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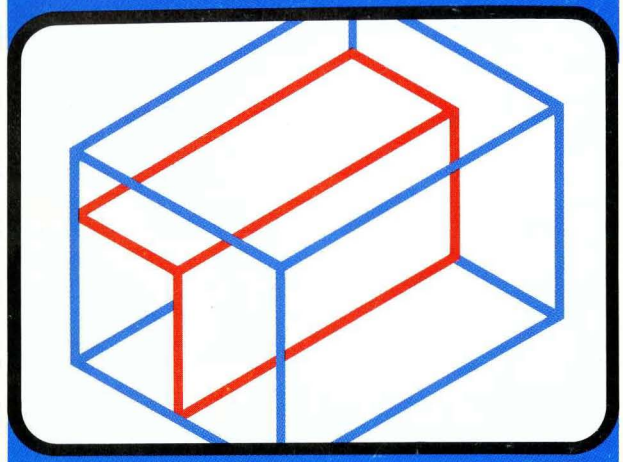

PLOT 10
INTERACTIVE GRAPHICS LIBRARY

USER'S REFERENCE GUIDE

CONTENTS

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ILLUSTRATIONS

TABLES

ABOUT THIS GUIDE

The PLOT 10 Interactive Graphics Library User's Reference Guide briefly describes all user-level IGL routines. It gives the syntax, the purpose, a brief description of all input and output arguments, and error messages for each routine.

For a complete explanation of the syntax and function of all routines, refer to the PLOT 10 Interactive Graphics Library User's Manual and the user's manuals for separately documented IGL options.

NOTE

This reference guide supports IGL level 2.0 and IGL level 3.0.

Table 1 lists all IGL options having routine descriptions ir this guide. (Table 1 does not cover Host I/O or device driver options — level 2 IGL — that do not have user-callable routines.)

Table 2 lists all IGL routines alphabetically and includes the arguments for each routine. This list may serve as a reminder of argument name and position, and as an index to this guide.

Tables 18, 19, and 20 (at the end of this guide) arrange all IGL routines by

- Error number, Table 18
- Functional category, Table 19
- Option (IGL level 2.0) and Standard Configuration (IGL level 3.0), Table 20

The principle part of this reference guide consists of routine descriptions arranged alphabetically. Each routine description begins with the routine name and argument(s) in bold type. Following these is a short statement of the purpose of the routine. Next, the input and output argument names are given along with definitions. Default values of arguments are given where appropriate. Error messages are explained if necessary, and notes point out device-dependent or software-specific information.

At the end of the guide is an ASCII Code Chart for use in text conversions. To help with color selection, you can refer to the Tektronix Color Standard on the back cover.

Table 1

IGL OPTIONS AND STANDARD CONFIGURATIONS INCLUDED IN THIS GUIDE

Name	Level 2.0 Option	Level 3.0 Standard Config.
4662 Device Driver	1D	20 & up
4663 Device Driver	1E	21 & up
4112/4113 Device Driver	1F	23 & up
4027 Device Driver	1H	21 & up
4114 Device Driver	1J	23 & up
4110 Series Special Feature Escapes	1K	23 & up
Primary Command Set	2A	20 & up
English Character Fonts	2B	21 & up
Math and Special Symbol Fonts	2C	21 & up
Panel Emulation	3C	21 & up
Graphics Text Emulation	3D	21 & up
Line Smoothing Emulation	3E	22 & up
Graphic Segments Support	4A	23 & up
3-D Graphics Support	4B	24
Panel Support	4C	21 & up
Graphics Text Composer	4D	21 & up
Line Smoothing Support	4E	22 & up

ROUTINES IN ALPHABETICAL ORDER

Table 2 gives the page number, routine number, and arguments for each routine included in this guide. Here you can quickly scan the list and find the names and order of each routine's arguments.

Look in the Error Numbers Table (Table 18) to find the routine associated with an error number. See the Routines by Functional Category (Table 19) or Routines by Option Tables (Table 20) to find routines organized by category and IGL option.

Table 2

ROUTINES IN ALPHABETICAL ORDER

Page	Number	Routine (Arguments)
18	026	ADDCHR (IFONT,ICHAR,ILEN,ISTR)
20	019	ADDFNT (IFONT,ICHN,IXMIN,IXMAX, IYMIN,IYMAX,ILOCHR,IHICHR)
20	339	ADDMBR (ISEG,INUM,IARRAY)
21	542	ADVMED (PDIST)
21	119	APPEAR
21	004	ARC (PRAD,PSTARA,PENDA)
22	015	ARC3PT (PX2,PY2,PX3,PY3)
22	089	BATCH (QBAT)
22	154	BAUDRT (IBAUD)
23	299	BB2W3 (PXGDU,PYGDU,POINT)
23	430	BEG1X (ICHR1,ICHR2,IMAXSZ,IBUF)
24	520	BEG63 (ICMD1,ICMD2,IMAXSZ,IBUF)
24	041	BELL
24	047	BILLBD (ORG,XMAX,YMAX)
25	121	BKGCLR (ICOLOR)
25	488	BORDER (IBVIS)
25	532	BPROC (INMPRO)
26	062	CAMERA (QCAMRA)
26	437	CHR1X (ICHAR,IBUF)
26	442	CHRY1X (ICHCNT,ICHARY,IBUF)
27	528	CHRY63 (ICHCNT,ICHARY,IBUF)
27	053	CLIP
27	159	CLOCAP
27	105	CLOPOL
28	033	CLOSEG

Page	Number	Routine (Arguments)
28	152	CLRMAP (IMAPNO,ITYPE,PCOLOR)
28	461	CLRPLT (ICOLOR,IDEVIC,IDEVOP,QERASE)
29	201	CMCLOS
29	200	CMOPEN
29	179	COPY (NROWS,ZIN,ZOUT)
30	320	CPYCHR (IFNT1,ICHR1,IFNT2,ICHR2)
30	036	CPYSEG (ISEG)
30	097	CRDLFT
30	098	CRDRHT
31	186	CVC2I (ILENST,ICHRAY,ICNVTD,ISTOPD)
31	187	CVC2R (ILENST,ICHRAY,PCNVTD,ISTOPD)
31	184	CVI2C (I2CONV,ILENST,ICHRAY)
32	185	CVR2C (P2CONV,ILENST,ICHRAY,IPASTD)
32	114	DASHPT (IPAT)
33	074	DEGREE
34	029	DELCHR (IFONT,ICHAR)
34	028	DELFNT (IFONT)
35	340	DELMBR (ISEG,INUM,IARRAY)
35	034	DELSEG (ISEG)
36	483	DELVW (IVWNUM)
36	039	DEVFNT (IFNT,IHDFNT)
37	283	DIST (ICNT,PX,PY,PS)
37	468	DLTCHR (IFONT,ICHAR)
38	006	DPOLAR (PDIST,PANGLE)
38	535	DPROC (INMPRO)
38	002	DRAW (PX,PY)
38	011	DRAW3D (PX,PY,PZ)
39	464	DRGSEG (ISEG)
39	460	DWNFNT (IFNT,IDVFNT)
40	052	EDGE (PXMIN,PXMAX,PYMIN,PYMAX)
40	099	EDGE3D (PUMIN,PUMAX,PVMIN,PVMAX)
40	432	END1X (IBUF,QSEND)
41	522	END63 (IBUF,QSEND)
41	107	ENDPNT (PX,PY)
41	109	ENDSLP (PDX,PDY)

ROUTINE DESCRIPTIONS

ADDCHR(IFONT,ICHAR,ILEN,ISTR)
"Add character"

Purpose
Adds a new character to a font

Inputs

IFONT	The number of the font in local storage to which the character is to be added
ICHAR	Character to be added; specified in current text format (ADE, A1, or AM)
ILEN	Length of array which defines character to be added
ISTR(ILEN)	Array containing definition of the new character. A character is defined by an encoded integer string (ISTR) developed by the following equation. The terms in the equation are explained in Tables 3 and 4 INTEGER = −(PACKING DENSITY * 100 + GRAPHIC FUNCTION)

Errors

02601	Font number (IFONT) out of range (0, value defined at installation); no-op
02602	Character (ICHAR) out of user-defined range; no-op
02621	Font (IFONT) not in local font table; no-op
02622	Integrity error: wrong font (IFONT) termination code; no-op
02623	Integrity error: wrong font (IFONT) header termination code; no-op
02624	Character (ICHAR) is already defined; no-op
02625	Not enough room in local IGL font table to add character description; no-op

Table 3

CHARACTER PACKING DENSITY

Density Value	Character Definition
1	Coordinates are packed two pairs per integer according to the following formulas: PAIR1 = X1 * 16 + Y1 + 3 PAIR2 = X2 * 16 + Y2 + 3 INTEGER = PAIR1 * 256 + PAIR2 If the second pair of points is not needed (an odd number of points is used), assign it a value of 128. X and Y values must be within the following range: 0 < = X < 7 −3 < Y > 12
2	Coordinate pairs are packed one per integer, according to the following formula: INTEGER = (X + 50) * 256 + Y + 50 X and Y values must be within the following range: −50 < = X < = 77 −50 < = Y < = 205
3	Coordinates occupy adjacent words in the array, both biased by a value of 10,000. X and Y values must be within the following range: −10000 < = X < = 22767 −10000 < = Y < = 22767

Table 4

GRAPHIC ACTION FUNCTION

Graphic Function	Purpose
1	Draw vectors
2	Draw dots
3	Draw panels
4	Draw fill
5	Draw arc, as per ARC3PT
6	Initialize line smoothing
7	Terminate line smoothing
8	Set character size
9	Draw "fat" lines

ADDFNT(IFONT,ICHN,IXMIN,IXMAX,IYMIN,IYMAX, ILOCHR,IHICHR)
"Add font"

Purpose
Adds a new font to the IGL font table

Inputs

IFONT	A number identifying font to be added
ICHN	Channel to be used to read the font; set to 0
IXMIN	Minimum X value of the digitizing space within which a prototypical character, usually an upper-case M, is defined
IXMAX	Maximum X value of the digitizing space within which a prototypical character is defined
IYMIN	Minimum Y value of the digitizing space within which a prototypical character is defined
IYMAX	Maximum Y value of the digitizing space within which a prototypical character is defined
ILOCHR	ASCII decimal equivalent (ADE) value of first character in font
IHICHR	ADE value of last character in font

Errors

01901	Font number (IFONT) out of range: (0,value set at installation); no-op
01911	Font (IFONT) already defined; no-op
01921	Not enough room in local IGL font table to add font description; no-op

ADDMBR(ISEG,INUM,IARRAY)
"Add (a) member (to a segment class)"

Purpose
Adds a member to one or more segment classes

Inputs

ISEG

−1	All retained segments are to be added to the specified classes
−2	A default segment class membership is being defined
−3	The members of the match class are to be added to the specified classes
1-32767	Integer name of a segment to be added to classes

INUM	The number of classes the segment should be added to
IARRAY	The list of classes the segment should be added to

(continued, next page)

Errors

01951	Segment ISEG is not an existing retained segment; no-op
01952	Parameter INUM < 0; no-op
01953	Class ID out of range (−1,1 through 64); no-op
01961	Illegal to modify dynamic attribute of open segment; no-op
01962	Number of classes > 64, use first 64; report
01971	Parameter ISEG out of range; no-op

ADVMED(PDIST)
"Advance (the) media"

Purpose
Advances the media

Inputs

PDIST	Distance the media is to advance in displa surface units

Errors

22251	PDIST less than or equal to 0; no-op
22271	Media advance option not present on device; no-op

APPEAR
"(Vector) appear"

Purpose
Returns device from selective erase mode; this is the default

Note
Requires device capable of selective erasing

ARC(PRAD,PSTARA,PENDA)
"Arc (draw)"

Purpose
Draws an arc counterclockwise with the given radius, from the starting angle to the ending angle

Inputs

PRAD	The radius for the arc; the current cursor position is the centerpoint
PSTARA	Starting angle for the arc
PENDA	Ending angle for the arc

Errors

00401	PRAD less than or equal to 0; no-op

ARC3PT(PX2,PY2,PX3,PY3)
"Arc three point"

Purpose
Draws an arc counterclockwise starting from the current cursor position through the two points specified

Inputs

PX2	The X coordinate of the point through which arc is to pass
PY2	The Y coordinate of the point through which arc is to pass
PX3	The X coordinate of the point at which the arc is to end
PY3	The Y coordinate of the point at which the arc is to end

BATCH(QBAT)
"Batch (display changes)"

Purpose
Begins and ends display change batching

Inputs
QBAT

.TRUE.	Starts batching of display changes
.FALSE.	Ends batching of display changes

Errors

08901	Batching was already in effect
08921	Illegal to change batching with a retained segment open; no-op

BAUDRT(IBAUD)
"Baud rate"

Purpose
Sets the baud rate for IGL communications

Inputs

IBAUD	Specified baud rate (e.g.1200)

Errors

15401	IBAUD < 0; no-op

BB2W3(PXGDU,PYGDU,POINT)
"Billboard to world (coordinate system in) 3-D"

Purpose
Transforms a point in the viewport from 2-D to 3-D world coordinate system units

Inputs

PXGDU, PYGDU	Point in 2-D (in GDU's)

Outputs

POINT(3)	3-D World Coordinate System point returned

Errors

29921	No billboard defined; no-op

BEG1X(ICHR1,ICHR2,IMAXSZ,IBUF)
"Begin (a) 4110 series (terminal command)"

Purpose
Begins a 4110 command by initializing the terminal command buffer

Inputs

ICHR1	First command character (in user text format)
ICHR2	Second command character (in user text format)
IMAXSZ	The maximum size of IBUF
IBUF	The terminal command buffer

Outputs

IBUF	The initialized terminal command buffer

Errors

11051	First command character (ICHR1) is not in ASCII range (0,127); no-op
11052	Second command character (ICHR2) is not in ASCII range (0,127); no-op

BEG63(ICMD1,ICMD2,IMAXSZ,IBUF)
"Begin 4663 (Plotter command)"

Purpose
Begins a 4663 Plotter style command by initializing the plotter command buffer

Inputs

ICMD1	First cmd char in user text format
ICMD2	Second cmd char in user text format
IMAXSZ	The maximum length of IBUF
IBUF	The plotter command buffer

Outputs

IBUF	The initialized plotter command buffer

Errors

20051	1st cmd char out of range (must be a letter); no-op
20052	2nd cmd char out of range (must be letter/space); no-op
20053	Buffer size too small: must be dimensioned to a minimum of 7; no-op

BELL
"(Ring the device's) bell"

Purpose
Makes device bell ring

BILLBD(ORG,XMAX,YMAX)
"Billboard"

Purpose
Defines a two-dimensional billboard in the 3-D world coordinate system for displaying text and 2-D graphics

Inputs

ORG(3)	An array containing the X, Y, and Z coordinates of the origin of the billboard
XMAX(3)	An array containing the X, Y, and Z coordinates of the point which determines the extent of the X-axis
YMAX(3)	An array containing the X, Y, and Z coordinates of the point to which the Y-axis of the billboard is to extend

Errors

04702	Points defined by ORG and YMAX are too close; no-op
04703	Points defined by ORG and XMAX are too close; no-op
04713	The X- and Y-axes defined by the three arrays are the same line (co-linear); no-op
04723	Illegal to modify viewing with retained segment open; no-op

BKGCLR(ICOLOR)
"Background color"

Purpose
Specifies the desired background color

Inputs

ICOLOR	The index of the desired color; see Table 5

Note
Requires device capable of displaying color.

Table 5

VALID RANGES OF BACKGROUND INDICES

4027	0-7	Solid color
	8-127	Color pattern
4112	0-1	1 bit plane
4112/13	0-7	3 bit planes
4113	0-15	4 bit planes

BORDER(IBVIS)
"Border"

Purpose
Makes a border around the current (active) view visible or invisible

Input

IBVIS	Border visibility switch 0: Turn the border off 1: Turn the border on 2: Reverse the current border visibility

Errors

16851	Border attribute out of range (0,2); no-op
16871	No local bordering capability on current device; no-op

BPROC(INMPRO)
"Begin (downloadable) procedure (definition)"

Purpose
Begins a downloadable procedure definition

Inputs

INMPRO	The downloadable procedure number to be defined (0,255)

Errors

21251	INMPRO out of range (0,255); no-op
21271	Downloadable procedure not present on device; no-op
21272	Segment is open, cannot download procedure

CAMERA(QCAMRA)
"Camera (mode on)"

Purpose
Specifies viewing mode

Inputs
QCAMRA

.TRUE.	Camera mode (default)
.FALSE.	SIG mode

Errors

06221	Illegal to modify viewing environment with retained segment open; no-op

CHR1X(ICHAR,IBUF)
"(Encode a) character (for a) 4110 series (terminal)"

Purpose
Place a user text format character in the terminal command buffer

Inputs

ICHAR	A character in user text format to be placed in the terminal command buffer
IBUF	The terminal command buffer

Outputs

IBUF	The updated terminal command buffer

Errors

11751	Character (ICHAR) not in ASCII range (0,127); no-op
11752	Terminal command buffer (IBUF) is too small for data; no-op

CHRY1X(ICHCNT,ICHARY,IBUF)
"(Encode a) character array (for a) 4110 series (terminal)"

Purpose
Places a user text format string in the terminal command buffer

Inputs

ICHCNT	Number of characters in the string
ICHARY	Array containing characters in current text format
IBUF	The terminal command buffer

Outputs

IBUF	The updated terminal command buffer

Errors

12251	Array length (ICHCNT) out of range (0,100); no-op
12252	A character is not in ASCII range (0,127); no-op

CHRY63(ICHCNT,ICHARY,IBUF)
"(Encode a) 4663 character array"

Purpose
Converts a character string from current user text format to ADE, and puts a character string into the plotter command buffer

Inputs

ICHCNT	Number of characters in the string
ICHARY	Array containing characters in current text format
IBUF	Plotter command buffer

Outputs

IBUF	Updated plotter command buffer

Errors

20851	ICHCNT is out of range (1,100); no-op
20853	IBUF too small to translate string to ADE; no-op

CLIP
"Clip (vectors at clipping edge)"

Purpose
Activates clipping; this is the default

Errors

05321	Illegal to modify viewing with ret. seg open; no-op

CLOCAP
"Close capture (file)"

Purpose
Terminates input to a capture/replay file

Errors

15921	Communications are not currently open; no-op

CLOPOL
"Closed polygon"

Purpose
Specifies that subsequent calls to POLY define closed polygons

CLOSEG
"Close segment"

Purpose
Closes the open retained segment

Errors

03311	There is no retained segment open; no-op

CLRMAP(IMAPNO,ITYPE,PCOLOR)
"Color map"

Purpose
Specifies a color to be updated or added to the color index

Inputs

IMAPNO	Index number (0-15) assigned to the defined color; see Table 10
ITYPE	Specifies method of defining the color 1 RGB (Red, green, blue) 2 CMY (Cyan, magenta, yellow) 3 HLS (Hue, lightness, saturation)
PCOLOR(3)	Color as defined by percentages of each parameter of the indicated ITYPE

Note
Requires device capable of displaying color

CLRPLT(ICOLOR,IDEVIC,IDEVOP,QERASE)
"Plot colored primitives (with a new device)"

Purpose
Draws all visible retained segment primitives of a given color or gray index on a specified device

Inputs

ICOLOR	
−1	Draws all visible primitives, using the current line color index
0-N	A number indicating the color index of visible primitives to be drawn (those with different indices are omitted)
IDEVIC	The number (4027, 4663, etc.) of the output device
IDEVOP	The option number of the output device
QERASE	If .TRUE. the display surface is cleared before drawing If .FALSE. the display surface is not cleared before drawing

Errors

14151	Illegal color index; no-op
14171	Illegal to plot while a segment is open;
14172	CLRPLT command not valid without segments; no-op

Note
Requires device capable of displaying color

CMCLOS
"Communications close"

Purpose
Temporarily closes IGL communication with the terminal

Errors

20121	Communications already closed; no-op

CMOPEN
"Communications open"

Purpose
Establishes IGL communication with the terminal; this is the default

Errors

20021	Communications are already opened; no-op

COPY(NROWS,ZIN,ZOUT)
"Copy (matrix)"

Purpose
Copies a four-column matrix into another matrix

Inputs

NROWS	Number of rows in both matrices
ZIN(NROWS,4)	Input matrix

Outputs

ZOUT(NROWS,4)	Output matrix

Errors

17901	Exit NROWS.LT.1; no-op

CPYCHR(IFNT1,ICHR1,IFNT2,ICHR2)
"Copy character"

Purpose
Copies a character from one font to another

Inputs

IFNT1	Font from which character is to be copied
ICHR1	Character to be copied, specified in current text format (ADE, A1, or AM)
IFNT2	Font to which ICHR1 is to be copied
ICHR2	Character to which ICHR1 is to be copied, specified in current text format room in NFNTBL

Errors

32002	ICHR1 not defined; no-op
32004	ICHR2 out of range for characters in IFNT2; no-op
32021	Not enough room in local IGL font storage to add character description; abort

CPYSEG(ISEG)
"Copy segment"

Purpose
Copies the contents of an existing retained segment into the open retained segment

Inputs

ISEG	Integer name of the segment to be copied

Errors

03601	Segment ISEG is not an existing retained segment; no-op
03602	ISEG is the currently open segment; no-op
03611	ISEG is 0 or negative; no-op
03621	No retained segment is open to copy into; no-op
03622	Incompatible type of segs; cannot copy; no-op

CRDLFT
"Coordinate left (3-D)"

Purpose
Sets the 3-D world coordinate system to left-handed

CRDRHT
"Coordinate right (3-D)"

Purpose
Sets the 3-D world coordinate system to right-handed; this is the default

CVC2I(ILENST,ICHRAY,ICNVTD,ISTOPD)
"Convert character to integer"

Purpose
Converts (decodes) character strings to FORTRAN integer variables

Inputs

ILENST	Number of characters in string to be converted
ICHRAY(ILENST)	String to be converted

Outputs

ICNVTD	Result of the conversion
ISTOPD	Set to the location of the character which terminates the conversion

Errors

18601	ILENST out of range (1,25); no-op

CVC2R(ILENST,ICHRAY,PCNVTD,ISTOPD)
"Convert character to real"

Purpose
Converts (decodes) numerical strings to FORTRAN real variables

Inputs

ILENST	Number of characters to be converted
ICHRAY(ILENST)	Array of characters to be converted

Outputs

PCNVTD	Result of the conversion
ISTOPD	Set to the location of the terminating character, or to ILENST + 1 if there was no terminating character

Errors

18701	ILENST less than or equal to 0; no-op
18721	Conversion terminated by non-numeric character; ISTOPD set
18722	Exponent overflow; indeterminate result in PCNVTD
18723	No legal number converted, PCNVTD set to 0.0

CVI2C(I2CONV,ILENST,ICHRAY)
"Convert integer to character"

Purpose
Converts (encodes) FORTRAN integer variables to numerical strings

Inputs

I2CONV	The integer to be converted
ILENST	Number of characters in ICHRAY

Outputs

ICHRAY(ILENST)	Result of the conversion

CVR2C(P2CONV,ILENST,ICHRAY,IPASTD)
"Convert real to character"

Purpose
Converts (encodes) FORTRAN real variables to character strings

Inputs

P2CONV	The real variable to be converted
ILENST	Number of characters in ICHRAY
IPASTD	Number of digits to appear past the decimal point, to a maximum of 23; a value of −1 suppresses the decimal point

Outputs

ICHRAY(ILENST)	Result of the conversion

Errors

18502	ILENST less than or equal to 0; no-op
18504	IPASTD out of range (−1,23); no-op
18521	String not long enough for conversion; fills string with asterisks

DASHPT(IPAT)
"Dash pattern"

Purpose
Specifies pattern for dashed lines

Inputs

IPAT — An integer indicating the desired dashed-line pattern

0	Specifies that a solid line should be drawn; this is the default
1-9	Specifies hardware-generated dashed-line pattern. For devices without appropriate hardware, an internal IGL routine is called for emulation (see Figure 1). Hardware and software patterns may look slightly different, as may hardware patterns displayed by different devices
< 0 or ≥ 10	A two or more digit sequence to define a pattern, described by a DRAW-MOVE sequence; units are always in GDUs. For example, the integer 12 dictates a DRAW of GDU in length and a MOVE of 2 GDUs. Zero means a dot. A negative sign can be used to force a leading zero. The maximum number of digits used to define the line pattern depends on the maximum integer your computer allows, but cannot exceed 9

Errors

11401	IPAT > 9 digits; no-op

DEGREE
"Degrees"

Purpose
Declares that angles are specified in degrees (default)

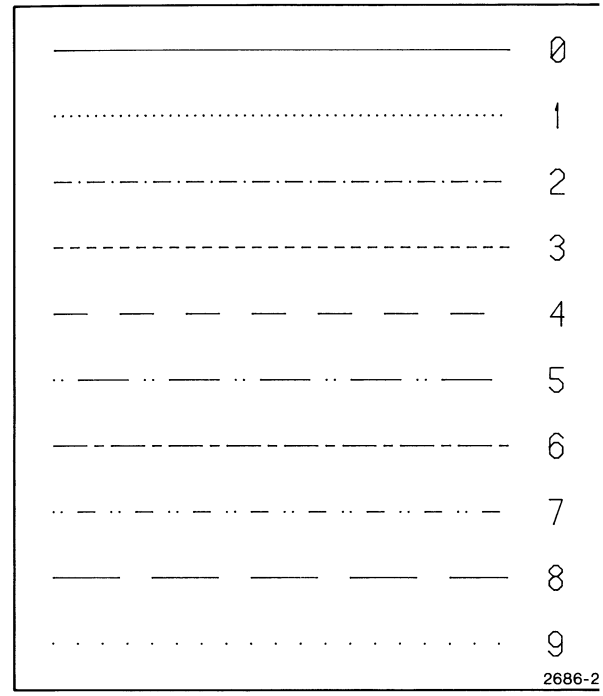


Figure 1. Emulated Dashed-Line Patterns.

DELCHR(IFONT,ICHAR)
"Delete character"

Purpose
Deletes a character from a font

Inputs

IFONT	Identification number of font from which character is to be deleted
ICHAR	Character to be deleted; specified in current text format (ADE, A1, or AM)

Errors

02901	Font number out of range; no-op
02902	Character out of range; no-op
02911	Font not defined; no-op
02912	Character not defined; no-op
02921	Font integrity error (incorrect font pointer table termination code); abort
02922	Font integrity error (incorrect font header identification); abort
02923	Font integrity error (incorrect font header termination code); abort

DELFNT(IFONT)
"Delete font"

Purpose
Deletes a font from IGL's temporary font storage

Inputs

IFONT	Identification number of font to be deleted

Errors

02801	Font number out of range; no-op
02811	Font not defined; no-op
02821	Font integrity error (incorrect font pointer table termination code); abort

DELMBR(ISEG,INUM,IARRAY)
"Delete (a) member (from a segment class)"

Purpose
Deletes a member from one or more segment classes

Inputs

ISEG

−3	Indicates that all segments are to be deleted from the specified class or classes
−2	Indicates that all subsequently defined segments are to be deleted from the specified class or classes
−1	Indicates that all segments are to be removed from the specified class or classes
1-32767	The name of a single segment to be removed from the specified class or classes

INUM	The number of classes from which the segment should be removed
IARRAY	The list of classes from which the segment should be removed

Errors

02051	Segment ISEG is not an existing retained segment; no-op
02052	Parameter INUM is < 1; no-op
02053	Class ID is out of range (−1, 1 through 64); no-op
02061	Illegal to modify dyn. attribute of open segment; no-op
02062	Number of classes > 64, use first 64; report
02071	Parameter ISEG out of range; no-op

DELSEG(ISEG)
"Delete segment"

Purpose
Deletes a retained segment or segments

Inputs

ISEG

−1	Indicates that all retained segments are to be deleted
−3	Indicates that all segments in the match class are to be deleted
1-32767	Indicates a specific retained segment to be deleted

Errors

03401	Retained segment ISEG does not exist; no-op

DELVW(IVWNUM)
"Deletes the specified view"

Purpose
Deletes the specified view

Inputs

IVWNUM	The number of the view to be deleted (1,16); −1 deletes all views

Errors

16351	View is out of range for current device; no-op
16371	No multiple view capability on device; no-op
16372	Attempted to delete current view; no-op
16373	Attempted to delete an undefined view; no-op

Note
Requires device with multiple view capability

DEVFNT(IFNT,IHDFNT)
"Device font"

Purpose
Associates IGL font number with device font number

Inputs

IFNT	IGL font number to be associated with hardware font
IHDFNT	Number of hardware font as it is known to a device (see Table 6)

Errors

03902	IHDFNT out of range for device; no-op

Note
Requires device with multiple hardware fonts; Table 6

Table 6

TEKTRONIX DEVICES WITH MULTIPLE HARDWARE FONTS

Device	Hardware Capabilities
4025/27	Font 0 resident; expandable to 32 fonts (0-31)
4112/13/14	Font 0 resident; expandable to 32767 fonts (0-32767)
4662	Fonts 0-9 resident; expandable to 16 fonts (0-15)
4663	Fonts 0-9 resident (font 7 reserved for APL); expandable to 16 fonts (0-15)

DIST(ICNT,PX,PY,PS)
"(Calculate) distances"

Purpose
Computes cumulative distances along a line

Inputs

ICNT	Number of points in the line
PX(ICNT)	Array containing the X coordinates of the line
PY(ICNT)	Array containing the Y coordinates of the line

Outputs

PS(ICNT)	The cumulative distances along the line

DLTCHR(IFONT,ICHAR)
"Delete (downloaded) character"

Purpose
Deletes a downloaded character from a device font

Inputs

IFONT	Device font number from which character is to be deleted (−1 to device maximum); if IFONT = −1, all fonts are deleted
ICHAR	Character to be deleted, current user format (−1 to 127). If ICHAR = −1, all characters in the specified font will be deleted

Errors

14851	Font (IFONT) not equal to −1 or greater than device limits; no-op
14852	Character (ICHAR) not equal to −1 and out of range (0 to 127); no-op
14871	Device does not support downloaded characters; no-op
14872	Graphic text emulation (Option 3D) expected but not present; no-op

DPOLAR(PDIST,PANGLE)
"Draw (in a) polar (coordinate system)"

Purpose
Draws an arc from the current cursor location to the specified polar coordinates

Inputs

PDIST	The distance from the pivot point
PANGLE	Angle component of destination point

DPROC(INMPRO)
"Delete Procedure (Definition)"

Purpose
Deletes a downloaded procedure definition

Inputs

INMPRO	The downloaded procedure number to be deleted (0 to 255); −1 deletes all procedures

Error

21551	INMPRO out of range (−1 to 255); no-op
21571	Downloadable procedures not present on device; no-op

DRAW(PX,PY)
"Draw (a vector)"

Purpose
Draws a vector from current location to a specified point

Inputs

PX	X coordinate of point
PY	Y coordinate of point

DRAW3D(PX,PY,PZ)
"Draw 3-D (vector)"

Purpose
Draws a vector in the 3-D world coordinate system from the current cursor location to a specified point

Inputs

PX	X coordinate of point
PY	Y coordinate of point
PZ	Z coordinate of point

DRGSEG(ISEG)
"Drag (a) segment"

Purpose
Specifies which segment is to be moved on the screen by the current GIN device

Inputs
ISEG

1 to 32767	Identification number of the segment to be moved

Errors

14451	Segment ISEG out of range (1 to 32767); no-op
14461	Segment ISEG does not exist; no-op
14471	Device does not support segment dragging; no-op

DWNFNT(IFNT,IDVFNT)
"Download (a) Font"

Purpose
Downnloads an IGL font from the host computer to a device

Inputs

IFNT	Number of the IGL font to be downloaded to the device
IDVFNT	Number of the device font to be associated with the downloaded font

Errors

14051	IGL S/W font out of range (0,MAX-NUM-OF-FONTS); no-op
14052	Downloaded font out of range for current device; no-op
14071	Graphics Text Emulation (Option 3D) option not present; no-op
14072	Segment is open, cannot download a font no-op
14073	Device does not support downloaded characters; no-op
14074	Cannot download with active billboard; no-op

EDGE(PXMIN,PXMAX,PYMIN,PYMAX)
"Edge (of clipped area)"

Purpose
Allows the clipping edge to be defined independently of the 2-D viewport

Inputs

PXMIN	Minimum X coordinate of clipping edge
PXMAX	Maximum X coordinate of clipping edge
PYMIN	Minimum Y coordinate of clipping edge
PYMAX	Maximum Y coordinate of clipping edge

Errors

05221	Minimum coordinate greater than or equal to the corresponding maximum coordinate; no-op
05222	Illegal to modify viewing environment while retained segment is open; no-op
05223	The edge must equal the viewport boundary with local viewport; no-op

EDGE3D(PUMIN,PUMAX,PVMIN,PVMAX)
"(Clipping) edge (for) 3-D"

Purpose
Allows the 3-D clipping edge to be defined independently of the 3-D window

Inputs

PUMIN	Minimum U coordinate of clipping edge
PUMAX	Maximum U coordinate of clipping edge
PVMIN	Minimum V coordinate of clipping edge
PVMAX	Maximum V coordinate of clipping edge

Errors

09921	Maximum coordinate < corresponding minimum coordinate; no-op
09931	Illegal to modify viewing with retained segment open; no-op

END1X(IBUF,QSEND)
"End (a 4110 series terminal) command"

Purpose
Terminates the construction of a 4110 command

Inputs

IBUF	The terminal command buffer
QSEND	If .TRUE. the command is sent to the terminal immediately If .FALSE. several commands are sent to the device together

Errors

11251	Terminal command buffer improperly formed; no-op

END63(IBUF,QSEND)
"End (a) 4663 (Plotter command)"

Purpose
Terminates the construction of a 4663 plotter command

Inputs

IBUF	The plotter command buffer
QSND	.TRUE. means send buffer now

Errors

20271	Invalid pointer in IBUF; no-op

ENDPNT(PX,PY)
"Ending point (for line smoothing)"

Purpose
Specifies a pseudo-ending point for calculation of a smoothed line

Inputs

PX	X coordinate of pseudo-ending point
PY	Y coordinate of pseudo-ending point

ENDSLP(PDX,PDY)
"Ending slope (for line smoothing)"

Purpose
Specifies ending slope for a smoothed line

Inputs

PDX	The change in X, to determine the ending slope of the line
PDY	The change in Y, to determine the ending slope of the line

EPROC
"End procedure (definition)"

Purpose
Ends a downloadable procedure definition

Errors

21371	Downloadable procedures not present on device; no-op
21372	Downloadable procedure definition not begun; no-op

EYEBAL(PDX,PDY,PDZ)
"Eyeball (position)"

Purpose
Specifies the displacement of the eye position from the view reference point

Inputs

PDX	X displacement of the EYEBAL, relative to the VRP
PDY	Y displacement of the EYEBAL, relative to the VRP
PDZ	Z displacement of the EYEBAL, relative to the VRP

Errors

06001	EYEBAL position corresponds with the VRP; no-op
06021	Illegal to modify viewing environment with retained segment open; no-op

FATLIN(ICNT,PX,PY,IN,PD,ITYPE)
"Fat Line"

Purpose
Draws wider than normal lines by drawing closely spaced vectors

Inputs

ICNT	Number of points
PX	X points
PY	Y points
IN	Number of additional vectors to be drawn close to the vector defining the character
PD	Distance between vectors, always specified in world units regardless of device surface units
ITYPE	Type of line
1	Hot Dog fat lines
2	Calligraphic lines

FBCP3D(PFDST,PBDST)
"Front (and) back clipping plane 3-D"

Purpose
Specifies the location of the front and back clipping planes along the view plane normal relative to the view reference point

Inputs

PFDST	Distance from VRP to front clipping plane (default is −100.0)
PBDST	Distance from VRP to back clipping plane (default is 0.0)

Errors

05721	Illegal to modify viewing with retained segment open; no-op
05722	PFDST > PBDST; no-op

FILPAN(IPATNO,QOUTLN)
"Fill panel"

Purpose
Specifies way in which panels are filled

Inputs

IPATNO	Number of pattern used to fill panel. See PATERN, Figure 4, and Table 7, Panel Fill Patterns
QOUTLN	
.TRUE.	Outlines panel in current vector color; this is the default
.FALSE.	Does not outline panel

Table 7
PANEL FILL PATTERNS

Device	Valid Range
4027	0 thru 127
4112	−8 thru 32767
4113	−16 thru 32767
emulated	0 thru 24

FIXUP(ILEVEL)
"Fixup (the display information)"

Purpose
Specifies when a 4112 or 4113 terminal updates the display

Inputs

ILEVEL	An integer fixup level
1	No action until new page
2	Additions mode, no deletions until new page
3	Additions mode, deletions mode, ghost images until new page
4	All actions updated immediately

Errors

16951	Fixup level is out of range for current device; no-op
16971	Current device does not support multiple fixup levels; no-op

Note
Requires a device that supports multiple fixup levels

GCHR1X(IBUF,ICHAR)
"(Decode a) character"

Purpose
Converts a 4110 series character report into current user text format

Inputs

IBUF(1)	A buffer which contains the character (in ADE) returned from the terminal.

Outputs

ICHR	Character in current user text format

GDUNIT
"Graphics display units"

Purpose
Specifies that display surface values in subsequent routines are graphics display units (GDUs) (see Table 8); this is the default

GETPIK(IDSEG,IDPIK)
"Get (coordinates to) pick (a segment)"

Purpose
Returns the integer names of a retained segment and a graphic primitive selected with a graphic input (GIN) device

Outputs

IDSEG	The integer name of the picked segment
IDPIK	The integer name ("pick ID") of a primitive within the segment

Errors

01821	No segments pickable, return IDSEG(0) IDPIK(0)
01822	Wrong number of values returned from device; no-op
01823	Type 3 segments not supported; no-op

Table 8

DISPLAY SURFACE SIZES OF TEKTRONIX DEVICES

Device	X by Y Display Area Device			
	MILLIM	INCHES	RASTER	GDUNIT
4006/10	193.5x147.6	7.62x5.81	1023x780	131.2x100.0
4012/13/51	193.5x147.6	7.62x5.81	1023x780	131.2x100.0
4014/15	362.9x276.7	14.28x10.89	1023x780	131.2x100.0
4014/15 (w/EGM)	362.9x276.7	14.28x10.89	4096x3120	131.2x100.0
4016	440.5x335.9	17.34x13.91	4096x3120	131.2x100.0
4025 (4025A)	228.8x150.0	9.01x5.91	639x419	152.5x100.0
4027 (4027A)	244.0x160.0	9.61x6.30	639x419	152.5x100.0
4112	266.7x200.0025	10.5x7.875	4096x2709	151.16x100.0
4113	357.1x267.66	14.06x10.54	4096x2709	151.16x100.0
4114	346.6x264.1	13.64x10.40	4096x3120	131.25x100.0

GETPXL(ICNT,IPIXRY,IENCOD,QEOF,IGOT)
"Get (a run of) pixels"

Purpose
Returns pixel index values from a host computer pixel data file

Inputs

ICNT	Dimension of IPIXRY

Outputs

IPIXRY	Array of pixels returned from file as integers
IENCOD	
1	Unencoded (each integer: one pixel index value)
2	Runlength (each integer pair: number-of-pixels, index-value-of-pixels)
QEOF	Flag indicating an END-OF-FILE on the last read
IGOT	The number of integers returned in IPIXRY

Errors

17151	ICNT is less than or equal to 0; no-op
17171	Header not processed correctly; no-op
17172	Internal consistency error detected on file; no-op
17173	No comma between length, val pair; abort
17174	End of file encountered with no EOF opcode; no-op
17175	Hex character improperly formatted; abort

GETUIN(ILENP,IPRRAY,ITOGET,INARRY,IGOT)
"Get user integer"

Purpose
Gets integer data entered from the keyboard and enters it into the program

Inputs

ILENP	Number of characters used in a prompting string
IPRRAY(ILENP)	Array containing prompting string
ITOGET	Maximum number of integers the program expects

Outputs

INARRY(ITOGET)	Array returning the integers input from the keyboard
IGOT	Number of integers entered from the keyboard

Errors

02521	Entry larger in magnitude than global variable NMXINT; set to NMXINT
02522	ITOGET > 25; first 25 characters entered

Note
Terminate input prematurely by pressing "X" after the last entry

GETURN(ILENP,IPRRAY,ITOGET,PINRAY,IGOT)
"Get user real number"

Purpose
Captures real number data entered from the keyboard and enters it into the program

Inputs

ILENP	Number of characters used in a prompting string
IPRRAY(ILENP)	Array containing prompting string
ITOGET	Maximum number of real numbers the program expects

Outputs

PINRAY(ITOGET)	Array containing the real numbers entered
IGOT	The number of numbers entered

Errors

02421	ILENP > 80; first 80 characters entered
02422	A previously uncleared error was detected; no action taken

Note
Terminate input prematurely by pressing "X" after the last entry

GETUTX(ILENP,IPRRAY,ITOGET,INARY,IGOT)
"Get user text"

Purpose
Captures alphanumeric keyboard response and enters it into the program

Inputs

ILENP	Number of text characters used in a prompting string
IPRRAY(ILENP)	Array containing prompting string
ITOGET	The maximum number of characters the program expects to receive

Outputs

INARY(ITOGET)	Array returning information entered; translated from literal string into current text format
IGOT	The number of characters entered

Errors

02301	ILENP > 80; first 80 characters entered
02303	ITOGET out of range [1,80]; no-op
02311	ILENP < 0; no-op

GINT1X(IBUF,IVAL)
"(Decode an) integer"

Purpose
Converts a 4110 series integer report into an integer on the host

Inputs

IBUF(3)	A buffer that contains the characters (in ADE) returned from the terminal. Three characters are required

Outputs

IVAL	An integer returned from the terminal

Errors

13051	Report not in valid integer-report format; no-op

GINT63(IARY,ISIZE,I1WORD,I2WORD)
"Convert seven ADE values to two integer values"

Purpose
Converts a block of seven ADE characters into two integer values

Inputs

IARY	The array containing the ADE values to be converted
ISIZE	The number of values in the array

Outputs

I1WORD	The integer calculated from ADE values 1,3,5, and 7
I2WORD	The integer calculated from ADE values 2,4,6, and7

Errors

21051	ISIZE too small: must be dimensioned to a minimum of 7; no-op

GRADS
"Gradians"

Purpose
Declares that angles are specified in gradians (400 to a circle)

GRAIN(PGRAIN)
"Granularity (roundness)"

Purpose
Specifies the granularity (roundness) of an arc

Inputs

PGRAIN	A value from 0.0 to 1.0 indicating the granularity of a curved line, where 0.0 is the smoothest curve and 1.0 is a rough approximation; 0.5 is the default.

Errors

11601	PGRAIN out of range [0.0,1.0]; this is not ignored and may be used to exceed normal granularity limits

GRL1X(IBUF,PVAL)
"(Decode a) real number"

Purpose
Converts a 4110 series real number report into a real number on the host

Inputs

IBUF(6)	A buffer that contains the characters (in ADE) returned from the terminal. Six characters are required

Outputs

PVAL	A real number returned from the terminal

Errors

12951	Report not in valid real number report format; no-op

GRSTOP
"Graphics stop"

Purpose
Terminates IGL

GRSTRT(IDEVIC,IOPT)
"Graphics start"

Purpose
Initializes IGL, directs output to a specified device (see Table 9)

Inputs

IDEVIC	Device on which output is to be displayed, usually the 4-digit Tektronix product number
IOPT	The device option code; further defines device by indicating its options

Table 9
GRSTRT DEVICE/OPTION COMBINATIONS

Device, Option (IDEVIC,IOPT)	Device and Features Supported
4006,1	Standard 4006 and 4010
4010,1	4010 with GIN mode
4012,1	Standard 4012
4012,2	4012 with small character option
4013,1	Standard 4013
4013,2	4013 with small character option
4014,1	Standard 4014
4014,2	4014 with EGM
4015,1	4015 with EGM
4015,2	4015 with 4014-compatible characters
4016,1	Standard 4016
4016,2	4016 with 4014-compatible characters
4025,1	Standard 4025
4025,5	4025 with 4010-style protocol
4025,9	4025 with GIN mode
4025,13	4025 with 4010-style protocol and GIN mode
[4025A]	(Use the 4025 device and option combinations)
4027,1	Standard 4027
4027,5	4025 with 4010-style protocol
[4027A]	(Use the 4027 device and option combinations)
4051,1	4051 or 4052 emulating a 4012
4054,1	4054 emulating a 4014
4112,1	4112 with any feature configuration
4113,1	4113 with any feature configuration
4114,1	4114 with any feature configuration
4662,1	Standard 4662
4662,5	4662 plotter with Option 31 (multiple-pen)
4663,1	4663 block mode with 12 bit resolution
4663,5	4663 block mode with 16 bit resolution
4663,9	4663 continuous mode with 12 bit resolution
4663,13	4663 continuous mode with 16 bit resolution
0,1	Non-graphic terminal (e.g. 4024)
0,2	Capture/replay only

GXY1 X(IBUF,PX,PY)
"(Decode an) X,Y pair"

Purpose
Converts a 4110 series X,Y coordinate report into two real numbers on the host representing the coordinate pairs in GDUs

Inputs

IBUF(5)	A buffer that contains the characters (in ADE) returned from the terminal. Five characters are required

Outputs

PX,PY	The X and Y coordinates in GDUs

Errors

12851	Characters in data not in ADE range (32,63); no-op

HDCOPY
"(Make a) hard copy"

Purpose
Activates an attached hard copy unit and copies the screen

HFCLOS(ICHN,QDELET)
"Host file close"

Purpose
Closes a host file communications channel

Inputs

ICHN	Channel to be closed (1-8)
QDELET	.TRUE. deletes the file accessed by ICHN .FALSE. saves the file accessed by ICHN

Errors

20601	Channel (ICHN) number out of range (1,8); no-op
20621	Channel not open; no-op

HFENQ(ICHN,IARRAY)
"Host file enquire"

Purpose
Provides information concerning the status of a specified channel

Inputs

ICHN	Channel for which information is requested (1-8)

Outputs

IARRAY(12)	Channel status information for the requested channel

Errors

20701	Channel number (ICHN) out of range (1,8); no-op

HFOPEN(ICHN,IFNAM,IFFMT,IFILSZ,IRECSZ)
"Host file open"

Purpose
Opens a specified host file communications channel

Inputs

ICHN	Channel number (1-8)
IFNAM(6)	File name, given in current text format
IFFMT	An integer (1-6) specifying the format of the file to be opened and whether a READ or WRITE is to be performed on the file
1	Read from a sequential text file (followed by calls to HFREAD)
2	Write to a sequential text file (followed by calls to HFWRIT)
3	Read from a sequential real number file (followed by calls to HFSQR)
4	Write to a sequential real number file (followed by calls to HFSQW)
5	Read from or write to a random access real number file (followed by calls to HFRNR, HFRNW, or both)
6	Read only from a random access real number file (followed by calls to HFRNR)
IFILSZ	File size in records (lines) for formats 5 and 6; ignored for formats 1 through 4. This argument should reflect the total number of records to be written to a file, or highest numbered record to be read from the file
IRECSZ	Real numbers per record for formats 5 and 6, up to a maximum of 20; ignored for formats 1 through 4

Errors

20501	Channel number out of range (1,8); no-op
20503	File format out of range; no-op
20504	Non-positive file length requested; no-op
20505	Non-positive record size requested; no-op
20521	File already open; no-op

HFREAD(ICHN,ICNT,IARRAY,QEOF)
"Host file read"

Purpose
Reads a text record from a sequential text file

Inputs

ICHN	Channel on which record is to be read (1-8)
ICNT	Number of characters to be read (0-80)

Outputs

IARRAY(80)	Receives the characters in current text format (ADE, A1, or AM)
QEOF	Returns .TRUE. when the end of file is reached

Errors

21001	Channel number out of range (1,8); no-op
21002	Character count out of range (1,80); no-op
21021	Communications channel (ICHN) not open; no-op
21022	File format argument in HFOPEN not set to 1; no-op
21023	End of file, nothing left to read; no-op

HFRNR(ICHN,IRECNO,PARRAY)
"Host file random (real number) read"

Purpose
Reads a record from a random access, real number file

Inputs

ICHN	Channel on which record is to be read (1-8)
IRECNO	Record number to read

Outputs

PARRAY(20)	Real number data read from file specified by ICHN. Must be dimensioned to a maximum value of 20

Errors

21401	Channel number out of range (1,8); no-op
21402	Record number (IRECNO) out of user-defined range; no-op
21421	Communications channel (ICHN) not open; no-op
21422	File format argument in HFOPEN not set to 5 or 6; no-op

HFRNW(ICHN,IRECNO,PARRAY)
"Host file random (real number) write"

Purpose
Writes a record to a random access real number file

Inputs

ICHN	Channel on which record is to be written (1-8)
IRECNO	Number of the record to be written
PARRAY(20)	Real number data to write via the channel specified by ICHN. Must be dimensioned to a maximum value of 20

Errors

21501	Channel number out of range (1,8); no-op
21502	Record number (IRECNO) out of user-defined range; no-op
21521	File not open to be written into; no-op
21522	File format argument in HFOPEN not set to 5; no-op

HFSQR(ICHN,ICNT,PARRAY,QEOF)
"Host file sequential real read"

Purpose
Reads a record from a sequential format file of real numbers

Inputs

ICHN	Channel to be read from (1-8)
ICNT	Number of real numbers to read (0-20)

Outputs

PARRAY(20)	Array to which the real numbers are read
QEOF	Set to .TRUE. if end of file is encountered

Errors

21201	Communications channel (ICHN) number out of range (1,8); no-op
21202	Number of real numbers (ICNT) out of range (0,20); no-op
21221	Communications channel (ICHN) not open; no-op
21222	File format argument in HFOPEN not set to 3; no-op
21223	End of file, nothing left to read; no-op

HFSQW(ICHN,ICNT,PARRAY)
"Host file sequential (real number) write"

Purpose
Writes a record to a sequential real number file

Inputs

ICHN	Channel to be written to (1,8)
ICNT	Number of reals to be written (1,20)
PARRAY(20)	Array of real numbers to be written

Errors

21301	Channel number (ICHN) out of range (1,8); no-op
21302	Number of real numbers (ICNT) < 0; no-op
21321	Specified file not open; no-op
21322	File format argument in HFOPEN not set to 4; no-op

HFWRIT(ICHN,ICNT,IARRAY)
"Host file write"

Purpose
Writes a record to a sequential text format file

Inputs

ICHN	Channel to be written to (1,8)
ICNT	Number of characters to be written
IARRAY(80)	Array of characters to be written; specified in current text format

Errors

21101	Communications channel (ICHN) number out of range (1,8); no-op
21102	Number of characters (ICNT) out of range (1,80); no-op
21121	Specified file not open; no-op
21122	File format argument in HFOPEN not set to 2; no-op

HOME
"(Return to) home (position)"

Purpose
Moves the cursor to a location one character position down from the upper left corner of the viewport

HSTCPY(IDIRCT,IORGLN,IORGFL,IDESLN,IDESFL)

"Host (computer file) copy"

Purpose

Transfers files from the host mass storage device to a terminal flexible disk or vice versa

Inputs

IDIRCT	Direction of file transfer
0	From host to flexible disk
1	From flexible disk to host
IORGLN	Number of characters in the source file name
IORGFL	Source file name in current text format
IDESLN	Number of characters in the destination file name
IDESFL	Destination file name in current text format

Errors

18451	Invalid file direction requested; no-op
18471	Block mode communications is not installed; no-op
18472	Local storage unit not available on device; no-op
18473	Origin name too long, truncated to 9 chars; report
18474	Origin specifier too long, truncated to 6 chars; report
18475	Destin name too long, truncated to 9 chars; report
18476	Destin specifier too long, truncated to 6 chars; report
18477	No communication channels available; no-op

Note

This routine requires block mode communication with the host computer. Check with a system programmer to find out whether your IGL library allows block mode I/O.

I2BIN(IWORD,ISIZE,IARRAY)

"Convert integer to binary"

Purpose

Converts an integer value into a bit string representative of size determined by ISIZE

Inputs

IWORD	The integer value to be converted
ISIZE	The number of bits into which the integer is converted (the dimension of IARRAY)

Outputs

IARRAY	The array containing the bit string representation

Errors

21751	IWORD out of range (−32767,32767); no-op
21752	ISIZE out of range (1,16); no-op

IERRNM(QCLEAR)

"Integer error number"

Purpose

Returns the routine number where the last error was encountered

Inputs

QCLEAR	Set to .TRUE. if NERROR, the global variable containing the error number, is to be cleared Set to .FALSE. if NERROR is not to be cleared

Outputs

IERRNM	The global variable NERROR is returned in the specified variable name

INCHES

"Inches"

Purpose

Specifies that display surface values in subsequent routines are inches (see Table 8)

INIFIL(IFNAM,IFILSZ,IMXFNT)
"Initialize file"

Purpose
Initializes a host file so that it is in the proper format to contain one or more fonts

Inputs

IFNAM	Name of the file to contain the fonts; specified in current text format (ADE, A1, or AM)
IFILSZ	File size; specified in terms of 20-word records
IMXFNT	Maximum font number to be contained in the file; first font number is 0, maximum allowable value is installation dependent

Errors

17621	No host file communication channels available; no-op

INIFNT
"Initialize (default) font"

Purpose
Initializes default software font

INQ2PV(ISEG,PX,PY)
"Inquire (segment type 1 or) 2 pivot point"

Purpose
Returns the pivot point of a type 1 or 2 segment or the X and Y pivot point coordinates of a type 3 segment

Inputs
ISEG

−2	Default
1-32767	A specific type 1 or 2 segment

Outputs

PX,PY	Pivot point in NDCs; default is (0.0,0.0)

Errors

03951	Segment ISEG is not an existing retained segment; no-op
03971	Parameter ISEG out of range; no-op

INQ2TN(ISEG,PSX,PSY,PANG,PTX,PTY)
"Inquire (type) 2 (segment image transform parameters)"

Purpose
Returns the 2-D image transform parameters of a type 2 or 3 segment

Inputs
ISEG

−2	Default
1-32767	A specific type 1 or 2 segment

Outputs

PSX,PSY	Scale factors applied to the X- and Y-axes respectively
PANG	Angle of rotation, measured in current angle units in a counterclockwise direction on the display surface
PTX,PTY	X and Y NDC coordinates or the point to which the segment pivot point is moved prior to drawing the segment

Errors

03751	Segment ISEG is not an existing retained segment; no-op
03771	Parameter ISEG out of range; no-op
03781	The seg's type is not compatible with current req.; no-op

Note
Requires installation of 3-D Graphics Support (Option 4B)

INQ3PV(ISEG,PX,PY,PZ)
"Inquire (segment type) 3 pivot point"

Purpose
Returns the pivot point of a type 3 segment

Inputs
ISEG

−2	Default
1-32767	A specific type 3 segment

Outputs

PX,PY,PZ	Pivot point in NDCs; default is (0.0,0.0,0.0)

Errors

04051	Segment ISEG is not an existing retained segment; no-op
04071	Parameter ISEG out of range; no-op
04072	3-D support not available; no-op
04081	The seg's type is not compatible with current req.; no-op

INQ3TN(ISEG,PSX,PSY,PSZ,PAX,PAY,PAZ, PTX,PTY,PTZ)
"Inquire (type) 3 (segment image transform)"

Purpose
Returns the image transform parameters of a type 3 segment

Inputs
ISEG

−2	Current default image transform values
1-32767	A specific type 3 segment

Outputs

PSX,PSY,PSZ	Scale factors applied to the X-, Y-, and Z-axes respectively
PAX,PAY,PAZ	Angle of rotation, expressed in current angle units (rotation around an axis is positive if, when looking down the axis toward the NDC origin, the rotation appears to be clockwise)
PTX,PTY,PTZ	NDC coordinates of the point to which the segment pivot point is moved prior to drawing the segment

Errors

03851	Segment ISEG is not an existing retained segment; no-op
03871	Parameter ISEG out of range; no-op
03872	3-D support not available; no-op
03881	The seg's type is not compatible with current req.; no-op

Note
Requires installation of 3-D Graphics Support (Option 4B)

INQAPT(PVAL)
"Inquire aperture (size)"

Purpose
Returns the pick aperture size

Outputs

PVAL	Length (in current display surface units) of a side of the square pick aperture

INQBTM(IVAL)
"Inquire segment batch mode (setting)"

Purpose
Returns value indicating the current batch mode

Outputs
IVAL

2	Indicates that all changes with visible effects on retained segments (including deletions, changes to dynamic attributes, and graphic and text output) are deferred by BATCH; changes to nonretained segments are not deferred
3	Indicates that only changes which cause a new page action (a terminal to erace the screen and redraw or a plotter to advance the paper or prompt user to change the paper) are deferred by BATCH
4	Indicates that BATCH defers nothing

INQCLS(ISEG,INUM,IARRAY,IGOT)
"Inquire (segment classes)"

Purpose
Returns the integer names of the classes to which a segment belongs

Inputs

ISEG	The segment whose class membership is to be returned
INUM	The length of array IARRAY (number of names expected

Outputs

IARRAY	The list of the classes to which ISEG belongs
IGOT	The number of classes to which ISEG belongs

Errors

04551	Retained segment ISEG does not exist; no-op
04552	INUM .LT. no. of classes (fill to INUM; IGOT= ACTUAL)
04561	ISEG out of range ((-2),(1-32767)); no-op

INQCRV(ICURVW)
"Inquire (about the) current view"

Purpose
Returns the number of the current (active) view

Outputs

ICURVW	The current (active) view

Errors

18971	Current device does not support multiple local view; no-op

INQCUR(ISEG)
"Inquire (about the) cursor"

Purpose
Returns the name of the GIN cursor

Outputs
ISEG

0	The crosshair cursor (default)
1-32767	A retained segment acting as the cursor

Errors

14771	Current device does not support user-defined cursors; no-op

INQDET(ISEG,QVAL)
"Inquire (segment) detectability (attribute)"

Purpose
Returns detectability attribute of specified retained segment

Inputs
ISEG

−2	Default
1-32767	A specific retained segment

Outputs
QVAL

.TRUE.	Indicates that the segment is detectable
.FALSE.	Indicates that the segment in not detectable; default

Errors

04351	Retained segment ISEG does not exist; no-op
04361	ISEG out of range ((−2),(1-32767)); no-op

INQDM(ISEG,IMODE)
"Inquire (about the) display mode"

Purpose
Returns the display mode of a given segment

Inputs
ISEG

−2	The default segment display mode
1-32767	The number of a particular retained segment

Output

IMODE	Display mode of the specified segment For the 4114: 1 Storage mode 2 Refresh mode For the 4112 and 4113: 1 Set mode 2 XOR mode

Errors

14351	Segment ISEG does not exist; no-op
14352	Display mode received from device is invalid; no-op
14361	Segment number is invalid; no-op
14371	Device does not support multiple seg display modes; no-op

INQFML(PDIST)
"Inquire (plotter) form length"

Purpose
Reads the current form length in display surface units

Outputs

PDIST	Form length in current display surface units

Errors

22371	Media advance option not present on current device; no-op

Note
Requires device with media advance capability

INQGIN(IDEV)
"Inquire (about) GIN (status)"

Purpose
Inquires about which device is being used as the graphic input (GIN) device

Outputs

IDEV	Current GIN device:
0	No GIN device available
1	The thumbwheels (the default GIN device
2	Optional data tablet
3	A plotter on port 0 of 3PPI
4	A plotter on port 1 of 3PPI
5	A plotter on port 2 of 3PPI

INQGRD(PXGRID,PYGRID)
"Inquire (about) gridding"

Purpose
Returns the current X and Y grid spacing for graphic input

Outputs

PXGRID	X grid spacing in world space units
PYGRID	Y grid spacing in world space units

Errors

10171	Device does not support input gridding; no-op

Note
Requires a device capable of input gridding

INQHIL(ISEG,QVAL)
"Inquire (about segment) highlight (attribute)"

Purpose
Returns highlight attribute of specified retained segment

Inputs

ISEG	
−2	Default
1-32767	A specific retained segment

Outputs

QVAL	
.TRUE.	Indicates that the segment is highlighted
.FALSE.	Indicates that the segment in not highlighted; default

Errors

04251	Retained segment ISEG does not exist; no-op
04261	ISEG out of range ((−2,),(1-32767)); no-op

INQINK(INK)
"Inquire (about) inking"

Purpose
Inquires whether inking is invoked for subsequent GIN operations

Outputs

INK	
0	Ink for subsequent GIN operations
1	Do not ink for subsequent GIN operations; (default: 1)

Errors

10371	Device does not support inking features; no-op

Note
Requires a device capable of inking

INQMCL(IMNUM,IMRAY,IMGOT,INMNUM, INMRAY,INMGOT)
"Inquire (about the) match class (matching criteria)"

Purpose
Returns the criteria by which match class membership is determined

Inputs

IMNUM	The length of the array IMRAY
INMNUM	The length of the array INMRAY

Outputs

IMRAY	An integer array containing the names of classes to which a segment must belong to be a member of the match class
IMGOT	The number of classes to which a segment must belong to be a member of the match class
INMRAY	An integer array containing the names of classes to which a segment must not belong if it is to be included in the match class
INMGOT	The number of classes to which a segment must not belong if it is to be included in the match class

Errors

04651	IMNUM .LT. # of mat classes (fill to IMNUM; IMGOT = ACTUAL)
04654	INMNUM .LT. # of mat classes (fill to INMNUM; INMGOT = ACTUAL)

INQNMS(ISEG,INUM,IARRAY,IGOT)
"Inquire (about segment) names"

Purpose
Returns the names of retained segments

Inputs
ISEG
- −1 — All retained segments
- 1-32767 — The name of a retained segment

INUM — Length of array IARRAY (number of names expected)

Outputs
IARRAY — List of retained segments
IGOT — The number of retained segments

Errors
04751 — Illegal segment value; no-op
04752 — INUM .LT. # of defined segs requested (fill to INUM; IGOT= ACTUAL)

INQPBM(IXPOS,IYPOS)
"Inquire (about the) pixel beam (position)"

Purpose
Returns the position of the pixel beam in pixel space relative to the current pixel viewport

Outputs
IXPOS — X position of the pixel beam relative to the lower-left corner of the pixel viewport
IYPOS — Y position of the pixel beam relative to the lower-left corner of the pixel viewport

Errors
19071 — Current device does not support pixel access; no-op

Note
Requires a device capable of pixel access

INQPID(ID)
"Inquire current pick ID"

Purpose
Returns the last pick ID specified

Outputs
ID
- 0 — Indicates that the subsequent primitives will not be pickable
- 1-32767 — The pick ID associated with primitives in the currently open segment

INQPNL(IOVR,IFBRDY,ISYNCH)
"Inquire (about the) panel (environment values)"

Purpose
Returns the current values that specify how a panel is filled

Outputs
IOVR — Overstrike or replace mode value:
- 0 — Replace
- 1 — Overstrike

IFBRDY — Fill-over-boundary value:
- 0 — No
- 1 — Yes

ISYNCH — Determines how the fill pattern is to be oriented on the screen
- 0 — The pattern is synchronized with the viewport
- 1 — The pattern is synchronized with the lower left panel edge
- 2 — The pattern is synchronized with the whole screen

Errors
15071 — Current device does not support pixel access; no-op

Note
Requires a device capable of pixel access

INQPRI(ISEG,IPRTY)
"Inquire (segment display) priority"

Purpose
Returns display priority of a specified retained segment

Inputs
ISEG
- −2 — Default
- 1-32767 — Integer name of a specific segment

Outputs
IPRTY — An integer from 0 to 32767 denoting display priority of the segment

Errors
04451 — Retained segment ISEG does not exist; no-op
04461 — ISEG out of range ((−2),(1-32767)); no-op

INQPVW(IXMIN,IXMAX,IYMIN,IYMAX)
"Inquire (about the) pixel viewport (dimensions)"

Purpose
Returns the current values that specify the size and position of the pixel viewport in raster memory space units (X= 0 to 479, Y= 0 to 639)

Inputs

IXMIN	Current minimum X value of the pixel viewport
IXMAX	Current maximum X value of the pixel viewport
IYMIN	Current minimum Y value of the pixel viewport
IYMAX	Current maximum Y value of the pixel viewport

Errors

17671	Device does not support pixel access; no-op

INQPXL(ISRFNM,IALU)
"Inquire (about the) pixel (image environment)"

Purpose
Returns the current values that specify the surface that the pixel viewport is on and the ALU mode of the pixels in that image

Outputs

ISRFNM	Specifies which surface the pixel viewport is on
IALU	Specifies which of 16 ALU modes is currently set

Errors

18771	Current device does not support pixel access; no-op

Note
Requires a device capable of pixel access

INQRUB(IRUBND)
"Inquire (about) rubberbanding"

Purpose
Inquires whether rubberbanding is enabled for subsequent GIN operations

Outputs
IRUBND

0	Rubberbanding is disabled for subsequent GIN functions (default)
1	Rubberbanding is enabled for subsequent GIN functions

Errors

10871	Device does not support rubberbanding; no-op

Note
Requires a device capable of rubberbanding

INQSRF(ISRFNM,IPLAN,ISVIS,ISPRIO)
"Inquire (about) surface (attributes)"

Purpose
Returns attributes of the specified surface

Inputs

ISRFNM	Surface number to inquire about

Outputs

IPLAN	The number of bit planes assigned to the specified surface
ISVIS	Surface visibility
0	Invisible
1	Visible
2	Blinking
ISPRIO	Display priority of the surface

Errors

16551	Surface number is out of range for the current device; no-op
16571	Device not capable of multiple surfaces; no-op

Note
Requires a device capable of multiple surfaces

INQSTR(QSTR,ITIME,PDIST)

"Inquire (about) stroking"

Purpose

Returns the stroke filtering parameters for subsequent tablet LOCATE operations

Outputs

QSTR	Stroke parameters for subsequent locates:
.TRUE.	Stroke input enabled with the specified time and distance filtering
.FALSE.	Stroke input disabled
ITIME	The value (in milliseconds) to be used for stroke time filtering; zero denotes no time filtering
PDIST	The value (in world space) to be used for stroke distance filtering; zero denotes no distance filtering

Errors

10571	Device does not support stroke input; no-op

INQTRN(ISEG,PX,PY)

"Inquire translation coordinates"

Purpose

Returns the 2-D translation coordinates of a type 1, 2, or 3 segment

Inputs

ISEG

−2	Default
1-32767	Integer name of a specific segment

Outputs

PX,PY	The translation coordinates of ISEG; default is (0.0,0.0)

Errors

03651	Retained segment ISEG does not exist; no-op
03661	ISEG out of range ((−2),(1-32767)); no-op

INQTYP(ISEG,ITYPE)

"Inquire segment type"

Purpose

Returns segment type specifications

Inputs

ISEG

−2	Default
1-32767	Integer name of segment whose type is requested

Outputs

ITYPE

0	Indicates a nonretained segment
1	Indicates a retained segment which can be translated in two dimensions by an image transform
2	Indicates a retained segment which can be scaled, rotated and translated in two dimensions by an image transform
3	Indicates a retained segment which can be scaled, rotated and translated in three dimensions by an image transform

Errors

03351	Retained segment ISEG does not exist; no-op
03361	ISEG out of range ((−2),(1-32767)); no-op

INQVIS(ISEG,QVAL)

"Inquire (segment) visibility (attribute)"

Purpose

Returns visibility attribute of specified retained segment

Inputs

ISEG

−2	Default
1-32767	Integer name of a specific segment

Outputs

QVAL

.TRUE.	Indicates that the segment is visible: default
.FALSE.	Indicates that the segment is invisible

Errors

03151	Retained segment ISEG does not exist; no-op
03161	ISEG out of range ((−2),(1-32767)); no-op

INQVW(IVWNUM,IDEFIN,ISRFNM,IBCKGD, IBORDR,PDIMEN)
"Inquire (about a) view"

Purpose
Returns attributes of a specified view

Inputs

IVWNUM	View number to inquire about

Outputs

IDEFIN	Returns 1 if the view is defined, otherwise 0
ISRFNM	Number of the surface the view occupies
IBCKGD	Color index used to erase the view
IBORDR	Color index of the view border
PDIMEN(4)	Array of XMIN, XMAX, YMIN, YMAX of viewport in display surface units

Errors

16151	View number is out of range for current device; no-op
16171	No multiple view capability on device; no-op

Note
Requires a device capable of multiple views

INRY1X(INCNT,IARRAY,IBUF)
"(Encode an) integer array"

Purpose
Places an integer array in the terminal command buffer

Inputs

INCNT	Number of elements in the integer array
IARRAY	Name of the array containing the integers
IBUF	The terminal command buffer

Outputs

IBUF	The updated terminal command buffer

Errors

11951	Array length (INCNT) is negative; no-op
11952	Value in array outside terminal's range (−32767,-32767); no-op
11953	Terminal command buffer too small for data; no-op

INT1X(IVAL,IBUF)
"(Encode an) integer"

Purpose
Places an integer in the terminal command buffer

Inputs

IVAL	The integer value to be encoded
IBUF	The terminal command buffer

Outputs

IBUF	The updated terminal command buffer

Errors

11351	IVAL is out of the terminal's range (−32767,32767); no-op
11352	Terminal command buffer too small for data; no-op

INT63(IVAL,IBUF)
"(Encode a) 4663 integer"

Purpose
Converts integers to ADE and put them in the plotter command buffer

Inputs

IVAL	The integers to be converted
IBUF	The plotter command buffer

Outputs

IBUF	The updated plotter command buffer

Errors

20351	IVAL out of range (−32767,32767);no-op
20352	Buffer (IBUF) too small to convert integer to ADE; no-op

INUMBR(INTVAL,IMXCHR)
"Integer number (output)"

Purpose
Displays integer data as text

Inputs

INTVAL	The integer to be displayed
IMXCHR	Maximum number of characters to displa

Errors

02201	IMXCHR < 1; no-op
02221	IMXCHR > 25; uses only first 25 characters

KA12AS(ICNT,IA1RAY,IASRAY)
"Convert (from) A1 to ADE"

Purpose
Converts character string from A1 to ADE format

Inputs

ICNT	Number of characters to be converted
IA1RAY(ICNT)	Array of characters in A1 format

Outputs

IASRAY(ICNT)	The resulting ADE array

Errors

18201	ICNT < 0; no-op

KAM2AS(ICNT,IAMRAY,IASRAY)
"Convert (from) AM to ADE"

Purpose
Converts character string from AM to ADE format

Inputs

ICNT	Number of characters to be converted
IAMRAY(ICNT)	Array of characters in AM format

Outputs

IASRAY (ICNT)	The resulting ADE array

Errors

18001	ICNT < 0; no-op

KAS2A1(ICNT,IASRAY,IA1RAY)
"Convert (from) ADE to A1"

Purpose
Converts character string from ADE to A1 format

Inputs

ICNT	Number of characters to be converted
IASRAY(ICNT)	Array of characters in ADE format

Outputs

IA1RAY(ICNT)	The resulting A1 array

Errors

18301	ICNT < 0; no-op

KAS2AM(ICNT,IASRAY,IAMRAY)
"Convert (from) ADE to AM"

Purpose
Converts character string from ADE to AM format

Inputs

ICNT	Number of characters to be converted
IASRAY(ICNT)	Array of characters in ADE format

Outputs

IAMRAY(ICNT)	The resulting AM array

Errors

18101	ICNT < 0; no-op

LINCLR(ICOLOR)
"Line color"

Purpose
Specifies the desired line color

Inputs

ICOLOR	Number of selected color

Note
Requires a device capable of displaying color

LLSQ(IPNTS,IDEGP1,PXRAY,PYRAY,IWRKSZ, PCOEF,PWORK)
"Least squares (fit)"

Purpose
Fits a curve of specified degree as close as possible to given points defining a curve

Inputs

IPNTS	The number of points to which the polynomial is to be fit
IDEGP1	The degree of the polynomial to be fit, plus one
PXRAY(IPNTS)	Array containing X coordinates of the points to be fit
PYRAY(IPNTS)	Array containing Y coordinates of the points to be fit
IWRKSZ	The size of the supplied work array, PWORK: size should be at least (IDEGP1)*(IDEGP1+1)

Outputs

PCOEF(IDEGP1)	Array containing the coeffecients of the polynomial
PWORK(IWRKSZ)	Scratch workspace specified by user

Errors

28605	IWRKSZ < (IDEGP1 * (IDEGP1+1)); no-op
28622	Unstable fit, usually caused by overlapping points or IDEGP1 too large; zeroes returned in PCOEF

LOC3D(IMAXPT,PX,PY,PZ,IDAT,IGOT)
"Locate 3-D (points)"

Purpose
Obtains digitized points from the graphics device and returns them as 3-D WCS (world coordinate system) units.

Inputs

IMAXPT	Maximum number of points to be located

Outputs

PX(IMAXPT)	Array containing the X coordinates of points returned in WCS units
PY(IMAXPT)	Array containing the Y coordinates of points returned in the WCS
PZ(IMAXPT)	Array containing the Z coordinates of points returned in the WCS
IDAT(IMAXPT)	Character(s) used to digitize the point(s)
IGOT	Number of points actually received

Errors

01301	IMAXPT < 1; no-op
01311	IMAXPT > 50; first 50 points digitized
01321	Plane of billboard is perpendicular to screen; no-op

Note
Requires device with GIN (graphics input) mode; actions to digitize points and/or to prematurely stop input are device-dependent

LOCATE(IMAXPT,PXARAY,PYARAY,IDAT,IGOT)
"Locate (points)"

Purpose
Puts the terminal into graphic input mode (GIN) and stores coordinates of points located by the graphic cursor

Inputs

IMAXPT	Maximum number of points to be located

Outputs

PXARAY(IMAXPT)	Array containing X coordinates of points located
PYARAY(IMAXPT)	Array containing Y coordinates of points located
IDAT(IMAXPT)	Character(s) used to digitize the point(s)
IGOT	Number of points located

Errors

00901	IMAXPT < 1; no-op
00911	IMAXPT > 50; first 50 points digitized

MAKCUR
"Make (display) current (immediately)"

Purpose
Transmits the contents of the IGL I/O buffer, updating the display immediately

MARGIN(PDIST)
"Margin"

Purpose
Defines a left and right margin for use during justification and truncation of character strings; specifies the "home" position

Inputs

PDIST	Distance between left and right margins in world units; default is −1.0

Note
Only affects environment of TYPSET routine

MARKER(PX,PY,IMARK)
"Marker"

Purpose
Displays a symbol at a specified point on the device surface

Inputs

PX	X coordinate of point where marker will be placed, in world coordinates
PY	Y coordinate of point where marker will be placed, in world coordinates
IMARK	ADE value of marker number, in current marker font; see Figures 2 and 3

Errors

02721	Marker emulation expected but not available; no-op

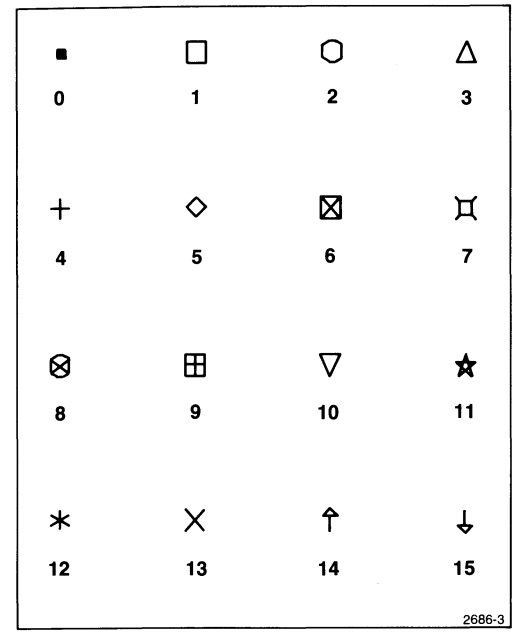


Figure 2. Default Markers.

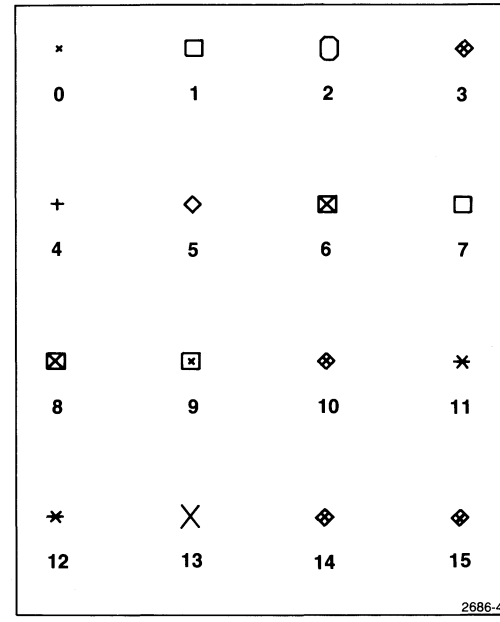


Figure 3. 4110 Series Markers.

MATIDN(PMAT)
"(Generate) identity matrix"

Purpose
Generates an identity matrix

Outputs

PMAT(4,4)	The identity matrix

MATMUL(IR1,ICR,IC2,PMAT1,PMAT2,PRESLT)
"Matrix Multiplication"

Purpose
Multiply two matrices

Inputs

IR1	Number of rows in the first matrix
ICR	Number of columns in the first matrix and the number of rows in the second and resultant matrix
IC2	Number of columns in the second and resultant matrix
PMAT1(IR1,ICR)	First matrix
PMAT2(ICR,IC2)	Second matrix

Outputs

PRESLT(IR1,IC2)	The resultant matrix

Errors

17801	One of the input arguments for row/column is less than or equal to 0

MILLIM
"Millimeters"

Purpose
Specifies that display surface values in subsequent routines are millimeters (see Table 8)

MODELT
"Modeling transform"

Purpose
Specifies that subsequent scaling, rotation, and translation transforms occur in world coordinate system as modeling transforms (default)

MOVE(PX,PY)
"Move (the cursor)"

Purpose
Moves cursor to a specified point without drawing a vector

Inputs

PX	X coordinate of point to which cursor moves
PY	Y coordinate of point to which cursor moves

MOVE3D(PX,PY,PZ)
"Move 3-D (cursor)"

Purpose
Moves cursor to a specified point in the 3-D world coordinate system without drawing a vector

Inputs

PX	X coordinate of point to which cursor moves
PY	Y coordinate of point to which cursor moves
PZ	Z coordinate of point to which cursor moves

MPOLAR(PDIST,PANGLE)
"Move (in a) polar (coordinate system)"

Purpose
Moves to the specified polar coordinates

Inputs

PDIST	The distance from the pivot point
PANGLE	Angle component of the destination point

MRKCLR(ICOLOR)
"Marker color"

Purpose
Sets marker color

Inputs
ICOLOR — Number of a color; see Table 10, IGL Default Color Maps

Note
Requires device capable of displaying color

Table 10

IGL DEFAULT COLOR MAPS

Index	4027	4112 Light-ness	4112 RGB or CMY	4113
0	white	black	black	black
1	red	21%	white	white
2	green	27%	white	red
3	blue	41%	white	green
4	yellow	57%	white	blue
5	cyan	68%	white	cyan
6	magenta	81%	white	magenta
7	black	white	white	yellow
8	n/a	white	white	red-yellow
9	n/a	white	white	green-yellow
10	n/a	white	white	green-cyan
11	n/a	white	white	blue-cyan
12	n/a	white	white	blue-magenta
13	n/a	white	white	red-magenta
14	n/a	white	white	dark gray
15	n/a	white	white	light gray
16-32677	n/a	white	white	light gray

MRKFNT(IFONT)
"Marker font"

Purpose
Selects font to be used for marker output

Inputs
Integer number of font

Errors
13101 — Font number < 0; no-op

MTR3D(PTRN,QREL)
"Matrix transform 3-D"

Purpose
Provides 3-D modeling capability

Inputs
PTRN(4,4) — The transform matrix (row, column)
QREL
- .TRUE. — Multiplies appropriate transforms by PTRN
- .FALSE. — Replaces appropriate transforms by PTRN

Errors
08801 — Fourth column of matrix out of range, must be (0.0,0.0,0.0,1.0); no-op
08821 — Singular matrix transforms; no-op

MTRAN(PTM,QRELTR)
"Matrix transform"

Purpose
Applies a given 2D matrix transform

Inputs
PTM(2,3) — The transform matrix
QRELTR
- .TRUE. — Indicates that the given matrix transform should be applied incrementally to the current transform the order in which it is applied is determined by a prior call to MODELT or VIEWT
- .FALSE. — Indicates that the given matrix transform replaces the current transform

Errors
07301 — Degenerate transformation specified; no-op if the combination of the current modeling/viewing transform and the window/viewport transform result in a singular total transform, the old total transform is kept, but the new modeling/viewing transform is stored anyway

MVLDPT
"(Perform a) MOVE (to the) load point (position)"

Purpose
Performs a MOVE to the 4663 load point position

NDC2W2(XNDC,YNDC,XWORLD,YWORLD)
"(Convert) NDC (coordinates) to 2(-D) World (coordinates)"

Purpose
Converts 2-D NDC coordinates to 2-D world coordinates

Inputs

XNDC	The X-axis NDC coordinate to be converted
YNDC	The Y-axis NDC coordinate to be converted

Outputs

XWORLD	An X-axis world coordinate
YWORLD	A Y-axis world coordinate

NDC2W3(XNDC,YNDC,ZNDC,XWORLD, YWORLD,ZWORLD)
"(Convert) NDC 3(-D) to World (Coordinates)"

Purpose
Converts 3-D NDC's to 3-D world coordinates

Inputs

XNDC	The X-axis NDC coordinate to be converted
YNDC	The Y-axis NDC coordinate to be converted
ZNDC	The Z-axis NDC coordinate to be converted

Outputs

XWORLD	An X coordinate in world space
YWORLD	A Y coordinate in world space
ZWORLD	A Z coordinate in world space

NEWDEV(IDEVIC,IOPT)
"New device"

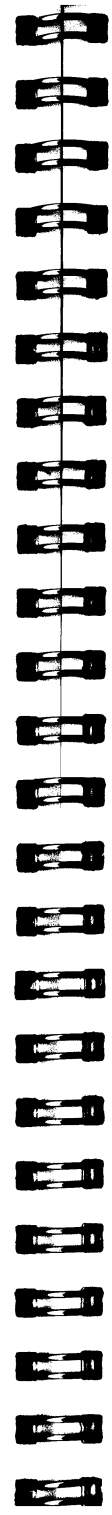
Purpose
Directs IGL output to a different device (see Table 9)

Inputs

IDEVIC	Device on which output is to be displayed; usually the four-digit Tektronix product number
IOPT	The device option code; further defines device by indicating its options

Errors

15721	The specified device (IDEVIC)/option (IOPT) combination given in the call is not supported; no-op



NEWPAG
"(Start a) new page"

Purpose
Provides a clean surface for display of output

NOCLIP
"No clipping (of vectors)"

Purpose
Terminates viewport clipping

NORMAL(N1,N2,PARRAY,QSNGL)
"Normalize (matrix)"

Purpose
Returns the normalized version of an N1 x N2 matrix (PARRAY) or indicates that the array is singular

Inputs

N1	Row dimensions of input matrix
N2	Column dimensions of input matrix
PARRAY(N1,N2)	The input array to be normalized

Outputs

PARRAY(N1,N2)	The normalized array
QSNGL	Set to .TRUE. if the matrix is singular

NOSMOO
"(Do) not smooth"

Purpose
Terminates line smoothing (default)

OPNCAP(IFNAM)
"Open capture (file)"

Purpose
Initiates capture of IGL output to a file

Inputs

IFNAM(6)	A six character name assigned to the file being created; entered in current text format

Errors
No error messages are generated by OPNCAP; however an error is detected in HFOPEN if the file cannot be opened

OPNPOL
"Open polygon"

Purpose
Specifies that subsequent polygons are not automatically drawn as closed polygons; this is the default

OPNSEG(ISEG)
"Open segment"

Purpose
Opens a new segment

Inputs

ISEG	An integer (1-32767) to identify the new segment

Errors

03101	Parameter ISEG is not a legal segment name; no-op
03111	Retained segment ISEG already exists; no-op
03121	There is already an open retained segment; no-op
03122	Viewport/clipping ext. may cause unexpected results; report

Defaults
A segment opened by a call to OPNSEG will be type 2 unless you have called SETTYP to specify otherwise. Dynamic segment attributes of the new segment are determined by the system default or by calls to specific attribute-setting routines.

PAG663(ISIZE,IFORM,IRATIO,QPRMPT)
"(Change IGL/)4663 page (size)"

Purpose
Updates the IGL environment in response to a change in 4663 parameter entry card settings for page size, margins, or aspect ratio

Inputs

ISIZE

Page	Size:
1	C
2	B
3	A
4	A2
5	A3
6	A4

IFORM

Page	Format:
1	Drafting
2	Graphing

IRATIO

Aspect	Ratio:
1	Full page
2	3X:2Y
3	4X:3Y
4	1X:1Y
5	3X:4Y
6	2X:3Y

QPRMPT .TRUE. indicates a prompt is sent to the user to set the Parameter Entry Card

Errors

21651	ISIZE out of range (1,6); no-op
21652	IFORM out of range (1,2); no-op
21653	IRATIO out of range (1,6); no-op
21671	Device is not a 4663 plotter; no-op

Note
Requires a 4663 plotter with parameter entry card settings corresponding to argument values

PANEL(ICNT,PXARAY,PYARAY)
"Panel"

Purpose
Displays a panel or an emulated panel on display device

Inputs

ICNT	Number of points defining perimeter of panel
PXARAY(ICNT)	An array containing X coordinates of points defining panel perimeter
PYARAY(ICNT)	An array containing Y coordinates of points defining panel perimeter

Errors

00701	Points (ICNT) out of range (2,500) in relative vector mode, (3,500) in absolute vector mode; no-op
00721	Panel emulation not available; no-op

PANL3D(ICNT,PXARAY,PYARAY,PZARAY)
"Panel (draw in) 3-D"

Purpose
Draws a panel in the 3-D world space

Inputs

ICNT	Number of points defining perimeter of panel
PXARAY(ICNT)	Array containing X coordinates of points defining panel perimeter
PYARAY(ICNT)	Array containing Y coordinates of points defining panel perimeter
PXARAY(ICNT)	Array containing Z coordinates of points defining panel perimeter

Errors

01401	Points (ICNT) out of range (2,500) in relative vector mode or (3,500) in absolute vector mode; no-op
01421	Panel emulation not available; no-op

PARALL
"Parallel (projection)"

Purpose
Specifies 3-D parallel projection; this is the default

Errors

05521	Illegal to modify viewing environment with retained segment open; no-op

PAT027(IPATNO,IPTDEF)
"Pattern 4027"

Purpose
Specifies a non-default filling pattern for the 4027

Inputs

IPATNO	Pattern number being defined (8-127)
IPTDEF(14,8)	An array of numbers specifying colors of dots in a character cell pattern; entries should be in range 0-7, corresponding to the current color map

Errors

26701	Pattern IPATNO out of range (8,127); no-op
26721	4027 device driver not installed; no-op

Note
Requires Panel Support (Option 4C); fourth character in PAT027 is zero, not uppercase O.

PATERN(IPATNO,PANGL,PDIST)
"Pattern"

Purpose
Specifies a non-default filling pattern for emulated panels; in Figure 4 each pattern is labeled with appropriate values for the arguments IPATNO, PANGL (defined in degrees), and PDIST (defined in GDUs)

Inputs

IPATNO	Pattern number (0-24); pattern 0 is the default
PANGL	Angle of lines in current angle units
PDIST	Distance between lines in current display surface units (lines in pattern 24 one raster apart)

Errors

28801	Pattern IPATNO out of range (0,24); no-op
28803	Distance between pattern lines (PDIST) is less than or equal to 0; no-op

Note
Part of Panel Emulation (Option 3C)

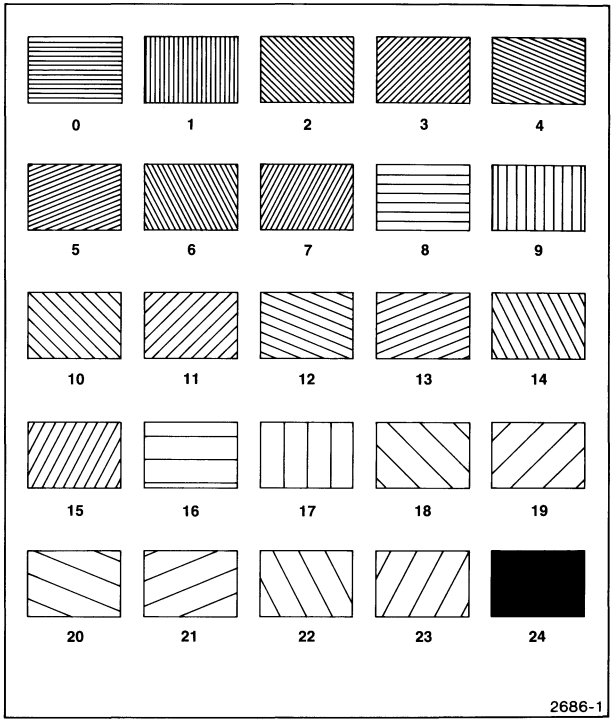


Figure 4. Default Patterns for Emulated Panels.

PENCLR(ICOLOR,ISTN,QPRMPT)
"Pen color"

Purpose
Maps a color index to a pen station

Inputs

ICOLOR	Color index (−2 to 999)
−2	To "undefine" a pen station
−1	Universal color
ISTN	Plotter pen station to be associated with the color index (−1, 1 to MAX-NUMBER-OF-STATIONS)
−1	All stations; may only be used with ICOLOR = −2
QPRMPT	
.TRUE.	Indicates a prompt is sent to the user to load the specified color into the specified pen station

Errors

10651	ICOLOR out of range (−2,999); no-op
10652	ISTN not valid on current device; no-op
10671	ICOLOR already assigned to another pen station; no-op
10672	Attempt to map color when universal colo is active; report
10673	Attempt to assign a specific color to all stations; no-op
10674	ISTN contains universal color-cannot reassign; no-op

PENTYP(ITYPE,PENWID)
"Pen type"

Purpose
Establishes "pen" width for extra-wide lines

Inputs

ITYPE	Type of line
1	"Hot dog" (rounded) fat lines
2	Calligraphic fat lines
PENWID	Width of pen, specified by a value from 1.0 to 100.0 representing the number of strokes of a pen that would fit inside the character from top to bottom; default is 20.0

Errors

14701	ITYPE out of range (1,2); no-op
14702	Pen width out of range (1.0,100.0); no-op

PICDIS(IDEV,IFLEN,IFILE)
"Display (a) picture (file)"

Purpose
Displays a pixel-format picture previously stored on a terminal flexible disk or in a host computer disk file

Inputs

IDEV	Numeric code for the input file device
1	Host-based file
2	Terminal (flexible disk) file
IFLEN	Length of the picture file name
IFILE	An array specifying the name of the file where the picture is stored in current user text format

Errors

17851	Invalid device for picture file; no-op
17871	Current device cannot support pixel data; no-op
17872	File specified is > 9 chars, truncated; report
17873	File name > 6 chars, truncated; report
17874	No open channels available; no-op
17876	Picture has too many rows for device; no-op
17877	Picture has too many columns for device; no-op
17878	Device has no flexible disk units; no-op

PICSAV(IDEV,IFLEN,IFILE,IENCOD)
"Save (a) picture (file)"

Purpose
Saves the pixel index values in the current pixel viewport on a terminal or host computer file

Inputs

IDEV	Numeric code for the device in which the picture will be saved
1	Host-based file
2	Terminal (flexible disk) file
IFLEN	Length of the picture file name to be created
IFILE	An array containing the name of the file where the picture is to be stored in the current user text format
IENCOD	The type of pixel encoding to be used in the file
1	Unencoded (raster)
2	Runlength

Errors

18051	Invalid device for picture file; no-op
18054	Invalid pixel encoding format specified; no-op
18071	Current device does not support pixel data; no-op
18072	File specified is > 9 chars; truncated; report
18073	File name is > 6 chars; truncated; report
18074	No open host channel is available; no-op
18075	Device has no flexible disk units; no-op
18076	Block mode communications not installed; no-op

PIRAD
"Pi-radians"

Purpose
Declares that angles are specified in pi-radians (2 to a circle)

PIVOT(PXINV,PYINV)
"Pivot point"

Purpose
Specifies the invariant pivot point for 2-D modeling transforms in the current coordinate system; the default is (0.0,0.0)

Inputs

PXINV	X coordinate of pivot point in world space
PYINV	Y coordinate of pivot point in world space

PIVT3D(PNTL,PNHD)
"Pivot 3-D"

Purpose
Specifies a pivot (invariant) point (PNTL) for 3-D modeling transforms and an axis of rotation (pivot axis) for ROTA3D; the pivot axis is a directed line segment from PNTL to PNHD

Inputs

PNTL(3)	(X,Y,Z) the coordinates of the invariant point; also the tail of the pivot axis as defined by PNTL-PNHD
PNHD(3)	(X,Y,Z) the coordinates of the pivot axis head as defined by PNTL-PNHD (defines an axis of rotation)

Errors

08601	PNTL and PNHD are defined to be the same point: null axis; no-op

PIXPAT(IPATNO,INMROW,INMCOL,IROW,ICOL, IBNPIX,IPTDEF)
"Pixel Pattern"

Purpose
Defines a panel fill pattern

Inputs

IPATNO	Pattern number to be defined
INMROW	Number of rows in IPTDEF
INMCOL	Number of columns in IPTDEF
IROW	Number of rows of the pixel pattern
ICOL	Number of columns of the pixel pattern
IBNPIX	Number of bits per pixel for the fill pattern
IPTDEF	INMCOL by INMROW matrix of pixel index values

Errors

17751	IPATNO is out of range for current device; no-op
17752	INMCOL outrange 1 to MAXINT or < ICOL; no-op
17753	INMCOL outrange 1 to MAXINT or < IROW; no-op
17754	ICOL is greater than the device allows; no-op
17755	IROW is greater than the device allows; no-op
17756	IBNPPIX is greater than the device allows; no-op
17757	Pixel value(s) in IPTDEF are outrange (0 . . . MAX INDEX); report
17771	Polygon fill capability not on device; no-op
17772	Device does not support pixel data; no-op

Note
Requires device capable of pixel access

POLVAL(PX,IDEGP1,PCOEF)
"Polynomial value"

Purpose
Computes the value of a polynomial at a given X value

Inputs

PX	The X value at which the polynomial is to be evaluated
IDEGP1	One plus the degree of the polynomial to be evaluated
PCOEF(IDEGP1)	The coefficients of the polynomial

Outputs

POLVAL	Returned as a functional value; it is the value of the polynomial at PX

Errors

28701	IDEGP1 < 1; value returned is 0.0

POLY(ICNT,XARRAY,YARRAY)
"Poly (draw)"

Purpose
Performs a series of draws

Inputs

ICNT	Size of XARRAY and YARRAY
XARRAY(ICNT)	X coordinates of points to be drawn; specified in world space
YARRAY(ICNT)	Y coordinates of points to be drawn; specified in world space

Errors

00301	Size of arrays(ICNT) less than or equal to 0; no-op

Note
If CLOPOL is in effect, the series of draws create a closed polygon, otherwise the polygon is not automatically closed

POLY3D(ICNT,PXARAY,PYARAY,PZARAY)
"Poly (draw in) 3-D"

Purpose
Performs a series of 3-D draws

Inputs

ICNT	Number of points to be drawn
PXARAY(ICNT)	Array containing X coordinates of points
PYARAY(ICNT)	Array containing Y coordinates of points
PZARAY(ICNT)	Array containing Z coordinates of points

Errors

01201	ICNT less than or equal to 0; no-op

Note
If CLOPOL is in effect the series of draws creates a closed polygon, otherwise the polygon is not automatically closed

POST3D
"Post-multiply (for modeling transforms) 3-D"

Purpose
Causes modeling transforms to be applied before previously specified transforms

PRE3D
"Pre-multiply (for modeling transforms) 3-D"

Purpose
Causes modeling transforms to be applied after previously specified transforms

PXLRD(ICNT,IPIXRY,IENCOD,IGOT)
"Pixel read"

Purpose
Reads pixel values from the pixel viewport starting at the current pixel beam position. The terminal must be in block mode

Inputs

ICNT	Dimension of IPIXRY (number of pixel values to be read)
IENCOD	Pixel encoding type
1	Unencoded
2	Runlength encoded

Outputs

IPIXRY	Array of pixels in integer form
IGOT	Number of integers returned in IPIXRY

Errors

17451	Number of pixels requested is < 1; no-op
17453	Illegal pixel encoding format request; no-op
17471	Block mode communications is not installed; no-op
17472	Current device does not support pixel data; no-op

PXLWRT(ICNT,IPIXRY,IENCOD)
"Pixel write"

Purpose
Writes pixel values in the pixel viewport starting at the current pixel beam position in the specified encoding format

Inputs

ICNT	The number of pixels to be written
IPIXRY	The pixel values (indices) to be written
IENCOD	Pixel encoding type
1	Unencoded
2	Runlength encoded

Errors

17351	Number of pixels requested is < 1; no-op
17353	Illegal pixel encoding format request; no-op
17371	Terminal does not support pixel data; no-op

Note
Requires terminal capable of pixel access

PXY1X(IX,IY,IBUF)
"(Encode an) X,Y pair (in raster memory space)"

Purpose
Builds an X,Y pair for a 4110 Series terminal in raster memory space

Inputs

IX	The X coordinates in rasters (0,639)
IY	The Y coordinates in rasters (0,479)
IBUF	The terminal command buffer

Outputs

IBUF	The updated terminal command buffer

Errors

13551	IX outside device's raster space; no-op
13552	IY outside device's raster space; no-op
13553	Terminal command buffer too small for data; no-op

QCLP3D(QEDGE,QFRONT,QBACK)
"Clip (in) 3-D?"

Purpose
Specifies 3-D clipping

Inputs

QEDGE	
.TRUE.	Edge clipping is on (default)
.FALSE.	Edge clipping is off
QFRONT	
.TRUE.	Front plane clipping is on
.FALSE.	Front plane clipping is off (default)
QBACK	
.TRUE.	Back plane clipping is on
.FALSE.	Back plane clipping is off (default)

Errors

05821	Illegal to modify viewing environment with retained segment open; no-op

RADIAN
"Radians"

Purpose
Declares that angles are specified in radians (6.28313 to a circle)

RASTER
"Rasters"

Purpose
Specifies that values in subsequent routines which refer to the display surface are interpreted as rasters (see Table 8)

RDFONT(IFNAM,IFILSZ,IFFNO,IFONT,QPAGE)
"Read font"

Purpose
Reads a font from a permanent host file into the local IGL font storage

Inputs

IFNAM(6)	Name of host file from which font is to be read; specified in current text format (ADE, A1, or AM)
IFILSZ	Size of permanent file from which font is to be read; specified in terms of 20-word records
IFFNO	An integer identifying a specific font in the host file
IFONT	An integer you assign the font to identify it in local IGL font storage
QPAGE	
.TRUE.	Indicates that only frequently used characters of the given font are to be kept in local font storage
.FALSE.	Indicates that the entire font is to be read into local font storage

Errors

01603	Font number (IFFNO) out of range (0, value set at installation); no-op
01613	Font (IFFNO) not defined; no-op
01621	No host-file communication channels available, call HFCLOS to clear one; no-op
01622	Font integrity error (incorrect termination code); abort
01623	Font integrity error (font does not match description); abort
01624	Not enough room in local IGL font storage to add character description; no-op
01641	IFONT already defined; no-op

RDPHDR(ICHN,IHTYPE,ICNT,IPARMS,IGOT)
"Read (a) picture (file) header"

Purpose
Reads and returns the information from a pixel file header

Inputs

ICHN	The channel number of the file to be read
ICNT	The number of parameters to be returned

Outputs

IHTYPE	Header type
1	Standard header
2	Color model header
IPARMS	Array of parameter values in header
IPARMS(1)	Number of bits per pixel
IPARMS(2)	XMIN of pixel viewport
IPARMS(3)	YMAX of pixel viewport
IPARMS(4)	YMIN of pixel viewport
IPARMS(5)	YMAX of pixel viewport
IGOT	Count of parameter values returned

Errors

18251	ICHN out of range (1,8); no-op
18253	Input buffer too small to return parameters; no-op
18261	File is not opened for sequential read; abort
18262	Illegal file header detected; abort
18271	End of file detected while reading a file header; abort
18272	Unrecognised delimiter in color information; abort
18273	Blank not found following type 1 header; report

REMOVE
"Remove (vectors)"

Purpose
Specifies selective erase mode

Note
Requires device capable of selective erasing

RENSEG(ISEG,INEWSG)
"Rename segment"

Purpose
Renames a retained segment

Inputs

ISEG	The current integer segment name
INEWSG	A new segment name

Errors

03501	No retained segment known as ISEG; no-op
03502	INEWSEG is not a valid retained segmen number; no-op
03512	Retained segment INEWSEG already exists; no-op

REPLAY(IFNAM,QHOW)
"Replay (captured file)"

Purpose
Replays a captured file

Inputs

IFNAM(6)	Name of file to be replayed; entered in current text format
QHOW	
.TRUE.	If an error report is to be output with the replay
.FALSE.	If an error report is not desired

Errors

16021	No host file channels available; abort
16022	Loss of data integrity on replay file; abor
16023	End of file encountered during replay; abort
16024	Missing tag (—999.0) on replay record; abort
16025	Buffer space overflow; abort
16027	Exceeded maximum replay depth; no-op
nnn48	Tried to replay routine number 'nnn' not entered at sysgen; abort
nnn49	Tried to replay routine number 'nnn' but cannot identify; abort

REPORT(IERR,IARRAY)
"Report (error description)"

Purpose
Displays the specified error message

Inputs

IERR	The error number to be described

Outputs

IARRAY(80)	Description of error, returned in current text format

Errors

16121	No host file communication channels available; no-op

RESSEG(ILEN,IFNAM)
"Restore segments (in saved display list)"

Purpose
Restores a retained segment display list which has been saved in a host file or on a flexible disk

Inputs

ILEN	The length of the file name given in the following argument
IFNAM	The name (in the current text format) of the display list file to be restored

Errors

02371	Segment is already defined; proceed to next segment
02372	No host file I/O channels available; no-op
02373	Named file is already open; no-op
02374	Cannot restore segments when a segment is open; no-op
02376	4100 does not support local segment restore; report
02377	First char of file name not alpha; no-op
02378	File name specifier too long, trunc to 9 char; report
02379	File name too long, truncated to 6 char; no-op

RESTOR(PBLOCK)
"Restore (environment)"

Purpose
Restores previously saved environmental condition

Inputs

PBLOCK(PBLOCK(2))	Name of array containing the previously saved environmental status

Errors

15101	The specified array is not intact or was not properly saved; abort
15111	End of block internal security check failure;abort
15121	Cannot modify viewing while a segment is open; abort

REVT3D(PNDS,POINT)
"Reverse transformation 3-D"

Purpose
Applies the reverse 3-D transform to PNDS to get its image in 3-D world space

Inputs

PNDS(3)	(X,Y,Z) point in the 3-D viewport (GDU's)

Outputs

POINT(3)	(X,Y,Z) point in world space coordinates

REVTRN(PXSCRN,PYSCRN,PXUSER,PYUSER)
"Reverse transformation"

Purpose
Performs the 2-space transformation from GDU space into world space

Inputs

PXSCRN	X coordinate of screen position
PYSCRN	Y coordinate of screen position

Outputs

PXUSER	Converted current user X coordinate in world space
PYUSER	Converted current user Y coordinate in world space

RL1X(PVAL,IBUF)
"(Encode a) 4110 series terminal real number"

Purpose
Place a real number in the terminal command buffer

Inputs

PVAL	The real number to be encoded
IBUF	The terminal command buffer

Outputs

IBUF	The updated terminal command buffer

Errors

11452	Terminal command buffer too small for data; no-op

RL63(PVAL,IBUF)
"(Encode a) 4663 real number"

Purpose
Encodes a real number in ADE format and puts it in the plotter command buffer

Inputs

PVAL	The real number to be encoded
IBUF	The plotter command buffer; enough room must be provided to allow for all the ADE values in addition to the regular buffer overhead

Outputs

IBUF	The updated plotter command buffer

Errors

20452	IBUF too small to convert integer to ADE; no-op

RNUMBR(PVALUE,IPASTD,IMXCHR)
"Real number (output)"

Purpose
Displays real number data as text

Inputs

PVALUE	The real number to be displayed
IPASTD	Maximum number of digits after the decimal point; set to −1 to suppress the decimal point
IMXCHR	Maximum number of characters to be displayed

Errors

02101	IMXCHR < 1; no-op
02121	IMXCHR > 25; uses only first 25 characters

ROTA3D(PANGAX)
"Rotate (about a pivot axis)"

Purpose
Causes rotation about the pivot axis (which is defined by the PIVT3D routine)

Inputs

PANGAX	Angle of rotation

ROTATE(PANGLX,PANGLY)
"Rotate (coordinate system)"

Purpose
Rotates the X- and Y-axes about the pivot point in current coordinate system

Inputs

PANGLX	X-axis rotation
PANGLY	Y-axis rotation

Errors
No errors are reported by ROTATE; however, any combination which would put the X- and Y-axes on the same line (that is, a combination with a difference of 90.0 degrees) is an error detected by MTRAN

ROTXYZ(PXANG,PYANG,PZANG)
"Rotate (3-D world coordinate system) XYZ (axis)"

Purpose
Causes rotation of the 3-D world coordinate system around one or more coordinate axes at the pivot point as defined in PIVT3D

Inputs

PXANG	X-axis rotation angle
PYANG	Y-axis rotation angle
PZANG	Z-axis rotation angle

RPT1X(INCNT,IARRAY,IGOTC)
"(Receive a) report from a 4110 Series terminal"

Purpose
Receives a report from a 4110 Series terminal

Inputs

INCNT	Number of characters to receive in IARRAY (including blank fill)

Outputs

IARRAY(INCNT)	Name of the array that receives the characters
IGOTC	Number of characters actually received

Errors

11651	Number of characters (INCNT) is negative; no-op

RSETM
"Reset modeling (transforms)"

Purpose
Resets the 3-D modeling transforms to the identity matrix

RSETWV
"Reset window/viewport (transforms)"

Purpose
Resets 3-D window/viewport transform to default values

Errors

04621	Illegal to modify viewing environment with retained segment open; no-op

SAVPXL(ICNT,IPIXRY,IENCOD)
"Save pixels (in a file)"

Purpose
Writes pixel index values to a pixel data file in either the runlength or raster encoding type

Inputs

ICNT	The dimension of IPIXRY, the pixel values array
IPIXRY	An array that holds the pixel index values to be written to a pixel data file
IENCOD	An integer representing the encoding type of the pixel to write to the pixel data file
0	End-of-file marker
1	Raster (unencoded)
2	Runlength

Errors

17251	Negative ICNT; no-op
17252	Negative value in IPIXRY; abort
17253	Illegal pixel encoding type specified; no-op
17261	Input count illegal for runcodes; no-op
17271	File header not written properly; abort
17272	Run count is negative; abort
17273	Runlength is negative; abort
02275	No retained segments defined; report
02276	4100 does not support local segment save; report
02277	First char of file name not alpha; no-op
02278	File name specifier too long, trunc to 9 char; report
02279	File name too long, truncated to 6 char; report

SAVSEG(ILEN,IFNAM)
"Save (a) segment (file)"

Purpose
Stores the active retained segment display list in a host computer file and/or on a terminal flexible disk

Inputs

ILEN	The length of the file name given in the array IFNAM
IFNAM	Name of the file in which the display list is to be stored (specified in current text format). When used with 4110 Series terminals equipped with flexible disk drives, the file name may include a device number of the form: F0:

Errors

02272	No host file I/O channels available; no-op
02273	File name already open; no-op
02274	Cannot save segments when a segment is open; no-op

Note
Part of Graphic Segments Support (Option 4A)

SCALE(PXSC,PYSC)
"Scale (coordinate system)"

Purpose
Specifies a scale factor to be applied to the coordinate system

Inputs

PXSC	Scale factor applied to X-axis
PYSC	Scale factor applied to Y-axis

Errors
No errors are reported by SCALE; however a zero scale factor creates an error detected by the MTRAN routine

SCAXYZ(PXSCAL,PYSCAL,PZSCAL)
"Scale (3-D world coordinate system) XYZ (axis)

Purpose
Specifies a scale factor to be applied to the 3-D world coordiante system

Input

PXSCAL	Scale factor applied to X-axis
PYSCAL	Scale factor applied to Y-axis
PZSCAL	Scale factor applied to Z-axis

SELVW(IVWNUM)
"Select (a) view"

Purpose
Selects the specified view as the current (active) view

Inputs

IVWNUM	Number of the view to become the current view

Errors

16251	View number is out of range for the current device; no-op
16271	No multiple view capability on device; no-op
16272	View has not been defined; no-op

Note
Requires a device capable of multiple views

SET2PV(PX,PY)
"Set (segment type 1 and) 2 pivot point"

Purpose
Establishes the X and Y pivot point coordinates of subsequently defined type 1, 2, and 3 segments

Inputs

PX,PY	The pivot point defined in NDC's

Default:
Lower left corner of the viewport (PX= 0.0, PY= 0.0)

Errors

00951	X pivot coordinate is out of range; no-op
00952	Y pivot coordinate is out of range; no-op

SET2TN(ISEG,PSX,PSY,PANG,PTX,PTY)
"Set 2-D transform"

Purpose
Sets the 2-D image transform parameters of a type 2 or 3 segment or segments

Inputs

ISEG	
—3	Sets this transform for all type 2 and 3 segments in the match
—2	Sets the applicable portions of this transform for all subsequently created segments of all types
—1	Sets this transform for all existing type 2 and type 2 and 3 segments
1-32767	Sets this transform for the specified segment
PSX	X-axis scale factor (default: 1.0)
PSY	Y-axis scale factor (default: 1.0)
PANG	A counterclockwise angle of rotation in current angle units (default: 0.0)
PTX	X coordinate of the point in the viewport to which the segment pivot point will be translated; expressed in NDC's (default: 0.0)
PTY	Y coordinate of the point in the viewport to which the segment pivot point will be translated; expressed in NDC's (default: 0.0)

Errors

00751	Segment ISEG is not an existing retained segment; no-op
00755	X translation coordinate out of range; no-op
00756	Y translation coordinate out of range; no-op
00761	Illegal to modify dynamic attribute of open segment; no-op
00771	Parameter ISEG out of range; no-op
00781	The seg's type is not compatible with current req.; no-op

SET3PV(PX,PY,PZ)
"Set (segment type 1, 2, and) 3 pivot (point)"

Purpose
Establishes the pivot point of subsequently defined type 1, 2 and 3 segments

Inputs

PX	X pivot coordinate; defined in NDC's (default: 0.0)
PY	Y pivot coordinate; defined in NDC's (default: 0.0)
PZ	Z pivot coordinate; defined in NDC's (default: 0.0)

Errors

01051	X pivot coordinate out of range; no-op
01052	Y pivot coordinate out of range; no-op
01053	Z pivot coordinate out of range; no-op
01072	3-D support is not available; no-op

Note
Requires installation of 3-D Graphics Support

SET3TN(ISEG,PSX,PSY,PSZ,PAX,PAY,PAZ,PTX, PTY,PTZ)
"Set (type) 3 (segment image transform)"

Purpose
Sets the image transform parameters of a type 3 segment or segments

Inputs

ISEG

−3	Sets this transform for all type 3 segments in the match class
−2	Sets the transform for all subsequently defined segments of all types
−1	Sets this transform for all existing type 3 segments
1-32767	Sets this transform for the specified type 3 segment

PSX	X-axis scale factor (default: 1.0)
PSY	Y-axis scale factor (default: 1.0)
PSZ	Z-axis scale factor (default: 1.0)
PAX	X-axis angle of rotation (default: 0.0)
PAY	Y-axis angle of rotation (default: 0.0)
PAZ	Z-axis angle of rotation (default: 0.0)

Note
PAX, PAY, and PAZ are expressed in current angle units; rotation around an axis is positive if, when looking down the axis toward the NDC origin, the rotation appears to be clockwise

(continued on next page)

PTX	X-axis coordinate of the point to which the segment pivot point is moved before drawing the segment (default: 0.0)
PTY	Y-axis coordinate of the point to which the segment pivot point is moved before drawing the segment (default: 0.0)
PTZ	Z-axis coordinate of the point to which the segment pivot point is moved before drawing the segment (default: 0.0)

Errors

00851	Segment ISEG is not an existing retained segment; no-op
00858	X translation coordinate out of range; no-op
00859	Y translation coordinate out of range; no-op
00860	Z translation coordinate out of range; no-op
00861	Illegal to modify dynamic attribute of open segment; no-op
00871	Parameter ISEG out of range; no-op
00872	3-D support not available; no-op
00881	The seg's type is not compatible with current req.; no-op

Note
Requires installation of 3-D Graphics Support

SETAPT(PVAL)
"Set (pick) aperture (size)"

Purpose
Sets the pick aperture size

Inputs

PVAL	Length (in current display surface units) of a side of the square pick aperture

Errors

00251	PVAL parameter is not a valid value (< 0.0); no-op

SETBLK(IBLKS)
"Set (segment) block (size)"

Purpose
Specifies the segment data block size in the display list

Inputs

IBLKS	Number of 20-word records to be used as a continuous segment data block; each 20-word record equals one block (default: block size of 2 records)

Errors

00151	Specified block size < 2; no-op
00161	Segment data file previously specified; no-op

SETBTM(IMODE)
"Set batch mode"

Purpose
Specifies which kinds of display changes will be batched

Inputs

IMODE

2	Defers visible changes to retained segments; changes to nonretained segments are not deferred
3	Defers changes which cause a "new page" action; erase and redraw for terminal: paper advance or prompt to change paper for plotter (default: 3)
4	Defers nothing

Errors

00451	IMODE not in range (2,4); no-op
00471	Illegal to change mode with batching in effect; no-op

SETCUR(ISEG)
"Set (graphic) cursor"

Purpose
Specifies the graphic cursor to be used for subsequent graphic input (GIN) functions

Inputs

ISEG	The name of the cursor to be used
0	The crosshair cursor (default)
1-32767	A retained segment

Errors

14551	ISEG value out of range (0,32767); no-op
14571	Device does not support user defined cursors; no-op

SETDET(ISEG,QVAL)
"Set (segment) detectability (attribute)"

Purpose
Determines whether a retained segment can be picked

Inputs

ISEG

−3	Establishes detectability of all segments in the match class
−2	Establishes detectability of all subsequently created segments
−1	Establishes detectability of all segments
1-32767	Establishes detectability of specified segment

QVAL

.TRUE.	Indicates that the segment is detectable
.FALSE.	Indicates that the segment is not detectable; default

Errors

01351	Retained segment ISEG does not exist; no-op
01361	Illegal to modify dynamic attribute of open segment; no-op
01371	ISEG out of range; no-op

SETDM(ISEG,IMODE)
"Set display mode"

Purpose
Sets the display mode of a given segment

INPUTS

ISEG	The integer name of the segment or segments whose display mode is to be set
−1	All defined segments
−2	All segments created in the future (the new default)
−3	All segments in the match class
1-32767	The number of a particular retained segment
IMODE	Display mode of the specified segment
	For the 4114:
1	Storage mode
2	Refresh mode
	For the 4112 and 4113:
1	Set mode
2	XOR mode

Errors

14251	Segment ISEG out of range (−1,−3) or (1-32767); no-op
14252	Display mode received from device is invalid; no-op
14271	Cannot change dynamic att of open segment; no-op

SETFML(PDIST)
"Set (plotter) form length"

Purpose
Sets a form length for advancing the media

Inputs

PDIST	The new form length in display surface units

Errors

22451	PDIST less than or equal to 0.0; no-op
22471	Media advance option not present on device; no-op

Note
Requires a device capable of automatically advancing the media

SETGIN(IDEV)
"Set Graphic Input (GIN) device"

Purpose
Tells the host system which device will provide graphic input (GIN) data

Inputs

IDEV	Device to be used for subsequent graphic input

Errors

04801	Specified GIN device (IDEV) < 0; no-op (If the specified GIN device is not available, the error is reported by the device driver routine and IDEV is set to 1)

SETGRD(PXGRID,PYGRID)
"Set gridding"

Purpose
Sets X and Y grid spacing for subsequent GIN operations

Inputs

PXGRID	X grid spacing in world space units
PYGRID	Y grid spacing in world space units

Errors

10051	Negative X-grid spacing specified; no-op
10052	Negative Y-grid spacing specified; no-op
10071	Gridding illegal — world rotation not 90° multiple; no-op
10072	Gridding not legal with billboard active; no-op
10073	Device does not support input gridding; no-op

SETHIL(ISEG,QVAL)
"Set (segment) highlight (attribute)"

Purpose
Determines whether a retained segment is highlighted

Inputs

ISEG	
−3	Establishes highlight attribute of segments in the match class
−2	Establishes highlight attribute of all subsequently created retained segments
−1	Establishes highlight attribute of all retained segments
1-32767	Establishes highlight attribute of a specified retained segment
QVAL	
.TRUE.	Indicates that the segment is highlighted
.FALSE.	Indicates that the segment is not highlighted (default)

Errors

01251	Retained segment ISEG does not exist; no-op
01261	Illegal to modify dynamic attribute of open segment; no-op
01271	ISEG out of range; no-op

SETINK(INK)
"Set inking"

Purpose
Enables or disables inking for subsequent executions of LOCATE and LOC3D

Inputs

INK	Inking switch
0	Do not ink for subsequent GIN operations
1	Ink for subsequent GIN operations

Errors

10251	Ink code out of range (0,1); no-op
10271	Device does support inking feature; no-op

Note
Requires a device capable of inking

SETMCL(IMNUM,IMRAY,INMNUM,INMRAY)
"Set (the current segment) match class"

Purpose
Establishes the membership of the segment match class

Inputs

IMNUM	The number of classes to which a segment must belong to be included in the match class
IMRAY	An integer array containing the names of classes to which a segment must belong to be a member of the match class
INMNUM	The number of classes to which a segment must not belong if it is to be to be a member of the match class
INMRAY	An integer array containing the names of classes to which a segment must not belong if it is to be included in the match class

Errors

02151	Parameter IMNUM .LT. 0; no-op
02152	Class ID not in range (−1,1-64); no-op
02153	Parameter INMNUM .LT. 0; no-op
02162	Number of classes > 64; use first 64
02171	A class is in both the "match" and "nomatch" arrays; no-op

SETPBM(IXPOS,IYPOS)
"Set (the) pixel beam (position)"

Purpose
Moves the beam to the specified location in the pixel viewport

Inputs

IXPOS	X position of the new pixel beam relative to the lower left corner of the pixel viewport
IYPOS	Y position of the new pixel beam relative to the lower left corner of the pixel viewport

Errors

18551	IXPOS is outside of pixel viewport; no-op
18552	IYPOS is outside of pixel viewport; no-op
18571	Current device does not support pixel access; no-op

Note
Requires a device capable of pixel access

SETPID(ID)
"Set (segment) pick ID"

Purpose
Identifies a portion of a retained segment for picking

Input
ID

0	Indicates that the subsequent graphics will not be pickable
1-32767	The pick ID associated with subsequent text or graphics (default: 1)

Errors

00551	ID out or range (0,32767); no-op
00571	No retained segment open; no-op

SETPNL(IOVR,IFBRDY,ISYNCH)
"Set panel filling mode"

Purpose
Determines how panels are to be filled

Outputs

IOVR	Overstrike or replace mode value
0	Replace (default: 0)
1	Overstrike
IFBRDY	"Fill-over-boundary" value
0	No (default: 0)
1	Yes
ISYNCH	Determines how the fill pattern is to be oriented on the display:
0	The pattern is synchronized to the viewport (default)
1	The pattern is synchronized to the lower left panel edge
2	The pattern is synchronized to the entire screen

Errors

18851	IOVR is out of range for current device; no-op
18852	IFBDRY is out of range for current device; no-op
18853	ISYNCH is out of range for current device; no-op
18871	No hardware fill capability on device; no-op

Note
Requires a device capable of hardware fill

SETPRI(ISEG,IPRTY)
"Set (segment display) priority"

Purpose
Determines the display priority of a specified retained segment or segments

Inputs
ISEG

−3	Establishes the display priority of segments in the match class
−2	Establishes the default segment display priority
−1	Establishes display priority of all retained segments
1-32767	Establishes priority attribute of specified retained segment

IPRTY — An integer from 0 to 32767 denoting display priority of the segment; priority increases with the value of IPRTY (default: 0)

Errors

01451	Retained segment ISEG does not exist; no-op
01452	IPRTY out of range (0-32767); no-op
01461	Illegal to modify dynamic attribute of open segment; no-op
01471	Parameter ISEG out of range; no-op

SETPVW(IXMIN,IXMAX,IYMIN,IYMAX)
"Set pixel viewport (dimensions)"

Purpose
Sets the pixel viewport position and size; coordinates are in 640 by 480 raster space

Inputs

IXMIN	Minimum X value of the pixel viewport
IXMAX	Maximum X value of the pixel viewport
IYMIN	Minimum Y value of the pixel viewport
IYMAX	Maximum Y value of the pixel viewport

Errors

17951	XMIN is not in range (0,639); no-op
17952	XMAX is not in range (0,639); no-op
17953	YMIN is not in range (0,479); no-op
17954	YMAX is not in range (0,479); no-op
17971	Device does not support pixel data; no-op
17972	XMAX < XMIN; no-op
17973	YMAX < YMIN; no-op

Note
Requires a device capable of pixel access

SETPXL(ISRFNM,IALU)
"Sets pixel (viewing environment)"

Purpose
Specifies what surface a pixel viewport is on and what ALU mode operates on existing pixels and pixels to be written

Inputs

ISRFNM	Specifies which surface of the pixel viewport is on; note: −1 specifies the "super surface" (default: 1)
IALU	Arithmetic and logic unit mode number (default: 11); see Table 11, ALU Modes, for values

Errors

18651	Surface number is out of range for current device; no-op
18652	IALU is out of range for current device; no-op
18671	Current device does not support pixel data; no-op
18672	No bit planes allocated to surface; no-op

Note
Requires a device capable of pixel access

Table 11

ALU MODES

ALU Mode Parameter	Operation	Use
1	not A[1]	Reverse video of existing image
2	not (A or B)	
3	(not A) and B	
4	0	Transparent
5	not (A and B)	
6	not B	Reverse video of new image
7	A xor B	Used twice, makes original image reappear
8	A and (not B)	
9	(not A) or B	
10	not (A xor B)	
11	B	New image completely replaces old image; "set mode"; (default)
12	A and B	
13	1	Maximum index
14	A or (not B)	
15	A or B	New image is written on top of old image; "overstrike mode"
16	A	

[1] **"A" is a pixel index in the currently displayed image and "B" is a pixel index in the image to be displayed.**

SETRUB(IRUBND)
"Set rubberbanding"

Purpose
Enables or disables rubberbanding for subsequent executions of LOCATE and LOC3D

Inputs
IRUBND

0	Rubberbanding is on for subsequent GIN functions
1	Rubberbanding is off for subsequent GIN functions (default)

Errors

10751	IRUBND out of range (0,1); no-op
10771	Device does not support rubberbanding; no-op

Note
Requires a device capable of rubberbanding

SETSPD(IUNITS,PSPEED)
"Set speed"

Purpose
Sets maximum speed for a device with variable speeds

Inputs

IUNITS	Units in which the speed is assigned
1	Millimeters
2	Inches
PSPEED	Speed in units per second (real numbers greater than zero)

Errors

26621	Device does not have variable speeds; no-op
26622	IUNITS is out of range (1,2); no-op
26623	PSPEED is less than or equal to zero; no-op

Note
Requires a device with variable speeds

SETSRF(ICNT,ISRFRY)
"Set surface (bit planes)"

Purpose
Allocates bit planes to a surface or surfaces

Inputs

ICNT	Number of elements in ISRFRY
ISRFRY	Array with number of elements corresponding to the number of surfaces; each element denotes the number of planes allocated to the corresponding surface

Errors

16451	Illegal number of surfaces for device; no-op
16452	A surface has more planes than device; no-op
16461	Number of planes allocated > device max; no-op
16471	No definable surfaces on device; no-op

Note
Requires a device capable of multiple surfaces

SETSTR(QSTR,ITIME,PDIST)
"Set stroking"

Purpose
Enables or disables stroke input for digitizing with a graphics tablet

Inputs

QSTR	Stroke parameters for subsequent locates:
.TRUE.	Stroke input enabled with the specified time and distance filtering
.FALSE.	Stroke input disabled
ITIME	The value (in milliseconds) to be used for stroke time filtering; zero denotes no time filtering for subsequent LOCATE's; when stroking is disabled the parameter is ignored
PDIST	The value (in world space) to be used for stroke distance filtering; zero denotes no distance filtering for subsequent LOCATE's; when stroking is disabled the parameter is ignored

Errors

10452	Time filter parameter < 0; no-op
10453	Distance filter parameter < 0; no-op
10471	Device does not support stroke input; no-op
10472	Distance filter illegal — world rotation not 90° multiple; no-op
10473	Distance filtering illegal with non-unity aspect ratio; no-op
10474	Distance filtering illegal with billboard active; no-op

Note
Requires a device capable of stroke input

SETTRN(ISEG,PTX,PTY)
"Set (image) translation"

Purpose
Sets the 2-D image translation of a type 1, 2, or 3 segment or segments

Inputs

ISEG	
−3	Sets the X,Y translation of all segments in the match class
−2	Sets the X,Y translation of all subsequently created segments
−1	Sets the X,Y translation of all retained segments
1-32767	Sets the X,Y translation of the specified retained segment
PTX	X-axis NDC coordinate at which the segment's pivot point will lie after translation (default: 0.0)
PTY	Y-axis NDC coordinate at which the segment's pivot point will lie after translation (default: 0.0)

Errors

00651	Retained segment ISEG does not exist; no-op
00652	X translation coordinate out of range; no-op
00653	Y translation coordinate out of range; no-op
00661	Illegal to modify dyn. attr. of open segment; no-op
00671	ISEG out of range; no-op

SETTYP(ITYPE)
"Set (segment) type"

Purpose
Specifies the type of segment opened by a call to OPNSEG

Inputs

ITYPE	
0-3	An integer type designation (default: 2)

Errors

00351	Illegal segment type specified; no-op
00361	3-D terminal support not available; no-op
00371	All segments are type 2 on terminal only; no-op
00372	3-D support not available; no-op

SETVIS(ISEG,QVAL)
"Set (segment) visibility (attribute)"

Purpose
Determines whether a retained segment is visible

Inputs

ISEG	Establishes visibility of:
−3	All segments in the match class
−2	All subsequently created segments
−1	All retained segments
1-32767	Specified retained segment
QVAL	
.TRUE.	Indicates that the segment is visible (default)
.FALSE.	Indicates that the segment is invisible

Errors

01151	Retained segment ISEG does not exist; no-op
01161	Illegal to modify dynamic attribute of open segment; no-op
01171	Parameter ISEG out of range; no-op

SETVW(IVWNUM,ISRFNM,IBCKGD,IBORDR)
"Set view (attributes)"

Purpose
Defines a view and sets its attributes

Inputs

IVWNUM	View number to be defined
ISRFNM	Number of the surface on which to place the view
IBCKGD	Color index used to erase the view (the wipe index)
IBORDR	Color index of the view border (when visible)

Errors

16051	View number is out of range for current device; no-op
16052	Illegal surface number; no-op
16053	Background color index < 0; no-op
16071	No multiple view capability on device; no-op

Note
Requires device capable of multiple views

SGFNAM(NAME)
"Segment file name"

Purpose
Names the host computer segment display list file before it is opened

Inputs

NAME	An integer array containing the segment file name in the current text format (6 characters maximum)

Errors

02451	Segment file name already open; no-op
02471	Host files not supported in terminal configuration; no-op

SHR3D(NAXFRM,NAXTO,PANGL)
"Shear 3-D (axis)"

Purpose
Shears one 3-D axis to another axis by specified angle

Inputs

NAXFRM	Sheared axis (X= 1, Y= 2, Z= 3)
NAXTO	Reference axis (X= 1, Y= 2, Z= 3)
PANGL	Angle of shear in current angle units

Errors

08103	Angle equals 90 degrees, tangent is undefined; no-op
8112	Illegal axis; no-op

SKIP
"Skip (the next vector)"

Purpose
Makes the next vector invisible

SMOOTH
"Smooth (a line)"

Purpose
Initializes line smoothing

SPLINE(PS,ICNT,PDEPRY,PSRAY,PCOEF,PSMAX)
"Spline fit"

Purpose
Returns the coefficients of a cubic polynomial fitted within a specified interval

Inputs

PS	A value which is compared to the elements in PSRAY to define the interval within which the curve is to be fitted
ICNT	The size of the control array (PSRAY)
PDEPRY(ICNT)	Array containing the dependent (Y-axis) variable to be fit
PSRAY(ICNT)	Array of independent variable values arranged in ascending order

Outputs

PCOEF(4)	The coefficients of a cubic polynomial fitted to the interval; the coefficients contain the value given for PS and are valid up to PSMAX
PSMAX	The maximum PS value for which the polynomial defined by PCOEF is valid

Errors

28101	PS < PSRAY(1) or PS > PSRAY(ICNT); PCOEF is set to all zeroes and PSMAX is set to PS −1.0; no-op
28102	ICNT < 1.0; no-op
28121	Singular matrix specified; abort

SRFPRI(ISRFNM,ISPRIO)
"(Set) surface priority"

Purpose
Assigns a display priority to a surface

Inputs

ISRFNM	A surface number
ISPRIO	The surface priority to be assigned to the surface

Errors

16751	Surface number is out of range for the device; no-op
16752	Surface priority is out of range for the device; no-op
16771	No definable surfaces on device; no-op

Note
Requires a device with definable surfaces

SRFVIS(ISRFNM,ISVIS)
"(Set) surface visibility"

Purpose
Sets the visibility of the specified surface

Inputs

ISRFNM	A surface number
ISVIS	The visibility of the surface:
0	Invisible
1	Visible
2	Alternating (the surface blinks)

Errors

16651	Surface number is out of range for the device; no-op
16652	Surface priority is out of range for the device; no-op
16671	No definable surfaces on device; no-op

Note
Requires a device with definable surfaces

STAT63(ICODE,INUM,IARRAY,IGOT)
"(Request) status of 4663"

Purpose
Requests 4663 plotter status information (see Tables 12 and 13)

Inputs

ICODE	Opcode to determine what is being requested from the status registers
INUM	The size of IARRAY for information requested

Outputs

IARRAY	The array containing the requested status information
IGOT	The number of elements returned in IARRAY

Errors

21951	ICODE out of range (1,7); no-op
21952	Less than one value requested; no-op
21962	Length of IARRAY less than number of values returned; no-op
21971	Less than 7 ADE values returned from plotter; no-op (this may be an indication of a communication problem)
21972	Device is not a 4663 plotter, no-op

Note
Requires a device with definable surfaces

Table 12

PLOTTER STATUS REPORT

ICODE	Location	Request
1		Device status; returns 16 values:
	1	Out of media
	2	Local position modification
	3	Local parameter modification
	4	Local data reset
	5	Unused
	6	Roll mode true if selected
	7	Pause/busy
	8	X mirrored
	9	Y mirrored
	10-13	Virtual position of current clipping limits (4 values in plotter units)
	14	Communications error
	15	Command/response error
	16	Internal error
2	1	Currently available RAM; returns 1 value
3	1	Maximum available RAM; returns 1 value
4	1-3	Plotter Options 31,32, and 36; returns 3 values: 1 if option is present, 0 if option is absent
5	1-2	X, Y position coordinates; returns 2 values in plotter units
6	1-2	Pen status (up, down) and pen station number (1, 2, or crosshairs: 0); returns 2 values
7	1	Plot time; returns 1 value; NOTE: The change in plot time is what should be noted here, since the plotter may return a negative value

Table 13

STATUS ARRAY SIZE

ICODE	INUM
1	16
2	1
3	1
4	3
5	2
6	2
7	1

STORPN
"Store pens"

Purpose
Stores all pens

Errors

26921	Current device cannot store pens; no-op

Note
Requires a device capable of storing pens

STRPNT(PX,PY)
"Starting point (for line being smoothed)"

Purpose
Specifies a pseudo-starting point for calculation of a smoothed line

Inputs

PX	X coordinate of pseudo-starting point
PY	Y coordinate of pseudo-starting point

STRSLP(PDX,PDY)
"Starting slope (for line being smoothed)"

Purpose
Specifies starting slope for smoothed line

Inputs

PDX	The change in X (for determining the starting slope)
PDY	The change in Y (for determining the starting slope)

SVE3TR(ILEN,PBLOCK)
"Save 3-D (modeling) transform (environment)"

Purpose
Saves 3-D modeling transforms

Inputs

ILEN	Size of the array into which the 3-D modeling transform environment is to be saved; should be set at least to 27

Outputs

PBLOCK(ILEN)	The saved status array; must be dimensioned to at least ILEN
PBLOCK(1) = 6.0	Identifies PBLOCK( ) as a 3-D modeling transform save block
PBLOCK(2) = 27	Total number of elements used in PBLOCK
PBLOCK(3) to PBLOCK (PBLOCK(2) −1)	The actual status data
PBLOCK(PBLOCK(2)) = −9999.0	Validity and logical end of block marker

Errors

19701	ILEN too small; PBLOCK is altered up to ILEN; abort

SVE3VW(ILEN,PBLOCK)
"Save 3-D viewing (environment)"

Purpose
Saves 3-D viewing environment

Inputs

ILEN	Size of the array into which the 3-D viewing status is to be saved; should be at least 82.0

Outputs

PBLOCK(ILEN)	The saved status array
PBLOCK(1) = 5.0	Identifies PBLOCK( ) as a 3-D viewing environment save block
PBLOCK(2) = 82.0	Total number of elements used in PBLOCK
PBLOCK(3) to PBLOCK(81)	The actual status data
PBLOCK(PBLOCK(2)) = −9999.0	Validity and logical end of block marker

Errors

19801	ILEN too small; PBLOCK is altered up to ILEN; abort

SVEALL(ILEN,PBLOCK)
"Save all (environmentals)"

Purpose
Saves the entire current environmental status into a specified array

Inputs

ILEN	Size of the array into which the environmental status is to be saved; should be at least 220; the actual array size is dependent upon your system configuration

Outputs

PBLOCK(ILEN)	The saved status array; must be dimensioned to ILEN
PBLOCK(1) = 1.0	Identifies PBLOCK( ) as a collection of all environmental save blocks
PBLOCK(2) = 220.0	Total number of elements in PBLOCK actually used
PBLOCK(3) to PBLOCK(PBLOCK(2) −1)	The actual status data
PBLOCK(PBLOCK(2)) = −9999.0	Validity and logical end of block marker

Errors
No errors are reported by this routine; however, errors are reported by SVEGRA, SVETXT, SVE3TR, SVE3WV, SVEWVT or SVETRN; which SVEALL calls to save the environment

SVEGRA(ILEN,PBLOCK)
"Save graphics (environment)"

Purpose
Saves current graphic environmental status into a specified array

Inputs

ILEN	Size of the array into which the graphic status is to be saved

Outputs

PBLOCK(ILEN)	The saved status array; must be dimensioned to at least ILEN
PBLOCK(1) = 2.0	Indicates a graphic save block
PBLOCK(2)	Total number of elements in PBLOCK actually used
PBLOCK(3) to PBLOCK(PBLOCK(2) −1)	The actual status data
PBLOCK(PBLOCK(2)) = −9999.0	Validity and logical end of block marker

Errors

16201	Array ILEN too small; PBLOCK is altered up to ILEN; abort

SVEMVS(ILEN,PBLOCK)
"Save multiple views, surfaces"

Purpose
Saves the attributes and parameters associated with multiple views and surfaces

Inputs

ILEN	Number of elements in PBLOCK storage array (172)

Outputs

PBLOCK(ILEN)	Saved array of multiple view and surface data
PBLOCK(1)	Returns 9.0 to indicate the kind of information stored in PBLOCK
PBLOCK(2)	Returns the number of elements of PBLOCK in which information has been stored
PBLOCK(3) to PBLOCK (PBLOCK(2) −1)	Returned data
PBLOCK(PBLOCK(2))	Returns −9999.0 validity and end-of-block marker

Errors

15151	Not enough space, 172 needed; PBLOCK altered to ILEN

SVETRN(ILEN,PBLOCK)
"Save transform (specifications)"

Purpose
Saves current transform specifications into a specified array

Inputs

ILEN	Size of the array into which the transform specifications are to be saved

Outputs

PBLOCK(ILEN)	The saved status array; must be dimensioned to ILEN
PBLOCK(1) = 3.0	Indicates a transform save block
PBLOCK(2)	Total number of elements in PBLOCK actually used
PBLOCK(3) to PBLOCK(PBLOCK(2) −1)	The actual status data
PBLOCK(PBLOCK(2)) = −9999.0	Validity and logical end of block marker

Errors

16301	Array ILEN too small; no-op, but PBLOCK is altered up to ILEN

SVETXT(ILEN,PBLOCK)
"Save text (environment)"

Purpose
Saves current text environmental status into a specified array

Inputs

ILEN	Size of the array into which the graphic status is to be saved

Outputs

PBLOCK(ILEN)	The saved status array; must be dimensioned to ILEN
PBLOCK(1) = 4.0	Identifies a text environment save block
PBLOCK(2)	Total number of elements in PBLOCK actually used
PBLOCK(3) to PBLOCK(PBLOCK(2) −1)	The actual status data
PBLOCK(PBLOCK(2)) = −9999.0	Validity and logical end of block marker

Errors

16401	ILEN too small; no-op, but PBLOCK is altered up to ILEN

SVEWVT(ILEN,PBLOCK)
"Save (2-D) window/viewport (and billboard) transforms"

Purpose
Saves 2-D window/viewport and billboard control points

Inputs

ILEN	Size of the array into which transforms are to be saved; should be set to at least 26

Outputs

PBLOCK	The saved status array
PBLOCK(1) = 8.0	Identifies PBLOCK( ) as a window/viewport and billboard save block
PBLOCK(2) = 26.0	Total number of elements in PBLOCK actually used
PBLOCK(3) to PBLOCK(PBLOCK(2) −1)	The actual status data
PBLOCK(PBLOCK(2)) = −9999.0	Validity and logical end of block marker

Errors

19601	ILEN too small; no-op, but PBLOCK is altered up to ILEN

TEXT(ILENST,ICHRAY)
"Text (output)"

Purpose
Displays a string of alphanumeric text

Inputs

ILENST	Number of characters in the string
ICHRAY	Name of the array containing the text string in the current user text format

Errors

02001	ILENST < 0; no-op
02021	ILENST > 120; displays first 120 characters
02022	Text emulation (Option 3D) not available; no-op

TRAN2(PXUSER,PYUSER,PXCRN,PYSCRN)
"Transform (in) 2(—space)"

Purpose
Performs 2-space transformation from world space into device-independent screen space (GDU's)

Inputs

PXUSER	X coordinate of point in world space
PYUSER	Y coordinate of point in world space

Outputs

PXSCRN	X coordinate converted to display surface units
PYSCRN	Y coordinate converted to display surface units

TRAN3D(POINT,PNDS)
"Transforms (in) 3-D"

Purpose
Apply current transform to POINT and return PNDS in device screen space units

Inputs

POINT(3)	(X,Y,Z) point in world space

Outputs

PNDS(3)	(X,Y,Z) point in screen space

TRANSL(PXDISP,PYDISP)
"Translate (coordinate system)"

Purpose
Performs 3-space transformation from world space into device-independent screen space (GDU's)

Inputs

PXDISP	Displacement along X-axis
PYDISP	Displacement along Y-axis

Errors
No errors reported by TRANSL, but see MTRAN for possible errors generated there

TRIDNT(QFULL)
"Transform identity"

Purpose
Resets the modeling/viewing transform, the window/viewport transform, or both, to identity (initial values)

Inputs
QFULL

.TRUE.	Resets modeling/viewing transforms and the window/viewport transform (WINDOW, VWPORT) to identity
.FALSE.	Resets modeling/viewing transform (SCALE, ROTATE, TRANSL, MTRAN) and PIVOT to identity

Errors

07721	Illegal to modify viewing environment with retained segment open; no-op

TRNXYZ(PX,PY,PZ)
"Translate (3-D origin by) XYZ (values)"

Purpose
Translates the 3-D world coordinate system to the specified point

Inputs

PX	X extent of translation
PY	Y extent of translation
PZ	Z extent of translation

TXA1
"Text (arguments in) A1 (format)"

Purpose
Specifies that subsequent text arguments are in A1 format (individual characters specified literally)

TXADE
"Text (arguments in) ADE (format)"

Purpose
Specifies that subsequent text arguments are defined by their ASCII decimal equivalents (default)

TXAM
"Text (arguments in) AM (format)"

Purpose
Specifies that text arguments are in AM format (literal strings)

TXANGL(PANGLE)
"Text angle"

Purpose
Establishes angle of line of text; (0.0) is the default

Inputs
PANGLE — Angle at which text is to be displayed

Note
Requires device capable of rotating text or Graphics Text Emulation (Option 3D)

TXBOTH
"Text (justified to) both (margins)"

Purpose
Declares that text be justified to both margins

Note
Only affects environment of TYPSET routine

TXCENT
"Text centered"

Purpose
Declares that text be centered on the line

TXCONS
"Text (spacing) constant"

Purpose
Sets constant spacing of text regardless of width of each character; this is the default

TXESC(ICHAR)
"Text escape (character)"

Purpose
Defines the command character to be used for TYPSET

Inputs
ICHAR — Desired command character in current user format; the default is ! (ADE 33)

Errors
14501 — ADE values (ICHAR) cannot be < 0; no-op

Note
Only affects environment of TYPSET routine

TXFCUR(IPOS)
"Text final cursor (position)"

Purpose
Establishes location of the cursor after a line of text is displayed

Inputs
IPOS — Specifies cursor position after line of text is output

- 1 — Cursor returns to a position one line width below the initial cursor position; simulates a carriage return/linefeed
- 2 — Cursor is left at a position one inter-character gap after the last character output; this is the default
- 3 — Cursor returns to the initial position

Errors
13501 — IPOS out of range (1,3); no-op

TXFONT(IFONT)
"Text font"

Purpose
Selects a character font

Inputs

IFONT	Font number, selected from a list of available fonts (see Figures 5 and 6 and Table 6) (default: 0)

Note
Requires device capable of displaying text in more than one font or Graphics Text Emulation (Option 3D) and English Character Fonts (Option 2B) or Math and Special Symbol Fonts (Option 2C)

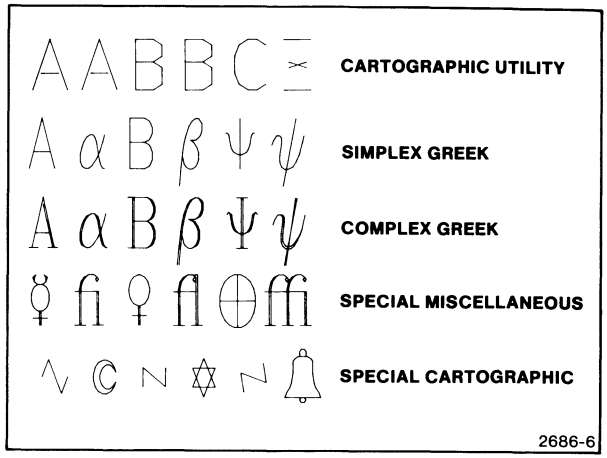


Figure 5. Sample Characters from Math and Special Symbol Fonts (Option 2C).

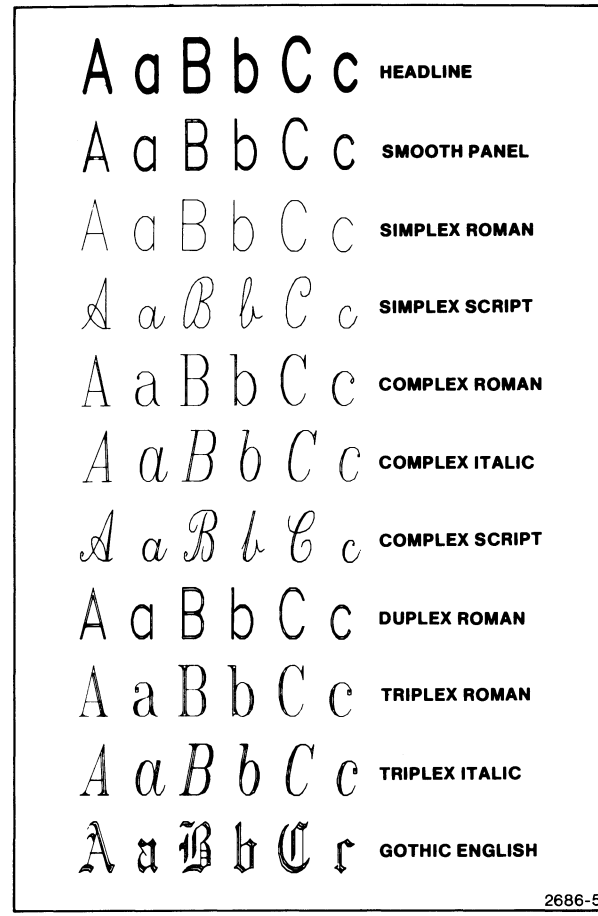


Figure 6. Sample Characters from English Character Fonts (Option 2B).

TXGAP(PXGAP,PYGAP)
"Text gap"

Purpose
Specifies the inter-character and inter-line gaps as ratios of current character size

Inputs

PXGAP	Ratio of the character cell width (Figure 7c) to the character width (Figure 7a); default is 14.0/11.0. A value less than or equal to −99.0 implies hardware default gap ration gap ratio (see Table 14)
PYGAP	Ratio of the character cell height (Figure 7f) to the character height (Figure 7d); default is 22.0/14.0. A value less than or equal to −99.0 implies hardware gap ratio

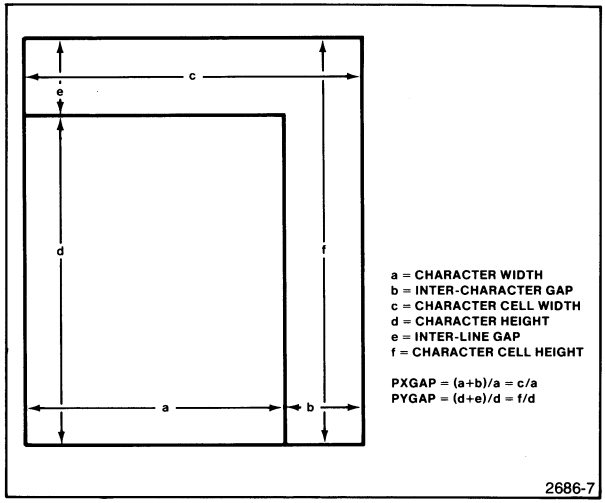


Figure 7. Character Cell.

Table 14

DEFAULT TEXT GAPS

Series Device	PXGAP	PYGAP
4010	14.0/11.0	22.0/14.0
4020	8.0/7.0	14.0/9.0
4112/13	14.0/9.75	21.0/13.0
4114	14.0/10.0	23.0/15.0
4660	9.0/6.0	20.0/11.0

TXICUR(IPOS)
"Text initial cursor (position)"

Purpose
Establishes the relationship of text output to the initial cursor position (see Figure 8)

Inputs

IPOS	Set to an integer from 1-9 to specify the position of text in relation to the initial cursor position; the default is 1

Errors

13401	IPOS out of range (1,9); no-op

TXLEFT
"Text left (justified)"

Purpose
Declares that text be left-justified on the line against the left margin; this is the default

Note
Only affects environment of TYPSET routine

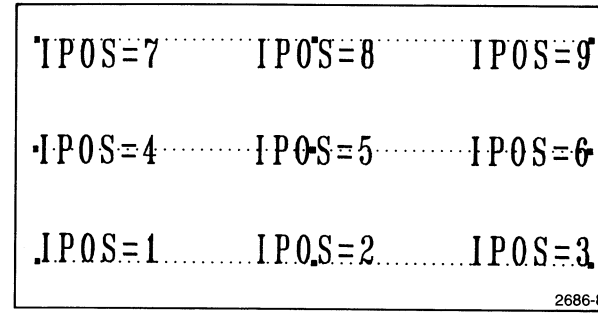


Figure 8. Text Positioning with TXICUR.

TXPROP
"Text (spacing) proportional"

Purpose
Sets proportional spacing of text based on width of each character

TXQUAL(IQUAL)
"Text quality"

Purpose
Sets quality level of character generation

Inputs

IQUAL	Text quality level
1	Text is output in hardware-generated font; prompting strings are always output at this level; appears in monitor or dialog area
2	Hardware implements those text specifications (such as size, rotation, and slant) that it can; no emulation is used. This is the default for users who don't have Graphics Text Emulation and/or Composer; represents GSPC (Graphic Standards Planning Committee of ACM/SIGGRAPH, 1979) character precision text
3	Hardware implements those text specificatons that it can; software emulation is used if the hardware is not able. This is the default for users who have Graphics Text Emulation and/or Composer; represents GSPC Stroke precision text. Only available to users with Graphics Text Emulation
4	All text specifications are emulated by software, regardless of hardware capabilities; only available to users with Graphics Text Emulation

Errors

13001	IQUAL out of range (1,4); no-op
13021	Emulation not available; IQUAL set to 2

Note
IPOS values of 3 and 4 require Graphics Text Emulation (Option 3D) and/or Graphics Text Composer (Option 4D)

TXRITE
"Text right (justified)"

Purpose
Declares that text be right-justified on the line against the right margin

Note
Only affects environment of TYPSET routine

TXSCRN
"Text (in) screen (coordinate system)"

Purpose
Interprets text environmentals in viewport; this is the default. Text is not affected by modeling transforms

TXSIZE(ISIZE,PXSIZE,PYSIZE)
"Text size"

Purpose
Establishes size of characters

Inputs

ISIZE	Indicates whether character size is defined by PXSIZE and PYSIZE, or if a hardware character size is used (see Table 15)
0	Specifies that character size is set by PXSIZE and PYSIZE; if PXSIZE and PYSIZE are also 0.0, you get the default hardware size (i.e., same effect as ISIZE= 1)
1	Specifies the default character size of the device
2-n	Specifies the desired hardware character size or scale factor
PXSIZE	Width of characters, given in current display surface units. Set to 0.0 if IGL is to calculate a PXSIZE proportionate (width/height of default hardware character set) to the given PYSIZE
PYSIZE	Height of characters, given in current coordinate system (screen or world). Set to 0.0 if IGL is to calculate a PYSIZE proportionate (height/width of default hardware character set) to the given PXSIZE

Errors

14101	ISIZE < 0; no-op

Note
Requires device capable of changing text size or Graphics Text Emulation (Option 3D)

TXSLNT(PANGLE)
"Text slant"

Purpose
Controls slant of text output

Inputs

PANGLE	Specifies angle at which text is to be slanted from vertical (0°); text slanted to right if positive

Errors

13201	PANGLE set to multiple of 90.0°; no-op

Note
Requires device capable of slanting text or Graphics Text Emulation (Option 3D)

TXTCLR(ICOLOR)
"Text color"

Purpose
Sets text color

Inputs

ICOLOR	Index number of selected color

Note
Requires device capable of displaying color

TXWORL
"Text (in) world (coordinate system)"

Purpose
Interprets text environmentals in world coordinate system and causes text to be affected by subsequently-specified modeling transforms

TYPSET(ICOUNT,IARRAY)
"Typeset"

Purpose
Displays text using in-string commands (see Table 16)

Inputs

ICOUNT	Length of string to display
IARRAY(ICOUNT)	String to display, in current text format

Errors

03721	World text being used with degenerate transform; abort
03722	TYPSET command string too long for "sysgened" workspace; will use "sysgened" buffer size: report

TYPSET's in-string commands almost always have the following format: a command character, a three letter mnemonic, an optional numeric argument, and a command terminator. An example would be !LIN3;, where the command character is !, LIN is the command, 3 is the numeric argument, and ; is the command terminator. (A semicolon is always acceptable as a command terminator and will always be considered part of the command.) The exception is the END command, which will be executed whether it is followed by a terminator or not.

TYPSIZ(ICOUNT,IARRAY,ITERM,ILSTCH)
"(Calculate) type size"

Purpose
Determines how much of text input in TYPSET will fit on the current text line

Inputs

ICOUNT	Number of command and text characters to look at
IARRAY(ICOUNT)	Array of command and text characters

Outputs

ITERM	Indicates if a line terminator was found
0	No terminator
1	!LIN < command terminator>
2	!HOM < command terminator>
14	!RIT < command terminator>
15	!LEF < command terminator>
16	!CEN < command terminator>
17	!BOT < command terminator>
ILSTCH	Index into IARRAY indicating the last character that will fit on the current text line

Note
Only affects environment of TYPSET routine

VALOF(IVAL)
"Value of (an environmental parameter)"

Purpose
Returns the value of an IGL environmental parameter

Inputs

IVAL	An integer representing the environmental parameter to be returned (see Table 17)

Outputs

VALOF	The value of the requested parameter (returned as a real number)

Errors

03801	IVAL out of range (0.0 returned)
03802	IVAL out of range for fancy text

Note
VALOF is a FUNCTION and not a subroutine

VECABS
"Vectors absolute"

Purpose
Declares that subsequent coordinates are absolute (relative to the origin); this is the default

VECREL
"Vectors relative"

Purpose
Declares that subsequent coordinates are relative to the cursor position

VIEWT
"Viewing transform"

Purpose
Specifies that subsequent scaling, rotation, and translation transforms should occur only at the viewing surface

VPDIST(PDIST)
"View plane distance"

Purpose
Specifies the distance between the view reference point and the view plane along the view plane normal

Inputs

PDIST	Distance from the VRP to the VP (default: 0.0)

Errors

06421	Illegal to modify viewing environment with retained segment open; no-op

VPN3D(PX,PY,PZ)
"View plane normal 3-D"

Purpose
Determines a vector (in world coordinate units) relative to the view reference point which defines the view plane orientation

Inputs

PX	X coordinate of the view plan normal (default: 0.0)
PY	Y coordinate of the view plan normal (default: 0.0)
PZ	Z coordinate of the view plan normal (default: −1.0)

Error

06101	PX= PY= PZ= 0, cannot define VPN; no-op
06121	Illegal to modify viewing environment with retained segment open; no-op

VRP3D(PX,PY,PZ)
"View reference point 3-D"

Purpose
Defines the view reference point (VRP)

Inputs

PX	X coordinate of the view reference point (default: 0.0)
PY	Y coordinate of the view reference point (default: 0.0)
PZ	Z coordinate of the view reference point (default: 0.0)

Error

06321	Illegal to modify viewing environment with retained segment open; no-op

VUP3D(PTXYZ,PHXYZ)
"(Define) view up 3-D (vector)"

Purpose
Defines the view up vector

Inputs

PTXYZ	The point which is the tail (origin) of the directed line segment (default: 0.0, 0.0, 0.0)
PHXYZ	The point which is the head (destination) of the directed line segment (default: 0.0, 1.0, 0.0)

Errors

05921	Null view up vector; no-op
05931	Illegal to modify viewing environment with retained segment open; no-op

VWPORT(XMIN,XMAX,YMIN,YMAX)
"Viewport"

Purpose
Defines, in display surface units, extent of the display surface on which output is to be displayed; default is entire display surface of output device

Inputs

XMIN	Minimum X coordinate of viewport
XMAX	Maximum X coordinate of viewport
YMIN	Minimum Y coordinate of viewport
YMAX	Maximum Y coordinate of viewport

Errors

05121	Minimum coordinate greater than or equal to corresponding maximum coordinate; no-op
05122	A viewport corner is outside device limits; no-op
05123	Illegal to modify viewing with ret. seg open; no-op

VWPT3D(PXMIN,PXMAX,PYMIN,PYMAX, PZMIN,PZMAX)
"Viewport 3-D"

Purpose
Specifies the extents of the 3-D viewport in the viewport coordinate system; the default X and Y extents are the entire display surface area, the default Z extent is 0.0 to 100.0 world units

Inputs

PXMIN	Minimum X coordinate of viewport
PXMAX	Maximum X coordinate of viewport
PYMIN	Minimum Y coordinate of viewport
PYMAX	Maximum Y coordinate of viewport
PZMIN	Minimum Z coordinate of viewport
PZMAX	Maximum Z coordinate of viewport

Errors

10021	One of the maximums is less than or equal to minimum coordinate; no-op
10022	Viewport corner is outside device limits; no-op
10023	Illegal to modify viewing environment with retained segment open; no-op

W22NDC(XWORLD,YWORLD,XNDC,YNDC)
"(Convert) world 2-D (coordinates) to NDC's"

Purpose
Converts 2-D world coordinates to normalized device coordinates (NDC's)

Inputs

XWORLD	X-axis world coordinate to be converted
YWORLD	Y-axis world coordinate to be converted

Outputs

XNDC	X-axis NDC coordinate
YNDC	Y-axis NDC coordinate

W32BB(POINT,PXGDU,PYGDU)
"World 3-D to billboard"

Purpose
Transforms a point in 3-D world space onto the billboard

Inputs

POINT(3)	(X,Y,Z) point in world space

Outputs

PXGDU	X coordinate of the point transformed into 2-D GDU space
PYGDU	Y coordinate of the point transformed into 2-D GDU space

Errors

29821	Billboard not defined; no-op

W32NDC(XWORLD,YWORLD,ZWORLD,XNDC, YNDC,ZNDC)
"(Convert) world 3-D (coordinates) to NDC's"

Purpose
Converts 3-D world coordinates to 3-D normalized device coordinates (NDC's)

Inputs

XWORLD	X-axis world coordinate to be converted
YWORLD	Y-axis world coordinate to be converted
ZWORLD	Z-axis world coordinate to be converted

Outputs

XNDC	X-axis NDC coordinate
YNDC	Y-axis NDC coordinate
ZNDC	Z-axis NDC coordinate

WAIT1X
"Wait (for a 4110 Series terminal response)"

Purpose
Waits until the terminal has processed all commands in the queue

WHER3D(PX,PY,PZ)
"Where (is the cursor or plotter pen in) 3-D?"

Purpose
Returns the location of the (unclipped) cursor or plotter pen in the 3-D world coordinate system

Outputs

PX	X coordinate of cursor or pen location
PY	Y coordinate of cursor or pen location
PZ	Z coordinate of cursor or pen location

WHERE(PX,PY)
"Where (is the cursor or plotter pen)?"

Purpose
Returns the location of the cursor or plotter pen in world space units

Outputs

PX	X coordinate of cursor or pen location
PY	Y coordinate of cursor or pen location

WINCLP(QVALUE)
"Window clipping (on or off)"

Purpose
Specifies whether subsequent graphics will be clipped at the world coordinate system window

Inputs

QVALUE	
.TRUE.	Initiates clipping of primitives at the window boundary (default)
.FALSE.	Ends window clipping

Errors

04921	Cannot change viewing while a segment is open; no-op

WIND3D(PUMN,PUMX,PVMN,PVMX,PFRNT,PBACK)
"Window 3-D"

Purpose
Specifies the dimensions of the 3-D window in the UV system

Inputs

PUMN	Minimum U coordinate
PUMX	Maximum U coordinate
PVMN	Minimum V coordinate
PVMX	Maximum V coordinate
PFRNT	Location of front clipping plane
PBACK	Location of back clipping plane

Errors

10121	Illegal to modify viewing environment with retained segment open; no-op
10131	Maximum coordinate less than or equal to corresponding minimum coordinate; no-op

WINDOW(XMIN,XMAX,YMIN,YMAX)
"Window"

Purpose
Specifies the portion of the coordinate system to be viewed

Inputs

XMIN	Minimum X coordinate of window
XMAX	Maximum X coordinate of window
YMIN	Minimum Y coordinate of window
YMAX	Maximum Y coordinate of window

Errors

05021	Minimum coordinate equals maximum coordinate; no-op
05031	Illegal to modify viewing with ret. seg open; no-op

WRPHDR(ICHN,IHTYPE,ICNT,IPARMS)
"Write picture (file) header"

Purpose
Writes a header to a pixel data file

Inputs

ICHN	The channel number of the file to be read
IHTYPE	Header type
1	Standard header
2	Color model header
ICNT	The count of parameter values in the header
IPARMS	Array of parameter values in header
IPARMS(1)	Number of bits per pixel
IPARMS(2)	XMIN of pixel viewport
IPARMS(3)	YMAX of pixel viewport
IPARMS(4)	YMIN of pixel viewport
IPARMS(5)	YMAX of pixel viewport

Errors

18351	ICHN out of range (1,8); no-op
18352	Invalid IHTYPE; no-op
18353	ICNT less than 5; no-op
18354	Invalid element in IPARMS; abort
18371	ICHN is not a sequential write file; abort

WTFONT(IFNAM,IFILSZ,IFFNO,IFONT)
"Write font"

Purpose
Writes a font from local font storage to a permanent host file

Inputs

IFNAM(6)	Name of host file, specified in current text format (ADE, A1, or AM)
IFILSZ	Size of host file to which font is to be written; specified in terms of 20-word records
IFFNO	Identification number of font in local storage
IFONT	Identification number assigned to the font in the new host file

Errors

03003	Input font number (IFFNO)out of user-defined range; no-op
03004	Output font number (IFONT) out of user-defined range; no-op
03021	Font (IFFNO) not defined; no-op
03022	Font integrity error (incorrect font header identification); abort
03023	No host communication channels available; no-op
03031	Font integrity error (incorrect font pointer table termination code); no-op
03032	Font integrity error (incorrect font header termination code); no-op
03033	Font integrity error (incorrect character termination code); no-op

XPROC(INMPRO)
"Execute a (downloaded) procedure"

Purpose
Executes a downloadable procedure definition

Inputs

INMPRO	The downloadable procedure number to be expanded (0,255)

Errors

21451	INMPRO out of range (0,255); no-op
21471	Downloadable procedures not present on device; no-op

XYPR1X(PX,PY,IBUF)
"(Encode a real) 4110 series terminal X,Y pair"

Purpose
Places a 4110 Series X,Y coordinate pair in the terminal command buffer

Inputs

PX	The X coordinates (in GDU's) to be encoded
PY	The Y coordinate (in GDU's) to be encoded
IBUF	The terminal command buffer

Outputs

IBUF	Updated terminal command buffer

Errors

11551	X parameter out of range ; no-op
11552	Y parameter out of range ; no-op
11553	Terminal command buffer too small for data; no-op

XYPR63(PX,PY,IBUF)
"(Encode a) real 4663 X,Y pair"

Purpose
Converts an X,Y coordinate pair to ADE format and put the pair into the plotter command buffer; enough room must be provided for all the ADE values plus the decimal points and comma, in addition to the regular buffer overhead; see the user's manual for buffer size information.

Inputs

PX	The X coordinate for a move or draw
PY	The Y coordinate for a move or draw
IBUF	The plotter command buffer

Outputs

IBUF	The updated plotter command buffer

Errors

20551	IBUF too small to translate X and Y value to ADE; no-op
20552	IBUF too small to translate Y value to ADE; no-op

ZOOM(PXMIN,PXMAX,PYMIN,PYMAX)
"(Host computer) zoom (and pan)"

Purpose
Zooms and pans in the current view

Inputs

PXMIN	The minimum X coordinate (in world units) of the area to be zoomed
PXMAX	The maximum X coordinate (in world units) of the area to be zoomed
PYMIN	The minimum Y coordinate (in world units) of the area to be zoomed
PYMAX	The maximum Y coordinate (in world units) of the area to be zoomed

Errors

17051	PXMIN is not within the window; no-op
17052	PXMAX is not within the window; no-op
17053	PYMIN is not within the window; no-op
17054	PYMAX is not within the window; no-op
17071	No zoom/pan capabilities on this device; no-op
17072	PXMIN greater than or equal to PXMAX; no-op
17073	PYMIN greater than or equal to PYMAX; no-op
17074	Cannot zoom with open segment; no-op

Note
Requires device with ZOOM feature

ZPERSP
"Z-axis perspective projection"

Purpose
Specifies 3-D Z-axis perspective projection

Errors

05621	Illegal to modify viewing environment with retained segment open; no-op

Table 15

CHARACTER CELL SIZES (IN GDUS) IN TEKTRONIX DEVICES

Device, Option	Font Size	Width	ICD[a]	CW[b]	Height	ILD[c]	CH[d]
4006,1	-	1.410	0.385	1.795	1.795	1.026	2.821
4010,1	-	1.410	0.385	1.795	1.795	1.026	2.821
4012/13,1	-	1.410	0.385	1.795	1.795	1.026	2.821
4012/13,2	1	1.410	0.385	1.795	1.795	1.026	2.821
	2	0.804	0.219	1.023	1.023	0.585	1.608
4014/4015,1	1	1.410	0.385	1.795	1.795	1.026	2.821
4016,2	2	1.283	0.350	1.633	1.633	0.933	2.566
	3	0.856	0.233	1.089	1.089	0.623	1.712
	4	0.776	0.212	0.988	0.987	0.564	1.551
4016,1	3	0.776	0.212	0.988	0.987	0.564	1.551
	4	0.582	0.159	0.741	0.741	0.424	1.165
4025/27 ("A" versions also)	-	1.667	0.238	1.905	2.143	1.190	3.333
4112	Default	1.440	.480	1.920	1.920	1.181	3.101
4113	Default	1.440	.480	1.920	1.920	1.181	3.101
4114	Default	1.282	.513	1.795	1.923	1.026	2.949
4662[e], 4663	-	1.367	0.684	2.051	1.969	1.253	3.222

Character cell dimensions vary with different aspect ratios. See the 4663 Programmer's Reference Manual for aspect ratio/cell dimension information

[a] **Inter-character distance**

[b] **Character cell width (width + ICD)**

[c] **Inter-line character distance**

[d] **Character cell height (height + ILD)**

[e] **Default for RS-232 I/F**

Table 16

TYPSET COMMAND FUNCTIONS

LIN<real>	Moves down <real> character heights, mimicking the effect of a carriage return/line feed. If the real value is negative or zero, it will be appropriately interpreted. For example, −1.0 reverses the line feed, 0.0 overwrites the current line. The default is 1.0
HOM<real>	Goes to the "home" position on the page, as defined by a call to MARGIN. The argument specifies the number of lines to move down from the "home" position. The default is that the first text line appears one line feed below the "home" point. See MARGIN.
LEF	Changes to left justification (see MARGIN and TXLEFT); this is the default.
RIT	Changes to right justification (see MARGIN and TXRITE).
CEN	Changes to center justification (see MARGIN and TXCENT).
BOT	Changes to both right and left justification (see MARGIN and TXBOTH).
FNT<int>	Changes to the IGL font number specified; FNT is equivalent to TXFONT and affects the rest of the IGL text environment.
SCA<real>	Scales current character width and height by the value given. SCA is similar but not identical to SCALE, which has separate arguments for scaling on the X- and Y-axes. Calling SCA affects the IGL text environment. An argument of 0.0 returns the default hardware character size.
SLT<real>	Changes the character slant to the value given. Multiple calls are not additive.
CLR<int>	Changes the text color to the color designated by the value given (as specified by CLRMAP — see the IGL User's Manual). CLR acts like TXTCLR.

Table 16 (cont)

TYPSET COMMAND FUNCTIONS

ADE<int>	Outputs the ADE character specified by the value given in the current text font.
SET<int>	Sets tab stop to the current cursor position. The integer value following SET must be in the range 1 to the ***NUMBER-OF-TABS***. By default the upper end of the range is 20, but this may be altered at installation; check with your system programmer. The default tab stop is 1. See the Graphics Text Composer (Option 4D) User's Manual for discussion about how to use SET with SUB and SUP.
TAB<int>	Moves to tab stop and forces the first character of the string to start right at the tab stop. The default is 1.IRIT and CEN will justify only the portion of a text string prior to an embedded TAB. Text following a TAB is left-justified to the tab stop. See TXBOTH in the Graphics Text Composer (Option 4D) User's Manual for discussion of its interaction with TAB.
UND<int>	Draws an underline. If the argument is a positive integer, one inter-character gap is subtracted from the end of the string to be underlined before the UND command is executed. If the argument is negative, the string is underlined from the tab stop to the current cursor position.
SUB	Changes to subscripting mode until further notice. Later subscripting and superscripting commands are additive. This command appropriately positions and scales characters.
SUP	Changes to superscripting mode until further notice. Later superscripting and subscripting commands are additive. This command appropriately positions and scales characters.
BAK<int>	Backs off <int> levels of subscripting and superscripting. The default is 1. TYPSET cannot back off more levels than specified by SUB and/or by SUP.

Table 16 (cont)

TYPSET COMMAND FUNCTIONS

END	END signals the end of the string but is not a line terminator. It is a buffer command, and its use alone does not output your input string. END may be used to circumvent the TYPSET argument ICOUNT. If your host computer/compiler does not do much run time checking of array declarations, it may be convenient to input a very large number for ICOUNT and type an END command at the end of the buffer. For example: CALL TYPSET(32000,'TEXT . . . <C>END;') where <C> equals a command character.

Table 17

VALUES RETURNED BY VALOF

IVAL	INFORMATION RETURNED	
1	Device number	(4010, 4025, etc.)
2	Device option	
3	Line color	
4	Dash pattern	
5	Background color	
6	Text format	(1 = ADE; 2 = A1; 3 = AM)
7	TXICUR value	
8	TXFCUR value	(1 = CRF; 2 = Concat.; 3 = Back to initial position)
9	Text color	
10	Text font number	
11	Text quality	
12	Maximum hardware dash pattern available	
13	Matrix premultiplication flag	(0 = No; 1 = Yes)
14	Relative vectors (1); absolute vectors (2)	
15	Viewport Clipping	(0 = CLIP; 1 = NOCLIP)
16	Skipping Flag	(0 = Next vector visible; SKIP has not been called)
17	Remove/Appear	(0 = Foreground color lines; 1 = Background color lines)
18	Surface display unit conversion factor	(user unit * factor = GDU's)
19	Angle unit conversion factor	(user unit * factor = radians)
20	2-D modeling pivot point X value	(world units)
21	2-D modeling pivot point Y value	(world units)
22	2-D window XMIN	(world units)
23	2-D window XMAX	(world units)
24	2-D window YMIN	(world units)
25	2-D window YMAX	(world units)
26	2-D viewport XMIN	(display surface units)
27	2-D viewport XMAX	(display surface units)
28	2-D viewport YMIN	(display surface units)
29	2-D viewport YMAX	(display surface units)
30	2-D clipping edge XMIN	(display surface units)
31	2-D clipping edge XMAX	(display surface units)
32	2-D clipping edge YMIN	(display surface units)
33	2-D clipping edge YMAX	(display surface units)

Table 17 (cont)

VALUES RETURNED BY VALOF

34	Granularity	
35	Text line angle	(current angle units)
36	Text slant angle	(current angle units)
37	Text character width	(if TXWORL has been called, world units; otherwise screen units)
38	Text character height	(if TXWORL has been called, world units; otherwise screen units)

With Graphic Text Emulation [Option 3D]

39	Character spacing	(1 = proportional; 2 = constant)
40	TYPSET justification	(1 = left; 2 = center; 3 = right; 4 = both)
41	TYPSET escape character	(in current text format)
42	Marker font number	
43	Marker color	
44	Pen type for calligraphic fonts	(1 = ball; 2 = line)
45	Text world flag	(1 = world units; 2 = display surface units)
46	Text intercharacter gap	(as a fraction of width)
47	Text interline gap	(as a fraction of height)
48	TYPSET page upper left X coordinate	(world units)
49	TYPSET page upper left Y coordinate	(world units)
50	TYPSET page margin distance	(world units)
51	Calligraphic pen point size	(in 1/line height notation)

With Line Smoothing [Option 4E]

52	Open/closed polygons	(0 = open; 1 = closed)
53	Smoothing	(1 = on; 0 = off)

With Panel Support [Option 4E]

54	Current pattern map to use in filling panels	
55	Panel outlining	(0 = no; 1 = yes)
56	.TRUE. if device does panels	

Table 17 (cont)

VALUES RETURNED BY VALOF

With 3-D Graphics Support [Option 4B]

57	Projection type	(1 = parallel; 2 = perspective)
58	Coordinate system polarity	(0 = right-handed; 1 = left-handed)
59	Viewing mode	(1 = Camera; 0 = Sig)
60	View volume side clipping	(0 = off; 1 = on)
61	Front plane view volume clipping	(0 = off; 1 = on)
62	Back plane view volume clipping	(0 = no; 1 = yes)
63	3-D pre-matrix multiplication flag	(0 = no; 1 = yes)
64	3-D pivot point X	(world units)
65	3-D pivot point Y	(world units)
66	3-D pivot point Z	(world units)
67	3-D axis of rotation X	(world units)
68	3-D axis of rotation Y	(world units)
69	3-D axis of rotation Z	(world units)
70	3-D clipping edge UMIN	(world units)
71	3-D clipping edge UMAX	(world units)
72	3-D clipping edge VMIN	(world units)
73	3-D clipping edge VMAX	(world units)
74	3-D viewport XMIN	(display surface units)
75	3-D viewport XMAX	(display surface units)
76	3-D viewport YMIN	(display surface units)
77	3-D viewport YMAX	(display surface units)
78	3-D viewport ZMIN	(display surface units)
79	3-D viewport ZMAX	(display surface units)
80	3-D window UMIN on viewplane	(world units)
81	3-D window UMAX on viewplane	(world units)
82	3-D window VMIN on viewplane	(world units)
83	3-D window VMAX on viewplane	(world units)
84	3-D window front distance	(world units)
85	3-D window back distance	(world units)
86	Billboard existence flag	(0 = no; 1 = yes)
87	Billboard point 1 X	(world units)
88	Billboard point 1 Y	(world units)
89	Billboard point 1 Z	(world units)

Table 17 (cont)

VALUES RETURNED BY VALOF

90	Billboard point 2 X	(world units)
91	Billboard point 2 Y	(world units)
92	Billboard point 2 Z	(world units)
93	Billboard point 3 X	(world units)
94	Billboard point 3 Y	(world units)
95	Billboard point 3 Z	(world units)
96	Back clipping plane distance	(world units)
97	Front clipping plane distance	(world units)
98	Center of projection (EYEBAL) X	(world units)
99	Center of projection (EYEBAL) Y	(world units)
100	Center of projection (EYEBAL) Z	(world units)
101	View plane distance	(world units)
102	View plane normal X	(world units)
103	View plane normal Y	(world units)
104	View plane normal Z	(world units)
105	View reference point X	(world units)
106	View reference point Y	(world units)
107	View reference point Z	(world units)
108	View up vector tail X	(world units)
109	View up vector tail Y	(world units)
110	View up vector tail Z	(world units)
111	View up vector head X	(world units)
112	View up vector head Y	(world units)
113	View up vector head Z	(world units)

With Graphics Segment Support [Option 4A]

114	Number of the open segment	(0 = temporary; 1 to 32767 = retained)

ERROR NUMBERS

In Table 18, you can look up all error numbers associated with routines in this guide. Refer to the other tables in this section or the main alphabetical section for more information about each routine.

Table 18

ERROR NUMBERS

Error Number	Routine	Error Number	Routine
00151	SETBLK	01201	POLY3D
00161	SETBLK	01251	SETHIL
00251	SETAPT	01261	SETHIL
00301	POLY	01271	SETHIL
00351	SETTYP	01301	LOC3D
00361	SETTYP	01311	LOC3D
00371	SETTYP	01321	LOC3D
00372	SETTYP	01351	SETDET
00401	ARC	01361	SETDET
00451	SETBTM	01371	SETDET
00471	SETBTM	01401	PANL3D
00551	SETPID	01421	PANL3D
00571	SETPID	01451	SETPRI
00651	SETTRN	01452	SETPRI
00652	SETTRN	01461	SETPRI
00653	SETTRN	01471	SETPRI
00661	SETTRN	01603	RDFONT
00671	SETTRN	01613	RDFONT
00701	PANEL	01621	RDFONT
00721	PANEL	01622	RDFONT
00751	SET2TN	01623	RDFONT
00755	SET2TN	01624	RDFONT
00756	SET2TN	01641	RDFONT
00761	SET2TN	01821	GETPIK
00771	SET2TN	01822	GETPIK
00781	SET2TN	01823	GETPIK
00851	SET3TN	01901	ADDFNT
00858	SET3TN	01911	ADDFNT
00859	SET3TN	01921	ADDFNT
00860	SET3TN	01951	ADDMBR
00861	SET3TN	01952	ADDMBR
00871	SET3TN	01953	ADDMBR
00872	SET3TN	01961	ADDMBR
00881	SET3TN	01962	ADDMBR
00901	LOCATE	01971	ADDMBR
00911	LOCATE	02001	TEXT
00951	SET2PV	02021	TEXT
00952	SET2PV	02022	TEXT
01051	SET3PV	02051	DELMBR
01052	SET3PV	02052	DELMBR
01053	SET3PV	02053	DELMBR
01072	SET3PV	02061	DELMBR
01151	SETVIS	02062	DELMBR
01161	SETVIS	02071	DELMBR
01171	SETVIS	02101	RNUMBR

Table 18 (cont)

ERROR NUMBERS

Error Number	Routine	Error Number	Routine
02121	RNUMBR	02902	DELCHR
02151	SETMCL	02911	DELCHR
02152	SETMCL	02912	DELCHR
02153	SETMCL	02921	DELCHR
02162	SETMCL	02922	DELCHR
02171	SETMCL	02923	DELCHR
02201	INUMBR	03003	WTFONT
02221	INUMBR	03004	WTFONT
02272	SAVSEG	03021	WTFONT
02273	SAVSEG	03022	WTFONT
02274	SAVSEG	03023	WTFONT
02275	SAVSEG	03031	WTFONT
02276	SAVSEG	03032	WTFONT
02277	SAVSEG	03033	WTFONT
02278	SAVSEG	03101	OPNSEG
02279	SAVSEG	03111	OPNSEG
02301	GETUTX	03121	OPNSEG
02303	GETUTX	03122	OPNSEG
02311	GETUTX	03151	INQVIS
02371	RESSEG	03161	INQVIS
02372	RESSEG	03311	CLOSEG
02373	RESSEG	03351	INQTYP
02374	RESSEG	03361	INQTYP
02376	RESSEG	03401	DELSEG
02377	RESSEG	03501	RENSEG
02378	RESSEG	03502	RENSEG
02379	RESSEG	03512	RENSEG
02421	GETURN	03601	CPYSEG
02422	GETURN	03602	CPYSEG
02451	SGFNAM	03611	CPYSEG
02471	SGFNAM	03621	CPYSEG
02521	GETUIN	03622	CPYSEG
02522	GETUIN	03651	INQTRN
02601	ADDCHR	03661	INQTRN
02602	ADDCHR	03721	TYPSET
02621	ADDCHR	03722	TYPSET
02622	ADDCHR	03751	INQ2TN
02623	ADDCHR	03771	INQ2TN
02624	ADDCHR	03781	INQ2TN
02625	ADDCHR	03801	VALOF
02721	MARKER	03802	VALOF
02801	DELFNT	03851	INQ3TN
02811	DELFNT	03871	INQ3TN
02821	DELFNT	03872	INQ3TN
02901	DELCHR	03881	INQ3TN

Table 18 (cont)

ERROR NUMBERS

Error Number	Routine	Error Number	Routine
03902	DEVFNT	06121	VPN3D
03951	INQ2PV	06221	CAMERA
03971	INQ2PV	06321	VRP3D
04051	INQ3PV	06421	VPDIST
04071	INQ3PV	07301	MTRAN
04072	INQ3PV	07721	TRIDNT
04081	INQ3PV	08103	SHR3D
04251	INQHIL	08112	SHR3D
04261	INQHIL	08601	PIVT3D
04351	INQDET	08801	MTR3D
04361	INQDET	08821	MTR3D
04451	INQPRI	08901	BATCH
04461	INQPRI	08921	BATCH
04551	INQCLS	09921	EDGE3D
04552	INQCLS	09931	EDGE3D
04561	INQCLS	10021	VWPT3D
04621	RSETWV	10022	VWPT3D
04651	INQMCL	10023	VWPT3D
04654	INQMCL	10051	SETGRD
04702	BILLBD	10052	SETGRD
04703	BILLBD	10071	SETGRD
04713	BILLBD	10072	SETGRD
04723	BILLBD	10073	SETGRD
04751	INQNMS	10121	WIND3D
04752	INQNMS	10131	WIND3D
04801	SETGIN	10171	INQGRD
04921	WINCLP	10251	SETINK
05021	WINDOW	10271	SETINK
05121	VWPORT	10371	INQINK
05122	VWPORT	10452	SETSTR
05123	VWPORT	10453	SETSTR
05221	EDGE	10471	SETSTR
05222	EDGE	10472	SETSTR
05223	EDGE	10473	SETSTR
05321	CLIP	10474	SETSTR
05521	PARALL	10571	INQSTR
05621	ZPERSP	10651	PENCLR
05721	FBCP3D	10652	PENCLR
05722	FBCP3D	10671	PENCLR
05821	QCLP3D	10672	PENCLR
05921	VUP3D	10673	PENCLR
05931	VUP3D	10674	PENCLR
06001	EYEBAL	10700	ENDPNT
06021	EYEBAL	10751	SETRUB
06101	VPN3D	10771	SETRUB

Table 18 (cont)

ERROR NUMBERS

Error Number	Routine	Error Number	Routine
10871	INQRUB	14271	SETDM
10901	ENDSLP	14351	INQDM
11051	BEG1X	14352	INQDM
11052	BEG1X	14361	INQDM
11251	END1X	14371	INQDM
11351	INT1X	14451	DRGSEG
11352	INT1X	14461	DRGSEG
11401	DASHPT	14471	DRGSEG
11452	RL1X	14501	TXESC
11551	XYPR1X	14551	SETCUR
11552	XYPR1X	14571	SETCUR
11553	XYPR1X	14701	PENTYP
11601	GRAIN	14702	PENTYP
11651	RPT1X	14771	INQCUR
11751	CHR1X	14851	DLTCHR
11752	CHR1X	14852	DLTCHR
11951	INRY1X	14871	DLTCHR
11952	INRY1X	14872	DLTCHR
11953	INRY1X	15071	INQPNL
12251	CHRY1X	15101	RESTOR
12252	CHRY1X	15111	RESTOR
12851	GXY1X	15121	RESTOR
12951	GRL1X	15151	SVEMVS
13001	TXQUAL	15401	BAUDRT
13021	TXQUAL	15721	NEWDEV
13051	GINT1X	15921	CLOCAP
13101	MRKFNT	16021	REPLAY
13201	TXSLNT	16022	REPLAY
13401	TXICUR	16023	REPLAY
13501	TXFCUR	16024	REPLAY
13551	PXY1X	16025	REPLAY
13552	PXY1X	16027	REPLAY
13553	PXY1X	16051	SETVW
14051	DWNFNT	16052	SETVW
14052	DWNFNT	16053	SETVW
14071	DWNFNT	16071	SETVW
14072	DWNFNT	16121	REPORT
14073	DWNFNT	16151	INQVW
14074	DWNFNT	16171	INQVW
14101	TXSIZE	16201	SVEGRA
14151	CLRPLT	16251	SELVW
14171	CLRPLT	16271	SELVW
14172	CLRPLT	16272	SELVW
14251	SETDM	16301	SVETRN
14252	SETDM	16351	DELVW

Table 18 (cont)

ERROR NUMBERS

Error Number	Routine	Error Number	Routine
16371	DELVW	17451	PXLRD
16372	DELVW	17453	PXLRD
16373	DELVW	17471	PXLRD
16401	SVETXT	17472	PXLRD
16451	SETSRF	17621	INIFIL
16452	SETSRF	17671	INQPVW
16461	SETSRF	17751	PIXPAT
16471	SETSRF	17752	PIXPAT
16551	INQSRF	17753	PIXPAT
16571	INQSRF	17754	PIXPAT
16651	SRFVIS	17755	PIXPAT
16652	SRFVIS	17756	PIXPAT
16671	SRFVIS	17757	PIXPAT
16751	SRFPRI	17771	PIXPAT
16752	SRFPRI	17772	PIXPAT
16771	SRFPRI	17801	MATMUL
16851	BORDER	17851	PICDIS
16871	BORDER	17871	PICDIS
16951	FIXUP	17872	PICDIS
16971	FIXUP	17873	PICDIS
17051	ZOOM	17874	PICDIS
17052	ZOOM	17876	PICDIS
17053	ZOOM	17877	PICDIS
17054	ZOOM	17878	PICDIS
17071	ZOOM	17901	COPY
17072	ZOOM	17951	SETPVW
17073	ZOOM	17952	SETPVW
17074	ZOOM	17953	SETPVW
17151	GETPXL	17954	SETPVW
17171	GETPXL	17971	SETPVW
17172	GETPXL	17972	SETPVW
17173	GETPXL	17973	SETPVW
17174	GETPXL	18001	KAM2AS
17175	GETPXL	18051	PICSAV
17251	SAVPXL	18054	PICSAV
17252	SAVPXL	18071	PICSAV
17253	SAVPXL	18072	PICSAV
17261	SAVPXL	18073	PICSAV
17271	SAVPXL	18074	PICSAV
17272	SAVPXL	18075	PICSAV
17273	SAVPXL	18076	PICSAV
17301	FILPAN	18101	KAS2AM
17351	PXLWRT	18201	KA12AS
17353	PXLWRT	18251	RDPHDR
17371	PXLWRT	18253	RDPHDR

Table 18 (cont)

ERROR NUMBERS

Error Number	Routine	Error Number	Routine
18261	RDPHDR	20051	BEG63
18262	RDPHDR	20052	BEG63
18271	RDPHDR	20053	BEG63
18272	RDPHDR	20121	CMCLOS
18273	RDPHDR	20271	END63
18301	KAS2A1	20351	INT63
18351	WRPHDR	20352	INT63
18352	WRPHDR	20452	RL63
18353	WRPHDR	20501	HFOPEN
18354	WRPHDR	20503	HFOPEN
18371	WRPHDR	20504	HFOPEN
18451	HSTCPY	20505	HFOPEN
18471	HSTCPY	20514	HFOPEN
18472	HSTCPY	20515	HFOPEN
18473	HSTCPY	20521	HFOPEN
18474	HSTCPY	20551	XYPR63
18475	HSTCPY	20552	XYPR63
18476	HSTCPY	20601	HFCLOS
18477	HSTCPY	20621	HFCLOS
18502	CVR2C	20701	HFENQ
18504	CVR2C	20851	CHRY63
18521	CVR2C	20853	CHRY63
18551	SETPBM	21001	HFREAD
18552	SETPBM	21002	HFREAD
18571	SETPBM	21021	HFREAD
18601	CVC2I	21022	HFREAD
18651	SETPXL	21023	HFREAD
18652	SETPXL	21051	GINT63
18671	SETPXL	21101	HFWRIT
18672	SETPXL	21102	HFWRIT
18701	CVC2R	21121	HFWRIT
18721	CVC2R	21122	HFWRIT
18722	CVC2R	21201	HFSQR
18723	CVC2R	21202	HFSQR
18771	INQPXL	21221	HFSQR
18851	SETPNL	21222	HFSQR
18852	SETPNL	21223	HFSQR
18853	SETPNL	21251	BPROC
18871	SETPNL	21271	BPROC
18971	INQCRV	21272	BPROC
19071	INQPBM	21301	HFSQW
19601	SVEWVT	21302	HFSQW
19701	SVE3TR	21321	HFSQW
19801	SVE3VW	21322	HFSQW
20021	CMOPEN	21371	EPROC

Table 18 (cont)

ERROR NUMBERS

Error Number	Routine	Error Number	Routine
21372	EPROC	**22271**	ADVMED
21401	HFRNR	**22371**	INQFML
21402	HFRNR	**22451**	SETFML
21421	HFRNR	**22471**	SETFML
21422	HFRNR	**26621**	SETSPD
21451	XPROC	**26622**	SETSPD
21471	XPROC	**26623**	SETSPD
21501	HFRNW	**26701**	PAT027
21502	HFRNW	**26721**	PAT027
21521	HFRNW	**26921**	STORPN
21522	HFRNW	**28101**	SPLINE
21551	DPROC	**28102**	SPLINE
21571	DPROC	**28121**	SPLINE
21651	PAG663	**28605**	LLSQ
21652	PAG663	**28622**	LLSQ
21653	PAG663	**28701**	POLVAL
21671	PAG663	**28801**	PATERN
21751	I2BIN	**28803**	PATERN
21752	I2BIN	**29821**	W32BB
21951	STAT63	**29921**	BB2W3
21952	STAT63	**32002**	CPYCHR
21962	STAT63	**32004**	CPYCHR
21971	STAT63	**32021**	CPYCHR
21972	STAT63		
22251	ADVMED		

ROUTINES BY FUNCTIONAL CATEGORY

The routines in Table 19 are grouped by general functional similarity. If you know what general function a routine performs, but cannot remember the specific routine, look here to find it.

Table 19

ROUTINES BY FUNCTIONAL CATEGORY

System Environment Routines

BATCH	NEWDEV	SVEGRA
BAUDRT	OPNCAP	SVEMVS
CLOCAP	REPLAY	SVETRN
CMCLOS	REPORT	SVETXT
CMOPEN	RESTOR	SVEWVT
GRSTOP	SVE3TR	VALOF
GRSTRT	SVE3VW	
IERRNM	SVEALL	

Segment Routines

ADDMBR	INQHIL	SET3PV
CLOSEG	INQMCL	SET3TN
CLRPLT	INQNMS	SETAPT
CPYSEG	INQPID	SETBLK
DELMBR	INQPRI	SETBTM
DELSEG	INQTRN	SETCUR
DRGSEG	INQTYP	SETDET
INQ2PV	INQVIS	SETDM
INQ2TN	MAKCUR	SETHIL
INQ3PV	NDC2W2	SETMCL
INQ3TN	NDC2W3	SETPID
INQAPT	OPNSEG	SETPRI
INQBTM	RENSEG	SETTRN
INQCLS	RESSEG	SETTYP
INQCUR	SAVSEG	SETVIS
INQDET	SET2PV	SGFNAM
INQDM	SET2TN	

General Purpose Escape Routines

BEG1X	GINT1X	PXY1X
BEG63	GINT63	RL1X
CHR1X	G4L1X	RL63
CHRY1X	GXY1X	RPT1X
CHRY63	I2BIN	STAT63
END1X	INRY1X	WAIT1X
END63	INT1X	XYPRIX
GCHR1X	INT63	XYPR63

Table 19 (cont)

Graphic Environment Routines

APPEAR	LINCLR	SETGRD
BILLBD	MILLIM	SETINK
BKGCLR	MODELT	SETPNL
CAMERA	MRKCLR	SETRUB
CLIP	MTR3D	SETSPD
CLOPOL	MTRAN	SETSRF
CLRMAP	NOCLIP	SETSTR
CRDLFT	NOSMOO	SETVW
CRDRHT	OPNPOL	SHR3D
DASHPT	PAG663	SKIP
DEGREE	PARALL	SMOOTH
DELVW	PAT027	SRFPRI
EDGE	PATERN	SRFVIS
EDGE3D	PENCLR	SRFPNT
ENDPNT	PIRAD	STRSLP
ENDSLP	PIVOT	TRANSL
EYEBAL	PIVT3D	TRNXYZ
FBCP3D	PIXPAT	VECABS
FILPAN	POST3D	VECREL
FIXUP	PRE3D	VIEWT
GDUNIT	QCLP3D	VPDIST
GRADS	RADIAN	VPN3D
GRAIN	RASTER	VRP3D
INCHES	REMOVE	VUP3D
INQCRV	ROTA3D	VWPORT
INQFML	ROTATE	VWPT3D
INQGIN	ROTXYZ	WIND3D
INQGRD	RSETM	WINDOW
INQINK	RSETWV	ZPERSP
INQPNL	SCALE	
INQRUB	SCAXYZ	
INQSRF	SELVW	
INQSTR	SETFML	
INQVW	SETGIN	

Graphic Action Routines

ADVMED	GETPIK	MVLDPT
ARC	HDCOPY	NEWPAG
ARC3PT	HOME	PANEL
BELL	LOC3D	PANL3D
BORDER	LOCATE	POLY
DPOLAR	MARKER	POLY3D
DRAW	MOVE	WHER3D
DRAW3D	MOVE3D	WHERE
FATLIN	MPOLAR	ZOOM

Table 19 (cont)

Text Environment Routines

DEVFNT	TXBOTH	TXPROP
MARGIN	TXCENT	TXQUAL
MRKFNT	TXCONS	TXRITE
PENTYP	TXESC	TXSCRN
RDFONT	TXFCUR	TXSIZE
TXA1	TXFONT	TXSLNT
TXADE	TXGAP	TXTCLR
TXAM	TXICUR	TXWORL
TXANGL	TXLEFT	

Text Action Routines

GETUIN	INUMBER	TYPSET
GETURN	RNUMBER	
GETUTX	TEXT	

Host File and I/O Routines

HFCLOS	HFREAD	HFSQR
HFENQ	HFRNR	HFSQW
HFOPEN	HFRNW	HFWRIT

Pixel Access Routines

GETPXL	PICSAV	SETPBM
INQPBM	PXLRD	SETPVW
INQPVW	PXLWRT	SETPXL
INQPXL	RDPHDR	WRPHDR
PICDIS	SAVPXL	

Utility Routines

ADDCHR	DLTCHR	NORMAL
ADDFNT	DPROC	POLVAL
BB2W3	DWNFNT	REVT3D
BPROC	EPROC	REVTRN
COPY	HSTCPY	SPLINE
CPYCHR	INIFIL	STORPN
CVC2I	INIFNT	TRAN2
CVC2R	KA12AS	TRAN3D
CVI2C	KAM2AS	TYPSIZ
CVR2C	KAS2A1	W32BB
DELCHR	LLSQ	WTFONT
DELFNT	MATIDN	XPROC
DIST	MATMUL	

ROUTINES BY OPTION

Table 20
ROUTINES BY OPTION AND STANDARD CONFIGURATION

4662 Device Driver [Option 1D] [Standard Configuration 20 & Up]

PENCLR	SETSPD	STORPN

4663 Device Driver [Option 1E] [Standard Configuration 21 & Up]

ADVMED	EPROC	RL63
BEG63	GINT63	SETFML
BPROC	I2BIN	STAT63
CHRY63	INQFML	XPROC
DLTCHR	INT63	XYPR63
DPROC	MVLDPT	
DWNFNT	PAG663	
END63	PENCLR	

4112/4113 and 4114 Device Drivers [Option 1F/1J] [Standard Configuration 23 & Up]

BEG1X	GRL1X	RL1X
CHR1X	GXY1X	RPT1X
CHRY1X	INRY1X	WAIT1X
END1X	INT1X	XYPR1X
GCHR1X	PENCLR	
GINT1X	PXY1X	

Table 20 (cont)

4027 Device Driver
[Option 1H]
[Standard Configuration 21 & Up]

PAT027

4110 Series Special Feature Escapes
[Option 1K]
[Standard Configuration 23 & Up]

BORDER	INQPVW	SETGRD
DELVW	INQPXL	SETINK
DLTCHR	INQRUB	SETPBM
DRGSEG	INQSRF	SETPNL
DWNFNT	INQSTR	SETPVW
FIXUP	INQVW	SETPXL
GETPXL	PICDIS	SETRUB
HSTCPY	PICSAV	SETSRF
INQCRV	PIXPAT	SETSTR
INQCUR	PXLRD	SETVW
INQDM	PXLWRT	SRFPRI
INQGIN	RDPHDR	SRFVIS
INQGRD	SAVPXL	SVEMVS
INQINK	SELVW	WRPHDR
INQPBM	SETCUR	ZOOM
INQPNL	SETDM	

Table 20 (cont)

Primary Command Set
[Option 2A]
[Standard Configuration 20 & Up]

APPEAR	HFRNR	REVTRN
ARC	HFRNW	RNUMBR
ARC3PT	HFSQR	ROTATE
BAUDRT	HFSQW	SCALE
BELL	HFWRIT	SETGIN
BKGCLR	HOME	SKIP
CLIP	IERRNM	SVEALL
CLOCAP	INCHES	SVEGRA
CLRMAP	INUMBR	SVETRN
CMCLOS	KA12AS	SVETXT
CMOPEN	KAM2AS	TEXT
CVC2I	KAS2A1	TRAN2
CVC2R	KAS2AM	TRANSL
CVI2C	LINCLR	TRIDNT
CVR2C	LOCATE	TXA1
DASHPT	MILLIM	TXADE
DEGREE	MODELT	TXAM
DPOLAR	MOVE	TXANGL
DRAW	MPOLAR	TXFCUR
EDGE	MTRAN	TXFONT
GDUNIT	NEWDEV	TXICUR
GETUIN	NEWPAG	TXQUAL
GETURN	NOCLIP	TXSIZE
GETUTX	OPNCAP	TXSLNT
GRADS	PIRAD	TXTCLR
GRAIN	PIVOT	VECABS
GRSTOP	POLY	VECREL
GRSTRT	RADIAN	VIEWT
HDCOPY	RASTER	VWPORT
HFCLOS	REMOVE	WHERE
HFENQ	REPLAY	WINDOW
HFOPEN	REPORT	
HFREAD	RESTOR	

Panel Emulation
[Option 3C]
[Standard Configuration 21 & Up]

PATERN

Table 20 (cont)

Graphic Text and Emulation
[Option 3D]
[Standard Configuration 21 & Up]

ADDCHR	DELFNT	RDFONT
ADDFNT	FATLIN	WTFONT
CPYCHR	INIFIL	
DELCHR	INIFNT	

Line Smoothing Emulation
[Option 3E]
[Standard Configuration 22 & Up]

DIST	NORMAL	SPLINE
LLSQ	POLVAL	

Graphics Segment Support
[Option 4A]
[Standard Configuration 23 & Up]

ADDMBR	INQMCL	SET3PV
BATCH	INQNMS	SET3TN
CLOSEG	INQPID	SETAPT
CLRPLT	INQPRI	SETBTM
COPY	INQTRN	SETDET
CPYSEG	INQTYP	SETHIL
DELMBR	INQVIS	SETMCL
DELSEG	MAKCUR	SETPID
GETPIK	MATIDN	SETPRI
INQ2PV	MATMUL	SETTRN
INQ2TN	NDC2W2	SETTYP
INQ3PV	NDC2W3	SETVIS
INQ3TN	OPNSEG	SGFNAM
INQAPT	RENSEG	VALOF
INQBTM	RESSEG	W22NDC
INQCLS	SAVSEG	W32NDC
INQDET	SET2PV	WINCLP
INQHIL	SET2TN	

Table 20 (cont)

3-D Graphics
[Option 4B]
[Standard Configuration 21 & Up]

BB2W3	PANL3D	SVE3VW
BILLBD	PARALL	SVEWVT
CAMERA	PIVT3D	TRAN3D
COPY	POLY3D	TRNXYZ
CRDLFT	POST3D	VPDIST
CRDRHT	PRE3D	VPN3D
DRAW3D	QCLP3D	VRP3D
EDGE3D	REVT3D	VUP3D
EYEBAL	ROTA3D	VWPT3D
FBCP3D	ROTXYZ	W32BB
LOC3D	RSETM	WHER3D
MATIDN	RSETWV	WIND3D
MATMUL	SCAXYZ	ZPERSP
MOVE3D	SHR3D	
MTR3D	SVE3TR	

Panel Support
[Option 4C]
[Standard Configuration 21 & Up]

FILPAN	PANEL

Graphics Text Support
[Option 4D]
[Standard Configuration 21 & Up]

DEVFNT	TXBOTH	TXPROP
MARGIN	TXCENT	TXRITE
MARKER	TXCONS	TXSCRN
MRKCLR	TXESC	TXWORL
MRKFNT	TXGAP	TYPSET
PENTYP	TXLEFT	TYPSIZ

Line Smoothing Support
[Option 4E]
[Standard Configuration 22 & Up]

CLOPOL	NOSMOO	STRPNT
ENDPNT	OPNPOL	STRSLP
ENDSLP	SMOOTH	

ASCII CODE CHART

BITS B4 B3 B2 B1	B7 B6 B5 = 0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
	CONTROL		HIGH X & Y GRAPHIC INPUT		LOW X		LOW Y	
0 0 0 0	NUL 0	DLE 16	SP 32	0 48	@ 64	P 80	\ 96	p 112
0 0 0 1	SOH 1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113
0 0 1 0	STX 2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114
0 0 1 1	ETX 3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115
0 1 0 0	EOT 4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116
0 1 0 1	ENQ 5	NAK 21	% 37	5 53	E 69	U 85	e 101	u 117
0 1 1 0	ACK 6	SYN 22	& 38	6 54	F 70	V 86	f 102	v 118
0 1 1 1	BEL 7	ETB 23	' 39	7 55	G 71	W 87	g 103	w 119
1 0 0 0	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120
1 0 0 1	HT 9	EM 25	) 41	9 57	I 73	Y 89	i 105	y 121
1 0 1 0	LF 10	SUB 26	* 42	: 58	J 74	Z 90	j 106	z 122
1 0 1 1	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123
1 1 0 0	FF 12	FS 28	, 44	< 60	L 76	\ 92	l 108	¦ 124
1 1 0 1	CR 13	GS 29	- 45	= 61	M 77	] 93	m 109	} 125
1 1 1 0	SO 14	RS 30	. 46	> 62	N 78	^ 94	n 110	~ 126
1 1 1 1	SI 15	US 31	/ 47	? 63	O 79	_ 95	o 111	RUBOUT (DEL) 127

REV, JUN 1982

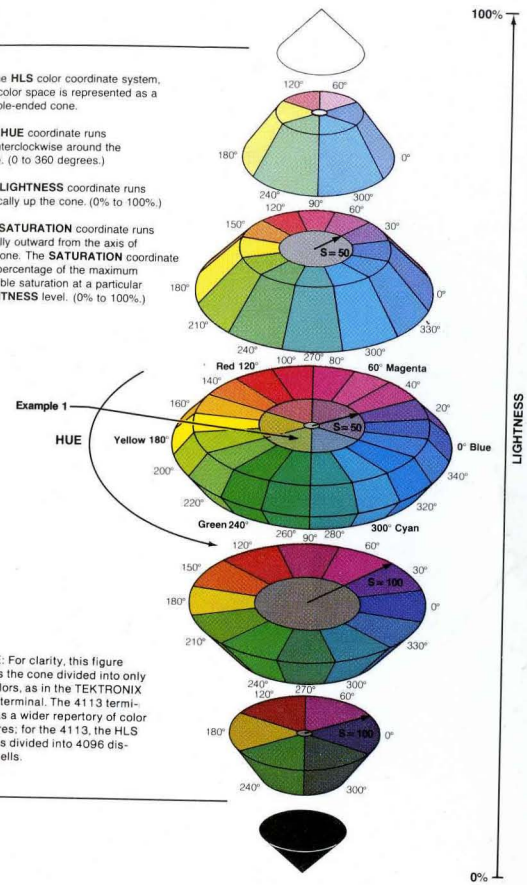
TEKTRONIX COLOR STANDARD

In the **HLS** color coordinate system, the color space is represented as a double-ended cone.

The **HUE** coordinate runs counterclockwise around the cone. (0 to 360 degrees.)

The **LIGHTNESS** coordinate runs vertically up the cone. (0% to 100%.)

The **SATURATION** coordinate runs radially outward from the axis of the cone. The **SATURATION** coordinate is a percentage of the maximum possible saturation at a particular **LIGHTNESS** level. (0% to 100%.)



NOTE: For clarity, this figure shows the cone divided into only 64 colors, as in the TEKTRONIX 4027 terminal. The 4113 terminal has a wider repertory of color mixtures; for the 4113, the HLS cone is divided into 4096 distinct cells.

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