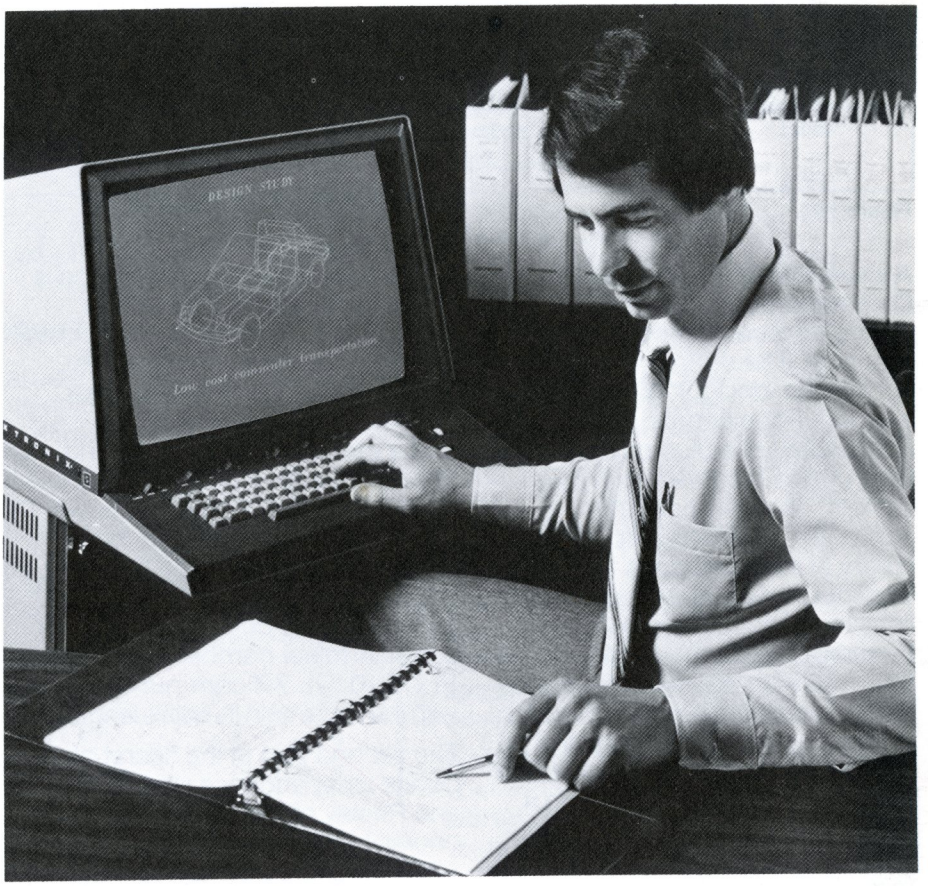
PLOT 10

Tektronix®

Display technology independent software for more productive graphics applications.

Interactive Graphics Library



Productivity and long term value are key issues in any business investment. When selecting a software product as a component of your company's investment in increased productivity, our **PLOT 10 Interactive Graphics Library** is a wise choice. To start, PLOT 10 IGL has the rich set of graphics tools needed to turn an idea into a meaningful display in minimum time. Thus, more time can be allocated to applications analysis and less to coding of graphics output. A better use of human resources.

In the long run, PLOT 10 IGL will pay off in extending the life of applications software. Maintenance and retraining costs are minimized because of the proven design of this product. Display technology is undergoing rapid change. Simply link in a new device driver software module and take advantage of progress...the new larger display, color, or intelligence option.

Standardizing has another advantage, too. Not only do you benefit from one base product for many applications, but changes in central processing power are less traumatic. PLOT 10 IGL is written to run under ANSI FORTRAN IV. It has been installed and tested on most major computer systems.

Product Specifications

Design Philosophy. The structure of PLOT 10 Interactive Graphics Library follows the concepts suggested in the ACM/SIGGRAPH study on a core standard for computer graphics. Though conformance of PLOT 10 IGL is neither guaranteed nor implied to exactly match the evolving core recommendation, it is offered in support of the recognized need for consistency in fundamental computer graphics concepts.

Figure 1 is a logical block diagram of PLOT 10 IGL. The major portion of the fundamental graphics commands are located in the Primary Command Set. Device independence is achieved by use of device driver modules which resolve any differences between a model terminal and the actual or target display device. Device drivers are offered as options to the main product. As new products are introduced new device drivers may be linked in to gain immediate use of previously developed applications code.

I/O routines are also offered separately. These are system dependent routines used to communicate with the terminal via the available data communication link. Host disk file I/O routines are included in this component of PLOT 10 IGL.

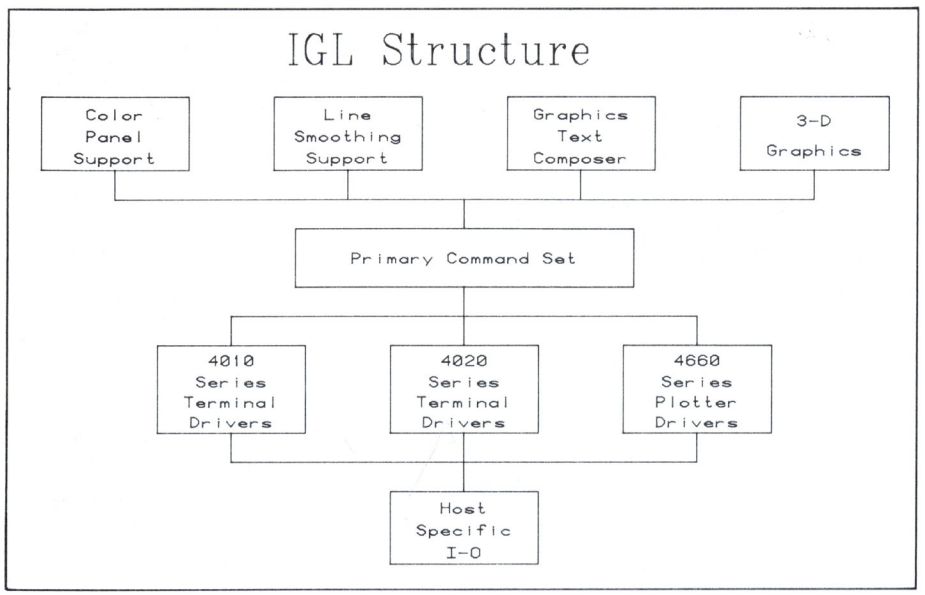


Figure 1.

A short tutorial on the Primary Command Set and an environmental approach to computer graphics. It takes time to write a subroutine, doing it twice can be avoided. For example, suppose a component of a blue print calls for a part to be drawn with solid vectors. Then the next time the subroutine is selected from your library of standard parts the component must be drawn with dotted lines or perhaps blue ink rather than red. Recode? No. With PLOT 10 IGL, you will write object drawing subroutines with Graphic Action commands such as MOVE and DRAW. Without changing the subroutine, you can adapt it to a new environment. Simply change the environment from the default (solid lines) to a dash pattern with DASHPT or perhaps specify a new line color with a call to LINCLR.

Graphic text has its own Environment and Action commands. Specify an environment such as centered text, a specific height and width, slant, color and even a new font. Then call TEXT to put out the string(s) per your environmental specifications. Centering titles and alignment of text to graphics suddenly becomes easy, even in FORTRAN.

A secret of device independence is visible in System Environment Commands (See Fig. 2). Consider GRSTRT, i.e. Graphics Start. Its arguments are a device number, such as 4006, 4027 or 4663, and a second number signifying attached terminal options, such as a graphic tablet. PLOT 10 IGL will route commands through the device driver selected by GRSTRT. It follows that an application program need only prompt for the target terminal number and PLOT 10 IGL will communicate with the terminal in its native language.

The second part of the secret of device independence is in Capture and Replay of pictures. Pictures originally developed on a 4027 or 4016, for example, may be played back on a 4006-1 or 4662 or vice versa. The technique is simple though not obvious, we capture the inputs to graphic commands rather than the output. Therefore, when a new device is identified via the NEWDEV command or GRSTRT, the captured picture data is routed through the appropriate new device driver.

Every programmer needs a convenient set of utilities to manipulate numbers and text. PLOT 10 IGL has a collection of Host File (disk) handling routines as well as text and number conversion routines. Applications programmers will spend less time worrying about word size problems and disk access methods. Programs become easier to move from machine to machine.

Color control is built-in, not added on. Even monochrome displays can benefit, follow along. The Primary Command Set comes standard with environmental commands for line and text color. Color mixing commands use the Tektronix color standard of Hue, Lightness and Saturation (HLS). Or if you prefer, create your own color mixtures with Red, Green and Blue (RGB) or Cyan, Magenta and Yellow. PLOT 10 IGL adapts to your way of thinking about color.

A functional list of commands is illustrated in Figure 2. You will probably expand your PLOT 10 Interactive Graphics Library with a list of graphic objects just as a draftsman assembles a collection of drawing templates.

High performance options (extensions) are similar to the extra capability frequently offered as plug in terminal options. Select only the routines from the library needed to do the job with minimum memory space. The design of PLOT 10 IGL is flexible and accommodating. Options may be purchased separately at a later time and linked to the Primary Command Set.

The application or user written code may call commands in any of the high performance options and the Primary Command Set. PLOT 10 IGL will automatically take advantage of intelligence in a terminal's firmware. If a feature such as dashed lines is missing from the device, PLOT 10 IGL will emulate the feature, automatically.

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System Environment

BAUDRT	NEWDEV	SVEALL
CLOCAP	OPNCAP	SVEGRA
CMCLOS	REPLAY	SVETRN
CMOPEN	REPORT	SVETXT
GRSTOP	RESTOR	SVEWVT
GRSTRT	SVE3TR	
IERRNM	SVE3VW	

Graphic Environment

APPEAR	MODELT	RSETWV
BILLBD	MRKCLR	SCALE
BKGCLR	MTR3D	SCAXYZ
CLIP	MTRAN	SHR3D
CLOPOL	NOCLIP	SKIP
CLRMAP	NOSMOO	SMOOTH
CRDLFT	OPNPOL	STRPNT
CRDRHT	PARALL	STRSLP
DASHPT	PAT027	TRANSL
DEGREE	PATERN	TRIDNT
EDGE	PIRAD	TRNXYZ
EDGE3D	PIVOT	VECABS
ENDPNT	PIVT3D	VECREL
ENDSLP	POST3D	VIEWT
EYEBAL	PRE3D	VPDIST
FBCP3D	QCLP3D	VRP3D
FILPAN	RADIAN	VUP3D
GDUNIT	RASTER	VWPORT
GRADS	REMOVE	VWPT3D
GRAIN	ROTA3D	WIND3D
INCHES	ROTATE	WINDOW
LINCLR	ROTXYZ	ZPERSP
MILLIM	RSETM	

Graphic Action

ARC	LOC3D	PANL3D
ARC3PT	LOCATE	PENTYP
BELL	MARKER	POLY
DPOLAR	MOVE	POLY3D
DRAW	MOVE3D	WHER3D
DRAW3D	MPOLAR	WHERE
HDCOPY	NEWPAG	
HOME	PANEL	

Text Environment

DEVFNT	TXCENT	TXPROP
MARGIN	TXCONS	TXQUAL
MRKFNT	TXESC	TXRITE
TXA1	TXFCUR	TXSCRN
TXADE	TXFONT	TXSIZE
TXAM	TXGAP	TXSLNT
TXANGL	TXICUR	TXTCLR
TXBOTH	TXLEFT	TXWORL

Text Action

GETUIN	INUMBER	TYPSET
GETURN	RNUMBER	
GETUTX	TEXT	

Host File and I/O

HFCLOS	HFREAD	HFSQR
HFENQ	HFRNR	HFSQW
HFOPEN	HFRNW	HFWRIT

Utilities

ADDCHR	DIST	NORMAL
ADDFNT	FATLIN	POLVAL
CPYCHR	INIFIL	RDFONT
CVC2I	INIFNT	REVTRN
CVC2R	KA12AS	SPLINE
CVI2C	KAM2AS	TRAN2
CVR2C	KAS2A1	TYPSIZ
DELCHR	KAS2AM	WTFONT
DELFNT	LLSQ	

Figure 2.

Product Name:
4010C01 PLOT 10
Interactive Graphics Library

Language:
ANSI FORTRAN IV

Order Information:
Your local Tektronix Sales Engineer will assist you in selection of I/O routines for your computer, device drivers to match your terminal and advanced feature options to fit your application requirements.

OEM and Time Sharing Licenses are available in addition to standard end user agreements.

Each order is configured on magnetic tape. You will receive source code, a source listing, user level and internal system level documentation. Installation instructions and several User's Reference Guides (pocket size) are included.

Size Estimates:
Memory occupancy is primarily a function of the needs of an application program, compiler efficiency, operating system overhead and CPU word size. A minimum configuration of one device driver, the primary command set without Capture and Replay, but with Color Panel Support, may satisfactorily fit on a DEC PDP-11 RSX-11M with at least 32K words. PLOT 10 IGL has been successfully installed on mini computers supporting virtual memory or its equivalent.

A fairly complex application using most of the commands available in PLOT 10 IGL could take 256K bytes on an IBM 370 computer.

The following table lists lines of FORTRAN source code in several options.

Option Number	Name	Approximate Lines
2A	Primary Command Set	4,900
3C & 4C	Panel Support	660
3D & 4D	Graphics Text Composer	5,000
3E & 4E	Line Smoothing	6,100
4B	3-D Graphics	6,100
1A	4010 Device Driver	690
1B	4014 Device Driver	740
1D	4662 Device Driver	940
1G	4025 Device Driver	560
1H	4027 Device Driver	960
0A	IBM I/O	700
0E	CDC NOS I/O	1,250
0J	DEC 10 I/O	780
0K	PDP-11 RSX-11 I/O	1,080
MORTRAN configurator		1,370

The MORTRAN configurator program packaged with Option 2A can be used to generate application specific subsets of PLOT 10 IGL on site.

Watch for new modules to link into your PLOT 10 Interactive Graphics Library. Productivity and long-term value are our goals, too.

This product is included in Support Category B. PLOT 10 IGL updates are distributed in printout form at no additional charge for one year after receipt of signed license agreement.

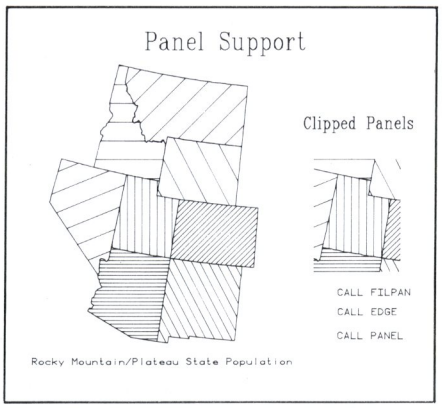

Figure 3.

Color Panel Support is an extension to the library for display and emulation of color panels. Concave and convex polygons filled with a specified color (or pattern on a 4027) may be drawn in a single command to the PANEL routine. Mix your own half tone style color patterns for a palette of up to 120 displayable combinations. Very elaborate shading of picture objects is possible. Or keep it simple and use the default colors to highlight data and focus attention on important points.

Remember PLOT 10 IGL is device independent. Commands to fill panels or polygons with color on a color display are emulated automatically on a monochrome display (See Fig. 3). If output is directed to a Tektronix plotter, its device driver will prompt to the terminal screen for a pen change on the plotter if necessary. Carrying plotter control one step further, consider the NEWPAG command. It will erase the screen on a 4010 storage terminal or 4020 Series raster terminal, advance paper automatically on a 4663 plotter, or prompt for a new sheet of paper on a 4662 flat bed plotter. Device independent application programs are assured a longer productive life with PLOT 10 IGL.

The Line Smoothing Option is designed to support applications which require smooth contouring through empirical data points. The command to initiate smoothing couldn't be simpler, it's SMOOTH. What had been drawn as straight lines between points will now be drawn as a smooth line passing through each point.

Publication quality graphs, weather maps, stress lines in FEM models and land elevation maps are examples of graphics in which people expect to see smooth contour lines.

The Line Smoothing algorithm starts with a quadratic curve and switches to a locally fit cubic spline as it draws between points. Thus, extra memory is not required to hold a large number of interim data points.

CLOPOL will instruct the Line Smoothing option to close polygons without seams or visual breaks in the curve. Figure 4 displays an example of smoothed lines.

Packaged with the Line Smoothing option are several other very useful

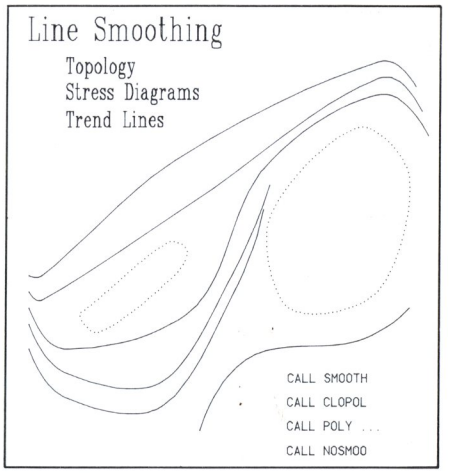

Figure 4.

software tools. DIST will return the cumulative distance along a specified line. POLVAL provides the value of a polynomial at a given abscissa. NORMAL returns the normalized version of a matrix. SPLINE returns the coefficients of a cubic polynomial fitted within a specified interval. And finally, LLSQ will fit specified points in curve to a given degree of freedom. A good set of tools will get your project off on a faster start.

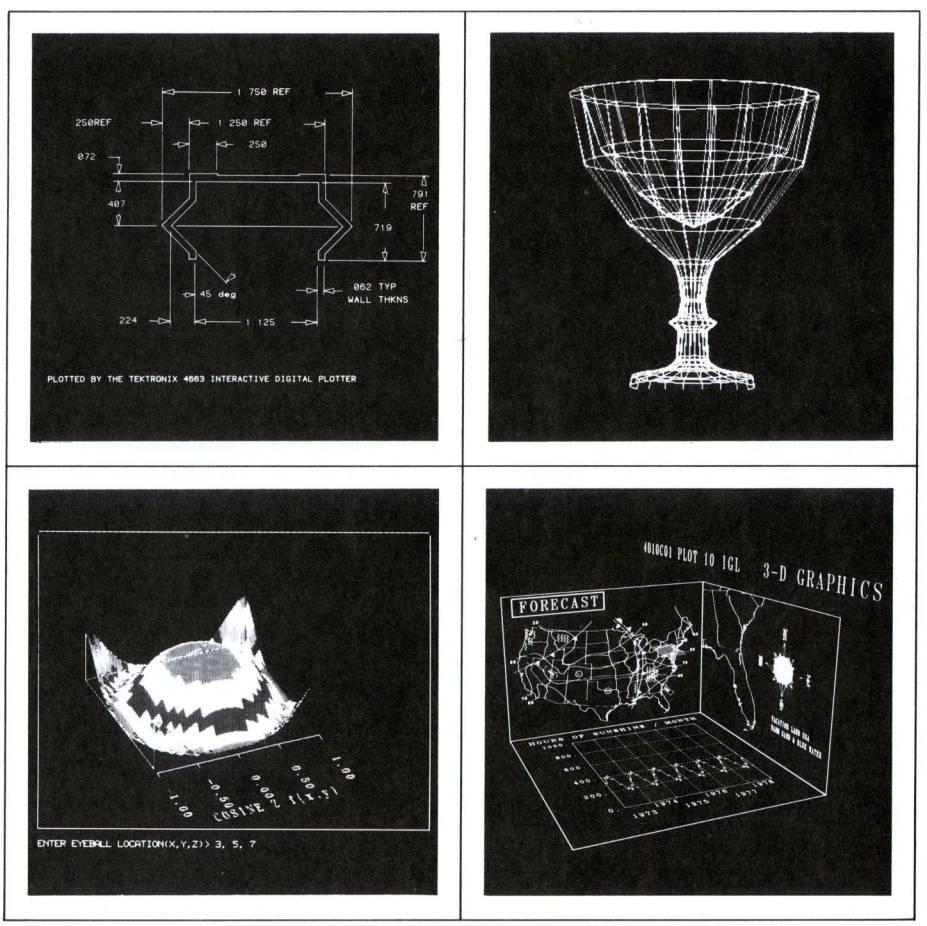

Figure 5.

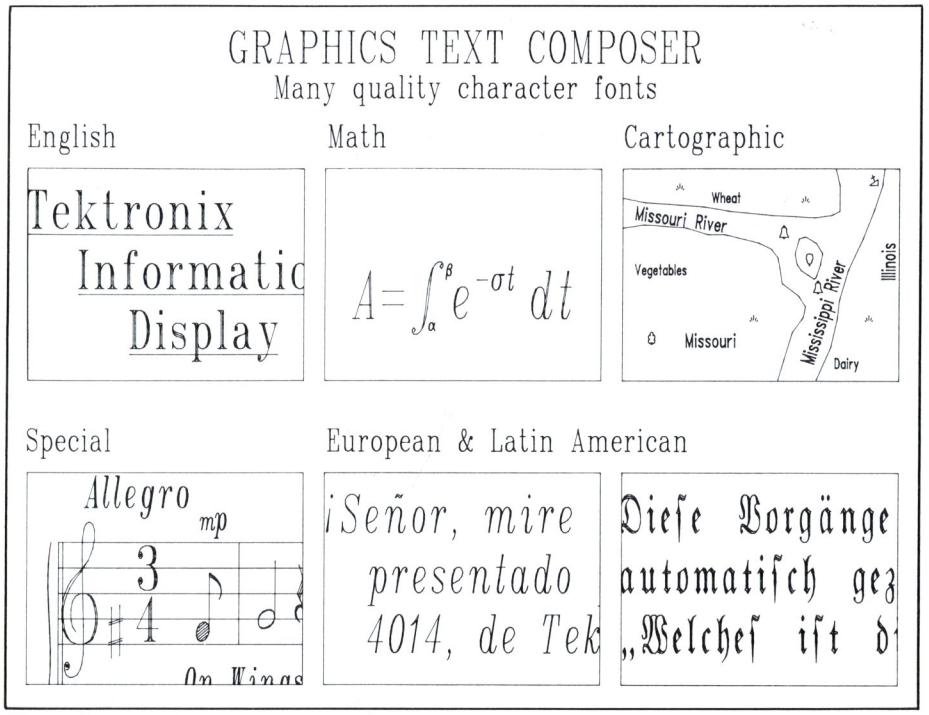

Figure 6.

The Graphics Text Composer option in PLOT 10 IGL adds the capability of manipulating and displaying high quality text to the graphics library. Demand paging is supported; a technique which uses disk space to manage character fonts when memory space is limited. Now you can add great looking text to high resolution graphics for publication quality output. Figure 6 suggests some possibilities.

Like vector graphics, text is manipulated by establishing an environment and then calling various text action routines. For example, a situation may call for rotated text of a certain font, X-Y size, slant, a color and either left justified, centered, or right justified. The text action command, TEXT, will then draw the text string as specified in the current environmental parameters.

Proportional or constant spacing between characters is supported. Multi level super and subscripting is included, too. The term "typeset" is sometimes used to describe the commands and resultant output of the Graphics Text Composer option. Text strings may contain embedded commands to tab, back tab, underline, switch fonts, change color, etc. Composing a page of text with complex mathematical formula is a straightforward task with PLOT 10 IGL.

Markers (unscaled centered symbols) are supported for such applications as annotation of geologic maps. The range of fonts and special symbols is varied and expanding. One option is a collection of English Character Fonts, another contains Math and Special Symbol Fonts.

Three-dimensional graphics (3-D) extends the capabilities provided by 2-D graphics commands. MOVE and DRAW with X, Y, Z parameters, create isometric piping diagrams, examine clearances within a complex structure, prepare input and examine output of finite element analysis with three dimensional graphics. Add impact to display of statistical data with 3-D.

Colored lines, panels and text are all supported directly in 3-D, or emulated automatically on non-color output devices. Two-dimensional graphics may be combined with 3-D; 2-D pictures may be drawn on a billboard (a plane defined by three points in space), and any number of billboards or 2-D graphs may be combined with 3-D graphics.

Billboards and objects created in 3-space may be viewed from any angle. Front and back clipping of the 3-D image may be specified. Clipping is done in 3-space by clipping to the 3-D window which is a cubic volume. Clipping is accomplished before the final projection to the 2-D screen. Introduction to 3-D graphics is clearly presented in a step-by-step tutorial in the 3-D Graphics Support (Option 4B) User's Manual.

Both parallel and perspective projections are offered with the 3-D option to PLOT 10 IGL. Multi-view orthographic projections are provided, and possible variations include plan views, elevated orthographic, and axonometric projections.

Communicate with the 3-D scene. PLOT 10 IGL supports the LOCATE command for identification of X, Y points in 2-space. It also supports the command for capturing X, Y, Z points on any active billboard in 3-space. Thus, if annotation of a structural beam is required, its end points may be selected with the LOC3D command, and its length labeled with centered text of any desired font.

Three-dimensional pictures may be captured on disk using the capture (OPNCAP) command. A new viewpoint in space may be given before redisplay of an object. This feature allows a plotter or terminal to draw multiple views of an object for analysis or publication while significantly reducing compute time of complex objects.

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