Computer Museum

Graphics/1000-II
Device Handlers Manual

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Preface

Who should read this manual?

The *Device-Independent Graphics Device Handlers Manual* is intended for users of Hewlett-Packard's AGP/DGL software family of software application packages. Application programmers can use this manual to determine how a particular package interacts with different devices.

What is the purpose of this manual?

This manual details the interaction between AGP/DGL software and the device supported. It discusses the effect that certain subroutines have on each of the devices, the dimensions of each device, and how some of the special capabilities of each device are accessed.

What does it assume?

This manual assumes that a programmer understands the features of at least one member of the AGP/DGL software family of software packages. DGL programmers can refer to the *DGL Programmer's Reference Manual* for an explanation of the DGL package. Users of the AGP package can gain a thorough understanding of AGP by reading the *AGP User's Manual* and the *AGP Reference Manual*.

How is it organized?

This manual is organized by the devices supported. Each chapter explains how the graphics systems interact with a particular device. The chapters are, in turn, organized by functions. Within each chapter, the method in which functions are implemented by the graphics systems is explained.

Chapter 1 describes the dummy logical devices. A dummy logical device exists for all of the supported logical devices.

Chapter 2 describes the HP 2647A/2647F/2648A Graphics Terminals. It is divided into the logical devices of alphanumeric, button, graphics display, keyboard, pick, locator, and valuator devices.

Chapter 3 discusses the HP 9872 Plotters. The logical devices discussed are the graphics display, locator, and pick devices.

Chapter 4 explains the logical devices supported by the HP 7580A/7585A Drafting Plotters. They are the graphics display, locator, and pick devices.

Chapter 5 discusses the HP 1350/1351 Graphics Translators, along with four types of Display Screens: 1310, 1311, 1317, and 1321. It explains how the displays are used as logical graphics display devices.

Chapter 6 explains how to use the HP 9111A or HP 9111A Option 50 Graphics Tablets as logical button, locator, pick, and valuator devices.

Chapter 7 discusses the logical functions available when using the HP 9111A Option 50 together with the HP 1350A/1351A Graphics Translator. The HP 9111A Option 50 can perform as a locator or pick device, with the Graphics Translator serving as the echoing device.

Chapter 8 describes the HP 2623A Graphics Terminal. It is divided into the logical devices of alphanumeric, button, graphics display, keyboard, pick, locator, and valuator devices.

Chapter 9 discusses the HP 9874A Digitizer. The logical devices discussed are the graphics display, locator, and pick devices.

Chapter 10 describes the use of the HP 2608A line printer as a graphical output device; the display device is supported on the HP 2608A line printer. The user should be familiar with Appendix A before running the application program.

Chapter 11 covers the use of the HP 7220 Graphics Plotters as graphics display and locator devices.

Chapter 12 describes device-dependent features of the HP 7221 Graphics Plotters when used as display and locator devices.

Chapter 13 explains the use of the HP 7225 Graphics Plotters as logical display and locator devices.

Chapter 14 discusses the graphics display and locator functions of the HP 7470A Graphics Plotter.

Chapter 15 describes the HP 2627A Graphics Terminal. It is divided into the logical devices of alphanumeric, button, graphics display, keyboard, pick, locator, and valuator devices.

Appendix A explains how to use raster-addressed devices. The devices are defined and standard operation, including the applications program and translator program, are described. Default and optional file specifications are explained. Special considerations are discussed and errors are explained.

Appendix B contains all of the System/1000 dependencies.

The table on page xxvii details the functions that are supported on each device. The entries in the table indicate the device handler used to perform a specific function on a specific physical device.

Table of Contents

Chapter 3
HP 9872 Graphics Plotters

Chapter 4
HP 7580A/7585A Drafting Plotters

Chapter 5
HP 1350A/1351A Graphics Translator

Chapter 6
HP 9111A and HP 9111A Option 50 Graphics Tablets

Chapter 7
HP 9111A Option 50 Graphics Tablet

Chapter 8
HP 2623A Graphics Terminal

Chapter 11
HP 7220 Graphics Plotters

Chapter 12
HP 7221 Graphics Plotters

Chapter 13
HP 7225 Graphics Plotters

Chapter 14
HP 7470A Graphics Plotter

Appendix A
Raster-Addressed Devices

Appendix B
System/1000 Dependencies

List of Figures

List of Tables

DEVICE HANDLERS

	GRAPHICS DISPLAY	ALPHA-NUMERIC DISPLAY	BUTTON	KEYBOARD	LOCATOR	VALUATOR	PICK
2647A / 2647F / 2648A Terminals	D0001	A0001	B0001	K0001	L0001	V0001	P0001
9872A/B/S/C/T Plotters	D0002				L0002		P0002
9872S Plotter with page advance	D0003				L0002		P0002
9872C Plotter with 8 pens	D0015				L0002		P0002
9872T Plotter with 8 pens and page advance	D0016				L0002		P0002
9111A / 9111A Opt 50 Data Tablets			B0004		L0004	V0004	P0004
9111A Opt 50 with 1350S Work Station			B0004		L0005	V0004	P0005
7580A / 7585A Drafting Plotters	D0006				L0006		P0006
1350A / 1351A with 1310 Display	D0007						
1350A /1351A with 1311 Display	D0008						
1350A / 1351A with 1317 Display	D0009						
1350A / 1351A with 1321 Display	D0010						
2623A Terminal	D0019	A0001	B0001	K0001	L0019	V0019	P0019
9874A Digitizer		A0017	B0017	K0017	L0017	V0017	P0017
2608A Line Printer	D0026						
7220C/T Plotters	D0018				L0018		
7220T Plotter	D0021						
7221A/B/S/C/T Plotters	D0027				L0027		
7221S/T Plotters	D0028						
7221C/T Plotters	D0029						
7221T Plotter	D0030						
7225A/B Plotter	D0032				L0032		
7470A Plotter	D0031				L0031		
2627A Terminal	D0036	A0001	B0001	K0001	L0019	V0019	P0019
17623A Data Tablet					L0019		

Chapter 1
Dummy Devices

GENERAL INFORMATION

The AGP/DGL Graphics Systems provide dummy device handlers which can be implictly loaded with the application program. There is one dummy handler for each logical device supported. All of these dummy handlers are contained in the DIDD library. The device name for all of the dummy devices is 'DUMMY '. The dummy device handlers are supported on all system configurations supported by AGP or DGL.

Loading with AGP

When loading a Work Station Program (WSP) for AGP, the user only needs to explicitly load the device handlers that are needed for the work station used by the AGP application. However, since the WSP must be able to access all logical devices supported by AGP, references are made to ALL of the logical devices. To satisfy references made to all logical devices by the WSP, dummy device handlers are implicitly loaded when the DIDD library is searched for all device handlers not explicitly loaded by the user. For example, if the user work station does not contain a valuator device, the user does not need to explicitly load a valuator device handler. A dummy valuator handler will be implicitly loaded when the DIDD library is searched.

Loading with DGL

When loading a DGL application program, the user typically loads all of the device handlers corresponding to the logical devices referenced by the DGL application program. If a device handler corresponding to a logical device referenced by the DGL application is not explicitly loaded by the user, then a dummy device handler will be implicitly loaded when DIDD is searched. For example, if a call is made to ZBUTN in the DGL program and the user does not explicitly load a button device handler (Bxxxx), then a dummy button handler will be implicitly loaded.

ALPHANUMERIC DEVICE HANDLER

Description

Inquiries, using the calls JIWS/ZIWS with the opcode 7050, about the dummy alphanumeric device always returns the following information:

Device name	'DUMMY '
Status	-1
Logical unit	0
Maximum number of lines displayable	0
Number of characters per line	0

Subroutine calls to Dummy Devices

AGP

When attempting to enable a dummy alphanumeric device (JEDEV), error 5 will be generated and the alphanumeric device will not be enabled. Therefore, any subsequent alphanumeric calls will generate errors since the device is not enabled.

DUMMY
ALPHA

DGL

When attempting to enable a dummy alphanumeric device (ZAINT), IERR will be set to 1 and any subsequent alphanumeric calls will be ignored.

BUTTON DEVICE HANDLER

Description

Inquiries, using the calls JIWS/ZIWS with the opcode 6051, about the dummy button device always returns the following information:

Device name	'DUMMY '
Status	-1
Logical unit	0
Number of buttons supported	0

Subroutine calls to Dummy Devices

AGP

When attempting to enable a dummy button device (JEDEV), error 5 will be generated and the button device will not be enabled. Therefore, any subsequent button calls will generate errors since the device is not enabled.

DUMMY
BUTTON

DGL

When attempting to enable a dummy button device (ZBINT), IERR will be set to 1 and any subsequent button calls will be ignored.

GRAPHICS DISPLAY DEVICE HANDLER

Description

The following information is always returned about the dummy graphics display device when JIWS/ZIWS is called with the opcode specified:

OPCODE	INFORMATION	RETURNED
251	Marker size	RLIST(1) = 0.0 RLIST(2) = 0.0
252	Resolution of graphics display	RLIST(1) = 1.0 RLIST(2) = 1.0
253	Maximum size of graphics display	RLIST(1) = 1.0 RLIST(2) = 1.0
254	Aspect ratios	RLIST(1) = Current aspect ratio of virtual coordinate system RLIST(2) = 1.0
1003(AGP)	Simulated raster erase	ILIST(1) = 0
1050	Hardware clipping capabilities	ILIST(1) = 0
1051	View surface justification	ILIST(1) = 0
1052(DGL)	Background color	ILIST(1) = 0
1053	Number of distinct colors	ILIST(1) = 0
1054	Number of colors displayable at once	ILIST(1) = 0
1055(DGL)	Number of highlights	ILIST(1) = 0

1056	Number of linestyles	ILIST(1) = 0
1057	Number of linewidths	ILIST(1) = 0
1058	Number of hardware character sizes	ILIST(1) = 0
1059	Number of markers	ILIST(1) = 0
1060(DGL)	Current color	ILIST(1) = 0
1061(DGL)	Current highlight	ILIST(1) = 0
1062(DGL)	Current linestyle	ILIST(1) = 0
1063(DGL)	Current linewidth	ILIST(1) = 0
1065	Polygon capabilities	ILIST(1) = 16
1066	Polygon interior color	ILIST(1) = 1
1067	Polygon style	ILIST(1) = 1
1068	Polygon hardware vertex limit	ILIST(1) = 0
1069	Polygon immediate retroactive style	ILIST(1) = 0
1070	Polygon hardware area capability	ILIST(1) = 0
1071	Immediate retro-active color	ILIST(1) = 0
1072	Background color redefinability	ILIST(1) = 0
1073	Color table modifi-ability	ILIST(1) = 0
1074	Current color model	ILIST(1) = 1
1075	Color table size	ILIST(1) = 0
1076	Polygon interior linestyle	ILIST(1) = 1

5050	Device name	ILIST(1) = 'DU' ILIST(2) = 'MM' ILIST(3) = 'Y '
	Status	ILIST(4) = -1
	Logical unit	ILIST(5) = 0

Subroutine calls to Dummy Devices

AGP

When attempting to enable a dummy graphics display device (JWON), error 144 will be generated and the graphics display device will not be enabled. Therefore, any subsequent graphics display calls will generate errors since the device is not enabled.

DGL

When attempting to enable a dummy graphics display device (ZDINT), IERR will be set to 1 and any subsequent graphics display calls will be ignored.

KEYBOARD DEVICE HANDLER

Description

Inquiries using the calls JIWS/ZIWS with the opcode 5051 about the dummy keyboard device always returns the following information:

Device name	'DUMMY '
Status	-1
Logical unit	0

Subroutine calls to Dummy Devices

AGP

When attempting to enable a dummy keyboard device (JEDEV), error 5 will be generated and the keyboard device will not be enabled. Therefore, any subsequent keyboard calls will generate errors since the device is not enabled.

DGL

When attempting to enable a dummy keyboard device (ZKINT), IERR will be set to 1 and any subsequent keyboard calls will be ignored.

LOCATOR DEVICE HANDLER

Description

The following information is always returned about the dummy locator device when JIWS/ZIWS is called with the opcode specified:

OPCODE	INFORMATION	RETURNED
255	Resolution of locator	RLIST(1) = 0.0 RLIST(2) = 0.0
256	Maximum size of locator	RLIST(1) = 1.0 RLIST(2) = 1.0
6050	Device name	ILIST(1) = 'DU' ILIST(2) = 'MM' ILIST(3) = 'Y '
	Status	ILIST(4) = -1
	Logical unit	ILIST(5) = 0
	Number of locator buttons	ILIST(1) = 0

Subroutine calls to Dummy Devices

AGP

When attempting to enable a dummy locator (JEDEV), error 5 will be generated and the locator will not be enabled. Therefore, any subsequent locator calls will generate errors since the device is not enabled.

DUMMY
LOCATOR

DGL

When attempting to enable a dummy locator device (ZLINT), IERR will be set to 1 and any subsequent locator calls will be ignored.

PICK DEVICE HANDLER (AGP ONLY)

Description

The following information is always returned about the dummy locator device when JIWS is called with the opcode specified:

OPCODE	INFORMATION	RETURNED
255	Resolution of pick device	RLIST(1) = 0.0 RLIST(2) = 0.0
256	Maximum size of pick device	RLIST(1) = 1.0 RLIST(2) = 1.0
6049	Device name	ILIST(1) = 'DU' ILIST(2) = 'MM' ILIST(3) = 'Y '
	Status	ILIST(4) = -1
	Logical unit	ILIST(5) = 0
	Number of pick buttons	ILIST(1) = 0

Subroutine calls to Dummy Devices

When attempting to enable a dummy pick (JEDEV), error 5 will be generated and the pick will not be enabled. Therefore, any subsequent pick calls will generate errors since the device is not enabled.

VALUATOR DEVICE HANDLER

Description

Inquiries using the calls JIWS/ZIWS with the opcode 7051 about the dummy valuator device always returns the following information:

Device name	'DUMMY '
Status	-1
Logical unit	0
Number of valuator buttons	0
Number of subvaluators	0

Subroutine calls to Dummy Devices

AGP

When attempting to enable a dummy valuator device (JEDEV), error 5 will be generated and the valuator device will not be enabled. Therefore, any subsequent valuator calls will generate errors since the device is not enabled.

DGL

When attempting to enable a dummy valuator device (ZVINT), IERR will be set to 1 and any subsequent valuator calls will be ignored.

Chapter 2
HP 2647A/2647F/2648A Graphics Terminals

GENERAL INFORMATION

This chapter pertains to the HP 2647A, HP 2647F, and HP 2648A Graphics Terminals. The user should be familiar with the operations of the HP 2647A, HP 2647F, or HP 2648A Graphics Terminals. If necessary, refer to the following manuals for the appropriate operating instructions:

HP 2647A Intelligent Graphics User's Manual	*(02647-90001)*
HP 2647A Intelligent Graphics Reference Manual	*(02647-90002)*
HP 2647F Intelligent Graphics Reference Manual	*(02647-90037)*
HP 2647F Intelligent Graphics BASIC/47 Manual	*(02647-90038)*
HP 2647F Intelligent Graphics AUTOPLOT/47 Manual	*(02647-90042)*
HP 2648A Graphics Terminal User's Manual	*(02648-90001)*
HP 2648A Graphics Terminal Reference Manual	*(02648-90002)*

Logical Devices Supported

The following logical devices are supported by the AGP/DGL Graphics Systems when using the graphics terminals:

Logical Device	Device Handler Name
Alphanumeric	A0001
Button	B0001
Graphics display	D0001
Keyboard	K0001
Locator	L0001
Pick (AGP only)	P0001
Valuator	V0001

Device Configuration

The terminals should be strapped for normal point-to-point operation. This means that all of the keyboard interface straps should be closed (the normal position). The terminal should not be in block mode.

ALPHANUMERIC DEVICE HANDLER (AGP/DGL)

Description

The graphics terminals have independent alphanumeric and graphics display memories which allow either or both types of data to be displayed on the same CRT. The alphanumeric device handler, A0001, allows the application programmer to send messages and alphanumeric display control commands to the terminals.

The dimensions of the alphanumeric display are as follows:

Screen size:	254 mm wide by 127 mm high
Screen capacity:	24 lines and 80 characters per line
Character size:	2.46 mm wide by 3.175 mm high

Initialization

JEDEV/ZAINT

When the alphanumeric device is initialized, the alphanumeric display is turned on and the contents of the alphanumeric memory are left unchanged. DGL sets the device name to the terminal name, e.g. '2647A '.

Alphanumeric Output

JALPH/ZALPH

The state of the alphanumeric display is not altered before sending the character string to the terminal. The entire character string passed is sent directly to the terminal. A maximum of 132 characters can be sent to the alphanumeric device at one time. If the text output exceeds the size of a line, the terminal performs a carriage return-line feed and text output continues on the next line. The character string may contain alphanumeric characters or command sequences which control the alphanumeric display (e.g. clear alphanumeric memory, alphanumeric cursor control, etc.). Command sequences which affect other parts of the terminal (e.g. graphics display) should not be contained in the string since they could destroy the integrity of the graphics system.

Termination

JDDEV/ZAEND

When the alphanumeric device is terminated, the alphanumeric display is not affected. The device name is set to '0001 ', and the device status and I/O unit description are set to 0.

BUTTON DEVICE HANDLER (AGP/DGL)

Description

The graphics terminals have eight *softkeys* which together are supported as a button device. These keys are above the standard ASCII keys and are labeled *f1* through *f8*. The numeric keys 1 through 8 can also be used in the same way as the softkeys. The device handler required to use the button device is B0001. When the button device is in use, the terminal should not be in block mode.

Initialization

JEDEV/ZBINT

When the button device is initialized, all previous softkey definitions are destroyed. The softkeys *f1* through *f8* are loaded with the ASCII characters 1 through 8 respectively. The device name is set to the terminal name.

Button Input

JBUTN/ZBUTN

Once the button device has been enabled, it is available for input operations. When JBUTN or ZBUTN are called, a read operation is set pending on the terminal. Striking a softkey or an ASCII key between 1 and 8 will return the button as an integer value ranging from 1 to 8. If an invalid, transmittable (i.e. ASCII) key is struck, an integer 0 will be returned as the button value.

Echoes Supported

The button device handler supports the following echoes:

ECHO#	ECHO PERFORMED
0	Echoing is not performed
1	The terminal bell is sounded if a valid button is activated.

Termination

JDDEV/ZBEND

When the button device is terminated, the softkey definitions remain as they were defined by the button device initialization. The device name is set to '0001 ', and the device status and I/O unit descriptor are set to 0.

GRAPHICS DISPLAY DEVICE HANDLER (AGP ONLY)

Description

The dimensions of the graphics terminals are as follows:

Screen size:	254 mm wide by 127 mm high
Screen capacity:	720 points wide by 360 points high
Aspect ratio of maximum area:	.4993
Resolution:	2.8346 points/mm in X and Y directions

The default logical display surface of the graphics display device is the maximum physical limits of the screen. The physical origin is the lower left corner of the display.

The view surface is always centered within the current logical display surface.

Initialization

JDINT

When initialized, the following operations are performed:

Device name set to terminal name.

The graphics cursor is turned off and is in the lower left corner of the display.

Zoom is set to size 1 and is turned off.

Zoom position is same as position of graphics cursor.

Alphanumeric memory is unaffected.

The alphanumeric and graphics displays are turned on.

The color table will be initialized to the default values. See Color section for the default color table.

The screen is cleared unless bit 7 is set in the control word for the JDINT call. If bit 7 is set, graphics memory is unaffected.

The following occurs which applies to low and medium quality text:
Slant is set to 0 degrees (no slant)
Label direction is set to 0 degrees (horizontal)
Label origin is set to 1 (left,bottom justified)

User-defined area and line patterns are set to solid.

The logical display surface is set to the maximum physical limits of the display.

The view surface is centered within the logical display surface.

Simulated raster erase is enabled if bit 3 of the control word in the JDINT call was set. See new-frame-action for details on simulated raster erase.

Device Enabling

JWON

Device-dependent actions are not performed.

Supported Primitive Attributes

COLOR

JCOLR

The D0001 display handler provides a software color table of two colors. The colors available are black and white. The size of the color table cannot be changed. The default values of the color table are shown in Table 2-1.

Table 2-1. Default Color Table

```
COLOR TABLE ENTRY  = 0 >> Color set to black (background color)
                   = 1 >> Color set to white
```

The color table is initialized when JDINT is called. The color table cannot be redefined or inquired using JDCOL or JICOL.

The color selected corresponds to the color defined in the color table.

```
COLOR  = 0 >> Color table entry 0 is selected
       = 1 >> Color table entry 1 is selected
```

REDEFINING COLOR

JDCOL/JICOL

The colors in the color table cannot be redefined or inquired.

POLYGON INTERIOR COLOR

JPICL

There are two colors supported by AGP on the graphics terminals, black and white. Both colors can be displayed at one time. The supported values of the color attributes are:

```
COLOR  = 0 >> Color set to black (background color)
       = 1 >> Color set to white
```

POLYGON STYLE

JDPST

Using JDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

JPILS

The interior linestyle attribute is ignored if device-dependent area fill is requested.

Refer to JLSTL for information regarding linestyle for device-independent polygon interiors.

HIGHLIGHTING

JSHI/JGHI

Highlighting is not supported.

LINESTYLE

JLSTL

Eight predefined linestyles are supported. In addition, two user-definable styles can be selected. These linestyles can be defined through the use of output escape functions (JOESC) 2050 and 8050. Initially, the two user-definable linestyles are set to solid. See Figure 2-1 for the linestyles available on the graphics terminals.

All of the supported linestyles are *continuous*. Refer to the JLSTL subroutine description in the *AGP Reference Manual* for a complete description of a continuous linestyle.

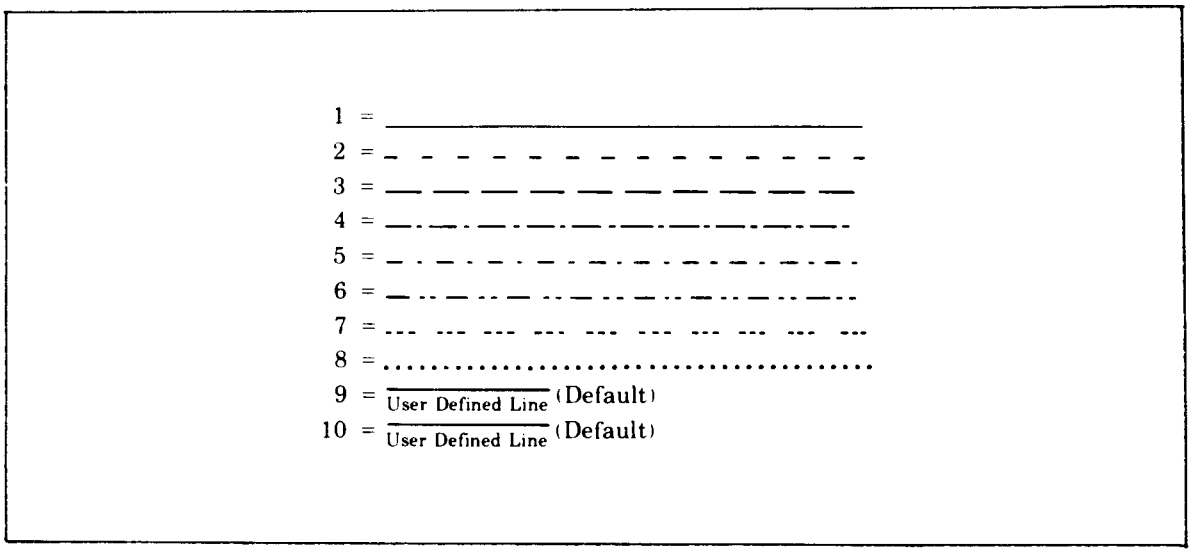

Figure 2-1. Supported Linestyles

LINEWIDTH

JLWID

Only one linewidth is supported.

LINEWIDTH = 1 >> Primitives drawn with a linewidth of one pixel.

CHARACTER SIZES

JCSIZ

Eight distinct character sizes are supported. They all have a constant aspect ratio of 1.43. The supported character sizes are:

Width	Height
2.45 mm	3.5 mm
4.9 mm	7.0 mm
7.35 mm	10.5 mm
9.8 mm	14.0 mm
12.25 mm	17.5 mm
14.7 mm	21.0 mm
17.15 mm	24.5 mm
19.60 mm	28.0 mm

When using medium and low quality text, the character is placed within the character cell as shown in Figure 2-2.

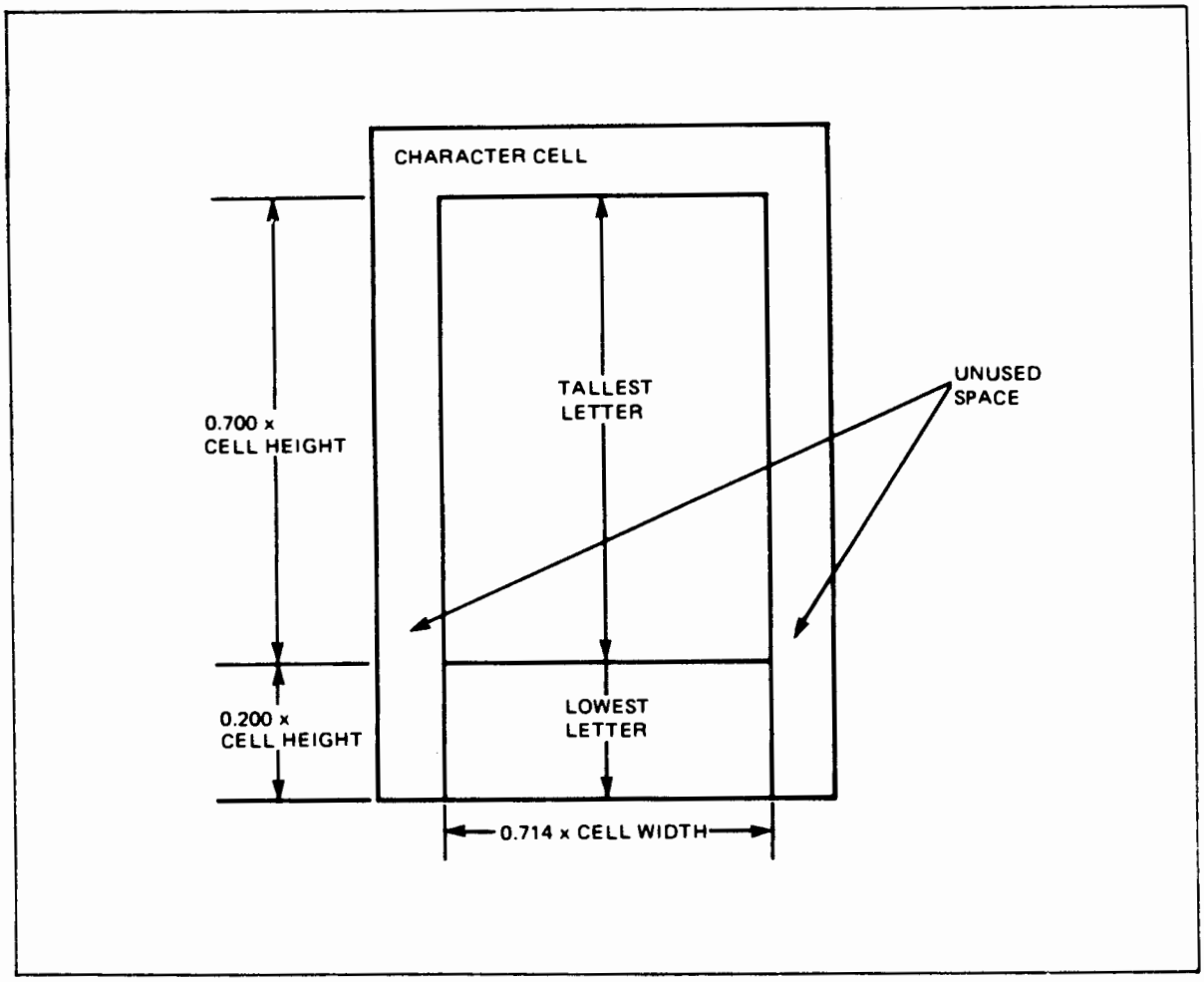

Figure 2-2. Character Placement in a Character Cell

Output Primitives

CLIPPING

The graphics terminals do not provide hardware vector clipping. If window clipping is turned off in AGP and vectors are created that lie entirely or partially outside of the view surface, unpredictable results may occur. Medium and low quality text strings will be clipped if they do not lie entirely within the physical limits of the graphics display.

POLYGONS

J2PGN/J3PGN/JR2PG/JR3PG

Single rectangles with device-dependent polygon styles are displayed using hardware area fill. Their edges must be parallel to the X and Y axes of the virtual coordinate system. Polygon sets which contain more than one member polygon will not be filled even if each member is a rectangle.

If the style specifies a fill density of 1.0 or -1.0, then the rectangle will be filled with the current user-defined area pattern. The default for this pattern is solid. (See JOESC, OPCODE 8050, for further details.)

If the style specifies any other fill density, then the rectangle will be filled with a pattern that approximates the requested interior density to the nearest multiple of 1/8, and approximates the interior orientation to the nearest multiple of 45 degrees. Crosshatching is supported, but interior linestyle is ignored.

Except when the style specifies a fill density of 1, -1, or 0, the user-defined area fill pattern will be set to solid, after device-dependent display of a rectangle.

MARKERS

J2MRK/J3MRK/JR2MK/JR3MK

The 19 standard markers are the only markers supported. The smallest character size (2.45 mm X 3.5 mm) is always used to generate markers.

MEDIUM AND LOW QUALITY TEXT

JTEXM/JTEXL

Medium and low quality graphics text are generated with a hardware character generator. The characters are drawn with a size ratio of 5 wide and 7 high in a character cell with a size ratio of 7 wide by 10 high. See Figure 2-3 for the viewable graphics character set.

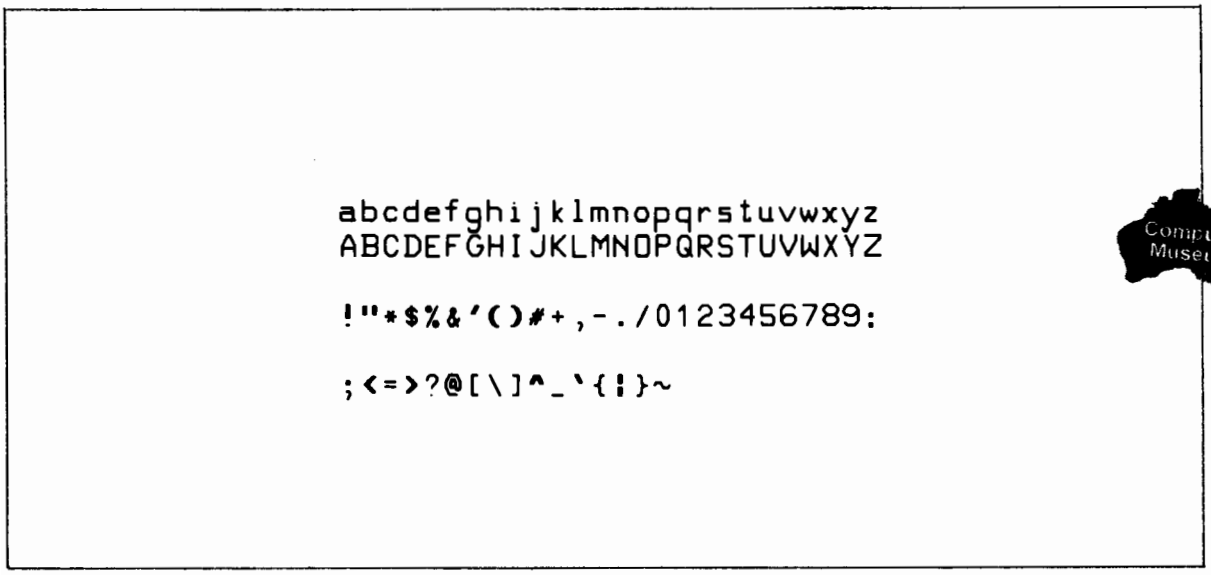

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Figure 2-3. Supported Graphics Text Characters

If a medium or low quality text string is not clipped by AGP and extends beyond the physical limits of the graphics display, all characters which do not lie entirely within the physical limits will be clipped by the terminal.

Medium and low quality text use the color attribute but do not use the linestyle and linewidth attributes. Characters are always generated using solid lines. The direction, slant, and justification of these types of text can be modified through the use of escape functions (see JOESC 1050, 1051 and 1052).

New-Frame-Action

JNEWF/JPURG/JSVIS/JSHI/JVSAL/JCLR

The action taken when a new-frame-action is given is dependent on whether the simulated raster erase bit was set during the JDINT call and is outlined in the following two sections.

SIMULATED RASTER ERASE NOT SET

A new-frame-action given when the device is enabled and not in a batch of updates will clear the CRT to the background color and redraw all visible segments.

When the new-frame-action is given with the display not enabled, it will not alter the display.

When the new-frame-action is given inside a batch of updates the screen will not be changed until the call JUPDT is given. At this time the screen will be cleared to the background color and all visible segments will be redrawn.

SIMULATED RASTER ERASE SET

The graphics terminals have the ability to undraw images. AGP uses this feature when the simulated raster erase bit is set in the JDINT call. This feature removes graphics elements without first clearing the CRT. For example, AGP uses simulated raster erase when a segment is purged.

Note: Undrawing is done by redrawing the image in black (i.e., the background color); therefore, white lines crossing the image to be purged can also have parts of them undrawn, leaving holes.

An explicit JNEWF call will always clear the CRT and redraw all visible segments when given on an enabled work station outside of a batch of updates. This gives the user of simulated raster erase a means of generating a clean surface (one without holes).

The other calls that implicitly cause a new-frame-action (e.g. JPURG) use simulated raster erase only when the work station is enabled. Simulated raster erase is not used on disabled work stations, since by definition, the display must not change. Simulated raster erase is not used in a batch of updates since changes cannot occur to the display until the JUPDT call is given. A new-frame-action inside a batch of updates will always result in the screen being cleared and visible segments being redrawn when the JUPDT call is given.

Inquiry Escape Functions

JIESC

The following inquiry escape functions are supported by AGP with the graphics terminals:

OPCODE	FUNCTION
2050	Inquire hardware zoom status.

ILIST(1) = Zoom size between 1 and 16
ILIST(2) = Zoom on/off
0 = off
1 = on

3050	Inquire medium and low quality text status.

ILIST(1) = Current medium and low quality hardware text justification. See Figure 2-4 for possible values.
ILIST(2) = Current medium and low quality hardware text direction. Possible values are 0, 90, 180, or 270 degrees.
ILIST(3) = Current medium and low quality hardware text slant. Possible values are 0 and 45 degrees.

Output Escape Functions

JOESC

Several output escape functions are supported by AGP with the graphics terminals. Error checking is not performed by the graphics system on any of the parameters which are to be sent to the device. If a parameter is outside of the range specified in the escape function definition, the terminal will ignore the function.

Escape functions are not stored in the segment display area. This can have implications when used with AGP segments. For example, suppose the linestyle is set to 10 and the escape function JOESC (2050) is used to define a line pattern. A segment is created and then appears on the screen with the given line pattern. If the line pattern is changed and a new-frame-action is given, the segment will be redrawn with the current line pattern, (not the line pattern with which it was originally created).

Escape functions may have undesirable effects on low and medium quality text. For example, if JJUST is used to set AGP justification to center, and a hardware justification is chosen, the text may not end up justified.

Escape functions are sent from AGP directly to DGL. The state of AGP may become undefined when an escape function is given that overrides a mode set by AGP (e.g. hardware text justification).

The following output escape functions are supported with the graphics terminals:

OPCODE	FUNCTION
250	Set zoom position to a virtual coordinate point. RLIST(1) = X position in virtual coordinates. RLIST(2) = Y position in virtual coordinates.
450	Perform rectangular area fill using the current linestyle and color. The rectangular area is specified in virtual coordinates. RLIST(1) = Minimum X border of rectangle RLIST(2) = Maximum X border of rectangle RLIST(3) = Minimum Y border of rectangle RLIST(4) = Maximum Y border of rectangle
1050	Set device text direction which will apply to subsequently output low quality graphics text. This will apply to characters individually for medium quality graphics text. ILIST(1) = New text direction 0 = 0 degrees (horizontal) 1 = 90 degrees counterclockwise 2 = 180 degrees counterclockwise 3 = 270 degrees counterclockwise
1051	Set device character slant for subsequently output medium and low quality graphics text. ILIST(1) = Text slant 0 = 0 degrees (normal) 1 = 45 degrees

1052 Set device text justification for subsequently output medium and low quality graphics text. This will apply to characters individually for medium quality graphics text.

ILIST(1) = Text justification. See Figure 2-4 for the supported justifications.

When centering or right justification is used, the text strings are buffered (stored) until all of the characters in the string have been received. The string must be terminated by a CR or LF and is not displayed until the CR or LF is received. The maximum length of a string when center or right justifying is 80 characters (not including the CR(LF)). In all cases, data written beyond the edge of the screen is lost. There is no automatic RETURN when the screen boundry is reached.

1053 Turn zoom on/off.

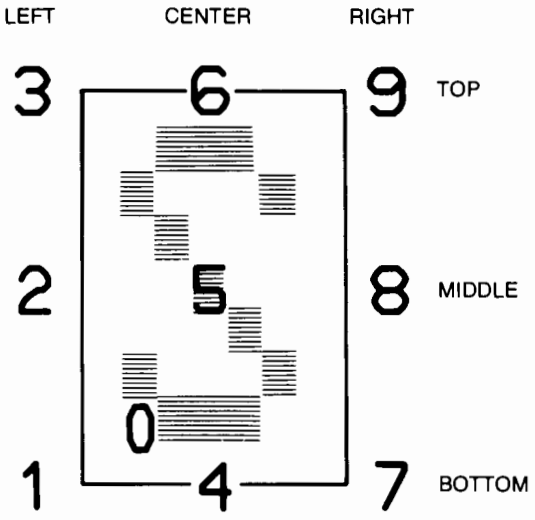
ILIST(1) = 0 >> Turn zoom off
= 1 >> Turn zoom on

1054 Set zoom size.

ILIST(1) = Zoom size ranging from 1 to 16 with size 1 being the smallest (no zoom).

1055 Turn graphics display on/off. This only controls whether the graphics memory is displayed by the terminal. It does not affect the contents or output primitives sent.

ILIST(1) = 0 >> Turn graphics display off
= 1 >> Turn graphics display on



The numbers 1-9 represent the cursor position with respect to the character cell used for graphics text characters. The number 0 represents the cursor position with respect to the character (not this cell).

JUSTIFICATION/ORIGIN. Text strings can be automatically right or left justified, or centered about a specified point. An ASCII character 0 through 9 indicates the origin (justification and base line) for characters with respect to the current pen position. This function is useful when drawing labels.

If text is left justified, the current pen position is the left margin. Center causes the label to be centered on the pen position. Right justify selects the pen position as the right margin. Bottom, middle, and top select the base line for the line of text.

For example, if text was to be right justified and set with a base line on top of the normal character position, the number "9" would be used.

Figure 2-4. Hardware Justification

1056 Set special drawing modes. Using this escape function will override the color as defined by the JCOLR call. After generating output primitives in a special drawing mode, the application program can terminate the special drawing mode by making any call to JCOLR. See Figure 2-5 for the effect of color and the special drawing modes.

ILIST(1) = 1 >> Enable complement drawing mode.

All primitives output in this mode will toggle the color of the pixels on the display. For example, when drawing a line in this mode, all white pixels in the line's path will turn black, and all black pixels will turn white.

= 2 >> Enable jam drawing mode.

Jam mode has the affect of overlaying the output primitives generated with it over the current primitives on the graphics display.

2050 Define line pattern. This allows the user to define the dot pattern used to draw vectors. Once a line pattern is defined, it can be used by setting the linestyle to 9. See Figure 2-6 for examples on defining line patterns.

ILIST(1) = A decimal value between 0 and 255 which defines an 8-bit binary pattern.

ILIST(2) = A scale factor between 1 and 16 to be applied to the pattern.

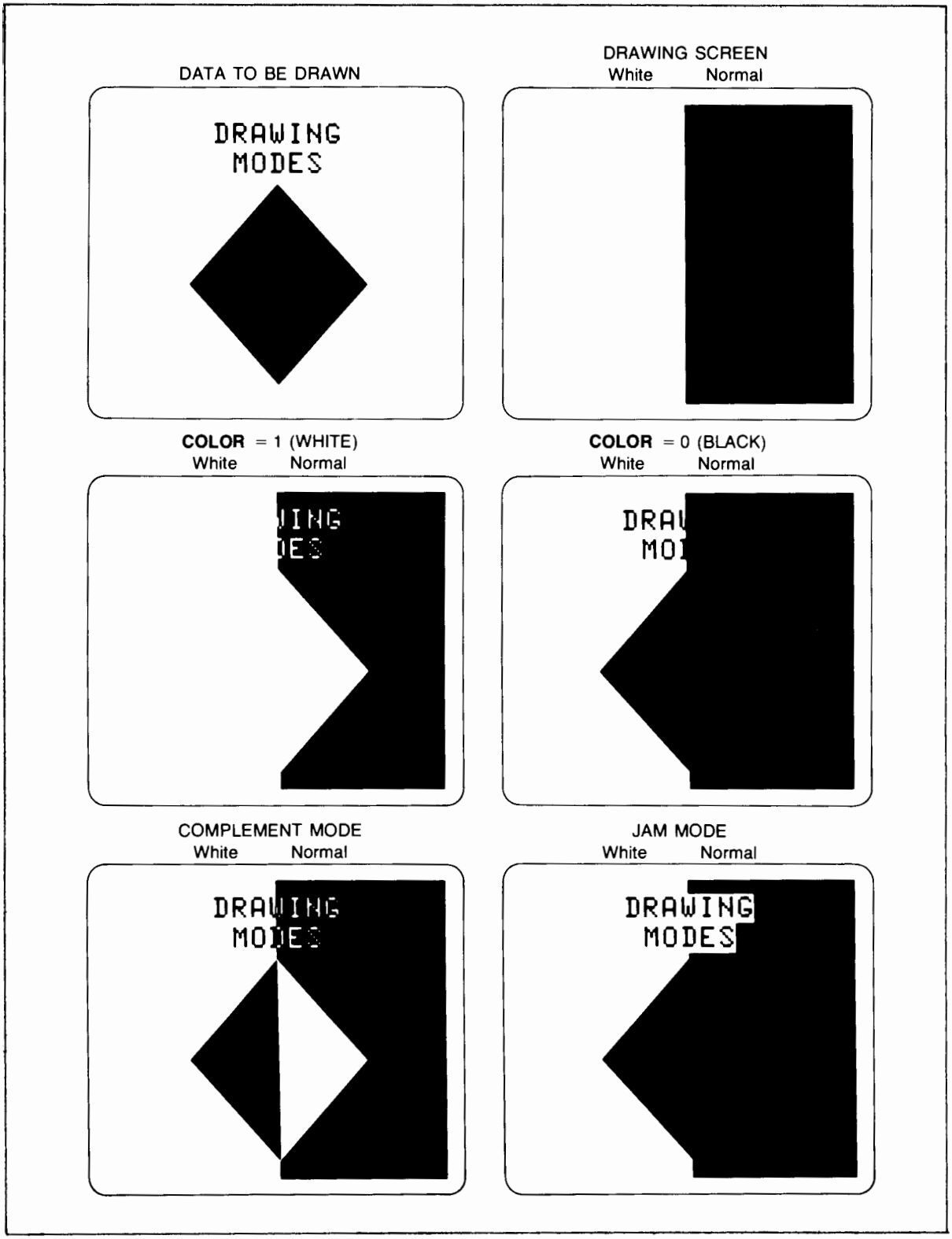


Figure 2-5. Special Drawing Modes

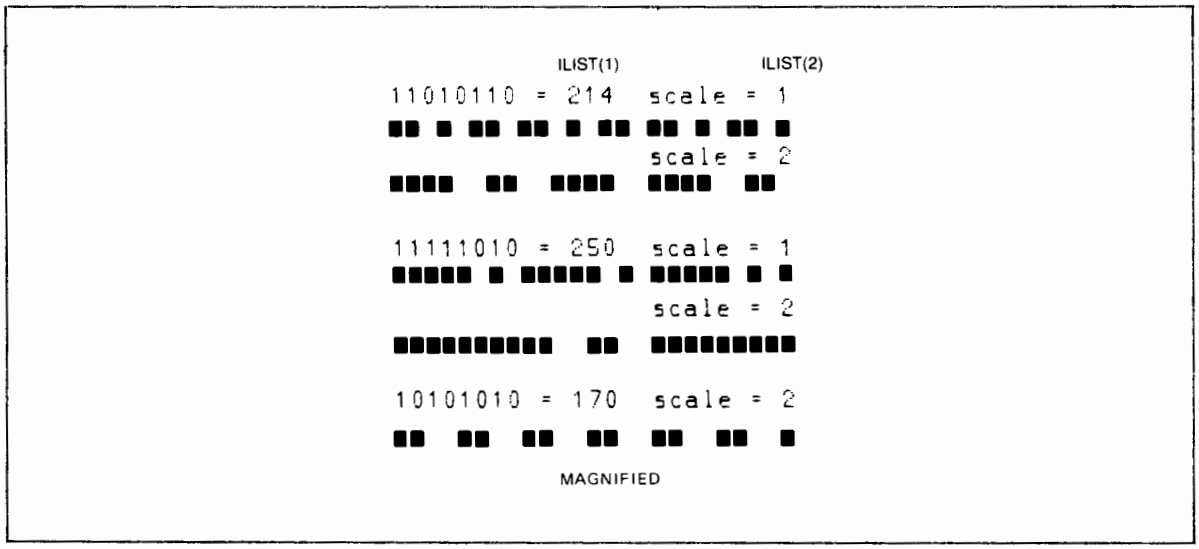


Figure 2-6. Examples of User Defined Linestyles

8050 Define area pattern.

An 8x8 pattern can be defined for use in drawing horizontal and vertical lines, filling rectangular areas (see OPCODE 450), and for device-dependent polygon filling. The area pattern is defined by specifying each row of the pattern with a decimal number ranging between 0 and 255 which defines an 8-bit binary pattern. The graphics display is divided into 8x8 cells such that every point on the display maps to a corresponding bit in the pattern.

Once the area pattern has been defined, it can be used by setting the linestyle to 10. Drawing any horizontal and vertical lines causes the corresponding row or column of the pattern to be used as the line pattern. See OPCODE 450 for use in filling rectangular area. The user-defined area pattern can be used for filling polygons when the current polygon style has density -1, and specifies device-dependent output. Figures 2-7 and 2-8 contain sample area fill patterns.

ILIST(1) = Row 0 of the area pattern
ILIST(2) = Row 1 of the area pattern
ILIST(3) = Row 2 of the area pattern
ILIST(4) = Row 3 of the area pattern
ILIST(5) = Row 4 of the area pattern
ILIST(6) = Row 5 of the area pattern
ILIST(7) = Row 6 of the area pattern
ILIST(8) = Row 7 of the area pattern

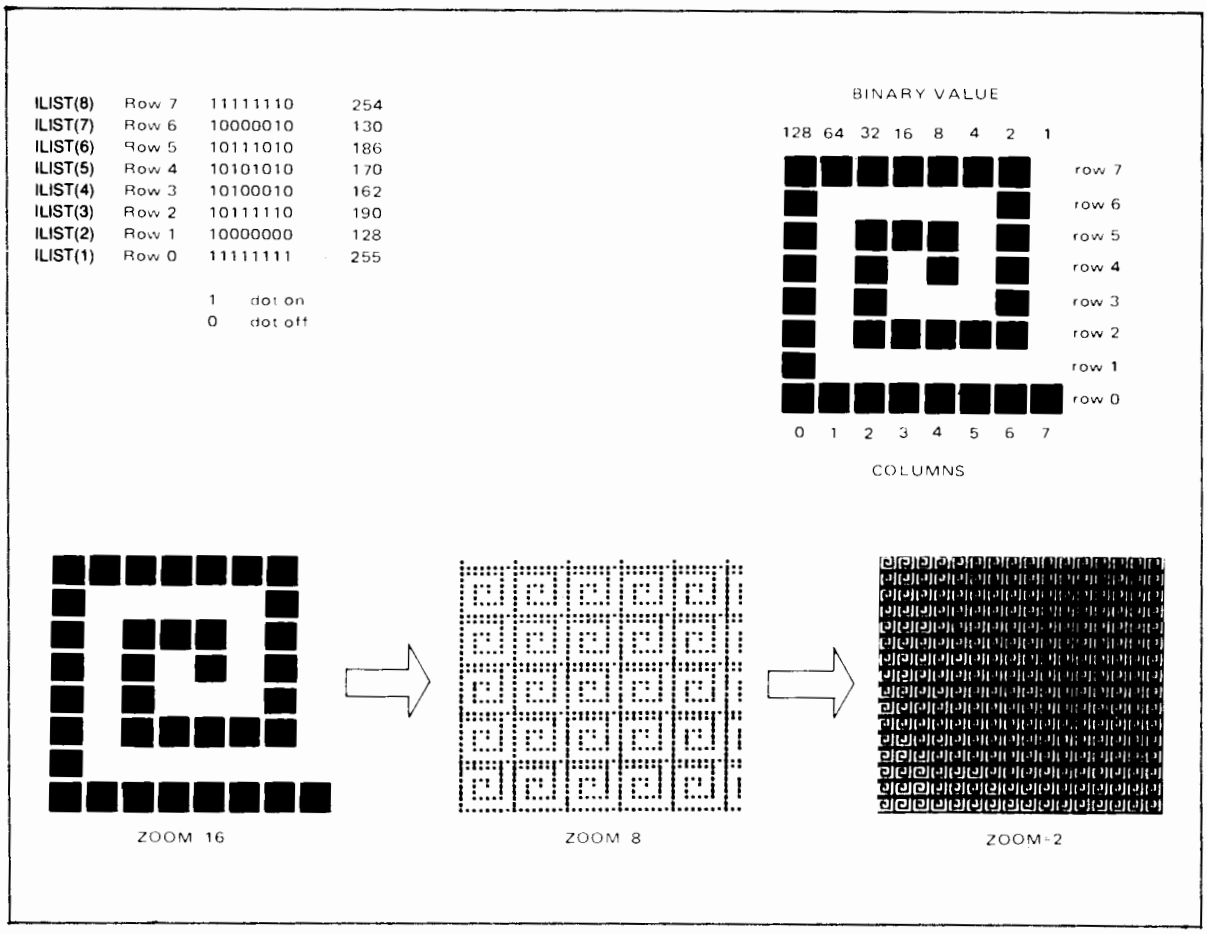


Figure 2-7. Defining Area Patterns

Locator Echoes on the Graphics Display

JWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

Computer Museum

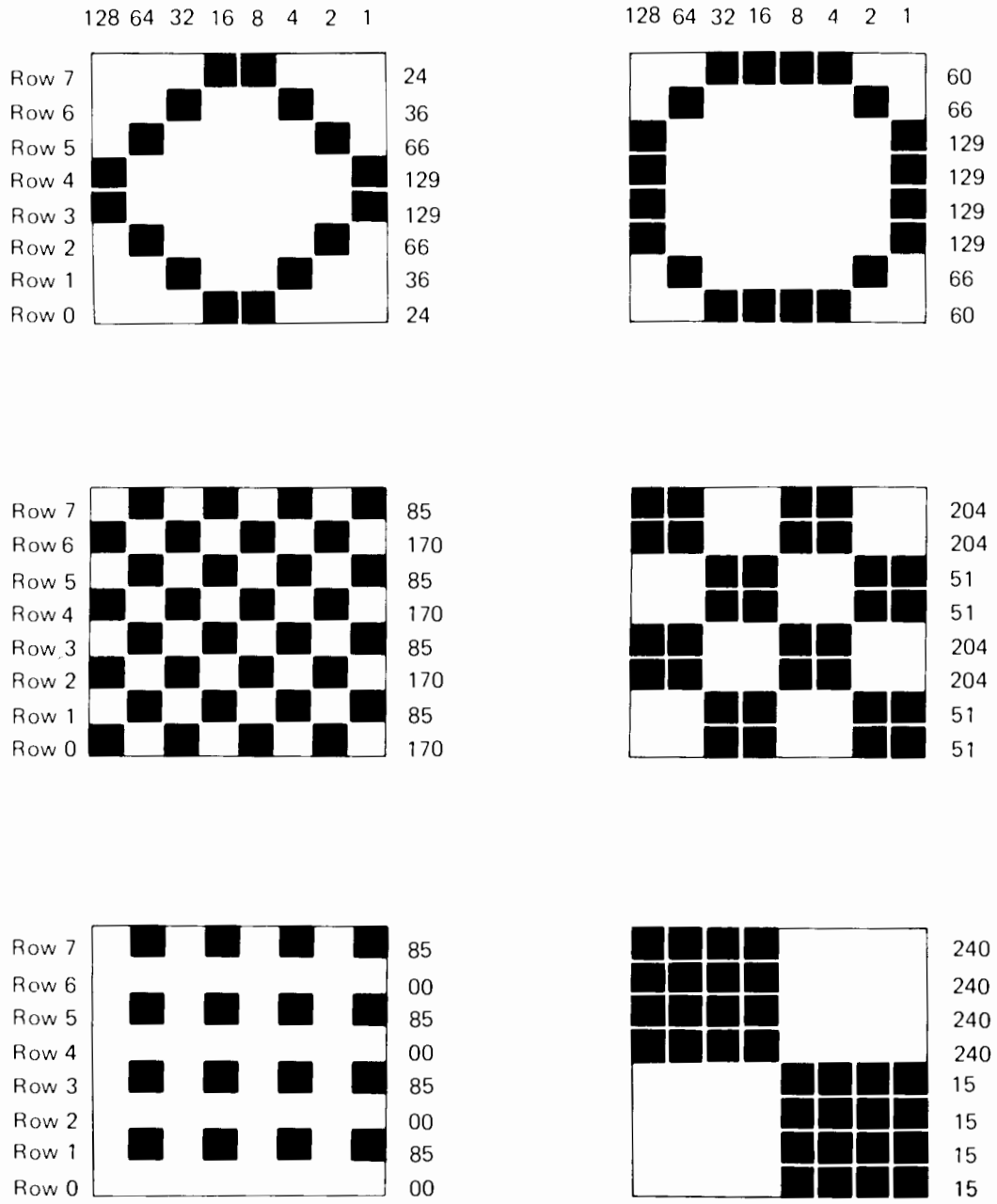


Figure 2-8. Magnified Example of Area Patterns

SAME PHYSICAL DEVICE

If the locator and graphics display are the same physical device, the following echoes are supported on the display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until operator response. When an operator response occurs, the graphics cursor is turned off.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position and a line will extend from the locator echo position to the current locator position (i.e. rubber band line) until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off and the rubber band line is removed.
5	Horizontal rubber band line The graphics cursor and the locator echo position are handled in the same manner as they are in ECHO 4. The point returned has the X coordinate of the graphics cursor and the Y coordinate of the locator echo position.
6	Vertical rubber band line The graphics cursor and the locator echo position are handled in the same manner as they are in ECHO 4. The point returned has the X coordinate of the locator echo position and the Y coordinate of the graphics cursor.

7 Horizontal/vertical rubber band line

The graphics cursor and the locator echo position are handled in the same manner as they are in ECHO 4. The point returned is same as ECHO 5 or ECHO 6, which ever defines a longer line from the locator echo position.

8 Rubber band box

The graphics cursor and the locator echo position are handled in the same manner as they are in ECHO 4. The point returned is the position of the graphics cursor.

DIFFERENT PHYSICAL DEVICES

If the locator and display devices are different physical devices and the locator device supports echoing on the graphics display, then the following echoes are supported on the graphics display. (Because of the eavesdrop configuration allowed with some plotters, the locator device and display device can have the same I/O unit descriptor, but be different physical devices.)

ECHO#	ECHO PERFORMED
2	Small cursor

Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until the locator operation is terminated. Before control is returned to the application program, the graphics cursor is turned off.

3 Full cross-hair cursor

Same as ECHO 2.

4 Rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position and a line will extend from the locator echo position to the current locator position (rubber band line) until the locator operation is terminated. Before the control is returned to the application program, the graphics cursor is turned off and the line is removed.

5 Horizontal rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. The graphics cursor will then be displayed at a point defined by the X coordinate of the current locator echo position and the Y coordinate of the current locator echo position. A horizontal line will extend from the locator echo position to the position of the graphics cursor until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off and the line is removed.

6 Vertical rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. The graphics cursor will then be displayed at a point defined by the X coordinate of the current locator echo position and the Y coordinate of the current locator echo position. A vertical line will extend from the locator echo position to the position of the graphics cursor until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off and the line is removed.

7 Horizontal/vertical rubber band line

Either a horizontal or vertical line will be displayed from the current locator echo position to the graphics cursor. The effect will be the same as ECHO 5 if the length of the horizontal line between the locator echo position is longer the vertical line between the same two points, otherwise the effect will be the same as ECHO 6.

8	Rubber band box The graphics cursor and the locator echo position are handled in the same manner as they are in ECHO 4. The rubber band line represents the diagonal of the box defined with corner points at the locator echo position and the current locator position.

Pick Echoes on the Graphics Display

JPICK

For echoes supported on the pick device, see the corresponding chapter which discusses the pick device in question.

ECHO#	ECHO PERFORMED
2	Initially the graphics cursor will be turned on at the current pick echo position. The cursor will then reflect the current pick position (i.e. tracked) until the pick operation is completed. Before control returns to the application program the graphics cursor is turned off.

Disabling

JWOFF

The display is not reset to initial values when JWOFF is called. Values will remain as they were last set. For example, color may remain set to the background color if the last operation was a simulated raster erase.

GRAPHICS DISPLAY DEVICE HANDLER (DGL ONLY)

Description

The dimensions of the graphics terminals are as follows:

Screen size:	254 mm wide by 127 mm high
Screen capacity:	720 points wide by 360 points high
Aspect ratio of maximum area:	.4993
Resolution:	2.8346 points/mm in X and Y directions

The default logical display surface of the graphics display device is the maximum physical limits of the screen. The physical origin is the lower left corner of the display.

The view surface is always centered within the current logical display surface.

Initialization

ZDINT

When initialized, the following operations are performed:

Device name set to terminal name.

Color set to 1.

Highlighting set to 1.

Linewidth set to 1.

Linestyle set to 1.

The graphics cursor is turned off and is in the lower left corner of the display.

The starting position is in the lower left corner of the display.

Zoom is set to size 1 and is turned off.

Zoom position is same as position of graphics cursor.

Alphanumeric memory is unaffected.

The alphanumeric and graphics displays are turned on.

The color table will be initialized to the default values. See the color section for the default color table.

The screen is cleared unless bit 7 is set in the control word for the ZDINT call. If bit 7 is set, graphics memory is unaffected.

Text slant is set to 0 degrees, text label direction is set to 0 degrees (horizontal), and label origin is set to 1 (left, bottom justified).

User-defined area and line patterns are set to solid.

The logical display limits are set to the maximum dimensions of the display.

New-frame-action will be buffered if bit 6 of the control word in the ZDINT call was set. See buffered new-frame-action for more specific details.

The view surface is centered within the logical display limits.

Supported Primitive Attributes

COLOR

ZCOLR

The D0019 display handler provides a software color table of two colors. The colors available are black and white. The size of the color table cannot be changed. The default values of the color table are shown in Table 2-2.

Table 2-2. Default Color Table

```
COLOR TABLE ENTRY = 0 >> Color set to black (background color)
                  = 1 >> Color set to white.
```

The color table is initialized when ZDINT is called. The color table cannot be redefined or inquired using ZDCOL or ZICOL.

The color selected corresponds to the color defined in the color table.

```
COLOR = 0 >> Color table entry 0 is selected.
        1 >> Color table entry 1 is selected.
```

REDEFINING COLOR

ZDCOL/ZICOL

The colors in the color table cannot be redefined or inquired.

POLYGON INTERIOR COLOR

ZPICL

There are two colors supported by DGL on the graphics terminals, black and white. Both colors can be displayed at one time. The supported values of the color attributes are:

```
COLOR  = 0 >> Color set to black (background color)
       = 1 >> Color set to white
```

POLYGON STYLE

ZDPST

Using ZDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

ZPILS

Refer to ZLSTL for information regarding linestyle.

HIGHLIGHTING

ZHIGH

Highlighting is not supported.

LINESTYLE

ZLSTL

Eight predefined linestyles are supported. In addition, there are two user-definable styles that can be selected. These linestyles can be defined through the use of output escape functions (ZOESC) 2050 and 8050. Initially, the two user-definable linestyles are set to solid. See Figure 2-9 for the linestyles available on the graphics terminals.

All of the supported linestyles are *continuous* line styles. Refer to the ZLSTL subroutine description in the *DGL Programmers Reference Manual* for a complete discussion of a continuous line style.

LINEWIDTH

ZLWID

Only one linewidth is supported.

LINEWIDTH = 1 >> Primitives drawn with a linewidth of one pixel.

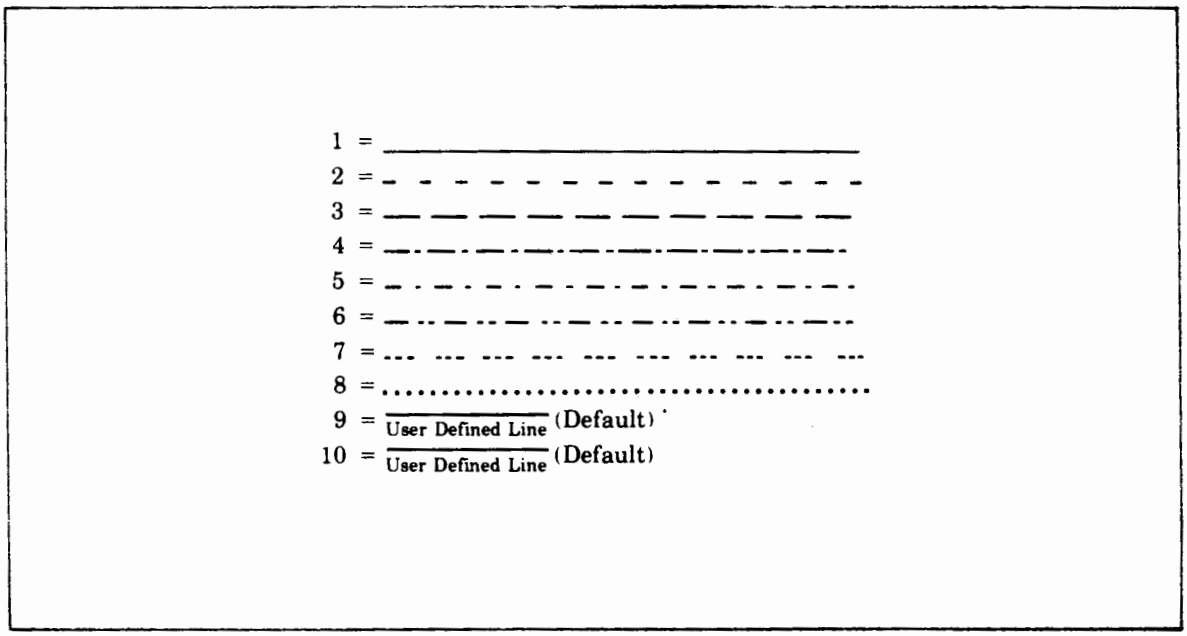


Figure 2-9. Supported Linestyles

CHARACTER SIZES

ZCSIZ

Eight distinct character sizes are supported. They all have a constant aspect ratio of 1.43. The supported character sizes are:

Width	Height
2.45 mm	3.5 mm
4.9 mm	7.0 mm
7.35 mm	10.5 mm
9.8 mm	14.0 mm
12.25 mm	17.5 mm
14.7 mm	21.0 mm
17.15 mm	24.5 mm
19.60 mm	28.0 mm

The character is placed within the character cell as shown in Figure 2-10.

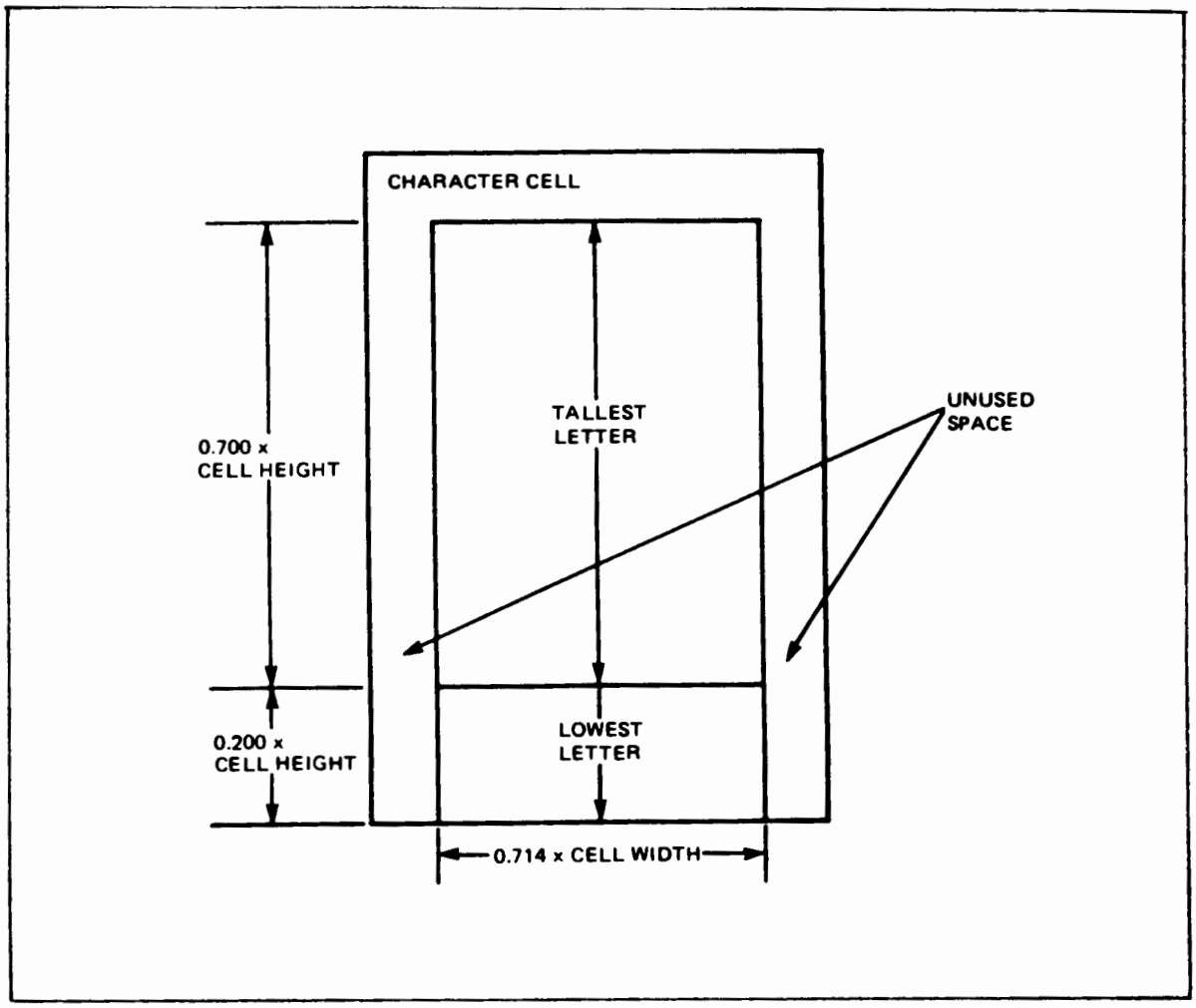


Figure 2-10. Character Placement in a Character Cell

Output Primitives

CLIPPING

The graphics terminals do not provide hardware vector clipping. A vector with one or both of its endpoints outside the physical limits is displayed in an unpredictable manner. Text characters will be clipped if they do not lie within the physical limits of the graphics display.

POLYGONS

ZPGDD

Hardware filling is provided for rectangular polygons (For non-rectangular polygons, refer to the ZPGDD section of the *DGL Reference Manual*.)

If the user specifies a fill density of 1.0 or -1.0, then the polygon will be filled with the current user-defined area pattern. (See ZOESC, OPCODE 8050, for further details.)

If the user specifies any other fill density, then the polygon will be filled with a pattern that approximates the requested interior density to the nearest multiple of 1/8, and approximates the interior orientation to the nearest multiple of 45 degrees. Crosshatching is supported, but the interior linestyle attribute is ignored.

Except when the user specifies a fill density of 1, -1, or 0, the user-defined area fill pattern will be set to solid by ZPGDD upon its completion.

MARKERS

ZMARK

The 19 standard markers are the only markers supported. The smallest character size (2.45 mm X 3.5 mm) is always used to generate markers.

TEXT

ZTEXT

Graphics text is generated with a hardware character generator. The characters are drawn with a size ratio 5 wide and 7 high in a character cell with a size ratio of 7 wide by 10 high. See Figure 2-11 for the viewable graphics character set. In addition to the viewable characters, text strings can also include the following control characters:

DECIMAL CODE	FUNCTION
8	Move *backward* one character cell
9	Move *forward* one character cell
10	Move *down* one character cell
11	Move *up* one character cell
13	Carriage return

The actual direction moved by these control functions is dependent on the text direction and text origin in use. Only the above special characters should be included in graphics text strings in addition to the printable ASCII characters.

Graphics text is not affected by the linestyle attribute; character strings will be output as solid lines. The direction, slant, and justification of text can be modified through the use of escape functions (see ZOESC 1050, 1051, 1052). If a text string extends beyond the physical limits of the graphics display, all characters which do not lie entirely within the physical limits will be clipped by the terminal.

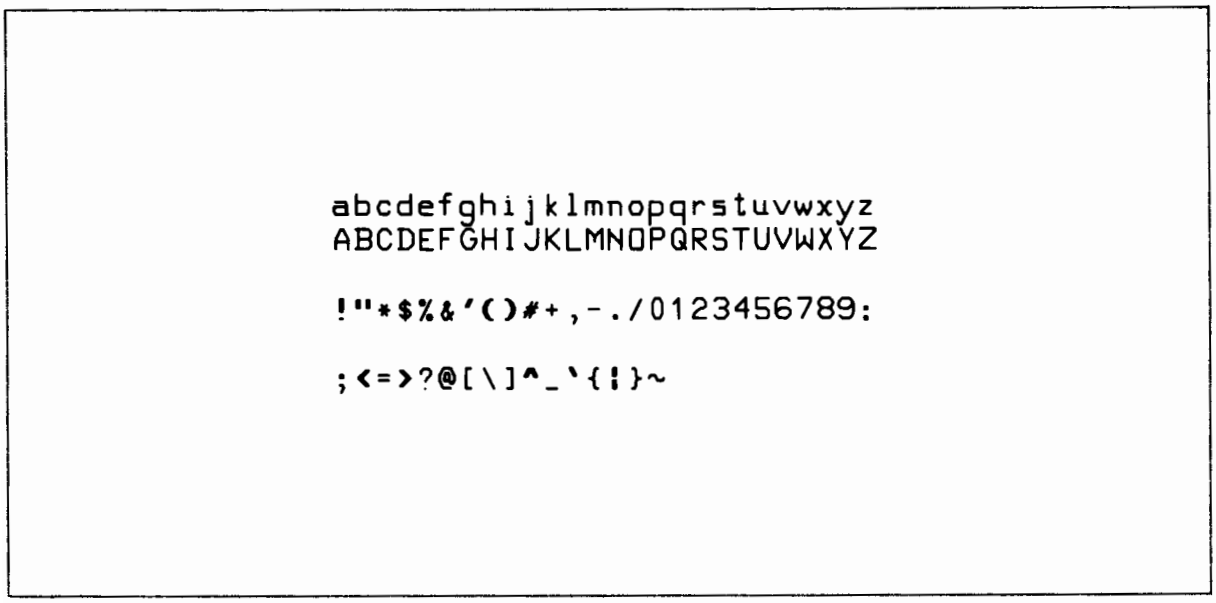


Figure 2-11. Supported Graphics Text Characters

New-Frame-Action

NON-BUFFERED NEW-FRAME-ACTION
(Bit 6 of the ZDINT control word not set)

ZNEWF

A call to ZNEWF makes the picture current and then erases the graphics display.

BUFFERED NEW-FRAME-ACTION
(Bit 6 of the ZDINT control word is set)

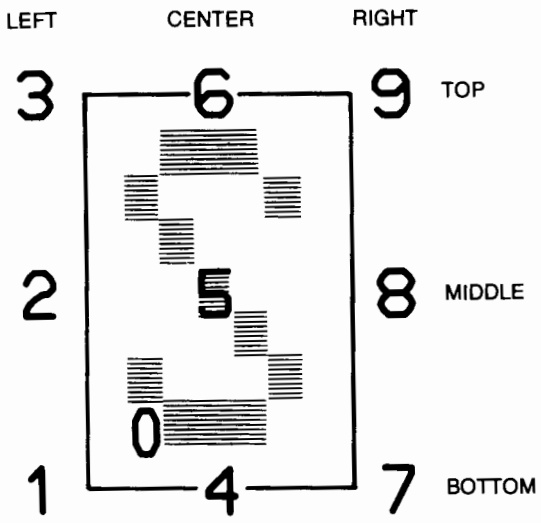
When ZNEWF is called, the graphics display is made current. The instruction to clear the graphics display is stored in the DGL buffer and will not be sent to the device until the next time the buffer is sent. When the buffer is sent, the display will be cleared to the background color and whatever calls to DGL were put into the buffer after the ZNEWF call will take affect on the graphics display. The effect is that the current display will remain until the next buffer is sent. If immediate visibility is being used, the action is the same as if bit 6 were not set since the buffer is sent after every DGL call.

Inquiry Escape Functions

ZIESC

The following inquiry escape functions are supported:

OPCODE	FUNCTION
2050	Inquire hardware zoom status. ILIST(1) = Zoom size between 1 and 16 ILIST(2) = Zoom on/off 0 = off 1 = on
3050	Inquire text status. ILIST(1) = Current text justification. See Figure 2-12 for possible values. ILIST(2) = Current text direction. Possible values are 0, 90, 180 or 270 degrees. ILIST(3) = Current text slant. Possible values are 0 and 45 degrees.



The numbers 1-9 represent the cursor position with respect to the character cell used for graphics text characters. The number 0 represents the cursor position with respect to the character (not this cell).

JUSTIFICATION/ORIGIN. Text strings can be automatically right or left justified, or centered about a specified point. An ASCII character 0 through 9 indicates the origin (justification and base line) for characters with respect to the current pen position. This function is useful when drawing labels.

If text is left justified, the current pen position is the left margin. Center causes the label to be centered on the pen position. Right justify selects the pen position as the right margin. Bottom, middle, and top select the base line for the line of text.

For example, if text was to be right justified and set with a base line on top of the normal character position, the number "9" would be used.

Figure 2-12. Hardware Text Justification

Output Escape Functions

ZOESC

Several output escape functions are supported by DGL with the graphics terminals. Error checking is not performed by the graphics system on any of the parameters which are to be sent to the device. If a parameter is outside of the range specified in the escape function definition, then the terminal will ignore the function. None of the supported output escape functions alter the starting position for the next primitive.

The following output escape functions are supported:

OPCODE	FUNCTION
250	Set zoom position to a world coordinate point. RLIST(1) = X position in world coordinates. RLIST(2) = Y position in world coordinates.
450	Perform rectangular area fill using the current linestyle and color. The rectangular area is specified in world coordinates. RLIST(1) = Minimum X border of rectangle RLIST(2) = Maximum X border of rectangle RLIST(3) = Minimum Y border of rectangle RLIST(4) = Maximum Y border of rectangle
1050	Set text direction for subsequently output graphics text. ILIST(1) = New text direction 0 = 0 degrees (horizontal) 1 = 90 degrees counterclockwise 2 = 180 degrees counterclockwise 3 = 270 degrees counterclockwise
1051	Set character slant for subsequently output graphics text. ILIST(1) = Text slant 0 = 0 degrees (normal) 1 = 45 degrees

1052 Set text justification for subsequently output graphics text.

ILIST(1) = Text justification. See Figure 2-12 for the supported justifications.

When centering or right justification is used, the text strings are buffered (stored) until all of the characters in the string have been received. The string must be terminated by a CR or LF and is not displayed until the CR or LF is received. The maximum length of a string when centerr or right justifying is 80 characters (not including the CR (LF)). In all cases, data written beyond the edge of the screen is lost. There is not automatic RETURN when the screen boundry is reached.

1053 Turn zoom on/off.

ILIST(1) = 0 >> Turn zoom off
= 1 >> Turn zoom on

1054 Set zoom size.

ILIST(1) = Zoom size ranging from 1 to 16 with size 1 being the smallest (no zoom).

1055 Turn graphics display on/off. This only controls whether the graphics memory is displayed by the terminal. It does not affect the contents or output primitives sent.

ILIST(1) = 0 >> Turn graphics display off
= 1 >> Turn graphics display on

1056 Set special drawing modes. Using this escape function will override the color as defined by the ZCOLR call. After generating output primitives in a special drawing mode, the application program can terminate the special drawing mode by making any call to ZCOLR. See Figure 2-13 for the effect of color and the special drawing modes.

ILIST(1) = 1 >> Enable complement drawing mode. All output primitives output in this mode will toggle the color of the pixels on the display. For example, when drawing a line in this mode, all white pixels in the line's path will turn black and all black pixels will turn white.

= 2 >> Enable jam drawing mode. Jam mode has the affect of overlaying the output primitives generated with it over the current primitives on the graphics display.

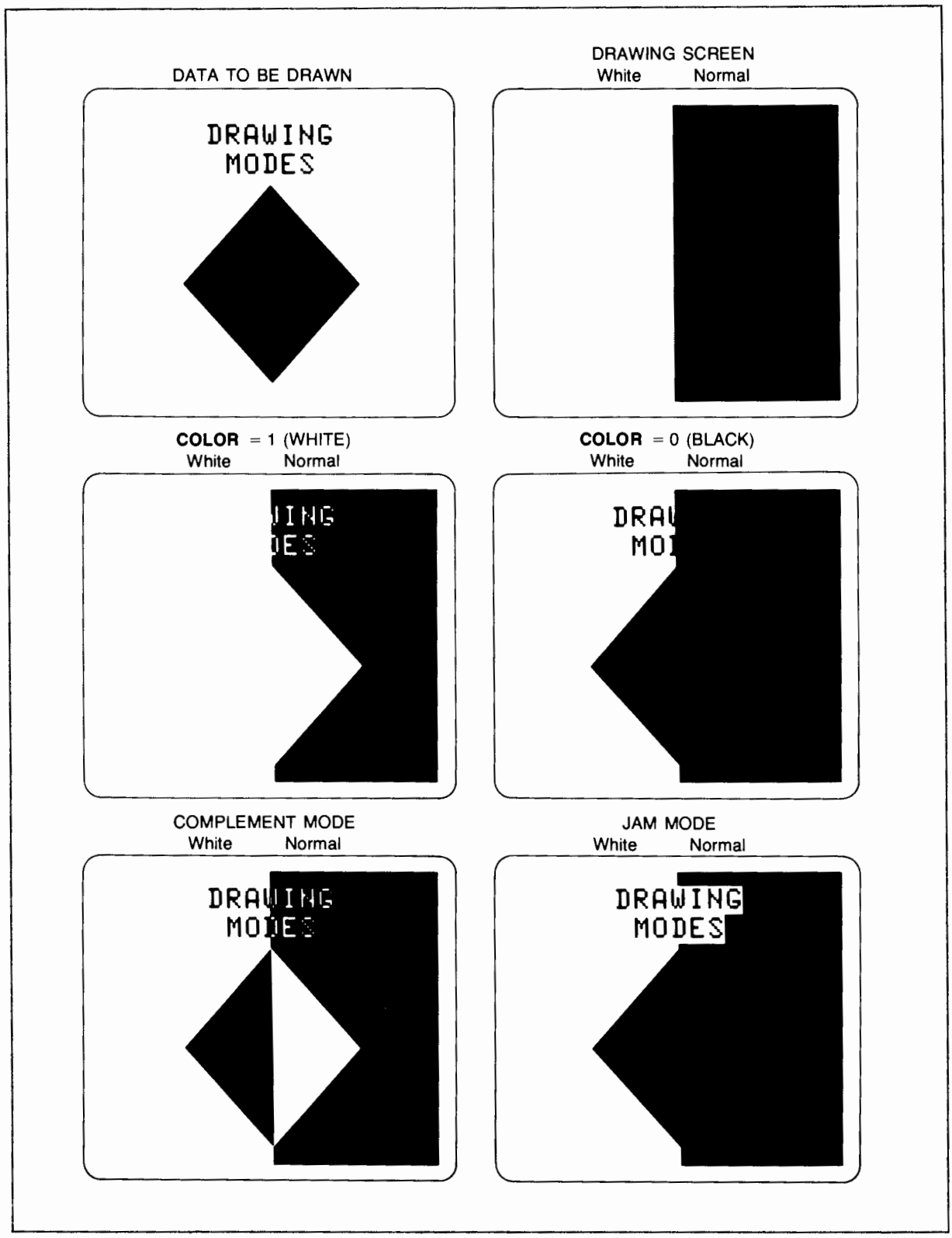


Figure 2-13. Special Drawing Modes

2050 Define line pattern. This allows the user to define the dot pattern used to draw vectors. Once a line pattern is defined, it can be used by setting the linestyle to 9. See Figure 2-14 for examples on defining line patterns.

ILIST(1) = A value between 0 and 255 defining an 8-bit binary pattern.
ILIST(2) = A scale factor between 1 and 16 to be applied to the pattern.

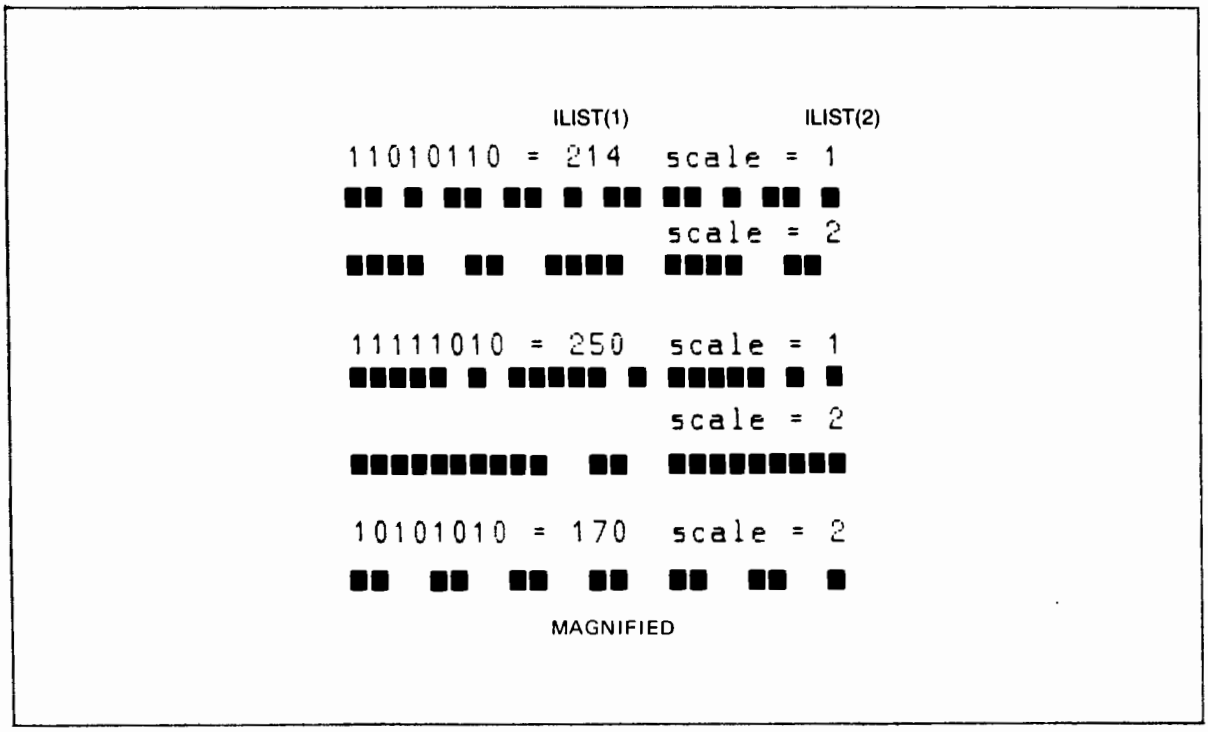


Figure 2-14. Examples of User Defined Linestyles

8050 Define area pattern.

An 8x8 pattern can be defined for use in drawing horizontal and vertical lines, filling rectangular areas (see OPCODE 450), and filling polygons via ZPGDD. The area pattern is defined by specifying each row of the pattern with a decimal number ranging between 0 and 255 which defines an 8-bit binary pattern. The graphics display is divided into 8x8 cells such that every point on the display maps to a corresponding bit in the pattern.

Once the area pattern has been defined, it can be used for drawing lines by setting the linestyle to 10. Drawing any horizontal and vertical lines causes the corresponding row or column of the pattern to be used as the line pattern. See OPCODE 450 for use in filling rectangular areas. The user-defined area pattern can be used for filling polygons by calling ZPGDD when the current polygon style has density -1. Figures 2-15 and 2-16 contain sample area fill patterns.

ILIST(1) = Row 0 of the area pattern
ILIST(2) = Row 1 of the area pattern
ILIST(3) = Row 2 of the area pattern
ILIST(4) = Row 3 of the area pattern
ILIST(5) = Row 4 of the area pattern
ILIST(6) = Row 5 of the area pattern
ILIST(7) = Row 6 of the area pattern
ILIST(8) = Row 7 of the area pattern

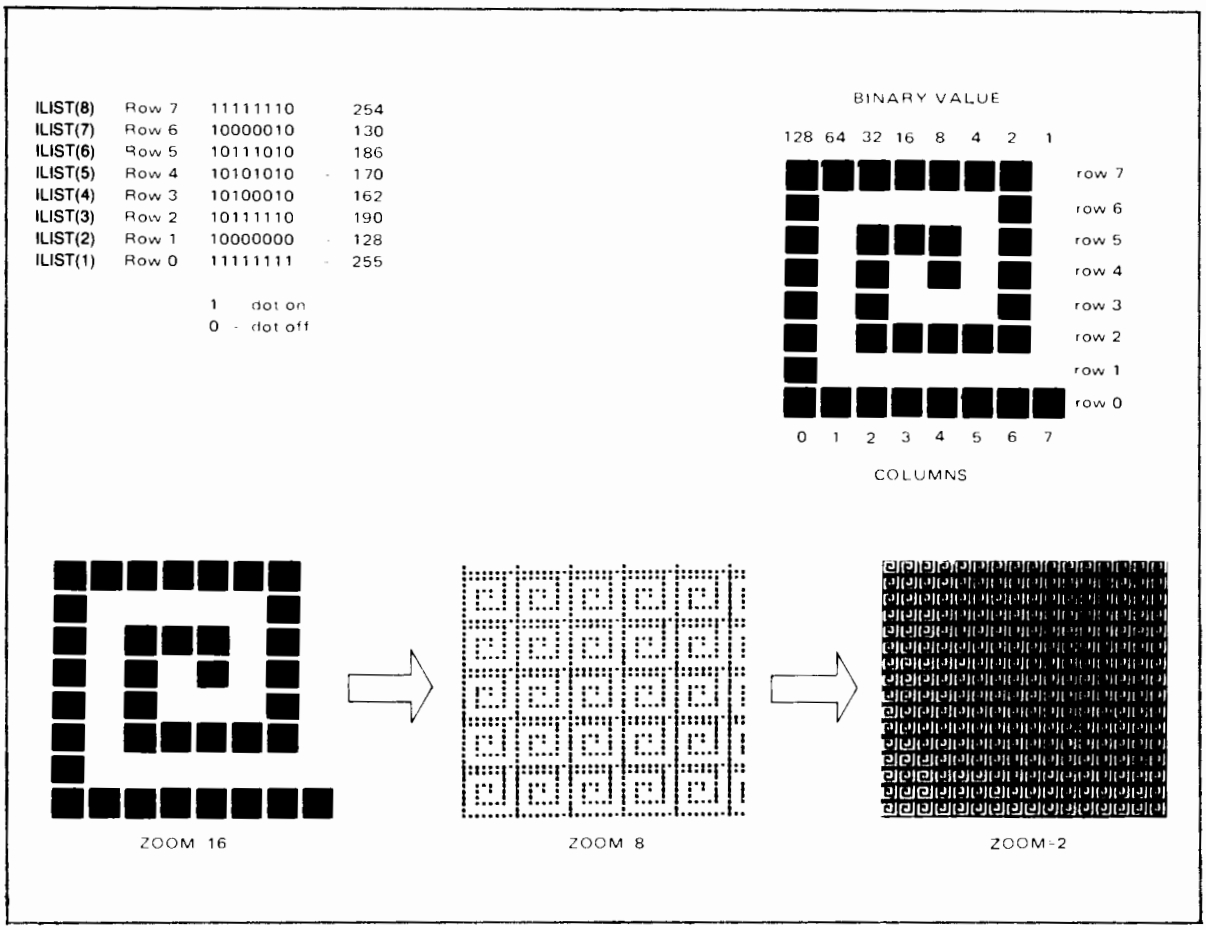


Figure 2-15. Defining Area Patterns

Locator Echoes on the Graphics Display

ZWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

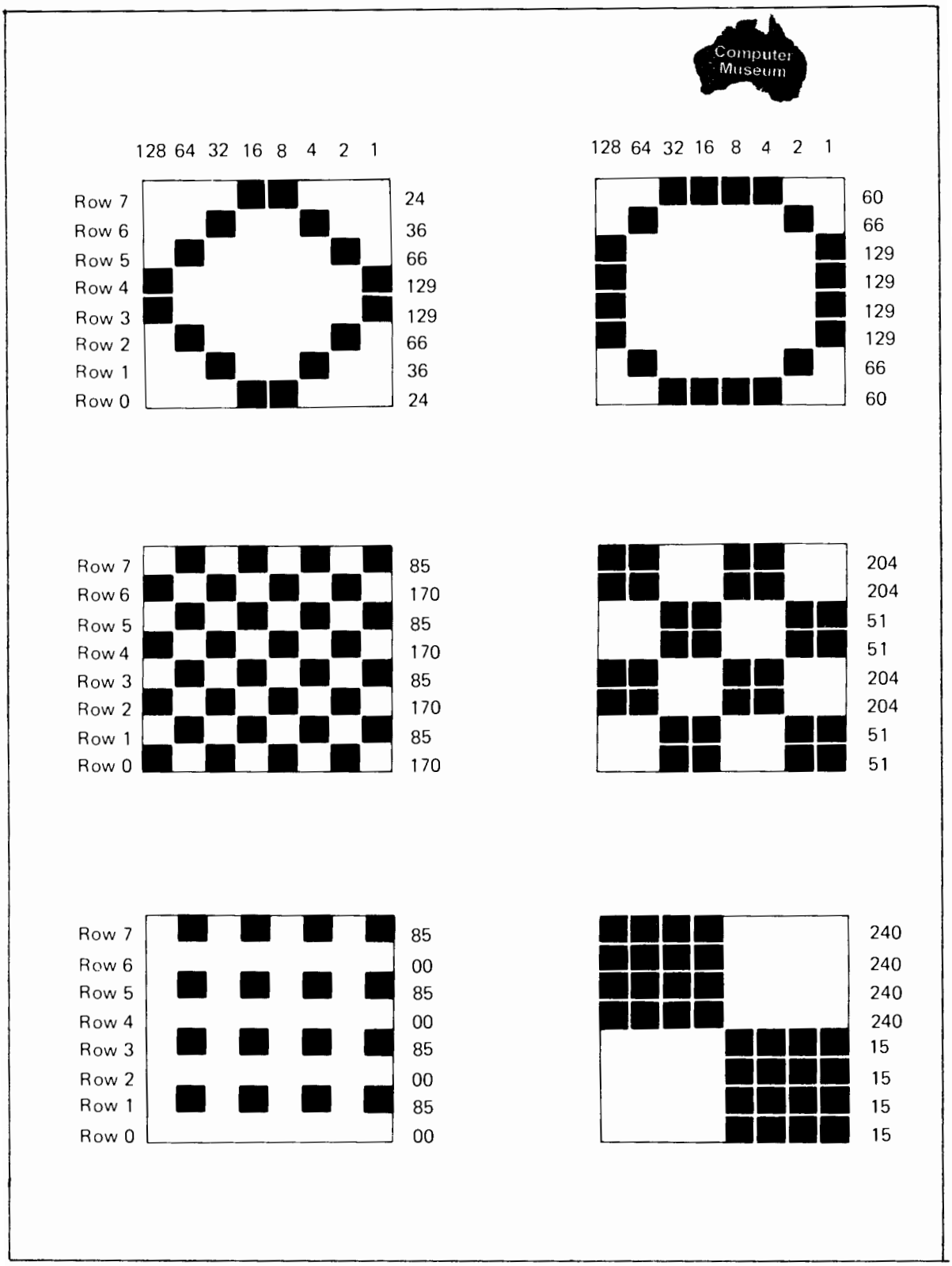


Figure 2-16. Magnified Example of Area Patterns

SAME PHYSICAL DEVICE

If the locator and graphics display are the same physical device, then the following echoes are supported on the display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until operator response. When an operator response occurs the graphics cursor is turned off.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position and a line will extend from the locator echo position to the current locator position (i.e. rubber band line) until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off and the rubber band line is removed.
5	Horizontal rubber band line The graphics cursor and the locator echo position are handled in the same manner as for ECHO 4. The point returned has the X coordinate of the graphics cursor and the Y coordinate of the locator echo position.
6	Vertical rubber band line The graphics cursor and the locator echo position are handled in the same manner as for ECHO 4. The point returned has the X coordinate of the locator echo position and the Y coordinate of the graphics cursor.

7 Horizontal/vertical rubber band line

The graphics cursor and the locator echo position are handled in the same manner as for ECHO 4. The point returned is the same as ECHO 5 or ECHO 6, which ever defines a longer line from the locator echo position.

8 Rubber band box

The graphics cursor and the locator echo position are handled in the same manner as for ECHO 4. The point returned is the position of the graphics cursor.

DIFFERENT PHYSICAL DEVICES

If the locator and display devices are different physical devices and the locator device supports echoing on the display, then the following echoes are supported on the graphics display. (Because of the eavesdrop configuration allowed with some plotters, the locator device and display device can have the same system identifier, but be different physical devices.)

ECHO#	ECHO PERFORMED
2	Small cursor

Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until the locator operation is terminated. Before control is returned to the application program, the graphics cursor is turned off.

3 Full cross-hair cursor

Same as ECHO 2.

4 Rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position and a line will extend from the locator echo position to the current locator position (rubber band line) until the locator operation is terminated. Before the control is returned to the application program, the graphics cursor is turned off and the line is removed.

5 Horizontal rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. The graphics cursor will then be displayed at a point defined by the X coordinate of the current locator echo position and the Y coordinate of the current locator echo position. A horizontal line will extend from the locator echo position to the position of the graphics cursor until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off and the line is removed.

6 Vertical rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. The graphics cursor will then be displayed at a point defined by the X coordinate of the current locator echo position and the Y coordinate of the current locator echo position. A vertical line will extend from the locator echo position to the position of the graphics cursor until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off and the line is removed.

7 Horizontal/vertical rubber band line

Either a horizontal or vertical line will be displayed from the current locator echo position to the graphics cursor. The effect will be the same as ECHO 5 if the length of the horizontal line between the locator echo position is longer the vertical line between the same two points, otherwise the effect will be the same as ECHO 6.

8	Rubber band box

The graphics cursor and the locator echo position are handled in the same manner as for ECHO 4. The rubber band line represents the diagonal of the box defined with corner points at the locator echo position and the current locator position.

Termination

ZDEND

The graphics display is unaltered. The device name is set to '0001 ', and the device status and I/O unit descriptor are set to 0. All attribute values remain unchanged until the system is reinitialized or the display device is enabled again.

KEYBOARD DEVICE HANDLER (AGP/DGL)

Description

The graphics terminals have a standard ASCII keyboard which is supported as a keyboard input device. The device handler required to use the keyboard device is K0001.

Initialization

JEDEV/ZKINT

When the keyboard device is initialized, the terminal alphanumeric display is turned on. The device name is set to the terminal name.

Keyboard Input

JKYBD/ZKYBD

Once the keyboard device has been enabled, it is available for input operations. When JKYBD or ZKYBD are called, a read operation is set pending on the terminal. The operator then enters the desired text and terminates the operation by entering a carriage return. Some keys have a special meaning when entered by the operator and are not returned to the application program (see Appendix B for a description of these keys).

Echoes Supported

The keyboard device supports the following echoes:

ECHO #	ECHO PERFORMED
0	Text is not displayed on the terminal alphanumeric display as it is entered.
1	Text is displayed on the terminal alphanumeric display as it is entered.

Termination

JDDEV/ZKEND

The alphanumeric display is unaltered. The device name is set to '0001 ', and the device status and I/O unit descriptor are set to 0.

LOCATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the graphics terminals are as follows:

Screen size:	254 mm wide by 127 mm high
Screen capacity:	720 points wide by 360 points high
Resolution:	2.8346 points/mm in X and Y directions

The default locator limits are set equal to the maximum physical limits of the screen.

The physical origin of the locator device is the lower left corner of the display.

The graphics terminals have a graphics locator which is capable of returning any point on the screen. The device handler required to use the locator device is L0001.

Initialization

JEDEV/ZLINT

When the locator device is initialized, the terminal graphics display is left unaltered. The device name is set to the terminal name.

Wait Locator Input

JWLOC/ZWLOC

The wait locator input function sets a read operation pending on the graphics terminal. The operator then positions the graphics cursor to the desired position and strikes an alphanumeric key. The (X,Y) coordinate value of the graphics cursor (which is a function of the echo) and the key struck are returned to the application program. Any of the ASCII keys can be used to terminate the locator function so the key returned to the application program can range from 0 to 127.

Echoes Supported

Locator input can be echoed on either a graphics display device or a locator device. The echo can only be performed on a graphics display device when the locator and the graphics display devices are implemented on the same physical device (i.e. same graphics terminal). Refer to the graphics display sections to see how the locator can echo input on the graphics display. The following echoes can be performed:

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	Initially the graphics cursor is turned on and will appear wherever it was last positioned on the display. The graphics cursor can then be moved by the operator through the use of the graphics cursor control keys. When the graphics cursor is positioned over the desired point, the operator strikes an alphanumeric key and the locator function is terminated. Before control returns to the application program, the graphics cursor is turned off.

Sample Locator Input

JSLOC/ZSLOC

The sample locator input function returns the current locator position without waiting for an operator response. The graphics cursor is turned off following the sample locator function.

Echoes Supported

The following locator echoes are supported:

ECHO#	ECHO PERFORMED
0	Echo is not performed.
1	The bell in the terminal is sounded when the locator is sampled.

Termination

JDDEV/ZLEND

The device name is set to '0001 ', and the device status and I/O unit descriptor are set to 0.

PICK DEVICE HANDLER (AGP ONLY)

Description

The pick device is only supported with AGP. The dimensions of the graphics terminals are as follows:

Screen size:	254 mm by 127 mm
Screen capacity:	720 points by 360 points
Resolution:	2.8346 points/mm in X and Y directions

The physical origin of the pick device is the lower left corner of the display.

The graphics terminals have a pick device which is capable of differentiating between any point on the graphics display. The device handler required to use the pick device is P0001.

Initialization

JEDEV

When initialized, the terminal graphics display is left unaltered. The device name is set to the terminal name.

Pick Input

JPICK

The pick input function sets a read operation pending on the graphics terminal. The operator then positions the graphics cursor to the desired position and strikes an alphanumeric key. The segment name, pick-id, and the value of the pick button are then returned to the application program. Any of the ASCII keys can be used to terminate the pick function so the value of the pick button returned to the application program can range from 0 to 127.

Echoes Supported

Pick input can be echoed on either a graphics display device or a pick device. The echo can only be performed on a graphics display device when the pick and the graphics display devices are implemented on the same physical device (i.e. the same graphics terminal). Refer to the AGP graphics display section to determine the supported pick echoes on the graphics display. The following echoes can be performed:

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	Initially the graphics cursor is turned on and will appear wherever it was last positioned on the display. The graphics cursor can then be moved by the operator through the use of the graphics cursor control keys. When the graphics cursor is positioned over the desired point the operator strikes an alphanumeric key and the pick function is terminated. Before control returns to the application program, the graphics cursor is turned off.

Termination

JDDEV

The device name is set to '0001 ', and the device status and I/O unit descriptor are set to 0.

VALUATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the graphics terminals are as follows:

Screen size: 254 mm by 127 mm

Screen capacity: 720 points by 360 points

The graphics terminals can simulate a valuator device with the graphics locator. The simulation is done by splitting the X and Y coordinates into two subvaluators and scaling the locator coordinates to values which range from 0.0 to 1.0. The device handler required to use the valuator device is V0001.

Initialization

JEDEV/ZVINT

When the valuator device is initialized, the terminal graphics display is left unaltered. The device name is set to the terminal name.

Wait Valuator Input

JWVAL/ZWVAL

The wait valuator input function sets a read operation pending on the graphics terminal. The operator then positions the graphics cursor to the desired position and strikes an alphanumeric key.

In addition to returning the subvaluator value, the key struck to terminate the valuator operation is also returned to the application program. Any of the ASCII keys can be used to terminate the valuator function so the button returned to the application program can range from 0 to 127. The values returned are a function of the subvaluator specified as follows:

Subvaluator	Value returned
1	Value returned is the X coordinate of the graphics cursor position scaled to a number between 0.0 and 1.0. A value of 0.0 is returned if the cursor is at the left edge and a value of 1.0 is returned if the cursor is at the right edge of the display.
2	Value returned is the Y coordinate of the graphics cursor position scaled to a number between 0.0 and 1.0. A value of 0.0 is returned if the cursor is at the bottom of the display and a value of 1.0 is returned if the cursor is at the top of the dispay.

Echoes Supported

The supported echoes for the wait valuator function are as follows:

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	Initially the graphics cursor is turned on and will appear wherever it was last positioned on the display. The graphics cursor can then be moved by the operator through the use of the graphics cursor control keys. When the graphics cursor is positioned over the desired point the operator strikes an alphanumeric key and the valuator function is terminated. Before control returns to the application program, the graphics cursor is turned off.

Sample Valuator Input

JSVAL/ZSVAL

The sample valuator input function returns a subvaluator value without waiting for an operator response. The valuator simulation is performed in the same way as for the wait valuator function.

Echoes Supported

The following valuator echoes are supported with the graphics terminals when using the sample valuator function:

ECHO#	ECHO PERFORMED
0	Echo is not performed.
1	The terminal bell is sounded when the valuator is sampled.

Termination

JDDEV/ZVEND

The device name is set to '0001 ', and the device status and I/O unit descriptor are set to 0.

Chapter 3
HP 9872 Graphics Plotters

GENERAL INFORMATION

The user should be familiar with the operation of the HP 9872A, HP 9872B, HP 9872S, HP 9872C or HP 9872T Graphics Plotters. If necessary, refer to the following manuals for the appropriate operating instructions:

HP 9872A Graphics Plotter Interfacing and Programming Manual *(09872-90003)*

HP 9872B and 9872S Graphics Plotters Operating and Programming Manual *(09872-90008)*

HP 9872C Graphics Plotter and 9872T Graphics Plotter Operating and Programming Manual using HP-GL Instructions *(09872-90011)*

HP 9872C/T Graphics Plotter Service Manual *(09872-90012)*

Logical Devices Supported

The following logical devices are supported by the AGP/DGL Graphics Systems when using the HP 9872 Graphics Plotters.

Logical Device	Device Handler Name	Physical Device
Graphics display	D0002	HP 9872A/B/S/C/T
Graphics display	D0003	HP 9872S/T
Graphics display	D0015	HP 9872C/T
Graphics display	D0016	HP 9872T
Locator	L0002	HP 9872A/B/S/C/T
Pick (AGP only)	P0002	HP 9872A/B/S/C/T

D0002 can be used with the HP 9872A, HP 9872B, HP 9872C, HP 9872S, and HP 9872T. It drives all plotters as if they are a 9872A (no paper advance control, no cutter enable, four pens only, etc).

D0003 can be used with the HP 9872S and the HP 9872T. It uses the paper advance mechanisms on both plotters, but only uses four pens.

D0015 can be used with the HP 9872C or HP 9872T. It drives the HP 9872T as if it is an HP 9872C plotter (paper advance control not available).

D0016 should only be used with the HP 9872T. It uses the paper advance feature of the HP 9872T and allows full usage of the eight pens.

All information presented in this chapter applies to all HP 9872 plotters unless stated otherwise.

GRAPHICS DISPLAY DEVICE HANDLER (AGP ONLY)

Description

The dimensions of the HP 9872 Graphics Plotters are as follows:

Platen surface:	420 mm wide by 297 mm high
Plotting area:	400 mm wide by 285 mm high
Plotting capacity:	16000 points wide by 11400 points high
Aspect ratio of maximum area:	0.7125
Resolution:	40.0 points/mm in the X and Y directions

When using D0002 or D0015, the default logical display surface of the HP 9872 plotters ranges from 15.25 to 346.4 mm in the X direction and 7.25 to 260.5 mm in the Y direction. The aspect ratio of the default limits is: 0.66448.

When using D0003 or D0016, the default logical display surface of the HP 9872 plotters ranges from 0.0 to 400.0 mm in the X direction and 16.5 to 285.0 mm in the Y direction (fitted paper roll size). The aspect ratio of the logical display surface is: 0.67125.

The physical origin of the device is 12 mm to the right of the left edge of the platen and 6 mm above the lower edge of the platen. This is the lower left boundary for pen movement.

The view surface is always justified in the lower left corner of the current logical display surface.

Initialization

JDINT

When the HP 9872 is initialized, the following operations are performed:

Device name is set to '9872A ' or '9872B ' or '9872C ' or '9872T ' (D0002)

Device name is set to '9872B ' (D0003)

Device name is set to '9872C ' or '9872T ' (D0015)

Device name is set to '9872T ' (D0016)

Pen velocity is set to 36 cm/sec.

ASCII character set is set to 'ANSI ASCII' for medium and low quality text.

Medium and low quality text slant are set to 0 degrees (no slant) and text label direction is set to 0 degrees (horizontal).

The logical display surface is set to the default value.

The view surface is justified in the lower left corner of the logical display surface.

Hardware clipping limits are set to the view surface boundaries.

Paper cutter is enabled (D0003, D0016).

Advance page option is enabled (D0003, D0016).

Paper is advanced one full page (D0003, D0016) if bit 7 in the control word is not set. If bit 7 is set, the paper is not advanced.

Device Enabling

JWON

When an HP 9872 Graphics Plotter is enabled, the pen representing the current color attribute is selected.

Supported Primitive Attributes

COLOR

JCOLR

The D0002 and D0003 display handlers for the HP 9872A/B/S provide a software color table of four distinct colors which support four pens. The size of the color table cannot be changed. The default values of the color table are shown in Table 3-1.

Table 3-1. Default Color Table for Four Pen Plotters

	R	G	B
COLOR TABLE ENTRY = 1 >> Black	0.0	0.0	0.0
= 2 >> Red	1.0	0.0	0.0
= 3 >> Green	0.0	1.0	0.0
= 4 >> Blue	0.0	0.0	1.0

The color table is initialized to the default values when JDINT is called. The color table can be redefined or inquired using JDCOL or JICOL.

The pen selected corresponds to the color index passed in the JCOLR call. The color table is not used when selecting the pen on a JCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 0 >> Current pen is returned to its stall
      = 1 >> Pen #1 is selected
      = 2 >> Pen #2 is selected
      = 3 >> Pen #3 is selected
      = 4 >> Pen #4 is selected
```

The D0015 and D0016 display handlers for the HP 9872C/T provide a software color table of eight distinct colors, which support eight pens. The size of the color table cannot be changed. The default values of the color table are shown in Table 3-2.

Table 3-2. Default Color Table for Eight Pen Plotters

	R	G	B
COLOR TABLE ENTRY = 1 >> Black	0.0	0.0	0.0
= 2 >> Red	1.0	0.0	0.0
= 3 >> Yellow	1.1	1.1	0.0
= 4 >> Green	0.0	1.0	0.0
= 5 >> Cyan	0.0	1.0	1.0
= 6 >> Blue	0.0	0.0	1.0
= 7 >> Magenta	1.0	0.0	1.0
= 8 >> White	1.0	1.0	1.0

The color table is initialized to the default values when JDINT is called. The color table can be redefined or inquired using JDCOL or JICOL.

The pen selected corresponds to the color index passed in the JCOLR call. The color table is not used when selecting the pen on a JCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 0 >> Current pen is returned to its stall
      = 1 >> Pen #1 is selected
      = 2 >> Pen #2 is selected
      = 3 >> Pen #3 is selected
      = 4 >> Pen #4 is selected
      = 5 >> Pen #5 is selected
      = 6 >> Pen #6 is selected
      = 7 >> Pen #7 is selected
      = 8 >> Pen #8 is selected
```

REDEFINING COLOR

JDCOL/JICOL

All of the colors in the color table can be redefined, or inquired, except for the background color. When the color table is redefined, it only affects the values returned on JICOL calls. AGP does not use the color table when selecting the pen on a JCOLR or JPICL call. The color table is provided for the user's convenience.

POLYGON INTERIOR COLOR

JPICL

Refer to JCOLR for information regarding color.

POLYGON STYLE

JDPST

Since the HP 9872 Graphics Plotters are hard copy devices, using JDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

JPILS

Refer to JLSTL for information regarding linestyle.

HIGHLIGHTING

JSHI/JGHI

Highlighting is not supported on the HP 9872 plotters.

LINESTYLE

JLSTL

Seven predefined linestyles are supported on the HP 9872 plotters. All of the supported linestyles are *continuous*. See Figure 3-1 for the linestyles available on the HP 9872 plotters. Refer to the JLSTL subroutine description in the *AGP Reference Manual* for a complete description of a continuous linestyle.

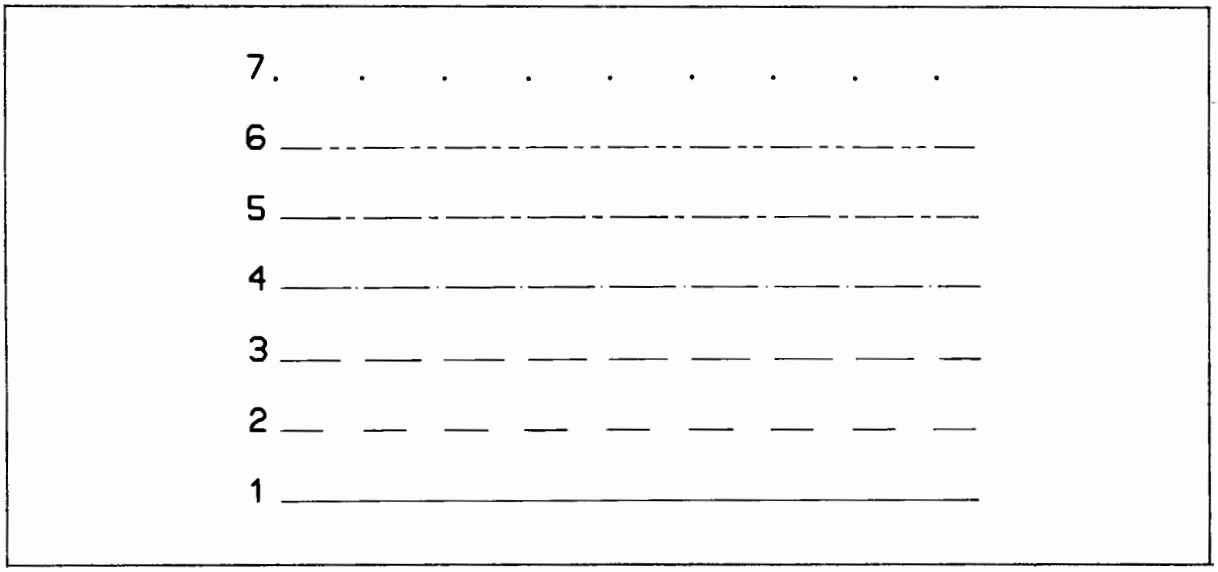


Figure 3-1. Supported Linestyles

LINEWIDTH

JLWID

Only one linewidth is supported on the HP 9872 plotters.

LINEWIDTH = 1 >> Primitives drawn with the linewidth of the pen selected.

CHARACTER SIZES

JCSIZ

For medium and low quality text, the HP 9872 pen plotters support all character cell sizes which have a width and height not less than 1 mm and not greater than 250 mm.

When using medium and low quality text, the character is placed within the character cell as shown in Figure 3-2.

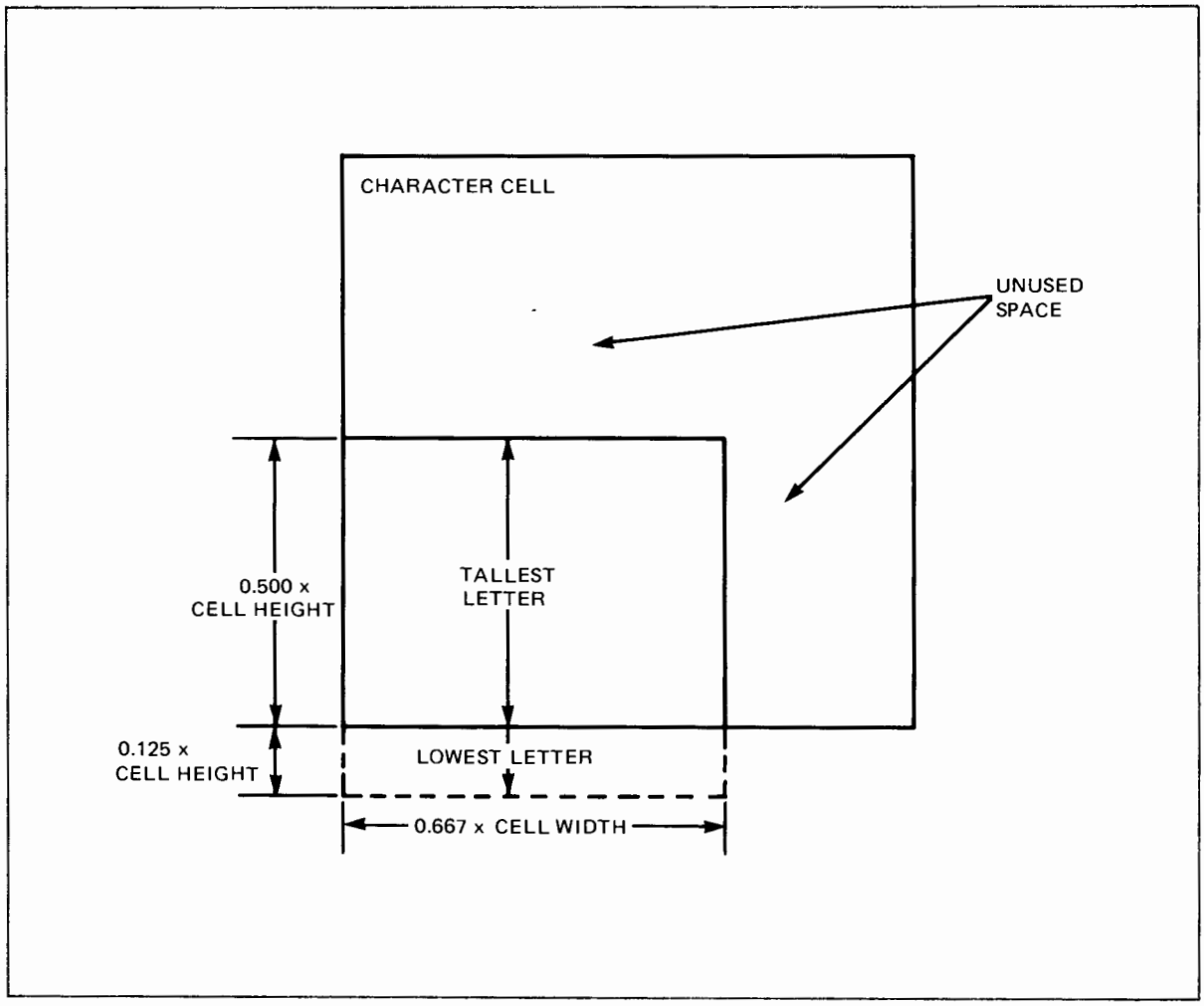


Figure 3-2. Placement of Character in Character Cell

Output Primitives

CLIPPING

The AGP user can access the hardware vector clipping feature of the HP 9872 plotters through the output escape function JOESC (450). Calls to JASPK, JWIND, JVIEW, JDLIM, and JDINT will reset the hardware clipping limits to the view surface boundaries. The user can redefine the hardware clipping limits to be any region within the boundaries of the view surface by a call to JOESC (450).

If AGP window clipping is disabled and parts of the image are outside of the view surface limits, then unpredictable results may occur. Graphics items which extend past the view surface limits will activate the plotter's *out-of-limits* lights. If the image is entirely within the view surface limits, then only the portion of the image that is within the hardware clipping limits will be displayed.

If AGP window clipping is enabled, only the portion of the image which is within the viewport and within the hardware clipping limits will be displayed.

POLYGONS

J2PGN/J3PGN/JR2PG/JR3PG

This device does not have hardware area fill.

MARKERS

J2MRK/J3MRK/JR2MK/JR3MK

The 19 standard markers are the only markers supported with the 9872 plotters. A character size of 2.0 mm by 2.0 mm is always used to generate the markers. Markers are affected by the color attribute.

MEDIUM AND LOW QUALITY TEXT

JTEXM/JTEXL

Medium and low quality graphics text are generated with a hardware character generator. Hardware text is affected by color but is not affected by linestyle attribute. It is always generated with solid lines.

If a medium or low quality text string is not clipped by AGP, all characters which extend beyond the hardware clipping limits will be clipped by the plotter.

A standard ASCII character set is used as the default character set. There are four additional character sets available to the user via HP 9872 escape functions. These character sets are given in Table 3-3.

The user can modify the direction and slant of medium and low quality text through the output escape function (see JOESC (150), JOESC (250)).

Table 3-3. Supported Hardware Character Sets

Plotter ASCII Code Definitions

Decimal Code	ASCII Character	9872 Function/Character Set				
		Set Ø	Set 1	Set 2	Set 3	Set 4
0	NULL	Error 4 Generated In Plotter				
1	SOH	Error 4 Generated In Plotter				
2	STX	Error 4 Generated In Plotter				
3	ETX	End Label Instruction				
4	ETO	Error 4 Generated In Plotter				
5	ENQ	Error 4 Generated In Plotter				
6	ACK	Error 4 Generated In Plotter				
7	BEL	No Operation (NOP)				
8	BS	Backspace				
9	HT	NOP				
10	LF	Line Feed				
11	VT	Inverse Line Feed				
12	FF	NOP				
13	CR	Carriage Return				
14	SO	Select Alternate Character Set				
15	SI	Select Standard Character Set				
16	DLE	Error 4 Generated In Plotter				
17	DC1	NOP				
18	DC2	NOP				
19	DC3	NOP				
20	DC4	NOP				
21	NAK	Error 4 Generated In Plotter				
22	SYN	Error 4 Generated In Plotter				
23	ETB	Error 4 Generated In Plotter				
24	CAN	Error 4 Generated In Plotter				
25	EM	Error 4 Generated In Plotter				
26	SUB	Error 4 Generated In Plotter				
27	ESC	Error 4 Generated In Plotter				
28	FS	Error 4 Generated In Plotter				
29	GS	Error 4 Generated In Plotter				
30	RS	Error 4 Generated In Plotter				
31	US	Error 4 Generated In Plotter				
32	SP	Space				
33	!	!	!	!	!	!
34	"	"	"	"	"	"
35	#	#	#	£	£	¿
36	$	$	$	$	$	$
37	%	%	%	%	%	%
38	&	&	&	&	&	&
39	'	'	'	´	´	´
40	(	(	(	(	(	(
41	)	)	)	)	)	)
42	*	*	*	*	*	*
43	+	+	+	+	+	+
44	,	.	.	.	.	.
45	–	–	–	–	–	–
46	.	.	.	.	.	.
47	/	/	/	/	/	/

NOTE: Characters offset to the left have the automatic backspace feature.

Table 3-3. Supported Hardware Character Sets (continued)

Plotter ASCII Code Definitions (Continued)

Decimal Code	ASCII Character	9872 Function/Character Set				
		Set Ø	Set 1	Set 2	Set 3	Set 4
48	Ø	Ø	Ø	Ø	Ø	Ø
49	1	1	1	1	1	1
50	2	2	2	2	2	2
51	3	3	3	3	3	3
52	4	4	4	4	4	4
53	5	5	5	5	5	5
54	6	6	6	6	6	6
55	7	7	7	7	7	7
56	8	8	8	8	8	8
57	9	9	9	9	9	9
58	:	:	:	:	:	:
59	;	;	;	;	;	;
60	<	<	<	<	<	<
61	=	=	=	=	=	=
62	>	>	>	>	>	>
63	?	?	?	?	?	?
64	@	@	@	@	@	@
65	A	A	A	A	A	A
66	B	B	B	B	B	B
67	C	C	C	C	C	C
68	D	D	D	D	D	D
69	E	E	E	E	E	E
70	F	F	F	F	F	F
71	G	G	G	G	G	G
72	H	H	H	H	H	H
73	I	I	I	I	I	I
74	J	J	J	J	J	J
75	K	K	K	K	K	K
76	L	L	L	L	L	L
77	M	M	M	M	M	M
78	N	N	N	N	N	N
79	O	O	O	O	O	O
80	P	P	P	P	P	P
81	Q	Q	Q	Q	Q	Q
82	R	R	R	R	R	R
83	S	S	S	S	S	S
84	T	T	T	T	T	T
85	U	U	U	U	U	U
86	V	V	V	V	V	V
87	W	W	W	W	W	W
88	X	X	X	X	X	X
89	Y	Y	Y	Y	Y	Y
90	Z	Z	Z	Z	Z	Z
91	[	[	[	[	Ø	[
92	\	\	f	ç	f	ı
93	]	]	]	]	ø	]
94	^	^	↑	^	^	^
95	_	_	_	_	_	_
96	`	`	`	`	`	`
97	a	a	a	a	a	a

Table 3-3. Supported Hardware Character Sets (continued)

Plotter ASCII Code Definitions (Continued)

Decimal Code	ASCII Character	9872 Function/Character Set				
		Set Ø	Set 1	Set 2	Set 3	Set 4
98	b	b	b	b	b	b
99	c	c	c	c	c	c
100	d	d	d	d	d	d
101	e	e	e	e	e	e
102	f	f	f	f	f	f
103	g	g	g	g	g	g
104	h	h	h	h	h	h
105	i	i	i	i	i	i
106	j	j	j	j	j	j
107	k	k	k	k	k	k
108	l	l	l	l	l	l
109	m	m	m	m	m	m
110	n	n	n	n	n	n
111	o	o	o	o	o	o
112	p	p	p	p	p	p
113	q	q	q	q	q	q
114	r	r	r	r	r	r
115	s	s	s	s	s	s
116	t	t	t	t	t	t
117	u	u	u	u	u	u
118	v	v	v	v	v	v
119	w	w	w	w	w	w
120	x	x	x	x	x	x
121	y	y	y	y	y	y
122	z	z	z	z	z	z
123	{	{	{	{	{	{
124	|	|	|	|	|	|
125	}	}	}	}	}	}
126	~	~	~	~	~	~
127	DEL	Error 4 Generated In Plotter				

New-Frame-Action

JNEWF/JPURG/JSVIS/JSHI/JVSAL/JCLR

When using D0002 and D0015, a new-frame-action causes the picture to be made current. All visible segments are then drawn, or redrawn, on the display surface. The application program should generate pause time, if necessary, so that the user can change the paper.

When using D0003 and D0016, a new-frame-action causes the picture to be made current. The paper roll is then advanced a full page and the paper is cut. All visible segments are then drawn, or redrawn on the new page. The cutter and paper advance mechanisms can be controlled by escape functions.

Inquiry Escape Functions

JIESC

The following inquiry escape functions are supported by AGP with the HP 9872 Graphics Plotters.

OPCODE	FUNCTION
1050	Inquire error

ILIST(1) = 0 No error
= 1 Instruction not recognized
= 2 Wrong number of parameters
= 3 Parameter out-of-range
= 4 Illegal characters
= 5 Unknown character set
= 6 Position overflow
= 7 Reserved
= 8 Out of paper roll (only on the 9872S and 9872T)

Output Escape Functions

JOESC

Several output escape functions are supported by AGP with the HP 9872 plotters. Error checking is not performed by the graphics system for out-of-limit or incorrect parameters. Out-of-range parameters flag an error in the plotter and the corresponding command is ignored.

Escape functions are not stored in the segment display area. This can have implications when used with AGP segments. For example, a character slant of 10 degrees is set with escape function JOESC(150). If a text string is created inside a segment, the character slant is changed to 30 degrees and a new-frame-action is given. The string will be redrawn with the present character slant of 30 degrees, rather than the character slant of 10 degrees it was created with.

Escape functions can also have undesired effects on low and medium quality text. For example, since medium quality text is output a character at a time, setting the text direction angle will affect each character by itself not producing the same angled text that would be output if low quality text were used. See the AGP Users Guide for an example of the difference in low and medium quality text.

Escape functions are sent from AGP directly to DGL. The state of AGP may become undefined when an escape function is given that overrides a mode set by AGP (e.g. hardware text direction).

The following output escape functions are supported with all of the HP 9872 plotters:

OPCODE	FUNCTION
150	Set device character slant for subsequent medium and low quality text. See Figure 3-3. RLIST(1) = Tangent of angle from vertical (from 127.999 to -127.999)

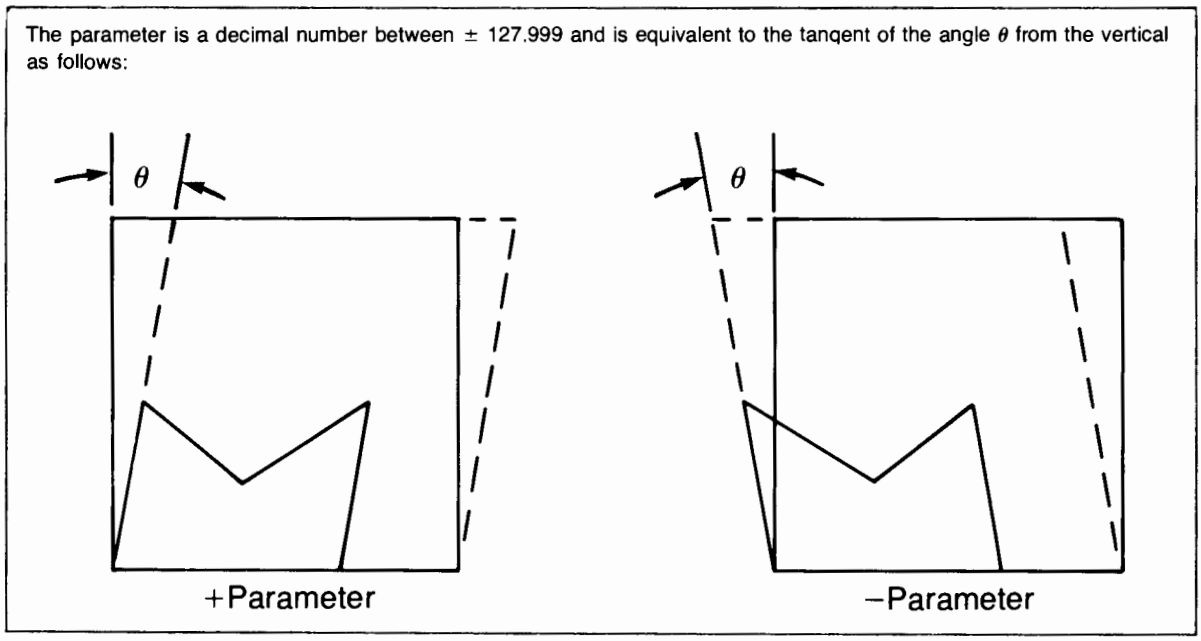


Figure 3-3. Character Slants

250 Set device character direction for subsequent medium and low quality text. See Figure 3-4.

RLIST(1) = X component of character direction slope (run)
RLIST(2) = Y component of character direction slope (rise)

450 Set hardware clipping limits. JASPK, JWIND, JVIEW, JDLIM, and JDINT will reset the hardware clipping limits to the view surface boundaries. Only points within the view surface will be clipped. Any vector or text given outside the view surface will give unpredictable results.

RLIST(1) = X min virtual coordinates
RLIST(2) = X max virtual coordinates
RLIST(3) = Y min virtual coordinates
RLIST(4) = Y max virtual coordinates

Run and rise are in decimal format between ±127.999 and specify the direction according to the relationship:

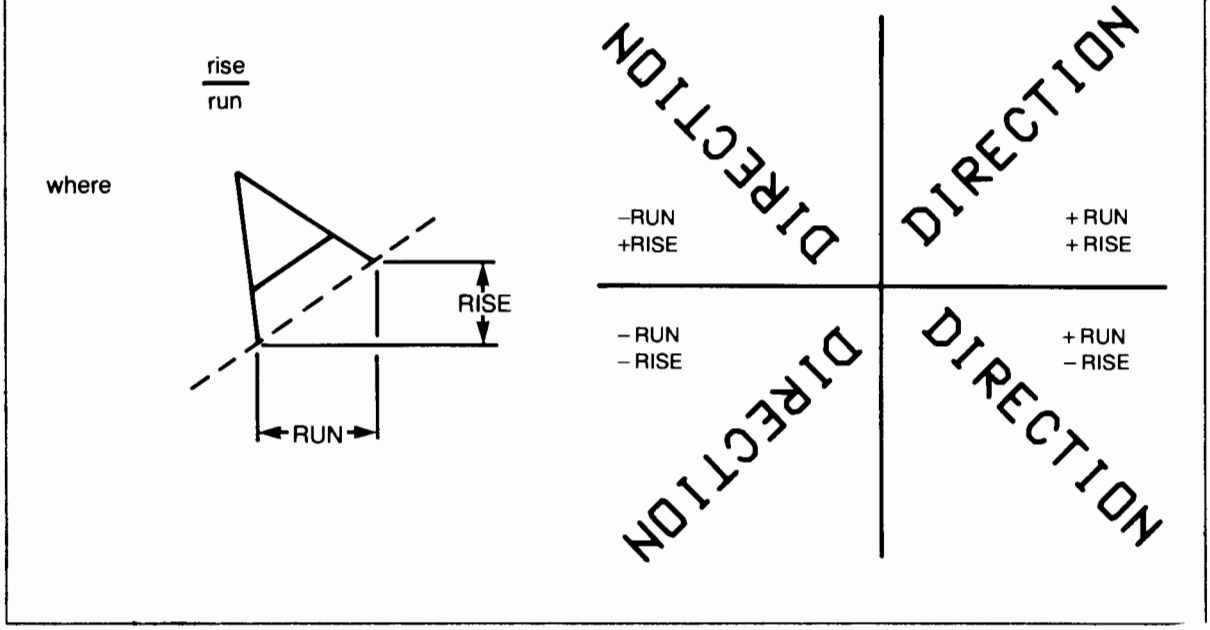


Figure 3-4. Character Direction

1050 Select medium or low quality text character set. This instruction provides a means for selecting an alternate character set.

```
ILIST(1) = 0 ANSI ASCII
           1 9872 ASCII
           2 European ASCII
           3 Scandinavian ASCII
           4 Spanish/Latin American ASCII
```

1051 For internal use only.

2050 Select pen speed. This instruction allows the user to modify the plotter pen speed. Pen speed can be set from 1 to 36 cm/sec.

```
ILIST(1) = Pen speed (integer from 1 to 36 cm/sec)
ILIST(2) = Pen number
           (Integer from 1 to 4 for 9872A, 9872B, and 9872S)
           (Integer from 1 to 8 for 9872C & 9872T)

           Pen numbers outside of these ranges will change
           speed for all pens.
```

The following output escape functions are only supported with the D0003 and D0016 libraries.

1052 Enable cutter. Provides means to control HP 9872S and HP 9872T paper cutters. Paper is cut after it is advanced.

ILIST(1) = 0 cutter is disabled
<> 0 cutter is enabled

1053 Advance Paper. This instruction makes the picture current and advances the paper either a half or full page.

ILIST(1) = 0 Advance half page
<> 0 Advance full page

Locator Echoes on the Graphics Display

JWLOC

Locator input can be echoed on either a graphics display or a locator device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

SAME PHYSICAL DEVICE

If the locator and graphics display are both physically implemented on the same HP 9872 plotter, then the following echoes are supported on the graphics display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the display pen will be moved to the current locator echo position. The pen will continue to reflect the current locator position (i.e. tracked) until the locator operation is terminated.

3 Full cross-hair cursor

Same as ECHO 2.

4 Rubber band line

Same as ECHO 2.

5 Horizontal rubber band line

The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the display pen and the Y coordinate of the locator echo position.

6 Vertical rubber band line

The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the locator echo position and the Y coordinate of the display pen.

7 Horizontal/vertical rubber band line

The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned is the same as ECHO 5 if the locator's X displacement from the locator echo position is greater than its Y displacement. The point returned is the same as ECHO 6 if the Y displacement becomes greater than the X displacement.

8 Rubber band box

Same as ECHO 2.

DIFFERENT PHYSICAL DEVICES

If the graphics display and the locator function is performed on different physical devices, then the following echoes are supported on the plotter.

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the plotter pen will be moved to the current locator echo position. The pen will then reflect the current locator position (i.e. track the locator position) until operator response.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator position and the Y coordinate of the current locator echo position.
6	Vertical rubber band line Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator echo position and the Y coordinate of the current locator position.
7	Horizontal/vertical rubber band line Initially, the plotters pen position is moved to the initial locator echo position. Subsequently, when the locator's X displacement becomes greater than its Y displacement, ECHO 5 is simulated. When the locator's Y displacement becomes greater than its X displacement, ECHO 6 is simulated.
8	Rubber band box Same as ECHO 2.

Computer Museum

Pick Echoes on the Graphics Display

JPICK

For echoes supported on the pick device, see the chapter which discusses the pick device in question.

ECHO#	ECHO PERFORMED
2	Initially, the plotter pen will be moved to the current pick echo position. The pen will then reflect the current pick position (i.e. track the pick position) until operator response.

Disabling

JWOFF

When the device is disabled, the current pen is returned to its stall.

GRAPHICS DISPLAY DEVICE HANDLER (DGL ONLY)

Description

The dimensions of the HP 9872 Graphics Plotters are as follows:

Platen surface:	420 mm wide by 297 mm high
Plotting area:	400 mm wide by 285 mm high
Plotting capacity:	16000 points wide by 11400 points high
Aspect ratio of maximum area:	0.7125
Resolution:	40.0 points/mm in X and Y directions

When using D0002 or D0015, the default logical display surface ranges from 15.25 to 396.4 mm in the X direction and 7.25 to 260.5 mm in the Y direction. The aspect ratio of the logical display surface is 0.66448.

When using D0003 or D0016, the default logical display surface ranges from 0.0 to 400.0 mm in the X direction and 16.5 to 285.0 mm in the Y direction (fitted paper roll size). The aspect ratio of the logical display surface is 0.67125.

The physical origin of the graphics display is 12 mm to the right of the left edge of the platen and 6 mm above the lower edge of the platen. This is the lower left boundary for pen movement.

The view surface is always justified in the lower left corner of the current logical display surface.

Initialization

ZDINT

When the HP 9872 plotter is initialized, the following operations are performed:

Device name is set to '9872A ', '9872B ', '9872C ', '9872T ' (D0002)

Device name is set to '9872B ' (D0003).

Device name is set to '9872C ', '9872T ' (D0015).

Device name is set to '9872T ' (D0016).

Color set to 1.

Highlighting set to 1.

Linewidth set to 1.

Linestyle set to 1.

Starting position is undefined.

Pen velocity is set to 36 cm/sec.

ASCII character set is set to 'ANSI ASCII'.

Text slant is set to 0 degrees (no slant), text label direction is set to 0 degrees (horizontal).

The logical display limits are set to the default value.

The view surface is justified to the lower left corner of the logical display surface.

Hardware clipping is set to view surface boundaries.

Paper cutter is enabled (D0003, D0016).

Advance page option is enabled (D0003, D0016).

Paper is advanced one full page (D0003, D0016), if bit 7 in the control word is not set. If bit 7 is set, the paper is not advanced.

Supported Primitive Attributes

COLOR

ZCOLR

The D0002 and D0003 display handlers for the HP 9872A/B/S provide a software color table of four distinct colors which support four pens. The size of the color table cannot be changed. The default values of the color table are shown in Table 3-4.

Table 3-4. Default Color Table for Four Pen Plotters

	R	G	B
COLOR ENTRY TABLE = 1 >> Black	0.0	0.0	0.0
= 2 >> Red	1.0	0.0	0.0
= 3 >> Green	0.0	1.0	0.0
= 4 >> Blue	0.0	0.0	1.0

The color table is initialized to the default values when ZDINT is called. The color table can be redefined or inquired using ZDCOL or ZICOL.

The pen selected corresponds to the color index passed in the ZCOLR call. The color table is not used when selecting the pen on a ZCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 0 >> Current pen is returned to its stall
      = 1 >> Pen #1 is selected
      = 2 >> Pen #2 is selected
      = 3 >> Pen #3 is selected
      = 4 >> Pen #4 is selected
```

The D0015 and D0016 display handlers for the HP 9872C/T provide a software color table of eight distinct colors, which support eight pens. The size of the color table cannot be changed. The default values of the color table are shown in Table 3-5.

Table 3-5. Default Color Table for Eight Pen Plotters

	R	G	B
COLOR TABLE ENTRY = 1 >> Black	0.0	0.0	0.0
= 2 >> Red	1.0	0.0	0.0
= 3 >> Yellow	1.1	1.1	0.0
= 4 >> Green	0.0	1.0	0.0
= 5 >> Cyan	0.0	1.0	1.0
= 6 >> Blue	0.0	0.0	1.0
= 7 >> Magenta	1.0	0.0	1.0
= 8 >> White	1.0	1.0	1.0

The color table is initialized to the default values when ZDINT is called. The color table can be redefined or inquired using ZDCOL or ZICOL.

The pen selected corresponds to the color index passed in the ZCOLR call. The color table is not used when selecting the pen on a ZCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 0 >> Current pen is returned to its stall
      = 1 >> Pen #1 is selected
      = 2 >> Pen #2 is selected
      = 3 >> Pen #3 is selected
      = 4 >> Pen #4 is selected
      = 5 >> Pen #5 is selected
      = 6 >> Pen #6 is selected
      = 7 >> Pen #7 is selected
      = 8 >> Pen #8 is selected
```

REDEFINING COLOR

ZDCOL/ZICOL

All of the colors in the color table can be redefined, or inquired, except for the background color. When the color table is redefined, it only affects the values returned on ZICOL calls. DGL does not use the color table when selecting the pen on a ZCOLR or ZPICL call. The color table is provided for the user's convenience.

POLYGON INTERIOR COLOR

ZPICL

Refer to ZCOLR for information regarding color.

POLYGON STYLE

ZDPST

Since the HP 9872 Graphics Plotters are hard copy devices, using ZDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

ZPILS

Refer to ZLSTL for information regarding linestyle.

HIGHLIGHTING

ZHIGH

Highlighting is not supported on the HP 9872 plotters.

LINESTYLE

ZLSTL

Seven predefined linestyles are supported on the HP 9872 plotters. All of the supported linestyles are *continuous*. See Figure 3-5 for the linestyles available on the HP 9872 plotters. Refer to the ZLSTL subroutine description in the *DGL Reference Manual* for a complete description of a continuous linestyle.

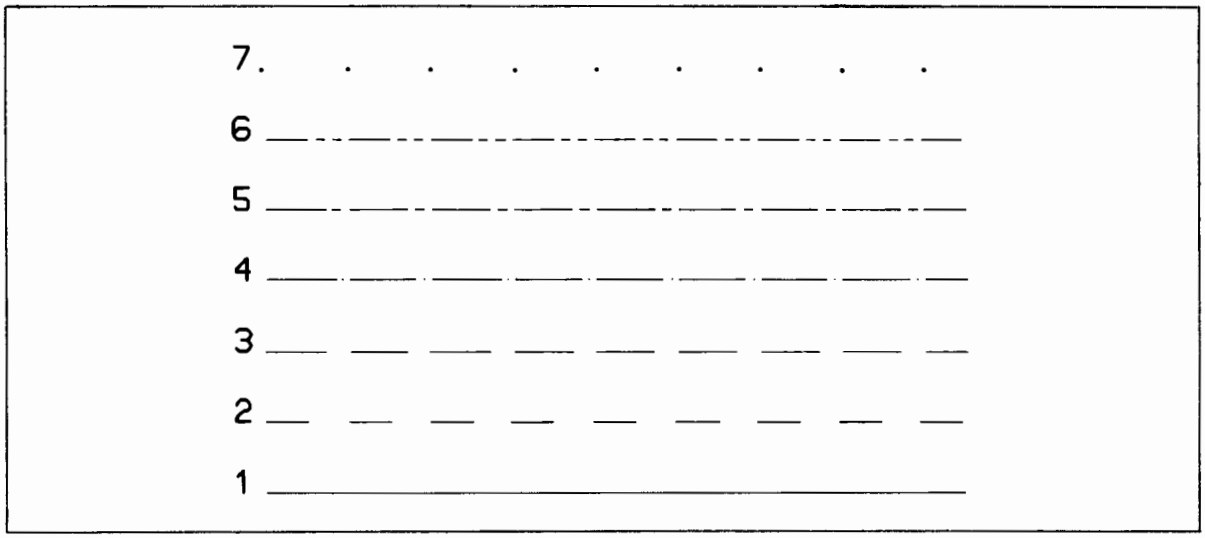


Figure 3-5. Supported Linestyles

LINEWIDTH

ZLWID

Only one linewidth is supported on the HP 9872 plotters

LINEWIDTH = 1 >> Primitives drawn with the linewidth of the pen selected.

CHARACTER SIZES

ZCSIZ

The HP 9872 plotters support all character cell sizes which have a width and height not less than 1 mm and not greater than 250 mm.

The character is placed within the character cell as shown in Figure 3-6.

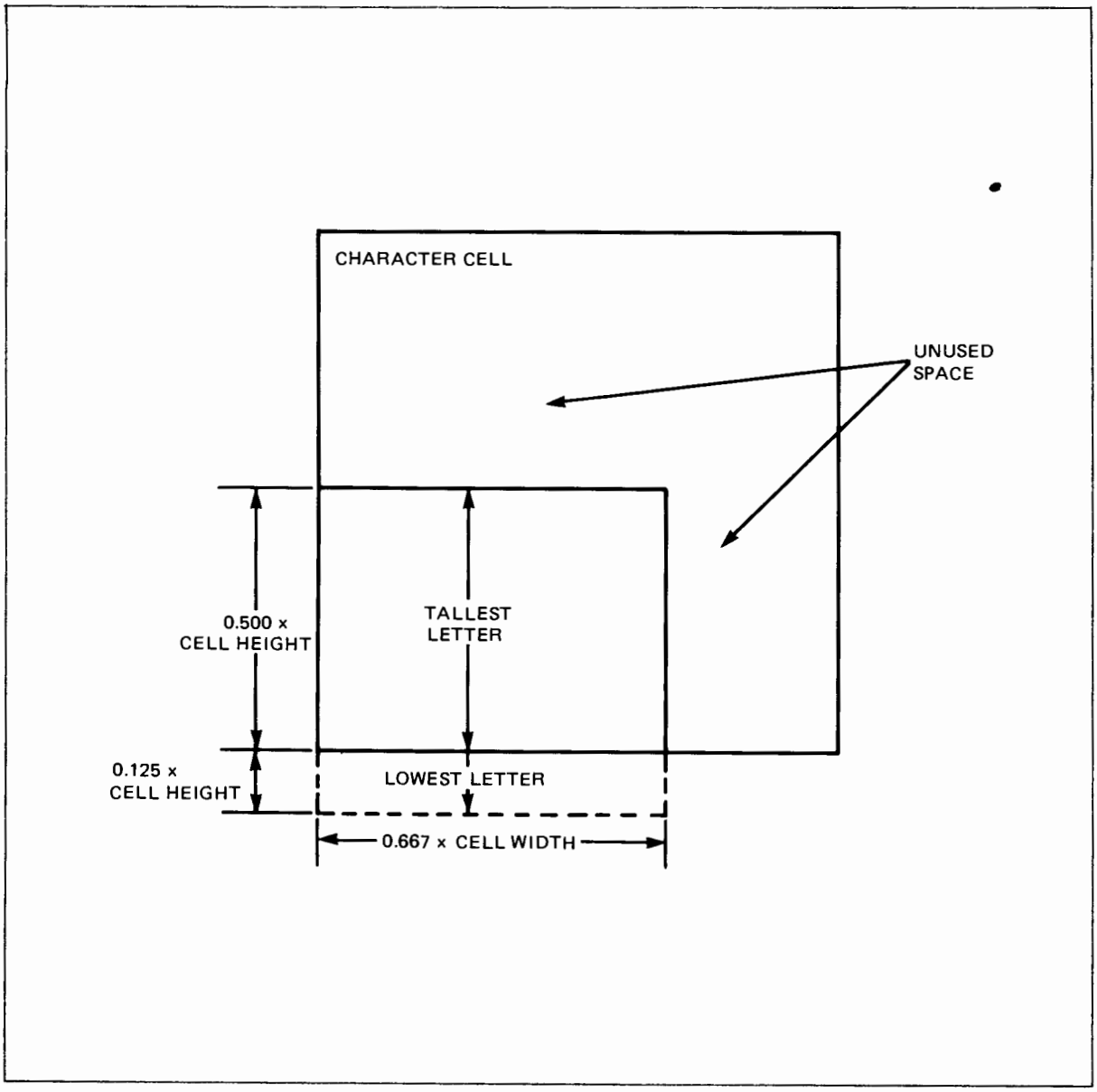


Figure 3-6. Placement of Character in Character Cell

Output Primitives

CLIPPING

The HP 9872 plotters have hardware vector and text clipping which is set to the view surface limits. Parts of graphics items which exceed the hardware clipping limits will be clipped. Graphics items which extend past the view surface limits will activate the plotter's *out-of-limit* light.

Calls to ZASPK, ZWIND, ZVIEW, ZDLIM, and ZDINT will reset the hardware clipping limits to the view surface boundaries. The user can redefine the hardware clipping limits to be any region within the boundaries of the view surface by a call to ZOESC (450).

POLYGONS

ZPGDD

The HP 9872 plotters do not provide hardware support of polygons. A polygon specified by ZPGDD will always be represented as described in the *DGL Reference Manual*.

MARKERS

ZMARK

The 19 standard markers are the only markers supported with the HP 9872 plotters. A character size of (2.0 mm by 2.0 mm) is always used to generate markers. Markers are affected by the color attribute.

TEXT

ZTEXT

Graphics text is generated with a hardware character generator. A standard ASCII character set is used as the default character set. There are four additional character sets available to the user via HP 9872 escape functions. The character sets are given in Table 3-6.

Only parts of characters which extend beyond the hardware clipping limits are clipped.

The user can modify text direction as well as text slant via escape functions (see ZOESC 150 and 250).

After ZTEXT, the starting position is set such that an additional call to ZTEXT will continue plotting characters along the same string of text. A carriage return moves the pen back to the beginning of the text string.

Text is affected by the color attribute but is not affected by the linestyle attribute (it is always generated using solid lines).

Table 3-6. Supported Hardware Character Sets

Plotter ASCII Code Definitions

Decimal Code	ASCII Character	9872 Function/Character Set				
		Set Ø	Set 1	Set 2	Set 3	Set 4
0	NULL	Error 4 Generated In Plotter				
1	SOH	Error 4 Generated In Plotter				
2	STX	Error 4 Generated In Plotter				
3	ETX	End Label Instruction				
4	ETO	Error 4 Generated In Plotter				
5	ENQ	Error 4 Generated In Plotter				
6	ACK	Error 4 Generated In Plotter				
7	BEL	No Operation (NOP)				
8	BS	Backspace				
9	HT	NOP				
10	LF	Line Feed				
11	VT	Inverse Line Feed				
12	FF	NOP				
13	CR	Carriage Return				
14	SO	Select Alternate Character Set				
15	SI	Select Standard Character Set				
16	DLE	Error 4 Generated In Plotter				
17	DC1	NOP				
18	DC2	NOP				
19	DC3	NOP				
20	DC4	NOP				
21	NAK	Error 4 Generated In Plotter				
22	SYN	Error 4 Generated In Plotter				
23	ETB	Error 4 Generated In Plotter				
24	CAN	Error 4 Generated In Plotter				
25	EM	Error 4 Generated In Plotter				
26	SUB	Error 4 Generated In Plotter				
27	ESC	Error 4 Generated In Plotter				
28	FS	Error 4 Generated In Plotter				
29	GS	Error 4 Generated In Plotter				
30	RS	Error 4 Generated In Plotter				
31	US	Error 4 Generated In Plotter				
32	SP	Space				
33	!	!	!	!	!	!
34	"	"	"	"	"	"
35	#	#	#	£	£	¿
36	$	$	$	$	$	$
37	%	%	%	%	%	%
38	&	&	&	&	&	&
39	'	'	'	´	'	´
40	(	(	(	(	(	(
41	)	)	)	)	)	)
42	*	*	*	*	*	*
43	+	+	+	+	+	+
44	,	,	,	,	,	,
45	–	–	–	–	–	–
46	.	.	.	.	.	.
47	/	/	/	/	/	/

NOTE: Characters offset to the left have the automatic backspace feature.

Table 3-6. Supported Hardware Character Sets (continued)

Plotter ASCII Code Definitions (Continued)

Decimal Code	ASCII Character	9872 Function/Character Set				
		Set Ø	Set 1	Set 2	Set 3	Set 4
48	Ø	Ø	Ø	Ø	Ø	Ø
49	1	1	1	1	1	1
50	2	2	2	2	2	2
51	3	3	3	3	3	3
52	4	4	4	4	4	4
53	5	5	5	5	5	5
54	6	6	6	6	6	6
55	7	7	7	7	7	7
56	8	8	8	8	8	8
57	9	9	9	9	9	9
58	:	:	:	:	:	:
59	;	;	;	;	;	;
60	<	<	<	<	<	<
61	=	=	=	=	=	=
62	>	>	>	>	>	>
63	?	?	?	?	?	?
64	@	@	@	@	@	@
65	A	A	A	A	A	A
66	B	B	B	B	B	B
67	C	C	C	C	C	C
68	D	D	D	D	D	D
69	E	E	E	E	E	E
70	F	F	F	F	F	F
71	G	G	G	G	G	G
72	H	H	H	H	H	H
73	I	I	I	I	I	I
74	J	J	J	J	J	J
75	K	K	K	K	K	K
76	L	L	L	L	L	L
77	M	M	M	M	M	M
78	N	N	N	N	N	N
79	O	O	O	O	O	O
80	P	P	P	P	P	P
81	Q	Q	Q	Q	Q	Q
82	R	R	R	R	R	R
83	S	S	S	S	S	S
84	T	T	T	T	T	T
85	U	U	U	U	U	U
86	V	V	V	V	V	V
87	W	W	W	W	W	W
88	X	X	X	X	X	X
89	Y	Y	Y	Y	Y	Y
90	Z	Z	Z	Z	Z	Z
91	[	[	[	[	Ø	[
92	\	\	f	ç	Æ	ı
93	]	]	]	]	ø	]
94	^	^	↑	^	æ	^
95	_	_	_	_	_	_
96	`	`	`	`	`	`
97	a	a	a	a	a	a

Table 3-6. Supported Hardware Character Sets (continued)

Plotter ASCII Code Definitions (Continued)

Decimal Code	ASCII Character	9872 Function/Character Set				
		Set Ø	Set 1	Set 2	Set 3	Set 4
98	b	b	b	b	b	b
99	c	c	c	c	c	c
100	d	d	d	d	d	d
101	e	e	e	e	e	e
102	f	f	f	f	f	f
103	g	g	g	g	g	g
104	h	h	h	h	h	h
105	i	i	i	i	i	i
106	j	j	j	j	j	j
107	k	k	k	k	k	k
108	l	l	l	l	l	l
109	m	m	m	m	m	m
110	n	n	n	n	n	n
111	o	o	o	o	o	o
112	p	p	p	p	p	p
113	q	q	q	q	q	q
114	r	r	r	r	r	r
115	s	s	s	s	s	s
116	t	t	t	t	t	t
117	u	u	u	u	u	u
118	v	v	v	v	v	v
119	w	w	w	w	w	w
120	x	x	x	x	x	x
121	y	y	y	y	y	y
122	z	z	z	z	z	z
123	{	{	{	¨	¨	~
124	¦	¦	¦	•	•	~
125	}	}	}	¨	¨	~
126	~	~	~		•	~
127	DEL	Error 4 Generated In Plotter				

New-Frame-Action

ZNEWF

When using D0002 and D0015, a new-frame-action causes the picture to be made current. All visible segments are then drawn, or redrawn, on the display surface. The application program should generate pause time, if necessary, so that the user can change the paper.

When using D0003 and D0016, a new-frame-action causes the picture to be made current. The paper roll is then advanced a full page and the paper is cut. All visible segments are then drawn, or redrawn, on the display surface. The cutter and paper advance mechanisms can be controlled by escape functions.

Inquiry Escape Functions

ZIESC

The following inquiry escape functions are supported by DGL with the HP 9872 Graphics Plotters:

OPCODE	FUNCTION	
1050	Inquire error	
	ILIST(1) = 0	No error
	= 1	Instruction not recognized
	= 2	Wrong number of parameters
	= 3	Parameter out-of-range
	= 4	Illegal characters
	= 5	Unknown character set
	= 6	Position overflow
	= 7	Reserved
	= 8	Out of paper roll (only on the HP 9872S or HP 9872T)

Output Escape Functions

ZOESC

Several output escape functions are supported by DGL with the HP 9872 plotters. Error checking is not performed by the graphics system for out-of-limit or incorrect parameters. Out-of-range parameters flag an error in the plotter and the corresponding command is ignored. None of the supported output escape functions alter the starting position. The following output escape functions are supported with all of the HP 9872 display libraries:

OPCODE	FUNCTION
150	Set character slant. See Figure 3-7.

RLIST(1) = Tangent of angle from vertical
(from 127.999 to -127.999)

The parameter is a decimal number between ± 127.999 and is equivalent to the tangent of the angle θ from the vertical as follows:

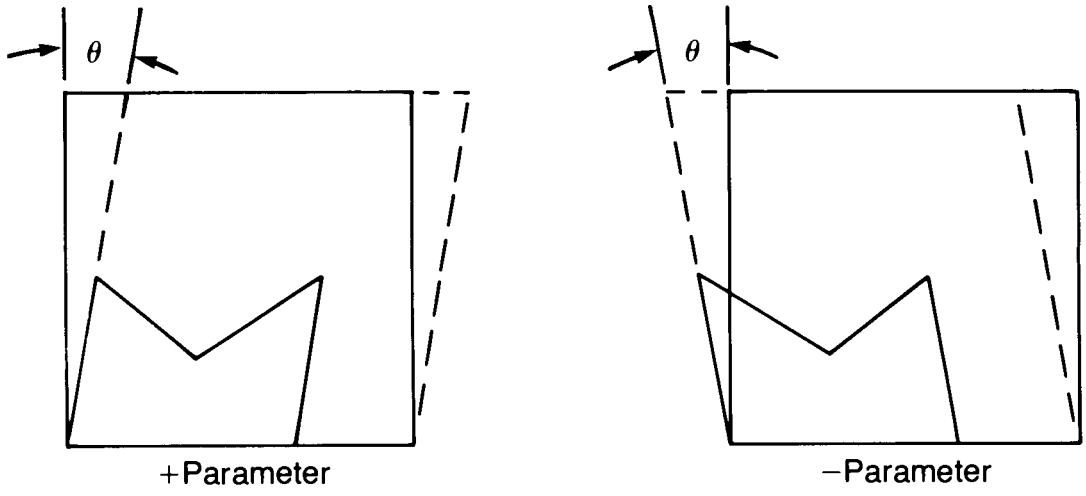


Figure 3-7. Character Slants

250 Set character direction. See Figure 3-8.

RLIST(1)= =X component of character direction slope (run)
RLIST(2) = Y component of character direction slope (rise)

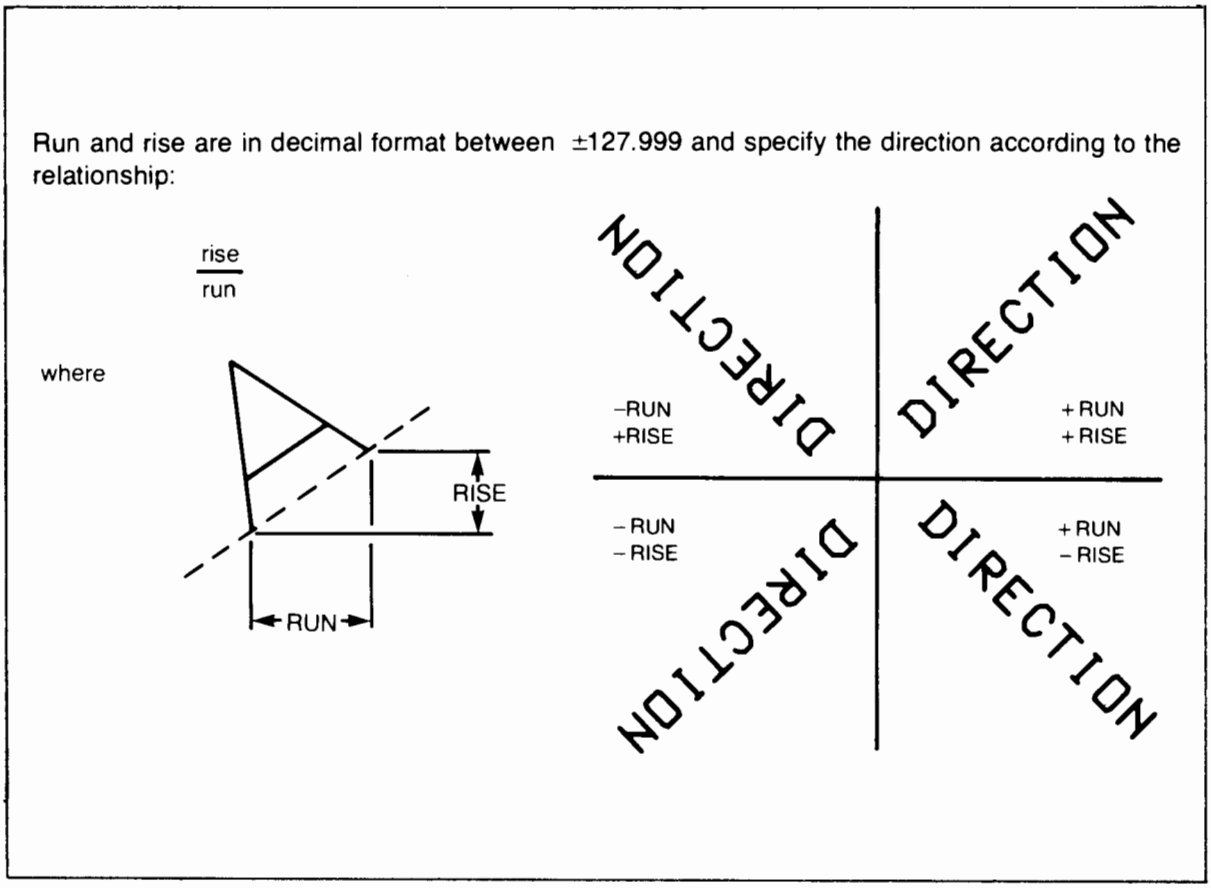


Figure 3-8. Character Direction

450 Set hardware clipping limits. ZWIND, ZASPK, ZVIEW, ZDLIM, and ZDINT will reset the hardware clipping limits to the view surface boundaries.

RLIST(1) = X min world coordinates units
RLIST(2) = X max world coordinates units
RLIST(3) = Y min world coordinates units
RLIST(4) = Y max world coordinates units

1050 Select character set. This instruction provides a means for selecting an alternate character set.

```
ILIST(1) = 0 ANSI ASCII
           1 HP 9872 ASCII
           2 European ASCII
           3 Scandinavian ASCII
           4 Spanish/Latin American ASCII
```

1051 Set symbol mode. This instruction provides a means for displaying an ASCII character at the end of each move or draw. ZCSIZ can be used to select symbol size. Symbol mode might cause undesirable results when using markers or text. All ASCII characters from decimal 31 through 127 can be used except for those values listed in Table 3-7.

```
ILIST(1) = 0 symbol mode is terminated
        <> 0 symbol mode is set with ASCII character
             in ILIST(1).
```

Table 3-7. Invalid Symbol Characters

All ASCII characters from decimal 35 through 122 can be specified except for the following:

ASCII Character	Decimal Value	ASCII Character	Decimal Value
%	37	>	62
&	38	?	63
'	39	@	64
(	40	[	91
)	41	\	92
/	47	]	93
:	58		94
;	59	_	95
<	60		96
=	61		

2050 Select pen speed. This instruction allows the user to modify the plotter pen speed. Pen speed can be set from 1 to 36 cm/sec.

ILIST(1) = Pen speed
(integer from 1 to 36 cm/sec)
ILIST(2) = Pen number
(Integer from 1 to 4 for 9872A, 9872B, and 9872S)
(Integer from 1 to 8 for 9872C & 9872T)

Pen numbers outside of these ranges will change speed for all pens.

The following output escape functions are only supported with D0003 and D0016 libraries:

OPCODE	FUNCTION

1052 Enable cutter. Provides means to control HP 9872S and HP 9872T paper cutters. Paper is cut after it is advanced.

ILIST(1) = 0 cutter is disabled
<> 0 cutter is enabled

1053 This instruction makes the picture current and advances the paper either one half or a full page.

ILIST(1) = 0 advance page half
<> 0 advance page full

Locator Echoes on the Graphics Display

ZWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

SAME PHYSICAL DEVICE

If the locator and display are the same physical device, then the following echoes are supported on the graphics display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the display pen will be moved to the current locator echo position. The pen will contine to reflect the current locator position (i.e. tracked) until the locator operation is terminated.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the display pen and the Y coordinate of the locator echo position.
6	Vertical rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the locator echo position and the Y coordinate of the display pen.

7 Horizontal/vertical rubber band line

The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned is the same as ECHO 5 if the locator's X displacement from the locator echo position is greater than its Y displacement. The point returned is the same as ECHO 6 if the Y displacement becomes greater than the X displacement.

8 Rubber band box

Same as ECHO 2.

DIFFERENT PHYSICAL DEVICES

If the locator and graphics display are physically different, then the following echoes are supported on the display:

ECHO#	ECHO PERFORMED
2	Small cursor
	Initially, the plotter pen will be moved to the current locator echo position. The pen will then reflect the current locator position (i.e. track the locator position) until operator response.
3	Full cross-hair cursor
	Same as ECHO 2.
4	Rubber band line
	Same as ECHO 2.

5 Horizontal rubber band line

Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator position and the Y coordinate of the current locator echo position.

6 Vertical rubber band line

Initially, the plotter pen position will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator echo position and the Y coordinate of the current locator position.

7 Horizontal/vertical rubber band line

Initially, the plotter pen position is moved to the locator echo position. Subsequently, when the locator's X displacement becomes greater than its Y displacement, ECHO 5 is simulated. When the locator's Y displacement becomes greater then its X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

Termination

ZDEND

All attributes except color remain unchanged until the system is reinitialized or the display device is enabled again. The color is set to 0. The device name is set to '0002 ' for D0002; to '0003 ' for D0003; to '0015 ' for D0015; and to '0016 ' for D0016. The device status and I/O unit descriptor are set to 0.

LOCATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 9872 Graphics plotters are as follows:

Platen surface:	420 mm wide by 297 mm high
Plotting area:	400 mm wide by 285 mm high
Platen capacity:	16000 points wide by 11400 points high
Resolution:	40.0 points/mm in X and Y directions

The default locator limits of the HP 9872 (L0002) are 400 mm in the X direction and 285 mm in the Y direction.

The physical origin of the locator device is 12 mm to the right of the left edge of the platen and 6 mm above the lower edge of the platen. This is the lower left corner of pen movement.

If locator echoing is requested on a different physical device, the current locator position will not be updated while the pen control buttons are pressed. Also, the wait locator call cannot be terminated by pressing the 'ENTER' button while the pen control keys are being used.

Initialization

JEDEV/ZLINT

When the locator device is initialized, the plotter's graphics display is left unaltered.

The device name is set to '9872A ' if an HP 9872A Graphics Plotter is used; to '9872B ' if an HP 9872B or HP 9872S is used; to '9872C ' if an HP 9872C is used; and to '9872T ' if an HP 9872T is used.

Wait Locator Input

JWLOC/ZWLOC

The wait locator input function enables a digitizing mode in the HP 9872 plotter which causes the enter light to be turned on. The operator then positions the pen to the desired position with the cursor buttons and strikes the enter key. The button value returned is always "1".

Echoes Supported

Locator input can be echoed on either a graphics display device or a locator device. For the echoes supported on a graphics display device, see the chapter which describes the graphics display in question.

The supported echoes on the locator device are as follows:

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	The HP 9872 pen tracks the locator position.

Sample Locator Input

JSLOC/ZSLOC

The sample locator input function returns the current plotter pen position without waiting for an operator response.

Echoes Supported

Locator echoes are not supported with the HP 9872 Graphics plotters when using the sample locator functions.

Termination

JDDEV/ZLEND

The device name is set to '0002 ', and the device status and I/O unit descriptor are set to 0.

PICK DEVICE HANDLER (AGP ONLY)

Description

The dimensions of the HP 9872 Graphics Plotters are as follows:

Platen surface:	420 mm wide by 297 mm high
Pick area:	400 mm wide by 285 mm high
Platen capacity:	16000 points wide by 11400 points high
Resolution:	40.0 points/mm in X and Y directions

The default pick limits are 400 mm in the X direction and 285 mm in the Y direction.

The physical origin of the pick device is 12 mm to the right of the left edge of the platen and 6 mm above the lower edge of the platen. This is the lower left corner of pen movement.

If pick echoing is requested on a different physical device, pick information will not be returned while the pen control buttons are pressed. Also, the pick call cannot be terminated by pressing the 'ENTER' button while the pen control keys are being used.

Initialization

JEDEV

When the pick device is initialized, the plotter's graphics display is left unaltered. The pick name is set to '9872A ' if an HP 9872A Graphics Plotter is used; to '9872B ' if an HP 9872B or HP 9872S is used; to '9872C ' if an HP 9872C is used; and to '9872T ' if an HP 9872T is used.

Pick Input

JPICK

The pick input function enables a digitizing mode in the HP 9872 plotter which causes the enter light to turn on. The operator then positions the pen to the desired pick location and strikes the enter button. The button value returned is always "1".

Echoes Supported

When using the HP 9872 as a pick device with a display which is not the same physical device, the logical pick position will not change while the pen control buttons are pressed. Therefore, any echo on the display device will not reflect the current pick position until the HP 9872 pen stops moving.

The supported echoes on the pick device are as follows:

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	The pick position is tracked by the pen.

Termination

JDDEV

The device name is set to '0002 ', and the device status and I/O unit descriptor are set to 0.

Chapter 4
HP 7580A/B and 7585A/B Drafting Plotters

GENERAL INFORMATION

This chapter pertains to the HP 7580A/B and HP 7585A/B Drafting Plotters. The user should be familiar with the operation of the HP 7580A/B or HP 7585A/B Drafting Plotters. If necessary, refer to the following manuals for the appropriate operating instructions:

HP 7580A/85A Interfacing & Programming Manual *(07580-90014)*

HP 7580B/85B Interfacing & Programming Manual *(07580-90024)*

HP 7580A/85A Operator's Manual *(07580-90013)*

HP 7580B/85B Operator's Manual *(07580-90023)*

Logical Devices Supported

The following logical devices are supported by the AGP/DGL graphics systems when using the plotters:

Logical Device	Device Handlers Name	Physical Device
Graphics display	D0006	HP 7580A/B and HP 7585A/B
Locator	L0006	HP 7580A/B and HP 7585A/B
Pick (AGP only)	P0006	HP 7580A/B and HP 7585A/B

Device Configuration

The plotters should be set in the normal position. This means that the switch in the back of the plotter should be set to NORMAL.

GRAPHICS DISPLAY DEVICE HANDLER (AGP ONLY)

Description

The dimensions of the HP 7580A/B Drafting Plotters are as follows:

Plotting area:	1190 mm wide by 622.3 mm high
Plotting capacity:	32380 points wide by 20970 points high
Aspect ratio of maximum area:	0.6476
Resolution:	40.0 points/mm in X and Y directions

The dimensions of the HP 7585A/B Drafting Plotters are as follows:

Plotting area:	1190 mm wide by 927 mm high
Plotting capacity:	42644 points wide by 33418 points high
Aspect ratio of maximum area:	0.7837
Resolution:	40.0 points/mm in X and Y directions

When spooling output to the plotters, "D" size paper is supported. In this case, the default logical display surface ranges from 0.0 to 809.5 mm in the X direction and from 0.0 to 524.25 mm in the Y direction. The aspect ratio of the logical display surface is therefore 0.6476.

When sending graphics output without spooling, the default display surface is set to the size of the paper currently in the plotter when the subroutine JDINT is called. If the paper is changed while the graphics display is initialized, it should be the same size of paper that was in the plotter when JDINT was called. If a different size of paper is required, the device should be terminated (see JWEND) and reinitialized (see JDINT) after the new paper has been placed in the plotter.

The view surface is always justified in the lower left corner (corner nearest the turret when in VIEW state) of the current logical display limits.

The physical origin is at the lower left boundary of pen movement, (corner nearest the turret when in VIEW state).

Initialization

JDINT

When initialized, the following operations are performed:

Device name is set to plotter name, e.g. '7580A '.

Pen velocity, force, and acceleration are set to default values for the turret loaded.

ASCII character set is set to 'ANSI ASCII' for medium and low quality text.

Medium and low quality text slant are set to 0 degrees (no slant), text label direction is set to 0 degrees (horizontal).

All automatic pen options are set.

The logical display surface is set to the default value.

Hardware clipping is set to the view surface boundaries.

Device Enabling

JWON

When enabled and the automatic pen option is set, the pen representing the current color attribute is selected.

Supported Primitive Attributes

COLOR

JCOLR

The D0006 display handler provides a software color table of eight distinct colors, which supports eight pens. The size of the color table cannot be changed. The default values of the color table are shown in Table 4-1.

Table 4-1. Default Color Table for Eight Pen Plotters

	R	G	B
COLOR TABLE ENTRY = 1 >> Black	0.0	0.0	0.0
= 2 >> Red	1.0	0.0	0.0
= 3 >> Yellow	1.1	1.1	0.0
= 4 >> Green	0.0	1.0	0.0
= 5 >> Cyan	0.0	1.0	1.0
= 6 >> Blue	0.0	0.0	1.0
= 7 >> Magenta	1.0	0.0	1.0
= 8 >> White	1.0	1.0	1.0

The color table is initialized to the default values when JDINT is called. The color table can be redefined or inquired using JDCOL or JICOL.

The pen selected corresponds to the color index passed in the JCOLR call. The color table is not used when selecting the pen on a JCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 0 >> Current pen is returned to its stall
      = 1 >> Pen #1 is selected
      = 2 >> Pen #2 is selected
      = 3 >> Pen #3 is selected
      = 4 >> Pen #4 is selected
      = 5 >> Pen #5 is selected
      = 6 >> Pen #6 is selected
      = 7 >> Pen #7 is selected
      = 8 >> Pen #8 is selected
```

REDEFINING COLOR

JDCOL/JICOL

All of the colors in the color table can be redefined, or inquired, except for the background color. When the color table is redefined, it only affects the values returned on JICOL calls. AGP does not use the color table when selecting the pen on a JCOLR or JPICL call. The color table is provided for the user's convenience.

POLYGON INTERIOR COLOR

JPICL

Refer to JCOLR for information regarding color.

POLYGON STYLE

JDPST

Since the plotters are hard copy devices, using JDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

JPILS

Refer to JLSTL for information regarding linestyle.

HIGHLIGHTING

JGHI/JSHI

Highlighting is not supported.

LINESTYLE

JLSTL

Thirteen predefined linestyles are supported. Linestyles 1 through 7 may be classified as being *continuous*. Linestyles 8 through 13 are the same patterns as styles 2 through 7 drawn in the *vector adjusted* format. See Figure 4-1 for the linestyles available.

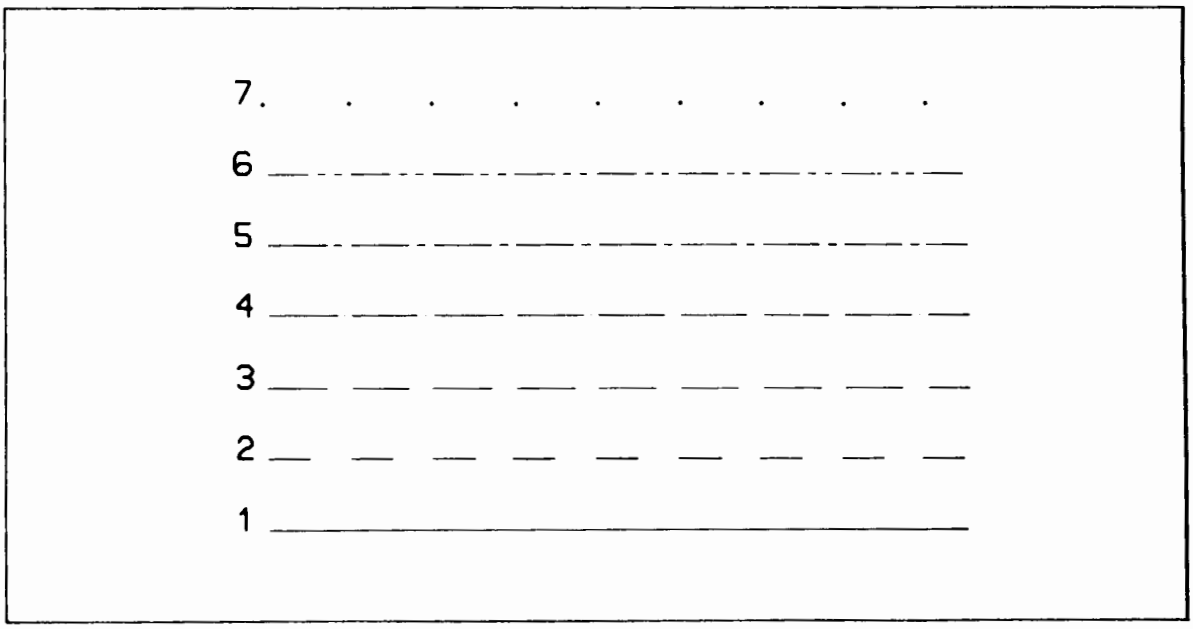


Figure 4-1. Supported Linestyles

LINEWIDTH

JLWID

Only one linewidth is supported.

LINEWIDTH = 1 >> Primitives drawn with the linewidth of the pen selected.

CHARACTER SIZES

JCSIZ

For medium and low quality text, the plotters support all character cell sizes which have a width and height not less than 1 mm and not greater than 250 mm.

When using medium and low quality text, the character is placed within the character cell as shown in Figure 4-2.

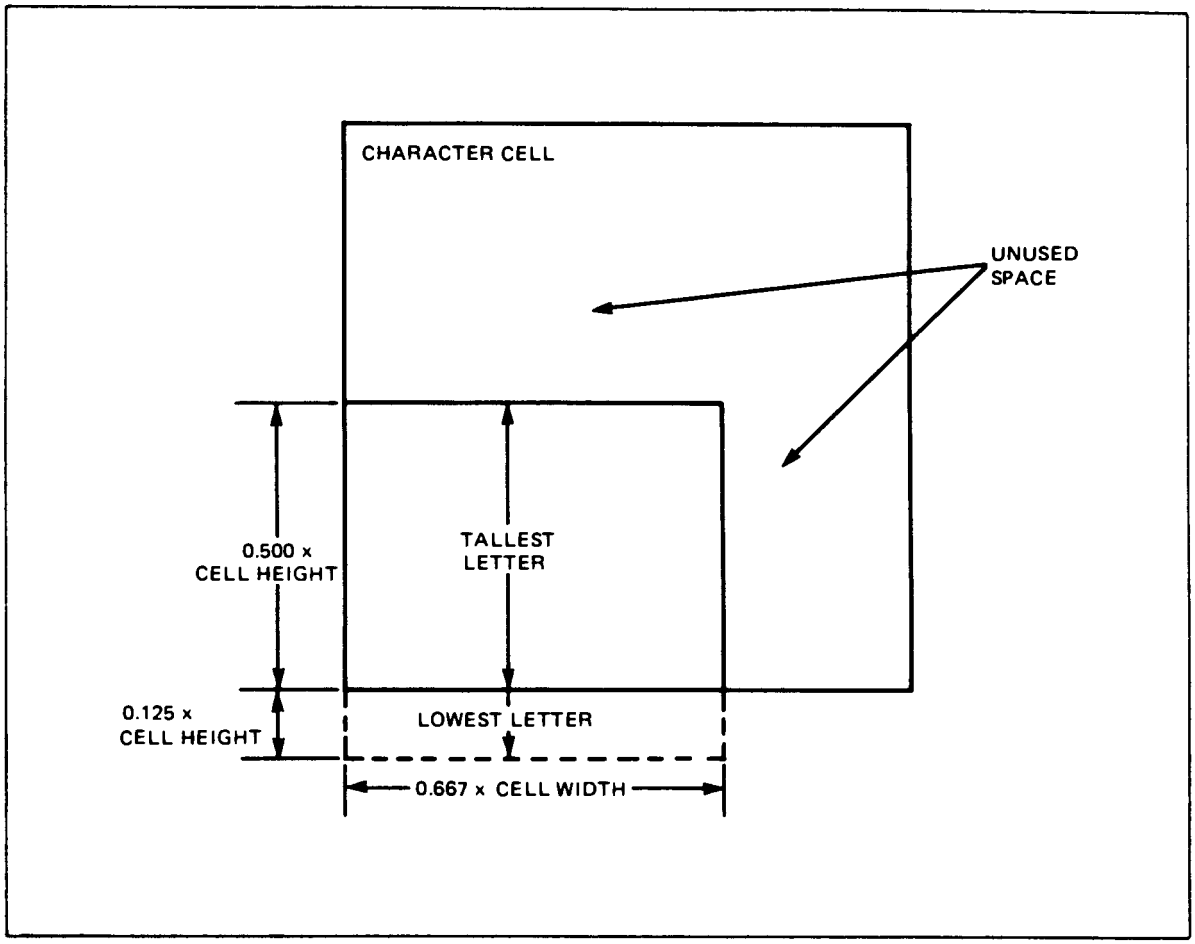


Figure 4-2. Character Placement in a Character Cell

Output Primitives

CLIPPING

The AGP user can access the hardware vector clipping feature through the output escape function JOESC (450). Calls to JASPK, JWIND, JVIEW, JDLIM and JDINT will reset the hardware clipping limits to the view surface boundaries. The user can redefine this window to be any region within the boundaries of the view surface by a call to JOESC (450).

If AGP window clipping is disabled and parts of the image are outside of the view surface limits, then unpredictable results may occur. Graphics items which extend past the view surface limits will activate the plotter's *out-of-limits* lights. If the image is entirely within the view surface limits, then only the portion of the image that is within hardware clipping limits will be displayed.

If AGP window clipping is enabled then only the portion of the image which is within the viewport and within the hardware clipping limits will be displayed.

POLYGONS

J2PGN/J3PGN/JR2PG/JR3PG

This device does not have hardware area fill.

MARKERS

J2MRK/J3MRK/JR2MK/JR3MK

The 19 standard markers are the only markers supported. A character size of 2.0 mm by 2.0 mm is always used to generate markers. Markers are affected by the color attribute.

MEDIUM AND LOW QUALITY TEXT

JTEXM/JTEXL

Medium and low quality graphics text are generated with a hardware character generator.

For text that is not clipped by AGP, only parts of characters which extend beyond the current hardware clipping limits or the paper limits are clipped.

A standard ASCII character set is used as the default character set. There are 11 additional character sets available to the user via the plotter's escape functions. The character sets are illustrated in Table 4-2.

The user can modify the text direction and slant for medium and low quality text through the output escape functions (see JOESC 150 and 250). Medium and low quality text are affected by color but not affected by linestyle (text is always drawn with solid lines).

Table 4-2. Supported Hardware Character Sets

Decimal Value	Set 0 ANSI ASCII	Set 1 7580 Set	Set 2 French German	Set 3 Scandinavian	Set 4 Spanish Latin American	Set 5 Special Symbols
33	!	!	!	!	!	!
34	"	"	"	"	"	"
35	#	#	£	£	¿	#
36	$	$	$	$	$	$
37	%	%	%	%	%	%
38	&	&	&	&	&	&
39	'	'	´	'	´	'
40	(	(	(	(	(	(
41	)	)	)	)	)	)
42	*	*	*	*	*	*
43	+	+	+	+	+	+
44	,	,	,	,	,	,
45	-	-	-	-	-	-
46	.	.	.	.	.	.
47	/	/	/	/	/	/
48	0	0	0	0	0	0
49	1	1	1	1	1	1
50	2	2	2	2	2	2
51	3	3	3	3	3	3
52	4	4	4	4	4	4
53	5	5	5	5	5	5
54	6	6	6	6	6	6
55	7	7	7	7	7	7
56	8	8	8	8	8	8
57	9	9	9	9	9	9
58	:	:	:	:	:	:

Table 4-2. Supported Hardware Character Sets (continued)

Decimal Value	Set 0 ANSI ASCII	Set 1 7580 Set	Set 2 French German	Set 3 Scandinavian	Set 4 Spanish Latin American	Set 5 Special Symbols
85	U	U	U	U	U	U
86	V	V	V	V	V	V
87	W	W	W	W	W	W
88	X	X	X	X	X	X
89	Y	Y	Y	Y	Y	Y
90	Z	Z	Z	Z	Z	Z
91	[	[	[	Ø	[	[
92	\	√	ç	Æ	¡	\
93	]	]	]	ø	]	]
94	^	↑	^	æ	^	^
95	_	_	_	_	_	_
96	`	`	`	`	`	`
97	a	a	a	a	a	∩
98	b	b	b	b	b	⊃
99	c	c	c	c	c	⊂
100	d	d	d	d	d	∪
101	e	e	e	e	e	⎯
102	f	f	f	f	f	≡
103	g	g	g	g	g	≅
104	h	h	h	h	h	≈
105	i	i	i	i	i	~
106	j	j	j	j	j	≤
107	k	k	k	k	k	≥
108	l	l	l	l	l	≠
109	m	m	m	m	m	Δ
110	n	n	n	n	n	∏

Table 4-2. Supported Hardware Character Sets (continued)

Decimal Value	Set 0 ANSI ASCII	Set 1 7580 Set	Set 2 French German	Set 3 Scandinavian	Set 4 Spanish Latin American	Set 5 Special Symbols
59	;	;	;	;	;	;
60	<	<	<	<	<	<
61	=	=	=	=	=	=
62	>	>	>	>	>	>
63	?	?	?	?	?	?
64	@	@	@	@	@	@
65	A	A	A	A	A	◫
66	B	B	B	B	B	⊙
67	C	C	C	C	C	△
68	D	D	D	D	D	+
69	E	E	E	E	E	×
70	F	F	F	F	F	◈
71	G	G	G	G	G	▲
72	H	H	H	H	H	⧖
73	I	I	I	I	I	⧗
74	J	J	J	J	J	Y
75	K	K	K	K	K	⧓
76	L	L	L	L	L	✱
77	M	M	M	M	M	⧖
78	N	N	N	N	N	ı
79	O	O	O	O	O	✱
80	P	P	P	P	P	–
81	Q	Q	Q	Q	Q	ı
82	R	R	R	R	R	R
83	S	S	S	S	S	S
84	T	T	T	T	T	T

Table 4-2. Supported Hardware Character Sets (continued)

Decimal Value	Set 0 ANSI ASCII	Set 1 7580 Set	Set 2 French German	Set 3 Scandinavian	Set 4 Spanish Latin American	Set 5 Special Symbols
111	o	o	o	o	o	Σ
112	p	p	p	p	p	±
113	q	q	q	q	q	∓
114	r	r	r	r	r	→
115	s	s	s	s	s	↑
116	t	t	t	t	t	←
117	u	u	u	u	u	↓
118	v	v	v	v	v	∫
119	w	w	w	w	w	÷
120	x	x	x	x	x	*
121	y	y	y	y	y	∇
122	z	z	z	z	z	•
123	{	π	¨	¨	~	{
124	|	⊢	•	•	~	|
125	}	→	¨	¨	~	}
126	~	~	˙	•	~	~

Table 4-2. Supported Hardware Character Sets (continued)

Decimal Value	Set 10 ANSI ASCII	Set 11 7580 Set	Set 12 French German	Set 13 Scandinavian	Set 14 Spanish Latin American	Set 15 Special Symbols
33	!	!	!	!	!	!
34	"	"	"	"	"	"
35	#	#	£	£	¿	#
36	$	$	$	$	$	$
37	%	%	%	%	%	%
38	&	&	&	&	&	&
39	'	'	´	'	´	'
40	(	(	(	(	(	(
41	)	)	)	)	)	)
42	*	*	*	*	*	*
43	+	+	+	+	+	+
44	,	,	,	,	,	,
45	-	-	-	-	-	-
46	.	.	.	.	.	.
47	/	/	/	/	/	/
48	0	0	0	0	0	0
49	1	1	1	1	1	1
50	2	2	2	2	2	2
51	3	3	3	3	3	3
52	4	4	4	4	4	4
53	5	5	5	5	5	5
54	6	6	6	6	6	6
55	7	7	7	7	7	7
56	8	8	8	8	8	8
57	9	9	9	9	9	9
58	:	:	:	:	:	:

Table 4-2. Supported Hardware Character Sets (continued)

Decimal Value	Set 10 ANSI ASCII	Set 11 7580 Set	Set 12 French German	Set 13 Scandinavian	Set 14 Spanish Latin American	Set 15 Special Symbols
59	;	;	;	;	;	;
60	<	<	<	<	<	<
61	=	=	=	=	=	=
62	>	>	>	>	>	>
63	?	?	?	?	?	?
64	@	@	@	@	@	@
65	A	A	A	A	A	◘
66	B	B	B	B	B	○
67	C	C	C	C	C	△
68	D	D	D	D	D	+
69	E	E	E	E	E	×
70	F	F	F	F	F	◇
71	G	G	G	G	G	↑
72	H	H	H	H	H	⧖
73	I	I	I	I	I	Z
74	J	J	J	J	J	Y
75	K	K	K	K	K	✖
76	L	L	L	L	L	✱
77	M	M	M	M	M	⧗
78	N	N	N	N	N	ı
79	O	O	O	O	O	✽
80	P	P	P	P	P	–
81	Q	Q	Q	Q	Q	ı
82	R	R	R	R	R	R
83	S	S	S	S	S	S
84	T	T	T	T	T	T

Table 4-2. Supported Hardware Character Sets (continued)

Decimal Value	Set 10 ANSI ASCII	Set 11 7580 Set	Set 12 French German	Set 13 Scandinavian	Set 14 Spanish Latin American	Set 15 Special Symbols
85	U	U	U	U	U	U
86	V	V	V	V	V	V
87	W	W	W	W	W	W
88	X	X	X	X	X	X
89	Y	Y	Y	Y	Y	Y
90	Z	Z	Z	Z	Z	Z
91	[	[	[	Ø	[	[
92	\	√	ç	Æ	¡	\
93	]	]	]	ø	]	]
94	^	↑	^	æ	^	^
95	_	_	_	_	_	_
96	`	`	`	`	`	`
97	a	a	a	a	a	∩
98	b	b	b	b	b	⊃
99	c	c	c	c	c	⊂
100	d	d	d	d	d	∪
101	e	e	e	e	e	‾
102	f	f	f	f	f	≡
103	g	g	g	g	g	≅
104	h	h	h	h	h	≈
105	i	i	i	i	i	~
106	j	j	j	j	j	≤
107	k	k	k	k	k	≥
108	l	l	l	l	l	≠
109	m	m	m	m	m	Δ
110	n	n	n	n	n	∏

Table 4-2. Supported Hardware Character Sets (continued)

Decimal Value	Set 10 ANSI ASCII	Set 11 7580 Set	Set 12 French German	Set 13 Scandinavian	Set 14 Spanish Latin American	Set 15 Special Symbols
111	o	o	o	o	o	Σ
112	p	p	p	p	p	±
113	q	q	q	q	q	∓
114	r	r	r	r	r	→
115	s	s	s	s	s	↑
116	t	t	t	t	t	←
117	u	u	u	u	u	↓
118	v	v	v	v	v	∫
119	w	w	w	w	w	÷
120	x	x	x	x	x	*
121	y	y	y	y	y	∇
122	z	z	z	z	z	•
123	{	π	¨	¨	~	{
124	|	⊢	•	•	~	|
125	}	→	¨	¨	~	}
126	~	~	'	•	~	~

New-Frame-Action

When using D0006, a new-frame-action causes the picture to be made current. All visible segments are then drawn, or redrawn, on the display surface. The application program should generate pause time, if necessary, so that the user can change the paper. When changing paper, the paper should be of the same size that was in the plotter when it was initialized. If a different size is required, the device should be terminated (see JWEND) and reinitialized (see JDINT) after the new paper is installed in the plotter.

Inquiry Escape Functions

JIESC

The following inquiry escape functions are supported:

OPCODE	FUNCTION
450	Inquire paper limits. The plotters set these limits following a chart load or axis align. RLIST(1) = X min (virtual coordinate units) RLIST(2) = X max (virtual coordinate units) RLIST(3) = Y min (virtual coordinate units) RLIST(4) = Y max (virtual coordinate units)
1050	Inquire current error status ILIST(1) = 0 No error = 1 Instruction not recognized = 2 Wrong number of parameters = 3 Bad parameter = 4 Reserved = 5 Unknown character set = 6 Position overflow = 7 Reserved = 8 Reserved

2050 Inquire current turret. This instruction returns information about the current turret.

ILIST(1) = -1 Turret mounted, but the type of pen is unknown
= 0 Turret not mounted
= 1 Fiber tip pens
= 2 Roller ball pens
= 3 Capillary pens

ILIST(2) = 0 Turret not mounted or turret doesn't have any pens
= n Sum of these values:
1: Pen in stall #1
2: Pen in stall #2
4: Pen in stall #3
8: Pen in stall #4
16: Pen in stall #5
32: Pen in stall #6
64: Pen in stall #7
128: Pen in stall #8

For example, if ILIST(2) = 3, pens would only be contained in stalls 1 and 2. A value of 192 for ILIST(2) would mean that pens are only contained in stalls 7 and 8.

Output Escape Functions

JOESC

Several output escape functions are supported by AGP with the plotters. Error checking is not performed by the graphics system for out-of-limit or incorrect parameters. Out-of-range parameters flag an error in the plotter and the corresponding command is ignored.

Escape functions are not stored in the segment display area. This can have implications when used with AGP segments. For example, a character slant of 10 degrees is set with escape function JOESC (150). A text string is created inside a segment. The character slant is changed to 30 degrees and a new-frame-action is given. The string will be redrawn with the present character slant of 30 degrees, rather than the original 10 degrees it was created with.

Escape functions can also have undesired effects on low and medium quality text. For example, since medium quality text is output one character at a time, setting the text direction angle will affect each character by itself not producing the same angled text that would be output if low quality text were used. See the *AGP Users Guide* for an example of the difference in low and medium quality text.

Escape functions are sent from AGP directly to DGL. The state of AGP may become undefined when an escape function is given that overrides a mode set by AGP (e.g. hardware text direction).

The following output escape functions are supported:

Computer Museum

OPCODE	FUNCTION
150	Set device character slant for subsequently output medium and low quality graphics text. See Figure 4-3. RLIST(1) = Tangent of angle from vertical (from 127.999 to -127.999)

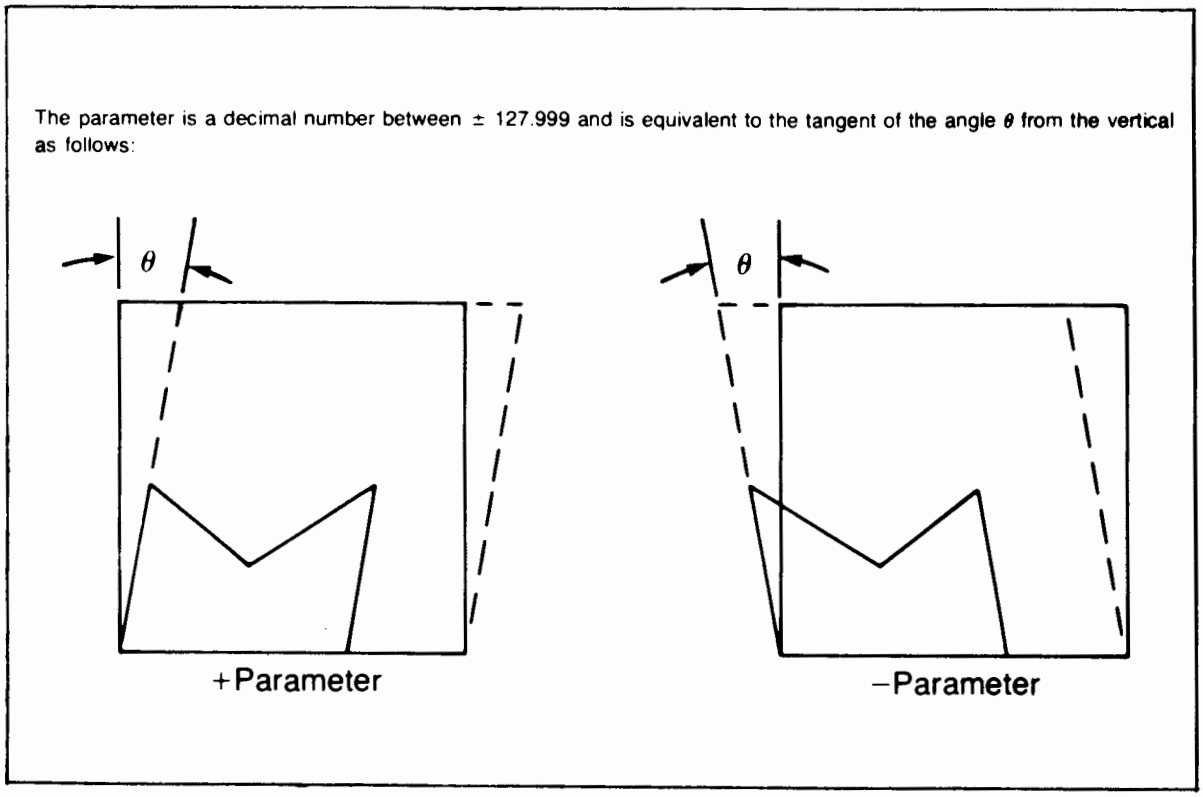


Figure 4-3. Character Slant

151 Set device character chord angle for subsequently output medium and low quality graphics text. Sets the maximum angle used when generating curved segments using character sets 10 through 15. Decreasing the chord angle increases the number of chords used which will result in smoother arcs in characters. The default chord angle is five degrees.

RLIST(1) = Chord angle in degrees

250 Set device character direction for subsequently output medium and low quality graphics text. Provides a means to specify the direction in which text is drawn. See Figure 4-4.

RLIST(1) = X component of character direction slope (run)
RLIST(2) = Y component of character direction slope (rise)

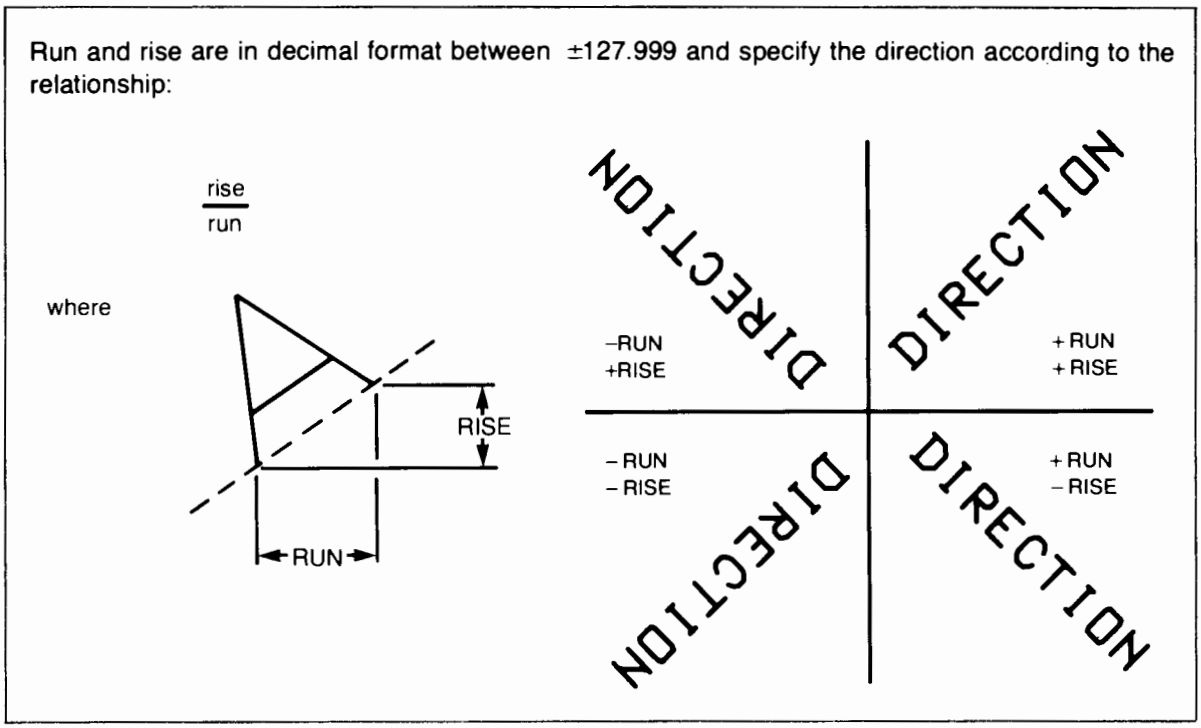


Figure 4-4. Character Direction

251 Set additional spacing between characters with low quality text. Medium quality text is not affected. A positive parameter causes more space to be left between characters while a negative value decreases the amount of space between characters. The space between characters and text lines is expressed as a fraction of the character cell size. A parameter value of 0.0 indicates that the default spacing should be used.

RLIST(1) = Additional space between characters expressed as a fraction of the character cell width.
RLIST(2) = Additional space between lines of text expressed as a fraction of the character cell width.

252 Draw circle. The current position defines the center of the circle. The sign of the circle's radius determines the starting point of the circle. If the radius specified is positive, the circle begins at the 0 degree point. If the radius specified is negative, the circle begins at the 180 degree point. Refer to Figure 4-5 for a specification of the circle.

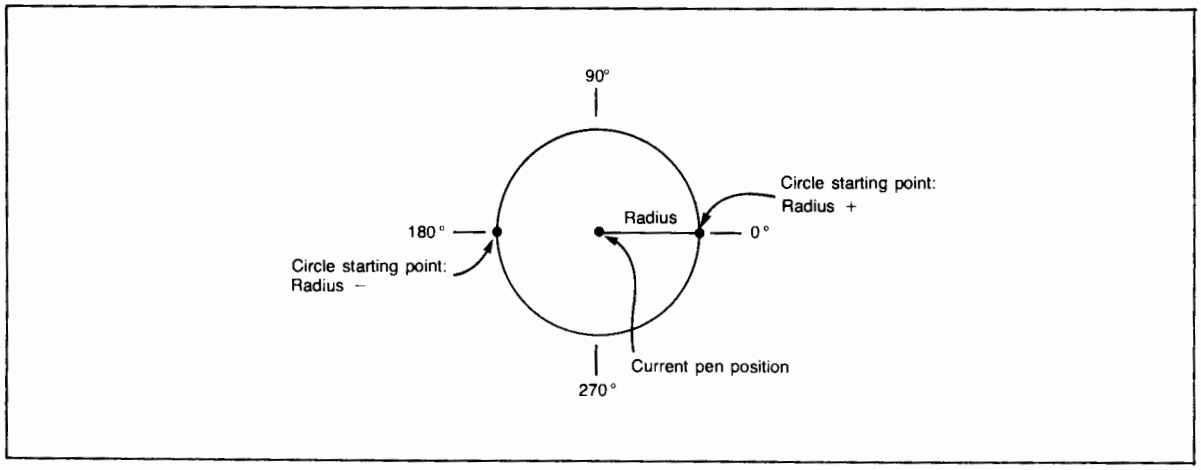


Figure 4-5. Circle Specifications

The circle is approximated by a multi-sided polygon. The accuracy of the circle generated can be controlled by the user. This is done by specifying the chord tolerance by either degrees or in terms of distance deviation. When using the degrees mode, the user specifies the maximum number of degrees subtended by a chord that is used to represent an arc segment of the circle (see Figure 4-6). Figure 4-7 shows the effects which different value of degrees subtended by a chord has on the circle generated.

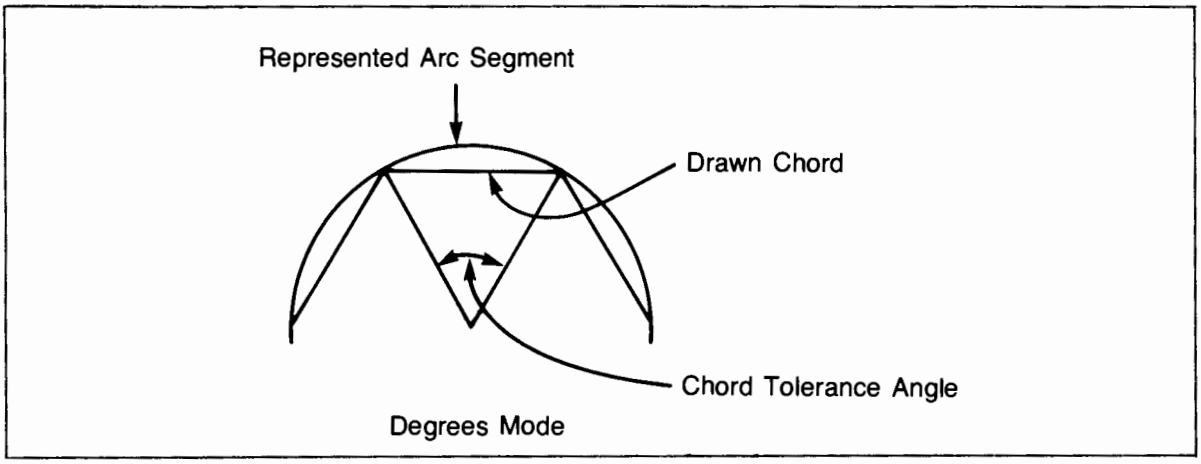


Figure 4-6. Specifying the Chord Tolerance in Degrees

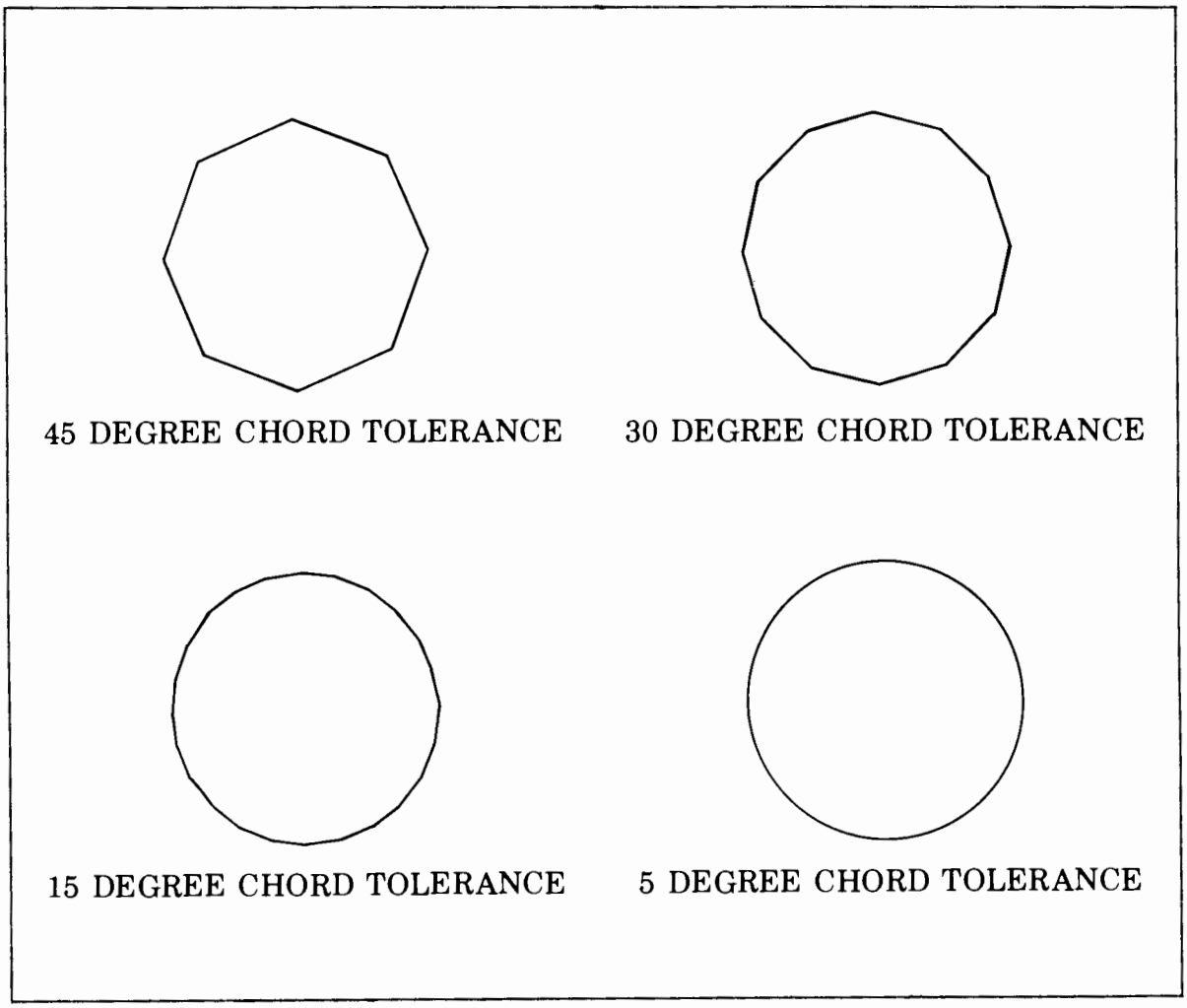


Figure 4-7. Effect of Different Chord Angles

When using distance deviation to specify the chord tolerance, the user specifies the maximum distance permitted between the chord drawn and the arc segment it represents (see Figure 4-8).

RLIST(1) = Radius of circle expressed in virtual coordinate units
RLIST(2) = Chord tolerance

> 0 RLIST(2) specifies the maximum number of degrees that can be spanned by any chord.

< 0 Absolute value of RLIST(2) specifies the maximum distance, in virtual coordinates, that any chord can be from the arc that it represents.

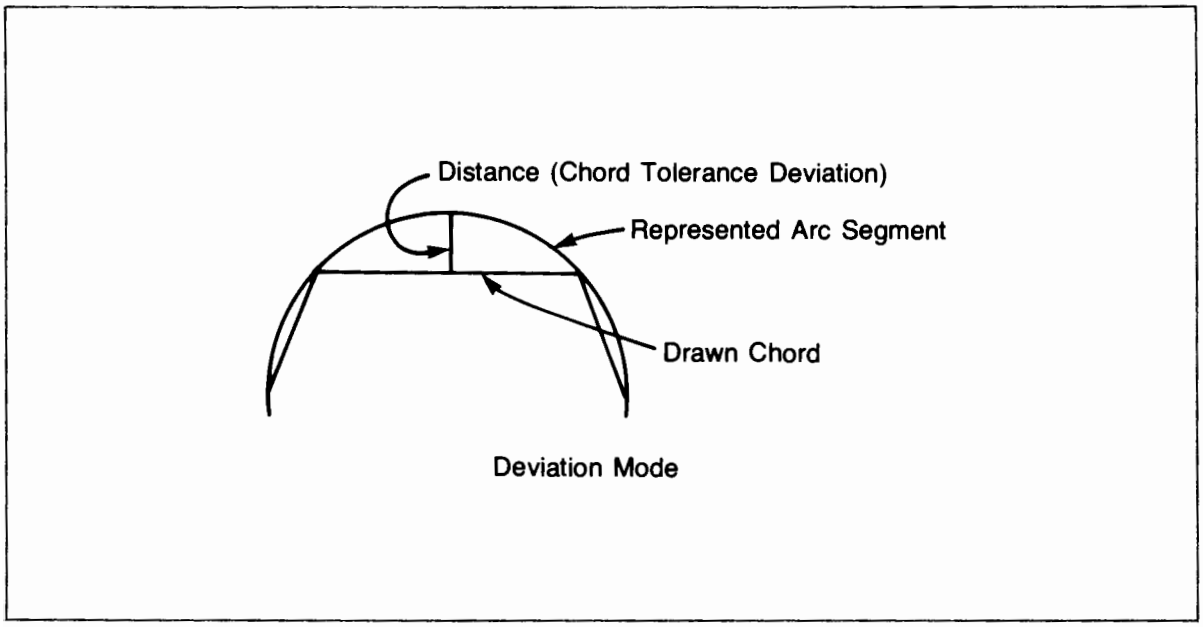


Figure 4-8. Specifying Chord Tolerance with Distance Deviation

450 Set hardware clipping limits. Provides a means to change the hardware clipping limits. JASPK, JWIND, JVIEW, JDLIM, and JDINT will reset the clipping limits to the view surface boundaries. Only points within the view surface will be clipped. Any vector or text given outside the view surface may give unpredictable results. See the section on medium and low quality text for information on clipping.

```
RLIST(1) = X min  (virtual coordinate units)
RLIST(2) = X max  (virtual coordinate units)
RLIST(3) = Y min  (virtual coordinate units)
RLIST(4) = Y max  (virtual coordinate units)
```

451 Draw arc. This instruction draws an arc along the circumference of the circle with center at RLIST(1), RLIST(2). The arc begins at the pen position and extends RLIST(3) degrees along the circle. If degrees is positive, the arc will be drawn in a counterclockwise direction from the starting position. Otherwise the arc is drawn in a clockwise direction. See JOESC (252) for a review of chord tolerance specifications.

```
RLIST(1) = X virtual coordinate of center of circle.
RLIST(2) = Y virtual coordinate of center of circle.
RLIST(3) = Degrees suspended by arc.
RLIST(4) = Chord tolerance.

           > 0 RLIST(4) specifies the maximum number of
               degrees that can be spanned by any chord.

           < 0 Absolute value of RLIST(4) specifies the
               maximum distance, in virtual coordinates,
               that any chord can be from the arc that it
               represents.
```

1050 Select character set. This instruction provides a means for selecting an alternate character set used for low and medium quality text. Refer back to Table 4-2 for the supported character sets.

```
ILIST(1) = 0 ANSI ASCII
           1 HP 7580A/B, HP 7585A/B ASCII
           2 French and German
           3 Scandinavian ASCII
           4 Spanish/Latin American ASCII
           5 Math and Calcomp symbols

          10 ANSI ASCII                  (Curved Segments)
          11 HP 7580A/B, HP 7585A/B              "
          12 French and German                   "
          13 Scandinavian ASCII                  "
          14 Spanish/Latin American ASCII        "
          15 Math and Calcomp symbols            "
```

1052 Set automatic pen. This instruction provides a means for utilizing the smart pen options. Initially, all smart pen options are enabled.

ILIST(1) => BIT 0 = 1 Lift pen if it has been down for the allotted time.

=> BIT 1 = 1 Put pen away if it has been motionless for the allotted time.

=> BIT 2 = 1 Do not select a pen until a command which makes a mark is issued. This causes the pen to remain in the turret for the longest possible time.

1053 Rotate coordinate system. Rotates the coordinate system 90 degrees. This results in images rotated by 90 degrees.

ILIST(1) = 1 Rotate coordinate system 90 degrees
<> 1 Turn off rotation.

1054 Set hardware text justification for subsequently output medium and low quality graphics text. This will apply to individual characters when using medium quality text. Figure 4-9 shows the effect of different text justifications. The number following TEXT is the justification used on the string.

ILIST(1) = Desired hardware text justification in range 1 through 9 and 11 through 19.

2050 Select pen velocity. Pen speed may be set from 1 to 60 cm/sec.

ILIST(1) = Pen velocity (integer from 1 to 60) in cm/sec.
ILIST(2) = Pen number (integer from 1 to 8; other integers select all pens)

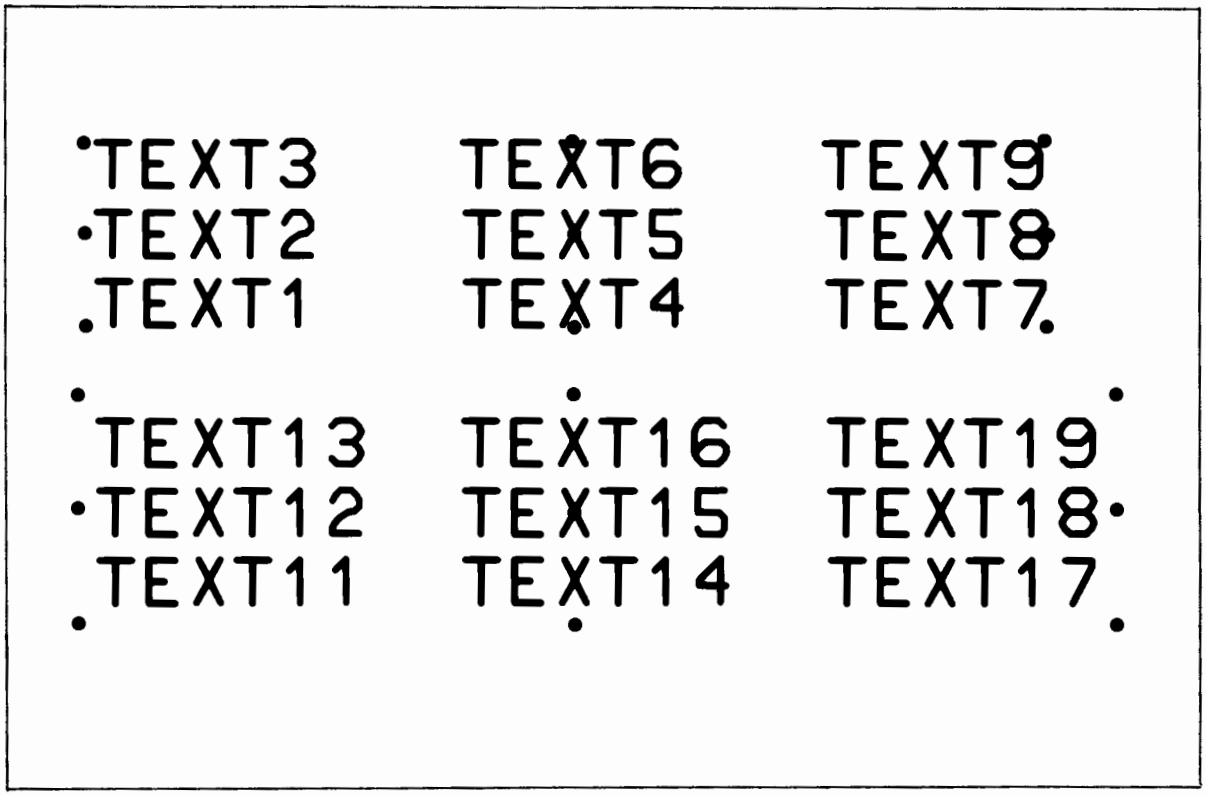


Figure 4-9. Hardware Text Justification

2051 Select pen force. The pen force may be set from 10 to 66 gram-weights.

```
ILIST(1) = Pen force (integer from 1 and 8)
           1 => 10 gram-weights
           2 => 18 gram-weights
           3 => 26 gram-weights
           4 => 34 gram-weights
           5 => 42 gram-weights
           6 => 50 gram-weights
           7 => 58 gram-weights
           8 => 66 gram-weights
ILIST(2) = Pen number (between 1 and 8; other integers
           select all pens)
```

2052 Select pen acceleration. The pen acceleration may set from 1 to 4 Gs.

ILIST(1) = Pen acceleration (between 1 and 4 in Gs)
ILIST(2) = Pen number (between 1 and 8; other integers select all pens)

Locator Echoes on the Graphics Display

JWLOC

For echoes supported on the locator device, see the chapter which describes the locator device in question. The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device.

SAME PHYSICAL DEVICE

If the locator and display are the same physical device, then the following echoes are supported on the graphics display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the display pen will be moved to the current locator echo position. The pen will continue to reflect the current locator position (i.e. tracked) until the locator operation is terminated.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.

5 Horizontal rubber band line

Simulated by ECHO 2 except the current locator X coordinate and the initial locator echo Y coordinate are returned.

6 Vertical rubber band line

Simulated by ECHO 2 except the initial locator echo X coordinate and the current locator Y coordinate are returned.

7 Horizontal/vertical rubber band line

If the locators X displacement from the locator echo position is greater than its Y displacement, ECHO 5 is simulated. When the Y displacement becomes greater than the X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

DIFFERENT PHYSICAL DEVICES

If the locator and graphics display are different physical devices, then the following echoes are supported on the display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the plotter pen will be moved to the current locator echo position. The pen will then reflect the current locator position (i.e. track the locator position) until operator response.
3	Full cross-hair cursor Same as ECHO 2.

4 Rubber band line

Same as ECHO 2.

5 Horizontal rubber band line

Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator position and the Y coordinate of the current locator echo position.

6 Vertical rubber band line

Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator position and the Y coordinate of the current locator echo position.

7 Horizontal/vertical rubber band line

Initially, the plotter pen position is moved to the locator echo position. Subsequently, when the locator's X displacement becomes greater than its Y displacement, ECHO 5 is simulated. When the locator's Y displacement becomes greater than its X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

Pick Echoes on the Graphics Display

JPICK

For echoes supported on the pick device, see the chapter which discusses the pick device in question. The following pick echoes are performed:

ECHO#	ECHO PERFORMED
2	Initially, the plotter pen will be moved to the current pick echo position. The pen will continue to reflect the current pick position (i.e. track) until the pick operation is terminated.

Disabling

JWOFF

When the device is disabled, and the automatic pen option is set, the current pen is returned to its stall.

GRAPHICS DISPLAY DEVICE HANDLER (DGL ONLY)

Description

The dimensions of the HP 7580A/B Drafting Plotters are as follows:

Plotting area:	1190 mm wide by 622.3 mm high
Plotting capacity:	32380 points wide by 20970 points high
Aspect ratio of maximum area:	0.6476
Resolution:	40.0 points/mm in X and Y directions

The dimensions of the HP 7585A/B Drafting Plotters are as follows:

Plotting area:	1190 mm wide by 927 mm high
Plotting capacity:	42644 points wide by 33418 points high
Aspect ratio of maximum area:	0.7837
Resolution:	40.0 points/mm in X and Y directions

When spooling output, "D" size paper is supported. In this case, the default logical display surface ranges from 0.0 to 809.5 mm in the X direction and from 0.0 to 524.25 mm in the Y direction. The aspect ratio of the logical display surface is therefore 0.6476.

When sending graphics output without spooling, the default display surface is set to the size of the paper currently in the plotter when the subroutine ZDINT is called. If the paper is changed while the graphics display is initialized, it should be the same size of paper that was in the plotter when ZDINT was called. If a different size of paper is required, the device should be terminated (see ZDEND) and reinitialized (see ZDINT) after the new paper has been placed in the plotter.

The view surface is always justified in the lower left corner (corner nearest the turret, when in VIEW state) of the current logical display surface.

The physical origin is at the lower left boundary of pen movement, (corner nearest the turret when in VIEW state).

Initialization

ZDINT

When initialized, the following operations are performed:

Device name is set to plotter name.

Color set to 1.

Highlighting set to 1.

Linewidth set to 1.

Linestyle set to 1.

Starting position is undefined.

Pen velocity, force, and acceleration are set to the default values for the turret loaded.

ASCII character set is set to 'ANSI ASCII'.

Text slant is set to 0 degrees (no slant), text label direction is set to 0 degrees (horizontal).

All automatic pen options are set.

The logical display surface is set to the default values.

Hardware clipping is set to the view surface boundaries.

Supported Primitive Attributes

COLOR

ZCOLR

The D0006 display handler provides a software color table of eight distinct colors, which support eight pens. The size of the color table cannot be changed. The default values of the color table are shown in Table 4-3.

Table 4-3. Default Color Table for Eight Pen Plotters

	R	G	B
COLOR TABLE ENTRY = 1 >> Black	0.0	0.0	0.0
= 2 >> Red	1.0	0.0	0.0
= 3 >> Yellow	1.1	1.1	0.0
= 4 >> Green	0.0	1.0	0.0
= 5 >> Cyan	0.0	1.0	1.0
= 6 >> Blue	0.0	0.0	1.0
= 7 >> Magenta	1.0	0.0	1.0
= 8 >> White	1.0	1.0	1.0

The color table is initialized to the default values when ZDINT is called. The color table can be redefined or inquired using ZDCOL or ZICOL.

The pen selected corresponds to the color index passed in the ZCOLR call. The color table is not used when selecting the pen on a ZCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 0 >> Current pen is returned to its stall
      = 1 >> Pen #1 is selected
      = 2 >> Pen #2 is selected
      = 3 >> Pen #3 is selected
      = 4 >> Pen #4 is selected
      = 5 >> Pen #5 is selected
      = 6 >> Pen #6 is selected
      = 7 >> Pen #7 is selected
      = 8 >> Pen #8 is selected
```

REDEFINING COLOR

ZDCOL/ZICOL

All of the colors in the color table can be redefined, or inquired, except for the background color. When the color table is redefined it only affects the values returned on ZICOL calls. DGL does not use the color table when selecting the pen on a ZCOLR or ZPICL call. The color table is provided for the user's convenience.

POLYGON INTERIOR COLOR

ZPICL

Refer to ZCOLR for information regarding color.

POLYGON STYLE

ZDPST

Since the plotters are hard copy devices, using ZDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

ZPILS

Refer to ZLSTL for information regarding linestyle.

HIGHLIGHTING

ZHIGH

Highlighting is not performed.

LINESTYLE

ZLSTL

Thirteen predefined linestyles are supported. Linestyles 1 through 7 may be classified as being *continuous*. Linestyles 8 through 13 are the same patterns as styles 2 through 7 drawn in the *vector adjusted* format. See Figure 4-10 for the supported linestyles.

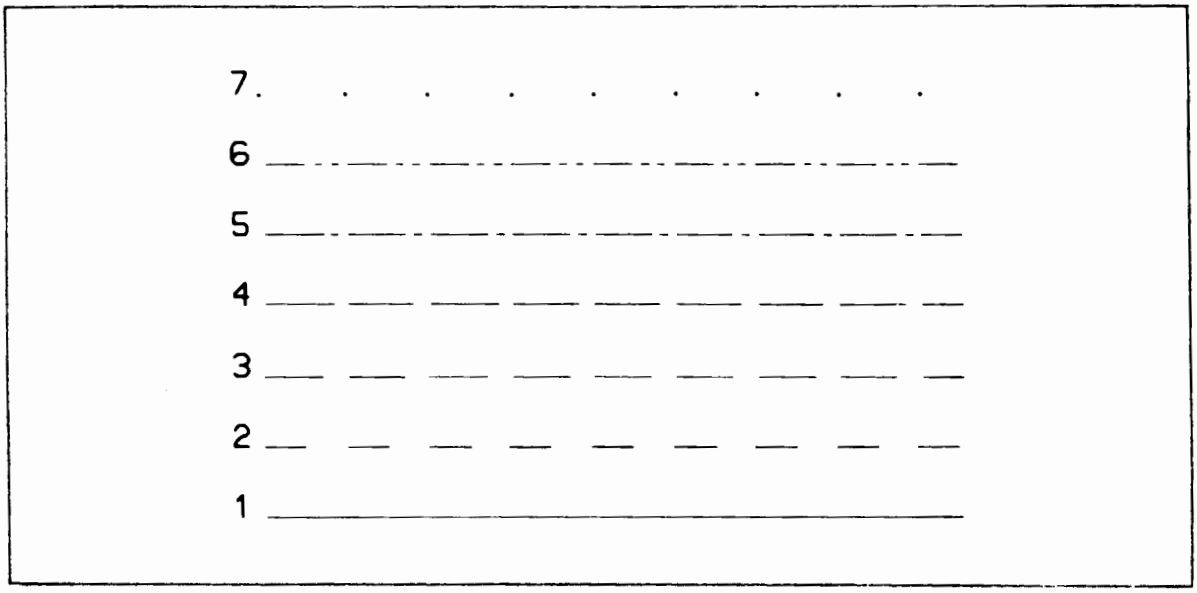


Figure 4-10. Supported Linestyles

LINEWIDTH

ZLWID

Only one linewidth is supported.

LINEWIDTH = 1 >> Primitives drawn with the linewidth of the pen selected.

CHARACTER SIZES

ZCSIZ

The plotters support all character cell sizes which have a width and height not less than 1 mm and not greater than 250 mm.

The character is placed within the character cell as shown in Figure 4-11.

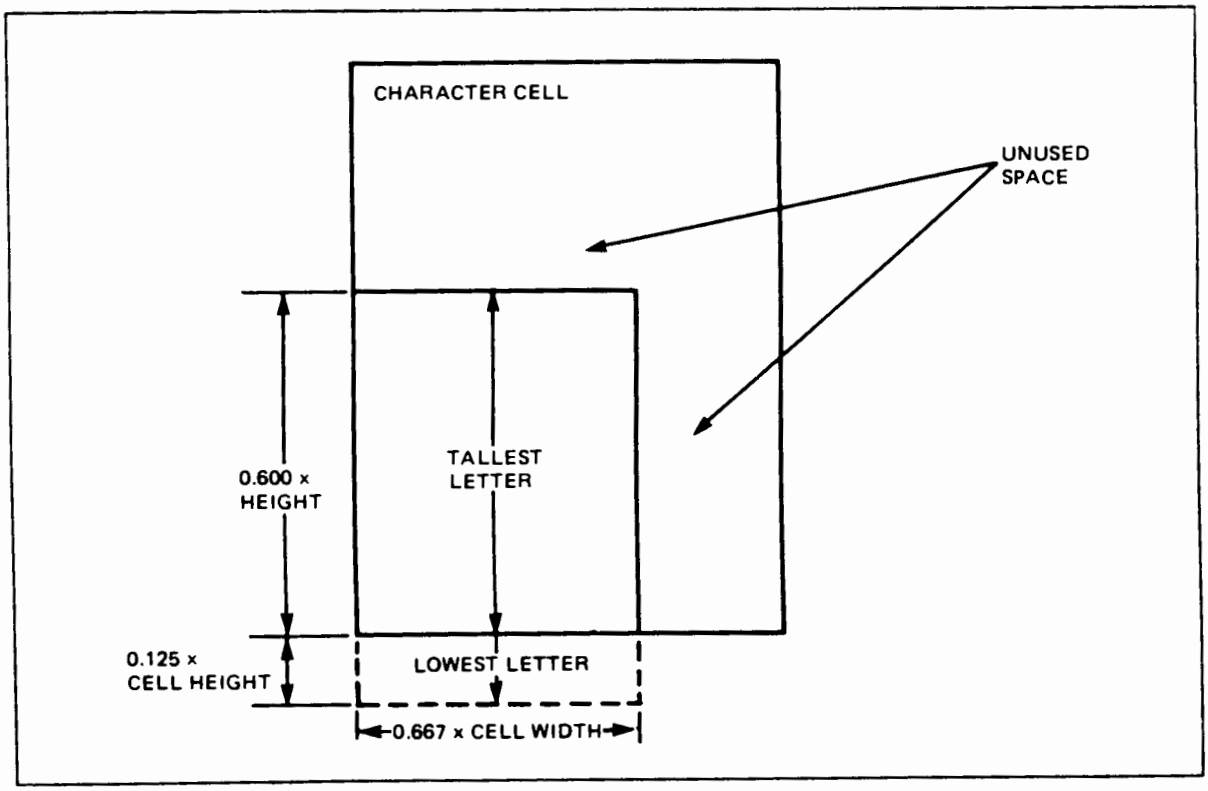


Figure 4-11. Character Placement in a Character Cell

Output Primitives

CLIPPING

The plotters provide hardware vector and text clipping which are set to the hardware clipping limits. Only parts of the graphics items which exceed the view surface boundaries will be clipped. Graphics items which extend past the view surface limits will activate the plotter's *out-of-limit* light. The hardware clipping limits can be modified by calling ZOESC with an OPCODE of 450.

Calls to ZASPK, ZWIND, ZVIEW, ZDLIM, and ZDINT will reset the hardware clipping limits to the view surface boundaries. The user can redefine the hardware clipping limits to be any region within the boundaries of the view surface by a call to ZOESC (450).

POLYGONS

ZPGDD

Hardware support of polygons is not provided. A polygon specified by ZPGDD will always be represented as described in the *DGL Reference Manual*.

MARKERS

ZMARK

The 19 standard markers are the only markers supported. A character size of 2.0 mm by 2.0 mm is always used to generate markers. Markers are affected by the color attribute.

TEXT

ZTEXT

Graphics text is generated with a hardware character generator. A standard ASCII character set is used as the default character set. There are 11 additional character sets available to the user via the plotter's escape functions. Refer to Table 4-1 for the character set illustrations.

Only parts of characters which extend beyond the hardware clipping limits or the paper limits are clipped.

The user can modify text direction as well as text slant via escape functions (see ZOESC 150 and 250).

After ZTEXT, the starting position is left such that an additional call to ZTEXT will continue plotting characters along the same direction of text. A carriage return moves the pen back to the beginning of the text string. Text is affected by the color attribute but is not affected by linestyle (text is always generated with solid lines).

New-Frame-Action

ZNEWF

When using D0006, a new-frame-action causes the picture to be made current. All visible segments are then drawn, or redrawn, on the display surface. The application program should generate pause time, if necessary, so that the user can change the paper. When changing paper, the paper should be of the same size that was in the plotter when it was initialized. If a different size is required, the device should be terminated (see ZDEND) and reinitialized (see ZDINT) after the new paper is installed in the plotter.

Inquiry Escape Functions

ZIESC

The following inquiry escape functions are supported:

OPCODE	FUNCTION
450	Inquire paper limits. The plotters set these limits following a chart load or axis align. RLIST(1) = X min world coordinate units RLIST(2) = X max world coordinate units RLIST(3) = Y min world coordinate units RLIST(4) = Y max world coordinate units
1050	Inquire current error status ILIST(1) = 0 No error = 1 Instruction not recognized = 2 Wrong number of parameters = 3 Bad parameter = 4 Reserved = 5 Unknown character set = 6 Position overflow = 7 Reserved = 8 Reserved
2050	Inquire current turret. This instruction returns information about the current turret. ILIST(1) = -1 Turret mounted, but type is unknown = 0 Turret not mounted = 1 Fiber tip pens = 2 Roller ball pens = 3 Capillary pens ILIST(2) = 0 Turret not mounted or turret doesn't have any pens = n Sum of these values: 1: Pen in stall #1 2: Pen in stall #2 4: Pen in stall #3 8: Pen in stall #4 16: Pen in stall #5 32: Pen in stall #6 64: Pen in stall #7 128: Pen in stall #8 For example, if ILIST(2) = 3, pens would only be contained in stalls 1 and 2. A value of 192 for ILIST(2) would mean that pens are only contained in stalls 7 and 8.

Output Escape Functions

ZOESC

Several output escape functions are supported with the plotters. Error checking is not performed by the graphics system for out-of-limit or incorrect parameters. Out-of-range parameters flag an error in the plotter and the corresponding command is ignored. The output escape function does not alter the starting position unless otherwise stated. The following output escape functions are supported:

OPCODE	FUNCTION
150	Set character slant. See Figure 4-12. RLIST(1) = Tangent of angle from vertical (from 127.999 to -127.999)
151	Set character chord angle. Sets the maximum angle used when generating curved segments using character sets 10 through 15. Decreasing the chord angle increases the number of chords used which will result in smoother arcs in characters. The default chord angle is 5 degrees. RLIST(1) = Chord angle in degrees. (run)

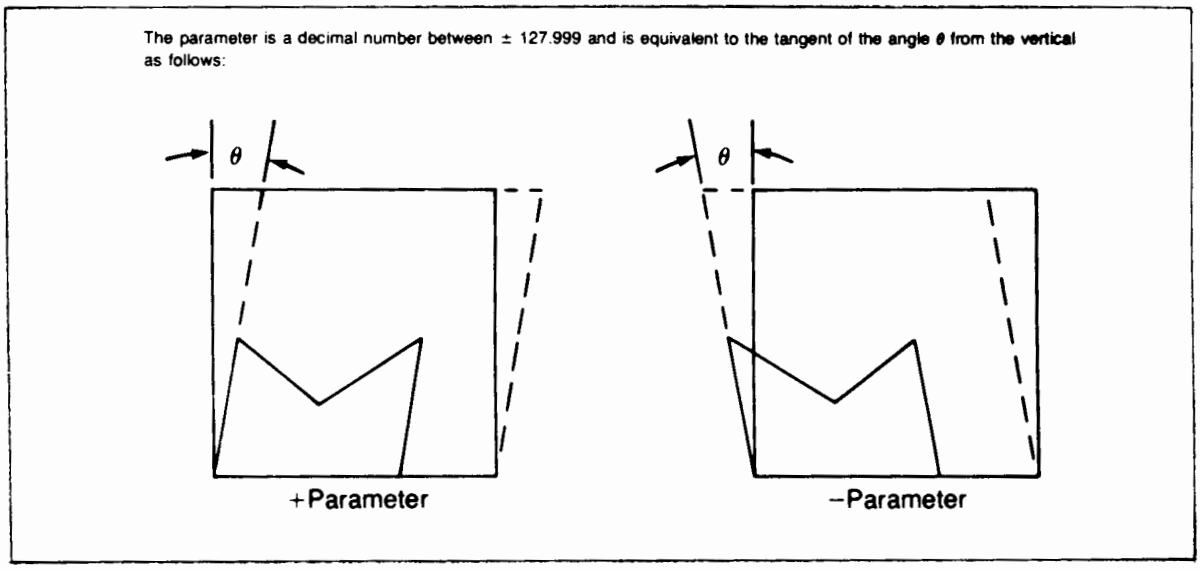


Figure 4-12. Character Slant

250 Set character direction. Provides a means to specify the direction in which text is drawn. See Figure 4-13.

RLIST(1) = X component of character slope (run)

RLIST(2) = Y component of character direction slope (rise)

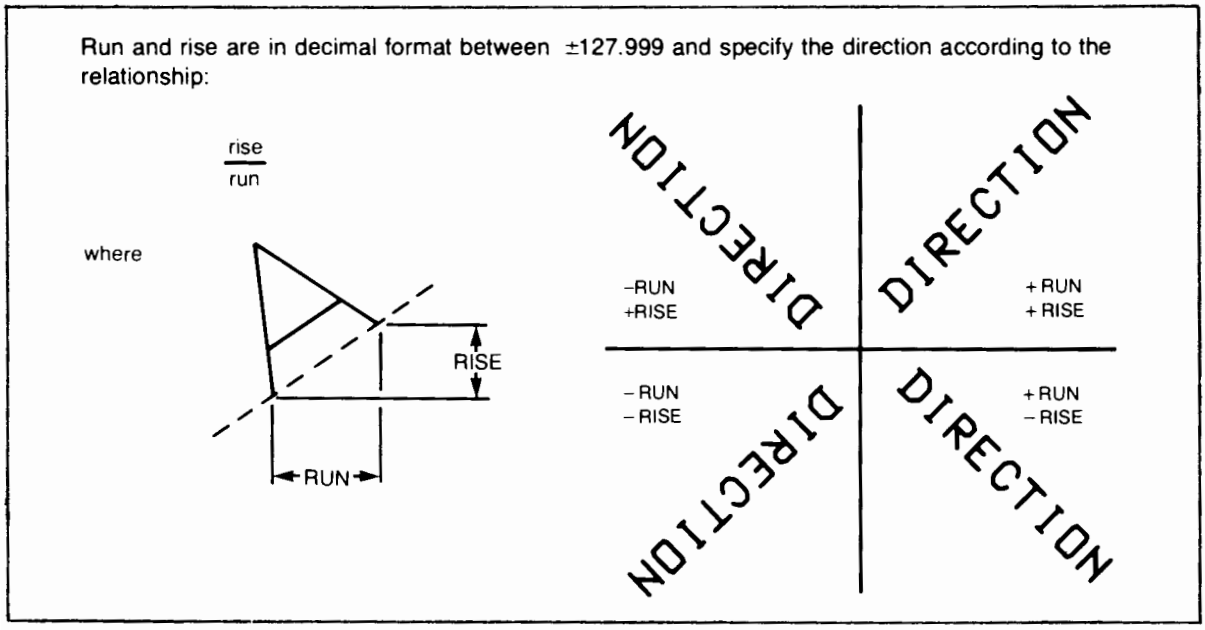


Figure 4-13. Character Direction

251 Set additional spacing between text characters. A positive parameter causes more space to be left between characters while a negative value decreases the amount of space between characters. The space between characters and text lines is expressed as a fraction of the character cell size. A parameter value of 0.0 indicates that the default spacing should be used.

RLIST(1) = Additional space between characters expressed as a fraction of the character cell width.

RLIST(2) = Additional space between lines of text expressed as a fraction of the character cell width.

252 Draw circle. The starting position defines the center of the circle. The sign of the circle's radius determines the starting point of the circle. If the radius specified is positive, the circle begins at the 0 degree point. If the radius specified is negative, the circle begins at the 180 degree point. Refer to Figure 4-14 for a specification of the circle.

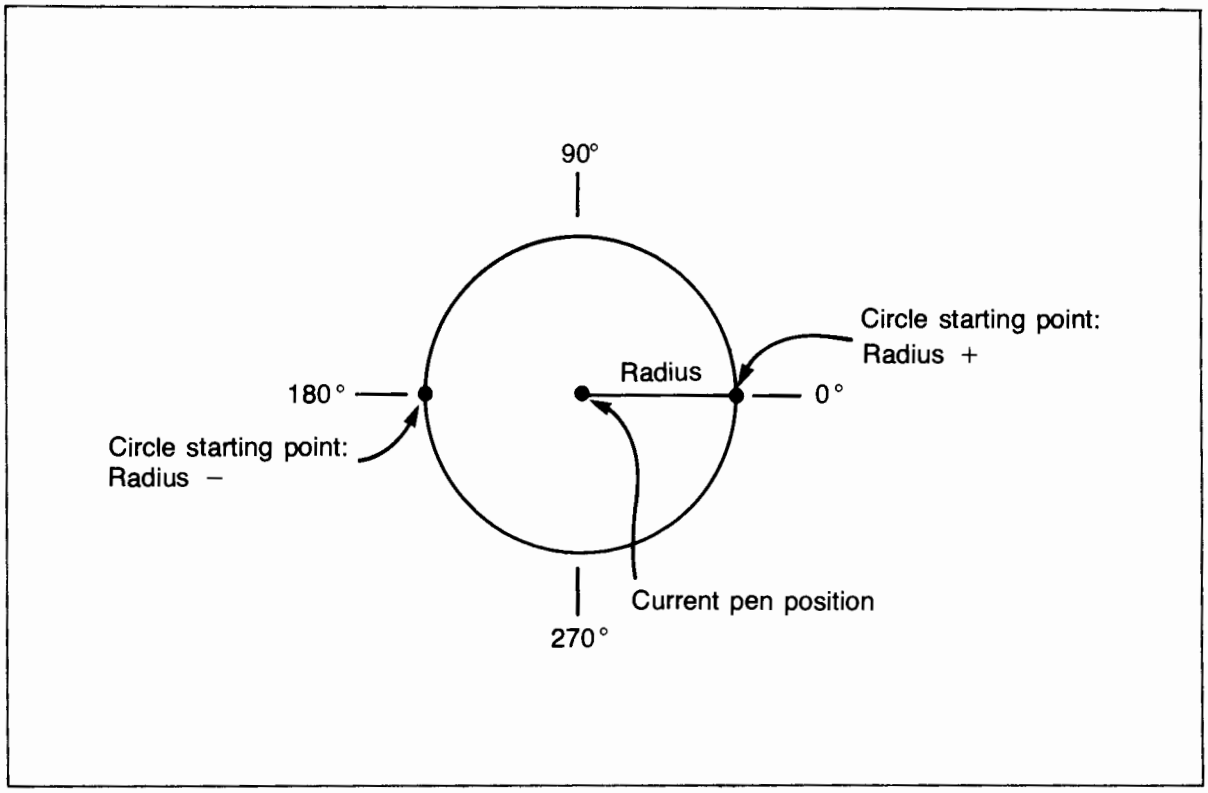


Figure 4-14. Circle Specifications

The circle is approximated by a multi-sided polygon. The accuracy of the circle generated can be controlled by the user. This is done by specifying the chord tolerance by either degrees or in terms of distance deviation. When using the degrees mode, the user specifies the maximum number of degrees subtended by a chord that is used to represent an arc segment of the circle (see Figure 4-15). Figure 4-16 shows the effects which different value of degrees subtended by a chord has on the circle generated.

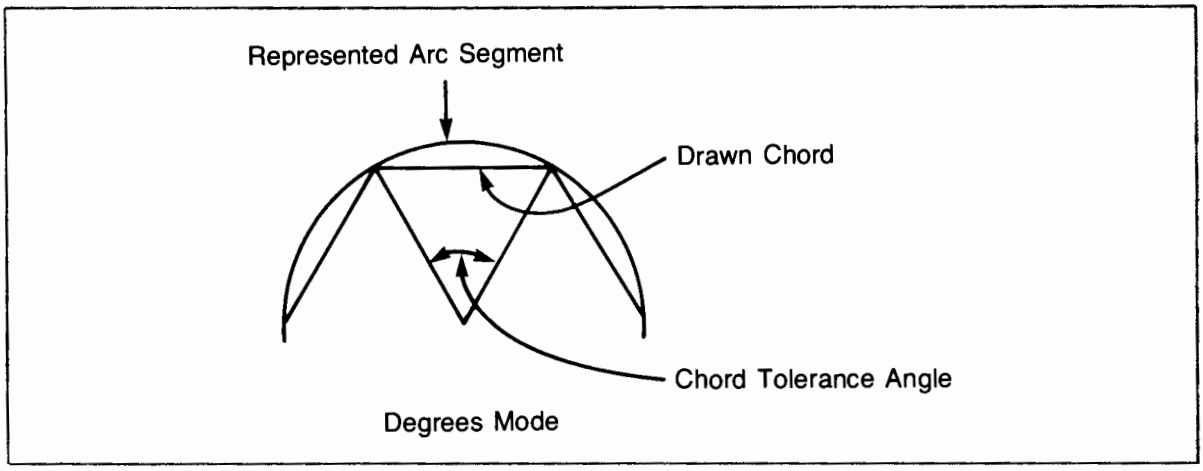


Figure 4-15. Specifying the Chord Tolerance in Degrees

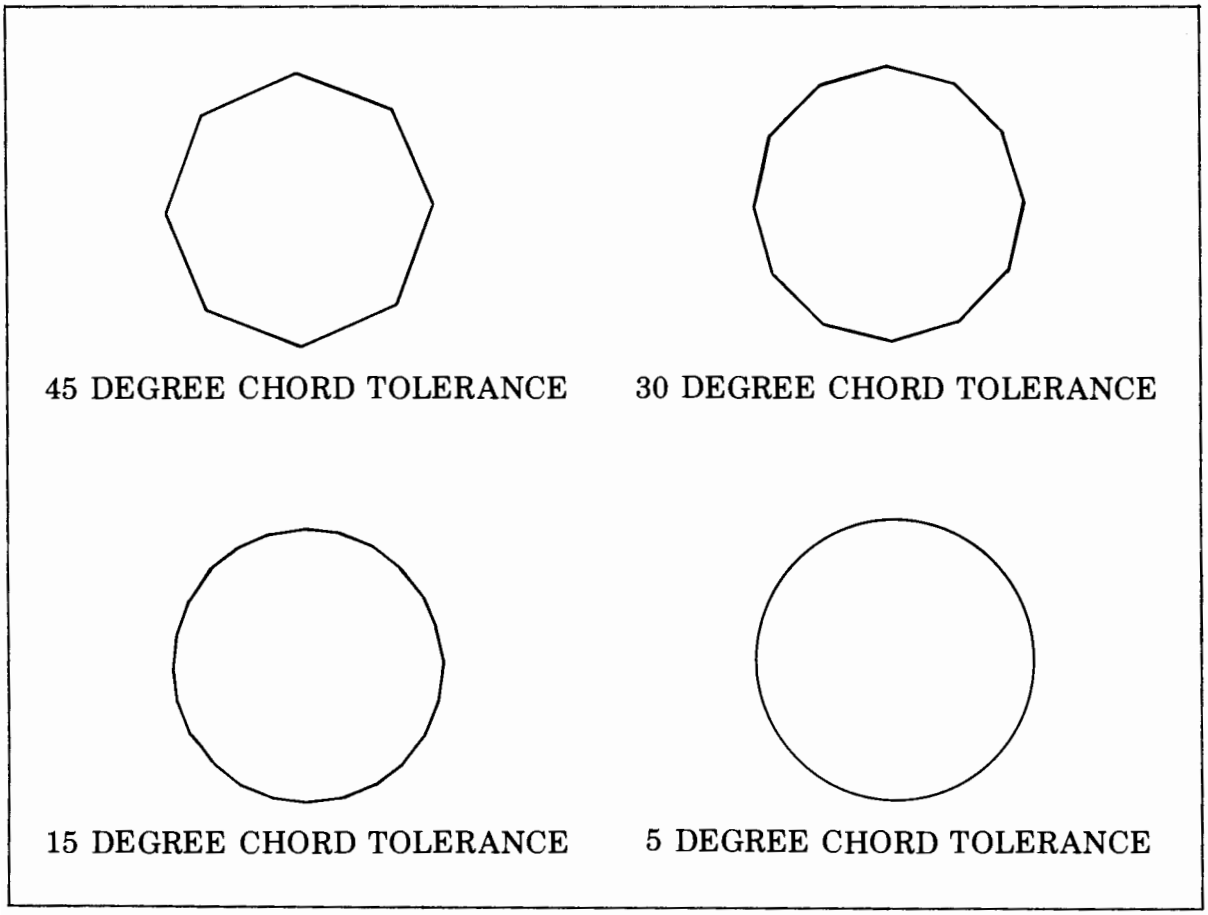


Figure 4-16. Effect of Different Chord Angles

When using distance deviation to specify the chord tolerance, the user specifies the maximum distance permitted between the chord drawn and the arc segment it represents (see Figure 4-17).

RLIST(1) = Radius of circle expressed in world coordinate units
RLIST(2) = Chord tolerance

> 0 RLIST(2) specifies the maximum number of degrees that can be spanned by any chord.

< 0 Absolute value of RLIST(2) specifies the maximum distance, in world coordinates, that any chord can be from the arc that it represents.

450 Set hardware clipping limits. Provides a means to change the hardware clipping limits. ZWIND, ZASPK, ZVIEW, ZDLIM, and ZDINT will reset hardware clipping limits to the view surface boundaries.

RLIST(1) = X min (world coordinates)
RLIST(2) = X max (world coordinates)
RLIST(3) = Y min (world coordinates)
RLIST(4) = Y max (world coordinates)

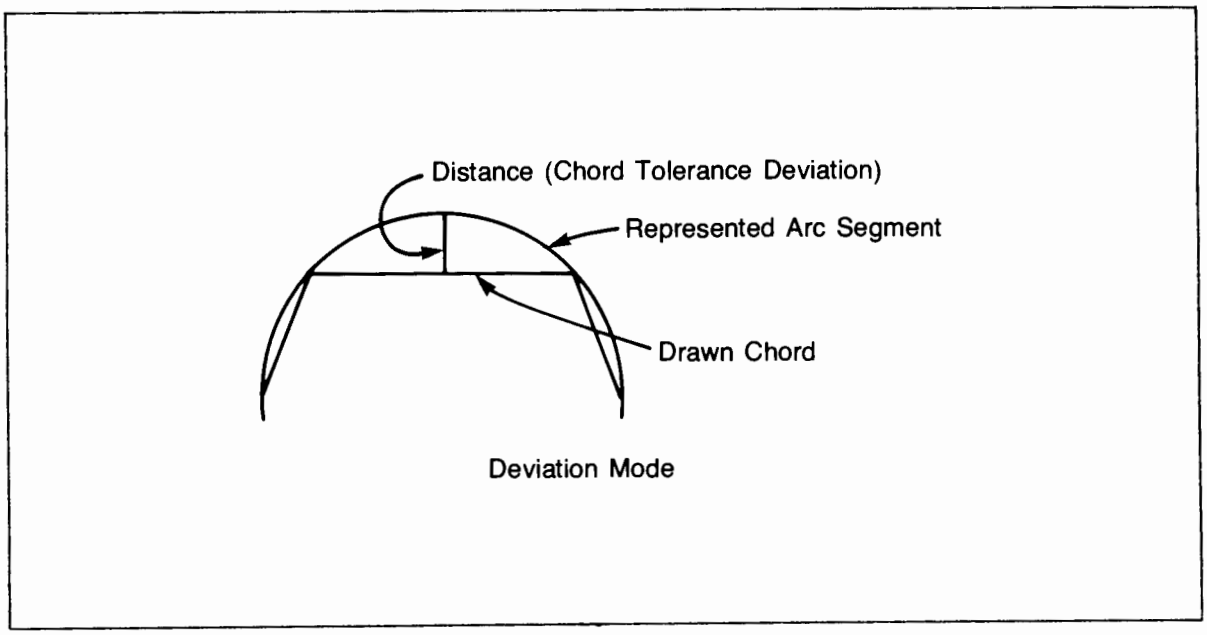


Figure 4-17. Specifying Chord Tolerance with Distance Deviation

451 Draw arc. This instruction draws an arc along the circumference of the circle with center at RLIST(1), RLIST(2). The arc begins at the starting position and extends RLIST(3) degrees along the circle. If degrees are positive, the arc will be drawn in a counterclockwise direction from the starting position. Otherwise the arc is drawn in a clockwise direction. The starting position is set to the end of the arc drawn by this call. Refer to ZOESC(252) for a review of the definition of the chord tolerance.

RLIST(1) = X world coordinate of center of circle.
RLIST(2) = Y world coordinate center of circle.
RLIST(3) = Degrees suspended by arc.
RLIST(4) = Chord tolerance.

>0 RLIST(4) specifies the maximum number of degrees that can be spanned by any chord.

<0 Absolute value of RLIST(4) specifies the maximum distance, in world coordinates, that any chord can be from the arc that it represents.

1050 Select character set. This instruction provides a means for selecting an alternate character set. Table 4-2 illustrates each of the following character sets.

ILIST(1) = 0 ANSI ASCII
1 HP 7580A/B, HP 7585A/B ASCII
2 French and German
3 Scandinavian ASCII
4 Spanish/Latin American ASCII
5 Math and Calcomp symbols
10 ANSI ASCII (Curved Segments)
11 HP 7580A/B, HP 7585A/B ASCII "
12 French and German "
13 Scandinavian ASCII "
14 Spanish/Latin American ASCII "
15 Math and Calcomp symbols "

1051 Set symbol mode. This instruction provides a means for displaying an ASCII character at the end of each move of draw. ZCSIZ can be used to select symbol size. Symbol mode may cause undesirable results when drawing polygons, polylines or markers. All ASCII characters with decimal values from 33 through 126, except for 59 which is a semicolon ";", can be used as a symbol. ILIST(1) = 0 symbol mode is terminated

<> 0 symbol mode is set with ASCII character in ILIST(1).

1052 Set automatic pen. This instruction provides a means for utilizing the smart pen options. Initially, all automatic pen options are enabled.

ILIST(1) => BIT 0 = 1 Lift pen if it has been down for the allotted time.

=> BIT 1 = 1 Put pen away if it has been motionless for the allotted time.

=> BIT 2 = 1 Do not select a pen until a command which makes a mark. This causes the pen to remain in the turret for the longest possible time.

1053 Rotate coordinate system. Rotates the coordinate system 90 degrees. This means that images generated will be rotated by 90 degrees on the paper.

ILIST(1) = 1 Rotate coordinate system 90 degrees
<> 1 Turn off rotation.

1054 Set hardware text justification. Positions text strings with respect to the starting position. Figure 4-18 shows the effect of different text justifications. The number following TEXT is the justification used on the string.

ILIST(1) = (1-19) Sets hardware text justification

2050 Select pen velocity. Pen speed may be set from 1 to 60 cm/sec.

ILIST(1) = Pen velocity (integer from 1 to 60) in cm/sec.
ILIST(2) = Pen number (integer from 1 to 8; other integers select all pens)

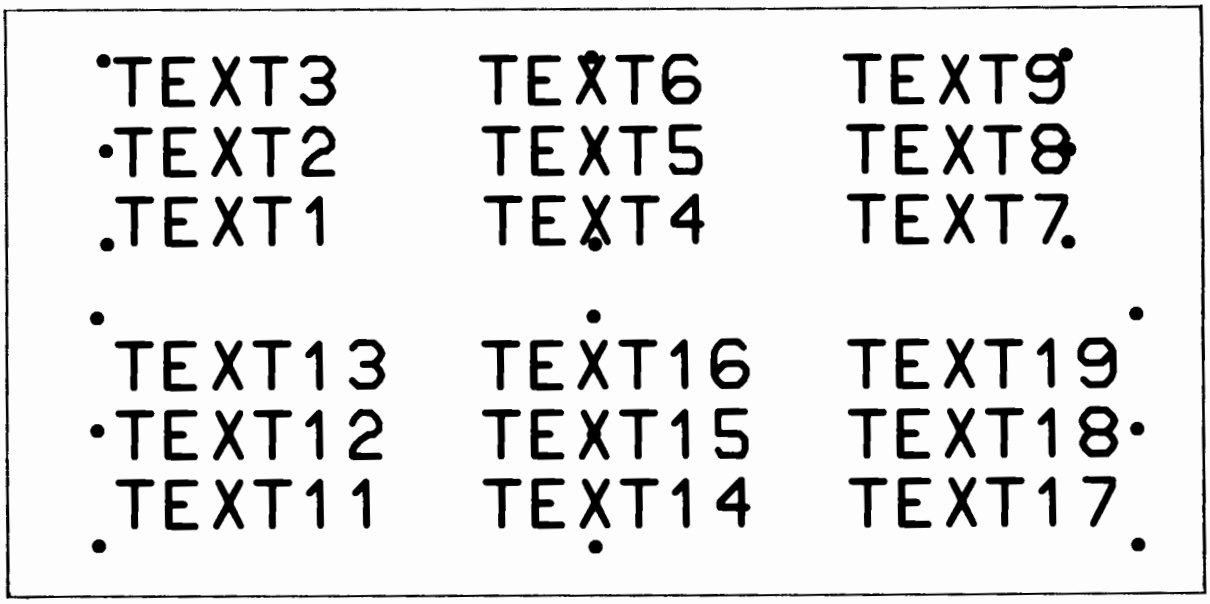


Figure 4-18. Hardware Text Justification

2051 Select pen force. The force may be set from 10 to 66 gram-weights.

ILIST(1) = Pen force (integer from 1 to 8)

1 => 10 gram-weights
2 => 18 gram-weights
3 => 26 gram-weights
4 => 34 gram-weights
5 => 42 gram-weights
6 => 50 gram-weights
7 => 58 gram-weights
8 => 66 gram-weights

ILIST(2) = Pen number (integer from 1 to 8; other integers select all pens)

2052 Select pen acceleration. The acceleration may be set from 1 to 4 Gs

ILIST(1) = Pen acceleration (between 1 and 4 Gs)

ILIST(2) = Pen number (between 1 and 8; other integers select all pens)

Locator Echoes on the Graphics Display

ZWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical devices. For the echoes supported on the locator device, refer to the chapter which describes the locator in question.

SAME PHYSICAL DEVICE

When the locator and display are the same physical device, then the following echoes are supported on the graphics display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the display pen will be moved to the current locator echo position. The pen will continue to reflect the current locator position (i.e. tracked) until the locator operation is terminated.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line Same as ECHO 2 except the current locator X coordinate and the initial locator echo Y coordinate are returned.

6 Vertical rubber band line

Same as ECHO 2 except the initial locator echo X coordinate and the current locator Y coordinate are returned.

7 Horizontal/vertical rubber band line

If the locators X displacement from the locator echo position is greater than its Y displacement, ECHO 5 is simulated. When the Y displacement becomes greater than the X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

DIFFERENT PHYSICAL DEVICES

When the locator and graphics display are different physical devices, then the following echoes are supported on the display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the plotter pen will be moved to the current locator echo position. The pen will then reflect the current locator position (i.e. track the locator position) until operator response.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.

5 Horizontal rubber band line

Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator echo position and the Y coordinate of the current locator position.

6 Vertical rubber band line

Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator echo position and the Y coordinate of the current locator position.

7 Horizontal/vertical rubber band line

Initially, the plotters pen position is moved to the initial locator echo position. Subsequently, when the locator's X displacement becomes greater than its Y displacement, ECHO 5 is simulated. When the locator's Y displacement becomes greater than its X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

Termination

ZDEND

All attributes except color remain unchanged until the system is reinitialized or the display device is enabled again. The color is set to 0. The device name is set to '0006 ', and the device status and I/O unit descriptor are set to 0.

LOCATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 7580A/B Drafting Plotters are as follows:

Plotting area:	809.5 mm wide by 524.25 mm high
Platen capacity:	32380 points wide by 20970 points long
Resolution:	40.0 points/mm in X and Y directions

The dimensions of the HP 7585A/B Drafting Plotters are as follows:

Plotting area:	1066.1 mm wide by 835.5 mm high
Platen capacity:	42644 points wide by 33418 points long
Resolution:	40.0 points/mm in X and Y directions

The default locator surface is set to the size of the paper installed in the plotter when the locator is enabled. If the paper is changed while the locator is enabled, it should be of the same size that was originally in the plotter. If a different size of paper is required, the device should be disabled and reenabled with the new paper installed in the plotter.

The physical origin of the locator device is at the lower left corner of the pen movement.

7580/85
LOCATOR

Initialization

JEDEV/ZLINT

When the locator device is initialized, the plotter's graphics display is left unaltered.

Device name is set to plotter name.

Wait Locator Input

JWLOC/ZWLOC

The wait locator input function enables a digitizing mode in the plotters which causes the enter light to be turned on. The operator then positions the pen to the desired position and strikes the enter key. The button value returned is always "1".

Echoes Supported

Locator input can be echoed on either a graphics display device or a locator device. For the echoes supported on a graphics display device see the chapter which describes the graphics display in question.

The supported echoes on the locator device are as follows:

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	The pen tracks the locator position.

Sample Locator Input

JSLOC/ZSLOC

The sample locator input function returns the current plotter pen position without waiting for an operator response.

Echoes Supported

The plotters cannot echo sampled locator input.

Termination

JDDEV/ZLEND

The device name is set to '0006 ', and the device status and I/O unit descriptor are set to 0.

PICK DEVICE HANDLER (AGP ONLY)

Description

The dimensions of the HP 7580A/B Drafting Plotters are as follows:

Plotting area:	809.5mm wide by 524.25mm high
Platen capacity:	32380 points wide by 20790 points long
Resolution:	40.0 points/mm in X and Y directions

The dimensions of the HP 7585A/B Drafting Plotters are as follows:

Plotting area:	1066.1 mm wide by 835.5 mm high
Platen capacity:	42644 points wide by 33418 points long
Resolution:	40.0 points/mm in X and Y directions

The default pick surface is set to the size of the paper installed in the plotter when the pick is enabled. If the paper is changed while the pick is enabled, it should be of the same size that was originally in the plotter. If a different size of paper is required, the device should be disabled and reenabled after the new paper is installed in the plotter.

The physical origin of the pick device is the lower left corner of the pen movement.

Initialization

JEDEV

When the pick device is initialized, the plotter's graphics display is left unaltered.

Device name is set to plotter name.

Pick Input

JPICK

The pick input function enables a digitizing mode which causes the enter light to be turned on. The operator then positions the pen to the desired position and strikes the enter key. The button value returned is always "1".

Echoes Supported

Pick input can be echoed on either the graphics display device or the pick device. For the echoes supported on a graphics display device see the chapter which describes the graphics display in question.

The supported echoes on the pick device are as follows:

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	The pen tracks the pick position.

Termination

JDDEV

The device name is set to '0006 ', and the device status and I/O unit descriptor are set to 0.

Chapter 5
HP 1350A/1351A Graphics Translator

GENERAL INFORMATION

Descripton

AGP and DGL only support those HP 1350A/1351A Graphics Translators which contain the HP-IB device interface card with a model number of 52101-66505. HP 1350A Graphics Translators with a serial number prefix greater than or equal to 2006A already contain this interface card (52101-66505).

The user should be familiar with the operation of the HP 1350A/1351A Graphics Translators. If necessary, refer to the following manuals for the appropriate operating instructions:

HP 1350A Graphics Translator Operating and Programming Manual *(01350-90908)*

HP 1350A Graphics Translator Operating and Service Manual *(01350-90904)*

HP 1351A Graphics Translator Operating and Service Manual *(01351-90901)*

There are four displays which are currently supported with the HP 1350A/1351A Graphics Translators. The main difference between these displays is their viewing area. The supported displays are listed below:

Model	Viewing Area
HP 1310	279 mm wide by 279 mm high (11 in. by 11 in)
HP 1311	216 mm wide by 216 mm high (8.5 in. by 8.5 in)
HP 1317	254 mm wide by 254 mm high (10 in. by 10 in)
HP 1321	305 mm wide by 305 mm high (12 in. by 12 in)

If necessary, refer to the following manuals for specifications on the CRT Displays:

Model 1310B Display Operating and Service Manual *(01310-90903)*

Model 1311B Display Operating and Service Manual *(01311-90902)*

Model 1317 Display Operating and Service Manual *(01317-90905)*

Model 1321 Display Operating and Service Manual *(01321-90903)*

Logical Devices Supported

The following logical devices are supported by the graphics systems when using the HP 1350A/1351A Graphics Translators:

Logical Device	Device Handler Name	Physical Device
Graphics display	D0007	(1350A/1351A w/1310 CRT)
Graphics display	D0008	(1350A/1351A w/1311 CRT)
Graphics display	D0009	(1350A/1351A w/1317 CRT)
Graphics display	D0010	(1350A/1351A w/1321 CRT)

MULTIPLE DISPLAYS

The HP 1350A/1351A can display separate pictures on four different displays at one time. Multiple picture displays are controlled by auxiliary functions of the HP 1350A/1351A. These functions can be accessed through the use of escape functions (ZOESC, JOESC). Initially, all graphics primitives generated will appear on all of the displays connected to the HP 1350A/1351A.

Because of the difference in display sizes, each device handler holds unique transformation constants for mapping between millimeter and device coordinates. If the millimeter calls, JDLIM/ZDLIM and JDPMM/ZDPMM, are not used by the application program, any combination of display libraries and CRTs are possible without ill effects.

GRAPHICS DISPLAY DEVICE HANDLER (AGP ONLY)

Description

The HP 1350A/1351A Graphics Translators are supported with four graphics display CRTs and may drive any combination of the four at one time. Their dimensions are as follows:

Screen size:	279 mm wide by 279 mm high (HP 1310)
	216 mm wide by 216 mm high (HP 1311)
	254 mm wide by 254 mm high (HP 1317)
	305 mm wide by 305 mm high (HP 1321)
Screen capacity:	1021 points wide by 1021 points high
Aspect ratio of maximum ratio:	1.0
Resolution:	3.667 points/mm in X and Y directions (HP 1310)
	4.736 points/mm in X and Y directions (HP 1311)
	4.028 points/mm in X and Y directions (HP 1317)
	3.354 points/mm in X and Y directions (HP 1321)

When using the HP 1350A/1351A Graphics Translators, the default logical display surface corresponds to the maximum physical limits of the CRT display. The view surface is always centered within the current logical display surface. The physical origin of the graphics display is the lower left corner of display.

Memory Management

Each time a graphics item (i.e. vector endpoint or hardware-generated character) is sent to the 1350A/1351A Graphics Translators it is added to the internal memory of the translator. The HP 1350A Graphics Translator has 2048 memory locations and the HP 1351A Graphics Translator has 8192 memory locations. See the *HP 1350A/1351A Operating and Programming Manuals* for details on how graphics translator memory is organized.

As each endpoint or hardware character is written into a memory word, the write pointer is automatically incremented by one count. The write pointer value is the memory word (0-2047/0-8191) where the next move, draw, or character will be stored. The write pointer can be manipulated by the programmer through escape functions. The value of the HP 1350A/1351A Graphics Translators write pointers are maintained in software. This software maintained value accurately represents the hardware value with the exception that some of the supported escape functions do not update the software maintained value (see JOESC). The software maintained value may be inquired by calling JIESC with an OPCODE of 1050.

AGP uses the first six locations in the translator memory (six graphics items) for cursor manipulation. This limits the user to 2042 displayable graphics items with the HP 1350A or 8186 with the HP 1351A.

The write pointer value is set to word 6 by AGP at initialization. When a new-frame-action occurs the CRT is cleared, the write pointer is reset to word 6, and all visible segments are output.

If more than 2042/8186 graphics items are sent to the HP 1350A/1351A (i.e. if the write pointer is greater then 2041/8185) then a wraparound condition is produced. If wraparound occurs, then new graphics items will replace the oldest items in a sequential manner. Wraparound can result in an unspecified vector appearing on the screen if the oldest and newest graphics items are vector endpoints. If pick or locator echoing is performed on the display after wraparound occurs, then the integrity of the display will be destroyed until a new-frame-action occurs.

The user should be aware that calculating the number of graphics items used in an AGP call is not always easy. For example, since moves are optimized when in batch-of-updates or system batching modes, a move might not use a graphics item. On the other hand, in immediate visibility a graphics item will be used for the implicit move given to "0.,0.,0." when a segment is opened. It should also be noted that the different types of text will use a different number of graphics items.

Initialization

JDINT

Since the HP 1350A/1351A Graphics Translators are listen only devices, AGP cannot confirm that an HP 1350A/1351A is at the specified I/O unit descriptor. AGP will, however, check for the correct system driver and make sure the I/O unit descriptor is up. When the HP 1350A/1351A Graphics Translators are initialized the following operations are performed:

Display name is set. (See Table 5-1)

Power interrupt light on the HP 1350A/1351A is turned off.

The HP 1350A/1351A file memory is cleared of vector, text and attribute data. File memory is left unblanked and the file names are cleared. File 0 is enabled for vectors and text. The HP 1350A/1351A write pointer is set to location 6.

The logical display surface is set to the maximum physical limits of the display.

The view surface is centered within the logical display surface.

Table 5-1. Device Naming Conventions

Display Library	CRT Display	Default name	Name set at initialization
D0007	1310	'0007 '	'135010'
D0008	1311	'0008 '	'135011'
D0009	1317	'0009 '	'135017'
D0010	1321	'0010 '	'135021'

Device Enabling

JWON

Device-dependent actions are not performed on the HP 1350A/1351A Graphics Translators.

Supported Primitive Attributes

COLOR

JCOLR

The D0007, D0008, D0009, and D0010 display handlers provide a software color table of one color. The size of the color table cannot be changed. The default value of the color table is shown in Table 5-2.

Table 5-2. Default Color Table

COLOR TABLE ENTRY = 1	>> Color set to green or white, depending on the phospher in the CRT.

The color table is initialized when JDINT is called. The color table cannot be redefined or inquired using JDCOL or JICOL.

The color selected corresponds to the color defined in the color table.

```
COLOR  = 1 >> Color table entry 1 is selected
```

REDEFINING COLOR

JDCOL/JICOL

The colors in the color table cannot be redefined or inquired.

POLYGON INTERIOR COLOR

JPICL

There is one color supported by AGP on the HP 1350A/1351A Graphics Translator. The supported value of the color attribute is:

COLOR = 1 >> Color set to green or white, depending on the phospher in the CRT.

POLYGON STYLE

JDPST

Using JDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

JPILS

Refer to JLSTL for information regarding linestyle.

HIGHLIGHTING

JSHI/JGHI

Pictures are highlighted by blinking at a rate of approximately four times per second. Highlighting will affect the output on the displays connected to the TTL Outputs 1, 2, and 3. A display connected to the TTL output 4 will never be affected by highlighting. In order to have any one of the displays blink, the corresponding blinking switches located on the input/output board of the HP 1350A/1351A must be on.

LINESTYLE

JLSTL

Only one linestyle is supported on the HP 1350A/1351A.

LINESTYLE = 1 >> Primitives drawn with a solid line.

LINEWIDTH

JLWID

Only one linewidth is supported on the HP 1350A/1351A Graphics Translators.

LINEWIDTH = 1 >> Primitives drawn with a linewidth one point wide.

CHARACTER SIZES

JCSIZ

Four character cell sizes are supported on each type of display. They all have a constant aspect ratio of 1.67. The supported character sizes are:

Width	Height	(HP 1310 graphics display)
3.27 mm	5.46 mm	
6.55 mm	10.91 mm	
13.09 mm	21.82 mm	
26.18 mm	43.64 mm	

Width	Height	(HP 1311 graphics display)
2.53 mm	4.22 mm	
5.07 mm	8.45 mm	
10.14 mm	16.89 mm	
20.27 mm	33.78 mm	

Width	Height	(HP 1317 graphics display)
2.98 mm	4.97 mm	
5.96 mm	9.93 mm	
11.92 mm	19.86 mm	
23.83 mm	39.73 mm	

Width	Height	(HP 1321 graphics display)
3.57 mm	5.96 mm	
7.16 mm	11.93 mm	
14.31 mm	23.85 mm	
28.62 mm	47.70 mm	

When using medium and low quality text, the character is placed within the character cell as shown in Figure 5-1.

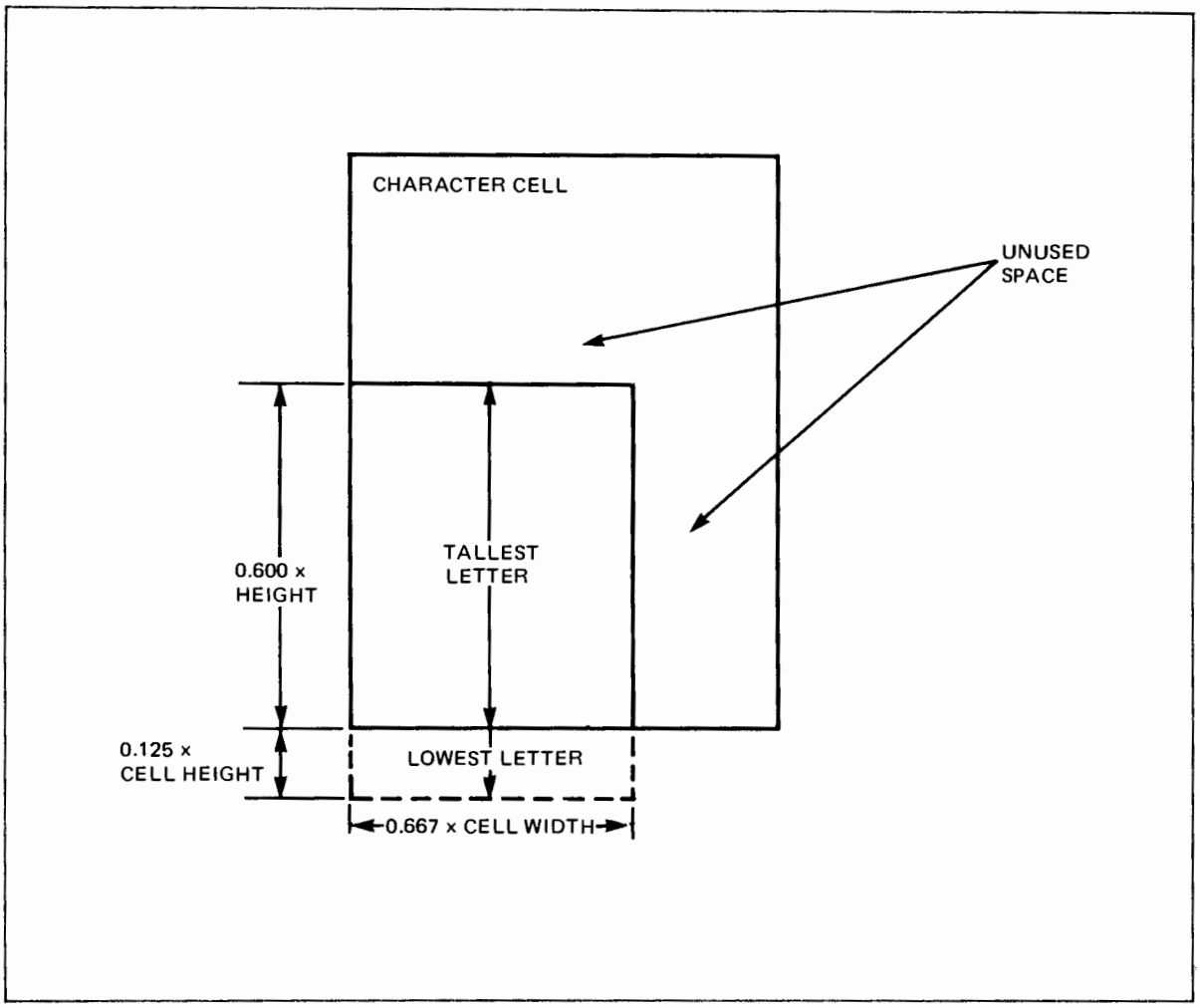


Figure 5-1. Placement of Character in Character Cell

Output Primitives

CLIPPING

The HP 1350A/1351A Graphics Translators do not provide hardware vector clipping. If clipping is turned off in AGP, and vectors or text are created with endpoints entirely or partially outside of the view surface, unpredictable results may occur.

POLYGONS

J2PGN/J3PGN/JR2PG/JR3PG

This device does not have hardware area fill.

MARKERS

J2MRK/J3MRK/JR2MK/JR3MK

The 19 standard markers are the only markers supported with the HP 1350A/1351A Graphics Translators. Markers are never larger than the box defined by the smallest character size. Marker 6 (triangle) uses five memory locations in the HP 1350A/1351A, marker 9 uses six memory locations, and all other markers use three memory locations.

MEDIUM AND LOW QUALITY TEXT

JTEXM/JTEXL

Medium and low quality graphics text are generated with a hardware character generator. The characters are drawn with a size ratio of 8 wide by 12 high in character cell with a size ratio of 10 wide by 20 high. Refer to Table 5-3 for the HP 1350A/1351A hardware character set.

Table 5-3. Supported Hardware Character Sets

Decimal Value		Octal Value	Character	Decimal Value	Octal Value	Character
3		003	ETX	55	067	7
8		010	Backspace	56	070	8
9		011	Inverse Line feed	57	071	9
10		012	Line feed	58	072	:
11	*	013	Vertical Tick Mark (|)	59	073	;
12	*	014	Horizontal Tick Mark(—)	60	074	<
13		015	Carriage Return	61	075	=
14	*	016	X Marker Symbol	62	076	>
15	*	017	Rectangle Symbol ▭	63	077	?
19		023	Pointer (←)	64	100	@
20		024	DC4	65	101	A
30	*	036	Diamond Symbol ◇	66	102	B
32		040	space	67	103	C
33		041	!	68	104	D
34		042	"	69	105	E
35		043	#	70	106	F
36		044	$	71	107	G
37		045	%	72	110	H
38		046	&	73	111	I
39		047	'	74	112	J
40		050	(	75	113	K
41		051	)	76	114	L
42		052	*	77	115	M
43		053	+	78	116	N
44		054	,	79	117	O
45		055	-	80	120	P
46		056	.	81	121	Q
47		057	/	82	122	R
48		060	0	83	123	S
49		061	1	84	124	T
50		062	2	85	125	U
51		063	3	86	126	V
52		064	4	87	127	W
53		065	5	88	130	X
54		066	6	89	131	Y

Table 5-3. Supported Hardware Character Sets (continued)

Decimal Value	Octal Value	Character	Decimal Value	Octal Value	Character
90	132	Z	109	155	m
91	133	[	110	156	n
92	134	√	111	157	o
93	135	]	112	160	p
94	136	↑	113	161	q
95	137	←	114	162	r
96	140	\	115	163	s
97	141	a	116	164	t
98	142	b	117	165	u
99	143	c	118	166	v
100	144	d	119	167	w
101	145	e	120	170	x
102	146	f	121	171	y
103	147	g	122	172	z
104	150	h	123	173	π
105	151	i	124	174	|
106	152	j	125	175	→
107	153	k	126	176	Σ
108	154	l	127	177	├

Computer Museum

New-Frame-Action

JNEWF/JPURG/JSVIS/JSHI/JVSAL/JCLR

When using D0007, D0008, D0009, and D0010, a new-frame-action causes the picture to be made current. The display is then cleared and the HP 1350A/1351A write pointer is reset to location 6. The new frame action does not affect auxiliary bits or file names which may have been set by escape functions. All visible segments are then drawn, or redrawn on the display surface.

Inquiry Escape Functions

JIESC

AGP supports one inquiry escape function with the HP 1350A/1351A.

OPCODE	FUNCTION
1050	Inquire write pointer. This function returns the value of the software maintained value of the HP 1350A/1351A write pointer. The write pointer specifies the address in the HP 1350A/1351A memory where the next graphics item will be placed. ILIST(1) = Current value of the software maintained write pointer.

Output Escape Function

JOESC

Several output escape functions are supported with the HP 1350A/1351A Graphics Translators. Error checking is not performed by the graphics system on any parameters sent to the device. Unless explicitly stated, the supported output escape functions do not modify the software maintained value of the write pointer.

The state of AGP may become undefined when an escape function is given that overrides a mode set by AGP (e.g. overriding highlighting by OPCODE 54).

In order to use the following escape codes, the user should be familiar with the *HP 1350A/1351A Operating and Programming Manuals*. The following output escape functions are supported with the HP 1350A/1351A Graphics Translators:

OPCODE	FUNCTION
50	Blank Memory. This instruction prevents the HP 1350A/1351A from displaying any information. The data in memory is not altered.

51 Unblank Memory. This instruction allows the HP 1350A/1351A to display information according to the data in the display memory (e.g. vectors and text). If a file is blanked, it will remain blanked at the completion of this call.

52 Erase Names. This erases all file names from memory and causes all memory locations to be assigned to file zero.

53 Stop Naming. Stops assigning data, vector endpoints and text characters to the last file named. This closes the current file. This function may affect highlighting of future primitives.

54 Erase Auxiliary. Removes all multiple display blanking information from memory. This function unhighlights all highlighted vectors on the display.

55 Stop Auxiliary. Stops assigning vectors and/or characters to memory which was set up by OPCODE 1056.

1050 Blank File. Prevents information associated with specified file from being displayed.

ILIST(1) = File to be blanked. Specify an integer between 0-31 for the HP 1350A and 0-63 for the HP 1351A.

1051 Erase File. Erases memory associated with specified file by writing *dummy vectors* (move to 0,0) in file memory. This command sets the hardware write pointer to location zero but does NOT modifiy the software maintained value of the write pointer.

ILIST(1) = File to be erased. Specify an integer between 0-31 for the HP 1350A and 0-63 for the HP 1351A.

1052 Find File. Moves the HP 1350A/1351A write pointers to the first memory location of the file specified. The file specified by the integer must have been previously named and must contain data. This command modifies the hardware write pointer but does NOT modify the software maintained value of the write pointer.

ILIST(1) = File to be located. Specify an integer between 0-31 for the HP 1350A and 0-63 for the HP 1351A.

1053 Name File. Assigns each subsequent vector endpoint and text character to the file specified.

ILIST(1) = File to be specified. Specify an integer between 0-31 for the HP 1350A and 0-63 for the HP 1351A.

1054 Unblank File. Causes a blanked file to be displayed.

ILIST(1) = File to be unblanked. Specify an integer between 0-31 for the HP 1350A and 0-63 for the HP 1351A.

1055 Find Location. Sets both the hardware and software maintained value of the write pointer to the location specified.

ILIST(1) = HP 1350A/1351A memory location. Specify an integer from 0-2047 inclusive for the HP 1350 and from 0-8191 inclusive for the HP 1351A.

1056 Write Auxiliary. Sets the combination of which displays are turned on and which are turned off when the HP 1350A/1351A is outputting vectors and/or character information. This function may affect highlighting.

ILIST(1) = Display parameter (0-15).

Locator Echoes on the Graphics Display

JWLOC

Locator input can be echoed on either a graphics display device or a locator device. For locator echoes on the locator device, refer to the section on the locator in question.

The HP 1350A/1351A should not be buffered by the operating system when performing locator tracking. The echoes which are supported on the HP 1350A/1351A are as follows:

ECHO#	ECHO PERFORMED
2	Small cursor

Initially, the graphics cursor will be turned on at the locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until the locator operation is terminated. Before control is returned to the application program, the graphics cursor is turned off.

3 Full cross hair cursor

Same as ECHO 2 except cursor extends across screen.

4 Rubber band line

A line will extend from the locator echo position to the current locator position (rubber band line) until the locator operation is terminated. Before control is returned to the application program, the line is removed.

5 Horizontal rubber band line

A horizontal line will be displayed which extends from the locator echo position to the X value of the current locator position until the locator operation is terminated. The line is removed before control is returned to the application program.

6 Vertical rubber band line

A vertical line will be displayed which extends from the locator echo position to the Y value of the current locator position until the locator operation is terminated. The line is removed before control is returned to the application program.

7 Horizontal/vertical rubber band line

Either a horizontal or vertical line will be displayed from the current locator echo position to the graphics cursor. The effect will be the same as ECHO 5 if the length of the horizontal line between the locator echo position is longer than the vertical line between the same two points, otherwise the effect will be the same as ECHO 6.

8 Rubber band box

A rectangle, which is defined by its diagonal (the line from the initial locator echo position to the current locator position), is used as the locator echo. When the locator operation is terminated, the box is removed and control is returned to the application program.

Pick Echoes on the Graphics Display

JPICK

For echoes supported on the pick device, see the chapter which describes the pick device in question.

The HP 1350A/1351A should not be buffered by the operating system when tracking a cursor with the pick function. The supported pick echo on the graphics display is:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the graphics cursor will be turned on at the pick echo position. The cursor will then reflect the current pick position (i.e. tracked) until the pick operation is terminated. Before control is returned to the application program, the graphics cursor is turned off.

Disabling

JWOFF

Device-dependent actions are not performed by the HP 1350A/1351A.

GRAPHICS DISPLAY DEVICE HANDLER (DGL ONLY)

Description

The HP 1350A/1351A Graphics Translators are supported with four graphics display CRTs and may drive any combination of four at one time. Their dimensions are as follows:

Screen size:	279 mm wide by 279 mm high (HP 1310)
	216 mm wide by 216 mm high (HP 1311)
	254 mm wide by 254 mm high (HP 1317)
	305 mm wide by 305 mm high (HP 1321)
Screen capacity:	1021 points wide by 1021 points high
Aspect ratio of maximum area:	1.0
Resolution:	3.667 points/mm in X and Y directions (HP 1310)
	4.736 points/mm in X and Y directions (HP 1311)
	4.028 points/mm in X and Y directions (HP 1317)
	3.354 points/mm in X and Y directions (HP 1321)

When using the HP 1350A/1351A Graphics Translators, the default logical display surface of the graphics display device corresponds to the maximum limits of the CRT display. The view surface is always centered within the current logical display surface. The physical origin of the graphics display is the lower left corner of the display.

Memory Management

Each time a graphics item (i.e. vector endpoint or hardware-generated character) is sent to the HP 1350A/1351A Graphics Translators it is added to the internal memory of the translator. The HP 1350A Graphics Translator has 2048 memory locations and the HP 1351A Graphics Translator has 8192 memory locations. See the *HP 1350A/1351A Operating and Programming Manuals* for details on how graphics translator memory is organized.

As each endpoint or hardware character is written into a memory word, the write pointer is automatically incremented by one count. The write pointer value is the memory word (0-2047/0-8191) where the next endpoint or character will be stored. The write pointer can be manipulated by the programmer through escape functions. The value of the HP 1350A/1351A Graphics Translators write pointers are maintained in software. This software maintained value accurately represents the hardware value with the exception that some of the supported escape functions do not update the software maintained value (see ZOESC). The software maintained value may be inquired by calling ZIESC with an OPCODE of 1050.

DGL uses the first six locations in the translator memory for cursor manipulation. This limits the user to 2042 displayable graphics items with the HP 1350A or 8186 with the HP 1351A.

The write pointer value is set to word 6 by DGL. If the application program produces more than 2042/8186 graphics items before a command is sent which resets the write pointer then a wraparound condition is produced. If wraparound occurs, new graphics items will replace the oldest items in a sequential manner. Wraparound can result in an unspecified vector appearing on the screen if the oldest and newest graphics items are vector endpoints. If pick or locator echoing is performed on the display after wraparound occurs, the integrity of the display will be destroyed until a new-frame-action occurs.

Initialization

ZDINT

Since the HP 1350A/1351A Graphics Translators are listen only devices, DGL cannot confirm that an HP 1350A/1351A is at the specified I/O unit descriptor. DGL will, however, check for the correct system driver and make sure the I/O unit descriptor is up. When the HP 1350A/1351A Graphics Translators are initialized the following operations are performed:

The display name is set. (See Table 5-4)

Highlighting set to 1.

The starting position is the lower left corner of the display.

Power interrupt light is turned off on the HP 1350A/1351A.

The HP 1350A/1351A file memory is cleared of vector, test and attribute data. The file memory is then displayed (unblanked). File names are cleared. File 0 is enabled for vectors and text. The HP 1350A/1351A write pointer is set to word 6. Text label direction is set to 0 degrees (horizontal).

The logical display surface is set to the maximum physical dimensions of the display.

The view surface is centered within the logical display surface.

Table 5-4. Device Naming Conventions

Display Library	CRT Display	Default name	Name set at initialization
D0007	1310	'0007 '	'135010'
D0008	1311	'0008 '	'135011'
D0009	1317	'0009 '	'135017'
D0010	1321	'0010 '	'135021'

Supported Primitive Attributes

COLOR

ZCOLR

The D0007, D0008, D0009, and D0010 display handlers provide a software color table of one color. The size of the color table cannot be changed. The default value of the color table is shown in Table 5-5.

Table 5-5. Default Color Table

COLOR TABLE ENTRY	= 1 >> Color set to green or white, depending on the phospher in the CRT.

The color table is initialized when ZDINT is called. The color table cannot be redefined or inquired using ZDCOL or ZICOL.

The color selected corresponds to the color defined in the color table.

COLOR = 1 >> Color table entry 1 is selected

REDEFINING COLOR

ZDCOL/ZICOL

The colors in the color table cannot be redefined or inquired.

POLYGON INTERIOR COLOR

ZPICL

There is one color supported by AGP on the HP 1350A/1351A Graphics Translator. The supported value of the color attribute is:

COLOR = 1 >> Color set to green or white, depending on the phospher in the CRT.

POLYGON STYLE

ZDPST

Using ZDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

ZPILS

Refer to JLSTL for information regarding linestyle.

HIGHLIGHTING

ZHIGH

Two levels of highlighting are supported on the HP 1350A/1351A Graphics Translators. Vectors and text are highlighted by blinking at a rate of approximately four times per second. Highlighting will affect the output on displays which are connected to the TTL outputs 1, 2, and 3. A display connected to TTL output 4 will never be affected by highlighting. In order to have any one of the displays blink, the corresponding blinking switches located on the input/output board must be on.

```
HIGHLIGHT = 1 >> Primitives drawn without highlighting.
          = 2 >> Primitives drawn with blinking.
```

LINESTYLE

ZLSTL

Only one linestyle is supported on the HP 1350A/1351A Graphics Translators.

```
LINESTYLE = 1 >> Primitives drawn with solid linestyle.
```

LINEWIDTH

ZLWID

Only one linewidth is supported on the HP 1350A/1351A Graphics Translators.

LINEWIDTH = 1 >> Primitives drawn with a linewidth one point wide.

CHARACTER SIZES

ZCSIZ

Four character cell sizes are supported on each type of display. They all have a constant aspect ratio of 1.67. ZCSIZ disables text rotation (see ZOESC (1057)).

The supported character sizes are:

Width	Height	(HP 1310 graphics display)
3.27 mm	5.46 mm	
6.55 mm	10.91 mm	
13.09 mm	21.82 mm	
26.18 mm	43.64 mm	

Width	Height	(HP 1311 graphics display)
2.53 mm	4.22 mm	
5.07 mm	8.45 mm	
10.14 mm	16.89 mm	
20.27 mm	33.78 mm	

Width	Height	(HP 1317 graphics display)
2.98 mm	4.97 mm	
5.96 mm	9.93 mm	
11.92 mm	19.86 mm	
23.83 mm	39.73 mm	

Width	Height	(HP 1321 graphics display)
3.57 mm	5.96 mm	
7.16 mm	11.93 mm	
14.31 mm	23.85 mm	
28.62 mm	47.70 mm	

The character is placed within the character cell as shown in Figure 5-2.

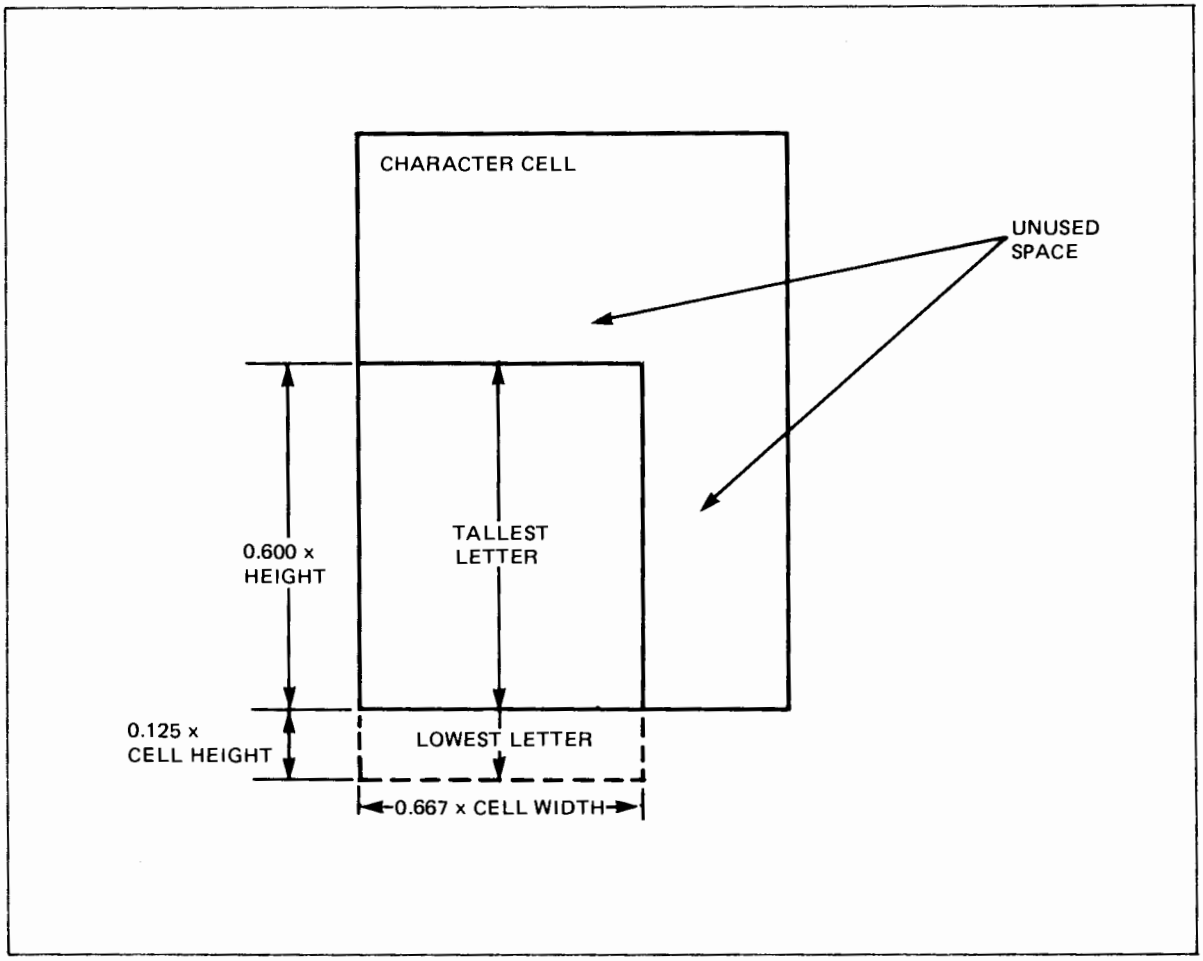


Figure 5-2. Placement of Character in Character Cell

Output Primitives

CLIPPING

The HP 1350A/1351A Graphics Translators do not provide hardware clipping. Vectors or text with endpoints entirely or partially outside of the physical limits of the display may generate unpredicable results.

POLYGONS

ZPGDD

The HP 1350A/1351A Graphics Translators do not provide hardware support of polygons. A polygon specified by ZPGDD will always be represented as described in the *DGL Reference Manual*.

MARKERS

ZMARK

The 19 standard markers are the only markers supported with the HP 1350A/1351A Graphics Translators. Markers are never larger than the box defined by the smallest character size. Marker 6 (triangle) uses five memory locations in the HP 1350A/1351A, marker 9 uses six memory locations, and all other markers use three memory locations.

TEXT

ZTEXT

Graphics text is generated with a hardware character generator. The characters are drawn with a size ratio of 8 high by 12 wide in a character cell with a size ratio of 10 wide by 20 high. Refer to Table 5-6 for the HP 1350A/1351A Graphics Translators supported hardware character set.

Through the use of escape functions (ZOESC (1057)), text may be rotated 90 degrees. Carriage returns imbedded in the ZTEXT string will move the pen to the left most border of the current row. After a call to ZTEXT, the starting position is set such that an additional call to ZTEXT will continue generating characters along the same line of text.

Table 5-6. Supported Hardware Character Sets

Decimal Value		Octal Value	Character	Decimal Value	Octal Value	Character
3		003	ETX	55	067	7
8		010	Backspace	56	070	8
9		011	Inverse Line feed	57	071	9
10		012	Line feed	58	072	:
11	*	013	Vertical Tick Mark (|)	59	073	;
12	*	014	Horizontal Tick Mark(—)	60	074	<
13		015	Carriage Return	61	075	=
14	*	016	X Marker Symbol	62	076	>
15	*	017	Rectangle Symbol ▭	63	077	?
19		023	Pointer (←)	64	100	@
20		024	DC4	65	101	A
30	*	036	Diamond Symbol ◇	66	102	B
32		040	space	67	103	C
33		041	!	68	104	D
34		042	"	69	105	E
35		043	#	70	106	F
36		044	$	71	107	G
37		045	%	72	110	H
38		046	&	73	111	I
39		047	'	74	112	J
40		050	(	75	113	K
41		051	)	76	114	L
42		052	*	77	115	M
43		053	+	78	116	N
44		054	,	79	117	O
45		055	-	80	120	P
46		056	.	81	121	Q
47		057	/	82	122	R
48		060	0	83	123	S
49		061	1	84	124	T
50		062	2	85	125	U
51		063	3	86	126	V
52		064	4	87	127	W
53		065	5	88	130	X
54		066	6	89	131	Y

Table 5-6. Supported Hardware Character Sets (continued)

Decimal Value	Octal Value	Character	Decimal Value	Octal Value	Character
90	132	Z	109	155	m
91	133	¦	110	156	n
92	134	√	111	157	o
93	135	|	112	160	p
94	136	t	113	161	q
95	137	_	114	162	r
96	140	\	115	163	s
97	141	a	116	164	t
98	142	b	117	165	u
99	143	c	118	166	v
100	144	d	119	167	w
101	145	e	120	170	x
102	146	f	121	171	y
103	147	g	122	172	z
104	150	h	123	173	π
105	151	i	124	174	|
106	152	j	125	175	→
107	153	k	126	176	Σ
108	154	l	127	177	⊢

New-Frame-Action

ZNEWF

NON-BUFFERED NEW-FRAME-ACTION
(Bit 6 of the ZDINT control word not set)

A call to ZNEWF makes the picture current and then erases the display CRT. The HP 1350A/1351A write pointers are reset to location 6. The new-frame-action does not effect auxiliary bits or file names which may have been set by escape functions.

BUFFERED NEW-FRAME-ACTION
(Bit 6 of the ZDINT control word is set)

When ZNEWF is called, the graphics display is made current. The instruction to clear the graphics display is stored in the DGL buffer and will not be sent to the device until the next time the buffer is sent. When the buffer is sent the display will be cleared, the write pointers will be reset to location 6 and whatever calls to DGL were put into the buffer after the ZNEWF call will take effect on the graphics display. The new-frame-action will not effect auxiliary bits or file names which may have been set by escape functions. The effect is that the current display will remain until the next buffer is sent. If immediate visibility is being used, the action is the same as if bit 6 were not set since the buffer is sent after every DGL call.

Inquiry Escape Functions

ZIESC

DGL supports one inquiry escape function with the HP 1350A/1351A.

OPCODE	FUNCTION
1050	Inquire write pointer. This function returns the value of the software maintained write pointer. The write pointer specifies the address in memory where the next graphics item will be placed. ILIST(1) = Current value of the software maintained write pointer.

Output Escape Functions

ZOESC

Several output escape functions are supported with the HP 1350A/1351A Graphics Translators. Error checking is not performed by the graphics system on any parameters sent to the device. Unless explicitly stated, the supported output escape functions do not modify the value of the software maintained write pointer.

In order to use the following escape codes, the user should be familiar with the *HP 1350A/1351A Operating and Programming Manuals*. The following output escape functions are supported with the HP 1350A/1351A Graphics Translators:

OPCODE	FUNCTION
50	Blank Memory. This instruction prevents the HP 1350A/1351A from displaying any information. The data in memory is not altered.
51	Unblank Memory. This instruction allows the HP 1350A/1351A to display information according to the data in the display memory (e.q. vectors and text). If a file is blanked before memory is blanked, it will remain blanked at the completion of this call.
52	Erase Names. This erases all file names from memory and causes all memory locations to be assigned to file zero.

53 Stop Naming. Stops assigning data, vector endpoints, and text characters to the last file named. This closes the current file. This function may affect highlighting.

54 Erase Auxiliary. Removes all multiple display blanking information from memory. This function unhighlights all highlighted vectors on the display.

55 Stop Auxiliary. Stops assigning vectors and/or characters to memory which was set up by OPCODE 1056.

1050 Blank File. Prevents information associated with specified file from being displayed.

ILIST(1) = File to be blanked. Specify an integer between 0-31 for the HP 1350A and 0-63 for the HP 1351A.

1051 Erase File. Erases memory associated with specified file by writing *dummy vectors* (move to 0,0) in file memory. This command sets the hardware write pointer to location zero but does NOT modify the software maintained value of the write pointer.

ILIST(1) = File to be erased. Specify an integer between 0-31 for the HP 1350A and 0-63 for the HP 1351A.

1052 Find File. Moves the HP 1350A/1351A write pointers to the first memory location of the file specified. The file specified by the integer must have been previously named and must contain some data. This command modifies the hardware write pointer but does not modify the software maintained value.

ILIST(1) = File to be located. Specify an integer between 0-31 for the HP 1350A and 0-63 for the HP 1351A.

1053 Name File. Assigns each subsequent vector endpoint and text character to the file specified.

ILIST(1) = File to be specified. Specify an integer between 0-31 for the HP 1350A and 0-63 for the HP 1351A.

1054 Unblank File. Causes a blanked file to be displayed.

ILIST(1) = File to be unblanked. Specify an integer between 0-31 for the HP 1350A and 0-63 for the HP 1351A.

1055 Find Location. Sets the write pointer to the memory location specified. Updates the software maintained value of the write pointer.

ILIST(1) = HP 1350A/1351A memory location. Specify an integer from 0-2047 inclusive for the HP 1350A and from 0-8191 inclusive for the HP 1351A.

1056 Write Auxiliary. Sets the combination of which displays are turned on and which are turned off when the HP 1350A/1351A is outputting vectors and/or character information. This function may affect highlighting.

ILIST(1) = Display parameter (0-15).

1057 Sets text direction. ZCSIZ and ZMARK will reset text direction.

ILIST(1) = 1 Text is rotated 90 degrees
<> 1 Text is reset to horizontal direction (0 degrees)

Locator Echoes on the Graphics Display

ZWLOC

Locator input can be echoed on either a graphics display device or a locator device. For echoes supported on the locator device, refer to the section which describes the locator in question.

The HP 1350A/1351A should not be buffered by the operating system when performing locator tracking. The echoes which are supported on the HP 1350A/1351A are:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the graphics cursor will be turned on at the locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until the locator operation is terminated. Before control is returned to the application program, the graphics cursor is turned off.
3	Full cross hair cursor Same as ECHO 2 except cursor extends across screen.

4 Rubber band line

A line will extend from the locator echo position to the current locator position (rubber band line) until the locator operation is terminated. Before control is returned to the application program, the line is removed.

5 Horizontal rubber band line

A horizontal line will be displayed which extends from the locator echo position to the X value of the current locator position until the locator operation is terminated. The line is removed before control is returned to the application program.

6 Vertical rubber band line

A vertical line will be displayed which extends from the locator echo position to the Y value of the current locator position until the locator operation is terminated. The line is removed before control is returned to the application program.

7 Horizontal/vertical rubber band line

Either a horizontal or vertical line will be displayed from the current locator echo position to the graphics cursor. The effect will be the same as ECHO 5 if the length of the horizontal line between the locator echo position is longer the the vertical line between the same two points, otherwise the effect will be the same as ECHO 6.

8 Rubber band box

A rectangle, which is defined by its diagonal (the line from the initial locator echo position to the current locator position), is used as the locator echo. When the locator operation is terminated, the box is removed and control is returned to the application program.

Termination

ZDEND

When the device is terminated the device name is reset as specified in Table 5-4. All attribute values remain unchanged until the system is reinitialized or the display device is enabled again.

Chapter 6
HP 9111A and HP 9111A Option 50 Graphics Tablets

GENERAL INFORMATION

The user should be familiar with the operation of the HP 9111A and HP 9111A Option 50 (previously HP 9111T) Graphics Tablets. If necessary, refer to the following manuals for the appropriate operating instructions:

HP 9111A Graphics Tablet User's Manual	*(09111-90000)*
HP 9111A Graphics Tablet Service Documentation	*(09111-90030)*
HP 9111T User's Manual Supplement	*(09111-90050)*
HP 9111T Service Documentation Supplement	*(09111-90035)*

Logical Devices Supported

The following logical devices are supported by the AGP/DGL Graphics Systems when using the HP 9111A and HP 9111A Option 50 Graphics Tablets:

Logical Device	Device Handler Name
Button	B0004
Locator	L0004
Pick (AGP only)	P0004
Valuator	V0004

When using the HP 9111A Option 50 Graphics Tablet with these device handlers it is treated as an HP 9111A with the exception that the device name is '9111T '. In order to use the local tracking capability of the HP 9111A Option 50 Graphics Tablet with an HP 1350A/1351A Graphics Translator, see Chapter 7.

BUTTON DEVICE HANDLER (AGP/DGL)

Description

The HP 9111A and HP 9111A Option 50 Graphics Tablets have a menu area which consist of sixteen boxes. The menu area of the data tablet is supported as a button device with the device handler, B0004.

Initialization

JEDEV/ZBINT

When the button device is initialized any error conditions which exist in the HP 9111A and HP 9111A Option 50 are cleared and the device name is set to '9111A ' or '9111T ' depending on the device being used.

Button Input

JBUTN/ZBUTN

When the button input function is invoked, the graphics tablet is continuously sampled until the stylus is positioned over the desired box and depressed. Control will not return to the application program until a valid box (button) is selected. Selecting a box between 1 and 16 will return the button as an integer value ranging from 1 to 16 respectively.

Echoes Supported

The button device handler supports the following echoes:

ECHO#	ECHO PERFORMED
0	When a box (button) is selected, the *menu* light will blink once.
1	When a box (button) is selected, the *menu* light will blink once and the beeper will be sounded.

Termination

JDDEV/ZBEND

The device name is set to '0004 ', and the device status and I/O unit descriptor are set to 0.

LOCATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 9111A and HP 9111A Option 50 Graphics Tablets are as follows:

Active platen size:	300.8 mm wide by 217.6 mm high The entire area within the outline on the platen.
Platen addressability:	12032 points wide by 8704 points high. The entire area within the outline on the platen.
Resolution:	40.0 points/mm in X and Y directions

The default locator limits are the active platen limits.

The physical origin of the locator device is the lower left corner of the outlined area on the platen.

The device handler required to use the locator device on the HP 9111A and HP 9111A Option 50 Graphics Tablets is L0004. When using the HP 9111A Option 50 Graphics Tablet with L0004 it is treated as an HP 9111A.

Initialization

JEDEV/ZLINT

When the locator device is initialized, any existing errors in the HP 9111A and HP 9111A Option 50 Graphics Tablets are cleared and the device name is set to '9111A ' or '9111T ' depending on the unit used.

Wait Locator Input

JWLOC/ZWLOC

When the wait locator input function is invoked, the *digitize* light on the data tablet is turned on and the position of the stylus is constantly monitored until the stylus (locator button) is depressed. To digitize a point, the operator positions the stylus to desired position and depresses it. When the the stylus is depressed, the *digitize* light is turned off, the digitized point is returned, and the value of the locator button is returned to the application program.

Echoes Supported

The HP 9111A and HP 9111A Option 50 Graphics Tablets can echo on any graphics display which support locator echoes. For the echoes supported on the graphics display device, see the chapter which discusses the graphics display in question. The supported echoes on the locator device are as follows:

ECHO#	ECHO PERFORMED
0	Echo is not performed.
1	The beeper is sounded when the stylus is depressed.

Sample Locator Input

JSLOC/ZSLOC

The sample locator input function returns the current position of the stylus on the platen without waiting for an operator response.

Echoes Supported

The following locator echoes are supported with the HP 9111A and HP 9111A Option 50 Graphics Tablets when using the sample locator function:

ECHO#	ECHO PERFORMED
0	Echo is not performed.
1	The beeper is sounded when the locator is sampled.

Termination

JDDEV/ZLEND

The device name is set to '0004 ', and the device status and I/O unit descriptor are set to 0.

PICK DEVICE HANDLER (AGP ONLY)

Description

The dimensions of the HP 9111A and HP 9111A Option 50 Graphics Tablets are as follows:

Active platen size:	300.8 wide by 217.6 mm high The entire area within the outline on platen.
Platen addressability:	12032 points wide by 8704 points high. The entire area within the outline on platen.
Resolution:	40.0 points/mm in X and Y directions

The default pick limits are the limits of the active platen area.

The physical origin of the pick device is the lower left corner of the outlined area on the platen.

The device handler required to use the pick device on the HP 9111A and HP 9111A Option 50 Graphics Tablets is P0004.

Initialization

JEDEV

When the pick device is initialized, any existing errors in the HP 9111A and HP 9111A Option 50 are cleared and the device name is set to '9111A ' or '9111T 'depending on the unit used.

Pick Input

JPICK

When the pick input function is invoked, the *digitize* light on the data tablet is turned on and the position of the stylus is constantly tracked until the stylus (pick button) is depressed. To digitize a point, the operator positions the stylus to the desired position and depresses it. The *digitize* light is turned off when the stylus is depressed. The segment name, pick-ID, and the value of the pick button are then returned to the application program.

Echoes Supported

The HP 9111A and HP 9111A Option 50 Graphics Tablets can echo on any graphics display which support pick echoes. For the echoes supported on the graphics display device see the chapter which discusses the graphics display in question. The supported echoes on the pick device are as follows:

ECHO#	ECHO PERFORMED
0	Echo is not performed.
1	The beeper is sounded when the stylus is depressed.

Termination

JDDEV

The device name is set to '0004 ', and the device status and I/O unit descriptor are set to 0.

VALUATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 9111A and HP 9111A Option 50 Graphics Tablets are as follows:

Active platen size:	300.8 wide by 217.6 mm high The entire area within the outline on platen.
Platen addressability:	12032 points wide by 8704 points high. The entire area within the outline on platen.
Resolution:	40.0 points/mm in X and Y directions

The valuator device handler for the HP 9111A and HP 9111A Option 50 Graphics Tablets support three subvaluators. Two of the subvaluators are simulated by taking the X and Y coordinates of the stylus position and scaling them to values which range from 0.0 to 1.0. The third valuator is simulated by the tip of the stylus. If the stylus is not depressed the value returned is 0.0; if the stylus is depressed the value returned is 1.0. The device handler required to use the valuator device on the HP 9111A and HP 9111A Option 50 Graphics Tablets is V0004. When using the HP 9111A Option 50 Graphics Tablet with V0004 it is treated as an HP 9111A.

Initialization

JEDEV/ZVINT

When the valuator device is initialized, any existing errors in the HP 9111A and HP 9111A Option 50 are cleared and the device name is set to '9111A ' or '9111T ' depending on the unit being used.

Wait Valuator Input

JWVAL/ZWVAL

When the wait valuator input function is invoked, the *digitize* light on the graphics tablet is turned on and the position of the stylus is constantly monitored until the stylus is depressed. The values returned are a function of the subvaluator specified as follows:

Subvaluator	Value returned
1	Value returned is the X coordinate of the stylus position scaled to a number between 0.0 and 1.0. If the stylus is on or to the left of the left border of the active area then 0.0 will be returned. If the stylus is on or to the right of the right border of the active area then 1.0 will be returned.
2	Value returned is the Y coordinate of the stylus position scaled to a number between 0.0 and 1.0. If the stylus is on or below the lower border of the active area then 0.0 will be returned. If the stylus is on or above the upper border of the active area then 1.0 will be returned.
3	Value returned is always 1.0 since stylus must be depressed to terminate the wait valuator function. This can be used to perform an operator pause in the application program.

When the the stylus (valuator button) is depressed, the *digitize* light is turned off, the requested subvaluator value is returned, and the valuator button (always 1) is returned to the application program.

Echoes Supported

The supported echoes on the valuator device are as follows:

ECHO#	ECHO PERFORMED
0	Echo is not performed.
1	The beeper is sounded when the stylus is depressed.

Computer Museum

Sample Valuator Input

JSVAL/ZSVAL

The sample valuator input function samples the current position of the stylus on the platen without waiting for an operator response. The value returned is a function of the subvaluator specified as follows:

Subvaluator	Value returned
1	Value returned is the X coordinate of the stylus position scaled to a number between 0.0 and 1.0. If the stylus is on or to the left of the left border of the active area then 0.0 will be returned. If the stylus is on or to the right of the right border of the active area then 1.0 will be returned.
2	Value returned is the Y coordinate of the stylus position scaled to a number between 0.0 and 1.0. If the stylus is on or below the lower border of the active area then 0.0 will be returned. If the stylus is on or above the upper border of the active area then 1.0 will be returned.
3	Value returned depends on whether stylus is depressed at the time the sample function occurs. If the stylus is not depressed 0.0 is returned, if it is depressed 1.0 is returned.

Echoes Supported

The following valuator echoes are supported with the HP 9111A and HP 9111A Option 50 Graphics Tablets when using the sample valuator function:

ECHO#	ECHO PERFORMED
0	Echo is not performed.
1	The beeper is sounded when the valuator is sampled.

Termination

JDDEV/ZVEND

The device name is set to '0004 ', and the device status and I/O unit descriptor are set to 0.

Chapter 7
HP 9111A Option 50 Graphics Tablet

GENERAL INFORMATION

The HP 9111A Option 50 Graphics Tablet (previously HP 9111T) is an HP-IB input device which is designed to work in conjunction with the HP 1350A/1351A Graphics Translators. The HP 9111A Option 50 differs from the HP 9111A in that it can locally control cursor operations on the HP 1350A/1351A without burdening the CPU.

The user should be familiar with the operation of the HP 9111A Option 50 Graphics Tablet. If necessary, refer to the following manuals for the appropriate operating instructions:

HP 9111A Graphics Tablet User's Manual	*(09111-90000)*
HP 9111A Graphics Tablet Service Documentation	*(09111-90030)*
HP 9111T User's Manual Supplement	*(09111-90050)*
HP 9111T Service Documentation Supplement	*(09111-90035)*

Logical Devices Supported

The following logical devices are supported by the AGP/DGL Graphics Systems when using the HP 9111A Option 50 Graphics Tablet:

Logical Device	Device Handler Name	
Button	B0004	(see Chapter 6)
Locator & HP 1350A/1351A with local tracking	L0005	
Locator w/o local tracking	L0004	(see Chapter 6)
Pick & HP 1350A/1351A with local tracking	P0005	
Pick w/o local tracking	P0004	(see Chapter 6)
Valuator	V0004	(see Chapter 6)

When using the HP 9111A Option 50 with devices other than the HP 1350A/1351A Graphics Translators, the locator and pick libraries (L0004 and P0004) which treat the HP 9111A Option 50 as an HP 9111A should be used (see Chapter 6).

LOCATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 9111A Option 50 Graphics Tablet are as follows:

Active area:	The active area of the platen is a square which is 204.0 mm high. The lower left corner of this square is the point which is 48.4 mm to the right of the leftmost outline of the platen and which is on the bottom outline of the platen.
Addressability:	8160 points wide by 8160 points high
Resolution:	40.0 points/mm in X and Y directions

The default locator limits are the active area limits. When using this device handler, the locator limits cannot be changed. Any calls to ZLLIM or JLLIM will therefore be ignored.

The physical origin of the locator device is the point which is 48.4 mm to the right of the left border of the outline on the platen and on the lower border of the outline on the platen.

The device handler required to use the locator device on the HP 9111A Option 50 Graphics Tablet with local cursor tracking on the HP 1350A/1351A Graphics Translators is L0005.

Initialization

JEDEV/ZLINT

When the locator device is initialized, any existing errors in the HP 9111A Option 50 are cleared and the device name is set to '9111T '.

Wait Locator Input

JWLOC/ZWLOC

When the wait locator input function is invoked, the *digitize* light on the data tablet is turned on. To digitize a point, the operator positions the stylus to the desired position and depresses it. When the stylus is depressed, the *digitize* light is turned off, the digitized point is returned, and the value of the locator's button is returned to the application program.

Echoes Supported

The HP 9111A Option 50 can echo locator input on the HP 1350A/1351A Graphics Translators or on the locator associated with the HP 9111A Option 50.

The supported echoes on the HP 9111A Option 50 are as follows:

ECHO#	ECHO PERFORMED
0	Echo is not performed.
1	The beeper is sounded when the stylus is depressed.

When echoing on the graphics display, the active area on the HP 9111A Option 50 maps to the entire physical limits of the HP 1350A/1351A regardless of the current aspect ratio of the view surface and the current logical display limits. If a program attempts to perform echoing on the graphics display when the HP 1350A/1351A is is not enabled, ECHO 1 will be performed.

The supported echoes on the HP 1350A/1351A Graphics Translators, when using the local tracking capabilities of the HP 9111A Option 50, are as follows:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the graphics cursor will be turned on at the locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until the locator operation is terminated. Before control is returned to the application program, the graphics cursor is turned off.
3	Full cross-hair cursor Same as ECHO 2 except cursor extends across screen.
4	Rubber band line A line will extend from the locator echo position to the current locator position (rubber band line) until the locator operation is terminated. Before control is returned to the application program, the line is removed.
5	Horizontal rubber band line A horizontal line will be displayed which extends from the locator echo position to the X value of the current locator position until the locator operation is terminated. The line is removed before control is returned to the application program.
6	Vertical rubber band line A vertical line will be displayed which extends from the locator echo position to the Y value of the current locator position until the locator operation is terminated. The line is removed before control is returned to the application program.
7	Horizontal/vertical rubber band line Same as ECHO 4.

8	Rubber band box A rectangle, which is defined by its diagonal (the line from the initial locator echo position to the current locator position), is used as the locator echo. When the locator operation is terminated, the box is removed and control is returned to the application program.

Sample Locator Input

JSLOC/ZSLOC

The sample locator input function returns the current position of the stylus on the platen without waiting for an operator response.

Echoes Supported

The following locator echoes are supported on the 9111A Option 50 Graphics Tablet when using the sample locator function.

ECHO#	ECHO PERFORMED
0	Echo is not performed.
1	The beeper is sounded when the locator is sampled.

Termination

JDDEV/ZLEND

The device name is set to '0005 ', and the device status and I/O unit descriptor are set to 0.

PICK DEVICE HANDLER (AGP ONLY)

Computer Museum

Description

The dimensions of the HP 9111A Option 50 Graphics Tablet are as follows:

Active area:	The active area of the platen is a square which is 204.0mm wide and 204.0 mm high. The lower left corner of this square is the point which is 48.4 mm to the right of the leftmost outline of the platen and which is on the bottom outline of the platen.
Addressability:	8160 points wide by 8160 points high
Resolution:	40.0 points/mm in X and Y directions

The default pick limits are the active area limits. When using this device handler, the pick limits cannot be changed and any calls to JPLIM will be ignored.

The physical origin of the pick device is the point which is 48.4 mm to the right of the left border of the outline on the platen and on the lower border of the outline on the platen.

The device handler required to use the pick device on the HP 9111A Option 50 Graphics Tablet with local cursor tracking on the HP 1350A/1351A Graphics Translators is P0005.

Initialization

JEDEV

When the pick device is initialized, any existing errors in the HP 9111A Option 50 are cleared and the device name is set to '9111T '.

Pick Input

JPICK

When the pick input function is invoked, the *digitize* light on the data tablet is turned on. To digitize a point, the operator positions the stylus to the desired position and depresses it. When the stylus is depressed, the *digitize* light is turned off, the name of the closest segment, pick-ID and the value of the pick's button are returned to the application program.

Echoes Supported

The HP 9111A Option 50 can echo pick input on the HP 1350A/1351A or on the HP 9111A Option 50.

The supported echoes on the HP 9111A Option 50 are as follows:

ECHO#	ECHO PERFORMED
0	Echo is not performed.
1	The beeper is sounded when the stylus is depressed.

When echoing on the HP 1350A/1351A, the active area on the HP 9111A Option 50 maps to the entire physical limits of the HP 1350A/1351A regardless of the current aspect ratio of the view surface and the current logical display limits. If a program attempts to perform echoing on the graphics display when the HP 1350A/1351A is not enabled, ECHO 1 will be performed.

The supported echoes on the HP 1350A/1351A Graphics Translators, when using the local tracking capabilities of the HP 9111A Option 50, are as follows:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the graphics cursor will be turned on at the pick echo position. The cursor will then reflect the current pick position (i.e. tracked) until the pick operation is terminated. Before control is returned to the application program, the graphics cursor is turned off.

Termination

JDDEV

The device name is set to '0005 ', and the device status and I/O unit descriptor are set to 0.

Chapter 8
HP 2623A Graphics Terminal

GENERAL INFORMATION

The user should be familiar with the operation of the HP 2623A Graphics Terminal. If necessary, refer to the following manuals for the appropriate operating instructions:

HP 2623A Graphics Terminal User's Manual (02623-90001)

HP 2623A Graphics Terminal Reference Manual (02622-90002)

Logical Devices Supported

The following logical devices are supported by the AGP/DGL Graphics Systems when using the HP 2623A Graphics Terminal:

Logical Device	Device Handler Name
Alphanumeric	A0001
Button	B0001
Graphics display	D0019
Keyboard	K0001
Locator	L0019
Pick (AGP only)	P0019
Valuator	V0019

Device Configuration

The HP 2623A Graphics Terminal should be strapped for normal point-to-point operation. The terminal should not be in block mode.

ALPHANUMERIC DEVICE HANDLER (AGP/DGL)

Description

The HP 2623A Graphics Terminal has independent alphanumeric and graphic display memories which allow either or both types of data to be displayed on the same CRT. The alphanumeric device handler, A0001, allows the application programmer to send messages and alphanumeric display control commands to the HP 2623A Graphics Terminal.

The dimensions of the alphanumeric display are as follows:

Screen size: 215 mm wide by 164 mm high

Screen capacity: 24 lines and 80 characters per line

Character size: 2.4 mm wide by 4.24 mm high

Initialization

JEDEV/ZAINT

When the alphanumeric device is initialized, the alphanumeric display is turned on and the contents of the alphanumeric memory are left unchanged. DGL sets the device name to '2623A '.

Alphanumeric Output

JALPH/ZALPH

The state of the alphanumeric display is not altered before sending the character string to the terminal. The entire character string passed is sent directly to the terminal. A maximum of 132 characters can be sent to the alphanumeric device at one time. If the text output exceeds the size of a line, the terminal performs a carriage return-line feed and text output continues on the next line. The character string may contain alphanumeric characters or command sequences which control the alphanumeric display (e.g. clear alphanumeric memory, alphanumeric cursor control, etc.). Command sequences which affect other parts of the terminal (i.e. graphics display) should not be contained in the string since they could destroy the integrity of the graphics system.

Termination

JDDEV/ZAEND

When the alphanumeric device is terminated, the alphanumeric display is not affected. The device name is set to '0001', and the device status and I/O unit descriptor are set to 0.

BUTTON DEVICE HANDLER (AGP/DGL)

Description

The HP 2623A Graphics Terminal has eight *softkeys* which together are supported as a button device. These keys are above the standard ASCII keys and are labeled *f1* through *f8*. The numeric keys 1 through 8 can also be used in the same way as the softkeys. The device handler required to use the button device on the HP 2623A Graphics Terminal is B0001. When using the HP 2623A button device, the terminal should not be in block mode.

Note: If the softkeys are to be used, the labels f1 through f8 must appear on the softkey area of the alphanumeric display.

Initialization

JEDEV/ZBINT

When the button device is initialized, all previous softkey definitions are destroyed. The softkeys *f1* through *f8* are loaded with the ASCII characters 1 through 8 respectively. The device name is set to '2623A '.

Button Input

JBUTN/ZBUTN

Once the button device has been enabled, it is available for input operations. When JBUTN or ZBUTN are called, a read operation is set pending on the terminal. Striking a softkey or an ASCII key between 1 and 8 will return the button as an integer value ranging from 1 to 8. If an invalid, transmittable (i.e. ASCII) key is struck, an integer 0 will be returned as the button value.

Echoes Supported

The button device handler supports the following echoes:

ECHO#	ECHO PERFORMED
0	Echoing is not performed
1	The terminal bell is sounded if a valid button is activated.

Termination

JDDEV/ZBEND

When the button device is terminated, the softkey definitions remain as they were defined by the button device initialization. The device name is set to '0001 ', and the device status and I/O descriptor are set to 0.

GRAPHICS DISPLAY DEVICE HANDLER (AGP ONLY)

Description

The dimensions of the HP 2623A Graphics Terminal is as follows:

Screen size:	215 mm wide by 164 mm high
Screen capacity:	512 points wide by 390 points high
Aspect ratio of maximum area:	.7612
Resolution:	2.3814 points/mm in X direction and 2.3780 points/mm in Y direction.

The default logical display surface of the graphics display device is the maximum physical limits of the screen. The physical origin is the lower left corner of the display.

The view surface is always centered within the current logical display surface.

Initialization

JDINT

When the HP 2623A Graphics Terminal is initialized, the following operations are performed:

Device name is set to '2623A '.

The graphics cursor is turned off and is in the lower left corner of the display.

Alphanumeric memory is unaffected.

The alphanumeric and graphics displays are turned on.

The color table will be initialized to the default values. See color section for the default color table.

The screen is cleared unless bit 7 is set in the control word for the JDINT call. If bit 7 is set, graphics memory is unaffected.

The following occurs which applies to low and medium quality text:
- Slant is set to 0 degrees (no slant)
- Label direction is set to 0 degrees (horizontal)
- Label origin is set to 1 (left,bottom justified)

User-defined area and line patterns are set to solid.

The logical display surface is set to the maximum physical limits of the display.

The view surface is centered within the logical display surface.

Simulated raster erase is enabled if bit 3 of the control word in the JDINT call was set. See new-frame-action for details on simulated raster erase.

Device Enabling

JWON

Device-dependent actions are not performed for the HP 2623A Graphics Terminal.

Supported Primitive Attributes

COLOR

JCOLR

The D0019 display handler provides a software color table of two colors. The colors available are black and white. The size of the color table cannot be changed. The default values of the color table are shown in Table 8-1.

Table 8-1. Default Color Table

COLOR TABLE ENTRY = 0 >> Color set to black (background color) = 1 >> Color set to white.

The color table is initialized when JDINT is called. The color table cannot be redefined or inquired using JDCOL or JICOL.

The color selected corresponds to the color defined in the color table.

COLOR = 0 >> Color table entry 0 is selected
= 1 >> Color table entry 1 is selected

REDEFINING COLOR

JDCOL/JICOL

The colors in the color table cannot be redefined or inquired.

POLYGON INTERIOR COLOR

JPICL

There are two colors supported by AGP on the HP 2623A Graphics Terminal (black and white). Both colors can be displayed at one time. The supported values of the color attributes are:

COLOR = 0 >> Color set to black (background color)
= 1 >> Color set to white.

POLYGON STYLE

JDPST

Using JDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

JPILS

The interior linestyle attribute is ignored if device-dependent area fill is requested. Refer to JLSTL for information regarding linestyle for device-independent polygon interiors.

HIGHLIGHTING

JSHI/JGHI

Highlighting is not supported on the HP 2623A Graphics Terminal.

LINESTYLE

JLSTL

Eight predefined linestyles are supported on the HP 2623A Graphics Terminal. In addition, two user-definable styles can be selected. These linestyles can be defined through the use of output escape functions (JOESC) 2050 and 8050. Initially, the two user-definable linestyles are set to solid. See Figure 8-1 for the linestyles available on the HP 2623A Graphics Terminal.

All of the supported linestyles are *continuous* linestyles. Refer to the JLSTL subroutine description in the *AGP Reference Manual* for a complete description of a continuous linestyle.

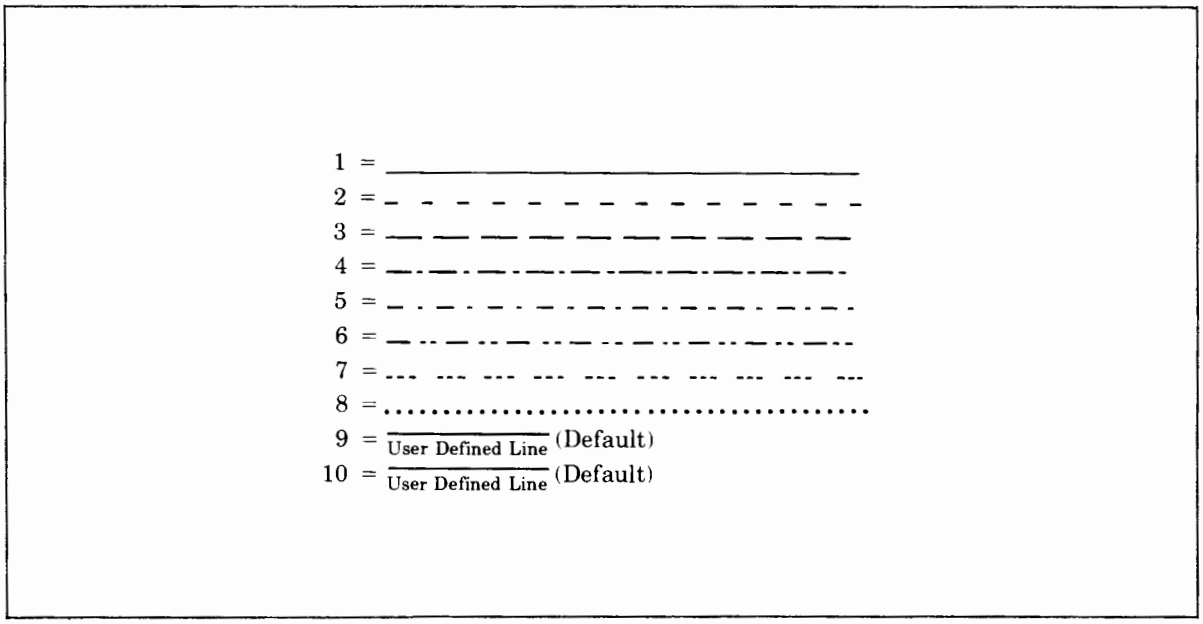


Figure 8-1. Supported Linestyles

LINEWIDTH

JLWID

Only one linewidth is supported on the HP 2623A Graphics Terminal.

```
LINEWIDTH = 1 >> Primitives drawn with a linewidth of one pixel.
```

CHARACTER SIZES

JCSIZ

There are eight distinct character sizes supported on the HP 2623A Graphics Terminal. They all have a constant aspect ratio of 1.43. The supported character sizes are:

Width	Height
2.9 mm	4.2 mm
5.9 mm	8.4 mm
8.8 mm	12.5 mm
11.8 mm	16.7 mm
14.7 mm	21.0 mm
17.7 mm	25.3 mm
20.5 mm	29.5 mm
23.5 mm	33.7 mm

When using medium and low quality text, the character is placed within the character cell as shown in Figure 8-2.

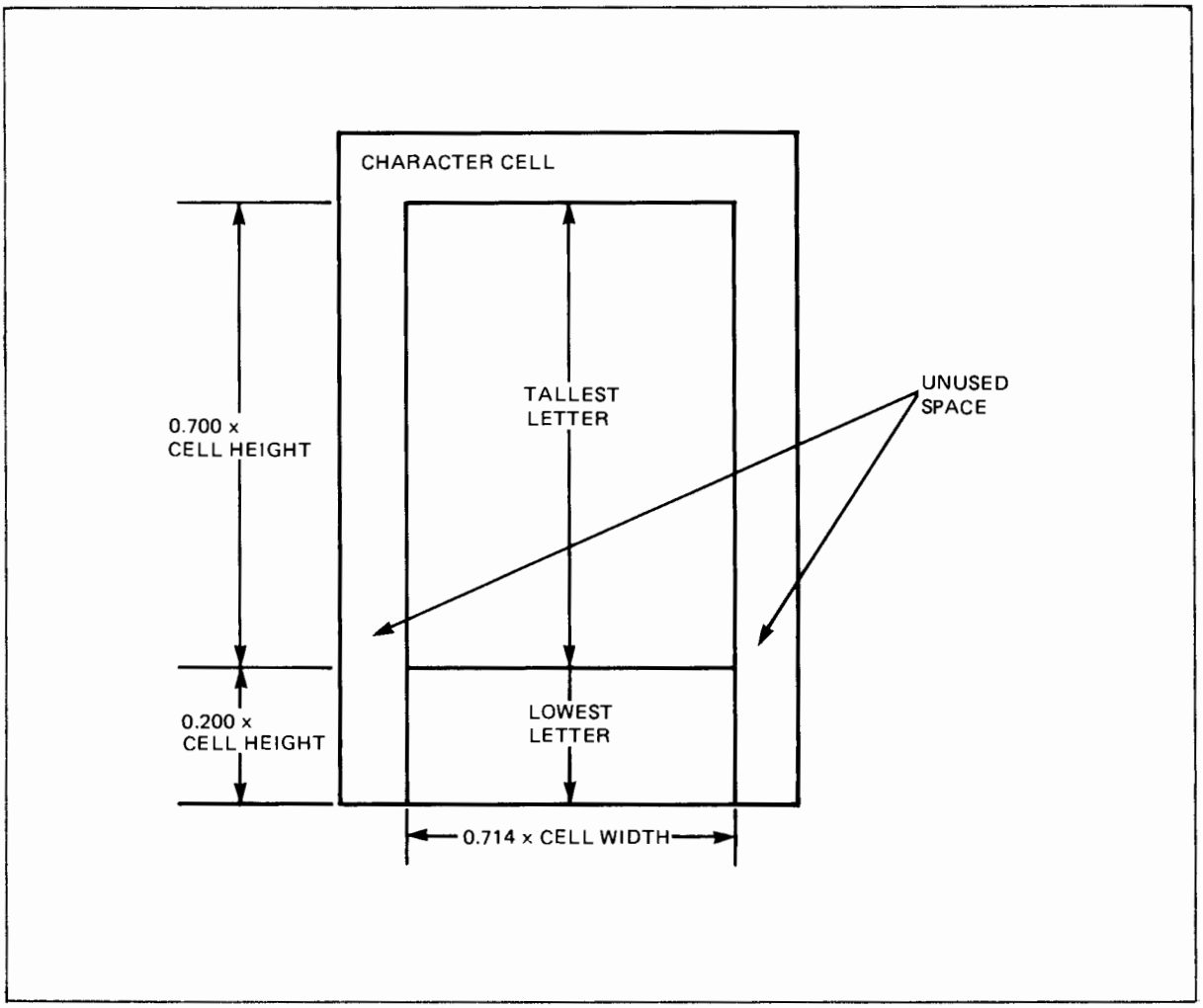


Figure 8-2. Placement of Character in Character Cell

Output Primitives

CLIPPING

The HP 2623A Graphics Terminal does not provide hardware vector clipping. If window clipping is turned off in AGP and vectors are created that lie entirely or partially outside of the view surface, unpredictable results may occur. Medium and low quality text strings will be clipped if they do not lie entirely within the physical limits of the graphics display.

POLYGONS

J2PGN/J3PGN/JR2PG/JR3PG

Single rectangles with device-dependent polygon styles are displayed using HP 2647A/2747F/2748A hardware area fill. Their edges must be parallel to the X and Y axes of the virtual coordinate system. Polygon sets which contain more than one member polygon will not be filled even if each member is a rectangle.

If the style specifies a fill density of 1.0 or -1.0, then the rectangle will be filled with the current user-defined area pattern. The default for this pattern is solid. (See JOESC, OPCODE 8050, for further details.)

If the style specifies any other fill density, then the rectangle will be filled with a pattern that approximates the requested interior density to the nearest multiple of 1/8, and approximates the interior orientation to the nearest multiple of 45 degrees. Crosshatching is supported, but the interior linestyle attribute is ignored.

Except when the style specifies a fill density of 1, -1, or 0, the user-defined area fill pattern will be set to solid, after device-dependent display of a rectangle.

MARKERS

J2MRK/J3MRK/JR2MK/JR3MK

The nineteen standard markers are the only markers supported with the HP 2623A Graphics Terminal. The smallest character size (2.9 mm by 4.2 mm) is always used to generate markers.

MEDIUM AND LOW QUALITY TEXT

JTEXM/JTEXL

Medium and low quality graphics text are generated with a hardware character generator. The characters are drawn with a size ratio of 5 wide and 7 high in a character cell with a size ratio of 7 wide by 10 high. See Figure 8-3 for the viewable graphics character set.

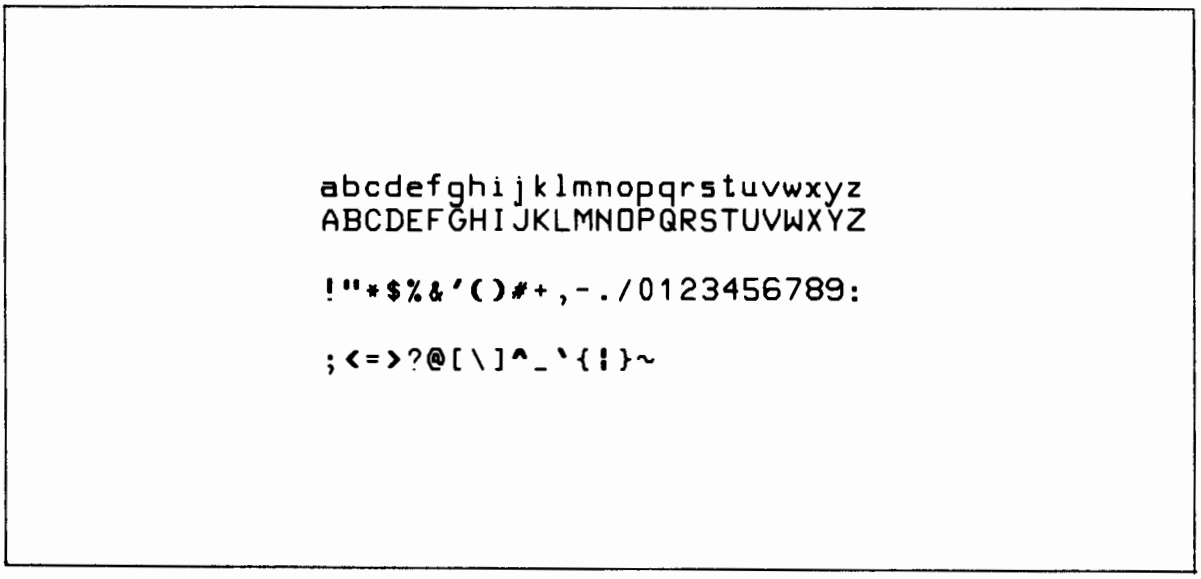


Figure 8-3. Supported Graphics Text Characters

If a medium or low quality text string is not clipped by AGP and extends beyond the physical limits of the graphics display, all characters which do not lie entirely within the physical limits will be clipped by the terminal.

Medium and low quality text use the color attribute but do not use the linestyle and linewidth attributes. Characters are always generated using solid lines. The direction, slant, and justification of these types of

text can be modified through the use of escape functions (see JOESC 1050, 1051 and 1052).

New-Frame-Action

JNEWF/JPURG/JSVIS/JSHI/JVSAL/JCLR

The action taken when a new-frame-action is given is dependent on whether the simulated raster erase bit was set during the JDINT call and is outlined in the following two sections.

SIMULATED RASTER ERASE NOT SET

A new-frame-action given when the device is enabled and not in a batch of updates will clear the CRT to the background color and redraw all visible segments.

When the new-frame-action is given with the display not enabled, it will not alter the display.

When given inside a batch of updates the screen will not be changed until the call JUPDT is given. At this time the screen will be cleared to the background color and all visible segments will be redrawn.

SIMULATED RASTER ERASE SET

The HP 2623A Graphics Terminal has the ability to undraw images. AGP will use this feature when the simulated raster erase bit is set in the JDINT call. AGP will use this feature to remove graphics elements without first clearing the CRT. For example, AGP uses simulated raster erase when a segment is purged.

Note: Undrawing is done by redrawing the image in black (i.e. the background color); therefore, white lines crossing the image to be purged may also have parts of them undrawn, leaving holes.

An explicit JNEWF call will always clear the CRT and redraw all visible segments when given on an enabled work station outside of a batch of updates. This gives the user of simulated raster erase a means of generating a clean surface (one without holes).

The other calls that implicitly cause a new-frame-action (e.g. JPURG) use simulated raster erase only when the work station is enabled. Simulated raster erase is not used on disabled work stations, since by definition, the display must not change. Simulated raster erase is not used in a batch of updates since changes cannot occur to the display until the JUPDT call is given. A new-frame-action inside a batch of updates will always result in the screen being cleared and visible segments being redrawn when the JUPDT call is given.

Inquiry Escape Functions

JIESC

The following inquiry escape functions are supported by AGP with the HP 2623A Graphics Terminal:

OPCODE	FUNCTION
3050	Inquire medium and low quality text status.

ILIST(1) = Current medium and low quality hardware text justification. See Figure 8-4 for possible values.
ILIST(2) = Current medium and low quality hardware text direction. Possible values are 0, 90, 180, or 270 degrees.
ILIST(3) = Current medium and low quality hardware text slant. Possible values are 0 and 45 degrees.

Output Escape Functions

JOESC

Several output escape functions are supported by AGP with the HP 2623A Graphics Terminal. Error checking is not performed by the graphics system on any of the parameters which are to be sent to the device. If a parameter is outside of the range specified in the escape function definition, the terminal will ignore the function.

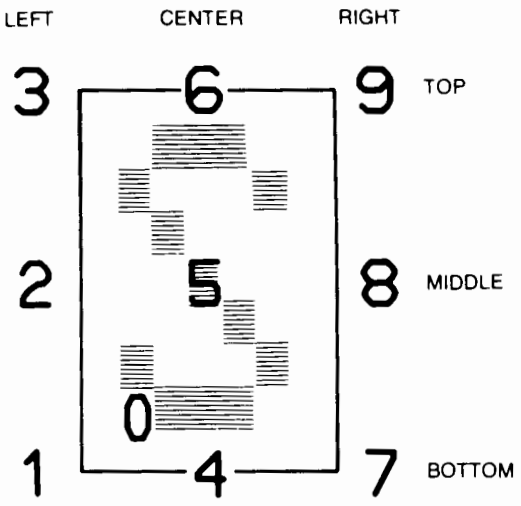
Escape functions are not stored in the segment display area. This can have implications when used with AGP segments. For example, suppose the linestyle is set to 10 and the escape function JOESC(2050) is used to define a line pattern. A segment is created and then appears on the screen with the given line pattern. If the line pattern is changed and a new-frame-action is given, the segment will be redrawn with the current line pattern and not the line pattern with which it was originally created.

Escape functions may have undesirable effects on low and medium quality text. For example, if JJUST is used to set AGP justification to center and a hardware justification is chosen, the text cannot end up justified.

Escape functions are sent from AGP directly to DGL. The state of AGP may become undefined when an escape function is given that overrides a mode set by AGP (e.g. hardware text justification).

The following output escape functions are supported with the HP 2623A Graphics Terminal:

OPCODE	FUNCTION
450	Perform rectangular area fill using the current linestyle and color. The rectangular area is specified in virtual coordinates. RLIST(1) = Minimum X border of rectangle RLIST(2) = Maximum X border of rectangle RLIST(3) = Minimum Y border of rectangle RLIST(4) = Maximum Y border of rectangle
1050	Set device text direction which will apply to subsequently output low quality graphics text and will apply on a character by character basis for subsequently output medium quality text. ILIST(1) = New text direction 0 = 0 degrees (horizontal) 1 = 90 degrees counterclockwise 2 = 180 degrees counterclockwise 3 = 270 degrees counterclockwise
1051	Set device character slant for subsequently output medium and low quality graphics text. ILIST(1) = Text slant 0 = 0 degrees (normal) 1 = 45 degrees
1052	Set device text justification for subsequently output medium and low quality graphics text. This will apply to characters individually for medium quality graphics text. ILIST(1) = Text justification. See Figure 8-4 for the supported justifications.
1055	Turn graphics display on/off. This only controls whether the graphics memory is displayed by the terminal. It does not affect the contents or output primitives sent. ILIST(1) = 0 >> Turn graphics display off = 1 >> Turn graphics display on



The numbers 1-9 represent the cursor position with respect to the character cell used for graphics text characters. The number 0 represents the cursor position with respect to the character (not this cell).

JUSTIFICATION/ORIGIN. Text strings can be automatically right or left justified, or centered about a specified point. An ASCII character 0 through 9 indicates the origin (justification and base line) for characters with respect to the current pen position. This function is useful when drawing labels.

If text is left justified, the current pen position is the left margin. Center causes the label to be centered on the pen position. Right justify selects the pen position as the right margin. Bottom, middle, and top select the base line for the line of text.

For example, if text was to be right justified and set with a base line on top of the normal character position, the number "9" would be used.

Figure 8-4. Hardware Text Justification

1056 Set special drawing modes. Using this escape function will override the color as defined by the JCOLR call. After generating output primitives in a special drawing mode, the application program can terminate the special drawing mode by making any call to JCOLR. See Figure 8-5 for the effect of color and the special drawing modes.

ILIST(1) = 1 >> Enable complement drawing mode.

All primitives output in this mode will toggle the color of the pixels on the display. For example, when drawing a line in this mode, all white pixels in the line's path will turn black, and all black pixels will turn white.

= 2 >> Enable jam drawing mode.

Jam mode has the affect of overlaying the output primitives generated with it over the current primitives on the graphics display.

2050 Define line pattern. This allows the user to define the dot pattern used to draw vectors. Once a line pattern is defined, it can be used by setting the linestyle to 9. See Figure 8-6 for examples on defining line patterns.

ILIST(1) = A decimal value between 0 and 255 which defines an 8-bit binary pattern.
ILIST(2) = A scale factor between 1 and 16 to be applied to the pattern.

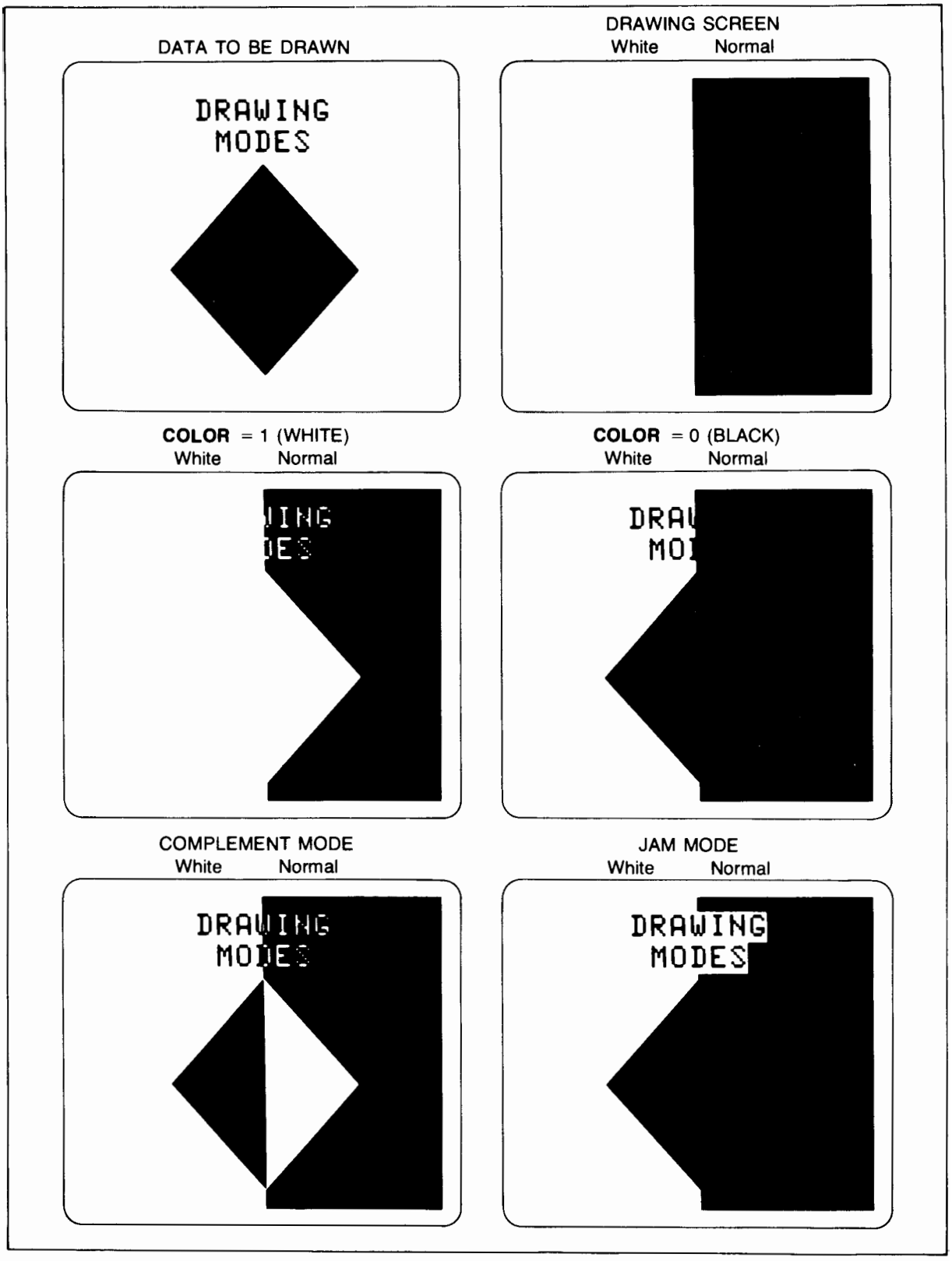


Figure 8-5. Special Drawing Modes

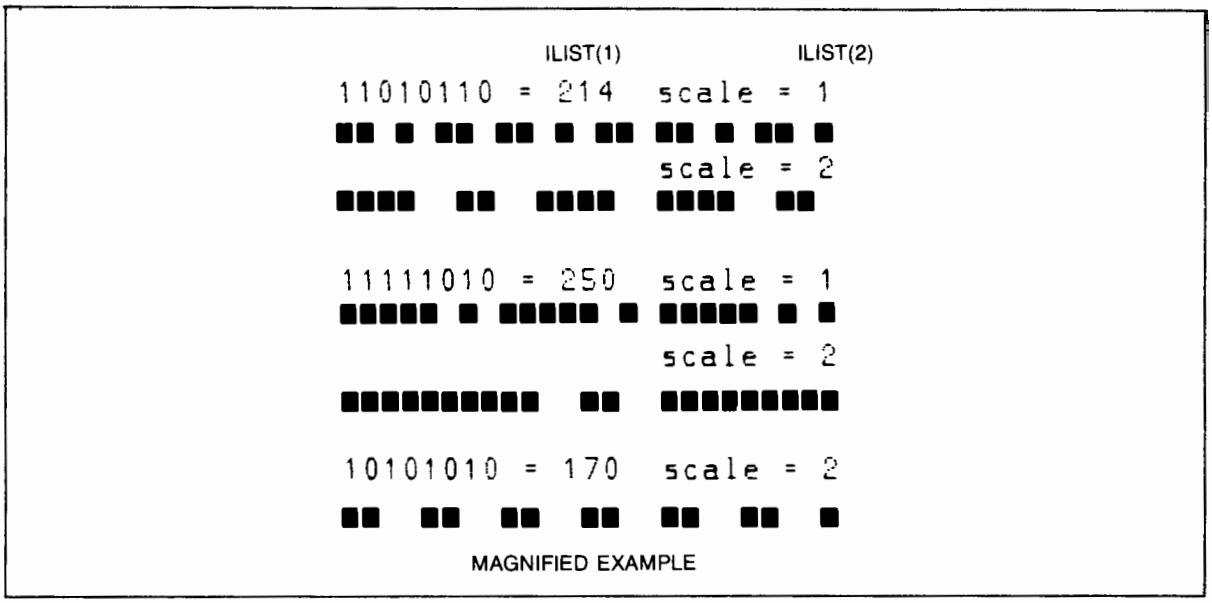


Figure 8-6. Magnified Examples of User Defined Linestyles

8050 Define area pattern.

An 8 x 8 pattern can be defined for use in drawing horizontal and vertical lines, filling rectangular areas (see OPCODE 450), and for device-dependent polygon filling. The area pattern is defined by specifying each row of the pattern with a decimal number ranging between 0 and 255 which defines an 8-bit binary pattern. The graphics display is divided into 8 x 8 cells such that every point on the display maps to a corresponding bit in the pattern.

Once the area pattern has been defined, it can be used by setting the linestyle to 10. Drawing any horizontal and vertical lines causes the corresponding row or column of the pattern to be used as the line pattern. See OPCODE 450 for use in filling rectangular area. The user-defined area pattern can be used for filling polygons when the current polygon style has density -1, and specifies device-dependent output. Figures 8-7 and 8-8 contain sample area fill patterns.

ILIST(1) = Row 0 of the area pattern
ILIST(2) = Row 1 of the area pattern
ILIST(3) = Row 2 of the area pattern
ILIST(4) = Row 3 of the area pattern
ILIST(5) = Row 4 of the area pattern
ILIST(6) = Row 5 of the area pattern
ILIST(7) = Row 6 of the area pattern
ILIST(8) = Row 7 of the area pattern

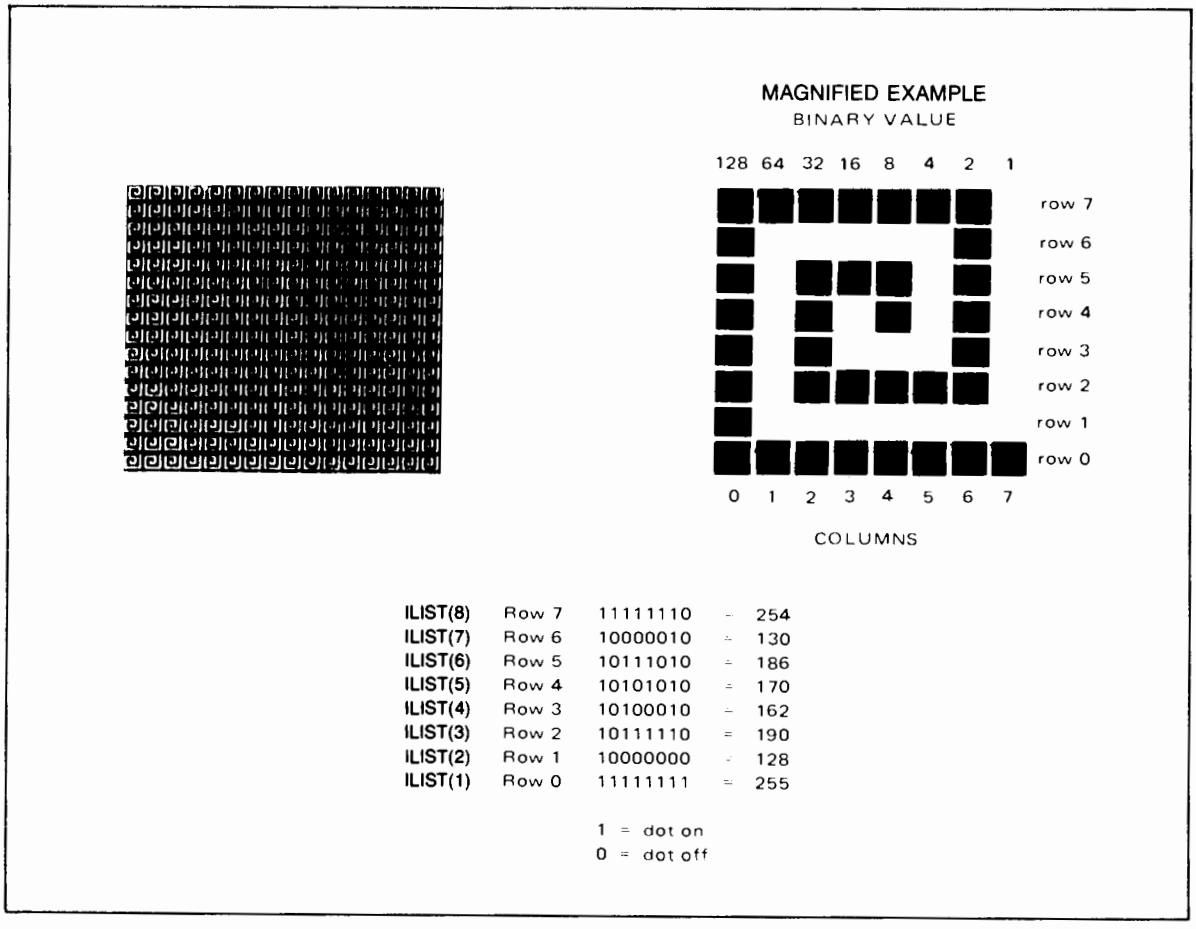


Figure 8-7. Defining Area Patterns

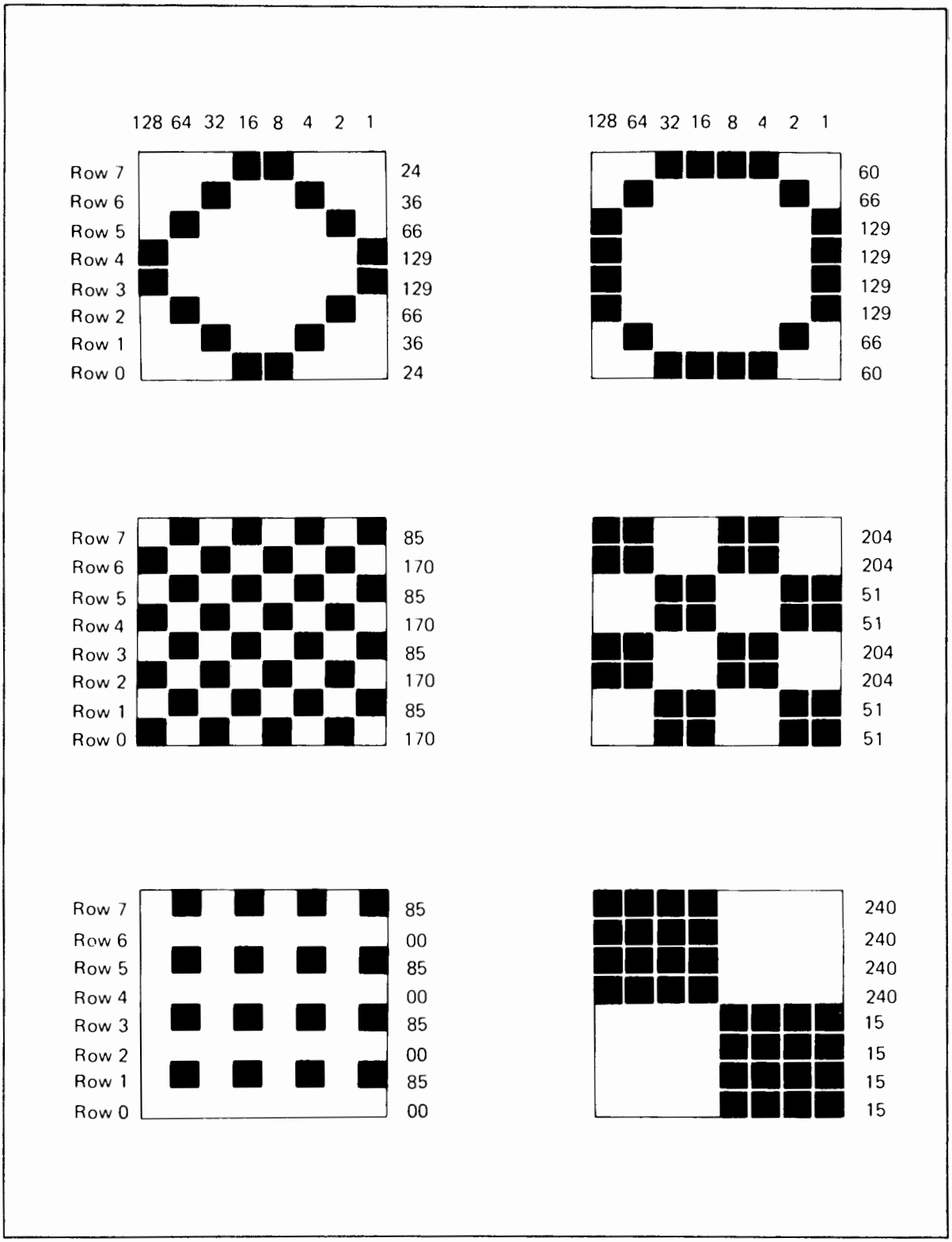


Figure 8-8. Magnified Examples of Area Patterns

Locator Echoes on the Graphics Display

JWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

SAME PHYSICAL DEVICE

If the locator and graphics display are the same physical device, the following echoes are supported on the display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until operator response. When an operator response occurs, the graphics cursor is turned off.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line The graphics cursor and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the graphics cursor and the Y coordinate of the locator echo position.

6 Vertical rubber band line

The graphics cursor and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the locator echo position and the Y coordinate of the graphics cursor.

7 Horizontal/Vertical rubber band line

The graphics cursor and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned is the same as ECHO 5 if the locator's X displacement from the locator echo position is greater than its Y displacement. The point returned is the same as ECHO 6 if the Y displacement becomes greater than the X displacement.

8 Rubber band box

Same as ECHO 2.

DIFFERENT PHYSICAL DEVICES

If the locator and display devices are different physical devices and the locator device supports echoing on the graphics display, then the following echoes are supported on the graphics display:

ECHO#	ECHO PERFORMED
2	Small cursor

Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until the locator operation is terminated. Before control is returned to the application program, the graphics cursor is turned off.

3 Full cross-hair cursor

Same as ECHO 2.

4 Rubber band line

Same as ECHO 2.

5 Horizontal rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. The graphics cursor will then be displayed at a point defined by the X coordinate of the current locator position and the Y coordinate of the locator echo position until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off.

6 Vertical rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. The graphics cursor will then be displayed at a point defined by the X coordinate of the locator echo position and the Y coordinate of the current locator position until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off.

7 Horizontal/vertical rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. Subsequently, when the locator's X displacement becomes greater than its Y displacement, ECHO 5 is simulated. When the locator's Y displacement becomes greater than its X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

Pick Echoes on the Graphics Display

JPICK

For echoes supported on the pick device, see the corresponding chapter which discusses the pick device in question.

ECHO#	ECHO PERFORMED
2	Initially the graphics cursor will be turned on at the current pick echo position. The cursor will then reflect the current pick position (i.e. tracked) until the pick operation is completed. Before control returns to the application program the graphics cursor is turned off.

Disabling

JWOFF

The display is not reset to initial values when JWOFF is called. Values will remain as they were last set. For example, color may remain set to the background color if the last operation was a simulated raster erase.

GRAPHICS DISPLAY DEVICE HANDLER (DGL ONLY)

Description

The dimensions of the HP 2623A Graphics Terminal is as follows:

Screen size:	215 mm wide by 164 mm high
Screen capacity:	512 points wide by 390 points high
Aspect ratio of maximum area:	0.7612
Resolution:	2.3814 points/mm in X direction and 2.3780 points/mm in Y direction

The default logical display surface of the graphics display device is the maximum physical limits of the screen. The physical origin is the lower left corner of the display.

The view surface is always centered within the current logical display surface.

Initialization

ZDINT

When the HP 2623A Graphics Terminal is initialized the following operations are performed:

Device name set to '2623A '.

Color set to 1.

Highlighting set to 1.

Linewidth set to 1.

Linestyle set to 1.

The graphics cursor is turned off and is in the lower left corner of the display.

The starting position is in the lower left corner of the display.

Alphanumeric memory is unaffected.

The alphanumeric and graphics displays are turned on.

The color table will be initialized to the default values. See the color section for the default color table.

The screen is cleared unless bit 7 is set in the control word for the ZDINT call. If bit 7 is set, graphics memory is unaffected.

Text slant is set to 0 degrees, text label direction is set to 0 degrees (horizontal), and label origin is set to 1 (left, bottom justified).

User-defined area and line patterns are set to solid.

The logical display limits are set to the maximum dimensions of the display.

New-frame-action will be buffered if bit 6 of the control word in the ZDINT call was set. See buffered new-frame-action for more specific details.

The view surface is centered within the logical display limits.

Supported Primitive Attributes

COLOR

ZCOLR

The D0019 display handler provides a software color table of two colors. The colors available are black and white. The size of the color table cannot be changed. The default values of the color table are shown in Table 8-2.

Table 8-2. Default Color Table

```
COLOR TABLE ENTRY = 0 >> Color set to black (background color).
                  = 1 >> Color set to white.
```

The color table is initialized when ZDINT is called. The color table cannot be redefined or inquired using ZDCOL or ZICOL.

The color selected corresponds to the color defined in the color table.

```
COLOR = 0 >> Color table entry 0 is selected
      = 1 >> Color table entry 1 is selected
```

REDEFINING COLOR

ZDCOL/ZICOL

The colors in the color table cannot be redefined or inquired.

POLYGON INTERIOR COLOR

ZPICL

There are two colors supported by DGL on the HP 2623A Graphics Terminal (black and white). Both colors can be displayed at one time. The supported values of the color attributes are:

```
COLOR = 0 >> Color set to background color (black).
      = 1 >> Color set to white.
```

POLYGON STYLE

ZDPST

Using ZDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

ZPILS

Refer to ZLSTL for information regarding linestyle.

HIGHLIGHTING

ZHIGH

Highlighting is not supported on the HP 2623A Graphics Terminal.

LINESTYLE

ZLSTL

Eight predefined linestyles are supported with the HP 2623A Graphics Terminal. In addition, two user-definable styles can be selected. These linestyles can be defined through the use of output escape functions (ZOESC) 2050 and 8050. Initially, the two user-definable linestyles are set to solid. See Figure 8-9 for the linestyles available on the HP 2623A Graphics Terminal.

All of the supported linestyles are *continuous* line styles. Refer to the ZLSTL subroutine description in the *DGL Programmer's Reference Manual* for a complete discussion of a continuous line style.

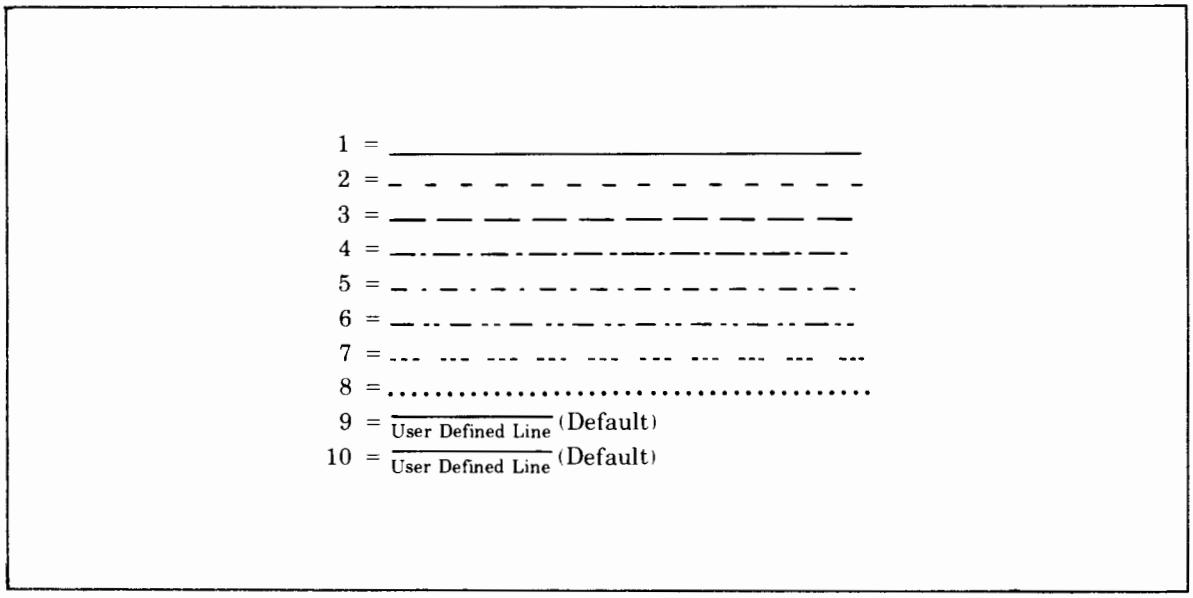


Figure 8-9. Supported Linestyles

LINEWIDTH

ZLWID

Only one linewidth is supported on the HP 2623A Graphics Terminal.

LINEWIDTH = 1 >> Primitives drawn with a linewidth of one pixel.

CHARACTER SIZES

ZCSIZ

There are eight distinct character sizes supported on the HP 2623A Graphics Terminal. They all have a constant aspect ratio of 1.43. The supported character sizes are:

Width	Height
2.9 mm	4.2 mm
5.9 mm	8.4 mm
8.8 mm	12.5 mm
11.8 mm	16.7 mm
14.7 mm	21.0 mm
17.7 mm	25.3 mm
20.5 mm	29.5 mm
23.5 mm	33.7 mm

The character is placed within the character cell as shown in Figure 8-10.

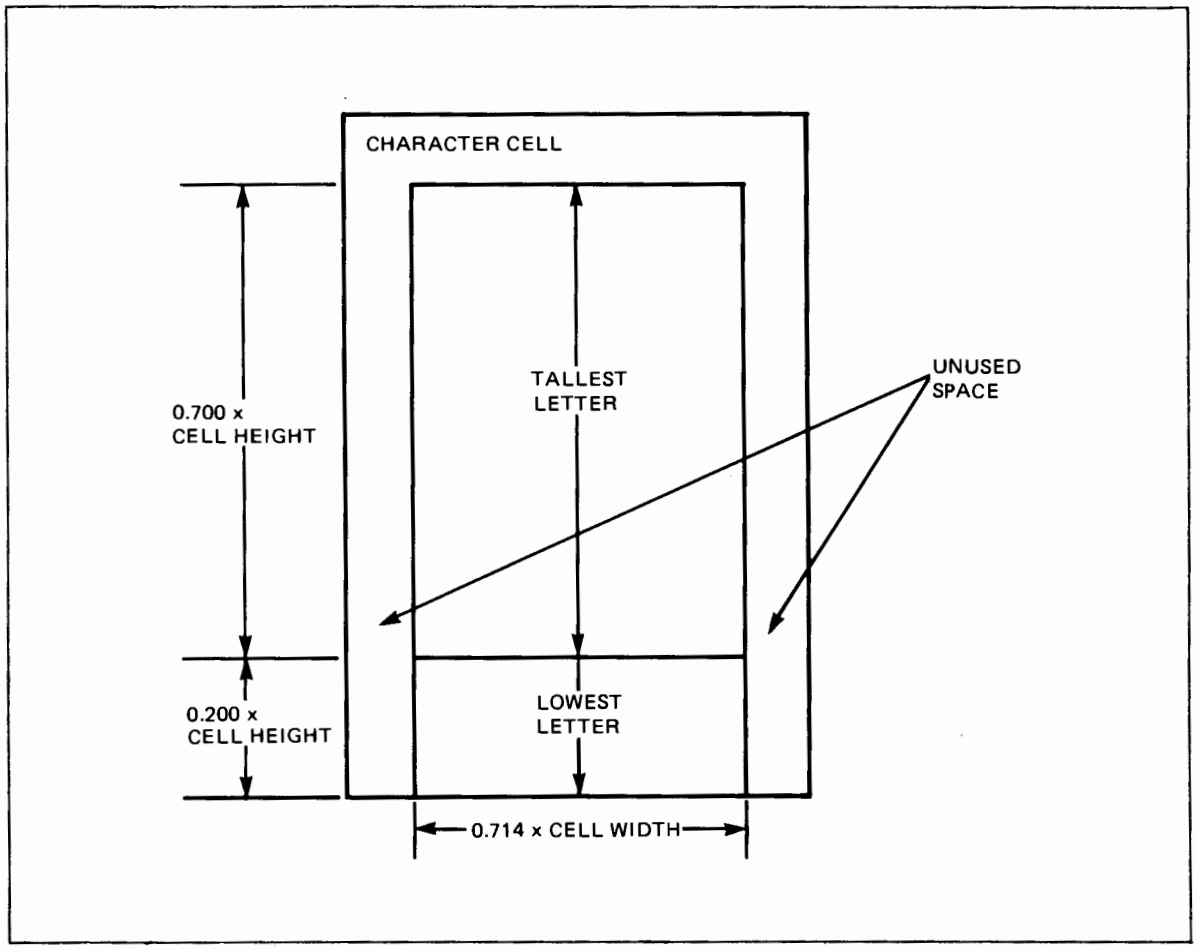


Figure 8-10. Placement of Character in Character Cell

Output Primitives

CLIPPING

The HP 2623A Graphics Terminal does not provide hardware vector clipping. A vector with one or both of its endpoints outside the physical limits is displayed in an unpredictable manner. Text characters will be clipped if they do not lie within the physical limits of the graphics display.

POLYGONS

ZPGDD

Hardware filling is provided for rectangular polygons. (For non-rectangular polygons, refer to the ZPGDD section of the DGL Reference Manual.)

If the user specifies a fill density of 1.0 or -1.0, then the polygon will be filled with the current user-defined area pattern (See ZOESC, OPCODE 8050, for further details.)

If the user specifies any other fill density, then the polygon will be filled with a pattern that approximates the requested interior density to the nearest multiple of 1/8, and approximates the interior orientation to the nearest multiple of 45 degrees. Crosshatching is supported, but the interior linestyle attribute is ignored.

Except when the user specifies a fill density of 1, -1, or 0, the user-defined area fill pattern will be set to solid by ZPGDD upon its completion.

MARKERS

ZMARK

The 19 standard markers are the only markers supported with the HP 2623A Graphics Terminal. The smallest character size (2.9 mm by 4.2 mm) is always used to generate markers.

TEXT

ZTEXT

Graphics text is generated with a hardware character generator. The characters are drawn with a size ratio 5 wide and 7 high in a character cell with a size ratio of 7 wide and 10 high. See Figure 8-11 for the viewable graphics character set. In addition to the viewable characters, text strings can also include the following control characters:

DECIMAL CODE	FUNCTION
8	Move backward one character cell
9	Move forward one character cell
10	Move down one character cell
11	Move up one character cell
13	Carriage return

The actual direction moved by these control functions is dependent on the text direction and text origin in use. Only the above special characters should be included in graphics text strings in addition to the printable ASCII characters.

Graphics text is not affected by the linestyle attribute; character strings will be output as solid lines. The direction, slant, and justification of text can be modified through the use of escape functions (see ZOESC 1050, 1051, 1052). If a text string extends beyond the physical limits of the graphics display, all characters which do not lie entirely within the physical limits will be clipped by the terminal.

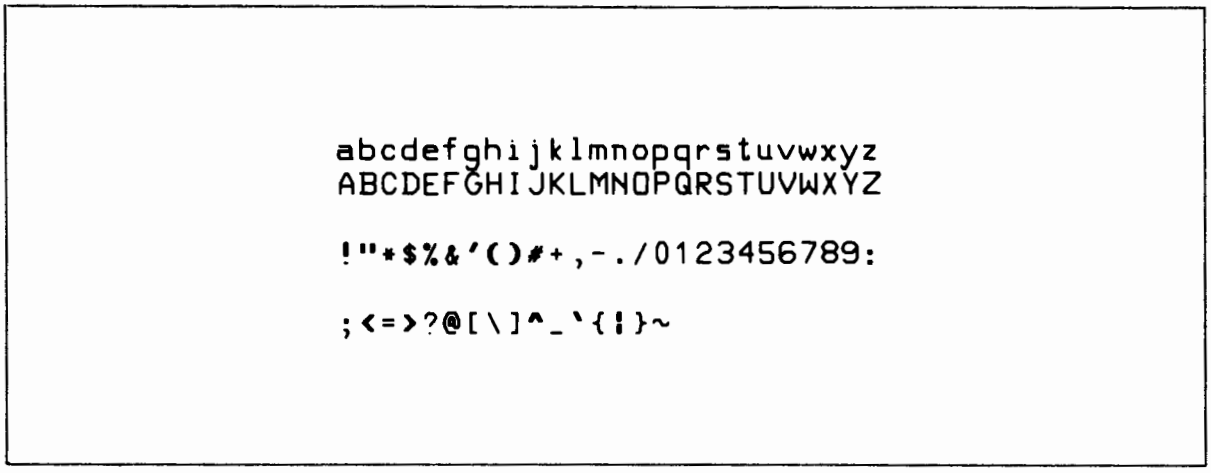


Figure 8-11. Supported Graphics Text Characters

New-Frame-Action

ZNEWF

NON-BUFFERED NEW-FRAME-ACTION (Bit 6 of the ZDINT control word not set)

A call to ZNEWF makes the picture current and then erases the graphics display.

BUFFERED NEW-FRAME-ACTION (Bit 6 of the ZDINT control word is set)

When ZNEWF is called, the graphics display is made current. The instruction to clear the graphics display is stored in the DGL buffer and will not be sent to the device until the next time the buffer is sent. When the buffer is sent, the display will be cleared to the background color and whatever calls to DGL were put into the buffer after the ZNEWF call will take affect on the graphics display. The effect is that the current display will remain until the next buffer is sent. If immediate visibility is being used, the action is the same as if bit 6 were not set since the buffer is sent after every DGL call.

Inquiry Escape Functions

ZIESC

The following inquiry escape functions are supported with the HP 2623A Graphics Terminal:

OPCODE	FUNCTION
3050	Inquire text status.
	ILIST(1) = Current text justification. See Figure 8-12 for possible values.
	ILIST(2) = Current text direction. Possible values are 0, 90, 180 or 270 degrees.
	ILIST(3) = Current text slant. Possible values are 0 and 45 degrees.

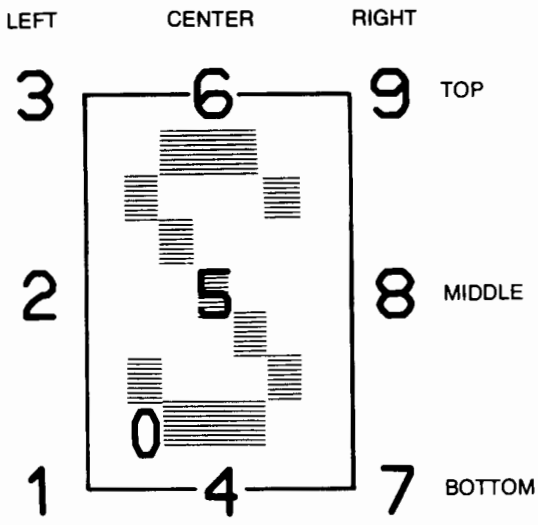
Output Escape Functions

ZOESC

Several output escape functions are supported by DGL with the HP 2623A Graphics Terminal. Error checking is not performed by the graphics system on any of the parameters which are to be sent to the device. If a parameter is outside of the range specified in the escape function definition, the terminal will ignore the function. None of the supported output escape functions alter the starting position for the next primitive.

The following output escape functions are supported with the HP 2623A Graphics Terminal:

OPCODE	FUNCTION
450	Perform rectangular area fill using the current linestyle and color. The rectangular area is specified in world coordinates. RLIST(1) = Minimum X border of rectangle RLIST(2) = Maximum X border of rectangle RLIST(3) = Minimum Y border of rectangle RLIST(4) = Maximum Y border of rectangle
1050	Set text direction for subsequently output graphics text. ILIST(1) = New text direction 0 = 0 degrees (horizontal) 1 = 90 degrees counterclockwise 2 = 180 degrees counterclockwise 3 = 270 degrees counterclockwise
1051	Set character slant for subsequently output graphics text. ILIST(1) = Text slant 0 = 0 degrees (normal) 1 = 45 degrees
1052	Set text justification for subsequently output graphics text. ILIST(1) = Text justification. See Figure 8-12 for the supported justifications.
1055	Turn graphics display on/off. This only controls whether the graphics memory is displayed by the terminal. It does not affect the contents or output primitives sent. ILIST(1) = 0 >> Turn graphics display off = 1 >> Turn graphics display on



The numbers 1-9 represent the cursor position with respect to the character cell used for graphics text characters. The number 0 represents the cursor position with respect to the character (not this cell).

JUSTIFICATION/ORIGIN. Text strings can be automatically right or left justified, or centered about a specified point. An ASCII character 0 through 9 indicates the origin (justification and base line) for characters with respect to the current pen position. This function is useful when drawing labels.

If text is left justified, the current pen position is the left margin. Center causes the label to be centered on the pen position. Right justify selects the pen position as the right margin. Bottom, middle, and top select the base line for the line of text.

For example, if text was to be right justified and set with a base line on top of the normal character position, the number "9" would be used.

Figure 8-12. Hardware Text Justification

1056 Set special drawing modes. Using this escape function will override the color as defined by the ZCOLR call. After generating output primitives in a special drawing mode, the application program can terminate the special drawing mode by making any call to ZCOLR. See Figure 8-13 for the effect of color and the special drawing modes.

ILIST(1) = 1 >> Enable complement drawing mode. All primitives output in this mode will toggle the color of the pixels on the display. For example, when drawing a line in this mode, all white pixels in the line's path will turn black and all black pixels will turn white.

= 2 >> Enable jam drawing mode. Jam mode has the affect of overlaying the output primitives generated with it over the current primitives on the graphics display.

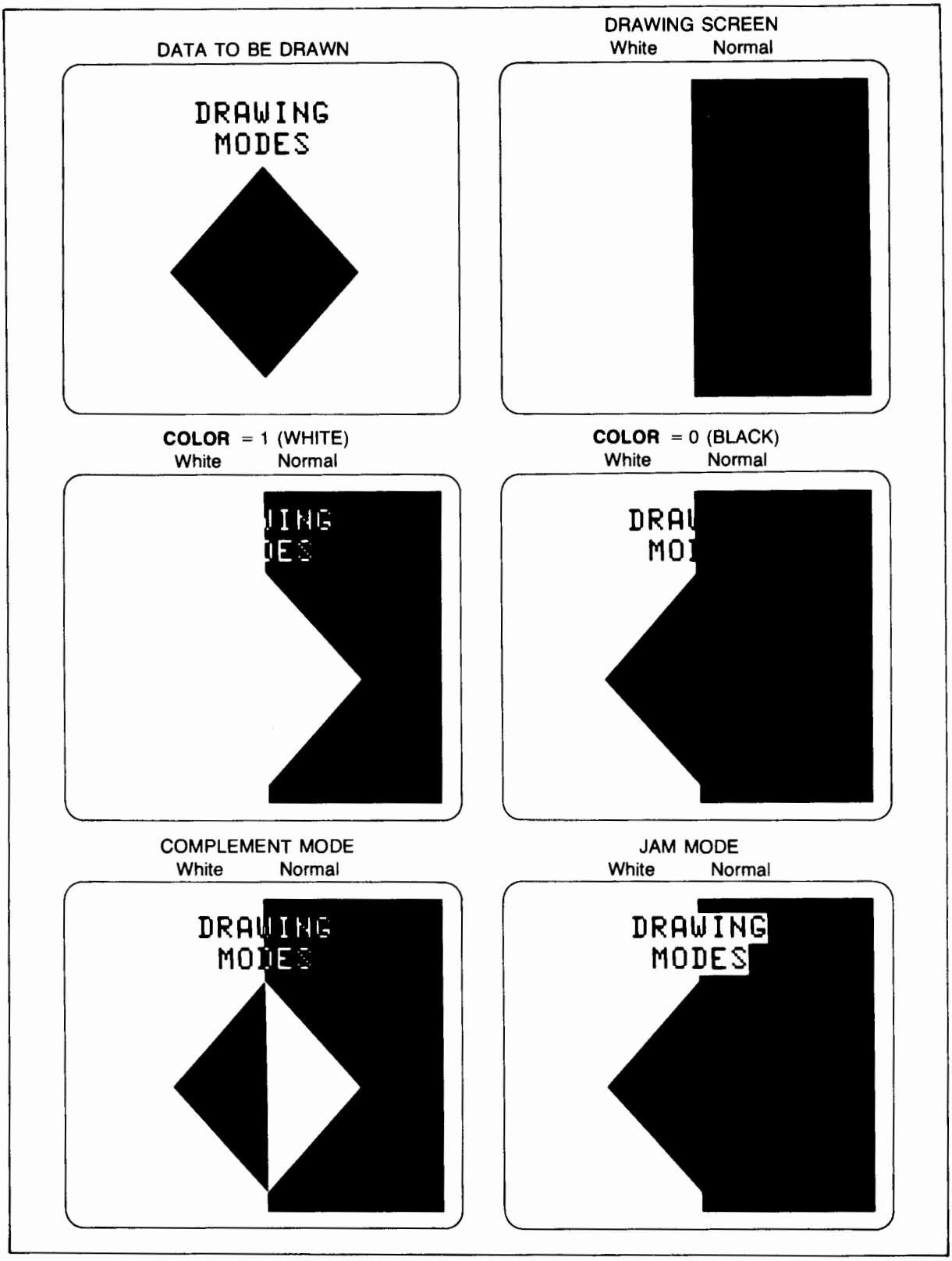


Figure 8-13. Special Drawing Modes

2050 Define line pattern.

This allows the user to define the dot pattern used to draw vectors. Once a line pattern is defined, it can be used by setting the linestyle to 9. See Figure 8-14 for examples on defining line patterns.

ILIST(1) = A value between 0 and 255 defining an 8-bit binary pattern.

ILIST(2) = A scale factor between 1 and 16 to be applied to the pattern.

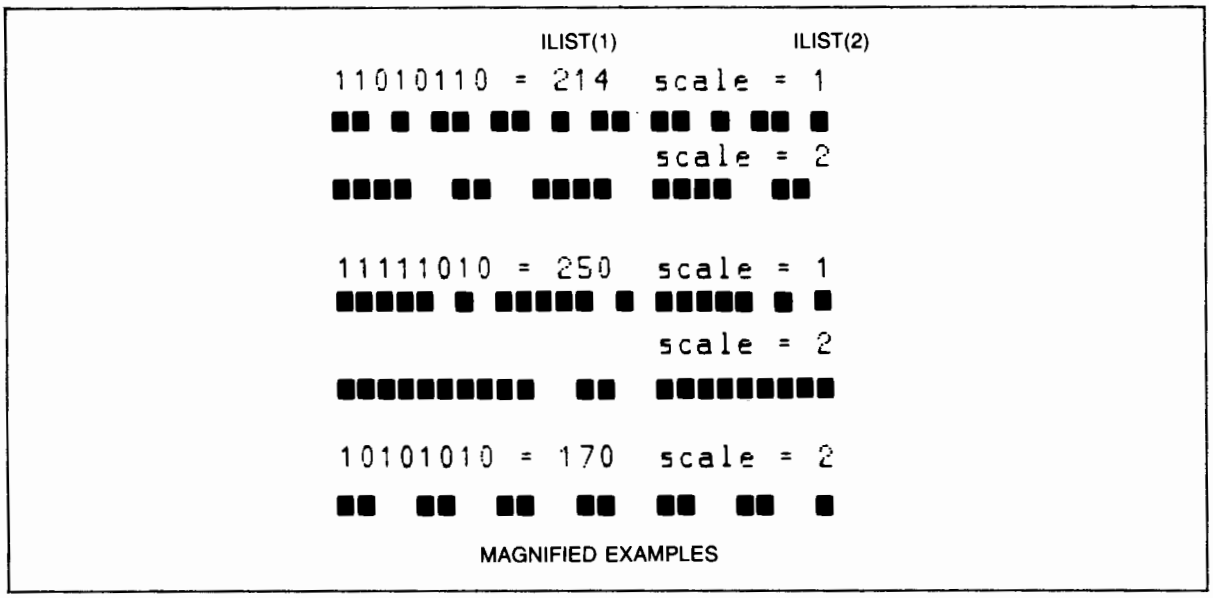


Figure 8-14. Magnified Examples of User Defined Linestyles

8050 Define area pattern.

An 8 x 8 pattern can be defined for use in drawing horizontal and vertical lines, filling rectangular areas (see OPCODE 450), and filling polygons via ZPGDD. The area pattern is defined by specifying each row of the pattern with a decimal number ranging between 0 and 255 which defines an 8-bit binary pattern. The graphics display is divided into 8 x 8 cells such that every point on the display maps to a corresponding bit in the pattern.

Once the area pattern has been defined, it can be used for drawing lines by setting the linestyle to 10. Drawing any horizontal and vertical lines causes the corresponding row or column of the pattern to be used as the line pattern. See OPCODE 450 for use in filling rectangular area. The user-defined area pattern can be used for filling polygons by calling ZPGDD when the current polygon style has density -1. Figures 8-15 and 8-16 contain sample area (See ZPGDD for further details.) fill patterns.

ILIST(1) = Row 0 of the area pattern
ILIST(2) = Row 1 of the area pattern
ILIST(3) = Row 2 of the area pattern
ILIST(4) = Row 3 of the area pattern
ILIST(5) = Row 4 of the area pattern
ILIST(6) = Row 5 of the area pattern
ILIST(7) = Row 6 of the area pattern
ILIST(8) = Row 7 of the area pattern

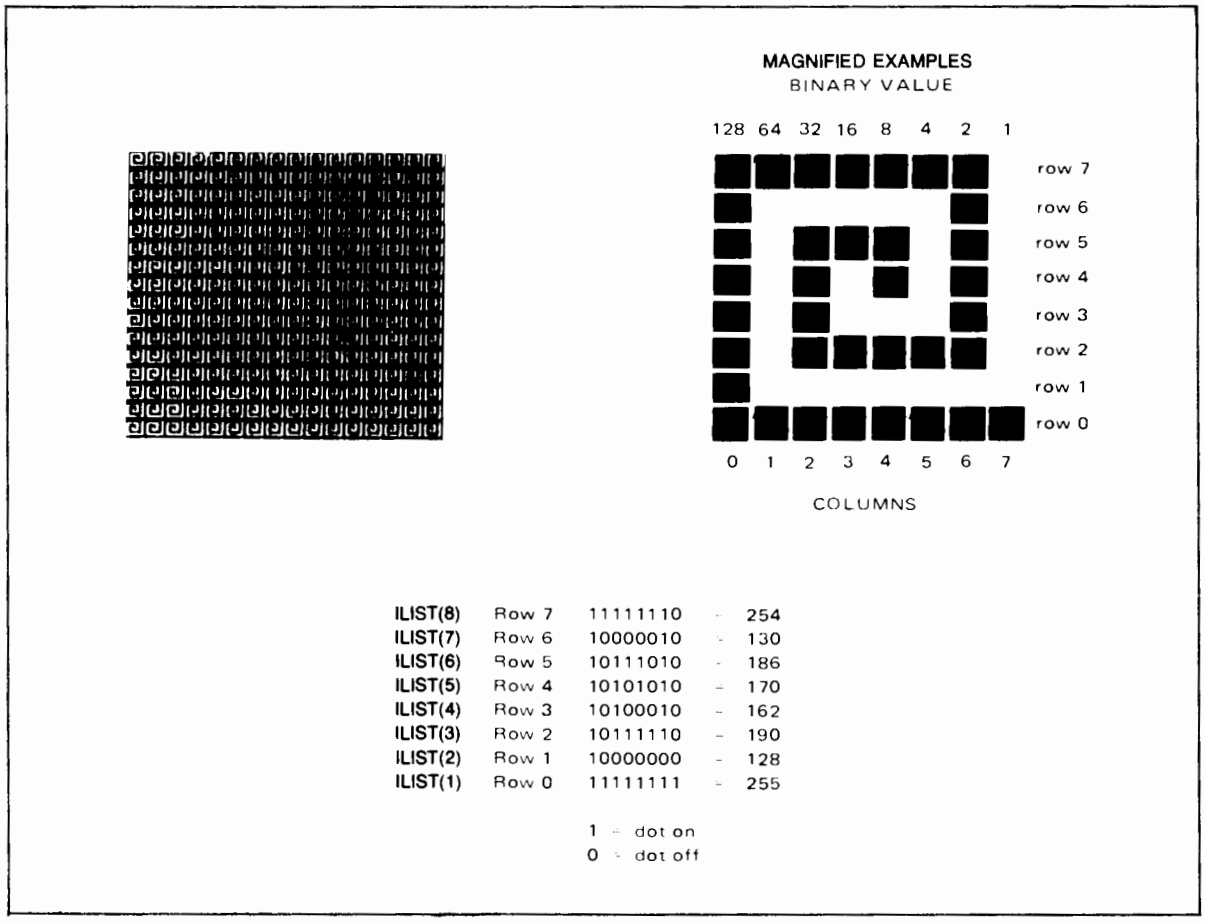


Figure 8-15. Defining Area Patterns

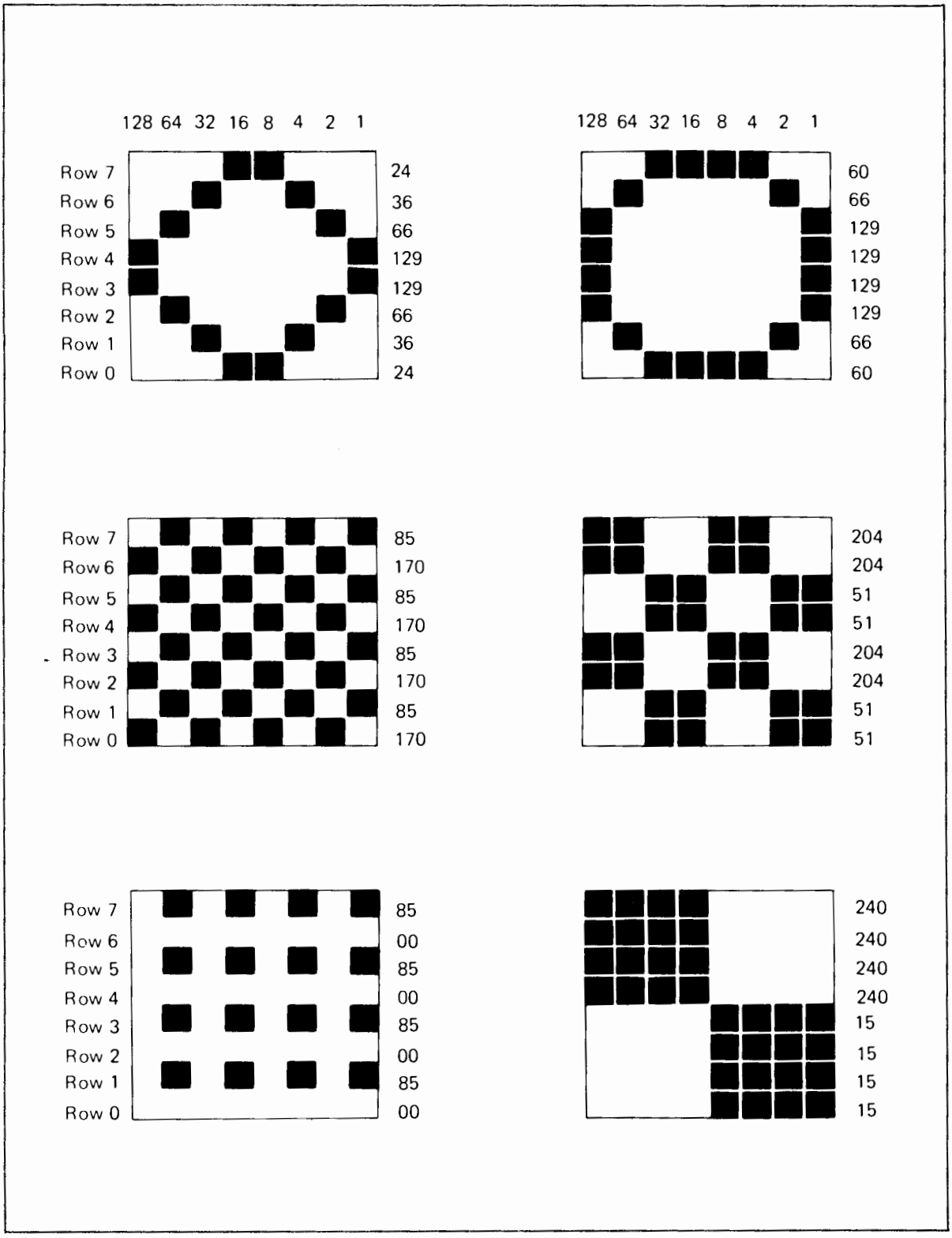


Figure 8-16. Magnified Examples of Area Patterns

Locator Echoes on the Graphics Display

ZWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

SAME PHYSICAL DEVICE

If the locator and graphics display are the same physical device, then the following echoes are supported on the display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until operator response. When an operator response occurs the graphics cursor is turned off.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line The graphics cursor and the locator echo position are handled in the same manner as for ECHO 2. The point returned has the X coordinate of the graphics cursor and the Y coordinate of the locator echo position.

6 Vertical rubber band line

The graphics cursor and the locator echo position are handled in the same manner as for ECHO 2. The point returned has the X coordinate of the locator echo position and the Y coordinate of the graphics cursor.

7 Horizontal/vertical rubber band line

The graphics cursor and the locator echo position are handled in the same manner as for ECHO 2. The point returned is the same as ECHO 5 if the locator's X displacement from the locator echo position is greater than its Y displacement. The point returned is the same as ECHO 6 if the Y displacement becomes greater than the X displacement.

8 Rubber band box

Same as ECHO 2.

DIFFERENT PHYSICAL DEVICES

If the locator and display devices are different physical devices and the locator device supports echoing on the display, then the following echoes are supported on the graphics display:

ECHO#	ECHO PERFORMED
2	Small cursor

Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until the locator operation is terminated. Before control is returned to the application program, the graphics cursor is turned off.

3 Full cross-hair cursor

Same as ECHO 2.

4 Rubber band line

Same as ECHO 2.

5 Horizontal rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. The graphics cursor will then be displayed at a point defined by the X coordinate of the current locator echo position and the Y coordinate of the locator echo position until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off.

6 Vertical rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. The graphics cursor will then be displayed at a point defined by the X coordinate of the locator echo position and the Y coordinate of the current locator position until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off.

7 Horizontal/vertical rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. Subsequently, when the locator's displacement becomes greater than its Y displacement, ECHO 5 is simulated. When the locator's Y displacement becomes greater than its X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

Termination

ZDEND

The graphics display is unaltered. The device name is reset to '0019 ', and the device status and I/O unit descriptor are set to 0. All attribute values remain unchanged until the system is reinitialized or the display device is enabled again.

KEYBOARD DEVICE HANDLER (AGP/DGL)

Description

The HP 2623A Graphics Terminal has a standard ASCII keyboard which is supported as a keyboard input device. The device handler required to use the keyboard device on the HP 2623A Graphics Terminal is K0001.

Initialization

JEDEV/ZKINT

When the keyboard device is initialized the terminal alphanumeric display is turned on. The device name is set to '2623A '.

Keyboard Input

JKYBD/ZKYBD

Once the keyboard device has been enabled it is available for input operations. When JKYBD or ZKYBD are called, a read operation is set pending on the terminal. The operator then enters the desired text and terminates the operation by entering a carriage return. Some keys have a special meaning when entered by the operator and are not returned to the application program (see Appendix B for a description of these keys).

2623
KEYBOARD

Echoes Supported

The keyboard device supports the following echoes:

ECHO#	ECHO PERFORMED
0	Text is not displayed on the terminal alphanumeric display as it is entered.
1	Text is displayed on the terminal alphanumeric display as it is entered.

Termination

JDDEV/ZKEND

The alphanumeric display is unaltered. The device name is set to '0001 ', and the device status and I/O unit descriptor are set to 0.

LOCATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 2623A Graphics Terminal are as follows:

Screen size:	215 mm wide by 164 mm high
Screen capacity:	512 points wide by 390 points high
Resolution:	2.3814 points/mm in X direction and 2.3780 points/mm in Y direction

The default locator limits are set equal to the maximum physical limits of the screen.

The physical origin of the locator device is the lower left corner of the display.

The HP 2623A Graphics Terminal has a graphics locator which is capable of returning any point on the screen. The device handler required to use the locator device on the HP 2623A Graphics Terminal is L0019.

Initialization

JEDEV/ZLINT

When the locator device is initialized, the terminal's graphics display is left unaltered. The device name is set to '2623A '.

2623
LOCATOR

Wait Locator Input

JWLOC/ZWLOC

The wait locator input function sets a read operation pending on the graphics terminal. The operator then positions the graphics cursor to the desired position and strikes an alphanumeric key. The (X,Y) coordinate value of the graphics cursor (which is a function of the echo) and the key struck are returned to the application program. Any of the ASCII keys can be used to terminate the locator input function so the key returned to the application program can range from 0 to 127.

Echoes Supported

Locator input can be echoed on either a graphics display device or a locator device. The echo can only be performed on a graphics display device when the locator and the graphics display devices are implemented on the same physical device (i.e. same HP 2623A Graphics Terminal). Refer to the HP 2623A graphics display sections to see how the locator can echo input on the graphics display. The following lists the echoes that can be performed by the locator device.

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	Initially the graphics cursor is turned on and will appear wherever it was last positioned on the display. The graphics cursor can then be moved by the operator through the use of the graphics cursor control keys. When the graphics cursor is positioned over the desired point, the operator strikes an alphanumeric key and the locator input function is terminated. Before control returns to the application program, the graphics cursor is turned off.

Sample Locator Input

JSLOC/ZSLOC

The sample locator input function returns the current locator position without waiting for an operator response. The graphics cursor is turned off following the sample locator input function.

Computer Museum

Echoes Supported

The following locator echoes are supported with the HP 2623A Graphics Terminal when using the sample locator input function:

ECHO#	ECHO PERFORMED
0	Echo is not performed.
1	The bell in the terminal is sounded when the locator is sampled.

Termination

JDDEV/ZLEND

The device name is set to '0019 ', and the device status and I/O unit descriptor are set to 0.

PICK DEVICE HANDLER (AGP ONLY)

Description

The pick device is only supported with AGP. The dimensions of the HP 2623A Graphics Terminal is as follows:

Screen size:	215 mm by 164 mm
Screen capacity:	512 points by 390 points
Resolution:	2.3814 points/mm in X direction and 2.3780 points/mm in Y direction

The physical origin of the pick device is the lower left corner of the display.

The HP 2623A Graphics Terminal has a pick device which is capable of differentiating between any point on the graphics display. The device handler required to use the pick device on the HP 2623A Graphics Terminal is P0019.

Initialization

JEDEV

When the pick device is initialized, the terminal's graphics display is left unaltered. The device name is set to '2623A '.

Pick Input

JPICK

The pick input function sets a read operation pending on the graphics terminal. The operator then positions the graphics cursor to the desired position and strikes an alphanumeric key. The segment name, pick-id, and the value of the pick button are then returned to the application program. Any of the ASCII keys can be used to terminate the pick function so the value of the pick button returned to the application program can range from 0 to 127.

Echoes Supported

Pick input can be echoed on either a graphics display device or a pick device. The echo can only be performed on a graphics display device when the pick and the graphics display devices are implemented on the same physical device (i.e. the same HP 2623A Graphics Terminal). Refer to the AGP HP 2623A graphics display section to determine the supported pick echoes on the graphics display. The following lists the echoes that can be performed by the pick device.

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	Initially the graphics cursor is turned on and will appear wherever it was last positioned on the display. The graphics cursor can then be moved by the operator through the use of the graphics cursor control keys. When the graphics cursor is positioned over the desired point the operator strikes an alphanumeric key and the pick function is terminated. Before control returns to the application program, the graphics cursor is turned off.

Termination

JDDEV

The device name is set to '0019 ', and the device status and I/O unit descriptor are set to 0.

VALUATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 2623A Graphics Terminal are as follows:

Screen size: 215 mm by 164 mm

Screen capacity: 512 points by 390 points

The HP 2623A Graphics Terminal can simulate a valuator device with the graphics locator. The simulation is done by splitting the X and Y coordinates into two subvaluators and scaling the locator coordinates to values which range from 0.0 to 1.0. The device handler required to use the valuator device on the HP 2623A Graphics Terminal is V0019.

Initialization

JEDEV/ZVINT

When the valuator device is initialized, the terminal's graphics display is left unaltered. The device name is set to '2623A '.

Wait Valuator Input

JWVAL/ZWVAL

The wait valuator input function sets a read operation pending on the graphics terminal. The operator then positions the graphics cursor to the desired position and strikes an alphanumeric key.

In addition to returning the subvaluator value, the key struck to terminate the valuator operation is also returned to the application program. Any of the ASCII keys can be used to terminate the valuator function so the button returned to the application program can range from 0 to 127.

The values returned are a function of the subvaluator specified as follows:

Subvaluator	Value returned
1	Value returned is the X coordinate of the graphics cursor position scaled to a number between 0.0 and 1.0. A value of 0.0 is returned if the cursor is at the left edge and a value of 1.0 is returned if the cursor is at the right edge of the display.
2	Value returned is the Y coordinate of the graphics cursor position scaled to a number between 0.0 and 1.0. A value of 0.0 is returned if the cursor is at the bottom of the display and a value of 1.0 is returned if the cursor is at the top of the dispay.

Echoes Supported

The supported echoes for the wait valuator function are as follows:

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	Initially the graphics cursor is turned on and will appear wherever it was last positioned on the display. The graphics cursor can then be moved by the operator through the use of the graphics cursor control keys. When the graphics cursor is positioned over the desired point the operator strikes an alphanumeric key and the valuator function is terminated. Before control returns to the application program, the graphics cursor is turned off.

2623
VALUATOR

Sample Valuator Input

JSVAL/ZSVAL

The sample valuator input function returns a subvaluator value without waiting for an operator response. The valuator simulation is performed in the same way as for the wait valuator function.

Echoes Supported

The following valuator echoes are supported with the HP 2623A Graphics Terminal when using the sample valuator function:

ECHO#	ECHO PERFORMED
0	Echo not performed.
1	The terminal bell is sounded when the valuator is sampled.

Termination

The device name is set to '0019 ' and the device status and I/O unit descriptor are set to 0.

Chapter 9
HP 9874A Digitizer

GENERAL INFORMATION

The user should be familiar with the operation of the HP 9874A Digitizer. If necessary, refer to the following manuals for the appropriate operating instructions:

HP 9874A Installation and Service Manual *(09874-90000)*

Logical Devices Supported

The following logical devices are supported by the AGP/DGL Graphics Systems when using the HP 9874A Digitizer:

Logical Device	Device Handler Name
Alpha	A0017
Button	B0017
Keyboard	K0017
Locator	L0017
Pick (AGP only)	P0017
Valuator	V0017

ALPHANUMERIC DEVICE HANDLER (AGP/DGL)

Description

The HP 9874A has a one line by 15 character LED display which is accessible through DGL alpha display handler, A0017. ASCII characters which are supported by this handler are listed in Table 9-1. The HP 9874A uses a low resolution grid composed of LEDs, primarily for the display of numeric data. Only low quality alpha characters are supported on this device.

The dimensions of the alphanumeric display are as follows:

Screen capacity: 1 line by 15 characters

Initialization

JEDEV/ZAINT

When the alphanumeric device is initialized, the alphanumeric display is erased and the device name is set to '9874 '.

Alphanumeric Output

JALPH/ZALPH

The alpha display is cleared before character data is displayed on the alpha device unless the previous alpha string was terminated by an underscore " _". A maximum of 15 characters can be displayed on the HP 9874 alpha display.

Termination

JDDEV/ZAEND

When the alphanumeric device is terminated, the alphanumeric display is not affected. The device name is set to '0017 ', and the device status and I/O unit descriptior are set to 0.

Table 9-1. ASCII Characters

DECIMAL VALUE	STD. ASCII CHARACTER	HP 9874A CHARACTER	DECIMAL VALUE	STD. ASCII CHARACTER	HP 9874A CHARACTER
0-32	Space	Space	99 & 67	C c	C
33	!	!	100 & 68	D d	d
34	"	"	101 & 69	E e	E
35	#	Space	102 & 70	F f	F
36	$	Space	103 & 71	G g	G
37	%	#	104 & 72	H h	H
38	&	Space	105 & 73	I i	I
39	'	'	106 & 74	J j	J
40	(	[	107 & 75	K k	K
41	)	]	108 & 76	L l	L
42	*	·	109 & 77	M m	m
43	+	Space	110 & 78	N n	n
44	,	Space	111 & 79	O o	o
45	-	-	112 & 80	P p	P
46	.	.	113 & 81	Q q	Q
47	/	/	114 & 82	R r	r
48	0	0	115 & 83	S s	S
49	1	1	116 & 84	T t	T
50	2	2	117 & 85	U u	u
51	3	3	118 & 86	V v	V
52	4	4	119 & 87	W w	W
53	5	5	120 & 88	X x	X
54	6	6	121 & 89	Y y	Y
55	7	7	122 & 90	Z z	Z
56	8	8	91	[	[
57	9	9	92	\	\
58	:	Space	93	]	]
59	;	Space	94	^	^
60	<	<	95	_	_
61	=	=	96	/	`
62	>	>	123	{	{
63	?	?	124	|	|
64	@	@	125	}	}
97 & 65	A a	A	126	~	~
98 & 66	B b	b			

BUTTON DEVICE HANDLER (AGP/DGL)

Description

The HP 9874A Digitizer has a set of function keys and a foot switch which are used to simulate 11 buttons as a logical button device. The digitizer is supported as a button device with the device handler, B0017.

Initialization

JEDEV/ZBINT

When the button device is initialized any error conditions which exist in the HP 9874A are cleared and the device name is set to '9874 '.

Button Input

JBUTN/ZBUTN

When the button input function is invoked, the digitizer is continuously sampled until the operator has selected a valid button sequence. Some button sequences require activating two keys before the associated button value is returned to the application program. In this case, the operator first strikes the *prefix* key and then strikes one of the five function keys to return the desired button value. The *prefix* key is the tan key located in the upper left-hand corner of the keyboard. Refer to Table 9-2 for the button values associated with the button sequence entered.

Table 9-2. Valid Button Sequences and Values Returned

KEY	VALUE RETURNED
[fa]	1
[fb]	2
[fc]	3
[fd]	4
[fd]	5
Prefix [fa]	6
Prefix [fb]	7
Prefix [fc]	8
Prefix [fd]	9
Prefix [fe]	10
Foot Switch (accessory)	11

Echoes Supported

The button device handler supports the following echoes:

ECHO#	ECHO PERFORMED
0	Echoes are not performed.
1	When a button is selected, the light above the selected button will blink once and the beeper will be sounded.

Termination

JDDEV/ZBEND

When the button device is terminated the device name is set to '0017 ', and the device status and I/O unit descriptor are set to 0.

KEYBOARD DEVICE HANDLER (AGP/DGL)

Description

The HP 9874A Digitizer has fifteen keys below the alphanumeric display which are used to enter numeric data. The device handler used with the HP 9874A is K0017. The 12 keys above the display are not supported by this device handler.

Initialization

JEDEV/ZKINT

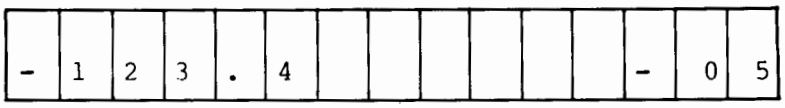
When the keyboard device is initialized the digitizer's alphanumeric display on the HP 9874A Digitizer is cleared. The device name is set to '9874 '.

Keyboard Input

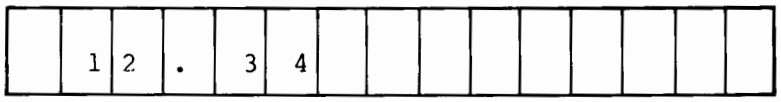
JKYBD/ZKYBD

Once the keyboard device has been enabled, it is available for input operations. When JKYBD or ZKYBD are called, a read operation is set pending on the digitizer. The operator enters the desired numeric data and terminates the operation by depressing the *ENTER* key. (See Table 9-3 for specifics on data entry.) Data sent to the application program will not have leading blanks nor blanks between the mantissa and the exponent. A maximum of 15 characters can be sent from the keyboard.

Eg.



Will be returned to the Application Program as -123.4E-05



Will be sent to the Application Program as 12.34

Only one decimal point may be entered from the keyboard.

Key	Function
ENTER	Writes display data to the 9874s number buffer. Data can then be read by the application program. The display is erased when *enter* is depressed.
CNG SIGN	Changes the sign of the mantissa or exponent. (See Table 9-3.)
ENTER EXP	Allows the user to enter an exponent. (See Table 9-3.)
CLEAR	Clears the display and the 9874As numeric buffer.

Echoes Supported

The keyboard device supports the following echoes:

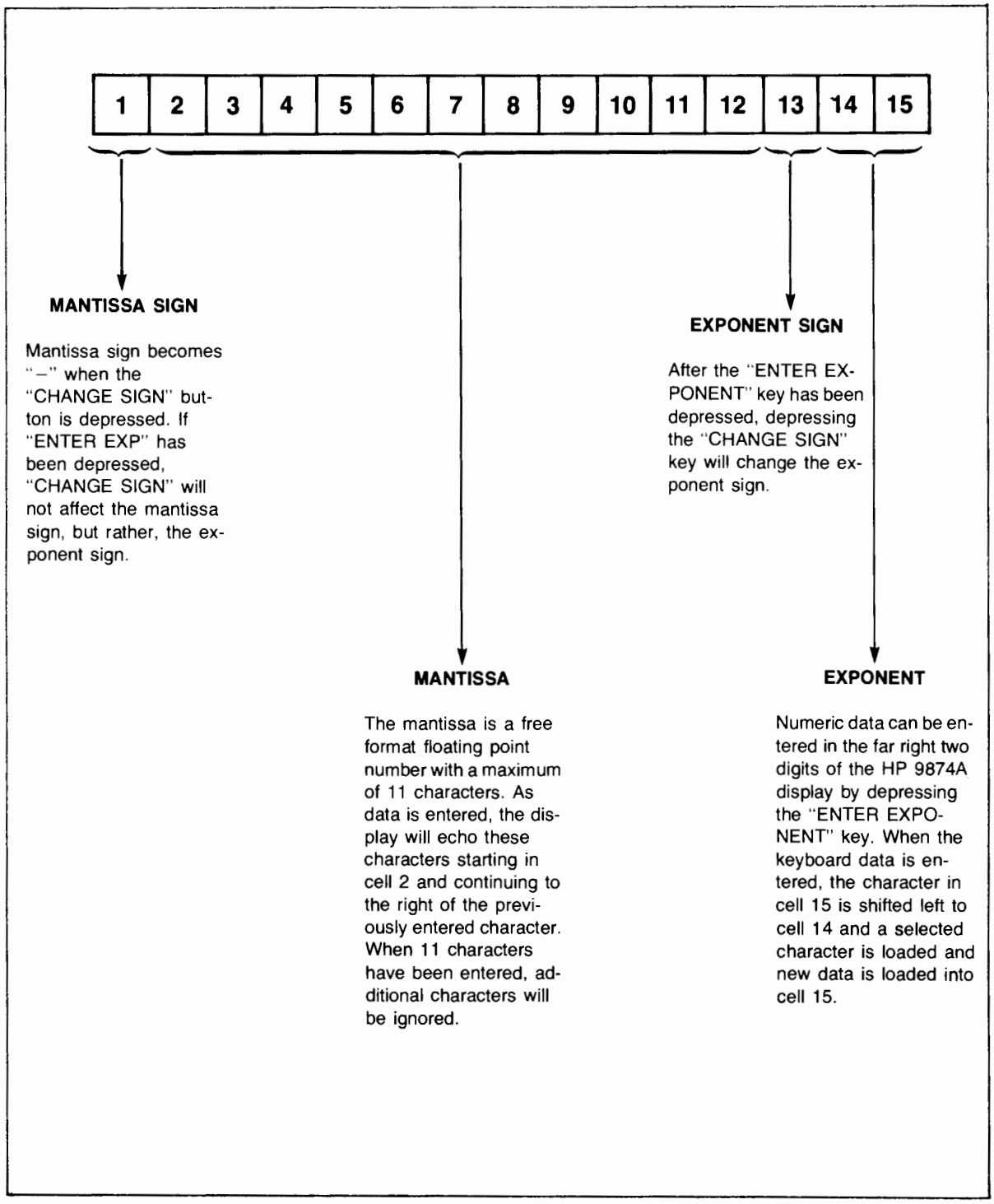
ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	Text is displayed on the digitizer's alphanumeric display as it is entered.

Termination

JDDEV/ZKEND

The alphanumeric display is unaltered. The device name is set to '0017 ', and the device status and I/O unit descriptor are set to 0.

Table 9-3. HP 9874A Display



LOCATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 9874A Digitizer are as follows:

Active platen size:	435.0 mm wide by 315.0 mm high The entire area within the outline on the platen.
Platen addressability:	17400 points wide by 12600 points high. The entire area within the outline on the platen.
Resolution:	40.0 points/mm in X and Y directions

The default locator limits are the active platen limits.

The physical origin of the locator device is the lower left corner of the outlined area on the platen.

The device handler required to use the locator device on the HP 9874A Digitizer is L0017.

Initialization

JEDEV/ZLINT

When the locator device is initialized, any existing errors in the HP 9874A Digitizer are cleared and the device name is set to '9874 '.

Wait Locator Input

JWLOC/ZWLOC

When the wait locator input function is invoked, the *single* light on the digitizer is turned on and the position of the stylus is constantly monitored until the operator responds. To digitize a point, the operator positions the stylus or cursor to the desired position and activates it. When using the stylus for digitizer input, it is activated by pressing it down at the desired point. When using the cursor, it is activated by pressing the button on the cursor labeled 'D'. When the stylus or cursor is activated, the *single* light is turned off, the digitized point is returned, and the value of the locator's button (always 1) is returned to the application program.

Echoes Supported

The HP 9874A Digitizer can echo on any graphics display which supports locator echoes. For the echoes supported on the graphics display device see the chapter which discusses the graphics display in question. The supported echoes on the locator device are as follows:

ECHO#	ECHO PERFORMED
0	Echo not performed.
1	The beeper is sounded when the stylus or cursor is activated.

Sample Locator Input

JSLOC/ZSLOC

The sample locator input function returns the current position of the stylus or cursor on the platen without waiting for an operator response.

Echoes Supported

The following locator echoes are supported with the HP 9874A Digitizer when using the sample locator input function:

ECHO#	ECHO PERFORMED
0	Echo not performed.
1	The beeper is sounded when the locator is sampled.

Termination

JDDEV/ZLEND

The device name is set to '0017 ', and the device status and I/O unit descriptor are set to 0.

PICK DEVICE HANDLER (AGP ONLY)

Description

The dimensions of the HP 9874A Graphics Tablets are as follows:

Active platen size:	435.0 mm wide by 315.0 mm high The entire area within the outline on platen.
Platen addressability:	17400 points wide by 12600 points high. The entire area within the outline on platen.
Resolution:	40.0 points/mm in X and Y directions

The default pick limits are the limits of the active platen area.

The physical origin of the pick device is the lower left corner of the outlined area on the platen.

The device handler required to use the pick device on the HP 9874A Digitizer is P0017.

Initialization

JEDEV

When the pick device is initialized, any existing errors in the HP 9874A are cleared and the device name is set to '9874 '.

Pick Input

JPICK

When the pick input function is invoked, the *single* light on the digitizer is turned on and the position of the stylus is constantly monitored until the operator responds. To digitize a point, the operator positions the stylus or cursor to the desired position and activates it. When using the stylus for digitizer input, it is activated by pressing it down at the desired point. When using the cursor, it is activated by pressing the button on the cursor labeled "D". The *single* light is turned off when the stylus or cursor is activated. The segment name, pick-ID, and the value of the pick's button (always 1) are then returned to the application program.

Echoes Supported

The HP 9874A Digitizer can echo on any graphics display which supports pick echoes. For the echoes supported on the graphics display device see the chapter which discusses the graphics display in question. The supported echoes on the pick device are as follows:

ECHO#	ECHO PERFORMED
0	Echo not performed.
1	The beeper is sounded when the stylus or cursor is activated.

Termination

JDDEV

The device name is set to '0017 ', and the device status and I/O unit descriptor are set to 0.

VALUATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 9874A Digitizer are as follows:

Active platen size:	435.0 mm wide by 315.0 mm high The entire area within the outline on platen.
Platen addressability:	17400 points wide by 12600 points high. The entire area within the outline on platen.
Resolution:	40.0 points/mm in X and Y directions

The valuator device handler for the HP 9874A Digitizer supports three subvaluators. Two of the subvaluators are simulated by taking the X and Y coordinates of the cursor or stylus position and scaling them to value which range from 0.0 to 1.0. The third valuator is simulated by returning the status of the cursor or stylus. If the cursor or stylus is not depressed , the value returned is 0.0; if the cursor or stylus is depressed the value returned is 1.0. The device handler required to use the valuator device on the HP 9874A Digitizer is V0017.

Initialization

JEDEV/ZVINT

When the valuator device is initialized, any existing errors in the HP 9874A are cleared and the device name is set to '9874 '.

Wait Valuator Input

JWVAL/ZWVAL

When the wait valuator input function is invoked, the *single* light on the digitizer is turned on and the position of the cursor or stylus is constantly monitored until the operator activates the input device being used. When using the stylus for digitizer input, it is activated by pressing it down at the desired point. When using the cursor, it is activated by pressing the button on the cursor labeled "D". The values returned are a function of the subvaluator specified as follows:

Subvaluator	Value returned
1	Value returned is the X coordinate of the cursor or stylus position scaled to a number between 0.0 and 1.0. If the point selected is on or to the left of the left border of the active area then 0.0 will be returned. If the point selected is on or to the right of the right border of the active area then 1.0 will be returned.
2	Value returned is the Y coordinate of the cursor or stylus position scaled to a number between 0.0 and 1.0. If the point selected is on or below the lower border of the active area then 0.0 will be returned. If the point selected is on or above the upper border of the active area then 1.0 will be returned.
3	Value returned is always 1.0 since the cursor or stylus must be depressed to terminate the wait valuator function. This can be used to perform an operator pause in the application program.

When the cursor or stylus is activated, the *single* light is turned off, the requested subvaluator's value is returned, and the valuator's button (always 1) is returned to the application program.

Echoes Supported

The supported echoes on the valuator device are as follows:

ECHO#	ECHO PERFORMED
0	Echo not performed.
1	The beeper is sounded when the cursor or stylus is activated.

Sample Valuator Input

JSVAL/ZSVAL

The sample valuator input function samples the current position of the cursor or stylus on the platen without waiting for an operator response. The value returned is a function of the subvaluator specified as follows:

Subvaluator	Value returned
1	Value returned is the X coordinate of the cursor or stylus position scaled to a number between 0.0 and 1.0. If the point selected is on or to the left of the left border of the active area then 0.0 will be returned. If the stylus is on or to the right of the right border of the active area then 1.0 will be returned.
2	Value returned is the Y coordinate of the cursor or stylus position scaled to a number between 0.0 and 1.0. If the point selected is on or below the lower border of the active area then 0.0 will be returned. If the point selected is on or above the upper border of the active area then 1.0 will be returned.

3	Value returned depends on whether the cursor or stylus is depressed at the time the sample function occurs. If the cursor or stylus is not depressed 0.0 is returned, if it is depressed 1.0 is returned.

Echoes Supported

The following valuator echoes are supported with the HP 9874A Digitizer when using the sample valuator function:

ECHO#	ECHO PERFORMED
0	Echo not performed.
1	The beeper is sounded when the valuator is sampled.

Termination

The device name is set to '0017 ', and the device status and I/O unit descriptor are set to 0.

Chapter 10
HP 2608A/2608S Line Printers

GENERAL INFORMATION

This chapter pertains to the HP 2608A and HP 2608S Line Printers. The HP 2608A/2608S Line Printers are raster-addressed devices. These devices are covered in detail in Appendix A, which should be reviewed carefully.

The user should be familiar with the operation of the HP 2608A/2608S Line Printers. If necessary, refer to the following manuals for the appropriate information:

HP 2608A Line Printer Operator's Manual	*(02608-90901)*
HP 2608S Line Printer Operator's Manual	*(02608-90911)*
HP 2608A Line Printer Technical Reference Manual	*(02608-90903)*
HP 2608S Line Printer Technical Reference Manual	*(02608-90910)*
HP 2608A Line Printer Driver DVB12	*(92062-90004)*

Logical Device Supported

The following logical device is supported by the AGP/DGL graphics systems when using the line printers.

Logical Device	Device Handler Name	Physical Device
Graphics display	D0026	HP 2608A/2608S

Special Considerations

ASYNCHRONOUS FILE ERRORS

When running an AGP/DGL software application program which uses D0026, asynchronous file errors may occur. Refer to Appendix A for a discussion of these errors and how they can be detected.

RESTORING LINE PRINTERS TO TEXT MODE

If the line printers are left in graphics mode (by OFing the translator program, for example), they can be returned to text mode either programmatically or via FMGR. Physically resetting the line printers will not return the printers to text mode. More information can be found in the *HP 2608A Line Printer Driver DVB12 Manual, 92062-90004*.

Programmatically, the user can use an exec call.

```
EXEC (3, ICNWD [,IPRAM])

where:

ICNWD = Control word

  To reset all parameters:

    ICNWD = Device I/O unit descriptor number
    IPRAM not required

  To only return to text mode:

    ICNWD = 3000B + I/O unit descriptor
    IPRAM = 0
```

Using FMGR, the user may return to text mode using a control request. Two CN calls are shown below:

```
:CN, LU, 0        This resets all parameters to default values.

:CN, LU, 30B, 0   This only places the printers in text mode.
```

GRAPHICS DISPLAY DEVICE HANDLER (AGP ONLY)

Description

The dimensions of the line printers are as follows:

Plotting area:	1082.6 mm wide by 335.9 mm high
Plotting capacity:	3069 points (4 pages) wide by 921 points high
Aspect ratio of maximum area:	0.3103
Resolution:	2.8346 points/mm in the X direction 2.7419 points/mm in the Y direction.

The default logical limits are set to 274.0 x 215.5 mm, which is just inside an 11 x 8.5 inch (279.4 x 215.9 mm) page of paper. The aspect ratio of the default limits is: 0.7725.

The physical origin is the upper left hand corner of the piece of paper. The X-axis extends down the page, and the Y-axis extends across the page. This means that the logical display surface is rotated 90 degrees clockwise about the physical origin. Figure 10-1 shows the orientation of the letter "A" when output on the page.

The view surface is always justified in the lower left corner of the current logical display surface.

The size of the logical display surface determines how many sheets of paper are required for output. The amount of paper is rounded up to the next page boundary, so a frame always starts at the beginning of a page.

The user should use care when loading paper to align the top of the form with the first few printing scan lines.

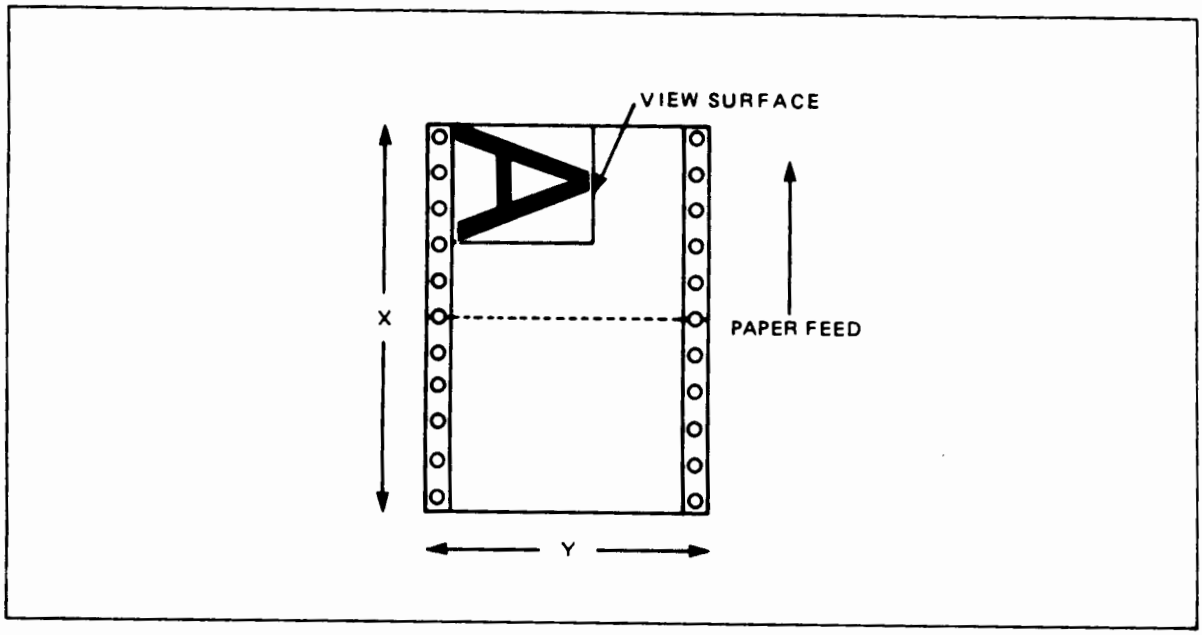


Figure 10-1. Output Orientation on the Physical Page

Initialization

JDINT

When initialized, the following operations are performed:

Device name is set to line printer name, e.g. '2608A '.

The logical display surface is set to the default value.

The view surface is justified to the lower left corner of the logical display surface.

The intermediate file is created and opened.

If bit 7 is not set, then page advances are not supressed and will occur at RTRAN initialization and after each frame that is output.

If bit 7 is set, the following rules apply:

1) A page advance will not occur at RTRAN initialization.

2) Page advances will occur after each frame is transmitted, with the exception of the last frame in the file. If the last frame in the file is translated, it will not be followed by a page advance.

Supported Primitive Attributes

COLOR

JCOLR

The D0026 display handler provides a software color table of one color. The size of the color table cannot be changed. The default value of the color table is shown in Table 10-1.

Table 10-1. Default Color Table

COLOR TABLE ENTRY = 1 >> Color set to black or blue, depending on the ribbon installed.

The color table is initialized when JDINT is called. The color table cannot be redefined or inquired using JDCOL or JICOL.

The color selected corresponds to the color defined in the color table.

COLOR = 1 >> Color table entry 1 is selected

REDEFINING COLOR

JDCOL/JICOL

The colors in the color table cannot be redefined or inquired.

POLYGON INTERIOR COLOR

JPICL

There is one color supported by AGP on the line printers. The supported value of the color attribute is:

COLOR = 1 >> Color set to black

POLYGON STYLE

JDPST

Using JDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

JPILS

Refer to JLSTL for information regarding linestyle.

HIGHLIGHTING

JSHI/JGHI

Highlighting is not supported.

LINESTYLE

JLSTL

Only one linestyle is supported.

LINESTYLE = 1 >> Primitives drawn with a solid line.

LINEWIDTH

JLWID

Only one linewidth is supported.

LINEWIDTH = 1 >> Primitives drawn with a linewidth one point wide.

CHARACTER SIZES

JCSIZ

For medium and low quality text, the line printers support all character cell sizes which have a width and height not less than 1 mm and not greater than 250 mm.

When using medium and low quality text, the character is placed within the character cell as shown in Figure 10-2.

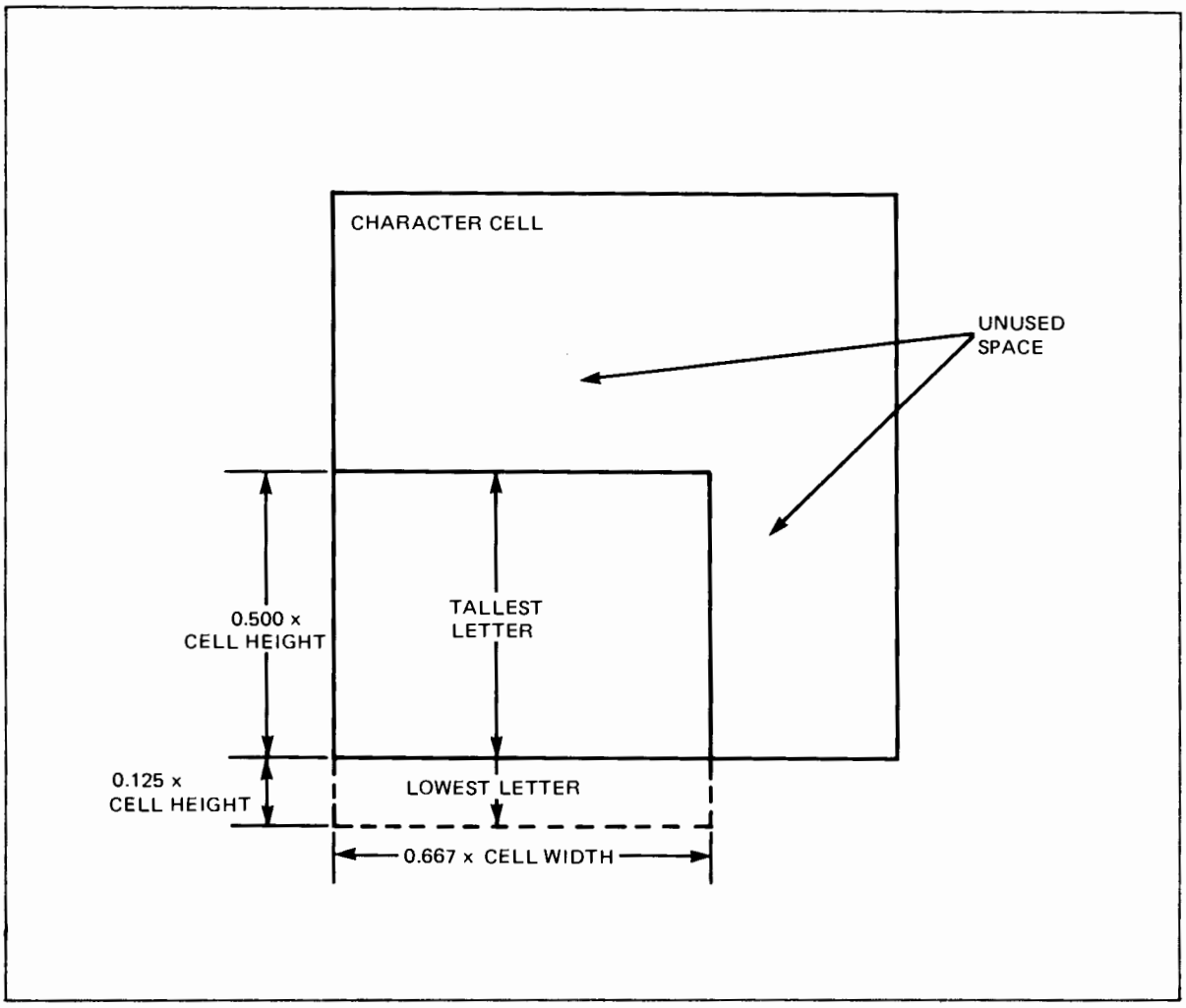


Figure 10-2. Placement of Character in Character Cell

Output Primitives

CLIPPING

If AGP window clipping is disabled and parts of the image are outside of the view surface limits, unpredictable results may occur.

POLYGONS

J2PGN/J2PGN/JR2PG/JR3PG

These devices do not have hardware area fill.

MARKERS

J2MRK/J3MRK/JR2MK/JR3MK

The 19 standard markers are the only markers supported. A character size of 2.5 mm X 2.5 mm is always used to generate the markers.

TEXT

JTEXL/JTEXM

Medium and low quality text are generated by a software text generator in DGL. The only character set that is available is the standard 96 character ASCII set. Figure 10-3 shows this character set.

If a medium or low quality text string is not clipped by AGP and extends beyond the view surface limits of the graphics display, any portion of a character that extends outside of the view surface will be clipped.

New-Frame-Action

JNEWF/JPURG/JSVIS/JSHI/JVSAL/JDLIM/JCLR

When using D0026, a new-frame-action causes the picture to be made current. The paper is then advanced to the next page boundary. All visible segments are drawn, or redrawn on the new page.

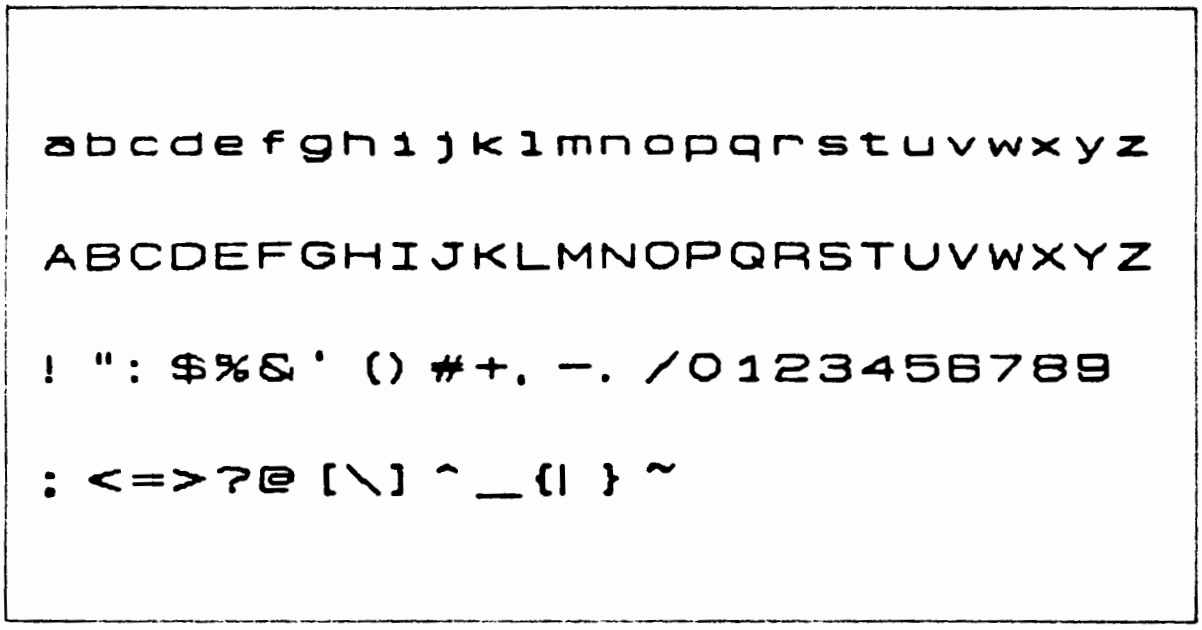


Figure 10-3. Supported Character Set

Input Escape Functions

JIESC

The following inquiry escape function is supported by AGP with the line printers:

Opcode	Function
6050	Inquire intermediate file specification

ILIST(1) - ILIST(3) = Six character disc file name
ILIST(4) = Security code
ILIST(5) = Disc cartridge number (or -disc LU)
ILIST(6) = File size in blocks (128 words)

Output Escape Functions

JOESC

Output escape functions are not supported.

Locator Echoes on the Graphics Display

JWLOC

Locator echoing on the display device is not supported.

Pick Echoes on the Graphics Display

JPICK

Pick echoing on the display device is not supported.

Termination

JWEND

The intermediate file is closed. Once the graphics display device has been terminated, output can be generated by running the translator program (see Appendix A).

GRAPHICS DISPLAY DEVICE HANDLER (DGL ONLY)

Description

The dimensions of the line printers are as follows:

Plotting area:	1082.6 mm wide by 324.91 mm high
Plotting capacity:	3069 points (4 pages) wide by 921 points high
Aspect ratio of maximum area:	0.3001
Resolution:	2.8346 points/mm in the X direction 2.7419 points/mm in the Y direction

The default logical limits are set to 279.0 X 215.5 mm, which is just inside an 11 x 8.5 inch (279.4 x 215.9 mm) page of paper. The aspect ratio of the default limits is: 0.7725.

The physical origin is the upper left hand corner of the piece of paper. The X-axis extends down the page, and the Y-axis extends across the page. This means that the logical display surface is rotated 90 degrees clockwise about the physical origin. Figure 10-4 shows the orientation of the letter "A" when output on the page.

The view surface is always justified in the lower left corner of the current logical display surface.

The size of the logical display surface determines how many sheets of paper are required for output. The amount of paper is rounded up to the next page boundary, so a frame always starts at the beginning of a page.

The user should use care when loading paper to align the top of the form with the first few printing scan lines.

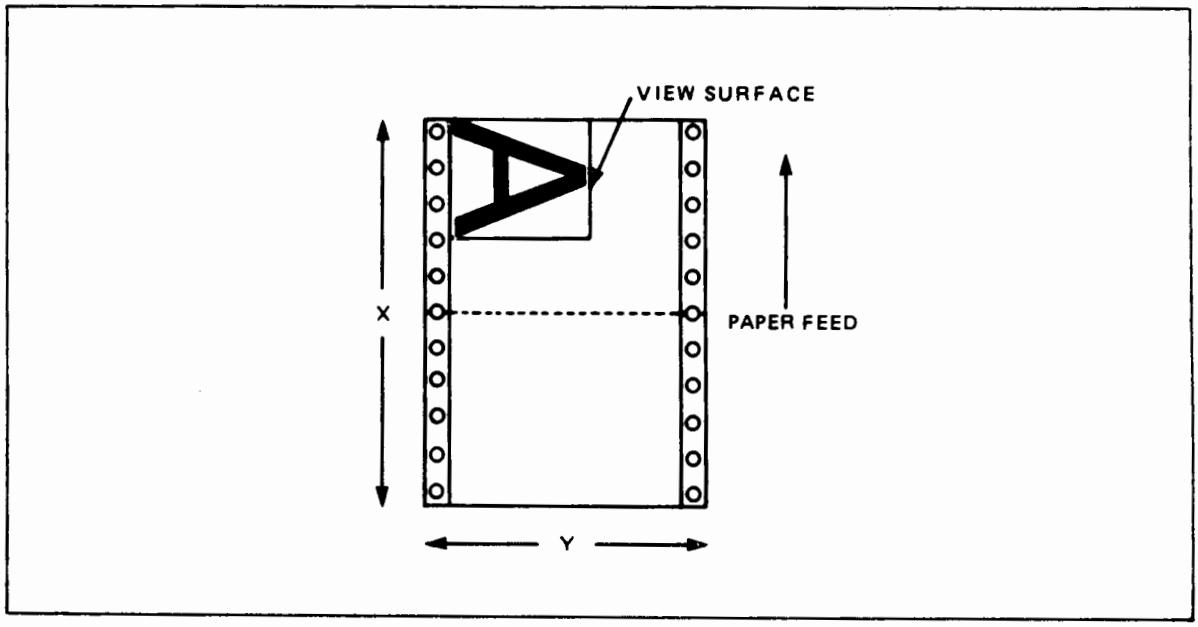


Figure 10-4. Output Orientation on the Physical Page

Initialization

ZDINT

When initialized, the following operations are performed:

Device name is set to printer name.

Color is set to 1.

Highlighting is set to 1.

Linewidth is set to 1.

Linestyle is set to 1.

Starting position is undefined.

Logical display limits are set to the default value.

The view surface is justified to the lower left corner of the logical display surface.

The intermediate file is created and opened.

If bit 7 is not set, then page advances are not supressed and will occur at RTRAN initialization and after each frame that is output.

If bit 7 is set, the following rules apply:

1) A page advance will not occur at RTRAN initialization.

2) Page advances will occur after each fram is translated, with the exception of the last frame in the file. If he last frame in the file is translated, it will not be followed by a page advance.

Supported Primitive Attributes

COLOR

ZCOLR

The D0026 display handler provides a software color table of one color. The size of the color table cannot be changed. The default value of the color table is shown in Table 10-2.

Table 10-2. Default Color Table

COLOR TABLE ENTRY = 1 >> Color set to black or blue, depending on the ribbon installed.

The color table is initialized when ZDINT is called. The color table cannot be redefined or inquired using ZDCOL or ZICOL.

The color selected corresponds to the color defined in the color table.

COLOR = 1 >> Color table entry 1 is selected

REDEFINING COLOR

ZDCOL/ZICOL

The colors in the color table cannot be redefined or inquired.

POLYGON INTERIOR COLOR

ZPICL

There is one color supported. The supported value of the color attribute is:

COLOR = 1 >> Color set to black

POLYGON STYLE

ZDPST

Using ZDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

ZPILS

Refer to JLSTL for information regarding linestyle.

HIGHLIGHTING

ZHIGH

Highlighting is not supported.

LINESTYLE

ZLSTL

Only one linestyle is supported.

LINESTYLE = 1 >> Primitives drawn with a solid line.

LINEWIDTH

ZLWID

Only one linewidth is supported.

LINEWIDTH = 1 >> Primitives drawn with a linewidth one point wide.

CHARACTER SIZES

ZCSIZ

The line printers support all character cell sizes which have a width and height not less than 1 mm and not greater than 250 mm.

The character is placed within the character cell as shown in Figure 10-5.

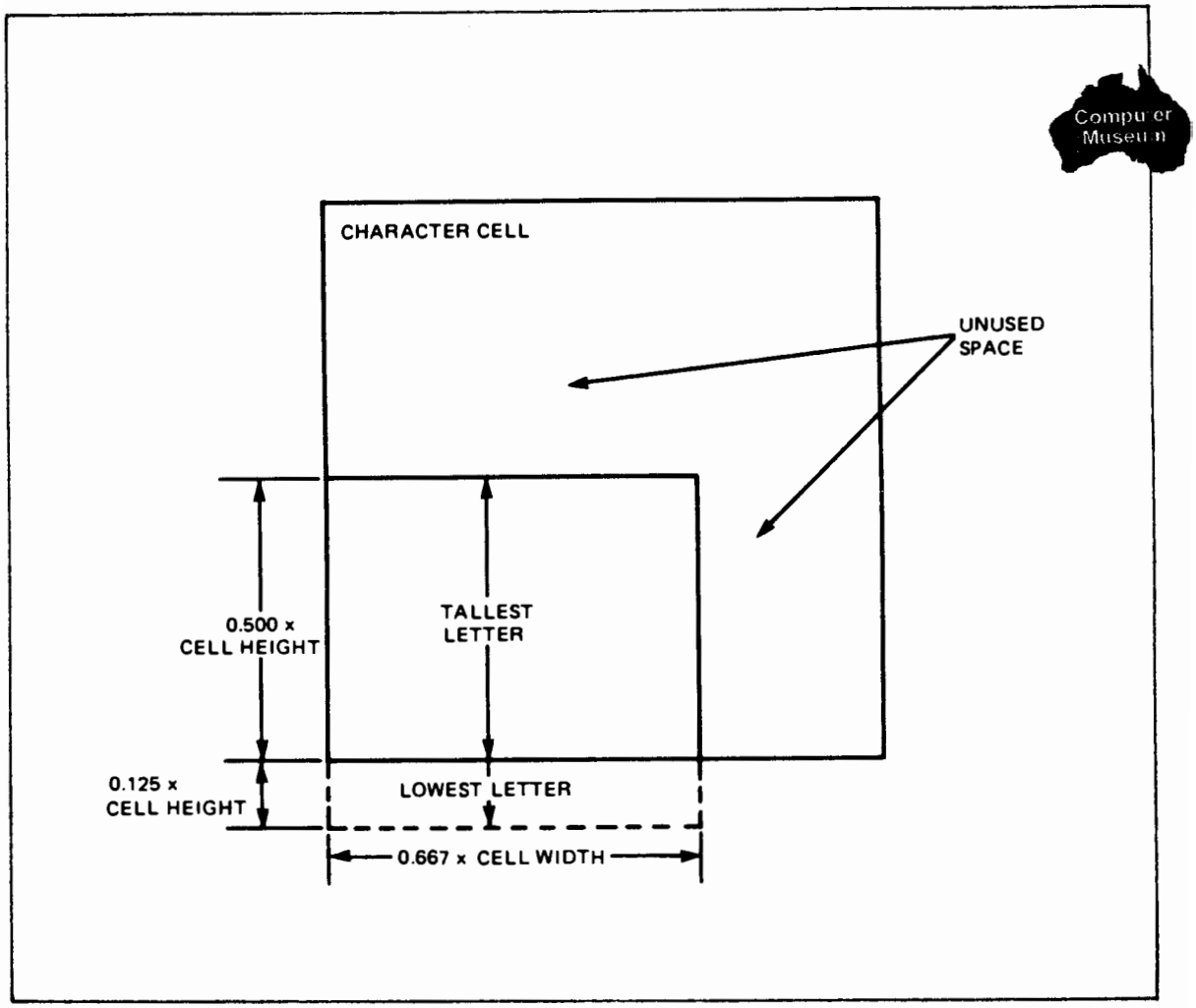


Figure 10-5. Character Placement in a Character Cell

Output Primitives

CLIPPING

The device handler supports vector and text clipping, both of which are set to the view surface limits. Parts of graphics items which exceed the view surface limits will be clipped.

POLYGONS

ZPGDD

The line printers do not provide hardware support of polygons. A polygon specified by ZPGDD will always be represented as described in the *DGL Reference Manual*.

MARKERS

ZMARK

The 19 standard markers are the only markers supported. A character size of 2.5 mm X 2.5 mm is always used to generate the markers.

TEXT

ZTEXT

Graphics text is generated by a software text generator in DGL. The only character set that is available is the standard 96-character ASCII set. Figure 10-6 shows this character set.

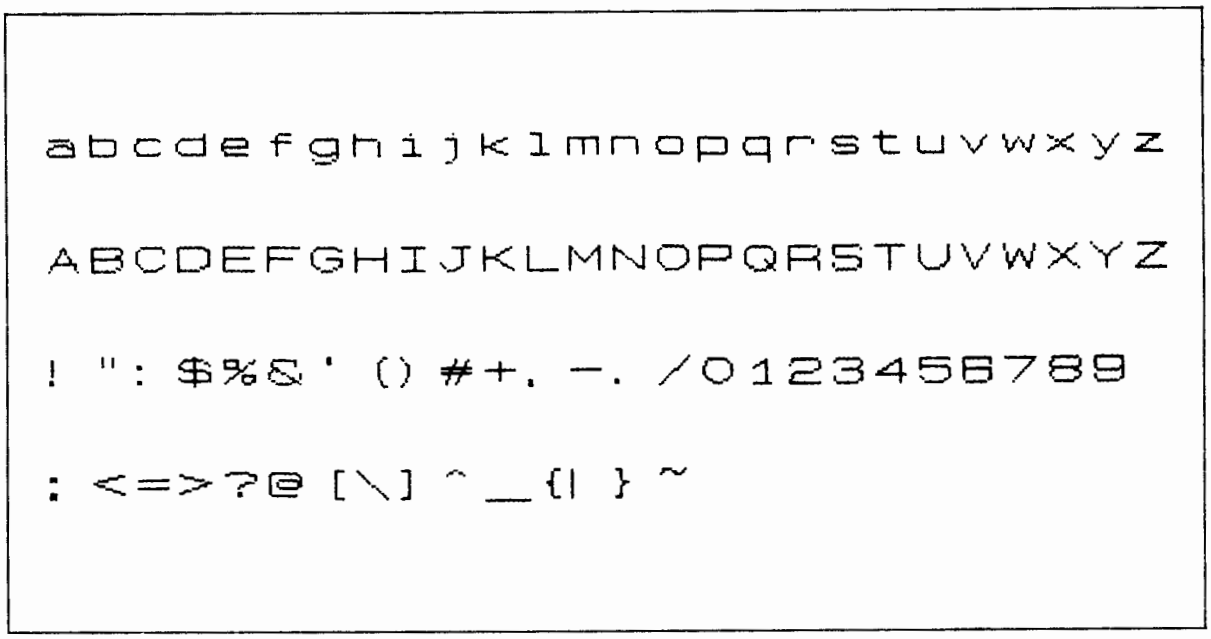


Figure 10-6. Supported Character Set

After a ZTEXT call, the starting position is set so that consecutive calls to ZTEXT will have the effect of concatenation. In addition to the viewable characters, text strings can also include the following control characters:

Control	Octal Code	Function
Backspace	10B	Move the starting position one character-cell width back
Line Feed	12B	Move the starting position one character-cell height down
Vertical Tab	13B	Move the starting position one character-cell height up
Carriage Return	15B	Move the starting position back to the beginning of the text string

Any other control characters are ignored.

New-Frame-Action

ZNEWF

A new-frame-action causes the picture to be made current and the paper to be advanced to the next page boundary.

Input Escape Functions

ZIESC

The following inquiry escape function is supported:

Opcode	Function
6050	Inquire intermediate file specification

ILIST(1)-ILIST(3) = Six character disc file name
ILIST(4) = Security code
ILIST(5) = Disc cartridge number (or -disc LU)
ILIST(6) = File size in blocks (128 words)

Output Escape Functions

ZOESC

Output escape functions are not supported.

Locator Echoes on the Graphics Display

ZWLOC

Locator echoing on the graphics display is not supported.

Termination

ZDEND

The intermediate file is closed, and the display name is set to '0026 '. Once the graphics display device has been terminated, output can be generated by the translator program (see Appendix A).

Chapter 11
HP 7220 Graphics Plotters

GENERAL INFORMATION

The user should be familiar with the operation of the HP 7220C or HP 7220T Graphics Plotters. If necessary, refer to the following manuals for the appropriate operating instructions:

HP 7220C and 7220T Graphics Plotter Operating and Programming Manual Using HP-GL Instructions *(07220-90003)*

HP 7220/7221C/T Graphics Plotter Service Manual *(07220-90004)*

Logical Devices Supported

The following logical devices are supported by the AGP/DGL Graphics Systems when using the HP 7220 Graphics Plotters.

Logical Device	Device Handler Name	Physical Device
Graphics display	D0018	HP 7220C/T
Graphics disply	D0021	HP 7220T
Locator	L0018	HP 7220C/T

D0018 may be used with the HP 7220C and HP 7220T. It drives both plotters as if they are an HP 7220C (no paper advance control, no cutter enable, etc.).

D0021 may be used with the HP 7220T. It utilizes the paper advance mechanisms on the plotter.

All information presented in this chapter applies to the HP 7220C and HP 7220T plotters unless stated otherwise.

Special Considerations

ADDITIONAL DATA DISPLAYED

When running AGP/DGL software application programs with HP 7220 Graphics Plotters in an eavesdrop configuration, a left parenthesis is displayed at the alpha cursor position on the eavesdrop terminal. This character is temporary and will not affect the location of subsequent alphanumeric characters displayed on the eavesdrop terminal.

OUTSPOOLING GRAPHICS NOT SUPPORTED

The HP 7220 Graphics Plotters do not support outspooling in an eavesdrop configuration. In DGL, if bit 0 of the control word in a ZDINT call is set to 1, IERR is returned as 3 and the device is not enabled. In AGP, if bit 0 of the control word in a JDINT call is set to 1, error 102 is reported and the call is ignored.

ABORTING PLOTTER OUTPUT

In the situation where there is a large amount of graphics data being transmitted, attempts to get a break mode prompt are usually unsuccessful. Therefore, to halt plotter instructions and begin communication to the terminal again, the following method should be used:

1) Switch the plotter to *STANDBY* or turn the plotter power off.

2) Type in a carriage return.

After the plotter is switched to the standby position, a few plotter instructions may appear on the terminal.

For DGL, the display device is disabled as if ZDEND had been called. All subsequent calls to the display device are ignored until ZDINT is called again. An inquiry to ZIWS with an opcode of 2050 returns a device status ILIST(1) of 22 and device error ILIST(2) of 0.

For AGP, the work station containing the plotter is terminated and error 160 is reported. In addition, if no work stations are left enabled, then the open segment (if there is one) is closed, and batch-of-updates (if it is in effect) is terminated. Future operations to the plotter work station will generate errors until the work station is re-initialized with a JDINT call. The application program can inquire if any errors have occurred by using a JIERR call.

GRAPHICS DISPLAY DEVICE HANDLER (AGP ONLY)

Description

The dimensions of the HP 7220 Graphics Plotters are as follows:

Platen surface:	420 mm wide by 297 mm high
Plotting area:	400 mm wide by 285 mm high
Plotting capacity:	16000 points wide by 11400 points high
Aspect ratio of maximum area:	0.7125
Resolution:	40.0 points/mm in the X and Y directions

When using D0018, the default logical display surface of the HP 7220 Graphics Plotters range from 15.25 to 396.4 mm in the X direction and 7.25 to 260.5 mm in the Y direction. The aspect ratio of the default limits is 0.66448.

When using D0021, the default logical display surface of the HP 7220 Graphics Plotters range from 0.0 to 400.0 mm in the X direction and 16.5 to 285.0 mm in the Y direction (fitted paper roll size). The aspect ratio of the logical display surface is 0.67125.

The physical origin of the device is 12 mm to the right of the left edge of the platen and 6 mm above the lower edge of the platen. This is the lower left boundary for pen movement.

The view surface is always justified in the lower left corner of the current logical display surface.

Initialization

JDINT

When the HP 7220 Graphics Plotters are initialized, the following operations are performed:

Device name is set to '7220C ' or '7220T ' (D0018)

Device name is set to '7220T ' (D0021)

Pen velocity is set to 36 cm/sec.

ASCII character set is set to 'ANSI ASCII' for medium and low quality text.

Medium and low quality text slant are set to 0 degrees (no slant) and text label direction is set to 0 degrees (horizontal).

The logical display surface is set to the default value.

The view surface is justified in the lower left corner of the logical display surface.

Hardware clipping limits are set to the view surface boundaries.

Paper cutter is enabled (D0021).

Advance page option is enabled (D0021).

Paper is advanced one full page (D0021), if bit 7 in the control word is not set. If bit 7 is set, the paper is not advanced.

Device Enabling

JWON

When HP 7220 Graphics Plotter are enabled, the pen representing the current color attribute is selected.

Primitive Attributes

COLOR

JCOLR

The D0018 and D0021 display handlers for the HP 7220C/T provide a software color table of eight distinct colors, which support eight pens. The size of the color table cannot be changed. The default values of the color table are shown in Table 11-1.

Table 11-1. Default Color Table for Eight Pen Plotters

	R	G	B
COLOR TABLE ENTRY = 1 >> Black	0.0	0.0	0.0
= 2 >> Red	1.0	0.0	0.0
= 3 >> Yellow	1.1	1.1	0.0
= 4 >> Green	0.0	1.0	0.0
= 5 >> Cyan	0.0	1.0	1.0
= 6 >> Blue	0.0	0.0	1.0
= 7 >> Magenta	1.0	0.0	1.0
= 8 >> White	1.0	1.0	1.0

The color table is initialized to the default values when JDINT is called color table can be redefined or inquired using JDCOL or JICOL.

The pen selected corresponds to the color index passed in the JCOLR call. The color table is not used when selecting the pen on a JCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 0 >> Current pen is returned to its stall
      = 1 >> Pen #1 is selected
      = 2 >> Pen #2 is selected
      = 3 >> Pen #3 is selected
      = 4 >> Pen #4 is selected
      = 5 >> Pen #5 is selected
      = 6 >> Pen #6 is selected
      = 7 >> Pen #7 is selected
      = 8 >> Pen #8 is selected
```

REDEFINING COLOR

JDCOL/JICOL

All of the colors in the color table can be redefined, or inquired, except for the background color. When the color table is redefined, it only affects the values returned on JICOL calls. AGP does not use the color table when selecting the pen on a JCOLR or JPICL call. The color table is provided for the user's convenience.

POLYGON INTERIOR COLOR

JPICL

Refer to JCOLR for information regarding color.

POLYGON STYLE

JDPST

Since the HP 7220C/T Graphics Plotters are hard copy devices, using JDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

JPILS

Refer to JLSTL for information regarding linestyle.

HIGHLIGHTING

JSHI/JGHI

Highlighting is not supported on the HP 7220 Graphics Plotters.

LINESTYLE

JLSTL

Seven predefined linestyles are supported on the HP 7220 Graphics Plotters. They may all be classified as being *continuous*. See Figure 11-1 for the supported linestyles.

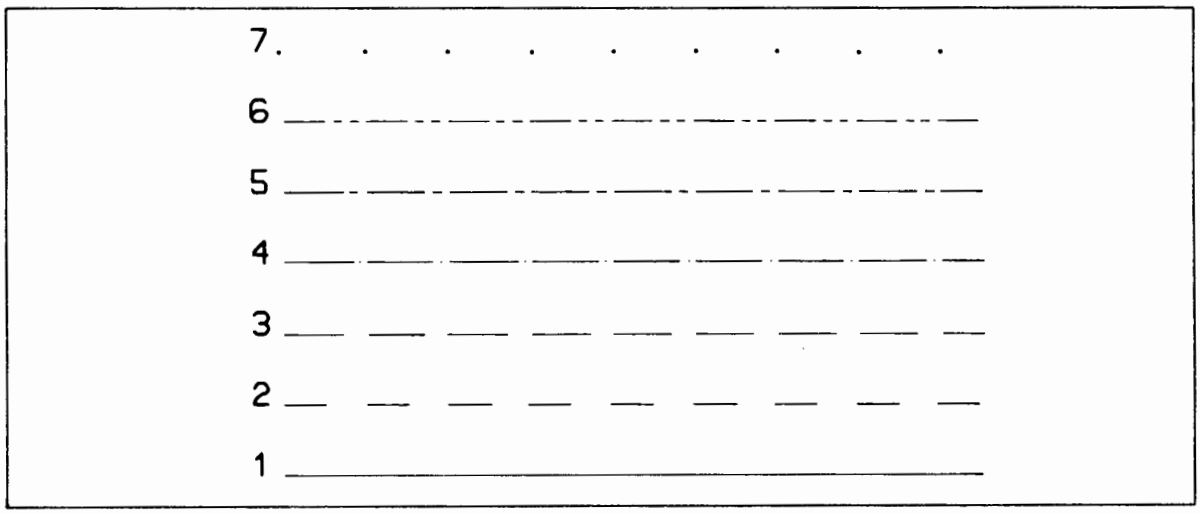


Figure 11-1. Supported Linestyles

LINEWIDTH

JLWID

Only one linewidth is supported on the HP 7220 Graphics Plotters.

LINEWIDTH = 1 >> Primitives drawn with the linewidth of the pen selected.

CHARACTER SIZES

JCSIZ

For medium and low quality text, the HP 7220 Graphics Plotters support all character cell sizes which have a width and height not less than 1 mm and not greater than 250 mm.

When using medium and low quality text, the character is placed within the character cell as shown in Figure 11-2.

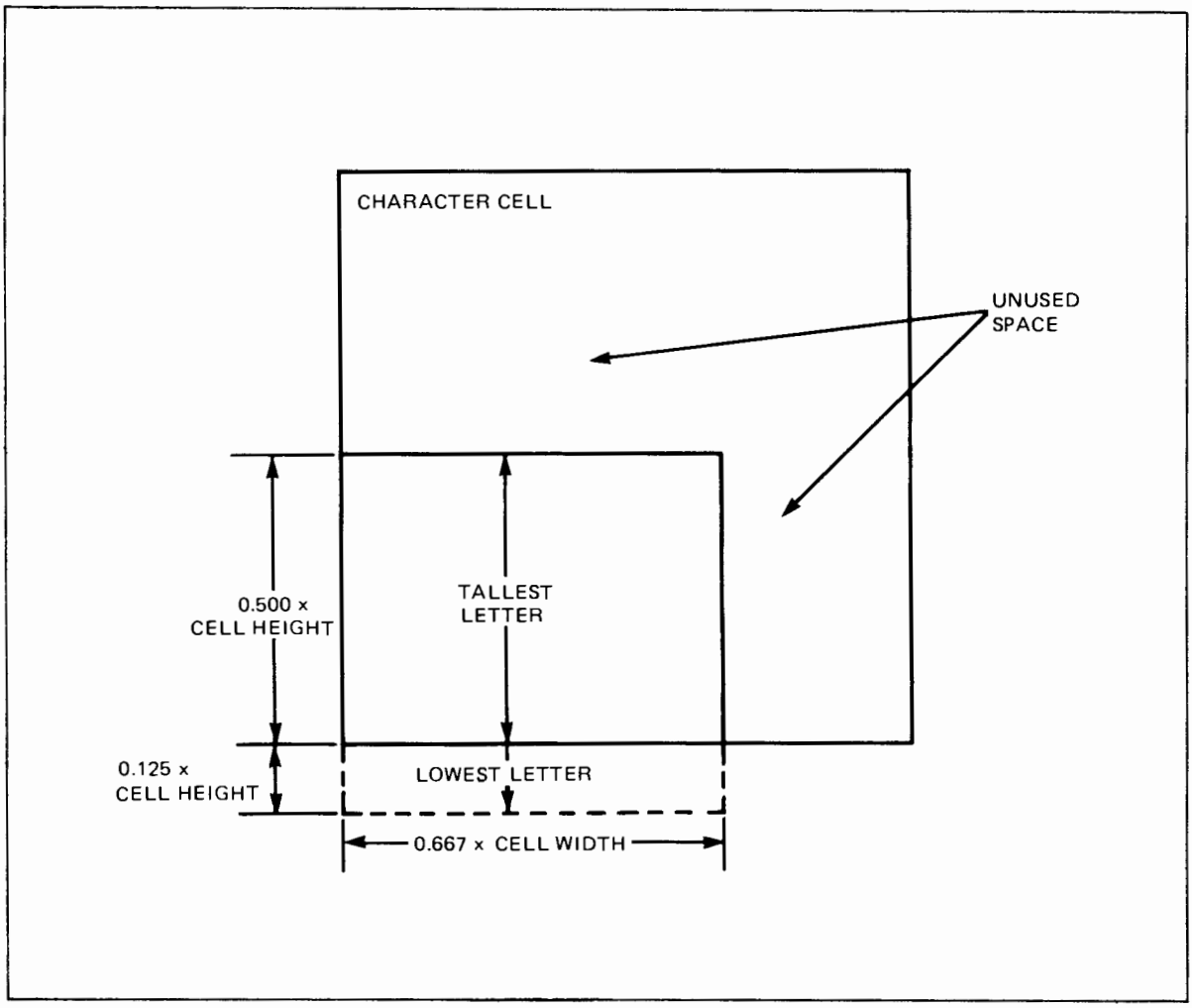


Figure 11-2. Placement of Character in Character Cell

Output Primitives

CLIPPING

The AGP user can access the hardware vector clipping feature of the HP 7220 Graphics Plotters through the output escape function JOESC(450). Calls to JASPK, JWIND, JVIEW, JDLIM and JDINT will reset the hardware clipping limits to the view surface boundaries. The user can redefine the hardware clipping limits to be any region within the boundaries of the view surface by a call to JOESC(450).

If AGP window clipping is disabled and parts of the image are outside of the view surface limits, then unpredictable results may occur. Graphics items which extend past the view surface limits will activate the plotter's *out-of-limits* lights. If the image is entirely within the view surface limits, then only the portion of the image that is within the hardware clipping limits will be displayed.

If AGP window clipping is enabled, only the portion of the image which is within the viewport and within the hardware clipping limits will be displayed.

POLYGONS

J2PGN/J3PGN/JR2PG/JR3PG

This device does not have hardware area fill.

MARKERS

J2MRK/J3MRK/JR2MK/JR3MK

The 19 standard markers are the only markers supported with the HP 7220 Graphics Plotters. A character size of 2.0 mm by 2.0 mm is always used to generate the markers. Markers are affected by the color attribute.

MEDIUM AND LOW QUALITY TEXT

JTEXM/JTEXL

Medium and low quality graphics text are generated with a hardware character generator. Hardware text is affected by color but is not affected by linestyle attribute. It is always generated with solid lines.

If a medium or low quality text string is not clipped by AGP, all characters which extend beyond the hardware clipping limits will be clipped by the plotter.

A standard ASCII character set is used as the default character set. There are four additional character sets available to the user via HP 7220 Graphics Plotters escape functions. These character sets are given in Table 11-2.

The user can modify the direction and slant of medium and low quality text through the output escape function (see JOESC(150), JOESC(250)).

Table 11-2. Supported Hardware Character Sets

Decimal Code	ASCII Character	7220 Function/Character Set				
		Set 0	Set 1	Set 2	Set 3	Set 4
0	NULL	No Operation (NOP)				
1	SOH	NOP				
2	STX	NOP				
3	ETX	Default End Label Instruction				
4	ETO	NOP				
5	ENQ	NOP				
6	ACK	NOP				
7	BEL	NOP				
8	BS	Backspace				
9	HT	NOP				
10	LF	Line Feed				
11	VT	Inverse Line Feed				
12	FF	NOP				
13	CR	Carriage Return				
14	SO	Select Alternate Character Set				
15	SI	Select Standard Character Set				
16	DLE	NOP				
17	DC1	NOP				
18	DC2	NOP				
19	DC3	NOP				
20	DC4	NOP				
21	NAK	NOP				
22	SYN	NOP				
23	ETB	NOP				
24	CAN	NOP				
25	EM	NOP				
26	SUB	NOP				
27	ESC	NOP				
28	FS	NOP				
29	GS	NOP				
30	RS	NOP				
31	US	NOP				
32	SP	Space				
33	!	!	!	!	!	¡
34	"	"	"	"	"	"
35	#	#	#	£	£	¿
36	$	$	$	$	$	$
37	%	%	%	%	%	%
38	&	&	&	&	&	&
39	'	'	'	`	'	`
40	(	(	(	(	(	(
41	)	)	)	)	)	)
42	*	*	*	*	*	*
43	+	+	+	+	+	+
44	,	,	,	,	,	,

NOTE: Plotter performs an automatic backspace before drawing any of the characters offset to the left.

Computer Museum

Table 11-2. Supported Hardware Character Sets (continued)

Decimal Code	ASCII Character	7220 Function/Character Set				
		Set 0	Set 1	Set 2	Set 3	Set 4
45	—	–	–	–	–	–
46	.	.	.	.	.	.
47	/	/	/	/	/	/
48	0	0	0	0	0	0
49	1	1	1	1	1	1
50	2	2	2	2	2	2
51	3	3	3	3	3	3
52	4	4	4	4	4	4
53	5	5	5	5	5	5
54	6	6	6	6	6	6
55	7	7	7	7	7	7
56	8	8	8	8	8	8
57	9	9	9	9	9	9
58	:	:	:	:	:	:
59	;	;	;	;	;	;
60	<	<	<	<	<	<
61	=	=	=	=	=	=
62	>	>	>	>	>	>
63	?	?	?	?	?	?
64	@	@	@	@	@	@
65	A	A	A	A	A	A
66	B	B	B	B	B	B
67	C	C	C	C	C	C
68	D	D	D	D	D	D
69	E	E	E	E	E	E
70	F	F	F	F	F	F
71	G	G	G	G	G	G
72	H	H	H	H	H	H
73	I	I	I	I	I	I
74	J	J	J	J	J	J
75	K	K	K	K	K	K
76	L	L	L	L	L	L
77	M	M	M	M	M	M
78	N	N	N	N	N	N
79	O	O	O	O	O	O
80	P	P	P	P	P	P
81	Q	Q	Q	Q	Q	Q
82	R	R	R	R	R	R
83	S	S	S	S	S	S
84	T	T	T	T	T	T
85	U	U	U	U	U	U
86	V	V	V	V	V	V
87	W	W	W	W	W	W
88	X	X	X	X	X	X
89	Y	Y	Y	Y	Y	Y

Table 11-2. Supported Hardware Character Sets (continued)

Decimal Code	ASCII Character	7220 Function/Character Set				
		Set 0	Set 1	Set 2	Set 3	Set 4
90	Z	Z	Z	Z	Z	Z
91	[	[	[	[	Ø	[
92	\	\	√	ç	Æ	¡
93	]	]	]	]	ø	]
94		^	↑	^	æ	^
95	_	‾	‾	‾	‾	‾
96						
97	a	a	a	a	a	a
98	b	b	b	b	b	b
99	c	c	c	c	c	c
100	d	d	d	d	d	d
101	e	e	e	e	e	e
102	f	f	f	f	f	f
103	g	g	g	g	g	g
104	h	h	h	h	h	h
105	i	i	i	i	i	i
106	j	j	j	j	j	j
107	k	k	k	k	k	k
108	l	l	l	l	l	l
109	m	m	m	m	m	m
110	n	n	n	n	n	n
111	o	o	o	o	o	o
112	p	p	p	p	p	p
113	q	q	q	q	q	q
114	r	r	r	r	r	r
115	s	s	s	s	s	s
116	t	t	t	t	t	t
117	u	u	u	u	u	u
118	v	v	v	v	v	v
119	w	w	w	w	w	w
120	x	x	x	x	x	x
121	y	y	y	y	y	y
122	z	z	z	z	z	z
123		{	¨	¨	¨	‿
124		|	⊢	°	°	‾
125		}	→	¨	¨	‿
126	~	~	‾		°	‾
127	DEL	NOP				

New-Frame-Action

JNEWF/JPURG/JSVIS/JSHI/JVSAL/JCLR

When using D0018, a new-frame-action causes the picture to be made current. All visible segments are then drawn, or redrawn, on the display surface. The application program should generate pause time, if necessary, to allow the user to change the paper.

When using D0021, a new-frame-action causes the picture to be made current. The paper roll is then advanced a full page and the paper is cut. All visible segments are then drawn, or redrawn on the new page. The cutter and paper advance mechanisms may also be controlled by escape functions.

Inquiry Escape Functions

JIESC

The following inquiry escape functions are supported by AGP with the HP 7220 Graphics Plotters.

OPCODE	FUNCTION
1050	Inquire error

ILIST(1) = 0 No error
= 1 Instruction not recognized
= 2 Wrong number of parameters
= 3 Parameter out-of-range
= 4 Not used
= 5 Unknown character set
= 6 Position overflow
= 7 Not used
= 8 Out of paper roll (only on the HP 7220T)

Output Escape Functions

JOESC

Several output escape functions are supported by AGP with the HP 7220 plotters. Error checking is not performed by the graphics system for out-of-range or incorrect parameters. Out-of-range parameters flag an error in the plotter and the corresponding command is ignored.

Escape functions are not stored in the segment display area. This can have implications when used with AGP segments. For example, a character slant of 10 degrees is set with escape function JOESC(150). If a text string is created inside a segment, the character slant is changed to 30 degrees and a new-frame-action is given. The string will be redrawn with the present character slant of 30 degrees, rather than the character slant of 10 degrees it was created with.

Escape functions may also have undesired effects on low and medium quality text. For example, since medium quality text is output a character at a time, setting the text direction angle will affect each character by itself, which will not produce the same angled text that would be output if low quality text were used. See the AGP Users Guide for an example of the difference in low and medium quality text.

Escape functions are sent from AGP directly to DGL. The state of AGP may become undefined when an escape function is given that overrides a mode set by AGP (e.g. hardware text direction).

The following output escape functions are supported with all of the HP 7220 plotters:

OPCODE	FUNCTION
150	Set device character slant for subsequent medium and low quality text. See Figure 11-3. RLIST(1) = Tangent of angle from vertical (from 127.999 to -127.999)

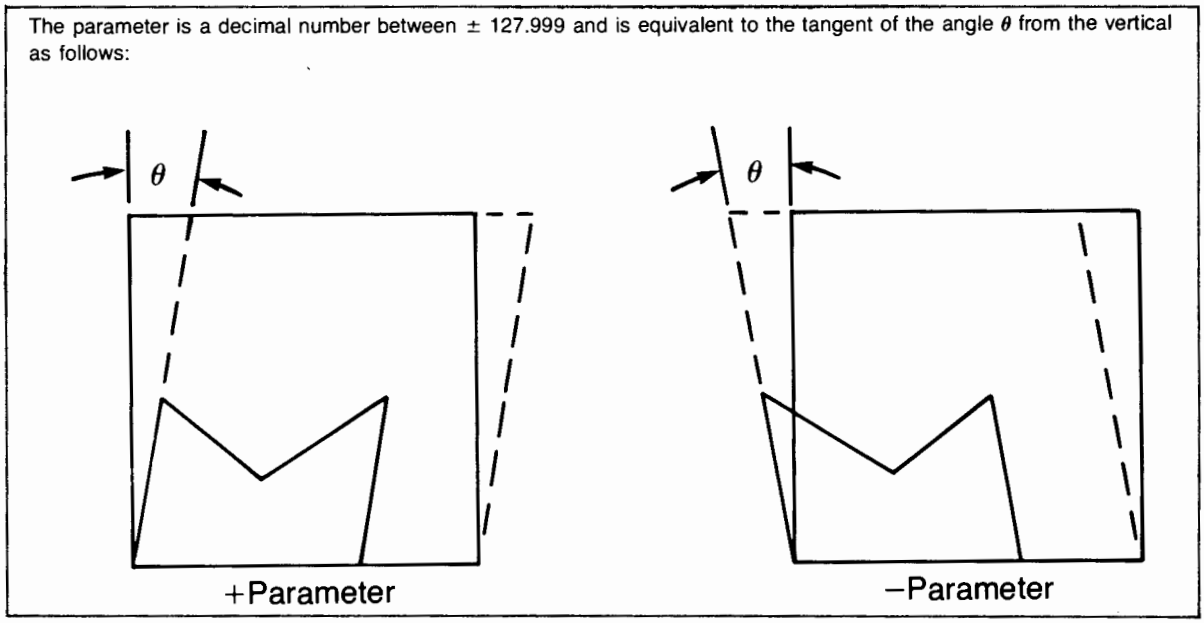


Figure 11-3. Character Slant

250 Set device character direction for subsequent medium and low quality text. See Figure 11-4.

RLIST(1) = X component of character direction slope (run)
RLIST(2) = Y component of character direction slope (rise)

252 Draw circle. The current position defines the center of the circle. The sign of the circle's radius determines the starting point of the circle. If the radius specified is positive, the circle begins at the 0 degree point. If the radius specified is negative, the circle begins at the 180 degree point. Refer to Figure 11-5 for a specification of the circle.

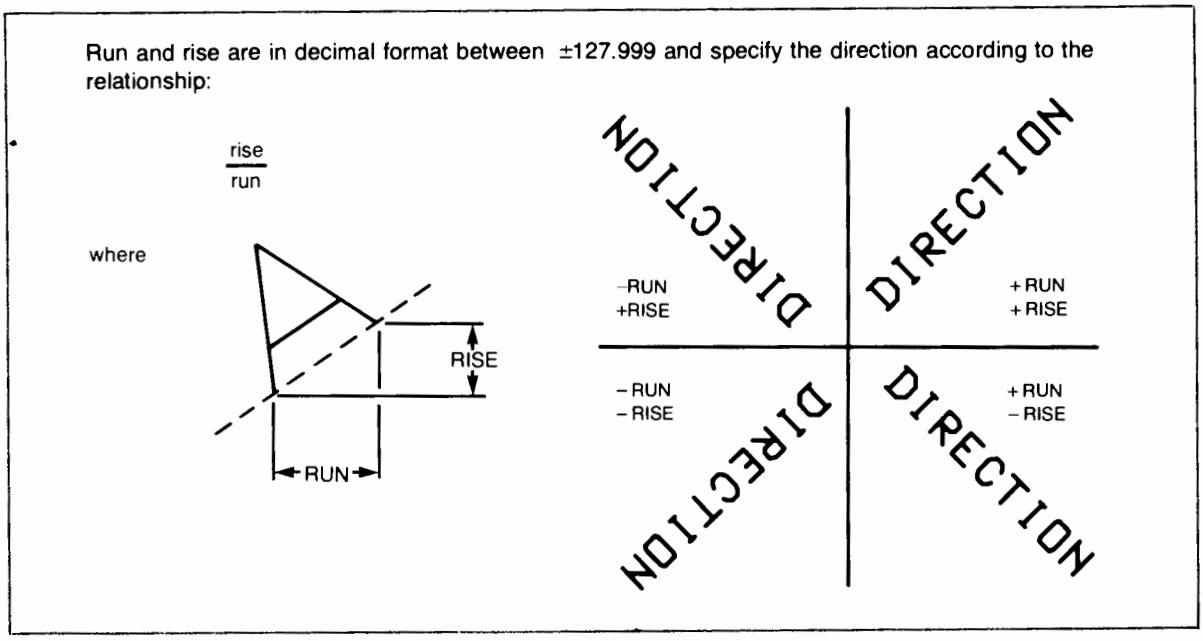


Figure 11-4. Character Direction

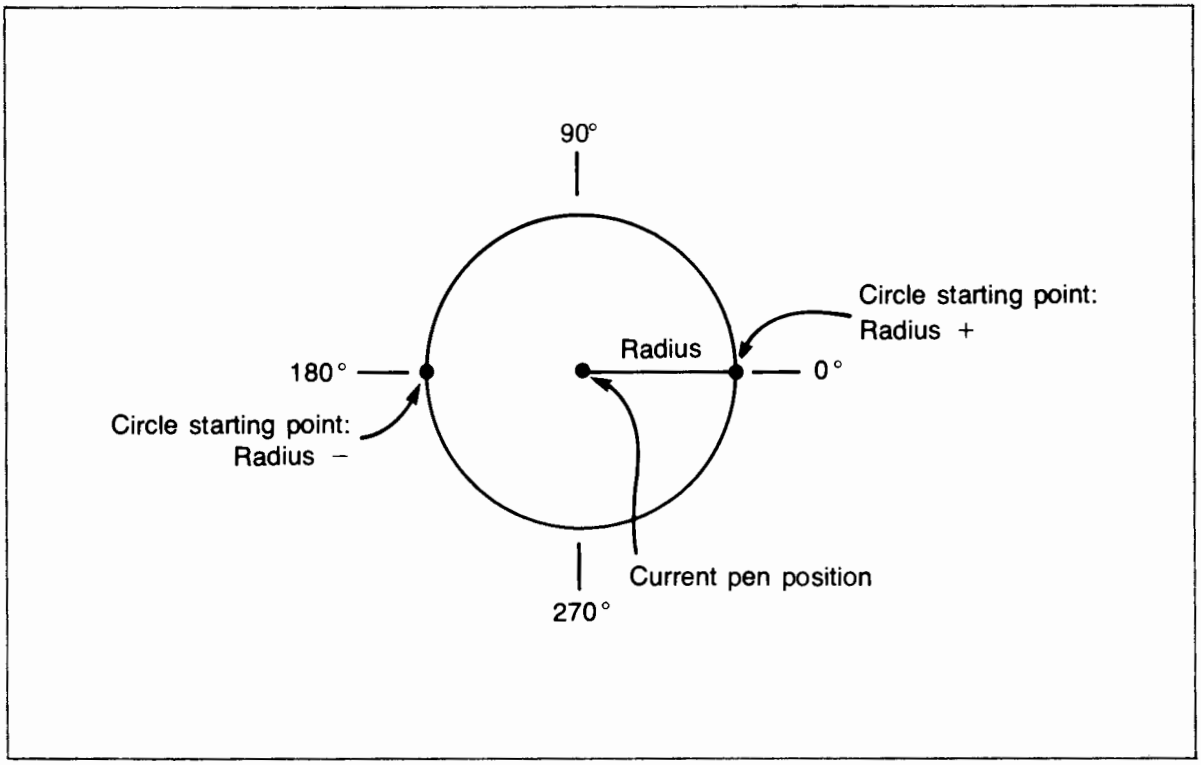


Figure 11-5. Circle Specifications

The circle is approximated by a multi-sided polygon. The accuracy of the circle generated can be controlled by the user. This is done by specifying the chord tolerance either by degrees or in terms of distance devication. When using the degrees mode, the user specifies the maximum number of degrees subtended by a chord that is used to represent an arc segment of the circle (see Figure 11-6). Figure 11-7 shows the effects which different value of degrees subtended by a chord has on the circle generated.

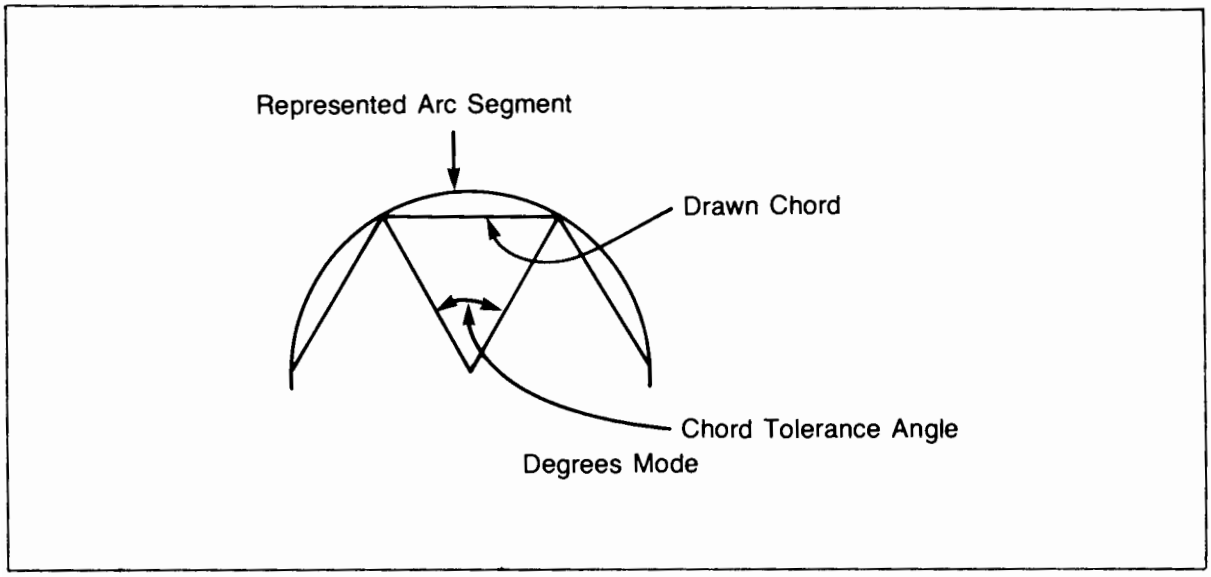


Figure 11-6. Specifying the Chord Tolerance in Degrees

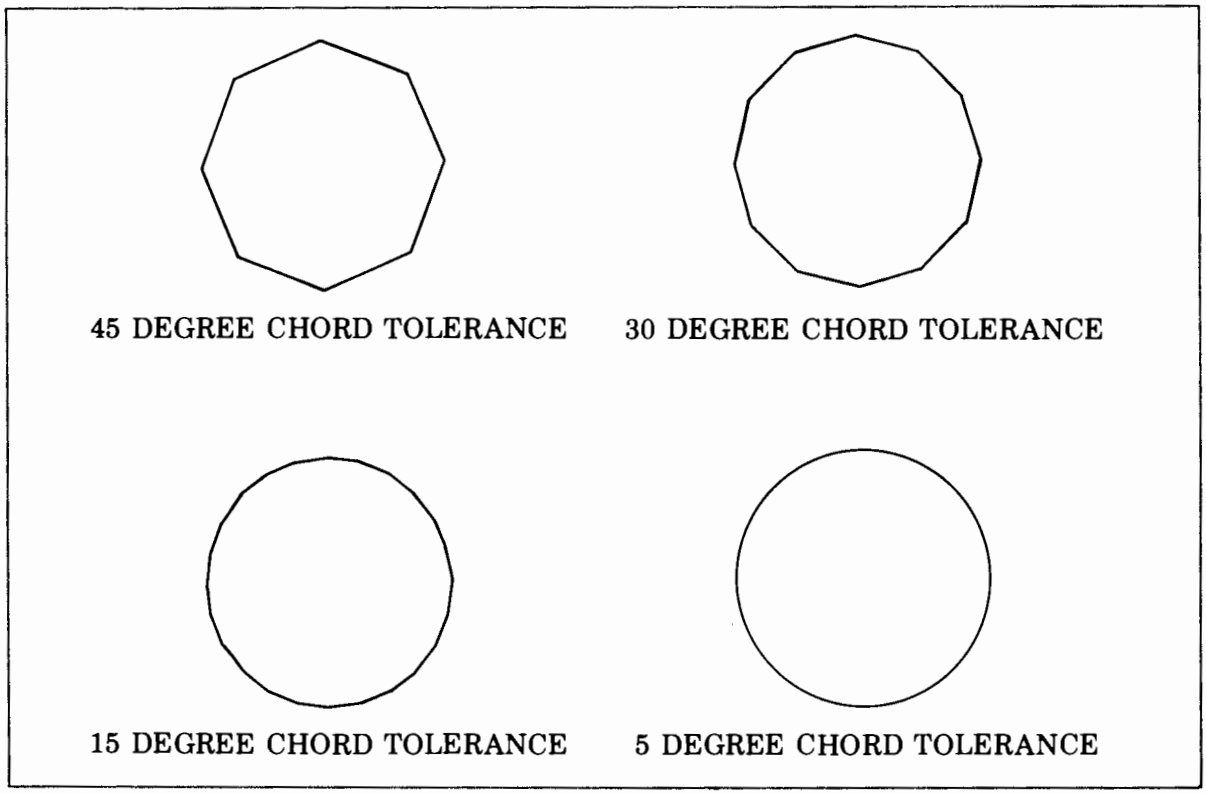


Figure 11-7. Effect of Different Chord Angles

When using distance deviation to specify the chord tolerance, the user specifies the maximum distance permitted between the chord drawn and the arc segment it represents (see Figure 11-8).

RLIST(1) = Radius of circle expressed in virtual coordinate units
RLIST(2) = Chord tolerance
- > 0 RLIST(2) specifies the maximum number of degrees that can be spanned by any chord.
- < 0 Absolute value of RLIST(2) specifies the maximum distance, in virtual coordinates, that any chord can be from the arc that it represents.

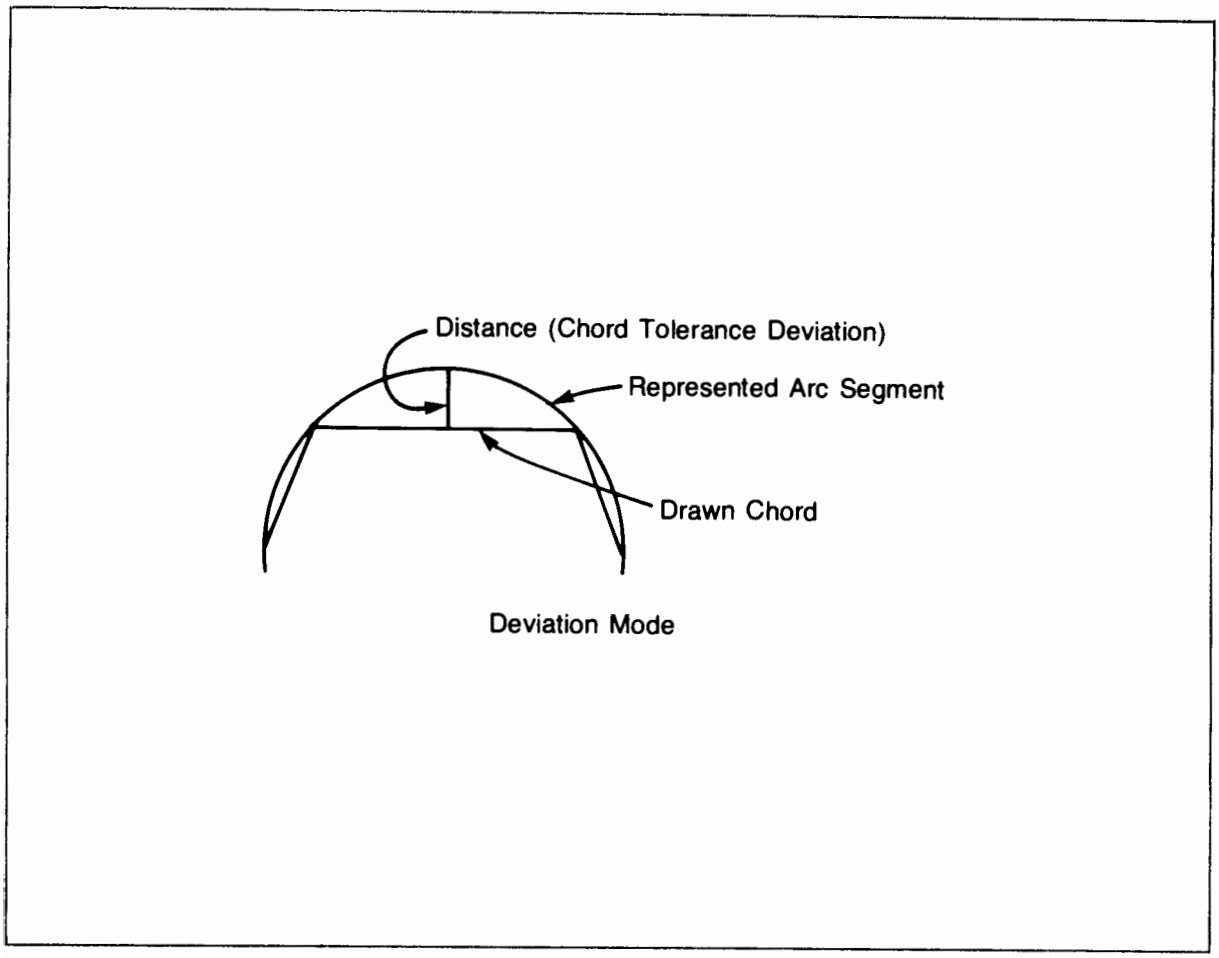


Figure 11-8. Specifying Chord Tolerance with Distance Deviation

450 Set hardware clipping limits. Provides a means to change the hardware clipping limits. JASPK, JWIND, JVIEW, JDLIM, and JDINT will reset the hardware clipping limits to the view surface boundaries. Only points within the view surface will be clipped. Any vector or text given outside the view surface may give unpredictable results. See the section on Medium and Low Quality Text for information on clipping.

```
RLIST(1) = X min  (virtual coordinate units)
RLIST(2) = X max  (virtual coordinate units)
RLIST(3) = Y min  (virtual coordinate units)
RLIST(4) = Y max  (virtual coordinate units)
```

451 Draw arc. This instruction draws an arc along the circumference of the circle with center at (RLIST(1), RLIST(2)). The arc begins at the pen position and extends RLIST(3) degrees along the circle. If RLIST(3) is positive, the arc will be drawn in a counter-clockwise direction from the starting

position. Otherwise the arc is drawn in a clockwise direction. See JOESC(252) for a review of chord tolerance specifications.

RLIST(1) = X virtual coord. of center of circle.
RLIST(2) = Y virtual coord. of center of circle.
RLIST(3) = Degrees suspended by arc.
RLIST(4) = Chord tolerance.
> 0 RLIST(4) specifies the maximum number of degrees that can be spanned by a chord.
< 0 Absolute value of RLIST(4) specifies the maximum distance, in virtual coordinates, that any chord can be from the arc that it represents.

1050 Select medium or low quality text character set. This instruction provides a means for selecting an alternate character set. See Table 11-1 for the HP 7220 hardware character set.

ILIST(1) = 0 ANSI ASCII
1 7220 ASCII
2 French/German ASCII
3 Scandinavian ASCII
4 Spanish/Latin American ASCII

1051 For internal use only.

1052 Enable cutter. Provides means to control the HP 7220T paper cutter. Paper is cut after it is advanced. (Supported only with the D0021 library.)

ILIST(1) = 0 cutter is disabled
<> 0 cutter is enabled

1053 Advance paper. This instruction makes the picture current and advances the paper either a half or full page. (Supported only with the D0021 library.)

ILIST(1) = 0 Advance half page
<> 0 Advance full page

2050 Select pen speed. This instruction allows the user to modify the plotter pen speed. Pen speed may be set from 1 to 36 cm/sec.

ILIST(1) = Pen speed (integer from 1 to 36 cm/sec)
ILIST(2) = Pen number (integer from 1 to 8) Pen numbers outside of this range will change speed for all pens.

Locator Echoes on the Graphics Display

JWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

SAME PHYSICAL DEVICE

If the locator function and graphics display function are both physically implemented on the same HP 7220 plotter, then the following echoes are supported on the graphics display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the display pen will be moved to the current locator echo position. The pen will continue to reflect the current locator position (i.e. tracked) until the locator operation is terminated.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the display pen and the Y coordinate of the locator echo position.

6 Vertical rubber band line

The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the locator echo position and the Y coordinate of the display pen.

7 Horizontal/vertical rubber band line

The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned is the same as ECHO 5 if the locator's X displacement from the locator echo position is greater than its Y displacement. The point returned is the same as ECHO 6 if the Y displacement becomes greater than the X displacement.

8 Rubber band box

Same as ECHO 2.

DIFFERENT PHYSICAL DEVICES

If the graphics display and the locator functions are performed on different physical devices and the locator supports echoes on a different physical display device, then the following echoes are supported on the plotter. (Because of the eavesdrop configuration, the locator device and display device may be the same I/O unit descriptor, but be different physical devices.)

ECHO#	ECHO PERFORMED
2	Small cursor

Initially, the plotter pen will be moved to the current locator echo position. The pen will then reflect the current locator position (i.e. track the locator position) until operator response.

3 Full cross-hair cursor

Same as ECHO 2.

4 Rubber band line

Same as ECHO 2.

5 Horizontal rubber band line

Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator position and the Y coordinate of the current locator echo position.

6 Vertical rubber band line

Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator echo position and the Y coordinate of the current locator position.

7 Horizontal/Vertical rubber band line Initially, the plotters pen position is moved to the initial locator echo position. Subsequently, when the locator's X displacement becomes greater than its Y displacement, ECHO 5 is simulated. When the locator's Y displacement becomes greater than its X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

Disabling

JWOFF

When the device is disabled, the current pen is returned to its stall.

GRAPHICS DISPLAY DEVICE HANDLER (DGL ONLY)

Description

The dimensions of the HP 7220 Graphics Plotters are as follows:

Platen surface:	420 mm wide by 297 mm high
Plotting area:	400 mm wide by 285 mm high
Plotting capacity:	16000 points wide by 11400 points high
Aspect ratio of maximum area:	0.7125
Resolution:	40.0 points/mm in X and Y directions

When using D0018, the default logical display surface ranges from 15.25 to 396.4 mm in the X direction and 7.25 to 260.5 mm in the Y direction. The aspect ratio of the logical display surface is 0.66448.

When using D0021, the default logical display surface ranges from 0.0 to 400.0 mm in the X direction and 16.5 to 285.0 mm in the Y direction (fitted paper roll size). The aspect ratio of the logical display surface is 0.67125.

The physical origin of the graphics display is 12 mm to the right of the left edge of the platen and 6 mm above the lower edge of the platen. This is the lower left boundary for pen movement.

The view surface is always justified in the lower left corner of the current logical display surface.

Initialization

ZDINT

When the HP 7220 plotter is initialized, the following operations are performed:

Device name is set to '7220C ', '7220T ' (D0018).

Device name is set to '7220T ' (D0021).

Color set to 1.

Highlighting set to 1.

Linewidth set to 1.

Linestyle set to 1.

Starting position is undefined.

Pen velocity is set to 36 cm/sec.

ASCII character set is set to 'ANSI ASCII'.

Text slant is set to 0 degrees (no slant), text label direction is set to 0 degrees (horizontal).

The logical display limits are set to the default value.

The view surface is justified to the lower left corner of the logical display surface.

Hardware clipping is set to view surface boundaries.

Paper cutter is enabled (D0021).

Advance page option is enabled (D0021).

Paper is advanced one full page (D0021), if bit 7 in the control word is not set. If bit 7 is set, the paper is not advanced.

Supported Primitive Attributes

COLOR

ZCOLR

The D0018 and D0021 display handlers for the HP 7220C/T provide a software color table of eight distinct colors, which support eight pens. The size of the color table cannot be changed. The default values of the color table are shown in Table 11-3.

Table 11-3. Default Color Table for Eight Pen Plotters

	R	G	B
COLOR TABLE ENTRY = 1 >> Black	0.0	0.0	0.0
= 2 >> Red	1.0	0.0	0.0
= 3 >> Yellow	1.1	1.1	0.0
= 4 >> Green	0.0	1.0	0.0
= 5 >> Cyan	0.0	1.0	1.0
= 6 >> Blue	0.0	0.0	1.0
= 7 >> Magenta	1.0	0.0	1.0
= 8 >> White	1.0	1.0	1.0

The color table is initialized to the default values when ZDINT is calle color table can be redefined or inquired using ZDCOL or ZICOL.

The pen selected corresponds to the color index passed in the ZCOLR call. The color table is not used when selecting the pen on a ZCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 0 >> Current pen is returned to its stall
      = 1 >> Pen #1 is selected
      = 2 >> Pen #2 is selected
      = 3 >> Pen #3 is selected
      = 4 >> Pen #4 is selected
      = 5 >> Pen #5 is selected
      = 6 >> Pen #6 is selected
      = 7 >> Pen #7 is selected
      = 8 >> Pen #8 is selected
```

REDEFINING COLOR

ZDCOL/ZICOL

All of the colors in the color table can be redefined, or inquired, except for the background color. When the color table is redefined, it only affects the values returned on ZICOL calls. DGL does not use the color table when selecting the pen on a ZCOLR or ZPICL call. The color table is provided for the user's convenience.

POLYGON INTERIOR COLOR

ZPICL

Refer to ZCOLR for information regarding color.

POLYGON STYLE

ZDPST

Since the HP 7220C/T Graphics Plotters are hard copy devices, using ZDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

ZPILS

Refer to ZLSTL for information regarding linestyle.

HIGHLIGHTING

ZHIGH

Highlighting is not performed on the HP 7220 plotters.

LINESTYLE

ZLSTL

Seven predefined linestyles are supported on the HP 7220 plotters. All linestyles supported on the 7220 plotters may be classified as being "continuous". See Figure 11-9 for the supported linestyles.

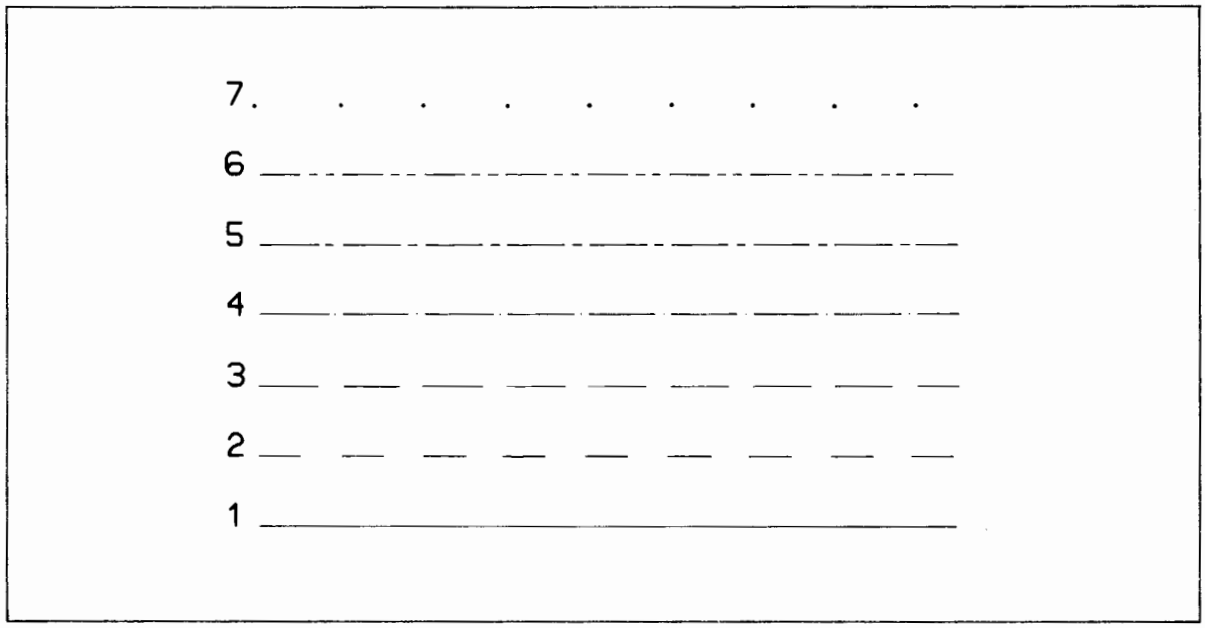


Figure 11-9. Supported Linestyles

LINEWIDTH

ZLWID

Only one linewidth is supported on the HP 7220 plotters

LINEWIDTH = 1 >> Primitives drawn with the linewidth of the pen selected.

CHARACTER SIZES

ZCSIZ

The HP 7220 plotters support all character cell sizes which have a width and height not less than 1 mm and not greater than 250 mm.

The character is placed within the character cell as shown in Figure 11-10.

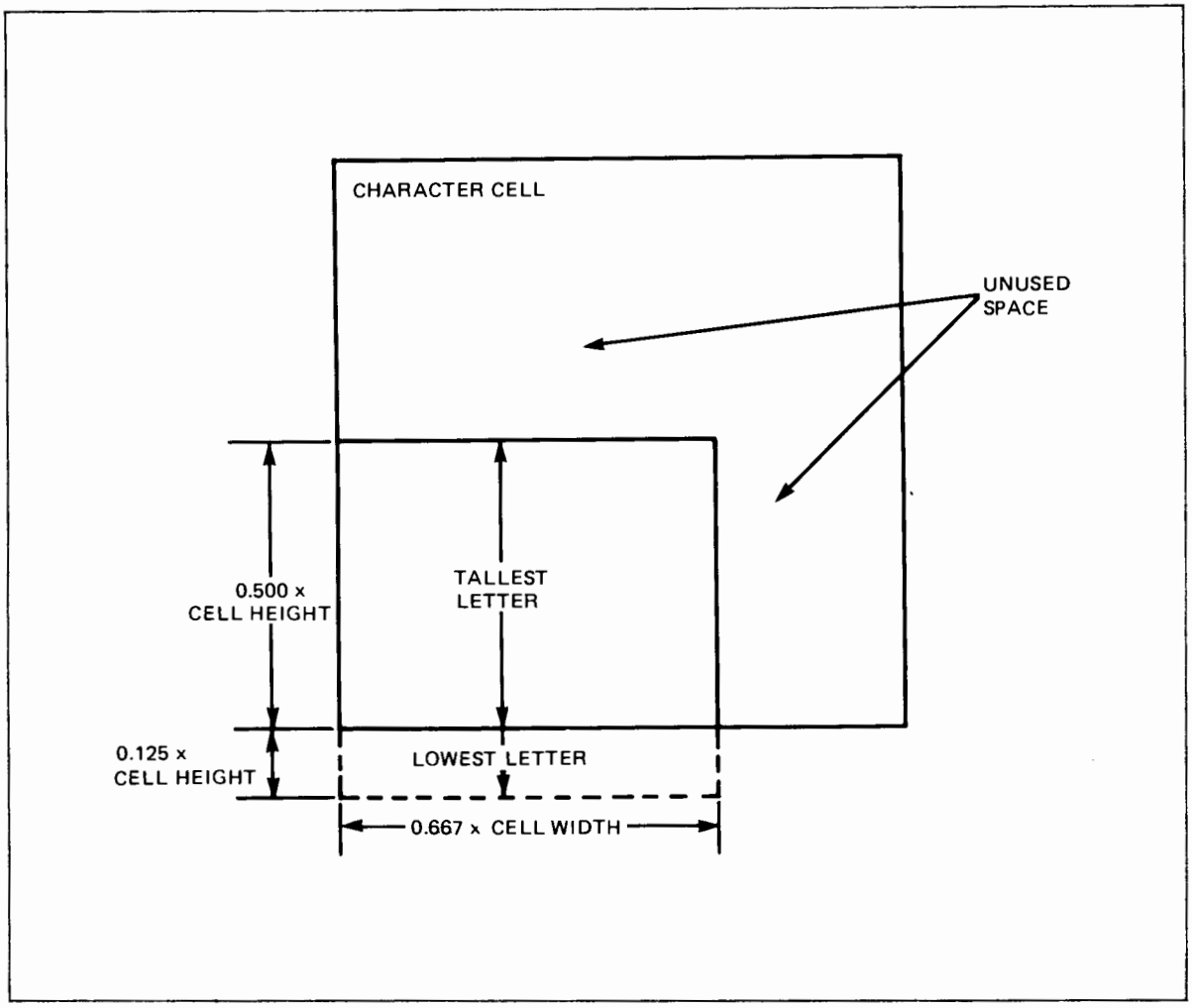


Figure 11-10. Placement of Character in Character Cell

Output Primitives

CLIPPING

The HP 7220 plotters have hardware vector clipping for vectors and text which is set to the view surface limits. Parts of graphics primitives which exceed the hardware clipping limits will be clipped. Graphics primitives which extend past the view surface limits will activate the plotter's *out-of-limits* light.

Calls to ZASPK, ZWIND, ZVIEW, ZDLIM, and ZDINT will reset the hardware clipping limits to the view surface boundaries. The user can redefine the hardware clipping limits to be any region within the boundaries of the view surface by a call to ZOESC (450).

POLYGONS

ZPGDD

The HP 7220 plotters do not provide hardware support of polygons. A polygon specified by ZPGDD will always be represented as described in the *DGL Reference Manual*.

MARKERS

ZMARK

The 19 standard markers are the only markers supported with the HP 7220 plotters. A character size of (2.0 mm by 2.0 mm) is always used to generate markers. Markers are affected by the color attribute.

TEXT

ZTEXT

Graphics text is generated with a hardware character generator. A standard ASCII character set is used as the default character set. There are four additional character sets available to the user via HP 7220 escape functions. The character sets are given in Table 11-4.

Only parts of characters which extend beyond the hardware clipping limits are clipped.

The user may modify text direction as well as text slant via escape functions (see ZOESC (150) and ZOESC (250)).

After ZTEXT, the starting position is set such that an additional call to ZTEXT will continue plotting characters along the same string of text. A carriage return moves the pen back to the beginning of the text string.

Text is affected by the color attribute but is not affected by the line-style attribute (it is always generated using solid lines).

New-Frame-Action

ZNEWF

When using D0018, a new-frame-action causes the picture to be made current. All visible segments are then drawn, or redrawn, on the display surface. The application program should generate pause time, if necessary, to allow the user to change the paper.

When using D0021, a new-frame-action causes the picture to be made current. The paper roll is advanced a full page and the paper is cut. All visible segments are then drawn, or redrawn, on the display surface. The cutter and paper advance mechanisms may also be controlled by escape functions.

Table 11-4. Supported Hardware Character Sets

Decimal Code	ASCII Character	7220 Function/Character Set				
		Set 0	Set 1	Set 2	Set 3	Set 4
0	NULL	No Operation (NOP)				
1	SOH	NOP				
2	STX	NOP				
3	ETX	Default End Label Instruction				
4	ETO	NOP				
5	ENQ	NOP				
6	ACK	NOP				
7	BEL	NOP				
8	BS	Backspace				
9	HT	NOP				
10	LF	Line Feed				
11	VT	Inverse Line Feed				
12	FF	NOP				
13	CR	Carriage Return				
14	SO	Select Alternate Character Set				
15	SI	Select Standard Character Set				
16	DLE	NOP				
17	DC1	NOP				
18	DC2	NOP				
19	DC3	NOP				
20	DC4	NOP				
21	NAK	NOP				
22	SYN	NOP				
23	ETB	NOP				
24	CAN	NOP				
25	EM	NOP				
26	SUB	NOP				
27	ESC	NOP				
28	FS	NOP				
29	GS	NOP				
30	RS	NOP				
31	US	NOP				
32	SP	Space				
33	!	!	!	!	!	¡
34	"	"	"	"	"	"
35	#	#	#	£	£	¿
36	$	$	$	$	$	$
37	%	%	%	%	%	%
38	&	&	&	&	&	&
39	'	'	'	´	'	´
40	(	(	(	(	(	(
41	)	)	)	)	)	)
42	*	*	*	*	*	*
43	+	+	+	+	+	+
44	,	,	,	,	,	,

NOTE: Plotter performs an automatic backspace before drawing any of the characters offset to the left.

Table 11-4. Supported Hardware Character Sets (continued)

Decimal Code	ASCII Character	7220 Function/Character Set				
		Set 0	Set 1	Set 2	Set 3	Set 4
45	—	–	–	–	–	–
46	.	.	.	.	.	.
47	/	/	/	/	/	/
48	0	0	0	0	0	0
49	1	1	1	1	1	1
50	2	2	2	2	2	2
51	3	3	3	3	3	3
52	4	4	4	4	4	4
53	5	5	5	5	5	5
54	6	6	6	6	6	6
55	7	7	7	7	7	7
56	8	8	8	8	8	8
57	9	9	9	9	9	9
58	:	:	:	:	:	:
59	;	;	;	;	;	;
60	<	<	<	<	<	<
61	=	=	=	=	=	=
62	>	>	>	>	>	>
63	?	?	?	?	?	?
64	@	@	@	@	@	@
65	A	A	A	A	A	A
66	B	B	B	B	B	B
67	C	C	C	C	C	C
68	D	D	D	D	D	D
69	E	E	E	E	E	E
70	F	F	F	F	F	F
71	G	G	G	G	G	G
72	H	H	H	H	H	H
73	I	I	I	I	I	I
74	J	J	J	J	J	J
75	K	K	K	K	K	K
76	L	L	L	L	L	L
77	M	M	M	M	M	M
78	N	N	N	N	N	N
79	O	O	O	O	O	O
80	P	P	P	P	P	P
81	Q	Q	Q	Q	Q	Q
82	R	R	R	R	R	R
83	S	S	S	S	S	S
84	T	T	T	T	T	T
85	U	U	U	U	U	U
86	V	V	V	V	V	V
87	W	W	W	W	W	W
88	X	X	X	X	X	X
89	Y	Y	Y	Y	Y	Y

Table 11-4. Supported Hardware Character Sets (continued)

Decimal Code	ASCII Character	7220 Function/Character Set				
		Set 0	Set 1	Set 2	Set 3	Set 4
90	Z	Z	Z	Z	Z	Z
91	[	[	[	[	Ø	[
92	\	\	√	ç	Æ	¡
93	]	]	]	]	ø	]
94		^	↑	^	æ	^
95	_	←	←	←	¿	¿
96		`	`	`	`	`
97	a	a	a	a	a	a
98	b	b	b	b	b	b
99	c	c	c	c	c	c
100	d	d	d	d	d	d
101	e	e	e	e	e	e
102	f	f	f	f	f	f
103	g	g	g	g	g	g
104	h	h	h	h	h	h
105	i	i	i	i	i	i
106	j	j	j	j	j	j
107	k	k	k	k	k	k
108	l	l	l	l	l	l
109	m	m	m	m	m	m
110	n	n	n	n	n	n
111	o	o	o	o	o	o
112	p	p	p	p	p	p
113	q	q	q	q	q	q
114	r	r	r	r	r	r
115	s	s	s	s	s	s
116	t	t	t	t	t	t
117	u	u	u	u	u	u
118	v	v	v	v	v	v
119	w	w	w	w	w	w
120	x	x	x	x	x	x
121	y	y	y	y	y	y
122	z	z	z	z	z	z
123		{	¶	¨	¨	´
124		|	⊢	°	°	~
125		}	→	¨	¨	´
126	~	~	`	'	°	~
127	DEL	NOP				

Inquiry Escape Functions

ZIESC

The following inquiry escape functions are supported by DGL with the HP 7220 Graphics Plotters:

OPCODE	FUNCTION
1050	Inquire error

ILIST(1) = 0 No error
= 1 Instruction not recognized
= 2 Wrong number of parameters
= 3 Parameter out-of-range
= 4 Not used
= 5 Unknown character set
= 6 Position overflow
= 7 Not used
= 8 Out of paper roll (only on the HP 7220T)

Output Escape Functions

ZOESC

Several output escape functions are supported with the HP 7220 plotters. Error checking is not performed by the graphics system for out-of-range or incorrect parameters. Out-of-range parameters flag an error in the plotter and the corresponding command is ignored. The output escape function does not alter the starting position unless otherwise stated.

The following output escape functions are supported with the HP 7220:

OPCODE	FUNCTION
150	Set character slant. See Figure 11-11.

RLIST(1) = Tangent of angle from vertical (from 127.999 to -127.999)

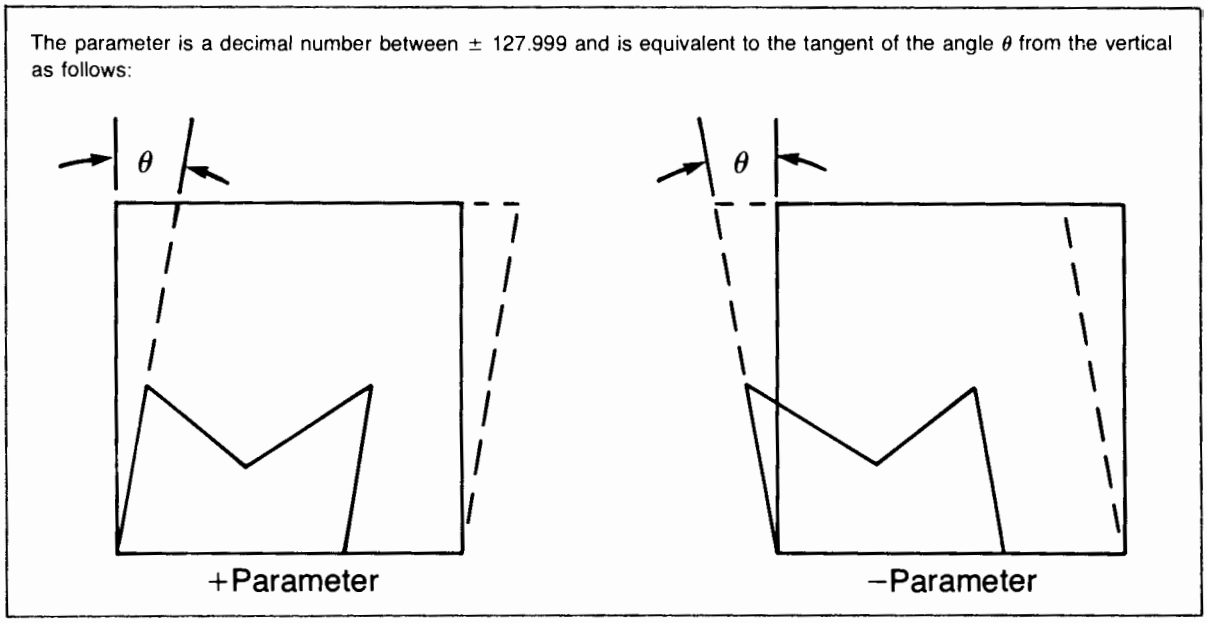
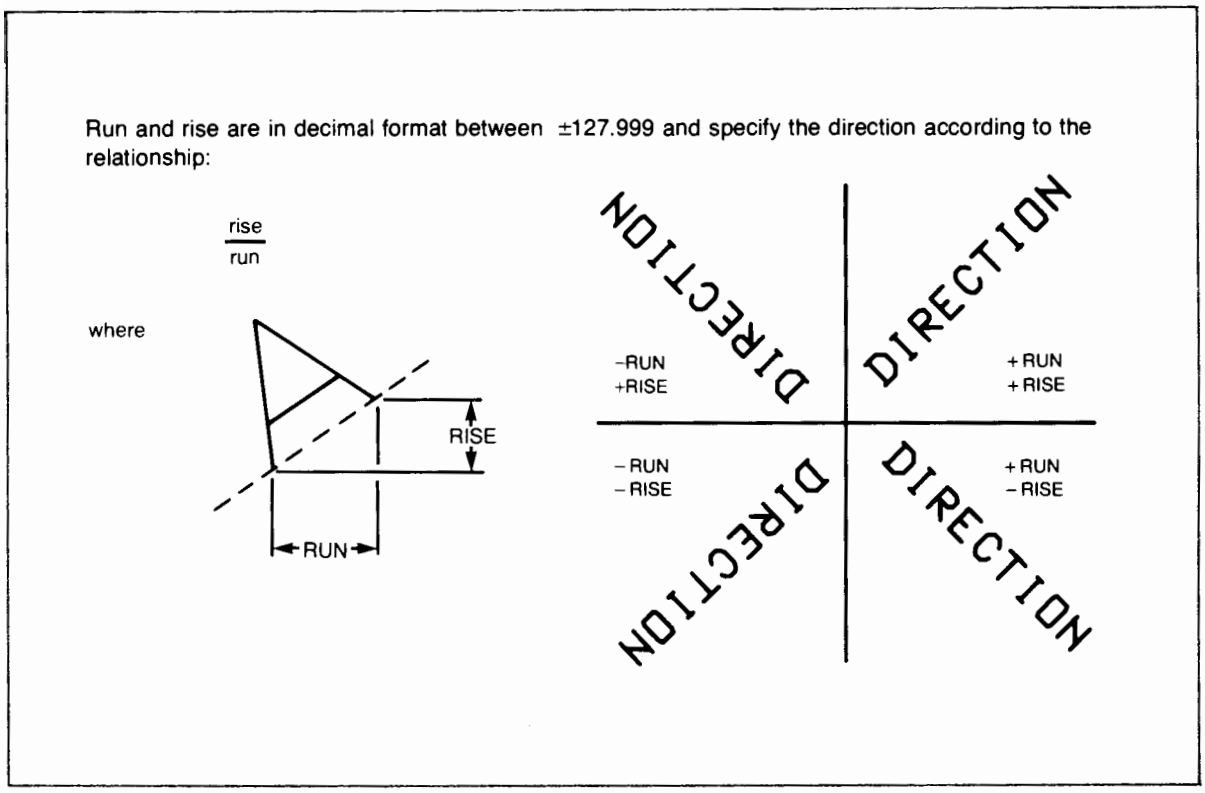


Figure 11-11. Character Slant

250 Set character direction. Provides a means to specify the direction in which text is drawn. See Figure 11-12.

```
RLIST(1) = X component of character direction slope
           (run)
RLIST(2) = Y component of character direction slope
           (rise)
```



Computer Museum

Figure 11-12. Character Direction

252 Draw circle. The starting position defines the center of the circle. The sign of the circle's radius determines the starting point of the circle. If the radius specified is positive, the circle begins at the 0 degree point. If the radius specified is negative, the circle begins at the 180 degree point. Refer to Figure 11-13 for a specification of the circle.

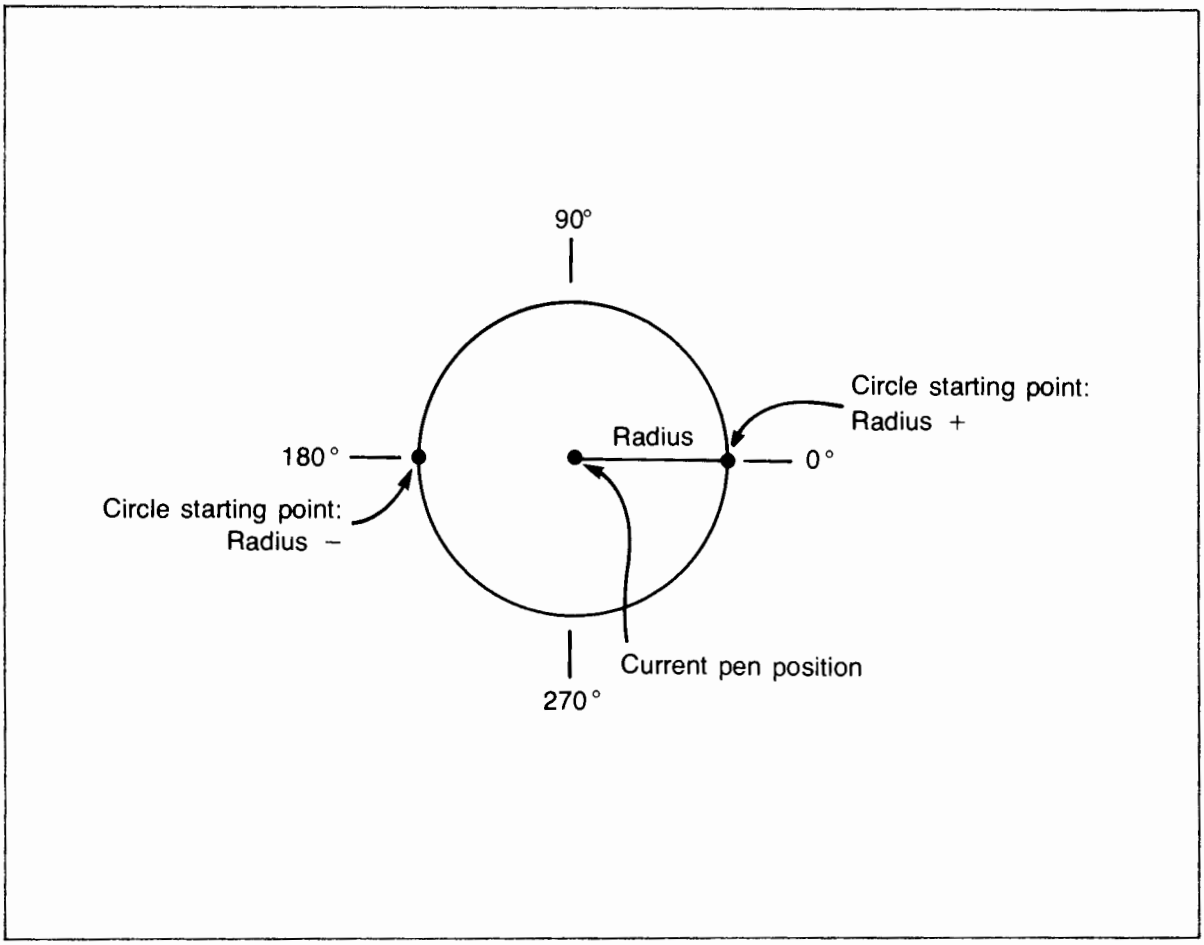


Figure 11-13. Circle Specifications

The circle is approximated by a multi-sided polygon. The accuracy of the circle generated can be controlled by the user. This is done by specifying the chord tolerance either by degrees or in terms of distance deviation. When using the degrees mode, the user specifies the maximum number of degrees subtended by a chord that is used to represent an arc segment of the circle (see Figure 11-14). Figure 11-15 shows the effects which different value of degrees subtended by a chord has on the circle generated.

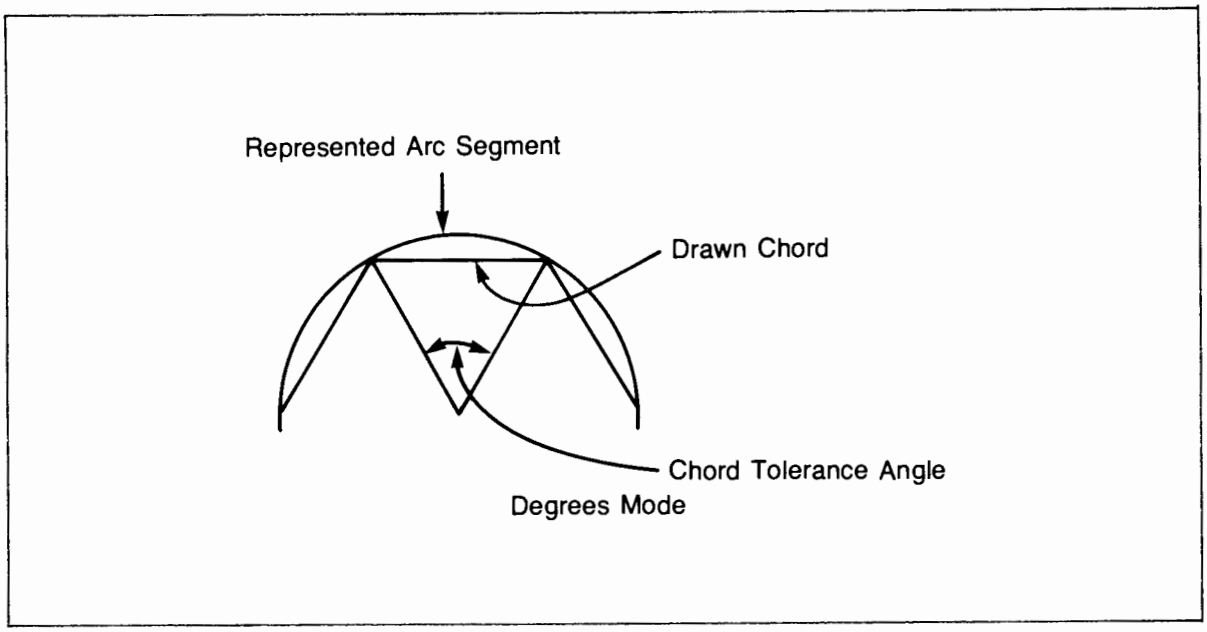


Figure 11-14. Specifying the Chord Tolerance in Degrees

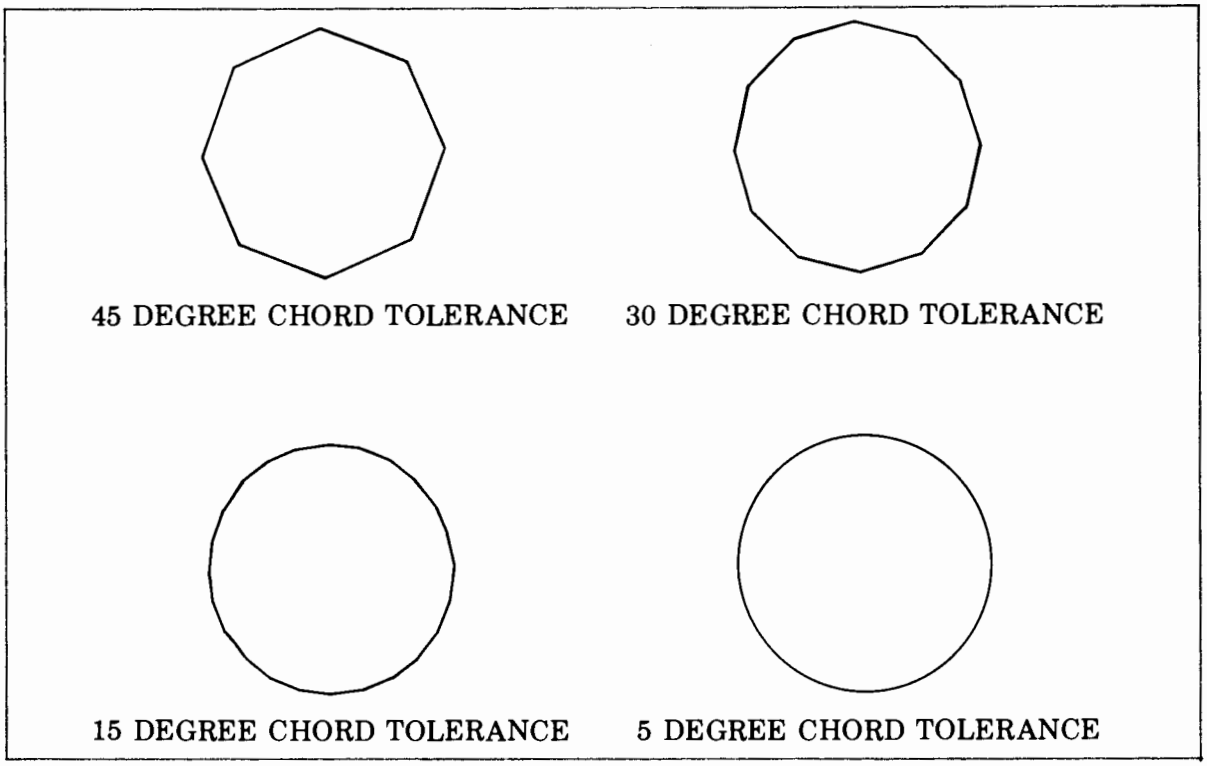


Figure 11-15. Effect of Different Chord Angles

When using distance deviation to specify the chord tolerance, the user specifies the maximum distance permitted between the chord drawn and the arc segment it represents (see Figure 11-16).

RLIST(1) = Radius of circle expressed in world coordinate units
RLIST(2) = Chord tolerance
- > 0 RLIST(2) specifies the maximum number of degrees that can be spanned by any chord.
- < 0 Absolute value of RLIST(2) specifies the maximum distance, in world coordinates, that any chord can be from the arc that it represents.

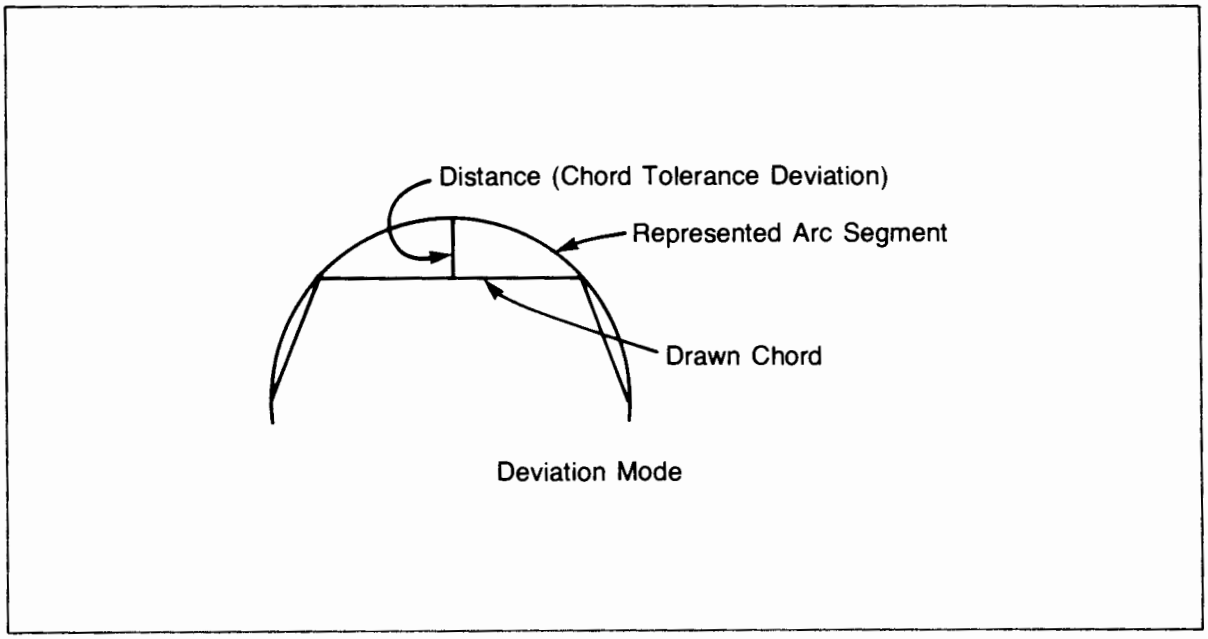


Figure 11-16. Specifying Chord Tolerance with Distance Deviation

450 Set hardware clipping limits. Provides a means to change the hardware clipping limits. ZWIND, ZASPK, ZVIEW, ZDLIM, and ZDINT will reset hardware clipping limits to the view surface boundaries.

RLIST(1) = X min (world coordinates)
RLIST(2) = X max (world coordinates)
RLIST(3) = Y min (world coordinates)
RLIST(4) = Y max (world coordinates)

451 Draw arc. This instruction draws an arc along the circumference of the circle with center, (RLIST(1), RLIST(2)). The arc begins at the starting position and extends RLIST(3) degrees along the circle. If RLIST(3) is positive, the arc will be drawn in a counter clockwise direction from the starting position. Otherwise the arc is drawn in a clockwise direction. The starting position is set to the end of the arc drawn by this call. Refer to ZOESC(252) for a review of the definition of the chord tolerance.

```
RLIST(1) = X world coord. of center of circle.
RLIST(2) = Y world coord. of center of circle.
RLIST(3) = Degrees suspended by arc.
RLIST(4) = Chord tolerance.
         > 0  RLIST(4) specifies the maximum number of degrees
              that can be spanned by any chord.
         < 0  Absolute value of RLIST(4) specifies the maximum
              distance, in world coordinates, that any chord
              can be from the arc that it represents.
```

1050 Select character set. This instruction provides a means for selecting an alternate character set. See Table 11-2 for the HP 7220 hardware character set.

```
ILIST(1) = 0 ANSI ASCII
           1 HP 7220 ASCII
           2 French/German ASCII
           3 Scandinavian ASCII
           4 Spanish/Latin American ASCII
```

1051 Set symbol mode. This instruction provides a means for displaying an ASCII character at the end of each move or draw. ZCSIZ can be used to select symbol size. Symbol mode might cause undesirable results when using markers or text. All ASCII characters from decimal 33 through 126 can be used except for ASCII 59 (";") and ASCII 44 (",").

```
ILIST(1) = 0 symbol mode is terminated
         <> 0 symbol mode is set with ASCII character in
              ILIST(1).
```

1052 Enable cutter. Provides means to control HP 7220T paper cutter. Paper is cut after it is advanced. (Supported only with the D0021 library.)

```
ILIST(1) = 0 cutter is disabled
         <> 0 cutter is enabled
```

1053 This instruction makes the picture current and advances the paper either one half or a full page. (Supported only with the D0021 library.)

ILIST(1) = 0 Advance page half
<> 0 Advance page full

2050 Select pen speed. This instruction allows the user to modify the plotter pen speed. Pen speed may be set from 1 to 36 cm/sec.

ILIST(1) = Pen speed (integer from 1 to 36 cm/sec)
ILIST(2) = Pen number (integer from 1 to 8) Pen numbers outside of this range will change speed for all pens.

Locator Echoes on the Graphics Display

ZWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

SAME PHYSICAL DEVICE

If the locator function and graphics display function are both physically implemented on the same HP 7220 plotter, then the following echoes are supported on the graphics display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the display pen will be moved to the current locator echo position. The pen will continue to reflect the current locator position (i.e. tracked) until the locator operation is terminated.

3 Full cross-hair cursor

Same as ECHO 2.

4 Rubber band line

Same as ECHO 2.

5 Horizontal rubber band line

The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the display pen and the Y coordinate of the locator echo position.

6 Vertical rubber band line

The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the locator echo position and the Y coordinate of the display pen.

7 Horizontal/vertical rubber band line

The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned is the same as ECHO 5 if the locator's X displacement from the locator echo position is greater than its Y displacement. The point returned is the same as ECHO 6 if the Y displacement becomes greater than the X displacement.

8 Rubber band box

Same as ECHO 2.

DIFFERENT PHYSICAL DEVICES

If the graphics display and the locator functions are performed on different physical devices and the loactor supports echoes on a different physical display devices, then the following echoes are supported on the plotter. (Because of the eavesdrop configuration, the locator device and display device may be the same I/O unit descriptor, but be different physical devices.)

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the plotter pen will be moved to the current locator echo position. The pen will then reflect the current locator position (i.e. track the locator position) until operator response.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator position and the Y coordinate of the current locator echo position.
6	Vertical rubber band line Initially, the plotter pen position will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator echo position and the Y coordinate of the current locator position.

7 Horizontal/vertical rubber band line

Initially, the plotter pen position is moved to the locator echo position. Subsequently, when the locator's X displacement becomes greater than its Y displacement, ECHO 5 is simulated. When the locator's Y displacement becomes greater then its X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

Termination

ZDEND

All attributes except color remain unchanged until the system is reinitialized or the display device is enabled again. The color is set to 0. The device name is set to '0018 ' for D0018 and to '0021 ' for D0021.

LOCATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 7220 Graphics plotters are as follows:

Platen surface:	420 mm wide by 297 mm high
Plotting area:	400 mm wide by 285 mm high
Platen capacity:	16000 points wide by 11400 points high
Resolution:	40.0 points/mm in X and Y directions

The default locator limits of the HP 7220 (L0018) are 400 mm in the X direction and 285 mm in the Y direction.

The physical origin of the locator device is 12 mm to the right of the left edge of the platen and 6 mm above the lower edge of the platen. This is the lower left corner of pen movement.

If locator echoing is requested on a different physical device, the current locator position will not be updated while the pen control buttons are pressed. Also, the wait locator call cannot be terminated by pressing the *ENTER* button while the pen control keys are being used.

Initialization

JEDEV/ZLINT

When the locator device is initialized, the plotter's graphics display is left unaltered. The device name is set to '7220C ' if an HP 7220C plotter is used or to '7220T ' if an HP 7220T is being used as the locator device.

Wait Locator Input

JWLOC/ZWLOC

The wait locator input function enables a digitizing mode in the HP 7220 plotter which causes the enter light to be turned on. The operator then positions the pen to the desired position with the cursor buttons and strikes the enter key. A "1" is always returned as the button value.

Echoes Supported

Locator input can be echoed on the display device only if the locator device and display device are the same physical device.

The supported echoes on the locator device are as follows:

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	The HP 7220's pen tracks the locator position.

Sample Locator Input

JSLOC/ZSLOC

The sample locator input function returns the current plotter pen position without waiting for an operator response.

Echoes Supported

Locator echoes are not supported with the HP 7220 Graphics plotters when using the sample locator functions.

Termination

JDDEV/ZLEND

The device name is set to '0018 ', and the device status and I/O unit descriptor are set to 0.

Chapter 12
HP 7221 Graphics Plotters

GENERAL INFORMATION

The user should be familiar with the operation of the HP 7221A, HP 7221B HP 7221S, HP 7221C, or HP 7221T Graphics Plotters. If necessary, refer to the following manuals for the appropriate operating instructions:

HP 7221A Graphics Plotter Operating and Programming Manual *(07221-90001)*

HP 7221B and HP 7221S Graphics Plotters Operating and Programming Manual *(07221-90014)*

HP 7221C and HP 7221T Graphics Plotters Operating and Programming Manual *(07221-90024)*

HP 7220/7221C/T Graphics Plotters Service Manual *(07221-90025)*

Logical Devices Supported

The following logical devices are supported by the AGP/DGL Graphics Systems when using the HP 7221 Graphics Plotters.

Logical Device	Device Handler Name	Physical Device
Graphics display	D0027	HP 7221A/B/S/C/T
Graphics display	D0028	HP 7221S/T
Graphics display	D0029	HP 7221C/T
Graphics display	D0030	HP 7221T
Locator	L0027	HP 7221A/B/S/C/T

D0027 may be used with the HP 7221A, HP 7221B, HP 7221C, HP 7221S, and HP 7221T Graphics Plotters. It drives the plotters as if it were an HP 7221A (no paper advance control, no cutter enable, four pens only, etc.).

D0028 may be used with the HP 7221S and the HP 7221T Graphics Plotters. It utilizes the paper advance mechanisms on both plotters, but only uses four pens.

D0029 may be used with the HP 7221C or HP 7221T Graphics Plotters. It drives the HP 7221T as if it were an HP 7221C plotter (paper advance control not available).

D0030 should only be used with the HP 7221T Graphics Plotter. It uses the paper advance feature of the HP 7221T and allows full usage of the eight pens.

All information presented in this chapter applies to all HP 7221 Graphics Plotters unless stated otherwise.

Special Considerations

ADDITIONAL DATA DISPLAYED

When running AGP/DGL software with the HP 7221 Graphics Plotters in an eavesdrop configuration, a left parenthesis is displayed at the alpha cursor position on the eavesdrop terminal. This character is temporary and will not affect the location of subsequent alphanumeric characters displayed on the eavesdrop terminal.

OUTSPOOLING GRAPHICS NOT SUPPORTED

The HP 7221 Graphics Plotters do not support outspooling in an eavesdrop configuration. In DGL, if bit 0 of the control word in a ZDINT call is set to 1, IERR is returned as 3 and the device is not enabled. In AGP, if bit 0 of the control word in a JDINT call is set to 1, error 102 is reported and the call is ignored.

ABORTING PLOTTER OUTPUT

In the situation where there is a large amount of graphics data being transmitted, attempts to get a break mode prompt are usually unsuccessful. Therefore, to halt plotter instructions and begin communication to the terminal again, the following method should be used:

1) Switch the plotter to *STANDBY* or turn the plotter power off.

2) Type in a carriage return.

After the plotter is switched to the standby position, a small amount of graphics data may appear on the terminal.

For DGL, the display device is disabled as if ZDEND had been called. All subsequent calls to the display device are ignored until ZDINT is called again. An inquiry to ZIWS with an OPCODE of 2050 returns a device status ILIST(1) of 22 and device error ILIST(2) of 0.

For AGP, the work station containing the plotter is terminated and error 160 is reported. In addition, if no work stations are left enabled, then the open segment (if there is one) is closed, and batch of updates (if it is in effect) is terminated. Future operations to the plotter work station will generate errors until the work station is re-initialized with a JDINT call. The application program can inquire if any errors have occurred by using a JIERR call.

GRAPHICS DISPLAY DEVICE HANDLER (AGP ONLY)

Description

The dimensions of the HP 7221 Graphics Plotters are as follows:

Platen surface:	420 mm wide by 297 mm high
Plotting area:	400 mm wide by 285 mm high
Plotting capacity:	16000 points wide by 11400 points high
Aspect ratio of maximum area:	0.7125
Resolution:	40.0 points/mm in the X and Y directions

When using D0027 or D0029, the default logical display surface of the HP 7221 Graphics Plotters ranges from 15.25 to 396.4 mm in the X direction and 7.25 to 260.5 mm in the Y direction. The aspect ratio of the default limits is 0.66448.

When using D0028 or D0029, the default logical display surface of the HP 7221 Graphics Plotters ranges from 0.0 to 400.0 mm in the X direction and 16.5 to 285.0 mm in the Y direction (fitted paper roll size). The aspect ratio of the logical display surface is 0.67125.

The physical origin of the device is 12 mm to the right of the left edge of the platen and 6 mm above the lower edge of the platen. This is the lower left boundary for pen movement.

The view surface is always justified in the lower left corner of the current logical display surface.

Initialization

JDINT

When the HP 7221 Graphics Plotters are initialized, the following operations are performed:

Device name is set to '7221A ' or '7221B ' or '7221C ' or '7221T ' (D0027).

Device name is set to '7221B ' or '7221T ' (D0028).

Device name is set to '7221C ' or '7221T ' (D0029).

Device name is set to '7221T ' (D0030).

Pen velocity is set to 36 cm/sec.

ASCII character set is set to 'ANSI ASCII' for medium and low quality text.

Medium and low quality text slant are set to 0 degrees (no slant) and rotate direction is set to 0 degrees.

The logical display surface is set to the default value.

The view surface is justified in the lower left corner of the logical display surface.

Paper cutter is enabled (D0028, D0030).

Advance page option is enabled (D0028, D0030).

Paper is advanced one full page (D0028, D0030), if bit 7 is in the control word is not set. If bit 7 is set, the paper is not advanced.

Device Enabling

JWON

When HP 7221 Graphics Plotters are enabled, the pen representing the current color attribute is selected.

Supported Primitive Attributes

COLOR

JCOLR

The D0027 and D0028 display handlers for the HP 7221A/B/S provide a software color table of four distinct colors which support four pens. The size of the color table cannot be changed. The default values of the color table are shown in Table 12-1.

Table 12-1. Default Color Table for Four Pen Plotters

	R	G	B
COLOR TABLE ENTRY = 1 >> Black	0.0	0.0	0.0
= 2 >> Red	1.0	0.0	0.0
= 3 >> Green	0.0	1.0	0.0
= 4 >> Blue	0.0	0.0	1.0

The color table is initialized to the default values when JDINT is called. The color table can be redefined or inquired using JDCOL or JICOL.

The pen selected corresponds to the color index passed in the JCOLR call. The color table is not used when selecting the pen on a JCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 0 >> Current pen is returned to its stall
      = 1 >> Pen #1 is selected
      = 2 >> Pen #2 is selected
      = 3 >> Pen #3 is selected
      = 4 >> Pen #4 is selected
```

The D0029 and D0030 display handlers for the HP 7221A/B/S provide a software color table of eight distinct colors, which support eight pens. The size of the color table cannot be changed. The default values of the color table are shown in Table 12-2.

Table 12-2. Default Color Table for Eight Pen Plotters

	R	G	B
COLOR TABLE ENTRY = 1 >> Black	0.0	0.0	0.0
= 2 >> Red	1.0	0.0	0.0
= 3 >> Yellow	1.1	1.1	0.0
= 4 >> Green	0.0	1.0	0.0
= 5 >> Cyan	0.0	1.0	1.0
= 6 >> Blue	0.0	0.0	1.0
= 7 >> Magenta	1.0	0.0	1.0
= 8 >> White	1.0	1.0	1.0

The color table is initialized to the default values when JDINT is called. The color table can be redefined or inquired using JDCOL or JICOL.

The pen selected corresponds to the color index passed in the JCOLR call. The color table is not used when selecting the pen on a JCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 0 >> Current pen is returned to its stall
      = 1 >> Pen #1 is selected
      = 2 >> Pen #2 is selected
      = 3 >> Pen #3 is selected
      = 4 >> Pen #4 is selected
      = 5 >> Pen #5 is selected
      = 6 >> Pen #6 is selected
      = 7 >> Pen #7 is selected
      = 8 >> Pen #8 is selected
```

REDEFINING COLOR

JDCOL/JICOL

All of the colors in the color table can be redefined, or inquired, except for the background color. When the color table is redefined, it only affects the values returned on JICOL calls. AGP does not use the color table when selecting the pen on a JCOLR or JPICL call. The color table is provided for the user's convenience.

POLYGON INTERIOR COLOR

JPICL

Refer to JCOLR for information regarding color.

POLYGON STYLE

JDPST

Since the HP 7221A/B/S Graphics Plotters are hard copy devices, using JDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

JPILS

Refer to JLSTL for information regarding linestyle.

HIGHLIGHTING

JSHI/JGHI

Highlighting is not supported on the HP 7221 Graphics Plotters.

LINESTYLE

JLSTL

Thirteen predefined linestyles are supported on the HP 7221 Graphics Plotters. Linestyles 1 through 7 can all be classified as being *continuous*. Linestyles 8 through 13 are the same patterns as styles 2 through 7 drawn in the *vector-adjusted* format. See Figure 12-1 for the supported linestyles on the HP 7221 Graphics Plotters.

LINEWIDTH

JLWID

Only one linewidth is supported on the HP 7221 Graphics Plotters.

LINEWIDTH = 1 >> Primitives drawn with the linewidth of the pen selected.

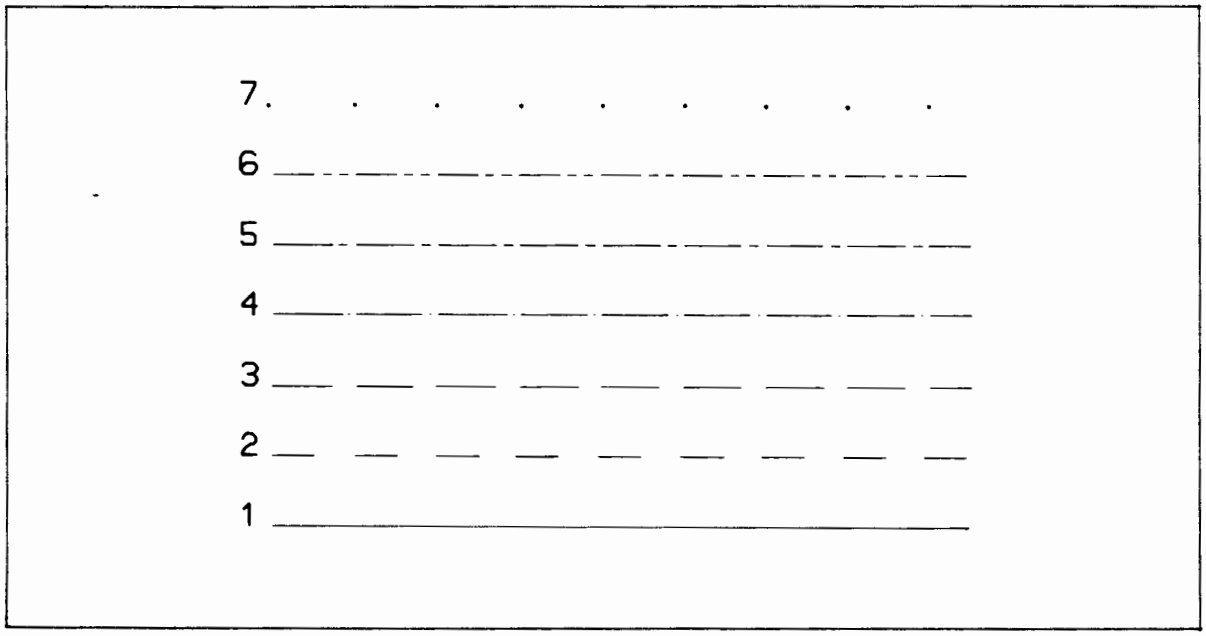


Figure 12-1. Supported Linestyles

CHARACTER SIZES

JCSIZ

For medium and low quality text, the HP 7221 Graphics Plotters support all character cell sizes which have a width and height not less than 1 mm and not greater than 250 mm.

When using medium and low quality text, the character is placed within the character cell as shown in Figure 12-2.

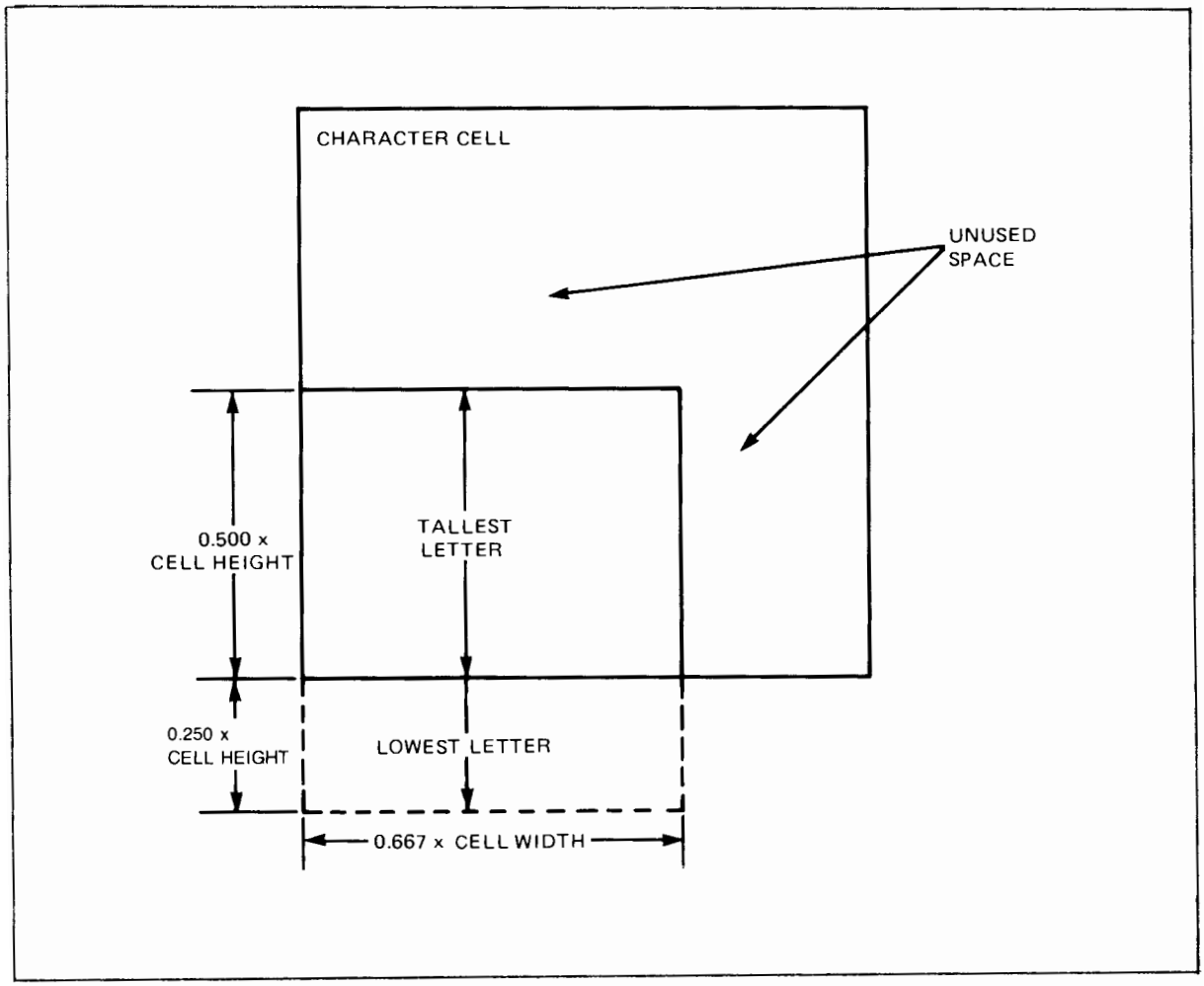


Figure 12-2. Placement of Character in Character Cell

Output Primitives

CLIPPING

The AGP user can access the hardware vector clipping feature of the HP 7221 Graphics Plotters through the output escape function JOESC(450). Calls to JASPK, JWIND, JVIEW, JDLIM, and JDINT will reset the hardware clipping limits to the view surface boundaries.

If AGP window clipping is disabled and parts of the image are outside of the view surface limits, then unpredictable results may occur. Graphics items which extend past the view surface limits will actuate the plotter's *out-of-limits* lights.

If AGP window clipping is enabled, only the portion of the image which is within the viewport will be displayed.

POLYGONS

J2PGN/J3PGN/JR2PG/JR3PG

This device does not have area fill.

MARKERS

J2MRK/J3MRK/JR2MK/JR3MK

The 19 standard markers are the only markers supported with the HP 7221 Graphics Plotters. A character size of 2.0 mm by 2.0 mm is always used to generate the markers. Markers are affected by the color attribute.

MEDIUM AND LOW QUALITY TEXT

JTEXM/JTEXL

Medium and low quality graphics text are generated with a hardware character generator. Hardware text is affected by color but is not affected by linestyle attribute. It is always generated with solid lines.

If a medium or low quality text string is not clipped by AGP, all characters which extend beyond the view surface will be clipped by the plotter.

A standard ASCII character set is used as the default character set. There are five additional character sets available to the user via HP 7221 Graphics Plotters escape functions. These character sets are given in Table 12-3.

The user can modify the slant of medium and low quality text through the output escape function (see JOESC(150)).

Table 12-3. Supported Hardware Character Sets

Decimal Value	Set 0 ANSI ASCII	Set 1 7221 Set	Set 2 French German	Set 3 Scandinavian	Set 4 Spanish Latin American	Set 5 Special Symbols
33	!	!	!	!	!	!
34	"	"	"	"	"	"
35	#	#	£	£	¿	#
36	$	$	$	$	$	$
37	%	%	%	%	%	%
38	&	&	&	&	&	&
39	'	'	´	'	´	'
40	(	(	(	(	(	(
41	)	)	)	)	)	)
42	*	*	*	*	*	*
43	+	+	+	+	+	+
44	,	,	,	,	,	,
45	-	-	-	-	-	-
46	.	.	.	.	.	.
47	/	/	/	/	/	/
48	0	0	0	0	0	0
49	1	1	1	1	1	1
50	2	2	2	2	2	2
51	3	3	3	3	3	3
52	4	4	4	4	4	4
53	5	5	5	5	5	5
54	6	6	6	6	6	6
55	7	7	7	7	7	7
56	8	8	8	8	8	8
57	9	9	9	9	9	9
58	:	:	:	:	:	:

Table 12-3. Supported Hardware Character Sets (continued)

Decimal Value	Set 0 ANSI ASCII	Set 1 7221 Set	Set 2 French German	Set 3 Scandinavian	Set 4 Spanish Latin American	Set 5 Special Symbols
59	;	;	;	;	;	;
60	<	<	<	<	<	<
61	=	=	=	=	=	=
62	>	>	>	>	>	>
63	?	?	?	?	?	?
64	@	@	@	@	@	@
65	A	A	A	A	A	◘
66	B	B	B	B	B	○
67	C	C	C	C	C	△
68	D	D	D	D	D	+
69	E	E	E	E	E	×
70	F	F	F	F	F	◇
71	G	G	G	G	G	↑
72	H	H	H	H	H	⊠
73	I	I	I	I	I	≥
74	J	J	J	J	J	¥
75	K	K	K	K	K	¤
76	L	L	L	L	L	✳
77	M	M	M	M	M	⧖
78	N	N	N	N	N	ı
79	O	O	O	O	O	✽
80	P	P	P	P	P	–
81	Q	Q	Q	Q	Q	ı
82	R	R	R	R	R	R
83	S	S	S	S	S	S
84	T	T	T	T	T	T

Table 12-3. Supported Hardware Character Sets (continued)

Decimal Value	Set 0 ANSI ASCII	Set 1 7221 Set	Set 2 French German	Set 3 Scandinavian	Set 4 Spanish Latin American	Set 5 Special Symbols
85	U	U	U	U	U	U
86	V	V	V	V	V	V
87	W	W	W	W	W	W
88	X	X	X	X	X	X
89	Y	Y	Y	Y	Y	Y
90	Z	Z	Z	Z	Z	Z
91	[	[	[	Ø	[	[
92	\	√	ç	Æ	¡	\
93	]	]	]	ø	]	]
94	^	↑	^	æ	^	^
95	_	_	_	_	_	_
96	`	`	`	`	`	`
97	a	a	a	a	a	∩
98	b	b	b	b	b	⊃
99	c	c	c	c	c	⊂
100	d	d	d	d	d	∪
101	e	e	e	e	e	⎯
102	f	f	f	f	f	≡
103	g	g	g	g	g	≅
104	h	h	h	h	h	≈
105	i	i	i	i	i	~
106	j	j	j	j	j	≤
107	k	k	k	k	k	≥
108	l	l	l	l	l	≠
109	m	m	m	m	m	Δ
110	n	n	n	n	n	∏

Table 12-3. Supported Hardware Character Sets (continued)

Decimal Value	Set 0 ANSI ASCII	Set 1 7221 Set	Set 2 French German	Set 3 Scandinavian	Set 4 Spanish Latin American	Set 5 Special Symbols
111	o	o	o	o	o	Σ
112	p	p	p	p	p	±
113	q	q	q	q	q	∓
114	r	r	r	r	r	→
115	s	s	s	s	s	↑
116	t	t	t	t	t	←
117	u	u	u	u	u	↓
118	v	v	v	v	v	∫
119	w	w	w	w	w	÷
120	x	x	x	x	x	*
121	y	y	y	y	y	∇
122	z	z	z	z	z	•
123	{	π	¨	¨	~	{
124	|	⊢	•	•	~	|
125	}	→	¨	¨	~	}
126	~	~	˙	•	~	~

New-Frame-Action

JNEWF/JPURG/JSVIS/JSHI/JVSAL/JCLR

When using D0027 and D0029, a new-frame-action causes the picture to be made current. All visible segments are then drawn/redrawn on the display surface. The application program should generate pause time, if necessary, to allow the user to change the paper.

When using D0028 and D0030, a new-frame action causes the picture to be made current. The paper roll is then advanced a full page and the paper is cut. All visible segments are then drawn, or redrawn on the new page. The cutter and paper advance mechanisms may also be controlled by escape functions.

Inquiry Escape Functions

JIESC

The following inquiry escape functions are supported by AGP with the HP 7221 Graphics Plotters.

OPCODE	FUNCTION
3050	Inquire error

ILIST(1) = 0 No error
= 1 Invalid byte received
= 2 Invalid byte received
= 3 Invalid byte received
= 4 Out of paper (HP 7221S and 7221T only)

= 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 These errors are not generated unless the application program bypasses AGP and performs I/O directly with the plotter. See the HP 7221 Graphics Plotters Manuals for more details on these errors.

ILIST(2) = The instruction in which the error occurred. See the HP 7221 Graphics Plotters Manuals for more details.

ILIST(3) = The number of errors since the last output error instruction.

Output Escape Functions

JOESC

Several output escape functions are supported by AGP with the HP 7221 Graphics Plotters. Error checking is not performed by the graphics system for out-of-range or incorrect parameters. Out-of-range parameters flag an error in the plotter and the corresponding command is ignored.

Escape functions are not stored in the segment display area. This can have implications when used with AGP segments. For example, a character slant of 10 degrees is set with escape function JOESC(150). If a text string is created inside a segment, the character slant is changed to 30 degrees and a new-frame-action is given. The string will be redrawn with the present character slant of 30 degrees, rather than the character slant of 10 degrees it was created with.

Escape functions may also have undesired effects on low and medium quality text. For example, since medium quality text is output a character at a time, setting the text direction angle will affect each character by itself, which will not produce the same angled text that would be output if low quality text were used. See the *AGP Users Guide* for an example of the difference in low and medium quality text.

Escape functions are sent from AGP directly to DGL. The state of AGP may become undefined when an escape function is given that overrides a mode set by AGP (e.g. hardware text direction).

The following output escape functions are supported with all of the HP 7221 Grahics Plotters:

OPCODE	FUNCTION
150	Set device character slant for subsequent medium and low quality text. See Figure 12-3.
	RLIST(1) = Angle counterclockwise from the horizontal (degrees). Positive angles only.
151	Rotates all primitives except MOVE and DRAW.
	RLIST(1) = Angle counterclockwise from the horizontal (degrees). Positive angles only.

The parameter is a decimal number between 0.0 and +127.999 and is equivalent to the tangent of the angle θ from horizontal as follows:

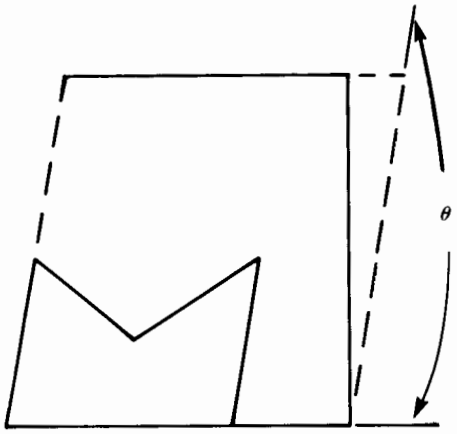


Figure 12-3. Character Slant

1050 Select medium or low quality text character set. This instruction provides a means for selecting an alternate character set. See Table 12-1 for the HP 7221 Graphics Plotters hardware character set.

```
ILIST(1) = 0 ANSI ASCII
           1 7221 ASCII
           2 European ASCII
           3 Scandinavian ASCII
           4 Spanish/Latin American ASCII
           5 Special symbols
```

1051 Select pen speed. This instruction allows the user to modify the plotter pen speed. Pen speed may be set from 1 to 36 cm/sec. This instruction changes the pen speed for all pens.

```
ILIST(1) = Pen speed
           (integer from 1 to 36 cm/sec)
```

1052 Enable cutter. Provides a means to control the HP 7221S and HP 7221T paper cutters. Paper is cut after it is advanced. (Supported only with the D0028 and D0030 libraries.)

```
ILIST(1) = 0 cutter is disabled
        <> 0 cutter is enabled
```

1053 Advance Paper. This instruction provides a means to control the HP 7221S and HP 7221T paper advance. The picture is made current and paper is advanced either a half or full page. (Supported only with the D0028 and D0030 libraries.)

ILIST(1) = 0 Advance half page
<> 0 Advance full page

1350 Draw arc. This instruction draws an arc along the circumference of the circle defined by the radius, start angle, and stop angle. (See Figure 12-4.)

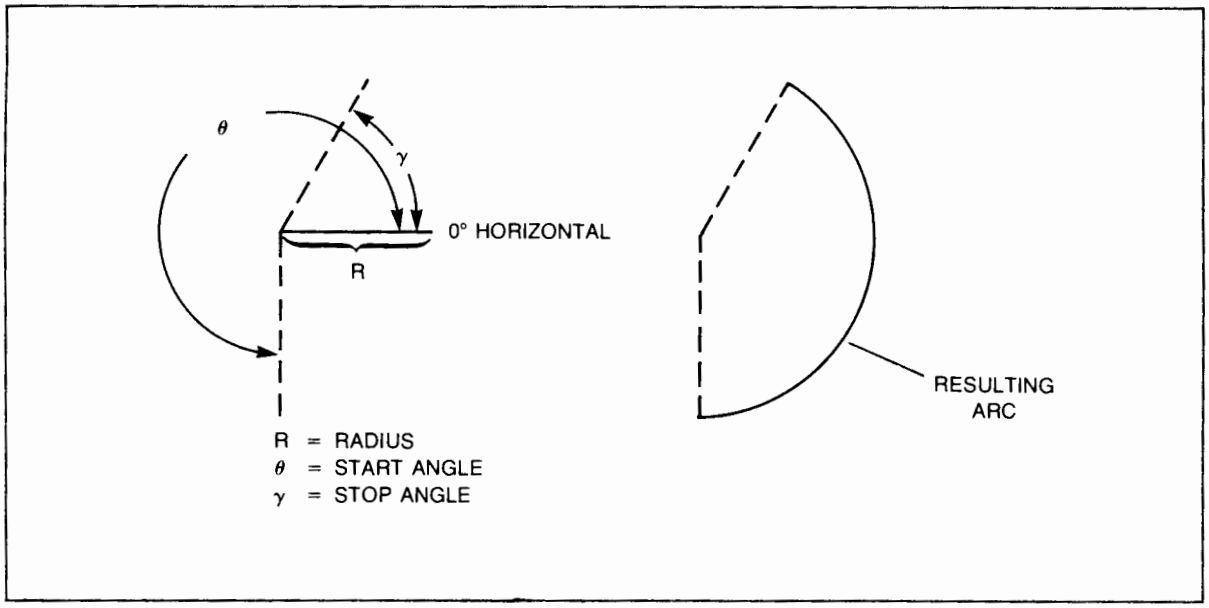


Figure 12-4. Specifying Radius, and Start and Stop Angle

If the stop angle is greater than the start angle, the circle is drawn in a counterclockwise direction beginning at the starting position. If the stop angle is less than the start angle, the circle is drawn in a clockwise direction beginning at the starting position.

ILIST(1) = Chord tolerance which specifies the maximum distance, in 0.025 mm units, that any chord generated by the HP 7221 Graphics Plotters can deviate from the circumference. (See Figure 12-5.)

RLIST(1) = Radius of the circle (world coordinates)

RLIST(2) = Start angle measured counterclockwise from the horizontal (degrees). Positive angles only.

RLIST(3) = Stop angle measured counterclockwise from the horizontal (degrees). Positive angles only.

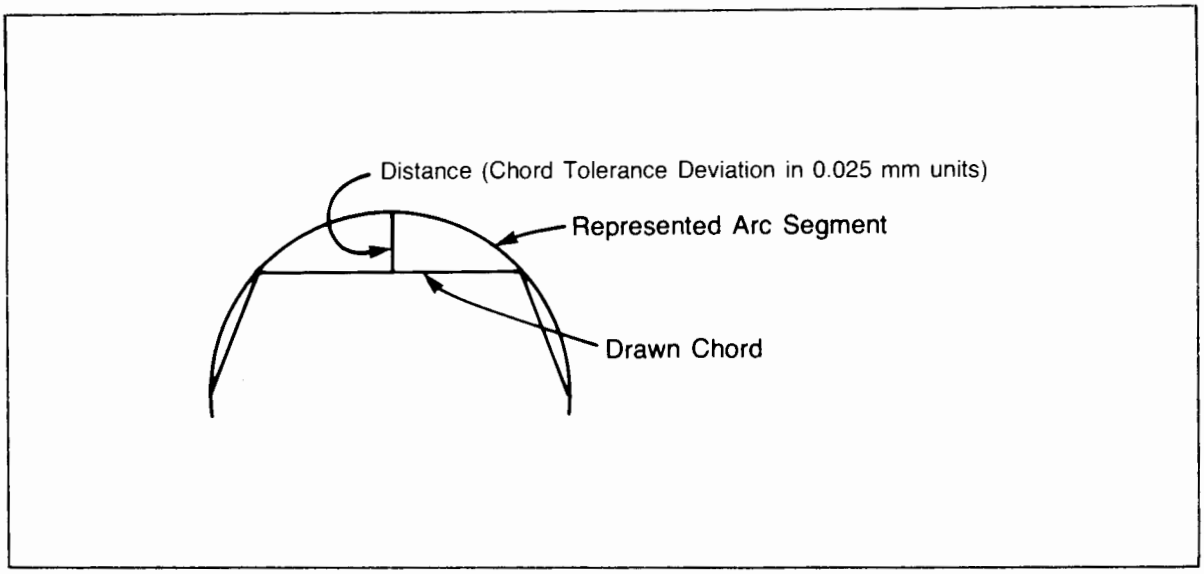


Figure 12-5. Specifying Chord Tolerance

Locator Echoes on the Graphics Display

JWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

SAME PHYSICAL DEVICE

If the locator and graphics display are both physically implemented on the same HP 7221 Graphics Plotters, then the following echoes are supported on the graphics display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the display pen will be moved to the current locator echo position. The pen will continue to reflect the current locator position (i.e. tracked) until the locator operation is terminated.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the display pen and the Y coordinate of the locator echo position.
6	Vertical rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the locator echo position and the Y coordinate of the display pen.
7	Horizontal/vertical rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned is the same as ECHO 5 if the locator's X displacement from the locator echo position is greater than its Y displacement. The point returned is the same as ECHO 6 if the Y displacement becomes greater than the X displacement.
8	Rubber band box Same as ECHO 2.

DIFFERENT PHYSICAL DEVICES

If the graphics display and the locator functions are performed on different physical devices and the locator supports echoes on a different physical display device, then the following echoes are supported on the plotter. (Because of the eavesdrop configuration, the locator device and display device may be the same I/O unit descriptor, but be different physical devices.)

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the plotter pen will be moved to the current locator echo position. The pen will then reflect the current locator position (i.e. track the locator position) until operator response.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator position and the Y coordinate of the current locator echo position.
6	Vertical rubber band line Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator echo position and the Y coordinate of the current locator position.

7 Horizontal/vertical rubber band line

Initially, the plotters pen position is moved to the initial locator echo position. Subsequently, when the locator's X displacement becomes greater than its Y displacement, ECHO 5 is simulated. When the locator's Y displacement becomes greater than its X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

Disabling

JWOFF

When the device is disabled, the current pen is returned to its stall.

GRAPHICS DISPLAY DEVICE HANDLER (DGL ONLY)

Description

The dimensions of the HP 7221 Graphics Plotters are as follows:

Platen surface:	420 mm wide by 297 mm high
Plotting area:	400 mm wide by 285 mm high
Plotting capacity:	16000 points wide by 11400 points high
Aspect ratio of maximum area:	0.7125
Resolution:	40.0 points/mm in X and Y directions

When using D0027 or D0029, the default logical display surface ranges from 15.25 to 396.4 mm in the X direction and 7.25 to 260.5 mm in the Y direction. The aspect ratio of the logical display surface is 0.66448.

When using D0028 or D0030, the default logical display surface ranges from 0.0 to 400.0 mm in the X direction and 16.5 to 285 mm in the Y direction (fitted paper roll size). The aspect ratio of the logical display surface is 0.67125.

The physical origin of the graphics display is 12 mm to the right of the left edge of the platen and 6 mm above the lower edge of the platen. This is the lower left boundary for pen movement.

The view surface is always justified in the lower left corner of the current logical display surface.

Initialization

ZDINT

When the HP 7221 Graphics Plotters are initialized, the following operations are performed:

Device name is set to '7221A ', '7221B ', '7221C ', '7221T ' (D0027).

Device name is set to '7221B ' (D0028).

Device name is set to '7221C ', '7221T ' (D0029).

Device name is set to '7221T ' (D0030).

Color set to 1.

Highlighting set to 1.

Linewidth set to 1.

Linestyle set to 1.

Starting position is undefined.

Pen velocity is set to 36 cm/sec.

ASCII character set is set to 'ANSI ASCII'.

Text slant is set to 0 degrees. Rotation is set to 0 (horizontal). degrees.

The logical display limits are set to the default value.

The view surface is justified to the lower left corner of the logical display surface.

Paper cutter is enabled (D0028, D0030).

Advance page option is enabled (D0028, D0030).

Paper is advanced one full page (D0028, D0030) if bit 7 in the control word is not set. If bit 7 is set, the paper is not advanced.

Supported Primitive Attributes

COLOR

ZCOLR

The D0027 and D0028 display handlers for the HP 7221A/B/S provide a software color table of four distinct colors which support four pens. The size of the color table cannot be changed. The default values of the color table are shown in Table 12-4.

Table 12-4. Default Color Table for Four Pen Plotters

	R	G	B
COLOR ENTRY TABLE = 1 >> Black	0.0	0.0	0.0
= 2 >> Red	1.0	0.0	0.0
= 3 >> Green	0.0	1.0	0.0
= 4 >> Blue	0.0	0.0	1.0

The color table is initialized to the default values when ZDINT is called. The color table can be redefined or inquired using ZDCOL or ZICOL.

The pen selected corresponds to the color index passed in the ZCOLR call. The color table is not used when selecting the pen on a ZCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 0 >> Current pen is returned to its stall
      = 1 >> Pen #1 is selected
      = 2 >> Pen #2 is selected
      = 3 >> Pen #3 is selected
      = 4 >> Pen #4 is selected
```

The D0015 and D0016 display handlers for the HP 7221A/B/S provide a software color table of eight distinct colors, which support eight pens. The size of the color table cannot be changed. The default values of the color table are shown in Table 12-5.

Table 12-5. Default Color Table for Eight Pen Plotters

	R	G	B
COLOR TABLE ENTRY = 1 >> Black	0.0	0.0	0.0
= 2 >> Red	1.0	0.0	0.0
= 3 >> Yellow	1.1	1.1	0.0
= 4 >> Green	0.0	1.0	0.0
= 5 >> Cyan	0.0	1.0	1.0
= 6 >> Blue	0.0	0.0	1.0
= 7 >> Magenta	1.0	0.0	1.0
= 8 >> White	1.0	1.0	1.0

The color table is initialized to the default values when ZDINT is called. The color table can be redefined or inquired using ZDCOL or ZICOL.

The pen selected corresponds to the color index passed in the ZCOLR call. The color table is not used when selecting the pen on a ZCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 0 >> Current pen is returned to its stall
      = 1 >> Pen #1 is selected
      = 2 >> Pen #2 is selected
      = 3 >> Pen #3 is selected
      = 4 >> Pen #4 is selected
      = 5 >> Pen #5 is selected
      = 6 >> Pen #6 is selected
      = 7 >> Pen #7 is selected
      = 8 >> Pen #8 is selected
```

REDEFINING COLOR

ZDCOL/ZICOL

All of the colors in the color table can be redefined, or inquired, except for the background color. When the color table is redefined, it only affects the values returned on ZICOL calls. DGL does not use the color table when selecting the pen on a ZCOLR or ZPICL call. The color table is provided for the user's convenience.

POLYGON INTERIOR COLOR

ZPICL

Refer to ZCOLR for information regarding color.

POLYGON STYLE

ZDPST

Since the HP 7221 Graphics Plotters are hard copy devices, using ZDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

ZPILS

Refer to ZLSTL for information regarding linestyle.

HIGHLIGHTING

ZHIGH

Highlighting is not performed on the HP 7221 Graphics Plotters.

LINESTYLE

ZLSTL

Thirteen predefined linestyles are supported on the HP 7221 Graphics Plotters. Linestyles 1 through 7 can be classified as being *continuous*. Linestyles 8 through 13 are the same pattern as linestyles 2 to 7 drawn in the *vector-adjusted* format. See Figure 12-6 for the supported linestyles on the HP 7221 plotters.

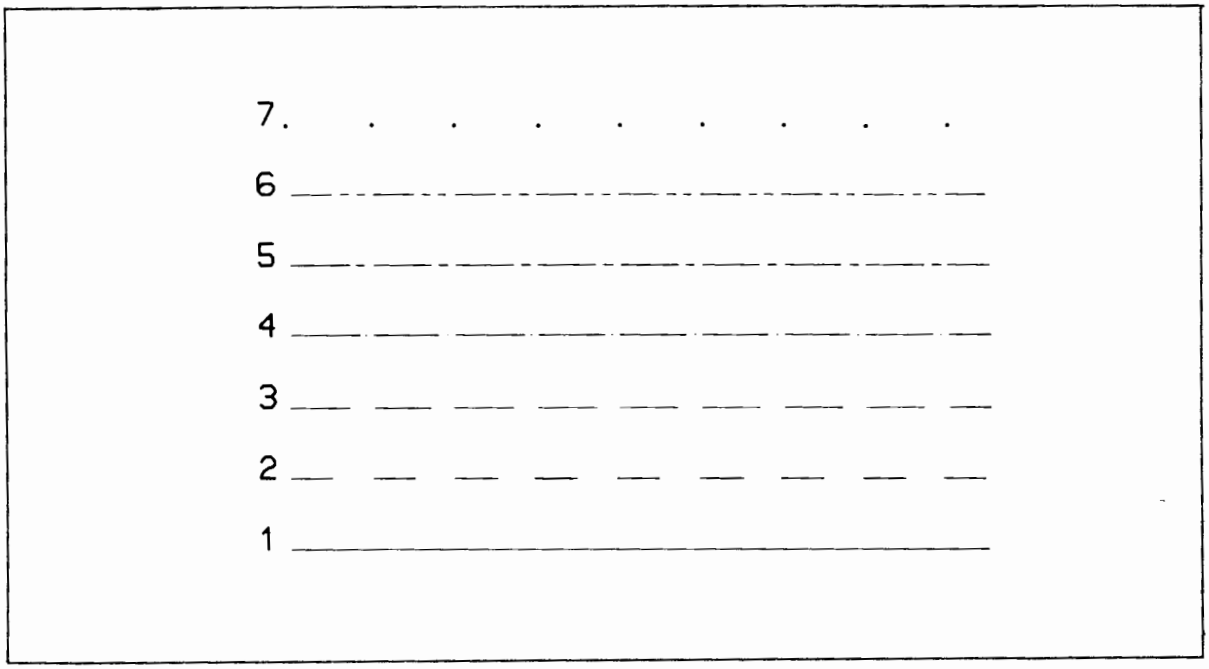


Figure 12-6. Supported Linestyles

LINEWIDTH

ZLWID

Only one linewidth is supported on the HP 7221 Graphics Plotters.

LINEWIDTH = 1 >> Primitives drawn with the linewidth of the pen selected.

CHARACTER SIZES

ZCSIZ

The HP 7221 Graphics Plotters support all character cell sizes which have a width and height not less than 1 mm and not greater than 250 mm.

The character is placed within the character cell as shown in Figure 12-7.

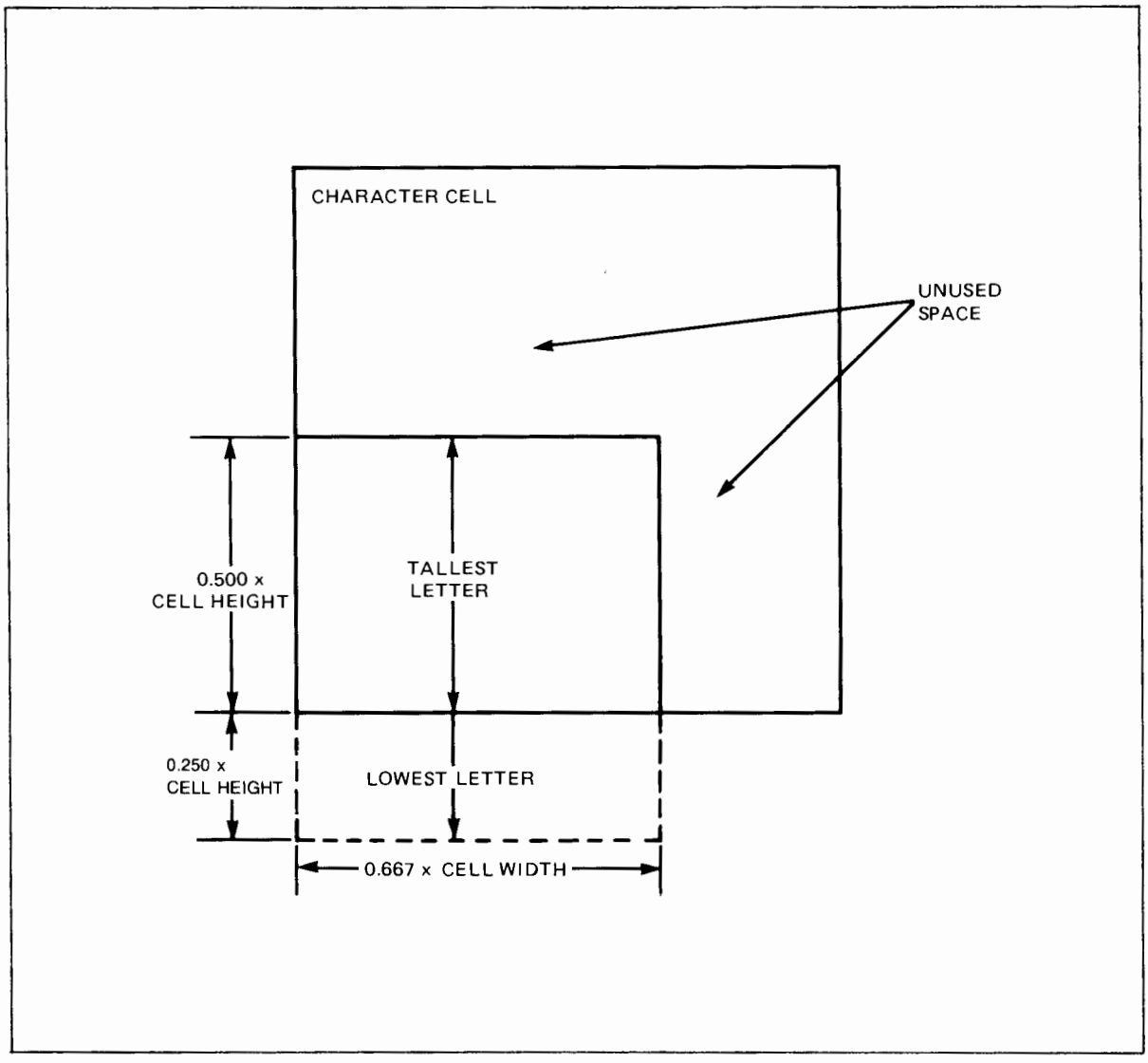


Figure 12-7. Placement of Character in Character Cell

Output Primitives

CLIPPING

The HP 7221 Graphics Plotters have hardware vector clipping for vectors and text which is set to the view surface limits. Parts of graphics primitives which exceed the hardware clipping limits will be clipped. Graphics primitives which extend past the view surface limits will activate the plotter's *out-of-limit* light.

Calls to ZASPK, ZWIND, ZVIEW, ZDLIM, and ZDINT will reset the hardware clipping limits to the view surface boundaries. The user can redefine the hardware clipping limits to be any region within the boundaries of the view surface by a cal to ZOESC (450).

POLYGONS

ZPGDD

The HP 7221 plotters do not provide hardware support of polygons. A polygon specified by ZPGDD will always be represented as described in the *DGL Reference Manual*.

MARKERS

ZMARK

The 19 standard markers are the only markers supported with the HP 7221 Graphics Plotters. A character size of 2.0 mm by 2.0 mm is always used to generate markers. Markers are affected by the color attribute.

TEXT

ZTEXT

Graphics text is generated with a hardware character generator. A standard ASCII character set is used as the default character set. There are five additional character sets available to the user via HP 7221 Graphics Plotters escape functions. The character sets are given in Table 12-6.

Parts of characters which extend beyond view surface boundary will be clipped.

The user can modify text slant via escape functions (see ZOESC(150)).

After ZTEXT, the starting position is set such that an additional call to ZTEXT will continue plotting characters along the same string of text. A carriage return moves the pen back to the beginning of the text string.

Graphics text is affected by the color attribute but is not affected by the linestyle attribute; character strings will be output as solid lines.

Table 12-6. Supported Hardware Character Sets

Decimal Value	Set 10 ANSI ASCII	Set 11 7221 Set	Set 12 French German	Set 13 Scandinavian	Set 14 Spanish Latin American	Set 15 Special Symbols
33	!	!	!	!	!	!
34	"	"	"	"	"	"
35	#	#	£	£	¿	#
36	$	$	$	$	$	$
37	%	%	%	%	%	%
38	&	&	&	&	&	&
39	'	'	´	'	´	'
40	(	(	(	(	(	(
41	)	)	)	)	)	)
42	*	*	*	*	*	*
43	+	+	+	+	+	+
44	,	,	,	,	,	,
45	–	–	–	–	–	–
46	.	.	.	.	.	.
47	/	/	/	/	/	/
48	0	0	0	0	0	0
49	1	1	1	1	1	1
50	2	2	2	2	2	2
51	3	3	3	3	3	3
52	4	4	4	4	4	4
53	5	5	5	5	5	5
54	6	6	6	6	6	6
55	7	7	7	7	7	7
56	8	8	8	8	8	8
57	9	9	9	9	9	9
58	:	:	:	:	:	:

Table 12-6. Supported Hardware Character Sets (continued)

Decimal Value	Set 10 ANSI ASCII	Set 11 7221 Set	Set 12 French German	Set 13 Scandinavian	Set 14 Spanish Latin American	Set 15 Special Symbols
59	;	;	;	;	;	;
60	<	<	<	<	<	<
61	=	=	=	=	=	=
62	>	>	>	>	>	>
63	?	?	?	?	?	?
64	@	@	@	@	@	@
65	A	A	A	A	A	◘
66	B	B	B	B	B	○
67	C	C	C	C	C	△
68	D	D	D	D	D	+
69	E	E	E	E	E	×
70	F	F	F	F	F	◇
71	G	G	G	G	G	↑
72	H	H	H	H	H	⧖
73	I	I	I	I	I	Z
74	J	J	J	J	J	Y
75	K	K	K	K	K	✕
76	L	L	L	L	L	✱
77	M	M	M	M	M	⧖
78	N	N	N	N	N	ı
79	O	O	O	O	O	✱
80	P	P	P	P	P	_
81	Q	Q	Q	Q	Q	ı
82	R	R	R	R	R	R
83	S	S	S	S	S	S
84	T	T	T	T	T	T

Table 12-6. Supported Hardware Character Sets (continued)

Decimal Value	Set 10 ANSI ASCII	Set 11 7221 Set	Set 12 French German	Set 13 Scandinavian	Set 14 Spanish Latin American	Set 15 Special Symbols
85	U	U	U	U	U	U
86	V	V	V	V	V	V
87	W	W	W	W	W	W
88	X	X	X	X	X	X
89	Y	Y	Y	Y	Y	Y
90	Z	Z	Z	Z	Z	Z
91	[	[	[	Ø	[	[
92	\	√	ç	Æ	¡	\
93	]	]	]	ø	]	]
94	^	↑	^	æ	^	^
95	_	_	_	_	_	_
96	`	`	`	`	`	`
97	a	a	a	a	a	∩
98	b	b	b	b	b	⊃
99	c	c	c	c	c	⊂
100	d	d	d	d	d	∪
101	e	e	e	e	e	⎯
102	f	f	f	f	f	≡
103	g	g	g	g	g	≥
104	h	h	h	h	h	≈
105	i	i	i	i	i	~
106	j	j	j	j	j	≤
107	k	k	k	k	k	≥
108	l	l	l	l	l	≠
109	m	m	m	m	m	Δ
110	n	n	n	n	n	∏

Table 12-6. Supported Hardware Character Sets (continued)

Decimal Value	Set 10 ANSI ASCII	Set 11 7221 Set	Set 12 French German	Set 13 Scandinavian	Set 14 Spanish Latin American	Set 15 Special Symbols
111	o	o	o	o	o	Σ
112	p	p	p	p	p	±
113	q	q	q	q	q	∓
114	r	r	r	r	r	→
115	s	s	s	s	s	↑
116	t	t	t	t	t	←
117	u	u	u	u	u	↓
118	v	v	v	v	v	∫
119	w	w	w	w	w	÷
120	x	x	x	x	x	*
121	y	y	y	y	y	∇
122	z	z	z	z	z	•
123	{	¨	¨	¨	~	{
124	|	⊢	•	•	~	|
125	}	→	¨	¨	~	}
126	~	~	'	•	~	~

New-Frame-Action

ZNEWF

When using D0027 and D0029, a new frame-action causes the picture to be made current. All visible segments are then drawn, or redrawn on the display surface. The application program should generate pause time, if necessary, to allow the user to change the paper.

When using D0028 and D0030, a call to ZNEWF makes the picture current, advances the paper roll a full page, and cuts the paper. The cutter and paper advance mechanisms may also be controlled by escape functions.

Inquiry Escape Functions

ZIESC

The following inquiry escape functions are supported by DGL with the HP 7221 Graphics Plotters:

OPCODE	FUNCTION
3050	Inquire error

ILIST(1) = 0 No error
= 1 Invalid byte received
= 2 Invalid byte received
= 3 Invalid byte received
= 4 Out of paper (HP 7221S and 7221T only)

= 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 These errors are not generated unless the application program bypasses DGL and performs I/O directly with the plotter. See the HP 7221 Graphics Plotters Manuals for more details on these errors.

ILIST(2) = The instruction in which the error occurred. See the HP 7221 Graphics Plotters Manuals for more details.

ILIST(3) = The number of errors since the last output error instruction.

Output Escape Functions

ZOESC

Several output escape functions are supported by DGL with the HP 7221 Graphics Plotters. Error checking is not performed by the graphics system for out-of-range or incorrect parameters. Out-of-range parameters flag an error in the plotter and the corresponding command is ignored. None of the supported output escape functions alter the starting position. The following output escape functions are supported with all of the HP 7221 Graphics Plotters display libraries:

OPCODE	FUNCTION
150	Set character slant. See Figure 12-8.

RLIST(1) = Angle counterclockwise from the horizontal (degrees). Positive angles only.

The parameter is a decimal number between 0.0 and +127.999 and is equivalent to the tangent of the angle θ from horizontal as follows:

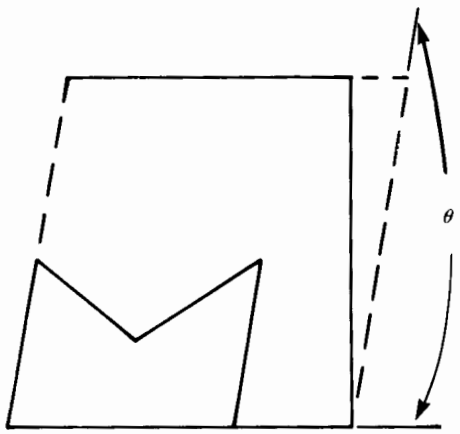


Figure 12-8. Character Slants

151 Rotates all primitives except MOVE and DRAW.

RLIST(1) = Angle counterclockwise from the horizontal (degrees). Positive angles only.

1050 Select character set. This instruction provides a means for selecting an alternate character set. See Table 12-2 for the HP 7221 Graphics Plotters hardware character sets.

```
ILIST(1) = 0 ANSI ASCII
           1 HP 7221 ASCII
           2 European ASCII
           3 Scandinavian ASCII
           4 Spanish/Latin American ASCII
           5 Special Symbols
```

1051 Select pen speed. This instruction allows the user to modify the plotter pen speed. Pen speed may be set from 1 to 36 cm/sec. This instruction changes the pen speed for all pens.

```
ILIST(1) = Pen speed
           (integer from 1 to 36 cm/sec)
```

1052 Enable cutter. Provides means to control HP 7221S and HP 7221T Graphics Plotters paper cutters. Paper is cut after it is advanced. (Supported only with the D0028 and D0030 libraries.)

```
ILIST(1) = 0 cutter is disabled
         <> 0 cutter is enabled
```

1053 Advance Paper. This instruction provides a means to control HP 7221S and HP 7221T Graphics Plotters paper advance. The picture is made current and paper is advanced either one half or a full page. (Supported only with the D0028 and D0030 libraries.)

```
ILIST(1) = 0 Advance page half
         <> 0 Advance page full
```

1350 Draw arc. This instruction draws an arc along the circumference of the circle defined by the radius, start angle, and stop angle. See Figure 12-9.

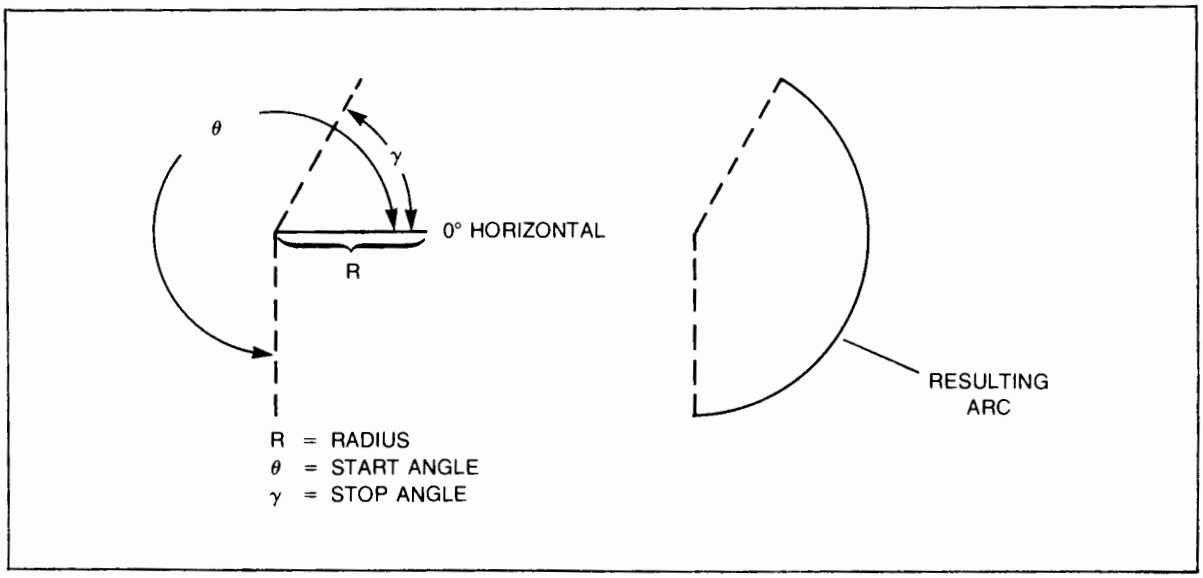


Figure 12-9. Specifying Radius, and Start and Stop Angle

If the stop angle is greater than the start angle, the circle is drawn in a counterclockwise direction beginning at the starting position. If the stop angle is less than the start angle, the circle is drawn in a clockwise direction beginning at the starting position.

ILIST(1) = Chord tolerance which specifies the maximum distance, in 0.025 mm units, that any chord generated by the HP 7221 Graphics Plotters can deviate from the circumference of the requested arc. ILIST(1) may range fro1 to 63. (See Figure 12-10.)

RLIST(1) = Radius of the circle (world coordinates)

RLIST(2) = Start angle measured counterclockwise from the horizontal (degrees). Positive angles only.

RLIST(3) = Stop angle measured counterclockwise from the horizontal (degrees). Positive angles only.

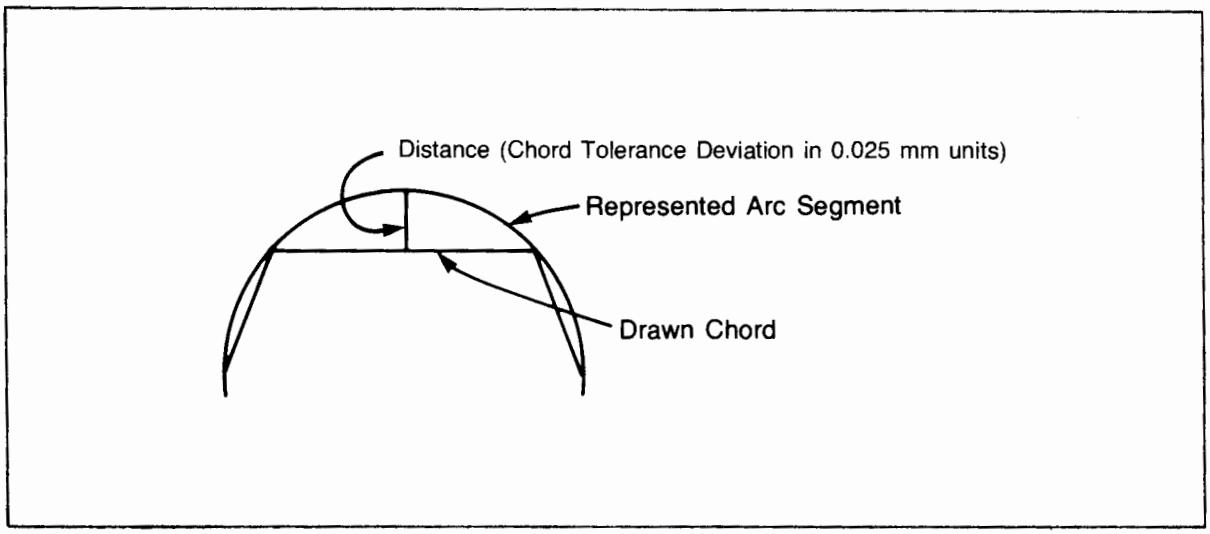


Figure 12-10. Specifying Chord Tolerance

Locator Echoes on the Graphics Display

ZWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

SAME PHYSICAL DEVICE

If the locator function and display function are both physically implemented on the same HP 7221 Graphics Plotter, then the following echoes are supported on the graphics display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the display pen will be moved to the current locator echo position. The pen will continue to reflect the current locator position (i.e. tracked) until the locator operation is terminated.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the display pen and the Y coordinate of the locator echo position.
6	Vertical rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the locator echo position and the Y coordinate of the display pen.
7	Horizontal/vertical rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned is the same as ECHO 5 if the locator's X displacement from the locator echo position is greater than its Y displacement. The point returned is the same as ECHO 6 if the Y displacement becomes greater than the X displacement.
8	Rubber band box Same as ECHO 2.

DIFFERENT PHYSICAL DEVICES

If the locator and graphics display functions are performed on different physical devices and the locator supports echoes on a different physical display device, then the following echoes are supported on the display. (Because of the eavesdrop configuration, the locator device and display device may be the same I/O unit descriptor, but be different physical devices.)

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the plotter pen will be moved to the current locator echo position. The pen will then reflect the current locator position (i.e. track the locator position) until operator response.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator position and the Y coordinate of the current locator echo position.
6	Vertical rubber band line Initially, the plotter pen position will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator echo position and the Y coordinate of the current locator position.

7 Horizontal/vertical rubber band line

Initially, the plotter pen position is moved to the locator echo position. Subsequently, when the locator's X displacement becomes greater than its Y displacement, ECHO 5 is simulated. When the locator's Y displacement becomes greater then its X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

Termination

ZDEND

All attributes except color remain unchanged until the system is reinitialized or the display device is enabled again. The color is set to 0. The device name is set to '0027' for D0027; to '0028' for D0028; to '0029' for D0029; and to '0030' to D0030. The device status and I/O unit descriptors are all set to 0.

LOCATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 7221 Graphics Plotters are as follows:

Platen surface:	420 mm wide by 297 mm high
Plotting area:	400 mm wide by 285 mm high
Platen capacity:	16000 points wide by 11400 points high
Resolution:	40.0 points/mm in X and Y directions

The default locator limits of the HP 7221 Graphics Plotters (L0027) are 400 mm in the X direction and 285 mm in the Y direction.

The physical origin of the locator device is 12 mm to the right of the left edge of the platen and 6 mm above the lower edge of the platen. This is the lower left corner of pen movement.

If locator echoing is requested on a different physical device, the current locator position will not be updated while the pen control buttons are pressed. Also, the wait locator call cannot be terminated by pressing the 'ENTER' button while the pen control keys are being used.

Initialization

JEDEV/ZLINT

When the locator device is initialized, the plotter's graphics display is left unaltered.

The device name is set to '7221A ' if an HP 7221A Graphics Plotter is used; to '7221B ' if an HP 7221B or HP 7221S is used; to '7221C ' if an HP 7221C is used; and to '7221T ' if an HP 7221T is used.

Wait Locator Input

JWLOC/ZWLOC

The wait locator input function enables a digitizing mode in the HP 7221 Graphics Plotters which causes the enter light to be turned on. The operator then positions the pen to the desired position with the cursor buttons and strikes the enter key. The button value returned is always 1.

Echoes Supported

Locator input can be echoed on either a graphics display device or a locator device. The HP 7221 Graphics Plotters locator can only echo on the graphics display if the locator and the display are the same device. For the echoes supported on the graphics display device, see the chapter which describes the HP 7221 graphics display.

The supported echoes on the locator device are as follows:

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	The HP 7221 Graphics Plotters pen tracks the locator position.

Sample Locator Input

JSLOC/ZSLOC

The sample locator input function returns the current plotter pen position without waiting for an operator response.

Echoes Supported

Locator echoes are not supported with the HP 7221 Graphics Plotters when using the sample locator functions.

Termination

JDDEV/JLEND

The device name is set to '0027' and the device status and I/O unit descriptors are set to 0.

Chapter 13
HP 7225 Graphics Plotters

GENERAL INFORMATION

The user should be familiar with the operation of the HP 7225A and HP 7225B Graphics Plotters. If necessary, refer to the following manuals for the appropriate operating instructions:

HP 7225A Graphics Plotter 17601A Operating and Programming Manual *(17601-90000)*

HP 7225B Graphics Plotter 17601A Operating and Programming Manual *(17601-90006)*

Logical Devices Supported

The following logical devices are supported by the AGP/DGL Graphics Systems when using the HP 7225 Graphics Plotters.

Logical Device	Device Handler Name	Physical Device
Graphics display	D0032	HP 7225A/B
Locator	L0032	HP 7225A/B

GRAPHICS DISPLAY DEVICE HANDLER (AGP ONLY)

Description

The dimensions of the HP 7225 Graphics Plotters are as follows:

Platen surface:	297.0 mm wide by 210.0 mm high
Plotting area:	285.5 mm wide by 203.5 mm high
Plotting capacity:	11420 points wide by 8140 points high
Aspect ratio of maximum area:	0.7128
Resolution:	40.0 points/mm in the X and Y directions

When using D0032, the default logical display surface of the HP 7225 Graphics Plotters ranges from 0.0 to 267.5 mm in the X direction and 0.0 to 203.0 mm in the Y direction. The aspect ratio of the default limits is 0.76074.

The physical origin of the device is the lower left boundary of pen movement. The view surface is always justified in the lower left corner of the current logical display surface.

Initialization

JDINT

When the HP 7225 Graphics Plotters are initialized, the following operations are performed:

Device name is set to '7225A ' or '7225B '.

Pen velocity is set to 25 cm/sec.

ASCII character set is set to 'ANSI ASCII' for medium and low quality text.

Medium and low quality text slant are set to 0 degrees (no slant) and text label direction is set to 0 degrees (horizontal).

The logical display surface is set to the default value.

The view surface is justified in the lower left corner of the logical display surface.

Hardware clipping limits are set to the view surface boundaries.

Device Enabling

JWON

When HP 7225 Graphics Plotters are enabled, the pen representing the current color attribute is selected.

Supported Primitive Attributes

COLOR

JCOLR

The D0032 display handler for the HP 7225A/B provides a software color table of one color. The size of the color table cannot be changed. The default value of the color table is shown in Table 13-1.

Table 13-1. Default Color Table for One Pen Plotter

COLOR TABLE ENTRY = 1 >> Pen #1 is selected

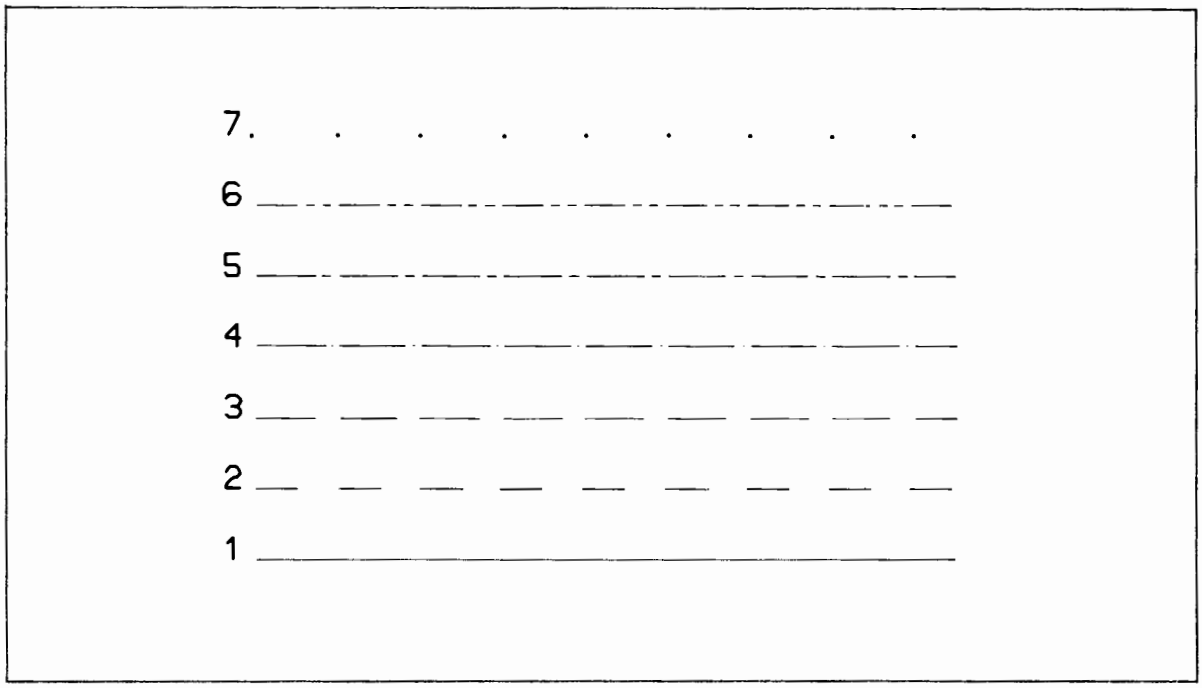


Figure 13-1. Supported Linestyles

LINEWIDTH

JLWID

Only one linewidth is supported on the HP 7225 Graphics Plotters.

LINEWIDTH = 1 >> Primitives drawn with the linewidth of the pen selected.

CHARACTER SIZES

JCSIZ

For medium and low quality text, the HP 7225 Graphics Plotters support all character cell sizes which have a width and height not less than 1 mm and not greater than 250 mm.

When using medium and low quality text, the character is placed within the character cell as shown in Figure 13-2.

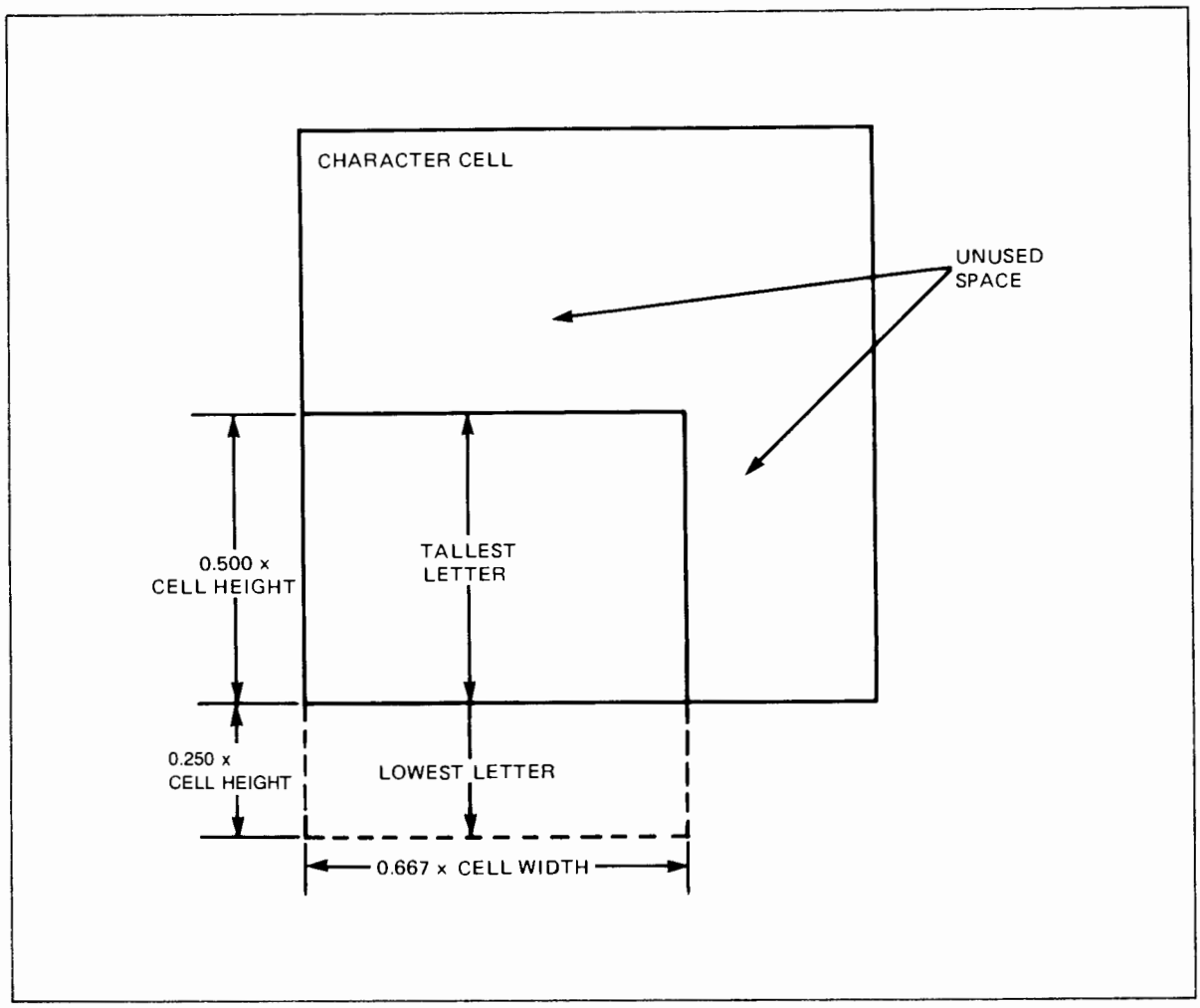


Figure 13-2. Placement of Character in Character Cell

Output Primitives

CLIPPING

The AGP user can access the hardware vector clipping feature of the HP 7225 Graphics Plotters through the output escape function JOESC (450). Calls to JASPK, JWIND, JVIEW, JDLIM, and JDINT will reset the hardware clipping limits to the view surface boundaries. The user can redefine the hardware clipping limits to be any region within the boundaries of the view surface by a call to JOESC (450).

If AGP window clipping is disabled and parts of the image are outside of the view surface limits, then unpredictable results may occur. Graphics items which extend past the view surface limits will activate the plotters *out-of-limits* lights. If the image is entirely within the view surface limits, then only the portion of the image that is within the hardware clipping limits will be displayed.

If AGP window clipping is enabled, only the portion of the image which is within the viewport and within the hardware clipping limits will be displayed.

POLYGONS

J2PGN/J3PGN/JR2PG/JR3PG

This device does not have area fill.

MARKERS

J2MRK/J3MRK/JR2MK/JR3MK

The 19 standard markers are the only markers supported with the HP 7225 Graphics Plotters. A character size of 2.0 mm by 2.0 mm is always used to generate the markers.

MEDIUM AND LOW QUALITY TEXT

JTEXM/JTEXL

Medium and low quality graphics text are generated with a hardware character generator. Hardware text is not affected by the linestyle attribute. It is always generated with solid lines.

If a medium or low quality text string is not clipped by AGP, all characters which extend beyond the hardware clipping limits will be clipped by the plotter.

A standard ASCII character set is used as the default character set. There are four additional character sets available to the user via HP 7225 Graphics Plotters escape functions. These character sets are given in Table 13-2.

The user can modify the direction and slant of medium and low quality text through the output escape function (see JOESC (150), JOESC (250)).

Table 13-2. Supported Hardware Character Sets

Decimal Code	ASCII Character	7225 Function/Character Set				
		Set Ø	Set 1	Set 2	Set 3	Set 4
0	NULL	Error 4 Generated In Plotter				
1	SOH	Error 4 Generated In Plotter				
2	STX	Error 4 Generated In Plotter				
3	ETX	End Label Instruction				
4	ETO	Error 4 Generated In Plotter				
5	ENQ	Error 4 Generated In Plotter				
6	ACK	Error 4 Generated In Plotter				
7	BEL	No Operation (NOP)				
8	BS	Backspace				
9	HT	NOP				
10	LF	Line Feed				
11	VT	Inverse Line Feed				
12	FF	NOP				
13	CR	Carriage Return				
14	SO	Select Alternate Character Set				
15	SI	Select Standard Character Set				
16	DLE	Error 4 Generated In Plotter				
17	DC1	NOP				
18	DC2	NOP				
19	DC3	NOP				
20	DC4	NOP				
21	NAK	Error 4 Generated In Plotter				
22	SYN	Error 4 Generated In Plotter				
23	ETB	Error 4 Generated In Plotter				
24	CAN	Error 4 Generated In Plotter				
25	EM	Error 4 Generated In Plotter				
26	SUB	Error 4 Generated In Plotter				
27	ESC	Error 4 Generated In Plotter				
28	FS	Error 4 Generated In Plotter				
29	GS	Error 4 Generated In Plotter				
30	RS	Error 4 Generated In Plotter				
31	US	Error 4 Generated In Plotter				
32	SP	Space				
33	!					
34	"					
35	#	#	#	£	£	¿
36	$	$	$	$	$	$
37	%	%	%	%	%	%
38	&	&	&	&	&	&
39	'					
40	(	(	(	(	(	(
41	)	)	)	)	)	)
42	*	*	*	*	*	*
43	+	+	+	+	+	+
44	,	,	,	,	,	,
45	–					
46	.	.	.	.	.	.
47	/	/	/	/	/	/

NOTE: Characters offset to the left have the automatic backspace feature.

Table 13-2. Supported Hardware Character Sets (continued)

Decimal Code	ASCII Character	7225 Function/Character Set				
		Set Ø	Set 1	Set 2	Set 3	Set 4
48	Ø	Ø	Ø	Ø	Ø	Ø
49	1	1	1	1	1	1
50	2	2	2	2	2	2
51	3	3	3	3	3	3
52	4	4	4	4	4	4
53	5	5	5	5	5	5
54	6	6	6	6	6	6
55	7	7	7	7	7	7
56	8	8	8	8	8	8
57	9	9	9	9	9	9
58	:	:	:	:	:	:
59	;	;	;	;	;	;
60	<	<	<	<	<	<
61	=	=	=	=	=	=
62	>	>	>	>	>	>
63	?	?	?	?	?	?
64	@	@	@	@	@	@
65	A	A	A	A	A	A
66	B	B	B	B	B	B
67	C	C	C	C	C	C
68	D	D	D	D	D	D
69	E	E	E	E	E	E
70	F	F	F	F	F	F
71	G	G	G	G	G	G
72	H	H	H	H	H	H
73	I	I	I	I	I	I
74	J	J	J	J	J	J
75	K	K	K	K	K	K
76	L	L	L	L	L	L
77	M	M	M	M	M	M
78	N	N	N	N	N	N
79	O	O	O	O	O	O
80	P	P	P	P	P	P
81	Q	Q	Q	Q	Q	Q
82	R	R	R	R	R	R
83	S	S	S	S	S	S
84	T	T	T	T	T	T
85	U	U	U	U	U	U
86	V	V	V	V	V	V
87	W	W	W	W	W	W
88	X	X	X	X	X	X
89	Y	Y	Y	Y	Y	Y
90	Z	Z	Z	Z	Z	Z
91	[	[	[	[	Ø	[
92	\	\	√	ç	Æ	\
93	]	]	]	]	ø	]
94	^	^	↑	^	æ	^
95	_	_	_	_	_	_
96	`	`	`	`		`
97	a	a	a	a	a	a

Table 13-2. Supported Hardware Character Sets (continued)

Decimal Code	ASCII Character	7225 Function/Character Set				
		Set Ø	Set 1	Set 2	Set 3	Set 4
98	b	b	b	b	b	b
99	c	c	c	c	c	c
100	d	d	d	d	d	d
101	e	e	e	e	e	e
102	f	f	f	f	f	f
103	g	g	g	g	g	g
104	h	h	h	h	h	h
105	i	i	i	i	i	i
106	j	j	j	j	j	j
107	k	k	k	k	k	k
108	l	l	l	l	l	l
109	m	m	m	m	m	m
110	n	n	n	n	n	n
111	o	o	o	o	o	o
112	p	p	p	p	p	p
113	q	q	q	q	q	q
114	r	r	r	r	r	r
115	s	s	s	s	s	s
116	t	t	t	t	t	t
117	u	u	u	u	u	u
118	v	v	v	v	v	v
119	w	w	w	w	w	w
120	x	x	x	x	x	x
121	y	y	y	y	y	y
122	z	z	z	z	z	z
123	{	{	{	{	{	~
124	|	|	|	•	•	~
125	}	}	}	••	••	~
126	~	~	~		•	~
127	DEL	Error 4 Generated In Plotter				

New-Frame-Action

JNEWF/JPURG/JSVIS/JSHI/JVSAL/JCLR

When using D0032, a new-frame-action causes the picture to be made current. All visible segments are then drawn, or redrawn on the display surface. The application program should generate any pause time, if necessary, so that the user can change the paper.

Inquiry Escape Functions

JIESC

The following inquiry escape functions are supported by AGP with the HP 7225 Graphics Plotters.

OPCODE	FUNCTION
1050	Inquire error

ILIST(1) = 0 No error
= 1 Instruction not recognized
= 2 Wrong number of parameters
= 3 Parameter out-of-range
= 4 Not used
= 5 Unknown character set
= 6 Position overflow
= 7 Not used
= 8 Not used

Output Escape Functions

JOESC

Several output escape functions are supported by AGP with the HP 7225 Graphics Plotters. Error checking is not performed by the graphics system for out-of-range or incorrect parameters. Out-of-range parameters flag an error in the plotter and the corresponding command is ignored.

Escape functions are not stored in the segment display area. This can have implications when used with AGP segments. For example, a character slant of 10 degrees is set with escape function JOESC (150). If a text string is created inside a segment, the character slant is changed to 30 degrees and a new-frame-action is given. The string will be redrawn with the present character slant of 30 degrees, rather than the character slant of 10 degrees it was created with.

Escape functions can also have undesired effects on low and medium quality text. For example, since medium quality text is output one character at a time, setting the text direction angle will affect each character by itself not producing the same angled text that would be output if low quality text were used. See the *AGP Users Guide* for an example of the difference in low and medium quality text.

Escape functions are sent from AGP directly to DGL. The state of AGP may become undefined when an escape function is given that overrides a mode set by AGP (e.g. hardware text direction).

The following output escape functions are supported with all of the HP 7225 Graphics Plotters:

OPCODE	FUNCTION
150	Set device character slant for subsequent medium and low quality text. See Figure 13-3. RLIST(1) = Tangent of angle from vertical (from 127.999 to -127.999)
250	Set device character direction for subsequent medium and low quality text. See Figure 13-4. RLIST(1) = X component of character direction slope (run) RLIST(2) = Y component of character direction slope (rise)

The parameter is a decimal number between ± 127.999 and is equivalent to the tangent of the angle θ from the vertical as follows:

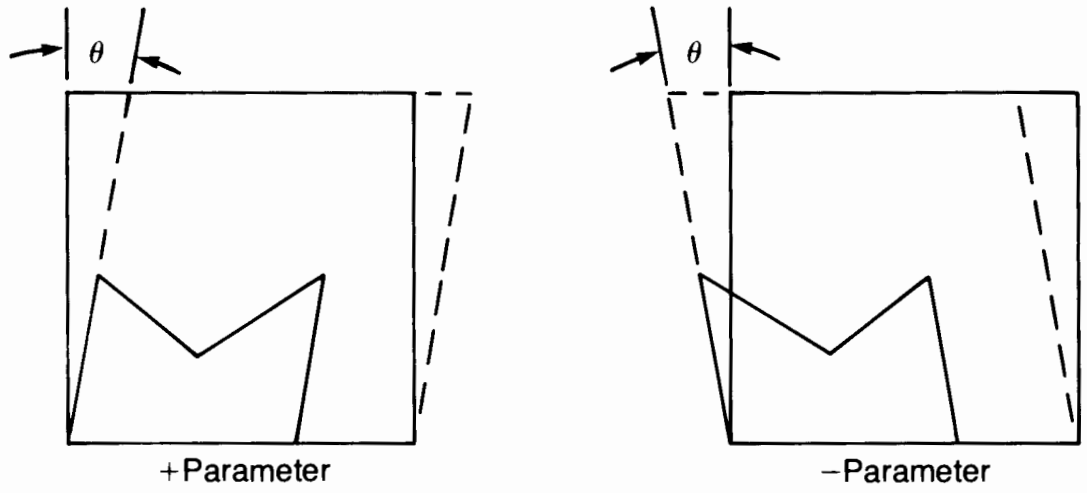
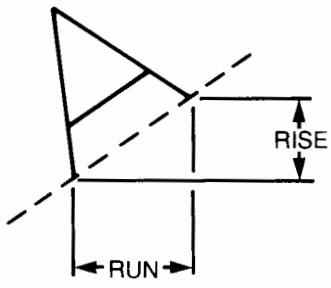


Figure 13-3. Character Slants

Run and rise are in decimal format between ±127.999 and specify the direction according to the relationship:

$$\frac{\text{rise}}{\text{run}}$$

where



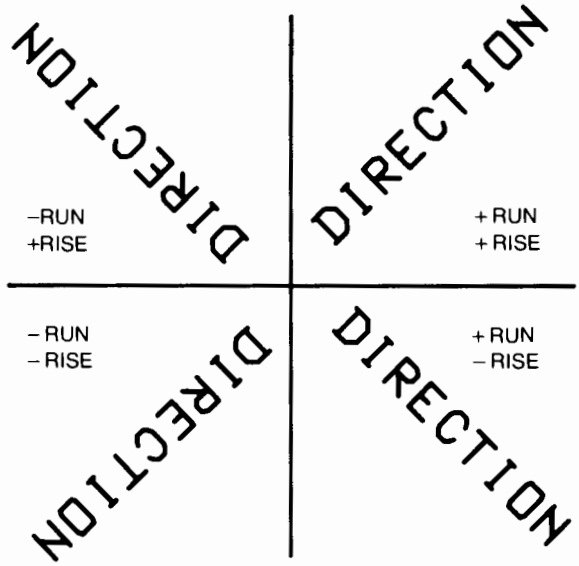


Figure 13-4. Character Direction

450 Set hardware clipping limits. JASPK, JWIND, JVIEW, JDLIM, and JDINT will reset the hardware clipping limits to the view surface boundaries. Only points within the view surface will be clipped. Any vector or text given outside the view surface will give unpredictable results.

RLIST(1) = X min virtual coordinates
RLIST(2) = X max virtual coordinates
RLIST(3) = Y min virtual coordinates
RLIST(4) = Y max virtual coordinates

1050 Select medium or low quality text character set. This instruction provides a means for selecting an alternate character set. See Table 13-1 for the HP 7225 Graphics Plotters hardware character set.

ILIST(1) = 0 ANSI ASCII
1 7225 ASCII
2 European ASCII
3 Scandinavian ASCII
4 Spanish/Latin American ASCII

1051 For internal use only.

2050 Select pen speed. This instruction allows the user to modify the plotter pen speed. Pen speed may be set from 1 to 25 cm/sec.

ILIST(1) = Pen speed (integer from 1 to 25 cm/sec)
ILIST(2) = Pen number. This number is ignored by the HP 7225.

Locator Echoes on the Graphics Display

JWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physcial device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

SAME PHYSICAL DEVICE

If the locator function and graphics display function are both physically implemented on the same HP 7225 Graphics Plotter, then the following devices are supported on the graphics display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the display pen will be moved to the current locator echo position. The pen will continue to reflect the current locator position (i.e. tracked) until the locator operation is terminated.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the display pen and the Y coordinate of the locator echo position.
6	Vertical rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the locator echo position and the Y coordinatte of the display pen.

7	Horizontal/vertical rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned is the same as ECHO 5 if the locator's X displacement from the locator echo position is greater than its Y displacement. The point returned is the same as ECHO 6 if the Y displacement becomes greater than the X displacement.
8	Rubber band box Same as ECHO 2.

DIFFERENT PHYSICAL DEVICES

If the graphics display and the locator functions are performed on different physical devices, and the locator supports echoes on a different physical display device, then the following echoes are supported on the plotter.

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the plotter pen will be moved to the current locator echo position. The pen will then reflect the current locator position (i.e. track the locator position) until operator response.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.

5 Horizontal rubber band line

Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator position and the Y coordinate of the current locator echo position.

6 Vertical rubber band line

Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator echo position and the Y coordinate of the current locator position.

7 Horizontal/vertical rubber band line

Initially, the plotters pen position is moved to the initial locator echo position. Subsequently, when the locator's X displacement becomes greater than its Y displacement, ECHO 5 is simulated. When the locator's Y displacement becomes greater than its X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

Disabling

JWOFF

Device-dependent actions are not performed for the HP 7225 Graphics Plotters.

GRAPHICS DISPLAY DEVICE HANDLER (DGL ONLY)

Description

The dimensions of the HP 7225 Graphics Plotters are as follows:

Platen surface:	297.0 mm wide by 210.0 mm high
Plotting area:	285.5 mm wide by 203.5 mm high
Plotting capacity:	11420 points wide by 8140 points high
Aspect ratio of maximum area:	0.7128
Resolution:	40.0 points/mm in X and Y directions

When using D0032 or D0015, the default logical display surface ranges from 0.0 to 267.5 mm in the X direction and 0.0 to 203.0 mm in the Y direction. The aspect ratio of the logical display surface is 0.76074.

The physical origin of the graphics display is the lower left boundary of pen movement. The view surface is always justified in the lower left corner of the current logical display surface.

Initialization

ZDINT

When the HP 7225 Graphics Plotter are initialized, the following operations are performed:

Device name is set to '7225A ' or '7225B'.

Color set to 1.

Highlighting set to 1.

Linewidth set to 1.

Linestyle set to 1.

Starting position is undefined.

Pen velocity is set to 25 cm/sec.

ASCII character set is set to 'ANSI ASCII'.

Text slant is set to 0 degrees (no slant), text label direction is set to 0 degrees (horizontal).

The logical display limits are set to the default value.

The view surface is justified to the lower left corner of the logical display surface.

Hardware clipping is set to view surface boundaries.

Supported Primitive Attributes

COLOR

ZCOLR

The D0032 display handler for the HP 7225A/B provides a software color table of one color. The size of the color table cannot be changed. The default value of the color table is shown in Table 13-3.

Table 13-3. Default Color Table for One Pen Plotter

COLOR ENTRY TABLE = 1 >> Pen #1 is selected

The color table is initialized to the default value when ZDINT is called. The color table cannot be redefined or inquired using ZDCOL or ZICOL. The pen selected corresponds to the color index passed in the ZCOLR call. The color table is not used when selecting the pen on a ZCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 1 >> Pen #1 is selected
```

REDEFINING COLOR

ZDCOL/ZICOL

The colors in the color table cannot be redefined or inquired.

POLYGON INTERIOR COLOR

ZPICL

Refer to ZCOLR for information regarding color.

POLYGON STYLE

ZDPST

Since the HP 9872 Graphics Plotters are hard copy devices, using ZDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

ZPILS

Refer to ZLSTL for information regarding linestyle.

HIGHLIGHTING

ZHIGH

Highlighting is not performed on the HP 7225 Graphics Plotters.

LINESTYLE

ZLSTL

Seven predefined linestyles are supported on the HP 7225 Graphics Plotters. All of the supported linestyles on the HP 7225 plotters are *continuous*. See Figure 13-5 for the supported linestyles.

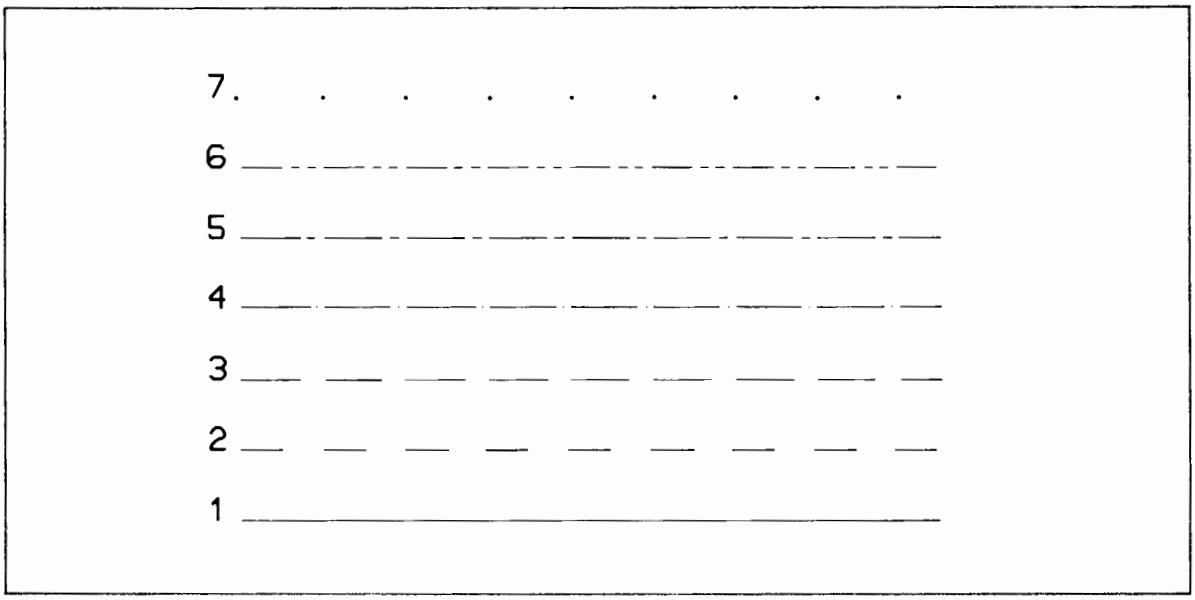


Figure 13-5. Supported Linestyles

LINEWIDTH

ZLWID

Only one linewidth is supported on the HP 7225 Graphics Plotters.

LINEWIDTH = 1 >> Primitives drawn with the linewidth of the pen selected.

CHARACTER SIZES

ZCSIZ

The HP 7225 Graphics Plotters support all character cell sizes which have a width and height not less than 1 mm and not greater than 250 mm.

The character is placed within the character cell as shown in Figure 13-6.

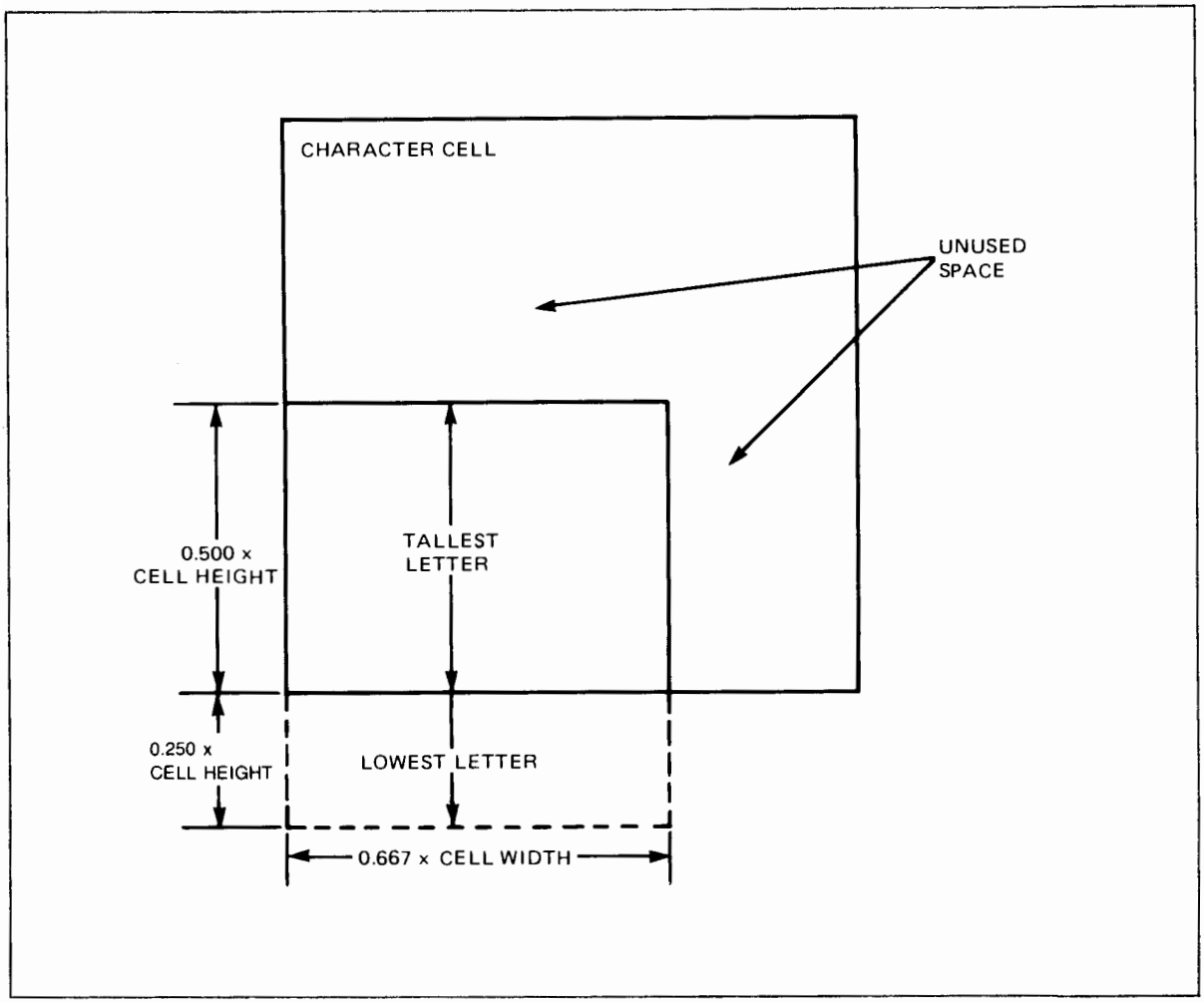


Figure 13-6. Placement of Character in Character Cell

Output Primitives

CLIPPING

The HP 7225 Graphics Plotters have hardware clipping for vectors and text which is set to the view surface limits. Parts of graphics primitives which exceed the hardware clipping limits will be clipped. Graphics primitives which extend past the view surface limits will activate the plotter's *out-of-limit* light.

Calls to ZASPK, ZWIND, ZVIEW, ZDLIM, and ZDINT will reset the hardware clipping units to the view surface boundaries. The user can redefine the hardware clipping units to be any region within the boundaries of the surface by a call to ZOESC (450).

POLYGON

ZPGDD

The HP 7225 plotters do not provide hardware support of polygons. A polygon specified by ZPGDD will always be represented as described in the *DGL Reference Manual*.

MARKERS

ZMARK

The 19 standard markers are the only markers supported with the HP 7225 Graphics Plotters. A character size of 2.0 mm by 2.0 mm is always used to generate markers.

TEXT

ZTEXT

Graphics text is generated with a hardware character generator. A standard ASCII character set is used as the default character set. There are four additional character sets available to the user via HP 7225 Graphics Plotters escape functions. The character sets are given in Table 13-4.

Only parts of characters which extend beyond the hardware clipping limits are clipped.

The user can modify text direction as well as text slant via escape functions (see ZOESC(150) and ZOESC(250)).

After ZTEXT, the starting position is set such that an additional call to ZTEXT will continue plotting characters along the same string of text. A carriage return moves the pen back to the beginning of the text string.

Text is not affected by the linestyle attribute; character strings will be output as solid lines.

Table 13-4. Supported Hardware Character Sets

Decimal Code	ASCII Character	7225 Function/Character Set				
		Set Ø	Set 1	Set 2	Set 3	Set 4
0	NULL	Error 4 Generated In Plotter				
1	SOH	Error 4 Generated In Plotter				
2	STX	Error 4 Generated In Plotter				
3	ETX	End Label Instruction				
4	ETO	Error 4 Generated In Plotter				
5	ENQ	Error 4 Generated In Plotter				
6	ACK	Error 4 Generated In Plotter				
7	BEL	No Operation (NOP)				
8	BS	Backspace				
9	HT	NOP				
10	LF	Line Feed				
11	VT	Inverse Line Feed				
12	FF	NOP				
13	CR	Carriage Return				
14	SO	Select Alternate Character Set				
15	SI	Select Standard Character Set				
16	DLE	Error 4 Generated In Plotter				
17	DC1	NOP				
18	DC2	NOP				
19	DC3	NOP				
20	DC4	NOP				
21	NAK	Error 4 Generated In Plotter				
22	SYN	Error 4 Generated In Plotter				
23	ETB	Error 4 Generated In Plotter				
24	CAN	Error 4 Generated In Plotter				
25	EM	Error 4 Generated In Plotter				
26	SUB	Error 4 Generated In Plotter				
27	ESC	Error 4 Generated In Plotter				
28	FS	Error 4 Generated In Plotter				
29	GS	Error 4 Generated In Plotter				
30	RS	Error 4 Generated In Plotter				
31	US	Error 4 Generated In Plotter				
32	SP	Space				
33	!	!	!	!	!	!
34	"	"	"	"	"	"
35	#	#	#	£	£	¿
36	$	$	$	$	$	$
37	%	%	%	%	%	%
38	&	&	&	&	&	&
39	'	'	'	'	'	'
40	(	(	(	(	(	(
41	)	)	)	)	)	)
42	*	*	*	*	*	*
43	+	+	+	+	+	+
44	,	,	,	,	,	,
45	—	—	—	—	—	—
46	.	.	.	.	.	.
47	/	/	/	/	/	/

NOTE: Characters offset to the left have the automatic backspace feature.

Table 13-4. Supported Hardware Character Sets (continued)

Decimal Code	ASCII Character	7225 Function/Character Set				
		Set Ø	Set 1	Set 2	Set 3	Set 4
48	Ø	Ø	Ø	Ø	Ø	Ø
49	1	1	1	1	1	1
50	2	2	2	2	2	2
51	3	3	3	3	3	3
52	4	4	4	4	4	4
53	5	5	5	5	5	5
54	6	6	6	6	6	6
55	7	7	7	7	7	7
56	8	8	8	8	8	8
57	9	9	9	9	9	9
58	.	:	:	:	:	:
59	;	;	;	;	;	;
60	<	<	<	<	<	<
61	=	=	=	=	=	=
62	>	>	>	>	>	>
63	?	?	?	?	?	?
64	@	@	@	@	@	@
65	A	A	A	A	A	A
66	B	B	B	B	B	B
67	C	C	C	C	C	C
68	D	D	D	D	D	D
69	E	E	E	E	E	E
70	F	F	F	F	F	F
71	G	G	G	G	G	G
72	H	H	H	H	H	H
73	I	I	I	I	I	I
74	J	J	J	J	J	J
75	K	K	K	K	K	K
76	L	L	L	L	L	L
77	M	M	M	M	M	M
78	N	N	N	N	N	N
79	O	O	O	O	O	O
80	P	P	P	P	P	P
81	Q	Q	Q	Q	Q	Q
82	R	R	R	R	R	R
83	S	S	S	S	S	S
84	T	T	T	T	T	T
85	U	U	U	U	U	U
86	V	V	V	V	V	V
87	W	W	W	W	W	W
88	X	X	X	X	X	X
89	Y	Y	Y	Y	Y	Y
90	Z	Z	Z	Z	Z	Z
91	[	[	[	[	Ø	[
92	\	\	ſ	ç	Æ	ı
93	]	]	]	]	ø	]
94	^	^	↑	^	^	^
95	_	_	_	_	_	_
96	`	`	`	`	`	`
97	a	a	a	a	a	a

Table 13-4. Supported Hardware Character Sets (continued)

Decimal Code	ASCII Character	7225 Function/Character Set				
		Set Ø	Set 1	Set 2	Set 3	Set 4
98	b	b	b	b	b	b
99	c	c	c	c	c	c
100	d	d	d	d	d	d
101	e	e	e	e	e	e
102	f	f	f	f	f	f
103	g	g	g	g	g	g
104	h	h	h	h	h	h
105	i	i	i	i	i	i
106	j	j	j	j	j	j
107	k	k	k	k	k	k
108	l	l	l	l	l	l
109	m	m	m	m	m	m
110	n	n	n	n	n	n
111	o	o	o	o	o	o
112	p	p	p	p	p	p
113	q	q	q	q	q	q
114	r	r	r	r	r	r
115	s	s	s	s	s	s
116	t	t	t	t	t	t
117	u	u	u	u	u	u
118	v	v	v	v	v	v
119	w	w	w	w	w	w
120	x	x	x	x	x	x
121	y	y	y	y	y	y
122	z	z	z	z	z	z
123	{	{	{	{	{	{
124	|	|	|	|	|	|
125	}	}	}	}	}	}
126	~	~	~	~	~	~
127	DEL	Error 4 Generated In Plotter				

New-Frame-Action

ZNEWF

When using D0032, a new-frame-action causes the picture to be made current. All visible segments are then drawn, or redrawn, on the display surface. The application program must generate any pause time, if necessary, so that the user can change the paper.

Inquiry Escape Functions

ZIESC

The following inquiry escape functions are supported by DGL with the HP 7225 Graphics Plotters:

OPCODE	FUNCTION	
1050	Inquire error	
	ILIST(1) = 0	No error
	= 1	Instruction not recognized
	= 2	Wrong number of parameters
	= 3	Parameter out-of-range
	= 4	Not used
	= 5	Unknown character set
	= 6	Position overflow
	= 7	Not used
	= 8	Not used

Output Escape Functions

ZOESC

Several output escape functions are supported with the HP 7225 Graphics Plotters. Error checking is not performed by the graphics system for out-of-range or incorrect parameters. Out-of-range parameters flag an error in the plotter and the corresponding command is ignored. None of the supported output escape functions alter the starting position. The following output escape functions are supported with all of the HP 7225 Graphics Plotters display libraries:

OPCODE	FUNCTION
150	Set character slant. See Figure 13-7.

RLIST(1) = Tangent of angle from vertical (from 127.999 to -127.999)

The parameter is a decimal number between ± 127.999 and is equivalent to the tangent of the angle θ from the vertical as follows:

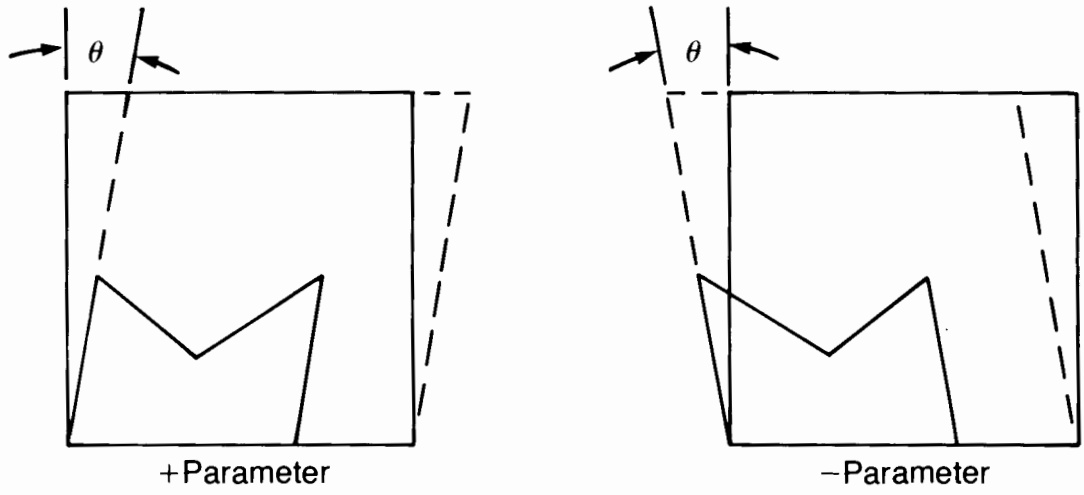


Figure 13-7. Character Slants

250 Set character direction. See Figure 13-8.

RLIST(1) = X component of character direction slope (run)
RLIST(2) = Y component of character direction slope (rise)

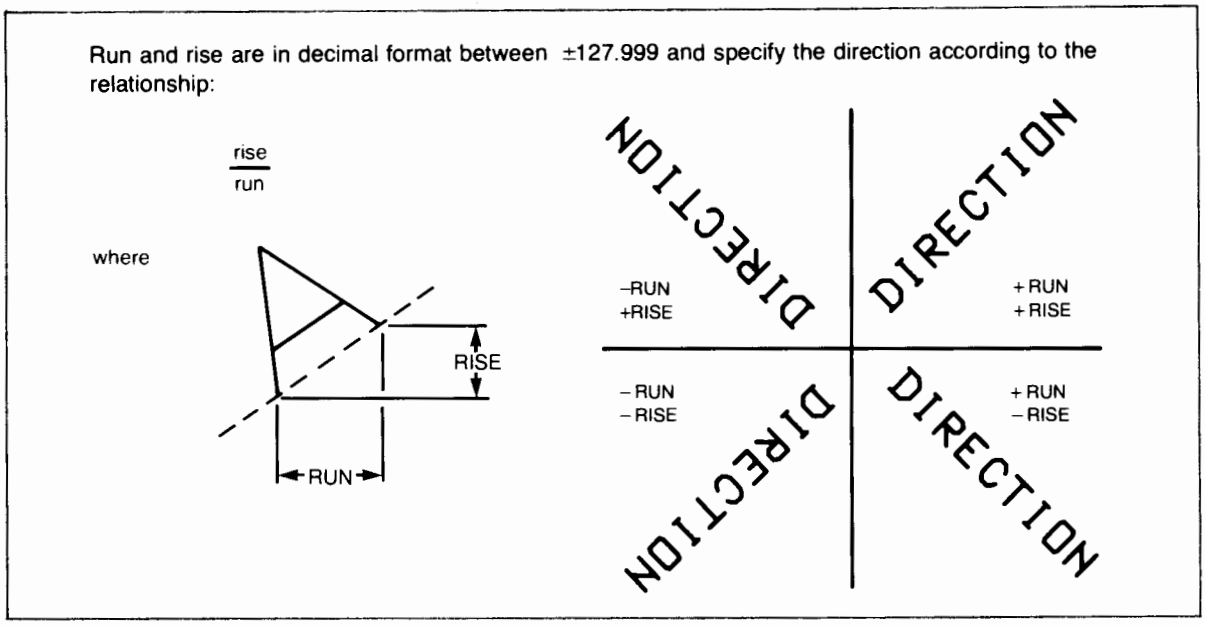


Figure 13-8. Character Direction

450 Set hardware clipping limits. ZWIND, ZASPK, ZVIEW, ZDLIM, and ZDINT will reset the hardware clipping limits to the view surface boundaries.

```
RLIST(1) = X min world coordinates units
RLIST(2) = X max world coordinates units
RLIST(3) = Y min world coordinates units
RLIST(4) = Y max world coordinates units
```

1050 Select character set. This instruction provides a means for selecting an alternate character set. See Table 13-2 for the HP 7225 Graphics Plotters hardware character set.

```
ILIST(1) = 0 ANSI ASCII
           1 HP 7225 ASCII
           2 European ASCII
           3 Scandinavian ASCII
           4 Spanish/Latin American ASCII
```

1051 Set symbol mode. This instruction provides a means for displaying an ASCII character at the end of each move or draw. ZCSIZ can be used to select symbol size. Symbol mode might cause undesirable results when using markers or text. All ASCII characters from decimal 31 through 127 can be used except for those values listed in Table 13-5.

```
ILIST(1) = 0 symbol mode is terminated
         <> 0 symbol mode is set with ASCII character in
            ILIST(1).
```

Table 13-5. Invalid Symbol Characters

All ASCII characters from decimal 35 through 122 can be specified except for the following:

ASCII Character	Decimal Value	ASCII Character	Decimal Value
%	37	>	62
&	38	?	63
'	39	@	64
(	40	[	91
)	41	\	92
/	47	]	93
:	58		94
;	59	_	95
<	60		96
=	61		

2050 Select pen speed. This instruction allows the user to modify the plotter pen speed. Pen speed may be set from 1 to 25 cm/sec.

```
ILIST(1) = Pen speed (integer from 1 to 25 cm/sec)
ILIST(2) = Pen number. This number is ignored by the HP 7225.
```

Locator Echoes on the Graphics Display

ZWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

SAME PHYSICAL DEVICE

If the locator function and graphics display function are both physically implemented on the same HP 7225 Graphics Plotter, then the following echoes are supported on the graphics display.

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the display pen will be moved to the current locator echo position. The pen will continue to reflect the current locator position (i.e. tracked) until the locator operation is terminated.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the display pen and the Y coordinate of the locator echo position.

6 Vertical rubber band line

The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the locator echo position and the Y coordinate of the display pen.

7 Horizontal/vertical rubber band line

The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned is the same as ECHO 5 if the locator's X displacement from the locator echo position is greater than its Y displacement. The point returned is the same as ECHO 6 if the Y displacement becomes greater than the X displacement.

8 Rubber band box

Same as ECHO 2.

DIFFERENT PHYSICAL DEVICES

If the locator and graphics display functions are performed on different physical devices, and the locator supports echoes on a different physical display device, then the following echoes are supported on the plotter.

ECHO#	ECHO PERFORMED
2	Small cursor

Initially, the plotter pen will be moved to the current locator echo position. The pen will then reflect the current locator position (i.e. track the locator position) until operator response.

3 Full cross-hair cursor

Same as ECHO 2.

4 Rubber band line

Same as ECHO 2.

5 Horizontal rubber band line

Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator position and the Y coordinate of the current locator echo position.

6 Vertical rubber band line

Initially, the plotter pen position will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator echo position and the Y coordinate of the current locator position.

7 Horizontal/vertical rubber band line

Initially, the plotter pen position is moved to the locator echo position. Subsequently, when the locator's X displacement becomes greater than its Y displacement, ECHO 5 is simulated. When the locator's Y displacement becomes greater then its X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

Termination

ZDEND

All attributes remain unchanged until the system is reinitialized or the display device is enabled again. D0032 resets the display name to '0032 '.

LOCATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 7225 Graphics Plotters are as follows:

Platen surface:	297.0 mm wide by 210.0 mm high
Plotting area:	285.0 mm wide by 203.0 mm high
Platen capacity:	11420 points wide by 8140 points high
Resolution:	40.0 points/mm in X and Y directions

The default locator limits of the HP 7225 Graphics Plotters (L0032) are 285.0 mm in the X direction and 203.0 mm in the Y direction.

The physical origin of the locator device is the lower left corner of pen movement.

If locator echoing is requested on a different physical device, the current locator position will not be updated while the pen control buttons are pressed. Also, the wait locator call cannot be terminated by pressing the 'ENTER' button while the pen control keys are being used.

Initialization

JEDEV/ZLINT

When the locator device is initialized, the plotter's graphics display is left unaltered. The device name is set to '7225A ' if an HP 7225A Graphics Plotter is used or to '7225B ' if an HP 7225B Graphics Plotter is being used as the locator device.

Wait Locator Input

JWLOC/ZWLOC

The wait locator input function enables a digitizing mode in the HP 7225 Graphics Plotters. The operator then positions the pen to the desired position with the cursor buttons and strikes the enter key. The button value returned is always 1.

Echoes Supported

Locator input can be echoed on either a graphics display device or a locator device. For the echoes supported on a graphics display device, see the chapter which describes the graphics display in question.

The supported echoes on the locator device are as follows:

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	The HP 7225 Graphics Plotters pen tracks the locator position.

Sample Locator Input

JSLOC/ZSLOC

The sample locator input function returns the current plotter pen position to the current position without waiting for an operator response.

Echoes Supported

Locator echoes are not supported with the HP 7225 Graphics Plotters when using the sample locator functions.

Termination

JDDEV/ZLEND

The device name is set to '0032 ', and the device status and I/O unit descriptor are set to 0.

Chapter 14
HP 7470A Graphics Plotter

GENERAL INFORMATION

The user should be familiar with the operation of the HP 7470A Graphics Plotter. If necessary, refer to the following manuals for the appropriate operating instructions:

HP 7470A Graphics Plotter Interfacing and Programming Manual *(07470-90001)*

HP 7470A Graphics Plotter Operating Manual *(07470-90002)*

Logical Devices Supported

The following logical devices are supported by the AGP/DGL Graphics Systems when using the HP 7470A Graphics Plotter.

Logical Device	Device Handler Name	Physical Device
Graphics display	D0031	HP 7470A
Locator	L0031	HP 7470A

GRAPHICS DISPLAY DEVICE HANDLER (AGP ONLY)

Description

The dimensions of the HP 7470A Graphics Plotter are as follows:

Platen surface:	297.0 mm wide by 210.0 mm high
Plotting area:	257.5 mm wide by 190.0 mm high
Plotting capacity:	10300 points wide by 7600 points high
Aspect ratio of maximum area:	0.73786
Resolution:	40.0 points/mm in the X and Y directions

When using D0031, the default logical display surface of the HP 7470A Graphics Plotter ranges from 0.0 to 257.5 mm in the X direction and 0.0 to 190.0 mm in the Y direction. The aspect ratio of the default limits is 0.73786.

The view surface is always justified in the lower left corner (corner nearest the paper load/hold lever when in the VIEW state) of the current logical display surface.

The physical origin is at the lower left boundary of pen movement.

Initialization

JDINT

When the HP 7470A Graphics Plotter is initialized, the following operations are performed:

Device name is set to '7470A ' (D0031)

Pen velocity is set to 38.1 cm/sec.

ASCII character set is set to 'ANSI ASCII' for medium and low quality text.

Medium and low quality text slant are set to 0 degrees (no slant) and text label direction is set to 0 degrees (horizontal).

The logical display surface is set to the default value.

The view surface is justified in the lower left corner of the logical display surface.

Hardware clipping limits are set to the view surface boundaries.

Computer Museum

Device Enabling

JWON

When an HP 7470A Graphics Plotter is enabled, the pen representing the current color attribute is selected.

Supported Primitive Attributes

COLOR

JCOLR

The D0031 display handler for the HP 7470A Graphics Plotter provides a software color table of two distinct colors which support two pens. The size of the color table cannot be changed. The default values of the color table are shown in Table 14-1.

Table 14-1. Default Color Table for Two Pen Plotters

	R	G	B
COLOR TABLE ENTRY = 1 >> Black	0.0	0.0	0.0
= 2 >> Red	1.0	0.0	0.0

The color table is initialized to the default values when JDINT is called. The color table can be redefined or inquired using JDCOL or JICOL.

The pen selected corresponds to the color index passed in the JCOLR call. The color table is not used when selecting the pen on a JCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 0 >> Current pen is returned to its stall
      = 1 >> Pen #1 is selected
      = 2 >> Pen #2 is selected
```

REDEFINING COLOR

JDCOL/JICOL

All of the colors in the color table can be redefined, or inquired, except for the background color. When the color table is redefined, it only affects the values returned on JICOL calls. AGP does not use the color table when selecting the pen on a JCOLR or JPICL call. The color table is provided for the user's convenience.

POLYGON INTERIOR COLOR

JPICL

Refer to JCOLR for information regarding color.

POLYGON STYLE

JDPST

Since the HP 7470A Graphics Plotter is a hard copy device, using JDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

JPILS

Refer to JLSTL for information regarding linestyle.

HIGHLIGHTING

JSHI/JGHI

Highlighting is not supported on the HP 7470A Graphics Plotter.

LINESTYLE

JLSTL

Seven predefined linestyles are supported on the HP 7470A Graphics Plotter. All of the supported linestyles are *continuous*. See Figure 14-1 for the supported linestyles.

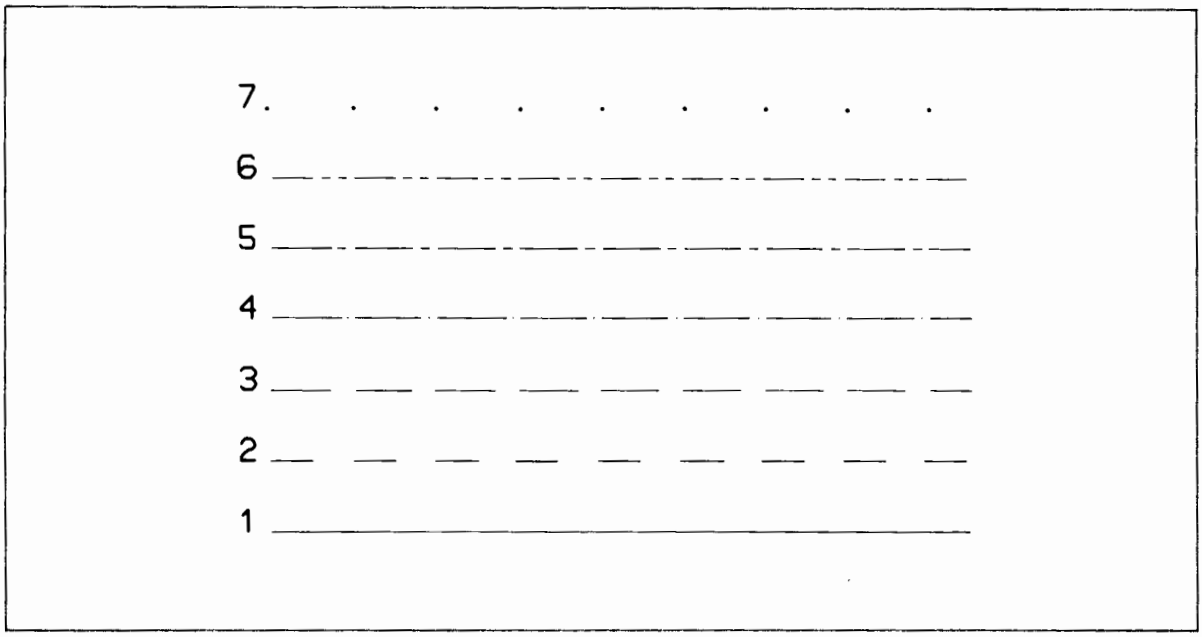


Figure 14-1. Supported Linestyles

LINEWIDTH

JLWID

Only one linewidth is supported on the HP 7470A Graphics Plotter.

LINEWIDTH = 1 >> Primitives drawn with the linewidth of the pen selected.

CHARACTER SIZES

JCSIZ

For medium and low quality text, the HP 7470A Graphics Plotter supports all character cell sizes which have a width and height not less than 1 mm and not greater than 250 mm.

When using medium and low quality text, the character is placed within the character cell as shown in Figure 14-2.

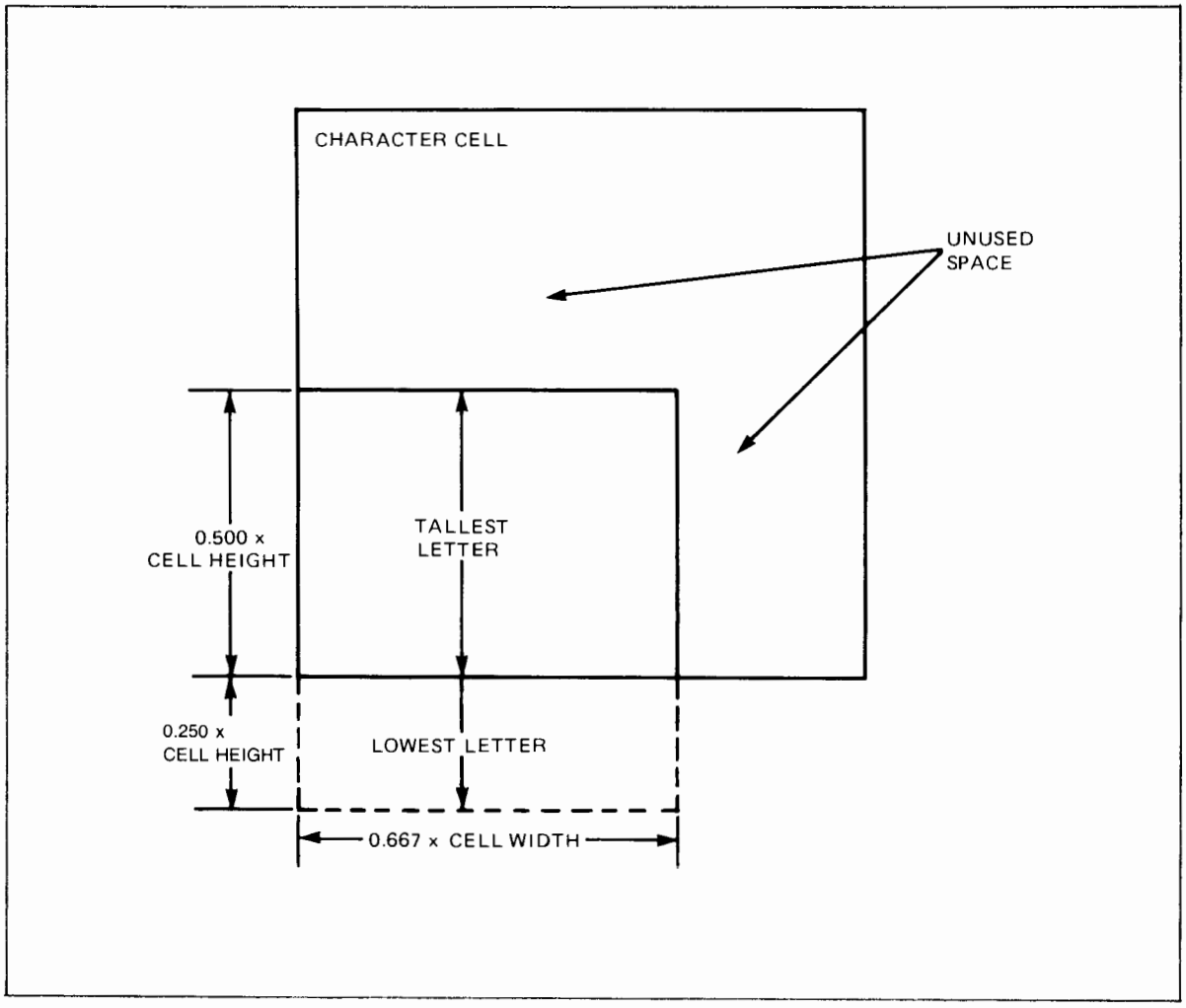


Figure 14-2. Placement of Character in Character Cell

Output Primitives

CLIPPING

The AGP user can access the hardware vector clipping feature of the HP 7470A Graphics Plotter through the output escape function JOESC(450). Calls to JASPK, JWIND, JVIEW, JDLIM, and JDINT will reset the hardware clipping limits to the view surface boundaries. The user can redefine the hardware clipping limits to be any region within the boundaries of the view surface by a call to JOESC (450).

If AGP window clipping is disabled and parts of the image are outside of the view surface limits, then unpredictable results may occur. Graphics items which extend past the view surface limits will activate the plotter's *out-of-limits* lights. If the image is entirely within the view surface limits, then only the portion of the image that is within the hardware clipping limits will be displayed.

If AGP window clipping is enabled, only the portion of the image which is within the viewport and hardware clipping limits will be displayed.

POLYGONS

JZPGN/J3PGN/JRZPG/JR3PG

This device does not have area fill.

MARKERS

J2MRK/J3MRK/JR2MK/JR3MK

The 19 standard markers are the only markers supported with the HP 7470A Graphics Plotter. A character size of 2.0 mm by 2.0 mm is always used to generate the markers. Markers are affected by the color attribute.

MEDIUM AND LOW QUALITY TEXT

JTEXM/JTEXL

Medium and low quality graphics text are generated with a hardware character generator. Hardware text is affected by color but is not affected by linestyle attribute. It is always generated with solid lines.

If a medium or low quality text string is not clipped by AGP, all characters which extend beyond the hardware clipping limits will be clipped by the plotter.

A standard ASCII character set is used as the default character set. There are four additional character sets available to the user via HP 7470A Graphics Plotters escape functions. These character sets are given in Table 14-2.

The user can modify the direction and slant of medium and low quality text through the output escape function (see JOESC (150), JOESC (250)).

Table 14-2. Supported Hardware Character Sets

Decimal Value	ASCII Character	All Sets
0	NULL	No Operation (NOP)
1	SOH	NOP
2	STX	NOP
3	ETX	End Label Instruction
4	ETO	NOP
5	ENQ	NOP
6	ACK	NOP
7	BEL	NOP
8	BS	Backspace
9	HT	NOP
10	LF	Line Feed
11	VT	Inverse Line Feed
12	FF	NOP
13	CR	Carriage Return
14	SO	Select Alternate Character Set
15	SI	Select Standard Character Set
16	DLE	NOP
17	DC1	NOP
18	DC2	NOP
19	DC3	NOP
20	DC4	NOP
21	NAK	NOP
22	SYN	NOP
23	ETB	NOP
24	CAN	NOP
25	EM	NOP
26	SUB	NOP
27	ESC	NOP
28	FS	NOP
29	GS	NOP
30	RS	NOP
31	US	NOP
32	SP	Space

NOTE: Characters offset to the left have the automatic backspace feature.

Table 14-2. Supported Hardware Character Sets (continued)

Decimal Value	Set 0	Set 1	Set 2	Set 3	Set 4
33	!	!	!	!	!
34	"	"	"	"	"
35	#	#	£	£	¿
36	$	$	$	$	$
37	%	%	%	%	%
38	&	&	&	&	&
39	'	'	´	'	´
40	(	(	(	(	(
41	)	)	)	)	)
42	*	*	*	*	*
43	+	+	+	+	+
44	,	,	,	,	,
45	-	-	-	-	-
46	.	.	.	.	.
47	/	/	/	/	/
48	0	0	0	0	0
49	1	1	1	1	1
50	2	2	2	2	2
51	3	3	3	3	3
52	4	4	4	4	4
53	5	5	5	5	5
54	6	6	6	6	6
55	7	7	7	7	7
56	8	8	8	8	8
57	9	9	9	9	9
58	:	:	:	:	:
59	;	;	;	;	;
60	<	<	<	<	<
61	=	=	=	=	=
62	>	>	>	>	>
63	?	?	?	?	?
64	@	@	@	@	@
65	A	A	A	A	A
66	B	B	B	B	B
67	C	C	C	C	C
68	D	D	D	D	D
69	E	E	E	E	E
70	F	F	F	F	F
71	G	G	G	G	G
72	H	H	H	H	H
73	I	I	I	I	I
74	J	J	J	J	J
75	K	K	K	K	K
76	L	L	L	L	L
77	M	M	M	M	M
78	N	N	N	N	N
79	O	O	O	O	O
80	P	P	P	P	P

Table 14-2. Supported Hardware Character Sets (continued)

Decimal Value	Set 0	Set 1	Set 2	Set 3	Set 4
81	Q	Q	Q	Q	Q
82	R	R	R	R	R
83	S	S	S	S	S
84	T	T	T	T	T
85	U	U	U	U	U
86	V	V	V	V	V
87	W	W	W	W	W
88	X	X	X	X	X
89	Y	Y	Y	Y	Y
90	Z	Z	Z	Z	Z
91	[	[	[	Ø	[
92	\	ſ	ç	Æ	¡
93	]	]	]	ø	]
94	^	↑	^	æ	^
95					
96	`	`	`	`	`
97	a	a	a	a	a
98	b	b	b	b	b
99	c	c	c	c	c
100	d	d	d	d	d
101	e	e	e	e	e
102	f	f	f	f	f
103	g	g	g	g	g
104	h	h	h	h	h
105	i	i	i	i	i
106	j	j	j	j	j
107	k	k	k	k	k
108	l	l	l	l	l
109	m	m	m	m	m
110	n	n	n	n	n
111	o	o	o	o	o
112	p	p	p	p	p
113	q	q	q	q	q
114	r	r	r	r	r
115	s	s	s	s	s
116	t	t	t	t	t
117	u	u	u	u	u
118	v	v	v	v	v
119	w	w	w	w	w
120	x	x	x	x	x
121	y	y	y	y	y
122	z	z	z	z	z
123	{	¤	¨	¨	~
124	¦	⊢	°	°	~
125	}	→	¨	¨	~
126	~	~	°	°	~
127	⊢	⊢	⊢	⊢	⊢

New-Frame-Action

JNEWF/JPURG/JSVIS/JSHI/JVSAL/JCLR

When using D0031, a new-frame-action causes the picture to be made current. All visible segments are then drawn, or redrawn on the display surface. The application program should generate pause time, if necessary, so that the user can change the paper.

Inquiry Escape Functions

JIESC

The following inquiry escape functions are supported by AGP with the HP 7470A Graphics Plotter.

OPCODE	FUNCTION
1050	Inquire error

ILIST(1) = 0 No error
= 1 Instruction not recognized
= 2 Wrong number of parameters
= 3 Parameter out-of-range
= 4 Not used
= 5 Unknown character set
= 6 Position overflow
= 7 Not used
= 8 Not used

Output Escape Functions

JOESC

Several output escape functions are supported by AGP with the HP 7470A Graphics Plotter. Error checking is not performed by the graphics system for out-of-range or incorrect parameters. Out-of-range parameters flag an error in the plotter and the corresponding command is ignored.

Escape functions are not stored in the segment display area. This can have implications when used with AGP segments. For example, a character slant of 10 degrees is set with escape function JOESC (150). If a text string is created inside a segment, the character slant is changed to 30 degrees and a new-frame-action is given. The string will be redrawn with the present character slant of 30 degrees, rather than the character slant of 10 degrees it was created with.

Escape functions may also have undesired effects on low and medium quality text. For example, since medium quality text is output one character at a time, setting the text direction angle will affect each character by itself not producing the same angled text that would be output if low quality text were used. See the *AGP Users Guide* for an example of the difference in low and medium quality text.

Escape functions are sent from AGP directly to DGL. The state of AGP may become undefined when an escape function is given that overrides a mode set by AGP (e.g. hardware text direction).

The following output escape functions are supported with the HP 7470A Graphics Plotter:

OPCODE	FUNCTION
150	Set device character slant for subsequent medium and low quality text. See Figure 14-3. RLIST(1) = Tangent of angle from vertical (from 127.999 to -127.999)
250	Set device character direction for subsequent medium and low quality text. See Figure 14-4. RLIST(1) = X component of character direction slope (run) RLIST(2) = Y component of character direction slope (rise)

The parameter is a decimal number between ± 127.999 and is equivalent to the tangent of the angle θ from the vertical as follows:

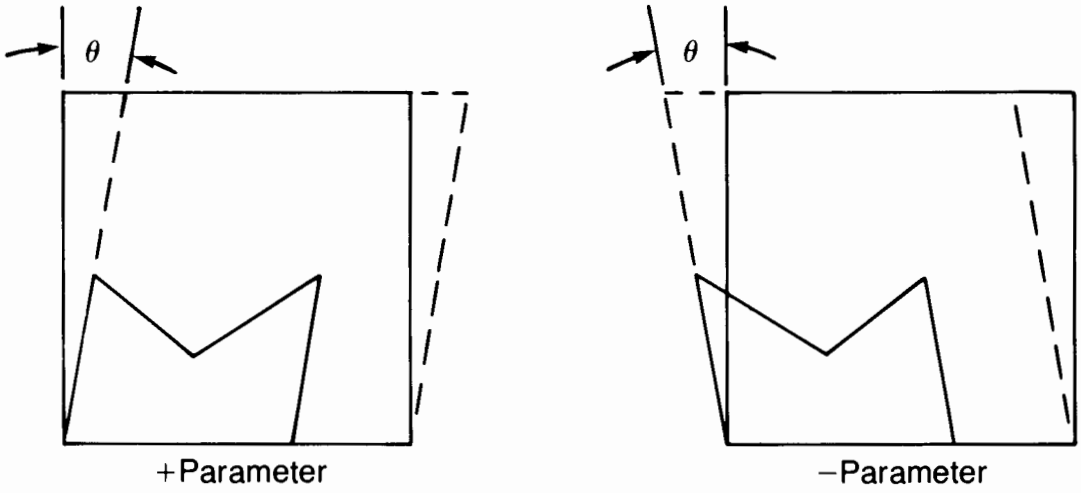
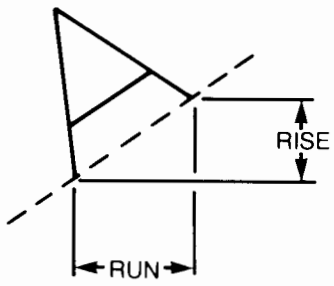


Figure 14-3. Character Slants

Run and rise are in decimal format between ±127.999 and specify the direction according to the relationship:

$$\frac{\text{rise}}{\text{run}}$$

where



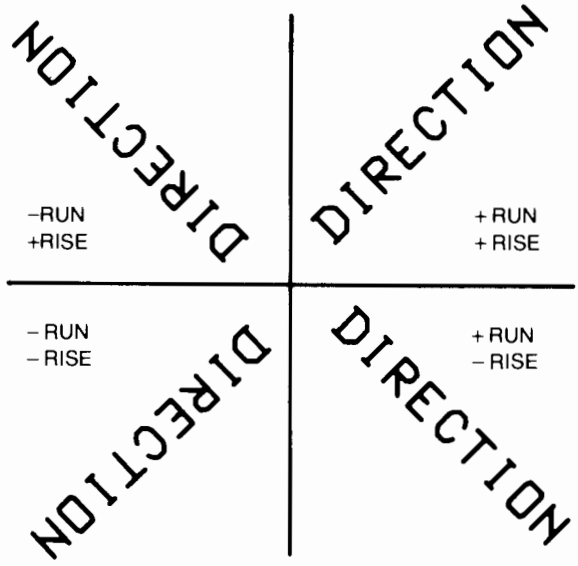


Figure 14-4. Character Direction

450 Set hardware clipping limits. JASPK, JWIND, JVIEW, JDLIM, and JDINT reset the hardware clipping limits to the view surface boundaries. Only points within the view surface will be clipped. Any vector or text given outside the view surface will give unpredictable results.

RLIST(1) = X min virtual coordinates
RLIST(2) = X max virtual coordinates
RLIST(3) = Y min virtual coordinates
RLIST(4) = Y max virtual coordinates

1050 Select medium or low quality text character set. This instruction provides a means for selecting an alternate character set. See Table 14-1 for the HP 7470A Graphics Plotter hardware character set.

ILIST(1) = 0 ANSI ASCII
1 7470A ASCII
2 European ASCII
3 Scandinavian ASCII
4 Spanish/Latin American ASCII

1051 For internal use only.

2050 Select pen speed. This instruction allows the user to modify the plotter pen speed. Pen speed may be set from 1 to 38 cm/sec.

ILIST(1) = Pen speed (integer from 1 to 38 cm/sec)
ILIST(2) = Pen number. This number is ignored by the HP 7470A Graphics Plotter; the pen speed is changed for all pens.

Locator Echoes on the Graphics Display

JWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

SAME PHYSICAL DEVICE

If the locator and graphics display are both implemented on the same HP 7470A Graphics Plotter, then the following echoes are supported on the graphics display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the display pen will be moved to the current locator echo position. The pen will continue to reflect the current locator position (i.e. tracked) until the locator operation is terminated.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the display pen and the Y coordinate of the locator echo position.
6	Vertical rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the locator echo position and the Y coordinate of the display pen.

7 Horizontal/vertical rubber band line

The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned is the same as ECHO 5 if the locator's X displacement from the locator echo position is greater than its Y displacement. The point returned is the same as ECHO 6 if the Y displacement becomes greater than the X displacement.

8 Rubber band box

Same as ECHO 2.

DIFFERENT PHYSICAL DEVICES

If the graphics display and the locator function are performed on different physical devices and the locator supports echoes on a different physical display device, then the following echoes are supported on the plotter.

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the plotter pen will be moved to the current locator echo position. The pen will then reflect the current locator position (i.e. track the locator position) until operator response.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.

5 Horizontal rubber band line

Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator position and the Y coordinate of the current locator echo position.

Computer Museum

6 Vertical rubber band line

Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator echo position and the Y coordinate of the current locator position.

7 Horizontal/vertical rubber band line

Initially, the plotter's pen position is moved to the initial locator echo position. Subsequently, when the locator's X displacement becomes greater than its Y displacement, ECHO 5 is simulated. When the locator's Y displacement becomes greater than its X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

Disabling

JWOFF

When the device is disabled, the current pen is returned to its stall.

GRAPHICS DISPLAY DEVICE HANDLER (DGL ONLY)

Description

The dimensions of the HP 7470A Graphics Plotter are as follows:

Platen surface:	297.0 mm wide by 210.0 mm high
Plotting area:	257.5 mm wide by 190.0 mm high
Plotting capacity:	10300 points wide by 7600 points high
Aspect ratio of maximum area:	0.73786
Resolution:	40.0 points/mm in X and Y directions

When using D0031, the default logical display surface ranges from 0.0 to 257.5 mm in the X direction and 0.0 to 190.0 mm in the Y direction. The aspect ratio of the logical display surface is 0.73786.

The view surface is always justified in the lower left corner (corner nearest the paper load/hold lever when in the VIEW state) of the current logical display surface.

The physical origin is at the lower left boundary of pen movement.

Initialization

ZDINT

When the HP 7470A Graphics Plotter is initialized, the following operations are performed:

Device name is set to '7470A ' (D0031).

Color set to 1.

Highlighting set to 1.

Linewidth set to 1.

Linestyle set to 1.

Starting position is undefined.

Pen velocity is set to 38.1 cm/sec.

ASCII character set is set to 'ANSI ASCII'.

Text slant is set to 0 degrees, text label direction is set to 0 degrees (horizontal).

The logical display limits are set to the default value.

The view surface is justified to the lower left corner of the logical display surface.

Hardware clipping is set to view surface boundaries.

Supported Primitive Attributes

COLOR

ZCOLR

The D0031 display handler for the HP 7470A Graphics Plotter provides a software color table of two distinct colors which support two pens. The size of the color table cannot be changed. The default values of the color table are shown in Table 14-3.

Table 14-3. Default Color Table for two Pen Plotters

	R	G	B
COLOR ENTRY TABLE = 1 >> Black	0.0	0.0	0.0
= 2 >> Red	1.0	0.0	0.0

The color table is initialized to the default values when ZDINT is called color table can be redefined or inquired using ZDCOL or ZICOL.

The pen selected corresponds to the color index passed in the ZCOLR call. The color table is not used when selecting the pen on a ZCOLR call. The color table exists merely for the user's convenience.

```
COLOR = 0 >> Current pen is returned to its stall
      = 1 >> Pen #1 is selected
      = 2 >> Pen #2 is selected
```

REDEFINING COLOR

ZDCOL/ZICOL

All of the colors in the color table can be redefined, or inquired, except for the background color. When the color table is redefined, it only affects the values returned on ZICOL calls. DGL does not use the color table when selecting the pen on a ZCOLR or ZPICL call. The color table is provided for the user's convenience.

POLYGON INTERIOR COLOR

ZPICL

Refer to ZCOLR for information regarding color.

POLYGON STYLE

ZDPST

Since the HP 7470A Graphics Plotter is a hard copy device, using ZDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

ZPILS

Refer to ZLSTL for information regarding linestyle.

HIGHLIGHTING

ZHIGH

Highlighting is not performed on the HP 7470A Graphics Plotter.

LINESTYLE

ZLSTL

Seven predefined linestyles are supported on the HP 7470A plotter. All linestyles supported on the HP 7470A plotter may be classified as being *continuous*. See Figure 14-5 for the supported linestyles.

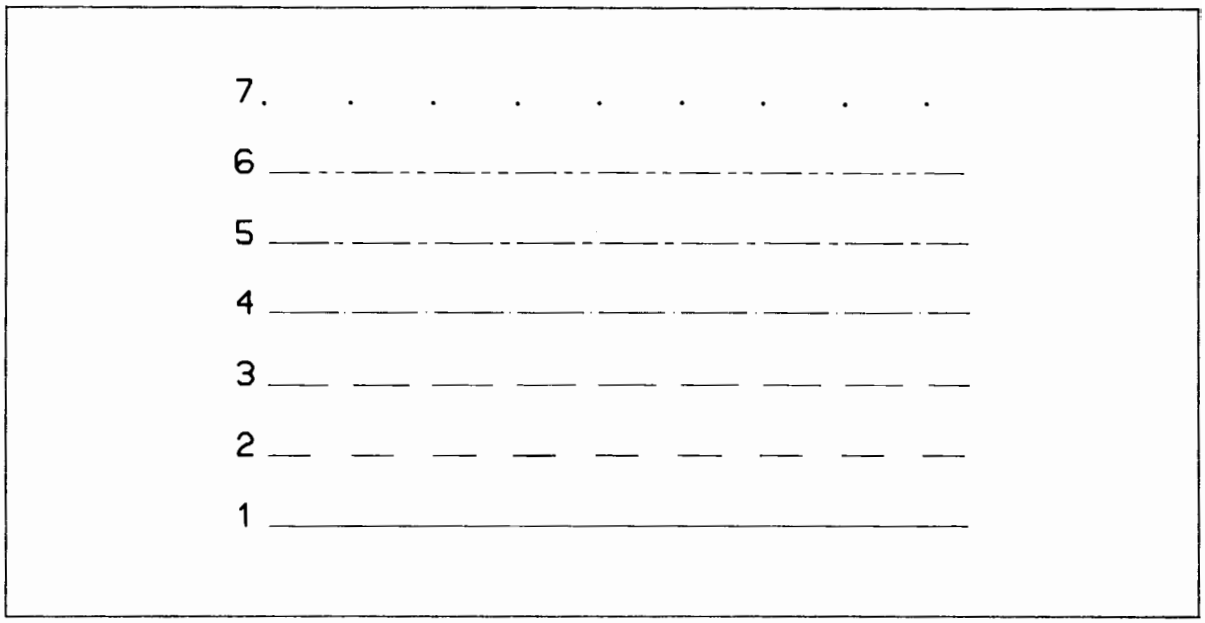


Figure 14-5. Supported Linestyles

LINEWIDTH

ZLWID

Only one linewidth is supported on the HP 7470A Graphics Plotter.

LINEWIDTH = 1 >> Primitives drawn with the linewidth of the pen selected.

CHARACTER SIZES

ZCSIZ

The HP 7470A Graphics Plotter supports all character cell sizes which have a width and height not less than 1 mm and not greater than 250 mm.

The character is placed within the character cell as shown in Figure 14-6.

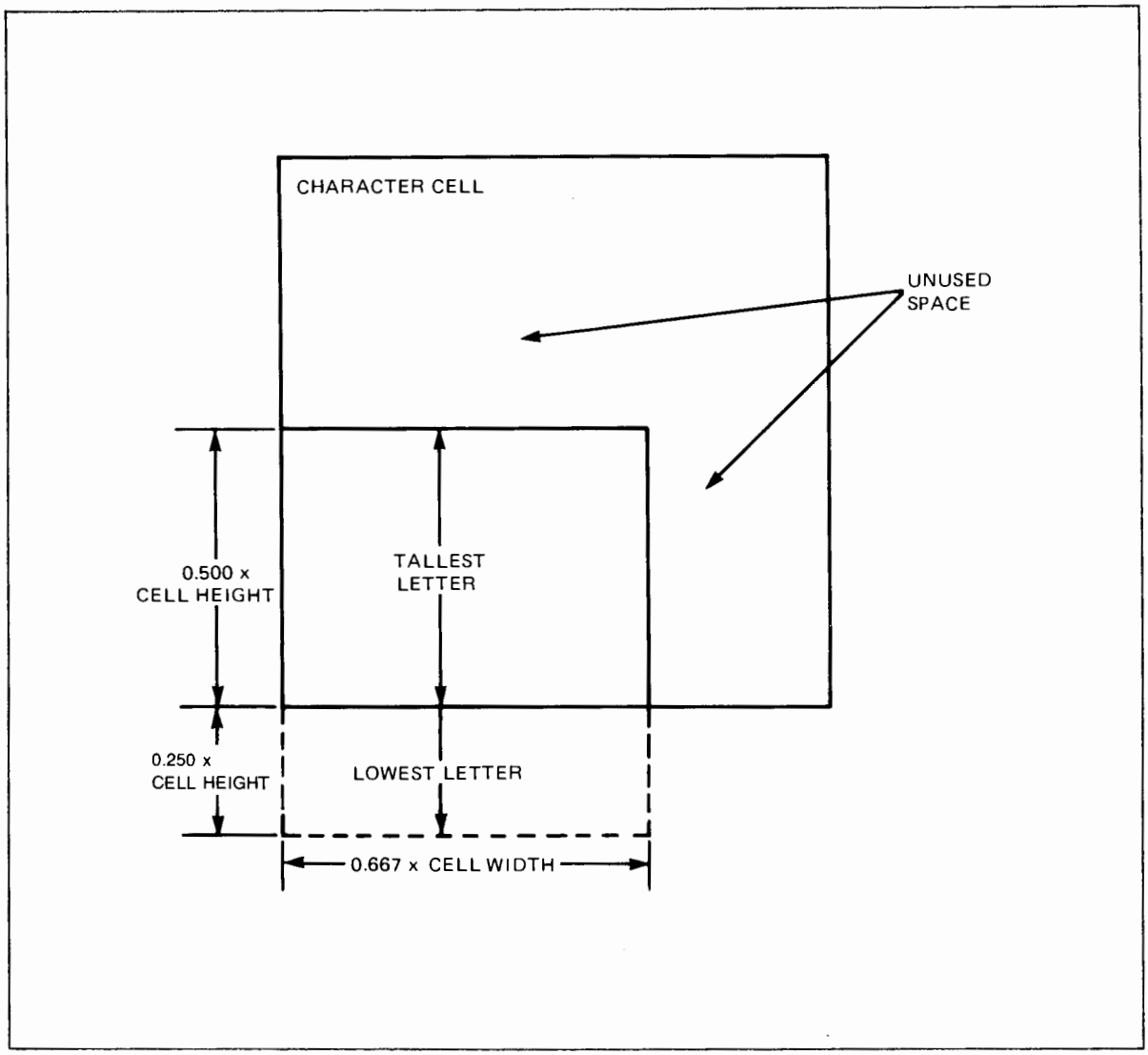


Figure 14-6. Placement of Character in Character Cell

Output Primitives

CLIPPING

The HP 7470A Graphics Plotter has hardware vector clipping for vectors and text which is set to the view surface limits. Parts of graphics primitives which exceed the hardware clipping limits will be clipped.

Calls to ZASPK, ZWIND, ZVIEW, ZDLIM, and ZDINT will reset the hardware clipping limits to the view surface boundaries. The user can redefine the hardware clipping limits to be any region within the boundaries of the view surface by a call to ZOESC (450).

POLYGONS

ZPGDD

The HP 7470 plotter does not provide hardware support of polygons. A polygon specified by ZPGDD will always be represented as described in the *DGL Reference Manual*.

MARKERS

ZMARK

The 19 standard markers are the only markers supported with the HP 7470A Graphics Plotter. A character size of 2.0 mm by 2.0 mm is always used to generate markers. Markers are affected by the color attribute.

TEXT

ZTEXT

Graphics text is generated with a hardware character generator. A standard ASCII character set is used as the default character set. There are four additional character sets available to the user via HP 7470A Graphics Plotters escape functions. The character sets are given in Table 14-4.

Only parts of characters which extend beyond the hardware clipping limits are clipped.

The user can modify text direction as well as text slant via escape functions (see ZOESC (150) and ZOESC (250)).

After ZTEXT, the starting position is set such that an additional call to ZTEXT will continue plotting characters along the same string of text. A carriage return moves the pen back to the beginning of the text string.

Text is affected by the color attribute but is not affected by the linestyle attribute; character strings will be output as solid lines.

Table 14-4. Supported Hardware Character Sets

Decimal Value	ASCII Character	All Sets
0	NULL	No Operation (NOP)
1	SOH	NOP
2	STX	NOP
3	ETX	End Label Instruction
4	ETO	NOP
5	ENQ	NOP
6	ACK	NOP
7	BEL	NOP
8	BS	Backspace
9	HT	NOP
10	LF	Line Feed
11	VT	Inverse Line Feed
12	FF	NOP
13	CR	Carriage Return
14	SO	Select Alternate Character Set
15	SI	Select Standard Character Set
16	DLE	NOP
17	DC1	NOP
18	DC2	NOP
19	DC3	NOP
20	DC4	NOP
21	NAK	NOP
22	SYN	NOP
23	ETB	NOP
24	CAN	NOP
25	EM	NOP
26	SUB	NOP
27	ESC	NOP
28	FS	NOP
29	GS	NOP
30	RS	NOP
31	US	NOP
32	SP	Space

NOTE: Characters offset to the left have the automatic backspace feature.

Table 14-4. Supported Hardware Character Sets (continued)

Decimal Value	Set 0	Set 1	Set 2	Set 3	Set 4
33	!	!	!	!	!
34	"	"	"	"	"
35	#	#	£	£	¿
36	$	$	$	$	$
37	%	%	%	%	%
38	&	&	&	&	&
39	'	'	'	'	'
40	(	(	(	(	(
41	)	)	)	)	)
42	*	*	*	*	*
43	+	+	+	+	+
44	,	,	,	,	,
45	-	-	-	-	-
46	.	.	.	.	.
47	/	/	/	/	/
48	0	0	0	0	0
49	1	1	1	1	1
50	2	2	2	2	2
51	3	3	3	3	3
52	4	4	4	4	4
53	5	5	5	5	5
54	6	6	6	6	6
55	7	7	7	7	7
56	8	8	8	8	8
57	9	9	9	9	9
58	:	:	:	:	:
59	;	;	;	;	;
60	<	<	<	<	<
61	=	=	=	=	=
62	>	>	>	>	>
63	?	?	?	?	?
64	@	@	@	@	@
65	A	A	A	A	A
66	B	B	B	B	B
67	C	C	C	C	C
68	D	D	D	D	D
69	E	E	E	E	E
70	F	F	F	F	F
71	G	G	G	G	G
72	H	H	H	H	H
73	I	I	I	I	I
74	J	J	J	J	J
75	K	K	K	K	K
76	L	L	L	L	L
77	M	M	M	M	M
78	N	N	N	N	N
79	O	O	O	O	O
80	P	P	P	P	P

Table 14-4. Supported Hardware Character Sets (continued)

Decimal Value	Set 0	Set 1	Set 2	Set 3	Set 4
81	Q	Q	Q	Q	Q
82	R	R	R	R	R
83	S	S	S	S	S
84	T	T	T	T	T
85	U	U	U	U	U
86	V	V	V	V	V
87	W	W	W	W	W
88	X	X	X	X	X
89	Y	Y	Y	Y	Y
90	Z	Z	Z	Z	Z
91	[	[	[	Ø	[
92	\	ſ	ç	Æ	¡
93	]	]	]	ø	]
94	^	↑	^	æ	^
95					
96	`	`	`	`	`
97	a	a	a	a	a
98	b	b	b	b	b
99	c	c	c	c	c
100	d	d	d	d	d
101	e	e	e	e	e
102	f	f	f	f	f
103	g	g	g	g	g
104	h	h	h	h	h
105	i	i	i	i	i
106	j	j	j	j	j
107	k	k	k	k	k
108	l	l	l	l	l
109	m	m	m	m	m
110	n	n	n	n	n
111	o	o	o	o	o
112	p	p	p	p	p
113	q	q	q	q	q
114	r	r	r	r	r
115	s	s	s	s	s
116	t	t	t	t	t
117	u	u	u	u	u
118	v	v	v	v	v
119	w	w	w	w	w
120	x	x	x	x	x
121	y	y	y	y	y
122	z	z	z	z	z
123	{	¨	¨	¨	¯
124	¦	⊢	•	•	~
125	}	⊣	¨	¨	¯
126	~	~	-	•	~
127	⊢	⊢	⊢	⊢	⊢

New-Frame-Action

ZNEWF

When using D0031, a new-frame-action causes the picture to be made current. All visible segments are then drawn, or redrawn, on the display surface. The application program should generate pause time, if necessary, so that the user can change the paper.

Inquiry Escape Functions

ZIESC

The following inquiry escape functions are supported by DGL with the HP 7470A Graphics Plotter:

OPCODE	FUNCTION	
1050	Inquire error	
	ILIST(1) = 0	No error
	= 1	Instruction not recognized
	= 2	Wrong number of parameters
	= 3	Parameter out-of-range
	= 4	Not used
	= 5	Unknown character set
	= 6	Position overflow
	= 7	Not used
	= 8	Not used

Output Escape Functions

ZOESC

Several output escape functions are supported by DGL with the HP 7470A Graphics Plotter. Error checking is not performed by the graphics system for out-of-range or incorrect parameters. Out-of-range parameters flag an

error in the plotter and the corresponding command is ignored. None of the supported output escape functions alter the starting position. The following output escape functions are supported with the HP 7470A Graphics Plotters display library:

OPCODE	FUNCTION
150	Set character slant. See Figure 14-7.

RLIST(1) = Tangent of angle from vertical
(from 127.999 to -127.999)

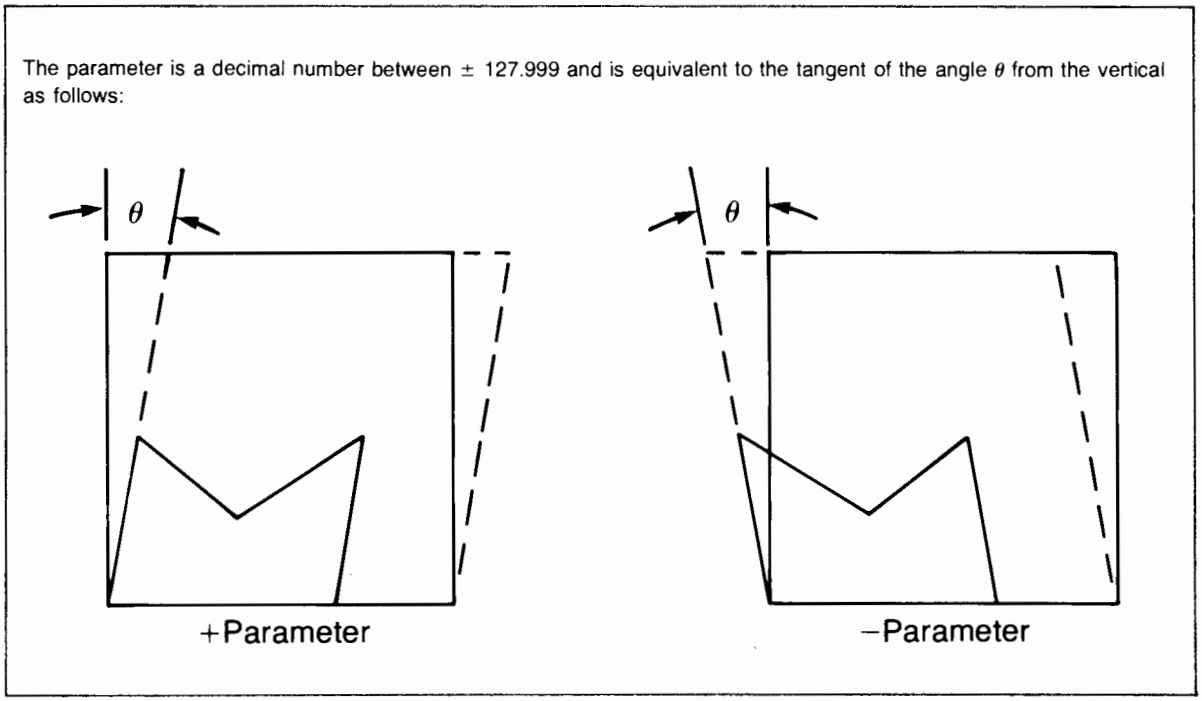


Figure 14-7. Character Slants

250 Set character direction. See Figure 14-8.

RLIST(1) = X component of character direction slope
(run)

RLIST(2) = Y component of character direction slope
(rise)

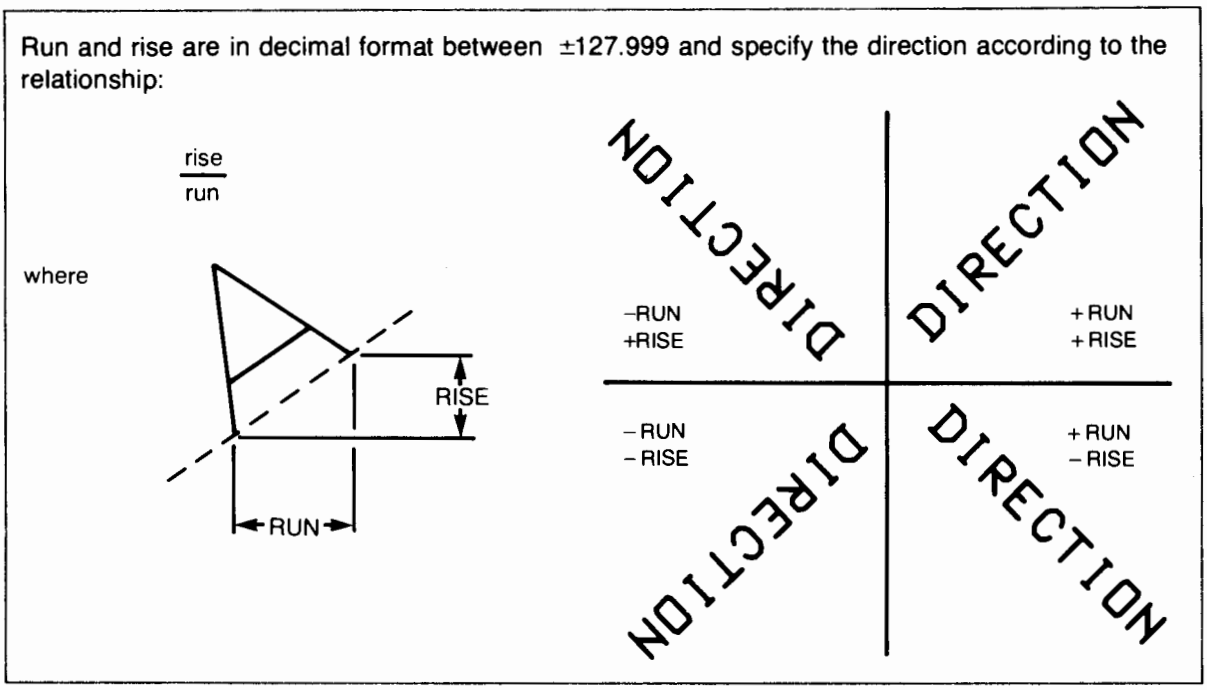


Figure 14-8. Character Direction

450 Set hardware clipping limits. ZWIND, ZASPK, ZVIEW, ZDLIM, and ZDINT will reset the hardware clipping limits to the view surface boundaries.

```
RLIST(1) = X min world coordinates units
RLIST(2) = X max world coordinates units
RLIST(3) = Y min world coordinates units
RLIST(4) = Y max world coordinates units
```

1050 Select character set. This instruction provides a means for selecting an alternate character set. See Table 14-5 for the HP 7470A Graphics Plotters hardware character set.

```
ILIST(1) = 0 ANSI ASCII
           1 HP 7470A ASCII
           2 European ASCII
           3 Scandinavian ASCII
           4 Spanish/Latin American ASCII
```

1051 Set symbol mode. This instruction provides a means for displaying an ASCII character at the end of each move or draw. ZCSIZ can be used to select symbol size. Symbol mode might cause undesirable results when using markers or text. All ASCII characters from decimal 31 through 127 can be used except for those values listed in Table 14-5.

```
ILIST(1) = 0 symbol mode is terminated
         <> 0 symbol mode is set with ASCII character
              in ILIST(1).
```

Table 14-5. Invalid Symbol Characters

All ASCII characters from decimal 35 through 122 can be specified except for the following:

ASCII Character	Decimal Value	ASCII Character	Decimal Value
%	37	>	62
&	38	?	63
'	39	@	64
(	40	[	91
)	41	\	92
/	47	]	93
:	58		94
;	59	_	95
<	60		96
=	61		

2050 Select pen speed. This instruction allows the user to modify the plotter pen speed. Pen speed may be set from 1 to 38 cm/sec.

```
ILIST(1) = Pen speed (integer from 1 to 38 cm/sec)
ILIST(2) = Pen number. This number is ignored by the HP 7470;
           the pen speed is changed for all pens.
```

Locator Echoes on the Graphics Display

ZWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

SAME PHYSICAL DEVICE

If the locator and display are the same physical device then the following echoes are supported on the graphics display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially, the display pen will be moved to the current locator echo position. The pen will continue to reflect the current locator position (i.e. tracked) until the locator operation is terminated.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Same as ECHO 2.
5	Horizontal rubber band line The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the display pen and the Y coordinate of the locator echo position.

6 Vertical rubber band line

The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned has the X coordinate of the locator echo position and the Y coordinate of the display pen.

7 Horizontal/vertical rubber band line

The display pen and the locator echo position are handled in the same manner as they are in ECHO 2. The point returned is the same as ECHO 5 if the locator's X displacement from the locator echo position is greater than its Y displacement. The point returned is the same as ECHO 6 if the Y displacement becomes greater than the X displacement.

8 Rubber band box

Same as ECHO 2.

DIFFERENT PHYSICAL DEVICES

If the locator and graphics display are different physical devices, and the locator supports echoes on a different physical display device, then the following echoes are supported on the display:

ECHO#	ECHO PERFORMED
2	Small cursor

Initially, the plotter pen will be moved to the current locator echo position. The pen will then reflect the current locator position (i.e. track the locator position) until operator response.

3 Full cross-hair cursor

Same as ECHO 2.

4 Rubber band line

Same as ECHO 2.

5 Horizontal rubber band line

Initially, the plotter pen will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator position and the Y coordinate of the current locator echo position.

6 Vertical rubber band line

Initially, the plotter pen position will be moved to the current locator echo position. The pen will then continue to reflect the X coordinate of the current locator echo position and the Y coordinate of the current locator position.

7 Horizontal/vertical rubber band line

Initially, the plotter pen position is moved to the locator echo position. Subsequently, when the locator's X displacement becomes greater than its Y displacement, ECHO 5 is simulated. When the locator's Y displacement becomes greater then its X displacement, ECHO 6 is simulated.

8 Rubber band box

Same as ECHO 2.

Termination

ZDEND

All attributes except color remain unchanged until the system is reinitialized or the display device is enabled again. The color is set to 0. The device name is set to '0031', and the device status and I/O unit descriptor are set to 0.

LOCATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 7470A Graphics Plotter are as follows:

Platen surface:	297.0 mm wide by 210.0 mm high
Plotting area:	257.5 mm wide by 190.0 mm high
Platen capacity:	10300 points wide by 7600 points high
Resolution:	40.0 points/mm in X and Y directions

The default locator limits of the HP 7470A Graphics Plotter (L0031) are 257.5 mm in the X direction and 190.0 mm in the Y direction.

The physical origin of the locator device is 12 mm to the right of the left edge of the platen and 6 mm above the lower edge of the platen. This is the lower left corner of pen movement.

If locator echoing is requested on a different physical device, the current locator position will not be updated while the pen control buttons are pressed. Also, the wait locator call cannot be terminated by pressing the 'ENTER' button while the pen control keys are being used.

Initialization

JEDEV/ZLINT

When the locator device is initialized, the plotter's graphics display is left unaltered. The device name is set to '7470A '.

Wait Locator Input

JWLOC/ZWLOC

The wait locator input function enables a digitizing mode in the HP 7470A Graphics Plotter. The operator then positions the pen to the desired position with the cursor buttons and strikes the enter key. The button value returned is always "1".

Echoes Supported

Locator input can be echoed on either a graphics display device or a locator device. For the echoes supported on a graphics display device, see the chapter which describes the graphics display in question.

The supported echoes on the locator device are as follows:

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	The HP 7470A Graphics Plotter pen tracks the locator position.

Sample Locator Input

JSLOC/ZSLOC

The sample locator input function returns the current plotter pen position without waiting for an operator response.

Echoes Supported

Locator echoes are not supported with the HP 7470A Graphics plotter when using the sample locator functions.

Termination

JDDEV/ZLEND

The device name is set to '0031 ', and the device status and I/O unit descriptor are set to 0.

Chapter 15
HP 2627A Graphics Terminal

GENERAL INFORMATION

The user should be familiar with the operation of the HP 2627A Graphics Terminal. If necessary, refer to the following manuals for the appropriate operating instructions:

HP 2627A Graphics Terminal User's Manual *(02627-90001)*

HP 2627A Graphics Terminal Reference Manual *(02627-90002)*

Logical Devices Supported

The following logical devices are supported by the AGP/DGL Graphics Systems when using the HP 2627A Graphics Terminal:

Logical Device	Device Handler Name
Alphanumeric	A0001
Button	B0001
Graphics display	D0036
Keyboard	K0001
Locator	L0019
Pick (AGP only)	P0019
Valuator	V0019

Device Configuration

The HP 2627A Graphics Terminal should be strapped for normal point-to-point operation. The terminal should not be in block mode.

ALPHANUMERIC DEVICE HANDLER (AGP/DGL)

Description

The HP 2627A Graphics Terminal has independent alphanumeric and graphic display memories which allow either or both types of data to be displayed on the same CRT. The alphanumeric device handler, A0001, allows the application programmer to send messages and alphanumeric display control commands to the HP 2627A Graphics Terminal.

The dimensions of the alphanumeric display are as follows:

Screen size: 215 mm wide by 164 mm high

Screen capacity: 24 lines and 80 characters per line

Character size: 2.4 mm wide by 4.24 mm high

Initialization

JEDEV/ZAINT

When the alphanumeric device is initialized, the alphanumeric display is turned on and the contents of the alphanumeric memory are left unchanged. DGL sets the device name to '2627A '.

Alphanumeric Output

JALPH/ZALPH

The state of the alphanumeric display is not altered before sending the character string to the terminal. The entire character string passed is sent directly to the terminal. A maximum of 132 characters can be sent to the alphanumeric device at one time. If the text output exceeds the size of a line, the terminal performs a carriage return-line feed and text output continues on the next line. The character string may contain alphanumeric characters or command sequences which control the alphanumeric display (e.g. clear alphanumeric memory, alphanumeric cursor control, etc.). Command sequences which affect other parts of the terminal (i.e. graphics display) should not be contained in the string since they could destroy the integrity of the graphics system.

Termination

JDDEV/ZAEND

When the alphanumeric device is terminated, the alphanumeric display is not affected. The device name is set to '0001 ' and the device status and I/O unit descriptor are set to 0.

BUTTON DEVICE HANDLER (AGP/DGL)

Description

The HP 2627A Graphics Terminal has eight *soft keys* which together are supported as a button device. These keys are above the standard ASCII keys and are labeled *f1* through *f8*. The numeric keys 1 through 8 can also be used in the same way as the soft keys. The device handler required to use the button device on the HP 2627A Graphics Terminal is B0001. When using the HP 2627A Graphics Terminal's button device, the terminal should not be in block mode.

Note: If the softkeys are to be used, the labels f1 through f8 must appear on the softkey area of the alphanumeric display.

Initialization

JEDEV/ZBINT

When the button device is initialized, all previous soft key definitions are destroyed. The soft keys *f1* through *f8* are loaded with the ASCII characters 1 through 8 respectively. The device name is set to '2627A '.

Button Input

JBUTN/ZBUTN

Once the button device has been enabled, it is available for input operations. When JBUTN or ZBUTN are called, a read operation is set pending on the terminal. Striking a soft key or an ASCII key between 1 and 8 will return the button as an integer value ranging from 1 to 8. If an invalid, transmittable (i.e. ASCII) key is struck, an integer 0 will be returned as the button value.

Echoes Supported

The button device handler supports the following echoes:

ECHO#	ECHO PERFORMED
0	Echoing is not performed
1	The terminal bell is sounded if a valid button is activated.

Termination

JDDEV/ZBEND

When the button device is terminated, the soft key definitions remain as they were defined by the button device initialization. The device name is set to '0001 ', and the device status and I/O unit descriptor are set to 0.

GRAPHICS DISPLAY DEVICE HANDLER (AGP ONLY)

Description

The dimensions of the HP 2627A Graphics Terminal is as follows:

Screen size:	215 mm wide by 164 mm high
Screen capacity:	512 points wide by 390 points high
Aspect ratio of maximum area:	0.7612
Resolution:	2.3814 points/mm in X direction and 2.3780 points/mm in Y direction.

The default logical display surface of the graphics display device is the maximum physical limits of the screen. The physical origin is the lower left corner of the display.

The view surface is always centered within the current logical display surface.

Initialization

JDINT

When the HP 2627A Graphics Terminal is initialized, the following operations are performed:

Device name is set to '2627A '.

The graphics cursor is turned off and is in the lower left corner of the display.

Alphanumeric memory is unaffected.

The alphanumeric and graphics displays are turned on.

The color table will be initialized to the default values. See color section for the default color table.

The screen is cleared unless bit 7 is set in the control word for the JDINT call. If bit 7 is set, graphics memory is unaffected.

The following occurs which applies to low and medium quality text:
Slant is set to 0 degrees (no slant)
Label direction is set to 0 degrees (horizontal)
Label origin is set to 1 (left,bottom justified)

User-defined area and line patterns are set to solid.

The logical display surface is set to the maximum physical limits of the display.

The view surface is centered within the logical display surface.

Simulated raster erase is enabled if bit 3 of the control word in the JDINT call was set. See new-frame-action for details on simulated raster erase.

Device Enabling

JWON

Device-dependent actions are not performed for the HP 2627A Graphics Terminal.

Supported Primitive Attributes

COLOR

JCOLR

The D0036 display handler provides a software color table of 17 colors. The default values of the color table are shown in Table 15-1.

Table 15-1. Default Color Table

	R	G	B
COLOR TABLE ENTRY = 0 >> Black	0.0	0.0	0.0
= 1 >> White	1.0	1.0	1.0
= 2 >> Red	1.0	0.0	0.0
= 3 >> Green	0.0	1.0	0.0
= 4 >> Yellow	1.0	1.0	0.0
= 5 >> Blue	0.0	0.0	1.0
= 6 >> Magenta	1.0	0.0	1.0
= 7 >> Cyan	0.0	1.0	1.0
= 8 >> Turquoise	0.0	0.533	0.600
= 9 >> Brown	0.400	0.133	0.0
= 10 >> Toasted Orange	0.933	0.333	0.0
= 11 >> Lime Green	0.6	1.0	0.067
= 12 >> Golden Yellow	0.933	0.733	0.0
= 13 >> Medium Blue	0.333	0.333	1.0
= 14 >> Violet	0.6	0.133	1.0
= 15 >> Blue-Green	0.0	0.4	0.533
= 16 >> Light Grey	0.8	0.8	0.8

The HP 2627A Graphics Terminal has eight *basic colors*. The color table is initialized when JDINT is called. The initial values of entries 0-7 in the color table correspond to the HP 2627A Graphics Terminal's eight basic colors. The colors in the color table can be redefined at any time (see JDCOL/JICOL). The color at index 0 will always be used for the background color.

Any colors other than the eight basic colors (default values 0-7) can only be produced through dithering. This includes the default values 8-16. JCOLR will approximate the color definition that is selected with the closest of the HP 2627A Graphics Terminal's eight basic colors. More flexible use of the color table is provided for polygon interior colors (see JPICL).

The color selected corresponds to the color defined in the color table.

```
COLOR = 0 >> Color table entry 0 is selected
      = 1 >> Color table entry 1 is selected
      = 2 >> Color table entry 2 is selected
      = 3 >> Color table entry 3 is selected
      = 4 >> Color table entry 4 is selected
      = 5 >> Color table entry 5 is selected
      = 6 >> Color table entry 6 is selected
      = 7 >> Color table entry 7 is selected
```

REDEFINING COLOR

JDCOL/JICOL

The colors in the color table can be redefined and inquired, including the background color (which has index 0 in the color table). Elements on the display (including the background itself) which have their color index redefined, will not be affected by a color redefinition until the next new-frame-action.

POLYGON INTERIOR COLOR

JPICL

With the exception of solid-filled, hardware generated (device dependent) polygon interiors, only the eight basic colors provided by the HP 2627A Graphics Terminal are available for output primitives. If solid-filled, hardware generated polygons are selected in the JPSTL call, hardware dithering will be used to fill the polygon with a color pattern that is as close as possible to the selected color definition.

POLYGON STYLE

JDPST

Using JDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

JPILS

The interior linestyle attribute is ignored if device-dependent area fill is requested. Refer to JLSTL for information regarding linestyle for device independent polygon interiors.

HIGHLIGHTING

JSHI/JGHI

Highlighting is not supported on the HP 2627A Graphics Terminal.

LINESTYLE

JLSTL

Eight predefined linestyles are supported on the HP 2627A Graphics Terminal. In addition, two user-definable styles can be selected. These linestyles can be defined through the use of output escape functions (JOESC) 2050 and 8050. Initially, the two user-definable linestyles are set to solid. See Figure 15-1 for the linestyles available on the HP 2627A Graphics Terminal.

All of the supported linestyles are *continuous* linestyles. Refer to the JLSTL subroutine description in the *AGP Reference Manual* for a complete description of a continuous linestyle.

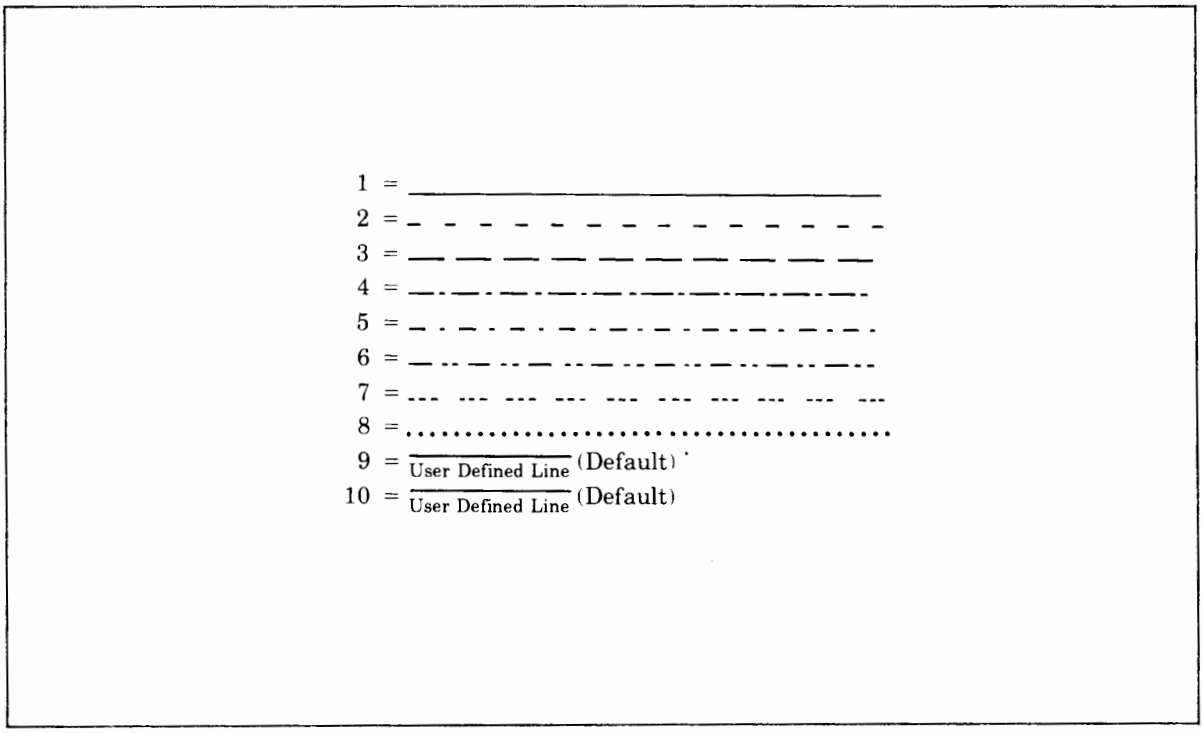


Figure 15-1. Supported Linestyles

LINEWIDTH

JLWID

Only one linewidth is supported on the HP 2627A Graphics Terminal.

LINEWIDTH = 1 >> Primitives drawn with a linewidth of one pixel.

CHARACTER SIZES

JCSIZ

There are eight distinct character sizes supported on the HP 2627A Graphics Terminal. They all have a constant aspect ratio of 1.43. The supported character sizes are:

Width	Height
2.9 mm	4.2 mm
5.9 mm	8.4 mm
8.8 mm	12.5 mm
11.8 mm	16.7 mm
14.7 mm	21.0 mm
17.7 mm	25.3 mm
20.5 mm	29.5 mm
23.5 mm	33.7 mm

When using medium and low quality text, the character is placed within the character cell as shown in Figure 15-2.

CLIPPING

The HP 2627A Graphics Terminal does not provide hardware vector clipping. If window clipping is turned off in AGP and vectors are created that lie entirely or partially outside of the view surface, unpredictable results may occur. Medium and low quality text strings will be clipped if they do not lie entirely within the physical limits of the graphics display.

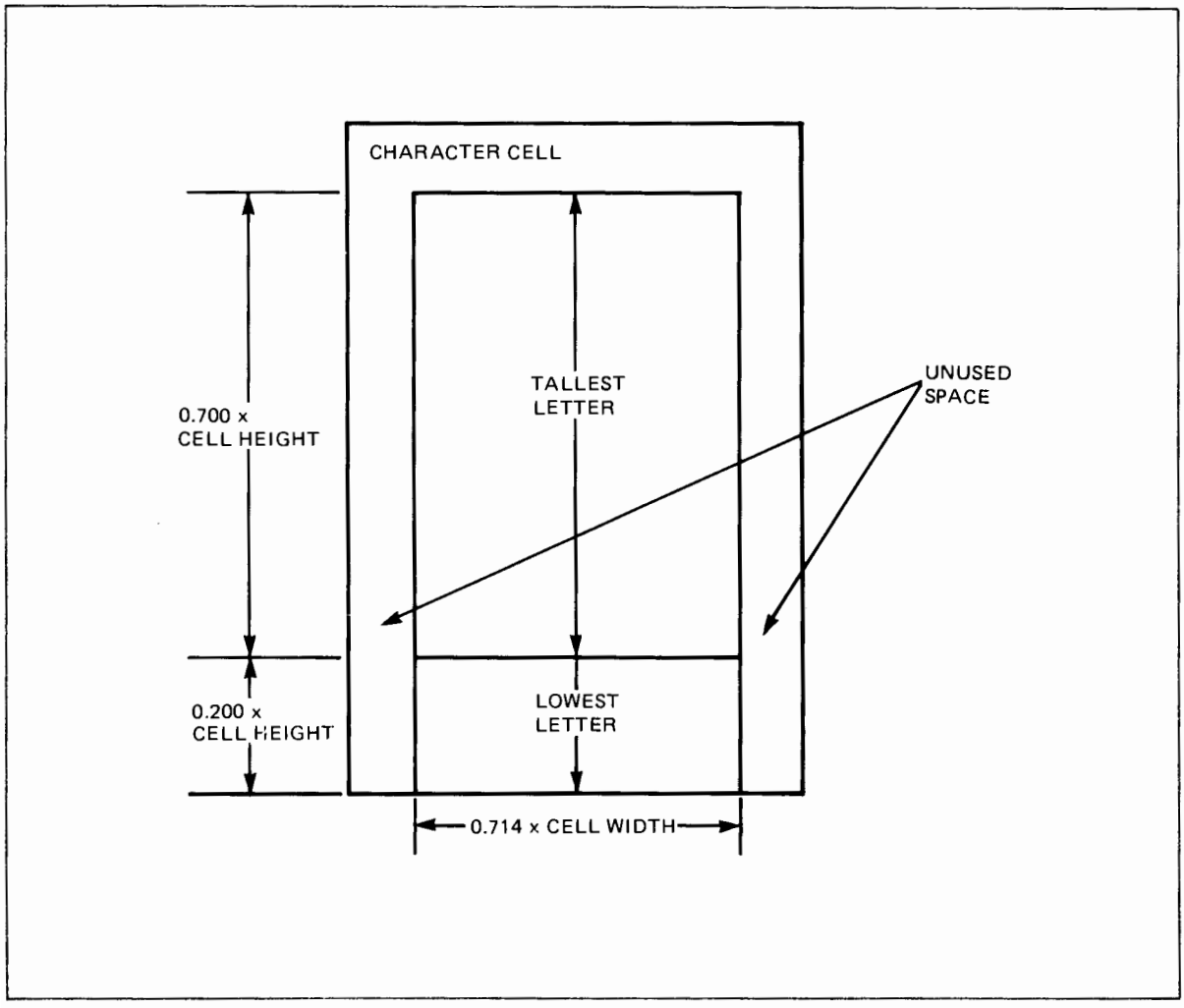


Figure 15-2. Placement of Character in Character Cell

POLYGONS

J2PGN/J3PGN/JR2PG/JR3PG

Polygon sets with device-dependent polygon styles are displayed using HP2627 hardware area fill. The HP2627 hardware supports convex, concave, and self-intersecting polygon sets. The hardware does not fill polygon sets which have more than 148 vertices after clipping by AGP. (To use this maximum, the AGP vertex buffer size must be increased, as described in the *AGP Reference Manual*.)

If the user specifies a fill density of 1.0, then the polygon set will be solid filled, using hardware dithering if necessary, to approximate the current polygon interior color selection.

If the style specifies a fill density of -1.0, then the polygon set will be filled with the current user-defined area pattern. The default for this pattern is solid. (See JOESC, OPCODE 8050, for further details.)

If the user specifies any other fill density, then the polygon set will be filled with a pattern that approximates the requested interior density to the nearest multiple of 1/8, and approximates the interior orientation to the nearest multiple of 45 degrees. Crosshatching is supported, but the interior linestyle attribute is ignored. The pattern will have the HP2627A Graphics Terminal's basic eight color which is the closest approximation to the current polygon interior color attribute.

Except when the style specifies a fill density of -1 or 0, the user-defined area fill pattern will be set to solid after device dependent filling of a polygon set.

MARKERS

J2MRK/J3MRK/JR2MK/JR3MK

The nineteen standard markers are the only markers supported with the HP 2627A Graphics Terminal. The smallest character size (2.9 mm by 4.2 mm) is always used to generate markers.

MEDIUM AND LOW QUALITY TEXT

JTEXM/JTEXL

Medium and low quality graphics text are generated with a hardware character generator. The characters are drawn with a size ratio of 5 wide and 7 high in a character cell with a size ratio of 7 wide by 10 high. See Figure 15-3 for the viewable graphics character set.

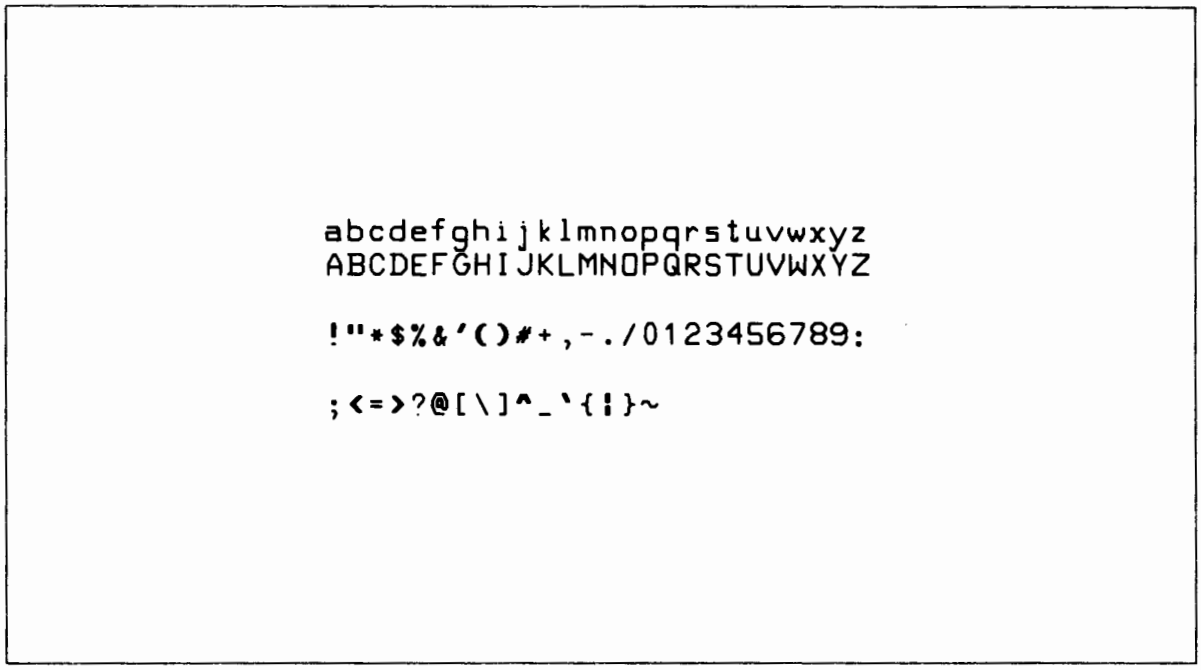


Figure 15-3. Supported Graphics Text Characters

If a medium or low quality text string is not clipped by AGP and extends beyond the physical limits of the graphics display, all characters which do not lie entirely within the physical limits will be clipped by the terminal.

Medium and low quality text use the color attribute but do not use the linestyle and linewidth attributes. Characters are always generated using solid lines. The direction, slant, and justification of these types of text can be modified through the use of escape functions (see JOESC 1050, 1051 and 1052).

New-Frame-Action

JNEWF/JPURG/JSVIS/JSHI/JVSAL/JCLR

The action taken when a new-frame-action is given is dependent on whether the simulated raster erase bit was set during the JDINT call and is outlined in the following two sections.

SIMULATED RASTER ERASE NOT SET

A new-frame-action given when the device is enabled and not in a batch of updates, will clear the CRT to the background color and redraw all visible segments.

When the new-frame-action is given with the display not enabled, it will not alter the display.

When the new-frame-action is given inside a batch of updates the screen will not be changed until the call JUPDT is given. At this time the screen will be cleared to the background color and all visible segments will be redrawn.

SIMULATED RASTER ERASE SET

The HP 2627A Graphics Terminal has the ability to undraw images. AGP will use this feature when the simulated raster erase bit is set in the JDINT call. AGP will use this feature to remove graphics elements without first clearing the CRT. For example, AGP uses simulated raster erase when a segment is purged.

Note: Undrawing is done by redrawing the image in the background color; therefore, lines crossing the image to be purged may also have parts of them undrawn, leaving holes.

An explicit JNEWF call will always clear the CRT and redraw all visible segments when given on an enabled work station outside of a batch of updates. This gives the user of simulated raster erase a means of generating a clean surface (one without holes).

The other calls that implicitly cause a new-frame-action (e.g. JPURG) use simulated raster erase only when the work station is enabled. Simulated raster erase is not used on disabled work stations, since by definition, the display must not change. Simulated raster erase is not used in a batch of updates since changes cannot occur to the display until the JUPDT call is given. A new-frame-action inside a batch of updates will always result in the screen being cleared and visible segments being redrawn when the JUPDT call is given.

Inquiry Escape Functions

JIESC

The following inquiry escape functions are supported by AGP with the HP 2627A Graphics Terminal:

OPCODE	FUNCTION
3050	Inquire medium and low quality text status.

ILIST(1) = Current medium and low quality hardware text justification. See Figure 15-4 for possible values.
ILIST(2) = Current medium and low quality hardware text direction. Possible values are 0, 90, 180, or 270 degrees.
ILIST(3) = Current medium and low quality hardware text slant. Possible values are 0 and 45 degrees.

Output Escape Functions

JOESC

Several output escape functions are supported by AGP with the HP 2627A Graphics Terminal. Error checking is not performed by the graphics system on any of the parameters which are to be sent to the device. If a parameter is outside of the range specified in the escape function definition, the terminal will ignore the function.

Escape functions are not stored in the segment display area. This can have implications when used with AGP segments. For example, suppose the linestyle is set to 10 and the escape function JOESC (2050) is used to define a line pattern. A segment is created and then appears on the screen with the given line pattern. If the line pattern is changed and a new-frame-action is given, the segment will be redrawn with the current line pattern and not the line pattern with which it was originally created.

Escape functions may have undesirable effects on low and medium quality text. For example, if JJUST is used to set AGP justification to center and a hardware justification is chosen, the text may not end up justified.

Escape functions are sent from AGP directly to DGL. The state of AGP may become undefined when an escape function is given that overrides a mode set by AGP (e.g. hardware text justification).

The following output escape functions are supported with the HP 2627A Graphics Terminal:

OPCODE FUNCTION

450 Perform rectangular area fill using the current linestyle and color. The rectangular area is specified in virtual coordinates.

RLIST(1) = Minimum X border of rectangle
RLIST(2) = Maximum X border of rectangle
RLIST(3) = Minimum Y border of rectangle
RLIST(4) = Maximum Y border of rectangle

1050 Set device text direction which will apply to subsequently output low quality graphics text and will apply on a character by character basis for subsequently output medium quality text.

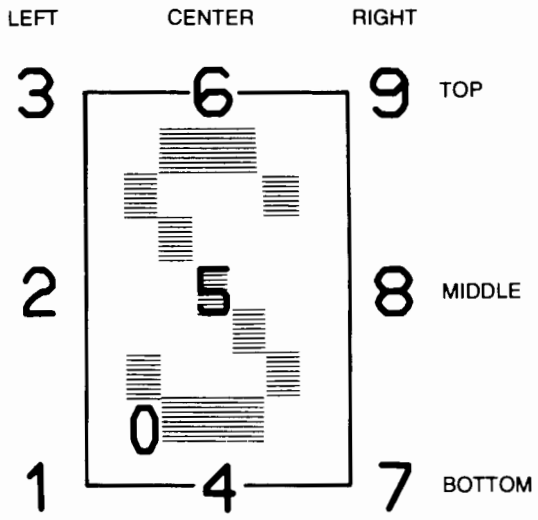
ILIST(1) = New text direction
0 = 0 degrees (horizontal)
1 = 90 degrees counterclockwise
2 = 180 degrees counterclockwise
3 = 270 degrees counterclockwise

1051 Set device character slant for subsequently output medium and low quality graphics text.

ILIST(1) = Text slant
0 = 0 degrees (normal)
1 = 45 degrees

1052 Set device text justification for subsequently output medium and low quality graphics text. This will apply to characters individually for medium quality graphics text.

ILIST(1) = Text justification. See Figure 15-4 for the supported justifications.



The numbers 1-9 represent the cursor position with respect to the character cell used for graphics text characters. The number 0 represents the cursor position with respect to the character (not this cell).

JUSTIFICATION/ORIGIN. Text strings can be automatically right or left justified, or centered about a specified point. An ASCII character 0 through 9 indicates the origin (justification and base line) for characters with respect to the current pen position. This function is useful when drawing labels.

If text is left justified, the current pen position is the left margin. Center causes the label to be centered on the pen position. Right justify selects the pen position as the right margin. Bottom, middle, and top select the base line for the line of text.

For example, if text was to be right justified and set with a base line on top of the normal character position, the number "9" would be used.

Figure 15-4. Hardware Text Justification

1055 Turn graphics display on/off. This only controls whether the graphics memory is displayed by the terminal. It does not affect the contents or output primitives sent.

ILIST(1) = 0 >> Turn graphics display off
= 1 >> Turn graphics display on

1056 Set special drawing modes. Using this escape function will override the color as defined by the JCOLR call. After generating output primitives in a special drawing mode, the application program can terminate the special drawing mode by making any call to JCOLR. See Figure 15-5 for the effect of color and the special drawing modes.

ILIST(1) = 1 >> Enable complement drawing mode.

All primitives output in this mode will toggle the color of the pixels on the display. For example, when drawing a line in this mode, all white pixels in the line's path will turn black, and all black pixels will turn white. Colors will be *toggled*. For example, using the RGB Color Model, a color that has a red value of a, green value of b, and blue value of c, will have a red value of 1-a, green value of 1-b, and blue value of 1-c. Red (1,0,0) becomes cyan (0,1,1) and yellow (1,1,0) becomes blue (0,0,1).

= 2 >> Enable jam drawing mode.

Jam mode has the affect of overlaying the output primitives generated with it over the current primitives on the graphics display.

2050 Define line pattern.

This allows the user to define the dot pattern used to draw vectors. Once a line pattern is defined, it can be used by setting the linestyle to 9. See Figure 15-6 for examples on defining line patterns.

ILIST(1) = A decimal value between 0 and 255 which defines an 8-bit binary pattern.
ILIST(2) = A scale factor between 1 and 16 to be applied to the pattern.

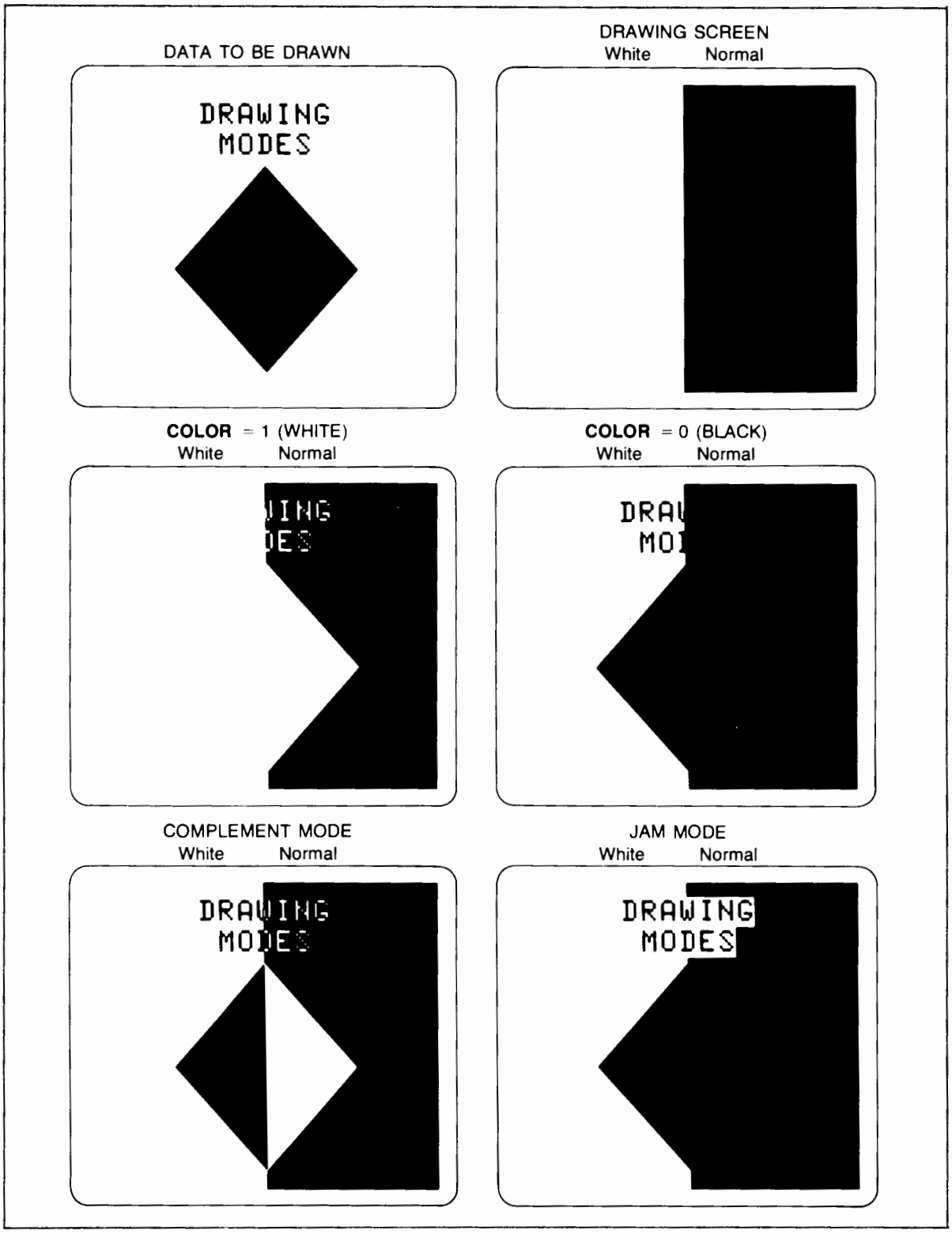


Figure 15-5. Special Drawing Modes

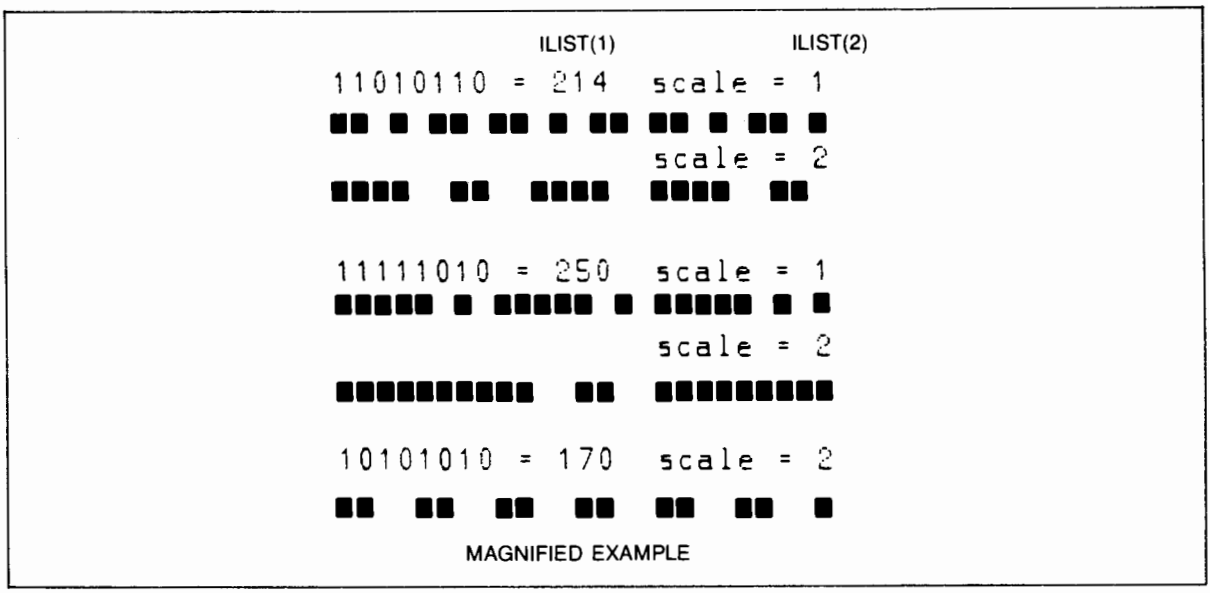


Figure 15-6. Magnified Examples of User Defined Linestyles

8050 Define area pattern.

An 8 x 8 pattern can be defined for use in drawing horizontal and vertical lines, filling rectangular areas (see OPCODE 450), and for device-dependent polygon filling. The area pattern is defined by specifying each row of the pattern with a decimal number ranging between 0 and 255 which defines an 8-bit binary pattern. The graphics display is divided into 8 x 8 cells such that every point on the display maps to a corresponding bit in the pattern.

Once the area pattern has been defined, it can be used for drawing lines by setting the linestyle to 10. Drawing any horizontal and vertical lines causes the corresponding row or column of the pattern to be used as the line pattern See OPCODE 450 for use in filling rectangular area. The user-defined area pattern can be used for filling polygons when the current polygon style has density -1, and specifies device-dependent output. Figures 15-7 and 15-8 contain sample area fill patterns.

ILIST(1) = Row 0 of the area pattern
ILIST(2) = Row 1 of the area pattern
ILIST(3) = Row 2 of the area pattern
ILIST(4) = Row 3 of the area pattern
ILIST(5) = Row 4 of the area pattern
ILIST(6) = Row 5 of the area pattern
ILIST(7) = Row 6 of the area pattern
ILIST(8) = Row 7 of the area pattern

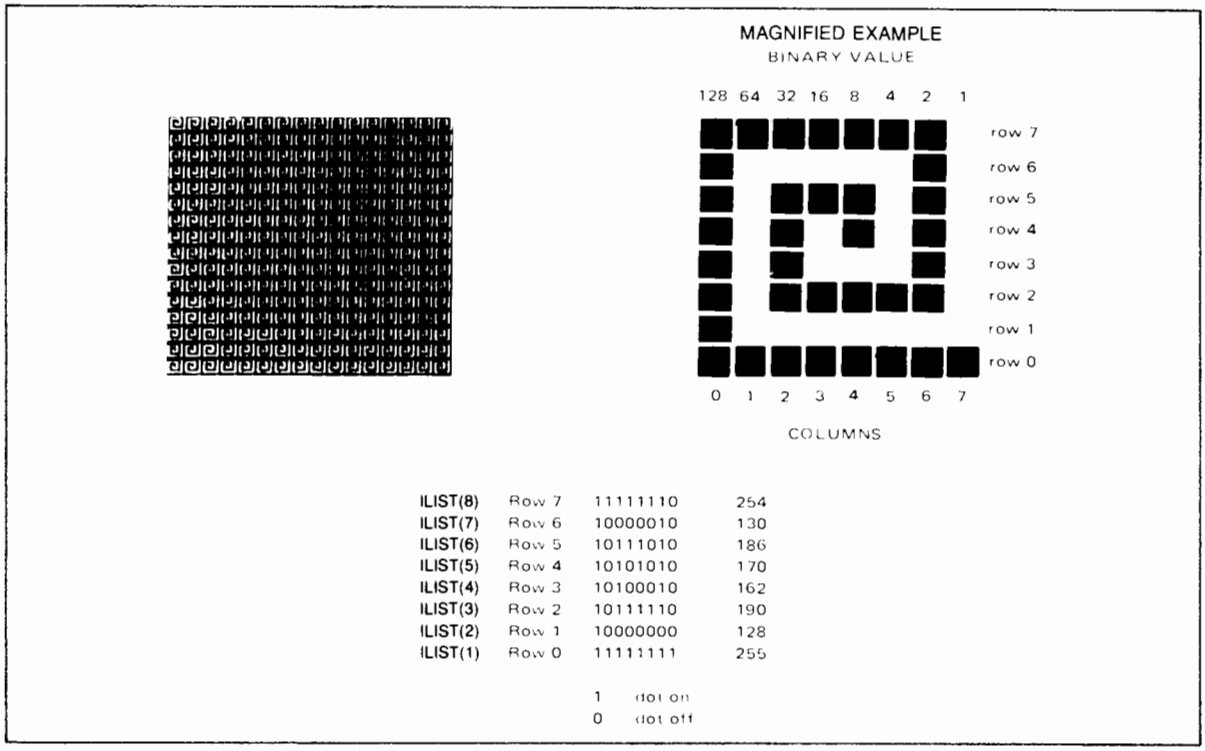


Figure 15-7. Defining Area Patterns

Locator Echoes on the Graphics Display

JWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

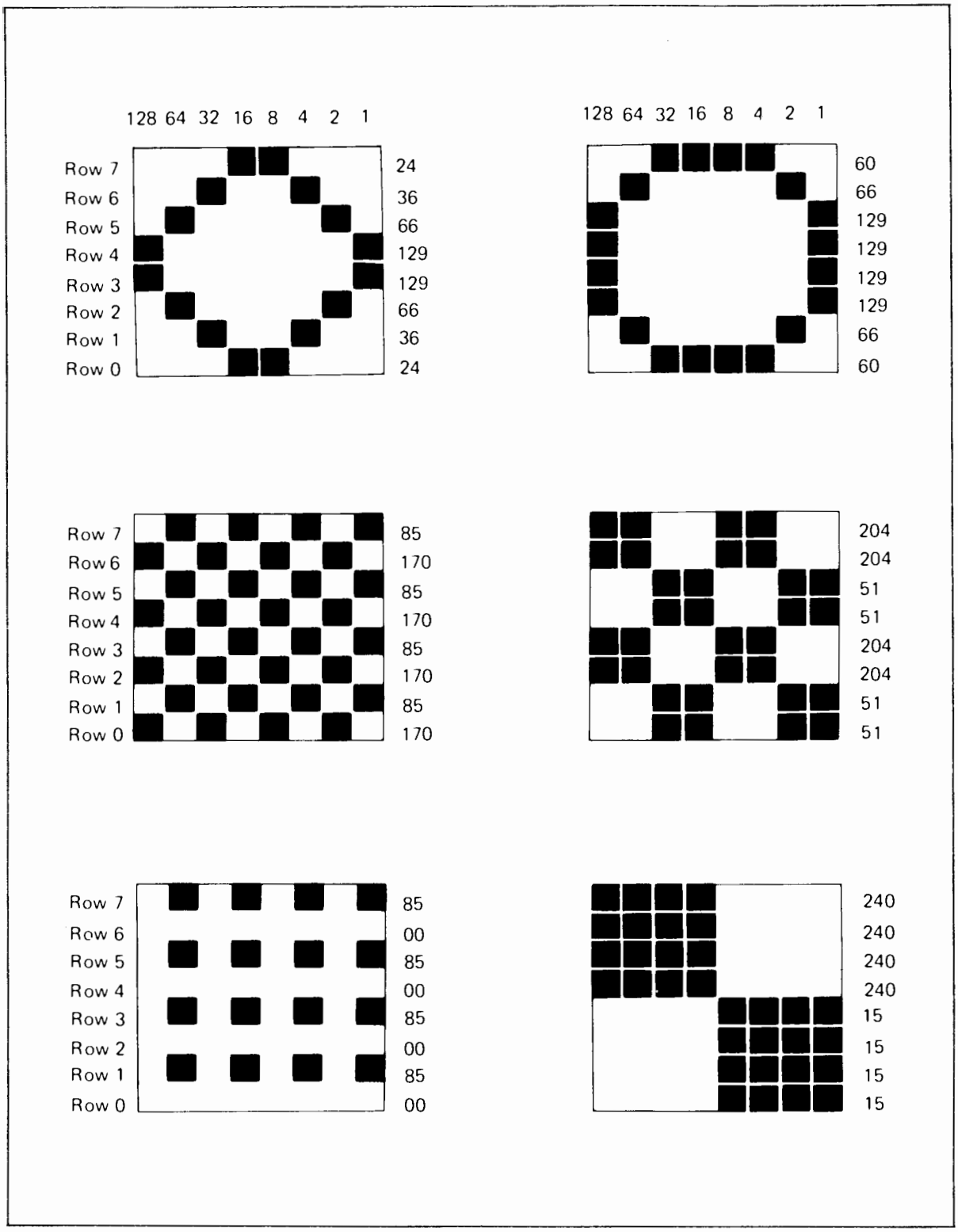


Figure 15-8. Magnified Examples of Area Patterns

SAME PHYSICAL DEVICE

If the locator and graphics display are the same physical device, the following echoes are supported on the display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until operator response. When an operator response occurs, the graphics cursor is turned off.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position and a line will extend from the locator echo position to the current locator position (i.e. rubber band line) until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off and the rubber band line is removed.
5	Horizontal rubber band line The graphics cursor and the locator echo position are handled in the same manner as they are in ECHO 4. The point returned has the X coordinate of the graphics cursor and the Y coordinate of the locator echo position.
6	Vertical rubber band line The graphics cursor and the locator echo position are handled in the same manner as they are in ECHO 4. The point returned has the X coordinate of the locator echo position and the Y coordinate of the graphics cursor.

7 Horizontal/vertical rubber band line

The graphics cursor and the locator echo position are handled in the same manner as they are in ECHO 4. The point returned is the same as ECHO 5 or ECHO 6, whichever defines a longer line from the locator echo position.

8 Rubber band box

The graphics cursor and the locator echo position are handled in the same manner as they are in ECHO 4. The point returned is the position of the graphics cursor.

If the HP 17623A Graphics Tablet is attached, it is considered the same logical device as the locator and is an extension to the terminal. It can be used in conjunction with the terminals original functionality. The only difference is that a button value of 128 will be returned when the tablet pen is depressed.

Computer Museum

DIFFERENT PHYSICAL DEVICES

If the locator and display devices are different physical devices and the locator device supports echoing on the graphics display, then the following echoes are supported on the graphics display.

ECHO#	ECHO PERFORMED
2	Small cursor

Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until the locator operation is terminated. Before control is returned to the application program, the graphics cursor is turned off.

3 Full cross-hair cursor

Same as ECHO 2.

4 Rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position and a line will extend from the locator echo position to the current locator position (rubber band line) until the locator operation is terminated. Before the control is returned to the application program, the graphics cursor is turned off and the line is removed.

5 Horizontal rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. The graphics cursor will then be displayed at a point defined by the X coordinate of the current locator echo position and the Y coordinate of the current locator echo position. A horizontal line will extend from the locator echo position to the position of the graphics cursor until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off and the line is removed.

6 Vertical rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. The graphics cursor will then be displayed at a point defined by the X coordinate of the current locator echo position and the Y coordinate of the current locator echo position. A vertical line will extend from the locator echo position to the position of the graphics cursor until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off and the line is removed.

7 Horizontal/vertical rubber band line

Either a horizontal or vertical line will be displayed from the current locator echo position to the graphics cursor. The effect will be the same as ECHO 5 if the length of the horizontal line between the locator echo position is longer the vertical line between the same two points, otherwise the effect will be the same as ECHO 6.

8	Rubber band box The graphics cursor and the locator echo position are handled in the same manner as they are in ECHO 4. The rubber band line represents the diagonal of the box defined with corner points at the locator echo position and the current locator position.

Pick Echoes on the Graphics Display

JPICK

For echoes supported on the pick device, see the corresponding chapter which discusses the pick device in question.

ECHO#	ECHO PERFORMED
2	Initially the graphics cursor will be turned on at the current pick echo position. The cursor will then reflect the current pick position (i.e. tracked) until the pick operation is completed. Before control returns to the application program the graphics cursor is turned off.

If the HP 17623A Graphics Tablet is attached, it is considered the same logical device as the pick and is an extension to the terminal. It can be used in conjunction with the terminals original functionality. The only difference is that a button value of 128 will be returned when the tablet pen is depressed.

Disabling

JWOFF

The display is not reset to initial values when JWOFF is called. Values will remain as they were last set. For example, color may remain set to the background color if the last operation was a simulated raster erase.

GRAPHICS DISPLAY DEVICE HANDLER (DGL ONLY)

Description

The dimensions of the HP 2627A Graphics Terminal is as follows:

Screen size:	215 mm wide by 164 mm high
Screen capacity:	512 points wide by 390 points high
Aspect ratio of maximum area:	0.7612
Resolution:	2.3814 points/mm in X direction and 2.3780 points/mm in Y direction

The default logical display surface of the graphics display device is the maximum physical limits of the screen. The physical origin is the lower left corner of the display.

The view surface is always centered within the current logical display surface.

Initialization

ZDINT

When the HP 2627A Graphics Terminal is initialized the following operations are performed:

Device name set to '2627A '.

Color set to 1.

Highlighting set to 1.

Linewidth set to 1.

Linestyle set to 1.

The graphics cursor is turned off and is in the lower left corner of the display.

Alphanumeric memory is unaffected.

The alphanumeric and graphics displays are turned on.

The color table will be initialized to the default values. See the color section for the default color table.

The screen is cleared unless bit 7 is set in the control word for the ZDINT call. If bit 7 is set, graphics memory is unaffected.

Text slant is set to 0 degrees, text label direction is set to 0 degrees (horizontal), and label origin is set to 1 (left, bottom justified).

User-defined area and line patterns are set to solid.

The logical display limits are set to the maximum dimensions of the display.

New-frame-action will be buffered if bit 6 of the control word in the ZDINT call was set. See buffered new-frame-action for more specific details.

The view surface is centered within the logical display limits.

Supported Primitive Attributes

COLOR

ZCOLR

The D0036 display handler provides a software color table of 17 colors. The default values of the color table are shown in Table 15-2.

Table 15-2. Default Color Table

	R	G	B
COLOR TABLE ENTRY = 0 >> Black	0.0	0.0	0.0
= 1 >> White	1.0	1.0	1.0
= 2 >> Red	1.0	0.0	0.0
= 3 >> Green	0.0	1.0	0.0
= 4 >> Yellow	1.0	1.0	0.0
= 5 >> Blue	0.0	0.0	1.0
= 6 >> Magenta	1.0	0.0	1.0
= 7 >> Cyan	0.0	1.0	1.0
= 8 >> Turquoise	0.0	0.533	0.600
= 9 >> Brown	0.400	0.133	0.0
= 10 >> Toasted Orange	0.933	0.333	0.0
= 11 >> Lime Green	0.6	1.0	0.067
= 12 >> Golden Yellow	0.933	0.733	0.0
= 13 >> Medium Blue	0.333	0.333	1.0
= 14 >> Violet	0.6	0.133	1.0
= 15 >> Blue-Green	0.0	0.4	0.533
= 16 >> Light Grey	0.8	0.8	0.8

The HP 2627A Graphics Terminal has eight *basic colors*. The color table is initialized when ZDINT is called. The initial values of entries 0-7 in the color table correspond to the HP 2627A Graphics Terminal's eight basic colors. The colors in the color table can be redefined at any time (see ZDCOL/ZICOL). The color at index 0 will always be used for the background color.

Any colors other than the eight basic colors (default values 0-7) can only be produced through dithering. This includes the default values 8-16. ZCOLR will approximate the color definition that is selected with the closest of the HP 2627 eight basic colors. More flexible use of the color table is provided for polygon interior colors (see ZPICL).

The color selected corresponds to the color defined in the color table.

```
COLOR = 0 >> Color table entry 0 is selected
      = 1 >> Color table entry 1 is selected
      = 2 >> Color table entry 2 is selected
      = 3 >> Color table entry 3 is selected
      = 4 >> Color table entry 4 is selected
      = 5 >> Color table entry 5 is selected
      = 6 >> Color table entry 6 is selected
      = 7 >> Color table entry 7 is selected
      = 8 >> Color table entry 8 is selected
      = 9 >> Color table entry 9 is selected
      =10 >> Color table entry 10 is selected
      =11 >> Color table entry 11 is selected
      =12 >> Color table entry 12 is selected
      =13 >> Color table entry 13 is selected
      =14 >> Color table entry 14 is selected
      =15 >> Color table entry 15 is selected
      =16 >> Color table entry 16 is selected
```

REDEFINING COLOR

ZDCOL/ZICOL

The colors in the color table can be redefined and inquired, including the background color (which has index 0 in the color table). Elements on the display (including the background itself) which have their color index redefined, will not be effected by a color redefinition until the next new-frame-action.

POLYGON INTERIOR COLOR

ZPICL

With the exception of solid-filled, hardware generated polygon interiors, only the eight basic colors provided by the HP 2627A Graphics Terminal are available for output primitives. If solid-filled, hardware generated (device independent) polygons are selected in the ZPSTL call, hardware dithering will be used to fill the polygon with a color pattern that is as close as possible to the selected color definition.

POLYGON STYLE

ZDPST

Using ZDPST will not cause polygons already displayed to change style.

POLYGON INTERIOR LINESTYLE

ZPILS

Refer to ZLSTL for information regarding linestyle.

HIGHLIGHTING

ZHIGH

Highlighting is not supported on the HP 2627A Graphics Terminal.

LINESTYLE

ZLSTL

Eight predefined linestyles are supported with the HP 2627A Graphics Terminal. In addition, two user-definable styles can be selected. These linestyles can be defined through the use of output escape functions (ZOESC) 2050 and 8050. Initially, the two user-definable linestyles are set to solid. See Figure 15-9 for the linestyles available on the HP 2627A Graphics Terminal.

All of the supported linestyles are *continuous* line styles. Refer to the ZLSTL subroutine description in the *DGL Programmer's Reference Manual* for a complete discussion of a continuous line style.

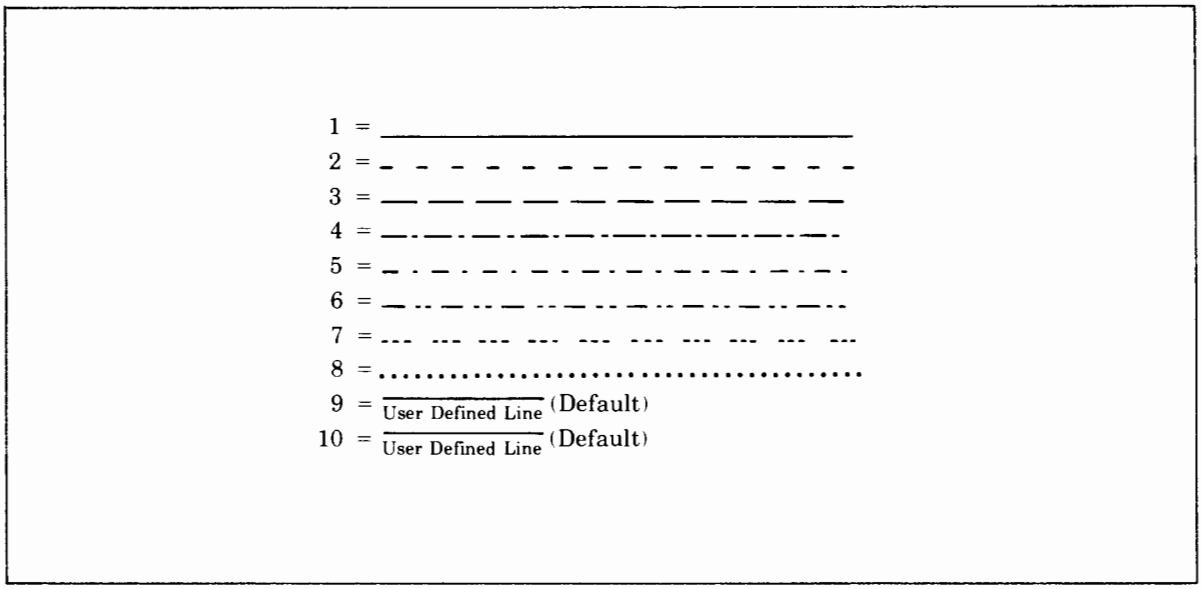


Figure 15-9. Supported Linestyles

LINEWIDTH

ZLWID

Only one linewidth is supported on the HP 2627A Graphics Terminal.

LINEWIDTH = 1 >> Primitives drawn with a linewidth of one pixel.

CHARACTER SIZES

ZCSIZ

There are eight distinct character sizes supported on the HP 2627A Graphics Terminal. They all have a constant aspect ratio of 1.43. The supported character sizes are:

Width	Height
2.9 mm	4.2 mm
5.9 mm	8.4 mm
8.8 mm	12.5 mm
11.8 mm	16.7 mm
14.7 mm	21.0 mm
17.7 mm	25.3 mm
20.5 mm	29.5 mm
23.5 mm	33.7 mm

The character is placed within the character cell as shown in Figure 15-10.

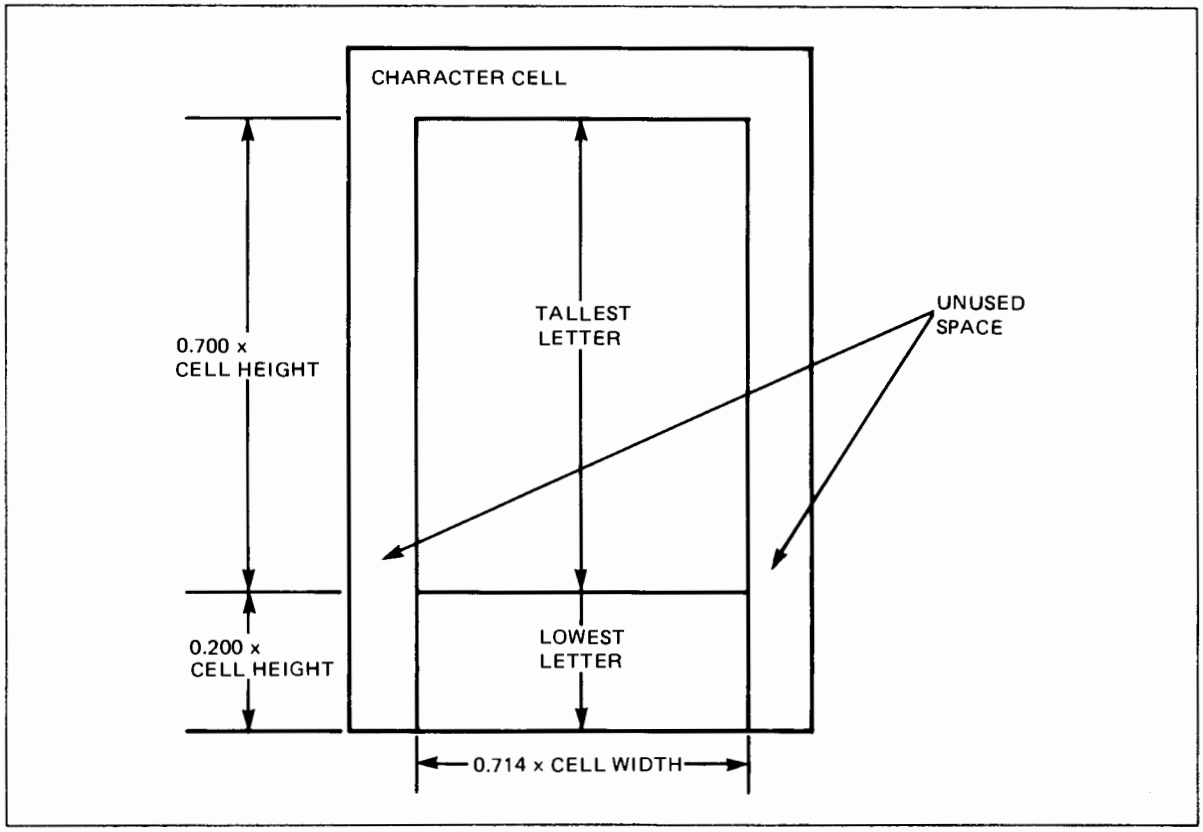


Figure 15-10. Placement of Character in Character Cell

Output Primitives

CLIPPING

The HP 2627A Graphics Terminal does not provide hardware vector clipping. A vector with one or both of its endpoints outside the physical limits is displayed in an unpredictable manner. Text characters will be clipped if they do not lie within the physical limits of the display.

POLYGONS

ZPGDD

Hardware filling is provided for polygon sets of up to 148 vertices.

If the user specifies a fill density of 1.0, then the polygon will be solid filled, using hardware dithering if necessary, to approximate the current polygon interior color selection.

If the user specifies a fill density of -1.0, then the polygon will be filled with the current user-defined area pattern. (See ZOESC, OPCODE 8050, for further details.)

If the user specifies any other fill density, then the polygon will be filled with a pattern that approximates the requested interior density to the nearest multiple of 1/8, and approximates the interior orientation to the nearest multiple of 45 degrees. Crosshatching is supported, but the interior linestyle attribute is ignored. The pattern will have the HP 2627A Graphics Terminal's eight basic colors which is the closest approximation to the current polygon interior color attribute.

Except when the user specifies a fill density of -1 or 0, the user-defined area fill pattern will be set to solid by ZPGDD upon its completion.

MARKERS

ZMARK

The 19 standard markers are the only markers supported with the HP 2627A Graphics Terminal. The smallest character size (2.9 mm by 4.2 mm) is always used to generate markers.

TEXT

ZTEXT

Graphics text is generated with a hardware character generator. The characters are drawn with a size ratio 5 wide and 7 high in a character cell with a size ratio of 7 wide and 10 high. See Figure 15-11 for the viewable graphics character set. In addition to the viewable characters, text strings can also include the following control characters:

DECIMAL CODE	FUNCTION
8	Move backward one character cell
9	Move forward one character cell
10	Move down one character cell
11	Move up one character cell
13	Carriage return

The actual direction moved by these control functions is dependent on the text direction and text origin in use. Only the above special characters should be included in graphics text strings in addition to the printable ASCII characters.

Graphics text is not affected by the linestyle attribute; character strings will be output as solid lines. The direction, slant, and justification of text can be modified through the use of escape functions (see ZOESC 1050, 1051, 1052). If a text string extends beyond the physical limits of the graphics display, all characters which do not lie entirely within the physical limits will be clipped by the terminal.

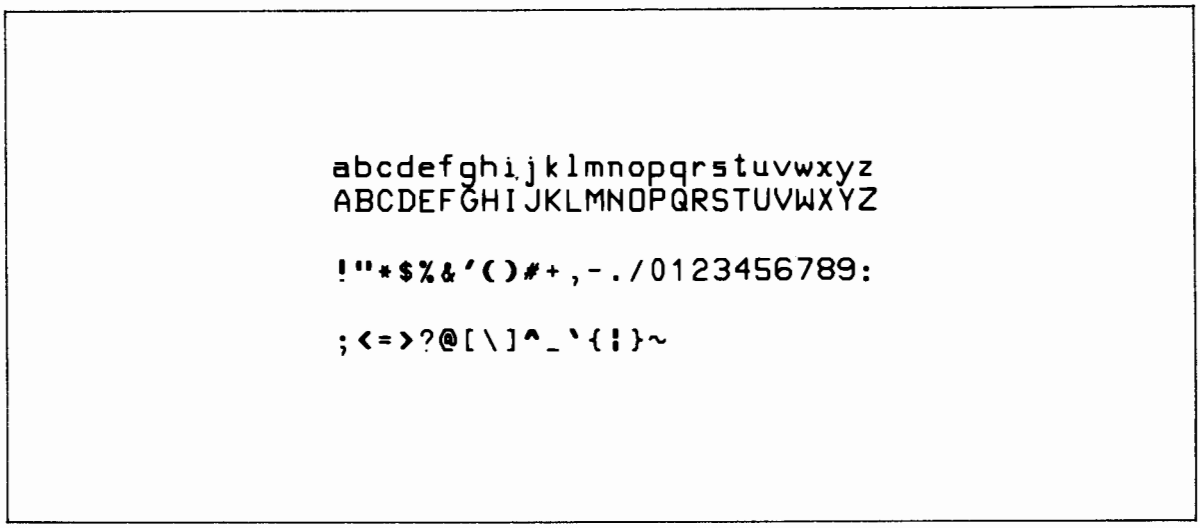


Figure 15-11. Supported Graphics Text Characters

New-Frame-Action

ZNEWF

NON-BUFFERED NEW-FRAME-ACTION
(Bit 6 of the ZDINT control word not set)

A call to ZNEWF makes the picture current and then erases the graphics display. The background is set to the background color.

BUFFERED NEW-FRAME-ACTION
(Bit 6 of the ZDINT control word is set)

When ZNEWF is called, the graphics display is made current. The instruction to clear the graphics display is stored in the DGL buffer and will not be sent to the device until the next time the buffer is sent. When the buffer is sent, the display will be cleared to the background color and whatever calls to DGL were put into the buffer after the ZNEWF call will take affect on the graphics display. The effect is that the current display will remain until the next buffer is sent. If immediate visibility is being used, the action is the same as if bit 6 were not set since the buffer is sent after every DGL call.

Inquiry Escape Functions

ZIESC

The following inquiry escape functions are supported with the HP 2627A Graphics Terminal:

OPCODE	FUNCTION
3050	Inquire text status.

ILIST(1) = Current text justification. See Figure 15-12 for possible values.
ILIST(2) = Current text direction. Possible values are 0, 90, 180 or 270 degrees.
ILIST(3) = Current text slant. Possible values are 0 and 45 degrees.

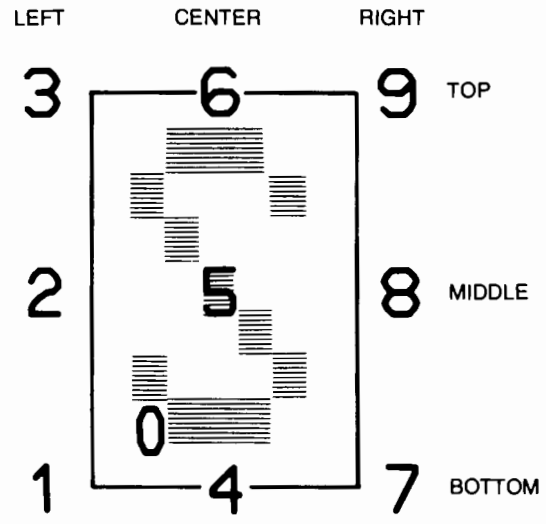
Output Escape Functions

ZOESC

Several output escape functions are supported by DGL with the HP 2627A Graphics Terminal. Error checking is not performed by the graphics system on any of the parameters which are to be sent to the device. If a parameter is outside of the range specified in the escape function definition, the terminal will ignore the function. None of the supported output escape functions alter the starting position for the next primitive.

The following output escape functions are supported with the HP 2627A Graphics Terminal:

OPCODE	FUNCTION
450	Perform rectangular area fill using the current linestyle and color. The rectangular area is specified in world coordinates. RLIST(1) = Minimum X border of rectangle RLIST(2) = Maximum X border of rectangle RLIST(3) = Minimum Y border of rectangle RLIST(4) = Maximum Y border of rectangle
1050	Set text direction for subsequently output graphics text. ILIST(1) = New text direction 0 = 0 degrees (horizontal) 1 = 90 degrees counterclockwise 2 = 180 degrees counterclockwise 3 = 270 degrees counterclockwise
1051	Set character slant for subsequently output graphics text. ILIST(1) = Text slant 0 = 0 degrees (normal) 1 = 45 degrees
1052	Set text justification for subsequently output graphics text. ILIST(1) = Text justification. See Figure 15-12 for the supported justifications.



The numbers 1-9 represent the cursor position with respect to the character cell used for graphics text characters. The number 0 represents the cursor position with respect to the character (not this cell).

JUSTIFICATION/ORIGIN. Text strings can be automatically right or left justified, or centered about a specified point. An ASCII character 0 through 9 indicates the origin (justification and base line) for characters with respect to the current pen position. This function is useful when drawing labels.

If text is left justified, the current pen position is the left margin. Center causes the label to be centered on the pen position. Right justify selects the pen position as the right margin. Bottom, middle, and top select the base line for the line of text.

For example, if text was to be right justified and set with a base line on top of the normal character position, the number "9" would be used.

Figure 15-12. Hardware Text Justification

1055 Turn graphics display on/off. This only controls whether the graphics memory is displayed by the terminal. It does not affect the contents or output primitives sent.

ILIST(1) = 0 >> Turn graphics display off
= 1 >> Turn graphics display on

1056 Set special drawing modes. Using this escape function will override the color as defined by the ZCOLR call. After generating output primitives in a special drawing mode, the application program can terminate the special drawing mode by making any call to ZCOLR. See Figure 15-13 for the effect of color and the special drawing modes.

ILIST(1) = 1 >> Enable complement drawing mode. All primitives output in this mode will toggle the color of the pixels on the display. For example, when drawing a line in this mode, all white pixels in the line's path will turn black and all black pixels will turn white. Colors will be *toggled*. For example, using the RGB Color Model, a color that has a red value of a, green value of b, and blue value of c, will have a red value of 1-a, green value of 1-b, and blue value of 1-c. Red (1,0,0) becomes cyan (0,1,1) and yellow (1,1,0) becomes blue (0,0,1).

= 2 >> Enable jam drawing mode. Jam mode has the affect of overlaying the output primitives generated with it over the current primitives on the graphics display.

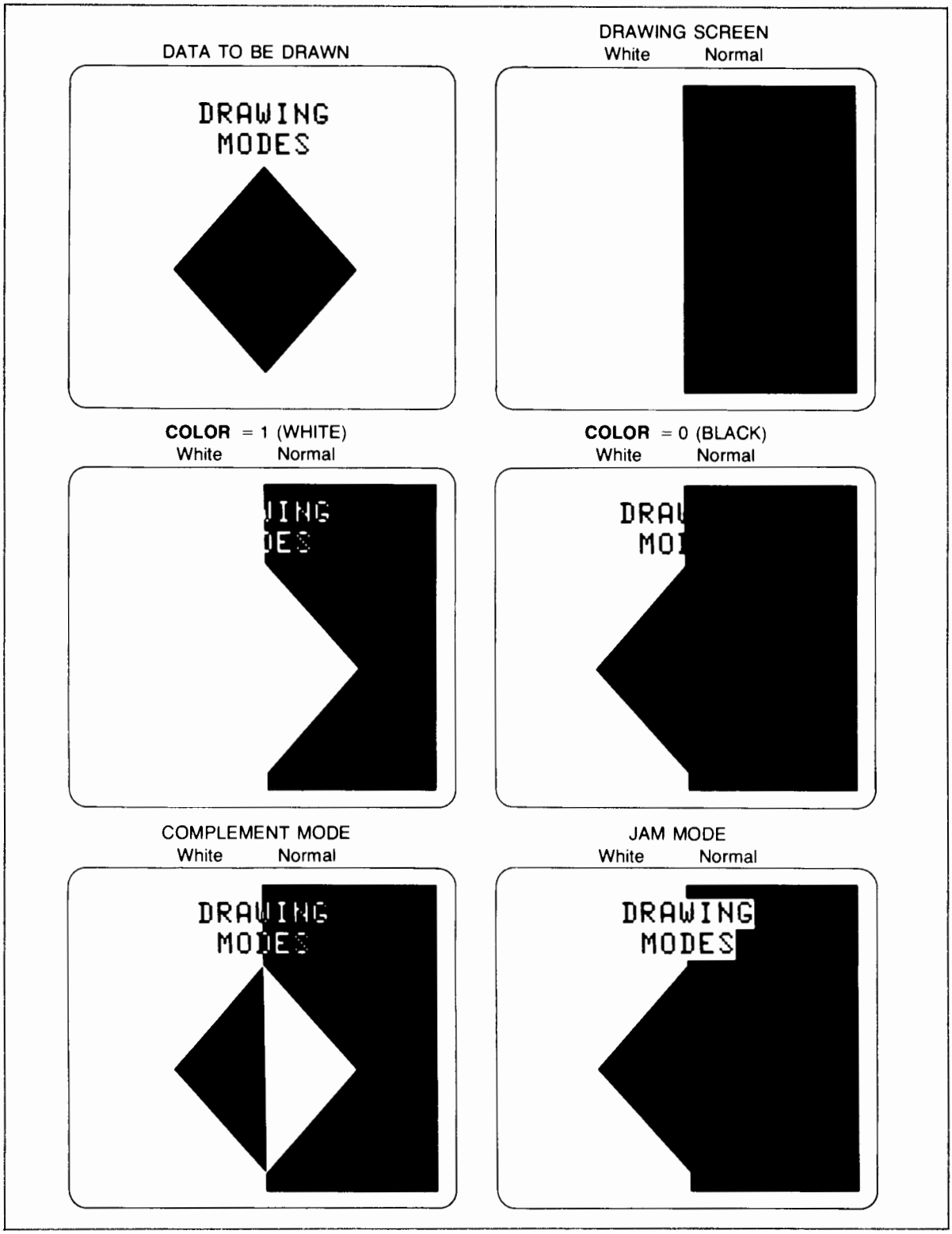


Figure 15-13. Special Drawing Modes

2050 Define line pattern.

This allows the user to define the dot pattern used to draw vectors. Once a line pattern is defined, it can be used by setting the linestyle to 9. See Figure 15-14 for examples on defining line patterns.

ILIST(1) = A value between 0 and 255 defining an 8-bit binary pattern.

ILIST(2) = A scale factor between 1 and 16 to be applied to the pattern.

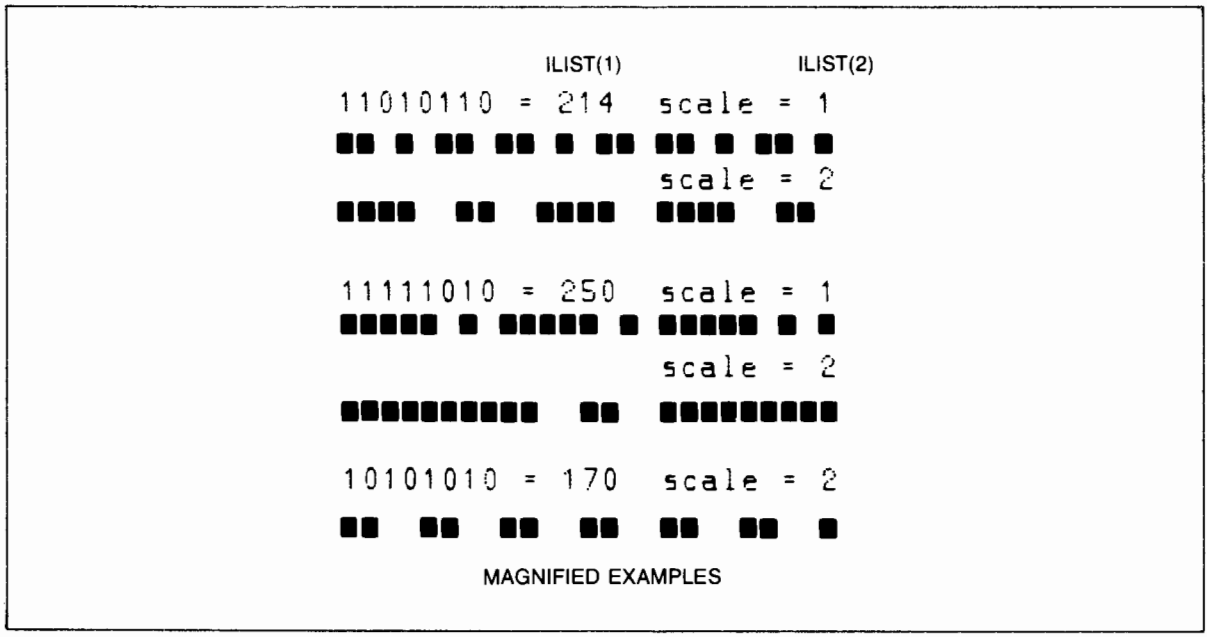


Figure 15-14. Magnified Examples of User Defined Linestyles

8050 Define area pattern.

An 8 x 8 pattern can be defined for use in drawing horizontal and vertical lines, filling rectangular areas (see OPCODE 450), and filling polygons via ZPGDD. The area pattern is defined by specifying each row of the pattern with a decimal number ranging between 0 and 255 which defines an 8-bit binary pattern. The graphics display is divided into 8 x 8 cells such that every point on the display maps to a corresponding bit in the pattern.

Once the area pattern has been defined, it can be used for drawing lines by setting the linestyle to 10. Drawing any horizontal and vertical lines causes the corresponding row or column of the pattern to be used as the line pattern. See OPCODE 450 for use in filling rectangular area. The user-defined area pattern can be used for filling polygons by calling ZPGDD when the current polygon style has density -1. (See ZPGDD for further details.) Figures 15-15 and 15-16 contain sample area fill patterns.

ILIST(1) = Row 0 of the area pattern
ILIST(2) = Row 1 of the area pattern
ILIST(3) = Row 2 of the area pattern
ILIST(4) = Row 3 of the area pattern
ILIST(5) = Row 4 of the area pattern
ILIST(6) = Row 5 of the area pattern
ILIST(7) = Row 6 of the area pattern
ILIST(8) = Row 7 of the area pattern

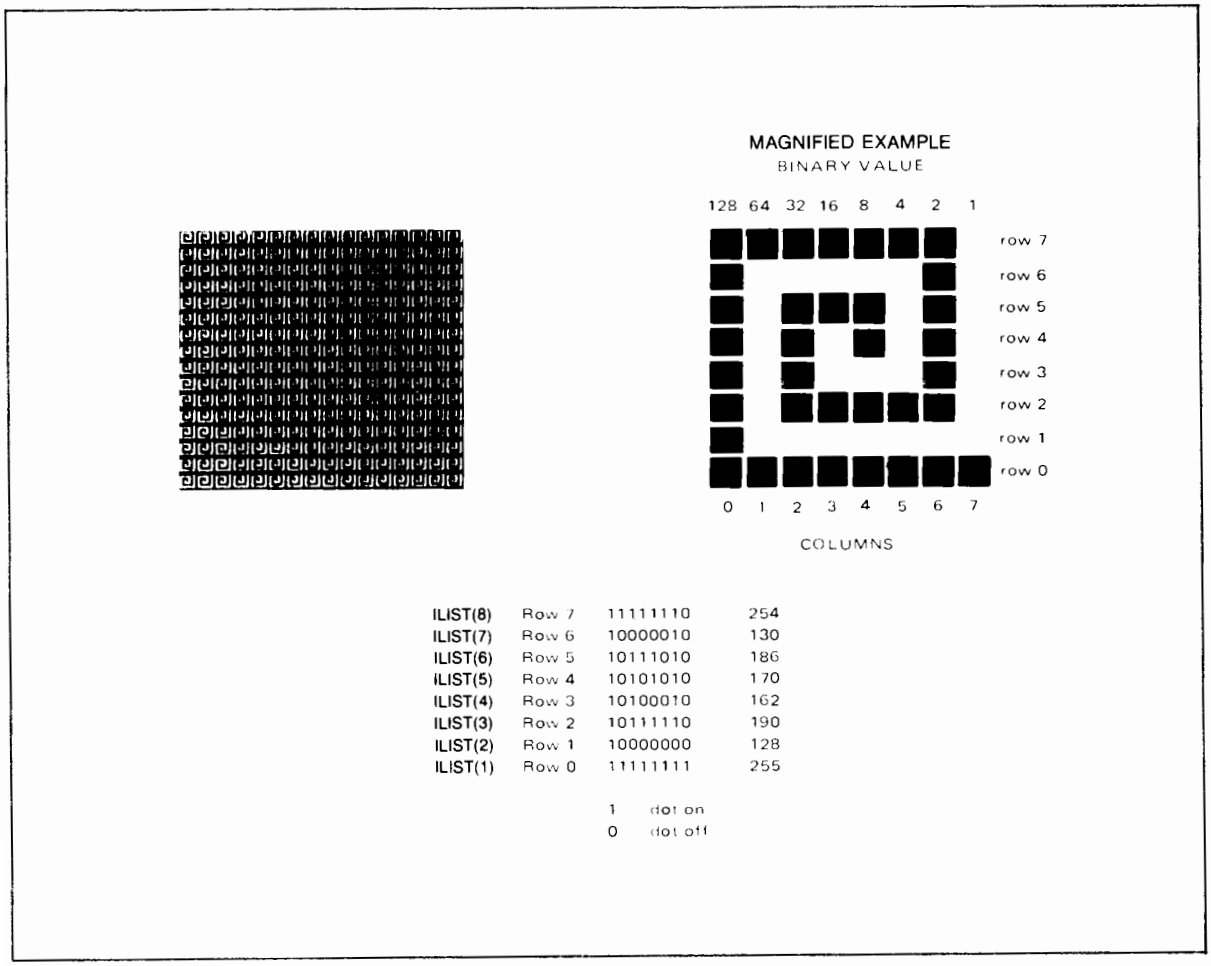


Figure 15-15. Defining Area Patterns

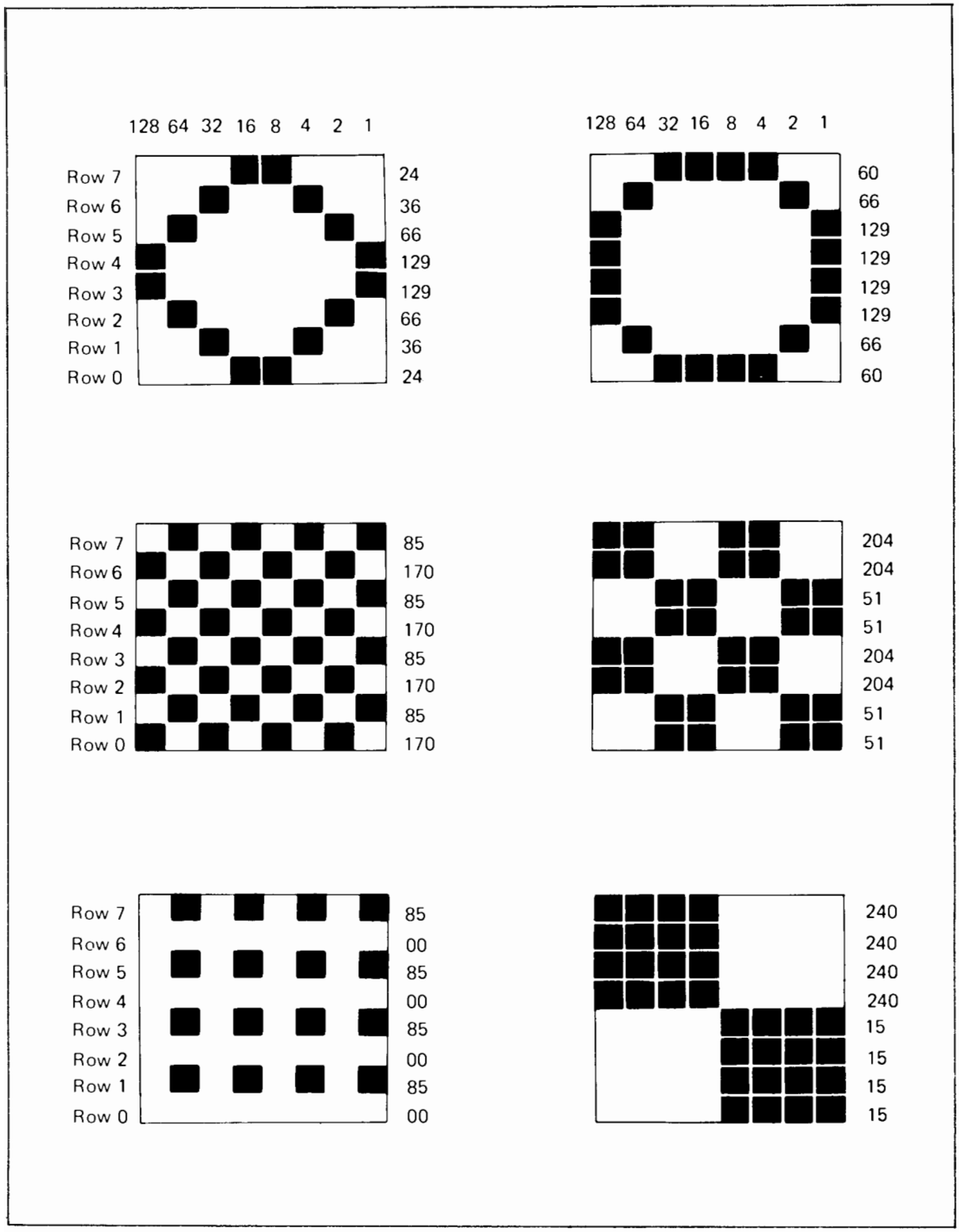


Figure 15-16. Magnified Examples of Area Patterns

Locator Echoes on the Graphics display

ZWLOC

The type of echoes available on the graphics display depends on whether or not the graphics display and locator are the same physical device. For echoes supported on the locator device, see the chapter which discusses the locator device in question.

SAME PHYSICAL DEVICE

If the locator and graphics display are the same physical device, then the following echoes are supported on the display:

ECHO#	ECHO PERFORMED
2	Small cursor Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until operator response. When an operator response occurs the graphics cursor is turned off.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position and a line will extend from the locator echo position to the current locator position (i.e. rubber band line) until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off and the rubber band line is removed.

5 Horizontal rubber band line

The graphics cursor and the locator echo position are handled in the same manner as for ECHO 4. The point returned has the X coordinate of the graphics cursor and the Y coordinate of the locator echo position.

6 Vertical rubber band line

The graphics cursor and the locator echo position are handled in the same manner as for ECHO 4. The point returned has the X coordinate of the locator echo position and the Y coordinate of the graphics cursor.

7 Horizontal/vertical rubber band line

The graphics cursor and the locator echo position are handled in the same manner as for ECHO 4. The point returned is the same as ECHO 5 or ECHO 6, which ever defines a longer line from the locator echo position.

8 Rubber band box

The graphics cursor and the locator echo position are handled in the same manner as for ECHO 4. The point returned is the position of the graphics cursor.

If the HP 17623A Graphics Tablet is attached, it is considered the same logical device as the locator and is an extension of the terminal. It can be used in conjunction with the terminals original functionality. The only difference is that a button value of 128 will be returned when the tablet pen is depressed.

DIFFERENT PHYSICAL DEVICES

If the locator and display devices are different physical devices and the locator device supports echoing on the display, then the following echoes are supported on the graphics display.

ECHO#	ECHO PERFORMED
2	Small cursor Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position (i.e. tracked) until the locator operation is terminated. Before control is returned to the application program, the graphics cursor is turned off.
3	Full cross-hair cursor Same as ECHO 2.
4	Rubber band line Initially the graphics cursor will be turned on at the current locator echo position. The cursor will then reflect the current locator position and a line will extend from the locator echo position to the current locator position (rubber band line) until the locator operation is terminated. Before the control is returned to the application program, the graphics cursor is turned off and the line is removed.
5	Horizontal rubber band line Initially the graphics cursor will be turned on at the current locator echo position. The graphics cursor will then be displayed at a point defined by the X coordinate of the current locator echo position and the Y coordinate of the current locator echo position. A horizontal line will extend from the locator echo position to the position of the graphics cursor until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off and the line is removed.

6 Vertical rubber band line

Initially the graphics cursor will be turned on at the current locator echo position. The graphics cursor will then be displayed at a point defined by the X coordinate of the current locator echo position and the Y coordinate of the current locator echo position. A vertical line will extend from the locator echo position to the position of the graphics cursor until the locator operation is terminated. Before control returns to the application program, the graphics cursor is turned off and the line is removed.

7 Horizontal/vertical rubber band line

Either a horizontal or vertical line will be displayed from the current locator echo position to the graphics cursor. The effect will be the same as ECHO 5 if the length of the horizontal line between the locator echo position is longer the vertical line between the same two points, otherwise the effect will be the same as ECHO 6.

8 Rubber band box

The graphics cursor and the locator echo position are handled in the same manner as for ECHO 4. The rubber band line represents the diagonal of the box defined with corner points at the locator echo position and the current locator position.

Termination

ZDEND

The graphics display is unaltered. The device name is set to '0036 ', and the device status and I/O unit descriptor are set to 0. All attribute values remain unchanged until the system is reinitialized or the display device is enabled again.

KEYBOARD DEVICE HANDLER (AGP/DGL)

Description

The HP 2627A Graphics Terminal has a standard ASCII keyboard which is supported as a keyboard input device. The device handler required to use the keyboard device on the HP 2627A Graphics Terminal is K0001.

Initialization

JEDEV/ZKINT

When the keyboard device is initialized the terminal alphanumeric display is turned on. The device name is set to '2627A '.

Keyboard Input

JKYBD/ZKYBD

Once the keyboard device has been enabled it is available for input operations. When JKYBD or ZKYBD are called, a read operation is set pending on the terminal. The operator then enters the desired text and terminates the operation by entering a carriage return. Some keys have a special meaning when entered by the operator and are not returned to the application program (see Appendix B for a description of these keys).

Echoes Supported

The keyboard device supports the following echoes:

ECHO#	ECHO PERFORMED
0	Text is not displayed on the terminal alphanumeric display as it is entered.
1	Text is displayed on the terminal alphanumeric display as it is entered.

Termination

JDDEV/ZKEND

The alphanumeric display is unaltered. The device name is set to '0001 ', and the device status and I/O unit descriptor are set to 0.

LOCATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 2627A Graphics Terminal are as follows:

Screen size:	215 mm wide by 164 mm high
Screen capacity:	512 points wide by 390 points high
Resolution:	2.3814 points/mm in X direction and 2.3780 points/mm in Y direction

The default locator limits are set equal to the maximum physical limits of the screen.

The physical origin of the locator device is the lower left corner of the display.

The HP 2627A Graphics Terminal has a graphics locator which is capable of returning any point on the screen. The device handler required to use the locator device on the HP 2627A Graphics Terminal is L0019.

Initialization

JEDEV/ZLINT

When the locator device is initialized, the terminal's graphics display is left unaltered. The device name is set to '2627A '.

Wait Locator Input

JWLOC/ZWLOC

The wait locator input function sets a read operation pending on the graphics terminal. The operator then positions the graphics cursor to the desired position and strikes an alphanumeric key. The (X,Y) coordinate value of the graphics cursor (which is a function of the echo) and the key struck are returned to the application program. Any of the ASCII keys can be used to terminate the locator function so the key returned to the application program can range from 0 to 127.

If the HP 17623A Graphics Tablet is attached, it is considered the same logical device as the locator and is an extension of the terminal. It can be used in conjunction with the terminals original functionality. The only difference is that a button value of 128 will be returned when the tablet pen is depressed.

Echoes Supported

Locator input can be echoed on either a graphics display device or a locator device. The echo can only be performed on a graphics display device when the locator and the graphics display devices are implemented on the same physical device (i.e. same HP 2627A Graphics Terminal). Refer to the HP 2627A Graphics Terminal's graphics display sections to see how the locator can echo input on the graphics display. The following lists the echoes that can be performed by the locator device.

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	Initially the graphics cursor is turned on and will appear wherever it was last positioned on the display. The graphics cursor can then be moved by the operator through the use of the graphics cursor control keys. When the graphics cursor is positioned over the desired point, the operator strikes an alphanumeric key and the locator function is terminated. Before control returns to the application program, the graphics cursor is turned off.

Sample Locator Input

JSLOC/ZSLOC

The sample locator function returns the current locator position without waiting for an operator response. The graphics cursor is turned off following the sample locator function.

Echoes Supported

The following locator echoes are supported with the HP 2627A Graphics Terminal when using the sample locator function:

ECHO#	ECHO PERFORMED
0	Echo is not performed.
1	The bell in the terminal is sounded when the locator is sampled.

Termination

JDDEV/ZLEND

The device name is set to '0001 ', and the device status and I/O unit descriptor are set to 0.

PICK DEVICE HANDLER (AGP ONLY)

Description

The pick device is only supported with AGP. The dimensions of the HP 2627A Graphics Terminal is as follows:

Screen size:	215 mm by 164 mm
Screen capacity:	512 points by 390 points
Resolution:	2.3814 points/mm in X direction and 2.3780 points/mm in Y direction

The physical origin of the pick device is the lower left corner of the display.

The HP 2627A Graphics Terminal has a pick device which is capable of differentiating between any point on the graphics display. The device handler required to use the pick device on the HP 2627A Graphics Terminal is P0019.

Initialization

JEDEV

When the pick device is initialized, the terminal's graphics display is left unaltered. The device name is set to '2627A '.

Pick Input

JPICK

The pick input function sets a read operation pending on the graphics terminal. The operator then positions the graphics cursor to the desired position and strikes an alphanumeric key. The segment name, pick-id, and the value of the pick button are then returned to the application program. Any of the ASCII keys can be used to terminate the pick input function so the value of the pick button returned to the application program can range from 0 to 127.

If the HP 17623A Graphics Tablet is attached, it is considered the same logical device as the pick and is an extension to the terminal. It can be used in conjunction with the terminals original functionality. The only difference is that a button value of 128 will be returned when the tablet pen is depressed.

Echoes Supported

Pick input can be echoed on either a graphics display device or a pick device. The echo can only be performed on a graphics display device when the pick and the graphics display devices are implemented on the same physical device (i.e. the same HP 2627A Graphics Terminal). Refer to the AGP HP 2627A Graphics Terminal's graphics display section to determine the supported pick echoes on the graphics display. The following lists the echoes that can be performed by the pick device.

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	Initially the graphics cursor is turned on and will appear wherever it was last positioned on the display. The graphics cursor can then be moved by the operator through the use of the graphics cursor control keys. When the graphics cursor is positioned over the desired point the operator strikes an alphanumeric key and the pick input function is terminated. Before control returns to the application program, the graphics cursor is turned off.

Termination

JDDEV

The device name is set to '0001 ', and the device status and the device status and I/O unit descriptor are set to 0.

VALUATOR DEVICE HANDLER (AGP/DGL)

Description

The dimensions of the HP 2627A Graphics Terminal are as follows:

Screen size: 215 mm by 164 mm

Screen capacity: 512 points by 390 points

The HP 2627A Graphics Terminal can simulate a valuator device with the graphics locator. The simulation is done by splitting the X and Y coordinates into two subvaluators and scaling the locator coordinates to values which range from 0.0 to 1.0. The device handler required to use the valuator device on the HP 2627A Graphics Terminal is V0019.

Initialization

JEDEV/ZVINT

When the valuator device is initialized, the terminal's graphics display is left unaltered. The device name is set to '2627A '.

Wait Valuator Input

JWVAL/ZWVAL

The wait valuator input function sets a read operation pending on the graphics terminal. The operator then positions the graphics cursor to the desired position and strikes an alphanumeric key.

In addition to returning the subvaluator value, the key struck to terminate the valuator operation is also returned to the application program. Any of the ASCII keys can be used to terminate the valuator function so the button returned to the application program can range from 0 to 127.

If the HP 17623A Graphics Tablet is attached, it is considered the same logical device as the valuator and is an extension to the terminal. It can be used in conjunction with the terminals original functionality. The only difference is that a button value of 128 will be returned when the tablet pen is depressed.

The values returned are a function of the subvaluator specified as follows:

Subvaluator	Value returned
1	Value returned is the X coordinate of the graphics cursor position scaled to a number between 0.0 and 1.0. A value of 0.0 is returned if the cursor is at the left edge and a value of 1.0 is returned if the cursor is at the right edge of the display.
2	Value returned is the Y coordinate of the graphics cursor position scaled to a number between 0.0 and 1.0. A value of 0.0 is returned if the cursor is at the bottom of the display and a value of 1.0 is returned if the cursor is at the top of the dispay.

Echoes Supported

The supported echoes for the wait valuator input function are as follows:

ECHO#	ECHO PERFORMED
0	Same as ECHO 1.
1	Initially the graphics cursor is turned on and will appear wherever it was last positioned on the display. The graphics cursor can then be moved by the operator through the use of the graphics cursor control keys. When the graphics cursor is positioned over the desired point the operator strikes an alphanumeric key and the valuator function is terminated. Before control returns to the application program, the graphics cursor is turned off.

Sample Valuator Input

JSVAL/ZSVAL

The sample valuator function returns a subvaluator value without waiting for an operator response. The valuator simulation is performed in the same way as for the wait valuator input function.

Echoes Supported

The following valuator echoes are supported with the HP 2627A Graphics Terminal when using the sample valuator function:

ECHO#	ECHO PERFORMED
0	Echo not performed.
1	The terminal bell is sounded when the valuator is sampled.

Termination

JDDEV/ZVEND

The device name is set to '0019 ', and the device status and I/O unit descriptor are set to 0.

Appendix A
RASTER-ADDRESSED DEVICES

GENERAL INFORMATION

This appendix contains information pertaining to the following raster-addressed device:

The HP 2608A Line Printer

The user should be familiar with the information provided here before using the device for graphics applications.

Definition of a Raster-Addressed Device

A vector device creates an image by drawing continuous lines from one end point to another. This produces an image composed of solid lines. On the other hand, a raster device creates an image by scanning a set of dots arranged in a matrix of columns and rows. As it scans the matrix row by row, it turns the dots on or off. In this way, the image created is actually composed of individual dots. If a dot is turned on, a point of light is displayed on a screen or a point of ink is printed on paper. If a dot is off, the point on the screen is turned off or the point on the paper is blank.

Because a raster device creates images differently from a vector device, the information it uses to create the image must be formatted differently. Some raster devices, such as the HP 2648A graphics terminal, can receive information in a vector format and internally convert this information to a raster format. Other raster devices, such as the HP 2608A line printer, cannot make this internal conversion. In this manual, a raster device that cannot convert vector-formatted information to raster format is referred to as a raster-addressed device.

Translating Vector-Formatted Information

To generate output on a raster-addressed device, two programs must be run. The application program is run, creating an intermediate disc file with vector-formatted information. A translator program (RTRAN) is then run to convert the information to raster format and send the reformatted information to the device. (Instead of running the translator program separately, the application program could internally schedule the translator after creating the intermediate file.)

Figure A-1 represents the steps involved in generating output on a raster-addressed device.

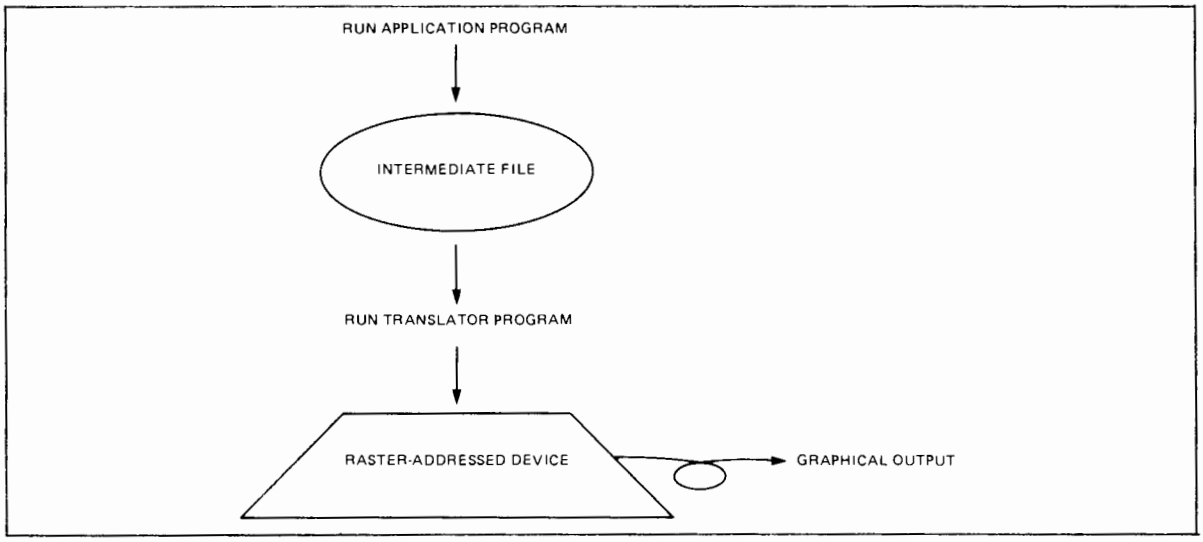


Figure A-1. Generating Graphical Output

STANDARD OPERATION

Standard operation for generating output on a raster-addressed device is to create the intermediate file, and then immediately afterward, translate this file. Also in standard operation, default conditions are set by the device handler and translator. Because of defaults associated with the name of the intermediate file, the translator program must be run from the same LU from which the application program was run or scheduled from the application program itself.

Loading and Running the Application Program

For a raster-addressed device, the process of loading and running the application program (and, for AGP, the work station program) is the same as that for any other device.

Loading the Translator Program

When using the RTE-A or RTE-A.1 operating system, the following command should be executed to load the translator program:

```
:RU,LINK,#RTRAN,RTRAN::CN
```

This will produce a type 6 file, RTRAN, on cartridge CN. The raster translator may then be run as specified in the section, Running the Translator Program which follows.

For all other operating systems, the translator program should be loaded using the transfer file, *RTRAN, which always OFF's the main and its segments before running the loader. The example below shows how to load the translator progam. (In this appendix, arguments enclosed in angle brackets (<>) must be specified. Those enclosed in square brackets ([]) are optional.)

:TR,*RTRAN,<#RTRAN_CRN>,<SP_CRN>,<SP_ecurity>,<purge>,<off>

where:

<#RTRAN_CRN> is the cartridge on which the loader command file #RTRAN is located.

<SP_CRN> is the cartridge to which the translator will be SP'ed. If <SP_CRN> is set to -1, the translator will not be SP'ed.

<SP_security> is the security code of the SP'ed translator. If <SP_CRN> is set to -1, this is ignored.

<purge> indicates whether or not the old translator should be purged. If <purge> is set to "PURGE", the old translator will be purged. "PURGE" need only be specified if the translator already exists on the system. If <purge> is set to 0, the old translator will not be purged.

<off> indicates whether or not the translator main and its segments should be OFF'ed after they are loaded. If <off> is set to "OFF", the translator will be OFF'ed. The translator should be OFF'ed only if it has been SP'ed. If <purge> is set to 0, the translator main and its segments will not be OFF'ed.

Recommended ways to load or reload the translator are shown below.

1) Load and SP the translator on LU 2 or 3. For example, if #RTRAN is on cartridge EM, the translator would be loaded and SP'ed on LU 2 as follows:

```
:TR,*RTRAN,EM,2,0,0,OFF
```

The translator would now be ready to run.

2) Load the translator and SP it on an LU other than 2 or 3. If #RTRAN is on cartridge EM, the translator can be loaded on LU 17, for example, as follows:

```
:TR,*RTRAN,EM,-17,0,0,OFF
```

Before the translator can be run, it must be RP'ed as follows:

```
:RP,RTRAN::LU
:RP,RTRA1::LU
:RP,RTRA2::LU
:RP,RTRA3::LU
```

After the translator is run, it should be OFF'ed as follows:

```
:SYOF,RTRAN,8
:SYOF,RTRA1,8
:SYOF,RTRA2,8
:SYOF,RTRA3,8
```

Running the Translator Program

Before running the translator, spooling should be configured. Refer to the next section for more information on spooling.

Next the translator should be run by specifying RU,RTRAN. (Special run-time commands are explained in a later section of this appendix.)

The intermediate file is purged if no errors occur. It is saved if an error is found.

FILES

Each time the graphics display is initialized (with JDINT or ZDINT) for a raster-addressed device, an intermediate file is created. If necessary, several intermediate files can be created before the translator is run. Although up to 520 intermediate files can be created from each controlling terminal, it is strongly advised that the number of files created be kept to a minimum. Retaining a large number of files uses up cartridge space and takes the application and translator programs longer to run.

The file sequence indicator, explained below, keeps track of the different intermediate files. By default, the translator program translates the most recent file created. The translator also creates a scratch file during translation, which is always purged afterward.

The Default File Specification

If the user does not define the file specification for the intermediate file when running the application program or translator, the specification defaults to a name, security code, cartridge reference, and block size as shown below:

```
spec = <name>:<security code>:<cartridge reference>::<block size>
```

The default name has the following format:

```
abbbcc
```

where:

a — represents a one-character file identifier.

bbb — represents a three-character logical unit.

cc — represents a two-character file sequence indicator.

The default file identifier for an intermediate file is "R". The scratch file used by the translator has a default file identifier of "S".

The default logical unit used is the system logical unit (system LU) of the terminal from which the application or translator program was run.

The first character of the file sequence indicator is a symbol or number (the sequence is listed below), and the second character is a letter of the alphabet. The first character remains static through the first twenty-six intermediate files created, as the second progresses through the alphabet. For example, the first file sequence indicator assigned is .A, the third is .C, and the sixth is .F. When the alphabet is exhausted, the first character is replaced by another symbol number and the second character begins again at A. For example, the twenty-sixth indication is .Z, twenty-seventh indicator is !A, and the twenty-ninth is !C.

The first character of the file sequence indicator follows the progression below:

. ! # * $ " % = & ? 0 1 2 3 4 5 6 7 8 9

The remainder of the default file specification uses the following conventions:

(<security code>:<cartridge reference>:<file type>:<block size>)

The security code defaults to zero. The cartridge specification also defaults to zero; that is, the file is stored on the first available cartridge. The file is always a type 1 file; any attempts to change the file type are ignored. The block size defaults to 24, enough to store 100,000 vectors on RTE operating systems with a revision 2101 or later (see Section regarding Operating System Considerations).

Changing the File Specification

If desired, a file specification other than the default can be defined for use in creating the file and subsequently for running the translator. This can be done before the application program is run, as explained below.

Overriding File Specifications

When running the translator, the user may override the intermediate and scratch file specification. Run-time commands are useful when an intermediate file created at one terminal is to be translated from a different terminal. When overriding the file specification, any part of the file specification that is not defined continues to take the value specified in the common block. For example, the intermediate file name can be changed to R052 without changing other parts of the specification, and the scratch file can be directed to cartridge XZ with a file size of 100 block.

```
:RU, RTRAN, FILE=R052, SCRATCH=::XZ::100
```

The intermediate file specification can be defined as absolute. This is useful when an intermediate file has been read from a minicartridge and stored into a file name. The translator can then be run using that absolute name as shown below:

```
:RU, RTRAN, FILE_ABS=GRAPH::GF
```

Changing the Output Logical Unit

Normally, the translator attempts to send its output to the logical unit specified in the ZDINT or JDINT call. The user can, however, override this output logical unit when running the translator program as shown below:

```
:RU, RTRAN, OUT_LU=<lu>,....
```

Changing the Control Word

Setting the control word will permit or prevent spooling. The translator uses the control word given in the ZDINT or JDINT call. This control word can be overridden at translator run time as follows:

```
:RU, RTRAN, CONTROL=<cntl>,....
```

Changing the Error Logical Unit

If an error occurs while the translator is running, an error message is sent to the controlling terminal. If desired, these messages can be sent to another logical unit by specifying:

```
:RU, RTRAN, LOG_LU=<lu>,....
```

The translator program performs no checks on this logical unit, so caution should be used with this command.

Specifying Which Frames to Print

A call to ZNEWF (DGL), JNEWF, JPURG, JSVIS, JSHI, JVSAL, JDLIM, or JCLR (AGP) generates a new frame, or picture. The translator prints all frames in the intermediate file unless a range of frames is specified at run time. When a range is specified, the translator prints only those frames in the range given and purges the intermediate file before it terminates.

When specifying which frames to print, a tilde or overscore (" ", ASCII 176B) is used to separate the beginning frame from the end frame. A "$" (ASCII 44B) is used to represent the last frame in the file.

Examples of this specification are shown below:

```
:RU, RTRAN, FRAME=1 10  (This prints the first ten frames.)
:RU, RTRAN, FRAME=5     (This prints the fifth frame.)
:RU, RTRAN, FRAME=2 $   (This prints all but the first frame.)
```

SPECIAL CONSIDERATIONS

Terminating the Translator Prematurely

If it is necessary to terminate the translator prematurely, this should be done in the following manner. The user should press any key to receive the break mode prompt, and then type in "BR". Breaking the translator will close any open files, and purge the scratch file.

The user should avoid OFF'ing the translator. This might leave the raster device in an undefined state, such as in graphics mode. If this occurs, refer to the instructions for the specific device in this manual. OFF'ing the translator might also leave the intermediate and scratch files open. Finally, the scratch file might not be purged, in which case, the user should purge it.

Running Multiple Translators

If the translator is to be used by more than one user at a time, the following options exist:

1) SP the translator and its segments on LU 2 or 3, making sure the T5IDM program is loaded on the system. (T5IDM is a program called by SEGLD to manage ID segment allocation.)

2) Permanently load the translator.

SP'ing the translator on LU 2 or 3 is the recommended method of running multiple translators.

ERRORS

Application Program Errors

When running an application program that uses a device handler for a raster-addressed device, asynchronous file errors may occur. The most common errors occur when the intermediate file runs out of space. Errors can be caused by several conditions: no more room is left in the file, no more directory entries are available, or no more disc space is available. These errors could happen anytime the application program is being run. After a file error occurs, an attempt is made to close the intermediate file, the graphics diplay is disabled, and no more information is placed into the intermediate file.

DGL PROGRAMS

The application program should check for the occurrence of a file error and process it accordingly. This is especially important for DGL programs since DGL will not print out an error message if a file error occurs. Checking for file errors can be done using a ZIWS call with an op code of 2050. The parameters are described below.

ISTAT(1) returns the machine-independent error status.

ISTAT(2) returns the machine-dependent error associated with ISTAT(1). FMP errors are returned in ISTAT(2).

ISTAT(1)	ISTAT(2) (Corresponding FMP Errors)	Error Explanation
0	0	No error
1	-2	Duplicate file name
2	-6	File not found

3	-1, -7, -13, -14, -32, -33	File cannot be opened
4	-12, -46	End of file found
5	-5	Illegal record length
6		File is of the wrong type -- a type 1 file was looked for.
7	-8	File is locked
-1	Varies	Other FMP errors not covered above. Refer to FMP error for details.

AGP PROGRAMS

In AGP if an error occurs on the JDINT call, it will be reported as a -5xxx error, where xxx is the FMGR error that occured. At other times an error will be reported asynchronously as a -6xxx error. The application program can inquire if any errors have occured using a JIERR call.

Translator Program Errors

The translator performs error checking on the user input and on the file system. If an incorrect command is entered in the run string, information describing the correct syntax is sent to the error logical unit. If an error other than an incorrect run string command occurs, a translator error message is written to the error logical unit. This message includes the name of the program in which the error occurred and additional information about the error.

The translator does not purge the intermediate file if an error occurs. The file is saved so that the user can try to translate it again. If rerunning the translator produces the same error, the file should be purged.

A list of errors reported by the translator follows. The line beginning with "**" prints at the error logical unit. PROGM is the system representation of the translator program being run.

** PROGM: Illegal op code in intermediate file. Op code = <numb>.

Info: An unrecognizable op code was read from the intermediate file. This is probably because the application program was OFF'ed, or the user did not call ZDEND or JWEND.

Action: Purge the intermediate file. Rerun the application program, making sure to call ZDEND or JWEND.

** PROGM: Unexpected EOF in intermediate file. IERR = <numb>.

Info: The end of the intermediate file was encountered, but no termination command was found. The file was treated as if there were a legal termination command, but the intermediate file was not purged. This is usually caused by OFF'ing the application program, not calling ZDEND or JWEND, or working on an operating system with nonextendable type 1 files. More than 255 extents also causes this error. (IERR contains the corresponding FMP error.)

Action: Make sure that the application program called ZDEND or JWEND, and check the size of the intermediate file to determine if 255 extents were used. Purge the intermediate file and rerun the application program after making the required changes (e.g., increasing the intermediate file size).

** PROGM: Can't find segment <name>.

Info: A call to SEGLD could not find the segment in question.

Action: RP the translator segments.

** PROGM: File <type> error <numb> in routine <name>. FMP error = <numb>.

Info: <type> = read
write
close
purge
creat
open

The error <numb> is given when a file system error occurs. The possible file system errors are:

Error	Corresponding FMP Errors	Explanation
1	-2	Duplicate file name
2	-6	File not found
3	-1, -7, -13, -14, -32, -33	File cannot be opened
4	-12, -46	End of file found
5	-5	Illegal record length
6		File is of the wrong type -- a type 1 file was looked for.
7	-8	File is locked
-1	Varies	Other FMP errors not covered above. Refer to FMP error for details.

** PROGM: Scratch file not large enough. IERR = <numb>.

Info: A write was attempted to the scratch file, but there was not enough space. IERR contains the corresponding FMP error.

Action: Make sure that there is enough room on the first available cartridge (or on the cartridge specified) for the scratch file. Check that the operating system supports extendable type 1 files, and increase the size of the scratch file if necessary. Rerun the translator.

** PROGM: Frame specification error.

Info: The last frame in the file was processed. The number of either the start or end frame (as specified on the command line) was greater than the number of the last frame in the intermediate file. The intermediate file was not purged.

Action: Use a proper frame specification and rerun the translator; or purge the intermediate file.

** PROGM: Intermediate file not found.
Looked for <name>

Info: The intermediate file was searched for and not found.

Action: Check the file specification, and verify that the file really exists.

** PROGM: Illegal intermediate file (<name>)

Info: The intermediate file did not have a legal raster intermediate file header, or it was prepared for a previous version of the translator.

Action: Make sure that a correct intermediate file name was specified. If the LU is being spooled, check to see if the spooling bit is set in the control word at display device initialization.

** PROGM: Init error on LU <numb>.

Info: This corresponds to an error 2 on a ZDINT call, or an error 94 on a JDINT call. This error can be caused by the following: the LU is illegal, the LU or its corresponding EQT is down, or the driver associated with the EQT is not the correct driver type.

Action: Make sure that the correct LU was specified, and that it is up.

** PROGM: Intermediate file loaded for device that translator could not support. Intermediate file was <name>.

Info: The intermediate file was generated for a device that this translator does not support.

Action: Use a supported handler/translator pair.

** PROGM: Can't lock output LU. LU is <numb>.

Info: The attempt to lock the output LU failed.

Action: Spool the LU, or wait for existing programs that locked the LU to terminate.

** PROGM: LURQ error AABB on attempted LU lock.

Info: An illegal LU was specified with the spooling bit set. (AABB is the code returned in the A and B registers after a call to subroutine LURQ.)

Action: Make sure that the correct LU was specified.

** PROGM: Scratch file template is full.
Last entry was <name>.

Info: There are no more scratch file names available; all possible sequence indicators have been used.

Action: Wait for current translators to terminate, then purge the scratch files.

** PROGM: AABB error on an EXEC CCCC. Routine = <name>.
ICNWD = <numb>.

Info: AABB is the code returned in the A and B registers after an EXEC error. CCC is the number of the attempted EXEC call. The translator program may be corrupt.

Action: Transfer to *RTRAN, which OFF's the translator and its segments and reloads it.

** PROGM: Exec error AABB on retrieval of run string.

Info: An exec error occured while attempting to retrieve the run string (EXEC 14). AABB are the A and B registers after the exec call. The translator program may be corrupt.

Action: Transfer to *RTRAN, which OFF's the translator and its segments and reloads it.

** PROGM: Scratch file format error in block <numb>.

Info: A block read in from the scratch file had an internal inconsistency. The translator program may be corrupt.

Action: Transfer to *RTRAN, which OFF's the translator and its segments and reloads it.

** PROGM: Internal error <numb>! Calling routine is <numb>.
Error array is <numb>,<numb>,<numb>,<numb>.

Info: This error is generated when a call to a fatal error handler was generated with an unexpected internal number. The translator program may be corrupt.

Action: Transfer to *RTRAN, which OFF's the translator and its segments and reloads it.

Appendix B
System/1000 Dependencies

FILE NAMES

An example of a device handler name listed in this manual is:

D0001

The file containing this handler is:

$D0001

All file names are the device handler names prefaced by $.

The DGL device-independent library is refered to in the manual as DIDD. The file containing this library is:

$DIDD

SPOOLING

Setting bit 0 of the control word in ZDINT or JDINT to 1 will permit out-spooling. Caution should be used when doing this, as setting bit 0 to 1 removes all checks to verify that the LU is in the correct range, that the correct system driver is attached to the LU, and that the device requested is at the LU. The following devices support spooling:

Device Name	Device Handler
HP 2647A/F/2648A Graphics Terminals	D0001
HP 2623A Graphics Terminal	D0019
HP 2627A Graphics Terminal	D0036
HP 9872 Graphics Plotters	D0002
HP 7580A/7585A Drafting Plotters	D0006
HP 7470 Graphics Plotter	D0031
HP 7225 Graphics Plotter	D0032
HP 1350/51 Graphics Translators w/1310 CRT	D0007
w/1311 CRT	D0008
w/1317 CRT	D0009
w/1321 CRT	D0010
HP 2608A Line Printer	D0026

Using Graphics Terminals

To send the graphics output created by the device handler for a specific Graphics Terminal from a disc file, use the following command:

```
ST,NAMR,cntrl
```

where cntrl = 3000B + the LU of the Graphics Terminal. Note that cntrl cannot be an expression.

Using HP Plotters or Translators

To send the graphics output created by the device handler for a specific HP Plotter or Translator from a disc file, use the following command:

```
ST,NAMR,cntrl
```

where cntrl = 2100B + the LU of the HP Plotter or Translator. Note that cntrl cannot be an expression.

Using Raster-Addressed Devices

The following examples show how to outspool the raster translator. In each case, bit 0 of the control word was set to 1 in the ZDINT or JDINT call in the application program.

Below is an example of spooling to LU 10. The application program in this example directs its graphical output to LU 10.

```
:RU,PROG                (Creates intermediate file.)
:SL,10,,,10             (Sets up LU 10 to be spooled.)
:RU,RTRAN               (Runs the translator with graphical
                        output outspooled to LU 10.)
:CS,10                  (Closes spool file.  The file will
                        be sent to the graphics output device
                        when it is available for use.)
```

When translator output is spooled to a file, spool headers must be included in the file format. The sequence of calls required to run a program that outspools to the file OUTPUT on cartridge TT, with graphical output directed to LU 10, is as follows:

```
:CR,OUTPUT::TT:3:24     (Creates a spool file if one doesn't exist.)
:SL,10,OUTPUT::TT,WRSH  (Sets up the file with spool headers (SH).)
:RU,RTRAN               (Runs the program with graphical output
                         outspooled to a file.)
:CS,10                  (Closes the spool file.)
:SL,10,OUTPUT::TT,,10   (Places spool file in spooling system.)
:CS,10                  (Closes spool file.  The file will be sent
                         to the graphics device when it is available
                         for use.)
```

Spooling

Under the RTE-A operating system, spooling graphical output requires different commands. If the application program directs its graphical output to LU 6, then the following command sequence applies:

```
:RU,PROG                (Creates intermediate file.)
:SP,ON,6                (Sets up LU 6 to be spooled.)
:RU,RTRAN               (Runs the translator on intermediate file
                         with graphical output spooled to LU 6.)
:SP,OF                  (Closes spool file.  The file will be set to
                         the graphics output device when it is
                         available for use.)
```

RTE-A does not support usage of the CR command to create user-named spool files for graphics. The command SP,ON,lu creates a default spool file. It is recognized by the spooling system as graphical output when the command SP,OF is executed.

The control word can be overridden at translator run time. Refer to the section on Run-Time Commands in Appendix A (Raster-Addressed Devices) for information about specifying the spooling option.

Using an HP 2608A Line Printer

To send the graphics commands to an HP 2608A Line Printer from a spool file created by the translator, use the following command:

```
ST,NAMR,LU
```

where:

```
NAMR = the namr of the spooled file
 LU  = the LU of the HP 2608A Line Printer
```

SYSTEM CONFIGURATION

HP 2647A/2647F/2648A Graphics Terminals

The AGP-3/DGL graphics systems support the HP 2647A/2647F/2648A Graphics Terminals with the following system configurations:

OPERATING SYSTEM	Driver	Use
RTE-IVB/ RTE-6/VM	DVR05	Direct connection to the computer
	DVA05	Modem operation
	DDV05	Multiplexor operation
RTE-L/ RTE-XL	ID.00&	Direct connection to the computer
	DD.00	

Computer Museum

HP 7470/7580A/7585A/9872 Graphics Plotter

The HP 7470/7580A/7585A/9872 Graphics Plotters are supported with the following system configurations:

SYSTEM	Driver	Use
RTE-IVB/ RTE-6/VM	DVR37	Control of HP-IB devices
RTE-L/ RTE-XL/ RTE-A.1	ID.37	Control of HP-IB devices

HP 1350/1351 Graphics Translator, HP 7225 Graphics Plotters, and HP 9874A Digitizer

The HP 1350/1351 Graphics Translators, HP 7225 Graphics Plotters, and HP 9874A Digitizer are supported with the following system configurations:

OPERATING SYSTEM	Driver	Use
RTE-IVB/ RTE-6/VM	DVR37	Control of HP-IB devices
RTE-L/ RTE-XL	ID.37	Control of HP-IB devices

HP 9111A and HP 9111A Option 50 Graphics Tablets

The HP 9111A and HP 9111A Option 50 Graphics Tablets are supported with the following system configurations:

OPERATING SYSTEM	Driver	Use
RTE-IVB/ RTE-6/VM	DVR37	Control of HP-IB devices

The HP 9111A is supported with the following system configurations:

OPERATING SYSTEM	Driver	Use
RTE-L/ RTE-XL/ RTE-A.1	ID.37	Control of HP-IB devices

HP 9111A Option 50

To perform local cursor tracking using JWLOC/ZWLOC and JPICK (AGP only), with the HP 1350/1351 Graphics Translators, the following requirements must be met:

1) The HP 9111A Option 50 and the HP 1350/1351 must be on the same HP-IB bus.

2) The LU of the HP 9111A Option 50 must be mapped to subchannel 1 of the HP-IB EQT. The value of this LU must be one greater than the LU of subchannel 0 of the HP-IB EQT. The user must set the HP-IB address of the HP 9111A Option 50 to 1 by setting the switches on the back of the HP 9111A Option 50.

3) The LU of the HP 1350/1351 must be mapped to subchannel 2 of the HP-IB EQT. The user must set the HP-IB address to 2 by setting the switches inside of the HP 1350/1351.

4) The HP 1350/1351 should not have the outspooling bit set (see ZDINT or JDINT).

5) No other device on the HP-IB bus can be doing any I/O operations while echoing is being performed.

The HP 9111A Option 50 Graphics Tablet are supported with the following system configuration:

OPERATING SYSTEM	Driver	Use
RTE-IVB	DVR37 w/SRQ	Control of HP-IB devices

HP 2623A/2627A Graphics Terminals

The AGP/DGL graphics systems support the HP 2623A/2627A Graphics Terminals with the following system configurations:

SYSTEM	Driver	Use
RTE-IVB,RTE-6/VM	DVR05	Direct connection
	DVA05	Modem operation
	DDV05	Multiplexor operation
RTE-L,RTE-XL,RTE-A	ID.00 with DD.00	Direct connection

HP 2608A Line Printer

The HP 2608A line printer is supported with the following configurations using an HP-IB Interface:

SYSTEM	Driver	Use
RTE-IVB,RTE-6/VM	DVB12	Line printer driver

When using the AGP/DGL software family, it is not necessary to generate driver DVZ12 into your system. DVZ12 is a special driver that is only necessary for the GPS Graphics Product (92840A).

HP 2608S Line Printer

The HP 2608S line printer is supported with the following configurations using an HP-IB Interface:

SYSTEM	Driver	Use
RTE-6/VM,RTE-A	DVC12	Line printer driver
	DDC12	Device driver

HP 7220/7221 Graphics Plotters

The HP 7220 Graphics Plotters are only supported in an eavesdrop configuration. An eavesdrop configuration is one in which an HP 7220 plotter is connected between the host computer and a terminal, and the plotter listens to the data sent from the host computer. When a special escape sequence is sent and recognized by the plotter, the plotter executes all subsequent graphics instructions and does not pass them on to the terminal. When a second special escape sequence is sent and recognized by the plotter, the plotter terminates execution and waits for the first escape sequence before beginning. Data is now allowed to pass through the plotter and on to the terminal. For more information see Figure B-1 or refer to the *HP 7220C and 7220T Graphics Plotters Operating and Programming Manual Using HP-GL Instructions, or the HP 7221 Graphics Plotters Operating and Programming Manual.*

The eavesdrop configuration can be used over a modem or by direct connection to the host computer. An HP 264X Graphics Terminal must be used as the terminal. The eavesdrop configuration is supported with the the following system configurations:

SYSTEM	Driver	Use
RTE-IVB/	DVR05	Direct connection to the computer
RTE-6/VM	DVA05	Modem operation

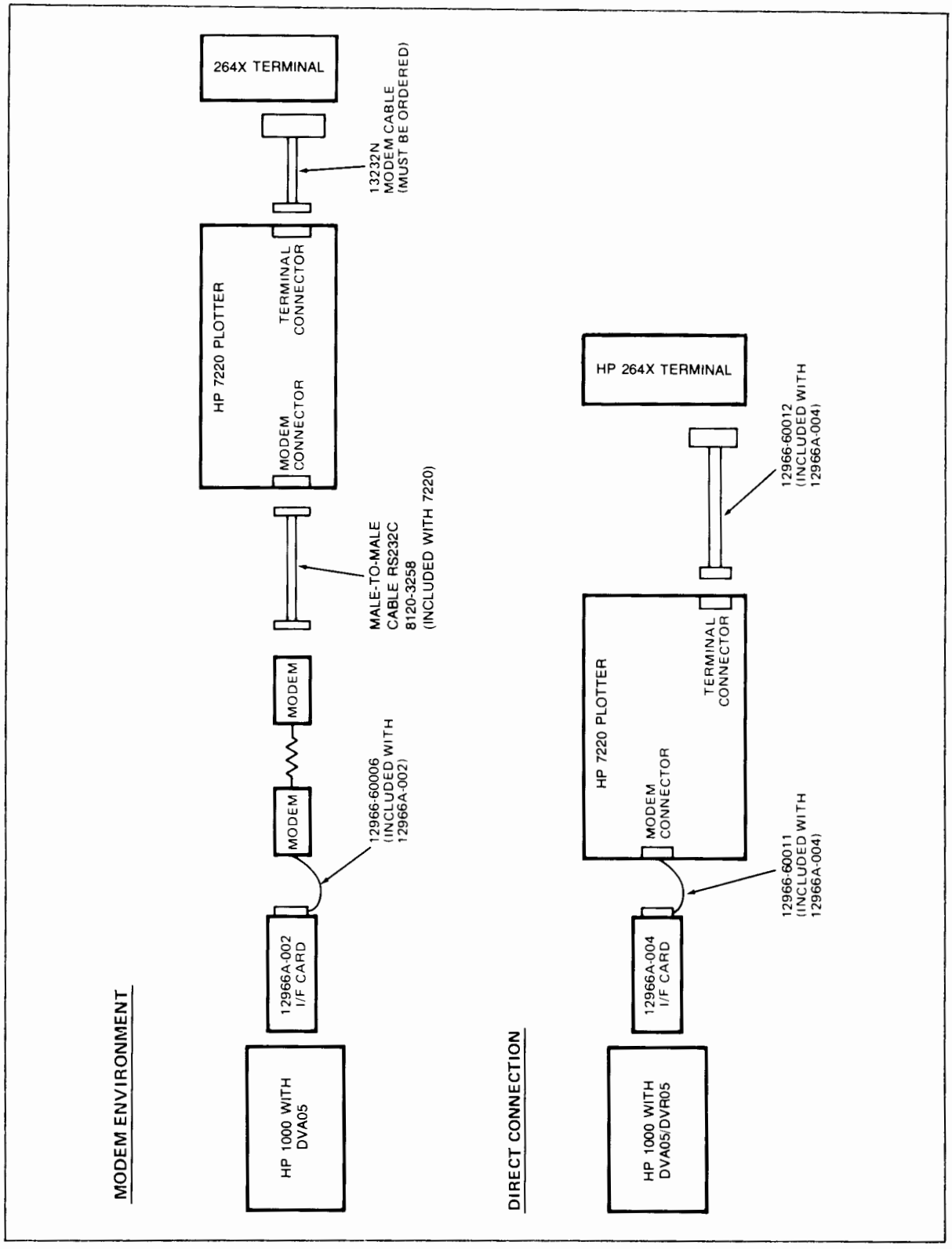


Figure B-1. Eavesdrop Configuration

TIME-OUT VALUE

HP 7225/7470/9872 Graphics Plotters

Because the HP 7225/7470/9872 Graphics Plotters are slower than the typical non-graphic computer peripherals, the time-out value should be set to some large value (e.g., 6000, which is a time of 60 seconds).

HP 7580A/7585A Drafting Plotters

To allow time for the initialization of the HP 7580A/7585A Drafting Plotters, the time out value should be set to some large value (e.g., 6000, which is a time of 60 seconds). To avoid additional time out problems, the operator should not keep the HP 7580A/7585A in the VIEW state for longer than the time out value if there is an I/O operation pending on the HP 7580A/7585A (e.g. in the middle of outputting graphics commands).

KEYBOARD INPUT

HP 2623A/2627A/2647A/2647F/2648A Graphics Terminals

The following keys have a special meaning when entered by the operator and are not returned to the application program:

Key	Function
DEL	Deletes the current line of text entered and outputs a \ followed by a CR-LF. The operator can then enter a new line of text.
BACKSPACE	Deletes the last character typed. The alphanumeric cursor moves back one character.
LINE FEED	A line feed is echoed on the alphanumeric display but it is not returned to the application program.
CNTL D	Terminates the keyboard operation. String will not be returned to the application program, the character count will be set to 0.

Note: DEL and LINE FEED do not function as specified when using DDV05. For DEL on DDV05, the "\" is not output, only the CR-LF line feed is output.

A line feed on DDV05 is both echoed and returned to the application program.

INDEX

A

B

C

D

E

F

G

H

Computer Museum

K

L

M

N

O

Computer Museum

P

R

S

T

U

V

W

Z

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