| | |
|----------------------|--|
| 2D_3D: | The value will be 2D for Features without elevation data. The value will be 3D for Features that have elevation data. |
| C_or_U: | The value will be C for corrected Features and U for uncorrected Features. |
| Sess/Intvl: | This is the session time for Point Features and the Interval for Line/Area Features. |
| PDOP: | This is the PDOP of the Feature. |
| Residual: | This is the Residual of the Feature. |
| SV: | This is the number of satellites tracked for the Feature |
| Quality: | This is the Quality value of the Feature (Dual-Frequency data only) |
| Position_X: | This is the X position of the Feature. This attribute will be called Longitude if the current Map coordinate system is LLA. |
| Position_Y: | This is the Y position of the Feature. This attribute will be called Latitude if the current Map coordinate system is LLA. |
| Elevation_Z: | This is the Z position (elevation) of the Feature. This will be either the Orthometric (MSL) or Ellipsoidal (HAE) elevation, depending upon the Export Elevation setting in the Custom Configuration dialog box (View/Configure, Default Coordinate System). |
| H_2DRMS: | Choose this option for corrected Point Features. This is the horizontal 2D RMS value of all fixes that are averaged together to define the Point's coordinates. |
| V_2DRMS: | Choose this option for corrected Point Features. This is the vertical 2D RMS value of all fixes that are averaged together to define the Point's coordinates. |
| N_2DRMS: | Choose this option for corrected Point Features. This is the northing 2D RMS value of all fixes that are averaged together to define the Point's coordinates. |
| N_2DRMS_sec: | Choose this option for corrected Point Features. This is the northing 2D RMS value of all fixes that are averaged together to define the Point's coordinates. Units of measurement are: seconds. |
| E_2DRMS: | Choose this option for corrected Point Features. This is the easting 2D RMS value of all fixes that are averaged together to define the Point's coordinates. |
| E_2DRMS_sec: | Choose this option for corrected Point Features. This is the easting 2D RMS value of all fixes that are averaged together to define the Point's coordinates. Units of measurement are: seconds. |
| Filename: | This is the name of the current Map file. |
| Feature_ID: | This is the ID of the Feature. |
| User Defined: | See Section 5.5.1.1 for use of this option |

When you use a pre-defined Attribute, the Values will be automatically entered for the Features in the Topic.

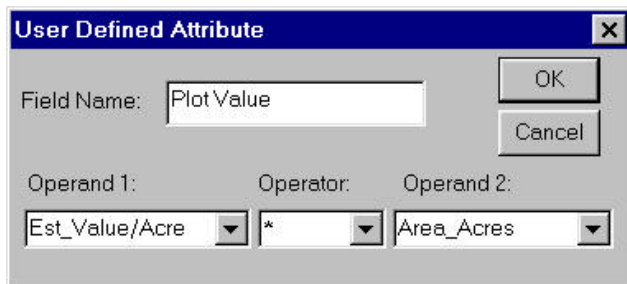
Please note: In PC-GPS 3.8 and PC-Mapper, if you add Features to the Topic after adding a pre-defined attribute, the values will be automatically entered for the new Features.

To delete an Attribute, highlight the Attribute and click on the delete button. The Attribute will be removed from the Topic. In addition, any Values contained in the Sheet View for the associated Attribute will be deleted.

To edit the Attribute name, simply click in the Field Name field and type-in a new name.

5.5.1.1 Adding User-Defined Attributes

The “User Defined” Attribute option allows you to add an Attribute “equation” to your Topic. This User Defined option is accessible from the **Sheet/Setup/Topic Structure** screen. From the Topic Structure screen, click on the Add button to add an Attribute. The default Attribute of “Name1” will be appended to the list of Attributes. Next, use the pull-down arrow to the right of the Field Name column and click on “User Defined”. The following User-Defined dialog will be displayed:



The dialog box is titled "User Defined Attribute". It contains a "Field Name" field with the text "Plot Value". Below this are three fields: "Operand 1:" with a pull-down menu showing "Est_Value/Acre", "Operator:" with a pull-down menu showing "*", and "Operand 2:" with a pull-down menu showing "Area_Acres". There are "OK" and "Cancel" buttons at the top right.

Field Name: Enter a name for your Attribute.

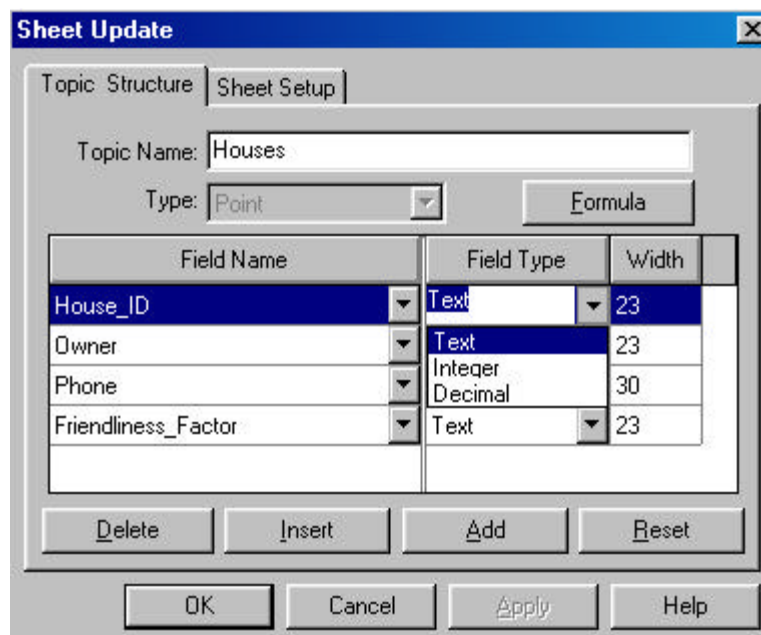
Operand 1 or 2: Enter an integer in the field **or** use the pull-down arrow to select an existing Attribute. (Attribute must be an integer type.)

Operator: Use the pull down arrow to select an operator.

Once you have entered the parameters for your Attribute, click on the OK button. The new User Defined Attribute will be displayed in the Attribute list of the Topic dialog box. From the New Topic dialog box, click on the OK button to save your Attributes and return to the Map View. From the Topic Structure dialog box, click on the Apply button and then the OK button to save the Attributes and return to the Map View.

5.5.2 Changing the Attribute Type

The **Topic Structure** function of the **Sheet/Setup** option can be used to change the Attribute type. Make the Topic you wish to work with active. Use the **Sheet/Setup** menu option. The following dialog box will be displayed:



The dialog box is titled "Sheet Update". It has two tabs: "Topic Structure" and "Sheet Setup". The "Topic Structure" tab is active. It contains a "Topic Name" field with the text "Houses". Below this is a "Type" field with a pull-down menu showing "Point". To the right of the "Type" field is a "Formula" button. Below these fields is a table with three columns: "Field Name", "Field Type", and "Width".

| Field Name | Field Type | Width |
|---------------------|------------|-------|
| House_ID | Text | 23 |
| Owner | Text | 23 |
| Phone | Integer | 30 |
| Friendliness_Factor | Decimal | 23 |

Below the table are four buttons: "Delete", "Insert", "Add", and "Reset". At the bottom of the dialog box are four buttons: "OK", "Cancel", "Apply", and "Help".

Example: The Topic Structure option for the Topic Houses in the example file, SWCVO.MAP, is displayed above.

The Attribute type for each Attribute is listed in the Field Type column. Click on the pull-down arrow to the right of the Field Type column to view the list of options. The choices for Attribute type are: Text, Integer, and Decimal. Only the width of String Attributes can be changed. The Attribute type definitions are as follows:

Text: A collection of characters. The default field width is 23 characters. The field width may be modified.

Integer: A whole number. The field width is fixed.

Decimal: A real number. The field width is fixed.

To select a different Attribute type, simply click on the desired type. Your selection will be highlighted and listed in the Field Type column. Click on the Apply button to save the change and then click on the OK button to exit the dialog box.

- For further information, use Help/Online Manual and search on "Topic Structure".

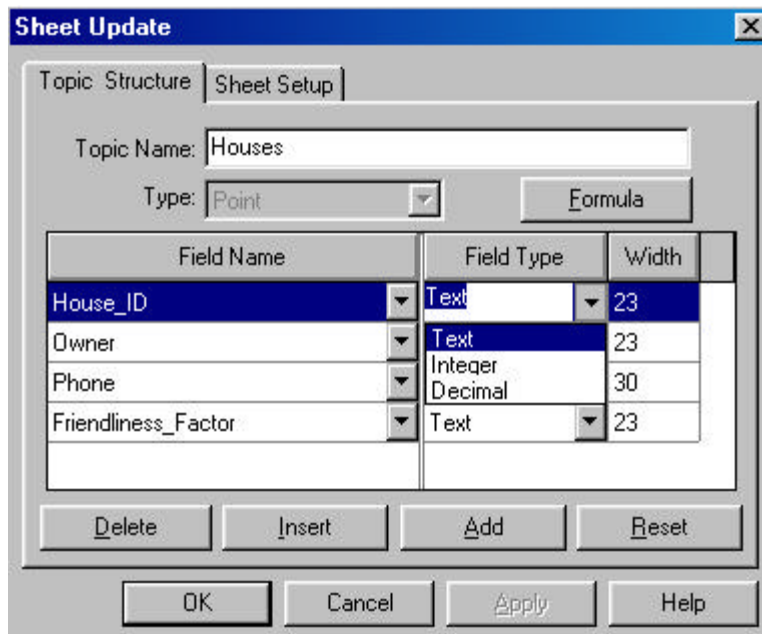
5.5.3 Changing Attribute Widths

The **Topic Structure** function of the **Sheet/Setup** option can be used to change the field width of String Attributes. Make the Topic you wish to work with active. Use the **Sheet/Setup** menu option. Click on the **Topic Structure** tab. The Attribute width for each Attribute is listed in the Width column. Simply highlight the current width and enter a new number. Click on the Apply button to save the changes and then click on the OK button to exit.

Please note: The Attribute width can only be changed for String value Attributes.

5.5.4 Changing the Topic Name

The **Topic Structure** function of the **Sheet/Setup** option can be used to change the Topic name. Make the Topic you wish to work with active. Use the **Sheet/Setup** menu option. Click on the **Topic Structure** Tab. The following Update dialog box is displayed:



Example: The Topic Structure option for the Topic Houses in the example file, SWCVO.MAP, is displayed above. A new Topic name can be entered in the Topic name field.

Highlight the current Topic name in the Topic field and enter a new Topic name. Save the name change by clicking on the Apply button. Finally, click on the **OK** button to exit the dialog box.

5.5.5 Sheet Setup Options

The **Sheet Setup** sub-option allows you to change the order of the Attributes in Sheet View and to assign an alias name to an Attribute. Options under the Sheet Setup tab are covered in the Help files. The **Topic Structure** sub-option allows you to add Attributes, change Attribute type, modify field widths and change the Topic name. **Topic Structure** options are discussed in the above sections under Editing your Topics.

- For further information, use Help/Online Manual and search on "Sheet Setup".

5.5.6 Formulae for user-defined attributes

The Sheet Setup function has been enhanced to allow for greater flexibility in defining formulas in the user-defined attributes.

You may define an attribute in terms of one or more of the other attributes for the same Feature Topic by using a formula. For example, suppose you have "Area (Acres)" and "Yield per Acre" in the Attribute list and added a new Attribute "Total Yield" defined by "Area Acres x Yield per Acre". In the Sheet View, each record in the "Total Yield" column will show the product of the corresponding acreage and yield per acre values.

To access this function, select the topic of interest and then choose Sheet/Setup. The following dialog is displayed:

Sheet Update

Topic: Structure | Sheet Setup

Topic Name: Road

Type: Line Formula

| Field Name | Field Type | Width |
|------------|------------|-------|
| NAME | Text | 29 |
| CFCC | Text | 3 |
| Name1 | Text | 23 |

Delete Insert Add Reset

OK Cancel Apply Help

Click on the **Add** button to add your own Field Name (attribute). The Name1 attribute appears by default. Click on the **Formula** button to create a formula for this attribute. The following dialog is displayed:

User Defined Attribute

Field Name: Name1 OK

Formula: Cancel

Help

(Example: att1*att2+60 where att1 and att2 are attribute names)

Rename the Field Name to a meaningful name. Use the following terminology and operands to define your formula for this user-defined attribute (in terms of the other attributes for the same Topic). There is no limitation on the number of attributes and operands you can use to define the formula.

Information for user-defined formulae:

- The valid arithmetic operators are: +, -, /, * . For the exponent operand, use ^ . For example, "DIAMETER^2" represents the square of the value of the attribute named DIAMETER. To obtain the square-root of the value of the attribute named AREA, enter "AREA^(1/2)".
- Constants are allowed in the expression, such as "DIAMETER+20" where DIAMETER is an existing attribute.
- Use parentheses to specify the order of operations. For example, (LENGTH1+LENGTH2)^2 means add the value of LENGTH1 to the value of LENGTH2 then square the sum.
- Conditional operators may be used such as: >, >=, =, <, <=, < >, **AND**, **OR**, **NOT**.

e. For conditional expressions use '?' to indicate IF and use ':' to indicate ELSE.

For example: $\text{LENGTH} > \text{WIDTH} ? \text{COSTA} + 10 : \text{COSTB} - 20$

This formula can be read as: If LENGTH is greater than WIDTH, then add 10 to the value of the attribute COSTA and show it as the value of the new attribute. Otherwise, show the value of COSTB less 20.

Similarly, you may use the following formula to define an attribute that displays the text "KEEP" or "CULL" based on the value of the attribute named DIAMETER:

$\text{DIAMETER} \geq 6 ? \text{"KEEP"} : \text{"CULL"}$

f. Formulas can be saved for later recalculation or reference.

g. PC-GPS allows flexibility in the field "type" and in "type" conversion between results and operands.

For example: If the attribute containing the formula is defined to be of "TEXT" type, the numeric result computed from another "INTEGER" type attribute will be stored as "TEXT" type.

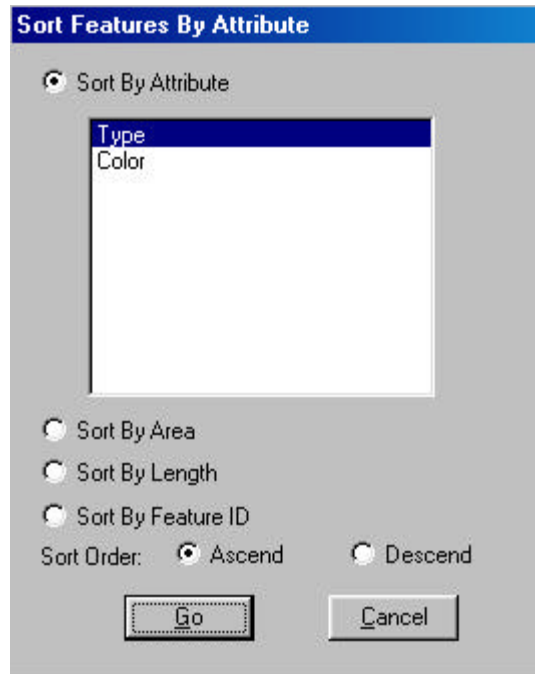
Please Note: If you have an attribute named HEIGHT and you want to multiply it by a constant, please enter "*" explicitly. For example, enter "2*HEIGHT" to double the height value. If you enter "2HEIGHT" the program will try to search for the attribute named "2HEIGHT".

5.5.7 Sorting Features in a Topic

The Sheet/Sort Features function works to allow you to sort your data presented in the Sheet View in ascending or descending order alphabetically or numerically.

There are also options for sorting by some of the key pre-defined attributes such as: Area, Length or Feature ID.

Select the Sheet/Sort Features function to be presented with the following dialog window:



Steps:

1. Select the Topic you want to sort.
2. Select **Sheet/Sort Features**.
3. In the dialog window, choose the desired **Sort By...** option.
4. Choose the **Sort Order** (either Ascending or Descending order).
5. Click on the **Go** button to sort the features by the specified parameters or select **Cancel** to abort the sorting session.

5.6 Printing Topic Data from the Sheet View

The Sheet View contains all of the Feature records for an active Topic. Sheet View data for the active Topic can be printed using the **Sheet/Print Sheet** option. First, make the Topic you wish to work with active by clicking on the Topic name. If the Sheet View is not visible, you will need to toggle it ON using the **View/Sheet** option. Use the **Sheet/Print Sheet** option to print the contents of the Sheet View.

5.7 Editing Data in the Sheet View

Individual Feature records can be easily edited in the Sheet View. First, make the Topic you wish to work with active by clicking on the Topic name in the Topic View. If the Sheet View is not visible, you will need to toggle it ON using the **View/Sheet** option.

To edit the Values for a Feature record, simply click the mouse in the Sheet View cell of the record you wish to modify. Press the **F2** key to use the cursor. Edit the Value for the Feature record and press the ENTER key to save your change.

The **Sheet/Copy Cell** and **Sheet/Paste Cell** options can also be used.

Please note: The Attribute name and type can be edited using the **Sheet/Setup/Topic Structure** option. For further information, see Section 5.5.1 and Section 5.5.2 in this manual.

5.8 Exporting Sheet View Data

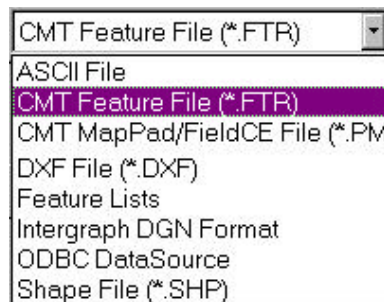
Feature records in the Sheet View can be exported to Microsoft Excel using the **Sheet/Save to CSV file** option. With this option, only the Feature records are exported, the coordinate data is not exported. First, make the Topic you wish to work with active. Then use the **Sheet/Save to CSV file** option. The Save As dialog box will be displayed. The file format is comma-separated-values format (*.CSV). Simply enter a name in the file name field and click on the OK button.

Section 6: Importing, Exporting and Printing

PC-GPS supports a number of data formats. Data can be easily imported into PC-GPS and exported from PC-GPS. The data formats supported include: ESRI Shape file, DXF, ASCII, ODBC (Open DataBase Connectivity), Intergraph DGN (Export only), PC-GPS Job (*.FTR), PC-GPS Feature List (*.FBR) and Field CE GIS file (*.PMP). This flexibility allows you to exchange data from PC-GPS with many other programs.

6.1 Specifying a Data Format

For all PC-GPS importing and exporting processes, the first step is the specification of the data format or “data source” to be used. To specify a data export format, select the format from the Data Source box on the Tool Bar. Click on the down-arrow to the right of the Data Source box to view a list of the data source options. Click on the desired format from the list. The selected format will be highlighted in blue in the Data Source Box. Once the data source is selected, data can be imported from or exported to the specified data source. The **File/Import** or **File/Export** menu options or icons can be used.



Please note: In addition to the above formats, CMT Survey can also import/export data in formats compatible with CMT Field Surveying software: SA2 (.FLD) and SA3 (.PSA).

6.2 Importing Data into PC-GPS

Spatial data can be imported into your Map from several data sources, including ArcView Shape, DXF, ASCII, Excel file, Access database, ODBC (Database), and even other PC-GPS Job files. The import process is very similar for each of these data sources. The general procedure is outlined below.

Summary of Steps for Importing Data into PC-GPS

1. Select the appropriate Data Source from the Data Source box.
2. Use the **File/Import** option or Import icon. The Open dialog box will be displayed.
3. Select a file to be imported from the Open dialog box.
4. The “Define Coordinate System of Imported Source” dialog box will be displayed if you are importing data from ArcView Shape, ASCII, or DXF. Make the appropriate selections for

the Coordinate System, datum and unit of measure of the data you are importing.

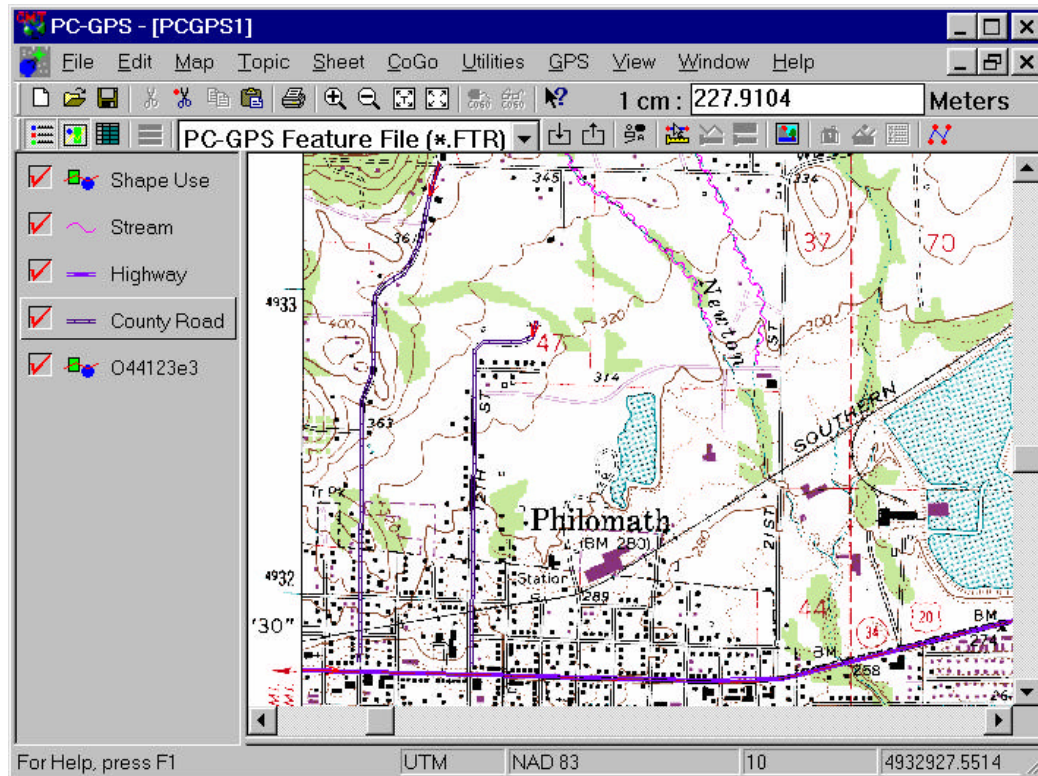
Result: The data imported will be displayed in the Map View, Sheet View, and Topic View.

- For further information on a specific import format, use Help/Help Topics and search on "File/Import" and "Importing". Information on the ASCII file format is provided in the export section below.

6.2.1 Importing Digital Images & Georeferencing

The **Map/Load Photo/Image** option is used to import digital images into the Map. PC-GPS supports Geotiff, MRSID® format images, GeoJPG, and JPEG2000 image formats as georeferenced imagery. DOQ (Digital Orthophoto Quadrangle) and DRG (Digital Raster Graphic) images can also be imported into PC-GPS. The file format for “Geo-Tiff” files needs to be TIF with the associated TFW world file. MRSID® format (*.SID) images also need the accompanying world file with the extension (*.SDW). Similarly, GeoJPEG images (.JPG) require the world files (.JGW) to be present.

After the image is imported, you may overlay GPS Features on the image or use the **Map/Add Feature by Mouse** functions to “heads-up digitize” Points, Lines, and Areas.



Summary of Steps for importing a georeferenced Image File:

1. Open either a new Map file or an existing Map file.
2. Set the Map coordinate system, datum and units to **match** the coordinate system, datum and units of the georeferenced image file. (You may need to contact the image vendor to get this information.)
3. Click on the **Load Photo/Image** tool icon or select the **Map/Load Photo/Image** menu option.

4. An Open dialog box will be displayed. All of the geo-referenced image files in the current directory will be listed with a “+” symbol in front of the file name. If importing a USGS Geotiff, the Quad Name will appear next to the Quad ID to help you select the image.

Example: 44123E33.TIF = Corvallis, OR. Select the image file you wish to use by double-clicking on the file name.

5. The “Coordinate System for Current Image” screen will be shown. Make sure the coordinate system, datum, zone and unit of measure are correct (same as specified in step 2) and then click on the **OK** button.

Result: The image will be imported and displayed in the Map View. A Topic, named with the image file name, will be appended to the Topic View. You may double-click on the image to view and add control points. You may also adjust the transparency of the image.

Please note: In order to achieve the best results with georeferenced images, it is recommended that you maintain the image datum. Converting the image file between datums may result in a small loss of display accuracy (coordinate position).

- For further information, use Help/Online Manual and search on “Images”.
- For information on Georeferencing, search the Help/OnLine Manual for “**Register Photo/Image**”.
- For information on the Map/Add Feature functions, search on “Heads-Up Digitizing”.

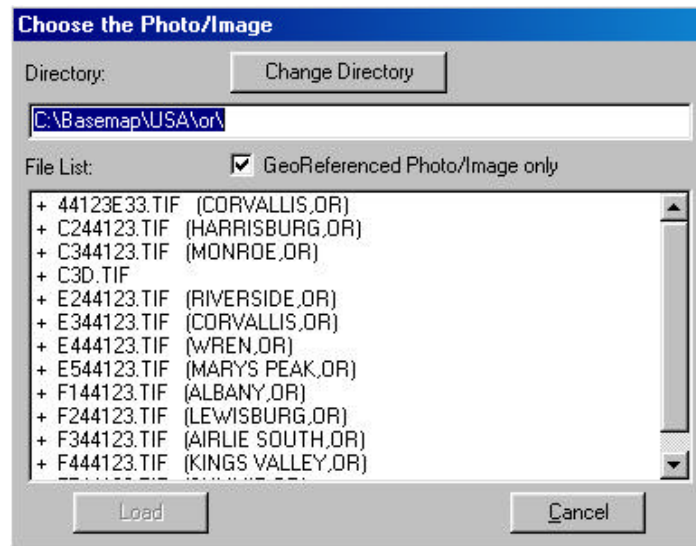
6.2.1 Loading images in the CMT PIM Format

PC-GPS now lets you load georeferenced imagery in the native CMT Windows CE format: PIM format. The PIM format is recommended for use in PC-GPS also, because it is a compressed image format and the image resolution at lower scales is also improved (the image will appear sharper and more resolute when zoomed out).

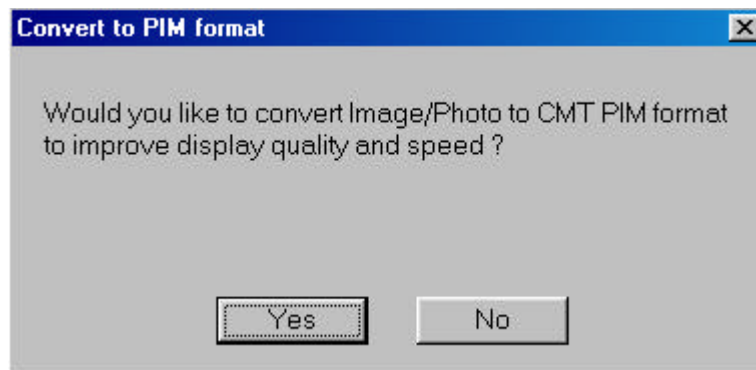
Working with the PIM format will reduce time spent by the software on redrawing the image after a change in scale (by zooming in or zooming out) as well as when panning the image.

The PIM format is also the format used by the CMT Windows CE software products (such as Field CE GIS). Clipping of this image may be done later to reduce the size of the image to be sent to the Windows CE mobile device. See information on Utilities/Geo-Image/Crop and Convert to PIM.

To convert your georeferenced image into the CMT PIM format, select the **Load Registered Photo/Image** button. The following dialog is displayed:



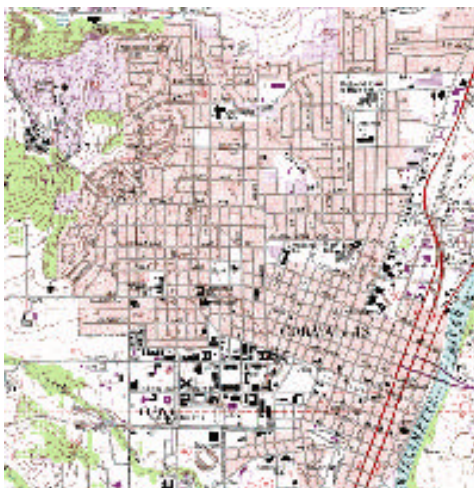
Select the image you want to load and click on the **Load** button. The following dialog is displayed:



Select **YES** if you want to convert your image to the PIM format and have it loaded in your Map. Choose **NO** if you wish to load your image in its native format in your Map without conversion. After choosing **YES** or **NO**, you will be prompted for the coordinate system information of the image to be loaded.

More information about the different options for this dialog prompt can be found under the View/Configure/Geo-Image option.

The following example illustrates the difference in resolution between PIM converted images and non-converted images:



PIM FORMAT

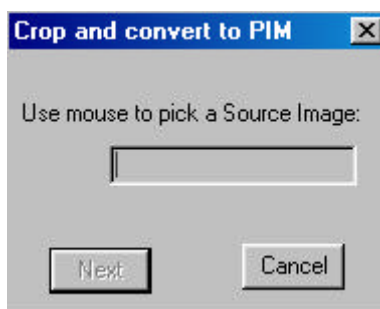


NON PIM FORMAT

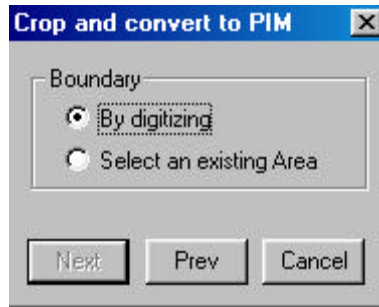
6.2.2 Converting and Cropping Georeferenced Images in PIM Format

Use the **Utilities/Geo-Image/Convert to PIM** function to convert your georeferenced image into the CMT PIM format. The PIM format is advantageous because it is a compressed image format and therefore requires less memory. As a result, the PIM images will take up less memory on your computer and will also provide faster update rates when zooming and panning. Also, this format uses bi-linear sampling to improve image resolution at large scales (when zoomed out).

The **Utilities/Geo-Image/ Crop and convert to PIM** function allows you to crop portions of your georeferenced image to be used in your Map. This function was previously only available to crop images to be sent to the mobile device, but now you can define the image boundary for use in PC-GPS as well. After selecting this function, the following dialog is displayed:



At this point, your mouse will turn into a crosshairs to allow you to select the target image. After selecting the image, the following dialog is displayed:



Select the method for defining the boundary: either by digitizing the area or by selecting an existing area to use as the border. Once the selection is made, proceed to either digitize or click on an existing area. Then, hit **NEXT**.

The final step is to name and save the newly cropped image. Choose a name for the image and choose **Save**. The image is then ready to be loaded into a map using the normal procedure for loading an image in .PIM format. Following is an example of a cropped image with an unusual boundary:



6.3 Exporting Data from PC-GPS

Data can be exported from PC-GPS into several data formats: ArcView Shape, DXF, ASCII, Intergraph DGN, and ODBC (Database), PC-GPS Job, and Feature List. The export process is similar for each of these data sources. The general procedure is outlined below. Information on some specific export formats is provided in later sections.

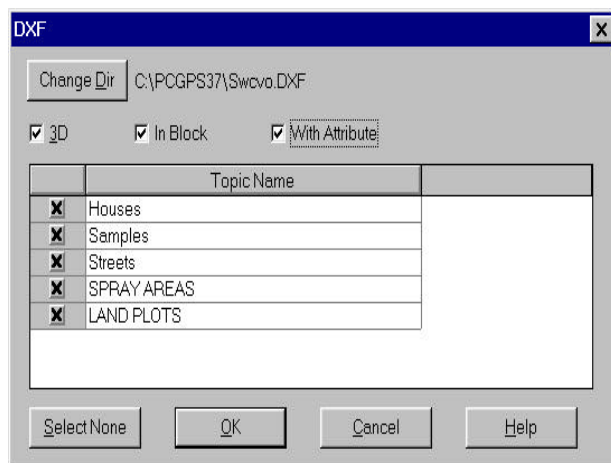
Summary of Steps for Exporting Data from PC-GPS:

1. Open the Map file you wish to export using the **File/Open** option.
2. Select the appropriate Data Source from the Data Source box.
3. Use the **File/Export** option or Export icon.
4. The export dialog box for the selected format will be displayed. The Topics in your Map file will be listed and marked for export. Click on the Mark box to toggle OFF or ON the export of individual Topics, as desired. For the DXF format, you will need to provide a file name.
5. Click on the OK button in the export dialog box. The Topics marked will be exported.
6. The main PC-GPS window will be displayed as the export process is being completed.

Please note: Only spatial data will be exported from PC-GPS. Any labels or objects in the Map file will not be exported to the selected format.

6.3.1 DXF Format Dialog Box

The DXF file format is widely accepted by many GIS and CAD software packages. The compatibility of the DXF format with any specific software package may vary. The steps for the export process are outlined above. The DXF Export dialog box is shown below.



Change Dir: Click this button to select a directory and file name.

3D: Select this option if you want elevation values to be exported.

In-Block: Select this option to export all Features into DXF block format. One layer will be created for each Topic.

With Attributes: Select this option to export Attributes and Values. This option is only active when In-Block is also selected.

Select: Toggle OFF or ON Topics for export.

6.3.2 ArcView Shape files (*.SHP/*.SHX/*.DBF)

Data in your Map file can be exported to the ArcView Shape file format. Shape files can be imported back into your Map, or imported into most ESRI GIS application software packages including ARC/INFO and ArcView. Three files are created for each Topic which is exported from the Map file. The file extensions are: SHP/SHX/DBF. The file name, excluding the extension, is based on the first eight-characters of the Topic name.

Note about Feature ID: By default, PC-GPS will assign sequential Feature IDs to the imported Features. If the Shape file contains a **Feature_ID** field, then PC-GPS will use the data in that field as the Feature ID of the imported Feature.

If you would like the Feature ID's to be remembered for re-importing the data later, then add the built-in Attribute named **Feature_ID** to the Sheet View before exporting to Shape file. Otherwise, PC-GPS will automatically assign sequential Feature IDs based on the name specified for the imported Topic.

- For information, use Help/Online Manual and search on "ArcView Shape file".

6.3.3 ASCII Format

PC-Mapper and PC-GPS will import or export Feature ID, coordinates and attribute/value data in ASCII text format.

Steps for exporting your point feature data to ASCII File Format:

1. Open the Map file you wish to export.
2. Select **ASCII File** from the Data Source Box.
3. Click the **Export Icon** or use the **File/Export** option.
4. From the ASCII Format Setup dialog box, select a topic you wish to export.
5. Create or select an ASCII format you wish to use. To save an ASCII format you just defined, click **Save**.
6. Specify whether the field names should be output as the first line in the ASCII file (see below for examples).
In the **Precision** field, specify the number of decimal digits to export.
7. Mark the data fields you wish to export.
8. Click the **Export Preview** button. If the ASCII data looks okay, click **Export**.
9. Enter or select a file name for storing the exported ASCII data.
10. Click **OK** to exit the ASCII Format Setup dialog.

The ASCII File Export function in PC-Mapper will export the Feature ID, Coordinates and Attributes of all the points in a selected Topic to an ASCII text file. An example is shown below:

ASCII Format Setup

Export Topic: Name: Number of Attributes:

Format file: Name: File Ext: Save New Delete

File Format Setting: ☒ First line contains field name: Header: Footer: Delimiter: End of line marker: Decimal Precision: Northing/Easting: Elevation:

| | Select | Name | Order | Mode | Width | Prefix |
|---|-------------------------------------|-----------------|-------|------|-------|--------|
| 1 | <input checked="" type="checkbox"/> | Feature ID | 1 | VAR | 0 | |
| 2 | <input checked="" type="checkbox"/> | Y (Latitude) | 2 | VAR | 0 | |
| 3 | <input checked="" type="checkbox"/> | X (Longitude) | 3 | VAR | 0 | |
| 4 | <input checked="" type="checkbox"/> | z (Elevation) | 4 | VAR | 0 | |
| 5 | <input checked="" type="checkbox"/> | Attribute/Value | 5 | VAR | 0 | |

Export Preview Export OK Cancel Help

```

HOUSES 1,44.549385,-123.299253,53.169846,AMPHI,Parks & Rec.,555-4678,5,1
HOUSES 2,44.553247,-123.294121,-0.000000,MNTN Shop,City D.P.W.,555-0234,7,2
HOUSES 3,44.553314,-123.295445,0.000000,MNTN Office,City D.P.W.,555-1212,4,3
HOUSES 4,44.555195,-123.294679,0.000000,North Church,Church,555-1213,8,4
HOUSES 5,44.553148,-123.297065,0.000000,3809,Ted Bear,555-1222,3,5
HOUSES 6,44.553371,-123.297036,0.000000,3809,Ted Kennedy,Disconne,2,6
HOUSES 7,44.553005,-123.297183,-0.000000,3790,Ted Roosevelt,555-1333,9,7
HOUSES 8,44.553005,-123.297183,-0.000000,3790,Ted Roosevelt,555-1333,9,7

```

The output of the ASCII export will look like the following:

ID,Y,X,Z,House_ID,Owner,Phone,Friendliness_Factor

Houses 1,44.5494,-123.2993,53.1698,AMPHI,Parks & Rec.,555-4678,5

Houses 2,44.5532,-123.2941,0.0000,MNTN Shop,City D.P.W.,555-0234,7

Houses 3,44.5533,-123.2954,0.0000,MNTN Office,City D.P.W.,555-1212,4

Houses 4,44.5552,-123.2949,0.0000,North Church,Church,555-1213,8

Houses 5,44.5531,-123.2971,0.0000,3809,Ted Bear,555-1222,3

Houses 6,44.5534,-123.2970,0.0000,3809,Ted Kennedy,Disconne,2

Houses 7,44.5530,-123.2972,0.0000,3790,Ted Roosevelt,555-1333,9

Houses 8,44.5530,-123.2975,0.0000,3800,Bob Dylan,555-1444,5

Please refer to the online manual for more information on ASCII file formats and importing ASCII files.

Exporting multiple topics to ASCII:

To export ASCII data for multiple topics, open the desired file and then choose the ASCII format under the Data Source Box and choose File/Export. The ASCII export dialog window is displayed:

ASCII Format Setup

Export Topic
 Name: LIGHT POST
 MAN HOLE COVER
 PARKING LOT
 BLOCK
 TREE
 VEHICLE
 Select None

Format file
 Name: test File Ext: txt
 Save New Delete

☐ Output in chronological order

File Format Setting
☒ First line contains field names ☐ Output value After Attribute
 Header:
 Footer:
 Delimiter: Comma
 End of line marker: <CR><LF>
 Decimal Precision:
 Northing/Easting: 6
 Elevation: 6

Field Format

| | Select | Name | Order | Mode | Width | Prefix |
|---|-------------------------------------|-----------------|-------|------|-------|--------|
| 1 | <input checked="" type="checkbox"/> | Feature ID | 1 | VAR | 0 | |
| 2 | <input checked="" type="checkbox"/> | Y (Latitude) | 2 | VAR | 0 | |
| 3 | <input checked="" type="checkbox"/> | X (Longitude) | 3 | VAR | 0 | |
| 4 | <input checked="" type="checkbox"/> | z (Elevation) | 4 | VAR | 0 | |
| 5 | <input checked="" type="checkbox"/> | Attribute/Value | 5 | VAR | 0 | |

Preview PREV LIGHT POST Preview Next Export OK Cancel Help

```
Feat_ID,Y,X,Z,REPLACE_BULB,#_OF_BULBS
LIGHT PO001,44.563123,-123.263655,172.668993,NO,TWO
LIGHT PO002,44.563162,-123.263455,204.205826,NO,ONE
LIGHT PO003,44.563370,-123.263524,187.857670,NO,TWO
```

All spatial data topics are displayed in the upper left corner of the screen and are available for selection. Use the **Select All** button to quickly select all listed topics. Alternatively, use your mouse to select individual topics for export.

Use the **Export Preview** button to see a preview of what the ASCII file will look like when exported. Only one topic at a time is displayed in the preview area. The first topic in the list will be used for the export preview and the topic name is listed in the gray box above the preview area. Use the **Preview PREV** and the **Preview NEXT** buttons to view the export preview for all other topics.

A new option is available under the File Format Setting frame. You can now export your data with the Attribute and Value contained in each row. This option is listed as: **Output Attribute Names also**. This option is only available when the option **First line contains field names** is not checked. In previous versions, the only option was to export with or without a “header” row that describes each column.

The following examples illustrate the different options.

A) Sample output with option: **“First line contains field names”**:

```
Feat_ID,Y,X,Z,REPLACE_BULB,#_OF_BULBS
LIGHT PO001,4934452.236361,479068.110049,70.939624,NO,TWO
LIGHT PO002,4934457.847605,479090.340236,67.831227,NO,ONE
LIGHT PO003,4934475.261013,479075.833786,72.141497,NO,TWO
```

B) Sample output with option: “**Output Attribute Names Also**”:

LIGHT PO001,4934452.236361,479068.110049,70.939624,REPLACE_BULB,NO,#_OF_BULBS,TWO
LIGHT PO002,4934457.847605,479090.340236,67.831227,REPLACE_BULB,NO,#_OF_BULBS,ONE
LIGHT PO003,4934475.261013,479075.833786,72.141497,REPLACE_BULB,NO,#_OF_BULBS,TWO

C) Sample output with no selected options:

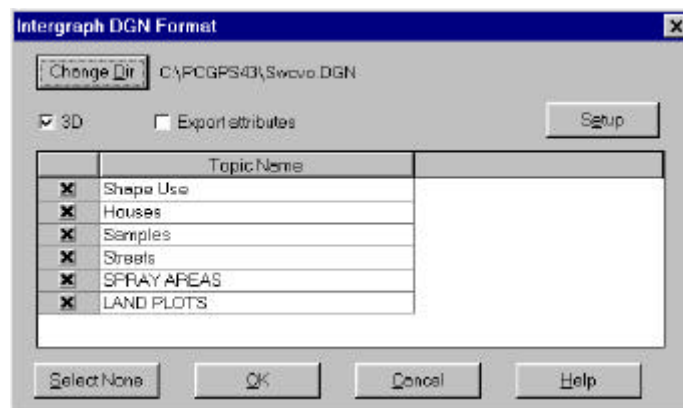
LIGHT PO001,4934452.236361,479068.110049,70.939624,NO,TWO
LIGHT PO002,4934457.847605,479090.340236,67.831227,NO,ONE
LIGHT PO003,4934475.261013,479075.833786,72.141497,NO,TWO

Line and area topics may also be exported. The ASCII output file will contain a record for each node found in the line or area feature.

There is also a general option in the ASCII export dialog for **Output in Chronological Order**. This function is useful if features in a topic have been re-ordered for layering and display purposes using the **Move Feature** option. When the box **Output in Chronological Order** is checked, all features in the specified topic will be listed in the output ASCII file in the correct chronological order (order in which they were collected) regardless of the order of features in the Sheet View. Please note that this option will only affect the output ASCII file and will not change the order of features in your Map View.

6.3.4 Intergraph DGN Format

Data in your Map file can be also be exported to Intergraph DGN Format. When you select Intergraph DGN Format from the Data Source box and use the **File/Export** menu option, the following export dialog box will be displayed:



Each Topic in your Map file will be listed and marked for export. All of the Features in the marked Topics will be saved to the DGN file. The 3D mark box is used to select the export of Feature elevations. You may use the Setup button to specify export parameters for Units, Color Index, and Weight. These parameters should match your Intergraph Microstation setup.

Summary of Steps for Exporting Data to Intergraph DGN Export:

1. Open the Map file you wish to export using the **File/Open** option.
2. Select the Intergraph DGN Format from the Data Source box.

3. Use the **File/Export** option or the Export icon. The Intergraph DGN Format dialog box will be displayed as shown above.
4. Enter a file name in the File Name field, if you wish to use a name other than the default.
5. Click on the mark box to toggle OFF or ON the export of individual Topics, as desired.
6. Click on the Setup button to verify the Setup for Units, Color Index and Weight. To save Setup changes, click on the Setup OK button.
7. Click on the OK button in the Intergraph dialog box to export your data.

Please note: Please make sure the coordinate system of your Map file matches the coordinate system in your Microstation system. Also, it is very important that the Global Origin settings in the DGN Setup exactly match your "GO" setting in your Microstation system.

Notes about the Setup

Global Origin

Set the Global Origin to match your existing GIS data. You can determine the Global Origin of your map in Microstation by entering the "GO?" command. Once you have determined the Global Origin of your existing Microstation map, enter the opposite values into the Global Origin fields.

For example, if the Global Origin of our map is -4000, 5296000, -2147483.648, then you would enter "4000", "-5296000" and "2147483.648" into the X, Y and Z fields, respectively.

Unit

The Unit page specifies the Master Units and the Sub Units of the DGN file, which will be created. This data is taken directly from your PC-GPS file.

The **Sub Units/UOR Ratio** field allows you to specify a relationship between the Sub Units and the Units of Resolution. In most cases, this relationship will be 1:1.

For example, if the **Master Units** of your Map are Meters, then the **Sub Units** would be Millimeters (with a Master Units/Sub Units Ratio of 1:1000). The Units of Resolution would also be Millimeters, so the Sub Units/UOR Ratio would be 1:1.

- For further information, please use Help/Help Topics and search on "Intergraph DGN Format."

6.3.5 Access file format

You may export all the Features from your job file to an .MDB file that may be viewed or edited using the Microsoft® Access program.

To do so, first select "**Access File (*.MDB)**" as the data source then select **File/Export**. Select the topics that you wish to export.

In the **Save As** dialog, enter the name of the file to be created then click the "**Save**" button.

The newly created file will contain the coordinate system used, the Topic names, the Feature ID's and coordinates, as well as the attributes and values.

6.3.6 Excel file format

You may export all the Features from your job file to an .XLS file that may be viewed or edited using the Microsoft® Excel program.

To do so, first select "**Excel File (*.XLS)**" as the data source then select **File/Export**.

Select the topics that you wish to export.

In the **Save As** dialog, enter the name of the file to be created then click the "**Save**" button.

The newly created file will contain the coordinate system used, the Topic names, the Feature ID's and coordinates, as well as the attributes and values.

If you wish, you may make changes to the Excel file then import the modified data back into PC-GPS.

6.3.7 Field CE GIS format

Data in your Map file can also be exported to a format compatible with CMT mobile device software (e.g. Field CE GIS). One file is created with the file extension: .PMP.

- For further information, use Help/Online Manual and search on "mobile device".

6.3.8 Survey file formats

In CMT Survey, field work data in your Map file can be exported to a format compatible with CMT Field Surveying software (SA2) and mobile device surveying software (SA3) When exporting to SA2 format, the file extension will be: .FLD. For files to be used in SA3, the file extension is: .PSA.

6.4 ODBC Open DataBase Connectivity

The PC-GPS ODBC (Open DataBase Connectivity) interface can be used to export Map data to databases which are Microsoft-ODBC compliant such as Microsoft Access, dBASE, and FoxPro. The ODBC interface is beyond the scope of this manual.

- For further information, use Help/Online Manual and search on "ODBC". There are a number of ODBC Help Topics.

6.5 Printing a Feature Report

The **File/Print** option is used to generate a Feature report from your Map file. The Feature report contains a listing of Feature coordinates, Attributes, PDOP values, and GPS Job information.

Please note: For a report of coordinates and attributes only, you may create an ASCII file using the **File/Export** function. Please refer to Sections 6.3 and 6.3.5.

Steps for Printing a Feature report

1. Open the Map file from which you wish to print.
2. Select the **File/Print** option. The Print dialog box will be displayed.
3. Click on the OK button in the Print dialog box.

The report will be sent to your printer.

An example of the Feature report from the SWCVO.MAP file is shown below:

JOB: SWCVO.FTR
Crew: John and Jane Doe
Dept: GPS Mapping Dept.
Desc. Mapping Fields in SW Benton County

Route:

Feature list: SWCVO.FBR

Session for static point: 60

Default logging mode: Dynamic

Nav beep: Yes

Warning range: 5 meters

Warning msg: No

Warning beep: No

Datum: WGS84

Unit: meter

North: True

Time mode: UTC

Local time offset: -8

Coord: LLA

Current Time: 11:00:41

Current Date: 08-21-97

Date Collected: 6-5-96

| Feature name | | | Longitude | MSL | Time | |
|--------------|-----------------|------|-----------------|-----------------|-------|----------|
| Seq | Attribute/Value | Type | Latitude | Fixed/Float | PDOP | Quality |
| 00001 | SPRAY AREAS | A | 044 33 00.5014N | 123 17 57.5282W | 75.72 | 19:39:31 |
| | | | | | 2.4 | |
| | Crop | | :Mustang Fescue | | | |

| | | | | | | |
|----------------|-----------------------|-----------------|-----------------|-------|----------|--|
| Condition | :Fair- some broadleaf | | | | | |
| Last_Inspected | :6/5/96 | | | | | |
| 00002 Continue | A | 044 33 01.5245N | 123 17 57.6468W | 76.06 | 19:41:55 | |
| | | | | 2.8 | | |
| 00003 Continue | A | 044 33 01.3904N | 123 18 03.5130W | 79.27 | 19:41:55 | |

Section 7: Waypoints And Routes

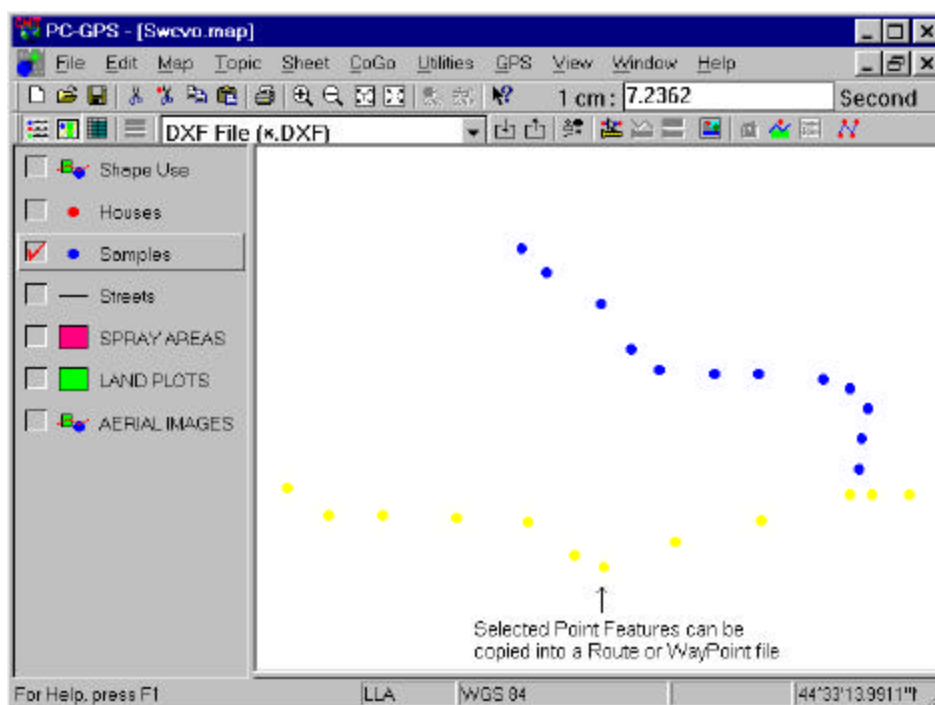
A **WayPoint** is a Feature with “known” or surveyed coordinates. A PC-GPS **Route file** contains a sequence of WayPoints which are joined together to form a navigation guide. The Route file may be downloaded to the GPS data collector and used to navigate to each of the WayPoints in series. The Route file has the file extension of *.PAT.

7.1 Creating Route Files

Route files may be created by: 1) copying Features from other PC-GPS files; or
2) manually entering known coordinate positions using the Add Point function. These two methods are discussed in the sections below.

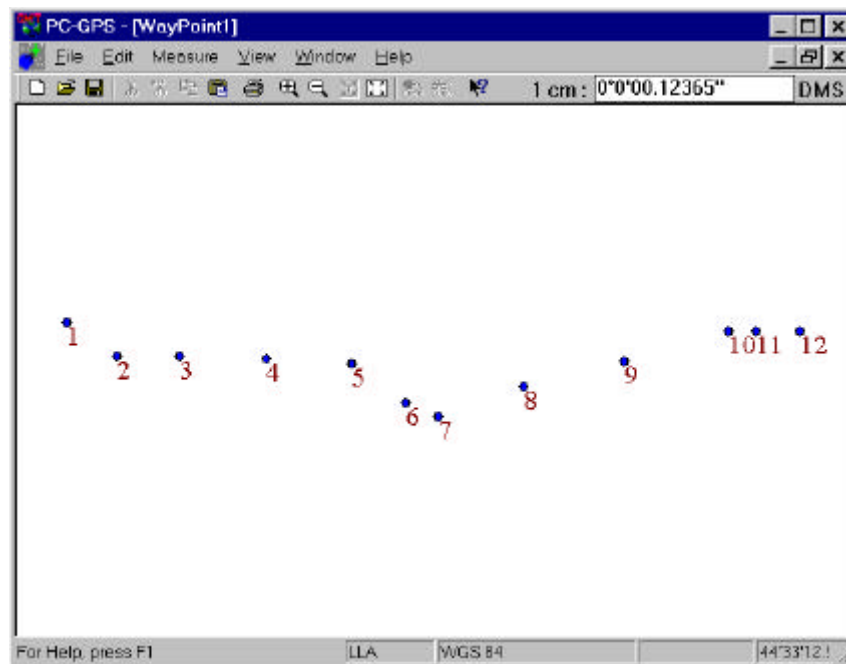
7.1.1 Creating WayPoints and Routes using Map file data

Features from your Map or Feature file can be used to create WayPoints. Point Features, Line Features or Area Features may be copied and pasted to a Route file. An example with the SWCVO.MAP file is provided below.



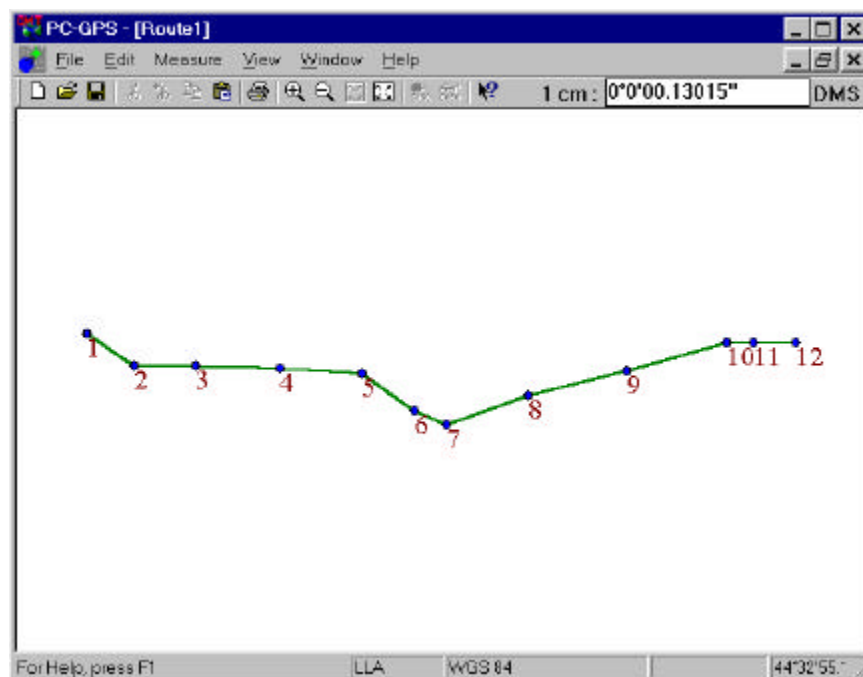
Example: Open the example file SWCVO.MAP. Toggle OFF all of the Topics except the Samples Topic as shown above. Select some Points from the Samples Topic by drawing a “rubberband” box around the Features. The selected Points will be highlighted in the selection color. Use the **Edit/Copy** menu option to copy the selected Points.

Next, use the **File/New** option and select **Route** from the document list. A new Route file will be displayed. From the new file, select **Edit/Paste**. For a WayPoint file, the copied Points will be displayed as follows:



The WayPoints in the above example have been labeled by ID number. Labeling options are available under the **Edit/Labeling** menu option.

In a Route file, the copied Points will be displayed as follows:



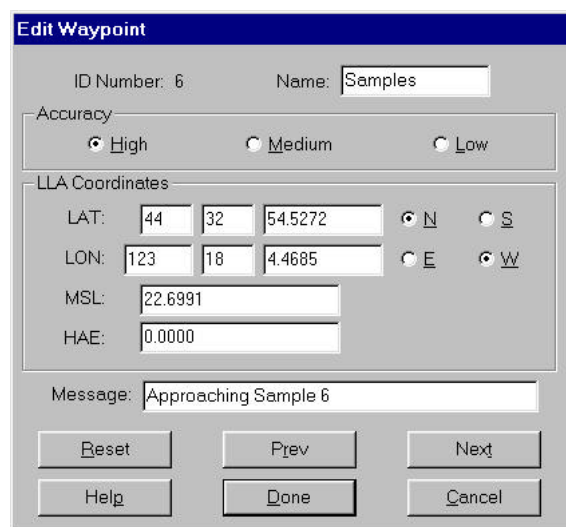
7.1.2 Adding WayPoints using the Add Point Function

The **Edit/Add WayPoint** function in a Route document is used to “manually” add a WayPoint to either a new file or an existing file.

If you are working with an existing Route file, the Add WayPoint function can be used to append or insert a WayPoint. The function will add or insert a WayPoint Before or After a selected WayPoint.

Steps to Add WayPoints to an existing file:

1. Open your Route file.
2. Select a (reference) WayPoint in the file. (Your new WayPoint will be placed before or after the selected Point.)
3. Use the Edit/WayPoint option. Select either the Before or After option.
4. The mouse cursor will be displayed as a crosshair. Click the mouse on the approximate location for the new WayPoint. A blue WayPoint will be added. Use the right mouse cursor button to turn off the Add WayPoint function.
5. Double-click on the new WayPoint to view the Edit WayPoint dialog box.
6. If you wish, you may edit the coordinates of the new WayPoints in this dialog box. Click on the OK button to exit the Edit WayPoint dialog box after you have made your changes.



ID Number: The ID reflects the WayPoint order number. This number cannot be edited.

Name: User-defined WayPoint name.

Accuracy: User-defined accuracy reference.
Example: “H” for surveyed locations, “M” for corrected GPS locations.

Coordinates: LLA, SPC, or UTM coordinates of selected WayPoint. Coordinates can be edited.

Message: “Warning Message” which can be displayed on the GPS unit as the WayPoint is approached during navigation.

The coordinates listed in the Edit WayPoint screen may be edited by simply entering the exact values for the Latitude, Longitude, and Altitude. Once you have edited the coordinates of the WayPoint, click on the **Done** button. Additional WayPoints may be added to your file using the same procedure.

To use the Add WayPoint function in a new Route file, use the **Edit/Add WayPoint/After** option. Your Route file may be saved using the **File/Save** menu option.

7.1.3 Editing WayPoint Coordinates

The coordinates of a WayPoint in your Route file may be edited in the Edit WayPoint dialog box. To access the Edit WayPoint dialog box for a specific WayPoint, double-click on the WayPoint in your Route file. The dialog box shown in Section 7.1.2 will be displayed. Place the mouse cursor in the coordinate field and edit the entry as necessary. Click on the **Done** button to exit the dialog box.

7.1.4 Changing the WayPoint Order

Each WayPoint in a Route file has an ID number, which reflects the order of the individual WayPoint within the file. WayPoint ID numbers can be viewed by using the **Edit/Labeling** menu option. The ID number for a specific WayPoint may also be referenced in the Edit WayPoint box. (Double-click on a WayPoint to view the Edit WayPoint dialog box.)

To change the order of a WayPoint, first select the WayPoint and use the **Edit/Change WayPoint** order function. The sub-options are: Move Point to first, Move Point to last, Move Point forward one, Move Point back one, and Move to... Select the appropriate move option from the list. The selected WayPoint will be moved according to your selection.

Please note: If you select the Move to... option, you may input a specific order number for the selected WayPoint.

7.1.5 Copying, Cutting or Deleting WayPoints

WayPoints may be copied, cut or deleted from your Route file using the functions under the Edit menu. First, select the WayPoint(s) by drawing a “rubberband” box around the WayPoint(s) with the mouse. When a WayPoint is selected, it will be displayed in yellow. Next, select the Editing operation you wish to use (**Copy**, **Cut** or **Delete**). The Edit operation will only affect the selected WayPoint(s).

- For information on selecting data, see Section 3.3.1 in this manual.

7.1.6 Auto Route

Use the Utilities/Auto Route function (Version dependent) to find out the best path to take from one location on the displayed basemap to another. This command is only active while a basemap is displayed. When you select Utilities/Auto Route, the following dialog will be displayed:

To obtain the routing information on the displayed basemap, first use the mouse to click on the Start Point and the End Point in the Select terminal section.

Click on the Color button to change the color of the start point mark (x), the end point mark (bull's eye) as well as the route.

In the Select route mode section, select one of the following options:

Shortest: Find the best path by shortest travel distance.

Quickest: Find the best path by shortest travel time.

Since the higher-class roads have higher speed limits, the shortest path is not necessarily the quickest path. Click on the Speed button to change the displayed speed limits based on your knowledge of the current speed limits.

Mark the Get directions check box and turn on the Sheet View if you wish to see written directions to your destination displayed on the screen. The directions will be placed in a topic named "Directions".

The number of directions provided will depend on the number of road intersections on the route as well as the value you specify in the Minimum interval field. For example, if you enter 2000 ft in the Minimum interval field, then directions will be given at the start and end points, at each road intersection, and once every 2000 ft on each road in the route. A Point Feature will be placed at each station at which directions are provided. Such point features have the following attributes:

Estimated time: Estimated time to travel from the start point

Distance: Distance from the start point

Directions: Directions to follow at the current station

Click on the Symbol button to change the point symbol displayed at each station.

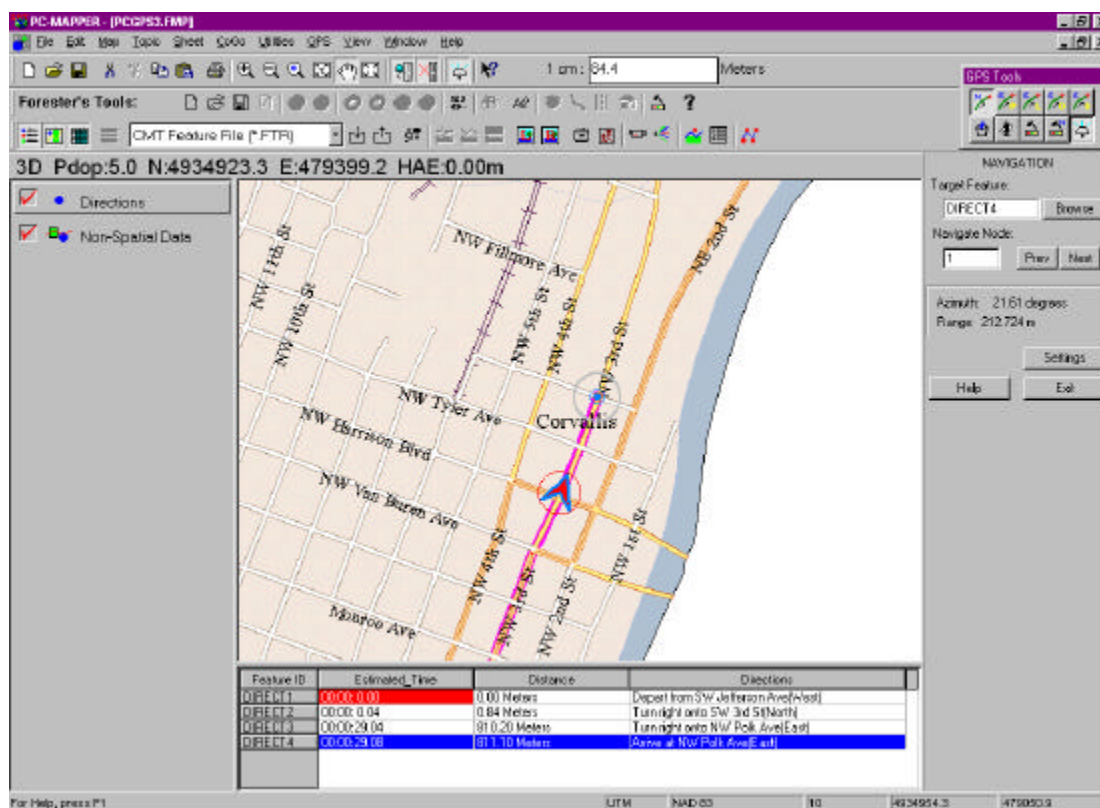
GO: Calculate the best route based on the information entered in this dialog box. The total estimated travel time and the total distance will be displayed in the Estimated Time and Distance fields, respectively. The recommended route will be highlighted in the basemap. If the Get directions check box is marked, then you will also see the route marked by stations at which directions are given. (Remember to turn on the Sheet View to see the actual directions.)

Exit: Exit this screen.

Clear: Clear the start/end point selection, best route and the directions.

Help: Display information about the Auto Route dialog box.

An example of a calculated Auto Route and Navigation along the Route is shown in the following dialog:



7.2 Managing your Routes

The following sections briefly cover a few Route operations. A complete description of the functions is available in the On-Line Manual (Help/On-Line Manual).

7.2.1 Opening your Route file

The **File/Open** menu option from any document (Map, WayPoint, or Route) can be used to open your Route file. The File Open dialog box will be displayed when this option is used. Since PC-GPS supports several file types, it may be necessary to change the file type under the List Files of Type column.

7.2.2 Downloading your Route to the GPS data collector

A PC-GPS Route file can be downloaded to the GPS data collector using the procedure described in Section 4.1.2 in this manual. In the case of a Route file, you will need to select Route as the File Type in the Transfer dialog box.

7.2.3 Copying WayPoints into a Map file

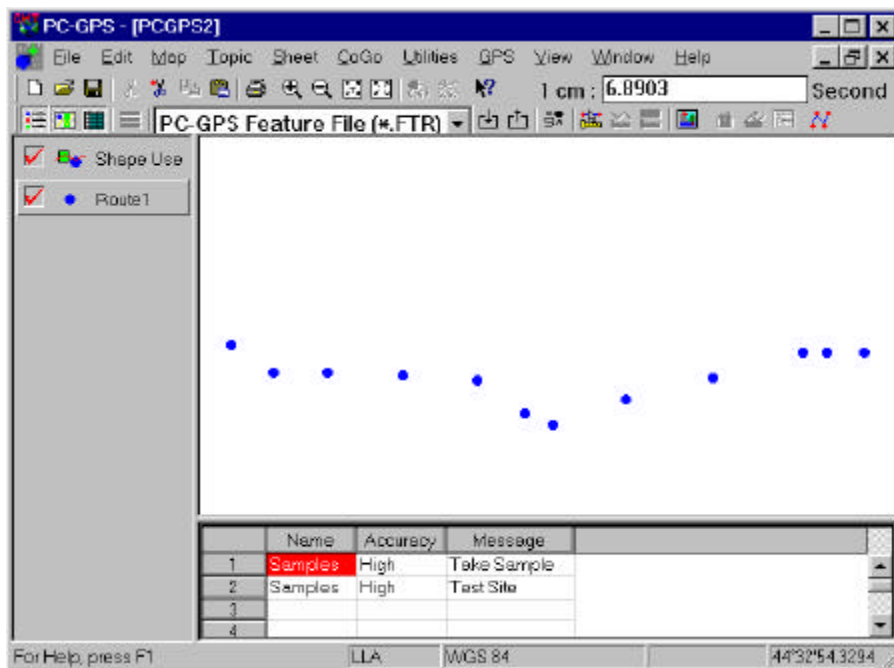
WayPoints in a Route file can be copied into a PC-GPS Map file. When copied into a Map file, WayPoints will be viewed as Point Features.

For example, use the **File/Open** option to open the example file ROUTE.PAT. Draw a “rubberband” box around the entire Route using the mouse. The selected WayPoints will be displayed in yellow. Use the **Edit/Copy** function to copy the WayPoints. Next, use the **File/New** option and select **Map File** from the document list. A new Map file will be displayed. From the menu, select the **Edit/Paste** option to paste the copied WayPoints into the new Map file.

The Topic View, Map View and Sheet View of the Map will be changed as follows:

- 1) A Point Topic will be created for the WayPoints. (The Topic name will be the same as the file name from which the WayPoints were copied.)
- 2) The copied WayPoints will be displayed as blue Points in the Map View.
- 3) The Sheet View for the new Point Topic will have the Attributes of Name, Accuracy, and Message. The Values for the Points will be copied from the original Route file.

An example Map file with WayPoints copied from the ROUTE.PAT file is shown below:



Please note: When a Route is copied into a Map file, the green Route line will not be displayed. The Utilities/Join function may be used to Join the Points together into a Line Feature. (For information on Joining Points, use Help/Help Topics and search on "Join Points".)

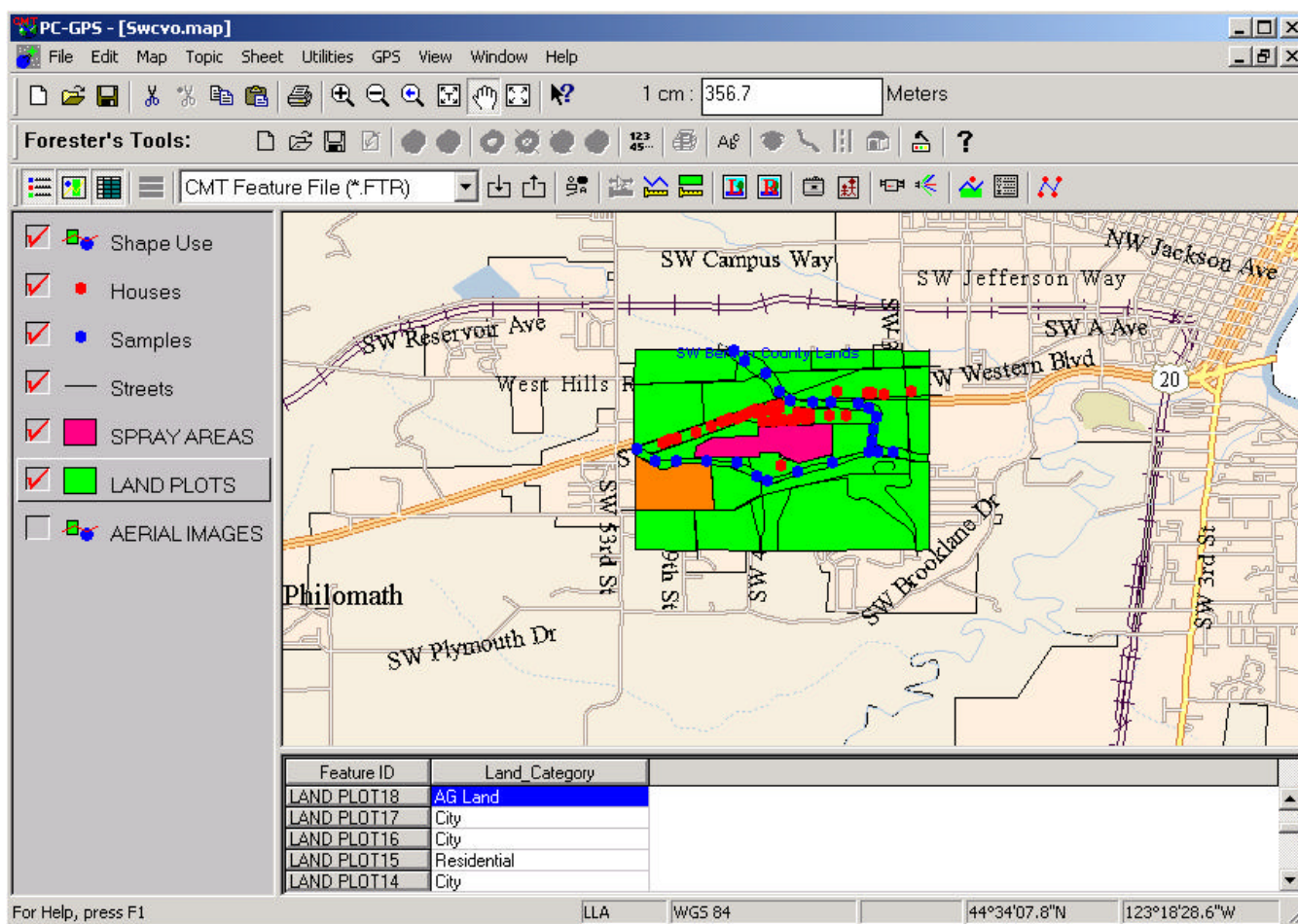
Once you have copied the WayPoints into the Map file, all of the standard functions of the Map file can be used on the new Point Features.

Section 8: BaseMap Functions

This section describes the BaseMap data for PC-GPS. The BaseMaps have been artistically enhanced for easy viewing and beautiful presentation. The BaseMaps can be loaded automatically with your Job or loaded manually.

8.1 BaseMaps with your Job

PC-GPS, PC-Mapper and CMT Survey provide the **View/BaseMap** option. With this option turned on, the associated BaseMap will be automatically displayed as the background when you open a Job. The BaseMap file may be loaded from the hard drive of your PC, from a local network or from a CD. A sample of a BaseMap is displayed for the SWCVO.MAP file:



For information about purchasing BaseMaps for your area, please contact CMT.

When you select Utilities/BaseMap/Load/Change BaseMap, the basemaps in the currently active basemap directory are listed.

Click on the Change Directory button to switch to a different directory. You may load a basemap from the hard drive of your PC, from a local area network, or from a CD. The default path is: C:\Basemap.

Select the State/Province and County of interest. Hold down the Shift key when selecting a block of county names. Hold down the Ctrl key to select multiple non-consecutive county names.

Please note: Multiple BaseMaps will take much longer to load than a single BaseMap. You may be able to conveniently load 2 or 3 BaseMaps at a time.

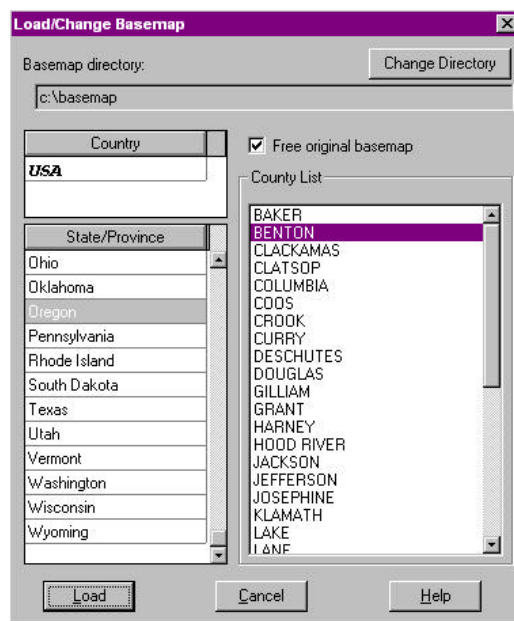
Check the **Free original basemap** option if you want to remove the currently loaded basemaps when the newly selected basemaps are loaded. Simply unchecking View\BaseMap\Display BaseMap only hides the loaded basemaps but does not remove them from the computer memory.

Click on the Change Directory button to switch to a different directory. You may load a basemap from the hard drive of your PC, from a local area network, or from a CD. Specify the path for the "basemap" folder. For example: "c:\basemap", "j:\basemap" or "e:\basemap".

Select the State/Province and County of interest. Hold down the Shift key when selecting a block of county names. Hold down the Ctrl key to select multiple non-consecutive county names.

Please note: Multiple BaseMaps will take much longer to load than a single BaseMap. You may be able to conveniently load 2 or 3 BaseMaps at a time.

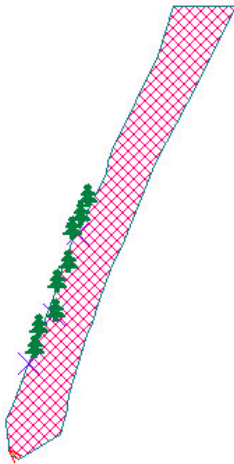
Click the **Load** button to load the specified basemaps.



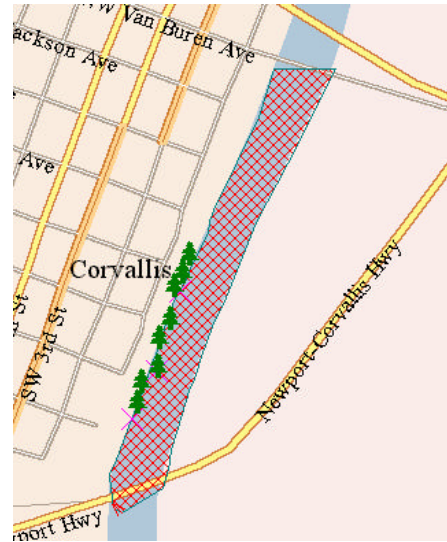
For further information, use Help/Online Manual and search on "View/BaseMap" and "Utilities/Load Change BaseMap".

8.1.1 Display BaseMap

The **View/BaseMap/Display BaseMap** command is used to toggle ON and OFF the display of BaseMaps in the Map View. This function can be accessed through the View/BaseMap/Display BaseMap Menu option.



Example Map – Display BaseMap OFF



Example Map – Display BaseMap ON

The default is for the Display BaseMap switch to be OFF. When Display BaseMap is ON, there will be a selection mark to the left of the Display BaseMap switch in the View/BaseMap menu.

If you have not already done so, please create the **c:\basemap** folder and copy the files supplied on the BASEMAP CDs to this folder.

When the basemap view is active, basemaps associated with the currently active job will be automatically displayed along with the job data. If your job straddles several counties, the basemaps for the counties at the center and at the four corners of your job will all be loaded automatically.

Each basemap contains a large amount of information. The larger the county, the longer the time it takes to load the corresponding basemap.

When the basemap view is turned off, no basemap will be automatically loaded. In addition, some of the commands related to basemaps will become inactive.

If you use the Load/Change BaseMap option in the Utilities menu to load a basemap, the basemap view will be automatically turned on.

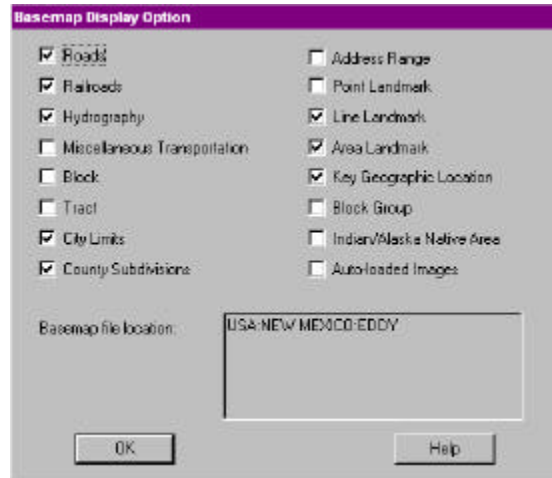
Please note: To retain the **Display Basemap status**, please save the currently active job or map as a map file after turning the basemap view on. The basemap view will be active in subsequent jobs or maps you open. If the basemap view is active but there are no basemaps in the basemap directory, you will be prompted to switch to the directory containing the basemaps.

If you do not wish to have the basemaps automatically loaded each time you open a job or map file, then turn off the basemap view and then save the currently active job or map as a map file. Please note that the Display Basemap status will not be saved

to a .ftr file. Whether a basemap will automatically be opened with a .ftr file depends on the current Display Basemap status.

8.1.2 BaseMap Options

The **View/BaseMap/BaseMap Option** command is available only when the BaseMap display is active. To turn on the BaseMap display, simply click on View\BaseMap\Display BaseMap.



The View\BaseMap\BaseMap Option command provides check boxes for the various categories of items (shapes) available in a basemap. To turn off a particular category of basemap items, simply unmark the associated box. Turning off the items that you don't really need will help speed up the BaseMap loading process. Please note that selecting Block, Block Group and Tract will obscure the City Limits, County Subdivisions and Indian/Alaska Native Area layers.

When **Roads** and **Address Range** are selected, placing your mouse pointer near any road will display the address ranges associated with that road. You can use Utilities\Search Basemap and Utilities\Search Address (see Section 8.2.1) to locate a specific address on the displayed basemap.

The option for **Auto-loaded Images** can be used for automatic loading of USGS topographic quad maps (DRG's) along with your BaseMap data.

In order to use this BaseMap option, you must first load the desired image and then choose the **Utilities/Encode Image for Auto-Loading** option to create a *.img file and place it with your BaseMap data.

For auto-loading of multiple images, you will need to manually create the *.img file. You will also need to put all of the DRG files for the BaseMap county of interest into the correct folder.

Example: Washington County, Oregon

1) Copy all DRG files for Washington County, Oregon to the \basemap\usa\or folder.

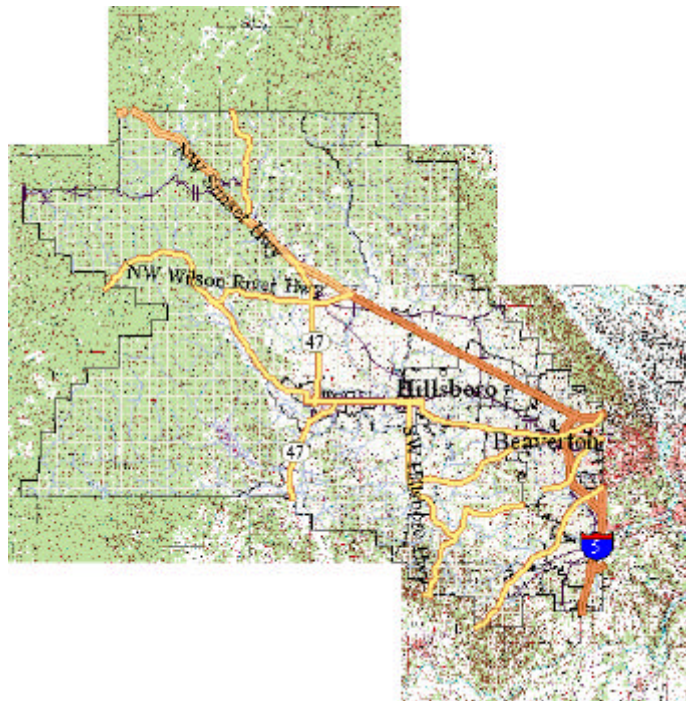
Please note: Since the DRG file size is very large for each county, it is recommended that you put the BaseMap files and the DRG files on your local hard drive. Additionally, it is a good idea to put the DRG files to your local hard drive because a rotation file (*.ROT) may need to be created to properly display the DRG files. A CD-ROM or remote disk may have limitations to create these rotation files.

2) Prepare the *.img file.

- a) Open a blank .map file (or .fmp file for Forester's Toolkit).
- b) Set the Coordinate System, Datum, Zone and Units of the blank map file to match that of the DRG files (typically UTM, NAD 27 CONUS).
- c) Import each of the DRG files for Washington County into that map file.
- d) Make sure the control points are not being displayed in the Map View. If they are on, they will appear as red crosses in each corner of the DRG.
- e) Save the file as a .map file with the following naming convention: **Mapxxyyy.map** where **xx** is the state index and **yyy** is the county index (see below). For Washington County, Oregon the file name would be: map41067.map (or map41067.fmp for file used in the Forester's Toolkit version of PC-GPS).
- f) Rename the file in Windows Explorer to have the extension: *.img. For Washington county, Oregon the file name would be: map41067.img
- g) Make sure that the *.img file that you just created is in the basemap/usa/or folder.

You can use the following method to get the **xx** and **yyy** values if you do not know them:

- a) Copy the file bnd???.bm from the basemap/usa folder to a temporary folder and rename it to: bnd???.map (or bnd???.fmp) where ?? is the state abbreviation.
 - b) Use PC-GPS to open the bnd???.map file. Look in the Sheet View to find the specific county you are working with. Under the column "map_name" you can find the correct index to be used for naming the *.img file.
- 3) With the BaseMap displayed and the **Auto-loaded Images** box checked, the DRG files will be displayed along with the BaseMap. Following is a *sample Map View of Washington County, Oregon*.



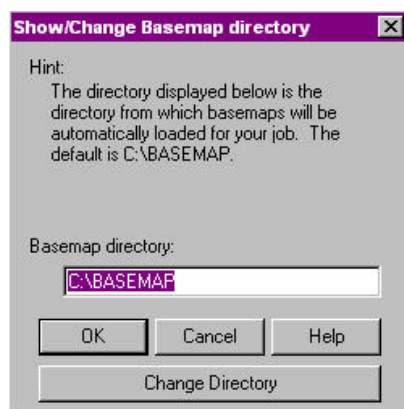
Please note: Any polygons in the BaseMap will be automatically converted to a transparent fill pattern for easy viewing of the DRG data in the background.

8.1.3 BaseMap Directory

The **View BaseMap/BaseMap** Directory command allows access to the directory from which basemaps will be automatically loaded for the currently displayed job.

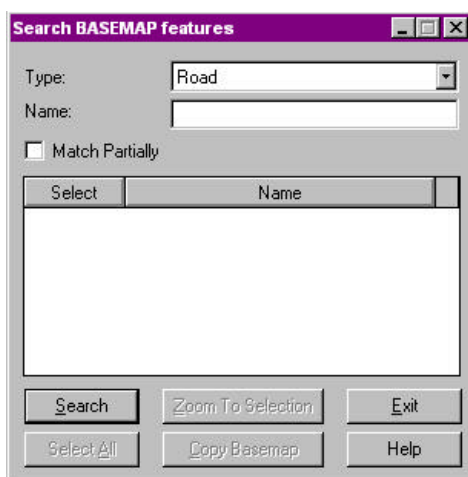
The default directory from which basemaps can be automatically loaded is "c:\basemap". If your basemaps are not in "c:\basemap", use this command to switch to the appropriate directory. Basemaps may be automatically loaded from the hard drive of your PC, from your local area network or from a CD containing the basemaps.

If your basemaps are not stored in c:\basemap folder, then click the **Change Directory** button to switch to the appropriate folder.



8.2 Search BaseMap

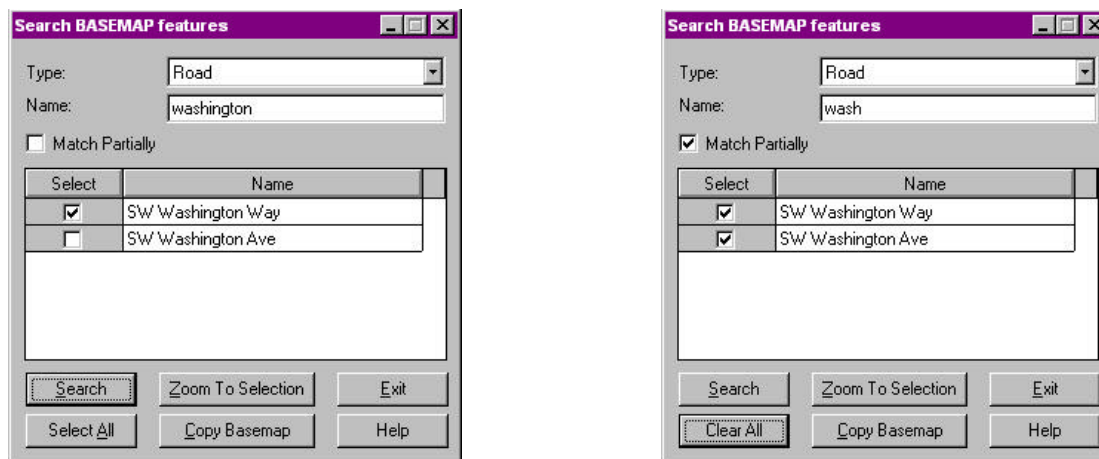
The **Utilities/Search BaseMap** function is used to quickly locate a specified item in the displayed basemap.



For example, to look for a particular street, select Road as the item Type and enter the name of the street. You do not need to enter the road designation such as the "Ave" in "SW Washington Ave". In

other words, to locate "SW Washington Ave" on the map, simply enter "SW Washington" into the Name field. If you just enter "Washington" and click on **Search**, then all roads containing the word "Washington" will be listed.

Check the **Match Partially** button to search for features that partially match the search condition. For example, to search for SW Washington Ave, enter "wash" into the Name field. Click on **Search** and PC-GPS will list all the items that partially match the specified name.



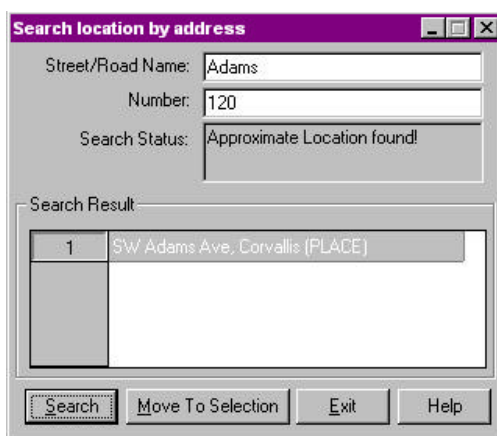
Highlight one or more of the listed items by using a **Click**, **Shift+Click** or **Ctrl+Click**.

Click on the **Select All** button to choose all of the displayed results. Click on the **ZoomToSelection** button to center the map on the selected items.

Please note: The **Select All** button will change to **Clear All** when all items are selected.

8.2.1 Search Address

The **Utilities/Search Address** function can be used to quickly locate an address in the displayed basemap.



For example, to look for 120 Adams Street, enter "Adams" into the **Street/Road Name** field and enter "120" into the **Number** field.

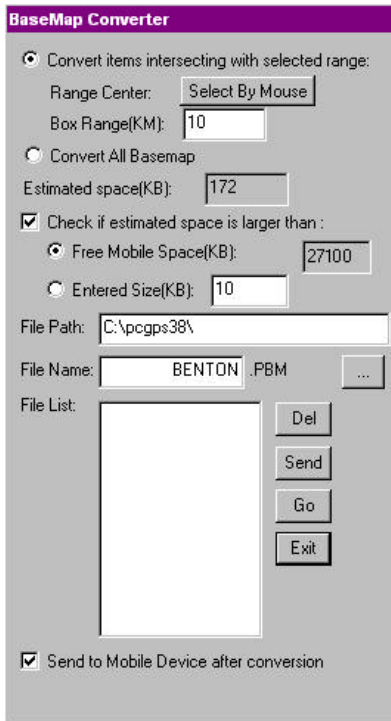
Click on **Search** and PC-GPS will display the search result. If a match is found, the target location is marked with a red flag.

Click on the **Move To Selection** button to center the map on the address found.

Click on the **Exit** button to close this dialog box.

8.3 BaseMap Conversion

You can use the **Utilities/BaseMap Converter** function to convert all or part of a BaseMap into a format (*.pbm) that can be used by the Field CE GIS or SA3 program running on your Windows® CE mobile device. First, load a Basemap into the Map View, then use the following dialog to convert:



If you wish to convert the entire basemap, mark the **Convert all Basemap** check box. Otherwise, use the mouse to indicate the center of a range and enter a value for its extent.

If you are sending the converted BaseMap to the mobile device, make sure there is sufficient space in the mobile device to accept it.

In the **File Path** field, select the PC folder into which to store the converted BaseMap.

In the **File Name** field, specify the name for the converted BaseMap.

If you wish to send the converted BaseMap to the mobile device, mark the **Send to mobile device after conversion** check box before clicking **Go**. Otherwise, do not mark this check box.

If you do not send the converted BaseMaps at the time they are created, later you may select one or more existing .pbm files and click the **Send** button to send them to the mobile device.

8.3.1 Copy BaseMap Shape

The **Utilities/Copy BaseMap Shape** function can be used to turn selected BaseMap features into features in your active job map.

Select one or more items in the displayed BaseMap and then select **Utilities/Copy BaseMap Shape**. The appropriate topics will be automatically created for these newly copied features.

Once the BaseMap Shape is converted into a feature, you may access the coordinate information or shape properties for the newly created feature as you would for any other feature in your active job map.

8.4 Digital Elevation Model (DEM) Data for your Basemaps

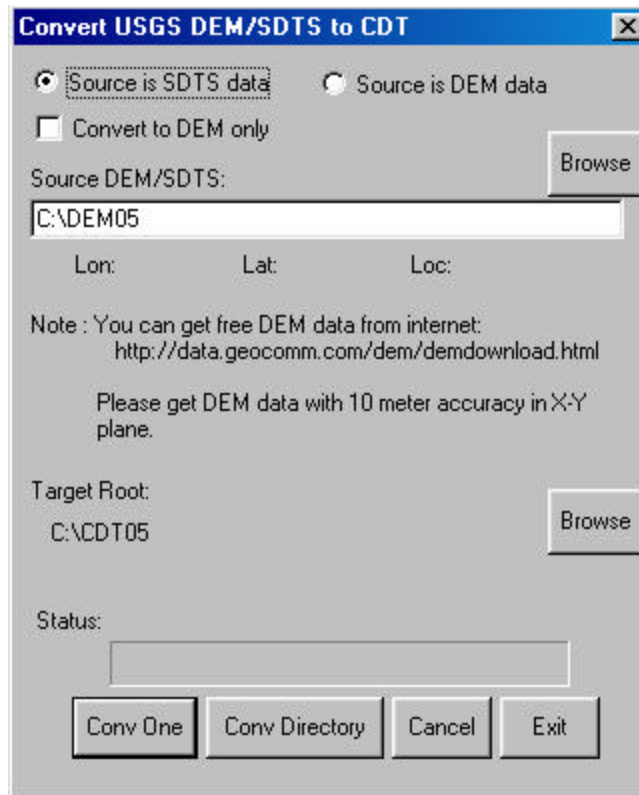
8.4.1 Convert DEM to CDT

You may obtain 10-meter accuracy (in x-y plane) DEM data free from the Internet in SDTS format or DEM format (just search for DEM data in your state).

This data must be converted to CMT CDT format for use in PC-GPS. The first step is to convert to the intermediary CDT format. The ultimate goal of this process is to convert the CDT format (in another step) to the CMT CDM format. These files are to be used by PC-GPS for elevation profiles and to show three-dimensional shaded relief on your maps. They are also used for generation of contour lines in your maps.

Upon installation, PC-GPS will create a folder called 'DEM05' on your local drive. We recommend using this folder to store any downloaded DEM data. PC-GPS can convert all DEM files found in this folder and correctly name and place them in the correct CDT folder or subdirectory.

In the **Utilities** menu, select **DEM/CDM/Profile/Contour** and then select **Convert DEM/SDTS to CDT**. The following dialog is displayed:



This function will convert the DEM and SDTS ASCII files to the CMT .cdt format. The DEM and SDTS ASCII files must be for the UTM coordinate system. The resultant CMT .cdt binary files are still in the UTM coordinate system. They will be automatically placed into the proper pre-defined folders. For example, the DEM file for the first quad (A1) of N44 W123 would be converted to: CDT05\W123\N44\A1.CDT.

Steps:

1. Upon installation, PC-GPS will create a folder called 'CDT05' on your local drive that will act as the target folder. With this naming convention, PC-GPS will automatically create subfolders in the target directory, which help to break up the DEM data into their respective locations.
2. Select the data source. Choose **DEM data** if the files you are working with have the extension *.DEM. Select the **SDTS data** option if you have DEM data in the SDTS format. The DEM data should be of 10-meter accuracy in the x-y plane and should be in the UTM coordinate system. PC-GPS will notify you if your DEM data is not in the UTM coordinate system.
3. Click on the **Browse** button to locate the sources of the DEM/SDTS data files. We recommend using a source directory named: 'dem05' for your original unconverted DEM files. Alternatively, you may skip browsing for individual files if all of the DEM files you wish to convert are in the same directory. If this is the case, you can click on the **Conv Directory** button to begin conversion of all found DEM files in the source directory to the CDT format. Make sure you have specified the 'cdt05' folder as the target directory.
4. To convert one file, locate the file you want to convert and click **Open**. The filename will appear in the "Source DEM/SDTS" line. Click on the **Conv One** button to convert this single file DEM file to the source directory in the CDT format

5. After all files have been converted to the CDT format, click on the **Exit** button to end the conversion session.

8.4.2 Convert CDT to CDM

In the Utilities menu, select DEM/CDM/Profile/Contour, then select **Convert CDT to CDM**. This will convert the CMT .cdt files to the CMT .cdm files.

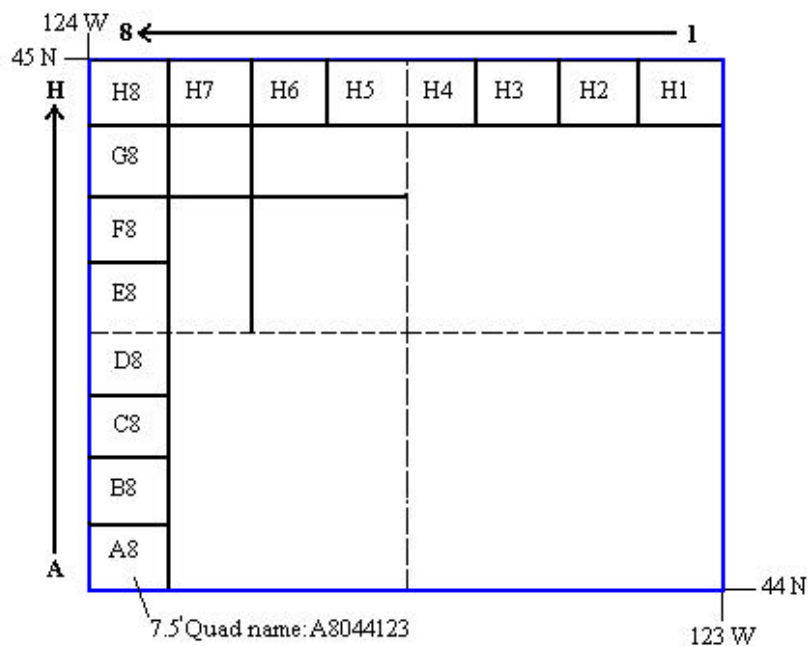
The resultant .cdm files contain data in the LLA coordinate system. Each .cdm file corresponds to a "2.5 minute by 2.5 minute" range. The .cdm files are automatically placed into pre-defined folders.

For example, the .cdm files for latitude N44-N435 and Longitude W123-W124 are placed in the folder: cdm05\W123\N44. With the required .cdm files placed in the appropriate folders, you will be able to see the DEM shading on the displayed basemap when you select **View/Basemap/Basemap Options** then mark the checkbox for **Contour Regions**.

Steps:

1. Upon installation, a folder called 'CDM05' will be created on your local drive as the target folder. A sample .CDM file is included in this folder for use with the CMT tutorial files: cmttut.ftr or swcvo.fmp. With this naming convention, PC-GPS will automatically create subfolders in the target directory, which help to break up the DEM data into their respective locations.
2. Specify the range from the lower-left corner to the upper-right corner in LAT-LON.

Mark the **Only One CDM file** box and specify the quad designation in the **Loc** field if you just need the one specified CDM file. Each CDM file covers one 7.5 minutes by 7.5 minutes quad, represented by A1,A2,...,H8. A sample grid is displayed that shows the naming convention:



For example, if you select the latitude range (44,45) and longitude range (-124,-123), and select the quad (Loc) E3, then you would get C:\CDM05\W123\N44\B44123E3.CDM. The program would get all the CDT files for this quad. Because of the coordinate conversion from UTM to LLA, more than one quad of CDT files may need to be converted to obtain B44123E3.CDM. (The main .cdt file is \CDT05\W123\N44\E3.CDT, while some of the neighboring files may also be used for the peripheral areas.)

3. Specify the CDT Root directory (default: CDT05) and CDM root directory (default: CDM05).
4. Click on the **Convert** button to begin conversion of all the .cdt files that are needed for the specified range.
5. After the conversion, click on the **Exit** button to end the conversion session.

Naming Convention for the CDM Files

The 64 *.cdm files for the 1x1 degree range "latitude N44-N45 and Longitude W123-W124" are named as follows:

B44123A1.CDM
 B44123A2.CDM
 ...
 B44123A8.CDM

 B44123B1.CDM
 B44123B2.CDM
 ...
 B44123B8.CDM

...
...
...
B44123H1.CDM
...
B44123H8.CDM

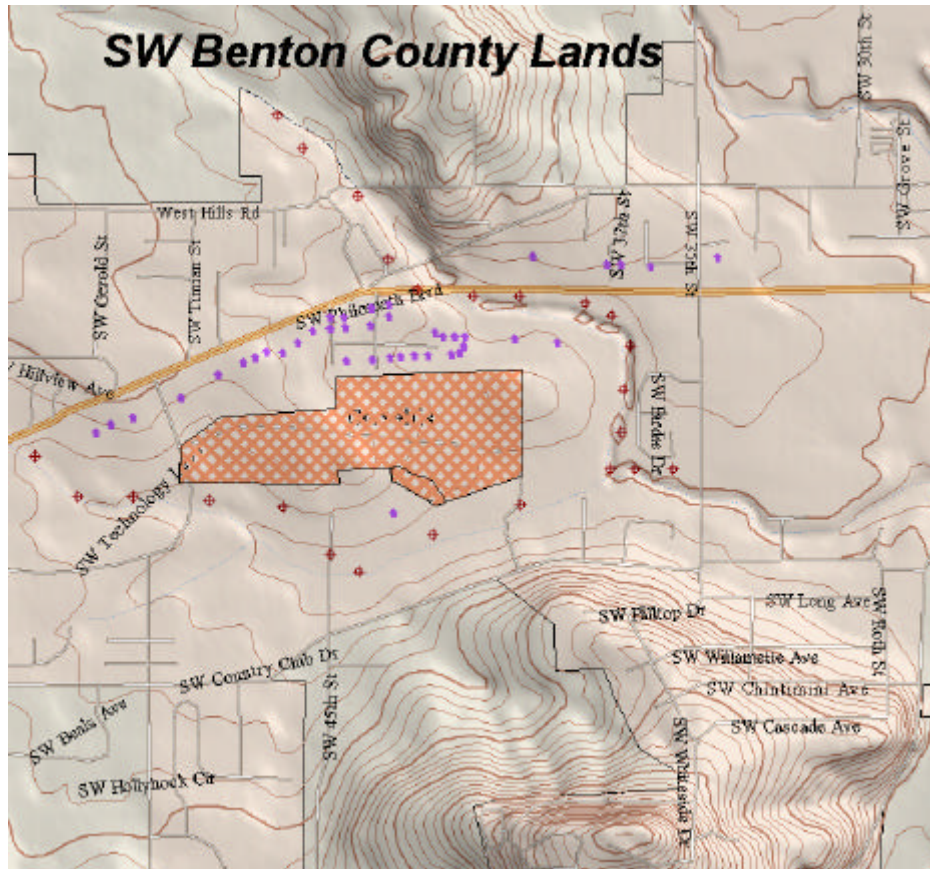
Naming convention for the first character:

A: north latitude, East Longitude
B: north latitude, West Longitude
C: south latitude, West Longitude
D: south latitude, East Longitude

Naming convention for the last two characters:

A1 : Lat : 44-44.125
Lon : 123-123.125
A2 : Lat : 44-44.125
Lon : 123.125-123.250
...
B1 : Lat : 44.125-44.250
Lon : 123-123.125
B2 : Lat : 44.125-44.250
Lon : 123.125-123.250

Once the CDM files have been created, they can be viewed as part of the CMT BaseMap. Mark the options for **Contour Lines** and **Contour Regions** found under the View/Basemap/Basemap Options to turn on the contour lines and shaded relief. Your basemap will automatically be updated to reflect the changes. An example is shown:



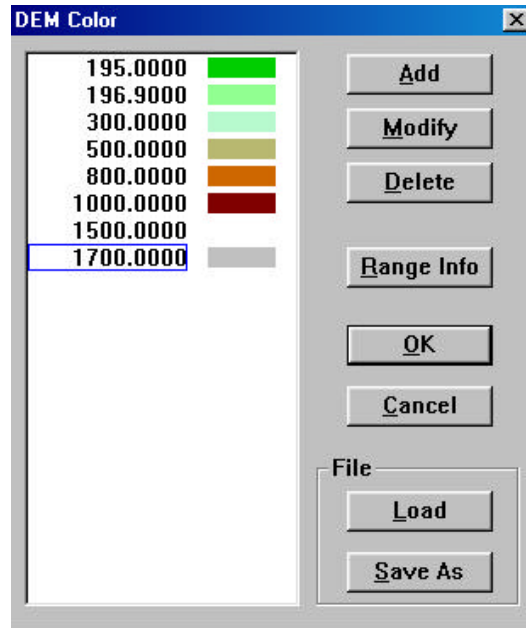
8.4.3 View/Basemap/CDM Directory

In the **Show/Change CDM Directory** window, you can specify the directory from which the CMT CDM data will be automatically loaded for the displayed BaseMap (when contour region or contour line is selected under BaseMap Options). It is recommended to leave this at the default setting.

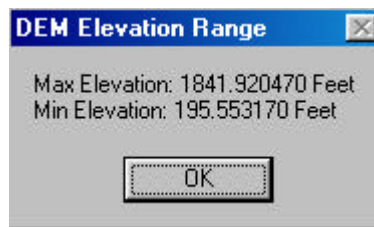
Standard DEM/SDTS files must be converted to the CMT CDM format before they may be used by PC-GPS. This conversion involves two steps because the standard DEM/SDTS files use the UTM coordinate system while PC-GPS requires the CDM files to be in the LLA system.

8.4.4 View/Basemap/DEM Color Setup

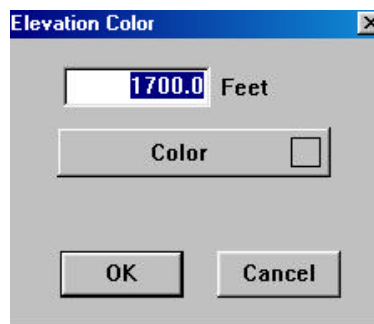
The DEM Color Setup option is used to manually define your own color gradient from lowest to highest elevations displayed in the CMT CDM data. When this option is selected, the following dialog window appears:



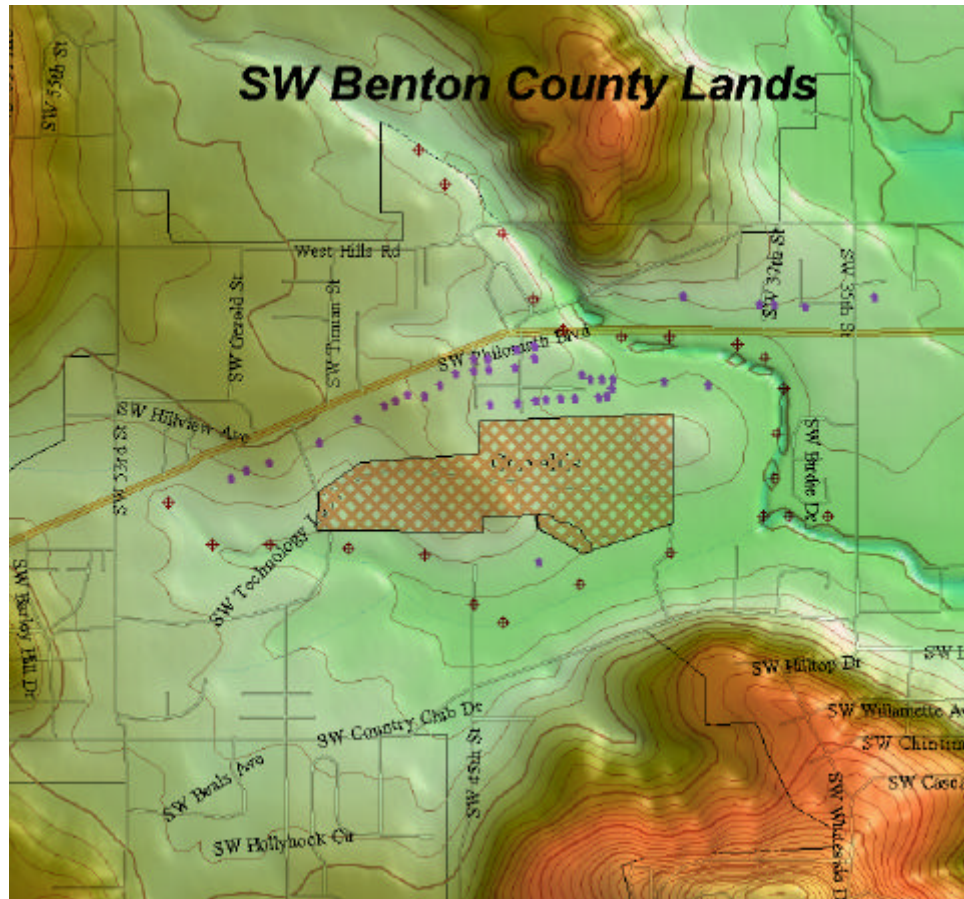
Click on the **Range Info** button to let PC-GPS calculate the minimum and maximum elevations and display them for you:



Use the **Add** button to add elevations and specify colors. Click on the **Modify** button to change any existing elevations and colors. An example is presented for the modify button:



An example is shown using the DEM Color Setup:



8.4.5 View/Basemap/DEM Ramp Setup

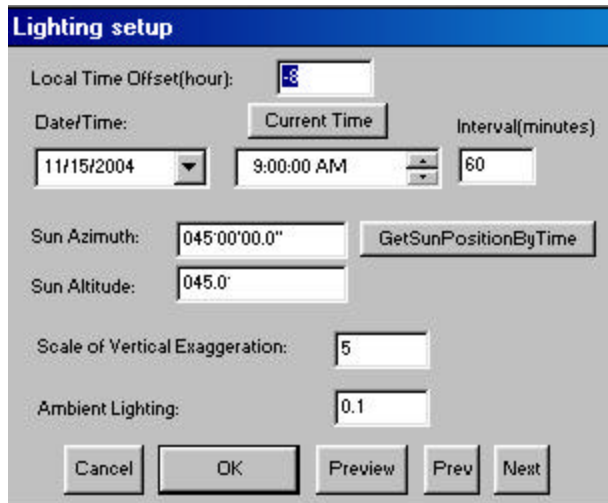
This option is to define the color “ramp” for DEM data displayed in PC-GPS. When using the color ramp mode, the minimum and maximum elevations are calculated by PC-GPS using the CDM data for your Map and presented to you.

Use the ramp setting to select a color for the minimum elevation and the maximum elevation. PC-GPS will automatically create a color gradient from the lowest to highest elevation points.

8.4.6 View/Basemap/DEM Light Setup

Use the DEM Light Setup option to view your DEM data and the shading in different levels of lighting based on the time of day and ambient lighting. There are specific settings for sun azimuth and sun altitude. However, these are automatically calculated for you based on your input for the time of day and date settings.

The following dialog is displayed:



The image shows a 'Lighting setup' dialog box with the following fields and buttons:

- Local Time Offset(hour):** A text box containing '-8'.
- Date/Time:** A date dropdown menu showing '11/15/2004'.
- Current Time:** A button next to the date dropdown.
- Interval(minutes):** A text box containing '60'.
- Sun Azimuth:** A text box containing '045°00'00.0"'. To its right is a button labeled 'GetSunPositionByTime'.
- Sun Altitude:** A text box containing '045.0'.
- Scale of Vertical Exaggeration:** A text box containing '5'.
- Ambient Lighting:** A text box containing '0.1'.
- Buttons:** At the bottom are five buttons: 'Cancel', 'OK', 'Preview', 'Prev', and 'Next'.

When using this function, it is important to make sure you have the correct time, date and UTC time offset entered. The UTC time offset is the difference between your local time and the time at Greenwich, England. For example, in the Pacific Time Zone, the offset between standard time (not daylight savings time) and UTC time is -8 . After determining the correct time offset, enter this information in the box at the top.

The Date/Time may be entered in manually or use the **Current Time** button to get this information automatically from your PC.

The fields for Sun Azimuth and Sun Altitude may also be entered in manually. Automatic entry for this information may be achieved by using the **Get Sun Position By Time** button. This function uses the current time/date settings and a table of sun angles to determine the correct sun altitude and azimuth.

Change the **Scale of Vertical Exaggeration** (between 0.01 and 100) to exaggerate the vertical scale of the DEM data.

Use the **Ambient Lighting** setting to change the brightness of ambient light in the area. Acceptable values range between 0 and 1.

Use the **Preview** button to see a preview of how these settings will look in your map.

Observe changes over the course of a day or over a specific time interval by setting the Interval in minutes. Then, use the **Prev** and **Next** buttons to increment the time based on the specified interval (acceptable intervals range from 1 to 9999).

8.4.7 View/Basemap/DEM Color Options

Select the color scheme of your choice for the displayed CDM data by choosing from one of three options:

- a) **None:** This choice indicates that no color scheme is to be used for different elevations in the current CDM data.

- b) **By Ramp:** This choice indicates that the color scheme to be used for the different elevations on the current CDM data will be dictated by the settings specified in the “DEM Ramp Setup” option.
- c) **By DEM Color Setup:** This choice indicates that the color scheme to be used for the different elevations on the current CDM data will be dictated by the “DEM Color Setup” option.

Please note: CDM data must be loaded and displayed for these menu items to be active.

Also note: The lighting setup (especially ambient lighting) will affect the display of you CDM data (even when the **None** option is selected).

8.4.8 Elevation Profiling

Use the Elevation Profile tool to get a cross-sectional view of a transect over the CMT BaseMap that is utilizing the DEM data. In the Utilities menu, select DEM/CDM/Profile/Contour then select **Elevation Profile**. Select an existing line or area feature for a cross-sectional view of the changes in elevation over the line feature or perimeter of the area boundary.

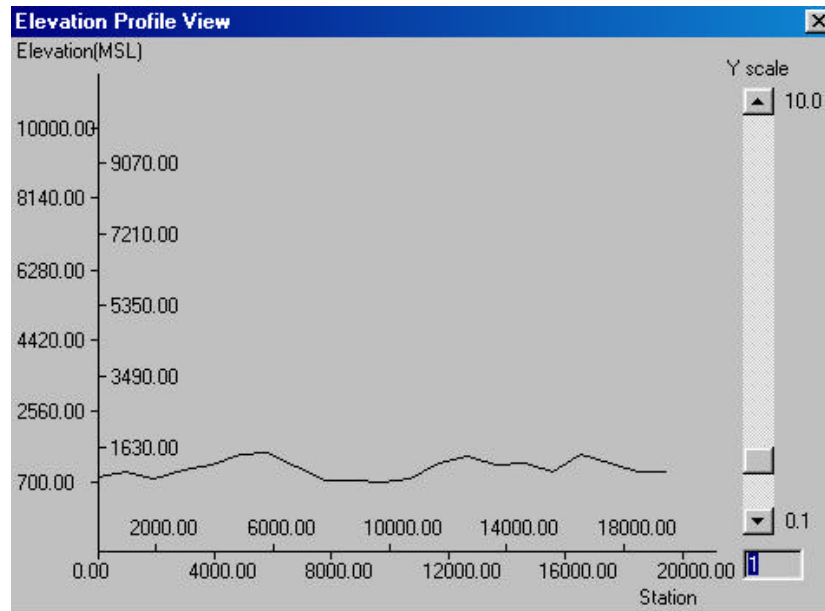
After selecting Elevation Profile, the following dialog panel is displayed at the right of the screen:

Steps:

1. Select the line or area feature in your Map View by clicking on it. The FeatureID of the line or area boundary is displayed in the Line/Area Feature box.
2. Place a checkmark in the **Get Elevation By DEM** option if you want to use the CMT CDM (DEM) data to create your elevation profile. If this option is selected, then the minimum and maximum elevations along the line or area boundary will be obtained from the CMT CDM (DEM) data.
Alternatively, if the line or area feature was created by GPS data, then you can uncheck this option to use the elevation data captured by the GPS.
3. Specify a desired **interval** and **smoothing range**. The interval specifies how often an elevation reading is taken over the course of the line or area boundary (x-axis). Larger intervals will result in

fewer listings in the Elevation Profile Printout. The Smoothing Range option lets you specify a range over which the elevation values will be averaged before being displayed at each interval. In general, using a smoothing range results in a smoother elevation profile.

4. Click on the **View** button to view a visual cross-section of the elevation change over the course of the selected feature. An example is presented:



5. Alternatively, click on the **Print** button to get a textual listing of the interval, x, y and z data (in both HAE and MSL). A sample text printout for the previous example is displayed:

| Elevation Profile Print | | | | |
|----------------------------|-----------|---------|-----------|-----------|
| File Print Help | | | | |
| | | | | |
| Elevation Profile Printout | | | | |
| Station | X | Y | HAE | MSL |
| 0.0000 | -123.2947 | 44.6349 | 794.0443 | 867.7804 |
| 500.0000 | -123.2963 | 44.6343 | 787.6717 | 869.0927 |
| 1000.0000 | -123.2979 | 44.6336 | 881.1846 | 998.3576 |
| 1500.0000 | -123.2974 | 44.6320 | 936.6209 | 957.3472 |
| 2000.0000 | -123.2987 | 44.6309 | 879.6516 | 940.2868 |
| 2500.0000 | -123.3004 | 44.6301 | 929.0996 | 985.8904 |
| 3000.0000 | -123.3020 | 44.6294 | 966.8330 | 1040.3523 |
| 3500.0000 | -123.3036 | 44.6286 | 1064.6156 | 1128.6067 |
| 4000.0000 | -123.3054 | 44.6285 | 1137.7916 | 1230.9687 |
| 4500.0000 | -123.3068 | 44.6273 | 1394.6987 | 1384.5117 |
| 5000.0000 | -123.3083 | 44.6265 | 1439.6626 | 1502.2936 |

You may send the printout to a printer or print directly to a file.

Use the button to close the Elevation Profile panel.

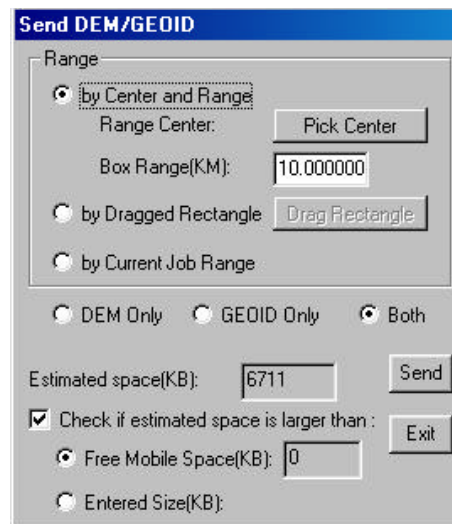
8.4.9 Converting DEM data to send to your Mobile Device

Use this function to search the DEMs (CDM's in fact) and the GEOID files in the specified range and transfer them to your mobile device. Since the DEM files are in a pre-defined folder, they may be difficult to find. This function is designed to help you locate and transfer the proper DEM files to your mobile device.

For PC-MAPPER and CMT-SURVEY, this function is named "CE DEM/GEOID". In addition to transferring the elevation data, it will also transfer the appropriate geoid files (2003 data) to the mobile device for more accurate HAE to MSL elevation data conversion.

Please note: The Geoid files are for use with Field CE Survey and the option to transfer the Geoid files is only available in PC-Mapper and CMT Survey.

The following dialog is presented when this option is selected:



The dialog box is titled "Send DEM/GEOID". It contains several sections:

- Range:** A group box containing three radio buttons: "by Center and Range" (selected), "by Dragged Rectangle", and "by Current Job Range".
 - Under "by Center and Range": A "Range Center:" label, a "Pick Center" button, and a "Box Range(KM):" text box with the value "10.000000".
 - Under "by Dragged Rectangle": A "Drag Rectangle" button.
 - Under "by Current Job Range": No visible controls.
- Data Selection:** Three radio buttons: "DEM Only", "GEOID Only", and "Both" (selected).
- Estimated space(KB):** A text box with the value "6711" and a "Send" button.
- Check if estimated space is larger than :** A checked checkbox, followed by two radio buttons: "Free Mobile Space(KB):" (selected) and "Entered Size(KB):". The "Free Mobile Space(KB):" text box has the value "0".
- Exit:** An "Exit" button.

Specify the range of data to be sent by **dragging a rectangle**, by specifying a **numeric box range**, or by the **current job range**.

Click on **Send** to send the selected data to the Mobile Device or click **Exit** to abort.

Section 9: Plotting Your Map

The PC-GPS plotting functions allow you to easily create and print a professional-looking map. This section covers many of the PC-GPS plotting capabilities and customization options. Please read the section thoroughly.

There are two menu options that access the plotting functions:

- The **File/Plot Preview** menu option displays the Plot Preview window for the current map. From the Plot Preview window you can customize plot objects and access the Plot Setup screen. (See Section 9.2)
- The **File/Plot** menu option displays the Plot Setup screen for the current map. After you specify the Plot parameters in the Plot Setup screen, the plot output will immediately be sent to your Printer. **File/Plot** does not provide a preview window. (See Section 9.6.3)

In most cases, it is recommended that you use the **File/Plot Preview** option to view the plot prior to printing.

9.1 Plotting Considerations

This sub-section covers basic plotting considerations. An understanding of the PC-GPS plotting assumptions may save time when you are creating your plot.

9.1.1 The Map View determines what is on your Plot

Your plot is created based on the Features and non-spatial objects that are displayed on the Map View. Your plot may include labels, aerial images, grid ticks and even OLE objects. All of the objects in the Map View will be sent together as one “map object” to the Plot Preview window.

Please note: Objects that are displayed on the Map View cannot be individually edited in the Plot Preview window.

Features or objects that are not displayed on the Map View will not be included in the plot. For example, if you are “zoomed into” a portion of your Map file when you use the **File/Plot Preview** option, only the Features that are visible on the Map View will be shown in the Plot Preview window. Similarly, if you have a Topic toggled OFF when you use the **File/Plot Preview** option, the Features in that Topic will not be represented in the plot.

9.1.2 Complete Map Plot and Partial Map Plot

PC-GPS allows you to either plot your complete map file or only a portion of the map file.

- To plot the **complete Map file**, make sure each Topic in the Map file is toggled ON and then use the Zoom-Fit function before selecting **File/Plot Preview**.

- To plot **only a particular area of your Map file**, zoom-in to that area of the Map View prior to using **File/Plot Preview**.
- To **exclude a Topic from your plot**, toggle OFF the Topic before using **File/Plot Preview**.

9.1.3 Symbol Sizes

Point symbols in your plot will be printed to scale. For example, if you have Tree Features in your map that are size 8 and Gate Features that are size 12, these relative sizes will be maintained in the default plot. However, if you wish to set all of your Point symbols to one uniform size, use the Point Size setting in the Plot Setup dialog box to specify a specific symbol size. (Please refer to Section 9.3.3)

9.1.4 Labels in the Map View

Text Labels and Autolabels that are on the Map View will be included in your Plot. For proper label sizing in the printed map, the label property “Freeze Text Size in Zoom” needs to be turned OFF.

To turn Freeze Text Size in Zoom for a Text Label OFF, double-click on the label and un-check the Freeze Text Size in Zoom option in the Text Setup dialog box. To turn Freeze Text Size in Zoom OFF for your Autolabels, re-label the Topic and un-check the Freeze Text Size in Zoom option before you exit the Autolabel screen.

9.1.5 Print Setup

PC-GPS uses your Windows system default printer and paper size to determine the ideal Plot Preview graphics display and plot scale. The PC-GPS **File/Print Setup** option can be used to change the printer selection or paper size.

9.1.6 Coordinate System and Scale Units

The Plot Setup screen allows to you select “paper” units and “real world” units for your plot. Plot scale is stated in terms of paper units to real world units - 1 paper unit = X real-world units. Your paper units may be either inches or centimeters. The real world units may be inches, centimeters, feet, meters, miles, or kilometers - unless you are using LLA as the coordinate system.

If you are using the LLA coordinate system, the real-world unit options are Degrees, Minutes or Seconds (DMS). If you wish to plot in scale other than **in** or **cm** to **DMS**, you will need to change the coordinate system of the Map to UTM, SPC or a user-defined grid before you use the Plot function.

9.1.7 Grid Ticks

If you would like your plot to include Tick marks, use the **View/Tick** menu option to display grid ticks or geodetic ticks in the Map View. The ticks displayed on the Map View will be printed with your plot.

Please note: The display of grid ticks on your plot may affect the default plot scale.

9.1.8 OLE Objects

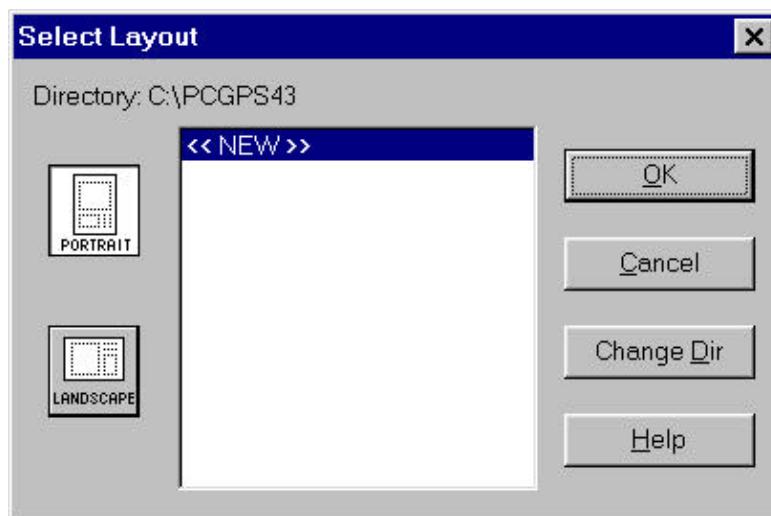
Any OLE objects in your Map file can be included in the Plot. The object placement and appearance should be edited in the Map View. The object will not be editable when it is displayed in the Plot Preview window.

9.2 Plot Preview: Viewing your Map

The **File/Plot Preview** function is used to view your plot prior to printing. Functions in the Plot Preview window allow you to customize your plot. You may change the object placement, text, size and scale. In addition, you might add special shapes and text to create a tailored, professional-looking map.

9.2.1 Viewing the Default Plot Format

To view the plot of your map, use the **File/Plot Preview** menu option. The following Select Layout dialog box will be displayed:



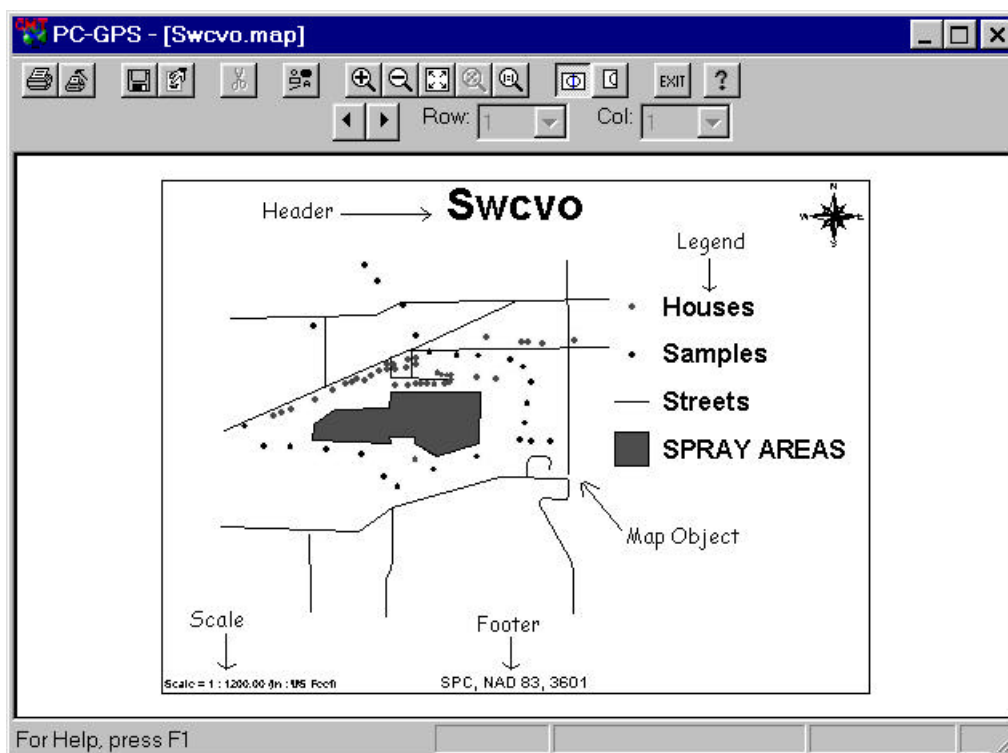
From the Select Layout screen, choose either the Portrait or Landscape option by clicking on the associated icon. If you are creating a new Plot Layout, highlight "<<NEW>>" Layout and then click on the OK button.

Please note: Please see section 9.5.2 for information on using specific layout files.

When you select <<NEW>> from the Select Layout screen, the default plot Layout will be used. The plot is created using the Map object, header, footer, legend, scale text, plot border and compass rosette (north arrow).

Object placement is determined by the orientation. The example layout on the following page shows the default object placement for landscape orientation. For a portrait orientation, map object

placement and legend placement is different. On a portrait layout, the map object is drawn in the center of the plot and the legend is placed below the map object as a default.



Default Plot Layout for Landscape Orientation

9.2.2 Plot Objects and Object Placement

A plot object is an individual object displayed on the Plot Preview screen. Plot objects include the map object, header, footer, legend, compass rosette (north arrow), border, ruler and scale bar.

A brief description of each plot object and its default placement is provided below.

Map Object: Features and non-spatial items displayed on the Map View when you use the Plot Preview option are collectively referred to as the “map object”. The map object is drawn near the center of the plot page.

Please note: Items in the map object cannot be individually edited in the Plot Preview window.

Header Object: The Map file name is used as the default header. The Header object is centered at the top of the plot page.

Legend Object: The legend lists the Topics in your plot. For landscape orientation, the legend is placed on the right side of the plot page. For portrait orientation, the legend is placed below the map object on the left hand side of the plot.

The default font size for the legend is determined by the number of lines in the Legend.

The text of the legend cannot be edited in the Plot Preview page. In order to modify the legend, you must edit the Topic name in the Map View (**Sheet/Setup/Topic Structure**).

Footer Object: The default footer is the Map Coordinate System, Datum and Zone. The Footer object is centered at the bottom of the plot page.

Scale Text Object: The scale of the plot is printed in the lower left-hand corner of the plot page. The number of decimal places shown is determined by the setting in the View/Configure/Map dialog box.

Compass Rosette Object: The compass rosette (north arrow) is displayed in the upper-right hand corner of the Plot Preview page.

Border Object: A single line border is displayed around the plot.

Scale Bar Object: The scale bar is an optional plot object. To display the scale bar on your plot, toggle ON the scale bar in the **Plot Setup/Objects** screen. (Please see Section 9.3.2)

Ruler Object: The ruler is an optional plot object. To display the ruler on your plot, toggle ON the scale bar in the **Plot Setup/Objects** screen. (Please see Section 9.3.2)

Customizing Plot Objects

Plot objects may be moved, re-sized, and modified. For example, you might move the legend, change the header text or decrease your map scale. Options for customizing your plot are discussed in Section 9.3.

9.2.3 Default Plot Scale (Units)

The units used for the scale of your map are determined by the Map coordinate system and unit of measure. The chart below shows the defaults for paper : real-world units by coordinate system and unit of measure.

| Coordinate System and unit of measure | Paper Units : Real World Units |
|---------------------------------------|--------------------------------|
|---------------------------------------|--------------------------------|

LLA Coordinate System:

| | |
|--|----------------------|
| Feet or Miles as unit of measure ----- | inches : seconds |
| Meters or KM as unit of measure----- | centimeter : seconds |

SPC, UTM, User, or NEZ Coordinates



















| | |
|--|---------------------|
| Int'l Feet as unit of measure----- | in : int'l feet |
| Miles as unit of measure----- | in : miles |
| US Survey Feet as unit of measure----- | in : US survey feet |
| Meters as unit of measure----- | cm : meters |
| KM as unit of measure----- | cm : KM |

The units used for your plot scale may be changed in the Plot Setup screen.

- Please refer to Section 9.4.4 for information on changing the scale units.

9.2.4 Plot Preview Tool Bar

The tool bar in the Plot Preview window provides many functions for viewing and working with your plot. Click on the tool bar icon to activate the associated function. The Zoom-in, Zoom-out, and Tool Palette functions can be toggled OFF by clicking the right mouse button. A brief summary of each tool bar function is listed:

- | | |
|---|---|
|  Print Out: Send plot to the printer. All pages in the plot will be printed. |  Tool Palette: Toggle Palette ON or OFF. |
|  Printer Setup: Select Printer and Paper size. |  Zoom-In: Zoom-in to the selected area. |
|  Save Layout: Save the plot layout with current object placement. |  Zoom Out: Zoom out from the current view. |
|  Plot Setup: Display Plot Setup screen. |  Zoom Fit: Zoom to fit all of the objects on the page. |
|  Delete: Delete selected plot object. <u>Note:</u> The map & ruler cannot be deleted. |  Zoom to Selected Object: Zoom to view the selected plot object. |
|  Zoom to Previous: Zooms to the previous view. |  Pan: Pan around in the current zoom. |
|  Zoom to Actual Size: Zoom to Real World scale. |  Merged Page(s) Mode: Show all plot pages. A blue dashed border will be drawn between the pages. |
|  One Page Mode: Switch page mode to 1 page. The page margins will be shown in blue. |  Exit the Plot Preview window |
|  Switch between pages: For multiple page plots, use the page arrows to switch between page views. |  Plot to File: Creates a JPEG or BMP image file for the current Plot Preview. |

Row: Col: **Move to Selected page.** For multiple page plots, use the row and column fields to select a specific page for viewing.

9.2.5 Printing your Plot from the Plot Preview window

The Plot icon on the tool bar of the Plot Preview window is used to send your plot to the printer. All of the pages of your plot will be printed. The Plot Preview window will remain displayed on your PC screen until you click on the Exit icon.

9.3 Customizing your Plot


PC-GPS plotting functions make it easy to create a professional map from your data. The plot format may be completely user-defined. Your plot objects can be moved, re-sized, added or deleted. You can create your own headers and footers. Text labels and drawing shapes can be used to enhance the plot. This section covers the methods for customizing your plot.

9.3.1 Summary

In some cases, more than one method can be used to “customize” a plot object. The following list summarizes the methods used:

- **Object Placement:**
Drag object with mouse in the Plot Preview screen. (Section 9.3.3)
- **Object Font Size:**
 - 1) Stretch object with mouse in the Plot Preview screen. (Section 9.3.3)
 - 2) Double-click on object in the Plot Preview window to go to the Text dialog. (Section 9.3.3)
- **Object Text:**
 - 1) Double-click on object in the Plot Preview window to go to the Text dialog. (Section 9.3.3)
 - 2) For Headers and Footers, you can use Plot Setup screen to enter text. (Section 9.3.2)
- **Map Object Scale**
 - 1) Use Scale options in Plot Setup dialog box to set a specific scale (Section 9.4.5)
 - 2) Stretch map object with mouse in Plot Preview screen. (Section 9.4.6)
- **Point Feature Plot Size**
Use Point Size setting in the Plot Setup dialog to set a plot size for all Point Symbols.
- **Deleting Plot Objects:**
 - 1) Select the object from the Plot Preview window and use the Cut icon.
 - 2) Go to Plot Setup screen and toggle OFF unwanted objects.
- **Plot Scale Units:**
Use Scale Units settings in Plot Setup dialog box to select paper and real-world units.
- **Plot Margins:**
Use Size options in Plot Setup dialog box to change margins. (Section 9.6.2)
- **Printer Selection and Paper Size:**
Use Printer Setup icon to display Printer options. (Section 9.6.1)

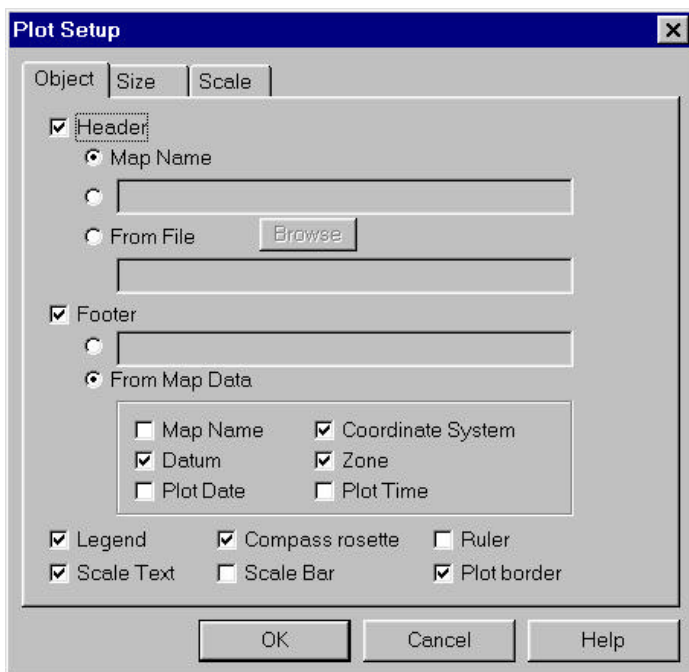
9.3.2 Using Plot Setup to Customize Plot Objects

The display of plot objects can be customized using the options of the **Plot Setup/Objects** screen. The Plot Setup screen can be accessed by clicking on the Plot Setup icon  in the Plot Preview window.

The Plot Setup screen can also be accessed using the **File/Plot** function.

The Plot Setup screen is divided into three pages: Objects, Scale, and Size. The Objects page provides options for customizing the display of plot objects. The Scale page is used to set the map scale and select the scale units. The Size page lists margin and point size options.

The **Objects** page of the **Plot Setup** screen is shown:



Default Object Options:



Header - Map Name

Footer - From Map Data

- Coordinate System
- Datum
- Zone

Other Plot Objects

- Legend
- Scale Text
- Compass rosette
- Plot Border

In this sample screen, each of the default plot objects is selected. Selected objects are marked by either a check mark or selection circle. The mark boxes  are used to toggle ON or OFF the display of the plot objects. The selection circles  are used to choose a Header or Footer option.

Header Options

There are three options for the plot header. Click on the selection circle that corresponds to the header option you wish to use.

Map Name: (first selection circle)

As the default, your Map file name is used as the header for the Plot. For example, if you are using the example file SWCVO.MAP, the header for the Plot would be "SWCVO".

Header Name: (second selection circle)

If you wish to enter a header name, click on the second selection circle and then enter a title for the plot in the adjacent entry field. The header may be up to 75 characters in length. (Note: The header entry field has space for up to 26 characters.)

From File: (third selection circle)

If you wish to use a text file for your header, click on the third selection circle and use the Browse button to choose a text file. The text file name will be shown in the corresponding field.

All of the text in the file will be displayed in the space allocated for the header object. You may need to re-size the header object using the mouse in order to display the text in a legible font size. If you are using a file that contains more than one line of text, you may want to change the header alignment and font. For multiple-lines, left-justification and courier font work best.

Footer Options

There are two options for your Plot footer. Click on the selection circle that corresponds to the footer option you wish to use.

Footer Name: (first selection circle)

If you wish to enter text for your footer, click on the first selection circle and then enter the name in the corresponding entry field.

From Map Data: (second selection circle)

If you wish to use map data for the footer, click on the second selection circle and then mark the data options you wish to use. As the default, the Coordinate System, Datum and Zone are used for the footer.

Optional Plot Objects

At the bottom of the **Plot Setup/Objects** screen, the optional plot objects are listed. You may toggle ON or toggle OFF any of these options by clicking in the associated mark box. The optional objects include: *Legend*, *Compass rosette*, *Ruler*, *Scale Text*, *Scale Bar* and *Plot Border*.

Optional objects, except the Ruler, may be cleared from the Plot window using the Cut icon.

9.3.3 Customizing Plot Objects from the Plot Preview Window

The object placement, object plot size, and text content of plot objects can be easily modified in the Plot Preview window.

Placement of Objects

To change the placement of an object, first select the object by clicking on the object once.

A “grid box” of black nodes will indicate that the object is selected. Once the object is selected, you can click on the middle of the object, hold down your mouse button and then drag the object to a different location on the page. When you release the mouse button, the object will be displayed in the new location.

Object Display Size

Plot objects may be re-sized using the mouse. To increase or decrease the display size of an object, first select the object by clicking on the object once. A “grid box” of black nodes will indicate that the object is selected. To re-size the object, click on a corner of the grid box, hold the mouse button down and drag the corner of the object in one direction or another:

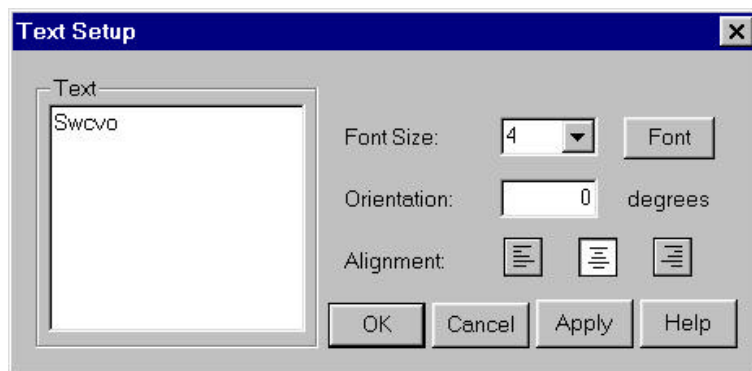
- Dragging the upper right corner directly to the right or left increases or decreases the width of the object, respectively.

- Dragging the upper right corner up or down increases or decreases the height of the object, respectively.
- Dragging the upper right corner to the upper right or the lower left increases or decreases both the height and the width of the object respectively.

Please note: Text labels cannot be re-sized using the mouse if the Freeze Text Size in Zoom option is ON. For information on re-sizing the map object see Section 9.4.5.

Object Alignment and Orientation

The alignment and orientation of text objects can be changed using the options of the Text Setup dialog box. To access the Text Setup dialog box, double-click on the text object you wish to modify. The following dialog box will be displayed:



Font Size: Select a font size from this column.

Orientation: Enter a number between 1 and 360 for the orientation. Orientation is in degrees, counter - clockwise from horizontal. An orientation of 0 is horizontal.

Alignment: Select Left justified, Centered or Right justified.

After you have entered an orientation value or an alignment option, click on the OK button to save your changes and return to the Plot Preview screen.

Please note: The alignment and orientation of the **Legend** and **Compass Rosette** cannot be changed.

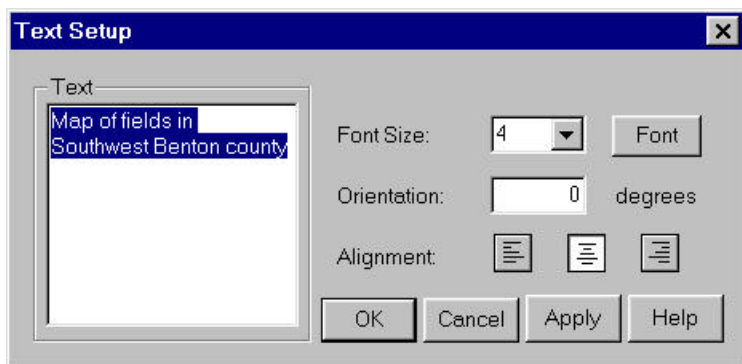
Example of Orientation:



Object Text

The content of a text object can easily be changed in the Text Setup dialog box. To access the Text Setup dialog box, double-click on the text object you wish to modify.

The Text dialog box will be displayed as shown below.



Text: When you double-click on your text object, the text will be highlighted in the Text column.

To change the text, you can either overwrite the existing text or click the mouse cursor on the part of the label you wish to change.

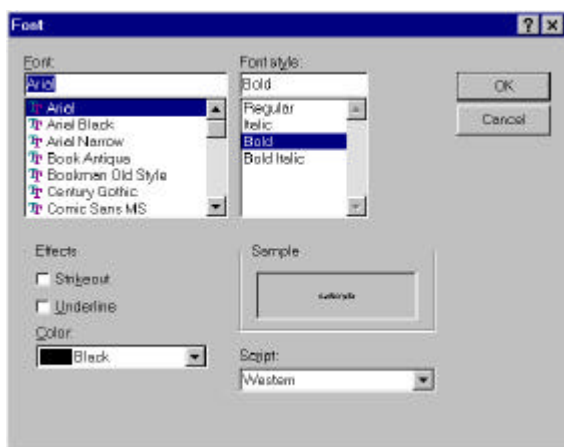
After you enter the new text, click on the **OK** button to save your changes.

Please note: The text content of the **Legend** and the **Compass Rosette** cannot be changed. For headers and footers, you may also use the Plot Setup dialog box to modify the corresponding text.

Object Font, Color, or Font Size

The font characteristics can be changed using the Font screen. To access the Font screen, first double-click on the object. The Text Setup dialog box will be displayed, as shown on the previous page. Click on the Font button. The Font dialog box will be displayed.

Please note: When you double-click on either the Legend or the Compass Rosette, the Font box will be displayed immediately.



Font: Select the font type from this column.

Font Style: Select the style from this column.

Color: Select a display color from this column.

After you have made your selections, click on the OK button in the Font dialog box. The Text Setup box will be displayed again. Click on the OK button in the Text Setup box to return to the Plot Preview window.

Please note: The font size of the Legend cannot be selected in the Font dialog box. In order to increase or decrease the font size, you may increase or decrease the size of the object using the mouse.


Point Symbol Sizing

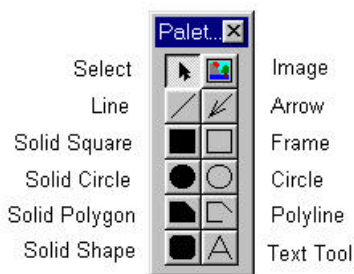
The size of Point Features in the Plot Preview window is initially determined by the size set in the Map View. To change the size of your Point Features for the plot output, use the Point Size setting in the **Plot Setup/Size** screen.

In the Size page, there are two Point Size options - **Original Size** and **Change Size**.

Select Change Size if you wish to set all of the point symbols in the plot preview to one uniform plot size. Enter the new Point Symbols size in the corresponding field. The Plot size of all Point Symbols will be changed to the value entered. Select Original Size if you wish to use the original symbol display sizes assigned in the Map View. After you have made a symbol size selection, click on the OK button to save your changes and return to the Plot Preview window.

9.3.4 Adding Drawing Shapes and Text

Your plot can be enhanced with text and drawing shapes using the tool palette in the Plot Preview window. When you click on the tool palette icon  in the Plot Preview window, the following tool palette will be displayed:



Drawing Shapes and Text Labels

Select a tool from the palette by clicking on the associated icon. The mouse cursor will be displayed as a crosshair. Place the mouse cursor on the plot page at the desired location. Click the mouse and hold down the left mouse button while dragging the mouse cursor across the page. When you release the mouse cursor the selected shape will be drawn.

If you are using the text tool, the Text Set Up dialog box will be displayed when you release the mouse cursor. In the Text Set Up dialog, you may enter the text for your label and choose label alignment or orientation.

Please note: To choose a font and font style click on the Font button.

Editing Drawing Shapes

To edit a drawing shape or text label, double-click on the object in the Plot Preview window. The associated shape properties dialog box will be displayed. You may change the style, color or thickness of the drawing shape in the properties box. Click on the OK button to save your changes and return to the Plot Preview window.

Drawing Shape and Text Notes:

- Drawing shapes and text can be moved and re-sized using the mouse.
- Drawing shapes and text are not saved with your layout.
- Drawing shapes and text cannot be placed “under” other plot objects.

9.4 Plot Scale

The scale of your plotted map can be changed in the Scale page of the Plot Setup dialog box. The scale of the map object can also be modified using the mouse. This sub-section covers plot scale considerations.

9.4.1 What is Scale in PC-GPS?

The scale of your map is defined as the number of real world units that are equivalent to 1 paper unit. The scale is stated as 1 paper unit : X real-world units. A scale of 1:5000 means that 1 paper unit equals 5000 units in the real world. The term “paper” means distance measured on your printed plot and the term “real-world” means distance measured on the ground.

In many cases, when referring to scale, the units used for the paper measurement and the units used for the real-world measurement are the same. In this case, units used could either be inches or centimeters.

PC-GPS also provides you the option of different units for Paper and Real World measurements. For example, the paper units might be inches and the real-world units might be feet. Therefore a scale of 1:5000 (in:feet) would mean that 1 inch of paper is equivalent to 5000 feet on the ground. You will notice that in the software and manual, each time the scale is listed, the units (paper:realworld) will also be shown.

Larger Scales and Smaller Scales:

When comparing map scales, the terms “larger scale” and “smaller scale” may be used.

Comparatively, larger scale indicates that one paper unit is equivalent to a greater number of real-world units (e.g. 1:5000). On a map of a smaller scale, with the same paper and real-world units, one paper unit would be equivalent to fewer real-world units (e.g. 1:1000).

There is an inverse relationship between scale and map object size. In comparing the same map displayed at different scales, the larger scale map (1:5000 in:in) is smaller on paper than the small scale map (1:1000 in:in).

Therefore, increasing the map scale means making the map object smaller on paper and decreasing the scale means making the map object larger on paper.

9.4.2 Understanding Scale in Terms of Paper Space Allocation

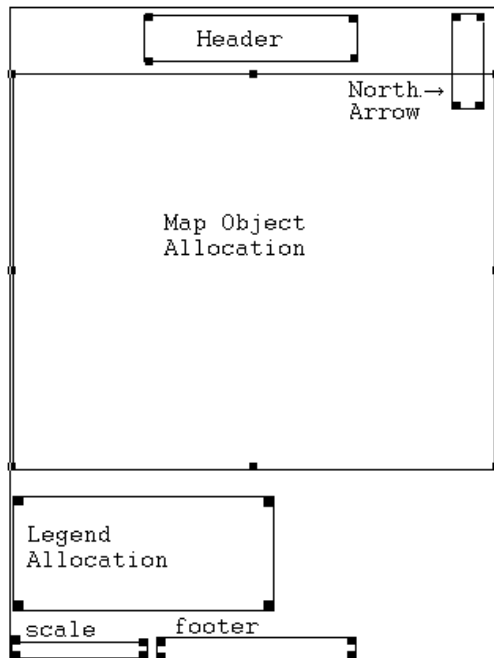
In PC-GPS, the default map scale is determined by the current scale in the Map View (displayed in the Scale Bar). Default plot units are discussed in Section 9.4.

Maximum Paper Space Allocation

The amount of paper allocated to the map object varies according to layout orientation, paper size, and print margins. Examples for standard paper size and margins are shown below.

For a given orientation, paper size, and margin setup, PC-GPS has a maximum paper space allocation. For example, the maximum paper allocation is **10 inches by 7.5 inches** for a portrait orientation on standard letter-size paper with one-quarter inch margins.

Portrait Layout - Placement and Paper Allocation:



Portrait Orientation

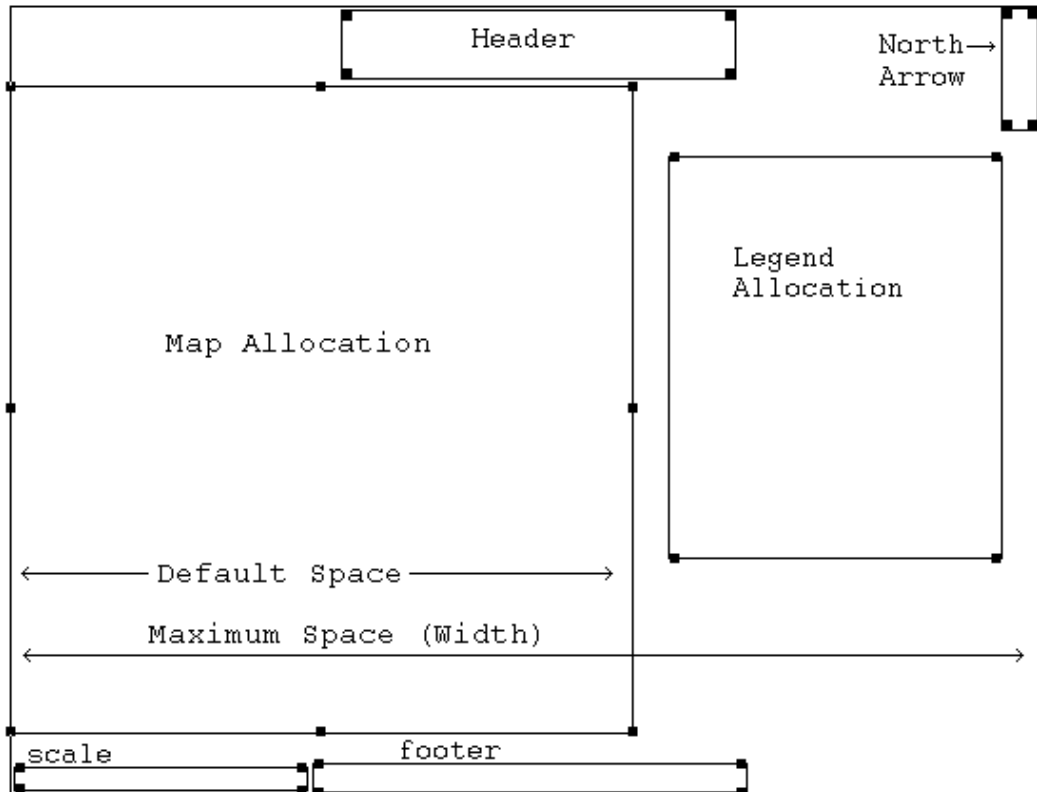
Standard 8.5 x 11 inch paper

.25 inch paper margin

Maximum Paper Space Allocated for Map object

- 10.00 inch height by 7.5 inch width

Landscape Layout - Placement and Paper allocation:



Map Object - Landscape Orientation:

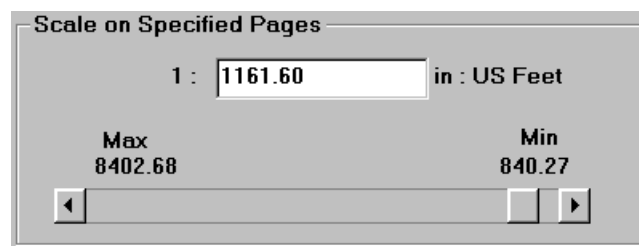
- Standard 8.5 x 11 inch paper
- .25 inch paper margin

Maximum Paper Space for map object

- 7.00 inch height by 10.0 inch width


Maximum Paper Space and Minimum Map Scale

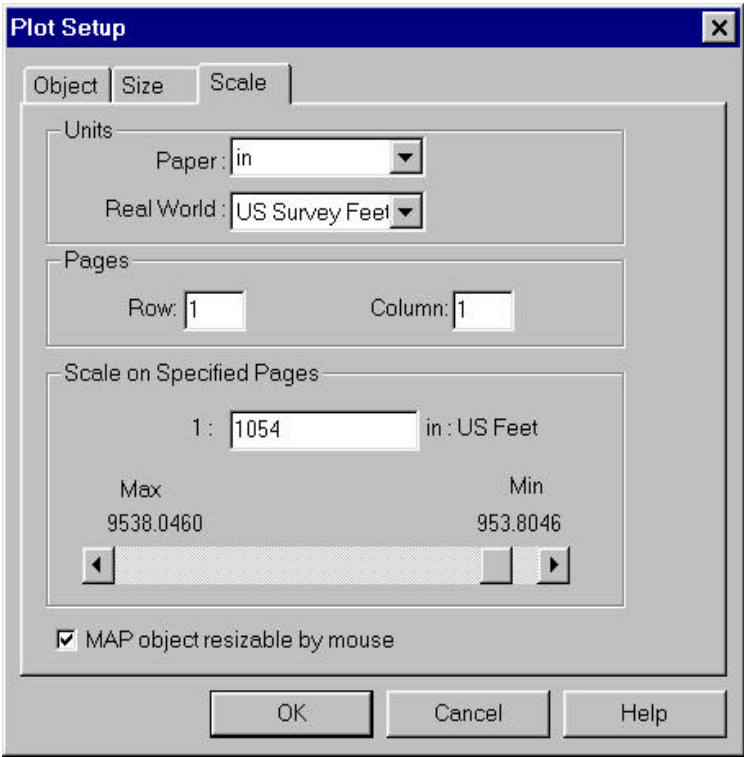
The maximum paper space allocation defines the minimum scale at which the map can be plotted. For example, the minimum scale may be 1:840 (in:feet). This means that when the map is plotted at a 1:840 scale, the map object is drawn so it completely fills the paper space available on the page. The minimum scale is displayed in the Plot Setup/Scale screen:



The scale of the map can be decreased to the minimum shown on the slide bar.

9.4.3 Plot Setup/Scale dialog box

The options in the **Plot Setup/Scale** dialog are used to select the **plot units** and **plot scale**. To access the Plot Setup screen from the Plot Preview window, either double-click on the map object or click on the Plot Setup icon: . Once the Plot Setup screen is displayed, click on the **Scale tab**. The following dialog box will be displayed:



Plot Setup: Scale options

Paper units: Choose either inches (in) or centimeters (cm)

Real World: Choose inches, centimeters, int'l feet, US survey feet, meters, miles or kilometers. For LLA coordinate system, choose Degrees, Minutes, or Seconds.

Pages: The default number of pages is one - expressed as 1 Row by 1 Column. If you want to use multiple pages, enter the number of pages as Rows by Columns. Row = Vertical Pages; Column = Horizontal Pages.
Example: 2 Rows x 2 Columns = 4 pages

Scale: The current scale is shown in this field. **To change the scale**, enter a value between the maximum and minimum.

MAP object resizable by mouse: This option allows you to resize the map using the mouse.

9.4.4 Selecting Units: Paper and Real World

The units used for the default scale of your map are determined by the Map coordinate system and unit of measure. The paper units will always be inches or centimeters. Real world unit options are inches, centimeters, international feet, US survey feet, meters, miles, kilometers. If you are using LLA Coordinate System, the real world unit options are degrees, minutes or seconds.

| Coordinate System and unit of measure | Default Paper to Real-World scale |
|--|-----------------------------------|
| <u>LLA Coordinate System:</u> | |
| Feet or Miles as unit of measure ----- | in : sec |
| Meters or KM as unit of measure----- | cm : sec |

SPC, UTM, User, or NEZ Coordinates

| | |
|--|---------------------|
| Int'l Feet as unit of measure----- | in : int'l feet |
| Miles as unit of measure----- | in : miles |
| US Survey Feet as unit of measure----- | in : US survey feet |
| Meters as unit of measure----- | cm : meters |
| KM as unit of measure----- | cm : KM |

The paper and real world units can be changed in the **Plot Setup/Scale** screen. To change either the paper units or the real-world units, go to the Scale page of the Plot Setup dialog box. Click on the pull-down arrow next to the respective option. A list of the available units will be displayed. Click on the unit you wish to use. Click on the OK button in the Plot Setup button to save your changes and return to the Plot Preview window.

9.4.5 Changing the Map Scale using the Scale option

The scale of your map can be decreased or increased using the scale option in the Plot Setup dialog box. To increase or decrease your map scale, double-click on the map object to display the **Plot Setup/Scale** screen. Enter the new map scale in the Scale field. Click on the OK button to save your changes and return to the Plot Preview screen. The map object will be re-drawn at the specified scale.

Please note: You may use any value between the minimum and maximum scale shown. If you need to plot at a scale larger than the maximum size, you may do so by typing the desired scale into the Scale box. The maximum scale that is displayed and accessible by the sliding bar is the suggested maximum for your current Map. If you wish to plot at a scale smaller than the minimum scale, you will need to increase the number of pages used for the plot. See Section 9.4.7.

If you enter a scale value which is under the minimum, a message "Scale Out of Range for Number of Pages Selected" will be displayed.

The map scale is inversely related to the relative size of your map object drawing. For example, the scale shown in the Plot Setup dialog box on the previous page is 1:1054. If you *decrease* the scale to 1:1000, then the map object will be *drawn larger* - one paper unit covers fewer real world units. If you *increase* the scale to 1:5000, then the map object will be *drawn smaller* - one paper unit covers more real world units.

9.4.6 Changing the Map Scale using the Mouse

The scale of the map object can also be modified using the mouse. As with other plot objects, you may expand or contract the size of the map object by pulling an edge of the map with the mouse in the Plot Preview window.

To increase or decrease size of the map object, first select the map object by clicking on the object once. A "grid box" of black selection nodes will indicate that the object is selected.

- To increase or decrease the width of the map object, click on one of the selection nodes on right edge, hold the mouse button down and drag the mouse cursor right (to increase width) or left (to decrease width). The map object will be redrawn when you release the mouse button.
- To increase or decrease the height of the map object, click on one of the selection nodes on bottom edge, hold the mouse button down and drag the mouse cursor down (to increase height) or up (to decrease height). The map object will be redrawn when you release the mouse button.

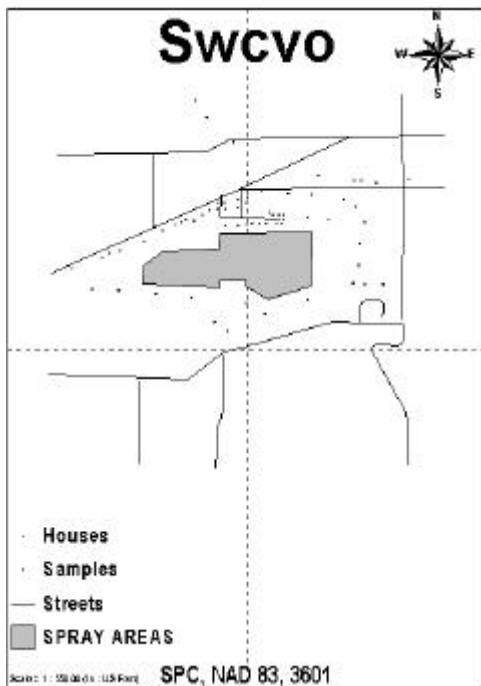
Please note: If you cannot re-size the map using your mouse, check to make sure that the MAP Object Resizable by Mouse option is toggled ON in the Scale page of the Plot Setup dialog box.

The scale of the map object is dynamically adjusted. If you increase the size of the map object, the scale will decrease. If you decrease the size of the map object, the scale will increase.

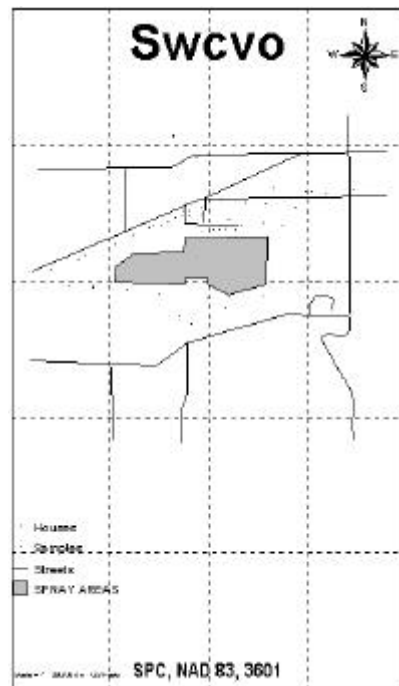
9.4.7 Multiple Page Plots

If you wish to set your plot to span multiple pages, you may use the Pages option in the **Plot Setup/Scale** screen. From the Plot Preview window, double-click on the map object. The Scale page of the Plot Setup screen will be displayed. In the Pages section, enter the number of rows (vertical pages) and columns (horizontal pages) for the multiple page plot. Click on the OK button to save your changes and return to the Plot Preview window.

Multiple Page Examples: (Shown in Merged Mode)



Plot Across 4 pages (2 rows x 2 columns)
SWCVO2.MAP scale is 1:550 (in:feet)
Grid lines separate the pages.





Plot Across 20 pages (5 rows x 4 columns)
SWCVO2.MAP scale is 1:250 (in:feet)
Grid lines separate the pages

Multiple Page Plot Notes:

- Plot objects can be selected, re-sized and modified using the methods described above.
- Plot objects (header, footer, legend, scale, and compass rosette) are placed in the same relative locations. In merged mode, you can see that the multiple page plot is viewed as “one big page” for object placement.
- Page borders are indicated by blue dashed lines in the Plot Preview window.
- Plot text objects that are placed across page borders may not plot completely. You may want to move header and footer such that the text falls completely within a page.

Moving between pages in your Multiple Page plot

There are two modes to view your plot. - **merge** mode  and **one page** mode . You may toggle between these two modes by clicking on the icons on the tool bar. The default mode is merge mode. In merge mode, all of the pages of your plot will be shown in the Plot Preview window. In one page mode, only one page will be displayed at a time. In one page mode, you can select a specific page by either using the page arrow or the row and column indicators.




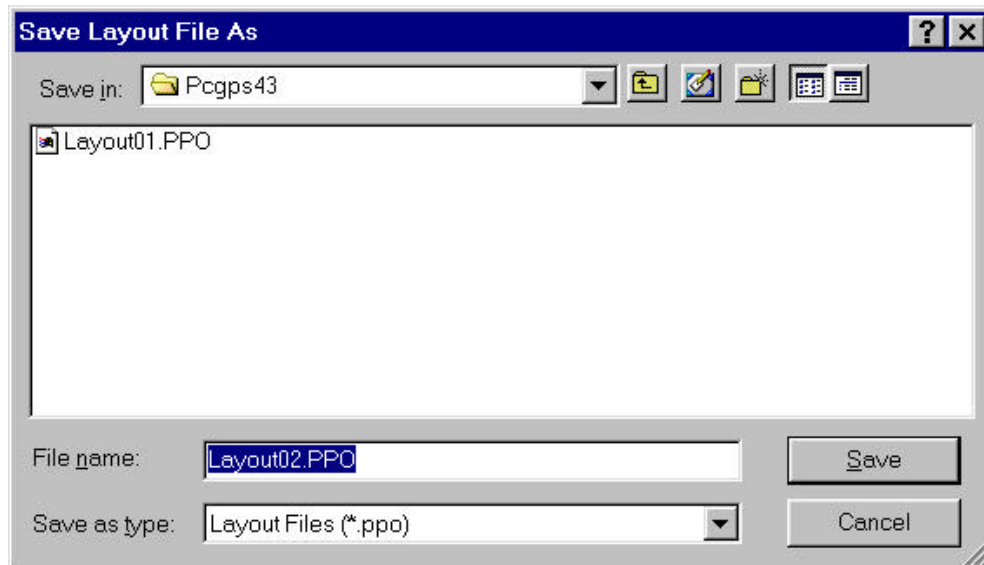
Page Arrow: Click on the right or left arrow to move between pages in your plot.



Row/Column: Use the pull-down arrow to select either the row or column page.

9.5 Saving your Plot Layout

After you have finished customizing your plot, you may want to save the plot layout for future use. The Save Layout icon  on the tool bar of the Plot Preview window is used to save the layout organization of your plot. The Save Layout dialog box will be displayed:



Enter a name for your layout file in the File name field. For easy reference, you may want to use the Map file name as part of the your layout file name. Click on the Save button to save the layout and return to the Plot Preview window.

The file extensions of layout files are *.PPO for Portrait orientation and *.PLN for Landscape.

9.5.1 What is saved with your Layout

When you create a plot layout, same of the basic layout elements are saved:

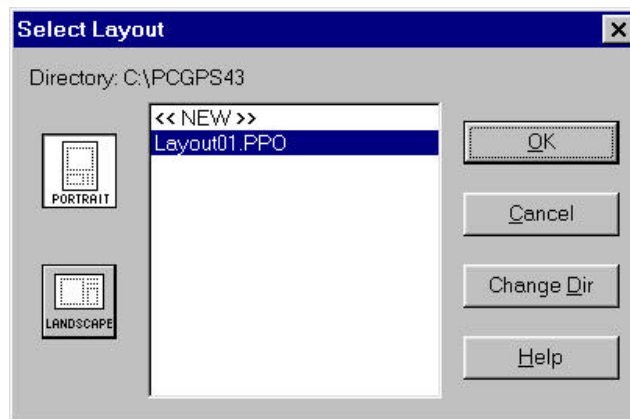
- Object placement
- Object size
- Headers and Footers
- Optional Plot Objects: map scale, ruler, border, etc...

When you use the layout file with the same Map file, these elements will be the same.

Please note: Scale is not saved with the plot layout. Each time you enter the Plot Preview screen, the default scale will be calculated based on the scale in the Map View.

9.5.2 Using your Layout File

If you have saved a layout file, the file name will be displayed in the Select Layout dialog box when you use either the **File/Plot** or **File/Plot Preview** menu option.



The layout files are listed by layout orientation. If you are using Portrait orientation, all of the *.PPO files in the current directory will be listed. If you are using Landscape orientation all of the *.PLN files in the current directory will be listed. Double-click on the name of the layout file you wish to use.

Please note: When you select a layout file, the layout will be applied to the current Map file. For the consistent plot preview results, layout files should only be used with the Map files they were generated from. If you use a layout file with a different Map file, the map scale and legend size may be different.

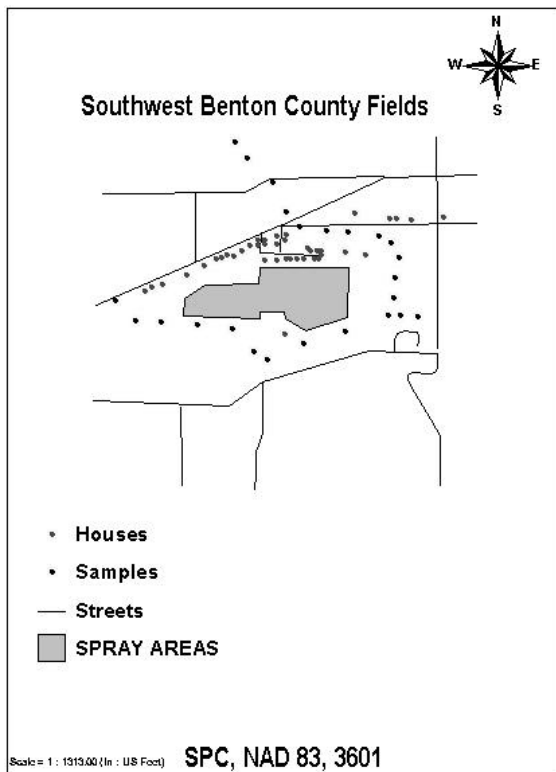
(See the example below)

After you have selected a layout file, either the Plot Preview window or the Plot Setup dialog box will be displayed. If have accessed the Select Layout dialog via the **File/Plot** option, the Plot Setup dialog box for the selected layout will be displayed. If you have accessed the Select Layout dialog via the **File/Plot Preview** option, the Plot Preview window will be displayed.

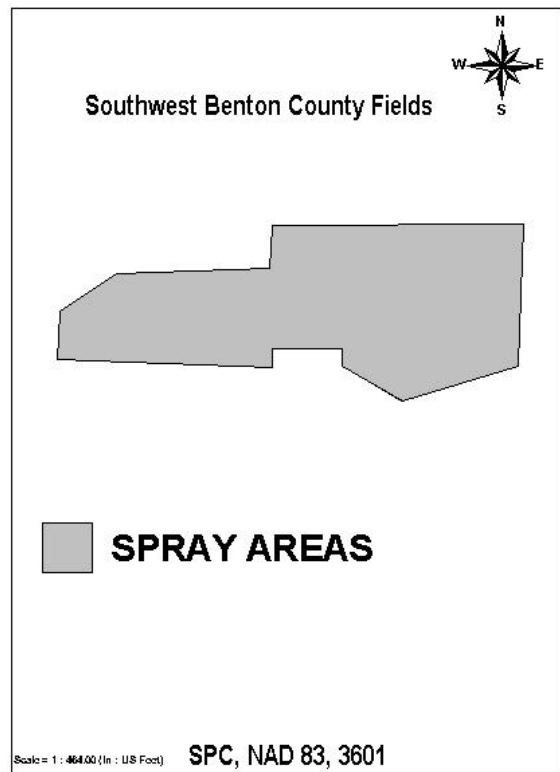
Layout file Example - Different Maps produce different results

The example portrait layout file called SWCVO.PPO can be used with the SWCVO.MAP file. When the layout file is used with the SWCVO.MAP, the plot will produce a map at the scale of 1:1313 (in:US survey feet). If this same layout file is used with another map, the map scale and the legend size may be different.

An example is shown below. Although the same layout file is being used, the map scale and the legend size are different.



SWCVO.PPO layout file used with the SWCVO.MAP. Notice the map scale and legend size. Scale = 1:1313 (in:US feet)




SWCVO.PPO layout file used with a subset of the SWCVO.MAP.

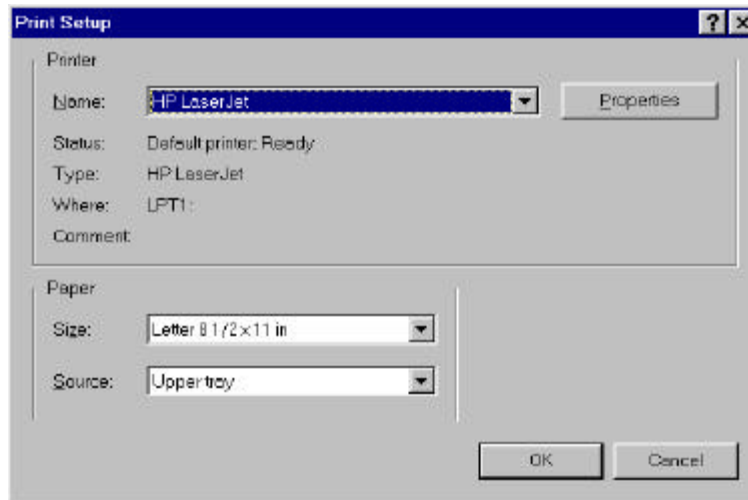
Scale = 1:464 (in:US feet)

9.6 Plot Output - Sending your Plot to the Printer

Your plot output can be sent to the printer using either the **File/Plot** function or the Print icon from the Plot Preview window. This section covers plot output considerations.

9.6.1 Printers and Paper Size

You can plot your map using any printer installed to your Windows system. PC-GPS will use your Windows default printer and paper size. To select another printer or paper size, use either the **File/Print Setup** menu option or the Printer Setup icon  in the Plot Preview window. The Windows Print Setup dialog box will be displayed:



Select the printer and paper size you wish to use and then click on the OK button.

How your Printer Type and Paper Size affect your Plot

The plot preview and plot output are affected by your printer selection and paper size.

For example, if you have chosen a color printer, then the Plot Preview window will display all of the plot objects in the selected colors. However, if you have chosen a monochrome printer, the Plot Preview window will not display your plot objects in color.

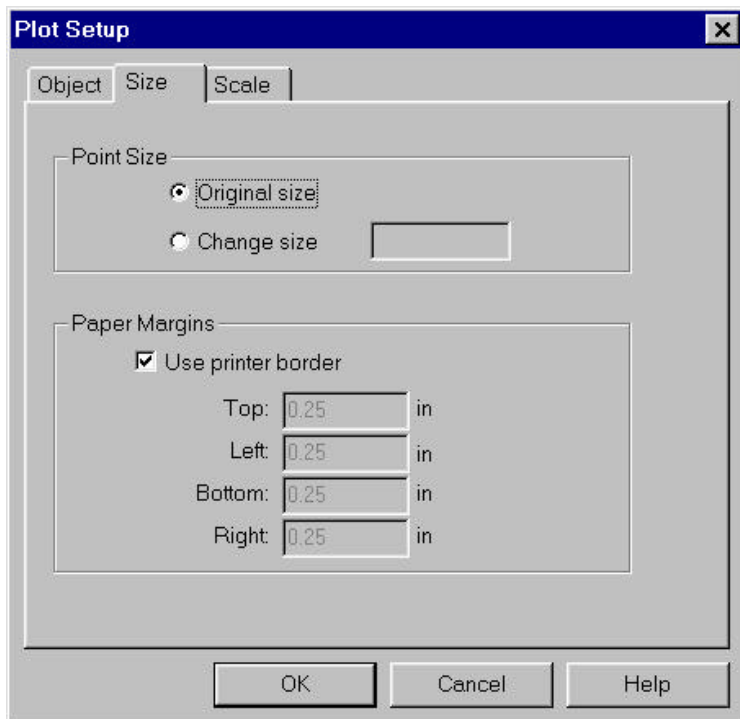
The paper size selection will affect the size and scale of all plot objects. If a given map plots at 1:1150 scale in landscape mode on standard 8.5 x 11 inch paper, the scale may decrease to 1:1000 if it is plotted in landscape mode on legal 8.5 x 14 inch paper.

Differences between Plot Preview and Plot output

The Plot Preview screen uses your printer selection to determine how the plot objects should be displayed. If there is a difference between the appearance of your plot in the Plot Preview screen and the output from your printer, you should check to make sure that the printer driver you are using matches the printer model.

9.6.2 Print Margins

PC-GPS uses the selected printer's margins as the default plot margins. For example, if you were using a HP Laser Jet III printer your printer margin might be .25 inches or .635 centimeters. In this case, the plot margins for left, right, top and bottom would be .25 inches. If you would like to change the plot margins, go to the Plot Setup/Size dialog box. The dialog box will be displayed as shown below:




To change the plot margins:

1. Toggle OFF the “Use printer border” option.
2. Enter new margin values in the Top, Left, Bottom or Right fields.
3. Click on the OK button to apply the changes.

Please note: The units listed for the margins (in or cm) match the selection under Paper units in the Plot Setup/Scale screen.

9.6.3 Plotting from the Plot Preview window

Once you have finalized your plot format in the Plot Preview window, you may use the Plot icon on the tool bar  to send the plot to your printer. After you plot your map, the Plot Preview window will remain your PC screen until you click on the exit button.

9.6.4 Plotting your Map using File/Plot Function

When you use the File/Plot function, the plot will be sent to your printer when you click on the OK button in the Plot Setup screen. In many plotting situations, you may prefer to preview your plot before sending it to the printer. To preview your plot prior to printing, please use the File/Plot Preview function.

Section 10: Forester's Toolkit Functions



The Forester's Toolkit meets the needs of thousands of foresters every day who want an easy and powerful stand-mapping program.

CMT provides an economic solution and a powerful tool that can be learned easily by foresters and other end-users.

Best of all, the Forester's Toolkit is not only for foresters! Farmers, ranchers, and other land managers can all take advantage of this new mapping tool. The topic headings: Tracts and Stands can easily be renamed using the Forester's Toolkit Settings button to apply to other land management schemes (for example, Tracts = Land lots; Stands = Crops). Thus, the Forester's Toolkit is actually a Project Toolkit. Upon renaming the Tract and Stand headings, your icons will change and the name of the toolbar will change:



10.1 Forester's Toolkit : GIS Multi-Relational Organizer

The GIS Multi-Relational Organizer is a tool that allows you to specify different spatial relationships depending on your mapping needs. Forestry professionals commonly use the relationship between Tracts and Stands to identify and manage their lands most effectively. In the Forester's Toolkit, the relationship is **TRACT : STAND**.

By renaming Tracts and Stands to other names, this powerful concept can be extended to other applications. Here are some examples of other relationships:

Fish & Wildlife Resource Management

REGION : ECOSYSTEM
ECOSYSTEM : SOIL TYPE
ECOSYSTEM : COMMUNITY

City/County GIS Planning & Survey

DEVELOPMENT: TAX LOT

Education & Research

RESEARCH AREA : TEST PLOT

Precision Agriculture

BLOCK : CROP
FARM : BLOCK
CROP : SOIL

The Forester's Toolkit in PC-GIS 3.8 PRO combines all of the power of traditional PC-GPS mapping tools in an easy-to-use format for foresters and field professionals.

10.2 Add New Tract/Stand

Click on the **Add Tract** or **Add Stand** button to create a Tract or Stand feature in your map. Use the on-screen step-by-step “wizards” to guide you through the tract/stand creation process. Two different approaches are available to add new tracts and stands to your map and instantly calculate acreage:

10.1.1 Heads-Up-Digitizing (HUD)


Use your mouse to digitize tracts and stands that can be seen from geo-referenced aerial photography. Use the friendly digitizing tools and the various “Snap to” options to create tracts/stands that share borders with existing tracts/stands. The “Snap to” options and “Include line/area boundary” options eliminate gaps and overlaps between adjacent parcels. Accuracy of acreage determination is improved when taking advantage of these digitizing tools.

Digitizing can be performed using the “point-per-click” method where each left mouse click inserts one point or node along your line or area boundary. Continuous streaming digitizing can also be used for quickly digitizing the desired line or area feature. To access the streaming digitizing mode, click and hold the left mouse button down while moving the mouse along the desired boundary. Nodes will automatically be created as you draw and continue to hold the left mouse button down.

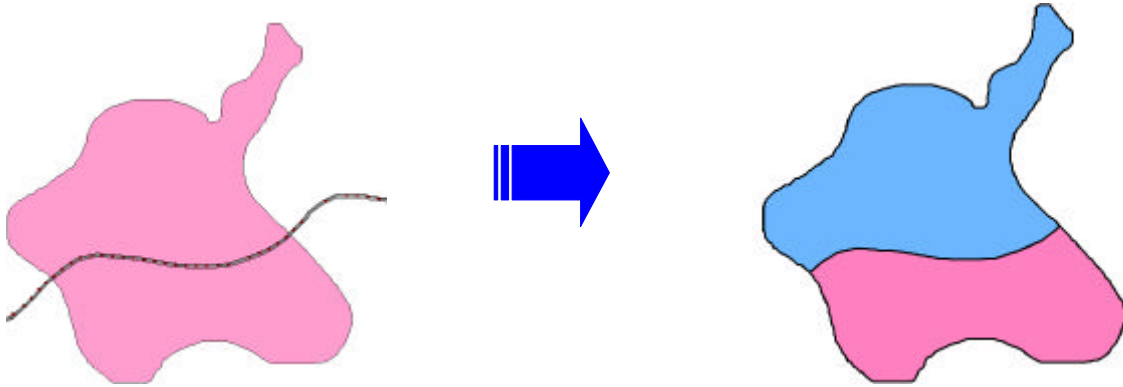
10.1.2 GIS/GPS Data

Data collected from CMT GPS units can easily be converted to tracts and stands in PC-GIS. Use the join functions to join point and line data into area features. Then, the user-friendly “wizard” will allow you to easily select the existing area feature to create new tracts and stands. Alternatively, use the digitizing tools to join your point, line, and area features into new area parcels that will become your tracts and stands. Finally, you can bring in GIS data from many other sources (e.g., AutoCAD, ArcView) to be used in the tract/stand creation process.

10.3 Split Tract/Stand


Tracts and stands can be easily split into smaller areas along user-defined borders. Select the **Split Area** tool  to choose how the split line will be defined. Follow the on-screen instructions for guidance. Available options are to: digitize your own line, select an existing line, or load a line or nodes from another feature (may be in another file). Use your mouse to choose the split line and also to select the area feature that will retain its original attributes. You will be prompted to input the new attributes and values for the remaining portion. The “Split” tool ensures that the resulting area features share a seamless border and will be free of any gaps or overlaps.

Example:



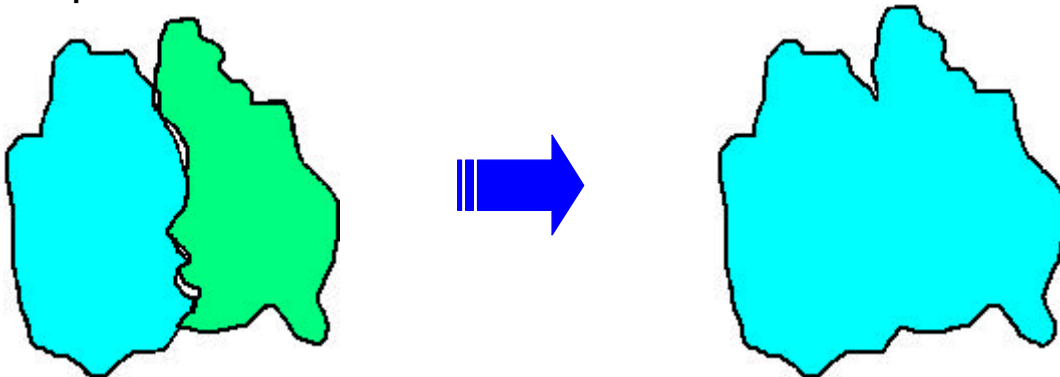
10.4 Combine Tracts/Stands

Tracts and stands can also be easily joined along common boundaries to form larger areas. Any pre-existing gaps or overlaps are automatically removed as the areas are combined.


Select the **Combine Area** tool  to select the two area features (they do not have to be tracts or stands) to be joined. PC-GPS will automatically join the two area features into one large area feature.

Use a combination of the "Combine" and "Split" tools, to eliminate any gaps between adjacent area features collected by GPS. Re-define the split using HUD or from an already existing road or creek line.

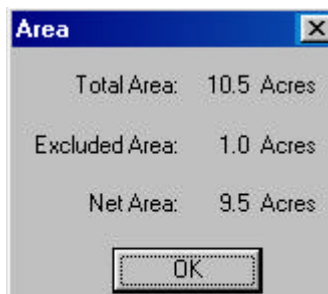
Example:



10.5 Create Island

"Islands" or other areas that are completely surrounded by other areas (or share an existing boundary of the larger area feature) can be deducted and/or removed from your map to give an accurate "net acreage" calculation for the larger, surrounding stand. Use the **Create Island** tool  to easily select the "island" stand found within the larger tract or stand. Upon selecting this function, PC-GIS will prompt you to select the "island" area. At that time, you will also have the option of deleting this stand from the map altogether (to create a donut). Click on OK to complete the sequence. The area of the "island" is automatically subtracted from the area of the larger tract or stand and is displayed as a net acreage.

Example:



10.6 Renumber Tracts/Stands


Use the Forester's Toolkit renumber function to automatically renumber your tracts and stands after a change has been made in numbering either by adding or removing parcels. For example, after timber harvest, certain stand numbers no longer contain timber and therefore are to be removed from the overall stand management plan. With the click of a button, PC-GIS will renumber the remaining stands and tracts and reassign a sequential number to each of the remaining tracts and stands (based on chronology of tract/stand creation). This function also works when new area parcels are added to the map and duplicate numbers exist or there are gaps in the numbering of existing area parcels.


10.7 Register Photo

Geo-reference your custom aerial photography or other imagery using GPS data, USGS topo maps or other vector data. Click on the “R” button below the Forester's Toolbar to choose the aerial photo you wish to register. Once selected, the register photo interface is presented and you have many different options for choosing the data used for the photo registration. Load one or more USGS topo maps by using the “L” button, import a Shapefile using the import function, or simply open a map file that contains the points you want to use. With the photo and data presented side-by-side, it is easy to click and add registration points to the photo and associate these points with the data on the left side. Repeat these steps until you have at least 4 control points on your photo. The photo registration is more accurate when these points fall near the corners of the extents of the photo.

Once all desired registration points have been added, use the “Preview” button to temporarily view the photo behind your registration data. An error is presented next to each control point to show you how accurate the registration session will be should you choose to accept it. Adjustments may be made to improve accuracy of each individual point. Click OK to accept the registration of the photo and return to your map or proceed to register another photo. Once georeferenced, you can use your aerial photos as a backdrop for digitizing new tracts and stands (or other features) with good accuracy.

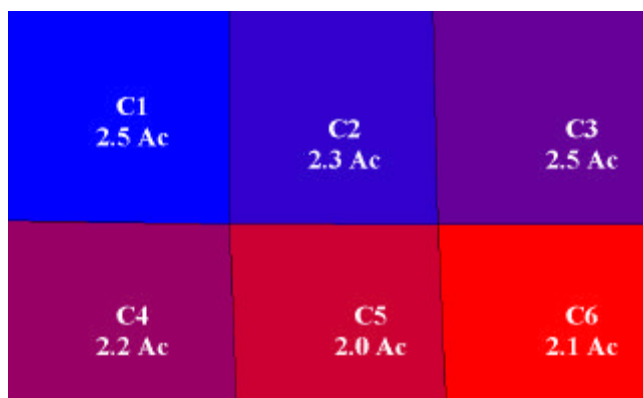
10.8 Automatic Labeling

Stands and tracts in your map can automatically be labeled as you create them or after creation. The  button is used as a toggle to turn labels on and off. PC-GIS will use the Tract or Stand Number for the labels. Acreage may also be included with the Tract or Stand Number. If acreage is desired for the auto label, then check the box “With Area” under the Label section of the Forester's Toolkit settings button. If you wish to use the traditional auto-labeling method (found under the Topic pull-down menu)

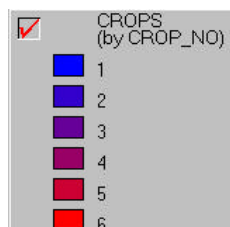
for other types of labels, then check the “No Auto Label” option under the Label section of the Forester’s Toolkit settings button. When disabled the  button will be grayed out. Alternatively, when the Auto Label button is used, then the traditional Topic/Auto Label function will be grayed out.

10.9 Automatic Classification

The Forester’s Toolkit can also be used to automatically classify your stands and tracts as you create them (either by GPS or by HUD). Create a color scheme using unique boundary colors and patterns as well as customized fill patterns. The Forester’s Toolkit can automatically ramp the colors for you or assign a random color sampling based on a Stand attribute of your choice (e.g. Description, Stand Number or Stand ID).



Turn on the legend view for a detailed classification breakdown of your data.



Different color schemes may be assigned to the classification including ramped colors (shown above) or random colors. Automatic classification attributes include: Feature ID, Feature Number or Description. Choose “None” if no automatic classification is desired. All attributes are available for selection under the traditional Topic/Classify menu.

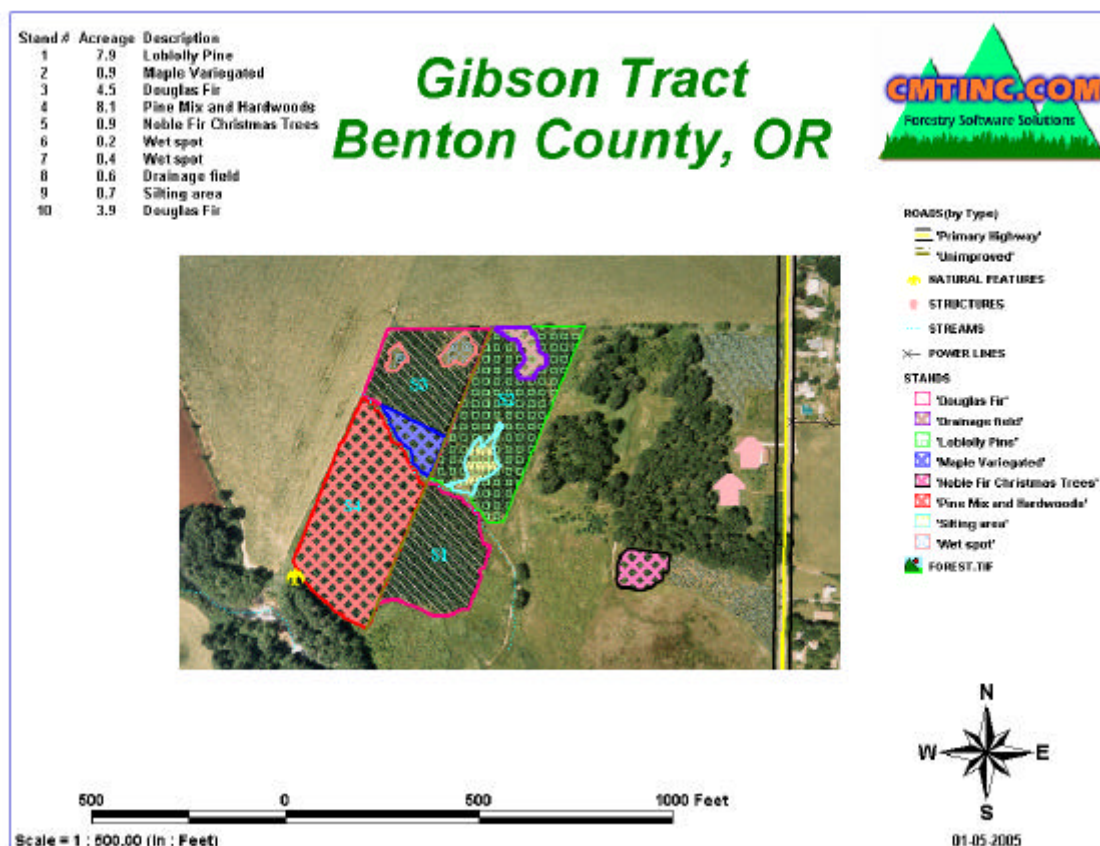
10.10 Plot

Plot your map to the size and scales that are commonly used for your application. For example, for forestry applications, you can create maps at the following pre-defined scales: 1” = 660 ft (10 chains), 1” = 1320 ft (20 chains) or 1” = 1980 ft (30 chains).

Built-in plot templates include: stand acreage summary (by classification), company logo, map legend, project title, scale bar, north arrow and more. Additional graphics (e.g., images, text, arrows, lines, etc.) can be easily added to your printouts. All items in the plot preview screen can be dragged and

dropped in the plot preview for true customization of the plot output. Save your plot layout (either in landscape or portrait format) for use with other maps and standardization for all your maps.

Example:



10.11 Quick Digitizing Tools

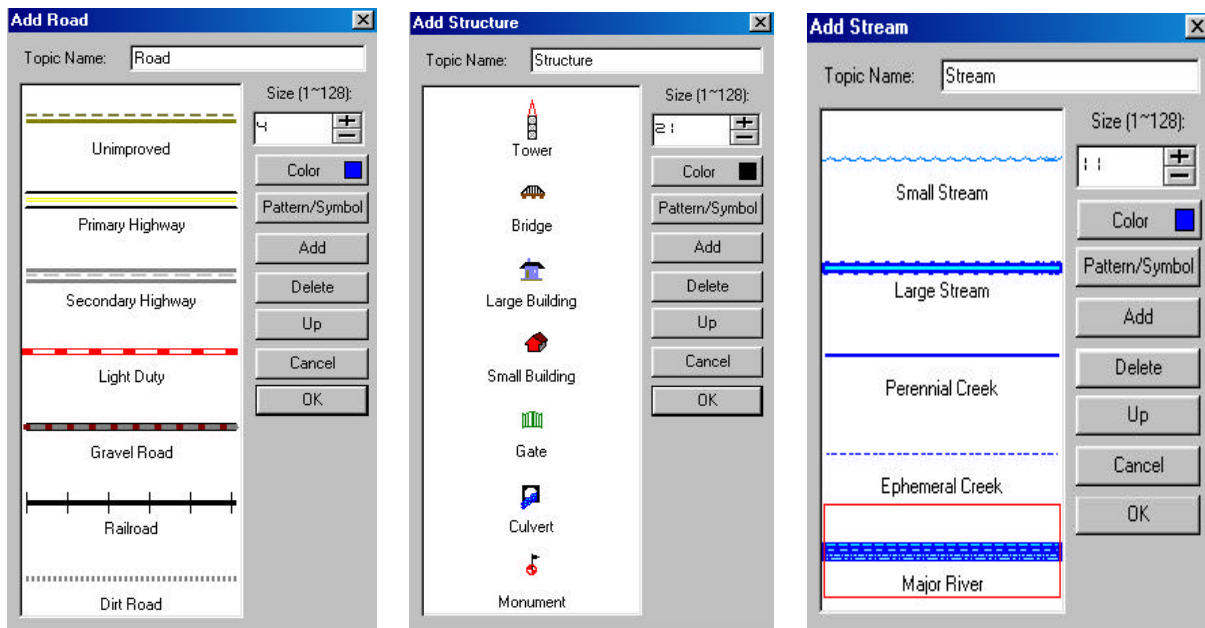
Features commonly encountered by field professionals are incorporated into the Forester's toolbar for quick access to add and digitize features onto your map. For example, the following tools are available:

Add Roads, Add Streams, Add Structures, Add Natural Features and **Add Power line** features.

These topics contain useful features such as: endangered species, roads, RR lines, power lines, towers, bridges, wetlands, etc. Simply click on the shortcut icon to start the digitizing session and add the feature of your choice to your map with the click of a button.


Customize your own shortcuts to include other features that you would like to map. Also, customize the symbols and patterns of these features to meet your needs and fit your application.

Example:



10.12 Merge Boundary

This function helps you tidy up boundaries of adjacent areas that were digitized in a hurry. It provides an automatic MERGE option as well as an option to select the beginning and ending NODES of the segment of boundaries to be merged.

Click on the **Merge Boundary** icon  to start the process of merging the area boundaries. The boundary of the Target Area will be modified by the corresponding section of the Reference Area boundary.

Select **Merge** (automatic) to automatically replace the overlapped boundary of the Target Area with the corresponding Reference Area boundary.

Select **Nodes** (manual) to specify the start and end nodes of the Target Area that should be fitted to the corresponding start and end nodes selected on the Reference Area. The start and end nodes need not be at the intersection of the two area boundaries.

Select the **Merge external boundaries** option if the goal is to enlarge the Target Area to include the Reference Area.

Select the **Fill the gaps** option if there are gaps in the overlap region and you want them filled.

Section 11 - COGO Functions

This section covers some of the commonly used Cogo menu functions. If you need information on any COGO function that is not discussed in this section, please refer to the OnLine Manual (Help/OnLine Manual).

11.1 Summary of COGO Functions

The coordinate geometry (Cogo menu) operations let you define new points by various mathematical techniques. The Cogo functions are outlined briefly in the table below.

| Function Name & Purpose: | Function Name & Purpose: |
|--|---|
| <u>Traverse</u> (See Section 11.4) Traverse (create points) by direction and distance, or by Scale factor. <ul style="list-style-type: none"> • Solve to calculate coordinates of new Point • Store to save coordinates of new Point | <u>Inverse</u> (See OnLine Manual) Determine direction and distance between Points. <ul style="list-style-type: none"> • Solution automatically calculated • Solve to store coordinates of inverse on a line |
| <u>Cogo T/R/S - Scale</u> (See Section 11.5) Scale a Feature to a fixed Point. <ul style="list-style-type: none"> • Solve to move Feature • Store to save Feature coordinates | <u>2 Point Resection</u> (See OnLine Manual) Use angle and distance data to two known Points to calculate coordinates of a new Point. <ul style="list-style-type: none"> • Solve to calculate coordinates • Store to save coordinates |
| <u>Cogo T/R/S - Rotate</u> (See Section 11.6) Rotate a Feature around a fixed Point. <ul style="list-style-type: none"> • Solve to rotate Feature • Store to save Feature coordinates | <u>3 Point Resection</u> (See OnLine Manual) Use angle data to 3 known Points to calculate coordinates of a new Point. <ul style="list-style-type: none"> • Solve to calculate coordinates • Store to save coordinates |
| <u>Cogo T/R/S - Translate</u> (See Section 11.7) Move a Feature to new coordinates. <ul style="list-style-type: none"> • Solve to move Feature • Store to save Feature coordinates | <u>Horizontal Curve</u> (See OnLine Manual) Define and place a Horizontal Curve. <ul style="list-style-type: none"> • Solve to generate curve and calculate defining points • Store to save curve and defining points |
| <u>Corner Angle</u> (See Section 11.8) | <u>3 Point Curve</u> (See OnLine Manual) |

| | |
|---|---|
| <p>Find the corner angle defined by 3 Points.</p> <ul style="list-style-type: none"> • Solution automatically calculated | <p>Define a Horizontal Curve using 3 known Points.</p> <ul style="list-style-type: none"> • Solve to generate curve, calculate segment and sector area • Store to store curve and PI, RP coordinates |
| <p><u>Multiple Points</u> (See Section 11.9)</p> <p>Define new Points at equal intervals between two known Points.</p> <ul style="list-style-type: none"> • Solve to calculate coordinates • Store to save coordinates | <p><u>Curve between Tangents</u> (See OnLine Manual)</p> <p>Determine the Curve between two Tangent lines.</p> <ul style="list-style-type: none"> • Solve to generate curve and defining points • Store to store curve and PI, PC, PT RP coordinates |

| | |
|--|--|
| <p><u>Direction Cut</u> (See Section 11.10)</p> <p>Determine the cut Points for a specific area by direction.</p> <ul style="list-style-type: none"> • Solve to calculate coordinates • Store to save coordinates | <p><u>Radius Point</u> (See OnLine Manual)</p> <p>Determine the Radius Point from a known PC, PT and radius.</p> <ul style="list-style-type: none"> • Solve to calculate Radius Point • Store to store Radius Point |
| <p><u>Hinge Cut</u> (See Section 11.11)</p> <p>Determine the cut Point for a specific area by a hinge Point.</p> <ul style="list-style-type: none"> • Solve to calculate coordinates • Store to save coordinates | <p><u>Vertical Curve</u> (See OnLine Manual)</p> <p>Define and place a Vertical Curve.</p> <ul style="list-style-type: none"> • Solve to calculate Vertical Curve solution • Print to print the curve solution |
| <p><u>Station Offset</u> (See OnLine Manual)</p> <p>Create Stakeout Points from a Line or Area Feature.</p> <ul style="list-style-type: none"> • Solve to calculate coordinates • Store to save coordinates | <p><u>Spiral Curve</u> (See OnLine Manual)</p> <p>Define and place a Spiral Curve.</p> <ul style="list-style-type: none"> • Store to calculate Spiral Curve solution • Print to print the curve solution |
| <p><u>Intersection</u> (See OnLine Manual)</p> <p>Create new Points based on Line intersections.</p> <ul style="list-style-type: none"> • Solve to calculate coordinates • Store to save coordinates | <p><u>Curve by Radius</u> (See OnLine Manual)</p> <p>Create curve based on known PI, direction of tangent lines and curve radius.</p> <ul style="list-style-type: none"> • Solve to calculate solution points • Store to save coordinates |
| <p><u>TRS Least Square Fit</u> (See OnLine Manual)</p> <p>“Fit” Features in one NEZ plane (Plane 1) to another NEZ Plane (Plane 2). One or more points in both Planes must be in the same</p> | <p><u>Earth Work</u> (Version 6.x only. See OnLine Manual)</p> <p>Define area sections and compute volumes based on cross-sections or borrow-pit areas.</p> |

| | |
|--|--|
| location. These points are the "Control Points". | |
|--|--|

11.2 Working with Cogo Functions

This sub-section covers the use of the Cogo View and the Cogo mouse. The COGO functions can be applied to the Feature data in your Job file or Map file. The functions are useful for making design drawings and creating stake Points that can be downloaded to the GPS data collector for use in stakeout work.

To define meaningful Point, Line and Area Features, please use the **Map/Coordinate System** function to verify or set the proper datum, coordinate system and units before starting COGO work. Also, check the settings under the **View/Configure** menu and the **Angle and COGO** option and make sure they are consistent with your units of measurement. The View/Configure page will also be used to set units for your angle measurements (see Section 11.3). It is advisable not to change the datum and coordinate system unnecessarily.

It is also advisable to set the proper map scale before starting a COGO design job. To do so, edit or type over the data in the "1 inch:" or "1 cm:" field in the Tool Bar. The currently active unit of length is displayed to the right of this field.

When using the COGO functions to create a curve based on given Point Feature(s), please keep in mind that the new curve (a Line Feature) is a separate entity from the Point Feature(s). Similarly, the Station Offset Points created on or alongside a Line Feature do not become part of the Line Feature. If you wish to treat the original and new Features as a group, such as for the COGO Scale, Rotate and Translate operations, you could store the newly created Feature under the same Topic name as the original Feature. You may then easily select all the Features under the same Topic for COGO Scale, Rotate or Translate by double-clicking the Topic name in the Topic View.

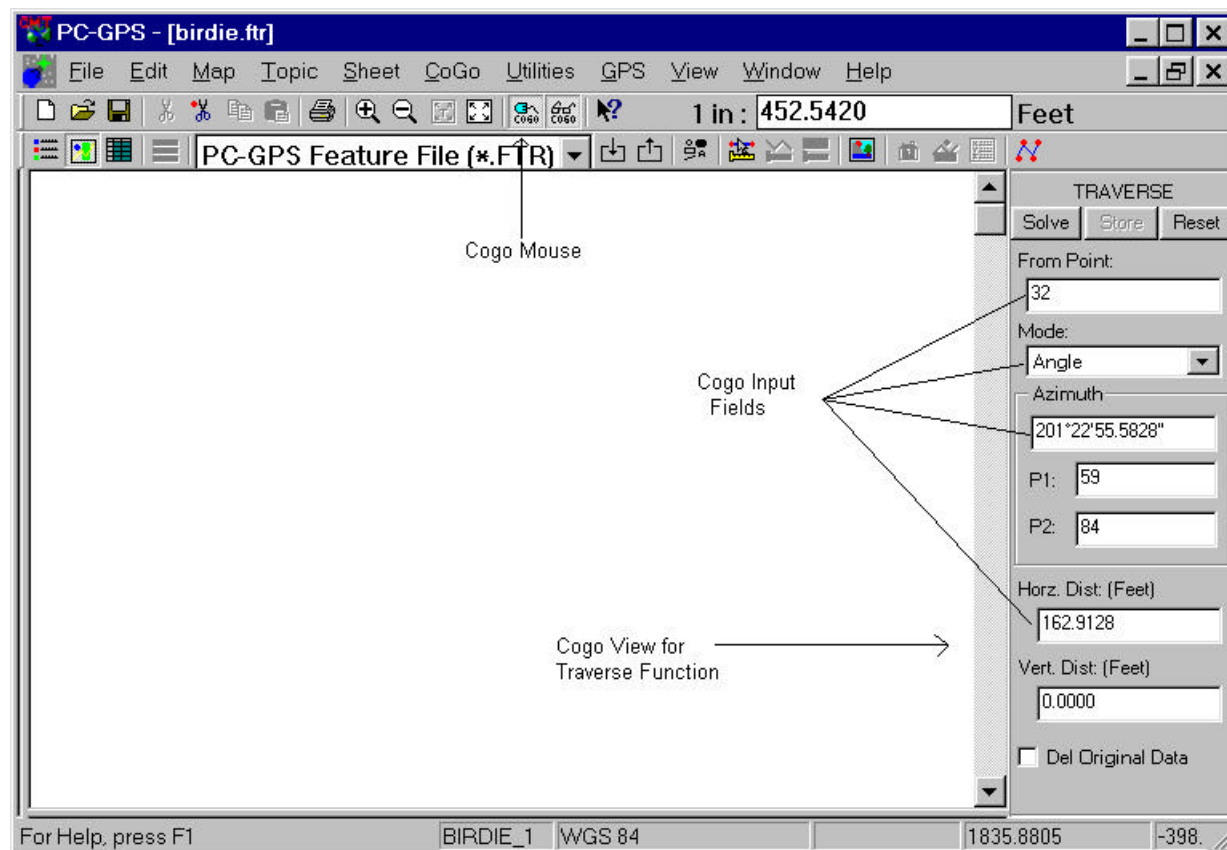
The new Features created by most of the COGO functions will be stored in a horizontal plane at 0 elevation. For example, when you select three Point Features to solve for a 3-Point Curve, only the (X,Y) coordinates of the three Points will be used in generating the curve and calculating the radius point and the point of intersection of the tangents. You may change the elevation of any Feature by editing the coordinates in the Feature Properties dialog.

However, a number of the COGO functions do make use of the elevation information. For example, the Traverse function lets you traverse in three dimensions. Also, you may translate or scale Features in three dimensions by using COGO Translate or COGO Scale, respectively. In addition, when you create a number of points at fixed intervals, the COGO Multiple Points function will store the new Points with the proper elevation values. And, of course, the COGO Vertical Curve function will create Points in a vertical plane at the specified interval.

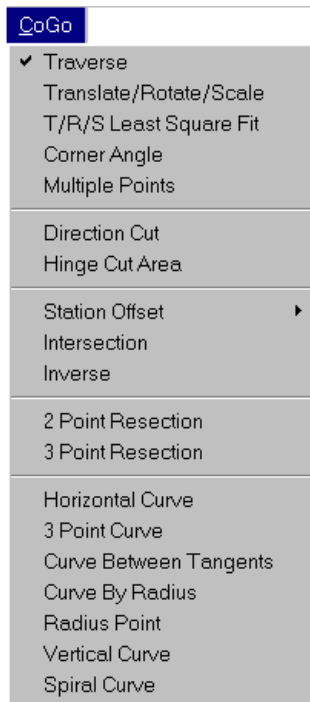
11.2.1 Cogo View

When you first select an option from the Cogo menu, the Cogo View will be displayed on the right-hand side of the screen. The active Cogo function will be listed at the top of the Cogo View.


The input and output fields displayed in the Cogo View vary according to the function selected. For example, when you select the **Cogo/Traverse** function, the “Cogo View” on the following page is displayed:




When the Cogo View is active for a function, a check mark will be displayed next to the associated Cogo menu option:



In this example, the Traverse function is selected. The Traverse option is marked with a check.

You can toggle **OFF** the Cogo View by un-marking the **View/Cogo View** menu option or clicking the Toggle Cogo View icon .

11.2.2 Cogo Mouse

When you select a function from the Cogo Menu, the Cogo Mouse is immediately made active. The Cogo Mouse icon, displayed on the tool bar, is displayed in light blue when the Cogo Mouse is active (or toggled ON). You can toggle the Cogo Mouse ON or OFF by clicking on the Cogo Mouse icon: .

The Cogo Mouse is used to select Features for Cogo functions. The Cogo Mouse is also used to indicate distance or direction for certain Cogo functions. To indicate distance, the Cogo Mouse activates the “Cogo Distance Circle”. To indicate direction, the Cogo Mouse activates the “Cogo Direction Line”. In this manual, the term **Cogo Mouse Field** is used to describe fields that accept input based upon the Cogo Mouse. When you place your mouse in a Cogo Mouse Field, the field will be highlighted in red.

The Cogo Mouse must be toggled ON in order for Cogo Mouse fields to accept mouse input. If the Cogo Mouse field will not accept mouse input, the Cogo Mouse probably is not toggled ON. Click on the Cogo Mouse icon on the tool bar to toggle it back ON.

When the Cogo Mouse is toggled ON, some of the standard PC-GPS mouse functions will not be accessible. You may notice that you cannot access the Feature Properties screen by double-clicking on a Feature if the Cogo Mouse is active.

Please note: Your mouse cursor will look the same regardless of whether the Cogo Mouse is toggled ON or toggled OFF. However, if the Cogo Mouse is active, your Cogo Mouse icon will be displayed in light blue. If the Cogo Mouse icon is not active, then the Cogo Mouse icon will be displayed in gray.

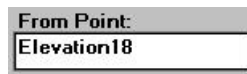
11.2.3 Selecting Data for Cogo Functions

The input fields in the Cogo View vary according to the selected Cogo function. Data can be entered in the Cogo input fields using several methods: by Cogo Mouse, by Keyboard, or by Pull-Down Menu.

Selecting Features using the Cogo Mouse:

All the Cogo functions have input fields for specific Feature numbers or Feature names. (Example: From Point field in Traverse function.) These fields are **Cogo Mouse Fields**.

To select a Feature for one of these fields, first click your mouse cursor in the input field (e.g. From Point field in Traverse function). The input field will be highlighted in red. Next, click your mouse on the Feature you wish to select. The Feature name will then be displayed in the input field.



If you would like to change the selection, you can either click on another Feature or simply type the Feature name in the input field.

Un-Selecting Features:

Selected Target Features may be “un-selected” by clicking the right-mouse button on the highlighted Feature in the Map View. Alternatively, you may right double-click on the Topic name in the Topic View. All of the Features in the Topic will be un-selected.

Multiple Feature Selection

For the **COGO Scale**, **Rotate** and **Translate** functions, you may select more than one Feature as the “Target”. This is particularly useful when you need to translate the entire Job to a correct reference point. It is also useful when you wish to move or scale a Line or Area Feature along with the Point Features from which it was created.

When you select a Target Feature for the COGO Scale, Rotate or Translate functions, it is added the “Target Features list”. When the Target Features field is highlighted, you may click on another Feature to add it to the list. Or, you may add all Features in a Topic to the list by double-clicking the corresponding Topic name in the Topic View. To work on all Features in the Job at the same time, simply click on **Edit/Select All**.

Please note: The Cogo Mouse must be active in order to select Features for Cogo functions by using the mouse.

An **Add** button is provided by the COGO Scale, Rotate and Translate functions to let you add a Feature to the Features list by entering its Feature ID into the Target Features field. To add a Feature, enter the Feature ID in the field above the Target Features list and then click on the Add button.

Selecting Angle Reference Points

Angle data for Cogo operations can be entered into the input fields using three different methods: **by reference points**, **by Cogo Direction Line** or **by keyboard**. For the reference point method, you select two reference points, called P1 and P2, from the Map. The azimuth between the P1 and P2 is the angle that will be automatically entered in the corresponding Azimuth or Angle field.

The **by Cogo Direction Line** and **by keyboard** methods are described in the next two sub-sections.

Using the Cogo Direction Line and Cogo Distance Circle

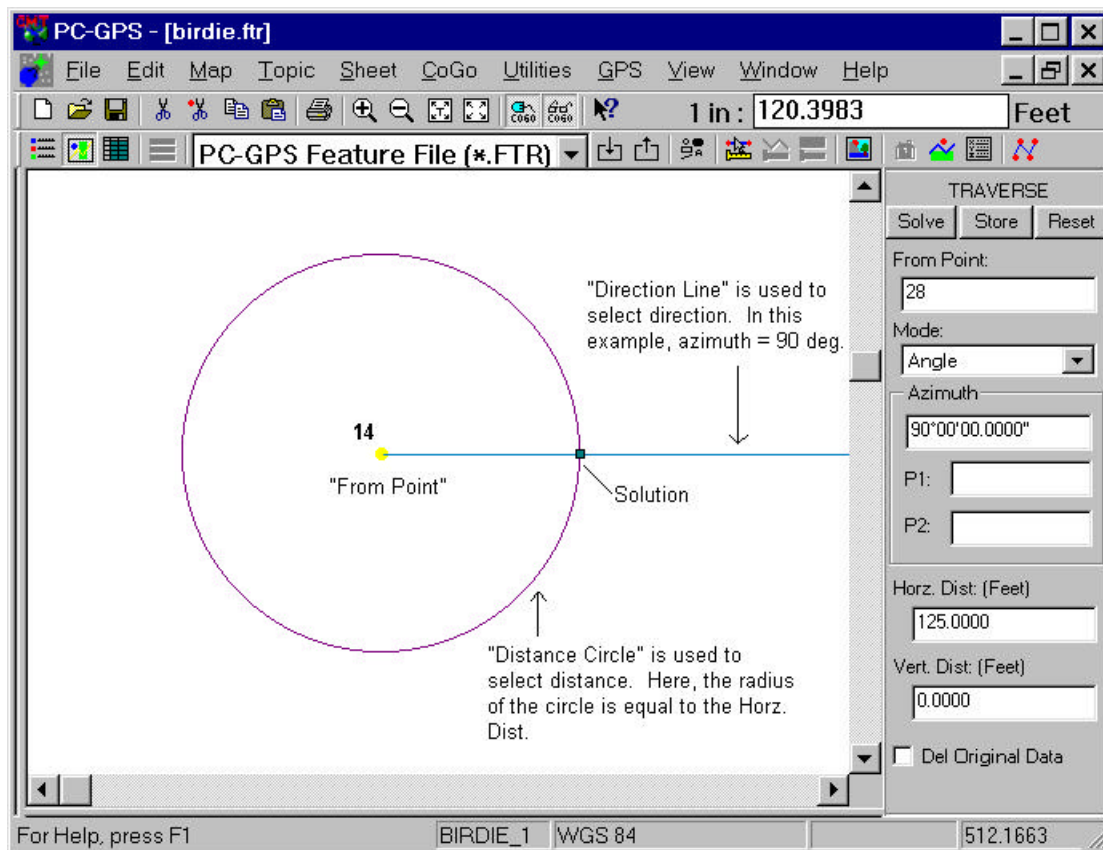
Many of the Cogo distance and direction fields accept input from the Cogo Mouse. When the Cogo Mouse is toggled ON, distance and azimuth can be quickly entered into these fields using the Cogo Direction Line and Cogo Distance Circle.

The Direction Line and Distance Circle are immediately displayed on the Map View when your cursor is placed in a Cogo Mouse direction or distance field. The direction or distance field will also be highlighted in red. (Not all distance and direction fields accept mouse input, so if the field is not highlighted in red, then you will need to enter the values via the keyboard.)

Please note: The Cogo Mouse must be toggled ON in order for the Distance Circle or Direction Line to become active.

Example using the Cogo/Traverse function

When you select the **Cogo/Traverse** function, the Direction Line is used to indicate the Azimuth and the Distance Circle is used to indicate the Horizontal Distance.



When you place the Cogo Mouse cursor in a direction field, like the Azimuth field shown above, the direction line will be displayed in the Map View. The value in the direction field corresponds to the current position of the direction line. When you move the direction line by dragging your mouse cursor across the Map View, you will notice that the direction value changes accordingly. When the value is correct, click your left-mouse button to “save” that direction value.

Please note: If you wish to enter a direction value using the keyboard, place your cursor in the field, double-click to highlight the field, then type-over the current value and immediately press the TAB key to save the new value.

When you place the Cogo Mouse cursor in a distance field, like Horizontal Distance field shown above, the distance circle will be displayed in the Map View. The value in the distance field corresponds with the radius of the distance circle. When you increase or decrease the size of the direction circle by moving your mouse, you will notice the distance value changes accordingly. When the value is correct, click your left-mouse button to “save” that direction value.

Please note: If you wish to enter a distance value using the keyboard, place your cursor in the field, double-click to highlight the field, then type-over the current value and immediately press the TAB key to save the new value.

Entering Data via the Keyboard

Some of the Cogo functions have input fields which require keyboard input.

(Example: Vertical Distance field in Traverse function)

To enter values into these fields, simply place your cursor in the associated field and then enter the appropriate number. To type over existing data, first double-click on the data field to highlight it, then key in the new value. Note: Keyboard-only input fields, like Vertical Distance, will not be highlighted in red when you place the mouse cursor in the field.

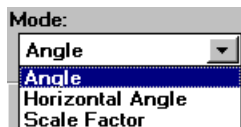
Entering Angle Data by Keyboard

Some COGO data input fields are for entering angle data. If the Angle Unit is set to D.M.S. in the View/Configure/Cogo dialog (Section 8.3), the angle data will be displayed with the degrees, minutes and seconds symbols such as in 90°15'25.2230". To change the displayed angle value, first double-click the data field to highlight it, then type over the existing data in the **dd-mm-ss.ssss** format. For example, to enter an azimuth of 90°15'25.2230" for the Traverse function, you would key in **90-15-25.2230**. To enter a bearing of N35°15'25.2230W", key in **N35-15-25.2230W**. Press the TAB key to save the data you just entered.

If you just wish to change a couple digits in the displayed data, you may place the mouse cursor next to those digits, use the Delete or Backspace key to clear them, then type in the new digits .

Using Cogo pull-down fields

Some of the Cogo functions have pull-down selection fields. (Example: Mode field in the Traverse function)



To enter data in the pull-down field, click the mouse on the down-arrow and then click on one of the options displayed. The selected option will be displayed in blue until you release the mouse cursor.

Moving between Cogo Input fields

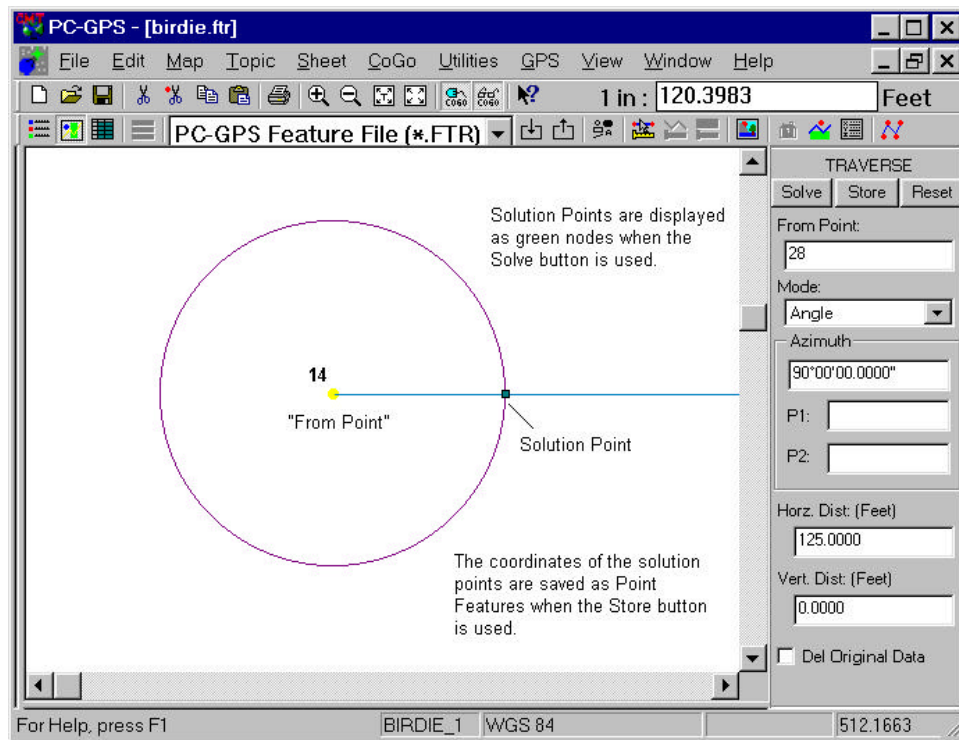
You can use either the TAB key or mouse cursor to move between fields.

Deleting Data in Cogo Input fields

To delete data in a Cogo Input field, place your cursor in the field, double-click to highlight the field and then use the delete key to erase the contents of the field.

11.2.4 Displaying the Solution

After you have entered all the required values for the Cogo Function you are using, click the “Solve” button in the Cogo View to calculate the solution.



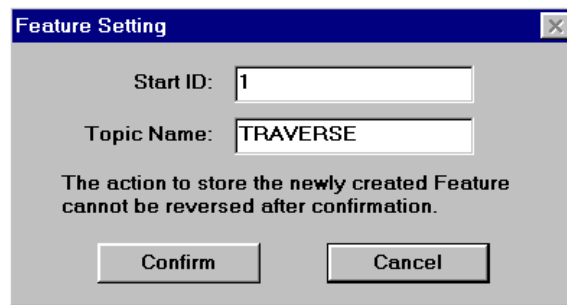
If the solution involves the creation of Points, then a green node will be displayed at the coordinate location of the new Point. The example above shows the Traverse function.

If the solution involves moving existing Points, the selected Points will be moved to the new location when you use the Solve button. (Example: Scale, Translate, and Rotate functions.)

The new locations will not be saved unless you click the “Store” button.

11.2.5 Storing new Coordinates

The “Store” button is used to save the coordinates of Points created by the Cogo functions. When you click the “Store” button, the Feature Setting dialog box will be displayed:



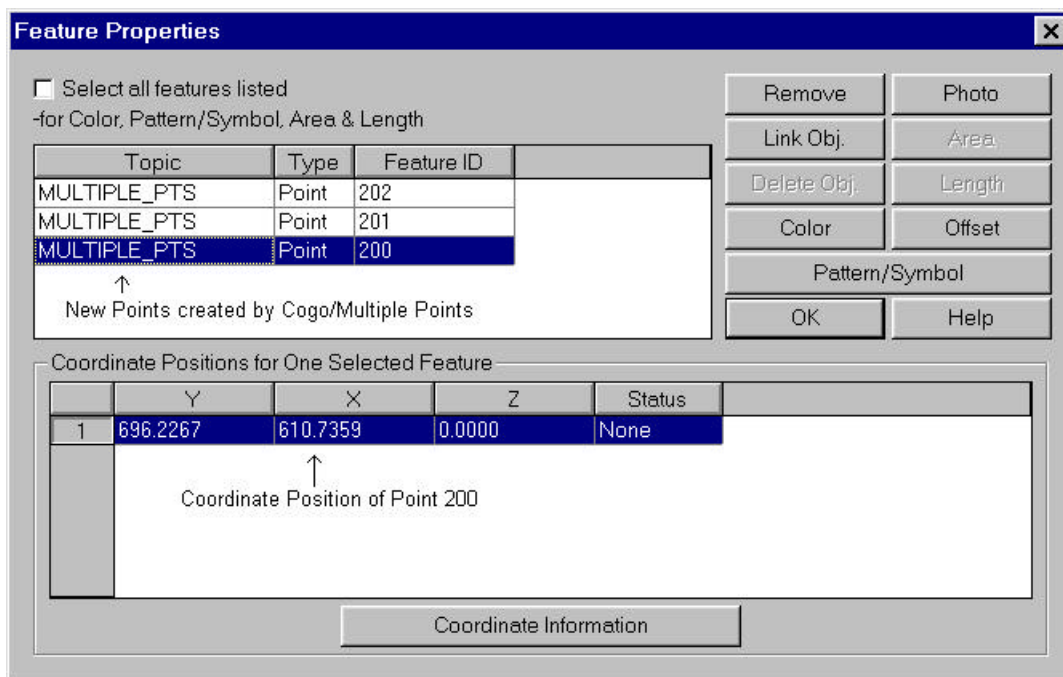
This dialog box is used to specify the **Start ID number** and **Topic** for the new Point.

The default **Topic** name corresponds to the Cogo function which was used to create the new Point. In the example shown above, the new Point was created by the TRAVERSE function, and therefore the default Topic name is TRAVERSE. If you wish to rename the Topic, you can type in another Topic name in the Topic Name field.

The **Start ID** number indicates the ID number or “Topic order number” for the Point. In the example above, the Point is the first point in the TRAVERSE Topic and therefore the default Start ID is 1. If you want to use another ID number, you can enter another number in the Start ID field. Note that the ID number must be unique.

After you have verified the Start ID and Topic name for the new Point(s), click on the OK button in the Feature Settings dialog box. The Point(s) will be stored and displayed on the Map View. In addition, the new Topic will be appended to the Topic View.

If the Cogo function has created more than one Point, the Feature Properties screen will be displayed immediately after you click on the Confirm button in the Feature Settings box.



Each new Point created is listed in the Feature Properties dialog. The Topic name is shown under the “Selected Shape” column. In this example, the Points were created by the **Cogo/Multiple Points**

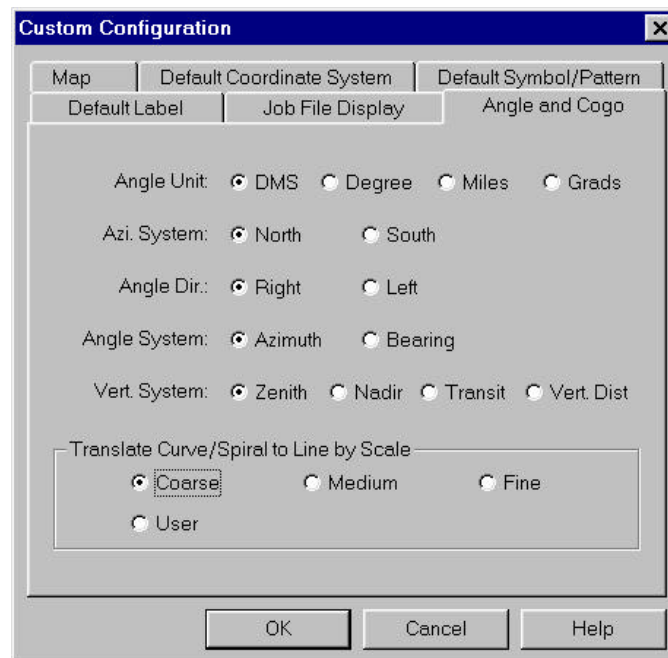
function and the Topic name is “Multiple Points”. The first Feature ID number corresponds to the Start ID number listed in the Feature Settings box.

When the Feature Properties dialog box is first displayed, the first Point listed will be highlighted in the Selected Shape/Type/Feature ID columns. The coordinates for the highlighted Point Feature are shown under the Latitude, Longitude and Elevation fields. To view the coordinates of another Point, simply click on the ID number listed in the Feature ID column.

To return to the Main PC-GPS screen, click on the **OK** button.

11.3 Cogo Configuration

The parameters for your Cogo functions can be set using the “Angle and Cogo” page of the **View/Configure** menu. When you select **View/Configure** and click on the Angle and Cogo tab, the following dialog box is displayed:



The default settings are shown in this example screen. To change any of these settings, click on the selection circle that corresponds to one of the other options and then click on the OK button. For example, to change the Angle Units from D.M.S. to Degrees (decimal degrees), click on the selection circle for Degree and then click on the OK button.

The options under **Translate Curve/Spiral to Line by Scale** are used to specify how your Curves and Spirals will be defined in PC-GPS. In PC-GPS, Curves and Spirals are stored as Line Features. The **Coarse**, **Medium**, **Fine** and **User** selections refer to the number of nodes which will be used in the Line Feature. The *Coarse* setting corresponds to the fewest number of nodes needed to represent the

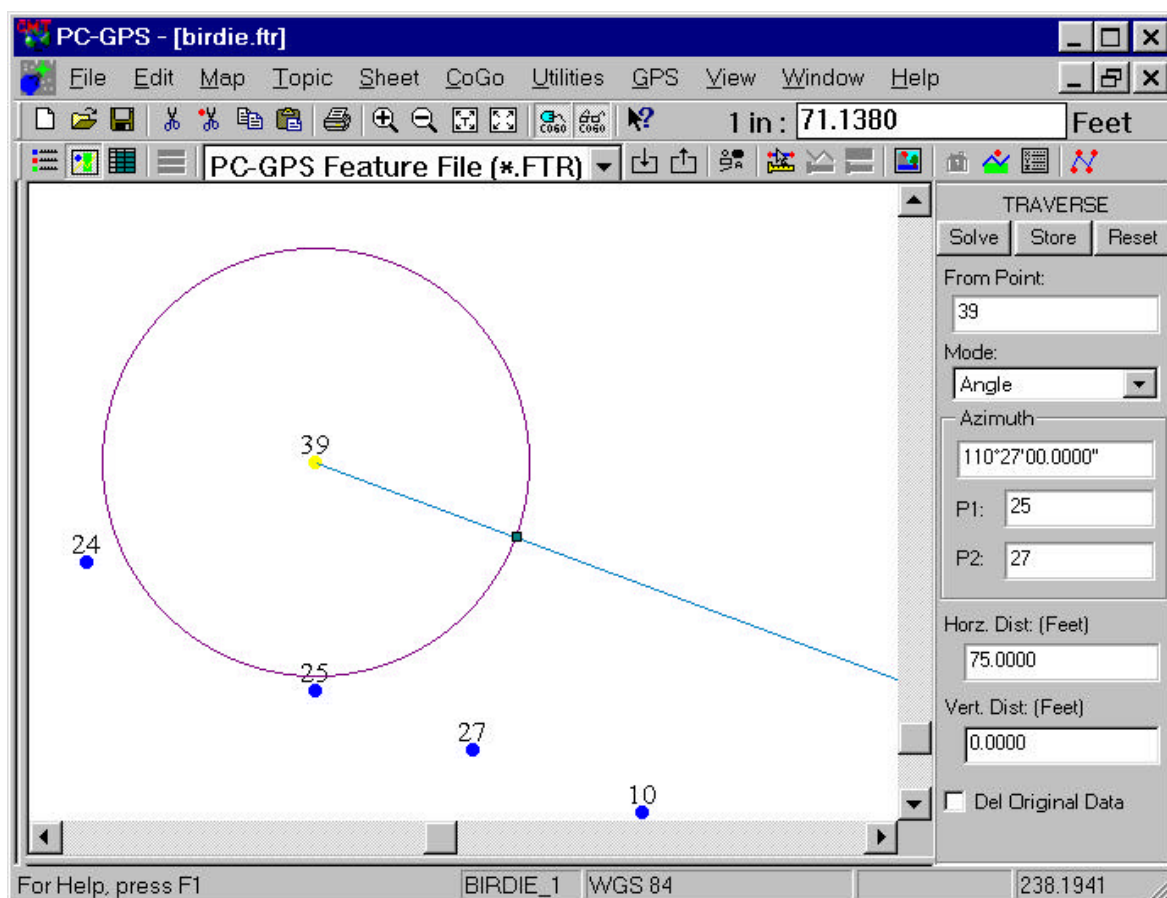
curve, while the *Fine* setting corresponds to a much larger number of nodes. **For example**, in a given curve, the Coarse setting may result in 40 nodes in the Line and the Fine setting might result in more than 1000 nodes in the Line. The *User* setting allows you to specify the interval between nodes. If your Map distance units are feet, an *User* interval of 1 would be equivalent to 1 node every foot along the Line.

Please set the desired scale before creating Cogo Line Features.

Please note: The Map distance units may be set using the Unit option under the **Map/Coordinate System** menu option.

11.4 Traverse Function

When you select the **Cogo/Traverse** function, a Cogo View similar to the example shown below is displayed:



Example of Traverse function using Angle mode

(Topic View & Sheet View are OFF and Points have been labeled using Topic/Autolabel.)

Summary The Traverse function is used to create a new Point based on direction and distance from a known point.

- **Solve** to calculate coordinates of new Point.
- **Store** to save coordinates of new Point.
- **Reset** to clear data fields.

Options: Under the “Mode” field there are three options: **Angle**, **Scale Factor**, and **Horizontal Angle**. It is a good idea to first select the mode you want to use before specifying values for the Cogo Input fields.

Angle mode is used to create a Point based on azimuth and distance from a Point. The Point is identified as the “From Point”. The azimuth between two reference points (“P1” and “P2”) is used for the azimuth of the traverse. The user needs to identify the From Point, P1, P2 and horizontal distance. (**Note:** If you do not want to use reference points to select azimuth, you may skip the P1, P2 fields. Instead, place your cursor in the Azimuth field and type-in the azimuth.)

Scale Factor mode is used to create a Point based on a scale factor between the “From Point” and to “To Point”. The user needs to specify the From Point, To Point, and Scale Factor. Scale with elevation selection is optional. The new Point will be created between the “From Point” and to “To Point” with the distance based upon the scale factor. For example, if the scale factor input is .5, then the new Point will be placed half way between the From Point and the To Point. **Note:** If you do not use the “scale with elevation” option, the solution point will maintain the elevation of the From Point.

Horizontal Angle is used to create a Point based on a distance and a horizontal angle. The horizontal angle is the angle formed by the line between the From Point and a Back Point AND the line between the From Point and the new traverse point. The user needs to specify From Point, Back Point, Horizontal Distance, and Horizontal Angle. Vertical Distance is optional.

Cogo **From Point:** Click Cogo Mouse on the Point Feature which is your From Point

Mouse **P1 and P2:** Click Cogo Mouse on the azimuth reference points.

Fields **Horizontal Distance or Scale:** Use Cogo Distance Circle to specify distance or scale.

To Point or Back Point: Click Cogo Mouse on the Point Feature to be To Point or Back Point.

Horizontal Angle: Use Cogo Direction Line to indicate angle.

Please note: For any of the Cogo Mouse fields, you may also enter the appropriate value by keyboard. After you enter the value, press the TAB key to move to the next field.

Steps for Traverse function using the Angle mode:

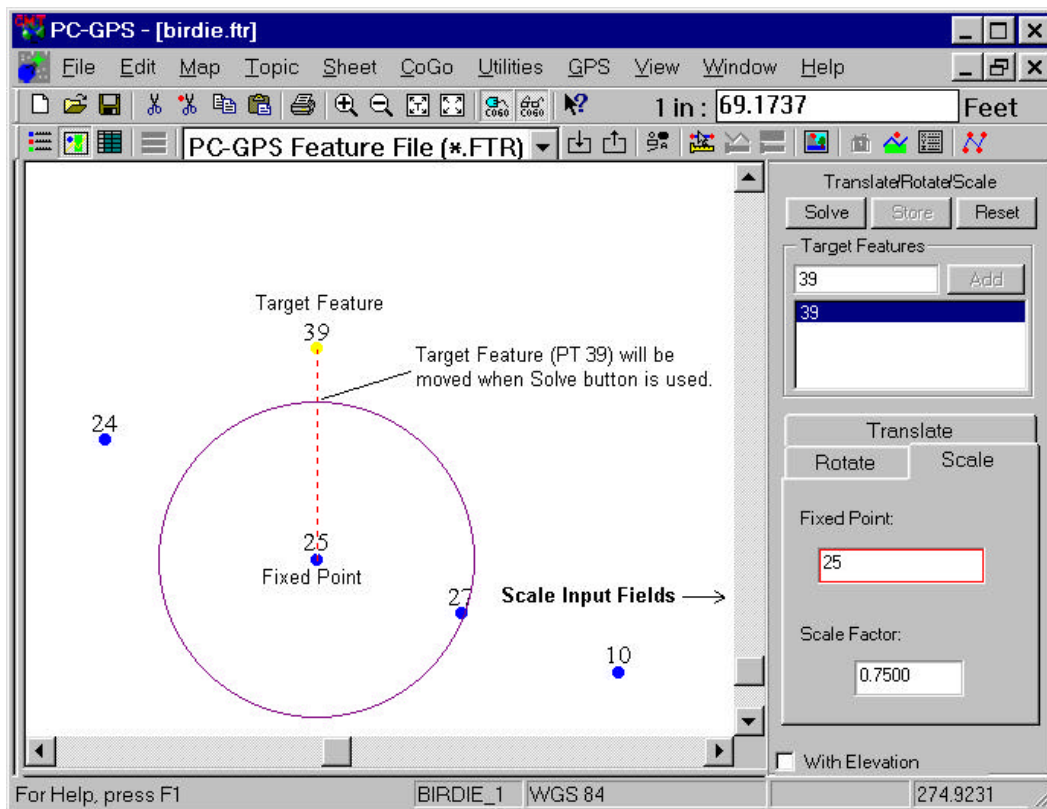
1. Select “Angle” in the Mode field.
2. Click your Cogo Mouse on the Point Feature which is your From Point.

3. Click the Cogo Mouse on the Point Feature which is the P1 reference point.
4. Click the Cogo Mouse on the Point Feature which is the P2 reference point. Remember that the azimuth between "P1" & "P2" will be used as the traverse azimuth from the "From Point".
5. Use the Distance Circle to select Horizontal Distance. Click the mouse to save the value.
6. (Optional) Enter a value for Vertical Distance.
7. Click on the **Solve** button. A green node will be placed at the solution location.
8. Click on the **Store** button to save a new Point at the solution location.
9. Verify the Start ID and the Topic name in the Feature Settings dialog and click on Confirm.

Results: A new Point will be placed at the solution location. This new Point will be assigned to the TRAVERSE topic.

11.5 Scale Function

When you use the **Cogo/Translate/Rotate/Scale** option, the Cogo View is displayed as follows. Note that separate input fields are provided for Translate, Rotate and Scale.



Example of Scale function

(Topic View & Sheet View are OFF and Points have been labeled using Topic/Autolabel.)

Summary The Scale function is used to move a Feature based on scale distance from a fixed Point.

- **Solve** to move selected Feature.
- **Store** to save the new coordinates of the Feature.
- **Reset** to clear the data fields.

Options: There is a mark-box option for **With Elevation**. Mark this option if you would like the scale to also apply to the elevation of the selected Feature.

Cogo Mouse Fields **Target Features:** Click the Cogo Mouse on the Point, Line or Area to be scaled. You may select multiple target Features for this function.

Fixed Point: Click the Cogo Mouse on the fixed reference Point Feature. The Fixed Point may not be the same as the first Point of the Feature in the Target Feature field.

Scale Factor: Use the Cogo Distance Circle to select the scale distance from the fixed Point. A scale greater than 1 will expand the scale Feature away from the fixed Point. A scale less than 1 will contract the scale Feature toward the fixed Point.

Steps for Scale function:

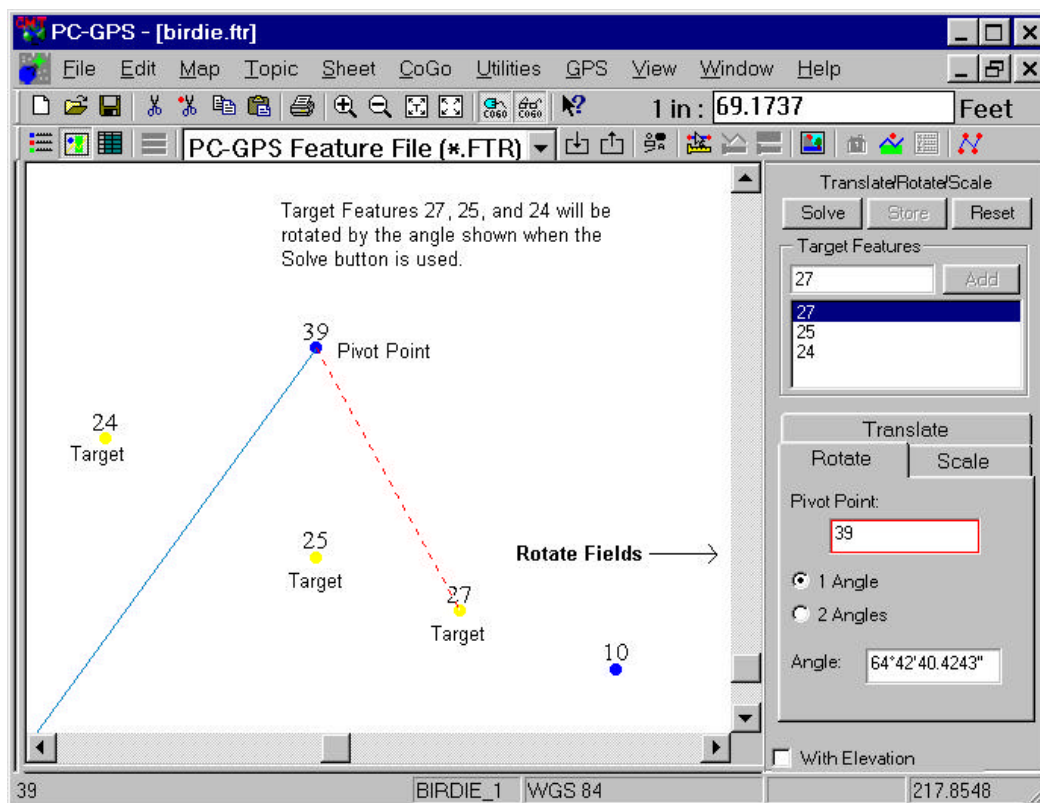
1. Click your Cogo Mouse on the Feature to be scaled (moved).
2. Place your cursor in the Scale Fixed Point field and then click your Cogo Mouse on the Point Feature which is the fixed reference Point.
3. Use the Cogo Distance Circle to indicate scale. Click the mouse button to save the value.
4. Click on the **Solve** button to display the new size of the scaled Feature.
5. Click on the **Store** button to save the new coordinates.

Please note: If you enter a Feature ID into the Target Features field via the keyboard, you must click on **Add** to append it to the list of selected Features.

If the new size/position of the scaled Feature(s) is not what you expect, you may click on the **Target Features** field to restore the display of the original data. If you wish to clear all data fields, simply click on **Reset**.

11.6 Rotate Function

When you use the **Cogo/Translate/Rotate/Scale** option, the Cogo View is displayed as follows. Note that separate input fields are provided for Translate, Rotate and Scale.



Example of Rotate function

(Topic View & Sheet View are OFF and Points have been labeled using Topic/Autolabel.)

- Summary** The Rotate function is used to rotate a Point, Line or Area Feature around a fixed Point
- **Solve** to rotate selected Feature.
 - **Store** to save the new coordinates of the Feature.
 - **Reset** to clear the data fields.

Options: There are two methods for the Rotate function - by **1 Angle** or by **2 Angles**.

1 Angle method is used to rotate a Point, Line or Area Feature by a given angle. The Rotate Feature is moved in relationship to a Pivot Point. The distance between the Rotate Point and the Pivot Point remains constant. The user needs to specify the Rotate Feature, Pivot Point and Rotate Angle.

2 Angles method is used to rotate a Point Feature using two reference Angles. The distance between the Rotate Point and the Pivot Point remains constant. The fields "Old" and "New" are displayed. The user needs to specify Rotate Feature, Pivot Feature, Old Angle and New Angle. The Feature will be rotated by an angle equal to the difference between the Old Angle and the New Angle. If the New Angle is greater than the Old Angle, then the Feature will be rotated clockwise.

Cogo Mouse Fields **Target Features:** Click the Cogo Mouse on the Feature to be rotated. You may select multiple target Features for this function.

Pivot Point: Click the Cogo Mouse on the Pivot Point. The Pivot Point must be a Point Feature. It cannot be a Node. The Pivot Point may not be the same as the first Point of the Feature in the Target Feature field.

Rotate Angle: Use the Cogo Direction Line to choose the rotation angle.

Old Angle: (Two Angles option) Use the Direction Line to choose the base angle.

New Angle: (Two Angles option) Use the Direction Line to choose a reference angle.

Please note: Suppose you are rotating an Area Feature along with the Point Features at the nodes of the Area Feature, and you wish to use the Point Feature at the first Node of the Area Feature as the Pivot Point. After selecting all Features to be rotated, place the Point Feature at the second Node of the Area Feature into the Target Features field, then select the Point Feature at the first Node of the Area Feature as the Pivot Point.

Steps for Rotate function using the Rotate Angle option:

1. Click your Cogo Mouse on the Feature(s) to be rotated. The Feature ID(s) will be shown in the Target Feature column.
2. Place your cursor in the Rotate Pivot Point field and then click your Cogo Mouse on the Point Feature which is the pivot point.
3. Use Cogo Direction Line to select the rotate angle. Click the mouse to save the angle.
4. Click on the **Solve** button to rotate the Feature.
5. Click on the **Store** button to save the new coordinates of the Feature.

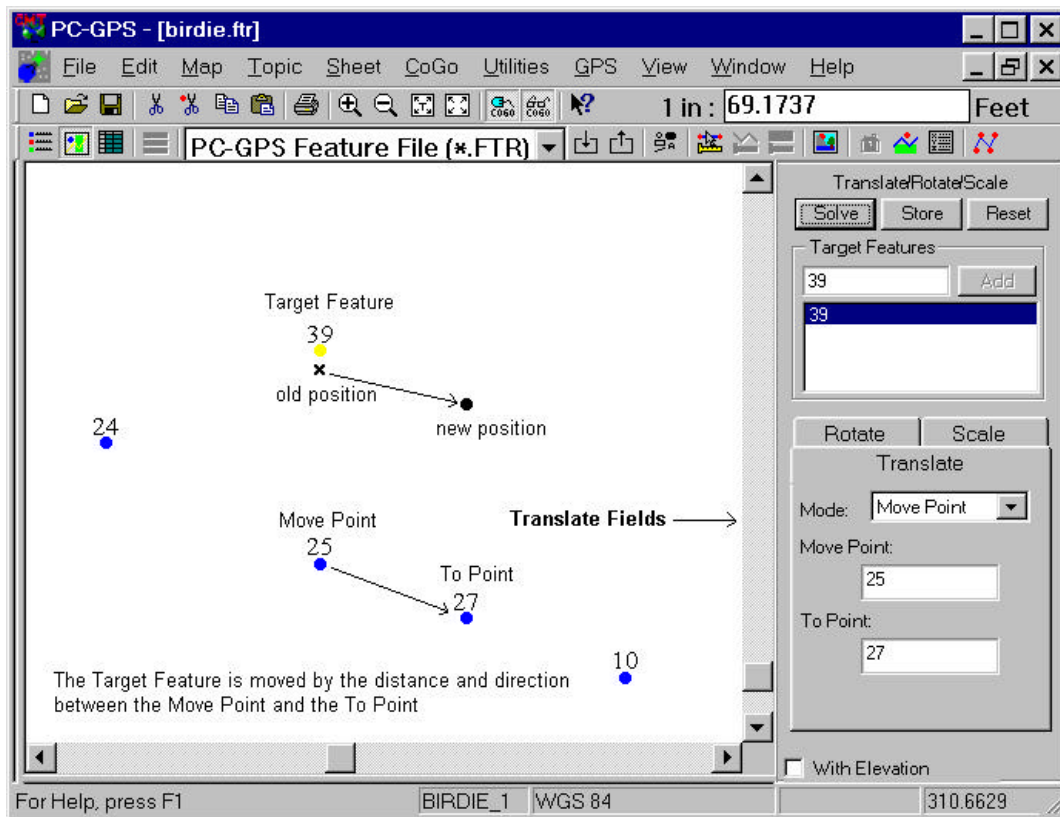
Result: The Rotate Point is rotated by the angle specified. The distance between the Rotate Point and Pivot point remains fixed.

Please note: If you enter a Feature ID into the Target Features field via the keyboard, you must click on **Add** to append it to the list of selected Features.

If the new position of the rotated Feature(s) is not what you expect, you may click on the **Target Features** field to restore the display of the original data. If you wish to clear all data fields, simply click on **Reset**.

11.7 Translate Function

When you use the **Cogo/Translate/Rotate/Scale** option, the Cogo View is displayed as follows. Note that separate input fields are provided for Translate, Rotate and Scale.



Example of Translate function using the Move Point option

(Topic View & Sheet View are OFF and Points have been labeled using Topic/Autolabel.)

Summary

The Translate function is used to move a Feature (Target Feature) a fixed distance in the X, Y, and Z direction. The user may specify the distance using relative or absolute values.

Note: The Target Feature may be a Point, Line or Area.

- **Solve** to move the Target Feature.
- **Store** to save the coordinates of the Feature.
- **Reset** to clear the data fields.

Options: There are three modes for this function - **Move Point**, **Adjust Point**, and **Coordinates**.

Move Point mode is used to move the Target Feature by relative distance and direction. The user needs to specify a Move Point and a To Point as well as a Target Feature. The distance and direction between the Move Point and the To Point determines the distance

and direction the Target Feature will be moved. In the example above, Point 39 (Target Feature) is moved by the distance and direction between Point 25 (Move Point) and Point 27 (To Point).

Please note: The Move Point and the To Point must be Point Features. They cannot be nodes.

Adjust Point mode is used to move the Target Feature a fixed distance in the X, Y, and Z directions. Easting, Northing and Elevation fields are displayed when this mode is selected. For these fields, the user needs to input the shift in each direction. For example, to move the Target Feature directly south by 200 feet, you would enter: Northing of -200, Easting of 0.000, and Elevation of 0.000.

Coordinates mode is used to move the Move Feature to an exact coordinate location. The fields of Northing, Easting, and Elevation will be displayed when the coordinates option is selected. The user needs to enter an exact coordinate location for the Target Feature in these fields.

Cogo **Target Features:** Click the Cogo Mouse on the Feature to be moved. You may select multiple target Features for this function.

Mouse **Move Point:** Click the Cogo Mouse on the first point for the relative distance/direction indication. With the Move Point option, the Target Feature will be moved the distance and direction between Move Point and To Point. With the Coordinate Option, the Move Point is moved to the coordinate location entered in the East, North & Elev fields.

Fields

To Point: Click the Cogo Mouse on the second point for the relative distance/direction indication. Target Feature will be moved the distance and direction between the Move Point and the To Point. (Move Point option)

Steps for the Translate function using the Move Point mode:

1. Click on the Target Feature(s). The Feature ID(s) will be shown in the Target Feature field.
2. Select "Move Point" from the mode pull-down field.
3. Place your cursor in the Move Point field and then click the Cogo Mouse on the point which represents the Move Point. The Feature ID will be displayed in the Move Point field.
4. Click the Cogo Mouse on the point which represents the To Point. The Feature ID will be displayed in the To Point field. Remember, the Target Feature(s) will be moved by the distance and direction between the From Point and the To Point.
5. Click on the **Solve** button to view the solution location.
6. Click the **Store** button to move the Target Feature(s) to the new coordinate location.

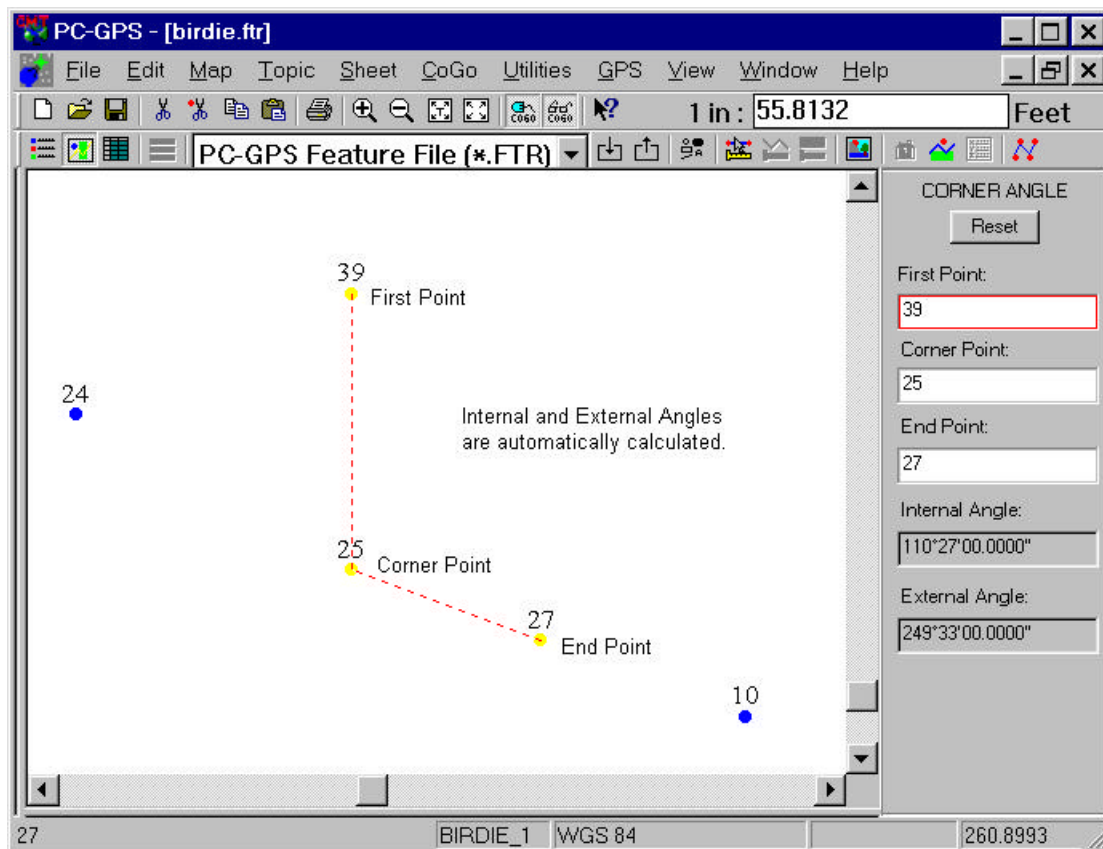
Please note: If you enter a Feature ID into the Target Features field via the keyboard, you must click on **Add** to append it to the list of selected Features.

If the new position of the moved Feature(s) is not what you expect, you may click on the **Target Features** field to restore the display of the original data. If you wish to clear all data fields, simply click on **Reset**.

After you have stored the new target location, you may return the Target Feature to the original location by reversing the From Point and the To Point.

11.8 Corner Angle Function

When you select the **Cogo/Corner Angle** function, a Cogo View similar to the example shown below is displayed:



Example of Corner Angle function

(Topic View & Sheet View are OFF and Points have been labeled using Topic/Autolabel.)

- | | |
|----------------|---|
| Summary | <p>The Corner Angle function is used to calculate the angle defined by 3 points.</p> <ul style="list-style-type: none">• Angle is calculated when First Point, Corner Point and End Point are identified.• Reset to clear the data fields. |
|----------------|---|

Cogo **First Point:** Click your Cogo Mouse on the Point which represents the first point.

Mouse **Corner Point:** Click your Cogo Mouse on the Point which represents the corner point.

Fields **End Point:** Click your Cogo Mouse on the Point which represents the end point.

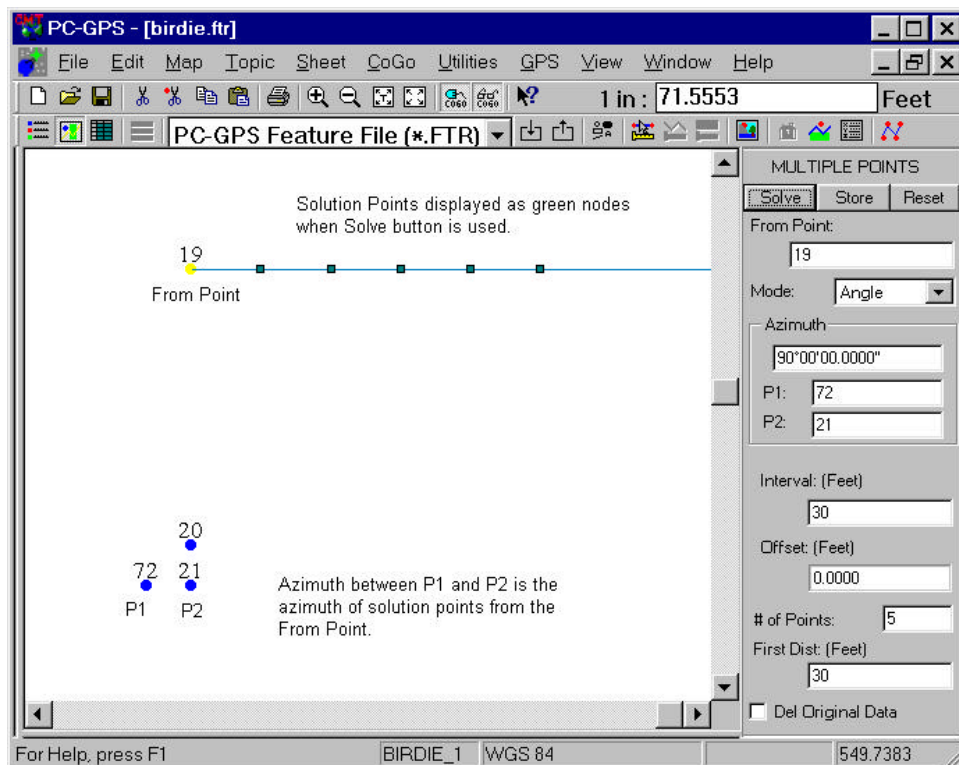
Steps for Corner Angle function

1. Identify the First Point by clicking on the Point with your mouse cursor.
2. Identify the Corner Point by clicking on the Point with the mouse cursor.
3. Identify the End Point by clicking on the Point with the mouse cursor.

Result: The angle formed by the three Points will be automatically calculated and displayed in the Corner Angle field.

11.9 Multiple Points Function

The data input panel for **Cogo/Multiple Points** looks like the following:



Example of Multiple Points function

(Topic View & Sheet View are OFF and Points have been labeled using Topic/Autolabel.)

Summary

The Multiple Points function is used determine the coordinates of a number of Points which lie on a line extending from an existing point. The **Number of Points** and/or the **Spacing** can be set by the user.

- **Solve** to calculate coordinates of multiple points.
- **Store** to save coordinates of the new Points.
- **Reset** to clear the data fields.

Options: There are two modes for the Multiple Point function - **To Point** mode and **Angle** mode. There are also options for Number of Points, Interval, Spacing, Offset, First Distance and Vertical Distance Spacing. Options vary by the mode selected.

To Point mode is used to determine the coordinates of points which lie between two existing points. The user must specify the "From Point" and the "To Point". Points can be created using either the Number Points option or the Interval option. If the number of Points is set by the user, PC-GPS will calculate the corresponding distance interval. If the distance interval is set by the user, PC-GPS will calculate the corresponding number of Points.

Angle mode is used to determine the coordinates of points which lie on a line extending from one known point. The azimuth of the line is determined by the azimuth between two reference points - P1 and P2. (Note: If you do not want to use reference points to select azimuth, you may skip the P1, P2 fields. Instead, place your cursor in the Azimuth field and move the Cogo Direction line to find azimuth.)

Number of Points: Enter the number of Points to be created. (Note: If you are using the To Point mode and you specify a horizontal or vertical interval, then the Number of Points field will show the calculated number of Points.)

Horizontal Dist. Spacing or Interval : Enter the horizontal interval between Points.

(Note: If you are using the To Point mode and you specify a number of Points, then the Horizontal Dist. Spacing field will display spacing after you click on Solve.)

Vertical Dist. Spacing: Enter the vertical interval between the new Points.

(Note: If you are using the To Point mode and you specify a number of Points, then the Vertical Dist. Spacing field will display spacing after you click on Solve.)

Offset: Enter an offset distance if you would like the Points to be offset from the "From Point". (Note: When the cursor is in the Offset field, the azimuth line from the "From Point" can be moved up/down or right/left to select the offset.)

First Distance: Enter the distance between the From Point and the first new Point.

Cogo **From Point:** Click your Cogo Mouse on the Point which represents the From Point.

Mouse **To Point:** Click your Cogo Mouse on the Point which represents the To Point.

Fields **P1 and P2:** Click Cogo Mouse on the azimuth reference points.

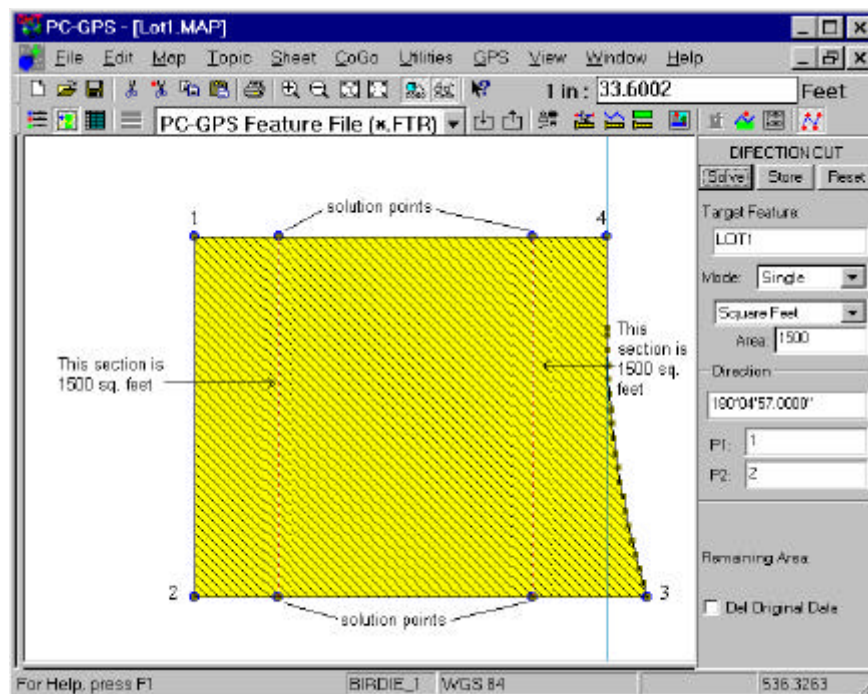
Steps for Multiple Points function using Angle mode: (P1 and P2 as reference points)

1. Select "Angle" from the Mode field.
2. Place the cursor in the From Point field and then click the Cogo Mouse on the From Point.
3. Click the Cogo Mouse on the Point that represents P1.
4. Click the Cogo Mouse on the Point that represents P2.
5. In the Interval field, enter the horizontal distance between the new points.
6. In the # of Points field, enter the number of new points to be created.
7. Enter the spacing between the first point and the From Point in the First Distance field.
8. Click on the **Solve** button. The solution Points will be displayed as green nodes.
9. Click on the **Store** button to save the new Points.
10. Verify the Start ID and the Topic Name in the Feature Settings dialog and click on Confirm.
11. The Feature Properties dialog box will show the coordinate locations of the new Points. Click on the OK button to return to the main PC-GPS screen.

Result: The new Points will be displayed on the Map View. The Points are assigned to the Multiple Points Topic.

11.10 Direction Cut Function

When you select **Cogo/Direction Cut**, the following Cogo View will be displayed:



Example of Direction Cut function (Single Mode)

(Topic View & Sheet View are OFF and Points have been labeled using Topic/Autolabel. LOT1 is the Area Feature)

Summary

The Direction Cut function is used to calculate solution Points which define lines to cut out a specified area from an Area Feature. The solution Points lie on the perimeter of the Area.

- **Solve** to calculate coordinates of solution Points.
- **Store** to save coordinates of the Points.
- **Reset** to clear the data fields.

Options: There are two **modes** for the Direction Cut function: **single** mode and **multiple** mode. Single mode is used to cut a section of a specified size from an Area Feature. Single mode yields two solutions. Multiple mode is used to evenly divide an Area Feature into two or more sections of a specified size. The remaining area is calculated and shown in the Cogo View. The user may specify remaining area to be on either Side 1 or Side 2.

Area: The pull-down field for Area lists Sq. Feet, Sq. Meters, Acres, and Hectares.

Direction: The direction of the cut is based on the azimuth between two reference points - P1 and P2. (Note: If you do not want to use reference points to select azimuth, you may skip the P1, P2 fields. Instead, place your cursor in the Azimuth field and enter the direction of the cut using the keyboard.)

Cogo

Mouse **Target Feature:** Click on the Area Feature you want to Cut. The Feature ID will be displayed in the Target Feature field.

Fields

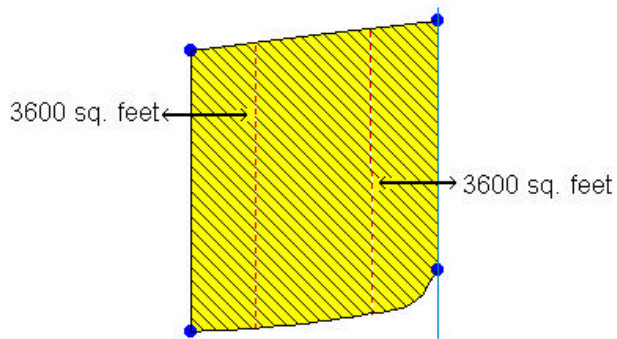
Steps for Direction Cut function (Single Mode): (P1 and P2 as azimuth reference points.)

1. Choose the Cut units using the Area pull-down field.
2. Enter a Cut value in the Area field. (e.g. 1500)
3. Place your cursor in the Target Feature field and click on the Area Feature you want to Cut. The Feature ID will be displayed in the Target Feature field.
4. Click on the Point that represents P1.
5. Click on the Point that represents P2. (Remember, the azimuth between P1 and P2 is the direction of the cut.)
6. Click on the **Solve** button. Two dashed lines will be drawn over the Area Feature. The intersections between the dashed lines and the perimeter of the Area Feature represent the solution Points.
7. Click on the **Store** button to save the new Points.
8. Verify the Start ID and the Topic Name in the Feature Settings dialog and click on Confirm.
9. The Feature Properties dialog box will show the coordinate locations of the new Points. Click on the OK button to return to the main PC-GPS screen.

Result: The four solution points will be displayed on the Map View. The Points are assigned to the Direction Cut Topic. If you want to create an Area Feature using these solution points, you may use the **Utilities/Join/Join Lines/Points** option.

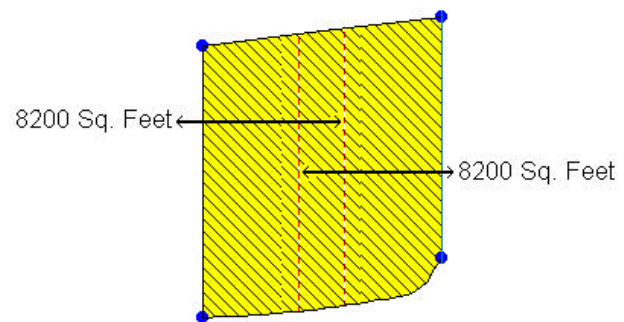
Please note: The following diagrams illustrate the case, in single mode, when the Cut value is less than half of the total area and the case when the Cut value is greater than half of the total area.

Cut value is less than half of total area:



Area Feature is 13800 square feet. Cut value is 3600 square feet.

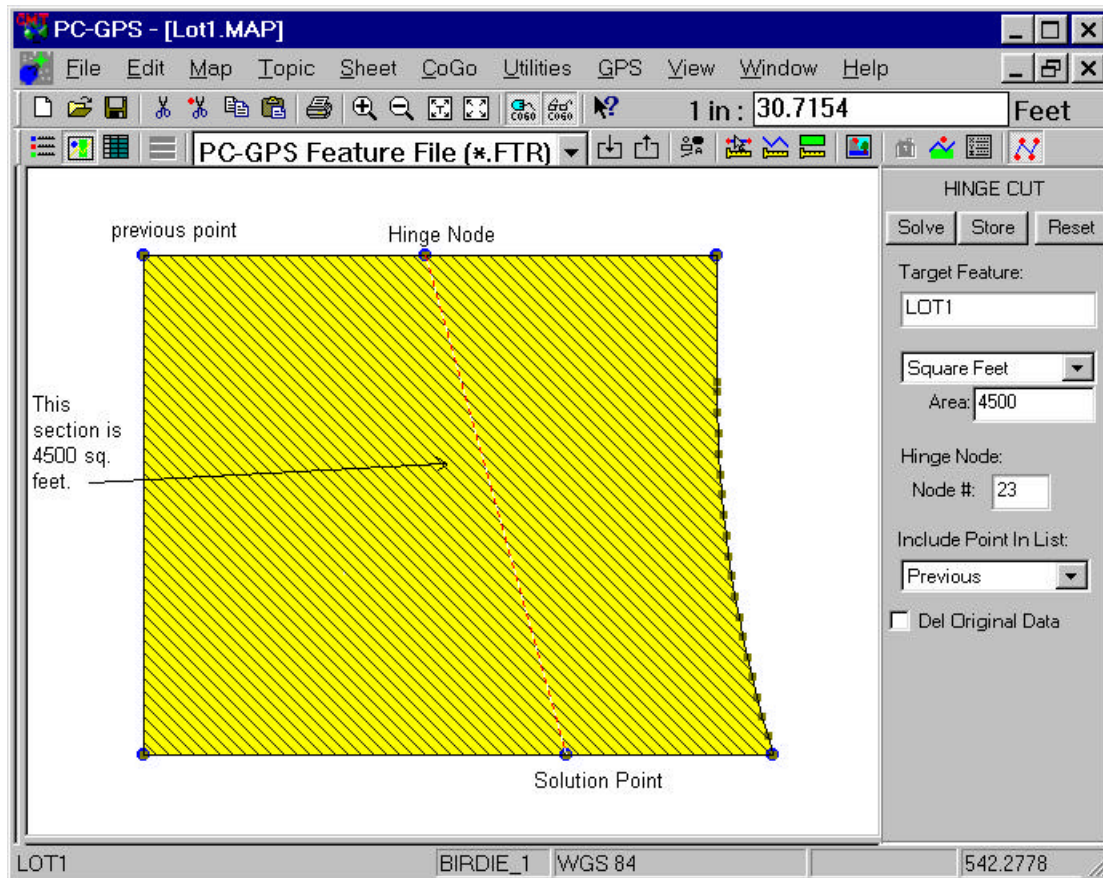
Cut value is more than half of total area:



Area Feature is 13800 square feet. Cut value is 8200 square feet.

11.11 Hinge Cut Area Function

When you select the **Cogo/Hinge Cut Area** function, the following Cogo View will be displayed:



Example of Hinge Cut Area function

(Topic View & Sheet View are OFF and Points have been labeled using Topic/Autolabel. LOT1 is the Area Feature)

- Summary** The Hinge Cut Area function is used to calculate a new Point that forms a line to cut out a specified area from an Area Feature. A hinge node is specified as the beginning point for the line. The hinge node is a node in the Area.
- **Solve** to calculate coordinates of solution Point.
 - **Store** to save coordinates of the new Point.

Options: There are options for **Area** and **Include Point**.

Area: The pull-down field for Area lists Sq. Feet, Sq. Meters, Acres, and Hectares. Choose the unit you wish to use for the Hinge Cut measurement.

Include Point in List: Choose either Previous or Next. Previous means that the node preceding the "Hinge Node #" will be included in the solution area. Next means that the node following the "Hinge Node #" will be included in the solution area.

Cogo **Target Feature:** Click on the Area Feature you want to Cut. The Feature ID will be displayed in the Target Feature field.

Mouse

Fields **Hinge Node:** Click on the node (in the Area Feature) which represents the hinge point for your Cut. Note: You can also enter the node number via the keyboard.

Steps for Hinge Cut function:

1. Choose the Cut units using the Area pull-down field. (The options are Sq. Meters, Sq. Feet, Acres, Hectares)
2. Enter a Cut value in the Area field. (e.g. 4500)
3. Place your cursor in the Target Feature field and click on the Area Feature you want to Cut. The Feature ID will be displayed in the Target Feature field.
4. Click on a node which represents your Hinge point (beginning point of the cut line). The node number will be displayed in the Hinge node field. (You may also enter the node number via the keyboard.)
5. From the Include Point in List field, select either Previous or Next.
6. Click on the **Solve** button. A dashed line will be drawn across the Area from the Hinge Point to the solution point. (The intersection between the dashed line and the perimeter of the Area Feature is the solution Point.)
7. Click on the **Store** button to save the new Point.
8. Verify the Start ID and the Topic Name in the Feature Settings dialog and click on Confirm.
9. The Feature Properties dialog box will show the coordinate locations of the new Points. Click on the OK button to return to the main PC-GPS screen.

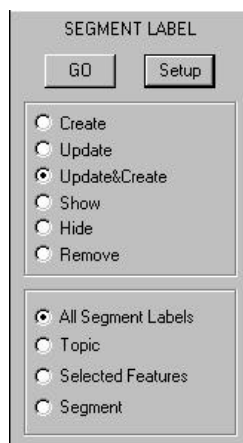
Result: The solution point will be displayed on the Map View. The Point will be assigned to the HINGE CUT Topic. If you want to create an Area Feature using this solution point, you may use the Join Lines/Points option under the Utilities/Join function.

Section 12 - Map Labels

The Map/Labels function is used to label and customize the appearance of Markers and other labels in your Job based on user-specified preferences. This section is applicable to CMT Survey only.

12.1 Segment Label

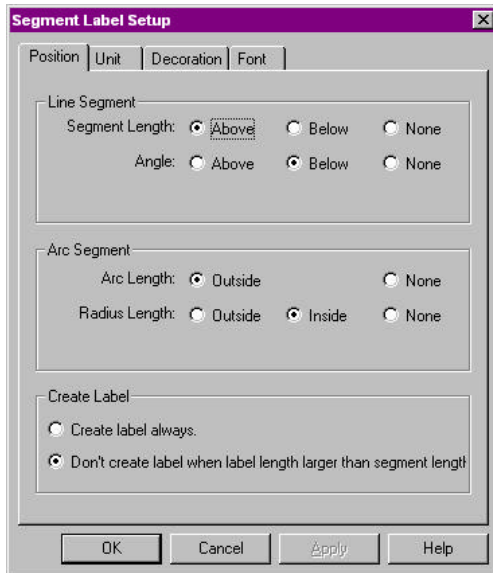
The Segment Label function is used to label any line segments in your map with length and directional information. These labels can be customized in a variety of ways. When you click on Map/Label/Segment Label, the following dialog is displayed to the right of the Map View. This is called the Label View :



Click on the **Setup** button to access the Setup menu. There are four options available in the Segment Label Setup dialog. Each option is discussed in the following sub-sections:

Position:

Click on the **Position** tab at the top of the screen to access the Position setup window. The Position dialog window will be used to define the location of the text label with respect to its corresponding line segment or arc segment. The Position setup dialog is displayed as follows:



Line Segment Length: Specify the position of the text label for segment length. Options are: Above (the segment), Below (the segment) or none (no label for segment length).

Line Segment Angle: Specify the position of the text label for the line segment angle.

Arc Segment, Arc Length: Choose to label arc lengths outside the arc or not at all.

Arc Segment, Radius Length: Choose to label arc segment radius lengths inside or outside the arc segment, or not at all.

If outside is specified for both arc length and radius length, a new option will appear asking you to pick which label will appear first: Arc Length or Radius Length.

Create Label: Choose to always create label or choose to only create the label when the label length does not exceed the length of the segment.

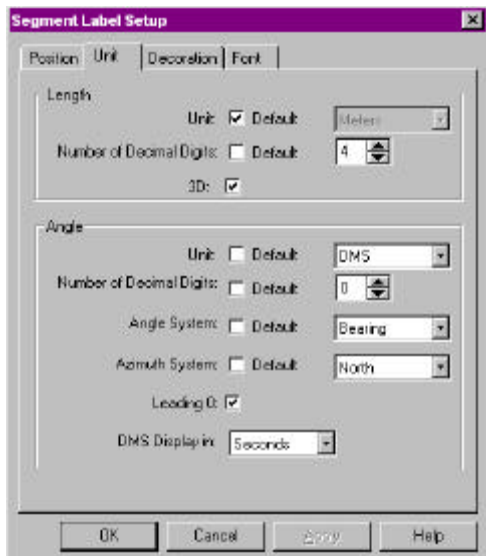
Choose **OK** to accept these settings and return to the Label View or **Cancel** to abort these changes and return to the Label View screen.

Please note: If the position of the label is the same for segment length and angle in line segments or arc length and radius length for arc segments (e.g. “above” and “above” for both segment length and angle), then a new option will appear underneath prompting you to specify which label will appear first.

Also note: If any changes are made, when both labels are in the same position, then you must choose the “Create” option to make the changes. The “Update & Create” or “Update” options will not work in this case.

Unit:

The Unit Setup dialog is used to define units of measurement, decimal precision and other display settings for length and angle labels. After clicking on the Unit tab, the following dialog is displayed:



Length, Unit: Mark the default check box if you want to use the global length measurement units specified in your Job. To use a different unit of measure, uncheck the Default box and choose from the available options: Meters, Feet (Int'l), KM, Miles and US Feet.

Length, Number of Decimal Digits: Specify the number of decimal digits to be used for length labels. To stay consistent with the global settings of your Job, check the Default box.

Length, 3D: Choose to label slope distance.

Angle, Unit: Mark the default check box if you want to use the global angle measurement units specified in your Job. To use a different unit of measure, uncheck the Default box and choose from the available options: DMS, Degree, Mils, or Grads.

Angle, Number of Decimal Digits: Specify the number of decimal digits to be used for angle labels. To stay consistent with the global settings of your Job, check the Default box.

Angle, Angle System: Specify the angle system to be used for angle labels.

Angle, Azimuth System: Choose between North and South for the azimuth system to be used for angle labels.

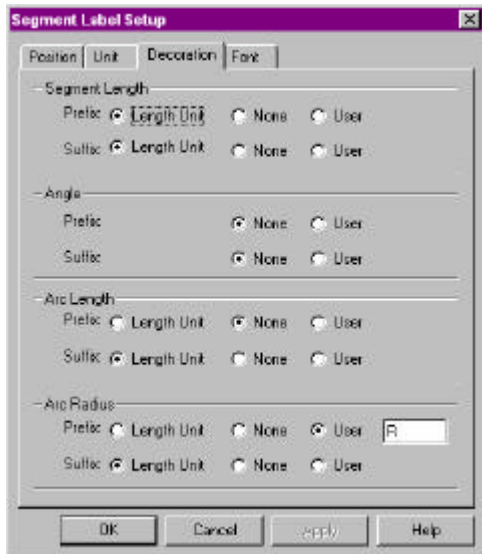
Angle, Leading 0: Choose to display angle measurements with a "0" in front of the measurement or not.

Angle, DMS Display in: Choose from available options to display DMS in: Degrees, Minutes or Seconds

Choose **OK** to save your settings and return to the Segment Label frame or choose **Cancel** to abort changes.

Decoration:

The Decoration Setup dialog is used to define all prefixes and suffixes for segments, angles and arcs (both radii and lengths). Choose from pre-defined prefixes and suffixes or enter your own. After clicking on the Decoration tab, the following dialog is displayed:



Segment Length, Prefix/Suffix: If a prefix or suffix is desired, choose to use the current unit of measurement or choose “User” to specify your own (limit of 5 characters). Choose “None” for no prefix or suffix.

Angle, Prefix/Suffix: If a prefix or suffix is desired, choose “User” to specify your own (limit of 5 characters). Choose “None” for no prefix or suffix.

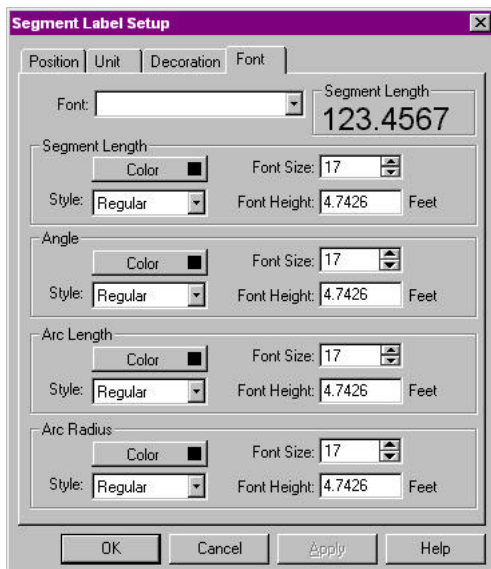
Arc Length, Prefix/Suffix: If a prefix or suffix is desired, choose to use the current unit of measurement or choose “User” to specify your own (limit of 5 characters). Choose “None” for no prefix or suffix.

Arc Radius, Prefix/Suffix: If a prefix or suffix is desired, choose to use the current unit of measurement or choose “User” to specify your own (limit of 5 characters). Choose “None” for no prefix or suffix.

Choose **OK** to save your settings and return to the Segment Label frame or choose **Cancel** to abort changes.

Font:

The Font Setup dialog is used to define all font types, sizes/heights, styles and colors for segments, angles and arcs (both radii and lengths). After clicking on the Font tab, the following dialog is displayed:



Font: Choose the desired font type from the pull-down menu.

Segment Length, Color: Click on the Color button to specify a color.

Segment Length, Style: Click on the pull-down menu to choose from one of the available font styles: Regular, *Italic*, **Bold**, or **Bold Italic**.

Segment Length, Font Size/Height: Specify a font size or height.

Angle, Color: Click on the Color button to specify a color.

Angle, Style: Click on the pull-down menu to choose from one of the available font styles: Regular, *Italic*, **Bold**, or **Bold Italic**.

Angle, Font Size/Height: Specify a font size or height.

Arc Length, Color: Click on the Color button to specify a color.

Arc Length, Style: Click on the pull-down menu to

choose from one of the available font styles: Regular, *Italic*, **Bold**, or **Bold Italic**.

Arc Length, Font Size/Height: Specify a font size or height.

Arc Radius, Color: Click on the Color button to specify a color.

Arc Radius, Style: Click on the pull-down menu to choose from one of the available font styles: Regular, *Italic*, **Bold**, or **Bold Italic**.

Arc Radius, Font Size/Height: Specify a font size or height.

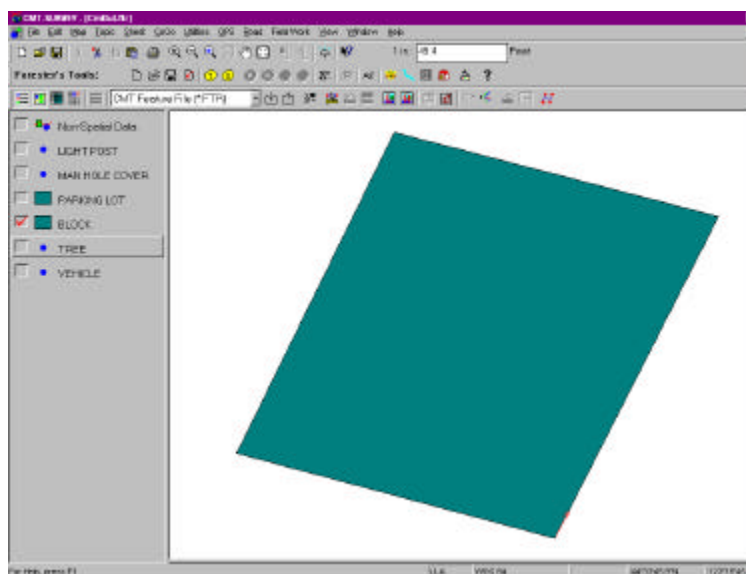
Choose **OK** to save your settings and return to the Segment Label frame or choose **Cancel** to abort changes.

Once you have defined all of the setup parameters for segment labeling, you are now ready to label your data.

Example:

For this example, we will use the CMTTUT.FTR file included with CMT-SURVEY. Open the file, CMTTUT.FTR in the Survey65 folder.

After the file has been opened, turn off all topics except for the “Block” topic. Your Map View will look similar to the following:



Now choose Map/Label/Segment Label to access the Segment Label frame on the right side of the Map View. Click on the **Setup** button and specify the following parameters:

Position:

Line Segment:

Segment length – Above
Angle – Below

Arc Segment:

Arc length – None
Radius length – None

Create Label:

Create label always

Unit:

Length:

Unit – US Feet
Number of Decimal Digits – 4
3D – (no check mark)

Angle:

Unit - DMS
Number of Decimal Digits – 2
Angle System – Azimuth
Azimuth System – North
Leading 0 – (no check mark)
DMS Display in – Seconds

Decoration:

Segment Length:

Prefix – None
Suffix – Length Unit

Angle:

Prefix – None
Suffix – None

Arc Length:

Prefix – None
Suffix – None

Arc Radius:

Prefix – None
Suffix – None

Font:

Segment Length:

Color – Black
Style - Regular
Size – 23

Angle:

Color – Black
Style – Regular
Size – 23

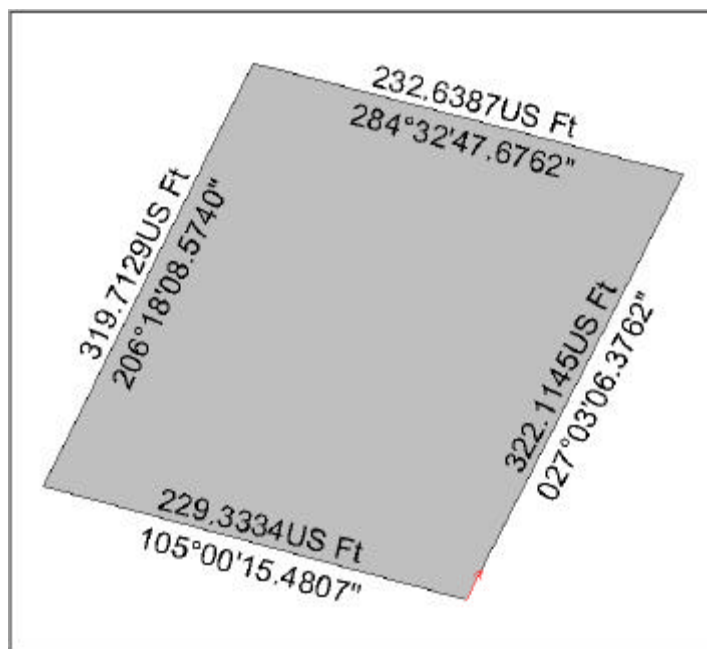
Arc Length:

Color – Black
Style – Regular
Size – 23

Arc Radius:

Color – Black
Style – Regular
Size – 23

After the above settings have been entered, click **OK** to accept these settings and return to the Segment Label screen. You are now ready to insert the labels. In the SEGMENT LABEL frame, click on the “Create” option and then click on the **GO** button. You should see the following in the Map View:



Please note: The segment labels will be created in the active topic and not the “Non-Spatial Data” topic.


Now that you have labels in your Map View, you may want to make some changes to customize the labels to your needs.


First, click once on any label. You will see the label gets selected with a dashed line around it along with some symbols. This will look like the following:



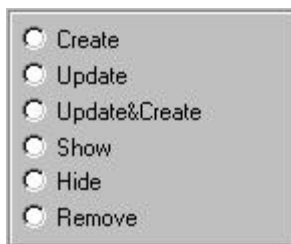
The different symbols allow for quick customization of the label:

 : MOVE. Click and drag on this symbol to move the label to a new position.

 : SIZE. Click and drag on this symbol to resize the text label.

 : ROTATE. Click and drag on this symbol to rotate the label.

To make changes to all of the labels, you will need to make changes under the SETUP dialog and then use the segment labeling tools to make the changes to your Map. Following is an explanation of the different segment labeling tools. To access the tool, simply select the tool by clicking on the circle to the left of the tool name and then click the **GO** button to see the action:



Create: Creates labels based on the contents and positions you have specified.

Update: Updates the position of the labels if changes are made. Update will not change the label contents.

Update & Create: Updates and creates the labels based on the contents and positions you have specified.

Show: Shows the labels after they have been hidden.

Hide: Hides the labels from view. This function does not delete the labels.

Remove: Deletes the labels from the Map.

You can also specify which segments you want to be labeled. The default option is for all segments to be labeled. You can choose different options using the following selection tool located at the bottom of the **SEGMENT LABEL** view:



All Segment Labels: Creates labels on all segments in the current Job.

Topic: Creates labels on all segments in the current Topic. When this option is selected, a pull-down menu will appear allowing you to specify the Topic.

Selected Features: Creates labels on all selected segments in the current Job.

Segment: Choosing this option will create a label on one segment. Your mouse pointer will turn into a crosshair allowing you to click on the segment to highlight it.

12.2 Marker Label

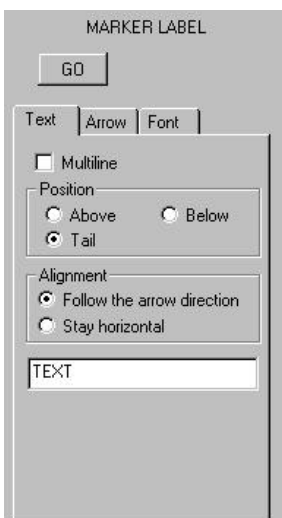
The Marker Label function is a quick and convenient way to add markers (arrows with text labels) to your Map. These markers can be customized for efficiency and convenience by setting size, location and font. When you select the Map/Label/Marker Label, the following label view is displayed:



There are three options available in the **MARKER LABEL** dialog. Each option is discussed in the following sub-sections:

Text:

Use the text section to specify what text, if any, is to be included in the marker. Also, the position and alignment of the marker can be specified. The following dialog is displayed:



Multiline: Check this box to enable multiple lines of text to be included in the marker. The default is for the text label to be all in one line.

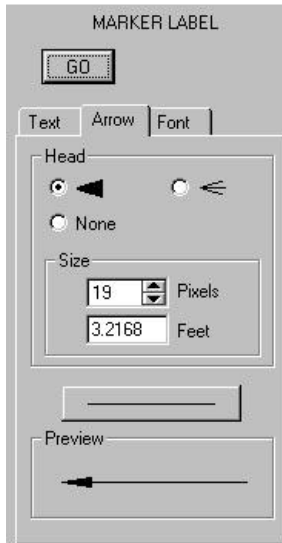
Position: Choose the position of the text with respect to the marker. Available options are for the text to be above the marker, below or attached to the tail.

Alignment (Tail position only): If you have selected “Tail” for position, then you will have the option to have the text rotate with the marker (follow the arrow direction) or stay horizontal.

TEXT BOX: Type the desired text label in this box. When Multiline is checked, the box will extend downward allowing text entry on multiple lines.

Arrow:

The Arrow section of the **MARKER LABEL** dialog allows customization of the marker itself. Options include changing the arrowhead style, size and line style. The following dialog is displayed after clicking on the “Arrow” tab:



Head: Choose a head type between the two head styles or choose “None” for no head.

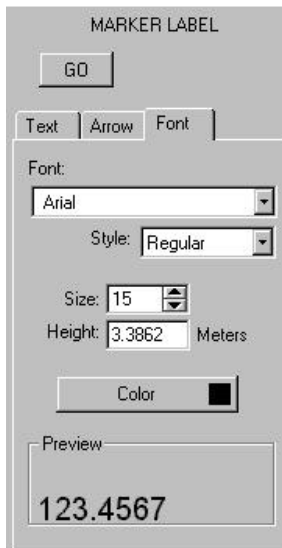
Head Size: Specify the size of the head (if one has been chosen) in either pixels or the specified units of measurement.

Alignment (Tail position only): If you have selected “Tail” for position, then you will have the option to have the text rotate with the marker (follow the arrow direction) or stay horizontal.

Line style: Click on the button with a line on it to choose from different styles of line patterns. The line pattern dialog will pop up with five different line styles to choose from. The line pattern dialog will also allow you to specify different colors and line sizes. A preview of the line marker will be displayed at the bottom of the MARKER LABEL dialog.

Font:

The Font section allows you to change the size, font and color of the text portion of the marker label. The following dialog is displayed for **Font**:



Font: Choose the font type.

Style: Specify the font style from one of the following: Regular, *Italic*, **Bold**, or **Bold Italic**.

Size/Height: Specify a font size or height.

Color: Click on the **Color** button to pick a Font color.

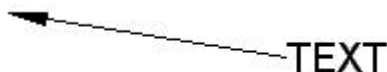
A Preview of the TEXT will be shown at the bottom of the MARKER LABEL dialog.

Once you have defined all of the setup parameters for marker labeling, you are now ready to add marker labels to your Map.

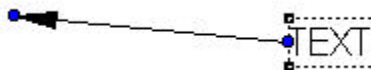
Click on the **GO** button at the top of the MARKER LABEL dialog so it is depressed.

Now, click once on your map to specify the point to which the marker will be pointing. Next, drag your mouse in a direction away from the initial point. Once you are satisfied with the position of the marker, click again once with your mouse to lock down the location of the marker.

An example of a completed marker label is provided:



The marker label may still be edited after it has been created. Click once on the marker label to show the “handles” for the selected label as follows:



These handles allow you to move and rotate the label. The handles are defined below:



: ROTATE. Allows you to rotate and extend/shorten the marker. The pivot point will be the opposite blue dot.



: ATTACHMENT. Click on a different black box to define the point of attachment for the text with respect to the tail of the marker.

Please note: The attachment handles are only available when you choose the text position to be on the TAIL and the alignment to STAY HORIZONTAL.

A new “Labels” topic is created for your marker labels. This topic is marked by the following symbol:



12.3 Angle Label

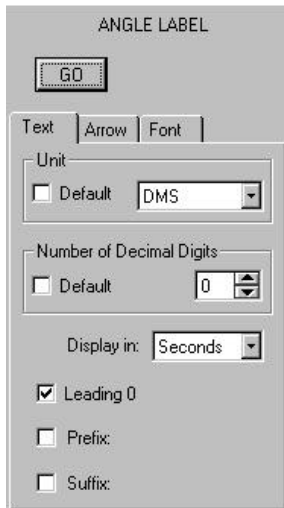
The angle label function provides a means for labeling angles in your job that occur in line and area features. When you select the Map/Label/Angle Label, the following label view is displayed:



There are three options available in the **ANGLE LABEL** dialog. Each option is discussed in the following sub-sections:

Text:

Use the text section to specify what text, if any, is to be included in the marker. Also, the position and alignment of the marker can be specified. The following dialog is displayed:



Unit: Mark the default check box if you want to use the global angle measurement units specified in your Job. To use a different unit of measure, uncheck the Default box and choose from the available options: DMS, Degree, Mils, or Grads.

Number of Decimal Digits: Specify the number of decimal digits to be used for angle labels. To stay consistent with the global settings of your Job, check the Default box.

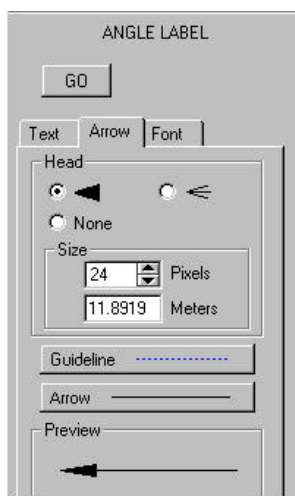
Display in: Choose to have the angle label displayed in Degrees, Minutes or Seconds by picking one of these options from the pull-down menu.

Leading 0: Place a check mark in this box if you wish to include a “zero” at the beginning of the label.

Prefix/Suffix: Place a check mark in either of these options and a text box will appear to the right of it allowing you to specify your own text for a prefix or suffix to be added to the label.

Arrow:

The Arrow section of the **ANGLE LABEL** dialog allows customization of the markers themselves. Options include changing the arrowhead style, size and line styles. The following dialog is displayed after clicking on the “**Arrow**” tab:



Head: Choose a head type between the two head styles or choose “None” for no head.

Head Size: Specify the size of the head (if one has been chosen) in either pixels or the specified units of measurement.

Alignment (Tail position only): If you have selected “Tail” for position, then you will have the option to have the text rotate with the marker (follow the arrow direction) or stay horizontal.

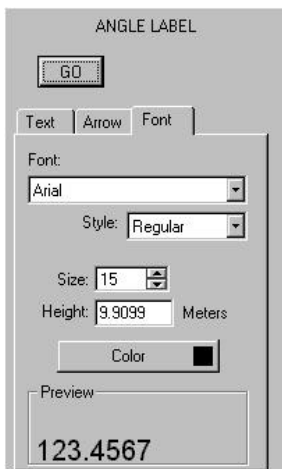
Guideline style: The guideline is used to show the angle boundary for supplemental angle labels. Click on the **Guideline** button to choose from different styles of line patterns for the Guideline. The line pattern dialog will pop up with five different line styles to choose from. The line pattern dialog will also allow you to specify different colors and line sizes. A preview of the line style is shown on the **Guideline** button.

Arrow style: Click on the button with a line on it to choose from different styles of line patterns. The line pattern dialog will pop up with five different line styles to choose from. The line pattern dialog will also allow you to specify different colors and line sizes.

A preview of the line marker will be displayed at the bottom of the **ANGLE LABEL** dialog.

Font:

The Font section allows you to change the size, font and color of the text portion of the marker label. The following dialog is displayed for "Font":



Font: Choose the font type.

Style: Specify the font style from one of the following: Regular, *Italic*, **Bold**, or **Bold Italic**.

Size/Height: Specify a font size or height.

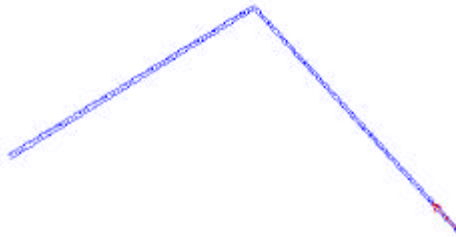
Color: Click on the **Color** button to pick a Font color.

A Preview of the TEXT will be shown at the bottom of the ANGLE LABEL dialog.

Once you have defined all of the setup parameters for angle labeling, you are now ready to add angle labels to your Map.

Click on the **GO** button at the top of the ANGLE LABEL dialog so it is depressed.

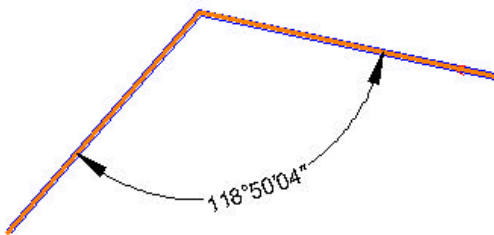
Assume you have a line with an angle in it that you want labeled. For example:



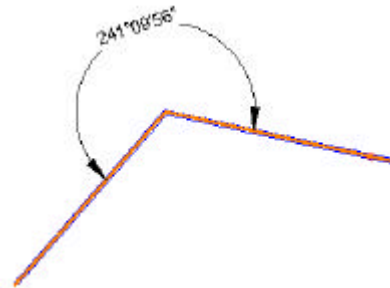
There are four different angles that can be labeled in the above example. Each of these is listed below. To select the angle, click once on one leg of the angle so it is highlighted. Next, click on the second leg of the angle so it is highlighted. The angle label will immediately appear. The angle labeled depends upon the location of your mouse.

As you move your mouse pointer around to different areas around the angle, you will notice the angle label changes automatically between the different angle measurements. Also, for each different angle measurement, you can move the mouse pointer around to change the position of the angle label (nearer or further away from the angle vertex). Following are examples of the different angle labels for the above line example:

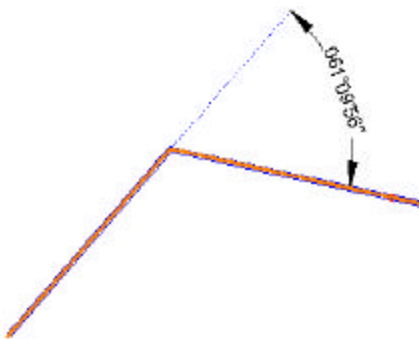
Internal angle:



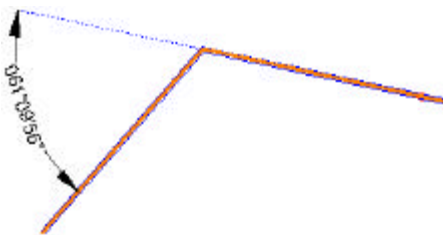
External angle:



Supplementary angle1:

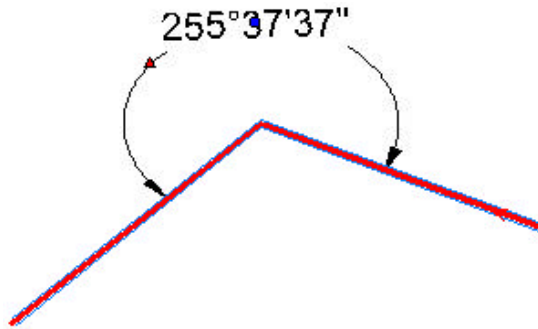


Supplementary angle2:




Once you are satisfied with the position of the marker, click again once with your mouse to lock down the location of the marker.

The angle label may still be edited/adjusted after it has been created. Click once on the angle label to show the “handles” for the selected label as follows:



These handles allow you to move and rotate the label. The handles are defined below:

 : **ROTATE**. Allows you to rotate the text along the arc (when possible). When the font size is too large to fit the label within the angle, the text will be placed outside of the angle and the arc will be replaced by two arrows. In this situation, you will not be able to use the blue dot to rotate the text because there is no arc available.



: **MOVE**. Click on the red arrow to move the location of the label with respect to the angle.

A new “**Labels**” topic is created for your marker labels. This topic is marked by the following symbol:



Please note: Angle labels can only be created for line or area features. Angle labels may not be calculated between point features.

12.4 Area Label

The area label function provides a method for labeling area features in your job that occur in line and area features. When you select the Map/Label/Angle Label, the following label view is displayed:

AREA LABEL

GO
Setup

☐ Create

☐ Update

☒ Update&Create

☐ Show

☐ Hide

☐ Remove

☐ With Additional Attributes

☒ All Area Features

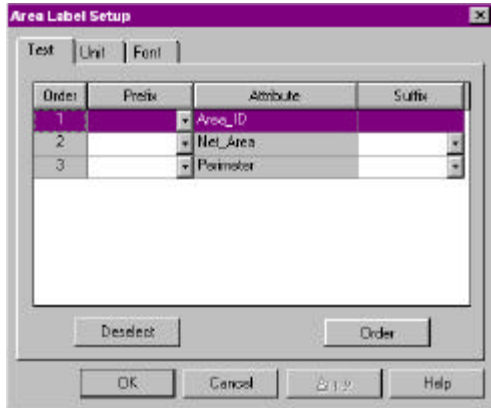
☐ Topic

☐ Selected Areas

Click on the Setup button to access the Setup menu. There are three options available in the Area Label Setup dialog. Each option is discussed in the following sub-sections:

Text:

Click on the **Text** tab at the top of the screen to access the Text setup window. The Text setup window will be used to define the order of the text labels as well as defining any prefixes or suffixes for the labels. The Text setup dialog is displayed as follows:



Order: Click on the **Order** button to change the order in which the labels will be displayed. Once clicked, the **Order** button will stay depressed. Click once (in the order column) the row of the label that you want to show first, then click the second row and so on. Once complete, the **Order** button will automatically turn off.

Prefix: Click on the pull-down menu to choose a prefix for the specified row (if desired).

Attribute: This column shows the Attribute name that will be used to create the labels for the specified area.

Suffix: Choose a suffix (if desired) to add the units of measurement to the "Net_Area" label and "Perimeter" label.

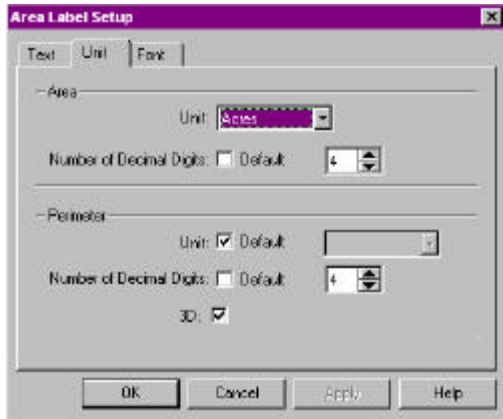
Select/Deselect: Click the **Deselect** button to exclude the highlighted row from being labeled. The order number will disappear to show it is not selected. To re-select it, simply highlight the row and click on the **Select** button again.

Choose **OK** to accept these settings and return to the Label View or **Cancel** to abort these changes and return to the Label View screen.

Please note: Additional attributes may be used. To do so, make sure you put a check mark in the box for "With Additional Attributes" in the main AREA LABELS view. Select or unselect the desired Attributes associated with the area. Also, use the above described method to specify the order in which the labels will be displayed.

Unit:

The Unit Setup dialog is used to define the units of measurement, decimal precision and other display settings for area and perimeter labels. After clicking on the **Unit** tab, the following dialog is displayed:



Area, Unit: Click on the pull-down menu to specify the measurement units for Area labels. Available options are: Acres, Hectares, Sq. Meters and Sq. Feet.

Area, Number of Decimal Digits: Specify the number of decimal digits to be used for length labels. To stay consistent with the global settings of your Job, check the Default box.

Perimeter, Unit: Mark the default check box to use the global measurement units specified in your Job. To use a different unit of measure, uncheck the Default box and choose from the Meters, Feet (Int'l), KM, Miles or US Feet.

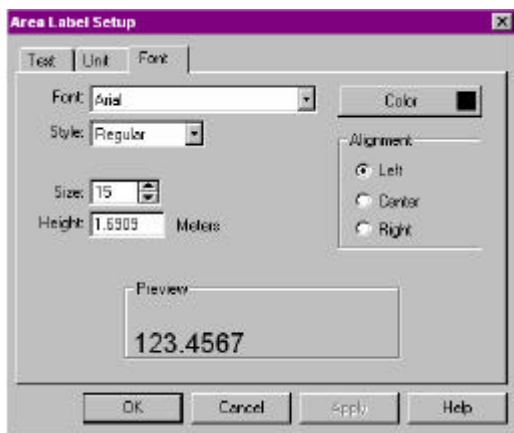
Perimeter, Number of Decimal Digits: Specify the number of decimal digits to be used for perimeter labels. To stay consistent with the global settings of your Job, check the Default box.

Length, 3D: Label perimeters with slope distance.

Choose **OK** to save your settings and return to the AREA LABEL view or choose **Cancel** to abort changes.

Font:

The Font Setup dialog is used to define the font type, size/height, style, color and alignment for area labels. After clicking on the **Font** tab, the following dialog is displayed:



Font: Choose the desired font type from the pull-down menu.

Color: Click on the Color button to specify a color.

Style: Click on the pull-down menu and choose a font style: Regular, *Italic*, **Bold**, or **Bold Italic**.

Font Size/Height: Specify a font size or height.

Alignments: Choose the justification for the area label from the options of: Left, Center or Right.

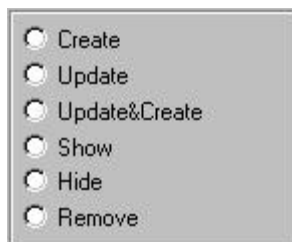
A preview of the font selection will be displayed at the bottom of the screen.

Choose **OK** to save your settings and return to the AREA LABEL view or choose **Cancel** to abort changes.

Once you have defined all of the setup parameters for segment labeling, you are now ready to label your data.

In the **AREA LABEL** view, you can specify which areas are to be labeled.

To make changes to all of the labels, you will need to make changes under the SETUP dialog and then use the segment labeling tools to make the changes to your Map. Following is an explanation of the different area labeling tools. To select a tool, click on the circle to the left of the tool name and then click the **GO** button to see the action:



Create: Creates labels based on the contents and positions you have specified.

Update: Updates the position of the labels if changes are made. Update will not change the label contents.

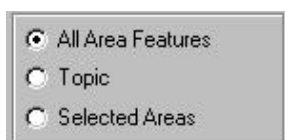
Update & Create: Updates and creates the labels based on the contents and positions you have specified.

Show: Shows the labels after they have been hidden.

Hide: Hides the labels from view. This function does not delete the labels.

Remove: Deletes the labels from the Map.

You can also specify which areas you want to be labeled. The default option is for all areas to be labeled. You can choose different options using the following selection tool located at the bottom of the **AREA LABEL** view:



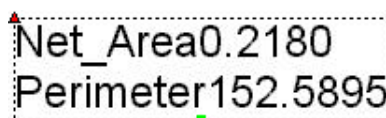
All Area Features: Creates labels on all areas in the current Job.

Topic: Creates labels on all areas in the current Topic. When this option is selected, a pull-down menu will appear allowing you to specify the Topic.

Selected Areas: Creates labels on all selected areas in the current Job.


Now that you have labels in your Map View, you may want to make some changes to customize the labels to your needs.

First, click once on any label. You will see the label gets selected with a dashed line around it along with some symbols. This will look like the following:



The different symbols allow for quick customization of the label:

 : **MOVE.** Click and drag on this symbol to move the label to a new position.

 : **SIZE.** Click and drag on this symbol to resize the text label.

Section 13 - Field Work in CMT-SURVEY

The Field Work menu in CMT-SURVEY lets you collect data directly into CMT-SURVEY using an electronic Total Station.

Before collecting data, first select the desired angle system and units of measurement under the **View/Configure** menu and the **Map/Coordinate System** settings, respectively. Specific settings for instrument, measurement conditions and repetition modes are discussed in the section titled **Field Work Setup**.

Horizontal Angle Measurements

The data to be entered into the "horizontal angle" data fields in the CMT-SURVEY is the conventional angle right or angle left measurement. Angle right is the angle in the horizontal plane measured clockwise from the backsight direction to the foresight direction. On the other hand, a deflection angle measures the angle between the foresight direction and the direction from the backsight point to the occupied station. So if the deflection angle of a foresight target is 0, then the foresight target and the backsight target are on opposite sides of the instrument. Put another way, the difference between the angle right measurement and the deflection angle measurement is half a circle, or 180° .

Deflection angles are commonly used for roadway design and surveys that proceed along a fairly straight course, so deflection angles are usually quite small. If you employ the deflection angle system, use the following method for taking the measurements. To conform to the procedures used by CMT-SURVEY for measuring horizontal angles, a backsight measurement must be taken before the foresight measurement. Use the face opposite from the one that is normally used for the backsight measurement. Use the normal face for the foresight measurement. This will have the effect of reversing the foresight and backsight readings. That is, the backsight reading will be 180° , and the foresight reading will be close to 0. With a transit, it is customary to record a deflection angle as a small, positive angle value followed by a right or left designator, e.g. 7.5 R or 10 L. With a theodolite, however, the angles right - angles left setting is typically set just once for an entire job. In this case, when an angle deflecting to the left is measured, for example 10L, it will appear as 350° when in "angles right" mode. The same is true for an angle deflecting to the right when in "angles left" mode.

Vertical Angle Measurements

Select the appropriate vertical system for displaying collected field work data. When you do a stakeout job, CMT-SURVEY always uses the vertical distance system to display the data.

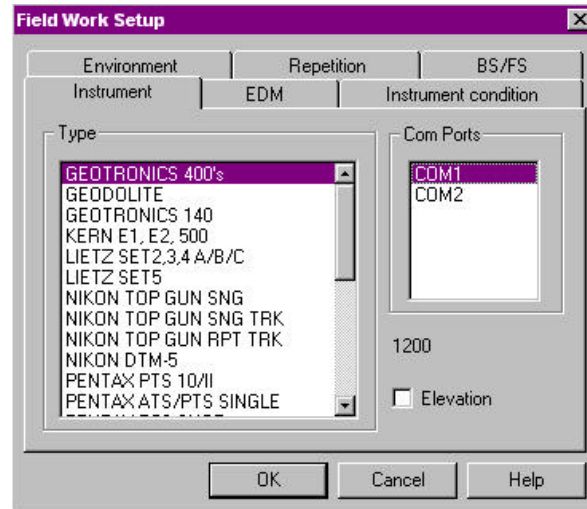
CMT-SURVEY assumes that the total station is set to output zenith angle and slope distance. When you select the VERT DIST mode, CMT-SURVEY will compute the horizontal and vertical distances. Therefore, please set your total station to measure zenith angle and slope distance even when you have selected VERT DIST as the vertical system to use in CMT-SURVEY.

Point ID in Measurement Data

The Point IDs in the measurement data records are the Feature IDs of the survey points. Although you may easily change the Feature ID of a survey point, it is not advisable to do so. When you change the Feature ID of a survey point via its Feature Properties screen, the Point ID of the survey point in the measurement data stays unchanged. You could edit the measurement data to change the Point ID, but generally we do not recommend altering the measurement data.

13.1 Field Work Setup

The FIELD WORK SETUP screen presents a number of sub-menus and is accessed by choosing **Field Work/Field Work Setup**. The following dialog is displayed:

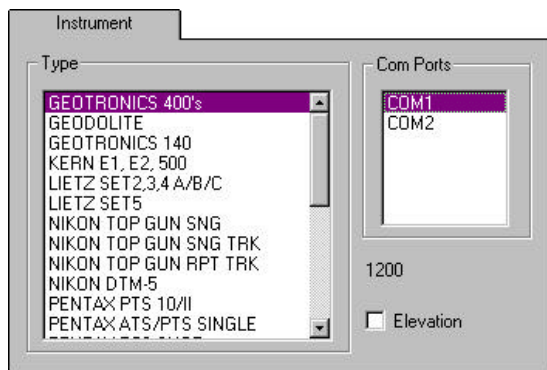


Select the setup option by clicking the corresponding tab at the top of the screen.

Some of the setup functions such as Instrument, Instrument Condition and Environment affect how raw measured data or the adjusted coordinate data will be corrected. Specify the corrections to be made if the conditions (e.g. curvature of the earth, atmospheric refraction, pressure, temperature, scale factor, etc.) affect the measurement accuracy and therefore need to be taken into consideration. This correction is applied to the raw data obtained from the total station when you click the **Measure** button. The corrected data displayed in CMT-SURVEY will be different from the data displayed on your total station.

13.1.1 Instrument Setup

Use the "INSTRUMENT SETUP" screen to specify elevations, instrument port and the instrument type.



Type: Choose the instrument ID by scrolling through the list.

COM Ports: Choose from available ports to specify the port the instrument will be connected to.

Elevation: Enter a check mark in this box to globally enable all references to elevation or height fields/measurements

Click **OK** to save these settings and return to the Map View.

13.1.2 EDM Setup

The **EDM SETUP** screen will permit you to enter data for atmospheric correction.

The screenshot shows a software interface titled "EDM" at the top. Below the title, there are four rows of input fields:

- EDM Type:** A dropdown menu with "PENTAX" selected.
- EDM Mode:** A dropdown menu with "PM-81" selected.
- Wave Length:** A text input field containing "0.85".
- Refractive Index:** A text input field containing "1.0002785".

EDM Type: Choose the EDM Type from the dropdown menu.

EDM Mode: Select the desired EDM mode.

Wave length: If you have selected a particular EDM type and mode, the wavelength for the EDM selection will be automatically displayed and cannot be changed. If you select "OTHER" as the EDM type, then you can enter an appropriate wavelength value.

Refractive Index: The refractive index for the EDM selection will be automatically displayed and cannot be altered by you. If you select "OTHER" as the EDM type, then you can enter an appropriate refractive index value.

The following EDM types and modes are supported by CMT-SURVEY:

PENTAX: PM-81, MD, OTHERS

GEODIMETER: 710,6BL,8, 6A, 6000, OTHERS

H.P.: 3800,3805, 3808,3820, 3810

KERN: 500, 501, OTHER

K&E: AR I, AR S,II

NIKON: ALL

P.I.: BEETLE, CITATION

SOKKISHA: RED MINI 2, RED 1, SDM-1C, OTHERS

TOPCON: DM-C2, OTHERS

WILD: DI3S,TC1,DI4, DI20, DI5S, DI1000, DI2000, DI3000,TC2000, TC1600, DI3

ZEISS: ELDI 1,2,3,SM4, ELTA 2,4, ELTA 3,20,46R,SM41,E-ELTA 3,4,6,ELDI 4, ELDI 10

OTHER: Other types of equipment

13.1.3 Instrument Condition Setup

You may enter and store instrument correction factors. The measured data will be corrected according to your entries for the instrument condition setup.

If the instrument is correcting for these conditions, then the data collector should not be correcting for the same. It is acceptable that no correction be performed by either the instrument or the data collector.

| Instrument condition | |
|-------------------------------|-------------------|
| Collimation: | No |
| Horizontal collimation error: | 000°00'00.000000" |
| Vertical collimation error: | 000°00'00.000000" |
| EDM offset: | 0.0 |
| Prism Offset: | 0.0 |
| Prism constant(mm): | 0.0 |
| Collimation | |

Collimation: This field allows you to specify whether the collimation values in the following two fields will be used to correct measured data. This correction will modify the horizontal and vertical angles. If the data is not measured in a set or is measured in an odd set, the collimation values will be added to the measured data; otherwise, they will be subtracted from the measured data.

Horizontal Collimation: Enter the instrument horizontal collimation error. If desired, you can get this value from actual measurements.

Vertical Collimation: Enter the instrument vertical collimation error. If desired, you can get this value from actual measurements.

EDM Offset: Enter the vertical offset from the scope to the EDM, in feet or meters depending on the unit used for the coordinate file. This value is used for EDM correction.

Prism Offset: Enter the vertical offset from prism in feet or meters depending on the unit used for the coordinate file. This value is used for EDM correction.

Prism Constant (mm): Enter the distance addition constant for the prism. The unit used for this value is always millimeters.

This correction will modify the slope distance received from the total station when the Measure button is clicked.

This correction is always applied if the prism constant is not set to zero.

Click on the COLLIMATION button to set the collimation value using actual measurements. To obtain the collimation value, you will need to make two measurements. The following dialog is displayed:

COLLIMATION

Direct Horizontal Angle: 000°00'00.000000"

Direct Vertical Angle: 090°00'00.000000"

Reverse Horizontal Angle: 000°00'00.000000"

Reverse Vertical Angle: 090°00'00.000000"

GO Direct Measure

Cancel Reverse Measure

Direct Measure: First, move the cursor to either the Direct Horiz. Angle or the Direct Vert. Angle field and click Direct Measure. The data will be automatically entered into these two fields.

Reverse Measure: Then, repeat the Direct Measure process with the cursor at either the Reverse Horiz. Angle or the Reverse Vert. Angle field.

GO: The difference between the direct and reverse measurements will be computed and automatically entered into the Vert. Collimation and Horiz. Collimation fields in the Instrument Condition Setup screen.

Cancel: Aborts the Collimation computation and returns to the Instrument Condition Setup screen.

13.1.4 Environmental Corrections

You may specify the environmental conditions that CMT-SURVEY should correct for.

If the instrument is correcting for these conditions, then the software should not be correcting for them also. It is permissible, however, that no correction be performed by either the instrument or the data collector. The following dialog is displayed when you click on the Environment tab:

Environment

Atmospheric corrections: No

Temperature: 0.000000

Unit: Fahrenheit

Pressure: 0.000000

Unit: Millimeter of mercury

Atmospheric Corrections: Choose "Yes" to enable atmospheric corrections, or "No" to disable it.

Temperature: Enter the temperature.

Unit: Specify the temperature units by choosing Fahrenheit or Celsius.

Pressure: Enter the pressure.

Unit: Specify the pressure units by choosing inches of mercury, millimeters of mercury, or millibars.

13.1.5 Repetition Setup

Use this screen to specify how repetition data is to be collected:

| Repetition | |
|---------------------|-------------------|
| Measure Sequence: | BFFB |
| Measure Type: | AVG |
| Turns: | 2 |
| H-Angle Tolerance: | 000°03'00.000000" |
| V-Angle Tolerance: | 000°03'00.000000" |
| Distance Tolerance: | 0.030480 |

Measure Sequence: Click the dropdown menu for available options:

The BFBF sequence collects with face 1, a backsight and then the foresights, then collects with face 2 the backsight again and then the foresights again.

The BFFB sequence collects with face 1 a backsight and then the foresights, but then collects with face 2 the foresights in reverse order and then the backsight.

The BBFF sequence first collects all the backsight measurements, alternating face 1 with face 2, then collects all foresight measurements, again alternating face 1 with face 2. This sequence is primarily used where working conditions prevent ease of movement around the instrument (mining, for example).

Measure Type: Click the dropdown menu to choose between single distance measurements and average distance measurements.

If single distance mode is selected then a distance measurement is made on the first measurement set only; the other sets just measure angles. If average distance mode is selected then a distance measurement is made with each measurement.

Turns: Click the dropdown menu to select the total number of measurement sets to take. **Note that each BFFB, BFBF or BBFF measurement sequence involves two turns (sets).** Therefore, only an even number of turns is permitted, from 2 to 16.

H-Angle Tolerance: Enter the maximum horizontal angle error that will be tolerated. Make sure you enter the tolerance value in the same unit system you are using for horizontal angle measurements. Keep in mind that the tolerance criterion will be applied to the horizontal angles, not the horizontal measurements (readings). A horizontal angle is the difference between the horizontal measurements to two different points. When working with a horizontal angle measurement set, the difference between the first horizontal angle value and the value for the same horizontal angle obtained in any subsequent turns are checked against the specified tolerance. For example, the following BFFB measurement set meets the tolerance specification of 0.02 decimal degrees even though there is a large difference between the first and second measurement readings for each point.

| Point | Measurement | Horizontal Angle | |
|-------|-------------|------------------|----------|
| BS 2 | 10.00 | | |
| FS 3 | 30.00 | 30.00 - 10.00 | = 20.00 |
| FS 4 | 140.00 | 140.00 - 30.00 | = 110.00 |
| FS 5 | 270.00 | 270.00 - 140.00 | = 130.00 |
| FS 5 | 290.01 | | |
| FS 4 | 160.00 | 290.01 - 160.00 | = 130.01 |
| FS 3 | 49.99 | 160.00 - 49.99 | = 110.01 |
| BS 2 | 30.01 | 49.99 - 30.01 | = 19.98 |

If the difference between the first horizontal angle value and the value for the same horizontal angle obtained in any subsequent turns exceeds the specified tolerance, a warning beep will be sounded. You then have the option of retaking the measurement or accepting the data anyway.

V-Angle Tolerance: Enter the maximum vertical (angle or distance) error that will be tolerated. Make sure you enter the tolerance value in the same unit system you are using for vertical angle measurements. If the difference between the first measurement of a vertical angle and a subsequent measurement of the same vertical angle exceeds the tolerance you specified, the latter measurement is deemed out of tolerance.

Distance Tolerance: Enter the maximum distance (slope or horizontal) error that will be tolerated. Make sure you enter the tolerance value in the same unit system you are using for distance measurements. If the difference between the first distance measurement and a subsequent distance measurement for the same point exceeds the tolerance you specified, the latter distance measurement is deemed out of tolerance.

13.1.6 BS/FS Setup

The BS/FS Setup dialog is displayed when you click on the BS/FS tab:

The screenshot shows a software dialog box titled "BS/FS". It contains two configuration options, each with a label and a dropdown menu. The first option is "Display Backsight Distance:" with a dropdown menu currently showing "No". The second option is "Foresight Height:" with a dropdown menu currently showing "Keep". The dialog box has a standard Windows-style title bar and a light gray background.

Display Backsight Distance: Choose **Yes** to have CMT-SURVEY prompt you for the backsight distance data. Choose **No** if you do not wish to measure backsight distance data. For high precision surveying, and to provide a check that the correct backsight point is sighted, use backsight distances. If the distance measured to the backsight point does not agree with the computed distance, a tolerance warning will be displayed. This can be used as a way to verify that the correct backsight point is

indeed sighted. (**The tolerance used here is the distance tolerance specified in the Repetition Setup**)

Foresight Height: Choose “Keep” to keep the foresight height (rod height), or “Clear”, to clear the data entered in the previous record. This field will not be visible if field elevations are disabled.

Keep the field data when the data entered in the previous point is normally reused in the current point. For example, if the rod height is constant, then set the HEIGHT field to keep its data. If instead a field is set to CLEAR, then the field will be made 0 when advancing to a new foresight point. Of course, data that is KEPT may still be changed.

13.2 Field Work Procedure

The "Field work" section is used for entering raw field data. Radial topography (side-shots) and traverses, or combinations of both, may be entered into a single job file. In addition, the CMT-SURVEY software allows measurement sets to be taken to improve accuracy.

The following discussion covers some basic concepts and practices used in surveying as well as how they pertain to the CMT-SURVEY Software. The Field Work data input screens are described in Sections 13.2 through 13.7. The tutorial in Section 13.11 includes a field work example.

13.2.1 General Notes on Data Collection

Field measurement data (raw data) may be entered by hand or recorded from a survey instrument. As data is entered, you can see the instrument point, the back-sight control point and the foresight point clearly marked with the corresponding symbols in Map View.

CMT-SURVEY automatically computes the coordinates of a survey point whenever sufficient measurement data has been recorded for that point and immediately displays the survey points in Map View.

If you toggle the **View/Measurement** option on, you will also see the lines representing the measurement data. Section 13.8 describes the measurement data records view and the associated functions.

After collecting field data, you may wish to adjust the survey to minimize errors or to take into account the averaged data in the measurements. **Survey Adjustment** is discussed in Section 13.9.

If you wish to fit the survey points to a different set of control points, please use the **T/R/S Least Squares Fit** function in the COGO menu.


13.2.2 Field Work/Collect

The **Field Work/Collect** routine handles all data collection activities and provides three main data entry screens. The OCCUPY STATION screen is discussed in Section 13.3. The BACKSIGHT screen is discussed in Section 13.4. The FORESIGHT screen is discussed in Section 13.5. The general procedure is to enter data into each screen, then click a Function button to execute the corresponding command.

After selecting Field Work/Collect, the following dialog is displayed to the right of the Map View:

| COLLECT | | |
|------------|--------|-----------|
| One prism | Remote | Change OS |
| Two prisms | Auto | Edit |
| Measure | Go | Traverse |

| Occupy Station | |
|----------------|------------|
| Feature ID: | 1 |
| Topic: | Field Work |
| HI: | 0.0 |

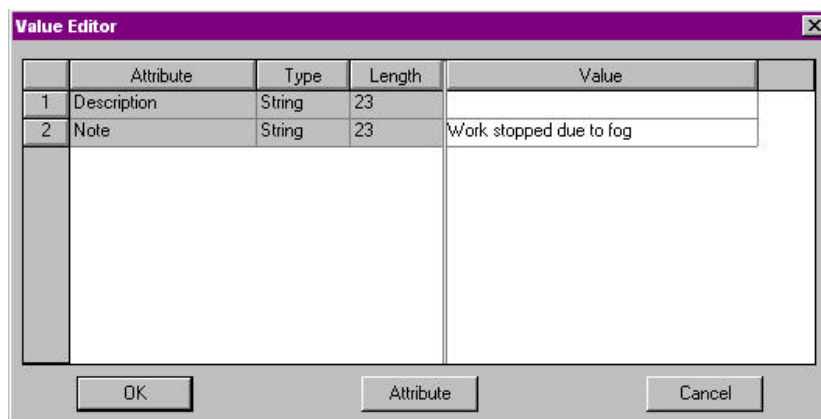
The data input panel may be turned off at any time by clicking on the “Disable Data Input” icon: .

The “Toggle Mouse” icon is used to control your mouse pointer and what it can select. When you select Field Work/Collect, the “Toggle Mouse” icon is automatically depressed and turned on. In this mode, your mouse pointer will select items for the field work data input panel. When this icon is toggled off, then you can click on and select items in the Map View as normal.

Please Note: The “Toggle Mouse” icon is used for selecting items for the data fields in the data input panel. You can toggle this icon off to select items in your map as you normally would. The “Toggle Mouse” icon may be toggled ON and OFF without interrupting the Field Work data collection session.

13.3 Occupy Station

Field data entry always begins with an occupy station activity. Enter the station point number and the topic name from the list of available topics in the pull-down menu. Enter the height of the instrument (HI) if elevations are being carried. Alternatively, you may click on the Feature ID: box and then click on the point in the Map View that you want to assign as the Occupy Station. Click on **Go** to advance to the BACKSIGHT screen. If the station point has not been previously defined, CMT-SURVEY will prompt you to create the point. Click on the **Edit** button to access the Value Editor screen for entering in descriptive Value information for the default Attributes and any other Attributes you may have added. The Value Editor screen is displayed after clicking on the **Edit** button:



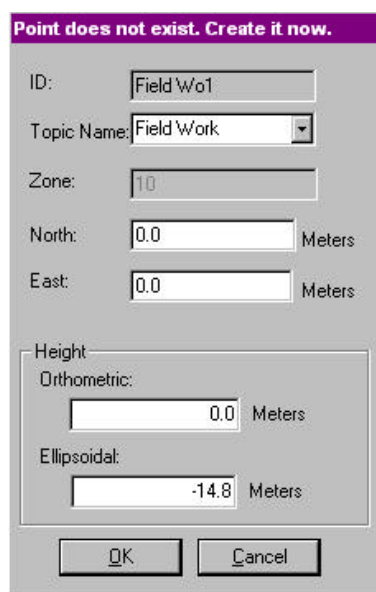
The Value Editor dialog box contains a table with the following data:

| | Attribute | Type | Length | Value |
|---|-------------|--------|--------|-------------------------|
| 1 | Description | String | 23 | |
| 2 | Note | String | 23 | Work stopped due to fog |

Buttons at the bottom: OK, Attribute, Cancel.

To enter a Value, simply click on the empty cell and type in the information. Select OK to save changes and return to the Collect screen. Click on the **Attribute** button to access the Sheet Update screen for Attribute editing.

The following screen is displayed for creating the Occupy Station point:



The dialog box contains the following fields:

- ID: Field W01
- Topic Name: Field Work
- Zone: 10
- North: 0.0 Meters
- East: 0.0 Meters
- Height:
 - Orthometric: 0.0 Meters
 - Ellipsoidal: -14.8 Meters

Buttons at the bottom: OK, Cancel.

Enter the coordinates and height of the Occupied Station in this dialog. If the coordinates of the point are not known, use assumed coordinates, such as Northing=1000, Easting=1000, Elevation=100 for a local coordinate system.


The Occupied Station point is displayed with a tripod symbol on top of it for easy visual reference of the

Occupy Station: 

13.4 Record Backsight

Next, the **BACKSIGHT** screen is displayed which allows measurement and entry of the backsight reading and point number. The following dialog is displayed to the right of the Map View for Backsight reading entry:

The COLLECT dialog box has a title bar 'COLLECT'. It contains three rows of buttons: 'One prism', 'Remote', 'Change OS'; 'Two prisms', 'Auto', 'Edit'; and 'Measure', 'Store', 'Set'. Below these is a section titled 'BackSight' with two input fields: 'Feature ID:' containing 'Field W01' and 'Topic:' containing 'Field Work'. Below this is 'OS: Field W001'. Then are three input fields: 'Back Reading:' with '000°00'00.0"', 'Zenith Angle:' with '090°00'00.0"', and 'Slope Distance:' with '100.0'.

Click on the point in your map to establish it as the Backsight point. The Backsight point will be represented with the following symbol in the Map View: . Click the **Store** button to store the Backsight point reading and proceed to the Foresight screen. If the Backsight point has not been previously defined, then CMT-SURVEY will prompt you to create the Backsight point. The following dialog is displayed:

The Field Work dialog box has a purple title bar 'Field Work'. It contains the text 'First Backsight point does not exist, create?'. Below this are three buttons: 'Coordinate', 'Bearing', and 'Cancel'.

Coordinate: Create the point by manual input of coordinates for the new point (as shown in the creation of a point for an Occupy Station).

Bearing: Display the reference direction screen to enable calculation of the Back Reading via a Bearing between two points. For this option, the Backsight point will be created at a default distance of **100 feet** from the instrument point. (This distance can be changed). Click the **Store** button to record the displayed Bearing and return to the Backsight screen or click on the **Measure** button to take a reading from your instrument.

Cancel: Cancel this function and return to the Occupy Station screen.

Manually enter the back reading or click on the **Measure** button to obtain the back reading directly from the instrument.

Click on the **Change OS** button if you wish to use a different point as the Occupied Station.

If sets of foresight measurements are to be taken, do not click on Measure or Store, but click on the **Set** button; sets of measurements will be recorded. Section 13.7 outlines the various procedures to use for recording sets of measurements.

13.5 Record Side-Shot or Traverse Point

The **FORESIGHT** screen is used to record measurements to side-shot points as well as traverse points. The Foresight screen is displayed after establishing the Backsight reading:

The screenshot shows the 'COLLECT' screen with a grid of buttons at the top: 'One prism', 'Remote', 'Change OS', 'Two prisms', 'Add', 'Edit', 'Measure', 'Side', and 'Traverse'. Below this is the 'ForeSight' section with the following fields: 'Feature ID' (containing 'STRUCTUR2'), 'Topic' (a dropdown menu showing 'Field Work'), 'HT' (containing '0.0'), 'OS: STRUCTUR001', 'BS: STRUCTUR002', 'Horizontal Angle' (containing '090°00'00.0"'), 'Zenith Angle' (containing '090°00'00.0"'), and 'Slope Distance' (containing '100.0').

To record side-shots, enter the foresight data or click on the **Measure** button to get the data from the instrument. Click on the **Side** button to record the data. The next available foresight point number is automatically displayed. Continue to use "Side" to record each measured side-shot point. When the side-shot measurements are completed and the next point is a traverse point, measure or enter the data, then click on the **Traverse** button; the measurement will be recorded and the program will return to the OCCUPY STATION screen with the last foresight point set to be the current occupied station point.

To improve the accuracy of a traverse, you may want to take a measurement to the next traverse point as soon as you have set up on the station, before taking the side-shot measurements. To use this method, simply record the foresight point as a "**temporary side-shot**" point and then take the actual side-shot measurements. After taking all side-shots, traverse to the "temporary side-shot" point by entering its point number and then clicking **Traverse**. Do not enter the measurement data again; it will be ignored if you do.

If the prism cannot be placed at the object or at the desired distance, you may use the **remote object method** or **offset shot method** to collect the required data. (See Section 13.6)

Repeat the Process

Continue to record traverse and side-shot measurements as the job requires.

13.6 Foresight options

The Offset Shots and Remote Objects options are available for foresight data collection. These are described below.

13.6.1 Offset Shots

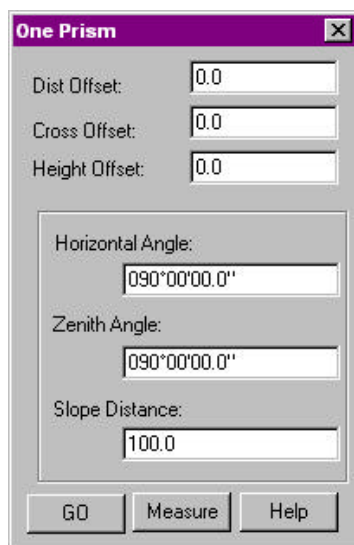
Use the **offset shot** method when the prism cannot be placed at the object but its position relative to the object can be determined (e.g. by taping).

Two methods are provided for making an offset shot. The "One prism" method lets you record the measurements to the prism and manually enter the offset data. The "Two prism" method makes use of a pole on which two prisms are mounted at a known distance from each other. Separate measurements are made to the two prisms from which the location of the inaccessible point is calculated.

To use an offset shot method, **click on the Offset function in the FORESIGHT screen.**

One Prism Method

With the "One prism" method, the foresight measurement data determines the location of the prism. The offset data "relocates" that point to the location of the object. To get the **distance offset**, project the horizontal distance between the prism and the object onto the vertical plane containing the instrument point and the prism. To get the **cross offset**, project the horizontal distance between the prism and the object onto the plane that contains the object and is perpendicular to the distance offset. The **height offset** is the vertical distance between the prism and the object. All three offsets are used in calculating the position of the offset target. The following dialog is displayed after clicking on the **One Prism** button:

A screenshot of a software dialog box titled "One Prism" with a close button (X) in the top right corner. The dialog contains several input fields: "Dist Offset:" with a value of "0.0", "Cross Offset:" with a value of "0.0", and "Height Offset:" with a value of "0.0". Below these is a section with three more fields: "Horizontal Angle:" with "090°00'00.0\"", "Zenith Angle:" with "090°00'00.0\"", and "Slope Distance:" with "100.0". At the bottom of the dialog are three buttons: "GO", "Measure", and "Help".

Distance Offset: This is the distance between the object and the prism projected onto the line of intersection between the horizontal plane and the vertical plane defined by the prism and the instrument point. Enter a positive value if the object is further away from the instrument point than the prism; otherwise, enter a negative value.

Cross Offset: This is the distance between the object and the vertical plane defined by the prism and the instrument point. Enter a positive value if the object is located to the right of the prism as viewed from the instrument point; otherwise, enter a negative value.

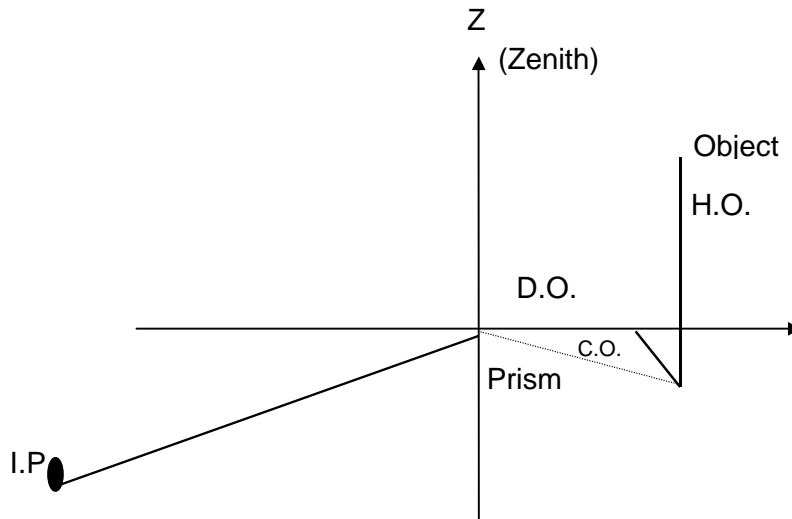
Height Offset: This is the difference in height between the object and the prism. Enter a positive value if the object is higher than the prism; otherwise, enter a negative value.

Click on the **Measure** button to get the angle and distance measurements of the prism. These will be automatically placed into the "Horizontal Angle", "Zenith Angle" and "Slope Distance" fields. If you had

clicked **Measure** from the main FORESIGHT screen, the values measured will already be shown in these fields.

Click on the **GO** button to compute the adjusted measurement values based on the measured values of the prism and the offsets entered. The computed values are automatically placed into the "FORESIGHT" screen. Click **Side** to store the data if it is acceptable.

The following diagram illustrates the position of the object in relation to the prism. The instrument point (I.P.) lies in the plane defined by the X-axis and the Z-axis. The distance offset (D.O.), cross offset (C.O.) and height offset (H.O.) are mutually perpendicular.



Note: To obtain correct results from offset computation, it is necessary that you set the rod height to zero before clicking on the **One Prism** button. After doing the offset shot, re-enter the correct rod height into the FORESIGHT screen.

Two Prisms Method

The "Two prisms" method uses a pole with two prisms mounted a known distance apart on it. You take a measurement to one of the prisms, and then you take another measurement to the other prism. Based on this information, CMT-SURVEY will determine the measurement values to the hidden point at the tip of the pole.



Please note: To obtain correct results from offset computation, it is necessary that you set the rod height to zero before clicking on the **Two Prisms** button. After doing the offset shot, re-enter the correct rod height into the FORESIGHT screen.

From the Foresight dialog box, click on the **Two Prisms** button to display the following:

| Two Prisms | |
|---|--------------|
| P1 | |
| Prism Len1: | 0.0 |
| Horizontal Angle: | 090°00'00.0" |
| Zenith Angle: | 090°00'00.0" |
| Slope Distance: | 100.0 |
| P2 | |
| Prism Len2: | 0.0 |
| Horizontal Angle: | 090°00'00.0" |
| Zenith Angle: | 090°00'00.0" |
| Slope Distance: | 100.0 |
| <div>GO Help</div> <div>P1 Measure P2 Measure</div> | |

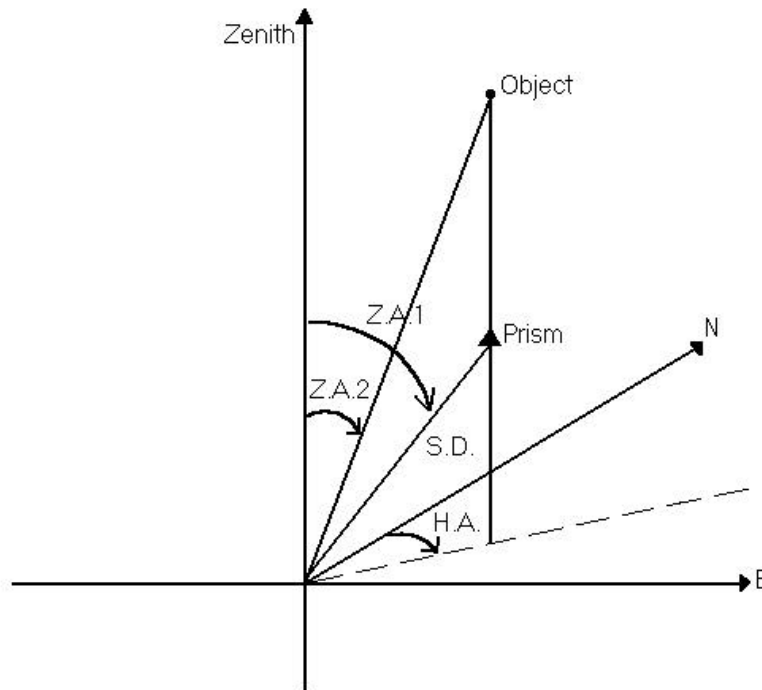
For P1, enter the distance from the far prism to the tip of the pole then click **P1 Measure** to take a shot at that prism.

Enter the distance from the near prism to the tip of the pole then click **P2 Measure** to take a shot at that prism. When done, click on the **GO** button to return to the FORESIGHT screen. The adjusted measurement values will be displayed in the FORESIGHT screen. Click on the **Side** button to store the data if it is acceptable.

13.6.2 Remote Object

When you cannot place the prism at an object because it is out of reach, you can use the **remote object** method to record its position if you can place the prism at the same horizontal distance as the object.

You will make a measurement to the prism and then record the direction to the object. CMT-SURVEY will calculate the correct angle and distance values from the instrument to the object.



Please note: To obtain correct results from remote object computation, it is necessary that you set the rod height to zero before clicking on the Remote button. After doing the remote object shot, re-enter the correct rod height into the FORESIGHT screen.

Suppose the next point you need to record is the tip of a tall pole and you don't feel like climbing up there to place the prism. **Enter "0" into the "HT:" field in the FORESIGHT screen**, then click on the **Remote** button to display the following dialog:

Following is an outline of the procedure for using the **Remote Object** function:

1. Place the prism beneath the object (say, at chest height on the pole), then click the **1st Measure** button to get the vertical angle and slope distance measurements. The data will be automatically entered into the two fields: Zenith Angle and Slope Distance fields under the 1st Measurement section. If the vertical system used is set to VERT. DIST., then measurements are still taken off zenith angle and slope distance in order to compute the vertical distance.
2. Point the instrument directly at the object (the tip of the pole) and click the **2nd Measure** button to get the true horizontal and vertical angle measurements to the object. These values will be automatically entered into the Horizontal Angle and Zenith Angle fields under the 2nd Measurement section.
3. Click on the **GO** button to compute the true distance to the object and return to the FORESIGHT screen. The computed value will be automatically entered into the SLOPE DISTANCE field of the FORESIGHT screen. The data in the Horizontal Angle field and the second Zenith Angle field of the REMOTE OBJECT screen will be copied to the corresponding fields of the FORESIGHT screen. Click on the **Side** button in the FORESIGHT screen to store the data.

Example 1:

You need a measurement to the center of a large tree. Assume the angle right to the tree center is 105.3 degrees and the distance to the tree center is 25.9 feet.

First enter "0" into the "HT:" field in the FORESIGHT screen. Place the prism beside the tree at the correct distance from the instrument. Click on the **1st Measure** button from the REMOTE OBJECT screen to measure the distance to the prism. The slope distance reading is 25.9. (Assume the zenith angle reading is 89.5.)

Next, aim the instrument at the center of the tree and click on the **2nd Measure** button to get the angle measurements. The Horizontal Angle reading is 105.3. (Again, assume the zenith angle reading is 89.5.)

Now, click on the **GO** button to place the calculated distance into the FORESIGHT screen. The horizontal measure will show 105.3, the vertical measure will show 89.5, and the distance measure will

show 25.9. All of the data has been combined properly to give a result that would have been obtained if the prism had been set inside the tree.

Example 2:

You need a measurement to the top of a power pole. Assume the power pole is 30 feet away from you, and has a height of 40 feet. (If you could put a prism on top of such a pole, you would find the slope distance is 50 feet and the zenith angle is 36.5212).

First enter "0" into the "HT:" field in the FORESIGHT screen. Place the prism at the base of the pole. Click on the **1st Measure** button from the REMOTE OBJECT screen to measure the distance to the base of the pole. If, for example, the prism is one foot higher than the instrument, then the zenith angle reading will be 88.0527, and the slope distance reading will be 30.0166.

Next, aim the instrument at the top of the pole and click on the **2nd Measure** button to get the angle measurements. Here, the zenith angle reading is 36.5212; let's assume the horizontal angle reading is 105.3.

Now, click on the **GO** button to place the calculated distance into the FORESIGHT screen. The horizontal angle will show 105.3 (same as was measured), the vertical angle will show 36.5212 (same as was measured), and the slope distance will show 50.4088 (this value is computed from the input data). The REMOTE OBJECT screen combines both sets of measured data to produce the result that would have been obtained if the prism had been set atop the pole.

13.7 Using Sets to Improve Accuracy

Various methods may be used to improve the accuracy of a survey by taking more than one measurement to a point. Two methods, and the data entry procedures to use with the CMT-SURVEY, are described below.

The data recorded for the multiple measurements will be used when you execute the **Field Work/Adjustment** function (Section 13.9). Within the Field Work/Collect function, no adjustment or angle averaging is performed on the measurement sets. You can use the **View/Measurement** function (Section 13.8) and click the "Summary" button to view the averaged angle and distance values for multiple measurements.

13.7.1 Repetition Angles

Measure a **repetition angle** (also called an **accumulation angle**) by taking repeated measurements to the backsight and foresight targets that define the **single angle** to be measured. Begin with a backsight reading of 0, then use the previous foresight angle for each new backsight reading so as to double, triple, quadruple, etc. the measured angle. The repetition angle method can only be used on theodolites with upper and lower motions (clamps).

The procedure for measuring a repetition angle with CMT-SURVEY is shown below:

1. In the Repetition Setup screen under Field Work/Field Work Setup, verify that the **repetition sequence** is **BFBF**, and that the desired number of turns in the measurement set is specified. Also confirm the acceptable tolerances.
2. From the BACKSIGHT screen, click on the **Set** button to begin a set of measurements.
3. Aim at the backsight target, clear the horizontal reading to 0, and record the backsight measurement. Click the **Store** button to advance to the "FORESIGHT" screen.
4. With the UPPER motion, aim at the foresight target and click **Side** to record the foresight measurement. This is the angle measurement from the backsight to the foresight.
5. Click **Endset** from the "FORESIGHT" screen to end the first turn (set) and begin the second turn (set) of measurements. The program will prompt you to reverse the instrument and then return to the "BACKSIGHT" screen.
6. Plunge the scope (to minimize collimation error), then with the LOWER motion aim at the backsight target and record the backsight measurement. This measurement should be the same as the previous foresight measurement. Click the **Side** button to proceed to the "FORESIGHT" screen again.
7. With the UPPER motion, aim at the foresight target and record the foresight measurement. This measurement will be double the previous foresight measurement. If the angle computed from the measurement is not within tolerance, you will be notified immediately to take corrective action. Click the **Side** button to record the measurement and return to the "BACKSIGHT" screen again.
8. Steps 5 and 6 are repeated for the number of turns specified in step 1.

13.7.2 Direction Sets

When multiple readings are used to improve accuracy, the direction set method of measuring angles makes the most of the measured data. With this method, you can take measurements for **any number of foresight points** within a measurement set. Up to 16 measurement sets (8 measurement sequences) can be made for each collection of points. The measurement sequence can be BFFB, BFBF or BBFF. Therefore, you may specify only an even number of measurement sets to be taken. Direction sets and repetition angles are measured in a similar fashion, although the lower motion is not used for direction sets, so any type of theodolite may be used for direction sets.

The procedure for measuring direction sets with CMT-SURVEY is shown below:

1. In the Repetition Setup screen under Field Work/ Field Work Setup, check that the repetition mode is set to: BFBF, BFFB, or BBFF and an even number of turns (sets) to be taken in the measurement is specified as desired.
2. From the BACKSIGHT screen, click the **Set** button to begin taking the first set (turn) of measurements.
3. Aim at the backsight target, and record a backsight measurement. The backsight measurement may have any value, including 0. Click the **Store** button to advance to the "FORESIGHT" screen.

4. Aim at a foresight target and take foresight measurement. This is the angle measurement from the backsight to the foresight. **Click Side to record the measurement**; the point number will automatically increment to the next unused point number.
5. Repeat step 3 for each foresight point in the measurement set. When all foresight points have been measured, click **Endset** to end the first set (turn) and begin the next set of measurements. The program will prompt you to reverse the instrument and then continue with the next measurement set. The distance and angle values obtained from this first measurement set will be used as a reference for determining if the values obtained from subsequent measurement sets are within tolerance.
6. Plunge the scope (to minimize collimation errors) and, depending on the sequence selected in the "Repetition Setup" screen, sight the backsight (for BFBF) or the last foresight (for BFFB).
7. Make sure you cover all the foresight points when taking the foresight measurements. If a distance or angle value is not within tolerance, you will be notified immediately to take corrective action.
8. When the second measurement set is finished, the program will prompt you for the third measurement set, and the process continues until all the measurement sets have been taken.

13.8 Viewing Measurement Data

Select the **View/Measurement** function to display the measurement data records:

| Reduced | Resize | OS | BS/FS | Type | Set | Horz. Angle | Vertical Dist | Horz. Dist | HT | HI |
|---------|--------|----|-------|------|-----|-------------|---------------|------------|-----|-----|
| Adjust | 1 | 1 | 06 | BS | 1/1 | 0.0° | 0.0 | 100.0 | 0.0 | 0.0 |
| | 2 | 1 | 03 | SS | 1/1 | 90.0° | 0.0 | 20.0 | 0.0 | 0.0 |
| Convert | 3 | 1 | 01 | SS | 1/1 | 0.0° | 0.0 | 100.0 | 0.0 | 0.0 |
| Add | 4 | 1 | 04 | SS | 1/1 | 90.0° | 0.0 | 65.0 | 0.0 | 0.0 |
| Del | 5 | 1 | 05 | FS | 1/1 | 180.0° | 0.0 | 55.0 | 0.0 | 0.0 |
| Show | 6 | 2 | 02 | BS | 1/1 | 135.0° | 0.0 | 100.0 | 0.0 | 0.0 |
| Edit | | | | | | | | | | |
| Value | | | | | | | | | | |
| Exit | | | | | | | | | | |

Click the **Show** button and turn on the display of traverse and side-shot paths. The measurement paths will be displayed in the Map View.

If you wish to see more of the Map displayed, use View/Sheet to turn off the Sheet View, then click the Zoom-Fit icon.

To create a Line Feature from the displayed traverse path, click the **Convert** button. A dialog will appear asking you to confirm the name of the new feature. A new topic will automatically be created for you containing the new feature.

Click the **Reduced** button to see the reduced data. If there are multiple measurement sets in the data, the angles and distances displayed are the averaged values.

To add a description or a note to a survey point, highlight the corresponding record, click the **Value** button and enter the information.

To edit a measurement, highlight that record and then click the **Edit** button. A dialog will appear that allows you to change measurements for that record. When finished making edits, click on the OK button and you will be prompted to perform an Adjustment based on the new measurement data.

To add a measurement, click the **Add** button.

To delete a measurement, highlight that record and then click the **Delete** button.

CAUTION: Do not make changes to the measurement records if you are not absolutely sure of what you are doing.

13.9 Survey Adjustment

The Field Work/Adjust option is used to adjust a traverse and balance any measurement errors that have occurred. **Only the point coordinates are changed; the raw field data measurements are always preserved.**

When you select Field Work/Adjust, or click the **Adjust** button from the Measurement View, the **Adjust Raw Data** screen is displayed:

ADJUST RAW DATA

| | Stop # | Path Start | Path End | Adjust Start | Adjust End | Close Point |
|---|--------|------------|----------|--------------|------------|-------------|
| 1 | 5 | 1 | 1 | 1 | 1 | 1 |

Adjust parameters for selected path:

Start OS: 1 End OS: 1 Close Point: 5
Start BS: 10 End FS/SS: 10 Loop type: semi-closed
Start Dir.: 067.8645 Ref Dir.: 067.8645 End Dir.: 067.933
Traverse Type: CLOSED LOOP Adjust Method: COMPASS
☒ Angle Adjust ☒ Elevation Adjust Distance Tolerance: 0.0000 Angle Tolerance: 000.0500

Error Summary

| | | | |
|--------------------------|-----------|----------------|-----------------|
| Horizontal-angle error: | 000.0000" | Linear error: | 0.4552 |
| Vertical distance error: | 0.0000 | Perimeter: | 1104.5000 |
| North/South error: | 0.0434 | Bearing error: | N00°00'00.0000" |
| East/West error: | 0.4525 | Precision: | 52 |

Closing Points

| | Northing: | Easting: | Orthometric: |
|---------------|-----------|----------|--------------|
| Start Point: | 860.5018 | 883.6442 | -11.4359 |
| End Point: | 860.5018 | 883.6442 | -11.4359 |
| Actual Point: | 860.4524 | 883.1917 | -11.4359 |

Buttons: **Adjust**, **Exit**, **Help**

The Adjust Raw Data screen displays the traverse paths to be adjusted, the number of stops in the path, the starting and ending point numbers for the paths as well as the type of the traverse path. If any traverse path is not to be adjusted when you click the **Adjust** button, then remove the check mark from the corresponding **Adjustment** box.

Before performing a traverse adjustment, first check the data in the **Adjustment Parameters for Selected Path** section.

Specify the beginning and ending traverse points. For a closed-loop traverse, the first and last points are the same. For an end-ties traverse, the last point must be a control point. CMT-SURVEY will automatically select these for you, but they may be changed.

Enter the angle and distance tolerances into the respective data entry fields.

Generally, CMT-SURVEY will determine the traverse type for you. Available options are **OPEN TRAVERSE**, **CLOSED LOOP TRAVERSE** and **END TIES TRAVERSE**.

Available **Adjust Methods** are: Compass, Transit and Least-Squares.

Place a check mark in the **Angle Adjust** box if angle adjustment is desired. If an adjustment method other than Compass or Transit is selected, then angle adjustment will automatically be performed as is appropriate for the adjustment method. If angle adjustment is selected for Compass or Transit, the angular error is distributed evenly to each angle in the traverse. In this case, you will see no angle errors in the Error Summary.

If angle adjustment is not selected, no angle adjustment will be performed. In this case, the total angle error will be shown in the horizontal angle error (HA-E) field of the RAW CLOSURE screen.

Place a check mark in the **Elevation Adjust** box if elevation adjustment is desired. When no elevation adjustment is selected, the total elevation error will be shown in the Error Summary and no error distribution is performed. When elevation adjustment is selected, the elevation error is distributed to each leg of the traverse, and 0 elevation error is shown in the Error Summary screen.

Based on the selected adjustment method and the type of traverse path, CMT-SURVEY displays the raw closure errors in the **Error Summary** section. The **Precision** value is the ratio of the length of the total traverse to the linear error. In general, a precision value of 5000 or higher indicates that there are no gross errors.

Coordinates for the starting and ending points are displayed in **Closing Points** section at the bottom of the screen.

If the closure information looks satisfactory, then perform the adjustment by clicking on the **Adjust** button.

The adjusted survey points will be conferred the "**3D Fixed**" status. This is displayed in the Feature Properties screen of each point. If you perform another adjustment on a previously adjusted job, you will be prompted to overwrite the existing traverse and side-shot points with the new adjusted points.

Please Note: A closed-loop or end-ties traverse needs to meet certain requirements on how the ending measurements are taken in order to be successfully adjusted. These requirements must be taken into consideration when you are collecting data with the Surveyor's Assistant program in the field.

Last OS of closed loop traverse with internal BS must be the same as the internal BS.

Last OS of closed loop traverse with external BS must be the same as the first OS point.

End-ties traverse must have last OS at a control point.

Last FS of closed loop traverse with internal BS must be the same as the first OS point.

Last FS of closed loop traverse with external BS must be the same as the first BS.

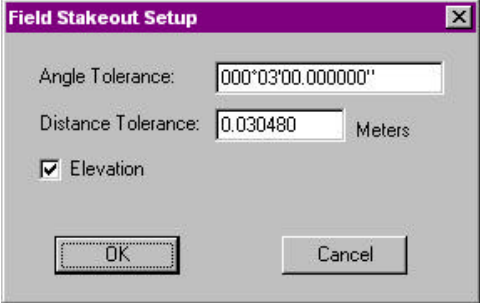
End-ties traverse must end with FS to an azimuth mark.

13.10 Stakeout

In addition to the powerful GPS Stakeout functions, CMT-SURVEY also provides Staking functions for your Total Station. The following sections describe the different Stakeout options available for CMT-SURVEY under the Field Work menu.

13.10.1 Stakeout Setup

When you select Field Work/Stakeout Setup the following dialog is displayed to specify acceptable tolerances during the stakeout process:

The image shows a software dialog box titled "Field Stakeout Setup". It has a purple title bar with a close button (X) on the right. The dialog contains three input fields: "Angle Tolerance:" with the value "000°03'00.000000\"", "Distance Tolerance:" with the value "0.030480" and the unit "Meters" to its right, and a checked checkbox labeled "Elevation". At the bottom, there are two buttons: "OK" and "Cancel".

| | |
|---|-------------------|
| Angle Tolerance: | 000°03'00.000000" |
| Distance Tolerance: | 0.030480 Meters |
| <input checked="" type="checkbox"/> Elevation | |
| OK | Cancel |

Specify the acceptable angle and distance tolerances in the above dialog. The angle system and units of measurement displayed reflect those global settings under the View/Configure menu and the Map/Coordinate System settings, respectively. Place a check mark in the Elevation box if you want these tolerances to apply to elevation readings (vertical plane) as well as data in the horizontal plane.

Please note: Note that the stakeout data may be stored only when both the horizontal angle measurement and the distance measurement are within the specified tolerances.

13.10.2 Point Stakeout

Use the Point Stakeout function to stake out individual points, or points along a line or area. Select Field Work/Stakeout/Point Stakeout to display the following dialog:

Stakeout Reset

Instrument Point

Height:

Backsight Point

Back Reading:

Measure

Target Point

Height:

Horizontal

Horizontal

Vertical Distance:

Instrument Point: Specify the instrument point number.

Height (Instrument): Specify the instrument height.

Backsight Point: Specify the backsight point number.

Back Reading: Enter the backsight reading; or, click the **Measure** button to take the reading from the instrument.

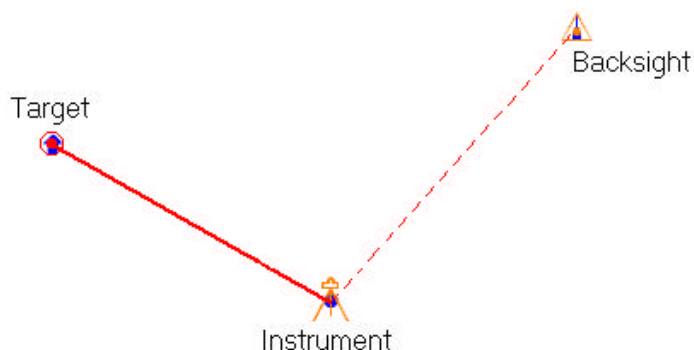
Target Point: Specify the foresight point number for the point you wish to stake.

Height (Target): Specify the rod height.

Please note: For entry of the points of “Instrument” and “Backsight”, you may either type in the Point ID itself, or (when the field has a red box in it indicating it is active) you can use your Mouse pointer and click on the point in your Map View. Only points in the current Job may be selected.

After the Instrument, Backsight and Target Points have been specified, CMT-SURVEY will automatically provide you with the Horizontal Angle and Distance measurements as well as Vertical Distance to the Target Point.

The Map View graphically shows each of these points and will look similar to the following:



After all data has been entered in the required fields, the **Stakeout** button will become active at the top of the screen. The **Reset** button will erase all data entered and reset the fields to zero. When you click **Stakeout**, the STAKEOUT POINTS frame will be displayed to show you the difference between the desired and measured values for the angles and distances:

The screenshot shows the CMT-SURVEY software interface. At the top, there are four buttons: 'Auto', 'Measure', 'Store', and 'Exit'. Below these, there are two input fields: 'Horizontal Angle:' with the value '257°45'56.053424"' and 'Horizontal Distance:' with the value '106.576813'. Below the input fields is a 'Save Meas.' button. Underneath the button, the text 'Distance OK' and 'Direction OK' is displayed in green. At the bottom, there is a diagram labeled 'Foresight Direction' showing a green square with a black circle inside, and a blue dot at the center of the circle, representing the instrument's position and the target point.

Auto: Sets CMT-SURVEY to auto-tracking mode for continuous position update (only for use with instruments that have the auto-tracking function).

Measure: Takes a new measurement from your instrument.

Store: Stores a point at the current location of the rod.

Exit: Exits the STAKEOUT POINTS screen and returns to the previous frame.

Each time you take a new measurement by clicking the **Measure** button, CMT-SURVEY will update the difference between the desired and measured values for the angles and distances. (To test this in the office, simply punch in some numbers close to the expected values.) This process is repeated until the measurement is within tolerance. Initially, the angle and distance shown are the values computed from the previous screen. These will be replaced with the actual measured values when a measurement is taken.

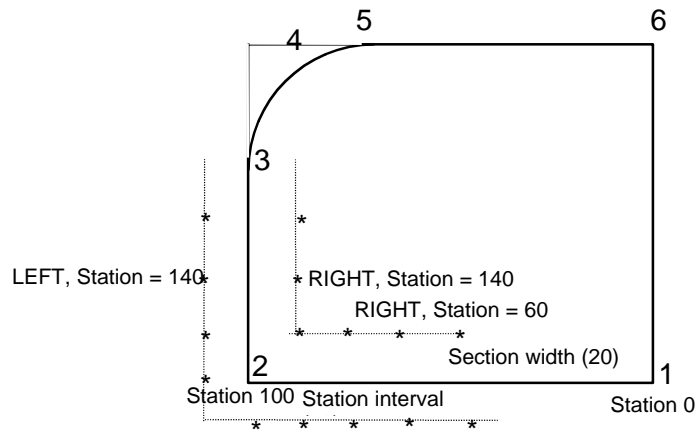
Use the displayed angle and distances to the point to aim the instrument in the direction specified and place the target at the distance specified, then click the **Measure** button.

When the data is within tolerance, a beep will be sounded and the Save Meas. Button will be made active. When this happens, set the stake in the ground and take another measurement. If the stake position is acceptable, click the **Save Meas.** button to record the measured data and return to the STAKEOUT LOCATION screen. **You will notice that the Target Point number has automatically advanced to that of the next point in your job file.** Repeat the point staking process until all points in the job have been staked.

Click the **Store** button to save the stake point location when it is within tolerance, if you wish.

13.10.3 Offset Stakeout

Use the offset stakeout routine when you have a defined figure and need to stake an identical figure at a fixed offset distance. For example, in road design you may have the data recorded for the centerline. To allow you to define the points for the roadsides, enter the width of the road from the centerline to the edge of the road. Enter an interval to specify the distance between the successive points you are staking on the offset. CMT-SURVEY will automatically advance to the next stake point at the click of a button. See the following diagram for definition of notation for offset staking.



This diagram for offset stakeout uses the following data:

| | | |
|------------------|------|---------------------------|
| FIGURE: | = 1 | (L:1-3, A:4, 5-6,1) |
| STATION INTERVAL | = 20 | |
| SECTION WIDTH | = 20 | (same for Right and Left) |
| CROSS SLOPE | = -5 | (same for Right and Left) |
| CURB HEIGHT | = 0 | |
| CURB WIDTH | = 0 | (same for Right and Left) |

The "*" points are the road boundary points to be staked. The inside "*" points are at the RIGHT direction of FIGURE 1 and the outside "*" points are at the LEFT direction.

In the above illustration, the intersection of the lines formed by the outside "*" points will not be automatically created by CMT-SURVEY. You can use the "COGO Intersect" routine to solve for this point by entering point 1, the azimuth for line 1-2, point 3, the azimuth for line 3-2 and the proper offsets. Use the "Point Stakeout" function to stake this point.

Click on **Offset Stakeout** from the Field Work/Stakeout Menu to display the OFFSET STAKEOUT frame. This screen allows you to locate the instrument, select an offset direction, select a figure, select an offset value, and set the initial backsight reading to be used in the offset stakeout procedure:

Instrument Point: Specify the instrument point number (or click on it in the Map View).

Height (Instrument): Specify the instrument height.

Backsight Point: Specify the backsight point number (or click on it in the Map View).

Back Reading: Enter the backsight reading manually; or, click the **Measure** button to take a reading from the instrument.

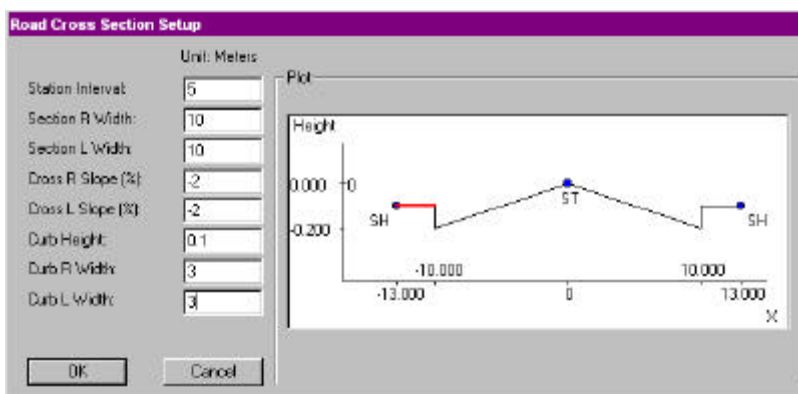
Target Feature: Specify the line or area figure number of the figure to be used for the offset calculations (or click on it in the Map View).

Height (Target): Specify the rod height.

Station: Specify the distance along the figure from the setup station from which the offset will be taken. This field will be automatically incremented by a predefined interval when you select **XSection**. The interval is specified in the ROAD SECTION screen which you can call up by clicking the **XSection** button.

Offset: Specify the offset direction (LEFT, RIGHT or CENTER). This determines whether the offset points will be to the left, to the right or centered on the figure.

Click on the **XSection** button to define the road section in the ROAD SECTION screen. The ROAD SECTION screen is used for defining the section interval as well as the offset and elevation of the boundary point of the road with respect to the centerline. After these are defined, CMT-SURVEY uses the station, offset and elevation information to compute the coordinates of the stake points which it then uses to stake the road boundary.



Station Interval: Specify the interval distance between successive stations.

Section R/L Width: Specify the perpendicular distance from the figure line to the hinge point on the right/left side.

Cross R/L Slope (%): Enter the right/left cross-section slope percentage for each offset point, omitting the percentage sign. This is the ratio between the height of the centerline and the section width, multiplied by 100.

Curb Height: Specify the height of the curb. If the curb has no height, enter 0. The unit is specified at the top of the screen.

Curb R/L Width: Specify the width of the curb on the right/left side. If the curb has no width, enter 0.

A graph of the road section is displayed to the right of the data entry fields.

Click **OK** to save the information entered in the ROAD SECTION screen and return to the OFFSET STAKEOUT screen or click **Cancel** to abort.

The following information is displayed in the Offset Stakeout screen after completion of all fields:

Horizontal Angle: Horizontal angle to the point.

Horizontal Distance: Horizontal distance to the point.

Vertical Distance: Vertical distance to the point.

After you have defined the road section and completed data entry in the OFFSET STAKEOUT screen, click the **Stakeout** button to go to the STAKEOUT POINTS screen, which displays the difference between the desired and measured values for the angle and distances:

Auto: Sets CMT-SURVEY to auto-tracking mode for continuous position update (only for use with instruments that have the auto-tracking function).

Measure: Takes a new measurement from your instrument.

Store: Stores a point at the current location of the rod.

Exit: Exits the STAKEOUT POINTS screen and returns to the previous frame.

Save Meas.: Saves the Stakeout measurement data and creates a point at the target.

Prev: Moves to the previous station.

Next: Moves to the next station.

Each time you take a new measurement by clicking the **Measure** button, CMT-SURVEY will update the difference between the desired and measured values for the angle and distances. To test this in the office, simply punch in some numbers close to the expected values. This process is repeated until the measurement is within tolerance. Initially, the angle and distance shown are the values computed from the previous screen.

A screen plot for the offset staking is shown in the STAKEOUT POINTS screen for easy visual reference of distance and direction needed. Any discrepancies between the measured position and the target position will be displayed above the graph. When within tolerance, these Fields will be shown in green and will indicate: "Distance OK" or "Direction OK". If outside tolerance, the following fields will be displayed in red along with the corrective distance or direction information. The following fields are displayed:

Horizontal Angle: Horizontal angle to the point.

Horizontal Distance: Horizontal distance to the point.

Vertical Distance: Vertical distance to the point.

SHORT/LONG: Distance long or short of the desired point.

RIGHT/LEFT: Distance left or right of the desired point.

Use the displayed angle and distances to the point to aim the instrument in the direction specified and place the target at the distance specified, then click the **Measure** button.

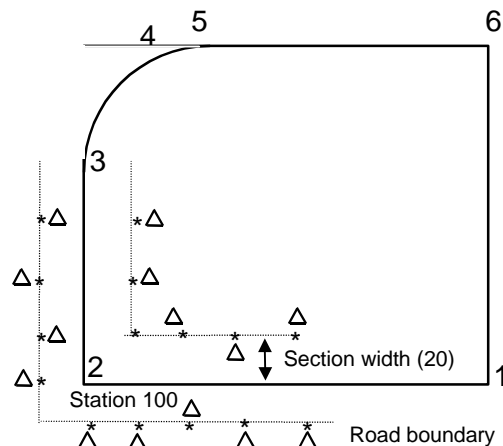
Click the **Store** button to save the current stake location when it is within tolerance, if you wish.

When the data is within tolerance, a beep will be sounded and the **Save Meas.** button will be made active. When this happens, set the stake in the ground and take another measurement. If the stake position is acceptable, click the **Save Meas.** button to record the measured data.

Click the **Next** button to advance to the next offset stakeout point and increment the station value by the interval defined in the ROAD SECTION screen.

13.10.4 Slope Stakeout

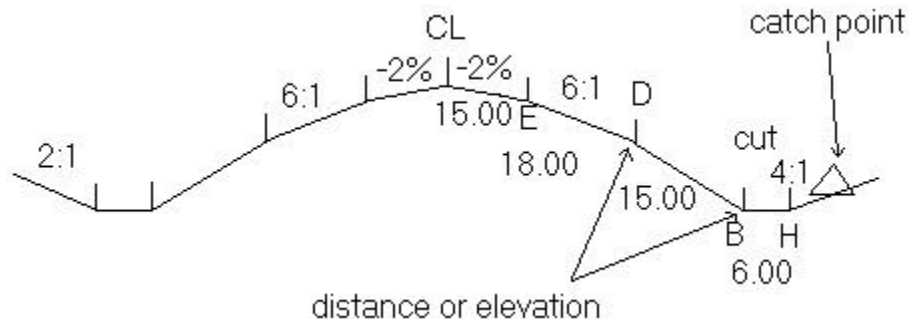
Slope staking is very similar to offset staking with the exception that the road section provides for multiple cross slopes as well as a positive or negative side slope. The following diagrams define the notation used in this section.



This diagram for slope stakeout uses the following data:

| | |
|------------------|---|
| FIGURE | = 1 (L:1-3, A:4, 5-6,1) |
| STATION INTERVAL | = 20 |
| SECTION WIDTH | = 15 |
| CROSS SLOPE | = -2 |
| DIST1 | = 18 |
| CROSS SLOPE1 | = -6 |
| DIST2 | = 15 |
| CROSS SLOPE2 | = -4 |
| DITCH WIDTH | = 6 (distance between hinge point and boundary point) |
| SIDE SLOPE | = 2 |

The "*" points are the road boundary points. The "Δ" points are the **catch points** that you want to find. Because the surface of the ground may not be at the same elevation, the catch points may not be as regular as the road boundary points. Following is a diagram of the road section for this example.



The technique for finding a **catch point** is not easy. First, this is a trial and error approach to locating the catch point. The measured data must be consistent with the road section. CMT-SURVEY will tell you the error in the current measured data with respect to the road section. This error will be helpful in locating the catch point but it is not an absolute error such as you find in the other stakeout methods. The error is dependent on the horizontal and vertical distances defining the slope from the boundary point to the catch point. These distances are measured values as well. The boundary point will be a known point after the road section is setup. Find the catch point by trying several stake points. For three-dimensional slope staking, it will be helpful if you can keep one of the variables constant. For example, try to keep the horizontal angle the same while moving the stake in or out to the required horizontal distance, then move the stake up or down to the required vertical distance.

The slope staking function allows you to define all the instrument data, the offset direction, the figure path, the current station distance, estimated cut/fill and the backsight reading. To call up the SLOPE STAKEOUT screen, select **Field Work/Stakeout/Slope Stakeout**.

Stakeout

Reset

Instrument Point

2

Height: 0.0

Backsight Point

STRUCTUR001

Back Reading: 000'00'00.0"

Measure

Target Feature

ROADS001

Height: 0.0

Station: 0.0

Offset: Left

Estimated: 0.0

Prev

Next

XSection

Horizontal Angle: 309°36'33.5"

Horizontal Distance: 98.7

Vertical Distance: 14.8

Instrument Point: Specify the instrument point number (or click on the Point in the Map View).

Height (Instrument): Specify the instrument height.

Backsight Point: Specify the backsight point number (or click on the Point in the Map View).

Back Reading: Enter the backsight reading manually; or, click the **Measure** button to take a reading from the instrument.

Target Feature: Specify the figure number of the figure to be used for the offset calculations. You may also click on the Figure in the Map View to select a figure from the current job.

Height (Target): Specify the rod height.

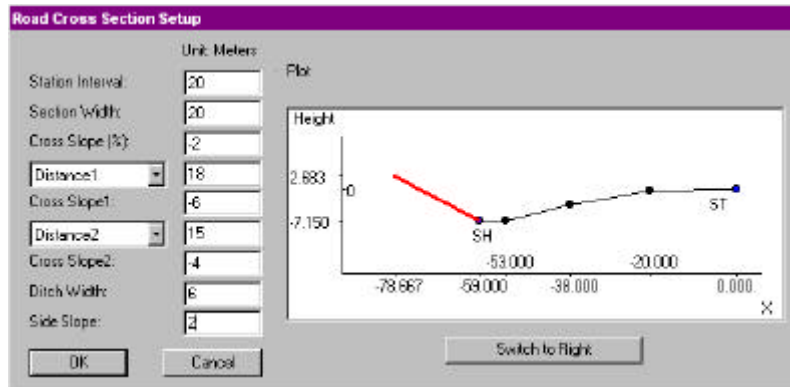
Station: Specify the distance along the figure from the setup station from which the offset will be taken. When you click the **Next** button, this field will be automatically incremented by the interval you specified in the ROAD SECTION screen

SECTION screen.

Offset: Specify the offset direction (LEFT or RIGHT). This determines whether the offset points will be to the left or to the right of the figure.

Estimated: Specify the estimated cut/fill for the catch point of the slope stakeout.

To enter the road section data, click the **XSection** button to call up the ROAD SECTION screen. The ROAD SECTION screen is used for defining the section interval as well as the cross slopes, ditch width and side slope for each side of the road. CMT-SURVEY uses this information to help you find the catch point.



Station Interval: Specify the interval distance between successive stakes.

Section Width: Specify the width of the central segment of the road.

Cross Slope (%): Enter the cross slope percentage for the central segment of the road, omitting the percentage sign. This is the ratio of the height of the central segment to the section width, multiplied by 100. Enter a negative value for a downward slope.

Distance1: Use the pull-down arrow to toggle between Distance1 and Elevation1.

Cross Slope1: Specify the cross slope that, in combination with Distance1 or Elevation1, defines the next segment of the road section. Enter a negative value for a downward slope.

Distance2: Use the pull-down arrow to toggle between Distance2 and Elevation2.

Cross Slope2: Specify the cross slope that, in combination with DIST2 or ELEV2, defines the next segment of the road section. Enter a negative value for a downward slope.

Ditch Width: Enter the ditch width.

Side Slope: Specify the side slope defined as the ratio between the horizontal distance from the boundary point to the catch point and the vertical distance from the boundary point to the catch point. (A side slope of 1 is 45 degrees.) This ratio can be positive only. The elevation computed by the measured data will decide whether the slope is positive or negative.

A graph of the road section is displayed to the right of the data entry fields for a visual reference.

Click **OK** to save the information entered in the ROAD SECTION screen and return to the SLOPE STAKEOUT screen or click **Cancel** to abort.

After you have defined the road section and completed data entry in the SLOPE STAKEOUT screen, click the **Stakeout** button to go to the STAKEOUT POINTS screen, which displays the difference between the desired and measured values for the angle and distances.

Auto: Sets CMT-SURVEY to auto-tracking mode for continuous position update (only for use with instruments that have the auto-tracking function).

Measure: Takes a new measurement from your instrument.

Store: Stores a point at the current location of the rod.

Exit: Exits the STAKEOUT POINTS screen and returns to the previous frame.

Save Meas.: Saves the Stakeout measurement data and creates a point at the target.

Prev: Moves to the previous station.

Next: Moves to the next station.

Catch Point Info.: Displays the Catch Point Information screen.

Each time you take a new measurement by clicking the **Measure** button, CMT-SURVEY will update the difference between the desired and measured values for the angle and distances. To test this in the office, simply punch in some numbers close to the expected values. This process is repeated until the measurement is within tolerance. Initially, the angle and distance shown are the values computed from the previous screen:

Horizontal Angle: Horizontal angle to the point.

Horizontal Distance: Horizontal distance to the point.


Vertical Distance: Vertical distance to the point.

LONG/SHORT: Distance long or short of the desired point.

RIGHT/LEFT: Distance left or right of the desired point.

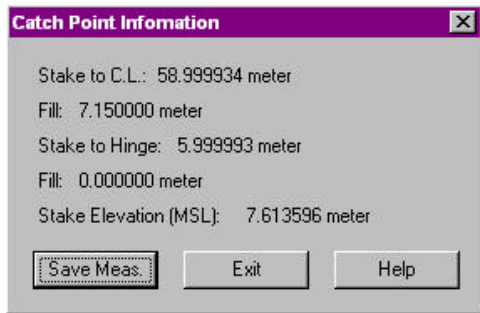
Use the displayed horizontal angle and the displayed distances to the point to aim the instrument in the direction specified and place the target at the distance specified, then click the **Measure** button.

Click the **Store** button to save the current stake location, if you wish.

A screen plot is shown at the bottom of the STAKEOUT POINTS screen for the slope staking. The solution point is marked as: .

When the data is within tolerance, a beep will be sounded and the **Save Meas.** button will be active. In addition, the **Catch Point Info** button will become active.

Click on the **Catch Point Info.** button to see information about the Catch Point:



Catch Point Information

Stake to C.L.: 58.999934 meter

Fill: 7.150000 meter

Stake to Hinge: 5.999993 meter

Fill: 0.000000 meter

Stake Elevation (MSL): 7.613596 meter

Save Meas. Exit Help

Stake to C.L.: The horizontal distance from the centerline (figure line) to the catch point (current stake point).

Cut/Fill: The vertical distance from the curb height to the catch point.

Stake to Hinge: The horizontal distance from the hinge point to the catch point.

Stake Elevation: The elevation of the catch point.

Cut/Fill: The vertical distance from the curb height to the catch point.

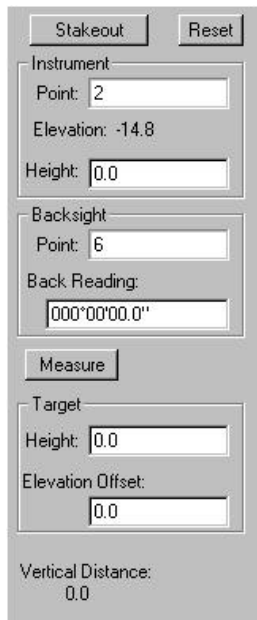
Click the **Exit** button to return to the STAKEOUT POINTS screen if the stake position is not acceptable.

If the stake position is acceptable, click **Save Meas.** to record the measured data, store the catch point coordinates and return to the STAKEOUT POINTS screen.

From the STAKEOUT POINTS screen, click **Next** to advance to the next slope stakeout point. The station value in the STATION field will be automatically incremented by the interval defined in the ROAD SECTION screen. Repeat the slope stake process until all stake points in the slope stakeout job have been staked.

13.10.5 Elevation Stakeout

Select Field Work/Stakeout/Elevation Stakeout to display the ELEVATION STAKEOUT frame. This screen allows you to locate the instrument, select an elevation offset with respect to the instrument elevation, and set the initial backsight reading to be used in the elevation stakeout procedure.



Stakeout Reset

Instrument

Point: 2

Elevation: -14.8

Height: 0.0

Backsight

Point: 6

Back Reading: 000°00'00.0"

Measure

Target

Height: 0.0

Elevation Offset: 0.0

Vertical Distance: 0.0

Instrument Point: Specify the instrument point number (or click on the Point in the Map View).

Height (Instrument): Specify the instrument height.

Backsight Point: Specify the backsight point number (or click on the Point in the Map View).

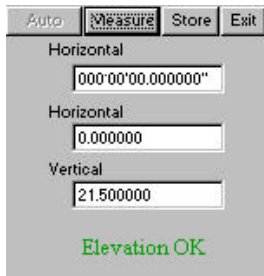
Back Reading: Enter the backsight reading manually; or, click the **Measure** button to take a reading from the instrument.

Target Height: Specify the rod height.

Target Elevation: Specify the rod elevation.

Vertical Distance: This field is automatically calculated and displayed based off of data entry in the target fields.

After you have completed data entry in the ELEVATION STAKEOUT screen, click the **Stakeout** button to go to the STAKEOUT POINTS screen.



Auto: Sets CMT-SURVEY to auto-tracking mode for continuous position update (only for use with instruments that have the auto-tracking function).

Measure: Takes a new measurement from your instrument.

Store: Stores a point at the current location of the rod.

Exit: Exits the STAKEOUT POINTS screen and returns to the previous frame.

Click the **Measure** button to get the measurements to the Foresight point. An example is shown in the above screen. Move the stake up or down until you see the message “Elevation OK”. As you move the stake up or down you will see a message saying “CUT” or “FILL” along with the actual number needed to reach the target. (The stakeout tolerances are not functional for the elevation stakeout.) At this time, the stake point is lower than the instrument point by the distance specified in the **Elevation Offset** field in the ELEVATION STAKEOUT screen.

Click the **Store** button to store the stake point. Then continue with the next stake point.

13.11 Field Work Tutorial

This tutorial covers the following topics:

- Create a job named 2LOTS-2.
- Traverse a plot of land.
- Do a closed-loop traverse adjustment.
- Use COGO to divide the plot into two sections of approximately equal areas.
- Stake the division point.

Please Note: A sample file named **2LOTS.FMP** is included in your CMT-SURVEY software package. You will be entering the same data into the **2LOTS-2.FMP** job. If you do not wish to enter data at this time but just want to try the adjustment and COGO functions, then open the 2LOTS.FMP file and save it as 2LOTS-2.FMP to play with.

Set up the 2LOTS-2 Job

Use File/New to open a new Map file. Then use File/Save As to save it as 2LOTS-2.FMP.

Use **Map/Coordinate System** to select NAD 83 datum, UTM Zone 10 coordinate system and **US Survey Feet** distance unit.

Use **View/Configure/Angle and Cogo** to select Angle Unit = DMS, Azi. System = North, Angle Dir = Right, Angle System = Azimuth, Vert. System = Zenith.

Use **View/Configure/Map** to set Number of Decimal Digits = 4.

Traverse a Plot of Land

CMT-SURVEY lets you to trigger measurements from your total station and input that data directly into the various Field Work screens. For our exercises, we will manually input the measurement data.

Step 1: Record the Occupied Station

All field work performed in CMT-SURVEY begins with OCCUPY STATION. Select **Field Work/Collect** to see the following screen:

| COLLECT | | |
|------------|--------|-----------|
| One prism | Remote | Change OS |
| Two prisms | Auto | Edit |
| Measure | Go | Traverse |

| Occupy Station | |
|----------------|------------|
| Feature ID: | 1 |
| Topic: | Field Work |
| HI: | 0.0 |

For this tutorial, we will keep the HI and HT (instrument height and target height) fields at "0.000".

Click the **Go** button to store the first OS record. Because Point 1 has not yet been created, you will be prompted to enter its coordinates. **Enter Northing = 1000** and **Easting = 501000**.

After entering data into a data field, press the **Tab** key on your keyboard to advance to the next field.

Step 2: Record the Backsight

Now, the BACKSIGHT screen is displayed. Change the Feature ID to "10".

| COLLECT | | |
|------------|--------|-----------|
| One prism | Remote | Change OS |
| Two prisms | Auto | Edit |
| Measure | Store | Set |

BackSight

Feature ID:
Topic:

OS: Field Wo001

Back Reading:

Zenith Angle:

Slope Distance:

Accept "0.0000" as the Back Reading. (If you were using a total station to sight the back point, you would click the MEASR button to automatically record the back angle.

Click the **Store** button to record the backsight point. Since Point 10 has not yet been created, you will be prompted to enter its coordinates or bearing. **Enter Northing = 1000 and Easting = 500900.**

Step 3: Record the Foresight Point

From the FORESIGHT screen, you can store a traverse record or a side-shot record. We will record a traverse point here. **Change the Feature ID to "2".**

| COLLECT | | |
|------------|--------|-----------|
| One prism | Remote | Change OS |
| Two prisms | Auto | Edit |
| Measure | Side | Traverse |

ForeSight

Feature ID:
Topic:

OS: 1

BS: 10

Horizontal Angle:

Zenith Angle:

Slope Distance:

Enter Horizontal Angle = 180 and Slope Distance = 200.

Then click on **Traverse** to store Point 2 as a traverse record and move to the next OCCUPY STATION screen.

Step 4: Repeat the Process


Notice that "2" is now the default Feature ID in the new OCCUPY STATION screen. Do not enter any data, but **click Go** to store this point as the new Occupied Station (OS). In the next BACKSIGHT screen, the Feature ID defaults to the previous OS point (Point 1). Again, do not enter any data, but **click Store** to store this point as the new BS.

In the next FORESIGHT screen, enter Horizontal Angle = 135 and Slope Distance = 300. Then click **Traverse** to store Point 3 as a traverse record and move to the next OCCUPY STATION screen.

Use the same procedure to complete the remaining traverse legs. The values to be entered are listed below. The last record is a side-shot.

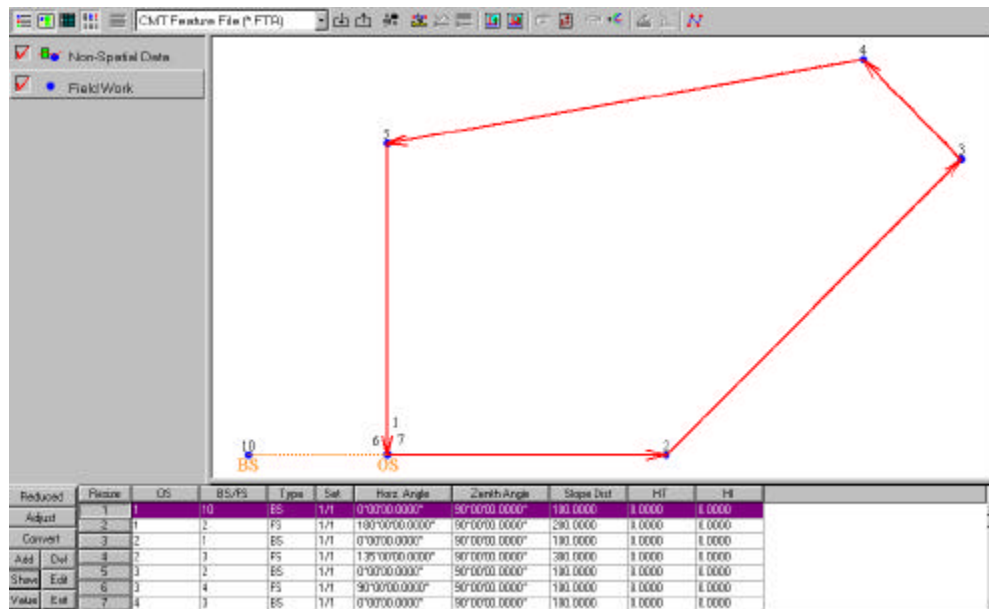
Please make sure to change the Feature ID as necessary to agree with the following data set.

| SCREEN | PT | HEIGHT | HORZ. ANGLE | ZENITH ANGLE | DISTANCE | BUTTON |
|-----------|----|--------|----------------|-----------------|----------|-----------------|
| OCC. STA. | 3 | 0.00 | | | | GO |
| BACKSIGHT | 2 | 0.00 | 0° | | | STORE |
| FORESIGHT | 4 | 0.00 | 90°00'00" | 90° | 100.0000 | <u>TRAVERSE</u> |
| OCC. STA. | 4 | 0.00 | | | | GO |
| BACKSIGHT | 3 | 0.00 | 0° | | | STORE |
| FORESIGHT | 5 | 0.00 | 125°03'00" | 90° | 346.7500 | <u>TRAVERSE</u> |
| OCC. STA. | 5 | 0.00 | | | | GO |
| BACKSIGHT | 4 | 0.00 | 0° | | | STORE |
| FORESIGHT | 1 | 0.00 | 99°56'30" | 90° | 222.7500 | <u>TRAVERSE</u> |
| OCC. STA. | 1 | 0.00 | | | | GO |
| BACKSIGHT | 5 | 0.00 | 0° | | | STORE |
| FORESIGHT | 10 | 0.00 | 270°00'00" | 90° | 0.0000 | SIDE |

When finished with the data entry, click on the  icon to close the data input panel.

Viewing Measurement Data

Select the **View/Measurement** function to display the measurement data records. Click the Reduced button to see the reduced data. Click the **Show** button and turn on the display of traverse and side-shot paths. You should see a graph of the 2LOTS-2 job as shown in the following screen:



To obtain a text report of the coordinates in your 2LOTS-2 job, select **File/Print** then select **Coordinate**. Select **Fielddata** to view or print out the measurement data.

Adjusting the Traverse

Our 2LOTS-2 job contains minor measurement errors that may be minimized by performing an adjustment. To perform an adjustment to this job, select **Field Work/Adjust**.

Accept the displayed start and end points for the closed loop traverse.

Enter Angle Tolerance = 5 min and Distance Tolerance = 0.3 survey ft.

The Error Summary section displays the calculated errors.

Click on **ADJUST**.

As the errors are within the specified angle and distance tolerances, the traverse will be balanced without question.

Using COGO

We will now cut the land into two lots.

First, select Map/Add Feature by Point List and then select Add Area.

Enter "1-5" as the definition of the Area Feature of interest. This specifies the area enclosed by a line going from Point 1 to Point 5.

Now, use the Measure Area icon to see the area of the plot of land.

We wish to cut the area into two pieces, using Point 2 as a hinge for the division line. The piece on the west side is to be exactly 0.9 acre in size.

Select **Cogo/Hinge cut Area**.

Select the Area Feature you created above as the target area.


Select **Acres** as the area unit.

Enter Area = 0.9. Enter "2" as the Hinge Node.

For Include Point in List, select **Previous**.

Click on the **SOLVE** button.

Click the **STORE** button to store the solution. Enter 6. This means to use 6 as the ID of the division line, 7 as the beginning point ID and 8 as the ending point ID of the division line.

Click on the  icon to close the data input panel.

Point Stakeout

We can use the Point Stakeout function to help us put a stake on the ground at the hinge point (**Point ID = 8**) we found in the above COGO procedure.

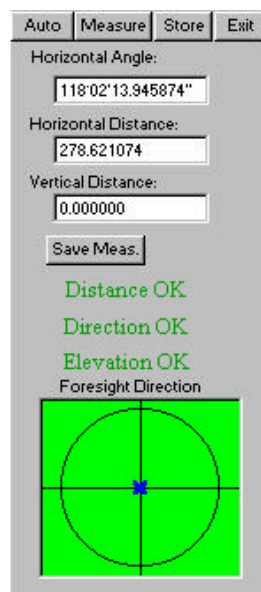
Select **Field Work/Stakeout Setup**.

Enter Angle Tolerance = 5 min, Distance Tolerance = 0.3 survey ft, Elevation = YES.

Select **Field Work/Stakeout/Point Stakeout**.

Enter Instrument Point = 1, Backsight Point = 10 and Target Point = 8. (You may use the mouse to select the points for these data fields.)

The horizontal angle and the distance from the instrument point to the target point are displayed. Click the **Stakeout** button to see the following screen:




The screenshot shows a software interface for point stakeout. At the top are four buttons: "Auto", "Measure", "Store", and "Exit". Below these are three input fields: "Horizontal Angle:" with the value "118°02'13.945874\"", "Horizontal Distance:" with the value "278.621074", and "Vertical Distance:" with the value "0.000000". Below the input fields is a "Save Meas." button. Underneath the button are three green status indicators: "Distance OK", "Direction OK", and "Elevation OK". At the bottom is a diagram labeled "Foresight Direction" showing a green circle with a blue dot in the center, representing the target point.

Now, change the displayed Horizontal Angle to 117 degrees and the Horizontal Distance to 280 survey ft. CMT-SURVEY tells you that you are about 1.3 ft long and about 5 ft too far to the left. You will also see the current rod location in Map View.

For an actual job, you would try to move the rod closer to the target and click the **Measure** button to get new measurement data. When the data is within tolerance of the target location, the diagram showing the rod location relative to the target will be colored green.

For our exercise, change the Horizontal Angle to 118 degrees and the Horizontal Distance to 278.5 survey ft so we are within the specified tolerance.

This is where you would put in the stake. If you wish to store the stake point into the job, click **Measure** again then click the **Store** button.

Click on the  icon to close the data input panel.

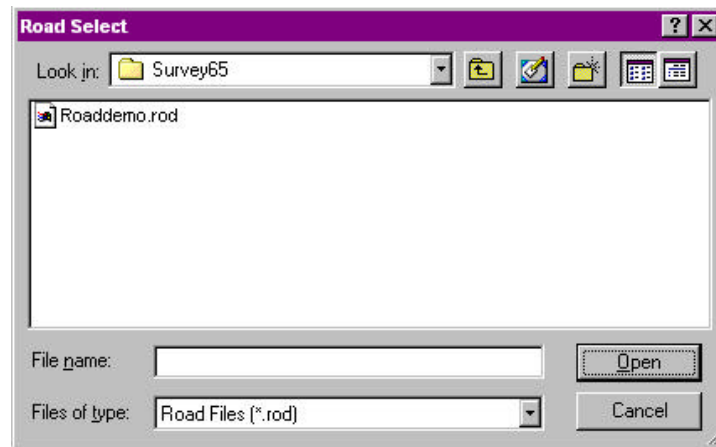
Section 14 - Road Design

The Road menu (only available in CMT Survey) provides several options for defining and staking out a Road. This information can then be added to your jobs, or downloaded to your hand-held computer for field stakeout.

When you select Road from the Main Toolbar, the following options are provided: **New/Open**, Property, **Layout** and **Save**.

14.1 Creating or Selecting a Road File

The **Road/New/Open** option allows you to create a new Road file, or select an existing one. When you select Road/New/Open, the following dialog box is displayed:



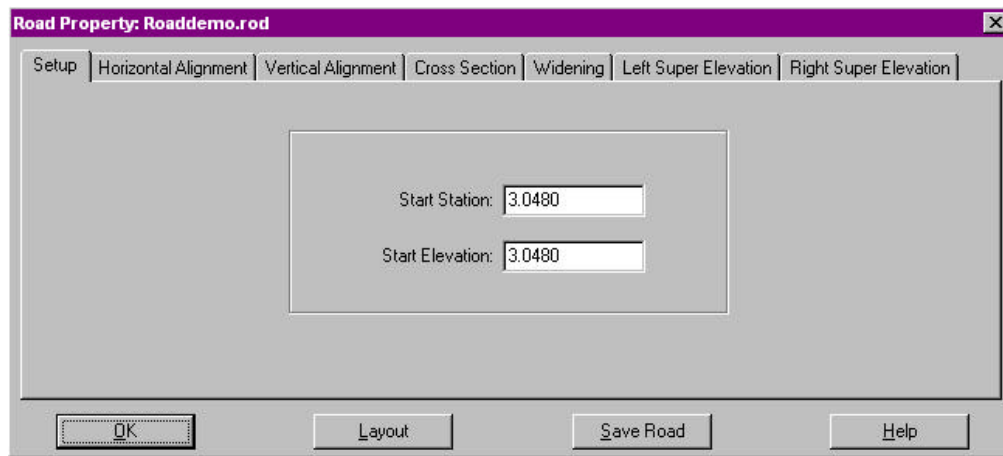
If you wish to use an existing road file simply double-click on the file or select the file and click the Open button it to activate it.

To create a new road file:

1. Select the New/Open option under the Road Menu.
2. Enter a new name in the File Name field.
3. Click the Open button to create the road. Once a Road has been created or selected, the Road Property dialog box will be displayed.
4. Use the Road Property dialog to specify the properties of the road, such as horizontal alignment, vertical alignment, etc. You can define new left and right templates or use existing templates to specify the cross-section for the road.
5. Use the Road Layout dialog box to place the road onto the map at the specified location.

14.2 Road Properties

After you have created or selected a Road file, you will want to assign properties to the Road. When you select **Road/Property**, the Road Property dialog box will be displayed:



The Road Property dialog box contains several pages for entering Road property information. These pages are described in the following sections.

14.2.1 Road Setup

The Setup page of the Road Property allows you to designate a starting station and starting elevation for your Road. All of the Road Property information that you supply will begin at this station number and elevation.

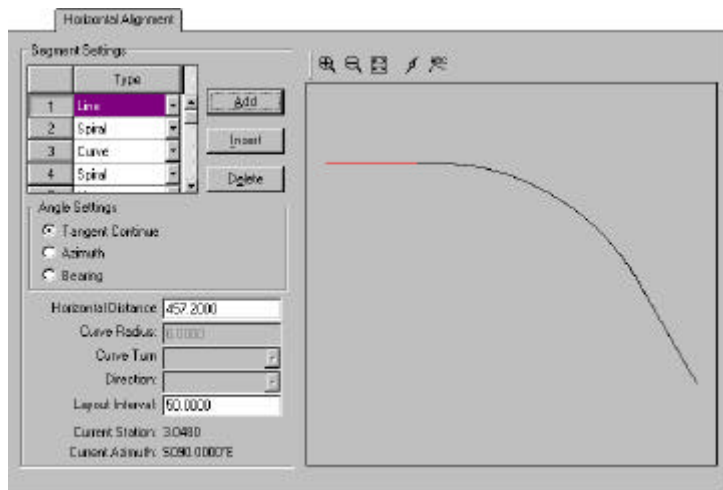
- OK:** Save the current settings of the active road file and returns to the Map View.
- Layout:** Display the layout dialog box. This function will allow you to place your road in the current job file.
- Save Road:** Save the settings for the current road file to a new filename.

14.2.2 Horizontal Alignment

Horizontal Alignment is used to describe how the Road is laid out in the horizontal plane.

You will use the Horizontal Alignment page to define each change in direction for your Road, and also to define how far your Road will travel in the specified direction.

When you select the Horizontal alignment option in the Road Property dialog box, the following page is displayed:



Add: Appends a new segment record to this page.

Insert: Inserts a new segment record above the current record.

Delete: Deletes the segment current record from the page or dialog box.

Type: Select the segment type from Line, Curve or Spiral. For line types, only horizontal distance and layout interval may be entered to define the line. Curves allow entry for all fields except direction. Spirals must use all fields to define the spiral.

**Horizontal Distance
/Spiral Length
/Curve Length:**

Enter the length of the current segment. The current segment is highlighted in red in the graphical display window.

Curve Radius:

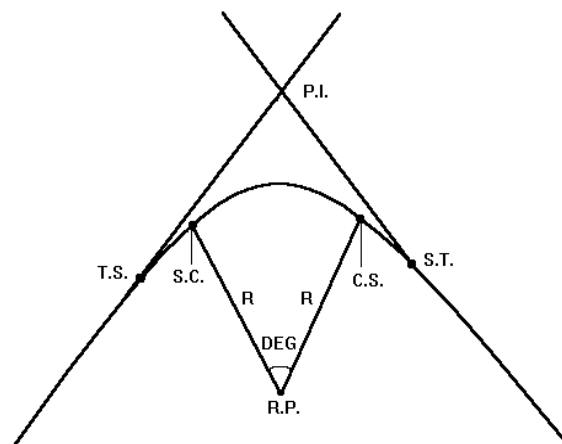
Enter the radius of the curve or spiral.

Curve/Spiral Turn:

Enter the direction of turn for the curve or spiral.

Direction (Spirals only):

Specify the direction of the spiral from CS → ST or from ST → CS. See diagram below for more information about the different components of a spiral curve.



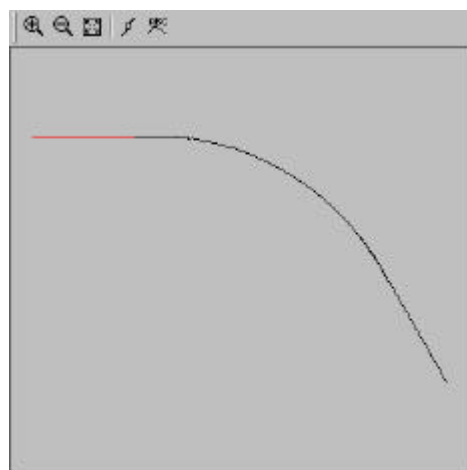
PI: Point of intersection






RP: Radius point

| | |
|-------------------------|--|
| TS: | "Tangent to spiral curve" intersection point |
| SC: | "Spiral to circular curve" intersection point |
| CS: | "Circular to spiral curve" intersection point |
| ST: | "Spiral curve to tangent" intersection point |
| R: | Radius of the circular curve |
| DEG: | Angle subtended by the circular portion of the spiral curve, in degrees |
| DELTA: | Supplement of the angle between the incoming and outgoing tangents (equal to the central angle subtended by the entire spiral curve) |
| Layout Interval: | Specify the interval between the stakeout station locations. |
| Current Station: | The Current Station field displays the station number where the current segment of the road alignment will begin. |
| Current Azimuth: | The Current Azimuth field displays the azimuth at the point where the current segment begins. |

You may use as many records as necessary to define the Horizontal Alignment of the Road.

The Horizontal Alignment dialog also provides a graphical display of the Horizontal Alignment of your Road, based on the data entered.



-  : Zooms in on the plot
-  : Zooms out on the plot
-  : Scales the plot to fit inside the window
-  : Shows the location of the segments along the Road.
-  : Labels each segment of the road with the record number.

14.2.3 Vertical Alignment

The Vertical Alignment is used to describe how the elevation of the Road changes, through the use of straight grade or parabolic vertical curves. You will define where changes in grade occur, and how long the grade is maintained.

When you select the Vertical alignment option in the Road Property dialog box, the following page is displayed:

Add: Appends a new segment record to this page.

Insert: Inserts a new segment record above the current record.

Delete: Deletes the current segment record from the page or dialog box.

Curve Type: Select from Straight or Parabolic to define the current segment type. The current segment is highlighted in red in the graphical display window.

Horizontal Distance: Enter the Horizontal Length of the Grade or Parabolic Curve.

Grade: Enter the grade of the segment in percent slope. For Parabolic segments a beginning and ending grade will need to be entered.

Current Station: The Current Station field displays the station number where the current segment of the road alignment will begin.

Elevation: The Elevation field displays the elevation at the start of the current grade or vertical curve.

You may use as many records as necessary to define the Vertical Alignment of the Road.

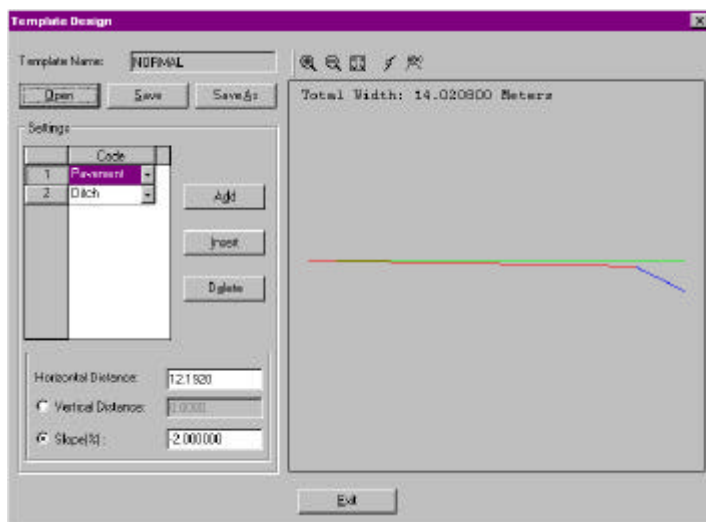
14.2.4 Cross Section

Once you have defined your Vertical and Horizontal Alignments, you are ready to create a Cross Section of your Road. You will need to assign the Templates to be used for specific station ranges of your Road. When you first enter the Cross Section option from the Road Property dialog, you will want to click on the **Template Design** button to define cross section templates. The creation of templates increases productivity in Road Design by reducing the number of repetitive steps to define your cross section.

A **Template** is used to describe a cross-section of a specified segment of the Road, given that the centerline of the Road has been established using the Horizontal and Vertical Alignments described above. Each Template describes segments of the Road that extend perpendicular to the centerline of the Road.

The Templates describe the Road width, curbing, sidewalks, ditches, etc., as well as the grading of the Road from the centerline out. Each Template describes one side of the Road between two specified stations.

When you click on the **Template Design** button from the Cross Section dialog, the following page will be displayed:



Open: Opens a template.

Save: Saves the current template under the current template name.

Save As: Saves the current template under a different name.

Add: Appends a new code record to this page.

Insert: Inserts a new code record above the current record.

Delete: Deletes the current code record from the page or dialog box.

Template Name: Display the name of the Template currently being used.

Open: Open an existing Template to view or modify.

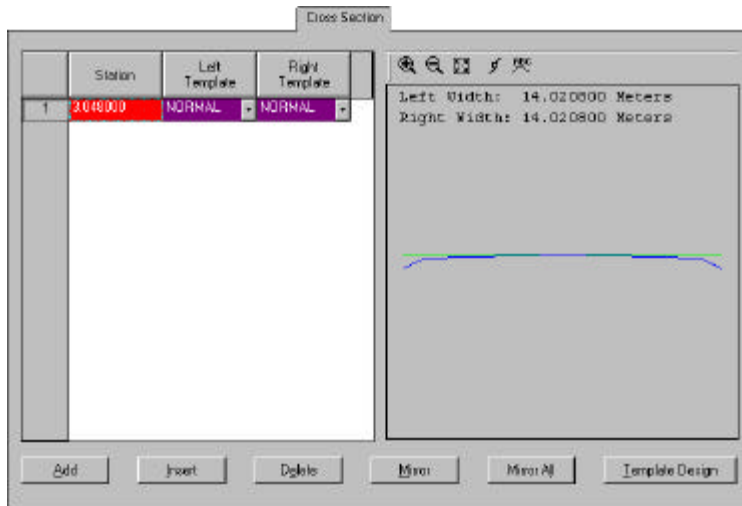
Code: This field is for a descriptive code of the Template segment. CMT-SURVEY provides some default codes (Pavement, Curb, Sidewalk, Ditch), or you may type in your own.

Horizontal Distance: Enter the Horizontal distance of the segment. The first segment in the Template starts at the centerline of the Road. Subsequent segments start at the end of the previous segment.

Vertical Distance: Enter the Vertical Distance of the segment. A positive value indicates a gradient above the centerline. Conversely, a negative value will indicate a downward gradient. As an alternative, you can enter the Slope as a percentage.

You may add as many segments (code records) as necessary to define the Template of the Road.

After definition of the templates, you are ready to design your Road Cross Section. Click on the **EXIT** button at the bottom of the page to exit and return to the Cross Section dialog. The following page will be displayed:



Add: Appends a new record to this page.

Insert: Inserts a new record above the current record.

Delete: Deletes the current record from the page or dialog box.

Mirror: Assigns the entered template to the blank template field in the same record.

Mirror All: Assigns the entered template to the blank template field for every cross section record.

Template Design: displays the select dialog box, which allows you to select a template from all existing templates.

Station: Enter the Station number where the specified Template will be applied to the Road.

Left Template: Specify which Template will be applied to the left side of the Road at the specified Station number.

Right Template: Specify which Template will be applied to the right side of the Road at the specified Station number.

Use the Add, Insert and Delete buttons to create and remove records. Click on a pull down button to view a list of the available Templates from which you can make a selection. Click the **Mirror** button to apply the same Template to both sides of the Road for the current segment, or click the **Mirror All** button to apply the same Template to both sides of the Road over the entire course of the Road.

You may use as many records as necessary to define the Cross Section of the road.

14.2.5 Widening

Widening is used to temporarily modify the width of the inner-most segment of your cross-section. You can also do this with a new Template, but the Widening function provides for a smooth transition and requires less work. You can define separate Widening for the left and right side of your Road.

When you select the Widening option from the Road Property dialog box, the following page is displayed:

Widening

| Left Widening | | | | Right Widening | | | | | |
|---------------|---------------|-------------|-------------|----------------|---|---------------|-------------|-------------|-----------|
| | Begin Station | End Station | Begin Width | End Width | | Begin Station | End Station | Begin Width | End Width |
| 1 | 100.584 | 132.988 | 12.192 | 7.620 | 1 | 100.584 | 132.988 | 12.192 | 7.620 |
| 2 | 162.880 | 217.932 | 7.620 | 12.192 | 2 | 162.880 | 217.932 | 7.620 | 12.192 |

Cross Section Information

| | Station | Left Template | Left Width | Right Template | Right Width |
|---|---------|---------------|------------|----------------|-------------|
| 1 | 3048000 | NORMAL | 14.021 | NORMAL | 14.021 |

Add: Appends a new record to this page.

Insert: Inserts a new record above the current record.

Delete: Deletes the current record from the page or dialog box.

Mirror to Right: Copies the current record in the left super elevation or widening page, to the right super elevation or widening page, or vice versa.

Mirror All to Right: Assigns the entered template to the blank template field for every cross section record.

Begin Station: Enter the station where the Widening will begin to be applied. You can see the station number in the Horizontal Alignment page.

End Station: Enter the station where the Widening will be completed.

Begin Width: Enter the width of the innermost segment of the Template at the Begin Station.

End Width: Enter the width of the innermost segment of the Template at the End Station.

You may use as many records as necessary to define the Widening of the Road. Click the **Mirror to Right** button to apply the current width to the right side of the Road as well. Click the **Mirror All** button to apply all of the widths to the right side of the Road as well.

Please note: You must create a second Widening record which returns the Template to its original width, or the changes created by the Widening will carry through until a new Template is assigned to the Road.

14.2.6 Super Elevations

Super Elevations are used to temporarily change the grading of the center segment of the cross-section. Super Elevations are typically used to create banking in your Roads as they enter and leave curves. You will apply different Super Elevations to the left and right sides of the Road, so there are two pages available.

When you select the Left Super Elevation or Right Super Elevation option from the Road Property dialog box, the following page will be displayed:

Left Super Elevation

| | Begin Station | End Station | Begin Slope | End Slope | Parabolic Begin Length | Parabolic End Length |
|---|---------------|-------------|-------------|-----------|------------------------|----------------------|
| 1 | 160.248 | 710.184 | -2.000 | 6.000 | 0.000 | 0.000 |
| 2 | 1609.344 | 1853.280 | 6.000 | -2.000 | 0.000 | 0.000 |

Cross Section Information

| | Station | Left Template | Elevation |
|---|----------|---------------|-----------|
| 1 | 3.046000 | NORMAL | -1.150 |

Add: Appends a new record to this page.

Insert: Inserts a new record above the current record.

Delete: Deletes the current record from the page or dialog box.

Mirror to Right: Copies the current record in the left super elevation or widening page, to the right super elevation or widening page, or vice versa.

Mirror All to Right: Assigns the entered template to the blank template field for every cross section record.

Begin Station: Enter the station where the Super Elevation begins.

End Station: Enter the station where the Super Elevation ends.

Begin Slope: Enter the slope, in percent, at the beginning station.

End Slope: Enter the slope, in percent, at the ending station.

Parabolic Begin Length: If you will use parabolic transitions, enter the length of the parabola that smoothes the transition from the Begin Slope to the End Slope.

Parabolic End Length: If you will use parabolic transitions, enter the length of the parabola that smoothes the transition from the End Slope to the Begin Slope.

You may use as many records as necessary to define the Super Elevation of the road. Use the Add, Insert and Delete buttons to create and remove records. Click the **Mirror to Right** button to apply the current super elevation segment to the right side of the Road as well. Click the **Mirror All** button to apply all of the super elevation segments to the right side of the Road as well.

Please note: If you are not using a parabolic transition, you must create a second Super Elevation record to bring your grading back to that of the original Template.

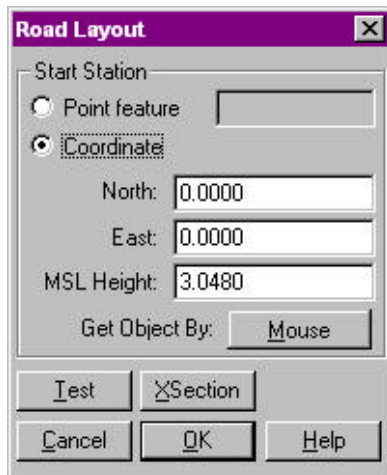
The functions of the Layout and Save Road buttons are detailed in Section 14.3 and 14.4.

14.3 Road/Layout

The Road Layout dialog box is used to assign the current Road file to a specific location in your current Map. After specifying the location for the road, click the Test button to see how the road looks on your

map. Click OK only if the road is exactly where you want it to be. When you click OK, the road and all the stakeout points will be added to your map.

When you select the Road/Layout menu option, or click the Layout button from the Road Property dialog box, the following Road Layout dialog box is displayed:

The image shows a software dialog box titled "Road Layout" with a purple title bar and a close button (X) in the top right corner. Inside the dialog, there is a "Start Station" section with two radio buttons: "Point feature" and "Coordinate". The "Coordinate" radio button is selected. Below these are three text input fields: "North:" with the value "0.0000", "East:" with the value "0.0000", and "MSL Height:" with the value "3.0480". Below these fields is a "Get Object By:" label followed by a button labeled "Mouse". At the bottom of the dialog, there are five buttons arranged in two rows: "Test", "XSection", "Cancel", "OK", and "Help".

Mouse: Click on a coordinate location in the current job which will serve as the starting point for the centerline of your road.

Test: Lets you see how the road will be placed in the current job.

XSection: Displays the XSection dialog box. In this dialog box, you will see a profile of your road as you move from station to station.

Cancel: Cancels the Layout function and returns to the Map View or the Road Property dialog box.

OK: Click the OK button only after you have used the "Test" Button to check the layout and determined that it is satisfactory.

Define the placement of the start of the Road centerline within your Job by Point Feature or by Coordinate.

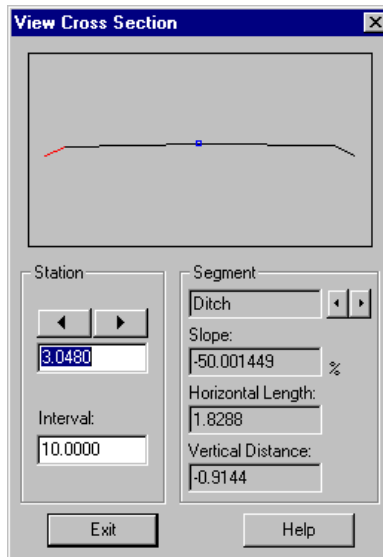
Point Feature: If you select the Point Feature method, enter the Point Number of the Point Feature in this field.

North, East, MSL Height: If you select the Coordinate method, enter the starting coordinates in the appropriate fields.

Layout Interval: Enter the interval at which you would like to determine coordinates along the Road for the purpose of creating a Line Feature of each Road segment, and for staking out the Road.

Click on the **Test** button to place the Road in your Job. If the position of the Road is correct, click the OK button.

Click on the **XSection** button to see a graph of the cross section of the Road.



Interval: Specify the interval at which you would like to move along the Road as you view it in the View XSection dialog box.

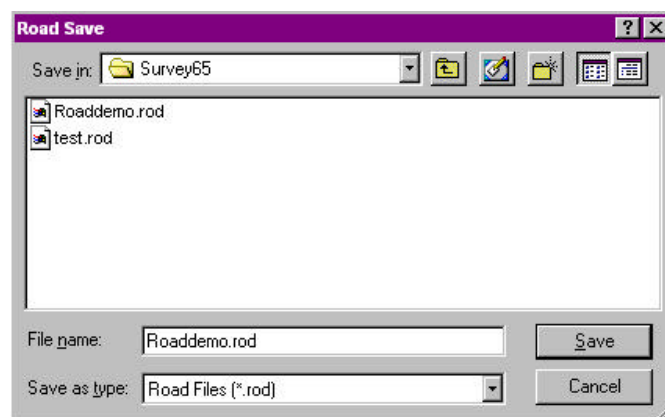
Station: This field displays the station number of the station that is currently being displayed.

Segment: Use the fields in this box to select a specific segment of the Road (highlighted in RED in the display) and the Horizontal Length, Slope and Vertical Distance for that segment will be displayed.

For example, click the right arrow until the center left segment is highlighted. The horizontal length, slope and vertical distance of the segment will be displayed.

14.4 Road/Save

The Road/Save menu option is used to save the configuration of the active Road file. When you select Road/Save, or click on the Save Road button in the Road Property dialog box, the Save Road dialog box below is displayed:



The Road Save dialog box operates like a standard Windows Save As dialog box. Enter the name of the Road to be saved and click the OK button to save it. If the Road already exists, you will be asked if you would like to overwrite the existing Road file.

Appendix A: Glossary

- Almanac** - Library of coarse satellite orbital characteristics used to calculate satellite rise times, set times, angles of elevation, etc. Almanac data is valid for 60 days. The almanac is used by the GPS receiver to determine which satellite constellations to track and by PC-GPS Mission Planning.
- Attributes** - Attributes are the third layer of data in PC-GPS Map files, and the second layer of data in PC-GPS Job files. Attributes are used to further describe collected Features. Attributes can be thought of as questions which are asked about the Feature.
- Azimuth** - The angular displacement in the horizontal plane between the antenna and the point at which the satellite first appears on the horizon, with respect to true north. Azimuth ranges from 0-360, with 0 and 360 indicating true north. For example, an azimuth of 90 indicates due east.
- C/A Code** - The standard (Coarse/Acquisition) GPS code. Without differential correction, C/A Code data provides 15 meter accuracy (50 meter accuracy with Selective Availability turned on). With differential correction C/A Code data can provide accuracies of 5 meters (2DRMS). Also known as the "civilian code."
(Note: Some GPS units are capable of sub-meter, post-processed, C/A code data.)
- Carrier Phase** - A type of differential processing that provides submeter accuracy. Data collection for carrier phase processing requires substantially higher occupation times and continuous lock on a satellite constellation.
- Constellation** - A group of GPS satellites visible to a receiver. The size of a usable constellation is a minimum of four satellites. Valid corrections may be computed from a constellation of four or more satellites.
- Differential Correction** - The process of improving accuracy by comparing field data against a GPS reference station. Differential correction requires GPS base station data for the same time-range as the field data. Differential correction can be performed in either real-time or post-processing modes. Base station data is typically available through electronic bulletin boards or the internet.
- Dilution of Precision (DOP)** - A measure of quality of the GPS derived position and time estimates, based on the geometry of the satellite constellation. A smaller DOP indicates better geometry which yields a better solution. Generally, the more spread out the satellites, the lower the DOP. The DOPs used for GPS satellite tracking are as follows:
- NDOP - Dilution of precision in the north axis.
 - EDOP - Dilution of precision in the east axis.
 - VDOP - Dilution of precision in the vertical axis.
 - TDOP - Dilution of precision with respect to time.
 - HDOP - Horizontal dilution of precision.
 - PDOP - Position dilution of precision.
 - GDOP - Geometric dilution of precision.
- Doppler Shift** - The apparent change in the frequency of a signal caused by the relative motion of the transmitter and receiver.
- Ellipsoid** - In geodesy, a mathematical figure formed by revolving an ellipse about its minor axis.
- Ellipsoidal Height** - Height of the ellipsoid relative to sea level. This is an alternate elevation system to Mean Sea Level.

- Ephemeris Data - Tabulation of accurate data describing position and health of the satellites over a 24 hour period. The data is uploaded from a ground control station to the satellites every 12 hours, but old data remains useful for 6 months. Ephemeris data is required for differential correction.
- Feature - Secondary organizational layer for data in PC-GPS Map files. Primary organizational layer for data in PC-GPS Job files. A Feature is the object which is being mapped (Point, Line or Area). Features are defined by a name and an X, Y, Z coordinate. Features can be further described by Attributes and Values.
- Feature List - List of Features, Attributes and Values which can be used in the field to streamline data collection. Feature Lists can be generated in PC-GPS and downloaded to the hand-held data collector.
- GPS Base Station - The GPS receiver located at a precisely known location which records the reference data used during differential correction.
- Geographic Information System (GIS) - System for presenting and analyzing spatial and non-spatial data. Typically PC or Workstation based, GIS systems are used to generate maps which reflect desired characteristics of the spatial data.
- Global Positioning System (GPS) - The NAVSTAR GPS, consisting of orbiting satellites, a network of ground control stations, and user positioning and navigation equipment. The system has 21 satellites in six orbital planes about 20,200 km above the earth. Three additional satellites are strategically stationed in orbit as spares in the event of on-line satellite malfunction.
- Initialize - Entering key operating constants into the hand-held data collector, enabling it to start producing accurate positions. The constants are latitude, longitude, time, date and altitude.
- Map File - Principal PC-GPS data file. The Map file contains spatial and non-spatial data. Most of the operation in PC-GPS are performed on Map files.
- Map View - Graphical representation of spatial and non-spatial data contained in a Map file. The Map View provides a "picture" of the Map file.
- Mission Planning - Process of evaluating satellite conditions to determine data collection conditions prior to initiating field work.
- Multipath Error - Errors caused by the interference of a signal that has reached the receiver antenna by two or more different paths. Usually caused by one path being bounced or reflected before reaching the receiver.
- Object Linking and Embedding (OLE) - Capability to link objects, such as pictures, video clips, documents and worksheets to a Map file or Feature in PC-GPS.
- Open DataBase Connectivity (ODBC) - Capability to transfer information between database formats. ODBC allows the user to export Map file data into several database formats, and to import data from a database format into a Map file.
- Pseudo-range - The distance from an orbiting satellite to a GPS receiver. The pseudo-range is calculated by measuring the time it takes for the satellite transmission to reach the GPS receiver, and then multiplying the result by the speed of light.
- Route - Series of WayPoints forming a path along which to navigate.
- Selective Availability - Refers to the policy of the US Government to degrade GPS accuracy available to civilian users to approximately 100 meters 2D RMS. Positional error caused by Selective Availability is removed by the differential correction process.

- Sheet View - Tabular representation of Attributes and Values associated with the Features in the active Topic. The Sheet View provides a spreadsheet like table containing all of the Attributes and Values for the active Topic.
- Signal-to- Noise Ratio - Quantitative relationship between the useful and non-useful part of the received satellite signal. A minimum value of 32 dB is needed for tracking. Average values range from 38-41 for low-elevation satellites and 42-50 for mid-to-high-elevation satellites.
- State Plane Coordinate (SPC) - Coordinate system designed by individual States. Many maps provided by State agencies reference SPC coordinates.
- Topic - Primary organizational layer for data in PC-GPS Map files. Each Topic contains Features which have the same Attributes. Topics may also contain Shapes and non-spatial data.
- Topic View - Listing of all of the Topics contained in the Map file. The Topic View contains a catalogue of all the Topics in the current Map File.
- Tracking - Receiver mode (TRK) where the GPS unit is locked onto a satellite and is evaluating its status.
- Universal Time Coordinated (UTC) - Greenwich Mean Time corrected for polar motion of the earth and seasonal variation in the earth's rotation.
- Universal Transverse Mercator (UTM) - Coordinate system used by most government agencies. Often used in the production of "Quad" maps.
- Values - Final organizational layer of data in PC-GPS Map and Job files. Values are the answers to the questions asked by the Attributes.
- WGS-84 Datum - The basic reference frame and geometric figure for the earth provided by the World Geodetic Survey of 1984. The datum is used by the GPS satellites.
- WayPoint - A known location which can be downloaded to the data collector via a route file and referenced during navigation operations.

Appendix B: Base Station Requirements

LEICA (Leica MX9112, MX9012, MX9212, MX4200, GPS Engine)

| TYPE | FILENAME | EPHEMERIS FILE REQUIRED? |
|-------|----------|-------------------------------|
| Leica | *.DIF | No (ephemeris in *.DIF file). |

MOTOROLA

| TYPE | FILENAME | EPHEMERIS FILE REQUIRED? |
|----------|----------|-------------------------------|
| Motorola | *.DIF | No (ephemeris in *.DIF file). |

NOVATEL

| TYPE | FILENAME | EPHEMERIS FILE REQUIRED? |
|---------|----------|-------------------------------|
| Novatel | *.DIF | No (ephemeris in *.DIF file). |

4000 (Trimble)

| TYPE | FILENAME | EPHEMERIS FILE REQUIRED? |
|------|----------|--------------------------------|
| 4000 | *.DAT | Yes (file must be named *.EPH) |

PC-GPS can differentially correct Trimble 4000 data. You do not need any other files to use the Trimble 4000 format.

TRIMBLE PATHFINDER COMMUNITY BASE STATION

| TYPE | FILENAME | EPHEMERIS FILE REQUIRED? |
|----------|----------|-------------------------------|
| SSF | *.SSF | No (ephemeris in *.SSF file). |
| SSF Sync | *.SSF | No (ephemeris in *.SSF file). |

You must acquire the Trimble program SSFRNX.EXE (filesize 63,756, file date 8/26/93) and copy it to the PC-GPS directory before PC-GPS can process Trimble *.SSF base station files. You must use this particular version of SSFRNX.EXE - other versions may not work. It is important to note that the files are copied together based on the numbers in the file name rather than the order in which you selected them.

If the base station is set to record SYNC data, you must acquire the Trimble file SYNC2RAW.EXE and copy it to the PC-GPS directory before trying to differentially correct.

RINEX

| TYPE | FILENAME | EPHEMERIS FILE REQUIRED? |
|-------|----------|---------------------------------|
| RINEX | *.0?O | Yes (file must be named *.0?N). |

Comments: RINEX (**R**eceiver **I**ndependent **E**Xchange format) is the "Generic" GPS format, usable by most GPS systems. Generally, there are three files containing RINEX data: a header file, observation file and an ephemeris file. Only the ephemeris and observation files are used by PC-GPS. Note: The ? in the file name refers to the year. For 2006 use "6". Currently, RINEX formatted base station information is available from the National Geodetic Survey on the **Internet**. As of this printing, the RINEX data may be accessed via <www.ngs.noaa.gov/CORS/Data.html> The NGS has many base stations set up across the US. They also are actively expanding the current network.

CORRECTIONS

| TYPE | FILENAME | EPHEMERIS FILE REQUIRED? |
|-------------|----------|---------------------------------|
| Corrections | *.COR | Yes (file must be named *.EPH). |

Comments: Corrections files are created by PC-GPS when the Rover Type selected is NONE. Corrections files can be created with any BASE TYPE. Since the corrections format requires both a *.COR file and a *.EPH file, PC-GPS creates both file types. If you are going to be correcting many different GPS Jobs against one base station file, the creation of a corrections file will substantially reduce the processing time.

Ashtech M-XII (and Dimension)

| TYPE | FILENAME | EPHEMERIS FILE REQUIRED? |
|---------------|----------|---------------------------------|
| Ashtech M-XII | *.DAT | Yes (file must be named *.EPH). |

Ashtech Z-12

| TYPE | FILENAME | EPHEMERIS FILE REQUIRED? |
|--------------|----------|---------------------------------|
| Ashtech Z-12 | *.DAT | Yes (file must be named *.EPH). |

WINBASE

| TYPE | FILENAME | EPHEMERIS FILE REQUIRED? |
|-------------|----------|-------------------------------|
| CMT Winbase | *.MCF | No (Ephemeris in *.MCF file). |

Appendix C: End User License Agreement

This is a legal agreement between you, the End User, and Corvallis Microtechnology, Inc. ("CMT"). By installing PC-GPS on your PC, you agree to be bound by the terms of this agreement.

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2. A sale of the PC-GPS software is not a sale of the intellectual property that it contains. The End User is granted the right to use such intellectual property, but not is ownership.

3. The End User shall not copy, disassemble, or reverse compile the software programs.

4. The software programs are provided to the end user "as is" without warranty of any kind, either expressed or implied, (including, but not limited to, general, special, consequential or incidental damages including damages for loss of business profits, business interruption, loss of business information and the like), arising from or in connection with the delivery, use or performance of the software programs. Information in the PC-GPS User's Manual is subject to change without notice and does not represent a commitment on the part of Corvallis Microtechnology.

This Agreement is governed by the laws of the State of Oregon. If you have any questions concerning this Agreement, please write to Customer Service, Corvallis Microtechnology, Inc., 413 SW Jefferson Avenue, Corvallis, Oregon 97333, USA.

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