
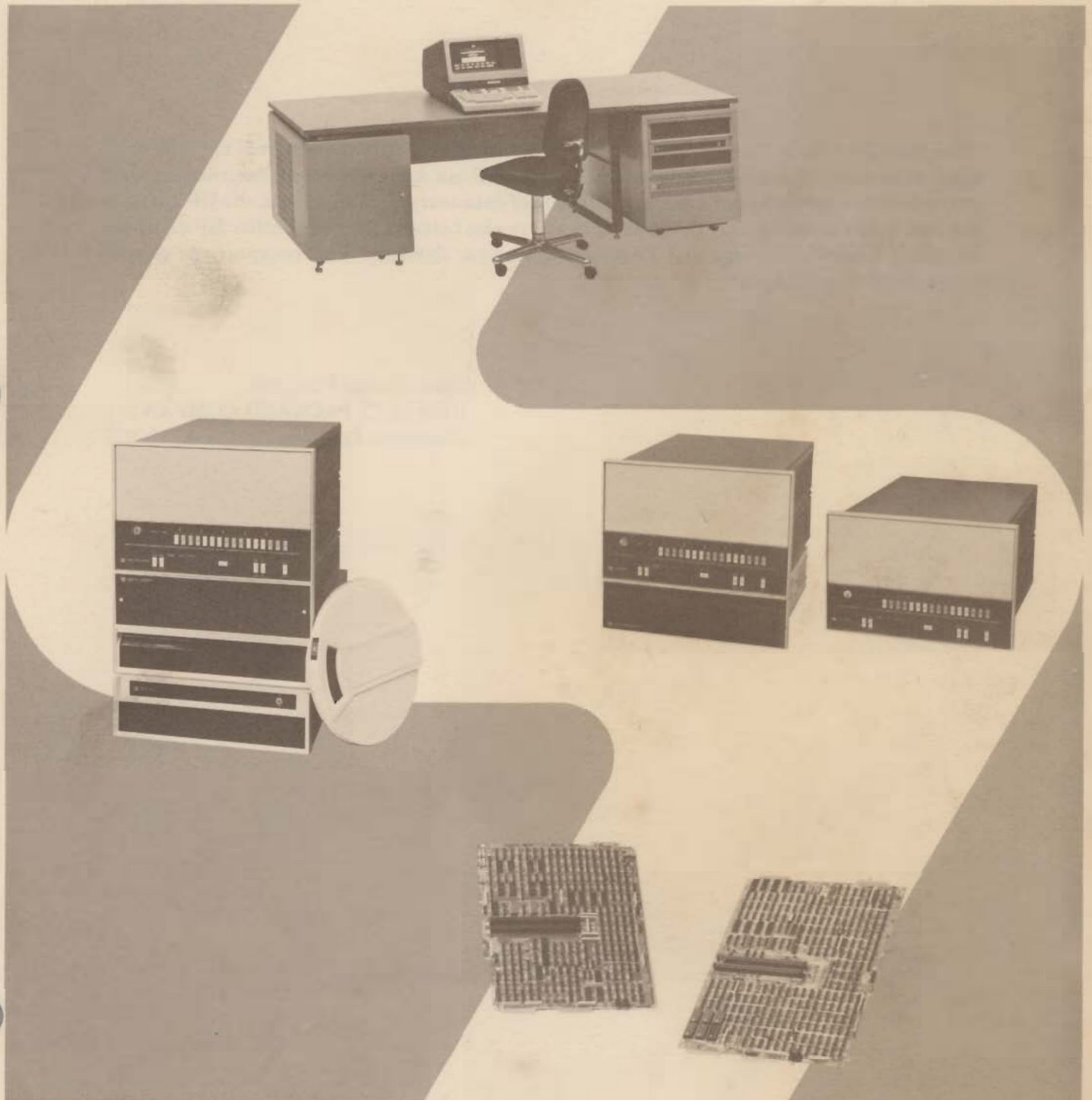


GRAPHICS/1000

HEWLETT  PACKARD

92840A Graphics Plotting Software

Field Training Manual



For Internal Use Only

92840A GRAPHICS PLOTTING SOFTWARE

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GRAPHICS/1000

Preface

What is Computer Graphics?

Computer graphics is the creation, manipulation, storage, and display of pictures on a computer system. Picture input and output is done with specialized devices called graphics devices or graphics peripherals. Examples of graphics devices for a computer system are pen plotters, graphics CRT displays, light pens and digitizer tablets.

When the creation and manipulation of pictures is done via human interaction with a graphics device, the process is called interactive computer graphics. In a typical application, a graphical tablet, function key menu, and a graphical CRT display are used in the creation of a mechanical drawing.

The separation of graphical input and output functions helps to separate many of the graphics applications. Output only tasks are often called plotting tasks. Interactive computer graphics tasks are a combination of input and output.

What is the 92840A?

The 92840A Graphics Plotting Software is the first in a new family of Graphics/1000 software products for use in HP 1000 computers and system operating under the RTE-MII/MIII or RTE-IV real-time executive system. The 92840A is a plotting oriented software package that offers the software tools required for user-written graphics application programs. It is included with the HP 1000 Model 45 (2177A/B) along with a 2648A Graphics Terminal or it can be ordered separately as a line item.

This new package offers a powerful set of primitive plotting subroutines available to the FORTRAN, BASIC, or Assembly language programmer. Its modularity also makes possible the support of a wide variety of HP graphics output devices, currently including the HP 2648A Graphics Terminal, 9872A Graphics Plotter, and 7245A Plotter/Printer.

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92840A GRAPHICS PLOTTING SOFTWARE

GRAPHICS/1000 Sample Press Release

New Device-Independent GRAPHICS Software for HP 1000s

The introduction of HP GRAPHICS/1000 commences a new family of graphics software for HP 1000 systems and computers. The modularity of this software makes possible the support of a wide variety of HP graphics output devices, currently including the 2648A raster-scan Graphics Terminal, the 7245A thermal Plotter/Printer, and the 9872A four-color Graphics Plotter.

The 92840A Graphics Plotting Software is a member of the GRAPHICS/1000 family. The 92840A is a plotting-oriented package that offers the software tools required for user-written graphics application programs. This package offers a powerful set of modularly-usable plotting subroutines to the FORTRAN, BASIC, or Assembly language programmer. It can be used in HP 1000 systems and computers operating under memory-based RTE-M or disc-based RTE-IV operating systems.

The Graphics Plotting Software is a system-level, device-independent graphics software package available for the HP 1000. Programmer's plotting requests simply identify the graphics output device by its RTE logical unit number and device subroutine identification number. In that way, the flexibility and power of the plotting subroutines can be applied to any or all of a variety of plotting devices.

The Graphics Plotting Software provides two levels of programming support for plotting. For the novice user, the 92840A software includes easily-used plotting subroutines which facilitate the creation of engineering, scientific, or business graphs. These subroutines perform functions such as: selecting the desired graphics output device and initializing it, defining the area and coordinates of the desired plot, drawing a line in either an absolute or incremental fashion and specifying a line style or character height.

The second level of programming support included with the Graphics Plotting Software is an additional group of plotting subroutines to help simplify the programming of more sophisticated graphics applications. These subroutines allow the user to easily draw axes with optional tic marks, labels, and grids. Also included are error handling subroutines to help debug application programs.

When using the Graphics Plotting Software, the user may describe his plot in a coordinate system of his own choosing (called world coordinates). The Graphics Plotting Software converts the world coordinates to physical device coordinates. This means that application programs don't have to be modified when a different output device is selected.

Another feature of the Graphics Plotting Software is that its modular design allows for efficient memory utilization. Only the plotting subroutine modules called in the user's program will be loaded into the memory. This leaves the HP 1000 user with more available memory space.

The range of applications for the GRAPHICS/1000 software is virtually unlimited. GRAPHICS/1000 can be a very useful addition to any HP 1000, whether the application is instrumentation, computation, or operations management. A few example applications for GRAPHICS/1000 are data plotting, computer-aided design, and process control.

The GRAPHICS/1000 software supports a very powerful set of graphics output devices for the HP 1000. The 2648A Graphics Terminal combines the latest in microprocessor and raster-scan technology to provide a bright, easy-to-read display. It offers all the alphanumeric capabilities of the popular 2645A terminal plus graphics text composition, and independent graphic and alphanumeric display memories. Additionally, the 2648A has the following features for offline operation: hardware zoom and pan, automatic plotting, rubber band line, and rectangular area shading. All this, plus more, makes the 2648A an excellent terminal for the HP 1000.

The 7245A Plotter/Printer is also supported by the GRAPHICS/1000 software. The quiet 7245A is a single-unit desktop thermal plotter and printer for quality graphics, flexible labelling, and clean printing to produce professional-looking finished documentation. The 7245A is interfaced through the Hewlett-Packard Interface Bus (HP-IB) which conforms to IEEE 488-1975. It also furnishes two additional advantages: long-axis plotting, plus unattended graphics and printing. In summary, the 7245A is the cost-effective choice for the HP 1000 that requires both plotting and printing at a low cost.

The 9872A Graphics Plotter is the third graphics output device supported by GRAPHICS/1000. It offers four-color, high quality plotting capability on any size chart up to 280 x 432mm (ISO A3). The 9872A also has exceptional line and character quality with addressable moves as small as 0.025 mm (0.001 in.). Like the 7245A Plotter/Printer, the interface to the HP 1000 is via HP-IB. These features make the 9872A the right plotter for high quality, multicolor plots on the HP 1000.

PRICE AND DELIVERY — The 92840A Graphics Plotting Software is included along with the 2648A Graphics Terminal in the high-performance HP 1000 Model 45 System or it can be ordered separately for other HP 1000 systems and computers. When ordered separately, the initial-order U.S. list price is \$500. First customer deliveries are expected in June.

GRAPHICS/1000

Product Description

Categories of Graphics Software

There are two general categories of graphics software: (1) primitive software, and (2) applications software.

The key objectives for a graphics primitive software package are the following: (1) **device independence** so that applications software written to draw a picture on one graphics device will give essentially the same picture on any other graphics device, within the limitation of device capability, (2) **computer system independence** so that applications software written for one computer system can be easily transported to another with minimal editing, (3) **application independence** so that the graphics primitive software provides a complete set of simple calls for most or all applications, while not containing complicated features that favor particular applications, (4) **ease of use**, (5) **high performance**, (6) **minimal memory requirements**, and (7) **full system capability**.

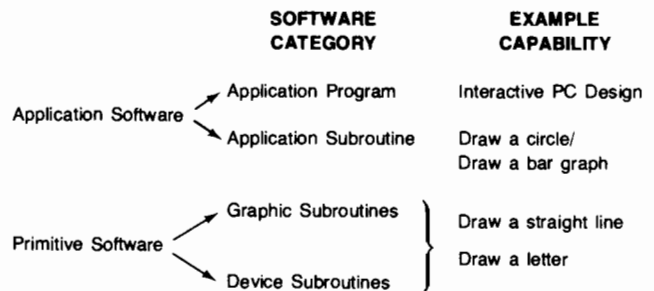
The graphics primitive software exists in two levels. The first is the set of graphics subroutines that are device independent and are called by application programs. These graphic subroutines perform such functions as: draw a straight line, draw an alphanumeric character, move the pen or cursor to a specified position, and specify the dimensions of the plotting area. The second level of the graphics primitive software is the set of device subroutines that map the device independent tasks to the particular devices. Examples of graphics primitive software include: (1) CALCOMP's Basic Software Package for electro-mechanical plotters, (2) Tektronix's PLOT-10 Terminal Control System, and (3) DEC's DECgraphic-11 FORTRAN.

The second category of graphics software is the applications software. Whereas primitive graphics software supplies the "software tools" required to do the elementary graphic tasks, the graphics applications software uses these tools to solve a specific application problem.

The graphics application software also exists in two levels. The highest level is the application program for a particular application. A user need only supply data and select among options the desired graphic output — no programming effort is required on the user's part. Application programs are usually written in a higher level language, usually FORTRAN. Examples of this level of application software are: (1) CALCOMP's FLOWGEN which produces and plots a flow chart of any FORTRAN IV program directly from a source deck, and (2) several Printed Circuit and Integrated Circuit design programs offered by companies like Calma, Computervision and Applicon.

The lower level of graphics application software is an intermediate level of subroutine calls which simplify for the programmer many common graphics functions. Examples of this are subroutines that draw a circle, draw a bar graph, and draw a sine curve. Typically these intermediate level subroutines are packaged in a library that allow you to do a wide variety of plots in areas such as engineering, business, drafting, and science. Commercial examples of this level of applications software are: (1) CALCOMP's Scientific, Business, and Drafting FORTRAN subroutine packages, (2) Tektronix's PLOT-10 Advanced Graphing — II, and (3) Integrated Software System's DISSPLA.

The chart below pictorially summarizes these levels of graphics software:



Where Does the 92840A Graphics Plotting Software Fit In?

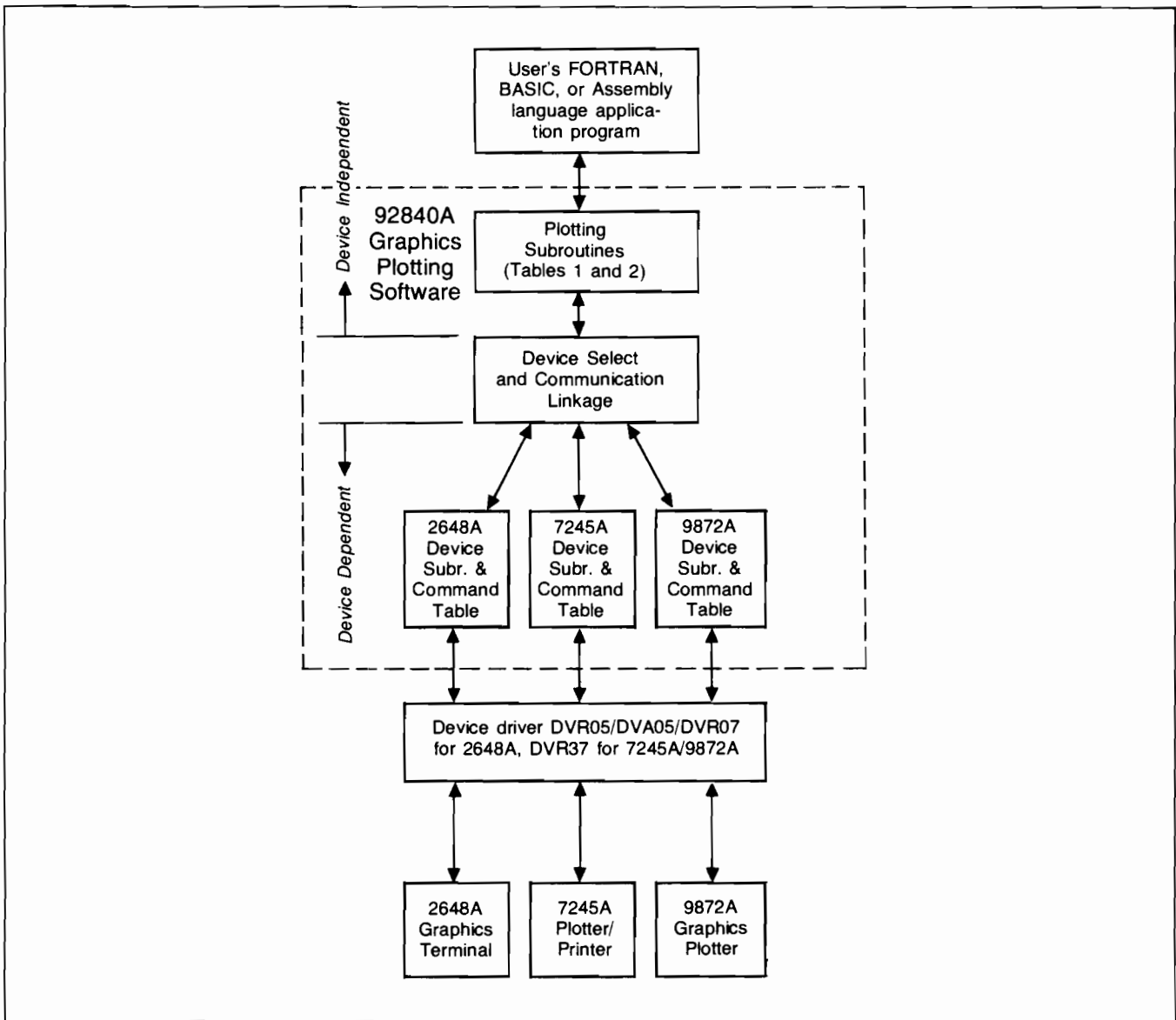
The 92840A software is the first in a new GRAPHICS/1000 family of graphics software and as such is a primitive level graphics software package. It would not be valid to compare our Graphics Plotting Software to a \$25,000 DISSPLA package or a sophisticated PC Design program since they are in different graphics software categories.

Although the Graphics Plotting Software is a first level software package, it provides the graphics capability necessary to satisfy 80 to 90% of our customers applications. The majority of graphics users write their own graphics application programs. A primitive level graphics software package is required for any application software that is developed by the customer or vendor. In summary, the 92840A is an excellent "software tool" that will leverage additional HP 1000 sales.

92840A GRAPHICS PLOTTING SOFTWARE

Product Structure

The diagram below illustrates the 92840A product structure. The modular organization provides device independent operation so that any or all of the devices shown in the diagram can be in the system. Programmer's plotting requests simply identify the graphics output device by logical unit number and device subroutine ID number. In that way, all of the flexibility and power of the plotting subroutines listed in Appendix A can be applied to any or all of a variety of plotting devices.



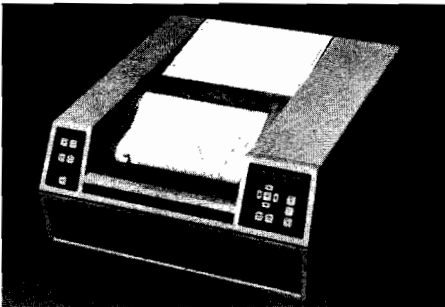
GRAPHICS/1000

Supported Graphics Devices

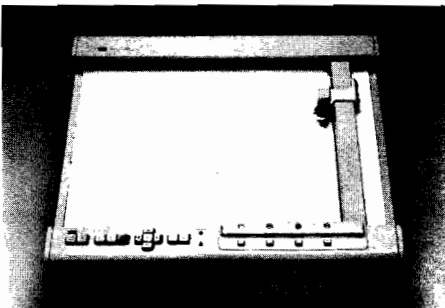
The 92840A software will support the 2648A Graphics Terminal, 7245A Plotter/Printer, and 9872A Graphics Plotter as a graphics output device. A picture and a few key features of each device is shown below:



2648A Graphics Terminal



7245A Plotter/Printer



9872A Graphics Plotter

- Raster-scan technology
- Independent graphic and alphanumeric display memories
- 7 dashed-line fonts
- Offline plotting possible (AUTO PLOT)
- Offline rubber band line
- Graphics text composition
- All the alphanumeric capabilities of a 2645A
- 5 meter (16.4 Ft) bidirectional paper drive
- HP-IB Interface
- Plotting and printing functions designed for unattended operation
- Plotting size, slant, direction, and placement of drawn characters is programmable
- 7 dashed-line fonts
- Dot matrix characters with 2 selectable widths
- Line printer performance with functions, such as left margin control, 10 horizontal tabs, and underlining
- Built-in confidence test and self-test
- Long-life thin-film print head
- Window plotting
- Programmable selection of 4 pens
- HP-IB Interface
- Error-free off scale data handling
- Window plotting
- 7 dashed-line fonts
- Point digitizing
- Built-in confidence test and self-test
- Electrostatic hold-down
- Plotting size, slant, direction, and placement of drawn characters is programmable
- High resolution plotting on various media

92840A GRAPHICS PLOTTING SOFTWARE



Data Systems will update the 92840A software with additional device subroutines as they are developed. If your customer is interested in receiving these updates automatically, he should order the 92840S Software Subscription Service or 92840T Comprehensive Software Support.

Data Systems has no intention of updating the 92840A software with a device subroutine for every HP graphics device. Our objective is to support only those graphics devices that will enhance HP 1000 sales and help solve the graphics problems of our customers. We would like to get feedback on the graphic devices **you** would like to see added along with your justification.

Applications

The range of applications for the 92840A Graphics Plotting Software is limited more by the imagination of the user than anything else. Graphics can be used by almost all of our HP 1000 customers, whether their application is instrumentation, computation, or operations management.

Many engineers, scientists, and businessmen have already recognized that computer-generated graphics can communicate ideas more rapidly and clearly than does a table of numbers. With the 92840A software the user can plot several sets of graphs and data on the same display or superimposed in the same screen area.

Two main graphics applications of interest to HP customers are data plotting and computer-aided design. Data plotting is

the presentation of data in chart form for easier interpretation. Computer-aided design is commonly used for designing mechanical parts, integrated circuits, printed circuits, electrical networks, digital logic diagrams, and architectural drawings.

Computer graphics can be a real time-saver. Next time you talk to your customer, ask him how much time is spent plotting out data by hand. Ask him whether he'd like to walk into his manager's staff meeting with a 4-color plot of last week's results rather than his usual hand-scribbled table of numbers. Best of all, ask your customer if **he** can think of any uses for computer graphics in his operation. It doesn't take long to figure out that graphics can make a real contribution in almost any application with an HP 1000.

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Features and Benefits

	Feature	Benefit
Easy Program Development	The 92840A includes a comprehensive set of plotting subroutines callable from FORTRAN IV, real-time BASIC, and HP's RTE Assembly Language. The plotting subroutines have mnemonic names that are easy to remember.	Lower software development costs.
Device Independent	The device select and communication linkage module of the 92840A allows the plotting subroutines to be device independent. Device dependent features are taken care of in device subroutines (one per device). The programmer need only specify the logical unit number and device subroutine ID number.	Lower software development costs.
Efficient Memory Utilization	Only the plotting subroutine modules called in the user's program will be loaded into memory.	The user has more available memory space.
Automatic Axis and Grid Plotting	The AXES plotting subroutine draws a pair of axes with optional tic-marks. The GRID plotting subroutine draws grids.	Lower software development costs.
RTE-MII/MIII RTE-IV Compatibility	The 92840A software is compatible with RTE-MII/MIII and RTE-IV operating systems (BASIC/1000M is not supported).	The customer has a wide range of HP 1000 Systems to choose from to help solve his graphics needs.
Error Handling	The Graphics Plotting Software includes error handling subroutines to help debug application programs.	Less time is spent in both developing and using an application program.

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	Feature	Benefit
Comprehensive Programming and Operating Manual	The 92840A Programming and Operating Manual teaches the novice user how to get started with the fundamental plotting sub-routines. The manual then instructs the more experienced user how to simplify the programming of more sophisticated graphics applications. Examples are included throughout the manual.	Lower software development costs.
Long-term HP Graphics Support	HP is committed to graphics support and long-term development. Data Systems is only one of at least nine HP divisions that are working on graphics projects. The 92840A Graphics Plotting software is the first in a new family of Graphics/1000 software products.	Your customer will not be stranded with an out-dated graphics system. HP will continue to offer state-of-the-art solutions for the graphics needs of our users.
User Defined World Coordinate System	The user may describe his plot in a coordinate system of his own choosing (world coordinates). The 92840A software converts the world coordinates to physical device coordinates.	Your customer doesn't have to change his application program to output to different devices.
Device Subroutines Included	The 92840A includes the device subroutines for all compatible graphics output devices. Currently, the supported devices are the 2648A Graphics Terminal, 7245A Plotter/Printer, and 9872A Graphics Plotter. Device subroutines for additional graphics devices will be incorporated into the 92840A software as they are developed.	Three powerful peripherals can be used by your customer now! Customers who order the 92840S or 92840T software support will receive the device subroutines for future graphic devices supported by the 92840A.

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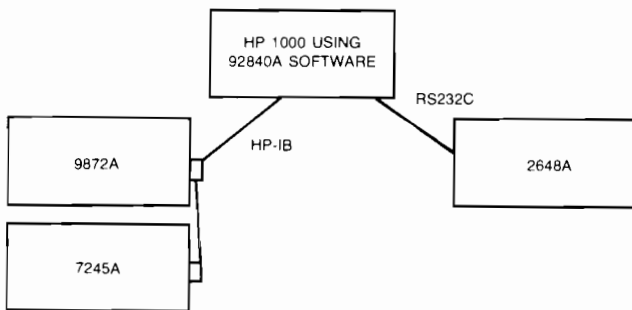
Configuration and Ordering Information

Configuration Information

There are many different ways to connect together an HP 1000 and some combination of 2648A, 7245A, or 9872A graphics devices. There are some configurations that are **not** supported by the 92840A software. The following examples of supported and non-supported configurations illustrate this.

Supported 92840A Configurations

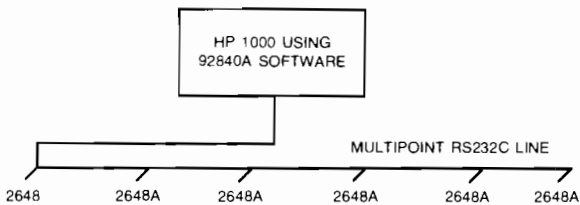
Example 1: Star Arrangement



This is a valid graphics system and the one we most commonly expect to see.

Note: The 7245A has two LU numbers; one as a plotter and the other as a printer.

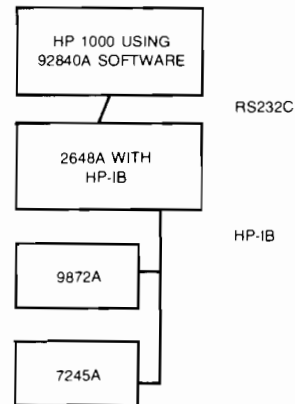
Example 2: Multipoint 2648A's



This is also a valid graphics system and takes advantage of our new 12790A Multipoint Terminal Subsystem Interface.

Configurations Not Supported by 92840A

Example 1: 7245A and/or 9872A connected to the 2648A via HP-IB



In this arrangement the 2648A can act as a graphics output device for the HP 1000, but the 9872A and 7245A are dedicated peripherals for the 2648A. The 7245A and 9872A **cannot** be used as graphic output devices for the HP 1000 using 92840A software in this configuration. (The RTE driver for the 2648A does not presently support this configuration.)

92840A GRAPHICS PLOTTING SOFTWARE



Ordering Information

Product Summary:

92840A Graphics Plotting Software \$500

The Graphics Plotting Software is included with the HP 1000 Model 45 (2177A/B). It can also be ordered as a line item #92840A.

The 92840A price does not include installation. This is available to the customer on a time-and-materials basis.

The 92840A is a Type II software product which allows a customer to make a copy if he meets the prerequisites specified in HP's software policy statement.

The 92840A consists of:

1. Software media choice option 020 which must be ordered.
2. Programming and Operating manual (92840-90001). That includes loading instructions.
3. Software numbering catalog (92840-90005).

92840A media option 020: Provides Graphics Plotting Software on minicartridges 92840-13301 and 13302 for read in via 2645A+007 or 2648A+007 CRT terminals.

92840S Software Subscription Service \$10/month

The 92840S provides software updates on minicartridges and manual updates to keep the Graphics Plotting Software current with respect to enhancements and other design changes as they are released by HP. The 92840S service is ordered in monthly units, and contracted for, and billed, on a quarterly basis. Software media option 020 must be ordered.

92840T Comprehensive Software Support

\$25/month for the first system

\$15/month for additional systems

The 92840T includes the 92840S as described above, and a phone-in consulting service for discussion of questions on the Graphics Plotting Software with a qualified HP system engineer. The 92840T service is ordered, contracted for, and billed on the same basis as 92840S. Software media option 020 must be ordered.

92840S and 92840T media option 020: Provides software updates on minicartridges for read in via 2645A+007 or 2648A+007 CRT terminals.

Compatibility Information:

Operating System: 92064A RTE-MII or RTE-MIII system without 92065A BASIC/1000M and 92067A RTE-IV system with or without 92101A BASIC/1000D.

Program Language: FORTRAN IV, Real-Time BASIC and HP RTE Assembly language.

Graphics Output Devices: HP 2648A Graphics Terminal (can be 2648A +007 also used as system console), 9872A Graphics Plotter, and 7245A Plotter/Printer.

Minimum System Requirements

In RTE-IV: Same as 92067A RTE-IV system, plus one or more compatible graphics output devices, selected from those listed above.

In RTE-M: Same as 92064A RTE-MII or RTE-MIII system, plus one or more compatible graphics output devices, selected from those listed above.

2645A or 2648A terminal with option 007 dual minicartridges.

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Competition

Competitive Summary

The 92840A Graphics Plotting Software is a significant addition to HP's graphics offering. We now have a primitive plotting package that will be a building block for additional graphics software products. Since almost all of our customers can use computer graphics to simplify their jobs, the 92840A can help you sell additional HP 1000s.

IBM doesn't offer any graphics software for their Series/1 minicomputers. You have to buy a mainframe-based 2250 or 3250 system if you want graphics capability from IBM. Use our GRAPHICS/1000 package as a lockout when you run up against IBM!

Data General doesn't offer any graphics software for their minicomputers either! In fact, the only minicomputer vendors to offer graphics software are DEC and now HP. Use this to your advantage when selling against the competition!

Included in this section is a detailed analysis of the graphics capability offered by Tektronix, DEC, and CALCOMP. All three vendors have been major suppliers of graphics devices and software for years. Overall, their software product offering is significantly more comprehensive than the 92840A Graphics Plotting Software. The 92840A does, however, offer a few advantages including: device independence, error handling, and low price (\$500).

When the 92840A software is combined with our powerful HP 1000 family and our expanding line of graphics devices, HP offers a very competitive system with graphics capability. Sell GRAPHICS/1000 on the HP 1000!

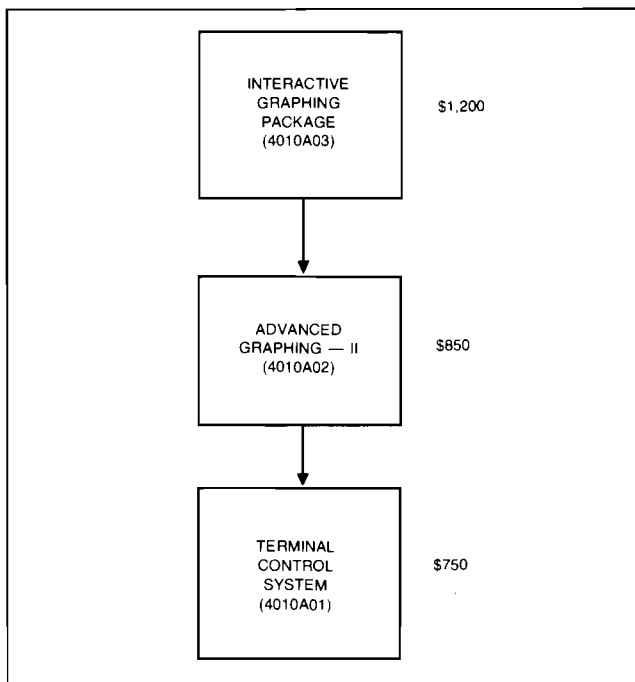
Tektronix

PRODUCT OFFERING

Tektronix offers a comprehensive line of graphics terminals, peripheral products, and supporting software compatible with most minicomputers and mainframes. Data Terminals Division has done a very good job in describing Tektronix terminals in their 2648A Field Training Manual and subsequent CSG newsletter articles so I'll focus in on Tektronix software.

Tektronix offers Plot 10, a family of graphics software packages that includes a primitive software package (Terminal Control System), an application subroutines package (Advanced Graphing — II), and a friendly plotting applications

package for non-programmers (Interactive Graphing Package). The hierarchy of these packages is shown below:



The Interactive Graphing Package has an English-language command structure that allows a non-programmer to interactively construct, edit, save, recall, and update graphs. It is written in FORTRAN IV and built on top of the Advanced Graphing II and Terminal Control Systems packages. In using these two lower level packages, it offers most of their features plus extensive data and graph-editing capabilities as well as the ability to enter data or commands interactively from files.

The Advanced Graphing II package consists of more than 40 subroutines with default values built on top of the Terminal Control System. It includes the following features: cartesian, semi-log, log-log, and time series coordinate graphs, bar charting, pie charting, multiple curve plotting, calendar and short form data entry, a variety of solid and dashed line styles, data symbols, grid and axis specifications, axis locations, labelling, shading, tic-mark forms, arcs, circles, polynomial fits, bode plots, and function plots.

The Terminal Control System is a primitive software package that is in use in more than 2000 installations. It consists of a set of FORTRAN IV subroutines that are capable of windowing, clipping, rotating, zooming, data scaling, solid or dashed lines, absolute or relative actions, alphanumeric formatting, and cartesian coordinates.

92840A GRAPHICS PLOTTING SOFTWARE

COMPETITIVE ANALYSIS

Advantages of 92840A Graphics Plotting Software:

- Device independent. You can output to any supported device without modifying the application software. Tek's software is terminal oriented, while the 92840A works just as well with a plotter or printer.
- The 92840A software includes higher level plot commands (AXES, GRID, FRAME) that are not included in Tek's Terminal Control System (TCS). The customer would have to purchase TCS (\$750) and Advanced Graphing-II (\$850) to have comparable commands.
- The HP 92840A offers world coordinates of any user-defined units whereas Tek offers only inches or centimeters.
- Error handling subroutines. Tek has none.
- Only \$500 versus \$750 for Tek's Terminal Control System plus any of their other packages.
- HP is a single vendor that can supply the computer, software, and graphics devices.

Advantages of Tektronix' software packages:

- Tek offers a family of primitive and application software packages. HP only offers the 92840A—a primitive graphics package that can only compete with Tek's Terminal Control System.
- Automatic data scaling. With their software you don't need to determine the minimum and maximum values of the data to be plotted in order for it to be properly scaled onto the plot.
- Hardcopy command for easy screen dump. With the 92840A you must (1) re-execute the application program with a hardcopy device as the selected output, or (2) dedicate a hardcopy device connected directly to the 2648A that is independent of the 92840A software. Tek uses the second method stated above but offers a system level command for a screen dump.

DEC

PRODUCT OFFERING

The PDP-11 family includes graphics products ranging from the low-cost VT55 graph drawing terminal, to the DECgraphic-11 line of interactive graphics terminals and subsystems. DECgraphic-11 is the family name for PDP-11 interactive graphics systems using the VT11 and VS60 Display Processors. The graphics products they offer are summarized below:

Hardware

VT55 — Low-Cost Graph-Drawing Terminal

Its features include: upper and lower case characters, 24 lines x 80 columns, 110-9600 baud operation, cursor control, upward scroll, 512 x 236 displayable resolution, histogram or point plot modes, graphic markers, horizontal and vertical grid lines. Sales price = **\$2,750**; with optional hard copy = **\$3,995**.

DECgraphic-11 Display Subsystems

VT11 — 17" dynamic refresh display that offers four line types, 1024 x 1024 displayable resolution, eight intensity levels, blink capability, and a hardware character generator. A light pen is standard. Sales price = **\$10,500**.

VS60 — 21" dynamic refresh display that is upward program compatible with the VT11 and adds features like hardware subpictures, naming and associative name searching, windowing, scaling with high speed internal coordinate processing and analog stroke vectoring. Sales price = **\$37,000**.

LK11 — 16 lighted push-button, function-key box with interface. Sales price = **\$1,200**.

LK40B — ASCII keyboard with serial interface. Sales price = **\$1,770**.

DECgraphic-11 Systems

These systems combine the above VT11 or VS60 display terminals with a PDP-11 processor with UNIBUS to form either terminal or stand-alone graphics systems.

GT41 — Graphic display terminal. Includes 11/04 processor with 32K byte MOS memory; VT11 display, LK40 keyboard or LA36 DEC writer. Sales price = **\$18,000-19,500**.

GT43 — Same as GT41 but with 11/34 processor. Sales price = **\$25,500-26,500**.

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GT46 — Graphics system. Includes 11/34 processor with 64K byte MOS or core memory, VT11, 2 RK05 disks, LA36 DEC writer. Sales price = **\$44,040-46,000**.

GT62 — High performance graphics terminal. Includes 11/34 processor, 32K byte MOS memory, VS60 display, LK11 push buttons, LK40 keyboard or LA36 DEC writer. Sales price = **\$54,000-56,000**.

Software

VT55 Graph-Drawing Routines

For graph-drawing operation, functions or subroutines exist for PDP-11 FOCAL, BASIC, and FORTRAN users. The graphics software for the VT55 allows the user to construct simple graphs, set their mode (histogram or point plot), add grid lines, and manipulate graphic markers. The sales price is **\$200-880** depending on whether it's FOCAL, BASIC, FORTRAN, or RSX-11M.

VT11 FOCAL and BASIC Extensions

Extensions to standard PDP-11 language kits provide VT11 users with functions or subroutines for drawing points, lines, graphs, characters and manipulating graphic images. Sales price is **\$370** for FOCAL and **\$830** for BASIC.

DECgraphic-11 FORTRAN Support

This is a package of FORTRAN subroutines for VT11 and VS60 stand alone systems in RT-11 and RSX-11M configurations. Sales price is **\$880** for RT-11 extensions and **\$200** for RSX-11M extensions.

COMPETITIVE ANALYSIS

This analysis of DEC's graphics software applies primarily to their DECgraphic-11 FORTRAN support. This package appears to be the main graphics software package they offer for their systems.

Advantages of 92840A Graphics Plotting Software:

- Device independent. You can output to any supported device without modifying the application software. DEC's software is very device dependent and oriented toward interactive terminal operation. It would probably require a massive rewrite of their software in order to support other graphics devices (plotters, printers, etc.).
- Easy program development. The 92840A plotting subroutines are callable from FORTRAN, BASIC, or Assembly language. The DECgraphic-11 software is only callable from FORTRAN. The 92840A plotting subroutines have mnemonic names that are easy to remember. The DECgraphic-11 commands are mnemonically confusing and contain too many parameters in some cases.
- The 92840A has a better set of output only high level commands (LAXES, LGRID, SETAR, LIMIT, etc.). We also provide a better interface for simple applications with commands like VIEWP and WINDW.
- Comprehensive Programming and Operating Manual. The 92840A User's Manual teaches the novice user how to get started with the fundamental plotting subroutines. The manual then instructs the more experienced user how to simplify the programming of more sophisticated graphics applications. The DECgraphic-11 FORTRAN manual is very confusing and not written for the novice. Basic concepts have been overlooked.
- The flexibility of the 92840A software allows the user to easily reconfigure his system. The configuration of DEC's graphics systems is very rigid; once you configure the graphics software into the system you better not change devices.

Advantages of DECgraphic-11 FORTRAN:

- Since DEC's software is device dependent their initialization (set-up) subroutines are very simple.
- DEC offers software for supporting a light pen for interactive applications. The 92840A software is primarily output oriented and would require user programming in order to support input devices like a light pen.
- DEC's software allows for picture segmentation and the manipulation of segments (called display files by DEC). This greatly enhances the interactive capability of the package.

92840A GRAPHICS PLOTTING SOFTWARE

CALCOMP



PRODUCT OFFERING

CALCOMP is the leading manufacturer of electromechanical plotters with more than 50% of the market. The product line spans from low-cost drum plotters to large high performance flatbed plotters. The resolution varies from .01 inch to .0001 inch and the plot speeds range from 1.5 to 40 inches per second.

In support of the plotters, CALCOMP offers three categories of software:

- Application programs
- Functional software
- Basic software

The Application programs are complete problem-solvers whereas the Functional software is what was earlier classified as application subroutines that offer tools for business, scientific, and drafting applications.

The lowest level of software used in producing a plot is their Basic software. CALCOMP's Basic software is a primitive package for drawing lines and characters, along with some chart preparation capability.

The Basic software has ten subroutines that can be called:

PLOTS	—	Initialization of plot
PLOT	—	Moves and draws
FACTOR	—	Scaling of image
WHERE	—	Inquiry of pen location
NEWPEN	—	Selection of pen
SYMBOL	—	Text generation
NUMBER	—	Plotting of floating point numbers
SCALE	—	Automatic scaling for charts
AXIS	—	Axis generation for charts
LINE	—	Plot a set of points

CALCOMP has a one-time lease charge for their software; they don't sell it outright. Their Basic software is device and CPU dependent so they offer many versions for lease. For HP 1000 computers and CALCOMP's most common controller, they charge the following:

Basic software: **\$500** offline (plotter connected to a dedicated CPU, data usually comes from other systems via magnetic tape); **\$1,500** online (plotter directly connected to the CPU).

Functional software: General category = \$200
Drafting category = \$150
Business category = \$250
Scientific category = \$300
All four together = \$750

COMPETITIVE ANALYSIS

Advantages of 92840A Graphics Plotting Software:

- Device independent. You can output to any supported device without modifying the application software. Only one size CALCOMP plotter can be used for a given application program when using their software.
- Grids and various line styles can be easily created with our software whereas CALCOMP requires the user to purchase both their Basic software package (\$1,500 online) and their General category functional software (\$200).
- The HP 92840A offers world coordinates of any user-defined units whereas CALCOMP offers only inches or centimeters.
- Error handling subroutines. CALCOMP has none.
- Only \$500 versus \$1,500 for a CALCOMP online Basic package plus any of their functional or applications packages.
- HP is a single vendor that can supply the computer, software, and graphics devices.

Advantages of CALCOMP's software packages:

- They offer a family of primitive and application software packages. HP only offers the 92840A—a primitive graphics package.
- Automatic data scaling. With their software you don't need to determine the minimum and maximum values of a data to be plotted in order for it to be properly scaled onto the plot.
- User simplicity. CALCOMP has only ten Basic subroutines while the 92840A has fifty-five plotting subroutines. The 92840A includes higher level commands like GRID and AXES plus it offers device independence and greater programming flexibility. The result is that the 92840A is a more comprehensive package but it is also more complex.

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Questions and Answers

Will application programs written for Tektronix's PLOT-10 software or CALCOMP's basic software work with HP's 92840A Graphics Plotting Software?

No. Although the Tek and CALCOMP software is similar to our 92840A software, (see Competition Section), it would require significant modifications to the user's software.

Can I still order the Tektronix PLOT-10 software for the 2648A that's modified for the HP 1000?

Yes, although you should try to sell the 92840A instead. The modified software is available from our Special Engineering Group by following these steps:

1. Order an additional 2648A for your HP 1000. The 2648A used as system console of the HP 1000 cannot be used to emulate the Tektronix terminal because it uses driver DVR05. The special PLOT-10 software uses driver DVR00.
2. Your customer must order the PLOT-10 package from Tektronix. He orders a 4010A01 (\$750) **with** Option 001 (NC) PLOT-10 Terminal Control System. He must specify delivery to Hewlett-Packard, Data Systems Division.
3. Order the special product 93596B, special modification for PLOT-10 software and manual (\$1200).

What is AGL?

AGL (A Graphics Language or Library) was designed by an HP task force to provide a uniform set of graphics related user-level utilities which can be implemented on all Computer Systems Group (CSG)/Calculator Products Group (CPG) system products. The task force had representatives from CSG, CPG, and Instrument Products Group.

The 92840A Graphics Plotting Software is Data System's implementation of AGL on the HP 1000. Calculator Products has implemented AGL on their 9845A/S Desktop Computer for BASIC programming. Data Terminals has implemented AGL on the 2647A Graphics Terminal for BASIC programming. Programs written for these products using their implementation of AGL allows transportability with minor modifications.

Why isn't the 92840A software offered on paper tape?

Although paper tape is still commonly used as a software media, Data Systems would like to move away from its use. Most of the customers who will use the 92840A software will have a 2645A/2648A with Option 007 (mini-cartridge), so only offering our Graphics Plotting Software on mini-cartridge should not be a problem.

Why isn't the 92840A software compatible with RTE-II or RTE-III?

Upon introduction of RTE-IV, RTE-II and RTE-III will become Class B mature software products. It is Data System's policy not to add compatibility of new products on operating systems that are no longer sold or are mature. Have your customer upgrade to an RTE-IV operating system!

Why isn't the 92840A software compatible with an RTE-M system with BASIC/1000M?

By the time the BASIC interpreter and the minimum required modules of the 92840A are loaded into memory, there is insufficient room for the user's application software. Have your customer use FORTRAN IV or HP assembly language for writing graphics programs in an RTE-M system.

Will a Tektronix graphics terminal, a CALCOMP plotter, or any other non-supported graphics peripheral work with the 92840A Graphics Plotting Software?

No. At the present time, only the HP 2648A Graphic Terminal, 7245A Plotter/Printer, and 9872A Graphics Plotter are supported output devices. However, the customer could write his own graphics device subroutine, device command table, and RTE driver (if one doesn't already exist). Eventually we plan to supply a manual on how to write a graphics device subroutine and command table to facilitate the addition of graphics devices to the 92840A.

How will the 92840A software be installed?

When ordered with a disc-based RTE-IV system, the 92840A software will be installed by the factory into the primary system. When ordered with a memory-based RTE-M system, the 92840A software will be customer installed. In both cases, the customer will receive a copy of the software on mini-cartridges. When ordered as an add-on, the 92840A software will be customer installed.

92840A GRAPHICS PLOTTING SOFTWARE

What is the Graphics Control Block (GCB) and why is it required for each plotting subroutine call?

The GCB is a 128 word table that contains the current transformation constants, device ID and LU numbers, and various other device dependent information such as plotter size and character width and height. It must exist in order to maintain device independence. The GCB allows the plotting subroutines and device subroutines to be re-entrant, that is, no variables are stored within the plotting subroutines or device subroutines. The GCB parameter is required in every call to allow easy use of the plotting subroutines with BASIC and allow users to write very large programs using segmentation.

Why are both the graphics device logical unit number and the graphic device subroutine I.D. number required for initialization?

The I.D. number distinguishes the device subroutine for each graphic device for selective loading and to allow the user to tailor the graphics package as he wants. Requiring both the L.U. and I.D. number makes it easy to modify either one by changing the device linkage table.

Are all the features of the compatible graphic output devices supported by the 92840A software?

No. The specific features not supported will be documented in the Programming and Operating Manual. A partial list of the graphics device features **not** supported when using the 92840A software is shown below:

2648A	7245A (In 9872A mode)	9872A
Rubber Band Line	Scaling mode	Pen Speed
Autoplot	Character Fonts	Character Fonts
Zoom and Pan		

What about the 92409A plotting software for the 7210A/12935A plotter?

The 92409A will be removed from the Corporate Price List on August 1, 1978. The 92840A software is a more comprehensive, device-independent package that supports the 9872A Graphics Plotter in addition to the 2648A and 7245A. The recently introduced 9872A plotter is far superior to the 7210A/12935A plotter. Since the 92840A will be added to the Corporate Price List on May 1, this will allow plenty of time for 92409A customers to start using the 92840A software.

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Appendix A: 92840A Plotting Subroutines

Table 1. Fundamental 92840A Subroutines

OUTPUT PRIMITIVES

MOVE	Moves pen to absolute position
MOVEI	Moves pen to incremental position
DRAW	Draws line to absolute position
DRAWI	Draws line to incremental position
CPLOT	Draws line or moves pen in increments of character blocks

Note: No specific text primitive is provided. A write or print statement causes the information to appear on the graphics display when the graphics text mode is turned on. See LABEL below.

OUTPUT PRIMITIVE ATTRIBUTES

PEN	Selects a pen
LINE	Selects one of a predefined set of line styles (solid, dashed, etc.)
LABEL	Used to turn on and off the graphics text mode
CSIZE	Specifies character height, width/height, and slant for graphics text
LDIR	Establishes direction of a group of graphics text characters
LORG	Designates origin of a group of graphics text characters relative to the current pen position

VIEWING TRANSFORMATIONS

SETAR	Defines width/height ratio of the logical view surface boundary. This is used to guarantee transportability of plots from one device to another.
VIEWP	Defines mapping area (viewport) on logical view surface in normalized device coordinates.
WINDW	Defines the area in world coordinate space to be mapped onto the viewport. The boundaries of this region are the soft clip limits. Only the portion of the picture within the soft clip limits will appear on the graphics display.

INPUT PRIMITIVES

CURSR	Reads cursor (locator) position
POINT	Moves cursor to absolute position
DIGTZ	Reads cursor position with a prompt and wait

CONTROL

PLOTR	Select and initialize graphics device
GPON	"Power on" reset of a graphics device
GCLR	Clears the display area or advances plot paper
LIMIT	Allows user to set device plotting limits within default physical device limits
CLPOF	Turns off soft clipping
CLPON	Turns on soft clipping

Table 2. Additional 92840A Subroutines

DATA DISPLAY FUNCTIONS

AXES	Draws a pair of axes with optional tic marks
LAXES	Performs AXES with labelling of tic marks
GRID	Draws a full grid within the limits of the data display area
LGRID	Performs GRID with labelling
FXD	Selects LAXES and LGRID labelling format
FRAME	Draws a rectangle around the limits of the data display area

OUTPUT PRIMITIVES

PENUP	Logically raises the pen
PENDN	Logically lowers the pen
LABON	Turns on graphics text mode
LABOF	Turns off graphics text mode
PLOT	Absolute position plotting with pen control
IPLOT	Incremental plotting with pen control
MOVER	Moves pen to relative position
DRAWR	Draws line to relative position
RPLLOT	Relative plotting with pen control

OUTPUT PRIMITIVE ATTRIBUTES

PORG	Defines origin for relative plotting
PDIR	Sets plotting direction (angle of rotation) for relative and incremental plotting

VIEWING TRANSFORMATIONS

MSCAL	Input units are in millimeters. Forces mapping so that picture is in true 1:1 scale
SETGU	Selects normalized device coordinate units as the input units for plotting and control
SETUU	Selects world coordinate system units as the input units for plotting and control
SHOW	Defines a window surrounding a region of interest in world coordinate space that gives isotropic scaling
CLIP	Redefines soft clip limits set by WINDW . The mapping remains unchanged
MARGN	Specifies the placement of the viewport within the physical limits of the plotting or display area

CONTROL

XMIT	Transmits data in I/O buffer to graphic device
LGERR	Sets the logical unit number of the error logging device
IGERR	Returns the most recent "soft" error, which is an error that does not prevent continued operation of the graphics software
HDERR	Causes all errors to be reported and may also stop processing by the graphics software because of an error that would not normally result in termination
WHERE	Returns the logical pen location and state (up or down)
GPMM	Converts millimeters to normalized device coordinates
GSTAT	Returns Graphics Plotting Software package status
DSTAT	Returns graphics device characteristics
DSIZE	Returns display size information

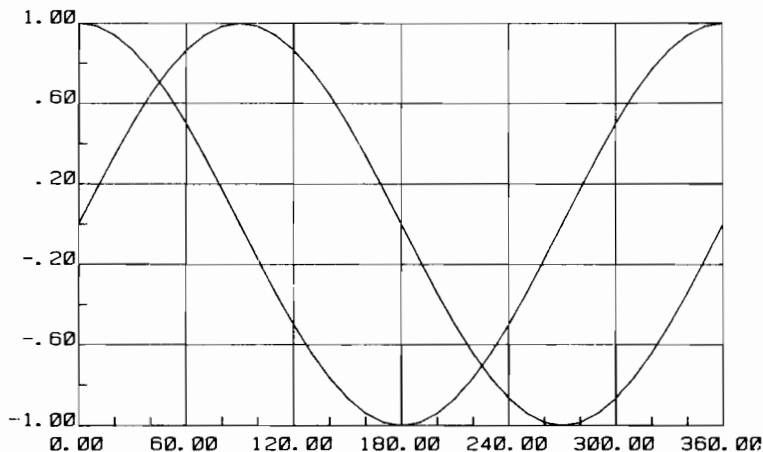
92840A GRAPHICS PLOTTING SOFTWARE

Appendix B: Example FORTRAN Program

Sample plotting program

```
FTN,L
PROGRAM DRWGD
DIMENSION IGCB(128),IPRAM(5)
EQUIVALENCE (IPRAM,LU),(IPRAM(2),ID)
C
C THIS PROGRAM IS AN ILLUSTRATION OF THE SEQUENCE OF
C PLOT COMMANDS TYPICALLY USED TO GET A SIMPLE PLOT.
C NOTE THE ORDER OF EVENTS, FIRST THE PLOT PACKAGE IS
C INITIALIZED (PLOT), THEN THE VIEWPORT (CLIPPING
C BOUNDARY) IS ESTABLISHED, AND FINALLY THE WINDOW
C IS SETUP FOR CREATING THE MATHEMATICAL TRANSFORMATION
C CONSTANTS WHICH WILL TRANSFORM USER UNITS INTO MACHINE
C UNITS MAPPED ONTO THE PRE-ESTABLISHED VIEWPORT
C
C GET THE LU NUMBER AND ID FOR THE DEVICE
C
C CALL RMPAR(IPRAM)
C
C INITIALIZE PLOT PACKAGE
C
C CALL PLOT(IGCB, ID, 1, LU)
C
C ESTABLISH VIEWPORT AND DEFAULT SOFT CLIPPING BOUNDARY
C
C CALL VIEWP(IGCB, 10., 90., 10., 60.)
C
C SETUP WINDOW - MATHEMATICAL TRANSFORMATION CONSTANTS.
C SINE AND COSINE FROM 0 TO 360 DEGREES RANGE FROM -1 TO +1.
C
C CALL WINDW(IGCB, 0., 360., -1., 1.)
C CALL FXD(IGCB, 2)
C
C DRAW GRID WITH LABELS F7.2 FORMAT
C
C CALL LGRID(IGCB, 20., .2, 0., 0., 3., 2., 1.)
C
C NOW LOOP TO DRAW SINE AND COSINE WAVEFORMS
C
DO 550 I=1,2
X = 0.
Y = 0.
CALL MOVE(IGCB, X, Y)
ANGL = 0.
DO 100 K=1,37
X = ANGL
Y = COS(ANGL/57.3)
IF(I.EQ.2)Y = SIN(ANGL/57.3)
CALL DRAW(IGCB, X, Y)
ANGL = ANGL + 10.
100 CONTINUE
200 CONTINUE
END
```

Sample plot, resulting from sample program (above)



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Appendix C: Sales Aids

92840A

Data Sheet

HP 1000 Computers and Systems
Active Software Data Book 5953-0861

Price and Configuration Information

HP 1000 Computer System Configu-
ration and Site Preparation Guide 5953-0898

HP 1000 Computers, Selection and
Configuration Guide 5953-0896

Brief Summaries

HP 1000 Computer Systems brochure 5953-3005

HP 1000 Computer Systems Tech-
nical Data Book 5953-0897

Real-Time Executive Software
Brochure 5953-0837

HP 1000 Computation Applications
Brochure 5953-3001

Reference Manuals

92840A Programming and Operating
Manual 92840-90001

92840A Software Numbering Catalog 92840-90005

92840A Demo Tape

2648A

Data Sheet 5952-9985

User's Manual 02648-90001

Reference Manual 02648-90002

Service Manual 02648-90003

User Instruction Cartridge 02648-13301

Field Training Manual 5952-9987

Sales Demo Cartridge
Contact DTD
Sales Development

7245A

Data Sheet 5952-2875D*

Service Manual 07245-90000

Operating and Programming Manual 07245-90001

Pocket Guide 07245-90002

Field Training Manual

*Delete letter D if not for domestic use.

9872A

Data Sheet 5952-2863

Operating and Service Manual 09872-90002

Interfacing and Programming Manual 09872-90003

HP-GL Card Manual 09872-90004

Video Tape 90416

Field Training Manual

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