

Computer Aided Drafting System for the H/Z89

USERS' MANUAL

HDOS and CP/M Versions 1.00

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CAD-89 is probably the most powerful and useful graphics editor that has ever been developed for the HDOS or CP/M 80 operating systems. It is certainly the most advanced graphics editor available for the H/Z89 or H8 microcomputers. This is a bold statement, since many graphics editors have been written for these computers, but after working with this software for a few hours we are sure you will agree.

The CAD-89 editor is the result of several years of development work on graphics extensions for the original Heath/Zenith digital computers. The first two steps were the development of the Universal Parallel Interface and Interactive Graphics Controller (IGC) circuit boards. These boards are required to give the H/Z89 and H8 the high resolution graphics capabilities that make a graphics editor practical.

The third step was the Interactive Graphics Device Driver (IG:/IGC:) software which gave H/Z89 and H8 programmers the ability to use the many features of the IGC hardware with relative ease. However, this device driver software has only tapped a small portion of the utility of the IGC upgrade because using it requires the time and experience needed in computer programming.

CAD-89 makes the H/Z89 and H8 a powerful CAD (Computer Aided Drafting) workstation by allowing the user to take full advantage of the graphics capabilities of the IGC upgrade without any programming. Although, programmers will also appreciate CAD-89 since all images that are drawn can be output to an IG:/IGC: compatible disk file for incorporation into user programs.

CAD-89 is an object-oriented type editor. Rather than draw pixel patterns and images that are very difficult to edit and store, CAD-89 builds a drawing list of objects as they are "rubberbanded" by the user in a very interactive manner. Objects such as lines, circles, dots, boxes, arcs, and area paints are entered in seconds by simply positioning a graphics cross-hair cursor with any of several graphics input devices such as the optical mouse and keypad arrow keys. Groups of objects called symbols can also be drawn by the user and duplicated elsewhere in seconds. Whole drawings of electrical schematics, printed circuit board layouts, architectural, and mechanical drawings such as the examples at the back of this manual can literally be drawn on the screen as fast as they could be drawn on paper with a pencil and ruler, but with greater precision, and easier editing.

The advanced drawing list architecture of CAD-89 allows many powerful editing functions to be performed on drawings instantly, such as clipping, flipping, scaling, 90 degree rotation, and erasing. Any object or symbol in a drawing can be quickly moved, modified, or deleted without redrawing any other objects or symbols in the drawing, even if they are drawn close to or on top of other objects which you do not wish to change. Completed drawings and symbols can be stored to disk files in a very compact format and then be read back from disk at any time in the future. Drawings can also be printed on most types of dot matrix printers by CAD-89.

CAD-89 stretches the performance of the H/Z89 and H8 computers beyond what many have ever thought possible. This is because it is not limited to the 64k of RAM memory of these computers. CAD-89 uses up to 192k of IGC memory to store drawing list information plus another 64k of IGC memory to store the high resolution image plus whatever amount of system CPU RAM memory is available. This allows CAD-89 to edit more graphics information at one time (without disk accesses) than has ever been possible before.

The execution speed of CAD-89 will also surprise you. Partly because it has over 300k bytes of RAM to work with, but also because it is written in highly optimized 8080/Z80 assembly language that outperforms the higher level languages most graphics editors are developed in. The CAD-89 program source code is over 21,000 lines in length.

Hardware Requirements

CAD-89 runs only under the HDOS (2.0 or 3.0) or CP/M (2.2) operating systems on an H/Z89/90, H-1000 or an H8 computer with a H/Z19 type terminal. Both 8080 and Z80 type CPU boards are supported to clock frequencies of 4MHz or less. It also requires the Interactive Graphics Controller and Universal Parallel Interface circuit board upgrades to this equipment. 48k or 64k of CPU RAM and 256k of IGC RAM are required. If either your CPU logic, or IGC circuit boards lack this amount of memory, inexpensive memory upgrades are available for both from SigmaSoft and Systems.

CAD-89 does not require an optical mouse or trackball input device, although they are recommended to enhance its performance. One of the many 4MHz modifications available for the H/Z89 will also improve the performance of CAD-89 significantly and are recommended.

This section details the installation of the optical mouse input device. If you purchased this option, it should be installed before using the CAD-89 software. If not, proceed to the next section of this manual. If you have not installed the Interactive Graphics Controller or any other components (such as a trackball, printer cable, or 256k IGC memory upgrade) refer to the IGC Users' Manual for details on accomplishing this.

Installing the Optical Mouse

The optical mouse comes complete with four major components, the mouse unit with a female DB-25 serial connector and interface cord, the aluminum mouse pad, a power plug adapter with power cord, and a technical reference manual. Begin the installation by reading the mouse reference manual. It details how the various components of the mouse are connected and also provides some important suggestions on how to use and maintain it properly.

The female DB-25 connector at the end of the mouse interface cable must be connected to one of the three serial ports of your H/Z89 (or four serial ports of the H8-4). These serial ports are usually cabled to the computer's backplate for easy connection of such devices. However, these backplate cables may need to be rearranged internally depending on the other devices you may have connected to the serial interface board, such as modems and printers.

The recommended location for the mouse device is serial port 3300 (216 decimal) which is the lower connector (P605) on the H88-3 serial interface board. This port should be cabled to the backplate with a male DB-25 connector that will fit the connector on the mouse. If not, you will need to swap the cable that is connected to P605 for another backplate cable that will.

The H88-3 serial interface board is located on the right side of the H/Z89 CPU board at either the P504 or P505 bus connectors. The three backplate cables that connect to the interface board are interchangeable so long as they are not being used by other devices. If a serial port usage conflict does exist, the mouse can be connected to another serial port provided that the proper backplate cable is used and the CAD-89 software is configured for the alternate port address.

Note that the orange-red colored plastic connectors on the ends of the backplate cables have 15 slots cut on one side which should always face towards the circuit board when plugged in. Also note that your serial interface board may be lacking some IC (Integrated Circuit) components in the center of the H88-3 board. If so, this means that you can not use serial port 3200 which is the center 15 pin connector on the board (P604).

The final step is to set the interrupt enable jumper on the serial board. The recommended interrupt level is 5. If you are using modem software which also requires interrupt level five you may need to use a different interrupt level for the mouse. CAD-89 is capable of sharing the same interrupt level with other devices as can most good modem software. If you do use an interrupt level other than 5, CAD-89 must be configured to match the alternate number.

The H88-3 serial interface board has three sets of interrupt priority level jumpers, one for each of the three serial ports. If you are using the lower serial port (3300) at P605, use the lower set of interrupt jumpers. The remaining two sets of jumpers correspond to the ports at P604 and P603 respectively.

This completes the installation of the optical mouse. Note that the mouse pad must be positioned horizontally with the mouse resting on it vertically to operate. The mouse interface cord should exit from the body of the mouse away from you and not to the front.

Introduction

The best way to learn the CAD-89 graphics editor is to use it. The software has been designed to behave in a "natural" and consistent manner to speed the learning process as much as possible. Once some of the basics are understood, such as rubberbanding, object clipping, and drawing grids, the user can very quickly learn the remaining functions of the software by experimentation due to its extremely interactive nature.

This section will help the beginner get started by covering some of these basic functions. If at any time you experience trouble or have a question about a specific editor command, refer to the next three sections of this manual which describe the purpose, capabilities, and operation of each command in complete detail.

Operation

The first step is to run the CAD-89 editor program. To do this, the IGC (Interactive Graphics Controller) board set must be installed and tested in your H/Z89 or H8/H19. If not, refer to the installation section of the IGC User's Manual. If you purchased an optical mouse input device, it should also be installed eventhough it is not required. Under HDOS type:

```
>CAD89
```

For CP/M type:

```
A>CAD89
```

For HDOS the CAD-89 filename is CAD89.ABS, for CP/M it is CAD89.COM. This is a very large program and will take a few seconds to load. Your H/Z89 must have at least 48k of processor RAM and the IGC board must have 256k of RAM for the editor to run. If the CAD-89 software is unable to communicate with your IGC board (due to its port address being set to a non-standard value or the IGC board not being present at all) the configuration menu will appear so that a valid port address can be entered. Refer to the Configure command description for more information on this.

If everything is installed correctly, CAD-89 will display a large title on the screen similar to the cover of this manual. If the graphics portion of the title looks incorrect or flickers strangely, the interlace mode of your IGC board may not be set for the same mode as the editor. This can be corrected by the Configure command.

When the title is displayed, simply press any key to enter the editor. Again, there will be a delay of several seconds while the editor prepares to draw. Note that in the future, pressing a double or triple carriage return after the >CAD89 command line will cause the title drawing to be skipped and the editor will be ready to draw more quickly.

The Graphics Cursor

At this point, the graphics cursor should appear in the center of your screen. This is a cross-hair cursor which has no relation to the character cursor of the H/Z89 or H/Z19 that you are more familiar with. It is similar in function, but dedicated to graphics operations.

As a general rule, the presence of this cursor (on) indicates that the editor is waiting for the user to perform the next desired function. The user should not attempt input when the cursor is off since this indicates that the editor is busy completing the last function that was requested.

The blinking of the cursor is done to help make it more visible, which can be important when the screen is filled with a complex drawing. The blink rate and size of the cursor can be adjusted by the Configure command.

At certain times, the graphics cursor will be replaced by the original character cursor when the editor requires text input (such as a filename) rather than positional graphics input. Also, text input will always be performed on the 25th line, whereas the graphics cursor can be positioned anywhere on the screen.

Graphics Input Devices

The movement of the graphics cursor is controlled by any of the three graphics input devices. If you have installed an optical mouse or trackball, they should move the graphics cursor. If not, check the Configure command. The third input device (the keypad) should always work regardless of configuration.

The four arrow keys on the keypad (2, 4, 6, and 8) will move the graphics cursor their respective horizontal and vertical directions. The four corner keys in this arrangement (1, 3, 7, and 9) will move the cursor in their respective diagonal directions. Also note that the REPEAT key can be pressed simultaneously with any of the cursor movement keys for faster cursor movement.

If you are using the keypad as your only input device, you may wish to learn the Grid command immediately since it is required to make the keypad move the cursor more quickly.

The Drawing Pen

The "drawing pen" is the fundamental feature of the CAD-89 editor which controls all drawing operations. It is easier to understand as an imaginary pencil that is placed on the screen (lowered, or pressed) and then dragged across the surface to draw a desired object. The pen has only two states, up and down, and its position on the screen is always the same as the graphics cursor.

The position of the pen is controlled by moving any of the graphics input devices and will be indicated by the graphics cursor. The state of the pen is controlled by one or two of the buttons on the input devices. On the keypad, the 5/HOME key will toggle the state of the drawing pen. Press it once to lower the pen, press it again to raise the pen, etc. The single button on the trackball device operates similarly.

The optical mouse has three buttons, which allow somewhat greater control. The right button behaves just as the 5/HOME key on the keypad. While, the center button acts as a temporary pen down control. Pressing it will lower the pen but only as long as you hold the button down. Releasing the center button automatically raises the pen. The left button on the mouse controls the panning of the display window which will be described in a moment.

Note that the state of the drawing pen is always indicated on the 25th line. The word "Pen" will be shown in reverse video only when the pen is down.

Drawing Object Types and Rubberbanding

Drawings are constructed by combining variations of the five basic types of objects that can be drawn with the CAD-89 editor. These five types are dots, lines, circles, arcs, and paints. Variations of these include boxes, ovals, and symbols. These objects are drawn by a process called "rubberbanding". To rubberband an object, simply move the graphics cursor while the drawing pen is down. The type of object that will be drawn depends on the command mode that is currently in effect. The Line command mode is the default.

For example, to draw a line using the keypad, first position the graphics cursor at where you wish the line to begin. Then, press the 5/HOME key to lower the drawing pen. While the pen is down, press any of the keypad directional keys repeatedly. This is the rubberbanding process which allows you to see and position the object before it is drawn. When the line is correctly positioned, simply press the 5/HOME key again to raise the pen and draw the line. This rubberbanding process is very similar for most of the other command modes as well.

Note that the command mode currently in effect is always displayed in the center of the 25th line. To change the command mode so that other object types can be drawn, simply press the key for the first letter of that object type name (Dot, Box, Circle, Line, Oval, etc.).

The Drawing Ink Modes

By default, CAD-89 will draw all objects white in color since the empty background is usually black. However, at times you may need to draw objects on top of other objects that are also white. It is important to note that the editor will still draw these objects even though they may not be visible due to a lack of contrast with the background color.

If you need to draw objects on top of a white background such that they are still visible, use a different ink color mode. Pressing the blue function key will cause the editor to begin drawing objects black in color. Objects drawn in this mode will be visible on a white background, but not a black one. The white function key will switch back to the White ink color mode.

Finally, the red function key will enable the third ink color mode which is called Reverse mode. Objects drawn in this mode will always be the opposite color of their background. This assures that the objects will be visible. Note that the drawing ink mode currently in effect is always displayed on the 25th line next to the command mode name.

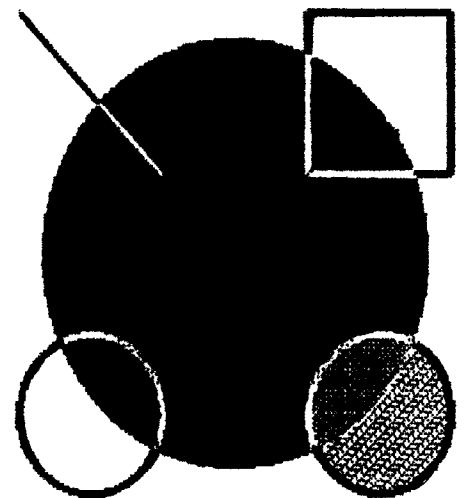
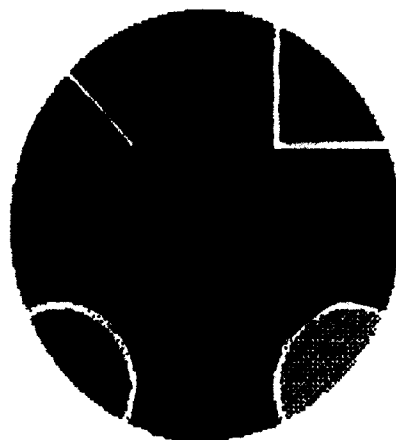
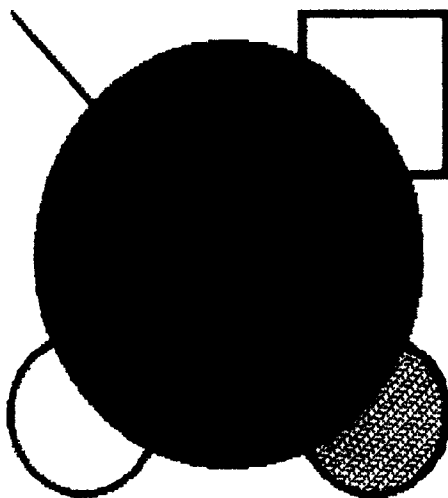
The following example illustrates the results of drawing line, box, circle, and paint objects on a white and black background in the three different drawing ink modes. The large painted circles represent "white" backgrounds on the screen, since the colors are reversed when printed.

Drawing Ink Mode Example

White Ink Mode

Black Ink Mode

Reverse Ink Mode



The Display Window and Panning

After you have drawn several objects, attempt to move the cursor off of the bottom of the screen. As you do this, the objects you have drawn will scroll off of the top of the screen. To bring them back, simply move the cursor back up to the top of the screen and the objects will scroll back down. This demonstrates an important feature of the IGC hardware and CAD-89 software called panning.

Since the maximum drawing area of the editor is three times the size of the screen, panning can be required to move from one part of your drawing to another, if it is very large. The portion of the drawing area that is currently displayed on the screen at any given time is called the display window.

Another way to pan the display window, is to hold the SHIFT key down and simultaneously press any of the vertical cursor direction keys on the keypad. The left button on the optical mouse will also pan the display when the mouse is moved vertically. Panning in horizontal directions is not supported by this software.

The Status Display Line

The CAD-89 editor constantly maintains a line of important status information on the 25th line of the screen to aid in its use. The following chart defines each of the entries on the status line, reading from left to right.

1. The horizontal and vertical position of the cursor (in grid points if enabled).
2. The horizontal and vertical delta (or size) of the object currently being rubberbanded (in grid points if enabled). These values will be shown in reverse video if they are equal.
3. The current horizontal and vertical drawing grid sizes, if enabled.
4. The command mode currently in effect.
5. The ink color mode currently in effect.
6. The state of the drawing pen (reverse indicates down).
7. The filename of the disk file currently being read or written, if any.
8. The amount of IGC drawing list memory remaining for use.

Note that it is possible to draw objects so that they obstruct your view of the status display line. When this happens, use the panning features of the editor to restore your view of this line.

The Drawing List

As mentioned before, there are only five types of objects that CAD-89 can draw, dots, lines, circles, arcs, and points. Everything else, including boxes, ovals, symbols, and text, is constructed from combinations of the basic five. Each time an object is drawn the editor performs two tasks. The first is to draw a representation of the object in the graphics video memory of the IGC board so that it will be seen by the user. The second task is to make an entry in the Drawing List for that object that details the exact information needed to reconstruct it in the future.

It is important that the user understand the differences between these two operations because when the drawing is saved to a disk file, it is the drawing list and not the video image that will be saved. The drawing list is a coded series of commands and coordinates that allows the CAD-89 editor to perform many powerful editing functions on drawings that would not be possible if they were saved as only a video memory image dump. The drawing list format is also much more memory efficient.

Each time an object is drawn, it is added to the drawing list. If an object is erased, it will be removed from the drawing list and the current image on the screen will be corrected to indicate that it is gone. This greatly improves the speed of the editor by eliminating the need for a complete redraw of the current image. However, some types of editing functions can not always be correctly represented on the screen and the editor may automatically perform an update function which will reconstruct the current image from the drawing list to insure that it is accurate.

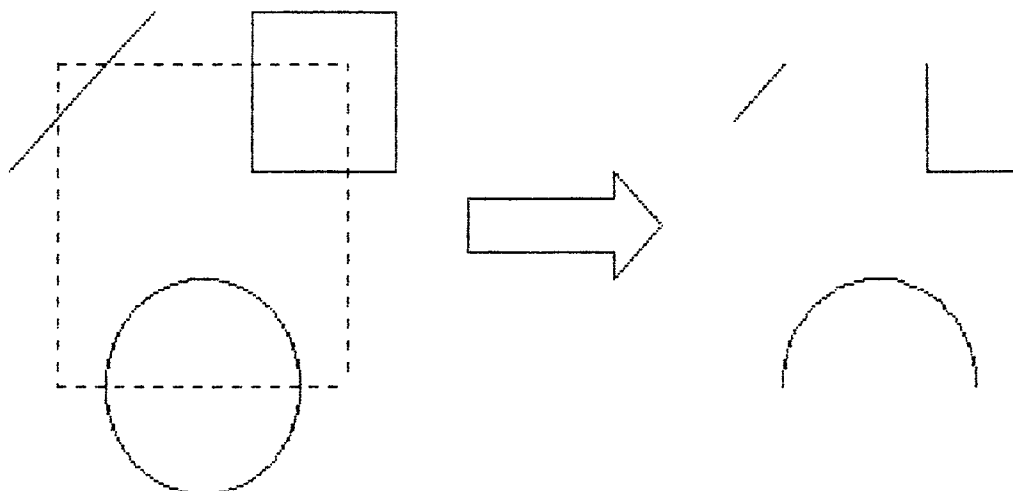
In some special cases the current image will show flaws in the drawing which are not really present and will be corrected by the next update operation. These effects are easy to understand and work with once you have developed some experience with the editor. Until then, use the Update command as often as you like to eliminate these drawing flaws.

Clipping

The Move command is one of the most powerful benefits of the drawing list architecture of the CAD-89 editor. It allows any drawing or portion of a drawing to be duplicated elsewhere in the drawing area. Move, and several other commands like Rotate and Write, have the ability to fractionalize objects into smaller objects so that only selected portions are duplicated. This process is known as clipping.

To demonstrate this, draw several objects and use the Move command to make a duplicate copy of them. When you rubberband the source region for the move operation, do it so that some of the objects are only partially within the region as shown in the example below.

Example of Object Clipping with the Move Command

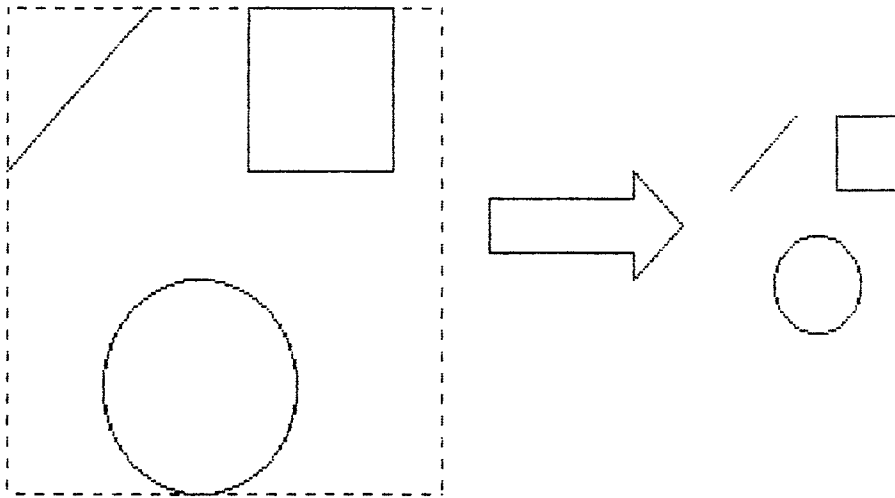


The entries for these objects in the drawing list will be clipped into new objects and also placed in the list, at the new position.

Scaling

Duplicate copies created by Move can also be changed in size and shape from the original to fit any desired region. This process is called scaling and is also supported by the Symbol and Text command modes. To demonstrate scaling, use another Move command on the same objects we just duplicated. However, when you rubberband the destination region, make it a different size from the source region as shown in the example below.

Example of Object Scaling with the Move Command



There are no limits to the amount that a drawing can be scaled up or down. However, objects should not be scaled down to less than 1/16 of their original size if you ever intend to scale the result back up. Scaling to smaller than 1/16 causes a loss of resolution which can not be regained later. Although this resolution loss is not detectable without scaling the object back up to its original size.

Graphics File Types

CAD-89 has the ability to create or read four different types of data files which are identified by their filename extension. By default, the File, Write, and Overlay commands read and write .CAD drawing files. These are full-sized drawing files which are stored in a compact binary format and can be read back in by the editor at any time for either more editing, or for use as an overlay. These files do not contain symbol names.

Symbol files (.SYM) are created by the Write command by saving a specified region of the drawing area. They are not complete drawings, and are assigned a name at the time they are created that is separate from their filenames. These files are for use as components in other drawings via the Symbol command, or for use in building symbol library files. They are also stored in a compact binary format.

IGC format files (.IGC) are created by a special option of the Write command for the purpose of compatibility with the IG: and IGC: graphics device drivers. These files have an ASCII format that is much more bulky than the binary format of .CAD and .SYM files. However, the ASCII files can be loaded into any text editor since they use a plain english syntax. IGC format files can not be read back and used by the CAD-89 editor.

The final file type is symbol library files (.LIB). These files are not created by the editor, but rather by using the PIP utility of either HDOS or CP/M to combine multiple .SYM files into a single file. This allows a collection of symbols which are related in use to be read and used by the CAD-89 editor simultaneously, such as symbols which compose the letters of the alphabet for a particular font style.

Summary of the Graphics File Types

<u>Name</u>	<u>Created By</u>	<u>Used By</u>	<u>Definitions</u>
.CAD	Write Command	File, Overlay Commands	Drawing Files
.SYM	Write Command	Symbol Commands	Symbol Files
.IGC	Write Command	IG:/IGC: Device Drivers	ASCII Files
.LIB	PIP Utility	Symbol, Text Commands	Symbol Library

Creating Symbol Library Files

The Write command is used to create symbol files. During the process of defining a symbol the editor will ask for a symbol name specification. This is very important, because this name will be required to locate a symbol after it has been combined with other symbols in a library file. Note that symbol names are much more flexible than file names, since lower case letters and most punctuation characters are legal.

Once the symbols you wish to use in the library have been created and saved into individual files, they can be concatenated with an HDOS or CP/M PIP command into one file. An example of this under HDOS would be as follows:

```
>PIP ALPHA.LIB=A.SYM,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W
```

for CP/M type:

```
A>PIP ALPHA.LIB=A.SYM,B.SYM,C.SYM,D.SYM,E.SYM,F.SYM,G.SYM,H.SYM
```

In this example, a text symbol library file is being created. The symbol filenames A.SYM, B.SYM, C.SYM, etc. each contain a symbol for their respective alphabetic letter. Lower case and numeral text symbols could also be combined with this library file in the same way. The ALPHA.LIB file that is created in this example could be used by the Text command for typing in text in the new font style.

The first category of editor commands is the Drawing Mode Commands. These are commands which place the editor into a mode of operation for drawing a particular type of object or objects. The drawing mode currently in effect is usually displayed in the center of the status display line. The names of the drawing modes indicate the type of objects that they will draw. There are only five fundamental object types which are actually entered into the drawing list (Arc, Dot, Circle, Line, and Paint) with the remaining types being a combination of these five. Arc is a special case which is generated by the Oval command or by clipping an existing circle.

The Drawing Mode Commands

<u>Command Name</u>	<u>Keyboard</u>	<u>Possible Object Types Generated</u>
Box	B	Lines (and Dots in Reverse Mode)
Circle	C	Circles (and Arcs if Clipped)
Dot	D	Dots
Draw	f2	Lines (and Dots in Reverse Mode)
Line	L	Lines
Oval	O	Arcs
Paint	P	Paints
Symbol	f1	All Five Types
Text	T	All Five Types

Description

The **Box** command mode allows the drawing of any number of square or rectangular polygons in the currently selected drawing ink mode and line style. This command mode is limited to drawing boxes with only horizontal and vertical lines.

Operation

A box is drawn by first positioning the cursor (with the drawing pen up) at any of the four corners you wish the box to connect. Then simply lower the drawing pen and move the cursor to the opposite corner of where you wish the box to be. Raising the drawing pen will then complete the box. If the box appears to vanish as the pen is raised check the status of the drawing ink modes and line style setting. Some line styles and ink colors may not be visible on similar backgrounds.

Effects on Drawing List

Four line objects will be entered into the drawing list for each box drawn with an additional four dot objects added on the box corners if the reverse ink mode is selected.

Alternates

Boxes can also be drawn using the **Line** and **Draw** command modes which are not limited to horizontal and vertical lines.

Description

The Circle command mode allows the drawing of any number of proportional (constant radius) circles in the currently selected drawing ink mode and line style.

Operation

A circle is drawn by first positioning the cursor (with the drawing pen up) at the point of center for the circle. Then simply lower the drawing pen and move the cursor in any direction to indicate the radius of the circle to be drawn. For speed purposes, a square box is used to indicate the size and position of the circle while it is rubberbanding. Raising the drawing pen will then replace the box with a circle of equalivalent size and position. If the circle appears to vanish as the pen is raised check the status of the drawing ink modes and line style setting. Some line styles and ink colors may not be visible on similar backgrounds.

Concentric circles or circles with a wider line style can easily be accomplished by drawing multiple circles about the same point of center.

Alternates

For drawing disporportionate circles use the Oval command mode. The Oval command can also be used to draw porportional circles if attention is given to the delta values on the status display line.

Effects on Drawing List

The Circle drawing mode will always enter only one circle object into the drawing list for each circle drawn.

Description

The Dot command mode allows the drawing of any number of single pixel dots in the currently selected drawing ink mode. The dots drawn are not affected by either the line or paint styles. The dot object type also has the special property of maintaining a constant size and shape (one pixel) regardless of any scale operations that may be done.

Operation

A dot is drawn by first positioning the cursor (with the drawing pen up) where you wish the dot to be drawn. Then simply press the drawing pen to draw the dot.

If the drawn dot is invisible check the status of the drawing ink modes. Dots must be drawn in the opposite color of their background to be seen. A single dot can be difficult to see anyway due to its small size.

Note that drawing dots on a visible drawing grid will look unusual until the grid is turned off since the color of the grid points are reversed to indicate the presence of a dot.

This command mode can be useful for free-hand shading if a mouse or trackball is moved while the pen is down. However, this should be done with discretion on large drawings since it can consume drawing list memory very quickly.

Effects on Drawing List

A single dot object will be entered into the drawing list each time the cursor changes position while the drawing pen is down or when the pen is raised.

Alternates

To draw a dot that will scale, paint a circle or box with the solid paint style. To draw a series of dots that connect and stay connected when scaled, use the Draw command mode.

Description

The Draw command mode allows the drawing of a continuous series of connected lines in the currently selected drawing ink mode and line style.

Operation

Lines are drawn in this mode by first positioning the cursor (with the drawing pen up) at an initial point where you wish the first line to begin. Then, simply lower the drawing pen and move the cursor along where you wish the line to be drawn. Raising the drawing pen will allow you to move the cursor to any new position without continuing the line to that position.

If the lines appear to vanish as they are drawn check the status of the drawing ink modes and line style setting. Some line styles and colors may not be visible on similar backgrounds.

This command mode can be used for free-hand sketching with either a mouse or trackball input device if the drawing grid is off. Greater precision and control can be achieved by raising the grid factor or by using the keypad.

Effects on the Drawing List

This command mode should be used with discretion on large drawings since it can consume list memory quickly (particularly when using fast input devices with the drawing grid off). A new line object will be entered into the drawing list each time the graphics input device changes direction with the pen down, or when the drawing pen is raised. A dot will also be drawn at all line intersection points if the reverse ink mode is selected.

Alternates

For greater precision and control in drawing lines use the Line command mode.

Description

The Line command mode allows the drawing of any number of straight lines in the currently selected drawing ink mode and line style. Lines of any slope can be drawn.

Operation

A line is drawn by first positioning the cursor (with the drawing pen up) at either of the two end positions that you wish the line to connect. Then simply lower the drawing pen and move the cursor to the opposite end of where you wish the line to be. Raising the drawing pen will then complete the line. If the line appears to vanish as the pen is raised check the status of the drawing ink modes and line style setting. Some line styles and ink colors may not be visible on similar backgrounds.

Effects on the Drawing List

A single line object will be entered into the drawing list for each line drawn.

Alternates

For faster drawing of continuous or curved lines use the Draw command mode.

Description

The Oval command mode allows the drawing of any number of disproportionate ovals or porportionate (constant radius) circles in the currently selected drawing ink mode and line style.

Operation

An oval is drawn by first positioning the cursor (with the drawing pen up) at any of the four corners of the region you wish the oval to occupy. Then simply lower the drawing pen and move the cursor to the opposite corner of this region. For speed purposes, a square box is used to indicate the size and position of the oval while it is rubberbanding. Raising the drawing pen will then replace the box with an oval of equalivalent size, shape, and position. If the oval appears to vanish as the pen is raised check the status of the drawing ink modes and line style setting. Some line styles and ink colors may not be visible on similar backgrounds.

Circles are drawn with the Oval command mode by releasing the drawing pen only when both the delta values shown on the status display line are equal (as indicated by inverse video).

Effects on the Drawing List

The Oval drawing mode will enter either one arc object into the drawing list for each oval drawn or one circle for each circle that is drawn.

Alternates

For faster drawing of circles use the Circle command mode. Note that ovals can also be generated by scaling circles.

Description

The Paint command mode allows any polygon shape to be easily filled in with any of fifty different patterns of paint styles as selected by the Style command mode. An outline of the opposite color of the background is used to determine the shape of the painted area. The paint object type has the unique property that they can not be clipped into multiple objects since their size and shape are controlled by surrounding objects.

Operation

A paint operation is performed by first rubber banding a rectangular paint boundary that completely surrounds the polygon to be painted. It is important that this region be defined as small as possible but still cover the entire polygon. When painting a simple object that has just been drawn or moved, defining the paint region is usually as simple as pressing the equal sign key (=).

The editor will highlight the defined paint boundary when the drawing pen is raised and lock the cursor within this region. The user should then position the cursor to the paint trigger point and press the drawing pen once more. The paint will then be drawn starting from the trigger point and continuing outwards in all directions until either a solid object or paint boundary is reached on all sides.

A paint operation will be aborted immediately if the current color of the pixel at the trigger point is the same as the currently selected ink mode, since this is considered the border color by the painting function. Therefore, to paint on a black background to a white border the white ink mode should be selected. Likewise, if you wish to paint on a white background to a black border the black ink mode should be selected. Finally, if the reverse ink mode is selected, the background color will be determined by the color of the pixel at the trigger point.

Effects on the Drawing List

Painting is extremely memory efficient since only a single paint object will be entered into the drawing list for each paint drawn, regardless of the size or complexity of the painted area.

The paint object type has the unique property that its size and shape is controlled by the polygon objects that surround it each time it is re-drawn. Therefore, special care must be taken when editing a section of the drawing list which contains a paint object type.

Alternates

The border and trigger points of paint objects can only be defined by the Paint command mode. The painting style can be edited at any later time with the Edit command mode.

Description

The Symbol command mode allows the drawing of any number of patterns or object groups which have been drawn and stored in a disk file by use of the Write command mode. Symbols can be any size and shape and contain any combination of object types which form an image that is useful in multiple drawings. Examples of symbols would be alphabetic letters, schematic representations of electronic components, mechanical parts, components of architectural drawings, etc.

This command mode is not affected by the current drawing ink mode, line, or paint style selections.

Operation (Entering Symbol and Symbol File Names)

Whenever the symbol command mode is entered (by pressing the f1 key) the user will be prompted for a symbol name and file name on the status display line as follows:

Read Symbol Name?

A valid symbol name should be entered followed by an optional file name specification (separated by a comma), and then a carriage return. An example would be as follows:

Read Symbol Name? RESISTOR, A:ELECTRON.SYM

In this example, the editor will read in the file named ELECTRON.SYM from the disk device A: and load the symbol in this file named RESISTOR into memory. Note that the A: device specification (SYØ: for HDOS) and the .SYM filename extension are the defaults and are therefore optional.

In fact, the entire file name specification (, A:ELECTRON.SYM in the above example) can be omitted if the symbol is stored in a file of the same name as the symbol. An example of this would be as follows:

Read Symbol Name? RESISTOR

This example would cause the editor to assume that the symbol named RESISTOR is to be read from a file also named RESISTOR (A:RESISTOR.SYM for CP/M, SYØ:RESISTOR.SYM for HDOS). Finally, if a symbol is to be read from a file of the same name, the filename can be entered without the symbol name preceding it. An example of this would be as follows:

Read Symbol Name? B:RESISTOR.SYM

Symbol names are limited to a maximum of eight characters in length and all printable characters are valid with the exception of the comma, period, colon, and space characters. Note also that the case of alphabetic characters is significant in symbol names.

If either the file or the symbol can not be found by the editor an appropriate error message will be displayed. Care must be taken to enter all symbol names in the proper case or they will not be found by the symbol command, even if the proper file is.

Operation (Reading Symbol and Symbol Library Files)

The CAD-89 editor will always read and store the entire contents of any symbol file that is accessed with this command mode. If the file contains more than one symbol (a library file), all of the symbols in that file will then be resident. Furthermore, if a symbol name is specified that is already present in memory, that symbol will be used and no disk accesses will occur.

Each time a symbol name is entered, the editor will attempt to find a symbol with a matching name that may already be present in memory before reading it from disk. However, not only the symbol name must match for it to be used, but the filename that the symbol was read from must also have been the same. If not, the symbol will be read from the new filename and replace any other symbols that may be resident.

These powerful features provide maximum flexibility and ease of use for the Symbol command mode. Symbols which are stored in individual files can be read in by simply giving the symbol or file name. Libraries of symbols that are stored in a single file can be loaded into memory simultaneously to minimize disk accesses while using the symbols that the library file contains.

Operation (Defining Symbol Destination Regions)

The final step of a symbol draw operation is to define a destination region with which the symbol is to be placed. After a valid symbol file has been read from disk, move the cursor to the desired position and press the pen down and release it again without moving the cursor (use the RETURN key). The position of the cursor will be used as the top left corner of the destination region for the symbol. The symbol will be drawn the default size which is the size it was when saved by the Write command mode.

The symbol can also be drawn a different size and/or shape than the default by simply rubberbanding a new destination region while the pen is down and then releasing it. A box will appear during the rubberbanding process to indicate the size and position of the new destination region. Also note that the same symbol can be drawn as many times as desired by simply defining more destination regions.

If the symbol is too large to be drawn at the indicated position, the editor will automatically move the destination region so that the entire symbol can be drawn. An error message will also appear on the status display line to indicate that the symbol was not drawn at the indicated position.

If the symbol is not visible when drawn, it may be because the objects in the symbol are of the same ink color or line style as the background which you have placed the symbol on. This can be corrected by either drawing the symbol on a different background, or by using the Edit command mode to change the ink color and/or line styles of the objects in the symbol after it is drawn.

Effects on the Drawing List

All of the objects in a symbol will be placed into the drawing list each time a symbol is drawn. These objects can be any combination of the five different object types. The amount of memory used by a symbol in the list is constant regardless of size or shape changes that may have been made when the symbol was drawn.

Description

The Text command mode is a special variation of the symbol function which is designed to greatly improve the speed at which alphanumeric text symbols can be drawn. A good understanding of the Symbol command mode is recommended before using this command mode.

In the Text command mode, symbol names are limited to a single character which correspond to a key on the H/Z89 or H/Z19 keyboard. Each of these symbols are normally graphics representations of the alphanumeric character they are named by. The process of entering a string of alphanumeric characters to spell out words and sentences is thus simplified to typing an individual key for each text symbol desired, without specifying a separate file name or destination region for each symbol.

This command mode is not affected by the current drawing ink mode, line, or paint style selections.

Operation (Defining the Text Size)

The first step in using the Text command mode is to define the size and shape of the text symbols that will be entered. Generally, this is best done with a drawing grid enabled with a proportional factor of either 10, 20 or 40. Accurate spacing between the letters being drawn is really more important than the size at which they are entered. This is because the size of the completed word or sentence can easily be scaled later by the Move command mode. Therefore, choose a grid factor and destination region size that are easy to work with.

Press the drawing pen down and rubber band a destination region of the proportion you wish the letters to be drawn in. When the drawing pen is raised, the defined destination region will be highlighted with a dashed line style to indicate where the first text symbol will be drawn. This highlighted region can then be repositioned by moving the cursor. Also note that the Text command mode indicator on the status display line will be shown in reverse video to indicate that the editor is waiting for text symbol names to be entered.

Operation (Entering Text Symbols)

Whenever a destination region is defined in the Text command mode, the keyboard is placed into a special mode of operation in which the keys no longer specify editor command mode changes, but rather single letter text symbol names. Each time an alphanumeric key is pressed in this mode, the editor will search for a symbol of that name and draw it in the currently highlighted destination region. Furthermore, the destination region will automatically move to the right after each text symbol is drawn in preparation for the next.

To exit this mode to where the keyboard will operate normally again, press the drawing pen again (use the RETURN key). This will also allow the text size and shape to be changed by rubber banding a new destination region while the pen is down and then releasing it.

If the text symbol is too large to be drawn at the indicated position, the editor will automatically move the destination region so that the entire symbol can be drawn. An error message will also appear on the status display line to indicate that the symbol was not drawn at the indicated position.

If either the file or the symbol can not be found by the editor an appropriate error message will be displayed. Care must be taken to enter the text symbol keys in the proper case or they will not be found by the Text command since both upper and lower case alphabetic characters in symbol names are supported.

If the symbol is not visible when drawn, it may be because the objects in the symbol are of the same ink color or line style as the background which you have placed the symbol on. This can be corrected by either drawing the symbol on a different background, or by using the Edit command mode to change the ink color and/or line styles of the objects in the symbol after it is drawn.

Operation (Reading Text Symbol and Text Library Files)

The CAD-89 editor will always read and store the entire contents of any symbol file that is accessed with this command mode. If the file contains more than one symbol (a library file), all of the symbols in that file will then be resident. Furthermore, if a symbol name is specified that is already present in memory, that symbol will be used and no disk accesses will occur.

Each time an alphanumeric key is pressed, the editor will attempt to find a symbol with a matching name that may already be present in memory. If it is not found in memory, a file by that name will then be read for the symbol. If the symbol is still not found, the default text library file will be searched, the name of which is defined by the Configure command mode.

For example, if the keys ABC are typed, the editor will first search for a symbol named A in memory. If not found, the file name A:A.SYM (SYØ:A.SYM) for HDOS) will be read and searched. If the symbol is still not found, the default library file A:MICRO.LIB (SYØ:MICRO.LIB) will then be read and searched. This procedure will then be repeated for the symbols B and C.

To use the Text command mode you must either have a set of symbol files on disk with names that correspond to the alphabet letters and numerals, or have a text symbol library file which contains all of these. If you have several library files you wish to use, you can switch from one to the other by either changing the text library file name specification in the Configuration menu, or use the Symbol command mode to read in a different library file.

Effects on the Drawing List

All of the objects in a symbol will be placed into the drawing list each time a symbol is drawn. These objects can be any combination of the five different object types. The amount of memory used by a symbol in the list is constant regardless of size or shape changes that may have been made when the symbol was drawn.

The second category of editor commands is the Drawing List Editing Commands. These are commands which place the editor into a mode of operation for editing objects and symbols which have already been drawn. The fundamental editing capabilities are clipping, erasing, duplicating, flipping, rotating, scaling, and changing the drawing ink mode, and line and paint styles of objects. Most of the editing command modes select objects based on a defined source and/or destination region. The Edit and Kill command modes also select objects based on their position in the drawing list (the order in which the objects were drawn).

The editing command mode currently in effect is usually displayed in the center of the status display line. Below is a summary of their names and functions.

The Drawing List Editing Command Modes

<u>Command Name</u>	<u>Keyboard</u>	<u>Capabilities</u>
Edit	E	Clips, Deletes, Style Changes
Erase	Erase	Clips and Deletes Objects
Kill	K	Deletes Last Object Drawn
Move	M	Clips, Duplicates, Scales, Flips
Rotate	R	Clips, Duplicates, Rotates

Description

The Edit command mode allows the user to selectively clip and delete individual objects in the drawing list regardless their position in the list or their orientation to other objects in the drawing area. Edit also allows the user to change the ink color mode and/or line or paint style of any object in the drawing list without deleting and redrawing the object.

This command mode is considerably more powerful than the Erase or Kill command modes for editing purposes with the trade-off being that it is also more difficult to learn to use. Therefore, a good understanding of the other list editing commands is recommended before attempting to use the Edit command mode.

Operation (Defining the Edit Region)

An Edit operation is performed by rubberbanding a region that includes some portion of each of the objects you wish to modify or delete. It is best to define this region so that it includes as few of the objects which you do not wish to edit as possible. This will allow the editor to find the object you wish to edit more quickly. If you wish to edit a single object, the region is best defined as a tiny line that only crosses that object.

Move the cursor while the drawing pen is down to define the region. When the drawing pen is raised, the outlined area will be highlighted with a dashed line style and the Edit command mode functions will be displayed on the status line. The editor will also highlight the first object in the drawing list which occupies any portion of the defined edit region.

If this is your first time to use the Edit command mode, press the RETURN key repeatedly to see how the various objects in the edit region will be highlighted in succession (if there are more than one). This is done to isolate the particular object you wish to modify or delete. The fewer objects there are in the edit region, the faster it will be found.

Different highlighting techniques are used for the various object types, and some may be difficult to see. For this reason, the object type of the currently highlighted object will always be displayed on the status line while you are in this mode of operation. The current ink color mode of the object will also be indicated on the status line (White, Black, or Reverse).

Lines, circles, and arcs will be highlighted by a dashed line style. Dots will be indicated by the presence of the cursor at the position of the dot, and paint objects types will be highlighted by a dashed line around the boundary of the paint with the cursor shown at the position of the paint trigger point.

Operation (Selecting the Edit Functions)

The object that is currently highlighted by the Edit command mode is known as the current object. Objects are edited in this mode by stepping through all of the objects in the defined edit region until the object you wish to modify or delete is the current object. Once the desired object is found, any of the available edit functions can be performed on it. All of these functions (except Repeat) operate on the current object only.

To perform an edit function on the current object, press the key that corresponds to the first letter of the function name, as summarized on the status display line. The edit function will be performed immediately, and the next object in the edit region will be selected as the new current object. Below is a description of the edit functions.

Kill

The Kill function operates similar to the Kill command mode by deleting the current object from the drawing list. The entire object is deleted with no clipping performed.

Erase

The Erase function operates similar to the Erase command mode by clipping the current object using the edit region and deleting only the portion of the object that is within the edit region. Note that the paint object type can not be clipped. If you use this function to erase a paint object, it will not be affected unless the edit region completely surrounds the boundaries of the object.

Terminate

The Terminate function will end the drawing list search for objects in the current edit region and allow the user to exit the edit command mode. Note that the same function is performed by the Delete and Backspace keys and when all of the other edit functions reach the end of the drawing list. This function may automatically perform an update operation of the current image if the editing changes to the drawing list have been too extensive to correct in the current image otherwise.

Style

The Style function will change the line or paint style of the current object to the style that was last selected by the Style command mode (before entering the Edit command mode). If the current object type is a paint, then the paint style will be changed. Otherwise, the line style of the current object will be changed. This function has no effect on dot object types.

Repeat

The Repeat function will automatically repeat the last edit mode function that was performed (Kill, Erase, Style, or Ink Mode Change) on every remaining object in the currently defined edit region beginning with the current object. This process can be aborted by pressing the DELETE or BACKSPACE keys at any time.

Next

The Next function will locate the next object in the drawing list that is within the edit region and make it the current object. The objects are not modified in any way by this function. Note that the RETURN and SPACE BAR keys will perform the same function.

Drawing Ink Mode Editing

To change the ink type (color) of the current object, press one of the three color keys for the ink mode type you wish the object to be changed to. The blue key will designate black, the red key will designate reverse, and the white key will designate white.

Effects on Drawing List

Line and paint style changes have no effect on the drawing list size. Killing whole objects with the Edit command mode will reduce the list size. The Erase function can decrease or increase the drawing list size depending upon whether whole objects are deleted, or if clipping is performed to generate new objects. The Terminate and Next functions have no effects on the drawing list.

Alternates

The Edit command mode is the only means of changing the line or paint style of an object after it is drawn, without deleting and redrawing the object. The Kill command mode can be used to delete objects in the reverse order of how they were drawn starting from the last object in the drawing list. The Erase command mode can be quicker to use if you wish to erase all of the objects in a designated region.

Description

The Erase command mode allows any rectangular shaped region to be quickly erased to a black background. Any objects that are completely within the specified erase region will be completely eliminated from the drawing list while objects that cross any of the erase region boundaries will be clipped so that the remaining portion of the objects are not affected.

Operation

An erase operation is performed by rubberbanding a region that completely surrounds the object or group of objects that are to be erased. This is done by moving the cursor while the drawing pen is down and then raising the pen when the desired region is outlined. When the drawing pen is raised, the defined region will be highlighted with a dashed line style and a large diagonal cross to indicate that the data within this region is about to be erased. Pressing the drawing pen again will erase the highlighted region. To abort the erase operation, press either the DELETE or BACKSPACE keys.

Special rules apply when erasing paint objects since they can not be clipped as the other object types can. A paint object can only be erased by completely surrounding the entire paint object boundary. If the defined erase region crosses any boundary of the paint object (which can be larger than the drawn object if the paint is surrounded by a polygon), none of the paint object will be erased.

Care should be taken when using the Erase command mode that the regions defined do not overlap or touch any objects other than the ones you wish to erase.

Effects on the Drawing List

An erase operation will usually free up some portion of the drawing list space for other uses. However, it is possible to actually increase the size of the drawing list with an erase operation. Line, circle, and arc object types which are partially erased will be clipped into new lines and arcs. Of course, if these objects are completely erased, then the drawing list will be smaller. The dot and paint object types can not be clipped and so can only be erased completely or not at all.

Alternates

If the symbol or objects you wish to erase are few in number and were the very last objects drawn, they can be erased more quickly with the Kill command mode which is also less likely to affect surrounding objects. The Edit command mode must be used if the objects you wish to erase are drawn on top of or under other objects which you do not want disturbed.

Description

The Kill command mode allows any object or symbol which has just been drawn to be quickly deleted without affecting any other objects in the drawing list, even if they are drawn directly underneath the object or symbol you wish to delete. Instead of defining a region, Kill works by simply deleting objects in the drawing list from the bottom up, which is the reverse order in which they were drawn. The kill command will also make an attempt to correct the current image on the screen without forcing an image update operation.

Operation

A kill operation is performed by simply pressing the K key on the keyboard. This will immediately delete the last object or symbol that was drawn. The amount of data that will be deleted by a kill command depends on which command mode was used to draw the last object in the drawing list. If the last object was drawn by either the Box, Circle, Dot, Line, or Oval command modes, then these objects will be deleted individually by each kill command. If the last object was drawn as part of a symbol by either the Draw, Move, Rotate, Symbol, or Text command modes, then all of the objects that were apart of that operation will be deleted by a single kill command.

It is important to understand that the Kill command may affect the appearance of other objects near the object being killed. However, this is only temporary and will automatically be corrected by the next list redraw operation. A redraw can be forced immediately by the Update command.

The Kill command makes a best attempt to correct the current image so that a redraw may not be necessary. This is done by redrawing the killed object in its opposite ink color, which can be misleading if the killed object was already drawn in the same color as its background, or if it was killed with a drawing grid displayed. These peculiarities greatly improve the speed of the editor and can be quite useful in some situations once the user is familiar with them. Otherwise, the Update command can be used to correct the current image after a Kill command.

Kill operations which involve one or more paint object types will automatically be followed by a complete image update from the drawing list. Note also that a kill operation may appear to do nothing if the last object drawn is in a different section of the drawing area than the current display window.

Effects on the Drawing List

The Kill command will always delete the last object in the drawing list unless it was a symbol, then the entire symbol will be deleted.

Alternates

The Erase command mode can be used to kill objects that are well isolated from other objects in the drawing area. The Edit command mode must be used if you wish to kill an object that is not at the bottom of the drawing list and is drawn on top of or under surrounding objects.

Description

The Move command mode allows any object or group of objects to be clipped from the drawing area to form a temporary symbol that can be duplicated elsewhere in the drawing with optional scaling and flip changes. Any objects that are completely within the specified source region will be moved to the destination region while objects that cross any of the source region boundaries will be clipped so that only the portions that were inside will be moved.

Operation

A move operation requires the rubberbanding of two separate regions which are known as the source region and the destination region. The source region is defined first and must completely surround the object or group of objects that are to be moved. Objects which cross the source region boundary will be clipped (with the exception of the paint object type).

Defining the source region is done by moving the cursor while the drawing pen is down and then raising the pen when the desired region is outlined. Raising the pen will cause the defined region to be highlighted with a dashed line style. A copy of the highlighted source region boundary will then be made when the cursor is moved while the drawing pen is up.

Next, position the duplicate boundary at the desired position in the drawing area and lower the drawing pen again. This duplicate boundary will become the destination region as soon as the drawing pen is raised for the second time. If the defined destination region is correct, and you wish to make a copy of the source that is exactly the same size and orientation, then raise the drawing pen without moving the cursor. Moving the cursor while the pen is down will allow the destination region to be scaled and/or flipped.

When the drawing pen is raised, the temporary symbol that was clipped from the source region will be duplicated at the destination region with the same dimensions as the defined destination region boundary. Note that the source and destination regions can overlap. To abort a move operation, press either the delete or backspace keys at any time during this process.

Special rules apply when moving paint objects since they can not be clipped as the other object types can. A paint object can only be moved by completely surrounding the entire paint object boundary. If the defined source region crosses any boundary of the paint object (which can be larger than the drawn object if the paint is surrounded by a polygon), the paint object will not be moved.

If objects in the source region of a move operation are not visible when drawn in the destination region, it may be because the objects are of the same ink color or line style as the background which you have placed the destination region on. This can be corrected by either moving the symbol to an area with a different background, or by using the Edit command mode to change the ink color and/or line styles of the objects in the destination region after they are drawn.

Objects can be scaled down by the Move command mode as small as desired. However, if you intend to ever scale the object back up to its original size (or larger), then the object should not be reduced to less than 1/16th of its original size. Scaling down below this point will cause precision to be lost, although this will not be detectable unless the object is enlarged again. Also, scaling regions that are very large in the vertical direction (more than half the size of the drawing area) can cause overflow errors if the destination region is also as large or larger. Such overflow errors will cause the editor to abort the move operation and report the error.

Effects on the Drawing List

All of the objects in the source region will be duplicated in the drawing list each time it is copied by the Move command mode. Once the objects are moved, the objects in the source region can then be erased to return the same amount of free list memory.

These objects can be any combination of the five different object types. The amount of memory used by these objects in the drawing list is constant regardless of size, shape, or flip changes that may have been made by the Move command.

Alternates

Duplicating, scaling, and flipping objects can also be accomplished by using the Write and Symbol command modes. This will make symbols that are more permanent than the temporary symbols created by the Move command. The Rotate command mode can also be used to move temporary symbols if you do not wish to scale them.

Description

The Rotate command mode allows any object or group of objects to be clipped from the drawing area to form a temporary symbol that can be duplicated elsewhere in the drawing with optional rotation of either 90, 180, 270, or 360 degrees. Objects that are completely within the specified source region will be moved to the destination region while objects that cross any of the source region boundaries will be clipped so that only the portions that were inside will be moved.

Operation

A rotate operation requires the rubber banding of two separate regions which are known as the source region and the destination region. The source region is defined first and must completely surround the object or group of objects that are to be rotated. Objects which cross the source region boundary will be clipped (with the exception of the paint object type).

Defining the source region is done by moving the cursor while the drawing pen is down and then raising the pen when the desired region is outlined. Raising the pen will cause the defined region to be highlighted with a dashed line style. A copy of the highlighted source region boundary will then be made when the cursor is moved while the drawing pen is up.

Next, position the duplicate boundary at the desired position in the drawing area and lower the drawing pen again. This duplicate boundary will become the destination region as soon as the drawing pen is raised for the second time. If the defined destination region is correct, and you wish to make a copy of the source that is not rotated, then raise the drawing pen without moving the cursor. Moving the cursor while the pen is down will allow the destination region to be rotated to any of the other 90 degree rotation boundaries.

Note that once the drawing pen is lowered for the second time, the Rotate command mode restricts the movement of the cursor to one of four possible rotation positions (90, 180, 270, and 360 degrees). These positions will be restricted even further if any portion of them exceed the drawing area boundaries. Attempting to move the cursor in a direction other than a valid destination region will have no effect.

When the drawing pen is raised, the temporary symbol that was clipped from the source region will be duplicated at the destination region with the proper rotation factor applied. Note that the source and destination regions can overlap. To abort a rotate operation, press either the delete or backspace keys at any time during this process.

Special rules apply when rotating paint objects since they can not be clipped as the other object types can. A paint object can only be rotated by completely surrounding the entire paint object boundary. If the defined source region crosses any boundary of the paint object (which can be larger than the drawn object if the paint is surrounded by a polygon), the paint object will not be rotated.

If objects in the source region of a rotate operation are not visible when drawn in the destination region, it may be because the objects are of the same ink color or line style as the background which you have placed the destination region on. This can be corrected by either moving the symbol to an area with a different background, or by using the Edit command mode to change the ink color and/or line styles of the objects in the destination region after they are drawn.

Effects on the Drawing List

All of the objects in the source region will be duplicated in the drawing list each time it is copied by the Rotate command mode. Once the objects are rotated, the objects in the source region can then be erased to return the same amount of free list memory.

These objects can be any combination of the five different object types. The amount of memory used by these objects in the drawing list is constant regardless of the rotation factor applied to them.

Alternates

The Move command mode can also effectively rotate objects and symbols by 180 degrees by flipping their destination regions in both horizontal and vertical directions.

The third category of editor commands is the Editor Control Commands. These are commands which place the editor into modes for configuring the operation of the editor, reading and writing drawing files, printing images, and various other control functions. The control command mode currently in effect is usually displayed in the center of the status display line.

The Editor Control Command Modes

<u>Command Name</u>	<u>Key</u>	<u>Command Functions</u>
Configuration	f3	Configures Various Editor Parameters
File	F	Reads Drawing Files from Disk
Help	H	Displays a Command List Summary
Input	I	Inputs a New Cursor Position from Keypad
Overlay	f4	Reads and Displays Overlay Files
Print	f5	Outputs Current Image to Printer
Quit	Q	Exits the Editor to Operating System
Style	S	Selects Paint and Line Styles
Update	U	Updates Current Image from List
View	V	Views Drawing Without Overlays or Grid
Write	W	Writes Drawing and Symbol Files to Disk
Zap	Z	Erases Entire Drawing List

Description

The Configure command allows the user to change many of the operating parameters of the CAD-89 editor. Some of these parameters are vital to the operation of the editor since they control how the software communicates with the IGC hardware. Other parameters only affect the operation of certain input devices or command modes, such as Print and Text. The remaining options only control certain aesthetic aspects of the graphics cursor and drawing grids.

Operation

To enter the Configuration command mode, simply press the f3 function key. The configuration menu will be displayed listing all of the available options and their current values as shown below. To make a change in a configuration option, press the letter that is designated for that option.

Configuration Options

Editor	A - Cursor Size	1-640
	B - Cursor Blink Rate	None/Slow/Medium/Fast
	C - Display Drawing Grid:	Yes/No
	D - Keypad Speed:	0-255
	E - Trackball Present:	Yes/No
	F - Terminal Initialization:	0,0,0,0,0,0,0,0
	G - Text Library File:	SY0:MICRO.LIB
	H - Save Configuration to Disk	
IGC	I - Parallel Port Address:	8
	J - Interlace:	On/Off
Mouse	K - Serial Port Address:	208/216/224
	L - Interrupt Level:	3/4/5
Printer	M - Printer Type:	Epson/IDS/CITOH/MPI/Oki
	N - Interface Type:	Parallel/Serial
	O - Port Address:	15/14
	P - Printer Initialization:	0,0,0,0,0,0,0,0
	Q - Parallel Interface Type:	SigmaSoft/8255
	R - Serial Baud Rate:	300/1200/4800/9600/19200
	S - Serial Handshake:	DSR/CTS

The configuration options are divided into four groups, editor operation options, IGC communication options, mouse communication options, and printer communication options. Note that Save Configuration to Disk (option H) is a special option which will make changes in the other options permanent. It is required by many options to make changes become effective. The following paragraphs describe each of the options in detail.

Cursor Size (Option A)

This option allows the user to adjust the size of the graphics cursor displayed in the drawing area by the CAD-89 editor. This value is the length of each of the four lines that comprise the cursor measured in pixels. Any whole number between 1 and 640 is valid. Smaller cursors have the advantage that they draw faster and therefore respond quicker to input device movement. Larger cursors can be easier to see on busy backgrounds.

Cursor Blink Rate (Option B)

This option allows the user to adjust the speed at which the graphics cursor flashes on the screen. Four blink rates are supported, None, Slow, Medium, and Fast. The speed of these blink rates is based on the H/Z89's 2 millisecond interrupt clock and is therefore unaffected by the CPU clock speed. The blink rate selected will not affect the cursor reaction or movement speed.

Display Drawing Grid (Option C)

This option allows the user to configure the drawing grid so that it is always invisible on the screen, even though it may still be present. Grids smaller than 10 in either the horizontal or vertical directions are never displayed anyway. So, this option only affects larger grids. Larger grids can be made invisible temporarily by the View command mode. For more information on drawing grids, refer to the Grid command mode.

Keypad Speed (Option D)

This option allows the user to adjust the speed at which the arrow keys on the H/Z89's keypad will accelerate the movement of the graphics cursor when these keys are used with the REPEAT key. Any whole number between 0 and 255 is valid with the larger numbers being the faster speeds. This timing is based on the H/Z89's 2 millisecond interrupt clock and is therefore unaffected by the CPU clock speed.

Trackball Present (Option E)

This option enables and disables the ability of the editor to use the graphics input device ports on the IGC board. Devices which operate as five digital switches with TTL compatible outputs can be connected to one of these ports to control the movement of the graphics cursor. Cables are available from SigmaSoft which convert this interface to a standard DB-9 type connector which is compatible with some trackball and joystick devices manufactured by Atari and Wico. These interfaces are not used by the optical mouse.

This option can not be used if you are using the 19200 baud data rate for terminal communications with a 2 MHz CPU clock speed. If you are using 19200 baud, you must either run CAD-89 at 4 MHz, disable this option, or switch to a 9600 baud data rate.

Terminal Initialization (Option F)

This option determines the 8 byte terminal initialization sequence which is output to the H/Z89 or H/Z19 console each time the CAD-89 program is run. Each of these eight values must be a whole number between 0 and 255.

If you will be using the Interlace option, these values must be configured to enable the interlaced display mode. The values required for this depend on the type of code ROM you have installed on your Terminal Logic Board. If you are not using interlace mode, all eight of these values should be zero. Below is a chart which lists the values needed for the various ROMs available. Unused values should be set to zero.

Values Required for the Terminal Initialization Option

<u>Code ROM Type</u>	<u>Required Values</u>
Standard Heath ROM	Does Not Support Interlace
Watzman ROM	Does Not Support Interlace
SigmaSoft ROM	0,0,0,0,0,0,0,0
Super19 ROM	27,104,57,0,0,0,0,0
Ultra ROM	27,104,52,0,0,0,0,0

Changes in this option do not become effective until a Save Configuration to Disk (Option H) is performed, and the editor program is exited and run again.

Text Library File (Option G)

This option defines the device and filename of the default text library file. This is the file that will be used by the Text command mode to locate text symbols for lettering purposes if they can not be found in memory or in files by the letter names. For more information, refer to the Text command mode description.

Any valid filename can be given here with .LIB being the default filename extension. The default device name is SY0: for HDOS and A: for CP/M. The MICRO.LIB file is a text library file that is supplied with the CAD-89 software. It contains a general purpose font.

Save Configuration to Disk (Option H)

This option writes the current settings of all of the other configuration options in the menu to the CAD-89 program file so that they need not be reconfigured each time the editor is run. The current settings will become the new defaults. This option is required to initiate changes in some of the other options since they do not become effective until the program is exited and run again.

IGC Port Address (Option I)

This option defines the I/O port address of the Interactive Graphics Controller. The value set here must correspond to the port address selection jumpers on the Universal Parallel Interface board. The standard value is 8. Any decimal value between 0 and 255 can be entered.

If the CAD-89 editor is run with this option configured incorrectly, it will not be able to communicate with the IGC board. This will cause the editor to display the configuration menu immediately so that a correct value can be entered. In this event, a Save Configuration to Disk (Option H) must also be performed to make the port address change become effective. The program will then exit to be run again.

Interlace (Option J)

This option enables and disables the interlaced display feature of the CAD-89 editor. To use this feature, the bank interlace mode must be selected on the IGC board (J1), a special ROM must be installed on the Terminal Logic Board, and the proper escape sequence must be configured for the Terminal Initialization (Option F). Refer to the IGC Users' Manual.

Interlace mode doubles the vertical pixel resolution of the drawing area from 768 to 1536 (the horizontal pixel resolution of 640 remains constant). However, interlace mode has the unpleasant side effect of causing the screen image to flicker since the refresh rate of the picture tube is reduced from 60 Hz to 30 Hz. For this reason, a replacement CRT screen with a long persistence phosphor is recommended if you plan to make extensive use of this feature. This mode will also improve the resolution of drawings that are printed on a dot matrix printer via the Print command mode.

Note that this software does not support page interlace mode since bank interlace is more practical with a 256k IGC board and the CAD-89 editor requires 256k of IGC memory anyway.

The three special ROMs which support interlaced operation are the Super19, Ultra ROM, and an interlace ROM available from SigmaSoft. Since only the latter is still commercially available, contact SigmaSoft and Systems for further information.

Changes in this option do not become effective until a Save Configuration to Disk (Option H) is performed, and the editor program is exited and run again.

Mouse Serial Port Address (Option K)

This option defines the serial port address of the optical mouse input device. This device can be connected to any of the H/89's three serial ports. The addresses of these are 208 (3200), 216 (3300), and 224 (3400). These values must be entered in decimal and not octal. The port address used here must correspond to the connector on the serial interface board that the mouse device is connected to. The standard port address for this device is 208 which is the bottom most connector on the serial interface board.

Changes in this option do not become effective until a Save Configuration to Disk (Option H) is performed, and the editor program is exited and run again.

Mouse Interrupt Priority Level (Option L)

This option defines the interrupt priority level of the serial port that the optical mouse input device is connected to. The three priority levels supported by the serial interface board are 3, 4, and 5. The standard value is 5. The value used here must correspond to the position of the interrupt level selection jumper on the serial interface board for the particular port/connector that you are using for the mouse device.

Changes in this option do not become effective until a Save Configuration to Disk (Option H) is performed, and the editor program is exited and run again.

Dot Matrix Printer Type (Option M)

This option defines the type of dot matrix printer that you are using with the CAD-89 editor. A whole number between 0 and 4 must be supplied for this option which is used as a printer type index by the Print command mode. Refer to the chart below to determine the proper value for your printer type.

Summary of Printer Type Values

<u>Value</u>	<u>Printer Type</u>
0	Epson/Star Gemini/Panasonic/Riteman/Mannesman
1	Integral Data Systems/Paper Tiger/Micro Prism
2	C. ITOH/Prowriter
3	MPI/99G/Bell and Howell/S Printer
4	Okidata/Microline/Okigraph

If you can not identify a printer type which corresponds to the type of printer you have, try performing a test Print command with each of these values. Most dot matrix printers manufactured today follow one of these standards. If none of these printer type values appear to work, you may have one or more of the other printer configuration options defined incorrectly.

Printer Interface Type (Option N)

This option selects between a parallel or serial printer interface type. This configuration must correspond to the type of interface board you are using to connect your printer to the H/Z89 or H8 bus. Serial printer interfaces must be an INS8250 type device as used on the standard Heath serial interface boards.

Parallel printer interfaces can be either an 8255 PPI type device as used on the standard Heath Multifunction I/O board for the H/Z89, or one of the two Centronics compatible printer interfaces on the SigmaSoft Universal Parallel Interface board as selected by option Q. The latter has the advantages of speed, greater reliability, and ease of configuration.

Note that the state of this option controls the display of other options in the configuration menu. If a parallel interface type is selected by this option, other options which only apply to a serial interface, will not be shown in the menu and vice versa.

Changes in this option do not become effective until a Save Configuration to Disk (Option H) is performed, and the editor program is exited and run again.

Printer Port Address (Option O)

This option defines the I/O port address of either the parallel or serial printer interface. The value set here must correspond to the interface board and connector you are using to interface your printer cable to the H/Z89 or H8 bus. If you are using a serial interface or the Heath Multifunction (8255) type parallel interface, the port address must be either 208 (320Q), 216 (330Q), or 224 (340Q). These values must be entered in decimal and not octal.

If you are using the SigmaSoft interface for your parallel printer connection, the port address is determined by the port address selection jumpers on the interface board. The standard values are 14 and 15 decimal with port 15 being the 10 and 12 pin connectors closest to the H/Z89 or H8 bus connectors.

Changes in this option do not become effective until a Save Configuration to Disk (Option H) is performed, and the editor program is exited and run again.

Printer Initialization (Option P)

This option determines the 8 byte printer initialization sequence which is output to the printer each time a Print command is performed. Each of these eight values must be a whole number between 0 and 255.

This data should contain any of the control characters or escape sequences that are required by your printer to initialize. This option can also be used to configure the printer for any special default modes that are desired. Refer to the operations manual for your printer to determine what modes are available. The following chart list the recommended values for this option for several different printer types. All unused values of this sequence should be set to zero.

Recommended Values for the Printer Initialization Option

<u>Values</u>	<u>Printer Type</u>
27,64	Epson/Star Gemini/Panasonic/Riteman/Mannesman
17,2,5,6,29	Integral Data Systems/Paper Tiger/Micro Prism
17,27,62	C. ITOH/Prowriter
17,29	Okidata/Microline/Okigraph

Parallel Printer Interface Type (Option Q)

This option selects between either an 8255 PPI type device as used on the standard Heath Multifunction I/O board for the H/Z89, or one of the two Centronics compatible printer interfaces on the SigmaSoft Universal Parallel Interface board. This configuration must correspond to the type of interface board you are using to connect your printer to the H/Z89 or H8 bus.

Changes in this option do not become effective until a Save Configuration to Disk (Option H) is performed, and the editor program is exited and run again.

Printer Serial Baud Rate (Option R)

This option defines the serial data baud rate used for communications between a serial printer interface and the printer.

This value must correspond to the baud rate selected on the internal switches of the printer you are using. Some of the valid baud rates are 300, 1200, 2400, 4800, 9600, and 19200. Note that baud rates above 1200 may be unreliable on some printers when printing high resolution graphics, due to limitations of their serial interface boards.

Changes in this option do not become effective until a Save Configuration to Disk (Option H) is performed, and the editor program is exited and run again.

Printer Serial Handshake Type (Option S)

This option selects between either DSR (Data Set Ready) active high and CTS (Clear to Send) active low handshaking for the serial printer interface. This configuration is determined by the printer type and cable that you are using. DSR is the more common configuration. If your printer cable crosses any handshaking wires the CTS option may be needed.

Changes in this option do not become effective until a Save Configuration to Disk (Option H) is performed, and the editor program is exited and run again.

Effects on the Drawing List

The Configuration command mode has no effect on the drawing list.

Alternates

The Configuration command mode is the sole means of changing these parameters.

Description

The File command mode will read drawings from a disk file which have been saved previously with the Write command mode and place the data into the drawing list. Any data that is already in the drawing list will be erased before the new file is read. Next, an update of the current image in the drawing area will be performed so that the new drawing is displayed.

These files must be in the standard compressed editor format that is generated by the Write command mode. Symbol and symbol library files can also be read although only the first symbol in the file will be found since the File command mode does not use a symbol name specification.

Operation

Whenever the File command mode is entered the user will be prompted for a filename on the status display line. If the drawing list still contains data which has not been saved to a disk file the editor will ask:

Erase Edited Drawing?

If you wish to erase the drawing list so the new file can be read, simply press the Y key. If not, press any other key. Next, the editor will prompt the user for a filename to read. An example would be as follows:

Read Filename? A:SCHEMATIC.CAD

Note that the A: device specification (SYØ: for HDOS) and the .CAD filename extension are the defaults and are therefore optional. An error may occur if the file can not be found by the name supplied, or if the contents of the file are invalid. In either case, an appropriate error message will be displayed. In the event that a file may have become damaged or if there is not enough list memory to hold the entire file, the editor will read and draw as much of the data as possible and then indicate the error.

Effects on the Drawing List

A file command will completely replace all of the data that may be in the drawing list. Two drawing list sizes are supported by CAD-89, 128k and 192k which is selected by the interlace option of the Configure command mode.

Alternates

The Overlay command will allow a drawing file to be read which is drawn in the current image, but is not included in the drawing list. This can allow drawings to be layered far beyond the normal memory limits of the editor.

Description

The Help command will display a summary of all of the valid commands for the CAD-89 editor.

Operation

Simply press the H key to display the command list summary. Pressing the ? key will display the command assignments for the function keys on the status display line without disabling the graphics display. To exit the help menu, simply press any key. For a complete command mode summary, refer to the References section at the back of this manual.

Effects on the Drawing List

The Help command mode has no effect on the drawing list.

Alternates

Pressing the ? key will display the command assignments for the function keys on the status display line without disabling the graphics display.

Description

The Input command allows the user to control the position of the graphics cursor manually by entering either an absolute or relative numerical position with the keypad.

Operation

Pressing either the I key or keypad ENTER key will cause a prompt to appear on the status display line for a new cursor position. Either the keyboard or keypad numeral keys can be used to enter the new position. The format for a new position is the horizontal coordinate followed by a comma or period and then the vertical coordinate followed by a carriage return or ENTER key.

The default coordinate system is absolute with the origin (coordinate 0,0) at the top left-most corner of the drawing area. Proceeding either or both of the coordinates with a negative (-) or positive sign (+) will cause the editor to consider them relative based on the current position of the cursor. The size of the addressable coordinate area is determined by the current drawing grid factor as set by the Grid command.

Effects on the Drawing List

The Input command mode has no effect on the drawing list.

Alternates

The cursor can usually be positioned more easily by use of a graphics input device such as the keypad arrow keys.

Description

The Overlay command mode will read drawings from a disk file which have been saved previously with the Write command mode and draw them underneath the current image. This command will not erase the drawing list or add the overlay file to the drawing list. The overlaid files will be displayed together in the drawing area although none of the overlay file data will be present in the drawing list.

Overlays are used to compare or trace two or more drawings from other drawings without the overlay data being confused with the drawing list data. Many types of drafting require this type of flexibility, such as the layout of printed circuit boards where two or more layers of the board need to be viewed together while only a single layer is edited at a time.

Overlay files must be in the standard compressed editor format that is generated by the Write command mode. Symbol and symbol library files can also be read although only the first symbol in the file will be found since the File command mode does not use a symbol name specification.

Operation

Whenever the Overlay command mode is entered the user will be prompted for an overlay filename on the status display line. An example would be as follows:

```
Read Overlay Filename? A:SCHEMATIC.CAD
```

Note that the A: device specification (SYØ: for HDOS) and the .CAD filename extension are the defaults and are therefore optional. An error may occur if the file can not be found by the name supplied, or if the contents of the file are invalid. In either case, an appropriate error message will be displayed. In the event that a file may have become damaged the editor will read and draw as much of the data as possible and then indicate the error.

If a valid file is found, an update of the current image will be performed with the overlay file drawn first, followed by the resident drawing list on top of the overlay. Up to ten overlay files can be active at one time. Each of which will be redrawn in the order in which they were originally entered each time an Update command is performed. The drawing list data will always be redrawn last regardless of when it was entered.

An update of the current image from the list data can be performed without the redrawing of the active overlays by the View command. However, the overlays will still be active and can be redrawn by the Update command. To eliminate the active overlays completely, use the Zap command.

Effects on the Drawing List

The overlay command has no effect on the drawing list. No IGC or system memory is used by overlays since they are read from a disk device each time they are redrawn.

Alternates

The File command will allow a drawing file to be read into the drawing list for editing purposes. Use the Symbol command to combine two or more files into the same drawing list.

Description

The Print command mode allows any drawing or symbol that has been created with the CAD-89 editor to be output to any of several different types of dot matrix printers. The editor will create a copy on paper that resembles the current image in the drawing area as much as possible. The dot matrix printer types supported include the Epson, IDS, C. ITOH, MPI, Okidata, and compatible printers. For this command mode to operate properly, the editor must be configured for the printer type you are using by the Configure command mode.

Operation

The Print command is performed by simply pressing the f5 function key. Your printer must be turned on and selected for operation. If incorrect data is printed, refer to the Configure command mode.

It is important to understand that the print command operates solely from the data in the current image of the drawing area, and not from the drawing list. Therefore, if you have just performed Kill, Edit, or any other commands which can cause discrepancies in the current image from the data in the drawing list, an Update command may be needed before the Print operation is performed. Furthermore, drawing grids and overlays will also be included in the printout if they are present in the current image. If you wish to print the current image without the grid or overlays, use the View command.

The Print command will output the entire current image except for leading and trailing blank areas, if present. The printout will begin at the first white pixel from the top of the drawing area and work downward through the image until blank space is encountered. If the blank space is followed by more drawings further down, line feeds will be output to the printer to advance the paper more quickly. If blank space is reached that extends to the end of the drawing area without more drawings, the print operation will be terminated. Note that a Print command can be aborted at any time by pressing either the Delete or Backspace keys.

Effects on the Drawing List

The Print command has no effect on the drawing list.

Alternates

The Print command is the sole means of hardcopy output from the CAD-89 editor. However, custom printer dump programs can easily be developed using the programming language of your choice since the current image created by the editor remains intact in the IGC memory when CAD-89 exits to the operating system via the Quit command. For more information on this, refer to the Advanced Programming Guide section of the IGC Users' Manual.

Description

The Quit command allows the user to exit from the CAD-89 editor and return to the controlling operating system (HDOS or CP/M) in an orderly manner.

Operation

To exit the editor via the Quit command, simply press the Q key. If any data has been added to the drawing list since the last file Write command, the editor will respond with:

Erase Edited Drawing?

If you do not wish to save the drawing you have created with the editor, press the Y key and the quit operation will be performed. If you do wish to save the drawing, press the N or RETURN key to abort the quit operation and then use the Write command mode.

If the drawing has already been saved to a file, or if the drawing list has not been modified since the last File command, the quit operation will be performed immediately.

Effects on the Drawing List

The entire contents of the drawing list will be discarded.

Alternates

The Zap command will erase the entire drawing list and overlays without exiting from the editor.

It is extremely dangerous to exit the CAD-89 editor via any means other than the Quit command. Using the control sequences ^Z^Z under HDOS or ^C under CP/M can cause the resident operating system and even disk files to be damaged. This is because of the interrupt driven software that is required to interface the graphics input devices to the H/Z89 and HB computers. The Quit command disables these interrupts as well as reprograms the keypad, 25th line, and IGC for normal operation.

Description

The Style command displays a visual menu of all the available paint and line styles at the bottom of the screen indicating the styles that are currently selected and allowing the user to change the selections interactively. A small sample of each of the fifty paint styles and twelve line styles will be shown so that the user can more easily choose the best styles for a particular application.

The styles that are selected by this command mode will be used by the Line, Box, Circle, Oval, Draw, Paint, and Edit command modes.

Operation

To enter the Style command mode simply press the S key. The display window will immediately pan to the bottom of the drawing area and the style menu will appear at the bottom of the screen. Most of the menu is occupied by the painting style samples, with the line style samples shown as vertical lines at the far right of the screen. The cursor boundaries will be restricted to the style menu area until an Exit command is entered.

The editor will highlight the paint and line styles that are currently selected. If you wish to change them, simply move the cursor to the desired style sample and press the drawing pen. Raising the pen will then allow the cursor to be moved to another area of the menu without changing your new style selection. The styles that are highlighted when you exit the style command mode will become the active drawing styles until they are changed again by another style command.

To exit the style command mode, press the E key or move the cursor to the Exit option in the menu and lower the drawing pen. The editor will immediately pan the display window back to the same position it was at before the style command was entered.

Effects on the Drawing List

The style command mode has no effect on the drawing list. However, the style information for each object drawn by the editor is contained in the drawing list so that each object will be accurately reproduced.

Alternates

The Style command is the sole means of selecting drawing styles for the CAD-89 editor.

Description

The Update command redraws the current image including all overlays, the entire drawing list, and any visible drawing grid that may be enabled. This is to allow the user to see the exact state of the data that is currently being edited.

Operation

An Update command is performed by pressing the U key. The editor will erase the current image and perform a complete redraw. Any overlays that have been entered by the Overlay command will be drawn first, in the order in which they were entered. The entire drawing list will be drawn next followed by the drawing grid if enabled and visible.

Effects on the Drawing List

The Update command has no effect on the drawing list.

Alternates

The View command can be used to redraw the list without any overlays or drawing grids displayed, which is how the drawing will really be stored by the Write command. An update operation is performed automatically by some other commands such as File, Zap, and sometimes Kill and Edit.

Description

The View command is a special variation of the Update command. View redraws the current image not including overlays or the drawing grid, eventhough they may be present. This is to allow the user to see the exact state of the data that is currently being edited without the interference of the overlay or grid drawing aids.

Operation

A View command is performed by pressing the V key. The editor will erase the current image and perform a complete redraw. Only the drawing list will be redrawn. Any active overlays and/or drawing grids will still be present, but invisible. An Update command will cause them to reappear.

Effects on the Drawing List

The View command has no effect on the drawing list.

Alternates

The Update command should be used to redraw the list with overlays and drawing grids visible.

Description

The Write command mode allows the user to save any drawing or symbol that is created with the CAD-89 editor to a file on disk. Files created by this command can be read back in at any time in the future by the File, Symbol, Text, or Overlay commands. The files can also be used by the IG:/IGC: device driver and other programs which are designed to read them. Note that it is the drawing list, and not the current image that is saved to a disk file, resulting in a tremendous reduction in disk space requirements.

Operation (Defining Write Source Regions)

The Write command mode is entered by pressing the W key. The editor will then be ready for the user to define the source region for the Write operation. If you wish to save the entire contents of the drawing area (everything that has been drawn), simply press the RETURN key to define the region. This will create a CAD drawing file.

If you wish to create a symbol file by writing only a portion of the drawing area, lower the drawing pen and rubberband an outline of the symbol you wish to save. When the pen is raised, the outlined region will be highlighted with a dashed line style to indicate that it will be used as the source region for the Write operation. Any objects that cross the defined source region boundary will be clipped (except for paint object types) so that only the portions of the objects within the region will be included in the new symbol file.

It is important to understand the differences between a drawing file and a symbol file. Pressing the RETURN key to define the source region indicates that you wish to save the entire drawing as a single file which might be read back in at a later time for more editing, or used as an overlay for another drawing, etc. However, rubberbanding a source region that is smaller than the entire drawing area indicates that you wish to create a symbol file.

Creating and using symbols is more complex since they can be combined with other symbols in a single file to create a symbol library file. This requires that each symbol be assigned a symbol name that is separate from its file name so that the editor can locate individual symbols in a single file.

Operation (Entering Symbol and File Names)

If the RETURN key was pressed to save the entire drawing to a drawing file, the editor will prompt the user for a file name on the status display line as follows:

Write Filename?

A valid filename should be entered followed by a carriage return. An example would be as follows:

```
Write Filename? A:SCHEMAT.CAD
```

In this example, the editor will write the entire drawing list to a file named SCHEMAT.CAD on the disk device A:. Note that the A: device specification (SYØ: for HDOS) and the .CAD filename extension are the defaults and are therefore optional.

Whenever a symbol is defined in the Write command mode the user will be prompted for a symbol name and file name on the status display line as follows:

```
Write Symbol Name?
```

A valid symbol name should be entered followed by an optional file name specification (separated by a comma), and then a carriage return. An example would be as follows:

```
Write Symbol Name? RESISTOR, A:ELECTRON.SYM
```

In this example, the editor will create a symbol named RESISTOR that consists of the objects that are within the defined source region and write this symbol to a file named ELECTRON.SYM on the the disk device A:. Note that the A: device specification (SYØ: for HDOS) and the .SYM filename extension are the defaults and are therefore optional.

In fact, the entire file name specification (, A:ELECTRON.SYM in the above example) can be omitted if you wish to write the symbol to a file of the same name on the default disk drive unit. An example of this would be as follows:

```
Write Symbol Name? RESISTOR
```

This example would cause the editor to assume that you wish to name the symbol RESISTOR and you wish to write the symbol to a file also named RESISTOR (A:RESISTOR.SYM for CP/M, SYØ:RESISTOR.SYM for HDOS). Finally, if a symbol is to be written to a file of the same name, the filename can be entered without the symbol name preceding it. An example of this would be as follows:

```
Write Symbol Name? B:RESISTOR.SYM
```

Symbol names are limited to a maximum of eight characters in length and all printable characters are valid with the exception of the comma, period, colon, and space characters. Note also that the case of alphabetic characters is significant in symbol names. Symbol names must be entered with the Write command exactly as how you will be entering it with the Symbol command or the symbol name will not be found by the symbol command, even if the proper file is.

Operation (File Format Control)

The Write command allows drawing and symbol files to be created in one of two different formats. These are designated as the ASCII and the Binary formats. Binary format is the default since it is more memory efficient, and is the format required by the File, Symbol, Text, and Overlay commands. ASCII format is a readable list of graphics commands that are compatible with the IG:/IGC: graphics device drivers. An ASCII format file that is produced by the CAD-89 editor can actually be read into a common text editor and modified manually if so desired.

The file format specification should be entered at the end of the filename specification separated by a comma. A letter A indicates ASCII format and a letter B indicates binary format. Note that there must be two commas, or the format specification will be confused for a filename. Several examples are given below.

Write Filename? A:RESISTOR.CAD,,A

Write Symbol Name? RESISTOR,SYØ:ELECTRON.SYM,B

Caution should be exercised when using ASCII format with the Write command since files which are written in this format can not be read back in by the CAD-89 editor.

Effects on the Drawing List

The Write command mode has no effect on the drawing list.

Alternates

The Write command mode is the sole means of saving drawings and symbols created with the CAD-89 Editor to a disk file.

Description

The Zap command erases the entire drawing list, all active overlays and all resident symbols. It then performs an update of the current image in the drawing area. Active drawing grids will not be affected.

Operation

To perform a Zap operation, simply press the Z key. If any data has been added to the drawing list since the last file Write command, the editor will respond with:

Erase Edited Drawing?

If you do not wish to save the drawing you have created with the editor, press the Y key and the zap operation will be performed. If you do wish to save the drawing, press the N or RETURN key to abort the zap operation and then use the Write command mode.

If the drawing has already been saved to a file, or if the drawing list has not been modified since the last File command, the zap operation will be performed immediately.

Effects on the Drawing List

The entire contents of the drawing list will be discarded.



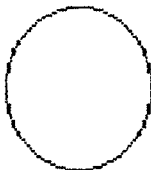

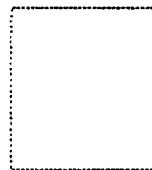
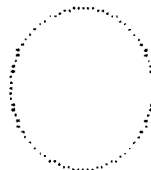
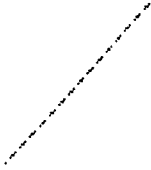

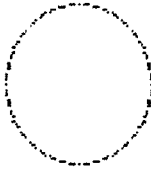
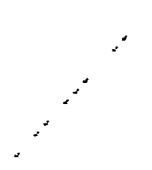
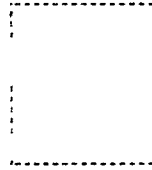








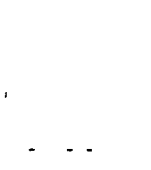


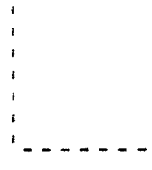

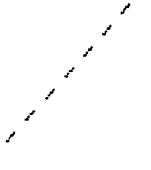
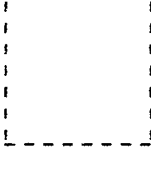

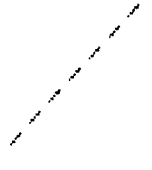
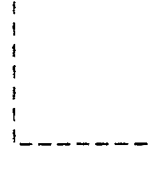

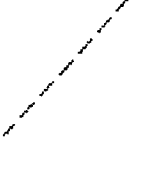
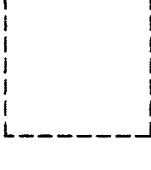


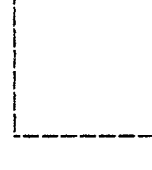

Alternates

The Erase, Kill, and Edit commands will allow selective erasures of the drawing list. If you wish to erase the entire drawing area, but keep overlays active and symbols resident, use the Erase command. A zap operation is also performed by the Quit and File commands.

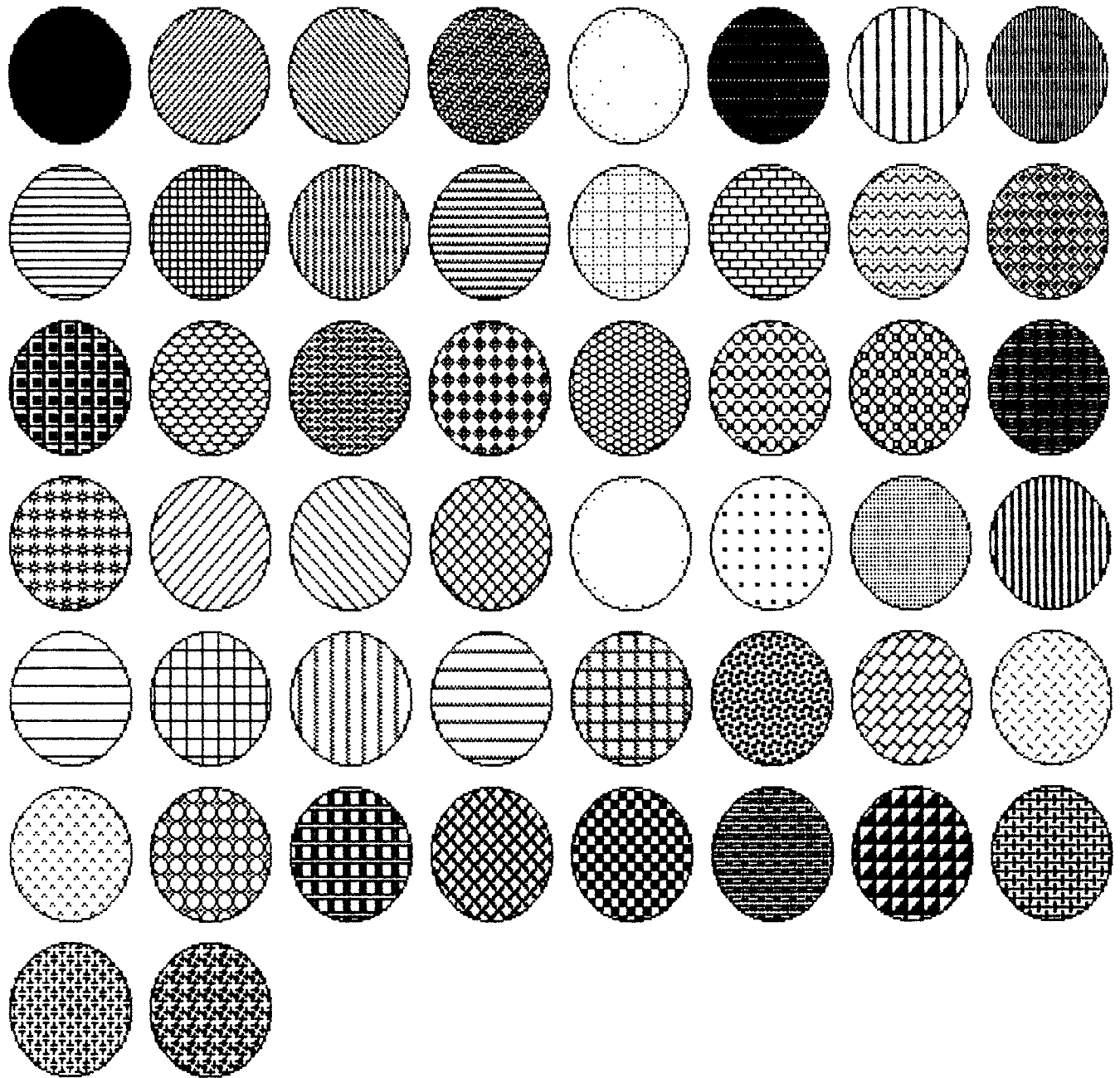
References

6.1 Drawing Examples

Line Style Samples

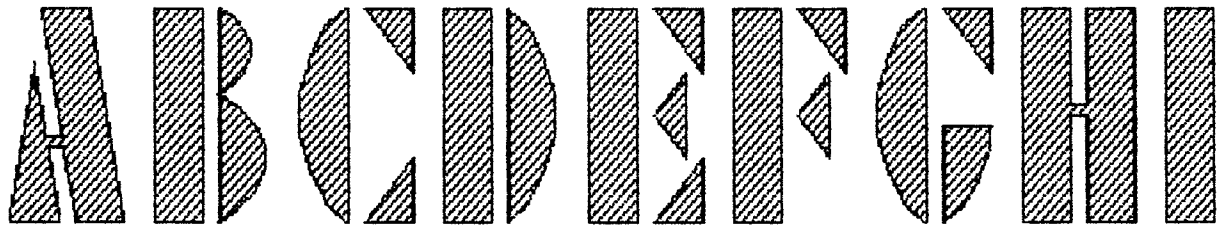
Paint Style Samples



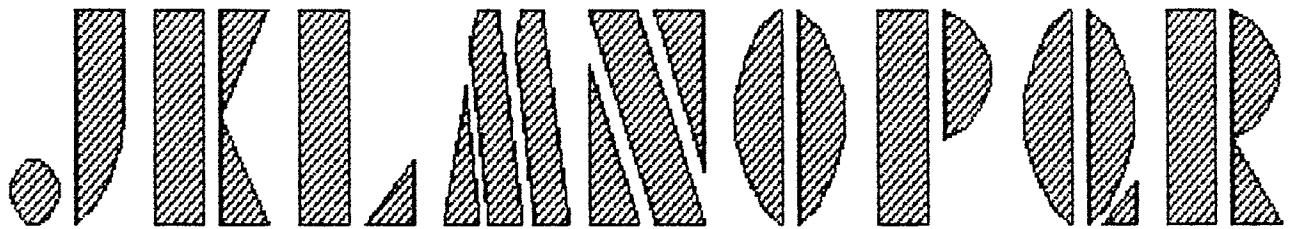
The Micro and Modern Lettersets

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

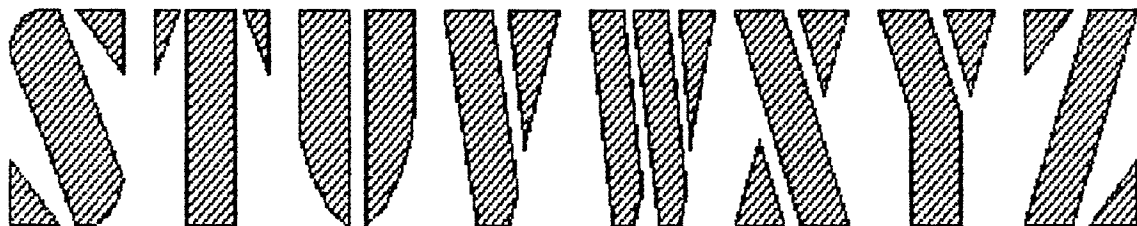
0 1 2 3 4 5 6 7 8 9



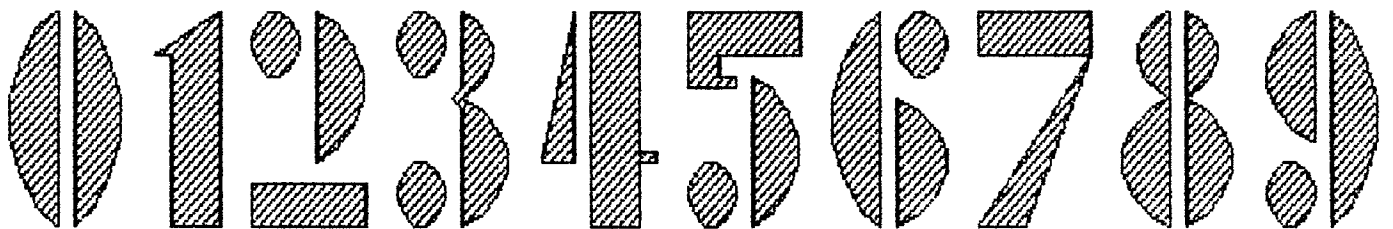
A B C D E F G H I



J K L M N O P Q R

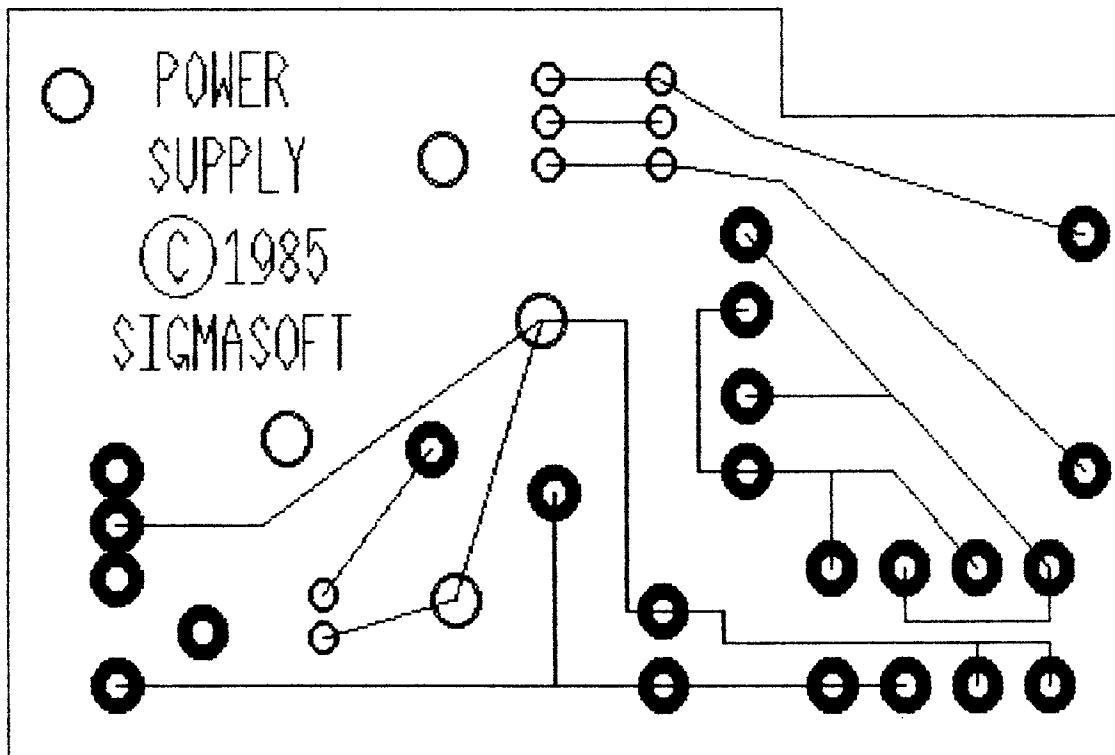
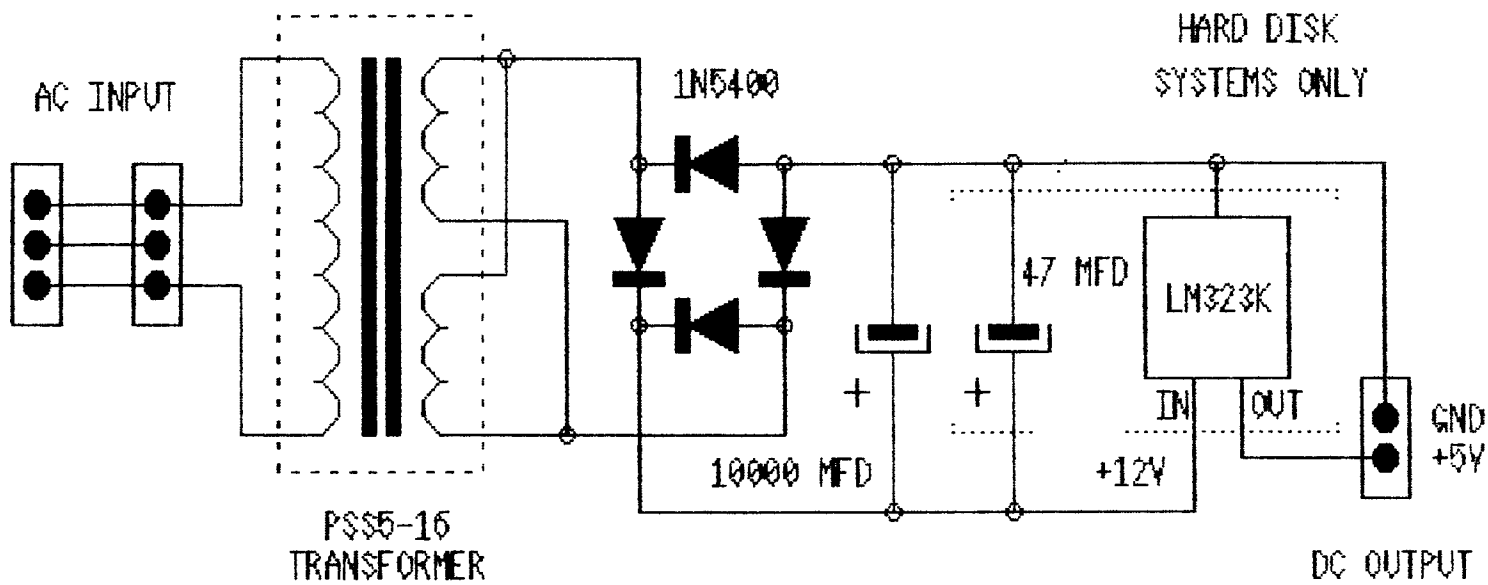


S T U V W X Y Z

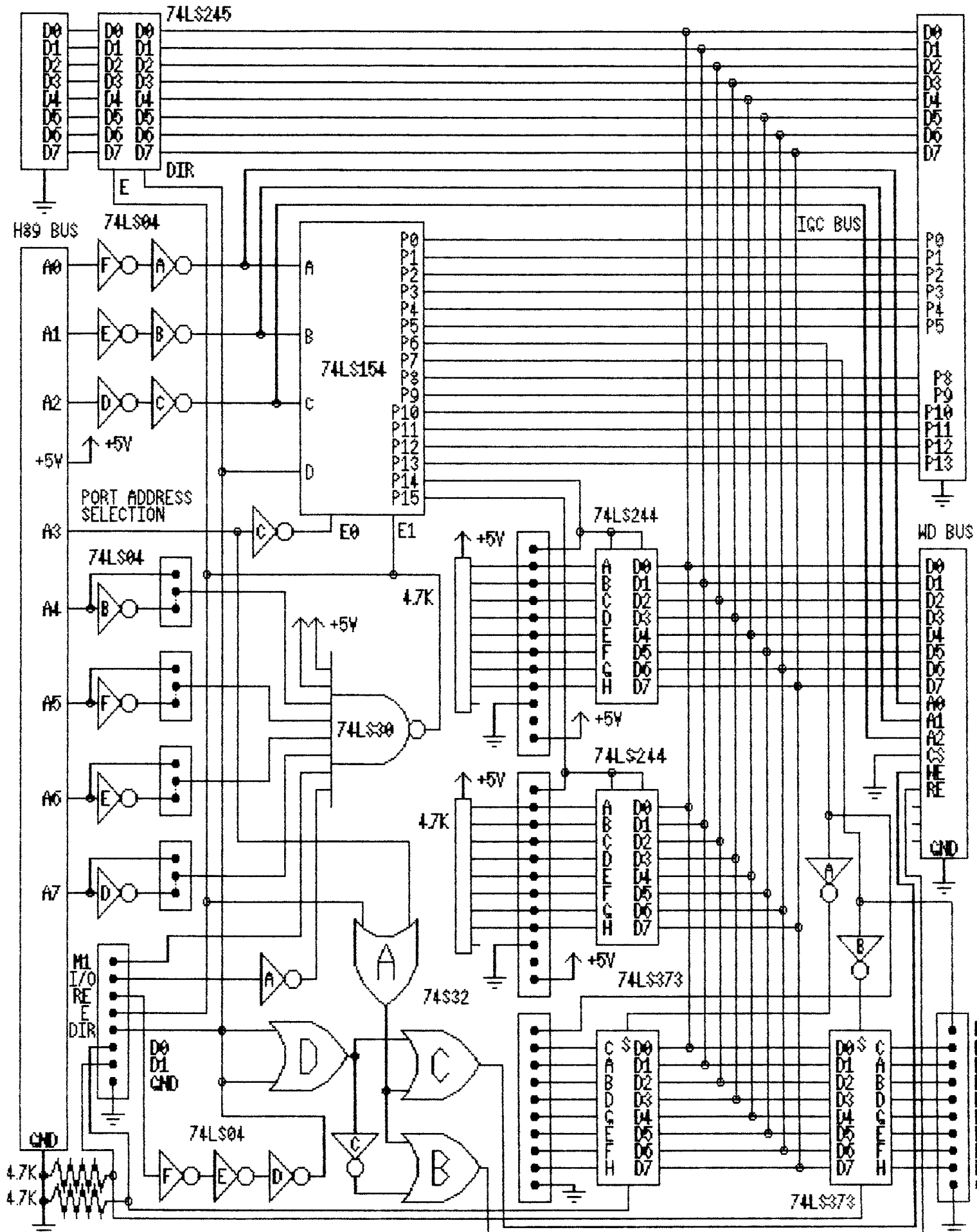


0 1 2 3 4 5 6 7 8 9

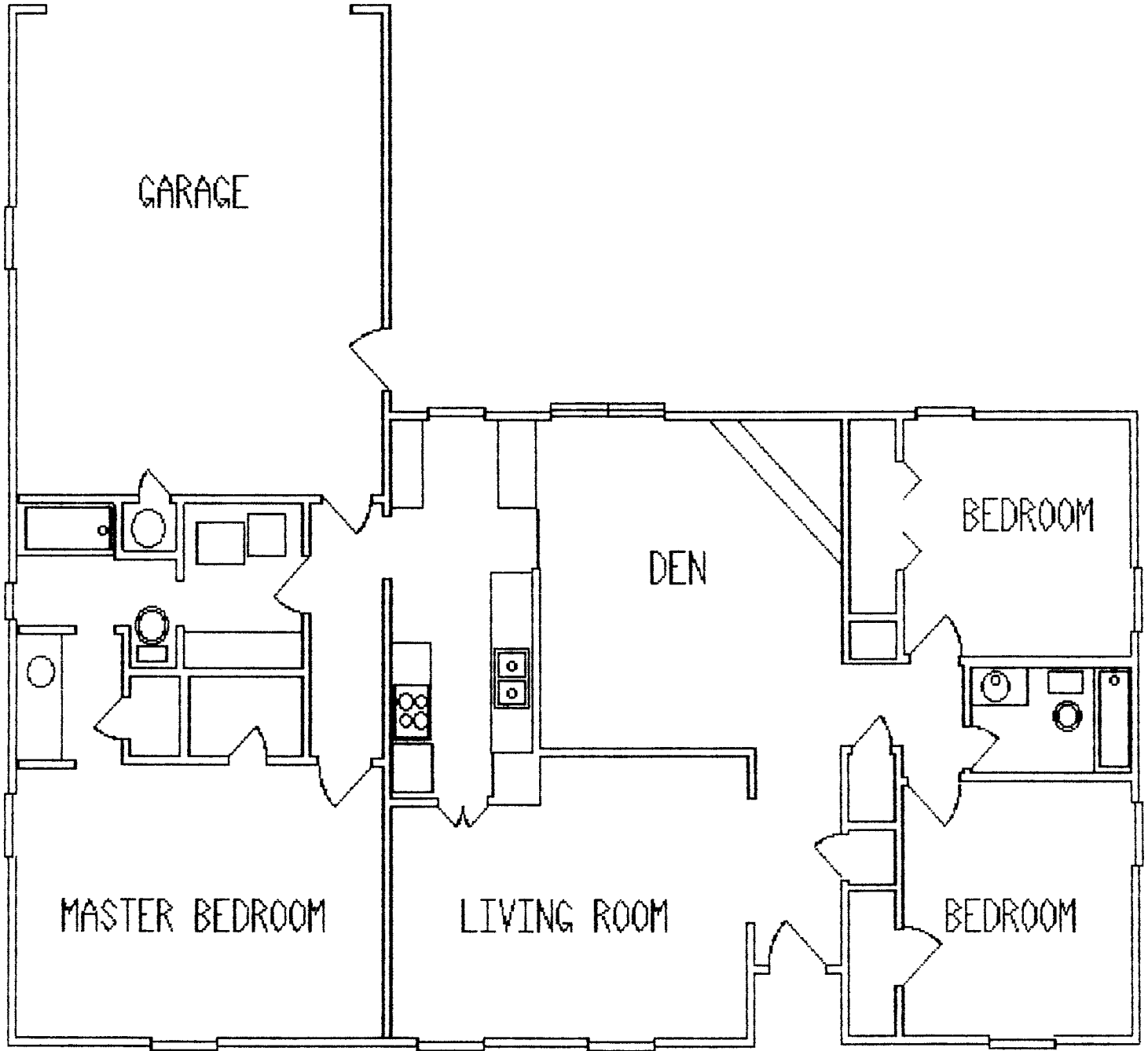
Linear Power Supply Schematic and Circuit Board Layout



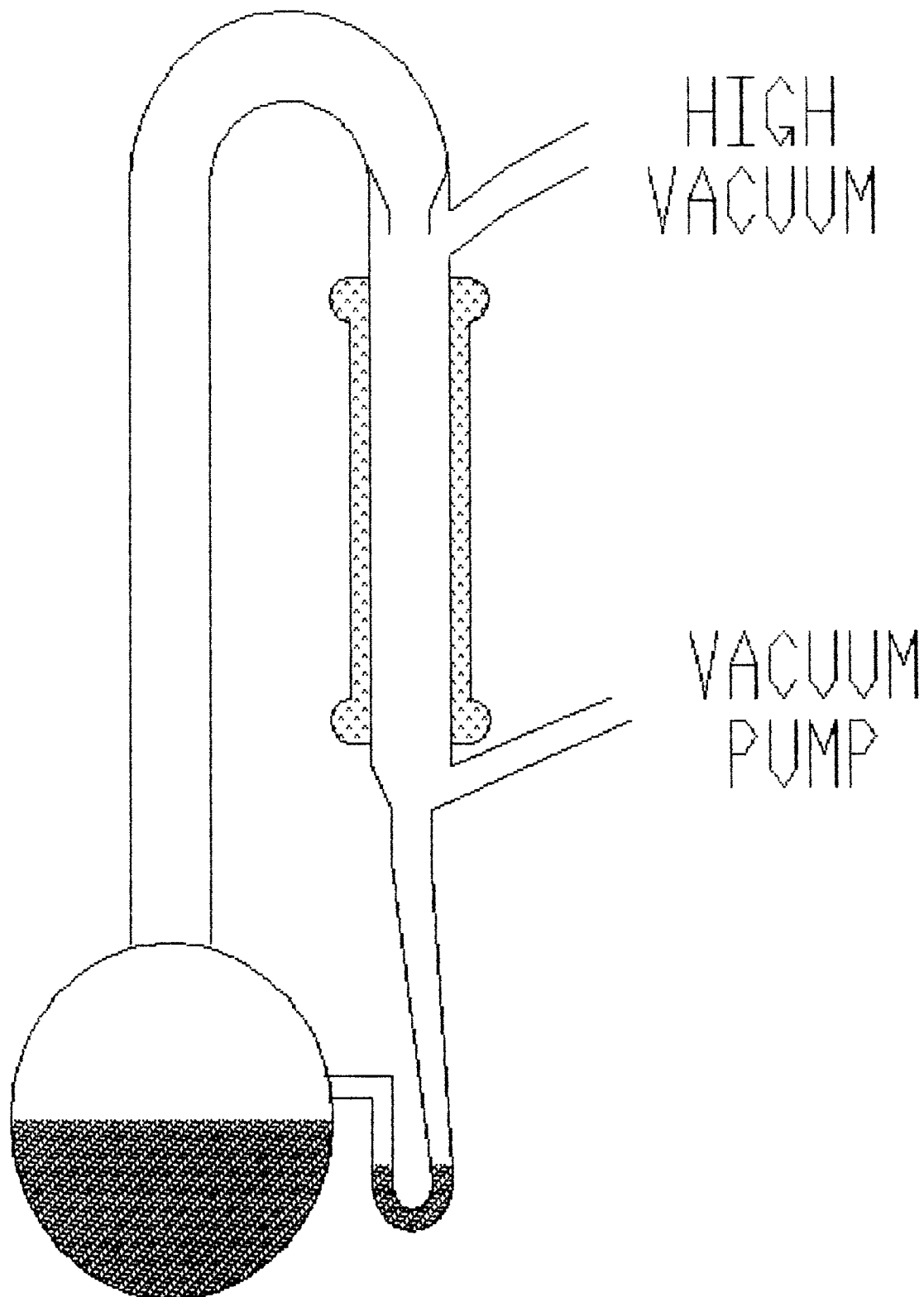
H/Z89 Universal Parallel Interface Board Schematic



House Floor Plan

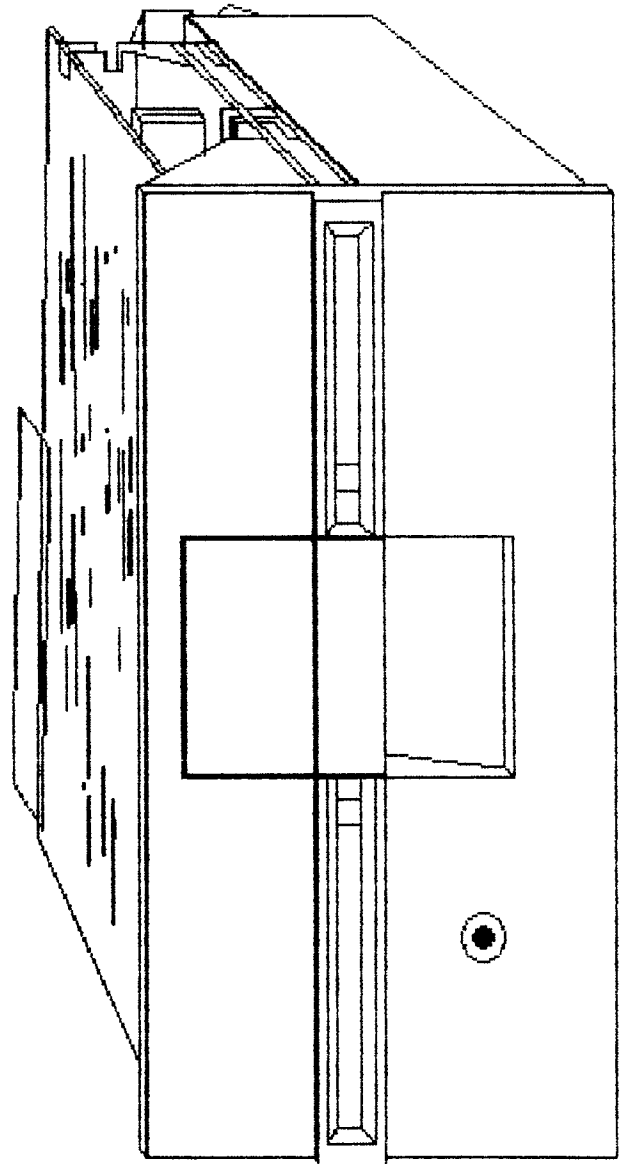


Laboratory Vacuum Pump



Drive Unit Pictorial

5.25 INCH
FLOPPY
DISK DRIVE
TM-100-4
96 TPI



Summary of CAD-89 Command Modes

<u>Command</u>	<u>Keyboard</u>	<u>Description</u>
Box	B	Box Drawing Mode
Circle	C	Circle Drawing Mode
Dot	D	Dot Drawing Mode
Edit	E	Edit Drawing List
File	F	Read Drawing from Disk File
Grid	G	Set Drawing Grid
Help	H	Display Command Summary
Input	I	Input New Cursor Position
Kill	K	Kill Last Object Drawn
Line	L	Line Drawing Mode
Move	M	Move and Scale Symbols
Oval	O	Oval Drawing Mode
Paint	P	Polygon Painting Mode
Quit	Q	Quit Drawing Session
Rotate	R	Rotate Symbols
Style	S	Select Drawing Styles
Text	T	Text Symbol Drawing Mode
Update	U	Update Drawing from List
View	V	View Drawing List
Write	W	Write Drawing or Symbol to Disk
Zap	Z	Zap Entire Drawing

Summary of Function Key Assignments

<u>Command</u>	<u>Function Key</u>	<u>Description</u>
Symbol	f1	Symbol Drawing Mode
Draw	f2	Connected Line Drawing Mode
Configure	f3	Editor Configuration Mode
Overlay	f4	Read Drawing Overlay from Disk
Print	f5	Print Drawing on Printer
Erase	Erase	Area Erasing Mode
Black Ink	Blue	Black Drawing Ink Mode
Reverse Ink	Red	Reverse Drawing Ink Mode
White Ink	White	White Drawing Ink Mode

Summary of Keypad Assignments

<u>Function</u>	<u>Keypad</u>	<u>Description</u>
Cursor Movement	1 (Shift)	Down and Left (Pan Up)
Cursor Movement	2 (Shift)	Down (Pan Up)
Cursor Movement	3 (Shift)	Down and Right (Pan Up)
Cursor Movement	4	Left
Drawing Pen	5 (HOME)	Toggle Pen State Up or Down
Cursor Movement	6	Right
Cursor Movement	7 (Shift)	Up and Left (Pan Down)
Cursor Movement	8 (Shift)	Up (Pan Down)
Cursor Movement	9 (Shift)	Up and Right (Pan Down)
Save Cursor	.	Save Cursor Position
Restore Cursor	@	Restore Cursor Position
Input	ENTER	Input New Cursor Position

Other Special Keys

<u>Function</u>	<u>Keyboard</u>	<u>Description</u>
Help	?	Display Function Key Assignments
Current Region	=	Repeat Last Defined Region
Abort	DELETE	Abort Current Command
Abort	BACKSPACE	Abort Current Command
Drawing Pen	RETURN	Press and Release Pen

The following charts summarize the format used by the CAD-89 editor to generate CAD drawing files. Symbol files are identical except that they contain a valid symbol name. This information allows experienced programmers to develop their own software to read the compact binary format of these files. For information on the ASCII IGC file formats, refer to the IGC Users' Manual.

CAD File Header Format

<u>Size in Bytes</u>	<u>Description</u>
1	Binary File Type Identification (FFH)
1	CAD File Type Identification (40H)
3	Symbol Object List Size
8	Symbol Name (Terminated with a Null Character)
2	Horizontal Size of Symbol
2	Vertical Size of Symbol
8	Reserved for Future Use
*	Object List Begins (First Object Header)

Object Header Formats

<u>Object Type</u>	<u>Size in Bytes</u>	<u>Description</u>
Dot	1	Object Type Byte
	2	Minimum X boundary
	2	Minimum Y boundary
	2	Maximum X boundary
	2	Maximum Y boundary
Line	1	Object Type Byte
	2	Minimum X boundary
	2	Minimum Y boundary
	2	Maximum X boundary
	2	Maximum Y boundary
	1	Line Style Number
Circle	1	Object Type Byte
	2	Minimum X boundary
	2	Minimum Y boundary
	2	Maximum X boundary
	2	Maximum Y boundary
	1	Line Style Number
	2	X Coordinate of Center Point
	2	Y Coordinate of Center Point
	2	Radius

Arc	1	Object Type Byte
	2	Minimum X boundary
	2	Minimum Y boundary
	2	Maximum X boundary
	2	Maximum Y boundary
	2	X Coordinate of Center Point
	2	Y Coordinate of Center Point
	2	X Scaling Factor
	2	Y Scaling Factor
	1	Line Style Number
	2	Radius
	2	Starting Angle in Degrees
	2	Ending Angle in Degrees
2	Rotation Angle (Reserved)	
Paint	1	Object Type Byte
	2	Minimum X boundary
	2	Minimum Y boundary
	2	Maximum X boundary
	2	Maximum Y boundary
	2	X Coordinate of Trigger Point
	2	Y Coordinate of Trigger Point
1	Paint Style Number	

Object Type Byte Format Detail

<u>Description</u>	<u>Bit Positions</u>	<u>Assignments</u>
Object Type Index	XXXXX000B	Reserved
	XXXXX001B	Arc
	XXXXX010B	Circle
	XXXXX011B	Dot
	XXXXX100B	Line
	XXXXX101B	Paint
	Ink Color Mode Index	00XXXXXXB
01XXXXXXB		Black
11XXXXXXB		Reverse
Type Specific Flag	XX1XXXXXB	Line Slope is Reversed
Reserved for future use	XXX00XXXXB	

Background Color

The color (black or white) of the pixels that a given object or symbol is drawn on top of. Normally, black is the background color. However, white and black objects can be drawn on top of other objects which are white. In this case, these objects would have a white background.

Border Color

The color (white or black) of the pixels that comprise a polygon which encloses a paint object type. The border color of a paint object must always be the opposite color of the paint object's background.

Boundary

The minimum and maximum positions (left, right, up and down) with which the graphics cursor is allowed to move. Normally the boundary is the entire drawing area (about 3 screens depending upon interlace mode) but can be temporarily reduced by some command modes such as Paint.

Clip

The process of dividing lines, circles, or arcs into separate objects so that portions inside of a defined region can be moved or altered without affecting the portions that are outside of the region (or vice versa). Clipping is performed automatically in many list editing command modes such as Erase.

Command Mode

A state of the editor program in which only a particular type of operation can be performed. The command modes are logically divided into three groups of those which draw objects, those which edit list data, and those which control the editor program.

Concentric

When two or more arcs, circles, or ovals have the same point of center.

Coordinate

A count of horizontal and vertical pixel or grid points between the top left-most corner of the drawing area and some other position in the drawing area.

Current Image

The pixels that are displayed on the screen by the editor to represent the drawing list data. The current image may vary at times from the real contents of the list and this is corrected by the Update command.

Current Region

The rectangular zone of the drawing area that was last defined by drawing an object with any input device. Most of the command modes automatically redefine the current region everytime they are used. This region can then be quickly specified again by pressing the equal sign (=) key.

Cursor, Graphics

A pointer or indicator of the current pixel or grid position as controlled by the user with a graphics input device. The graphics cursor is drawn as two perpendicular lines crossing at the current position. The size and blinking speed of the cursor can be configured.

Delta Values

The distances (in either pixels or grid points) from the first corner of a specified region to the other two corners which are along either the same horizontal or vertical coordinates of that region. The delta values are shown on the status line display for most rubber banding operations

Destination Region

A rectangular zone that is defined by rubber banding to specify the size, shape, and position of a new object or symbol to be drawn.

Drawing Area

The maximum boundaries of the objects that can be drawn. This area is about three times the size of the screen (window area) and contains the current image. The cursor boundaries of the drawing area are 0 through 639 horizontal, and 0 through 1535 vertical. The pixel resolution of the drawing area is determined by the interlace configuration of the IGC board since this controls the way in which the IGC allocates its video memory. In non-interlace mode, the pixel resolution of the drawing area is 640 horizontal by 768 vertical. Interlace mode doubles the vertical resolution to 1536.

Erase

To clip and eliminate any portion of an object or objects which extends into a specified region.

Flip

To copy an object or group of objects so that the destination is a mirror image of the source. Flipping can be accomplished either horizontally, vertically, or both with the Move command.

Grid, Drawing

A consistently spaced array of dots that extends over the entire drawing area used to improve the speed and accuracy of cursor movements. When a grid is used the cursor automatically moves from one grid point to the next without passing over positions in between. Grids may be present without being visible if they are too small or have been disabled by the Configuration or View commands.

Highlight

A temporary change that is made in the appearance of an object in the current image (not the list) by the editor to indicate that it is the current object being edited. Highlighting is used extensively by the Edit command mode and usually involves the object being redrawn in a dashed line style and reverse ink mode.

IGC

An abbreviation for the Interactive Graphics Controller, which is the circuit board required to run the CAD-89 software. Also refers to the ASCII output files which are compatible with the Interactive Graphics Device Drivers (IG: and IGC:).

Input Device, Graphics

A device that is physically operated to indicate to the editor how the graphics cursor, drawing pen, and display window should be positioned. The three graphics input devices supported by the editor are the keypad arrows, a mouse, and an Atari/Wico compatible Trackball or Joystick.

Interlaced

A mode of operation of the IGC hardware and CAD-89 software in which the vertical pixel resolution is doubled for both the display window and the entire drawing area. This mode requires special IGC configuration and a special CRT screen is recommended.

Ink Mode, Drawing

One of three operating modes which determine the manner in which pixels are drawn. The White Ink mode is the most commonly used which draws white pixels. The Black Ink mode draws black pixels and the Reverse Ink mode draws pixels which are always the opposite color of the background that they are drawn on.

Library File, Symbol

A file which contains a group of symbols which are logically related and so are normally used together such as a collection of alphabetic letter symbols which are of the same font.

List, Drawing

The data array that is generated and maintained by the editor which allows it to redraw and duplicate all of the objects and symbols which are drawn by the user. The list is entirely separate from the image data that is displayed on the screen.

Move

To clip an object or group of objects from the drawing (source region) and make a copy of this clipped region somewhere else in the drawing (destination region). Moves often involve scaling and flips as well.

Mouse

One of the three graphics input devices supported by the CAD-89 editor.

Object

Any of five fundamental drawing primitives (dot, line, circle, arc, or paint) which comprise all symbols and drawings.

Overlay

Any full sized drawing which is read from a disk file by the Overlay command and displayed on the screen as a reference or separate layer of another drawing.

Pan

To move or scroll the position of the display window in the drawing area of the editor by use of the keypad or other input device.

Pen, Drawing

An imaginary instrument which controls the rubber banding functions of the editor, and in some command modes, the drawing of pixels or lines. The Drawing Pen has two states (up and down) as controlled by the Return Key and all input devices. The down state of the Pen is always indicated on the status display line with inverse video.

Pixel

The smallest point of light that can be displayed on the drawing screen by the IGC hardware. All objects and text characters are composed of pixels which each have only two states, on or off.

Polygon

Any geometric shape that can be drawn by connecting any number of lines end to end so long as the final line connects back to the beginning of the first to form a closed loop.

Radius

The distance in either pixels or grid points between the center point of a circle, oval, or arc and the perimeter of the curve.

Resident

The current contents of the drawing list and any symbols which may have been read from disk and are now present in the IGC memory.

Rotate

To clip an object or group of objects from the drawing (source region) and make a copy of this clipped region somewhere else in the drawing (destination region) such that the copy is turned either 90, 180, or 270 degrees from the original.

Rubberbanding

The process of defining a region or position for a new object or symbol in which a box or the object to be drawn is slid across the drawing area by operating a graphics input device.

Scale

To clip an object or group of objects from the drawing (source region) and make a copy of this clipped region somewhere else in the drawing (destination region) such that the copy is a different size than the original. A scale operation can be performed with the Move command to change an object's horizontal size, vertical size or both.

Source Region

A rectangular zone that is defined by rubber banding from which all objects and portions of objects contained within will be copied to another zone (destination region).

Status Display Line

The special zone of text information which is continuously shown at the bottom of the screen by the editor. The status display line indicates such things as the command mode that is currently in effect, the cursor position, the amount of free memory remaining for the drawing list, etc.

Style, Line

Any of twelve different dash and dot patterns which can be selected by the Style command for use when drawing lines, boxes, circles, ovals, etc.

Style, Paint

Any of fifty different pixel matrix patterns which can be selected by the Style command for use by the Paint command. Any polygon can be filled in with one of these styles as displayed by the style menu.

Symbol

A group of objects which can consist of any combination of dots, lines, arcs, circles, and paints. Symbols which are stored in separate symbol files are usually figures which are repetitious in a drawing and will be used in future drawings.

Symbol Name

A string of characters that is assigned to a symbol to describe its purpose or use. Symbol names are assigned by the Write command and can consist of up to eight characters. Most printable ACSII characters are valid with the exception of some special characters like the comma and period.

Symbol, Temporary

A symbol which is clipped from the drawing area by either the Move or Rotate commands for duplication in the drawing list, rather than for writing to a disk file.

Trigger Point, Paint

The pixel coordinate at which the cursor was positioned when the Pen was lowered to paint a polygon. This is the initial point from which the paint will spread each time the paint is redrawn.

Window, Display

The portion of the drawing area that is currently shown on the screen by the editor.