
GammaCAD™
version 1.10

Gamma Software

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INTRODUCTION

GammaCAD is a full featured CAD (Computer Aided Design) program for Windows. It provides a wide range of functionality in an easy to use package.

GammaCAD allows you to create drawings of real world objects in two dimensions using their actual measurements. They can then be plotted at any scale you choose on any of the vast number of printers and plotters supported by Windows. The biggest advantage of using a computer to create these drawings over conventional hand methods is the ease with which a computer based drawing can be edited and replotted at different scales.

CAD is used in many fields including: architecture, cartography, electronics and engineering. It can be used to create house plans, maps of all kinds, printed circuit diagrams, and any kind of graph, chart, diagram or illustration.

This program allows you to create drawings using 5 basic drawing elements. These elements are: lines, arcs, circles, points and text. You may enter exact coordinates for these elements, pick a position on the display or "snap" to a position on another element in the drawing. For example, you can draw a line which starts exactly at the end of an existing line.

GammaCAD also has predefined symbols you can place in your drawing for such things as floor plans, furniture, polygons, electronics, landscaping, computer equipment and civil engineering.

Once these basic drawing elements are in your drawing you can edit them to your liking. They can be edited individually or as a group. The elements can be deleted, copied, scaled, rotated and their properties can be changed. These operations can be undone. This allows you to experiment with the drawing.

Many properties of the drawing elements can be specified. The line type (e.g. solid, dashed, dotted, etc.), line color and line width can be specified. Text properties include: font, size, color, angle and justification. Point type, color and size can also be set.

The drawing can be zoomed and panned to look at different parts in more detail. Zoom functions include: window, extents, previous and factor.

The drawings you create in GammaCAD can be copied to the Windows clipboard as a bitmap and pasted into your favorite word processor, paint program or any program which lets you paste a bitmap. This means you can place technical drawings in your documents.

GammaCAD is designed to be powerful and easy to use. The program contains on-line help to get you up and running as quickly as

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possible. A prompt area is displayed at the bottom of the window which instructs you how to perform each command. A status area displays pertinent program information at a glance. The program also employs easy to use visual dialog boxes.

Gamma Software is committed to providing you with quality software at affordable prices.

About This Manual

Read the "Getting Started" section first. The rest of the manual can be read as needed to get more information on a particular subject.

Getting Help

If you have a problem with this program and cannot find the answer in the documentation help may be obtained by calling:

(303) 490-2928 voice/fax (start fax immediately after dialing)

or via E-mail at:

Compuserve: 73737,1721
GEne: T.EMMER
Internet: 73737.1721@compuserve.com

or by writing to:

Gamma Software
P.O. Box 8191
Fort Collins, CO 80526
U.S.A.

Please describe the problem in sufficient detail so it can be reproduced by us.

We are open 8am-5pm Mountain time (Mon-Fri) excluding holidays.

Support is currently free and unlimited. We do reserve the right to change these policies in the future.

INTRODUCTION

System Requirements

- Windows 3.1 and a system capable of running it:
 - Personal computer (286 or better).
 - 640K conventional memory and at least 256K extended memory.
 - DOS 3.1 or later.
 - Windows supported display.
- Hard disk with at least 650K of free disk space.
- Floppy drive (if installing from floppy disk).
- A Windows supported printer, mouse and color display are highly recommended.

Note - this program will NOT work with Windows 3.0 or previous versions of Windows.

Manual Conventions

When two keys need to be pressed simultaneously to perform a given operation they are separated by a plus (+). For example, Shift+Tab means to press the Shift key and hold it down while the Tab key is pressed. When a menu option or other text from the program is mentioned it is enclosed in quotes. Values which must be input by the user are enclosed in quotes as well. Enter them without the quotes. For example, if the manual instructs you to enter "45" in a field within the program enter the number without the quote marks.

GETTING STARTED

This section will take you on a brief guided tour of the program and demonstrate how to use some of its main features. It is assumed you are familiar with Windows. If you are new to Windows you should read the getting started section of the Windows manual first. If you are already familiar with CAD you can probably skip this section. It is also assumed you have already installed GammaCAD and executed the program and you are currently at the main program window, below.

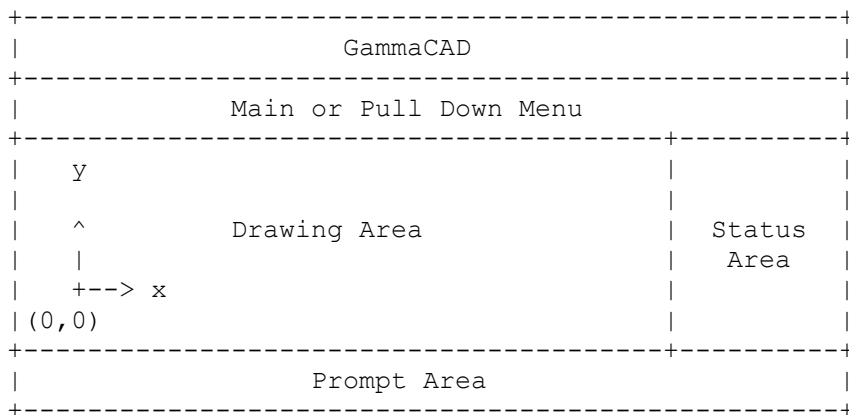


Figure 1 - Main Window

When you first enter GammaCAD you are placed in a new "Untitled" drawing. This program uses a standard 2 dimensional xy coordinate system. Positions are specified by giving their x and y value. These positions are indicated by 2 values within parentheses in this manual. For example, (2,3) indicates an x position of 2 and a y position of 3. The origin of this coordinate system (0,0) is initially placed in the lower-left of the drawing area. The x axis starts at the origin and increases to the right. The y axis starts at the origin and increases upward. The first 2 fields in the status area indicate the current xy position of the cursor within the drawing area. When the cursor is within the drawing area it is displayed as a small cross. It can be moved using the mouse or the keyboard arrow keys. These xy positions can be in any units and are referred to as "drawing units" in this program. They are related to actual sizes using the plot scale (more on this later). Move the cursor around the drawing area and watch how the xy position in the status area changes to get a feel for the coordinate system.

The initial drawing is blank, this means it contains no drawing elements. To draw elements within the drawing area you simply select "Draw" from the pull down menu and select one of the options on this menu. For example, to draw a line starting at the

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position (1,1) select "Line" from the "Draw" menu. The prompt area will display:

```
Select first end point of line
MOUSE: position cursor, press left button. Right button for...
KEYBOARD: position with arrow keys, press Enter. F2 for...
```

The first line of the prompt area tells you what the program is currently looking for. In this case it is asking you to enter the first point of a line. The second line of the prompt area tells you how to accomplish this using the mouse. The third line tells you how to accomplish the task using the keyboard. This same format for the prompt area is used throughout the program. The first line tells you what the program wants, the second line tells you how to do it with the mouse and the third line tells you how to do it with the keyboard.

Getting back to what we set out to do -- draw a line starting at (1,1) -- click the right mouse button or press the F2 key. This brings up a coordinate input dialog box. You are initially placed in the x value field. Enter "1" in this field. Now press Tab or click on the Y-coordinate field. Then enter "1" in that field. Press Enter or click on the "OK" button. The position (1,1) has now been specified for the first end of the line.

The first line of the prompt area has now changed to prompt us for the second end point of the line. You do not have to specify exact coordinates for drawing elements. You can also simply pick them within the drawing area. To do this move the cursor using the mouse or arrow keys to any position within the drawing area. As you move the cursor a line is drawn from the first point you selected to the current cursor position. This represents the line which will be drawn if the current cursor location is selected. When you have positioned the cursor where you want it, click the left mouse button or press Enter. We have now successfully drawn a line. You may continue to draw another line starting at the end of the previous one or you can draw another element.

To draw an arc select "Arc" from the "Draw" menu. Arcs must always be drawn in a counter-clockwise direction by entering the first end point, then the center and finally the second end point. For example, lets draw an arc starting at (5,1), has a center point of (3,1) and an end point of (1,1). To do this, click the right mouse button or press F2. Next, enter the coordinates (5,1) in the dialog box the same way you did for the first line end point in the previous step. Repeat this procedure to enter the center point of the arc at (3,1). Now move the cursor and as you do so an arc is drawn using the previously specified end and center points and the current cursor position as the last end point. This represents the arc which would be drawn if the current cursor position is used for the last end point. Select the position

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(1,1) for the last end point as before (click the right mouse button or press F2 and enter the coordinates in the dialog). You have now drawn an arc. You can continue drawing more arcs by entering their start, center and end points or select another drawing element.

To draw a circle you follow the same kind of procedure as for lines and arcs. Select "Circle" from the "Draw" menu. Select a position for the center of the circle. A circle is then drawn with the given center and through the current cursor position. Select a position on the circle and the circle is added to the drawing.

To draw points select "Point" from the "Draw" menu and then select a position for the point. A point is added to the drawing at the given position.

To draw text select "Text" from the "Draw" menu and enter the text alignment point. This is the upper-left corner of the text string. After selecting the alignment point a dialog box is displayed to allow you to enter a text string. Type in the desired text string and click on the "OK" button or press Enter. The given text is added to the drawing at the specified position.

Experiment with these drawing commands until you feel comfortable with them.

As we have seen selecting another command from the "Draw" menu ends the previous one. Selecting anything from the main menu except "Options" will end a drawing command. The reason "Options" does not end the current drawing command is so you can change the properties of whatever you are drawing without having to reselect the drawing command (more on this in a moment). There is also another way to end a drawing command. Click the right mouse button or press F2 while a drawing command is prompting you for a position and select the "End" button from the coordinate input dialog. For example, select "Line" from the "Draw" menu. Now click the right mouse button or press F2. Next select the "End" button. This will end the line command and clear the prompt area. The "Cancel" button on the coordinate input menu cancels manual input of the coordinates and allows you to go back to selecting them with the cursor, it does not end the command.

We have now covered all of the drawing elements you can create with this program. Next we will cover some ways of changing the look of these drawing elements. The "Options" menu contains all of the properties you can specify for the drawing elements in the "Draw" menu. Some general program parameters can be set using the "Options" menu as well.

First lets look at the different kinds of lines we can draw.

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Select "Line Color" from the "Options" menu. This brings up the color selection dialog. Select one of the colors from this menu. Only solid colors can be specified. This means if you select a nonsolid color it will be mapped to the closest solid color. See your Windows manual for more information on colors.

After entering a color select "Line" from the "Draw" menu and pick 2 points within the drawing area. A line will be drawn in the selected color between the 2 given points.

You can change line properties in the middle of drawing lines without ending the line command. For example, select "Line Type" from the "Options" menu. This brings up the line type dialog. Click on the "Dash" line type. The "Dash" radio button will be marked and the previously marked line type is unmarked. Now click on the "OK" button or press Enter. Now select the second end point of a line (the first will be the end of your previous line). The line will be drawn using your selected color and line type.

The last line property is width. Select "Line Width" from the "Options" menu and enter "0.2" for the line width. The width is specified in drawing units. Now enter the second end point of another line. The line width hasn't changed, has it? This demonstrates an important point. Only solid lines can have a width greater than 1 pixel. Select the solid line type from the options menu and enter the second end point of another line. This time the line will be wider.

Line properties affect not only lines but arcs and circles as well. Draw a few arcs and circles to see how your current line property settings affect them.

The main property of a text element is its font. With Windows 3.1 TrueType fonts were introduced. These fonts work best in this program and are recommended over previous Windows fonts. When there is a check mark to the left of the "TrueType Fonts Only" selection in the "Options" menu, the "Text Font" selection below it will list only TrueType fonts. To access other fonts click on the "TrueType Fonts Only" selection. The check mark will be removed and all fonts will be listed in font selection.

Now select "Text Font" from the "Options" menu. This brings up the font selection dialog. With this dialog you specify the font name, style, size, color and effects. Sizes are in points. A point is 1/72 of an inch. The point size selected is the size you want the text to appear on paper when the drawing is plotted. The size of the text on your display will vary depending on the plot scale you have specified and the current extents of the drawing area. Once you have selected a font from this menu, draw a text string as you did previously to see the font you have selected. Experiment with the different font parameters in the

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font selection dialog until you get a feel for what each one does.

Text may be placed at an angle using the "Text Angle" selection on the "Options" menu. This angle is measured counter-clockwise from the x axis in degrees. First select the "Arial" font using the "Text Font" selection on the options menu. Next select "Text Angle" from the "Options" menu. Enter "45" for the text angle. Now draw a text string. Its baseline will be at a 45 degree angle.

Text orientation specifies the rotation of individual characters within a text string. It has no affect on TrueType fonts so this menu selection is dimmed if "TrueType Fonts Only" is checked. Only Windows vector fonts (e.g. Roman, Script and Modern) support orientation angles. See the "Setting Text Properties" section for more information on how to use orientation angles.

To change the alignment point of a text string from the upper-left to another position within the string, use the "Text Justification" item on the "Options" pull down. For example, if you want to specify a text alignment point representing the lower right end of a text string, select the "Text Justification" option and set "Right" and "Bottom" as the text alignment. Now when you draw text, the alignment point you pick will specify the right bottom position of the text string.

Point properties can be entered in much the same way as line and text properties. Experiment with changing these properties and drawing points to see the effects.

At this point we should do something which should always be done periodically when creating a drawing, save it to disk. This will prevent losing your drawing in case of a power failure, system crash or similar catastrophe. To save this file select "Save As" from the "File" menu. This will bring up the Windows file selection dialog. Enter "TEST" in the "File Name" field and click on the "OK" button. The drawing will be saved to TEST.GC1 in the directory shown and can be retrieved later using the "Open" option on the "File" menu.

To produce a printed or plotted output of a drawing you use the "Print/Plot" option on the "File" menu. First select "Open" off the "File" menu and select the file SAMPLE.GC1 supplied with the program. This drawing shows the top, right and front views of a flange. Next select "Print/Plot" from the "File" menu. This will bring up the plot scale dialog. Enter a scale of "2" (1 inch = 2 drawing units) and click on the "OK" button. Select the desired print parameters from the Print Setup dialog and click on "OK".

The current coordinates of the lower left of the drawing area will be used as the lower-left of the plot. As much of the drawing as can be displayed using the given scale will be plotted to the current print device. If you do not care about the scale and

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simply want to plot the current view as large as possible click on the "Fit plot to page" check box in the scale dialog. The plot scale is ignored for these type plots.

Now lets look at some of the "View" menu options. These allow you to look at your drawing in more or less detail. For example, to look at the top view in more detail select "Zoom Window" from the "View" menu. The program will prompt for the first corner of the window. Pick a point just below and to the left of the top view. Next the program will prompt for the second point defining the window. As you move the cursor a box is displayed with one corner on the first point you selected and the other at the current cursor position. This box represents the window. Move the cursor to a point above and to the right of the top view so the whole top view is enclosed in the box and press the left mouse button. The program will then display the area you selected using the entire drawing area.

The right and front views are no longer visible. To make sure all the elements in the drawing are visible use the "Zoom Extents" option. Select "Zoom Extents" form the "View" menu. The drawing area window is adjusted so all drawing elements are visible and as large as possible.

To return to the previous view select "Zoom Previous" from the "View" menu. Select this option.

If you want to shift what is currently displayed in the drawing area to see other parts of the drawing you use the "Pan" command. Select this option and pick a point near the bottom center of the top view. Next, pick a point directly above the previous point and near the top of the drawing area. The drawing is then shifted up within the drawing area.

The view commands simply change how the drawing elements are displayed. They do not change their coordinates or dimensions. To change the drawing element coordinates or dimensions use the "Edit" commands.

The last things we need to look at in this overview of the program are the "Edit" functions. First let's move the top view to another position in the drawing. Select "Zoom Extents" from the "View" menu so the entire drawing is visible. Then pick "Select" from the "Edit" menu and pick a point below and to the left of the top view for the first point. Pick a point above and to the right for the second point so the entire top view is within the rectangle. All the drawing elements which are within or cross the selection area are selected. They are displayed in the selection color (initially light gray). Now select "Cut" from the "Edit" menu. The program then prompts for a reference point. Pick a point near the middle of the top view. The top view is then

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erased. To move it to another position select "Paste" from the "Edit" menu. The program then prompts for the alignment point. This point will be the new position of the reference point you specified in the cut operation. Pick a point more to the right of the reference point you selected. The top view will be redrawn at this new position. You can continue to select other alignment points and insert multiple copies of the top view in your drawing. The "Copy" option does much the same as "Cut" except it does not delete the original copy of the selected elements. The "Cut" and "Copy" options are the only ones which set the elements for the "Paste" operation. None of the other "Edit" options affect what is pasted during the "Paste" option.

To simply delete unwanted elements in the drawing you use the "Delete" option. This option does not allow you to paste the deleted elements back into the drawing. However, you can recover them by selecting "Undo". For example, "Select" the drawing elements in the top view as you did before. Next select "Delete" from the "Edit" menu. The elements will be erased from the display area and deleted from the drawing. Now select "Undo" from the "Edit" menu and the previously deleted elements will be redrawn and placed back in the drawing.

To change the angle of elements within the drawing, you use the "Rotate" command. Select the top view as you did previously. Then select "Rotate" and pick a position near the center of the selected top view as the center of rotation. A dialog to enter the rotation angle will appear. Enter "45" and press Enter. The top view will be rotated 45 degrees counter-clockwise.

The "Scale" option functions much the same as rotate except it is used to make the current element selection larger or smaller. For example, select "Scale" and pick a point near the center of the top view which you selected in the last step. Enter a scale factor of "0.5" in the dialog box. The selected top view will be drawn at half its original size.

The "Change" item on the "Edit" menu allows you to change drawing element properties. For example, select "Change" and pick "Line Color" from the change dialog. This will bring up the color selection dialog. Pick a new color from this menu. In order to see the color change you must select "Clear Selection" from the "Edit" menu. The current selection is always drawn in the selection color. The current selection is only changed when a new selection is made or the selection is cleared.

Finally, for on-line help with the features in this program select "Help" from the "Help" menu. This brings up the Windows help facility. For more information on how to use this facility look in your Windows manual.

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This concludes your guided tour of the program. Hopefully you will have enough information at this point to get started with your first drawing. You can look at the other sections of this manual as needed to get more details on specific areas.

GENERAL PROGRAM INFORMATION

Parts Of The Program Window

The figure below shows the different areas within the program window. These will be referred to throughout this manual.

Figure 1 - Main Window

The main or pull down menu contains the program commands.

The prompt area displays what the program currently wants you to enter and how to do it.

The status area displays the current cursor xy coordinates, the amount of memory available, the current element snap mode and the number of fonts defined in the drawing. The format of the xy positions is affected by the international settings in the Windows Control Panel (see "International Number Formats" below).

The drawing area is where drawing elements are displayed and drawn.

The title bar contains the program name and the current file name.

The system menu contains the standard Windows system menu options.

The min/max buttons minimize and maximize the program window.

International Number Formats And Measurements / Number of Decimals

This program utilizes the settings in the international section ("intl") of the Windows WIN.INI file. These parameters can be configured using the "International" option in the Control Panel. The "Decimal Separator" and "Decimal Digits" fields under "Number Format" are used by this program when formatting decimal numbers. Set the "Decimal Digits" field to the number of decimal places you want the program to display to the right of the decimal point. This causes the program to display that number of decimal places everywhere it displays a real number.

The "Measurement" field determines whether the plot scale is specified in inches or centimeters.

The Program Coordinate System

This program uses a standard 2 dimensional cartesian coordinate system. This consists of 2 axes, x and y, which are perpendicular to each other. The x axis increases to the right and the y axis increases upward.

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Figure 2 - XY Coordinate System

Coordinates within this coordinate system are specified by giving their x and y distance from the origin. These coordinates are denoted by x and y values in parentheses within this manual (x,y).

For example, (10,20) designates a position 10 units to the right (x distance) and 20 units up (y distance) from the origin.

Figure 3 - Coordinate Example

The origin of this coordinate system is where the x and y axes intersect at coordinates (0,0). When a new drawing is first loaded, the origin is at the lower-left of the drawing area. This can change when any of the view options are selected. The drawing area can be thought of as a window which displays a portion of the entire coordinate range. Drawing elements which lie outside the current window are not displayed but are still part of the drawing.

Figure 4 - Drawing Area Window

The extents of the drawing are the minimum and maximum xy coordinates of all the drawing elements. The drawing area extents are the lower-left and upper-right coordinates of the current drawing area.

Figure 5 - Drawing Area Extents

The "X:" and "Y:" fields of the status area give you the current coordinates of the cursor within the drawing area. The cursor is initially a small plus sign when it is within the drawing area. It can be moved with the mouse or keyboard arrow keys and the xy position in the status area will be updated as it is moved.

The units the drawing area represents can be anything. For example, they can represent inches, feet, miles, millimeters, meters, kilometers and so on. The scale you enter when plotting specifies the relationship between the units in the drawing and the plot units (inches or centimeters).

Specifying Positions

You need to specify positions for many of the options in this program. A position is the (x,y) coordinates designating a point in the drawing.

There are three methods for specifying positions within this program:

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1. Pick a position in the drawing area using the cursor.
2. Enter exact coordinates (manual entry).
3. Snap to an existing drawing element.

The first method is the easiest. All you have to do is position the cursor at the desired point in the drawing area using the mouse or keyboard arrow keys. Then click the left mouse button

or press Enter. The disadvantage to using this method is you cannot specify the exact coordinates of the point. For example, if you wanted to pick a point at exactly (10,10) you could not do it using this method. This is due to the fact the cursor moves in steps. This method is best used when you do not care about the exact positions and dimensions of what you are drawing.

The second method, manual entry, allows you to specify exact positions. To use this method click the right mouse button or press F2 while the cursor is in the drawing area or select "Enter Coordinates" from the "Options" pull down menu. This will bring up a "Coordinate Input" dialog. You use this dialog to enter the exact (x,y) coordinates of a drawing position. This method is used when you have the exact coordinates or dimensions of the object you are drawing.

Figure 6 - Coordinate Input Dialog

The third method, using element snaps, allows you to specify positions based on elements already in the drawing. For example, if you want a line to start at the exact same position as the end of another line in your drawing, you would use the "End" element snap. To use element snaps, simply select the desired mode using the "Element Snap" item on the "Options" pull down menu.

Figure 7 - Element Snap Dialog

You can select an element snap before or during a command. The element snap selected remains in affect until another is chosen. The current element snap mode is displayed in the status area. If an element snap other than "NONE" is in affect, the cursor will change from a cross to a box. When a position is selected the program will look to see if an element is within the box. If one is the program will determine the proper coordinates from this element using the current snap mode. The program tries to snap to the first element it finds within the box. If it cannot snap to this element it uses the center of the box as the input point. When you are using element snaps, you should make sure only one

1 In reality you may be able to enter an exact coordinate using this method if one of the cursor steps just happens to fall on it, but it is unlikely and in general you cannot enter exact coordinates using method 1.

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element lies within the cursor box, so you are certain you are snapping to the proper element. Use the "Zoom Window" command to enlarge the area around the element you are snapping to if necessary to avoid getting other elements in your cursor box.

For example, if the box cursor is placed as in the figure below and the current snap mode is set to "End," the program will use the coordinates of the closest end of the line as input.

Figure 8 - Element Snap Pick

In this case the program "snapped" to the top of the line and that point is used as the start of a new line as shown below.

Figure 9 - Element Snap Result

The element snaps which are available within this program are:

- None - no element snaps are used, the cursor is a cross.
- End - snap to the end of the selected element.
- Center - snap to the center of an arc or circle element.
- Point - snap to the position of a point element.

The table below summarizes which element snap modes can be used for each drawing element. If the element does not support a particular snap mode, no snap position is determined and the position of the center of the cursor box is used.

	End	Center	Point
Line	X	X	
Arc	X	X	
Circle		X	
Point			X
Text			

Table 1 - Element Snaps

The figure below demonstrates how the different snap modes can be used:

Figure 10 - Element Snaps

Lines

Lines are drawn by entering their start and end points.

Figure 11 - Line Input

To Draw a line all you have to do is select "Line" from the "Draw" pull down menu or you can press Ctrl+L. The prompt area will display:

```
Select first end point of line
MOUSE: position cursor, press left button. Right button for...
KEYBOARD: position with arrow keys, press Enter. F2 for...
```

After entering the first end point, the first line of the prompt area changes to:

```
Select second point
```

As you move the cursor a line is drawn from the first point to the current cursor position which represents the line which would be added to the drawing if the current cursor position is used for the second end point. When the second end point is specified, a line with the designated start and end points is added to the drawing. It is displayed using the current line properties in affect.

The program continues to prompt you for a second point. If you wish to draw another line which starts at the end of the previous one, you simply select the second end point of that line.

To end line input, select another operation from the main menu (except those on the "Options" menu). You can also end line input by clicking the right mouse button (or press F2) and select "End" from the dialog box which appears.

See the section on "Specifying Positions" for more information on entering the line end points. See the section on "Line Properties" for more information the different types of lines which can be drawn.

Arcs

Arcs are drawn by specifying their start, center and end points. They are always drawn in a counter-clockwise direction.

Figure 12 - Arc Input

To Draw an arc all you have to do is select "Arc" from the "Draw"

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pull down menu or you can press Ctrl+A. The prompt area will display:

Select first end point of arc

MOUSE: position cursor, press left button. Right button for...

KEYBOARD: position with arrow keys, press Enter. F2 for...

After entering the first end point the first line of the prompt area changes to:

Select center point of arc

After entering the center point the first line of the prompt area changes to:

Select second end point of arc

As you move the cursor an arc is drawn from the first point to the current cursor position around the given center point in a counter-clockwise direction. This represents the arc which would be added to the drawing if the current cursor position is used for the second end point. When the second end point is specified an arc with the designated start and end points is added to the drawing. It is displayed using the current line properties in affect.

The program continues to prompt you for the first point of an arc. If you wish to draw another arc, you can enter it at this point.

To end arc input, select another operation from the main menu (except those on the "Options" menu). You can also end arc input by clicking the right mouse button (or press F2) and select "End" from the dialog box which appears.

See the section on "Specifying Positions" for more information on entering the arc points. See the section on "Line Properties" for more information on the different types of arcs which can be drawn.

Circles

Circles are drawn by specifying their center point and a point anywhere on the circle.

Figure 13 - Circle Input

To Draw a circle all you have to do is select "Circle" from the

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"Draw" pull down menu or you can press Ctrl+I. The prompt area will display:

Select center point of circle
MOUSE: position cursor, press left button. Right button for...
KEYBOARD: position with arrow keys, press Enter. F2 for...

After entering the center point the first line of the prompt area changes to:

Select point on circle

As you move the cursor, a circle is drawn around the center point and through the current cursor position. This represents the circle which would be added to the drawing if the current cursor position was used. When the point on the circle is specified, a circle with the designated center and circumference point is added to the drawing. It is displayed using the current line properties in affect.

The program continues to prompt you for the center point of the next circle. If you wish to draw another circle, you can enter it at this point.

To end circle input, select another operation from the main menu (except those on the "Options" menu). You can also end circle input by clicking the right mouse button (or press F2) and select "End" from the dialog box which appears.

See the section on "Specifying Positions" for more information on entering the circle points. See the section on "Line Properties" for more information on the different types of circles which can be drawn.

Points

Points are drawn by specifying their position.

To Draw a point all you have to do is select "Point" from the "Draw" pull down menu or you can press Ctrl+P. The prompt area will display:

Select point position
MOUSE: position cursor, press left button. Right button for...
KEYBOARD: position with arrow keys, press Enter. F2 for...

When a position is specified, a point is drawn using the current point properties in affect.

The program continues to prompt you for a point position. If you

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wish to draw more points you can do so at this time.

To end point input, select another operation from the main menu (except those on the "Options" menu). You can also end point input by clicking the right mouse button (or press F2) and select "End" from the dialog box which appears.

See the section on "Specifying Positions" for more information on entering the point positions. See the section on "Point Properties" for more information on the different types of points which can be drawn.

Text

Text is drawn by specifying the text alignment point and the desired text string.

Figure 14 - Text Input

To Draw text, all you have to do is select "Text" from the "Draw" pull down menu or you can press Ctrl+T. The prompt area will display:

Select text alignment point

MOUSE: position cursor, press left button. Right button for...

KEYBOARD: position with arrow keys, press Enter. F2 for...

When a position is specified the text string input dialog is displayed.

Figure 15 - Text Input Dialog

Enter the desired text and select the "OK" button. The text is then displayed using the current text properties in affect.

The program continues to prompt you for a text alignment position. If you want to enter more text strings do so at this point.

To end text input, select another operation from the main menu (except those on the "Options" menu). You can also end text input by clicking the right mouse button (or press F2) and select "End" from the dialog box which appears.

See the section on "Specifying Positions" for more information on entering the text alignment points. See the section on "Text Properties" for more information on the different types of text which can be drawn.

Symbol Libraries

Any of the predefined GammaCAD symbols can be placed in the drawing by specifying their insertion point, angle and scale factor.

To place a symbol in your drawing select "Symbol Libraries" from the "Draw" pull down menu. A dialog is displayed that allows you to pick the type of symbol you want to draw. Click on the library you desire and then click on the "OK" button. The symbols in this library are displayed in the next dialog. Click on the symbol you want and click on the "OK" button.

The prompt area will display:

```
Select insert position
MOUSE: position cursor, press left button. Right button for...
KEYBOARD: position with arrow keys, press Enter. F2 for...
```

The base point of the symbol is aligned with the insertion point you enter.

When a position is specified the rotation angle dialog is displayed. Enter the desired rotation angle for the symbol in degrees counter-clockwise and select the "OK" button. Enter "0" for no rotation. The scale dialog is displayed next. Enter a value greater than 0. A value less than 1 will cause the symbol to be displayed smaller than its actual size (e.g. 0.5 will cause it to be half size). A value greater than 1 will cause it to be larger than actual size (e.g. 2. will cause it to be double size).

After the angle and scale have been entered the program will draw the symbol using the parameters you specified. It then prompts you for the insertion point again. You can place any number of the same symbol in the drawing, each with its own angle and scale. To end symbol input select another operation from the main menu (except those on the "Options" menu). You can also end input by clicking the right mouse button (or press F2) and select "End" from the dialog box which appears.

See the section on "Specifying Positions" for more information on entering the symbol insertion points. See the "Symbol" appendix for more information on the symbols supplied with GammaCAD (e.g. the base point location, default dimensions, etc.).

Setting Line Properties

All lines (including those used in arcs and circles) have the following three properties:

1. Color.
2. Type.
3. Width.

These properties can be specified before or during the input of a drawing element. The selected properties remain in affect until another selection is made. Whenever a line, arc or circle is created, it is displayed using the current line color, type and width. They will always be displayed this way unless the properties are changed. See the section "Changing Drawing Element Properties" for more information.

Lines can only be displayed in solid colors. In other words they cannot use dithered colors which use a pattern of different solid colors to produce the look of another color. The number of solid colors which are available is dependent on the display device.

To specify a line color, select "Line Color" from the "Options" menu. To make a selection from the color input dialog, simply click on the desired color (or highlight it using the arrow keys and press the spacebar). Then select the "OK" button. If a nonsolid color is selected the closest solid color is used instead. You must also be careful not to select colors which map to the solid color white since they will not be visible on the white background.

Figure 16 - Line Color Dialog

To specify a line type, select "Line Type" from the "Options" menu. To select a line type, click on the desired type (or use the arrow keys). The selected line type is displayed to the right. Click on the "OK" button (or press Enter) to use the displayed line type.

Figure17 - Line Type Dialog

To specify a line width, select "Line Width" from the "Options" menu. Enter the desired line width. This value is specified in drawing units and its displayed width will vary depending on the current drawing area extents. Specifying a width of 0 will cause the line to be drawn as thin as possible (1 pixel wide) no matter what the drawing area extents.

Figure 18 - Line Width Dialog

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One important limitation is only solid lines can have a width of more than one pixel. If a line type other than solid is selected the current line width setting is ignored and the line is drawn with the specified type but at a 0 width.

Setting Text Properties

Text strings have the following properties:

1. Font name.
2. Font style.
3. Size.
4. Effects.
5. Color.
6. Angle.
7. Orientation.
8. Justification.

These properties can be specified before or during the input of a text element. The selected properties remain in affect until another selection is made. Whenever a text string is created it is displayed using the current text properties. It will always be displayed this way unless the properties are changed. See the section "Changing Drawing Element Properties" for more information.

The font name is the main property affecting the appearance of a text string. It determines how different characters in the string are drawn. Windows comes with several built in fonts. With version 3.1 of Windows TrueType fonts were introduced. It is recommended you use these fonts exclusively. The program defaults to allowing the selection of TrueType fonts only. The TrueType fonts work much better with this program than some of the other Windows fonts.

To access the other fonts available to Windows click on the "TrueType Fonts Only" item on the "Options" pull down. This will remove the check mark next to this item. The next time you select "Text Font" from the "Options" menu it will display all the fonts available to Windows in the "Font Name" list. When the check mark is present to the left of "TrueType Fonts Only," only TrueType fonts are listed by the "Text Font" option. When there is no check mark present all fonts are listed. The drawing may or may not already contain fonts other than TrueType fonts. This toggle does not change existing text strings.

The first 5 text properties are all specified using the "Text Font" selection on the "Options" menu. To select the font name, click on the desired font name from the list. You can scroll the list up and down by clicking on the scroll arrows if the list is longer than the number displayed. To select a font style, click on the

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desired style. The font size, effects and color can be specified in the same way. A sample of the currently selected font is displayed in the lower right of the dialog. When you have input the desired text properties click on the "OK" button.

Figure 19 - Font Dialog

The parameters in this dialog are pretty self-explanatory with the possible exception of the "Size" parameter. These sizes are in points. A point is 1/72 of an inch. This specifies the size of the text when plotted. The size which appears on the display will vary depending on the currently specified plot scale and the current drawing area extents. When you specify a text size, it is converted to the units you are using in the drawing area using the currently specified plot scale and drawn with that size in the drawing area. For example, if you specified a 10 point font and your current plot scale is 1 inch equals 100 drawing units then the height in drawing units for the text would be 13.9 (10/72 X 100). If the y extent of the drawing area is 100 then the text will be 13.9% as tall as the y extent of the drawing area. If the drawing is zoomed so the y extent is 50 then the text will be 27.8% of the drawing area height.

Figure 20 - Text Example

The text will always be plotted at a 10 point size (0.139") no matter what the plot scale or current drawing extents (unless the "Fit" plot option is used).

The text angle specifies the rotation of the baseline of the text string in degrees counter-clockwise from the x axis.

Figure 21 - Text Angle

The Windows raster fonts (i.e. Courier, Fixedsys, MS Sans Serif, MS Serif, Small Fonts, System and Terminal) will not rotate.

The text orientation is not used by TrueType fonts so it is dimmed and unselectable on the menu if TrueType fonts only are specified. The only fonts currently supplied with Windows which support orientation angles are the vector fonts: Modern, Script and Roman. The orientation angle is the rotation of the individual characters of a text string in a counter-clockwise direction from the x-axis. The interaction between the baseline angle and the orientation angle for the vector fonts can be quite difficult to understand. The figure below shows some of the most common uses of baseline and orientation angles with vector fonts.

Figure 22 - Text Orientation

There are a couple of drawbacks to using the vector fonts. One is

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the "Zoom Extents" command only uses the alignment point of vector fonts in its calculations. This means part or all of a text string which uses a vector font may lay outside the drawing area even after a "Zoom Extents" command. The second drawback is you must include the alignment point in your selection area in order to select a string using a vector font.

The last property we will cover is text justification. When you create a text element you are asked to input the alignment point. This point can represent different positions within the string depending on the current text justification setting. The text justification is initially set to "Top" and "Left" when the program is first loaded. To change this setting select "Text Justification" from the "Options" menu. The text justification dialog allows you to specify one of three horizontal justification points (Left, Center and Right) and one of three vertical justification points (Top, Baseline and Bottom). To select one click on its radio button and click on "OK".

Figure 23 - Text Justification Dialog

The figure below shows all of the possible text justification points.

Figure 24 - Text Justification

The following table summarizes the capabilities of the fonts which come with Windows.

<u>Font</u>	<u>True</u> <u>Type</u>	<u>Vector</u>	<u>Raster</u>	<u>Scal-</u> <u>able</u>	<u>Rotat.</u> <u>Angles</u>	<u>Orient.</u> <u>Angles</u>	<u>Fixed</u> <u>Pitch</u>
Arial	X	X		X	X		
Courier New	X	X		X	X		X
Symbol	X	X		X	X		
Times New Roman	X	X		X	X		
Wingdings	X	X		X	X		
Modern		X		X	X	X	
Script		X		X	X	X	
Roman		X		X	X	X	
Fixedsys			X				X
MS Sans Serif			X				
MS Serif			X				
Small Fonts			X				
System			X				
Terminal			X				X

TABLE 2 - Font Information

A check mark for a font in the TrueType, Vector or Raster column indicates what type of font it is. A check in any of the following

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columns means that feature is supported by the font. The vector fonts are scalable which means they can be increased or decreased to any size. Raster fonts come in discrete sizes. Fixed pitch fonts have a constant character width.

Most of these fonts also support the regular, bold, italic and bold italic font styles. They all support the underline and strikeout effects as well as color.

Setting Point Properties

Points have the following three properties:

1. Color.
2. Type.
3. Size.

These properties can be specified before or during the input of a point element. The selected properties remain in affect until another selection is made. Whenever a point is created, it is displayed using the current point color, type and size. The point will always be displayed this way unless its properties are changed. See the section "Changing Drawing Element Properties" for more information.

Points can only be displayed in solid colors. In other words, they cannot use dithered colors which use a pattern of different solid colors to produce the look of another color. The number of solid colors available is dependent on the display device.

To specify a point color, select "Point Color" from the "Options" menu. To make a selection from the color input dialog simply click on the desired color (or highlight it using the arrow keys and press the spacebar). Then select the "OK" button. If a nonsolid color is selected the closest solid color is used instead. You must also be careful not to select colors which map to the solid color white since they will not be visible on the white background.

Figure 25 - Point Color Dialog

To specify a point type, select "Point Type" from the "Options" menu. To select a point type click on the desired type (or use the arrow keys). The selected type is displayed to the right. Click on the "OK" button (or press Enter) to use the displayed type.

Figure 26 - Point Type Dialog

To specify a point size, select "Point Size" from the "Options" menu. Enter the desired point size. This value is specified in drawing units and its displayed size will vary depending on the current drawing area extents.

Figure 27 - Point Size Dialog

FILE OPERATIONS

Saving The Drawing

There are 2 commands for saving the drawing, "Save" and "Save As", both are on the "File" pull down menu. The "Save As" command allows you to specify a file name. Once a file name has been specified for a drawing, you save it to the same file by selecting "Save" or by pressing CTRL+S. There are no further prompts when using the "Save" command. The "Save" option is dimmed and unselectable until a file name has been specified for the drawing with the "Save As" option.

The "Save As" option brings up a file selection dialog box. To specify a file name, select a drive from the drive list and a directory from the directories list. Type in the name of the file in the "File Name" box. You do not have to specify an extension for the file name. If you do not specify one, the extension ".GC1" will be appended to the name you enter. It is recommended you use a ".GC1" extension on all your drawing files so they will appear in the list of file names in the file selection dialog. If you enter an existing file name, the program will warn you and ask if you want to replace it. Selecting "Yes" will completely replace the contents of the file with the current drawing. The previous drawing will be lost. The file name dialog will not allow you to enter an invalid path or file name. When the desired drive, path and file name have been entered, select the "OK" button and the current drawing will be saved to the given file.

Figure 28 - Save As Dialog

When a drawing is saved all the undo levels are removed. This means previous operations cannot be undone after a save has been performed. This is done to free up the memory used by the undo feature.

Opening An Existing Drawing

If you want to edit a drawing created previously, select the "Open" command from the "File" menu. This brings up the file selection dialog. Select the proper drive and directory from the drive and directory lists and select one of the files from the file name list and click on the "OK" button. The drawing in the given file will be displayed in the drawing area. You must select an existing file with this option. You can now edit the elements in the displayed drawing or add more elements if desired.

Figure 29 - Open Dialog

FILE OPERATIONS

If you select the "Open" item from the "File" menu and the drawing you are currently working on has not been saved, a message box will appear and ask if you want to save the current drawing. If "No" is selected, any changes made to the current drawing will be lost. Selecting "Cancel," ends the "Open" command and returns you to the current drawing. If you select "Yes," the drawing will be saved to the file name you specified previously. If no previous name was specified, you will be prompted for a name. After saving the file, the file open dialog will be displayed.

Figure 30 - File Exists Message Box

Creating A New Drawing

If you are currently editing a drawing and would like to start a new drawing, select "New" from the "File" menu. The contents of the drawing area is cleared and you are placed in a blank drawing.

If you select the "New" item from the "File" menu and the drawing you are currently working on has not been saved, a message box will appear and ask if you want to save the current drawing. If "No" is selected, any changes made to the current drawing will be lost. Selecting "Cancel," ends the "New" command and returns you to the current drawing. If you select "Yes," the drawing will be saved to the file name you specified previously. If no previous name was specified, you will be prompted for a name. After saving the file, you are placed in a new drawing.

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Printing / Plotting The Drawing

The drawing may be plotted to any print device using the "Print/Plot" command on the "File" menu. A print device is added to Windows using the Control Panel and it can be a printer or a plotter. When "Print/Plot" is selected, a plot scale dialog is displayed. The drawing may be plotted to scale or the current drawing area can be "fit" to the available plot area on the output device.

Figure 31 - Plot Scale Dialog

To fit the drawing area to the plot page click on the "Fit plot to page" check box so the box is checked and then select the "OK" button. The current drawing area will be sent to the current print device and displayed as large as possible on the page. The scale of the drawing will be adjusted to allow the drawing area to be displayed as large as possible. The plot scale value set in the dialog is ignored.

To plot the drawing to scale, enter the desired scale in the dialog and select the "OK" button. The drawing will be plotted at the scale specified. The "Fit Plot to page" check box must be unchecked for this plot method.

For both of these plot methods, the origin of the plot is set to the lower-left corner of the drawing area. This means you must zoom and pan the drawing using the "View" menu to get the desired plot origin point at the lower left of the drawing area. The figure below demonstrates how the drawing area is mapped to the plot page using these two methods.

Figure 32 - Drawing To Plot Page Mapping

When the "OK" button is pressed in the plot scale dialog, the print setup dialog is displayed. To use the current setup parameters select the "OK" button. See the next section "Print Setup" for more information on specifying printer parameters.

After the "OK" button is pressed in the print setup dialog, another dialog box is displayed. This dialog is displayed while the plot is being created. This dialog has one button, "Cancel". Pressing this button will cause the plot operation to be canceled. If this button is not selected the plot is created and sent to the Print Manager. For more information on the Print Manager see your Windows manual.

Figure 33 - Cancel Dialog

If you have configured Windows to use "English" units, your plot scale specifies the number of drawing units per inch. If you have

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configured Windows to use "Metric" units, the plot scale specifies the number of drawing units per centimeter. The "International" option on the Windows Control Panel is used to set this parameter. Select the desired units from the "Measurement" field. See your Windows manual for more information.

This program does not care what units you use in the drawing. They can be anything. The plot scale is used to relate the drawing units to inches (or centimeters) on the printer/plotter.

Print Setup

When "Print Setup" or "Print/Plot" is selected from the "File" menu the program displays the print setup dialog. The "Print Setup" option allows you to set print parameters without plotting the drawing. The "Print/Plot" option brings up the setup dialog to allow you to change parameters before you plot the drawing.

Figure 34 - Print Setup Dialog

This dialog allows you to select the desired printer for output and change options for the selected printer. Not all printers support all options. An option may be dimmed and unselectable if it is not available. The print setup dialog contains a "Setup" button allowing you to set options specific to the currently selected printer. If you select this button you can change these options and when you select "OK" you are returned to the print setup dialog. Selecting "Cancel" ignores any changes you made.

When you have finished making changes in the print setup dialog select the "OK" button. This completes the command if you initially selected "Print Setup" from the pull down menu. If you selected "Print/Plot" the program proceeds to create the printout. Selecting "Cancel" ends either command ignoring any changes you have made and no printout is created.

VIEW OPERATIONS

The view options are used to display different parts of your drawing. They can be used to look at an area in detail or the drawing as a whole. They do not change the actual coordinates or dimensions of the drawing elements. They only allow you to view them in different ways.

Zooming In On An Area Of The Drawing

To see an area of the drawing in more detail, use the "Zoom Window" option on the "View" menu. With this option you input a rectangular area within the display area and that area is enlarged to cover the entire display area.

Figure 35 - Zoom Window

When you select "Zoom Window" from the "View" menu or press Ctrl+W the prompt area changes to:

Select first corner of window

MOUSE: position cursor, press left button. Right button for...

KEYBOARD: position with arrow keys, press Enter. F2 for...

You may select any corner of the area you want to enlarge. Once you have selected the first corner the prompt changes to:

Select second point

As you move the cursor, a box is drawn from the first point entered to the current cursor position. This box represents the area which will be enlarged if the current cursor position is selected. When the second point is selected, the input area is enlarged as much as possible while still displaying the entire area selected. If the area you input is of a different shape than the shape of the current drawing area, you may get some elements in the drawing area which were not in the area selected and the enlargement may not be as much as expected. Keep in mind, this command displays the entire area selected at a minimum. It will display more in one direction if necessary to display the entire area in the other direction.

Figure 36 - Effects Of Zoom Window Shape

Displaying All The Elements In The Drawing

To display all the elements in the drawing within the drawing area, use the "Zoom Extents" command on the "View" menu. This command will display all the drawing elements as large as possible within the drawing area.

VIEW OPERATIONS

Restoring A Previous View

To display the previous view, select "Zoom Previous" from the "View" menu or press Ctrl+R. If there is no previous view to restore, the "Zoom Previous" option is dimmed and unselectable. Up to 10 previous views are saved and can be restored.

Zooming In And Out

The drawing may be zoomed in (enlarged) and out (shrunk) using the "Zoom Factor" option on the "View" menu. When you select this option a dialog box appears which prompts you for a zoom factor. To zoom in, specify a number greater than 1. To zoom out, specify a number greater than zero but less than one. For example, specifying a value of 2 causes the drawing to be displayed at twice its current size. Specifying a value of 0.5 causes the drawing to be displayed at half its current size.

The current center point of the display area remains in the center after the zoom.

Figure 37 - Zoom Factor

Moving The Drawing Right/Left/Up/Down In The Drawing Area

The drawing elements may be moved right, left, up and down in the drawing area while still maintaining the current zoom factor by using the "Pan" option on the "View" menu. Selecting this option changes the prompt area to:

Select first point to define the displacement

MOUSE: position cursor, press left button. Right button for...

KEYBOARD: position with arrow keys, press Enter. F2 for...

Pick a position within the drawing area you want to move elsewhere
The first line of the prompt area changes to:

Select second point

Pick the position you would like the first point to be moved to within the drawing. The drawing area will be redrawn with the drawing elements shifted by the specified amount.

Figure 38 - Pan

VIEW OPERATIONS

Redraw: Cleaning Up The Drawing Area

During the course of drawing and editing you may get extra tic marks and such within the drawing area which are not actually part of the drawing. To erase the drawing area and redraw only the elements actually in the drawing, select "Redraw" from the "View" menu.

EDIT OPERATIONS

Selecting Drawing Elements

All of the options on the "Edit" menu within the block starting with "Select" (excluding "Paste") require one or more drawing elements be selected first. They are dimmed and unselectable if no drawing elements are selected. To select elements, pick the "Select" option off of the "Edit" menu. The prompt area will display:

Select first corner of selection area
MOUSE: position cursor, press left button. Right button for...
KEYBOARD: position with arrow keys, press Enter. F2 for...

When selecting drawing elements you input opposite corners of a rectangular area and all elements falling within this area or cross it will be selected. You may pick any corner of the area first. After selecting the first corner the first line of the prompt area becomes:

Select second point

Now you must enter the diagonally opposite corner of the selection area rectangle. As you move the cursor, a box is displayed with one corner at your first selection point and the opposite corner at your current cursor position. This represents the area which would be used for the selection if the current cursor position was used for the second point.

Figure 39 - Selecting Elements

When the second point is selected, the program displays the elements which are inside or cross the selection area in the selection color. These are the selected elements. The selection color is initially set to light gray but it can be changed using the "Selection Set Color" item on the "Options" menu.

Moving Drawing Elements

Elements within the drawing can be moved from one position to another by using a combination of the "Cut" and "Paste" options on the "Edit" menu. To move a drawing element, first select the element(s) you want to move. See the section on selecting drawing elements for information on how to do this.

Once the desired elements have been selected pick the "Cut" command off of the "Edit" menu. The prompt area will display:

Select cut reference point
MOUSE: position cursor, press left button. Right button for...
KEYBOARD: position with arrow keys, press Enter. F2 for...

EDIT OPERATIONS

The point you pick will correspond to the alignment point you select when you perform the paste operation. Once the reference point has been entered the selected elements will be erased from the display and deleted from the drawing.

Next select "Paste" from the "Edit" menu. The prompt line will display:

```
Select paste alignment point
MOUSE: position cursor, press left button. Right button for...
KEYBOARD: position with arrow keys, press Enter. F2 for...
```

As mentioned previously, the paste alignment point corresponds to the cut reference point. When an alignment point is selected, the elements cut previously are drawn at the new position and added to the drawing.

Figure 40 - Moving Drawing Elements

The elements may be pasted as many times as desired at any location in the drawing area. To end the paste command select another command from the menu or click the right mouse button and select "End" from the dialog.

The cut operation copies the selected elements to the Windows Clipboard. The paste operation retrieves them from the Clipboard and inserts them into the drawing. The "Paste" option is dimmed and unselectable if no data has been cut or copied to the clipboard.

This program uses a private data format when storing data in the clipboard. This is because none of the currently defined clipboard formats provide enough information for drawing elements to be cut or copied to the clipboard and then pasted back without loss of information. This means drawing elements cut or copied to the clipboard cannot be pasted into other programs unless they specifically support the GammaCAD clipboard format. Also, the GammaCAD "Paste" option cannot paste things from the clipboard which were cut/copied by another program. See the "Copy Bitmap" command for information on how to copy a bitmap from GammaCAD to another program. The appendix on the "Clipboard Data Format" contains a definition of the GammaCAD clipboard format.

Copying Drawing Elements Within The Same Drawing

Elements within the drawing can be copied to another position by using a combination of the "Copy" and "Paste" options on the "Edit" menu. To copy a drawing element first select the element(s) you want to move. See the section on selecting drawing elements for information on how to do this.

EDIT OPERATIONS

Once the desired elements have been selected pick the "Copy" command off of the "Edit" menu. The prompt are will display:

```
Select copy reference point
MOUSE: position cursor, press left button. Right button for...
KEYBOARD: position with arrow keys, press Enter. F2 for...
```

The point you pick will correspond to the alignment point you select when you perform the paste operation. Unlike the "Cut" command, the "Copy" command does not erase the selected elements. They remain in the drawing.

Next select "Paste" from the "Edit" menu. The prompt line will display:

```
Select paste alignment point
MOUSE: position cursor, press left button. Right button for...
KEYBOARD: position with arrow keys, press Enter. F2 for...
```

As mentioned previously, the paste alignment point corresponds to the copy reference point. When an alignment point is selected, the elements copied previously are drawn at the new position and added to the drawing.

Figure 41 - Copying Drawing Elements

The elements may be pasted as many times as desired at any location in the drawing area. To end the paste command, select another command from the menu or click the right mouse button and select "End" from the dialog.

This program uses a private data format when storing data in the clipboard. This is because none of the currently defined clipboard formats provide enough information for drawing elements to be cut or copied to the clipboard and then pasted back without loss of information. This means drawing elements cut or copied to the clipboard cannot be pasted into other programs unless they specifically support the GammaCAD clipboard format. Also, the GammaCAD "Paste" option cannot paste things from the clipboard which were cut/copied by another program. See the "Copy Bitmap" command for information on how to copy a bitmap from GammaCAD to another program. The appendix on the "Clipboard Data Format" contains a definition of the GammaCAD clipboard format.

Moving / Copying Drawing Elements Between Drawings

Drawing elements can be moved and copied between drawings as well as within the same drawing. To do this perform the cut or copy operation just as you do for moving/copying elements within the same drawing. Then load another copy of the GammaCAD program

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and bring up the drawing you wish to move/copy the elements to. Next paste the elements into that drawing. Alternatively, instead of loading another copy of GammaCAD you can open the drawing you want to paste into within the current instance of the program and paste the elements. The first method requires more memory but is much more convenient, especially if you need to perform multiple copy operations.

Figure 42 - Copying Drawing Elements Between Drawings

Deleting Drawing Elements

To delete drawing elements, first select the elements to delete (see the section on selecting elements). Then select "Delete" from the "Edit" menu. The selected elements are deleted from the drawing and erased from the drawing area.

Rotating Drawing Elements

To rotate drawing element, first select the elements to rotate (see the section on selecting elements). Then select "Rotate" from the "Edit" menu. The prompt area will display:

Select rotation center point

MOUSE: position cursor, press left button. Right button for...

KEYBOARD: position with arrow keys, press Enter. F2 for...

After picking a position, a dialog is displayed which allows you to enter the desired rotation angle. Enter the angle in degrees counter-clockwise and click on the "OK" button. The selected elements will be rotated about the given center point by the given angle.

Figure 43 - Rotating Drawing Elements

The program continues to prompt you for a rotation center point. You can pick another point and rotate the elements again or end the command by clicking the right mouse button and selecting "End" from the dialog.

Scaling Drawing Elements

This command is used to increase or decrease the size of drawing elements.

To scale drawing elements, first select the elements to scale (see the section on selecting elements). Then select "Scale" from the "Edit" menu. The prompt area will display:

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Select scale reference point

MOUSE: position cursor, press left button. Right button for...

KEYBOARD: position with arrow keys, press Enter. F2 for...

After picking a position, a dialog is displayed which allows you to enter the desired scale factor. A factor greater than one increases the size of the selected elements and a factor greater than 0 but less than 1 reduces the size of the elements. For example a scale factor of 2 doubles the size of the elements. A scale factor of 0.5 halves the size of the elements. When the

desired scale factor has been input, click on the "OK" button. The selected elements will be scaled about the given reference point by the input scale factor.

Figure 44 - Scaling Drawing Elements

The program continues to prompt you for a scale reference point. You can pick another point and scale the elements again or end the command by clicking the right mouse button and selecting "End" from the dialog.

Changing Drawing Element Properties

To change the properties of drawing elements, first select the elements to change. Then select "Change" from the "Edit" menu or press Ctrl+H. This will bring up a dialog which allows you to select what property to change. You can only change one property at a time. To select a property, click on its radio button and then click on the "OK" button.

Figure 45 - Change Dialog

The program will bring up a dialog which allows you to specify the new property. These dialogs are the same ones used in the corresponding selections on the "Options" menu. See the appropriate section under "Drawing Element Properties" in this manual for more information on using these dialogs.

When the new property is specified, the selected elements are changed. You will have to clear the selection set (see that section) in order to see color changes since the current selection set is always drawn in the selection set color.

Listing Drawing Elements

With the "List" option on the "Edit" pull down menu you can display the properties for selected elements. First select the elements to list and then pick "List" from the "Edit" menu.

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A dialog with the properties for the first element in the selection set is displayed. Select "OK" to display the next element's properties or "Cancel" to quit.

Figure 46 - List Dialog

Clearing The Current Selection

To clear the current selection and display the selected drawing elements in their actual color, select "Clear Selection" from the "Edit" menu.

Undoing Changes To The Drawing

The "Undo" option on the "Edit" pull down menu can be used to undo edit operations. If there are no edit operations which can be undone, the "Undo" option is dimmed and unselectable.

All of the commands on the "Edit" menu can be undone with the exception of "Select", "Copy", "List" and "Clear Selection". You also cannot undo an "Undo" command. The commands on the "Draw" menu can also all be undone.

Copy Bitmap - Placing Drawings In Other Programs

The "Copy Bitmap" option on the "Edit" pull down menu allows you to select a rectangular area in the drawing area to be copied to the Windows clipboard as a bitmap. The bitmap can be pasted into any program which allows you to paste a bitmap.

To copy a bitmap to the clipboard select the "Copy Bitmap" option off of the "Edit" menu. The prompt area will display:

Select first corner of bitmap area

MOUSE: position cursor, press left button. Right button for...

KEYBOARD: position with arrow keys, press Enter. F2 for...

When selecting the area you input opposite corners of a rectangular area. You may pick any corner of the area first. After selecting the first corner, the first line of the prompt area becomes:

Select second point

Now you must enter the diagonally opposite corner of the bitmap area rectangle. As you move the cursor, a box is displayed with one corner at your first selection point and the opposite corner at your current cursor position. This represents the area which would be used for the selection if the current cursor position was used for the second point.

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When the second point is selected, the program copies the selected area to the clipboard as a bitmap. To paste it into another program, change to that program and select "Paste" from its menu. Not all programs will paste a bitmap. See the documentation for the program you want to paste a drawing into for more information.

GammaCAD will not paste a bitmap from the clipboard. The GammaCAD "Paste" option will only paste drawing elements placed in the clipboard using the "Copy" or "Cut" options on the GammaCAD "Edit" menu.

Modifying Symbols

The drawing elements making up a symbol are treated as a unit once a symbol is inserted into a drawing. When you select one drawing element in a symbol, the entire symbol is selected. This is due to the fact the elements making up a symbol are stored in the drawing only once. Each insertion of a symbol only contains the symbol name, position, scale and rotation.

The "Change" command on the "Edit" menu has no affect on symbols. To change a symbol you must load the symbol file into GammaCAD using the "Open" command on the "File" menu. Symbol files are exactly the same as other drawing files. They are given a .SYM extension merely as a file keeping aid. From the "Open" dialog click on the arrow button to the right of the "List Files of Type" field (or press Alt+T and then the down arrow key). Select "Symbol File (*.SYM)" from the list. The dialog will list the symbol files in the current directory. Select the desired symbol from the list. You may need to change to the GammaCAD directory.

Once the symbol file is loaded you can use any of the program commands to add, change or delete drawing elements. Select the "Save" command from the "File" menu when you are done editing the symbol. The next time you insert the symbol into a new drawing the new symbol will be used. The changes will not affect drawings created previously containing the symbol.

See the "Symbol" appendix to determine which symbol files correspond to which symbols.

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Changing The Selection Set Color

The program displays selected elements in a certain color. To change the color, pick the "Selection Set Color" item off of the "Options" menu. This will bring up the color selection dialog. Select the new color from this menu and click on the "OK" button. The selection set will now be displayed in that color.

Setting The Plot Scale

The "Plot Scale" selection on the "Options" menu allows you to set a plot scale. This selection brings up a plot scale dialog. This dialog is also displayed when "Plot" is selected from the "File" menu. There are 2 differences between them, however. The "Fit plot to page" is dimmed and unselectable in the "Options" version of the plot scale dialog. This version also does not try to plot the drawing when the "OK" button is selected. This option is placed here so a plot scale can be set without plotting the drawing. Plot scale affects the size of the text in the drawing area. This option allows the plot scale to be changed if the text is too small or large. See the section on text properties for a further explanation of text size and plot scale.

Changing The Cursor Step Size

The cursor moves a certain number of pixels on the display when an arrow key is pressed. The cursor increment or step size specifies how many pixels it moves. This value is initially set to 5. Larger values cause the cursor to move more quickly across the display but make it more difficult to position the cursor at desired coordinates. Smaller values have the opposite effect.

To change this value select "Cursor Increment" off of the "Options" menu. Enter the desired cursor increment (greater than 0) and click on the "OK" button. The cursor will then move by that number of pixels when an arrow key is pressed and the cursor is in the drawing area.

HELP

Getting Help On-Line

To get help on different aspects of this program using the Windows help facility, select "Help" from the "Help" pull down menu or press F1. See your Windows manual for more information on using this help facility.

Exiting The Program

To exit the program, simply select "Exit" from the "File" menu.

If you select the "Exit" item from the "File" menu and the drawing you are currently working on has not been saved, a message box will appear and ask if you want to save the current drawing. If "No" is selected, any changes made to the current drawing will be lost. Selecting "Cancel," ends the "Exit" command and returns you to the current drawing. If you select "Yes," the drawing will be saved to the file name you specified previously. If no previous name was specified, you will be prompted for a name. After saving the file, the program will exit.

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Quick Key Summary

Quick keys can be used as a short-cut instead of selecting the corresponding options off of the menu. The table below summarizes the quick keys which can be used in this program and what they do.

<u>Key</u>	<u>Description</u>
Ctrl+S	Save the drawing to the current file.
Ctrl+Z	Undo the last edit operation or draw operation.
Ctrl+E	Select drawing elements.
Ctrl+X	Cut the current selection to the clipboard.
Ctrl+C	Copy the current selection to the clipboard.
Ctrl+V	Paste the contents of the clipboard.
Ctrl+H	Change properties of the current selection.
Ctrl+L	Draw a line.
Ctrl+A	Draw an arc.
Ctrl+I	Draw a circle.
Ctrl+P	Draw a point.
Ctrl+T	Draw a text string.
Ctrl+W	Zoom window.
Ctrl+R	Zoom previous.
F2	Brings up the coordinate input dialog when the program is prompting for a position.
F1	Brings up the Windows help facility.

Clipboard Format

The clipboard data used by this program is stored in binary format. It is registered with Windows using the following text string:

GCAD Vector Graphics

The first integer gives the number of font table entries. This is followed by 54 bytes for each font table entry (font id, font index and LOGFONT structure). Following the font table entries is the name of the first figure. If this name is "MAIN" then it is the main figure, otherwise it is an inserted figure (symbol). Next comes the xy coordinates of the user selected reference point for "MAIN" and the base point for inserted figures. Following this are the actual drawing elements for the figure. They start with a type identifier and are followed by a specific number of parameters depending on the type. The drawing elements can be in any order. They are terminated by a type value of 0. Following this is the name of the next figure, its xy position and then its elements. A zero length figure name marks the end of the clipboard data.

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<u>Type</u>	<u>Bytes</u>	<u>Description</u>
int	2	Number of fonts which follow.
int	2	Type. Font table entry = 13.
int	2	Font index.
LOGFONT	50	Logical font structure defined in Windows SDK.
* char	9	Name of figure. "MAIN" is the main figure and all others are inserted figures (symbols). This is a NULL (0x00) terminated string.
double	8	X-coordinate of user selected reference point for the "MAIN" figure and the base point for an inserted figure.
double	8	Y-coordinate.
int	2	Type. Line = 1.
int	2	Reserved.
long	4	RGB color value.
double	8	X-coordinate of first end.
double	8	Y-coordinate of first end.
int	2	Line type. Uses the standard Windows GDI values.
double	8	Line width.
double	8	X-coordinate of second end.
double	8	Y-coordinate of second end.
int	2	Type. Arc = 2.
int	2	Reserved.
long	4	RGB color value.
double	8	X-coordinate of center.
double	8	Y-coordinate of center.
int	2	Line type. Uses the standard Windows GDI values.
double	8	Line width.
double	8	Start angle (radians).
double	8	End angle (radians).
double	8	Radius.
* int	2	Type. Insert = 3.
int	2	Reserved.
long	4	RGB color value. Not used.
double	8	X-coordinate of insertion point.
double	8	Y-coordinate of insertion point.
char	9	Symbol name. This is an insertion of the figure with this name.
double	8	Rotation angle (radians).
double	8	Scale factor.

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<u>Type</u>	<u>Bytes</u>	<u>Description</u>
int	2	Type. Circle = 6.
int	2	Reserved.
long	4	RGB color value.
double	8	X-coordinate of center.
double	8	Y-coordinate of center.
int	2	Line type. Uses the standard Windows GDI values.
double	8	Line width.
double	8	Radius.
int	2	Type. Point = 7.
int	2	Reserved.
long	4	RGB color value.
double	8	X-coordinate of point.
double	8	Y-coordinate of point.
int	2	Point type. 1 = plus, 2 = x, 3 = circle, 4 = box.
double	8	Size.
int	2	Type. Text = 8.
int	2	Reserved.
long	4	RGB color value.
double	8	X-coordinate of text alignment point.
double	8	Y-coordinate of text alignment point.
int	2	Font index. Correlates to the font table index.
double	8	Height (inches).
double	8	Baseline angle (radians).
double	8	Orientation angle (radians).
int	2	Justification. Standard Windows GDI value.
int	2	Length of text string.
char	?	The actual text string. Length is given above.
int	2	Type. End of data = 0.

* New to version 1.10.

Memory Management

This program allocates memory for the drawing elements in blocks. The default block size is 50k and the default number of blocks is 100. This allows a potential drawing size of approximately 5M. Both of these parameters can be changed by inputting different values on the command line. To do this, simply add the desired block size and then the number of blocks at the end of the command line. There must be a space between the end of the command line and the block size and also a space between the block size and the number of blocks. For example:

```
c:\gcad\gcad 64000 200
```


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would set the block size to 64000 bytes and the number of blocks to 200. You must specify both parameters. You cannot just specify a block size. The block size must be between 1024 and 64511. The number of blocks must be greater than 0 and less than 64511.

When the program needs another memory block and cannot allocate it, you receive the message, "Out of memory. Save your drawing". Saving the drawing will free the memory used by the undo feature. It also deletes the current selection and frees the memory used by it. Then it compacts the drawing in memory to remove any wasted space due to deleted elements. If you get another out of memory message immediately after saving your drawing then your drawing cannot be made any larger without providing more memory to the program. Close some other applications or increase your available disk swap space in enhanced mode. If you are using a system with very little available memory you may need to decrease the block size parameter to make more efficient use of memory.

If you get the message, "Memory table overflow" you may need to increase the number of blocks parameter on the command line.

Symbols

The following table lists the details associated with each symbol available in GammaCAD.

<u>Group</u>	<u>Name</u>	<u>File</u>	<u>Size</u>	<u>Base Point</u>
Polygons	Triangle	triangle	1x1	Center
Polygons	Square	square	1x1	Center
Polygons	Pentagon	pentagon	1x1	Center
Polygons	Hexagon	hexagon	1x1	Center
Polygons	Heptagon	heptagon	1x1	Center
Polygons	Octagon	octagon	1x1	Center
Floor Plans	Tub	tub60x32	5.0x2.6	Lower-left
Floor Plans	Door	door24	2.0x2.0	Lower-left
Floor Plans	Window	window48	4.0x0.5	Lower-left
Floor Plans	Toilet	toilet	1.8x2.3	Lower-left
Floor Plans	Lavatory	lav36x22	3.0x1.8	Lower-left
Furniture	Chair	chair1	2.8x2.7	Center
Furniture	Chair (office)	chair2	2.4x1.6	Center
Furniture	Couch	couch1	7.3x3.0	Center
Furniture	Desk	dsk60x30	5.0x2.5	Center
Furniture	Bed (Queen)	bedq	5.3x2.8	Center
Landscaping	Car	car	.45x1.0	Lower-left
Landscaping	Tree (plan)	tree1	1x1	Center
Landscaping	Tree (profile)	tree2	0.5x1.0	Center
Landscaping	Light	light1	0.3x1.0	Center
Landscaping	Bush	bush1	1x1	Center

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<u>Group</u>	<u>Name</u>	<u>File</u>	<u>Size</u>	<u>Base Point</u>
Electronics	Resistor	resistor	1.0x0.2	Left-center
Electronics	Capacitor	capacitr	1.0x0.6	Left-center
Electronics	Inductor	inductor	1.0x.15	Left-center
Electronics	Transistor	transist	.35x1.0	Left-center
Electronics	Diode	diode	1.0x1.0	Left-center
Electronics	Ground	ground	1.0x1.0	Top-center
Networks	PC (desktop)	pc_desk	1.8x2.0	Lower-left
Networks	PC (tower)	pc_tower	2.2x2.0	Lower-left
Networks	Mouse	mouse	0.3x0.8	Top-left
Networks	Digitizer	digitizr	1x1	Lower-left
Networks	Printer	printer	1.1x2.3	Lower-left
Civil Eng.	North Arrow	n_arrow	0.1x1.0	Lower-left
Civil Eng.	Scale	scale	1.0x0.1	Lower-left
Civil Eng.	Manhole	man_hole	1x1	Center
Civil Eng.	Light Pole	lt_pole	1x1	Center
Civil Eng.	Storm Drain	st_drain	1x1	Center

The "File" column lists the file which contains the symbol (add a ".SYM" extension). The "Size" column gives the dimensions if the symbol is inserted with a scale factor of one. Some symbols are drawn to actual size while others have a dimension of one for x and/or y. For these symbols enter a scale factor equal to the size you want the symbol in your drawing. For example, to create a car with a length of 10 in your drawing enter a scale factor of 10. The "Base Point" column lists the point in the symbol which is aligned with the insertion point you pick in your drawing.

Revision History

The following changes were made from version 1.00 to 1.10.

1. Symbol capability was added.
2. Printer setup dialogs were added.
3. The copy bitmap function was added.
4. The install/setup program was added.
5. The program name was changed from CAD Vantage to GammaCAD.
6. The option on the plot scale dialog to reverse text angles on the printout was eliminated. This option should no longer be required.
7. Text justification was modified to produce better results on printers and plotters. Applies to TrueType fonts only.
8. The "Zoom Factor" command was changed to behave more like the other commands which use a scale factor. A number less than 1 decreases and greater than 1 increases the drawing size.
9. Program now uses Windows 3.1 print calls.
10. Text selection was improved.
11. An error which occurred when zooming by a very small window was corrected.

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12. The drawing file extension was changed from .DWG to .GC1 to avoid confusion with AutoCAD drawing files.
13. The "Print/Plot" and "Save" commands no longer reset the current text font.
14. More information is now given in the text list dialog.
15. The default scale of a new drawing is now 1" = 1 drawing unit (1cm = 1 drawing unit if metric configured).
16. The initial window in a new drawing is set to at least 8.5x11.
17. Using the "Zoom Extents" command in an empty drawing used to set an invalid drawing window. This was corrected.

GLOSSARY

Glossary

CAD	Computer Aided Design.
Current Selection	All the drawing elements which have been selected using the "Select" command.
Cursor Increment	The number of pixels the cursor moves when a keyboard arrow key is pressed.
Cursor Step	Same as "Cursor Increment".
Dialog Box	A windows pop up menu which contains input fields, check boxes, buttons and so on.
Drawing Area Extents	The range of coordinates displayed in the drawing area.
Drawing Extents	The range of coordinates covered by all the drawing elements.
Drawing Element	One of the 5 basic parts of a drawing: lines, arcs, circles, points and text.
Drawing Units	The dimensions used in the drawing area. They can be anything (e.g. feet, meters, etc.)
Font	A particular style of text.
K (Kilobyte)	1024 bytes of memory or disk space.
M (Meg or Megabyte)	1024 K bytes of memory or disk space.
Origin	The (0,0) point of an xy coordinate system.
Pan	To shift the view of the drawing within the drawing area left, right, up or down.
Plot Units	The dimensions used to specify sizes on the plot (inches or centimeters).
Quick Key	A short-cut key sequence which can be used instead of selecting a command from a menu.
Raster	In this manual it denotes graphics defined by a series of points as opposed to "Vector". For example, a line is defined by a series of points.
Selected Elements	Same as "Current Selection".
Selection Set	Same as "Current Selection".
Text Angle	The rotation, counter-clockwise, of the baseline of a text string.
Text Justification	How the text is aligned. For example, at the left top corner.
Text Orientation	The rotation, counter-clockwise, of the individual characters in a text string.
Vector	In this manual it denotes graphics defined by their end points as opposed to "Raster". For example, a line is defined by 2 points.
Zooming	Enlarging or decreasing the view of the drawing.