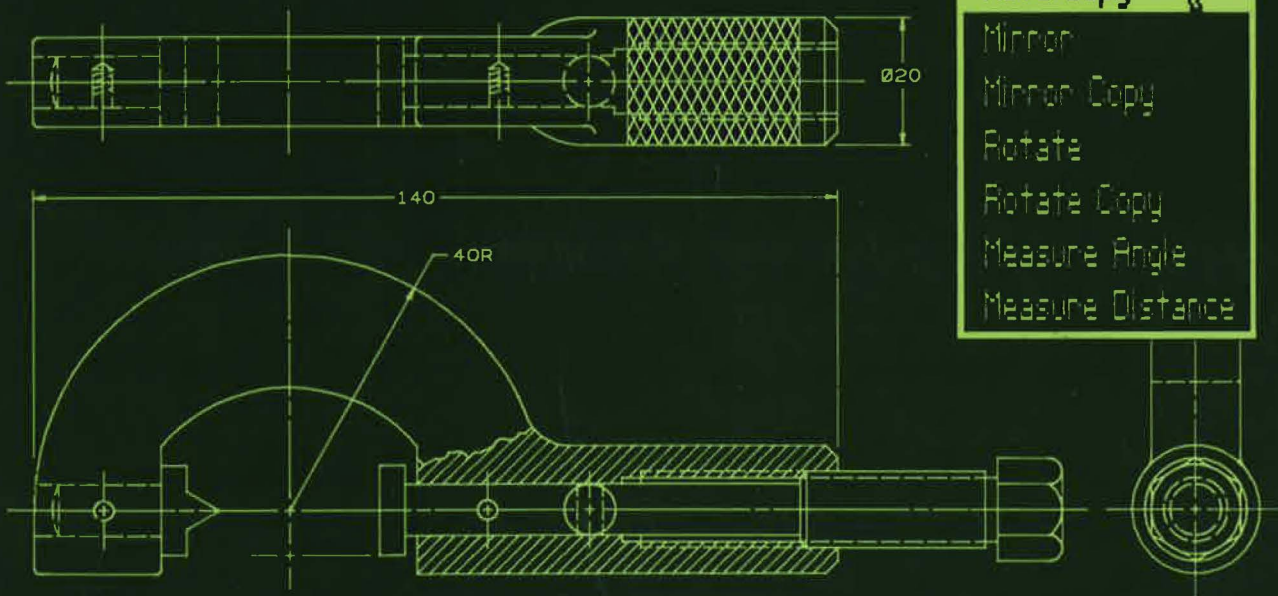


discoverCAD II

Computer Aided Drafting Software

File Screen Entity <-Modify Text & Dimension <-Modify Edit Mask Plot

Trim Line
Trim Circle
Trim Arc
Move
Move Copy
Mirror
Mirror Copy
Rotate
Rotate Copy
Measure Angle
Measure Distance



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Bugs

Each version of discoverCAD is thoroughly reviewed and tested before its release; however, should you encounter a system error or bug, please note the error message generated by the software as well as the command for which it was issued, and contact the Technical Support staff.

discoverCAD II Software Manual
TABLE OF CONTENTS

Chapter	Title	Page	Description
1	INTRODUCTION	1 - 1	Introduction
		1 - 2	Hardware Setup
		1 - 3	Getting Started
		1 - 3	Using the Mouse, Menus, & Keyboard
		1 - 5	Apple Menu Commands (Trace & Slot #)
2	FILE MENU	2 - 1	Format
		2 - 2	Directory
		2 - 2	Save
		2 - 3	Edit
		2 - 3	Drive
		2 - 4	Merge
3	SCREEN MENU	2 - 5	Symbol
		3 - 1	Draw Grid
		3 - 1	Snap Grid
		3 - 2	Use Layer
		3 - 3	Draw Layer
		3 - 3	Erase Layer
		3 - 4	Status Layer
		3 - 4	Zoom In
		3 - 5	Zoom Out
		3 - 6	Zoom Origin
		3 - 6	Zoom Screen
		3 - 7	Zoom Window
		3 - 8	Pan
3 - 8	Redraw		
4	ENTITY MENU	4 - 1	Draw Line
		4 - 2	Erase Line
		4 - 2	Draw Rectangle
		4 - 2	Draw Circle
		4 - 3	Erase Circle
		4 - 3	Draw Arc
		4 - 4	Erase Arc
		4 - 4	Draw Point
		4 - 5	Erase Point
		4 - 5	Erase
		4 - 6	Erase Window
4 - 6	Erase All		
5	ENTITY MODIFY MENU	5 - 1	None
		5 - 1	Hidden
		5 - 2	Length
		5 - 2	Vertical
		5 - 3	Horizontal
		5 - 4	Parallel
		5 - 4	Perpendicular
5 - 5	Angle		
5 - 6	Radius		

discoverCAD II Software Manual
TABLE OF CONTENTS

Chapter	Title	Page	Description
5	ENTITY MODIFY MENU cont.	5 - 7	Diameter
		5 - 7	Intersect
6	TEXT & DIMENSION MENU	6 - 1	Draw Linear Dimension
		6 - 2	Erase Linear Dimension
		6 - 2	Draw Radial Dimension
		6 - 3	Erase Radial Dimension
		6 - 3	Draw Diameter Dimension
		6 - 4	Erase Diameter Dimension
		6 - 4	Draw Text
		6 - 5	Erase Text
		6 - 6	Erase All
7	TEXT & DIM MODIFY MENU	7 - 1	None
		7 - 1	Precision
		7 - 2	Alternate Text
		7 - 3	Vertical
		7 - 3	Horizontal
		7 - 4	Point to Point
		7 - 4	Height
		7 - 5	Width
		7 - 6	Slant
		7 - 7	Angle
		7 - 7	Left Justify
		7 - 8	Center Justify
7 - 8	Right Justify		
8	EDIT MENU	8 - 1	Trim Line
		8 - 1	Trim Circle
		8 - 2	Trim Arc
		8 - 3	Move
		8 - 3	Move Copy
		8 - 4	Mirror
		8 - 5	Mirror Copy
		8 - 5	Rotate
		8 - 6	Rotate Copy
		8 - 6	Measure Angle
8 - 7	Measure Distance		
9	MASK MENU	9 - 1	Window
		9 - 2	End
		9 - 3	Origin
		9 - 3	Absolute
		9 - 4	Polar
10	PLOT MENU	10 - 1	Plotter
		10 - 1	Apple
		10 - 2	Roland DXY
		10 - 2	HI PC695A
		10 - 2	HI DMP 40

**discoverCAD II Software Manual
TABLE OF CONTENTS**

Chapter	Title	Page	Description
10	PLOT MENU cont.	10 - 3	HI DMP 41
		10 - 3	HP 7470
		10 - 3	HP 7475
		10 - 4	Pen Number
		10 - 4	Dim Scale
		10 - 4	Printer

**discoverCAD II Software Manual
APPENDIX**

Appendix	Title	Page	Description
A	DRAW TUTORIALS	A - 1	Draw Tutorial Level 1
		A - 4	Draw Tutorial Level 2
B	SYMBOL TUTORIAL	B - 1	Symbol Tutorial
C	PRINT TUTORIAL	C - 1	Printing Instructions
D	PLOT TUTORIAL	D - 1	Plotting Instructions
E	HELPFUL HINTS	E - 1	Deleting Files
		E - 1	Dimensioning
		E - 2	Drawing Backup
		E - 2	Draw Grid
		E - 2	Draw Line Angle
		E - 3	Dual Printer/Plotter Configuration
		E - 3	Edit
		E - 4	Merge
		E - 4	Plotting
		E - 4	Save
		E - 5	Symbol
E - 5	Zoom Window		
F	TECHNICAL NOTES	F - 1	Plotting
		F - 2	Apple 410 Color Plotter
		F - 2	Epson HI 80 Plotter
		F - 2	Hewlett Packard 7440A Color Pro Plotter
		F - 2	Hewlett Packard 7550 Plotter
		F - 3	Zericon PC 34/36 Plotter
		F - 3	Cable Specifications
		F - 7	Laser 128 Computer
		F - 7	Apple II+ Computer
		F - 7	Apple IIGS Computer
F - 7	Apple IIC Plus Computer		
F - 8	Color Monitor		
F - 8	Envoy Serial Card		

discoverCAD II Software Manual
APPENDIX

Appendix	Title	Page	Description
F	TECHNICAL NOTES cont.	F - 9	Peripheral Cards
		F - 9	Printing
		F - 9	RAM Card & Network versions
		F - 10	Command Selection
		F - 10	Compatible Software
		F - 10	Disks
		F - 10	3.5" vs 5.25" Disk
		F - 10	Display (Apple IIE)
		F - 10	DOS
		F - 10	Draw Grid
		F - 11	Erasing
		F - 11	Redraw Speed
		F - 11	Resolution
		F - 11	Saving Drawings
		F - 11	Scaling
		F - 11	Screen Size
		F - 11	Startup
		F - 12	CADPAKs
		F - 12	Instructional Material
		F - 12	Software Demonstration

Chapter 1

INTRODUCTION

Welcome! discoverCAD is a powerful Computer Aided Design (CAD) tool for creating structured graphics: architectural, electrical, and mechanical drawings, and much more. With discoverCAD, it's easy to create precise, complex drawings and even easier to change and modify what you create. Some of you are computer whizzes, some are complete novices. Either way, the software and manual are designed to get you up and running as painlessly as possible.

The discoverCAD software has ten menus, each menu containing a logical grouping of commands. discoverCAD's menus are organized from left to right in the menu bar as follows:

The **Apple** menu contains any miscellaneous commands that can be used to manipulate discoverCAD's default values used during the course of a drawing session.

The **File** menu contains any commands that pertain to the disk operations or basic utilities of discoverCAD (ex. saving a drawing to a floppy disk).

The **Screen** menu contains any commands that pertain to the positioning or scaling of your drawing. Also included in this menu are the grid and layer commands.

The **Entity** menu contains any commands that pertain to the creation of the basic entities of a drawing such as lines, circles, arcs, and points (entity is a general term for an individual line, circle, arc, point, etc.). Also included in this menu are the commands necessary to erase such entities.

The **<-Modify** menu contains any modifiers that pertain to the **Draw Line, Draw Rectangle, Draw Circle, Draw Arc, and Draw Point** commands in the **Entity** menu. Please note that there are two **<-Modify** menus; this particular menu contains all the modifiers relating to the **Entity** menu.

The **Text & Dimension** menu contains any commands that pertain to the creation of text and dimensioning. Text may be any notes or messages you might add to your drawing such as a name, date, description, etc. Dimensioning is a process that calculates the length of a line, the radius of a circle or arc, or the diameter of a circle or arc, and automatically draws the correct dimension lines, extension lines, arrowheads, and dimension text. Also included in this menu are the commands necessary to erase such entities.

The **<-Modify** menu contains any modifiers that pertain to the **Draw Linear Dim, Draw Radial Dim, Draw Diameter Dim, and Draw Text** commands in the **Text & Dimension** menu. Please note that there are two **<-Modify** menus; this particular menu contains all the modifiers relating to the **Text & Dimension** menu.

The **Edit** menu contains any commands that pertain to the alteration or replication of any basic entity (i.e. line, circle, arc, or point). By using the commands found in this menu, you will be able to save time utilizing graphic manipulation to duplicate and reposition drawing entities.

The **Mask** menu contains any masks that are used to limit selection during coordinate specification (i.e. clicking) to a particular area of the screen, position on the end of an existing entity (i.e. line, circle, arc, or point), or position in the center of an existing entity. Masks will work with practically any command that requires you to specify a coordinate or coordinates. Also included in this chapter are the masks necessary to specify coordinates using the Cartesian or polar coordinate systems.

The **Plot** menu contains any commands that pertain to the output of your drawing.

The discoverCAD manual is organized just like the software as described above, with a chapter for each menu. Each chapter contains an explanation of every command found in the menu, along with the operation, parameters, default value, and errors associated with each command. Also included in the manual are the **Draw Tutorial**, **Symbol Tutorial**, **Print Tutorial**, and **Plot Tutorial** appendices, which are detailed examples of various discoverCAD operations. Last you will find the **Helpful Hints** and **Technical Notes** appendices, which are a collection of suggestions and solutions to various questions and problems that pertain to the various functions of discoverCAD. Beginners should complete this introduction, then move on to the Draw Tutorials to familiarize themselves with the basics of discoverCAD. Experts will want to use this manual as a reference guide to any discoverCAD commands that they are unfamiliar with, or do not know how to use correctly. The tutorials will also be of use to the expert, as they are loaded with useful techniques. Whether beginner or expert, we hope you enjoy your experience with discoverCAD.

After you have completed this chapter, you will be able to configure your computer for discoverCAD, startup the software, use the mouse, menus, and keyboard. Also included in this chapter are the commands found in the **Apple** menu, which are used to manipulate discoverCAD's default values used during the course of a drawing session.

Hardware Setup

In order to use discoverCAD on your Apple IIC, IIE, or IIGS, you must first configure your hardware. In all cases, discoverCAD requires a minimum of 128K RAM, the AppleMouse, a monochrome monitor (discoverCAD will work on a color monitor, however, it does not currently display in color), and two 5.25" disk drives, or one 3.5" disk drive and one 5.25" disk drive.

Apple IIC: 1) Connect the AppleMouse to the mouse port on the back of the computer.
2) Plug the monitor cable into the monitor jack on the back of the computer.
3) Connect the external 5.25" disk drive to the drive port on the back of the computer. If you are having difficulty configuring your computer, see the Apple IIC Owner's Guide for more on installation.

Apple IIE: 1) If your IIE does not have the 128K RAM required by discoverCAD (the newer IIE has 128K, the older one does not), install the Apple Extended 80-Column Text Card in the Auxiliary slot (make sure the Double Hi Res Jumper Block is in place).
2) Install the AppleMouse IIE card in slot 4 or 5 of the computer.
3) Connect the AppleMouse to the mouse card port on the back of the computer.
4) Plug the monitor cable into the monitor jack on the back of the computer.
5) Connect the first external 5.25" disk drive (or first external 3.5" disk drive) to the disk controller card installed in slot 6 of the computer.
6) Connect the second external 5.25" disk drive to the drive port on the back of the first external disk drive. If you plan to use more than two disk drives, simply continue to link, or "daisy chain" them together. If you are having difficulty configuring your computer, see the Apple IIE Owner's Guide for more on installation.

Apple IIGS: 1) Connect the AppleMouse to the mouse port on the back of the computer.
2) Plug the monitor cable into the monitor jack on the back of the computer.
3) Connect the first external 5.25" disk drive (or first external 3.5" disk drive) to the drive port on the back of the computer.
4) Connect the second external 5.25" disk drive (or second external 3.5" disk drive) to the drive port on the back of the first external disk drive. If you plan to use more than two disk drives, simply continue to link, or "daisy chain" them together.
5) Reconfigure the IIGS display via the Desk Accessories firmware. To get the Desk Accessories Program, press the Control, Open Apple, and Escape keys simultaneously. Press the Up Arrow or Down Arrow to highlight the Control Panel option, then press Return. Press the Up Arrow or Down Arrow to highlight the Display option, then press Return. Press the Up Arrow or Down Arrow to highlight the Type option, then press the Right Arrow or the Left Arrow to change it to Monochrome.

Press Return to save the configuration, then Quit the Control Panel and Desk Accessories menus. The IIGS will remember this configuration in all subsequent sessions. If you are having difficulty configuring your computer, see the Apple IIGS Owner's Guide for more on installation.

Getting Started

Having configured your Apple system per the instructions above, you are now ready to start a session with discoverCAD. Before you start, it is important to remember that the discoverCAD system disks must remain in the disk drives at all times.

Apple IIC and IIE: Always use the 1st disk drive (or any other drives connected besides the 2nd disk drive) for the **File** commands such as **Format**, **Directory**, **Save**, **Edit**, and **Merge**, and keep the 5.25" discoverCAD System Disk 2 in the 2nd disk drive at all times.

Apple IIGS: Always use the 2nd disk drive (or any other drives connected besides the 1st disk drive) for the **File** commands such as **Format**, **Directory**, **Save**, **Edit**, and **Merge**, and keep the 3.5" discoverCAD System Disk in the 1st disk drive at all times.

Usually you will want to specify the drive to be used for the **File** commands before starting your drawing by using the **Drive** command as described in the **File Menu** chapter. Should your IIC, IIE, or IIGS be equipped with more than two disk drives, you may also use the **Drive** command to access the additional drives. In general, never remove the discoverCAD system disks unless prompted to do so by the system, and never try to **Save** a drawing to the system disks. Also, please note that you should never write protect your discoverCAD system disks; you may receive a error message. If this happens, remove the write protection from the disk and reboot the system. Also, make sure the Caps Lock key is depressed during your session with discoverCAD. Finally, when booting the discoverCAD system, make sure that the discoverCAD system disks are the only ones present; if there are other disks on line, the system may get confused and try to boot off the foreign disk.

3.5" disk drive users: If your system configuration consists of a 3.5" disk drive as the first drive, and either a 3.5" or 5.25" disk drive as the second, place the 3.5" discoverCAD System Disk in the first drive and turn on the power switch. After approximately 45 seconds the discoverCAD Menu Bar will appear on screen. At this time, you may want to configure discoverCAD to recognize a disk drive other than the first disk drive as the disk drive to be used for all **File** commands (see the **Drive** command in the **File Menu** chapter to specify your data drive).

5.25" disk drive users: If your system configuration consists of a 5.25" disk drive as the first drive, and a 5.25" disk drive as the second, place the 5.25" discoverCAD System Disk 1 in the first drive, and the 5.25" discoverCAD System Disk 2 in the second drive, and turn on the power switch. After approximately 45 seconds the discoverCAD Menu Bar will appear on screen.

Using the Mouse

Having started the discoverCAD system per the instructions above, you are now ready to learn how to use the mouse. Try sliding the mouse around on a clean, flat surface next to your computer. When you move the mouse across your desk, notice how the small arrow, called the pointer, moves in a corresponding way across the screen.

Using the Menus

Now that you are familiar with the mouse, you are now ready to select a command from one of the pull-down menus. Use the mouse to position the arrow over the word **Entity** in the menu bar at the top of the screen. Now, press the mouse button down and hold it down. The contents of the **Entity** menu should now appear on screen. While still holding the mouse button down, slowly drag the mouse toward you until the command **Draw Line** is highlighted. Now release the mouse button to activate the **Draw Line** command (the disk drives will whirl momentarily while the command is being loaded). Simple enough? That's the way all discoverCAD commands will be executed! Next, click the mouse button once where you would like the line to begin (pressing and releasing the mouse button is called clicking). Click a second time where you would like the line to end, and a line will be drawn between the two points you clicked. Practice drawing a few lines to further familiarize yourself with the use of the mouse and pull-down menus.

Using the Keyboard

While it is strongly recommended that you use a mouse with discoverCAD, you may use the keyboard instead.

Apple IIC and IIE: Press the Open Apple and Closed Apple keys simultaneously, then release only the Closed Apple key (this tells discoverCAD that you will be using the keyboard for all command and coordinate entry). Now you can use the directional arrow keys on the keyboard to position the mouse pointer on the screen (similar to moving the mouse), and the Closed Apple key to click (similar to clicking the mouse). Remember you must have the Open Apple key depressed at all times. Try drawing a line as described above in the mouse section, only substitute the mouse actions with the corresponding keyboard actions. Please note that it is necessary to release the Open Apple key when you are inserting text (see the **Draw Text** command in the **Text & Dimension Menu** chapter).

Apple IIGS: Follow the keyboard instructions as described above in the IIC and IIE users section, only substitute the Option key for the Closed Apple key. Please note that it is necessary to release the Open Apple key when you are inserting text (see the **Draw Text** command in the **Text & Dimension Menu** chapter).

APPLE MENU

The **Apple** menu contains any miscellaneous commands that can be used to manipulate discoverCAD's default values used during the course of a drawing session. A default value is a value that is assumed to be equal to an existing condition unless otherwise stated (ex. the computer assumes you will be plotting from Slot 2 of your computer unless you tell it otherwise).

After you have completed this section, you will be able to use the **Trace** and **Slot Number** commands.

Trace

The **Trace** command is used to specify whether or not you want the arrow cursor to leave a dot at each coordinate clicked.

Operation: Highlight the **Trace** command in the **Apple** menu, and release the mouse button. The tracing feature will now be in effect (when trace is on, the command will have a check mark next to it in the **Apple** menu). To turn the trace off, simply reselect the **Trace** command.

Parameters: On/Off.

Default Value: Trace = Off.

Errors: None.

Slot Number

The **Slot Number** command is used to specify which slot you want to plot from, either Slot 1 or Slot 2. If you are using an Apple IIC or IIGS, you are actually specifying which port to use (see the **Plot Tutorial** appendix for more on setting the serial port). If you are using an Apple IIE, you are specifying which slot contains the serial card (slot 1 is used for printing, slot 2 is used for plotting). See the **Plot Tutorial** appendix for more on setting the serial card.

Operation: Highlight the **Slot Number** command in the **Apple** menu, and release the mouse button. You will then be prompted "Slot Number (1,2):"; type which slot/port number you wish to plot from, and press Return. From now on discoverCAD will expect to find the plotter attached to the slot/port number you have specified.

Parameters: Slot (integer 1 or 2).

Default Value: Slot = 2.

Errors: The system will continue to prompt you until a valid slot number is entered (i.e. 1 or 2).

Chapter 2

FILE MENU

The **File** menu contains any commands that pertain to the disk operations of discoverCAD (ex. saving a drawing to a floppy disk). Before you use any of the **File** commands, it is important to remember that the discoverCAD system disks must remain in the disk drives at all times.

Apple IIC and IIE: Always use the 1st disk drive (or any other drives connected besides the 2nd disk drive) for the **File** commands such as **Format, Directory, Save, Edit, and Merge**, and keep the 5.25" discoverCAD System Disk 2 in the 2nd disk drive at all times.

Apple IIGS: Always use the 2nd disk drive (or any other drives connected besides the 1st disk drive) for the **File** commands such as **Format, Directory, Save, Edit, and Merge**, and keep the 3.5" discoverCAD System Disk in the 1st disk drive at all times.

Usually you will want to specify the drive to be used for the **File** commands before starting your drawing by using the **Drive** command as described below. Should your IIC, IIE, or IIGS be equipped with more than two disk drives, you may also use the **Drive** command to access the additional drives. In general, never remove the discoverCAD system disks unless prompted to do so by the system, and never try to **Save** a drawing to the system disks.

After you have completed this chapter, you will be able to use the **Format, Directory, Save, Edit, Drive, Merge, and Symbol** commands.

Format

The **Format** command must be used before you can save a drawing created with discoverCAD. If you are planning to save to a 5.25" disk drive, use a single-sided double-density 5.25" diskette. If you are planning to save to a 3.5" disk drive, use a double-sided double-density 3.5" diskette. Please note that once a disk has been formatted, it is not necessary to reformat the disk unless you wish to erase its entire contents.

Operation: Highlight the **Format** command in the **File** menu, and release the mouse button. You will then be prompted "Place the disk to be formatted in drive #x:, then press RETURN." (where x represents the disk drive being used for the **File Menu** commands). Replace the discoverCAD system disk with the disk you wish to format, and press Return. If the disk you have inserted is new, the system will immediately begin to format. If the disk you have inserted has already been formatted, you will be prompted "WARNING: Wish to erase this disk? (Y/N)". If you type Y, the disk will be reformatted (and its contents erased). If you type N, the disk will not be formatted. When formatting is completed (approximately 25 seconds for a 5.25" disk, 45 seconds for a 3.5" disk), you may be prompted "Replace discoverCAD system disk 1 in drive #1:, then press RETURN.". Replace the newly formatted disk with the discoverCAD system disk you removed, and press Return to resume discoverCAD.

Parameters: None.

Default Value: Drive = 1 (can be changed using the **Drive** command).

Errors: 1) If the discoverCAD system disk is inserted for formatting, you will be prompted "ERROR: Unable to format system disk. Press RETURN."
2) If no disk is inserted for formatting, you will be prompted "ERROR: Unable to format disk. Press RETURN."
3) If the disk inserted for formatting is write protected, you will be prompted "ERROR: Disk is write-protected. Press RETURN."

4) If the discoverCAD system disk is not replaced after formatting, you will continue to be prompted "Replace discoverCAD system disk 1 in drive #1:, then press RETURN." until the discoverCAD system disk is replaced.

Directory

The **Directory** command is used to obtain a directory listing of the drawing or symbol files you have stored on a floppy disk. Please note that it is advisable to use this command before you begin drawing, as it is necessary for the system to redraw the screen after this command has been executed, and, depending on the size of your drawing, could be time consuming.

Operation: Highlight the **Directory** command in the **File** menu, and release the mouse button. You will then be prompted "Place the desired disk in drive #x:, then press RETURN." (where x represents the disk drive being used for the **File Menu** commands). Replace the discoverCAD system disk with the disk you wish to obtain a directory listing from, and press Return. The contents of the disk you have inserted will now be listed on the screen. When the listing is completed, you may be prompted "Replace discoverCAD system disk 1 in drive #1:, then press RETURN.". Replace the drawing disk with the discoverCAD system disk you removed, and press Return to resume discoverCAD.

Parameters: None.

Default Value: Drive = 1 (can be changed using the **Drive** command).

Errors: 1) If no disk is inserted for listing, you will be prompted "ERROR: Disk error. Press RETURN."
2) If the disk inserted for listing is not formatted, you will be prompted "ERROR: Disk error. Press RETURN."
3) If the discoverCAD system disk is not replaced after listing, you will continue to be prompted "Replace discoverCAD system disk 1 in drive #1:, then press RETURN." until the discoverCAD system disk is replaced.

Save

The **Save** command is used to store a drawing that you have created with discoverCAD onto a disk that has been formatted with discoverCAD. Please note that it is advisable to save your drawing every 15 minutes or so to prevent the loss of your work should the computer fail. Also, IIGS users should see the **Drive** command below before saving, as it is necessary to specify the drive where the drawing disk will be found (substitute drive #x: for drive #1: in the saving instructions listed below, where x represents the disk drive being used for the **File Menu** commands).

Operation: Highlight the **Save** command in the **File** menu, and release the mouse button. You will then be prompted "Place drawing disk in drive #x:, then press RETURN." (where x represents the disk drive being used for the **File Menu** commands). Insert a disk that has already been formatted using discoverCAD, and press Return. You will then be prompted "File name:". Type in a name for the drawing consisting of up to 8 alpha and/or numeric characters (if you make a mistake while typing the filename, you may use the Delete or Left Arrow keys to remove the error). Now press Control Q to enter the filename (depress the Control and Q key at the same time). The drawing you currently have displayed on the screen will now be saved. Once the drawing has been saved, you may be prompted "Replace discoverCAD system disk 1 in drive #1:, then press RETURN.". Replace the drawing disk with the discoverCAD system disk you removed, and press Return.

Parameters: File name (up to 8 alpha and/or numeric characters).

Default Value: Drive = 1 (can be changed using the **Drive** command).

Errors: 1) If no file name is given for the drawing (i.e. you press Control Q without specifying a file name), you may be prompted to replace the discoverCAD system disk.
2) If you try to type the file name and nothing appears, make sure the Caps Lock key is depressed.

- 3) If the file name you specify is longer than 8 characters, the system will truncate it to a length of 8 characters.
- 4) If no disk is inserted for saving, an error message will be issued.
- 5) If the disk inserted for saving is not formatted, an error message will be issued.
- 6) If the disk inserted for saving is write protected, an error message will be issued.
- 7) If the disk inserted for saving is full, you will be prompted "ERROR: Disk full. Press RETURN."
- 8) If the discoverCAD system disk is not replaced after saving, you will continue to be prompted "Replace discoverCAD system disk 1 in drive #1.; then press RETURN." until the discoverCAD system disk is replaced.

Edit

The **Edit** command is used to retrieve a drawing that you have saved onto a disk that has been formatted with discoverCAD. Please note that IIGS users should see the **Drive** command below before editing, as it is necessary to specify the drive where the drawing disk will be found (substitute drive #x: for drive #1: in the editing instructions listed below, where x represents the disk drive being used for the **File Menu** commands).

Operation: Highlight the **Edit** command in the **File** menu, and release the mouse button. You will then be prompted "Place drawing disk in drive #x.; then press RETURN." (where x represents the disk drive being used for the **File Menu** commands). Insert the disk that contains the drawing you wish to retrieve, and press Return. You will then be prompted "File name:". Type in the name of the drawing (if you make a mistake while typing the filename, you may use the Delete or Left Arrow keys to remove the error) and press Control Q to enter the filename (depress the Control and Q key at the same time). Once the drawing name has been specified, you may be prompted "Replace discoverCAD system disk 1 in drive #1.; then press RETURN.". Replace the drawing disk with the discoverCAD system disk you may have removed, and press Return. The drawing will now be displayed on the screen, after which you can resume discoverCAD. If you can't remember the name of the drawing, use the **Directory** command to obtain a listing of the drawing disk.

Parameters: File name (up to 8 alpha and/or numeric characters).

Default Value: Drive = 1 (can be changed using the **Drive** command).

- Errors:**
- 1) If no file name is given for the drawing (i.e. you press Control Q without specifying a file name), you may be prompted to replace the discoverCAD system disk.
 - 2) If you try to type the file name and nothing appears, make sure the Caps Lock key is depressed.
 - 3) If the file name you specify is longer than 8 characters, the system will truncate it to a length of 8 characters.
 - 4) If no disk is inserted for editing, an error message will be issued.
 - 5) If the disk inserted for editing is not formatted, an error message will be issued.
 - 6) If the disk inserted for editing is empty, or the drawing name specified is not found on the disk, you will be prompted "ERROR: Drawing not found. Press RETURN."
 - 7) If the discoverCAD system disk is not replaced after editing, you will continue to be prompted "Replace discoverCAD system disk 1 in drive #1.; then press RETURN." until the discoverCAD system disk is replaced.

Drive

The **Drive** command is used to specify which disk drive to access for the **Format**, **Directory**, **Save**, **Edit**, and **Merge** commands. You will typically use this command to specify the 2nd disk drive as the primary drive when using discoverCAD on the IIGS, or to access any additional drives you may have connected to your IIC, IIE, or IIGS. Please note that you must keep the 3.5" discoverCAD system disk in drive one at all times if you are using a 3.5" disk drive as the startup drive. If you are using a 5.25" disk drive as the startup drive, you must keep the 5.25" discoverCAD system disk 2 in drive 2 at all times.

Operation: Highlight the **Drive** command in the **File** menu, and release the mouse button. You will then be prompted "Drive number (1,2,3,4,5,6):". discoverCAD assigns numbers to the disk drives connected to your IIC, IIE, or IIGS configuration as follows:

- #1 is the startup drive, attached to slot 4, 5, or 6.
- #2 is the 2nd drive, attached to the same slot as the startup drive.
- #3 is the 3rd drive, attached to slot 4, 5, or 6.
- #4 is the 4th drive, attached to the same slot as the 3rd drive.
- #5 is the 5th drive, attached to slot 4, 5, or 6.
- #6 is the 6th drive, attached to the same slot as the 5th drive.

Type in the number of the disk drive you wish to access for the **File** commands, and press Return. Once a valid value for the drive number has been entered, discoverCAD will access that drive during the **File** commands for the remainder of your work session.

Parameters: Drive (integer 1 - 6).

Default Value: Drive = 1.

- Errors:** 1) The system will continue to prompt you until a valid drive number is entered (i.e. 1 - 6).
2) If the drive you have specified is not on line, you will be prompted "ERROR: Disk drive not on line. Press RETURN."

Merge

The **Merge** command is used to attach a symbol file that has been previously created to a drawing that is currently being created or edited, thereby allowing you to later access a symbol layer (see the **Symbol** command below). Please note that IIGS users should see the **Drive** command above before merging, as it is necessary to specify the drive where the symbol disk will be found (substitute drive #x: for drive #1: in the merging instructions listed below, where x represents the disk drive being used for the **File Menu** commands). Also, please note that it is worthwhile to review the **Symbol Tutorial** appendix to take full advantage of this command.

Operation: Highlight the **Merge** command in the **File** menu, and release the mouse button. You will then be prompted "Place drawing disk in drive #x:, then press RETURN." (where x represents the disk drive being used for the **File Menu** commands). Insert the disk that contains the symbol file you wish to retrieve, and press Return. You will then be prompted "File name:". Type in the name of the symbol file (if you make a mistake while typing the filename, you may use the Delete or Left Arrow keys to remove the error) and press Control Q to enter the filename (depress the Control and Q key at the same time). Once the symbol file has been specified, you may be prompted "Replace discoverCAD system disk 1 in drive #1:, then press RETURN.". Replace the symbol disk with the discoverCAD system disk you may have removed, and press Return. The drawing you are currently creating or editing will now be redrawn on the screen, after which you can resume discoverCAD. The symbol file will not be displayed unless the layer(s) that contain(s) the symbol(s) are currently drawn on screen, or "echoed" (see the **Screen Menu** chapter for more on layers). If you can't remember the name of the symbol file, use the **Directory** command to obtain a listing of the symbol disk.

Parameters: File name (up to 8 alpha and/or numeric characters).

Default Value: Drive = 1 (can be changed using the **Drive** command).

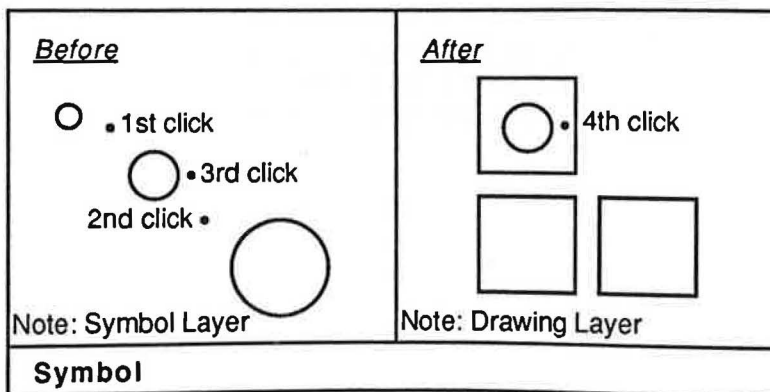
- Errors:** 1) If no file name is given for the symbol file (i.e. you press Control Q without specifying a file name), you may be prompted to replace the discoverCAD system disk.
2) If you try to type the file name and nothing appears, make sure the Caps Lock key is depressed.
3) If the file name you specify is longer than 8 characters, the system will truncate it to a length of 8 characters.

- 4) If no disk is inserted for merging, an error message will be issued.
- 5) If the disk inserted for merging is not formatted, an error message will be issued.
- 6) If the disk inserted for merging is empty, or the symbol file name specified is not found on the disk, an error message will be issued.
- 7) If the discoverCAD system disk is not replaced after merging, you will continue to be prompted "Replace discoverCAD system disk 1 in drive #1:, then press RETURN." until the discoverCAD system disk is replaced.

Symbol

The **Symbol** command is used to copy a symbol from another layer, or a symbol file that has already been merged to a drawing that is currently being created or edited (see the **Merge** command above). Please note that a symbol can be one entity or a group of several entities (i.e. lines, circles, arcs, points). However, this does not include text and dimensioning. A symbol must not contain text or dimensioning; any attempt to transfer such may result in unpredictable results. Also, please note that your workspace is limited to one screen full; you may Pan or Zoom to aid you when creating the symbols, however, you will only be able to view and retrieve the symbols visible with the screen at its original scaling and origin (i.e. **Zoom Origin**). Finally, please note that it is worthwhile to review the **Symbol Tutorial** appendix to take full advantage of this command.

Operation: Highlight the **Symbol** command in the **File** menu, and release the mouse button. You will then be prompted "Copy symbol from layer number?"; type in the number of the layer that contains the symbol you wish to copy, and press Return (if you press Return without entering a value for the layer, the system will exit the **Symbol** command). Next, you will be prompted "Copy symbol to layer number?"; type in the number of the layer that you wish to copy the symbol to (typically your drawing layer), and press Return (again, if you press Return without entering a value for the layer, the system will exit the **Symbol** command). Finally, you will be prompted "Symbol Scaling?"; type in the desired scale of the symbol in relationship to the drawing (ex. if you want the symbol:drawing scale to be 2:1, or twice as big, type in a 2), and press Return. If you press Return without entering a value for the scaling, a value of 1 will be used. At this time, the layer you specified as the layer to copy the symbol from will be displayed. To select the symbol you wish to copy, click twice in such a manner that the two coordinates you have specified will define a rectangle, or "window", around the desired symbol. Please note that arcs are treated as circles in determining if they are in the window; if you have an arc with a very large radius, you will have to define your window so that it encompasses the arc's entire radius in all directions (i.e. pretend the arc is a circle). Having done this, click once more to indicate a point of reference on the symbol. The system will now display the layer you specified as the layer to copy the symbol to; click where you would like the symbol to be placed, and it will be drawn with the point of reference placed at the coordinate you specify. If you wish to copy more symbols, simply repeat the above steps, otherwise simply press Return without specifying a layer number when prompted "Copy symbol from layer number?".



This diagram shows the effect of the **Symbol** command when used to copy a symbol from layer 2 (i.e. the circles) to layer 1 (i.e. the rectangles), using a scaling of 1.

- Parameters:
- 1) Layer to copy to (integer 1 - 128).
 - 2) Layer to copy from (integer 1- 128).
 - 3) Scaling (real > 0 and < 1001).

Default Value: Scaling = 1.00.

- Errors:
- 1) The system will continue to prompt you until a valid layer number is entered (i.e. 1- 128).
 - 2) The system will continue to prompt you until a valid scale is entered (i.e. > 0 and < 1001).
 - 3) If the window you specify does not contain a symbol, the system will exit the **Symbol** command upon completion.
 - 4) When scaling with a ratio greater than 1000, the resulting display may be unpredictable.

Chapter 3

SCREEN MENU

The **Screen** menu contains any commands that pertain to the positioning or scaling of your drawing. Also included in this menu are the grid and layer commands.

After you have completed this chapter, you will be able to use the **Draw Grid**, **Snap Grid**, **Use Layer**, **Draw Layer**, **Erase Layer**, **Status Layer**, **Zoom In**, **Zoom Out**, **Zoom Origin**, **Zoom Screen**, **Zoom Window**, **Pan**, and **Redraw** commands.

Draw Grid

The **Draw Grid** command is used to display a series of evenly spaced rows and columns of dots. This command is useful when the accuracy of a drawing is important. Please note that in some instances the time that it takes to display a grid may be lengthy (especially when the grid is very dense). You may find it useful to **Zoom In** first, before displaying the grid, as this will make the grid less dense, and therefore capable of being displayed much quicker (see the **Zoom In** command below).

Operation: Highlight the **Draw Grid** command in the **Screen** menu, and release the mouse button. You will then be prompted "Grid Size?"; type in the desired grid size and press Return. If you press Return without specifying a value for the grid size, a value of 1 unit will be used (discoverCAD uses a generic unit system for scaling, where 1 unit can represent any distance). The grid will now be drawn on the screen (when the grid is displayed, the command will have a check mark next to it in the **Screen** menu). To erase a grid, simply reselect the **Draw Grid** command.

Parameters: Grid Size (real > 0 and < 1001).

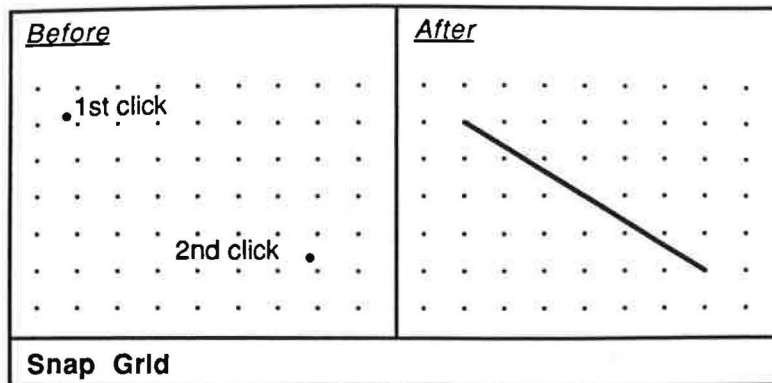
Default Value: Grid Size = 1 unit. Please note that the default value for the grid size will be 1 unit the first time the command is used. After that, the default value will be equal to the last value specified.

Errors: 1) If the grid size specified is too dense to be drawn, you will be prompted "WARNING: Grid too small. Press RETURN to continue."

Snap Grid

The **Snap Grid** command is used to "snap" a coordinate to the grid system (your clicks will automatically snap to the nearest grid dot). This command is useful when the accuracy of a drawing is important. Please note that it is possible to snap to a grid system even if the grid is not currently displayed (the grid size will be equal to the last value specified).

Operation: Highlight the **Snap Grid** command in the **Screen** menu, and release the mouse button. The snapping feature will now be in effect (when snap is on, the command will have a check mark next to it in the **Screen** menu). To turn the snap off, simply reselect the **Snap Grid** command.



This diagram shows the effect of **Snap Grid** when using the **Draw Line** command.

Parameters: On/Off.

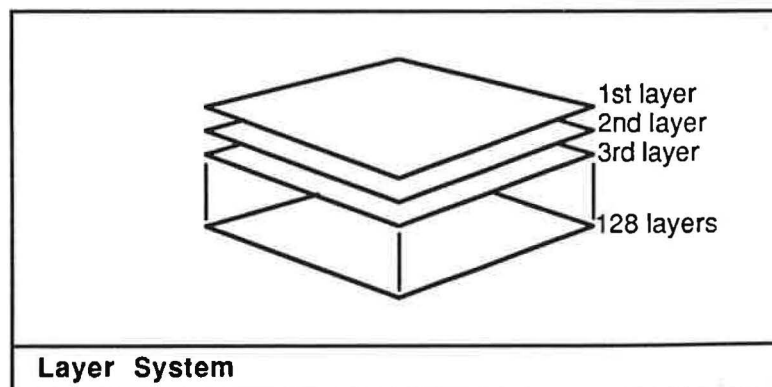
Default Value: Snap = Off.

Errors: None.

Use Layer

The **Use Layer** command is used to specify which layer to use when drawing. This command is useful when you want to divide a drawing into independent levels (ex. a floor plan may have the plumbing on one layer, the electrical on another, etc.), providing you with the ability to later view or plot the drawing a layer at a time, or any combination thereof, using the **Draw Layer** and **Erase Layer** commands (see below).

Operation: Highlight the **Use Layer** command in the **Screen** menu, and release the mouse button. You will then be prompted "Layer:"; type in the number of the layer you wish to draw on, and press Return (if you press Return without entering a value for the layer, the system will exit the **Use Layer** command). From now on, any drawing you do will be contained on the specified layer.



Parameters: Layer (integer 1 - 128).

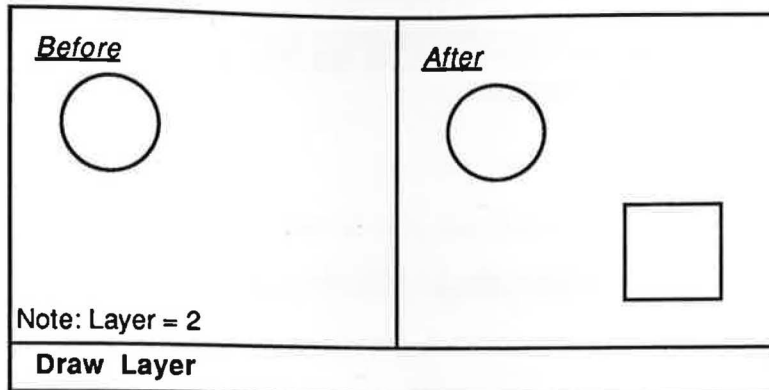
Default Value: Layer = 1.

Errors: 1) If you don't specify a valid layer number (i.e. 1 - 128), the system will ignore what you have entered.

Draw Layer

The **Draw Layer** command is used to display a previously created layer that is not currently visible. Please note that this command is most commonly used to recall, or "draw" a layer that has been temporarily erased with the **Erase Layer** command (see below). Also, please note that the time it takes to redraw the screen may be lengthy, especially when your drawing is excessively large.

Operation: Highlight the **Draw Layer** command in the **Screen** menu, and release the mouse button. You will then be prompted "Layer:"; type in the number of the layer you wish to add to the current display, and press Return (if you press Return without entering a value for the layer, the system will exit the **Draw Layer** command). The screen will now be redrawn to include the layer you have specified.



This diagram shows the effect of the **Draw Layer** command, assuming you already had one layer displayed on screen (i.e. the circle), and that layer 2 contained the rectangle.

Parameters: Layer (integer 1 - 128).

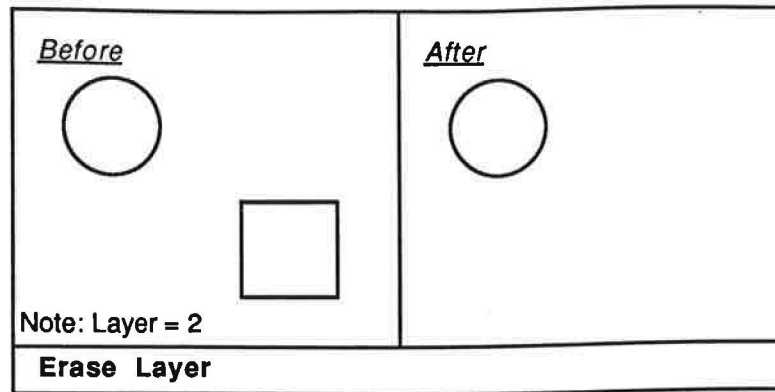
Default Value: Layer = 1.

Errors: 1) If you don't specify a valid layer number (i.e. 1 - 128), the system will ignore what you have entered.

Erase Layer

The **Erase Layer** command is used to temporarily remove a layer from the current display. Please note that this command does not actually erase the layer, but merely hides it from view. Also, please note that the time it takes to redraw the screen may be lengthy, especially when your drawing is excessively large.

Operation: Highlight the **Erase Layer** command in the **Screen** menu, and release the mouse button. You will then be prompted "Layer:"; type in the number of the layer you wish to remove from the current display, and press Return (if you press Return without entering a value for the layer, the system will exit the **Erase Layer** command). The screen will now be redrawn to exclude the layer you have specified.



This diagram shows the effect of the **Erase Layer** command, assuming you already had two layers displayed on screen, and that layer 2 contained the rectangle.

Parameters: Layer (integer 1 - 128).

Default Value: None.

Errors: 1) If you don't specify a valid layer number (i.e. 1 - 128), the system will ignore what you have entered.

Status Layer

The **Status Layer** command is used to determine what layer you are currently drawing on, and which layers are currently being displayed, or "echoed" on the screen. This command is useful when working with layers as described above.

Operation: Highlight the **Status Layer** command in the **Screen** menu, and release the mouse button. You will then be prompted "Drawing Layer: x. Press RETURN.", where x represents the layer you are currently drawing on; note x, then press Return. You will then be prompted "Echoed Layer(s): x y z. Press RETURN.", where x, y, and z represent the layer(s) that are currently displayed. You may have to press Return several times to list all the echoed layers if there are a lot of layers currently displayed.

Parameters: None.

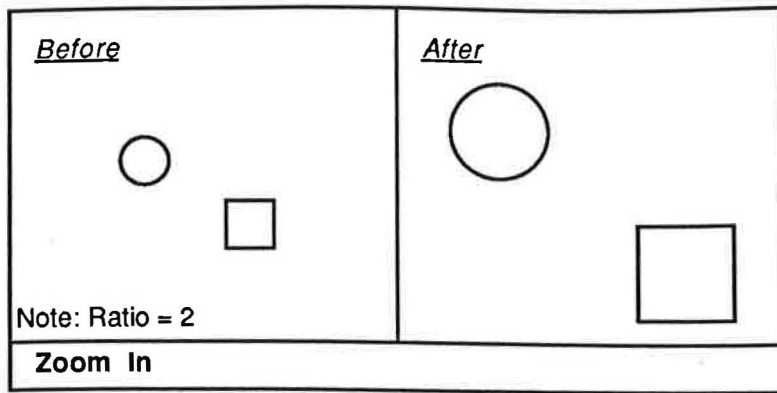
Default Value: None.

Errors: None.

Zoom In

The **Zoom In** command is used to enlarge the current display. This command is useful when you want to do detailed work on a small section of the drawing. Please note that the time it takes to redraw the screen when zooming may be lengthy, especially when you are enlarging the drawing a significant number of times.

Operation: Highlight the **Zoom In** command in the **Screen** menu, and release the mouse button. You will then be prompted "Ratio?"; type in the number of times you want to enlarge the drawing, and press Return (ex. if you want to make the drawing three times as big, type in a 3). Please note that if you enter a ratio that has a value less than 1, the drawing will actually be reduced. If you press Return without entering a ratio, a value of 2 will be used. The screen will now be redrawn, enlarged accordingly.



Parameters: Ratio (real > 0 and < 1001).

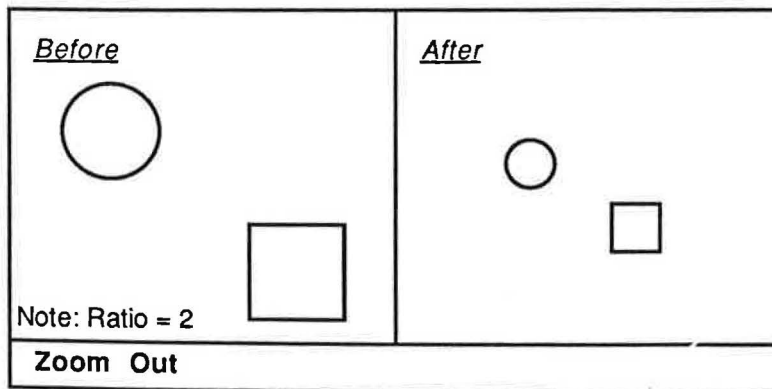
Default Value: Ratio = 2.

Errors: 1) If a negative number is entered for the ratio, the absolute value of that number will be used in its place.
 2) When zooming with a ratio greater than 1000, the resulting display may be unpredictable.

Zoom Out

The **Zoom Out** command is used to reduce the current display. This command is useful when you want to do work on a large section of the drawing. Please note that the time it takes to redraw the screen when zooming may be lengthy, especially when you are reducing the drawing a significant number of times.

Operation: Highlight the **Zoom Out** command in the **Screen** menu, and release the mouse button. You will then be prompted "Ratio?"; type in the number of times you want to reduce the drawing, and press Return (ex. if you want to make the drawing three times as small, type in a 3). Please note that if you enter a ratio that has a value less than 1, the drawing will actually be enlarged. If you press Return without entering a ratio, a value of 2 will be used. The screen will now be redrawn, reduced accordingly.



Parameters: Ratio (real > 0 and < 1001).

Default Value: Ratio = 2.

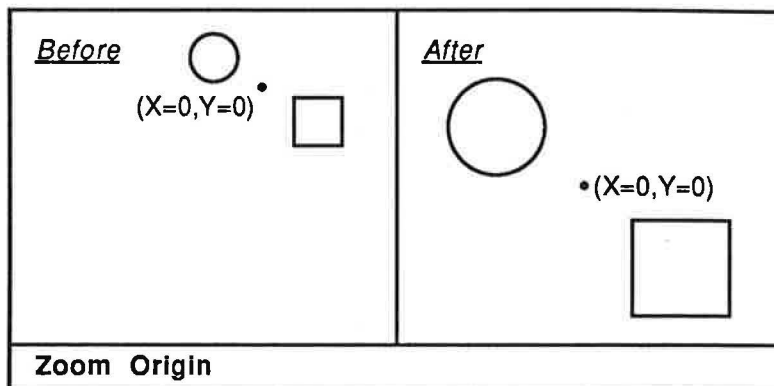
Errors: 1) If a negative number is entered for the ratio, the absolute value of that number will be used in its place.
 2) When zooming with a ratio greater than 1000, the resulting display may be unpredictable.

3) If you are using a grid that will be too dense to be drawn after zooming, an error message will be issued.

Zoom Origin

The **Zoom Origin** command is used to return the display to its original scaling, and place the origin of the grid system in the center of the screen (i.e. $x = 0, y = 0$). This command is useful when, after having adjusted the display using the zoom or pan commands, you want to restore the display to its original state (i.e. startup state). Please note that the time it takes to redraw the screen when zooming may be lengthy, especially when you are enlarging or reducing the drawing a significant number of times.

Operation: Highlight the **Zoom Origin** command in the **Screen** menu, and release the mouse button. The screen will now be redrawn at the original scale, with the origin of the grid system placed at the center of the screen.



This diagram shows the effect of the **Zoom Origin** command, assuming the origin had been shifted off center, and that the scaling of the drawing had been decreased before the command was issued.

Parameters: None.

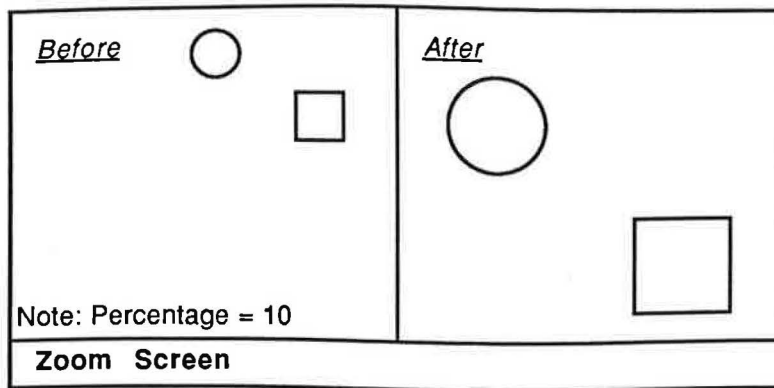
Default Value: None.

Errors: 1) If you are using a grid that will be too dense to be drawn after zooming, an error message will be issued.

Zoom Screen

The **Zoom Screen** command is used to adjust the display in such a manner that your entire drawing appears, centered on the screen. This command is useful when you want to "frame" your drawing before you print or plot. Please note that this command will only take into account the layers currently displayed on screen when calculated the frame. Also, please note that the time it takes to redraw the screen when zooming may be lengthy, especially when you are enlarging or reducing the drawing a significant number of times.

Operation: Highlight the **Zoom Screen** command in the **Screen** menu, and release the mouse button. You will then be prompted "Percentage?"; type in a value that represents the percentage of empty screen that is to surround your drawing (think of it as the size of a "frame" that is being placed around your drawing). Please note that you will typically want to use a value of 5 or 10 percent for most drawings. If you press Return without entering a value for the percentage, a value of 0 will be used. The screen will now be redrawn to display your entire drawing, with a blank border around it per the percentage specified.



Parameters: Percentage (real 0 - 1000).

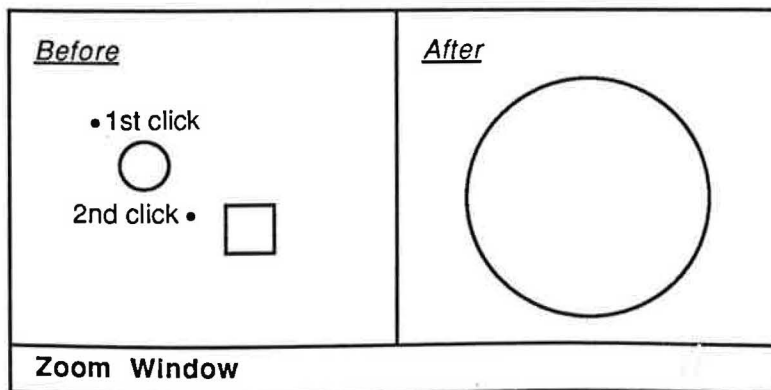
Default Value: Percentage = 0.

- Errors:
- 1) If a negative number is entered for the ratio, the absolute value of that number will be used in its place.
 - 2) When zooming with a percentage greater than 1000, the resulting display may be unpredictable.
 - 3) Please note that arcs are treated as circles in determining if they are in the display; if you have an arc with a very large radius, you may notice that the display is shifted.

Zoom Window

The **Zoom Window** command is used to zoom in on a specific portion of your drawing. This command is useful when you know exactly which part of your drawing you want to enlarge, and you want to do it quickly without having to **Zoom In** and/or **Pan** several times. Please note that the time it takes to redraw the screen when zooming may be lengthy, especially when you are enlarging the drawing a significant number of times.

Operation: Highlight the **Zoom Window** command in the **Screen** menu, and release the mouse button. Now, click twice in such a manner that the two coordinates you have specified will define a rectangle, or "window", around the area you wish to enlarge. The screen will now be redrawn, enlarged accordingly.



Parameters: None.

Default Value: None.

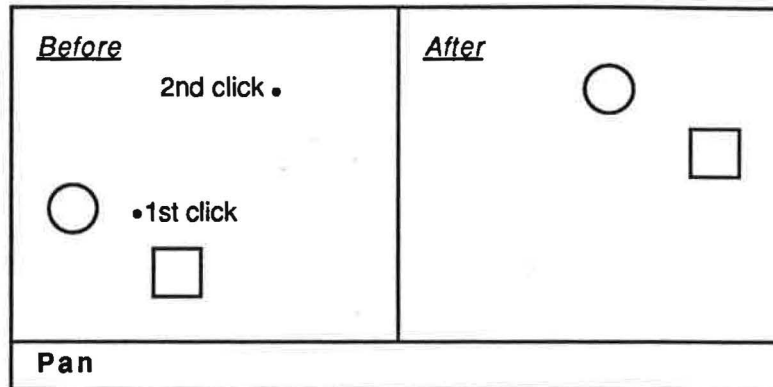
Errors: 1) If the two clicks you use to specify the window lie on the same coordinate, the system will exit the **Zoom Window** command.

2) When zooming in on an excessively small area, the resulting display may be unpredictable.

Pan

The **Pan** command is used to shift your drawing to the left, right, top, or bottom. This command is useful when you need more room to draw with, or wish to see a portion of your drawing that isn't currently displayed. Please note that the time it takes to redraw the screen when panning may be lengthy.

Operation: Highlight the **Pan** command in the **Screen** menu, and release the mouse button. Next, click once where you would like the pan to start, and once where you would like the pan to end (think of it as placing your finger on the screen and sliding the drawing in the desired direction). The screen will now be redrawn, shifted accordingly.



Parameters: None.

Default Value: None.

Errors: None.

Redraw

The **Redraw** command is used to redraw the screen display. This command is useful when you wish to remove the temporary screen garbage that may accumulate in the process of drawing (ex. the dots left on screen by the **Trace** command or the window left by the **Move Copy Window** command). Please note that the time it takes to redraw the screen when redrawing may be lengthy, especially when your drawing is excessively large.

Operation: Highlight the **Redraw** command in the **Screen** menu, and release the mouse button. The screen will now be redrawn.

Parameters: None.

Default Value: None.

Errors: None.

Chapter 4

ENTITY MENU

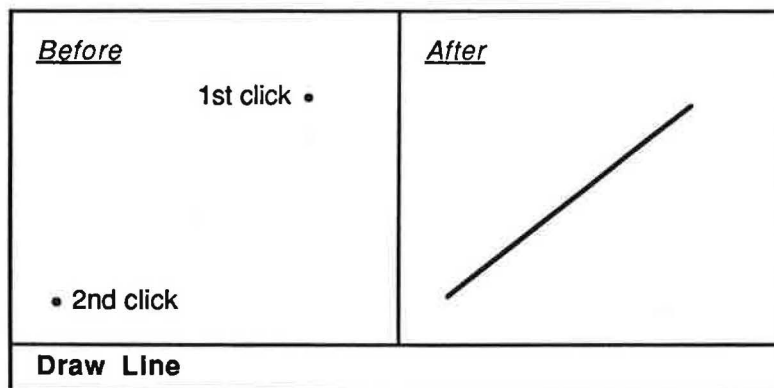
The **Entity** menu contains any commands that pertain to the creation of the basic entities of a drawing such as lines, circles, arcs, and points (entity is a general term for an individual line, circle, arc, point, etc.). Also included in this menu are the commands necessary to erase such entities. Several of the commands discussed in this chapter may be further enhanced by using modifiers and masks as explained in the **<-Modify Menu** and **Mask Menu** chapters. Please note that once you have initiated one of the **Entity** commands, you will remain in that command until another command is selected. Also, please note that it is worthwhile to review the **Draw Tutorial** appendix to take full advantage of these commands.

After you have completed this chapter, you will be able to use the **Draw Line**, **Erase Line**, **Draw Rectangle**, **Draw Circle**, **Erase Circle**, **Draw Arc**, **Erase Arc**, **Draw Point**, **Erase Point**, **Erase**, **Erase Window**, and **Erase All** commands.

Draw Line

The **Draw Line** command is used to draw a straight line between two coordinates. Please note that it is worthwhile to review the following chapter **<-Modify Menu** to take full advantage of this command.

Operation: Highlight the **Draw Line** command in the **Entity** menu, and release the mouse button. Next, click once where you would like the line to begin, and once where you would like it to end. The line will now be drawn between the two coordinates specified.



Parameters: None.

Default Value: None.

Errors: 1) If the two clicks you used to specify the line lie on the same coordinate, the system will not draw the line.

Erase Line

The **Erase Line** command is used to permanently erase a line from your drawing.

Operation: Highlight the **Erase Line** command in the **Entity** menu, and release the mouse button. Click on the line you wish to erase, and it will be permanently removed from your drawing.

Parameters: None.

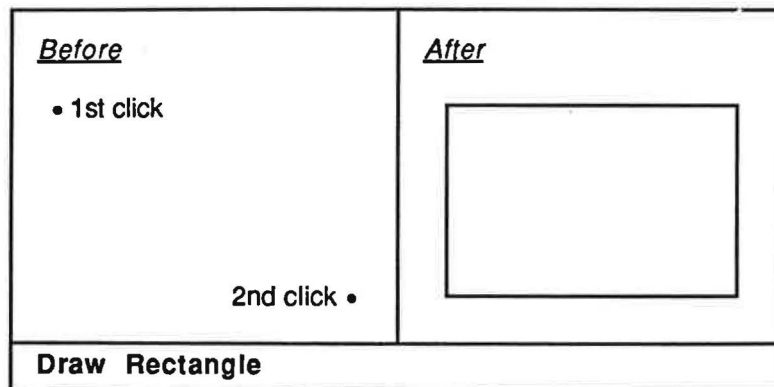
Default Value: None.

Errors: None.

Draw Rectangle

The **Draw Rectangle** command is used to draw rectangles of any shape or size. Please note that in order to erase a rectangle, you must use either the **Erase Line**, **Erase**, or **Erase Window** commands.

Operation: Highlight the **Draw Rectangle** command in the **Entity** menu, and release the mouse button. Next, click twice in such a manner that the coordinates you have specified will define the rectangle you desire. The rectangle will now be drawn accordingly.



Parameters: None.

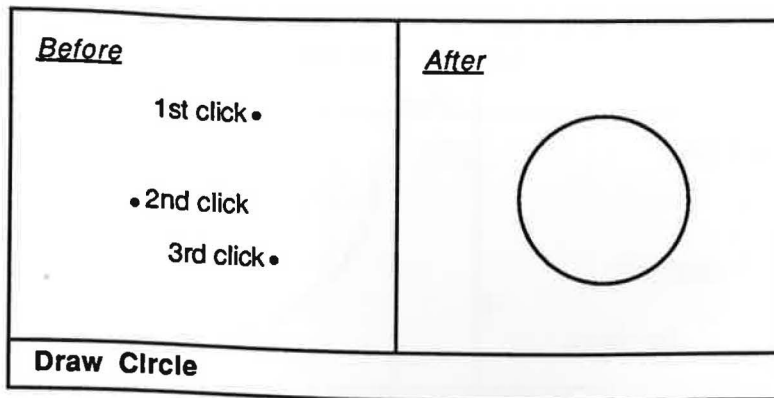
Default Value: None.

Errors: 1) If the two clicks you used to specify the rectangle lie on the same coordinate, or in a straight line, the system will not draw the rectangle.

Draw Circle

The **Draw Circle** command is used to draw circles. Please note that it is worthwhile to review the following chapter **<-Modify Menu** to take full advantage of this command.

Operation: Highlight the **Draw Circle** command in the **Entity** menu, and release the mouse button. Next, click three times in such a manner as to define the circumference of the circle. The circle will now be drawn, passing through the three coordinates you have specified.



Parameters: None.

Default Value: None.

Errors: 1) If the three clicks you used to specify the circle lie on the same coordinate, or in a straight line, the system will not draw the circle.

Erase Circle

The **Erase Circle** command is used to permanently erase a circle from your drawing.

Operation: Highlight the **Erase Circle** command in the **Entity** menu, and release the mouse button. Click on the circle you wish to erase, and it will be permanently removed from your drawing.

Parameters: None.

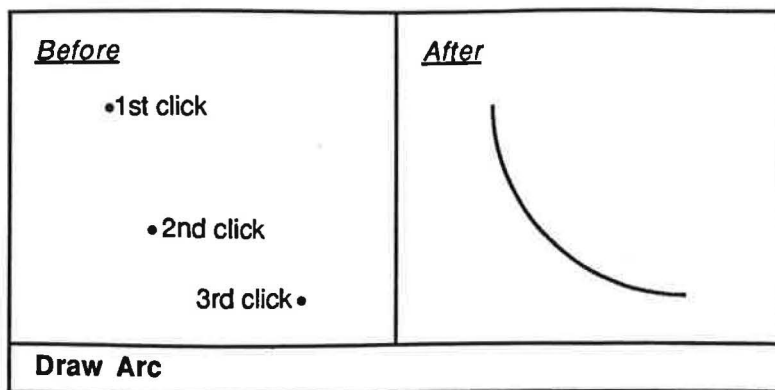
Default Value: None.

Errors: None.

Draw Arc

The **Draw Arc** command is used to draw arcs. Please note that arcs are drawn in a counterclockwise manner, and that you should define your coordinates accordingly. Also, please note that it is worthwhile to review the following chapter **<-Modify Menu** to take full advantage of this command.

Operation: Highlight the **Draw Arc** command in the **Entity** menu, and release the mouse button. Next, click three times in such a manner as to define the circumference of the arc. Remember that arcs are drawn counterclockwise, so you will typically want your first click to represent the starting angle of the arc, and the third click the ending angle of the arc. The arc will now be drawn, counterclockwise, passing through the three coordinates you have specified.



Parameters: None.

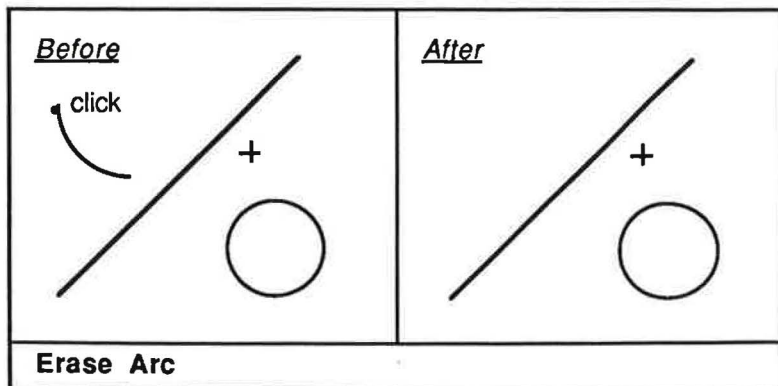
Default Value: None.

Errors: 1) If the three clicks you used to specify the arc lie on the same coordinate, or in a straight line, the system will not draw the arc.

Erase Arc

The **Erase Arc** command is used to permanently erase an arc from your drawing. Please note that if you are having difficulty erasing an arc, it may be useful to try clicking on either end of the arc.

Operation: Highlight the **Erase Arc** command in the **Entity** menu, and release the mouse button. Click on the arc you wish to erase, and it will be permanently removed from your drawing.



Parameters: None.

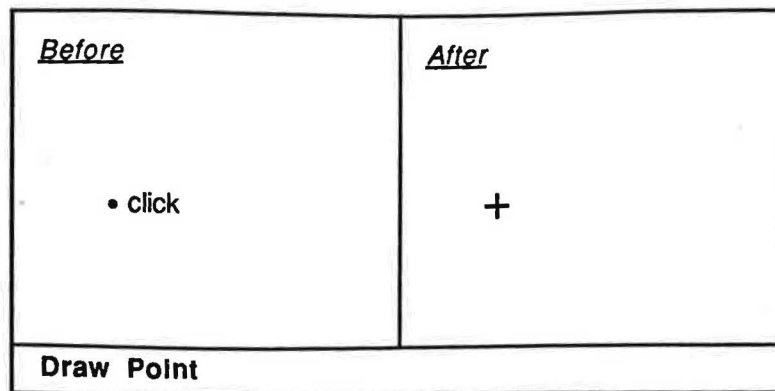
Default Value: None.

Errors: None.

Draw Point

The **Draw Point** command is used to draw points (a point appears as a small cross, or addition sign "+"). This command is particularly useful when you are constructing center lines. Please note that it is worthwhile to review the following chapter **←-Modify Menu** to take full advantage of this command.

Operation: Highlight the **Draw Point** command in the **Entity** menu, and release the mouse button. Click once where you would like the point to appear, and it will be drawn.



Parameters: None.

Default Value: None.

Errors: None.

Erase Point

The **Erase Point** command is used to permanently erase a point from your drawing.

Operation: Highlight the **Erase Point** command in the **Entity** menu, and release the mouse button. Click on the point you wish to erase, and it will be permanently removed from your drawing.

Parameters: None.

Default Value: None.

Errors: None.

Erase

The **Erase** command is used to permanently erase any of the above entities. Please note that if your drawing is extremely complicated, you may wish to use one of the more specific erase commands as described above, as this command may erase the wrong entity by mistake (ex. if you wish to erase a point that is in the midst of several other entities, it may be wise to use the **Erase Point** command instead of the **Erase** command).

Operation: Highlight the **Erase** command in the **Entity** menu, and release the mouse button. Click on the line, circle, arc, or point you wish to erase, and it will be permanently removed from your drawing.

Parameters: None.

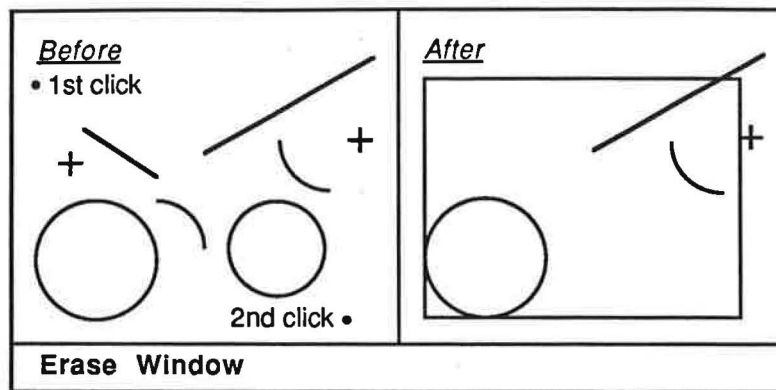
Default Value: None.

Errors: None.

Erase Window

The **Erase Window** command is used to permanently erase several entities at a time. This command is useful when you wish to erase an entire area of your drawing, or a symbol you no longer need. After you have specified the erase window, any entity contained within the window, and not touching the edge of the window, will be erased. Please note that a temporary window will be left on the screen after you have used this command; simply execute the **Redraw** command to redraw the screen if so desired (see the **Screen Menu** chapter). Also, please note that arcs are treated as circles in determining if they are in the window; if you have an arc with a very large radius, you will have to define your window so that it encompasses the arc's entire radius in all directions (i.e. pretend the arc is a circle). Finally, please note that this command will not erase text or dimensioning.

Operation: Highlight the **Erase Window** command in the **Entity** menu, and release the mouse button. Next, click twice in such a manner that the coordinates you have specified will define a rectangle, or "window", around the area you wish to erase. Any entities contained within the window you have specified will now be permanently removed from your drawing.



Parameters: None.

Default Value: None.

Errors: None.

Erase All

The **Erase All** command is used to erase your entire drawing from the display. Please note that if you wish to later retrieve the drawing from disk, you must **Save** it (see the **File Menu** chapter) before you **Erase All**.

Operation: Highlight the **Erase All** command in the **Entity** menu, and release the mouse button. You will then be prompted "WARNING: Wish to erase this drawing? (Y/N)"; type in Y, and the entire drawing will be erased from the display. If you type in N, the system will exit the **Erase All** command.

Parameters: None.

Default Value: None.

Errors: 1) The system will not accept your response unless you have the Caps Lock key depressed.

←-MODIFY MENU

The ←-Modify menu contains any modifiers that pertain to the **Draw Line**, **Draw Rectangle**, **Draw Circle**, **Draw Arc**, and **Draw Point** commands as described in the **Entity Menu** chapter. Modifiers are different from commands in that it is necessary to activate a command before you can use a modifier (think of a modifier as an adjective that enhances the command it is used with). For example, if you desired to draw lines that were always vertical, you would first select the **Draw Line** command from the **Entity** menu, then select the **Vertical** modifier from the first ←-Modify menu, and proceed with the command as usual (please note that there are two ←-Modify menus, one for the **Entity** menu and one for the **Text & Dimension** menu). Please note that it is important to remember that modifiers are deactivated once you exit the command they are modifying (except for the **Hidden** and **Length** modifiers).

After you have completed this chapter, you will be able to use the **None**, **Hidden**, **Length**, **Vertical**, **Horizontal**, **Parallel**, **Perpendicular**, **Angle**, **Radius**, **Diameter**, and **Intersect** modifiers.

None

The **None** modifier is used to deactivate any modifier that may be currently in effect (ex. you had been using **Draw Line** with the **Vertical** modifier, but now desire to use **Draw Line** without any modifiers). Please note that the **None** modifier will not affect the **Hidden** or **Length** modifiers.

Operation: Highlight the **None** modifier in the ←-Modify menu, and release the mouse button. Any modifier that was in effect will now be canceled.

Parameters: None.

Default Value: None.

Errors: None.

Hidden

The **Hidden** modifier is used to draw dashed, or "hidden" lines when using the **Draw Line**, **Draw Rectangle**, **Draw Circle**, and **Draw Arc** commands. Please note that this command may be used in conjunction with any of the other modifiers listed in this chapter.

Operation: Highlight the **Hidden** modifier in the ←-Modify menu, and release the mouse button. From now on, whenever you draw any lines, rectangles, circles, or arcs, they will be dashed (when hidden is on, the modifier will have a check mark next to it in the ←-Modify menu). To turn hidden off, simply reselect the **Hidden** modifier.

Parameters: On/Off.

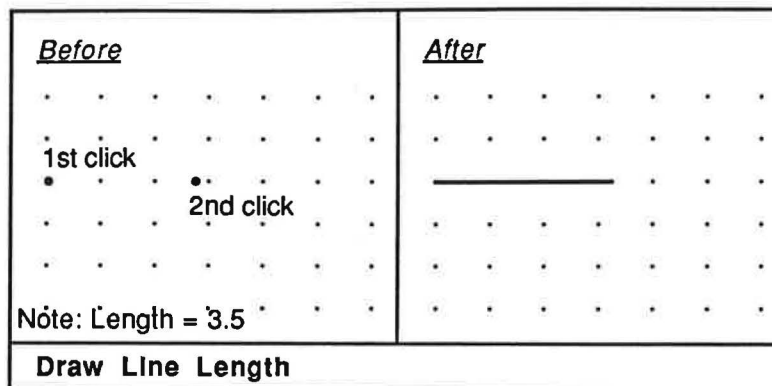
Default Value: Hidden = Off.

Errors: None.

Length

The **Length** modifier is used to modify the **Draw Line** command, and will allow you to specify the exact length of a line. Please note that this command may be used in conjunction with any of the other line modifiers (i.e. **Vertical**, **Horizontal**, **Parallel**, **Perpendicular**, **Angle**) listed in this chapter.

Operation: After you have selected the **Draw Line** command from the **Entity** menu, highlight the **Length** modifier in the **<-Modify** menu, and release the mouse button. Next, click once where you would like the line to start. You will then be prompted "Length:"; type in the desired length of the line, and press Return (if you press Return without entering a value for the length, the system will not draw the line). Remember that discoverCAD uses a generic unit system for scaling, where 1 unit can represent any distance. Finally, click in the direction that you would like the line to be drawn (depending on the length you have specified for the length, the line may or may not pass through the coordinate used to define the direction). When length is on, the modifier will have a check mark next to it in the **<-Modify** menu. To turn length off, simply reselect the **Length** modifier.



Parameters: Length (real > 0 and < 1001).

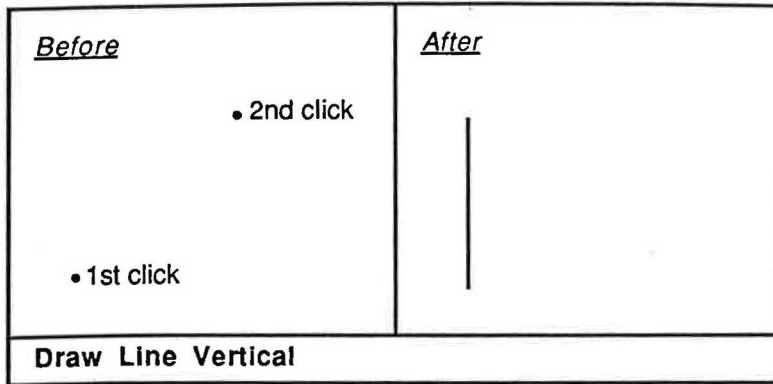
Default Value: None.

- Errors:** 1) If a negative number is entered for the length, the absolute value of that number will be used in its place.
2) When drawing with a length greater than 1001, the resulting line may be unreliable.

Vertical

The **Vertical** modifier is used to modify the **Draw Line** command, and will allow you to draw a line that is perfectly vertical. A vertical line is defined as a line that starts at point A, and extends to point B, where B is straight up or straight down from point A. Please note that this modifier may be used in conjunction with the **Hidden** and **Length** modifiers, but will cancel any other modifiers currently in effect.

Operation: After you have selected the **Draw Line** command from the **Entity** menu, highlight the **Vertical** modifier in the **<-Modify** menu, and release the mouse button. Next, click once where you would like the vertical line to start, and once where you would like it to end (the second coordinate is defining the length of the line, since it will be drawn vertical no matter what). The vertical line will now be drawn.



Parameters: None.

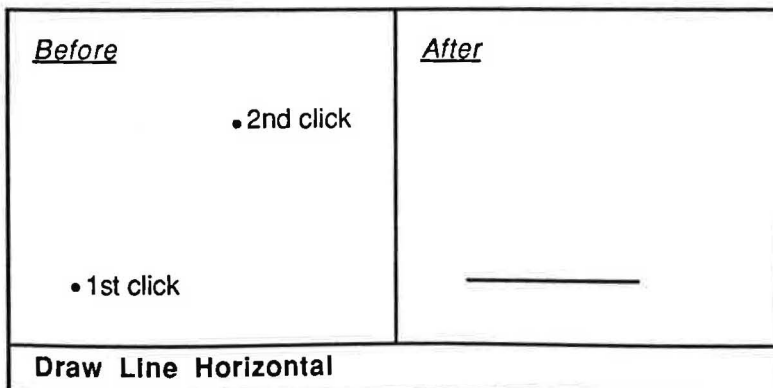
Default Value: None.

Errors: 1) If the second coordinate you click lies on the same horizontal plane as the first coordinate you click, the system will not draw the line.

Horizontal

The **Horizontal** modifier is used to modify the **Draw Line** command, and will allow you to draw a line that is perfectly horizontal. A horizontal line is defined as a line that starts at point A, and extends to point B, where B is straight right or straight left from point A. Please note that this modifier may be used in conjunction with the **Hidden** and **Length** modifiers, but will cancel any other modifiers currently in effect.

Operation: After you have selected the **Draw Line** command from the **Entity** menu, highlight the **Horizontal** modifier in the **<-Modify** menu, and release the mouse button. Next, click once where you would like the horizontal line to start, and once where you would like it to end (the second coordinate is defining the length of the line, since it will be drawn horizontal no matter what). The horizontal line will now be drawn.



Parameters: None.

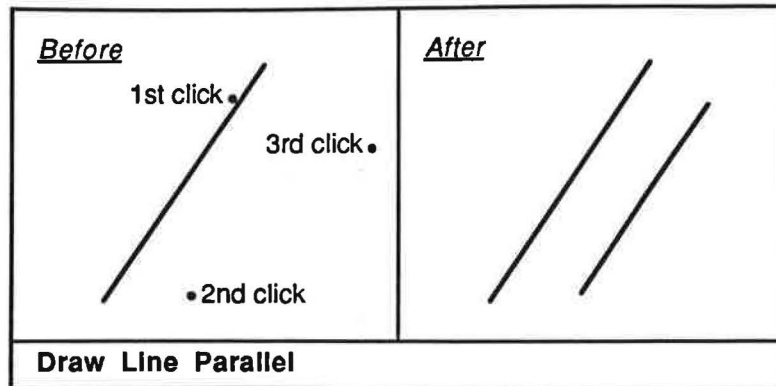
Default Value: None.

Errors: 1) If the second coordinate you click lies on the same vertical plane as the first coordinate you click, the system will not draw the line.

Parallel

The **Parallel** modifier is used to modify the **Draw Line** command, and will allow you to draw a line that is perfectly parallel to an existing line. A parallel line is defined as a line whose distance to an existing line remains constant at every point. This modifier is useful when constructing isometric drawings. Please note that this modifier may be used in conjunction with the **Hidden** and **Length** modifiers, but will cancel any other modifiers currently in effect.

Operation: After you have selected the **Draw Line** command from the **Entity** menu, highlight the **Parallel** modifier in the **<-Modify** menu, and release the mouse button. First, click on the existing line that you wish to use as a reference for the new parallel line. Next, click once where you would like the parallel line to start, and once where you would like it to end. The new line will be drawn, perfectly parallel to the line you specified with the first click.



Parameters: None.

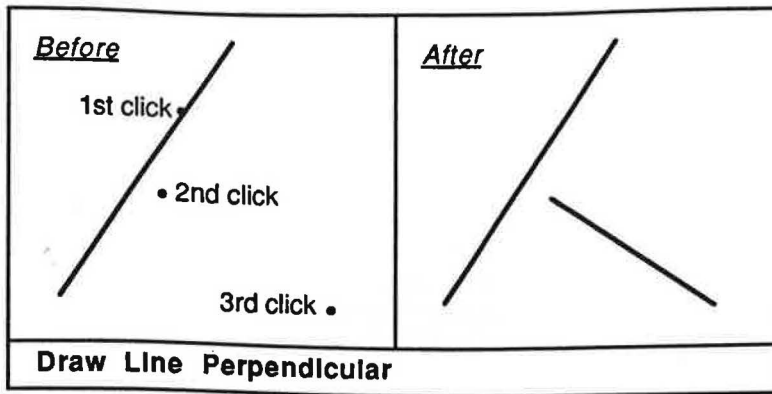
Default Value: None.

Errors: None.

Perpendicular

The **Perpendicular** modifier is used to modify the **Draw Line** command, and will allow you to draw a line that is perfectly perpendicular to an existing line. A perpendicular line is defined as a line whose angle in relationship to an existing line is 90 degrees (i.e. right angle). This modifier is useful when constructing isometric drawings. Please note that this modifier may be used in conjunction with the **Hidden** and **Length** modifiers, but will cancel any other modifiers currently in effect.

Operation: After you have selected the **Draw Line** command from the **Entity** menu, highlight the **Perpendicular** modifier in the **<-Modify** menu, and release the mouse button. First, click on the existing line that you wish to use as a reference for the new perpendicular line. Next, click once where you would like the perpendicular line to start, and once where you would like it to end. The new line will be drawn, perfectly perpendicular to the line you specified with the first click.



Parameters: None.

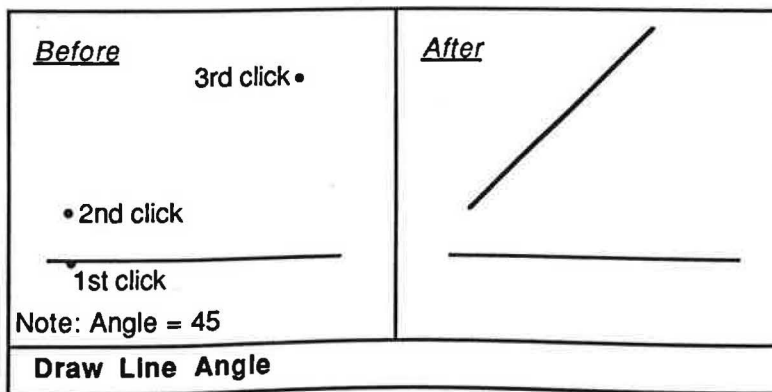
Default Value: None.

Errors: None.

Angle

The **Angle** modifier is used to modify the **Draw Line** command, and will allow you to draw a line of a specified angle in relationship to an existing line. This modifier is useful when constructing isometric drawings. Please note that this modifier may be used in conjunction with the **Hidden** and **Length** modifiers, but will cancel any other modifiers currently in effect.

Operation: After you have selected the **Draw Line** command from the **Entity** menu, highlight the **Angle** modifier in the **<-Modify** menu, and release the mouse button. First, click on the existing line that you wish to use as a reference for the new angular line (typically you will want to click on a horizontal line to use as a reference). You will then be prompted "Angle:"; type in the desired angle of the line in relationship to the existing line, and press Return (if you press Return without entering a value for the angle, the system will not draw the line) Next, click once where you would like the angular line to start, and once where you would like it to end. The new line will be drawn with the specified angle in relationship to the line you specified with the first click.



Parameters: Angle (real 0 - 359).

Default Value: None.

Errors: 1) If a negative number is entered for the angle, the absolute value of that number will be used instead.

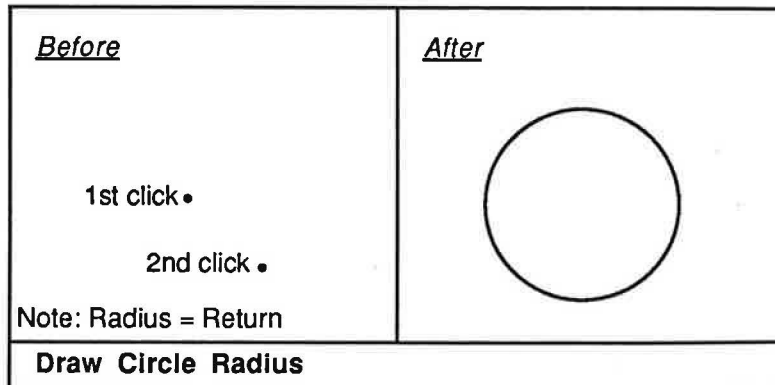
Radius

The **Radius** modifier is used to modify the **Draw Circle** and **Draw Arc** commands, and will allow you to specify the exact radius of a circle or arc. The radius of a circle or arc is defined as the distance between the center, or "origin" of the circle/arc to any point on the circumference of the circle/arc. Please note that you may define the radius by typing in a value or by using the mouse. Please note that this modifier may be used in conjunction with the **Hidden** modifier, but will cancel any other modifiers currently in effect.

Operation: After you have selected the **Draw Circle** or **Draw Arc** command from the **Entity** menu, highlight the **Radius** modifier in the **<-Modify** menu, and release the mouse button. Next, click where you would like the center, or "origin", of the circle or arc to be. You will be prompted "Radius?".

If you want to use a numerical value to define the radius, follow this set of instructions: Type in the desired radius of the circle or arc, and press Return. If you are using the **Radius** modifier with the **Draw Circle** command, the circle will now be drawn according to the specified radius. If you are using the **Radius** modifier with the **Draw Arc** command, click once to define the starting angle of the arc, and once to define the ending angle of the arc. The arc will now be drawn according to the specified radius, starting angle, and ending angle, in a counterclockwise direction.

If you want to use the mouse to define the radius, follow this set of instructions: Press Return without entering a value for the radius. If you are using the **Radius** modifier with the **Draw Circle** command, click once to define the radius of the circle (i.e. the distance between your first click for the origin and the second click will be the radius), and the circle will now be drawn according to the specified radius. If you are using the **Radius** modifier with the **Draw Arc** command, click once to define the radius and starting angle of the arc, and once to define the ending angle of the arc. The arc will now be drawn according to the specified radius, starting angle, and ending angle, in a counterclockwise direction.



Parameters: Radius (real > 0 and < 1001).

Default Value: None.

Errors: 1) If a negative number is entered for the radius, the absolute value of that number will be used in its place.

2) When drawing with a radius greater than 1001, the resulting circle or arc may be unreliable.

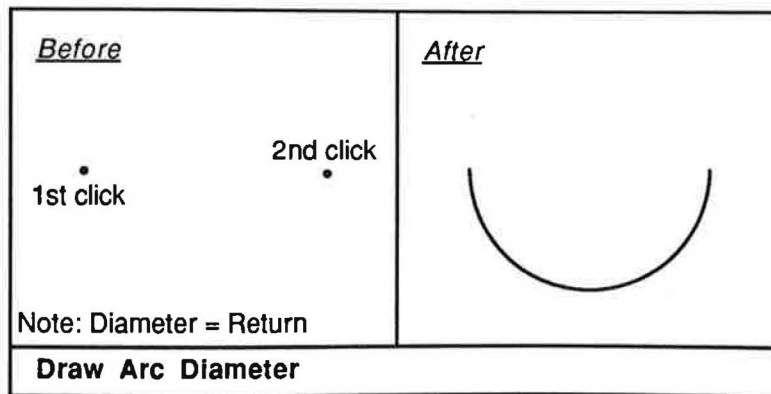
Diameter

The **Diameter** modifier is used to modify the **Draw Circle** and **Draw Arc** commands, and will allow you to specify the exact diameter of a circle or arc. The diameter of a circle or arc is defined as the distance of a straight line passing through the center of the circle/arc, ending at the outermost points of the circle/arc. Please note that you may define the diameter by typing in a value or by using the mouse. Also, please note that this modifier may be used in conjunction with the **Hidden** modifier, but will cancel any other modifiers currently in effect.

Operation: After you have selected the **Draw Circle** or **Draw Arc** command from the **Entity** menu, highlight the **Diameter** modifier in the **<-Modify** menu, and release the mouse button. Next, click where you would like the center, or "origin", of the circle or arc to be. You will then be prompted "Diameter?".

If you want to use a numerical value to define the diameter, follow this set of instructions: Type in the desired diameter of the circle or arc, and press Return. If you are using the **Diameter** modifier with the **Draw Circle** command, the circle will now be drawn according to the specified diameter. If you are using the **Diameter** modifier with the **Draw Arc** command, click once to define the starting angle of the arc, and once to define the ending angle of the arc. The arc will now be drawn according to the specified diameter, starting angle, and ending angle.

If you want to use the mouse to define the diameter, follow this set of instructions: Press Return without entering a value for the diameter. Next, click once to define the diameter of the circle or arc (i.e. the distance between your first click for the origin and the second click will be the diameter. The point originally specified as the origin will now be considered a point on the circumference of the circle or arc). If you are using the **Diameter** modifier with the **Draw Circle** command, the circle will now be drawn according to the specified diameter. If you are using the **Diameter** modifier with the **Draw Arc** command, the arc will now be drawn counterclockwise according to the specified diameter.



Parameters: Diameter (real > 0 and < 1001).

Default Value: None.

Errors: 1) If a negative number is entered for the diameter, the absolute value of that number will be used in its place.

2) When drawing with a diameter greater than 1001, the resulting circle or arc may be unreliable.

Intersect

The **Intersect** modifier is used to modify the **Draw Point** command, and will allow you to draw a point at the intersection of two existing lines.

Operation: After you have selected the **Draw Point** command from the **Entity** menu, highlight the **Intersect** modifier in the **<-Modify** menu, and release the mouse button. Next, click once on the first line, and once on the second line. The point will now be drawn at the intersection of the two lines.

Parameters: None.

Default Value: None.

Errors: 1) If the two lines specified are parallel, the system will not draw the point.

Chapter 6

TEXT & DIMENSION MENU

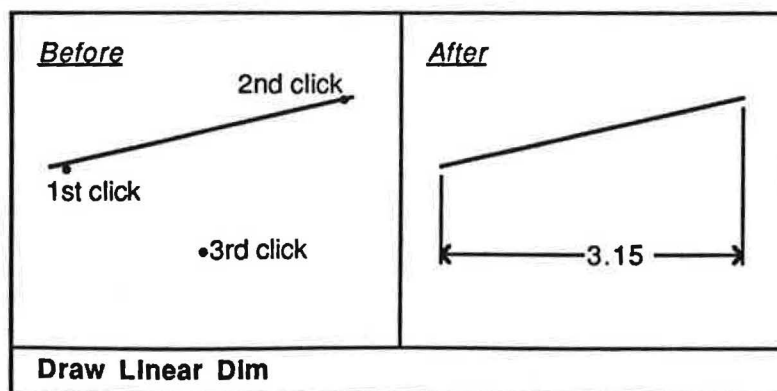
The **Text & Dimension** menu contains any commands that pertain to the creation of text and dimensioning. Text may be any notes or messages you might add to your drawing such as a name, date, description, etc. Dimensioning is a process that calculates the length of a line, the radius of a circle or arc, or the diameter of a circle or arc, and automatically draws the correct dimension lines, extension lines, arrowheads, and dimension text. Also included in this menu are the commands necessary to erase such entities. Several of the commands discussed in this chapter may be further enhanced by using modifiers and masks as explained in the **<-Modify Menu** and **Mask Menu** chapters.

After you have completed this chapter, you will be able to use the **Draw Linear Dim**, **Erase Linear Dim**, **Draw Radial Dim**, **Erase Radial Dim**, **Draw Diameter Dim**, **Erase Diameter Dim**, **Draw Text**, **Erase Text**, and **Erase All** commands.

Draw Linear Dim

The **Draw Linear Dim** command is used to indicate the distance between two locations. These locations can be the ends of lines, circles, arcs, or points. Please note that if you are using the **Draw Linear Dim** command without the **Vertical** modifier, you will only be able to dimension lines that have an angle less than 90 degrees (please note that it is worthwhile to review the following chapter **<-Modify Menu** to take full advantage of this command).

Operation: Highlight the **Draw Linear Dim** command in the **Text & Dimension** menu, and release the mouse button. Next, click once near the end of the first entity, and once near the end of the second entity (you may click near the other end of the first entity if you wish to dimension just that one entity). Finally, click where you would like the dimension text to appear. The dimension lines, extension lines, arrowheads, and dimension text will now be drawn.



Parameters: None.

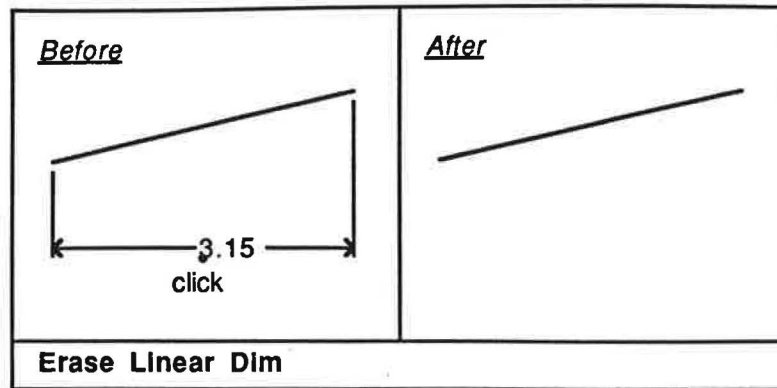
Default Value: Horizontal.

Errors: None.

Erase Linear Dim

The **Erase Linear Dim** command is used to permanently erase a linear dimension from your drawing.

Operation: Highlight the **Erase Linear Dim** command in the **Text & Dimension** menu, and release the mouse button. Click near the lower left corner of the dimension text of the linear dimension you wish to erase, and the entire linear dimension will be permanently removed from your drawing.



Parameters: None.

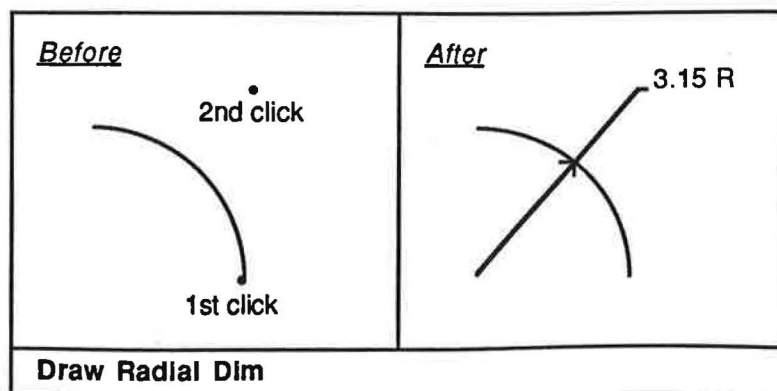
Default Value: None.

Errors: None.

Draw Radial Dim

The **Draw Radial Dim** command is used to dimension the radius of circles and arcs. Please note that the dimension text will be followed by a R to indicate radius. Also, please note that if you are having difficulty dimensioning an arc, it may be useful to try clicking on either end of the arc. Finally, please note that it is worthwhile to review the following chapter **<-Modify Menu** to take full advantage of this command.

Operation: Highlight the **Draw Radial Dim** command in the **Text & Dimension** menu, and release the mouse button. Next, click on the circle or arc you want to dimension. Finally, click where you would like the dimension text to appear (if you click inside the circle or arc, the system will not draw the dimension). The dimension line, leader line, arrowhead, and dimension text will now be drawn.



Parameters: None.

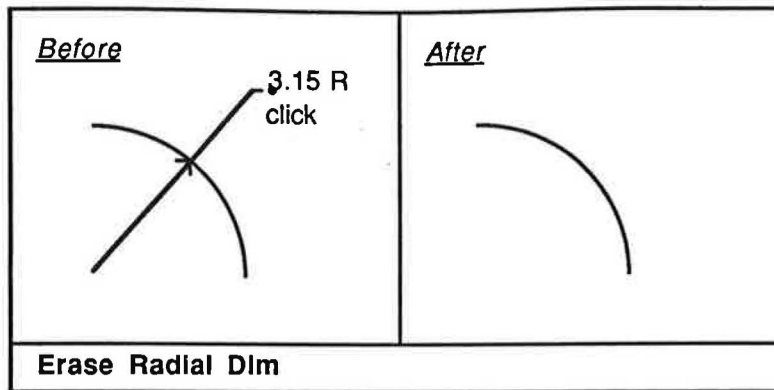
Default Value: None.

Errors: 1) If you click inside the circle or arc, the system will not draw the dimension.

Erase Radial Dim

The **Erase Radial Dim** command is used to permanently erase a radial dimension from your drawing.

Operation: Highlight the **Erase Radial Dim** command in the **Text & Dimension** menu, and release the mouse button. Click near the lower left corner of the dimension text of the radial dimension you wish to erase, and the entire radial dimension will be permanently removed from your drawing.



Parameters: None.

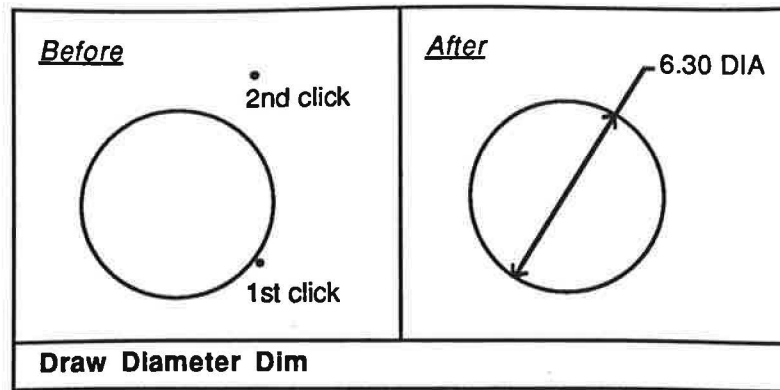
Default Value: None.

Errors: None.

Draw Diameter Dim

The **Draw Diameter Dim** command is used to dimension the diameter of circles and arcs. Please note that the dimension text will be followed by a DIA to indicate diameter. Also, please note that if you are having difficulty dimensioning an arc, it may be useful to try clicking on either end of the arc. Finally, please note that it is worthwhile to review the following chapter **<-Modify Menu** to take full advantage of this command.

Operation: Highlight the **Draw Diameter Dim** command in the **Text & Dimension** menu, and release the mouse button. Next, click on the circle or arc you want to dimension. Finally, click where you would like the dimension text to appear (if you click inside the circle or arc, the system will not draw the dimension). The dimension line, leader line, arrowheads, and dimension text will now be drawn.



Parameters: None.

Default Value: None.

Errors: 1) If you click inside the circle or arc, the system will not draw the dimension.

Erase Diameter Dim

The **Erase Diameter Dim** command is used to permanently erase a diameter dimension from your drawing.

Operation: Highlight the **Erase Diameter Dim** command in the **Text & Dimension** menu, and release the mouse button. Click near the lower left corner of the dimension text of the diameter dimension you wish to erase, and the entire diameter dimension will be permanently removed from your drawing.

Parameters: None.

Default Value: None.

Errors: None.

Draw Text

The **Draw Text** command is used to draw text. Please note that it is worthwhile to review the following chapter **←Modify Menu** to take full advantage of this command.

Operation: Highlight the **Draw Text** command in the **Text & Dimension** menu, and release the mouse button. Next, click once where you would like the text to start. You will then be prompted "Text: "; type in the desired text (if you make a mistake while typing the text, you may use the Delete or Left Arrow keys to remove the error). Now press Control Q (depress the Control and Q key at the same time). If you press Control Q without typing any text, the system will not draw the text. The text will now be drawn.

<u>Before</u>	<u>After</u>
• click Note: Text = THIS IS TEXT	THIS IS TEXT
Draw Text	

Parameters: Text (Up to 80 alphanumeric characters).

- Default Value:
- 1) Height = 0.15 units.
 - 2) Width = 0.12 units.
 - 3) Slant = 0 degrees.
 - 4) Angle = 0 degrees.
 - 5) Justification = Left.

- Errors:
- 1) If you try to type the text and nothing appears, make sure the Caps Lock key is depressed.
 - 2) If you type more than 80 characters for the text, the text will be truncated to 80 characters.

Erase Text

The **Erase Text** command is used to permanently erase text from your drawing.

Operation: Highlight the **Erase Text** command in the **Text & Dimension** menu, and release the mouse button. Click near the lower left corner of the text you wish to erase, and the entire text string will be permanently removed from your drawing. Please note that if the text you are trying to erase has been created using either the **Center Justify** or **Right Justify** modifier, you will have to adjust your click accordingly. For text that is center justified, click near the lower middle of the text. For text that is right justified, click near the lower right corner of the text.

<u>Before</u>	<u>After</u>
• THIS IS TEXT click	
Erase Text	

Parameters: None.

Default Value: None.

Errors: None.

Erase All

The **Erase All** command is used to erase your entire drawing from the display. Please note that if you wish to later retrieve the drawing from disk, you must **Save** it (see the **File Menu** chapter) before you **Erase All**.

Operation: Highlight the **Erase All** command in the **Text & Dimension** menu, and release the mouse button. You will then be prompted "WARNING: Wish to erase this drawing? (Y/N)"; type in Y, and the entire drawing will be erased from the display. If you type in N, the system will exit the **Erase All** command.

Parameters: None.

Default Value: None.

Errors: 1) The system will not accept your response unless you have the Caps Lock key depressed.

Chapter 7

←-MODIFY MENU

The ←-Modify menu contains any modifiers that pertain to the **Draw Linear Dim**, **Draw Radial Dim**, **Draw Diameter Dim**, and **Draw Text** commands as described in the **Text & Dimension Menu** chapter. Modifiers are different from commands in that it is necessary to activate a command before you can use a modifier (think of a modifier as an adjective that enhances the command it is used with). For example, if you desired to dimension a line that was vertical, you would first select the **Draw Linear Dim** command from the **Text & Dimension** menu, then select the **Vertical** modifier from the second ←-Modify menu, and proceed with the command as usual (please note that there are two ←-Modify menus, one for the **Entity** menu and one for the **Text & Dimension** menu). Please note that it is important to remember that modifiers are deactivated once you exit the command they are modifying.

After you have completed this chapter, you will be able to use the **None**, **Precision**, **Alternate Text**, **Vertical**, **Horizontal**, **Point to Point**, **Height**, **Width**, **Slant**, **Angle**, **Left Justify**, **Center Justify**, and **Right Justify** modifiers.

None

The **None** modifier is used to deactivate any modifier that may be currently in effect (ex. you had been using **Draw Linear Dim** with the **Vertical** modifier, but now desire to use **Draw Linear Dim** without any modifiers).

Operation: Highlight the **None** modifier in the ←-Modify menu, and release the mouse button. Any modifier that was in effect will now be canceled.

Parameters: None.

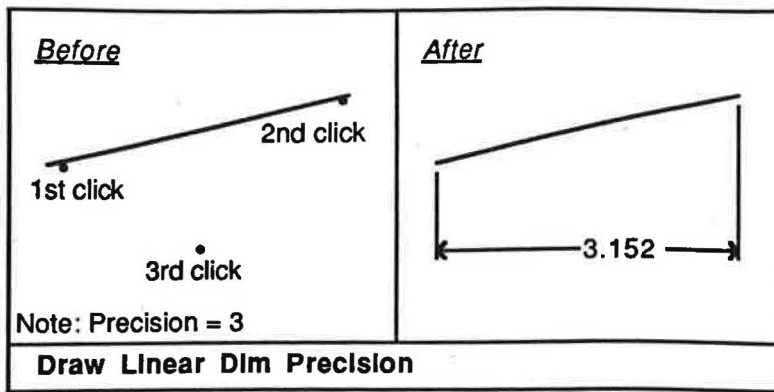
Default Value: None.

Errors: None.

Precision

The **Precision** modifier is used to modify the **Draw Linear Dim**, **Draw Radial Dim**, and **Draw Diameter Dim** commands, and will allow you to specify the number of digits following the decimal point for the dimension text. Please note that the dimension text for any of the dimensioning commands will have two digits after the decimal point if you do not use this modifier.

Operation: After you have selected the **Draw Linear Dim**, **Draw Radial Dim**, or **Draw Diameter Dim** from the **Text & Dimension** menu, highlight the **Precision** modifier in the ←-Modify menu, and release the mouse button. You will then be prompted "Precision:"; type in the desired precision of the dimensioning, and press Return (if you make a mistake while typing the precision, you may use the Delete or Left Arrow keys to remove the error). Having entered the precision, you may now proceed with the command as you normally would (each dimension drawn from now on will appear with the specified precision, until you select another command). Please note that the precision will revert to its default value once you exit the **Draw Linear Dim**, **Draw Radial Dim**, or **Draw Diameter Dim** command (i.e. the next time you **Draw Linear Dim**, **Draw Radial Dim**, or **Draw Diameter Dim** without a modifier, the precision will be 2).



Parameters: Precision (integer 0 -4).

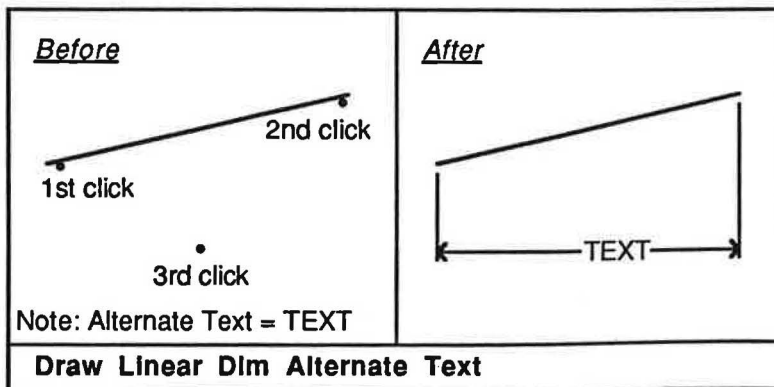
Default Value: Precision = 2.

Errors: 1) If you press Return without entering a value for the precision, or enter an invalid value, the system will use the precision last specified.

Alternate Text

The **Alternate Text** modifier is used to modify the **Draw Linear Dim**, **Draw Radial Dim**, and **Draw Diameter Dim** commands, and will allow you to substitute the dimension text with text of your own.

Operation: After you have selected the **Draw Linear Dim**, **Draw Radial Dim**, or **Draw Diameter Dim** from the **Text & Dimension** menu, highlight the **Alternate Text** modifier in the **<-Modify** menu, and release the mouse button. You will then be prompted "Text:"; type in the desired text (if you make a mistake while typing the text, you may use the Delete or Left Arrow keys to remove the error). Now press Control Q (depress the Control and Q key at the same time). Having entered the text, you may now proceed with the command as you normally would (each dimension drawn from now on will appear with the specified text, until you select another command).



Parameters: None.

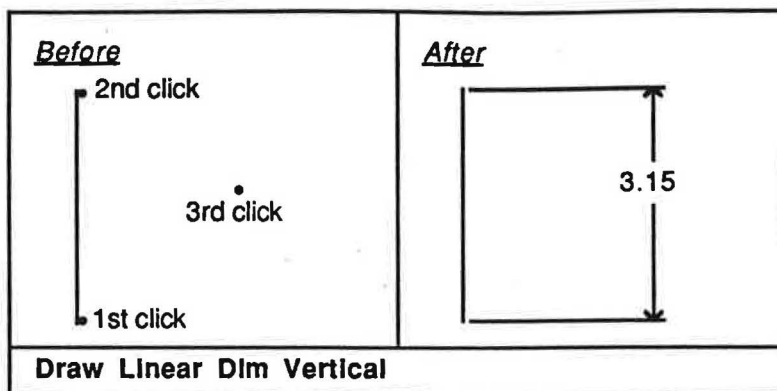
Default Value: None.

Errors: 1) If you press Return without entering any text, the system will use the text last specified.

Vertical

The **Vertical** modifier is used to modify the **Draw Linear Dim** command, and will allow you to dimension vertically. Please note that once you exit the **Draw Linear Dim** command, this modifier will no longer be in effect (i.e. the next time you use **Draw Linear Dim** without a modifier, it will assume you want to dimension horizontally).

Operation: After you have selected the **Draw Linear Dim** command from the **Text & Dimension** menu, highlight the **Vertical** modifier in the **<-Modify** menu, and release the mouse button. Proceed with the command as you normally would.



Parameters: None.

Default Value: None.

Errors: 1) If you try to dimension horizontally, the system will not draw the dimension.

Horizontal

The **Horizontal** modifier is used to modify the **Draw Linear Dim** command, and will allow you to dimension a line that is horizontal. Please note that the only time you will have to use this modifier is when you want to switch from the **Vertical** modifier to the **Horizontal** modifier (i.e. **Draw Linear Dim** always assumes horizontal dimensioning unless you tell it otherwise).

Operation: After you have selected the **Draw Linear Dim** command from the **Text & Dimension** menu, highlight the **Horizontal** modifier in the **<-Modify** menu, and release the mouse button. Proceed with the command as you normally would.

Parameters: None.

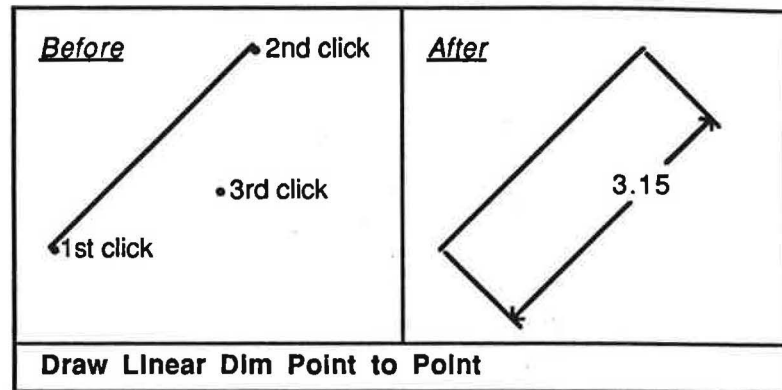
Default Value: None.

Errors: 1) If you try to dimension vertically, the system will not draw the dimension.

Point to Point

The **Point to Point** modifier is used to modify the **Draw Linear Dim** command, and will allow you to create point-to-point dimensions. This command is useful when you want the dimension line to be parallel to the line you are dimensioning. Please note that the dimension text will indicate the true distance between the two locations. Also, please note that once you exit the **Draw Linear Dim** command, this modifier will no longer be in effect (i.e. the next time you use **Draw Linear Dim**, it will assume you want to dimension horizontally).

Operation: After you have selected the **Draw Linear Dim** command from the **Text & Dimension** menu, highlight the **Point to Point** modifier in the **<-Modify** menu, and release the mouse button. Proceed with the command as you normally would.



Parameters: None.

Default Value: None.

Errors: None.

Height

The **Height** modifier is used to modify the **Draw Text** command, and will allow you to specify the height of the text you are drawing. Please note that text drawn with a height less than or equal to 0.15 units may be somewhat illegible due to the resolution of the computer screen. However, when plotted, the text will appear razor sharp.

Operation: After you have selected the **Draw Text** command from the **Text & Dimension** menu, highlight the **Height** modifier in the **<-Modify** menu, and release the mouse button. You will then be prompted "Height:"; type in the desired height of the text, and press Return (if you make a mistake while typing the height, you may use the Delete or Left Arrow keys to remove the error). Having entered the height, you may now proceed with the command as you normally would (all text drawn from now on will appear with the specified height, until you select another command). Please note that the height will revert to its default value once you exit the **Draw Text** command (i.e. the next time you **Draw Text** without a modifier, the height will be 0.15 units).

<u>Before</u>	<u>After</u>
• click	THIS IS TEXT
Note: Height = 1 unit	
Draw Text Height	

Parameters: Height (real > 0 and < 1001).

Default Value: Height = 0.15 units.

- Errors:
- 1) If you press Return without entering a value for the height, the system will use the height last specified.
 - 2) If a negative number is entered for the height, the absolute value of that number will be used in its place.
 - 3) When drawing with a height greater than 1000, the resulting display may be unreliable.

Width

The **Width** modifier is used to modify the **Draw Text** command, and will allow you to specify the width of the text you are drawing. Please note that text drawn with a width less than or equal to 0.12 units may be somewhat illegible due to the resolution of the computer screen. However, when plotted, the text will appear razor sharp.

Operation: After you have selected the **Draw Text** command from the **Text & Dimension** menu, highlight the **Width** modifier in the **<-Modify** menu, and release the mouse button. You will then be prompted "Width: "; type in the desired width of the text, and press Return (if you make a mistake while typing the width, you may use the Delete or Left Arrow keys to remove the error). Having entered the width, you may now proceed with the command as you normally would (all text drawn from now on will appear with the specified width, until you select another command). Please note that the width will revert to its default value once you exit the **Draw Text** command (i.e. the next time you **Draw Text** without a modifier, the width will be 0.12 units).

<u>Before</u>	<u>After</u>
• click	THIS IS T
Note: Width = 0.5 unit	
Draw Text Width	

Parameters: Width (real > 0 and < 1001).

Default Value: Width = 0.12 units.

Errors: 1) If you press Return without entering a value for the width, the system will use the width last specified.
2) If a negative number is entered for the width, the absolute value of that number will be used in its place.
3) When drawing with a width greater than 1000, the resulting display may be unreliable.

Slant

The **Slant** modifier is used to modify the **Draw Text** command, and will allow you to specify the slant of the text you are drawing. Please note that this modifier is useful when you wish to simulate italicized text.

Operation: After you have selected the **Draw Text** command from the **Text & Dimension** menu, highlight the **Slant** modifier in the **<-Modify** menu, and release the mouse button. You will then be prompted "Slant: "; type in the desired slant of the text, and press Return (if you make a mistake while typing the slant, you may use the Delete or Left Arrow keys to remove the error). Having entered the slant, you may now proceed with the command as you normally would (all text drawn from now on will appear with the specified slant, until you select another command). Please note that the slant will revert to its default value once you exit the **Draw Text** command (i.e. the next time you **Draw Text** without a modifier, the slant will be 0 degrees).

<i>Before</i>	<i>After</i>
•click	<i>THIS IS TEXT</i>
Note: Slant = 45 degrees	
Draw Text Slant	

Parameters: Slant (real -45 through 45 degrees).

Default Value: Slant = 0 degrees.

Errors: 1) If you press Return without entering a value for the slant, or enter an invalid value, the system will use the slant last specified.
2) If you attempt to draw text with a slant greater than 45 degrees or less than -45 degrees, the text may appear illegible.

Angle

The **Angle** modifier is used to modify the **Draw Text** command, and will allow you to specify the angle of the text you are drawing.

Operation: After you have selected the **Draw Text** command from the **Text & Dimension** menu, highlight the **Angle** modifier in the **<-Modify** menu, and release the mouse button. You will then be prompted "Angle:"; type in the desired angle of the text, and press Return (if you make a mistake while typing the angle, you may use the Delete or Left Arrow keys to remove the error). Having entered the angle, you may now proceed with the command as you normally would (all text drawn from now on will appear with the specified angle, until you select another command). Please note that the angle will revert to its default value once you exit the **Draw Text** command (i.e. the next time you **Draw Text** without a modifier, the angle will be 0 degrees).

<p><u>Before</u></p> <p>• click</p> <p>Note: Angle = 90 degrees</p>	<p><u>After</u></p> <p>THIS IS TEXT</p>
<p>Draw Text Angle</p>	

Parameters: Angle (real 0 - 359 degrees).

Default Value: Angle = 0 degrees.

Errors: 1) If you press Return without entering a value for the angle, or enter an invalid value, the system will use the angle last specified.

Left Justify

The **Left Justify** modifier is used to modify the **Draw Text** command, and will allow you to left justify the text you are drawing.

Operation: After you have selected the **Draw Text** command from the **Text & Dimension** menu, highlight the **Left Justify** modifier in the **<-Modify** menu, and release the mouse button. You may now proceed with the command as you normally would, and the text will be placed to the left in relationship to where you click.

Parameters: None.

Default Value: None.

Errors: None.

Center Justify

The **Center Justify** modifier is used to modify the **Draw Text** command, and will allow you to center justify the text you are drawing.

Operation: After you have selected the **Draw Text** command from the **Text & Dimension** menu, highlight the **Center Justify** modifier in the **<-Modify** menu, and release the mouse button. You may now proceed with the command as you normally would, and the text will be placed in the center in relationship to where you click. Please note that the justification will revert to its default value once you exit the **Draw Text** command (i.e. the next time you **Draw Text** without a modifier, the justification will be left).

<u>Before</u>	<u>After</u>
<p style="text-align: center;">• click</p> <p>Note: Text = THIS IS TEXT</p>	<p style="text-align: center;">THIS IS TEXT</p>
Draw Text Center Justify	

Parameters: None.

Default Value: None.

Errors: None.

Right Justify

The **Right Justify** modifier is used to modify the **Draw Text** command, and will allow you to right justify the text you are drawing. Please note that the only time you will have to use this modifier is when you want to switch from the **Left Justify** or **Center Justify** modifier to the **Right Justify** modifier (i.e. **Draw Text** always assumes right justification unless you tell it otherwise).

Operation: After you have selected the **Draw Text** command from the **Text & Dimension** menu, highlight the **Right Justify** modifier in the **<-Modify** menu, and release the mouse button. You may now proceed with the command as you normally would, and the text will be placed to the right in relationship to where you click. Please note that the justification will revert to its default value once you exit the **Draw Text** command (i.e. the next time you **Draw Text** without a modifier, the justification will be left).

<p><i>Before</i></p> <p>• click</p> <p>Note: Text = THIS IS TEXT</p>	<p><i>After</i></p> <p>THIS IS TEXT</p>
<p>Draw Text Right Justify</p>	

Parameters: None.

Default Value: None.

Errors: None.

Chapter 8

EDIT MENU

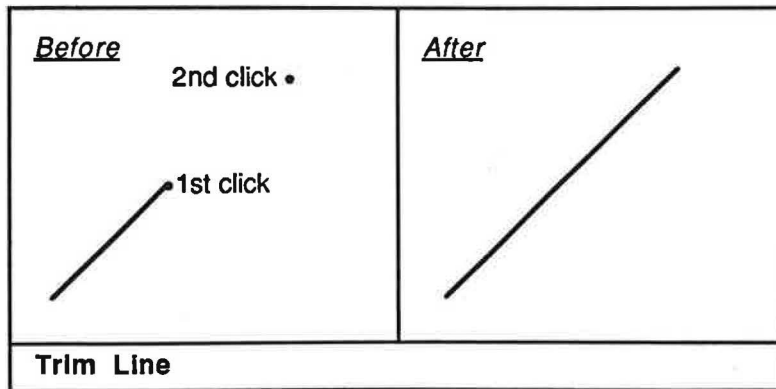
The **Edit** menu contains any commands that pertain to the alteration or replication of any basic entity (i.e. line, circle, arc, or point). By using the commands found in this menu, you will be able to save time utilizing graphic manipulation to duplicate and reposition drawing entities. Several of the commands discussed in this chapter may be further enhanced by using masks as explained in the **Mask Menu** chapter.

After you have completed this chapter, you will be able to use the **Trim Line**, **Trim Circle**, **Trim Arc**, **Move**, **Move Copy**, **Mirror**, **Mirror Copy**, **Rotate**, **Rotate Copy**, **Measure Angle**, **Measure Distance** commands.

Trim Line

The **Trim Line** command is used to relocate the end(s), and thereby the length, of an existing line. Please note that the **Trim Line** command is not limited to trimming a line shorter; you may also use it to extend an existing line.

Operation: Highlight the **Trim Line** command in the **Edit** menu, and release the mouse button. Next, click once on the desired line, closest to the end you wish to trim. Finally, click the location where you would like the line to be trimmed to, and the resulting line will be drawn.



Parameters: None.

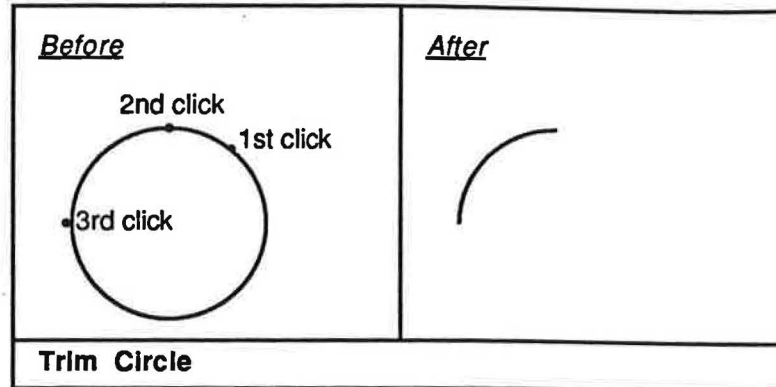
Default Value: None.

Errors: None.

Trim Circle

The **Trim Circle** command is used to relocate the end(s), and thereby the angle, of an existing circle. Please note that it is important to remember that circles are trimmed in a counterclockwise manner.

Operation: Highlight the **Trim Circle** command in the **Edit** menu, and release the mouse button. Next, click on the circle you wish to trim. Finally, click once on the circumference of the circle where you would like the trim to begin, and once where you would like the trim to end, and the resulting arc will be drawn. If, when selecting the circle to be trimmed you click on the beginning half, the resulting arc will go counterclockwise from the beginning of the trim to the end of the trim. However, if when selecting the circle to be trimmed you click on the ending half, the resulting arc will go counterclockwise from the end of the trim to the beginning of the trim.



Parameters: None.

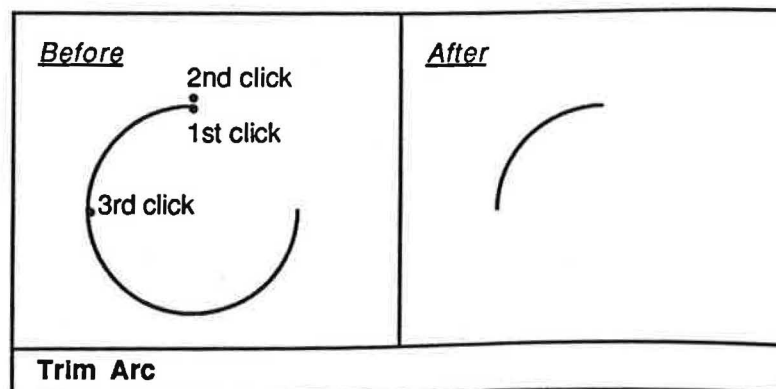
Default Value: None.

Errors: None.

Trim Arc

The **Trim Arc** command is used to relocate the end(s), and thereby the angle, of an existing arc. Please note that the **Trim Arc** command is not limited to trimming an arc shorter; you may also use it to extend an existing arc. Also, please note that it is important to remember that arcs are trimmed in a counterclockwise manner. Finally, please note that if you are having difficulty selecting an arc to trim, it may be useful to try clicking on either end of the arc.

Operation: Highlight the **Trim Arc** command in the **Edit** menu, and release the mouse button. Next, click on the arc you wish to trim. Finally, click once on the circumference of the arc where you would like the trim to begin, and once where you would like the trim to end, and the resulting arc will be drawn. If, when selecting the arc to be trimmed you click on the beginning half, the resulting arc will go counterclockwise from the beginning of the trim to the end of the trim. However, if when selecting the arc to be trimmed you click on the ending half, the resulting arc will go counterclockwise from the end of the trim to the beginning of the trim.



Parameters: None.

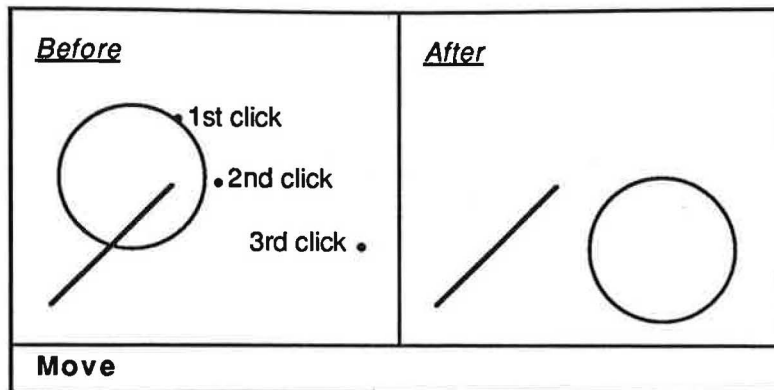
Default Value: None.

Errors: None.

Move

The **Move** command is used to move an existing entity (i.e. line, circle, arc, or point) from its current position to a different location. Please note that it is worthwhile to review the following chapter **Mask Menu** to take full advantage of this command.

Operation: Highlight the **Move** command in the **Edit** menu, and release the mouse button. Next, click on the entity you wish to move. Now, click once on or near the entity you are moving to define a reference point, and once where you would like to relocate the reference point to (the direction and distance of movement is determined by the direction and distance between the two locations specified by your clicks). The entity will now be moved to the new location.



Parameters: None.

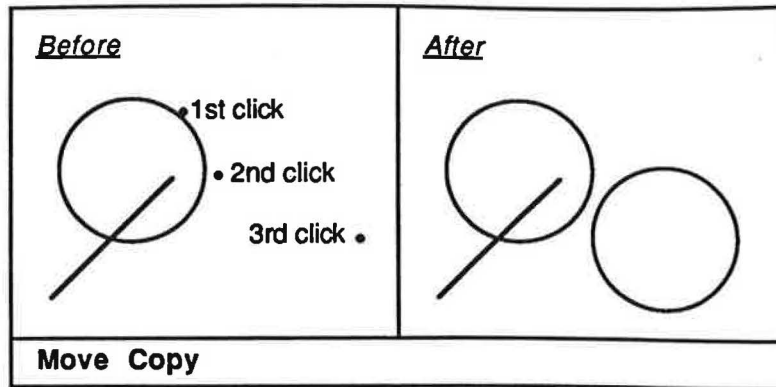
Default Value: None.

Errors: None.

Move Copy

The **Move Copy** command is used to move a copy of an existing entity (i.e. line, circle, arc, or point) to a different location, leaving the original entity in place. Please note that this command is useful when you wish to repeat a particular entity throughout your drawing without having to redraw it each time. Also, please note that it is worthwhile to review the following chapter **Mask Menu** to take full advantage of this command.

Operation: Highlight the **Move Copy** command in the **Edit** menu, and release the mouse button. Next, click on the entity you wish to move. Now, click once on or near the entity you are moving to define a reference point, and once where you would like to relocate the reference point to (the direction and distance of movement is determined by the direction and distance between the two locations specified by your clicks). A copy of the original entity will now be moved to the new location.



Parameters: None.

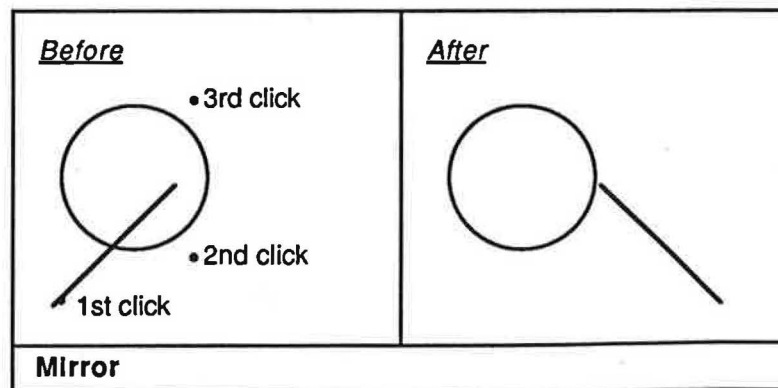
Default Value: None.

Errors: None.

Mirror

The **Mirror** command is used to mirror an existing entity (i.e. line, circle, arc, or point) about a specified axis. Please note that it is worthwhile to review the following chapter **Mask Menu** to take full advantage of this command.

Operation: Highlight the **Mirror** command in the **Edit** menu, and release the mouse button. Next, click on the entity you wish to mirror. Now, click twice in such a manner as to define the axis about which to mirror the entity. The entity will now be mirrored to the new location.



Parameters: None.

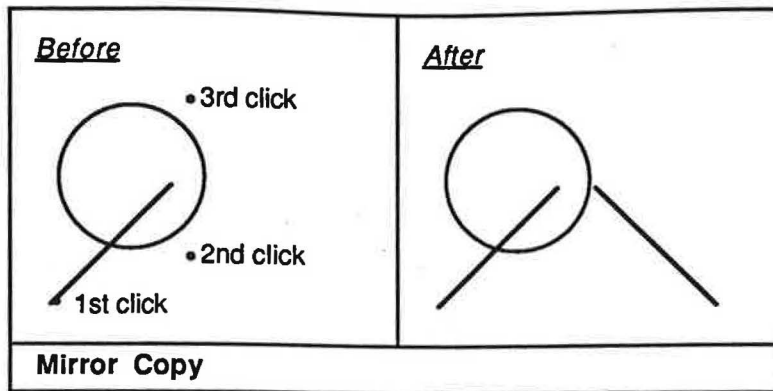
Default Value: None.

Errors: None.

Mirror Copy

The **Mirror Copy** command is used to create a mirror image of an existing entity (i.e. line, circle, arc, or point) about a specified axis, leaving the original entity in place. Please note that this command is useful when you are creating a symmetrical drawing (i.e. draw one half of the drawing, then use the **Mirror Copy** command to automatically generate the other half). Also, please note that it is worthwhile to review the following chapter **Mask Menu** to take full advantage of this command.

Operation: Highlight the **Mirror Copy** command in the **Edit** menu, and release the mouse button. Next, click on the entity you wish to mirror. Now, click twice in such a manner as to define the axis about which to mirror the entity. A copy of the original entity will now be mirrored to the new location.



Parameters: None.

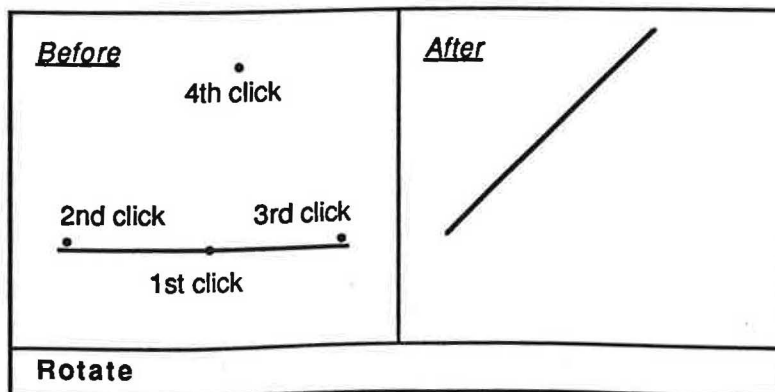
Default Value: None.

Errors: None.

Rotate

The **Rotate** command is used to rotate an existing entity (i.e. line, circle, arc, or point) about a specified center of rotation. Please note that it is worthwhile to review the following chapter **Mask Menu** to take full advantage of this command.

Operation: Highlight the **Rotate** command in the **Edit** menu, and release the mouse button. Next, click on the entity you wish to rotate. Now, click once to define the center of rotation, once to specify the starting angle of rotation, and once to specify the ending angle of rotation. The entity will now be rotated to the new location.



Parameters: None.

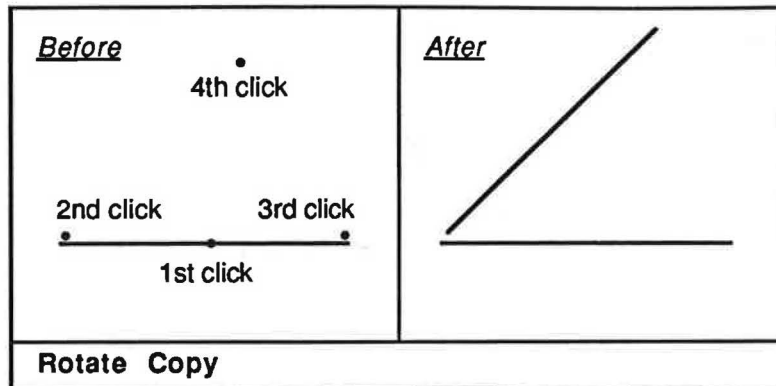
Default Value: None.

Errors: None.

Rotate Copy

The **Rotate Copy** command is used to rotate a copy of an existing entity (i.e. line, circle, arc, or point) about a specified center of rotation, leaving the original entity in place. Please note that this command is useful when you wish to create rotated copies of an entity or entities at equally spaced angles with a constant distance from a specified center of rotation. Also, please note that it is worthwhile to review the following chapter **Mask Menu** to take full advantage of this command.

Operation: Highlight the **Rotate Copy** command in the **Edit** menu, and release the mouse button. Next, click on the entity you wish to rotate. Now, click once to define the center of rotation, once to specify the starting angle of rotation, and once to specify the ending angle of rotation. A copy of the original entity will now be rotated to the new location.



Parameters: None.

Default Value: None.

Errors: None.

Measure Angle

The **Measure Angle** command is used to measure the angle between an existing line and the horizon. Please note that this command will indicate both the acute and obtuse angle values.

Operation: Highlight the **Measure Angle** command in the **Edit** menu, and release the mouse button. Now, click once on the line whose angle you are measuring. You will then be prompted "Acute: x Obtuse: y Press RETURN to continue.", where x equals the acute angle of the line in relationship to the horizon, and y equals the obtuse angle of the line in relationship to the horizon. Press Return when you are done viewing the angle.

Parameters: None.

Default Value: None.

Errors: None.

Measure Distance

The **Measure Distance** command is used to measure the distance between two coordinates on your drawing.

Operation: Highlight the **Measure Distance** command in the **Edit** menu, and release the mouse button. Now, click twice to define the distance you wish to measure. You will then be prompted "Distance x Press RETURN to continue.", where x equals the distance between the two coordinates specified in units. Press Return when you are done viewing the distance.

Parameters: None.

Default Value: None.

Errors: None.

Chapter 9

MASK MENU

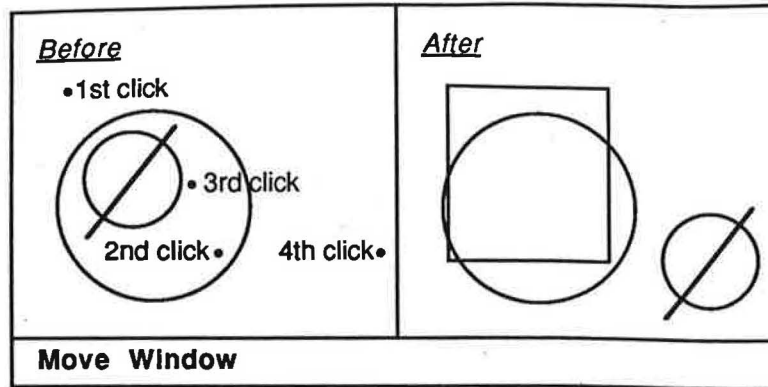
The **Mask** menu contains any masks that are used to limit selection during coordinate specification (i.e. clicking) to a particular area of the screen, position on the end of an existing entity (i.e. line, circle, arc, or point), or position in the center of an existing entity. Masks will work with practically any command that requires you to specify a coordinate or coordinates. Also included in this chapter are the masks necessary to specify coordinates using the Cartesian or polar coordinate systems. Masks are different from commands in that it is necessary to activate a command before you can use a mask. Masks are different from modifiers in that a mask will deactivate itself after the command it is masking is used once, whereas a modifier will stay in effect for as long as you use the command it is modifying (this provides you with great flexibility when masking). Please note that masks may be used with both commands and modifiers; select the command first, then the modifier, then the mask. For example, you may wish to draw a line that is vertical, where one end of the line "snaps" to the end of an existing entity. Select the **Draw Line** command from the **Entity** menu, then the **Vertical** modifier from the **<-Modify** menu, and finally the **End** mask from the **Mask** menu. Now, when you specify the coordinates of the line, click once near the end of the existing entity you wish to snap to, and once where you would like the line to end. The vertical line will now be drawn, with one end attached to the end of the specified entity.

After you have completed this chapter, you will be able to use the **Window**, **End**, **Origin**, **Absolute**, and **Polar** masks.

Window

The **Window** mask is used to specify a group of entities for editing when using the **Move**, **Move Copy**, **Mirror**, **Mirror Copy**, **Rotate**, and **Rotate Copy** commands (you may recall that when used without the **Window** mask, the above commands will only edit one entity at a time). After you have specified the window, any entity contained within the window, and not touching the edge of the window, will be affected. Please note that arcs are treated as circles in determining if they are in the window; if you have an arc with a very large radius, you will have to define your window so that it encompasses the arc's entire radius in all directions (i.e. pretend the arc is a circle). Also, please note that the **Window** mask will deactivate itself after the command it is masking is used once; simply reselect the mask to reactivate it.

Operation: After you have selected the **Move**, **Move Copy**, **Mirror**, **Mirror Copy**, **Rotate**, or **Rotate Copy** command from the **Edit** menu, highlight the **Window** mask in the **Mask** menu, and release the mouse button. Next, instead of clicking on the entity you wish to edit as you normally would for any of the commands above, click twice in such a manner that the coordinates you have specified will define a rectangle, or "window", around the entities you wish to edit. Having placed the window around the entities you wish to edit, you may now proceed with the command as you normally would, and all entities completely within the specified window not touching the edge will be edited accordingly.



Parameters: None.

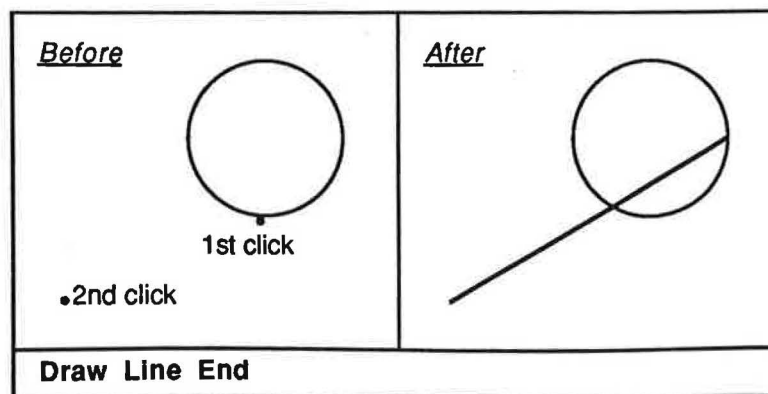
Default Value: None.

Errors: None.

End

The **End** mask is used to select the end point of an existing entity (i.e. line, circle, arc, or point) by clicking anywhere near the half of the entity closest to the end desired. The end of an entity is defined as follows: The end of a line is either endpoint, the end of a circle is 0 degrees on the circumference, the end of an arc is either endpoint, and the end of a point is its center. The **End** mask will affect virtually any command that requires coordinate specification (i.e. clicking).

Operation: After you have selected the desired command from its corresponding menu, highlight the **End** mask in the **Mask** menu, and release the mouse button. You may now proceed with the command as you normally would, however, when specifying the first coordinate of the command, click once near the end of the existing entity you wish to snap to; once you complete the command, the first coordinate will be aligned with the end of the specified entity accordingly. Please note that if you wish to align a coordinate other than the one specified by the first click, simply select a mask after the first coordinate has been specified, and before the desired coordinate has been clicked.



*This diagram shows the effect of the **End** mask when snapping to the end of a circle.*

Parameters: None.

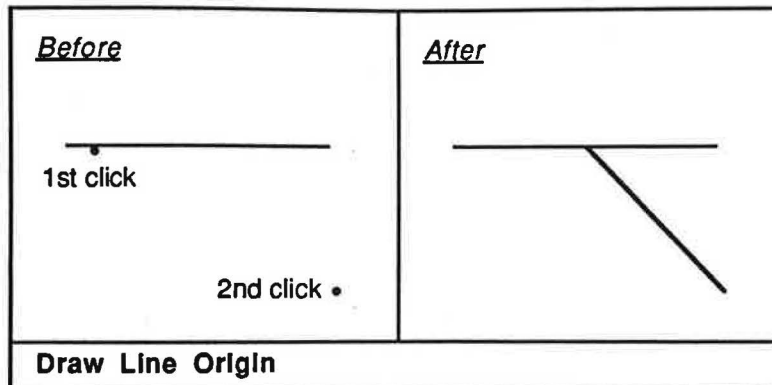
Default Value: None.

Errors: None.

Origin

The **Origin** mask is used to select the center, or "origin" of an existing entity (i.e. line, circle, arc, or point) by clicking anywhere on the desired entity. The origin of an entity is defined as follows: The origin of a line is its midpoint, the origin of a circle is its center, the origin of an arc is its center, and the origin of a point is its center. The **Origin** mask will affect virtually any command that requires coordinate specification (i.e. clicking).

Operation: After you have selected the desired command from its corresponding menu, highlight the **Origin** mask in the **Mask** menu, and release the mouse button. You may now proceed with the command as you normally would, however, when specifying the first coordinate of the command, click once on the existing entity you wish to snap to; once you complete the command, the first coordinate will be aligned with the origin of the specified entity accordingly. Please note that if you wish to align a coordinate other than the one specified by the first click, simply select the mask after the first coordinate has been specified, and before the desired coordinate has been clicked.



*This diagram shows the effect of the **Origin** mask when snapping to the origin of a line.*

Parameters: None.

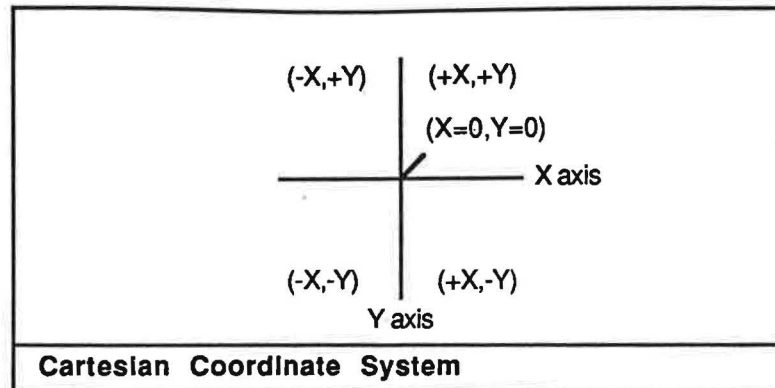
Default Value: None.

Errors: None.

Absolute

The **Absolute** mask is used to specify the explicit location of a coordinate using the Cartesian coordinate system, and will affect virtually any command that requires coordinate specification (i.e. clicking). In the Cartesian coordinate system, a coordinate is specified by a pair of X Y values, describing a given location in terms of its horizontal and vertical distance from a fixed point of reference called the origin (i.e. X = 0, Y = 0). Please note that when you first start the discoverCAD system, the origin is located in the exact center of the screen (zooming or panning may shift where the origin appears on the screen).

Operation: After you have selected the desired command from its corresponding menu, highlight the **Absolute** mask in the **Mask** menu, and release the mouse button. You may now proceed with the command as you normally would, however, when specifying the first coordinate of the command you will be prompted "X:"; type in the desired X value and press Return. You will then be prompted "Y:"; type in the desired Y value and press Return. If you make a mistake while typing X or Y, you may use the Delete or Left Arrow keys to remove the error. If you press Return without entering a value for either X or Y, the system will not proceed with the command. Please note that if you wish to align a coordinate other than the one specified by the first click (or in addition to it), simply select the mask after the first coordinate has been specified, and before the desired coordinate has been clicked.



Parameters: 1) X (real > -1001 and < 1001). 2) Y (real > -1001 and < 1001).

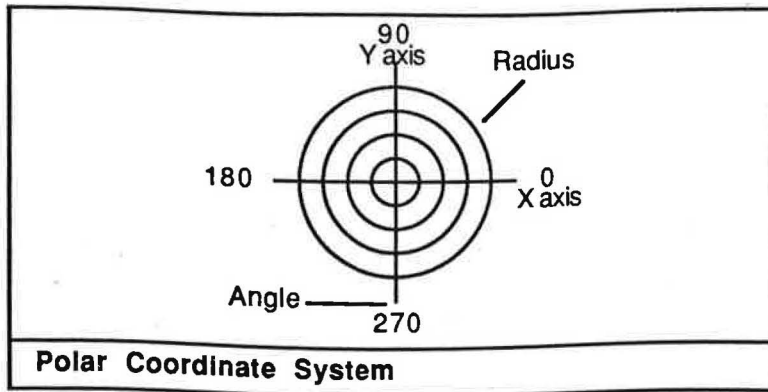
Default Value: None.

Errors: 1) When specifying a coordinate with a X or Y value greater than 1000, or less than -1000, the resulting display may be unreliable.

Polar

The **Polar** mask is used to specify the explicit location of a coordinate using the polar coordinate system, and will affect virtually any command that requires coordinate specification (i.e. clicking). In the polar coordinate system, a coordinate is specified by the direct distance of the position from the origin in combination with the angle of the position from the origin measured in a counterclockwise direction from the horizontal. Please note that when you first start the discoverCAD system, the origin is located in the exact center of the screen (zooming or panning may shift where the origin appears on the screen).

Operation: After you have selected the desired command from its corresponding menu, highlight the **Polar** mask in the **Mask** menu, and release the mouse button. You may now proceed with the command as you normally would, however, when specifying the first coordinate of the command you will be prompted "Radius:"; type in the desired value for the radius and press Return. You will then be prompted "Angle:"; type in the desired value for the angle and press Return. If you make a mistake while typing the radius or angle, you may use the Delete or Left Arrow keys to remove the error. If you press Return without entering a value for either the radius or angle, the system will not proceed with the command. Please note that if you wish to align a coordinate other than the one specified by the first click (or in addition to it), simply select the mask after the first coordinate has been specified, and before the desired coordinate has been clicked.



Parameters: 1) Radius (real > -1001 and < 1001). 2) Angle (real $0 - 359$ degrees).

Default Value: None.

Errors: 1) When specifying a coordinate with a radius greater than 1000, or less than -1000, the resulting display may be unreliable.
2) If a negative number is entered for the angle, the absolute value of that number will be used in its place.

Chapter 10

PLOT MENU

The **Plot** menu contains any commands that pertain to the output of your drawing. You may plot to one of the graphics plotters listed below, or print to a variety of serial and parallel dot matrix printers. Plotting will provide you with the most desirable hardcopy quality, whereas the dot matrix printer will be somewhat less exact in appearance. Please note that it is worthwhile to review the **Plot Tutorial** and **Technical Notes** appendices to take full advantage of these commands.

After you have completed this chapter, you will be able to use the **Plotter**, **Apple**, **Roland DXY**, **HI PC695**, **HI DMP40**, **HI DMP41**, **HP7470**, **HP7475**, **Pen Number**, **Dim Scale**, and **Printer** commands.

Plotter

The **Plotter** command is used to specify whether or not you want the output to go to the screen or the plotter.

Operation: Highlight the **Plotter** command in the **Plot** menu, and release the mouse button. The output will now be sent to the plotter instead of the screen (when plotter is on, the command will have a check mark next to it in the **Plot** menu). To turn the plotter off, simply reselect the **Plot** command (please note that the **Plotter** command will automatically shut itself off after the **Redraw** or **Draw Layer** command has been issued).

Parameters: On/Off.

Default Value: Plotter = Off.

Errors: None.

Apple

The **Apple** command is used to specify the Apple 410 Color Graphics Plotter as the plotter you will be using during plotting.

Operation: After you have selected the **Plotter** command from the **Plot** menu (i.e. plotter is on), highlight the **Apple** command in the **Plot** menu, and release the mouse button. You will then be prompted "Paper size A or B"; type in the desired paper size, and press Return (if you make a mistake while typing the paper size, you may use the Delete or Left Arrow keys to remove the error). The system will then initialize the plotter for the plotting process.

Parameters: Paper size (A or B).

Default Value: None.

Errors: 1) If you try to type the paper size and nothing appears, make sure the Caps Lock key is depressed.
2) The system will continue to prompt you until a valid paper size is entered.

Roland DXY

The **Roland DXY** command is used to specify the Roland DXY 880, DXY 980, or DXY 1100 graphics plotter as the plotter you will be using during plotting (these plotters have been tested and are known to work; other Roland plotters that have not been tested may work as well).

Operation: After you have selected the **Plotter** command from the **Plot** menu (i.e. plotter is on), highlight the **Roland DXY** command in the **Plot** menu, and release the mouse button. You will then be prompted "Paper size A or B"; type in the desired paper size, and press Return (if you make a mistake while typing the paper size, you may use the Delete or Left Arrow keys to remove the error). The system will then initialize the plotter for the plotting process.

Parameters: Paper size (A or B).

Default Value: None.

Errors: 1) If you try to type the paper size and nothing appears, make sure the Caps Lock key is depressed.
2) The system will continue to prompt you until a valid paper size is entered.

HI PC695

The **HI PC695** command is used to specify the Houston Instrument PC695, PC695A or PC595 graphics plotter as the plotter you will be using during plotting. Please note that if you are using the PC595 plotter, you must specify A as the paper size.

Operation: After you have selected the **Plotter** command from the **Plot** menu (i.e. plotter is on), highlight the **HI PC695** command in the **Plot** menu, and release the mouse button. You will then be prompted "Paper size A or B"; type in the desired paper size, and press Return (if you make a mistake while typing the paper size, you may use the Delete or Left Arrow keys to remove the error). The system will then initialize the plotter for the plotting process.

Parameters: Paper size (A or B).

Default Value: None.

Errors: 1) If you try to type the paper size and nothing appears, make sure the Caps Lock key is depressed.
2) The system will continue to prompt you until a valid paper size is entered.

HI DMP40

The **HI DMP40** command is used to specify the Houston Instrument DMP40 graphics plotter as the plotter you will be using during plotting. Please note that this command can be used to activate any other HI DMP series A/B plotter.

Operation: After you have selected the **Plotter** command from the **Plot** menu (i.e. plotter is on), highlight the **HI DMP40** command in the **Plot** menu, and release the mouse button. You will then be prompted "Paper size A or B"; type in the desired paper size, and press Return (if you make a mistake while typing the paper size, you may use the Delete or Left Arrow keys to remove the error). The system will then initialize the plotter for the plotting process.

Parameters: Paper size (A or B).

Default Value: None.

Errors: 1) If you try to type the paper size and nothing appears, make sure the Caps Lock key is depressed.
2) The system will continue to prompt you until a valid paper size is entered.

HI DMP41

The **HI DMP41** command is used to specify the Houston Instrument DMP41 graphics plotter as the plotter you will be using during plotting. Please note that this command can be used to activate any other HI DMP series C/D plotter.

Operation: After you have selected the **Plotter** command from the **Plot** menu (i.e. plotter is on), highlight the **HI DMP41** command in the **Plot** menu, and release the mouse button. You will then be prompted "Paper size C or D"; type in the desired paper size, and press Return (if you make a mistake while typing the paper size, you may use the Delete or Left Arrow keys to remove the error). The system will then initialize the plotter for the plotting process.

Parameters: Paper size (C or D).

Default Value: None.

Errors: 1) If you try to type the paper size and nothing appears, make sure the Caps Lock key is depressed.
2) The system will continue to prompt you until a valid paper size is entered.

HP 7470

The **HP 7470** command is used to specify the Hewlett Packard 7470 graphics plotter as the plotter you will be using during plotting.

Operation: After you have selected the **Plotter** command from the **Plot** menu (i.e. plotter is on), highlight the **HP 7470** command in the **Plot** menu, and release the mouse button. The system will then initialize the plotter for the plotting process.

Parameters: None.

Default Value: None.

Errors: None.

HP 7475

The **HP 7475** command is used to specify the Hewlett Packard 7475 or 7440A Color Pro graphics plotter as the plotter you will be using during plotting.

Operation: After you have selected the **Plotter** command from the **Plot** menu (i.e. plotter is on), highlight the **HP 7475** command in the **Plot** menu, and release the mouse button. You will then be prompted "Paper size A or B"; type in the desired paper size, and press Return (if you make a mistake while typing the paper size, you may use the Delete or Left Arrow keys to remove the error). The system will then initialize the plotter for the plotting process.

Parameters: Paper size (A or B).

Default Value: None.

Errors: 1) If you try to type the paper size and nothing appears, make sure the Caps Lock key is depressed.
2) The system will continue to prompt you until a valid paper size is entered.

Pen Number

The **Pen Number** command is used to specify which pen to use during plotting should your plotter have multi-pen capability.

Operation: After you have selected the **Plotter** command from the **Plot** menu (i.e. plotter is on), and have selected the appropriate plotter type (ex. **Apple**), highlight the **Pen Number** command in the **Plot** menu, and release the mouse button. You will then be prompted "Pen Number: "; type in the desired pen number, and press Return (if you make a mistake while typing the pen number, you may use the Delete or Left Arrow keys to remove the error). If you press Return without entering a value for the pen number, the system will exit the **Pen Number** command. The plotter will now select the indicated pen.

Parameters: Pen Number (integer 1 - 8).

Default Value: None.

Errors: 1) If you don't specify a valid pen number (i.e. 1 - 8), the system will ignore what you have entered).

Dim Scale

The **Dim Scale** command is used to scale any dimensioning you may have in your drawing separately from the rest of the entities. This command is useful when your drawing has been zoomed extensively prior to plotting or printing, and the dimensioning text appears too large or too small in relationship to the rest of the drawing. Please note that the time it takes to redraw the screen after scaling the dimensioning may be lengthy, especially when your drawing contains a lot of dimensioning.

Operation: Highlight the **Dim Scale** command in the **Plot** menu, and release the mouse button. You will then be prompted "Scale: "; type in the desired scaling of the dimensioning, and press Return (ex. if you want the dimensioning twice as big, type in a scale of 2; if you want the dimensioning twice as small, type in a scale of 0.5). If you make a mistake while typing the scale, you may use the Delete or Left Arrow keys to remove the error. If you press Return without entering a value for the scale, the system will exit the **Dim Scale** command. The screen will now be redrawn, with the dimensioning scaled accordingly.

Parameters: Scale (real > 0 and < 1001).

Default Value: None.

Errors: 1) If a negative number is entered for the scale, the absolute value of that number will be used in its place.
2) When scaling with a ratio greater than 1000, the resulting display may be unreliable.

Printer

The **Printer** command is used to print your drawing to a dot matrix printer. Please note that discoverCAD requires the use of Beagle Brother's Triple Dump software for this command. Also, please note that you should save your drawing using the **Save** command found in the **File** menu before using this command, as you will not be able to retrieve your drawing after printing if it has not been saved to disk.

Operation: Highlight the **Printer** command in the **Plot** menu, and release the mouse button. You will then be prompted "WARNING: Wish to save drawing before printing? (Y/N)". If you press Y, the system will exit the **Printer** command, thereby allowing you the chance to save your drawing before printing. If you press N, you will then be prompted "Replace discoverCAD disk(s) with Triple Dump disk, then press RETURN."; remove the discoverCAD system disk(s), insert the Triple Dump DOS 3.3 disk into the startup disk drive, and press Return. You will then be prompted "WARNING: Wish to reboot system now? (Y/N)". If you press N, the system will exit the **Printer** command. If you press Y, the computer will restart itself, after which time Triple Dump will be loaded and running (your discoverCAD drawing will still reside in the computer's memory). You may now proceed with the Triple Dump program as you normally would to print the drawing (see Triple Dump owner's manual).

Parameters: None.

Default Value: None.

Errors: 1) If you try to type a reply and nothing appears, make sure the Caps Lock key is depressed.

Appendix A

DRAW TUTORIAL LEVEL 1

In this tutorial you will be shown step by step how to draw a simple mechanical drawing using several of the basic discoverCAD commands. Among the commands featured are **Draw Grid**, **Snap Grid**, **Draw Line**, **Draw Rectangle**, and **Draw Circle** with the **Radius** modifier.

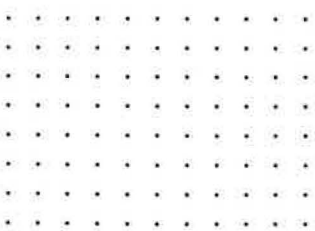
Before you begin this procedure, please refer to the **Introduction** chapter to familiarize yourself with basic command and coordinate selection. This tutorial assumes you have properly configured your computer, know how to start the discoverCAD system, and are familiar with the use of the mouse and menus.

Directions

The purpose of this tutorial is to construct the drawing depicted in the *After* diagram of step 5; simply follow the steps below in order to achieve the final drawing. Each step has an general overview of what the command can be used for, and how to use it. Also included is an illustration of what the screen should look like before and after you use the command. When entering a coordinate for a command (i.e. clicking the mouse button), see the *Before* screen for the proper location of your click(s) (count the grid dots in each diagram to make your drawing appear exactly as in the diagrams). The symbols C1, C2, C3, etc. will represent your 1st click, 2nd click, and 3rd click, etc. respectively. If you make a mistake during a procedure, you may need to use the **Erase** command to correct it (see the **Entity Menu** chapter for use of the **Erase** command). If you need additional information on the operation or effect of a command, refer to the appropriate location in this manual.

Step 1 - Draw Grid and Snap Grid

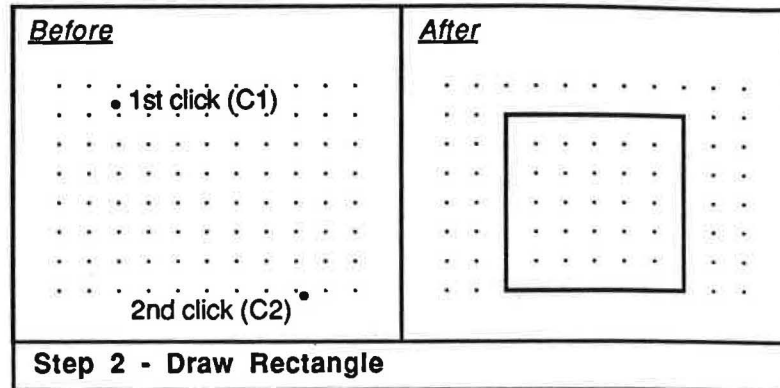
The **Draw Grid** command is used to display a series of evenly spaced rows and columns of dots. Used in conjunction with the **Snap Grid** command, the **Draw Grid** command is useful when the accuracy of a drawing is important. Highlight the **Draw Grid** command in the **Screen** menu, and release the mouse button. You will then be prompted "Grid Size?"; enter a value of 1, then press Return. The grid will now be drawn on the screen.

<i>Before</i>	<i>After</i> 
Note: Grid Size = 1	
Step 1 - Draw Grid and Snap Grid	

The **Snap Grid** command is used to "snap" a coordinate to the grid system (your clicks will automatically snap to the nearest grid dot). Highlight the **Snap Grid** command in the **Screen** menu, and then release the mouse button. The snapping feature will now be in effect.

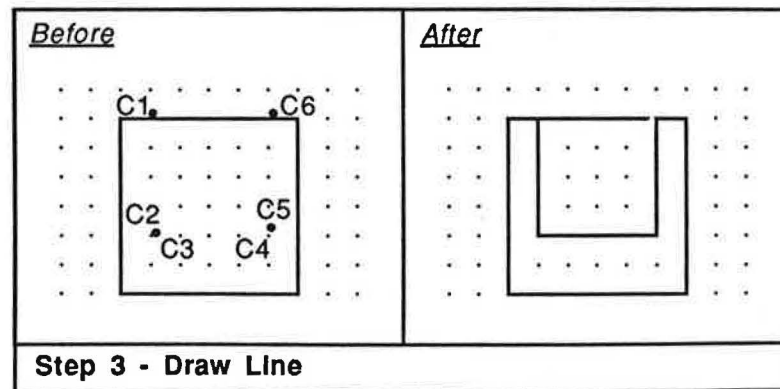
Step 2 - Draw Rectangle

The **Draw Rectangle** command is used to draw rectangles of any shape or size. Highlight the **Draw Rectangle** command in the **Entity** menu, and release the mouse button. Next, click twice (C1, C2) in such a manner that the coordinates you have specified will define the rectangle you desire. The rectangle will be drawn accordingly.



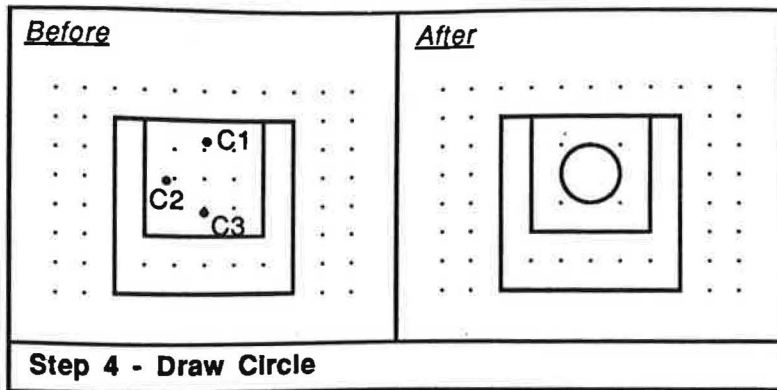
Step 3 - Draw Line

The **Draw Line** command is used to draw a straight line between two coordinates. Highlight the **Draw Line** command in the **Entity** menu, and release the mouse button. Next click once (C1) where you would like the line to begin, and once (C2) where you would like it to end. The line will now be drawn between the two coordinates. Continue drawing the next two lines, clicking at C3, C4 and C5, C6 respectively.



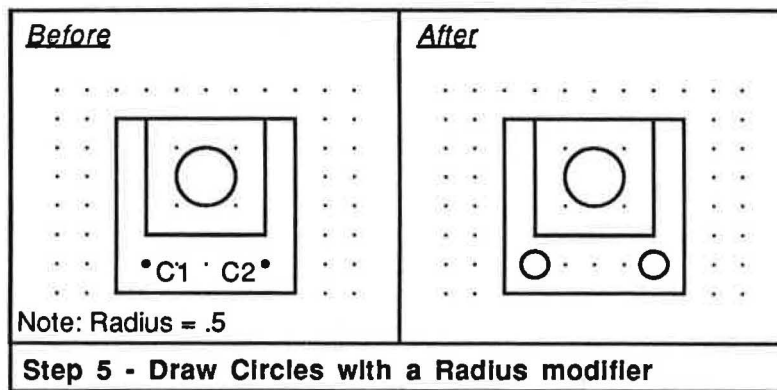
Step 4 - Draw Circle

The **Draw Circle** command is used to draw circles. Highlight the **Draw Circle** command in the **Entity** menu, and release the mouse button. Next, click three times (C1, C2, C3) in such a manner as to define the circumference of the circle. The circle will be drawn, passing through the three coordinates you have specified.



Step 5 - Draw Circles with a Radius modifier

The **Radius** modifier is used to modify the **Draw Circle** and **Draw Arc** commands, and will allow you to specify the exact radius of a circle or arc. After you have selected the **Draw Circle** command from the **Entity** menu, highlight the **Radius** modifier in the **<-Modify** menu, and release the mouse button. Next click once (C1) where you would like the center, or "origin", of the circle to be. You will be prompted "Radius?"; enter a value of .5, and press Return. The circle will now be drawn according to the specified radius. Continue by drawing the second circle clicking at C2, then entering a value of .5 for the Radius.



You have now completed **Draw Tutorial Level 1**. Proceed with the following tutorial to experience some of the more advanced features of discoverCAD.

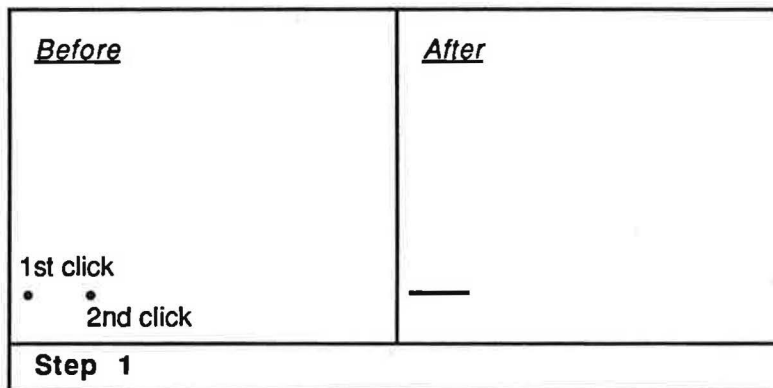
DRAW TUTORIAL LEVEL 2

In this tutorial you will be shown step by step how to draw a simple isometric cube with an ellipse, and in the process learn several important CAD techniques. Among the commands featured are **Zoom Origin**, **Zoom Window**, **Draw Line** with the **None**, **Length**, **Vertical**, **Horizontal**, **Parallel**, and **Angle** modifiers, **Erase Line**, **Draw Arc** with the **Radius** modifier, **Draw Point** with the **Intersect** modifier, **Erase Point**, **Draw Linear Dim** with the **Vertical** and **Point to Point** modifiers, **Move Copy**, and **End** and **Origin** masking.

Before you begin this procedure, please refer to the **Introduction** chapter to familiarize yourself with basic command and coordinate selection. This tutorial assumes you have properly configured your computer, know how to start the discoverCAD system, and are familiar with the use of the mouse and menus.

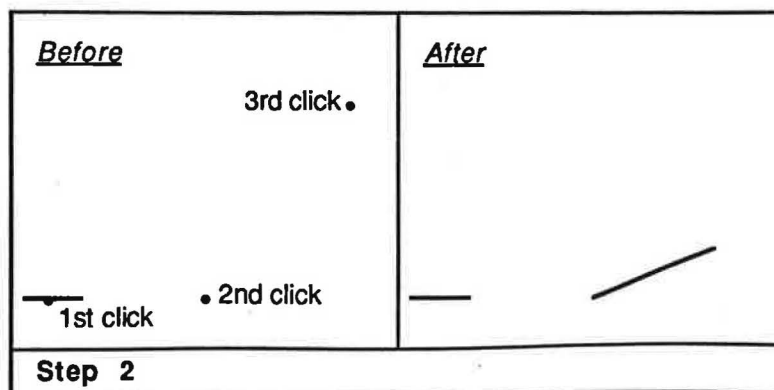
Step 1

Select the **Draw Line** command from the **Entity** menu, then the **Horizontal** modifier from the first **<-Modify** menu. Draw a small horizontal line near the lower left corner of the screen to serve as a reference for the **Draw Line Angle** command as used in the steps that follow.



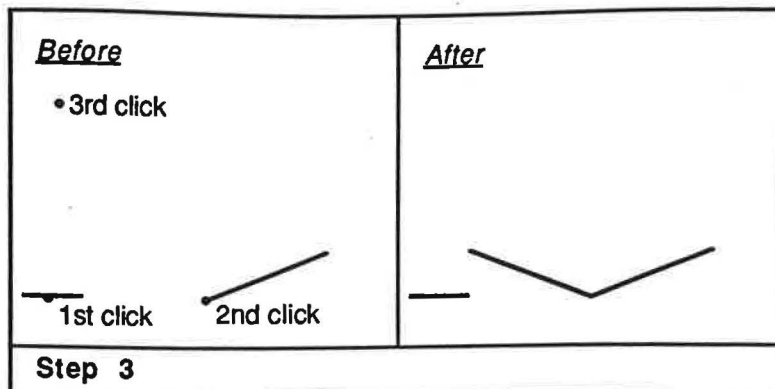
Step 2

Select both the **Angle** modifier, then the **Length** modifier from the first **<-Modify** menu. Click once on the horizontal line you created in step 1 above. Enter a value of 30 degrees for the angle, then press Return. Click once near the lower middle of the screen. Enter a value of 4 for the length, then press Return. Click once near the upper right corner of the screen to draw the first line of the cube.



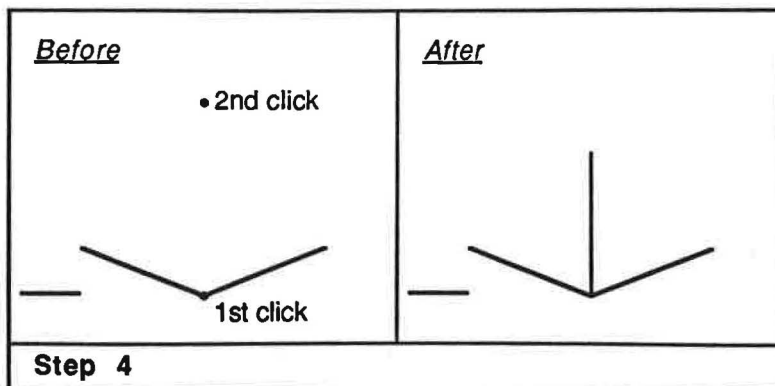
Step 3

Click once on the horizontal line you created in step 1 above. Enter a value of 150 degrees for the angle, then press Return. Select the **End** mask from the **Mask** menu. Click once near the bottom end of the 30 degree line you created in step 2 above. Enter a value of 4 for the length, then press Return. Click once near the upper left corner of the screen.



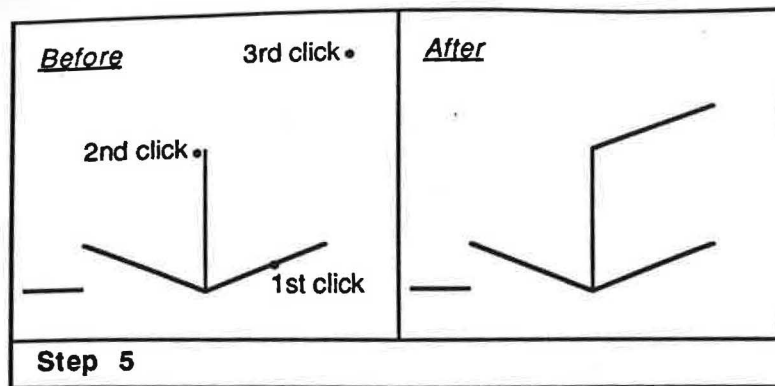
Step 4

Select the **Vertical** modifier from the first **<-Modify** menu. Select the **End** mask from the **Mask** menu. Click once near the intersection of the two lines you created in steps 2 and 3 above. Enter a value of 4 for the length, then press Return. Click once near the upper middle of the screen.



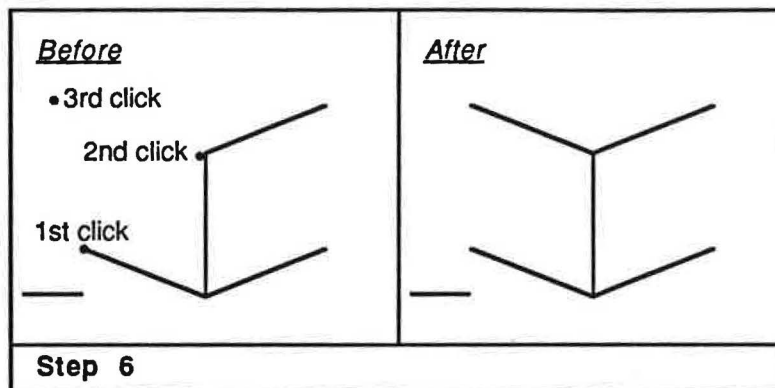
Step 5

Select the **Parallel** modifier from the first **<-Modify** menu. Click once on the 30 degree line you created in step 2 above. Select the **End** mask from the **Mask** menu. Click once near the top end of the vertical line you created in step 4 above. Enter a value of 4 for the length, then press Return. Click once near the upper right corner of the screen.



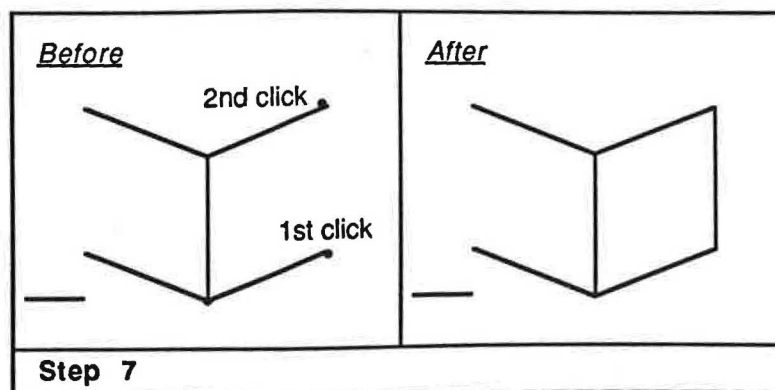
Step 6

Click once on the 150 degree line you created in step 3 above. Select the **End** mask from the **Mask** menu. Click once near the top end of the vertical line you created in step 4 above. Enter a value of 4 for the length, then press Return. Click once near the upper left corner of the screen.



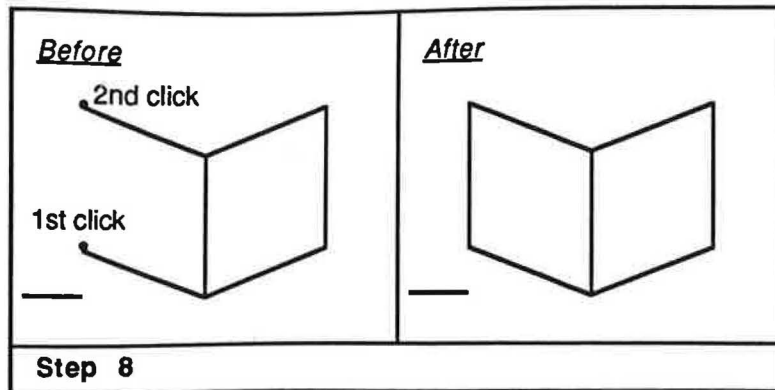
Step 7

Select both the **None** modifier, then the **Length** modifier from the first **<-Modify** menu. Select the **End** mask from the **Mask** menu. Click once near the right end of the 30 degree line you created in step 2 above. Select the **End** mask from the **Mask** menu. Click once near the right end of the parallel line you created in step 5 above.



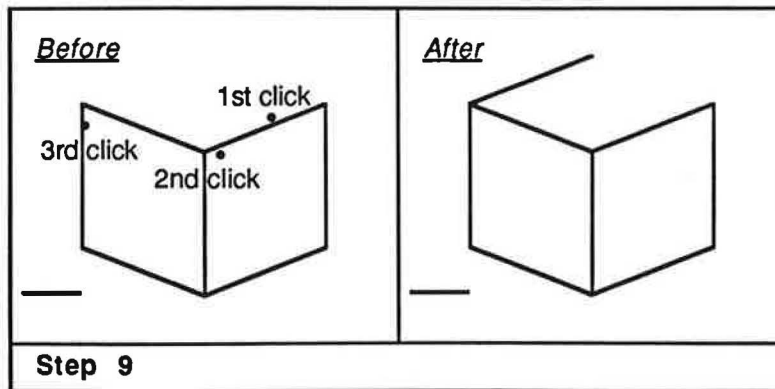
Step 8

Select the **End** mask from the **Mask** menu. Click once near the left end of the 150 degree line you created in step 3 above. Select the **End** mask from the **Mask** menu. Click once near the left end of the parallel line you created in step 6 above.



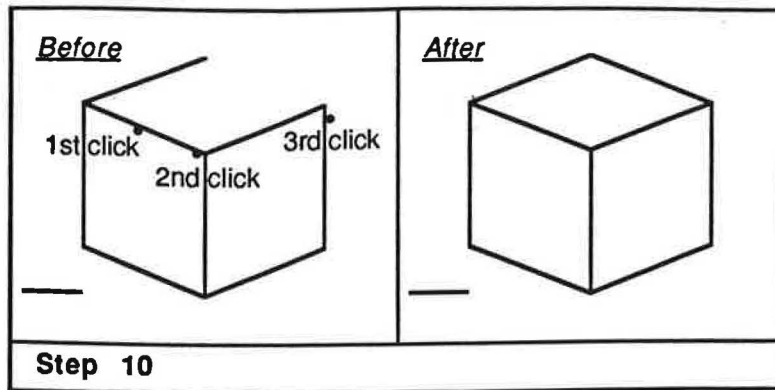
Step 9

Select the **Move Copy** command from the **Edit** menu. Click once on the parallel line you created in step 5 above. Select the **End** mask from the **Mask** menu. Click once near the left end of the parallel line you created in step 5 above. Select the **End** mask from the **Mask** menu. Click once near the top end of the line you created in step 8 above.



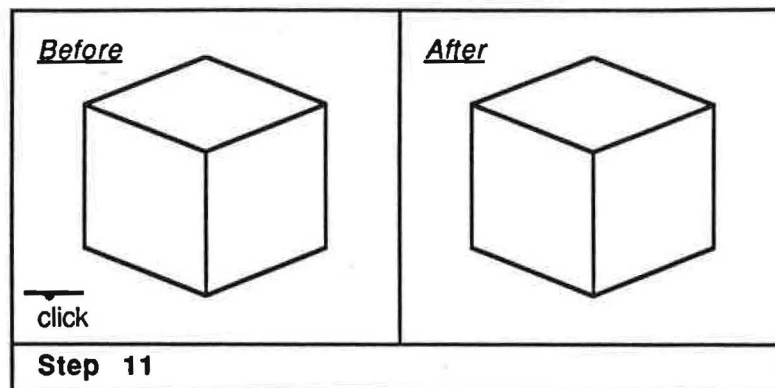
Step 10

Click once on the parallel line you created in step 6 above. Select the **End** mask from the **Mask** menu. Click once near the right end of the parallel line you created in step 6 above. Select the **End** mask from the **Mask** menu. Click once near the top end of the line you created in step 7 above.



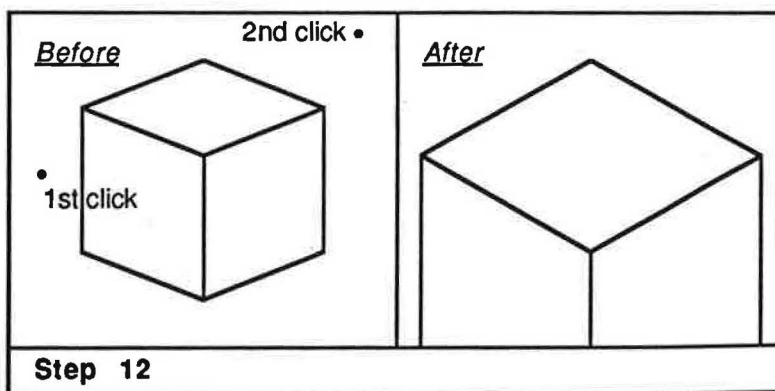
Step 11

Select the **Erase Line** command from the **Entlty** menu. Click once on the horizontal line you created in step 1 above.



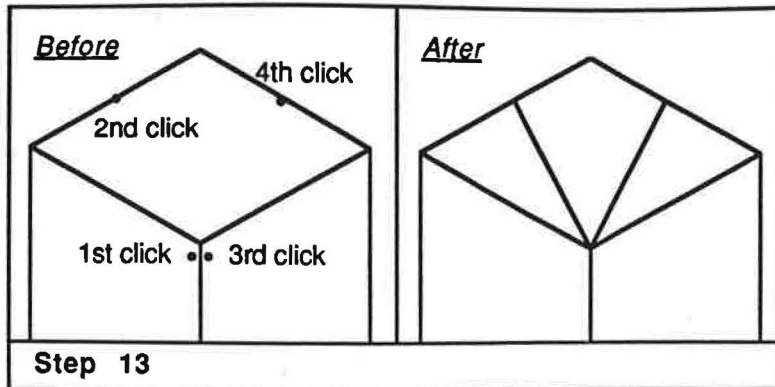
Step 12

Select the **Zoom Window** command from the **Screen** menu. Click twice in such a manner as to define a "window" that will surround the top of the isometric cube.



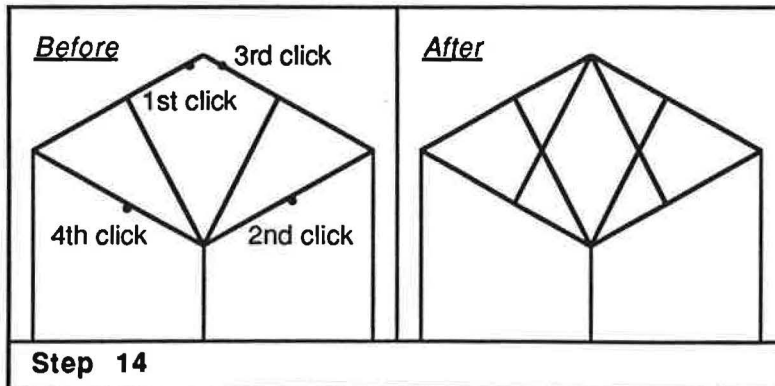
Step 13

Select the **Draw Line** command from the **Entity** menu. Select the **End** mask from the **Mask** menu. Click once near the vertical line you created in step 4 above. Select the **Origin** mask from the **Mask** menu. Click once on the line you created in step 9 above. Select the **End** mask from the **Mask** menu. Click once near the vertical line you created in step 4 above. Select the **Origin** mask from the **Mask** menu. Click once on the line you created in step 10 above.



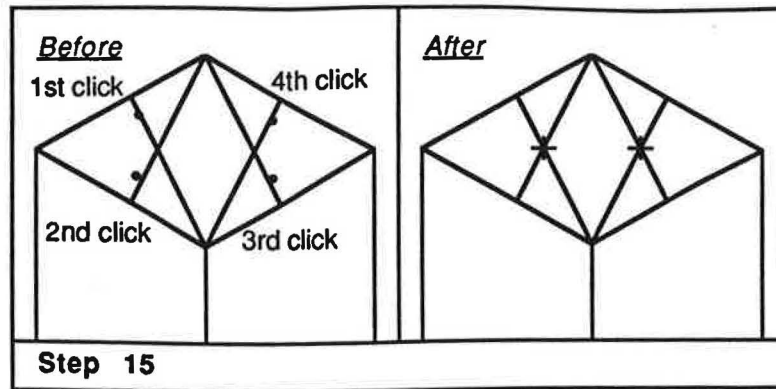
Step 14

Select the **End** mask from the **Mask** menu. Click once near the intersection of the two lines you created in steps 9 and 10 above. Select the **Origin** mask from the **Mask** menu. Click once on the parallel line you created in step 5 above. Select the **End** mask from the **Mask** menu. Click once near the intersection of the two lines you created in steps 9 and 10 above. Select the **Origin** mask from the **Mask** menu. Click once on the parallel line you created in step 6 above.



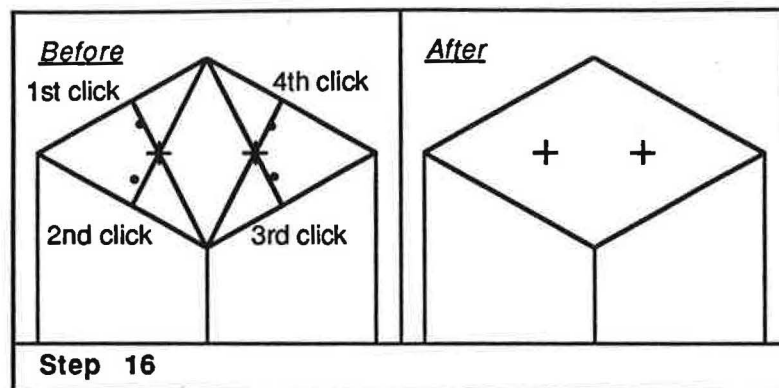
Step 15

Select the **Draw Point** command from the **Entity** menu, then the **Intersect** modifier from the first **<-Modify** menu. Click once on first line you created in step 13 above. Click once on second line you created in step 14 above. Click once on second line you created in step 13 above. Click once on first line you created in step 14 above.



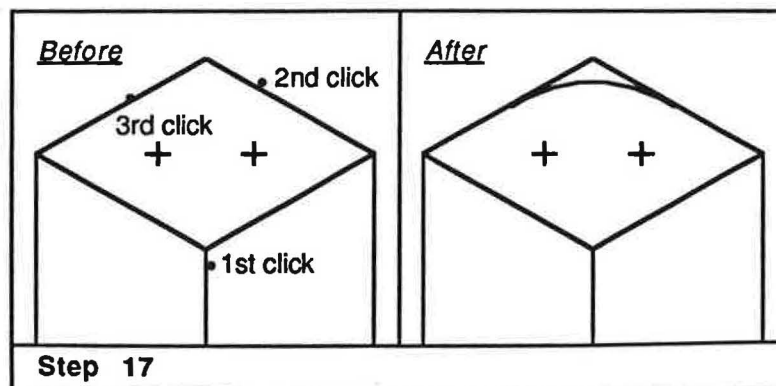
Step 16

Select the **Erase Line** command from the **Entity** menu. Click once on each of the four lines you created in steps 13 and 14 above.



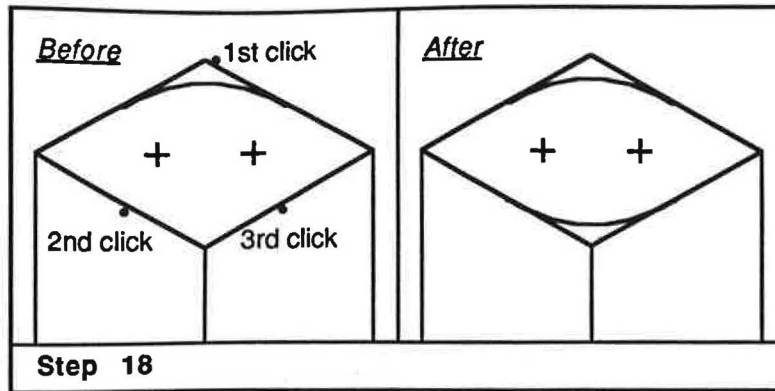
Step 17

Select the **Draw Arc** command from the **Entity** menu, then the **Radius** modifier from the first **<-Modify** menu. Select the **End** mask from the **Mask** menu. Click once near the vertical line you created in step 4 above. Press Return without entering a value for the radius. Select the **Origin** mask from the **Mask** menu. Click once on the line you created in step 10 above. Select the **Origin** mask from the **Mask** menu. Click once on the line you created in step 9 above.



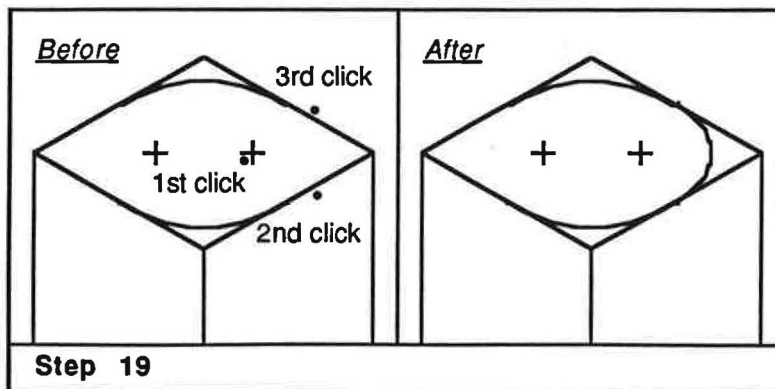
Step 18

Select the **End** mask from the **Mask** menu. Click once near the intersection of the two lines you created in steps 9 and 10 above. Press Return without entering a value for the radius. Select the **Origin** mask from the **Mask** menu. Click once on the parallel line you created in step 6 above. Select the **Origin** mask from the **Mask** menu. Click once on the parallel line you created in step 5 above.



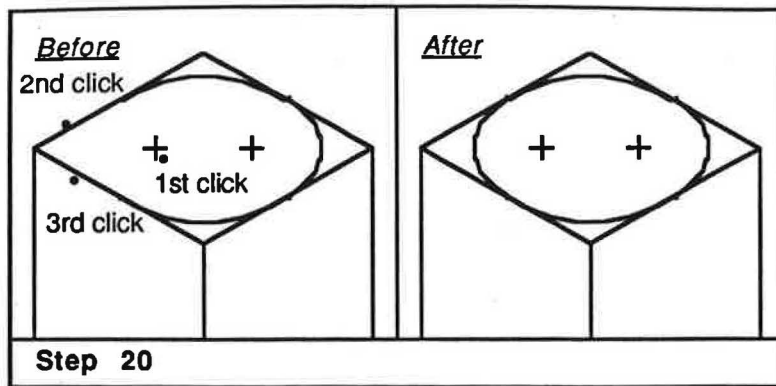
Step 19

Select the **Origin** mask from the **Mask** menu. Click once near the right most point you created in step 15 above. Press Return without entering a value for the radius. Select the **Origin** mask from the **Mask** menu. Click once on the parallel line you created in step 5 above. Select the **Origin** mask from the **Mask** menu. Click once on the line you created in step 10 above.



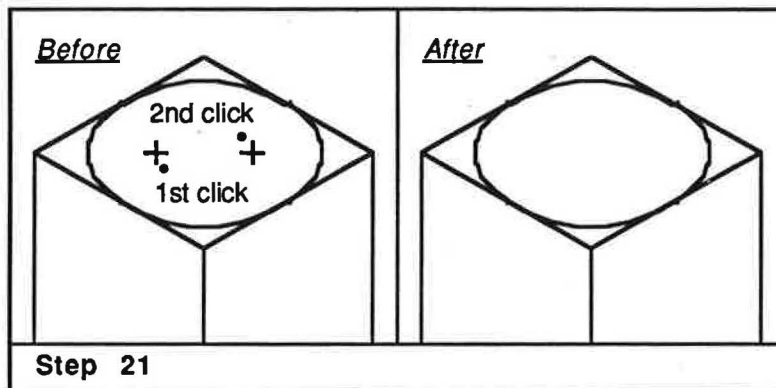
Step 20

Select the **Origin** mask from the **Mask** menu. Click once near the left most point you created in step 15 above. Press Return without entering a value for the radius. Select the **Origin** mask from the **Mask** menu. Click once on the line you created in step 9 above. Select the **Origin** mask from the **Mask** menu. Click once on the parallel line you created in step 6 above.



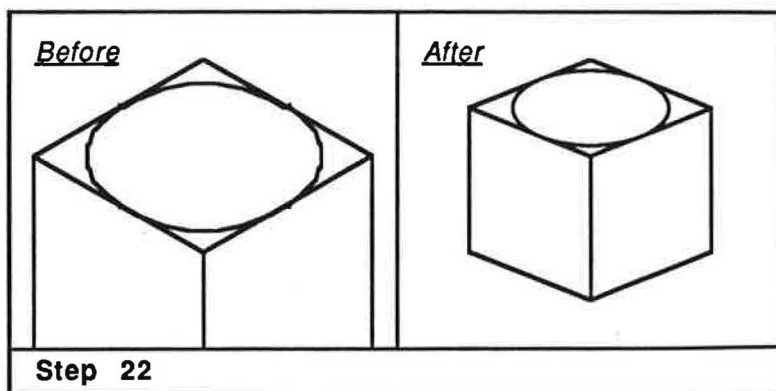
Step 21

Select the **Erase Point** command from the **Entity** menu. Click once on each of the points you created in step 15 above.



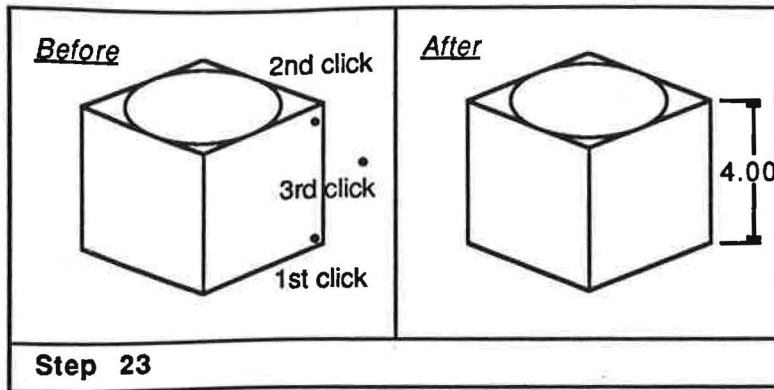
Step 22

Select the **Zoom Origin** command from the **Screen** menu.



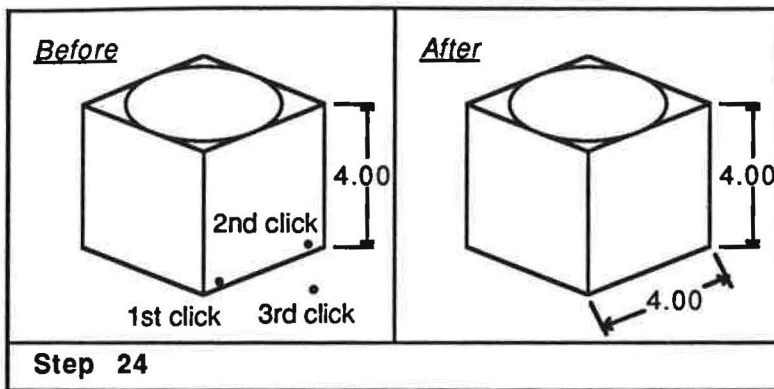
Step 23

Select the **Draw Linear Dim** command from the **Text & Dimension** menu, then the **Vertical** modifier from the second **<-Modify** menu. Click once near the bottom end of the line you created in step 7 above. Click once near the top end of the line you created in step 7 above. Click once where you would like the dimension text to be placed.



Step 24

Select the **Point to Point** modifier from the second **←Modify** menu. Click once near the left end of the line you created in step 2 above. Click once near the right end of the line you created in step 2 above. Click once where you would like the dimension text to be placed.



As you can see from this example, discoverCAD allows you great flexibility when creating and modifying drawings. Now that you have this simple drawing completed, try experimenting with some of the other discoverCAD commands to see what you can create on your own.

Appendix B

SYMBOL TUTORIAL

In this tutorial you will be shown step by step how to create and utilize a simple symbol file, and in the process learn several important discoverCAD techniques. Among the commands featured are **Save**, **Merge**, **Symbol**, **Draw Grid**, **Snap Grid**, **Use Layer**, **Erase Layer**, **Draw Line**, **Draw Rectangle**, **Draw Circle** with a **Radius** modifier, **Draw Arc** with a **Radius** modifier, and **Erase All**.

Before you begin this procedure, please refer to the **Introduction** chapter to familiarize yourself with basic command and coordinate selection, and the **Draw Tutorial** appendix to acquaint yourself with the creation of basic entities (i.e. lines, circles, arcs, points). This tutorial assumes you have properly configured your computer, know how to start the discoverCAD system, are familiar with the use of the mouse and menus, and know how to draw basic entities. It is also advisable to review the **File Menu** chapter before you begin.

Directions

The purpose of this tutorial is to construct the drawing depicted in the After diagram of step 9D; simply follow the steps below in order to achieve the final drawing. Each step has an general overview of what the command can be used for, and how to use it. Also included is an illustration of what the screen should look like before and after you use the command. When entering a coordinate for a command (i.e. clicking the mouse button), see the Before screen for the proper location of your click(s) (count the grid dots in each diagram to make your drawing appear exactly as in the diagrams). The symbols C1, C2, C3, etc. will represent your 1st click, 2nd click, and 3rd click, etc. respectively. If you make a mistake during a procedure, you may need to use the **Erase** command to correct it (see the **Entlty Menu** chapter for use of the **Erase** command). If you need additional information on the operation or effect of a command, refer to the appropriate location in this manual.

Before you begin the steps below, you may wish to format a blank disk at this time if you have not already done so, or one has not been provided for you; one will be needed to save your symbol file to once its completed (see the **File Menu** chapter for more on the **Format** command).

Step 1 - Fresh Start

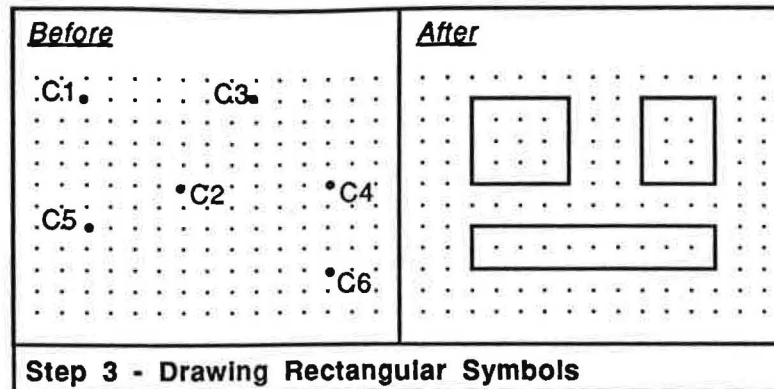
When creating a symbol file from scratch, it is advisable to start right after you have booted the discoverCAD software; that way, you are assured that none of the discoverCAD parameters have been changed in such a manner as to interfere with the creation of your symbol file. For this step boot the discoverCAD software as you normally would. Then, select the **Draw Grid** command from the **Screen** menu, and enter a value of 1 for the Grid Size. Finally, select the **Snap Grid** command to "snap" all of your coordinate entries (i.e. clicking the mouse button) to the grid dots.

Step 2 - Defining the Symbol Table Layer

Before you begin creating the symbols, it is important to decide which layer you want them to reside on. Typically, you will want to start drawing the symbols on the very last layer of the symbol file (i.e. layer 128), and work your way down from there. The logic behind this is that when you create a drawing file, you usually start with layer 1 and work your way up; when creating the symbol file, you want to do the exact opposite to insure that the layers of the symbol file will not overlap the layers of your drawing file once you **Merge** the two together. The **Merge** command will combine, or "merge" a previously saved symbol file with your current working drawing. If your symbol file has symbols on layer 127 and 128, those symbols will be merged over layer 127 and 128 of you working drawing (more on the **Merge** command later).

The **Use Layer** command is used to specify which layer to use when drawing. Select the **Use Layer** command from the **Screen** menu. Enter a value of 128 for the layer, then press Return. From now on, any drawing you do will be contained on layer 128 until you select **Use Layer** and specify a different value.
Step 3 - Creating Rectangular Symbols

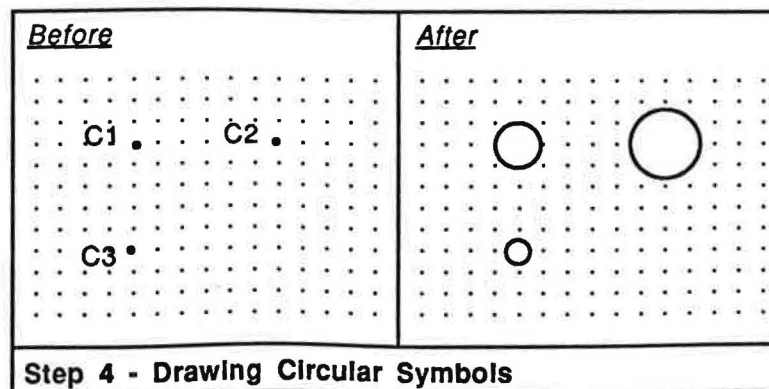
You may now create the symbols that you want to reside on layer 128. When drawing symbols, you can use any discoverCAD command with the exception of those found in the **Text & Dimension** menu; a symbol file must never, repeat never, contain text or dimensioning. Additionally, you will usually want to group symbols of a similar nature on the same layer. With this in mind, select the **Draw Rectangle** command from the **Entity** menu, and draw three rectangles clicking once each at C1 and C2, C3 and C4, and C5 and C6, respectively (obviously these "symbols" could be much more complex, but for this example rectangles will suffice).



Step 4 - Creating Circular Symbols

Now, supposing you wanted to draw some other symbols on layer 127, you would start by removing layer 128 from the display, select **Use Layer** with a value of 127, then draw your symbols.

The **Erase Layer** command is used to temporarily remove a layer from the current screen display. Please note that this command does not actually erase the layer, but merely hides it from view. Select the **Erase Layer** command from the **Screen** menu and enter a value of 128, then press Return. Layer 128 is now hidden from view. Continue by selecting the **Use Layer** command from the **Screen** menu. Enter a value of 127 for the layer, then press Return. You may now create the symbols you want to reside on layer 127. Select the **Draw Circle** command from the **Entity** menu and then select the **Radius** modifier from the **<-Modify** menu. Now, draw three circles clicking at C1, C2, and C3 for their center points and entering values of 1, 1.5, and .5 respectively for their radii. (again, these "symbols" could be much more complex, but for this example circles will suffice).



Step 5 - Saving a Symbol File

Now that you have created your symbols, you will want to save them as a symbol file. A symbol file is exactly the same as a drawing file, with the exception that the symbol file contains individual symbols rather than a drawing.

The **Save** command is used to store a drawing or symbol file that you have created with discoverCAD onto a disk that has been formatted with discoverCAD. Select the **Save** command from the **File** menu. You will then be prompted "Place drawing disk in drive #x:, then press Return." (where x represents the disk drive being used for the File Menu commands). Insert a formatted disk, and press Return. You will then be prompted "File name:". For this example name your symbol file SYM-127; by using this notation, you will know that the file contains symbols down to layer 127 (i.e. SYM designates symbol and 127 designates where the last layer of symbols reside). If you make a mistake while typing the filename, you may use the Delete or Left Arrow keys to remove the error. Now press Control Q to enter the filename (depress the Control and Q key at the same time). The symbol table will now be saved. Once the symbols have been saved, you may be prompted "Replace discoverCAD system disk 1 in drive #1; then press Return.". Replace the drawing disk with the discoverCAD system disk you may have removed, and press Return to resume discoverCAD.

Step 6 - Starting with a Clean Slate

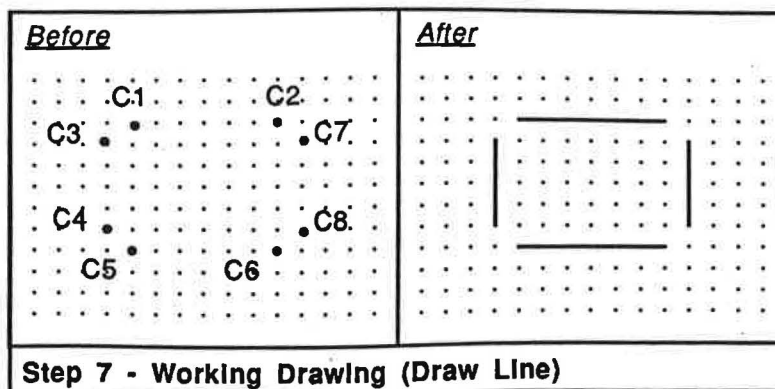
At this point you would normally have one of two options. You could either use the **Edit** command from the **File** menu to recall an existing drawing file to which you want to add symbols, or start a new drawing from scratch, then add the symbols. In either case you must first reset discoverCAD to its original startup state (i.e. clean slate). Select the **Erase Layer** command to remove layer 127 from the display, then select the **Use Layer** command to specify that you want to use layer 1 as the active drawing layer. Finally, perform the following to clear the screen of everything except the grid.

The **Erase All** command is used to permanently erase your entire drawing from the display. Select the **Erase All** command from the **Entity** menu, type in "Y" at the prompt, and the entire drawing will be erased from the screen, giving you a clean slate with which to draw (layers 127 & 128 as used in the steps above will be erased).

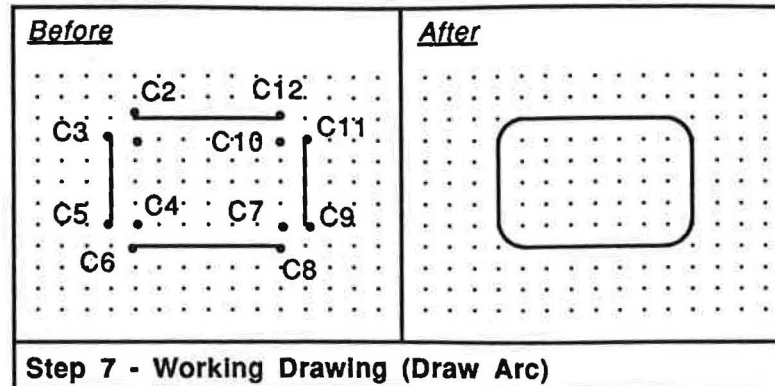
For the remainder of this tutorial, let's assume that you want to create a drawing from scratch, and then add a few of the symbols you created in the steps above.

Step 7 - Starting your Working Drawing

At this time the grid should be the only thing you see on your screen. Also, there should be a check mark next to the **Snap Grid** command in the **Screen** Menu indicating that it is turned on. To begin your drawing, simply select the **Draw Line** command and draw four lines as indicated below, clicking once each at C1 and C2, C3 and C4, C5 and C6, and C7 and C8, respectively.



Next, select the **Draw Arc** command with a **Radius** modifier and draw four arcs as indicated below. Click at C1 for the center point of the 1st arc, and press Return when prompted for a radius. Complete the arc by clicking at C2 for the beginning point and at C3 for the end point. Click at C4 for the center point of the 2nd arc and press Return when prompted for a radius. Complete the arc by clicking at C5 for the beginning point and at C6 for the end point. Continue to do this for the 3rd and 4th arcs by using C7 and C10 respectively as their radii.



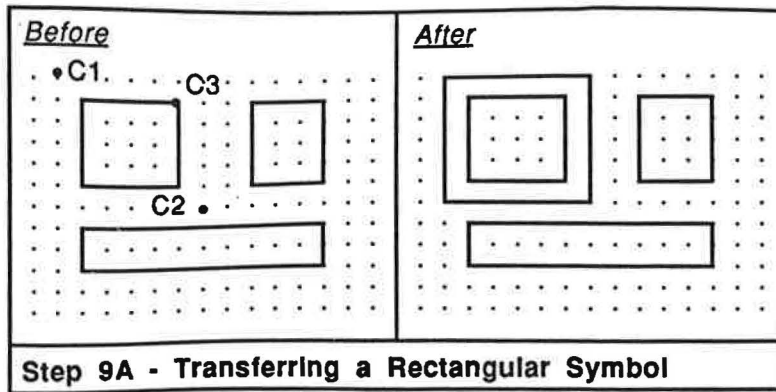
Step 8 - Merging Symbols to your Working Drawing

The **Merge** command is used to attach a symbol file that has been previously created with discoverCAD to a drawing that is currently being created or edited, thereby allowing you to later access a symbol layer using the **Symbol** command (more on the **Symbol** command in the following steps). Select the **Merge** command in the **File** menu, and release the mouse button. You will then be prompted "Place drawing disk in drive #x:", then press Return." (where x represents the disk drive being used for the File Menu commands). Insert the disk that contains the symbol file SYM-127, and press Return. You will then be prompted "File name:". Type in SYM-127 (if you make a mistake while typing the filename, you may use the Delete or Left Arrow keys to remove the error) and press Control Q to enter the filename (depress the Control and Q key at the same time). Once the symbol file has been specified, you may be prompted "Replace discoverCAD system disk 1 in drive #1; then press Return.". Replace the symbol disk with the discoverCAD system disk you may have removed, and press Return.

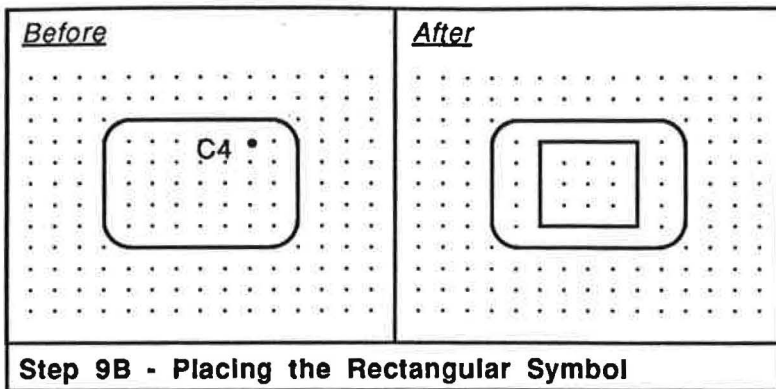
The drawing you are currently creating or editing will now be redrawn on the screen, after which you can resume discoverCAD. Please note that any symbol file you merge to your drawing becomes a permanent part of the drawing; in this example the symbol file SYM-127 is now a permanent part of the drawing you are creating, and may be accessed at any time. You may notice that the symbols are not visible, but they are there located on layers 128 and 127. It is also important to note the size of your drawing file will grow as you add symbol files to it; be careful not to get your drawing file too large. Finally, please note that you may merge more than one symbol file to your drawing; simply repeat the instructions as listed above.

Step 9 - Accessing your Symbol Tables

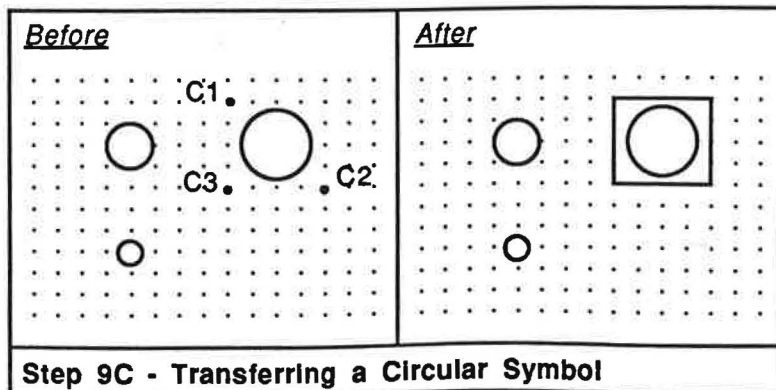
The **Symbol** command is used to copy a symbol from a layer to a drawing that is currently being created or edited. Select the **Symbol** command in the **File** menu, and release the mouse button. You will then be prompted "Copy symbol from layer number?"; type in 128, and press Return (if you press Return without entering a value for the layer, the system will exit the **Symbol** command). Next, you will be prompted "Copy symbol to layer number?"; type in 1, and press Return (again, if you press Return without entering a value for the layer, the system will exit the **Symbol** command). Finally, you will be prompted "Symbol Scaling?"; type in 1 for the desired scale of the symbol in relationship to the drawing and press Return. If you press Return without entering a value for the scaling, a value of 1 will be used. If you wanted the symbol drawing scale to be 2:1, or twice as big, you would have typed in a 2. At this time, layer 128 will be displayed.



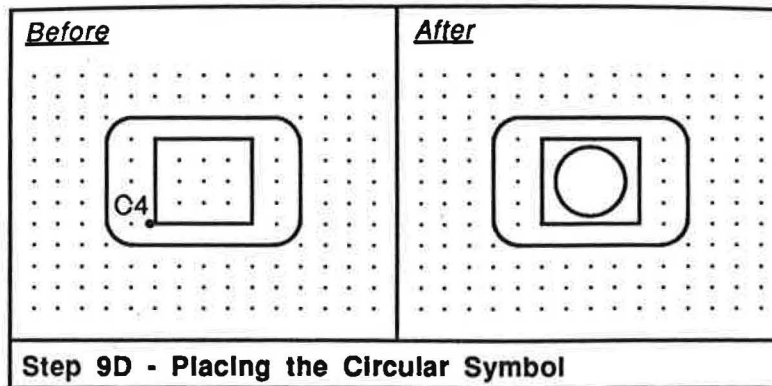
To select the symbol you wish to copy (in this example one of the rectangles you drew in step 3, click twice (C1, C2) in such a manner that the two coordinates you have specified will define a window around the desired symbol (i.e. rectangle). Having done this, click once more (C3) to indicate a point of reference on the symbol. The system will now display layer 1.



Finish by clicking once (C4) where you would like the symbol to be placed, and it will be drawn with the point of reference placed at the coordinate you specify. If you wish to copy more symbols, simply repeat the above steps, otherwise simply press Return without specifying a layer number when prompted "Copy symbol from layer number?". See if you can use the Symbol command to copy the symbols (i.e. circles) you created on layer 127. Enter a value of 127 at the prompt "Copy symbol from layer number?" and press Return. Next, you will be prompted "Copy symbol to layer number?"; type in 1, and press Return. Finally, you will be prompted "Symbol Scaling?"; type in 1 for the desired scale of the symbol in relationship to the drawing and press Return. At this time, layer 127 will be displayed.



To select the symbol you wish to copy (in this example one of the circles you drew in step 4), click twice (C1, C2) in such a manner that the two coordinates you have specified will define a window around the desired symbol (i.e. circle). Having done this, click once more (C3) to indicate a point of reference on the symbol. The system will now display layer 1.



Finish by clicking once (C4) where you would like the symbol to be placed, and it will be drawn with the point of reference placed at the coordinate you specify. If you wish to copy more symbols, simply repeat the above steps, otherwise simply press Return without specifying a layer number when prompted "Copy symbol from layer number?".

As you can see from this example, discoverCAD allows you great flexibility when creating and recalling symbols. Now that you have completed this simple example, try experimenting to see what symbols you can create on your own.

Appendix C

PRINT TUTORIAL

discoverCAD allows you to print your drawing to a variety of Dot Matrix Printers from the Apple IIC, IIE, and IIGS computers. To do this you must use the Triple Dump screen dump program by Beagle Brothers, available from Hearlihy & Co. (Hearlihy #A110 - \$31.95). Please note that the output you receive from the printer will not be quite as exact as the output a plotter would produce.

Before you begin this procedure, please refer to the Triple Dump Owner's Manual to properly configure Triple Dump (DOS 3.3 Version only, side one) for your printer and interface card. Once all the proper connections have been made, follow the steps shown below to correctly print your drawing.

Step 1

Position your drawing on the screen exactly as you would like to see it appear on paper. You may want to use the **Layer**, **Zoom**, and **Pan** commands to help position the drawing (see **Screen Menu** chapter). Please note that during the printing process there will be several screen prompts that appear at the bottom of the screen; you may want to position your drawing so that those prompts won't affect it. Also, please note that you should save your drawing using the **Save** command found in the **File** menu before using this command, as you will not be able to retrieve your drawing after printing if it has not been saved to disk.

Step 2

Highlight the **Printer** command in the **Plot** menu, and release the mouse button. You will then be prompted "WARNING: Wish to save drawing before printing? (Y/N)". If you press Y, the system will exit the **Printer** command, thereby allowing you the chance to save your drawing before printing. If you press N, you will then be prompted "Replace discoverCAD disk(s) with Triple Dump disk, then press RETURN."; remove the discoverCAD system disk(s), insert the Triple Dump DOS 3.3 disk into the startup disk drive, and press Return. Please note that if you are using an Apple IIC or IIE, you should put the Triple Dump disk (DOS 3.3 version, side one) in the first disk drive. If you are using an Apple IIGS, you should put the Triple Dump disk (DOS 3.3 version, side one) in the first 5.25" disk drive. In order to load a program from a 5.25" disk when using the Apple IIGS, you must have the IIGS Start Up SLOT set to SCAN in the Control Panel. You will then be prompted "WARNING: Wish to reboot system now? (Y/N)". If you press N, the system will exit the **Printer** command. If you press Y, the computer will restart itself, after which time Triple Dump will be loaded and running (your discoverCAD drawing will still reside in the computer's memory).

Step 3

After approximately 10 seconds, the Triple Dump banner will appear. You will then be prompted "<R> RUN TRIPLE DUMP, <Q> QUIT"; type R to start the program, and the Triple Dump menu will appear on the screen. Next, use the directional arrows to highlight the **TYPE** command, and press Return (TYPE should now display **DOUBLE HI-RES**). Now, press the Space Bar to view your drawing (this is what will be printed to your Dot Matrix Printer). Press the Space Bar again to return to the Triple Dump menu. At the top of the Menu you will notice the **PRINTER** and **INTERFACE** commands. Unless the configuration shown matches your current hardware setup, you will have to use the **CHANGE PRINTER** and **CHANGE INTERFACE** commands to specify the printer and interface you are using (if you are a IIGS user, select **APPLE FIRMWARE** for the **INTERFACE** selection). After configuring, select **SAVE PRINTER INFO** to save your hardware setup to the Triple Dump disk. Finally, select **PRINT PICTURE** and follow the prompts to print your drawing.

Step 4

If, after having printed your drawing it looks disproportionate (i.e. flattened circles), you may want to use the **MAGNIFY X** and **MAGNIFY Y** commands to achieve a better proportioned printout. In testing an ImageWriterII, we have found that **X = 1, Y = 2** works well. If you would like a white background with black lines versus a black background with white lines, change the **NEGATIVE** command from **NO** to **YES**. If you wish to remove the discoverCAD Menu Bar from the top of the printout, select the **CROP PICTURE** command and press Return. Next, press the **T** key. Now, press the right directional arrow key approximately twelve times until the Menu Bar is not inside the flashing rectangle called the **CROP WINDOW**, and press Return. Finally, select **PRINT PICTURE** and follow the prompts to reprint your drawing.

Printing with discoverCAD from the IIGS to serial printers can also be accomplished via the FingerPrint GSi Screen Dump Utility Card, available from Hearlihy & Co. (Hearlihy #7444GS \$127.50). Having installed the card per the FingerPrint Users Manual (make sure switch 8 is OFF, see page 9), the FingerPrint GSi accessories menu may be accessed from the discoverCAD screen as follows: First, move the arrow cursor into the far right corner of the menu bar. Then, while holding down the mouse button, press the red FingerPrint GSi activator button and release it. The FingerPrint menu will then appear, and may be utilized as described in the FingerPrint Users Manual.

Printing with discoverCAD from the IIGS to parallel printers can also be accomplished via the ProGrappler Printer Interface Card, available from Orange Micro, Inc., 1400 N. Lakeview Ave., Anaheim, CA 92807 (714) 779-2772. Having installed the card per the ProGrappler Operator's Manual, the ProGrappler accessories menu may be accessed from the discoverCAD screen as follows: First, move the arrow cursor into the far right corner of the menu bar. Then, enter the IIGS Desk Accessories program by pressing the Open Apple, Control, and Escape keys simultaneously. If the ProGrappler Printer Interface Card has been properly installed, the ProGrappler option should now appear in the Desk Accessory menu; highlight it and press Return. The ProGrappler menu will then appear, and may be utilized as described in the ProGrappler Operator's Manual.

XON/XOFF

2400 BPS

Appendix D

PLOT TUTORIAL

LOCAL

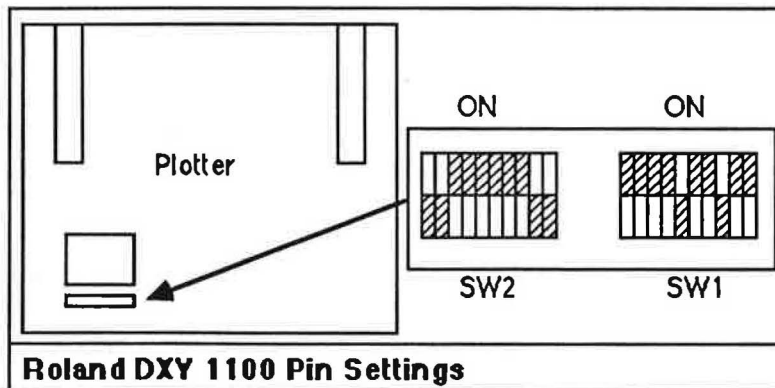
discoverCAD allows you to plot your drawing to a variety of graphics plotters from the Apple IIC, IIE, and IIGS computers. Please note that the output you receive from the plotter will be more exact than the output a printer would produce. Before you begin this procedure, take the time to insure that the computer is able to communicate properly with the plotter.

First, it may be necessary to configure your plotter for use with discoverCAD by setting the plotter's dip switches (these switches are usually found on the back of the plotter). Listed below are the dip switch settings for all of the plotters currently supported by discoverCAD.

Apple Plotter: From left to right, while directly facing the back of the plotter, the pins are set OFF ON OFF OFF ON ON OFF ON.

Roland DXY 880/980: From left to right, while directly facing the back of the plotter, the pins for BANK 1 are set D D D D U D D U D D, and the pins for BANK 2 are set D U D U D D U D D D, where D is down and U is up.

Please note that the Roland DXY 1100 plotter may be used in lieu of the DXY 880, and must be configured as follows: From left to right, while leaning over the front of the plotter, the pins for SW2 are set ON ON OFF OFF OFF OFF OFF OFF ON ON, and the pins for SW1 are set OFF OFF OFF OFF ON OFF OFF ON OFF OFF.



Houston Instrument PC695: From left to right, while directly facing the back of the plotter, the pins are set D U D D D U, where D is down and U is up.

Houston Instrument DMP40: No setting required (this includes any other HI DMP series A/B plotters).

Houston Instrument DMP41: No setting required (this includes any other HI DMP series C/D plotters).

Hewlett Packard 7470: From left to right, while leaning over the front of the plotter, the pins are set 0 0 0 1 1 0 0 0.

Hewlett Packard 7475: From left to right, while leaning over the front of the plotter, the pins are set 0 0 0 1 0 1 0 0 0.

Second, make sure to use the correct cable for the plotter and computer being used. Cables for Apple, Roland, Houston Instrument, and Hewlett Packard plotters are available from Hearlihy & Co. Attach the appropriate cable to the plotter as described in the plotter's owners manual, and to the computer as described below (please note that in all cases you should connect the plotter cable to the computer before you turn the power on, otherwise you may experience difficulty when plotting):

Apple IIC: Connect the cable to Port 2 of the computer.

Apple IIE: Connect the cable to the serial card (see below).

Apple IIGS: Connect the cable to the Modem Port of the computer.

Third, it may be necessary to configure your computer for plotting with discoverCAD by setting the computer's serial interface. Listed below are the settings for all of the computers currently supported by discoverCAD.

Apple IIC: Plotting from the Apple IIC with discoverCAD is accomplished using Port 2, and there is no setting required.

Apple IIE: Plotting from the Apple IIE with discoverCAD requires the use of a serial card. If you plan to use the Apple Super Serial Card configure it for use with a plotter as follows (please note that it may be wise to jot down the current settings of the Super Serial Card before you change them): First, set the dip switches on the card; from left to right, while directly facing the card, the pins for BANK 1 are set OFF ON OFF ON OFF ON ON, and the pins for BANK 2 are set ON OFF OFF ON OFF OFF OFF. Next, make sure the Jumper Block is pointing downward to TERMINAL. Now, install the Apple Super Serial Card card in slot 2 of the computer. The IIE will remember your new configuration, and use it in all subsequent sessions with the computer. If you plan to use the Envoy serial card, see the **Technical Notes** appendix for its settings.

Apple IIGS: Plotting from the Apple IIGS with discoverCAD is accomplished using the Modem Port. Configure the port for use with a plotter as follows: First, enter the IIGS Desk Accessories program by pressing the Open Apple, Control, and Escape keys simultaneously. Next, select the Control Panel option, then the Modem Port option (use the directional arrow keys to highlight the desired command). Now, set Device Connected to Printer, not Modem; set Line Length to 80, not Unlimited; set Baud to 2400, not 1200. Finally, press Return to save your configuration, then exit the Control Panel, then the Desk Accessories program. The IIGS will remember your new configuration, and use it in all subsequent sessions with the computer. Please note that plotting may also be accomplished using an Apple Super Serial Card installed in slot 2 of the IIGS (see IIE instructions above).

Once all the proper connections have been made, follow the steps shown below to correctly plot your drawing.

Step 1

Position your drawing on the screen exactly as you would like to see it appear on paper (what you see on screen is exactly what will be plotted). You may want to use the **Layer**, **Zoom**, and **Pan** commands to help position the drawing (see **Screen Menu** chapter). Please note that you should save your drawing using the **Save** command found in the **File** menu before using this command in the event that there is a malfunction during plotting. Also, please note that if you will be plotting from the printer port it is worthwhile to review the **Slot Number** command as outlined in the **Introduction** chapter or **Technical Notes** appendix (under Apple IIC Plus).

Step 2

Highlight the **Plotter** command in the **Plot** menu, and release the mouse button. Any subsequent output will now be sent to the plotter instead of the screen (when plotter is on, the command will have a check mark next to it in the **Plot** menu). Please note that this command will automatically shut itself off after the **Redraw** or **Draw Layer** command has been used.

Step 3

Highlight the appropriate command for the plotter you are using (ex. **Roland DXY**) in the **Plot** menu, and release the mouse button. If the plotter you are using supports more than one paper size, you will be prompted for the paper size to use (ex. A or B); type in the desired paper size, and press Return. The system will then initialize the plotter for the plotting process.

Step 4

Highlight the **Redraw** command in the **Screen** menu, and release the mouse button. Your drawing will now begin to plot on the plotter.

Please note that had you constructed your drawing using several layers, and wanted to plot them separately using a different color pen for each one, you would have used the **Draw Layer** command instead of **Redraw** in **Step 4**. Then, after the first layer was finished plotting, you would reselect the **Plotter** command (please note that this command will automatically shut itself off after the **Redraw** or **Draw Layer** command has been used), use the **Pen Number** command to switch pens (see the **Plot Menu** chapter), and then plot the next layer, once again using the **Draw Layer** command. Simply follow this procedure until all the layers of your drawing have been plotted (see the **Helpful Hints** appendix for a more detailed explanation of this procedure).

Appendix E

HELPFUL HINTS

The **Helpful Hints** appendix contains any miscellaneous helpful hints, and is meant to serve as a quick reference for any questions or problems you may have regarding a specific command or operation.

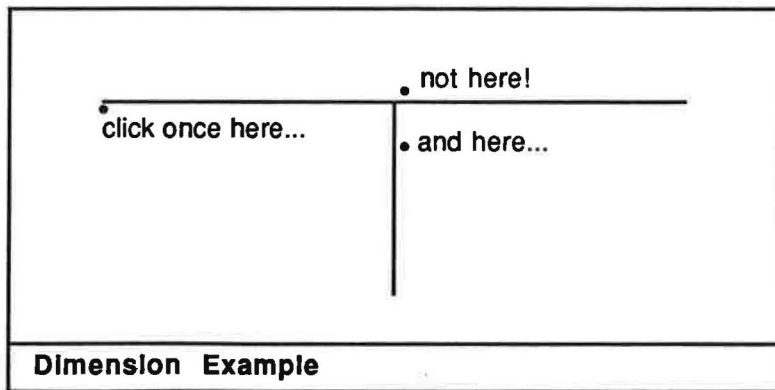
The commands or operations for which these suggestions pertain to appear in alphabetical order.

Deleting Files

To permanently erase any unwanted discoverCAD drawing files on your drawing disk, you can use any utility disk capable of erasing a Pascal file. The utilities disk that comes with the Apple IIC and Apple IIGS is capable of erasing such a file; Apple IIE users will have to use one of the many utilities disks available.

Dimensioning

1) Occasionally you may find that a dimension you have created is extended from an entity other than the one you desired, especially when you are trying to dimension an entity in the midst of several other entities. You may find it useful to zoom in on the area before you try to dimension, thereby making it easier to distinguish between the entities. Also, make sure to place your clicks carefully when specifying the entity to be dimensioned (see diagram below).



Supposing you wanted to dimension the distance between the left end of the horizontal line and the top end of the vertical line as depicted above, you would place your clicks as shown. Had your second click been placed in the area marked "not here!" in the diagram, the system may have mistakenly dimensioned the distance between the ends of the horizontal line. If you are still having problems dimensioning the correct entity, you may have to remove the obstructing entities and replace them after you have finished the dimension.

2) If you are having difficulty erasing a diameter, radial, or linear dimension, insure that you have selected the proper erase command for the type of dimensioning you are trying to erase by reselecting the command from the menu (i.e. you can't erase a linear dimension with **Erase Radial Dim!**). Also, remember that you must click at the lower left hand corner of the dimension text to erase the whole dimension; any other location will not work (it may take several clicks to locate this area). Finally, if you have the **Snap Grid** command in effect, turn it off; it may be causing your click to snap to the nearest grid dot instead of the dimension text.

Drawing Backup

It is possible to backup your drawing disk by using the utilities disk that came with your Apple IIC, Apple IIE, or Apple IIGS computer.

Draw Grid

When drawing a grid, it is helpful to know exactly how and when to do so in order to save as much time as possible (i.e. depending on the density of the grid being drawn, it can take up to several minutes for a grid to be drawn). By following this example, you can avoid wasting valuable drawing time: Suppose you are about to do some detailed work on your drawing, and have just performed the **Zoom Window** command to enlarge the drawing. Now you decide to display a fairly dense grid, and use the **Draw Grid** command with a size of 0.0625 units, or 1/16" to do so. Later, having completed your detailed work, you decide to use **Zoom Origin** to return to the original scaling of your drawing, but before doing so, you wish to remove the grid currently displayed. You could use the **Draw Grid** command to remove the grid (and thereby waste time waiting for the grid to be erased), but there is a better way. Knowing that the grid is too dense (i.e. size = 0.0625) to be drawn at the original scaling, you proceed with the **Zoom Origin** anyway. You will then be prompted "WARNING: Grid too small. Press RETURN to continue."; press Return, and your drawing will be redrawn without the grid. Next, execute the **Draw Grid** command. Once again, you will be prompted "WARNING: Grid too small. Press RETURN to continue."; press Return, and the grid will have been erased without you having had to wait for it to be drawn. As a general rule of thumb, a grid size of 0.15 or smaller will result in a grid too dense to be drawn at the original scaling (i.e. **Zoom Origin**).

Draw Line Angle

When using the **Draw Line** command in conjunction with the **Angle** modifier, you may find it helpful to use the following example in order to insure that the line you draw is of the desired angle, direction, and length:

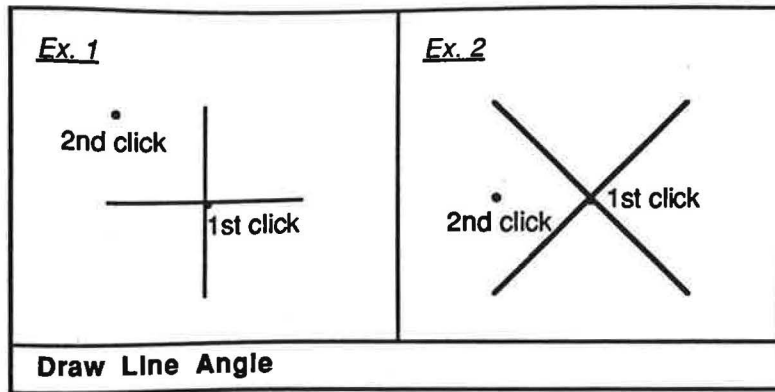
First, use the **Draw Line** command with the **Horizontal** modifier to draw a line that will serve as a reference.

Second, select the **Angle** modifier, and click once on the horizontal line you created in the step above (the angle of the new line will be based on its relationship to the horizontal line).

Third, enter a value of 150 degrees for the angle and press Return.

Fourth, click once where you would like the angular line to start. This click also theoretically defines the origin of the quadrant system as used in the step below.

Fifth, click once where you would like the angular line to end. It is at this step that you will typically want to click in the quadrant where the angle (and resulting line) will lie. In this example, since the angle (i.e 150 degrees) lies in the 2nd quadrant, click in the second quadrant to define the length of the angular line (see Ex. 1 in the diagram below). Please note that had the line you used as a reference in the example above not been horizontal, you would have had to adjust the coordinate you specify to define the length accordingly. Ex. 2 in the diagram below shows the appropriate coordinate placement for an angular line of 150 degrees that used a 45 degree line as a reference.



Dual Printer/ Plotter Configuration

It is possible to have both a printer and plotter connected to your computer configuration at the same time, thereby allowing you the flexibility of either printing or plotting your drawing.

Apple IIC: Simply connect the printer to the printer port, and the plotter to the modem port.

Apple IIE: Connecting both a printer and plotter to your IIE configuration requires that you have two serial cards (use either the Apple Super Serial Card available from any Apple dealer, or the Envoy Serial Card available from Hearlihy & Co.). Place the card to be used for the printer in slot 1 of the IIE, and the card to be used for the plotter in slot 2 (see the **Plot Tutorial** for the dip switch settings of the card being used for plotting). Now, simply connect the printer and plotter to the appropriate serial card.

Apple IIGS: Simply connect the printer to the printer port, and the plotter to the modem port (see the **Plot Tutorial** for the modem port settings). Please note that it is possible to install a serial card into slot 2 of the IIGS for plotting, thereby freeing the modem port for other use. Make sure that you set the dip switch settings of the serial card as described in the **Plot Tutorial**, then use the Desk Accessories firmware as follows to make the IIGS recognize your card: 1) To get the Desk Accessories Program, press the Control, Open Apple, and Escape keys simultaneously. 2) Press the Up Arrow or Down Arrow to highlight the Control Panel option, then press Return. 3) Press the Up Arrow or Down Arrow to highlight the Slots option, then press Return. 4) Press the Up Arrow or Down Arrow to highlight the Slot 2 option, then press the Right Arrow or the Left Arrow to change it to Your Card. Press Return to save the configuration, then Quit the Control Panel and the Desk Accessories menus. The IIGS will remember this configuration in all subsequent sessions.

Edit

You may have noticed that when discoverCAD saves a drawing to disk that it adds ".DATA" as a suffix to the drawing name. Please note that when using the **Edit** command to recall a drawing, you should not include the ".DATA" suffix; simply type the name of the drawing exactly as you did when you used the **Save** command to store it to disk.

Merge

When merging an existing discoverCAD II symbol file to your working drawing, bear in mind that the symbols of the symbol file will appear on the same layer of your working drawing as they do in the symbol file. For example, had you created a symbol file called SYM128 in which the symbols are contained on layer 128, after merging SYM128 to your working drawing, the symbols would appear on layer 128 of your working drawing, and remain there as a permanent part of the drawing. Please note that unless the layer on which the symbols appear is currently displayed (i.e. for this example layer 128), you will not see the symbol layer after merging. Once you have merged, you can use the **Draw Layer** command to review the symbol layer if so desired, and then the **Erase Layer** command to remove it from the display (**Erase Layer** will not actually erase the layer).

Plotting

When plotting your drawing, it is possible to achieve a multi-color and/or multi-line thickness plot. In order to do so, you must have first constructed your drawing using several different layers. For example, if you were creating an architectural floor plan, you could have the plot plan on layer 1, the electrical plan on layer 2, the furniture plan on layer 3, etc. Now, supposing you want to plot the floor plan a layer at a time, to achieve a multi-color and/or multi-line thickness plot follow this example:

First, use the **Erase Layer** command to remove all layers except layer 1 (i.e. the plot plan) from the display.

Second, plot layer 1 (i.e. the plot plan) as follows:

- 1) Select **Plotter** to direct the output to the plotter.
- 2) Select the appropriate plotter type and enter the paper size being used.
- 3) Select **Pen Number** and specify pen number 1.
- 4) Select **Redraw**. Layer 1 will now be plotted using pen number 1.

Third, plot layer 2 (i.e. the electrical plan) as follows:

- 1) Select **Erase Layer** to erase layer 1.
- 2) Select **Plotter** to direct the output to the plotter (**Plotter** must be selected before each and every layer being plotted).
- 3) Select **Pen Number** and specify pen number 2.
- 4) Select **Draw Layer** and specify layer 2. Layer 2 will now be plotted using pen number 2 (please note that the layer will not be drawn to the screen).

Fourth, plot layer 3 (i.e. the furniture plan) as follows:

- 1) Select **Erase Layer** to erase layer 2.
- 2) Select **Plotter** to direct the output to the plotter (**Plotter** must be selected before each and every layer being plotted).
- 3) Select **Pen Number** and specify pen number 3.
- 4) Select **Draw Layer** and specify layer 3. Layer 3 will now be plotted using pen number 3 (please note that the layer will not be drawn to the screen).

Assuming that the plotter had a different pen color or thickness for each pen number, you should now have a multi-color and/or multi-line thickness plot of your drawing. Please note that if the plotter you are using does not have multi-pen capability, it is still possible to achieve a multi-color and/or multi-line thickness plot by manually switching the pen for each layer plotted.

Save

When saving a new drawing file over an existing drawing file (i.e. you specify the same file name), please note that should the existing drawing file lie between two other existing drawing files on the disk, the new drawing will be placed at the end of the last file on the disk, and that the disk space occupied by the original drawing file will remain inaccessible, wasting valuable disk space. To remedy this problem, it is suggested that you save your work in a progressive order; by saving over the last file on the disk, you avoid the problem of having unaccessable blocks of disk space (i.e. do not save over a file that lies between two other files if at all possible).

Symbol

1) To insure you are using the proper size work area when creating a symbol file from scratch, before beginning you may find it useful to execute the **Zoom Origin** command to set the system to its original scaling. Then use the **Draw Rectangle** command to draw a box around the entire perimeter of the screen; that way, even if you zoom or pan during the course of creating the symbols, you will always know whether or not you are within the proper drawing area.

2) When transferring a symbol from a symbol layer to your working drawing, it is generally a good idea to transfer the symbol to a blank layer first; that way, if you have made an error (ex. the scaling of the symbol is incorrect), you may use the **Erase Window** to erase the mistake without erasing part of your drawing.

3) When transferring a symbol from a symbol layer to your working drawing, you may transfer it to a layer that is not currently visible. The symbol will appear on the screen when you transfer it, but will actually reside on the hidden layer you have specified. If you issue the **Redraw** command after you have transferred the symbol, you will notice that the symbol no longer appears on screen (use the **Draw Layer** command to display the layer that the symbol resides on to view the symbol). The above also applies when copying a symbol from a layer that is not currently visible.

Zoom Window

You may find that when using the **Zoom Window** command in conjunction with a grid, sometimes your drawing will not line up with the grid. If this is the case, activate the **Snap Grid** command, then use the **Pan** command to shift your drawing slightly; this should align your drawing with the grid.

Appendix F

TECHNICAL NOTES

The **Technical Notes** appendix contains any miscellaneous technical notes, and is meant to serve as a quick reference for any questions or problems you may have regarding a specific command or operation.

The commands or operations for which these suggestions pertain to appear in alphabetical order, grouped accordingly under the headings **Plotter Notes**, **Computer Notes**, **Drawing Notes**, or **Teaching Notes**.

PLOTTER NOTES

Plotting

It is possible to plot from the printer port (slot 1) of your Apple computer instead of the modem port (slot 2) that discoverCAD usually uses. To change from slot 2 to slot 1, select the **Slot** command from the **Apple** menu, and type 1 when prompted for the slot number. Next, before you turn on the computer, connect the appropriate cable to both the plotter and printer port (slot 1). Finally, configure the printer port (slot 1) for plotting as follows.

Apple IIC: Boot the IIC Utilities Disk, and use the directional arrow keys to select the Configure the Serial Ports option found under Advanced Operations. Choose Set Port 1, then select I Know My PIN. Type 164/1111 then press Return. This particular PIN will set the port to printer mode, 8 data bits with 2 stop bits, 2400 baud, no parity, no echo, no LF after CR, and no CR insert. Verify the above information, then press Return if its correct, or select NO if you have to reenter the PIN. Once you have entered the PIN correctly, use the Save command to store your configuration. Please note that you will have to reconfigure this port should wish to print from it later.

Apple IIE: Simply remove the serial card you are using from slot 2 and reinstall it in slot 1.

Apple IIGS: Enter the Desk Accessories program by pressing the Control, Open Apple, and Escape keys simultaneously. Use the directional arrow keys to select the Control Panel option, then the Printer Port option. Change Line Length from unlimited to 80, LF after CR from Yes to No, and the Baud Rate from 9600 to 2400 (all the other parameters should remain the same). Press Return to save the settings, then exit the Desk Accessories program. Please note that you will have to reconfigure this port should wish to print from it later. Now, when you are ready to plot, simply follow the **Plot Tutorial** as you normally would, the only difference being that you are using the printer port (slot 1) instead of the modem port (slot 2).

If you experience difficulty when plotting your drawing as outlined in the **Plot Tutorial**, the Hearlihy & Co. Tech. Support Staff can help. Review the following steps before you call, and be prepared to answer the questions outlined therein.

1) Are you following the plot procedure as outlined in the **Plot Tutorial**? Does the **Plotter** command have a check mark next to it in the **Plot** menu? Did you select the appropriate command for the plotter you are using? Did you specify the appropriate paper size for the paper you are using? Make sure the Caps Lock key is depressed before you type the paper size. Did you select **Redraw** or **Draw Layer** to start the plotting process? Please take note of exactly what happens.

2) Have you configured the serial interface of your computer as suggested in this manual? Remember that the Apple IIGS modem port must have been configured and saved via the Desk Accessories program, and that the serial card in the Apple IIE must have been configured via the dip switches on the card as described in the **Plot Tutorial** appendix.

3) Did you make sure to connect the cable to both the plotter and computer before you turned the computer's power on?

4) Are you using the correct cable? Some cables must be configured specifically for discoverCAD.

5) Is the cable faulty? Did you perform a continuity test on the cable? Cable specifications are available in the **Technical Notes** chapter of this manual. Where did you purchase the cable?

6) Did you run the plotter's self test? If it fails to pass the self test, you may have a plotter problem. Where did you purchase the plotter?

Apple 410 Color Plotter

Although the Apple 410 Color Plotter has been discontinued, it will work with discoverCAD. Replacement pen points for the plotter are available from Hearlihy & Co. (see Hearlihy's Times Newsletters and Catalogs). See the **Plot Tutorial** appendix for more on the Apple 410 Color Plotter.

Epson HI 80 Plotter

To use the Epson HI 80 plotter with discoverCAD, equip the plotter with the Horizon Data H P emulation board (unfortunately this board has apparently been discontinued). Install the Apple Super Serial Card in slot 2 of the computer (configure the card as outlined in the **Plot Tutorial**), and connect the plotter to the card via a standard straight through cable. To activate the plotter during the plotting process as outlined in the **Plot Tutorial**, select the **HP 7470** command. Please note that this information has been provided by a discoverCAD customer, and may not have been tested by Hearlihy & Co.

Hewlett Packard 7440A Color Pro Plotter

To use the Hewlett Packard 7440A Color Pro plotter with discoverCAD, equip the plotter with the HP 7440A Graphic Enhancement Cartridge, available from Hewlett Packard (approximately \$150.00).

Hewlett Packard 7550 Plotter

To use the Hewlett Packard 7550 plotter with discoverCAD, set the plotter to 2400 baud, no parity, hardware handshake, and remote mode. Install the Apple Super Serial Card in slot 2 of the computer (configure the card as outlined in the **Plot Tutorial**), and connect the plotter to the card via a standard RS 232 cable. To activate the plotter during the plotting process as outlined in the **Plot Tutorial**, select the **HP 7475** command. Please note that this information has been provided by a discoverCAD customer, and may not have been tested by Hearlihy & Co.

Zericon PC 34/36 Plotter

To use the Zericon PC 34/36 plotters with discoverCAD, set the plotter's dip switches as follows: from left to right, the pins are set D U D D D D, where D is down and U is up (this insures the plotter will run at 2400 baud). Connect the plotter to the modem port via one of the cables listed below. To activate the plotter during the plotting process as outlined in the **Plot Tutorial**, select the **HI DMP41** command. Please note that this information has been provided by a discoverCAD customer, and may not have been tested by Hearlihy & Co.

To connect the Zericon PC 34/36 plotter to the Apple IIC computer, construct your cable using one of the following configurations.

<p>4 Pin Telco Modular</p> <p>4 GND 3 RD 2 TD 1 (unconnected)</p>	<p>5 Pin DIN Connector</p> <p>2 GND 4 TD 5 RD 1,3 (unconnected)</p>
<p>6 Pin Modular</p> <p>4 GND 5 DSR 3 RD 2 TD 1,6 (unconnected)</p>	<p>5 Pin DIN Connector</p> <p>2 GND 3 DSR 4 TD 5 RD 1 (unconnected)</p>

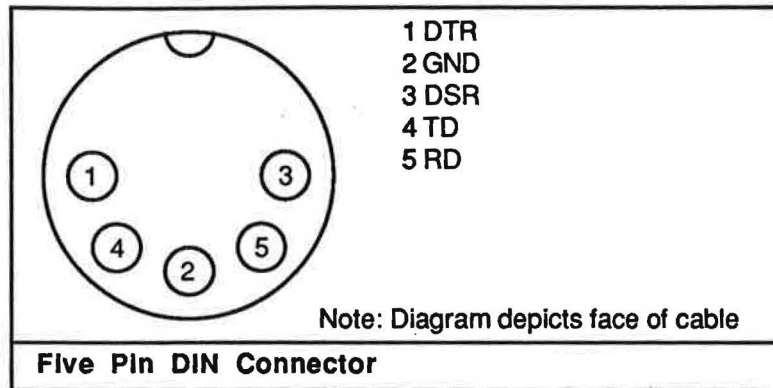
Cable Specifications

Listed below are the cable specifications for the plotters and computers supported by discoverCAD. Some of the configurations are standard per the manufacturer; others have been configured specifically for discoverCAD, and may not be appropriate for other applications. Check the table that follows for the number of the cable you should use with your plotter and computer (all cables are available from Hearlihy & Co.).

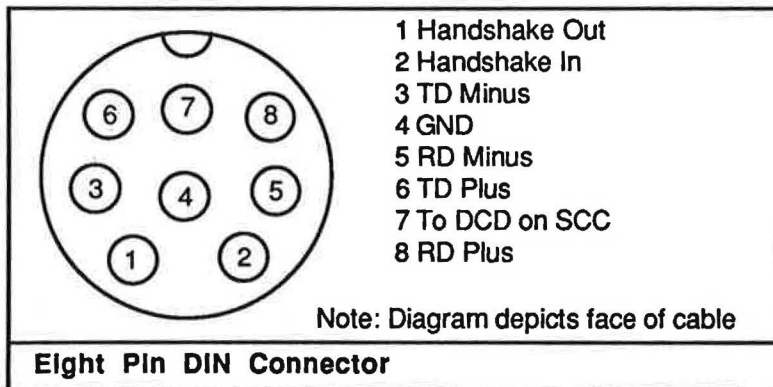
Computer Plotter	Apple IIC	Apple IIE	Apple IIGS
Apple410	2287	2289	2288
HI PC Series	2281	2286	2282
HI DMP Series	2283	2285	2284
HP Series	2287	2289	2288
Roland DXY Series	2287	2289	2288

The following abbreviations are used in detailing the cable specifications below.

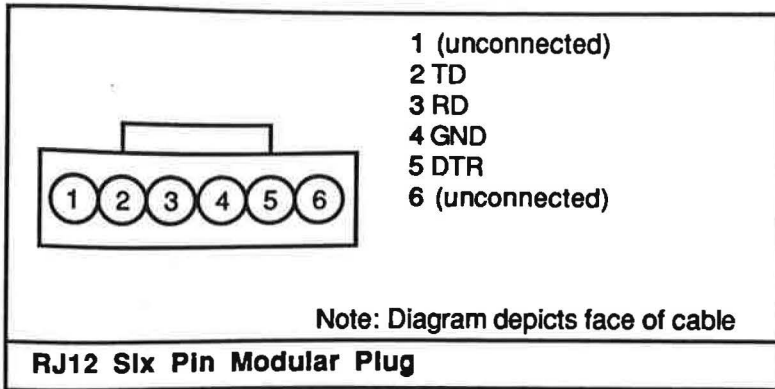
TD	Transmit Data
RD	Receive Data
GND	Ground
DTR	Data Terminal Ready
DSR	Data Set Ready
RTS	Request to Send
CTS	Clear to Send
SCD	Secondary Carrier Detector
SCTS	Secondary Clear to Send
DSRS	Data Signal Rate Selector
DCD	Data Carrier Detect
SCC	Serial Communication Channel



This diagram depicts the Five Pin DIN Connector as used in the cable configurations that follow.



This diagram depicts the Eight Pin DIN Connector as used in the cable configurations that follow.



This diagram depicts the RJ12 Six Pin Modular Plug as used in the cable configurations that follow.

<u>Cable #2281:</u>	RJ12 Six Pin Modular Plug	Five Pin DIN Connector
	1 (unconnected)	
	2 TD	5 RD
	3 RD	4 TD
	4 GND	2 GND
	5 DTR	3 DSR
	6 (unconnected)	1 (unconnected)

<u>Cable #2282:</u>	RJ12 Six Pin Modular Plug	DB-25P Connector
	1 (unconnected)	
	2 TD	2 TD
	3 RD	3 RD
	4 GND	7 GND
	5 DTR	4 & 20 RTS & DTR
	6 (unconnected)	1,5,6,8-19,21-25
		(unconnected)

Please note that on the DB-25P connector 4 RTS and 20 DTR are jumpered.

<u>Cable #2283:</u>	DB-25S Connector	Five Pin DIN Connector
	2 TD	5 RD
	3 RD	4 TD
	4 RTS	3 DSR
	7 GND	2 GND
	1,5,6,8-25 (unconnected)	1 (unconnected)

<u>Cable #2284:</u>	DB-25S Connector	DB-25P Connector
	2 TD	2 TD
	3 RD	3 RD
	4 RTS	4 RTS
	7 GND	7 GND
	1,5,6,8-25 (unconnected)	1,5,6,8-25 (unconnected)

<u>Cable #2285:</u>	DB-25S Connector	Eight Pin DIN Connector
	1 (unconnected)	
	2 TD	5 RD minus
	3 RD	3 TD minus
	4 RTS	2 Handshake in
	7 GND	4 GND
	1,5,6,8-25 (unconnected)	1,6-8 (unconnected)

<u>Cable #2286:</u>	RJ12 Six Pin Modular Plug	Eight Pin DIN Connector
	1 (unconnected)	
	2 TD	5 RD minus
	3 RD	3 TD minus
	4 GND	4 GND
	5 DTR	2 Handshake in
	6 (unconnected)	1,6-8 (unconnected)

<u>Cable #2287:</u>	DB-25P Connector	Five Pin DIN Connector
	2 TD	5 RD
	3 RD	4 TD
	6 DSR	1 DTR
	7 GND	2 GND
	20 DTR	3 DSR
	1,4,5,8-19,21-25 (unconnected)	

<u>Cable #2288:</u>	DB-25P Connector	DB-25P Connector
	1 GND	1 GND
	2 TD	2 TD
	3 RD	3 RD
	4 RTS	4 RTS
	5 CTS	5 CTS
	7 GND	7 GND
	8 GD	8 CD
	12 SCD	12 SCD
	13 SCTS	13 SCTS
	20 DTR	20 DTR
	23 DSRS	23 DSRS

Please note that pins 6,9,10,11,14,-19,21,22,25 are unconnected on either cable end.

<u>Cable #2289:</u>	DB-25P Connector	Eight Pin DIN Connector
	2 TD	5 RD Minus
	3 RD	3 TD Minus
	7 GND	4 GND
	20 DTR	2 Handshake In
	1,4,5,6,8-19,21-25 (unconnected)	1,6-8 (unconnected)

COMPUTER NOTES

Laser 128 Computer

discoverCAD will work on the Laser 128 computer (it's Apple IIC compatible), however, depending on the ROM version installed in your unit, you may encounter difficulty when plotting (lose of mouse control may result after you select the **Plotter** command from the **Plot** menu). If this problem occurs, simply use keyboard control to complete the plotting process. discoverCAD also runs on the Franklin 500 and 2100 computers, but has not been fully tested.

Apple II+ Computer

discoverCAD will not work on the Apple II+, due to the fact that the computer lacks the Double Hi-Resolution display required by the software.

Apple IIGS Computer

If you are running discoverCAD on the Apple IIGS and weird things are happening, most likely your problem is due to a misunderstanding of how the Apple IIGS operates with discoverCAD. Reread the **Introduction** chapter of this manual, paying special attention to the **Startup** section. Apple IIGS users should never remove the 3.5" discoverCAD system disk drive from the first disk drive, and should always use a drive other than the first disk drive for all **File** commands.

If you can't get a printout using the Triple Dump program on the Apple IIGS, either by itself or with discoverCAD, most likely your problem is due to an incorrect interface selection. When first configuring Triple Dump for use with the Apple IIGS, make sure to select APPLE FIRMWARE as the interface. If APPLE FIRMWARE does not appear on the interface list, it will be necessary for you to obtain an upgrade of the Triple Dump program by sending your original disk, along with a letter explaining that you need the APPLE FIRMWARE interface for use on the Apple IIGS, to Beagle Brothers Micro Software, Inc. (they should upgrade it for you at no extra charge).

Apple IIC Plus Computer

discoverCAD is capable of running on the newly released Apple IIC Plus computer. Listed below are the specifications necessary to use discoverCAD effectively on the Apple IIC Plus.

Compatibility: Every discoverCAD command has been successfully tested on the Apple IIC Plus for compatibility. The procedures for operating each command is correct as stated in this manual, unless stated otherwise in the notes that follow.

Clock Speed: The Apple IIC Plus has the option of running at 1.0 MHz (normal) or 4.0 MHz (fast); it is recommended that you use the faster clock speed (i.e. 4.0 MHz) with discoverCAD.

Display: The Apple IIC Plus has both a RGB and composite output jack; it is recommended that you use a monochrome composite monitor with discoverCAD. If you use a color composite monitor, be sure to set it to monochrome display for the best display.

Drives: The Apple IIC Plus has one built in 3.5" disk drive, designated as Slot 5, Drive 1 (please note that the drives for the Apple IIC Plus are numbered in the same manner as the Apple IIGS). You may also connect additional 3.5" and 5.25" disk drives to the IIC Plus by daisy chaining them together, as with the Apple IIGS. Use the discoverCAD **Drive** command to access the drives as follows: #1 is the internal 3.5" drive, #2 is the 1st external 3.5" drive, #3 is the 1st 5.25" drive, and so on.

Ports: As with the original Apple IIC, configuration of the Apple IIC Plus printer and modem ports is done via a utilities disk. However, the printer and modem port pin outs are similar to those on an Apple IIGS (both use an 8 pin connector).

Printing: To print from the Apple IIC Plus with discoverCAD, follow the printing procedure as outlined in the **Print Tutorial** appendix as you normally would, however, make sure to remove the discoverCAD System Disk from the internal 3.5" disk drive before you reboot (step 2 of the print tutorial). Otherwise, the Apple IIC Plus will reboot discoverCAD from the internal 3.5" disk drive instead of Triple Dump from the external 5.25" disk drive.

Plotting: Before plotting from the Apple IIC Plus with discoverCAD, take the time to insure that the computer is able to communicate properly with the plotter. First, it may be necessary to configure your plotter for use with discoverCAD by setting the plotter's dip switches (see the **Plot Tutorial** appendix for plotter settings). Second, make sure to use the correct cable. Since the pin outs and connectors for the Apple IIC Plus are the same as the Apple IIGS, you may use the same cable specifications for the plotter (see the section on cable specifications in this appendix). Please note that these cables are available through Hearlhy & Co. Third, attach the cable to the plotter as described in the plotter's owners manual, then to the computer as described below. To plot from the modem port, simply connect the cable to the Apple IIC Plus modem port, then follow the plotting process as detailed in the **Plot Tutorial** appendix. To plot from the printer port, connect the cable to the Apple IIC Plus printer port, then use the Apple IIC Plus Utilities Disk to configure the printer port as follows: select Setting Serial Ports, then Set Printer Port. Use the directional keys to change the settings; Device Connected is Printer, Line Length is 80, Add LF after CR is No, Echo is Yes, Baud is 2400, Data Stop Bits is 8/1, Parity is None, and XON/XOFF Handshake is No. Save the port settings, then follow the plotting process as detailed in the **Plot Tutorial** appendix when you are ready to plot. Please note that you must reconfigure the printer port to its original settings if you wish to print from it. Also, please note that if you will be plotting from the printer port it is worthwhile to review the **Slot Number** command as outlined in the **Introduction** chapter or **Technical Notes** appendix (under Apple IIC Plus).

Color Monitor

discoverCAD will work on a color monitor utilizing a RGB board, however, the resolution will not be quite as clear as it would be with a monochrome monitor. Set your color monitor to monochrome mode if it should have such a feature.

Envoy Serial Card

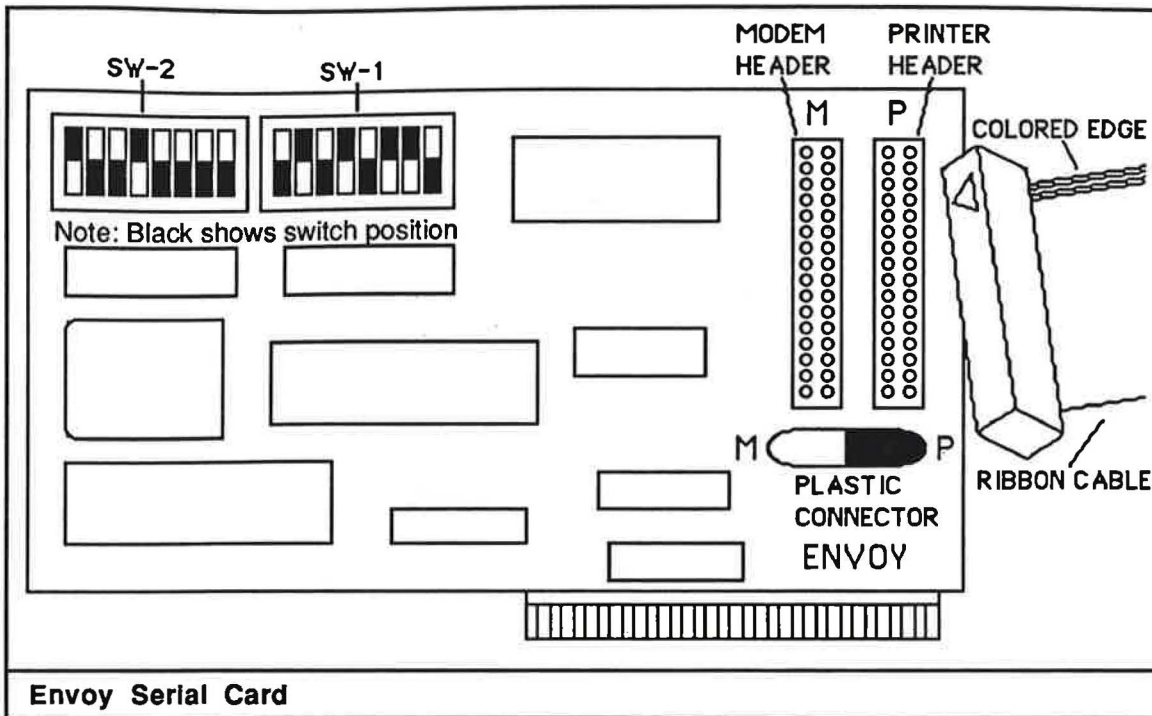
The Envoy Card is 100% Apple compatible, and may be used in lieu of the Apple Super Serial Card when running discoverCAD. Please note that there are several minor differences between the two cards.

Dip Switch Boxes: The numbering of the dip switch boxes on the Envoy card is reversed (i.e. the left box is number 2, the right box is number 1). However, the actual dip switch numbering is the same.

Dip Switches: There are 8 switches per box on the Envoy card, vs. 7 switches per box on the Apple Super Serial Card. Set the eighth switch of both boxes to off (i.e. down).

Jumper Block: Instead of using a jumper block to designate what type of output the card will handle (i.e. terminal or modem), the Envoy card has a separate header for each type of output. When using the Envoy card with discoverCAD, attach the ribbon cable to the header marked "Printer" as described below.

Ribbon Cable: When attaching the ribbon cable that comes with the Envoy card to the printer header, make sure that the small arrow on the plug end of the cable points toward the card, and faces the front of the computer. Also, the colored edge of the cable should be on top of the cable once connected to the header.



Peripheral Cards

Certain peripheral cards are not compatible with discoverCAD, and may cause problems when you boot the software. Among the offending cards we have found are any modem card installed in slot 2 of the Apple IIE or Apple IIGS, or connected to the modem port of the Apple IIGS, and the MicroSoft Premium SoftCard installed in the Auxiliary slot of the Apple IIE. Should one of these peripheral cards cause a problem, or you suspect that another card may be causing a problem, simply remove the card before you boot.

Printing

If you experience difficulty when printing your drawing with Triple Dump (i.e. you lose your drawing), it could be due to a speed up card you may have installed. Both the Speed Demon and Transwarp cards, as well as several other speed up cards, display a logo on screen whenever you warm or cold boot the system, effectively erasing your drawing in memory. If this problem occurs, simply remove the offending card before you print.

RAM Card & Network versions

discoverCAD is not currently available in a RAM card or network configuration. Watch Hearlihy's Times Newsletters and Catalogs for future update and upgrade information.

DRAWING NOTES

Command Selection

Please note that when selecting a command from a menu, you should give the system enough time to load the command before you proceed, as it is possible to incur a system error requiring you to reboot the system should you do otherwise.

Compatible Software

Due to the unique manner in which the discoverCAD database is designed, there are no other programs that will interface with discoverCAD.

Disks

Make sure to never write protect your discoverCAD system disk(s); you may receive a system error should you do so.

3.5" vs 5.25" Disk

The advantage to using discoverCAD on one 3.5" disk vs. two 5.25" disks lies in the fact that the 3.5" disk is more durable and less likely to lose information, or be damaged by a student than the 5.25" disks. Also, you will find that the 3.5" version of discoverCAD is a little quicker than the 5.25" version since there is less disk access time (i.e. one disk vs. two).

Display (Apple IIE)

If your display appears to have lines running across it when you first boot the system, check to make sure you have installed the Double Hi Res jumper block on the Apple Extended 80-Column Text Card.

DOS

discoverCAD is written in UCSD Pascal 1.3, and operates under the Pascal operating system.

Draw Grid

You may find that when displaying a grid at extreme magnifications (i.e. you are zoomed in at an extreme ratio), the grid does not start at the bottom of the screen as it normally does, but rather at some point else between the top and bottom of the screen. If this is the case, execute the **Redraw** command, and the grid should be redrawn starting at the bottom of the screen.

Erasing

When using any of the Erase commands (ex. Erase Line), you may find that occasionally the system will erase an entity other than the one you have specified. When this happens, it is usually due to the fact that the entities are too close together, and the system gets confused as to which entity you want to erase. discoverCAD searches the database starting with the entity last entered; if it finds an entity of the same type you are trying to erase that is close to where you have clicked, it will erase that entity instead of the intended entity. Should this problem occur, simply use either the **Zoom In** or **Zoom Window** command to enlarge the drawing, thereby making it easier to select the entity to be erased.

Redraw Speed

It is possible to speed up the Apple IIC, Apple IIE or Apple IIGS computers in order to get faster redraw and grid display times with discoverCAD. Apple IIC users can use the Zip Chip to increase the clock speed from 1.02 MHz to 4 MHz. Apple IIE users can use the Zip Chip to increase the clock speed from 1.02 MHz to 4 MHz, or the Transwarp Card to increase the clock speed from 1.02 MHz to 3.6 MHz. Apple IIGS users can use the Zip Chip to increase the clock speed from 2.8 MHz to 4 MHz, or the Transwarp GS to increase the clock speed from 2.8 MHz or 7 MHz. Please note that the Zip Chip is available from Zip Technology. The Transwarp Card is available from Hearlihy & Co.

Resolution

If you are experiencing poor screen resolution using discoverCAD on the Apple IIE, make sure that the Double Hi Res Jumper Block is installed on the Apple Extended 80-Column Text Card.

Saving Drawings

Depending on the complexity of the drawings you are trying to save, it is reasonable to assume that you can store 15 drawings on one 5.25" disk, and 40 drawings on one 3.5" disk.

Scaling

discoverCAD's scaling is calibrated generically, so that one grid space can be equated to anything from one millimeter to 1 mile or more. For example, if you desired to draw in inches, select the **Draw Grid** command from the **Screen** menu, then press Return without entering a value for the size. Conceptually, the spacing between each grid dot would represent one inch. If you had specified 0.25 as the grid size, the spacing between each grid dot would represent 1/4 inch.

Screen Size

When drawing with discoverCAD, the size of the screen is restricted due to the fact that the computer is limited as to the maximum number it may represent. You may find when pushing discoverCAD to its limits during the course of panning or zooming that the resultant display may not be accurate due to round off error.

Startup

If, upon starting the discoverCAD system on the Apple IIE the error message "80 column card not installed" appears, make sure you have properly installed the Apple Extended 80-Column Text Card in the Auxiliary slot; discoverCAD cannot function without it.

TEACHING NOTES

CADPAKs

When purchasing a discoverCAD CADPAK, it is not possible to get part of the set as 3.5" disks for the Apple IIGS, and the rest as 5.25" disks for the Apple IIC or Apple IIE (CADPAKs are not sold in mixed sets). However, by using our Format Exchange Policy, you can receive a 3.5" disk for each set of 5.25" disks returned to Hearlihy & Co., at a cost of only \$10.00 per system.

Instructional Material

For additional support material regarding discoverCAD, refer to Hearlihy's Times Newsletters and Catalogs for our discoverCAD courseWARE product. Written by three Engineering Graphics professors from Purdue University, a lot of time and effort has gone into making this a product you and your students can benefit from.

Software Demonstration

To effectively show discoverCAD to all of your students at the same time, you might consider the following suggestions. If you are trying to demonstrate discoverCAD to all of your students at the same time, you could use a computer projection panel (available from Hearlihy & Co.). Or, if you are trying to teach or show the program on an individual basis, Hearlihy & Co. has published a discoverCAD courseware program. Designed to be used with little or no additional instruction, you will find that the discoverCAD courseWARE program will get your students up to par quickly.

discoverCAD II Menus

🍎 File Screen Entity <-Modify Text & Dimension <-Modify Edit Mask Plot

File

Format
Directory
Save
Edit
Drive
Merge
Symbol

Screen

Draw Grid
Snap Grid
Use Layer
Draw Layer
Erase Layer
Status Layer
Zoom In
Zoom Out
Zoom Origin
Zoom Screen
Zoom Window
Pan
Redraw

Entity

Draw Line
Erase Line
Draw Rectangle
Draw Circle
Erase Circle
Draw Arc
Erase Arc
Draw Point
Erase Point
Erase
Erase Window
Erase All

<-Modify

None
Hidden
Length
Vertical
Horizontal
Parallel
Perpendicular
Angle
Radius
Diameter
Intersect

Text & Dimension

Draw Linear Dim
Erase Linear Dim
Draw Radial Dim
Erase Radial Dim
Draw Diameter Dim
Erase Diameter Dim
Draw Text
Erase Text
Erase All

<-Modify

None
Precision
Alternate Text
Vertical
Horizontal
Point to Point
Height
Width
Slant
Angle
Left Justify
Center Justify
Right Justify

Edit

Trim Line
Trim Circle
Trim Arc
Move
Move Copy
Mirror
Mirror Copy
Rotate
Rotate Copy
Measure Angle
Measure Distance

Plot

Plotter
Apple
Roland DXY
HI PC695
HI DMP40
HI DMP41
HP 7470
HP 7475
Pen Number
Dim Scale
Printer



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Slot Number

Mask

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