Hewlett-Packard Display Terminals

MANAGEMENT SUMMARY

UPDATE: *In the past eighteen months, Hewlett-Packard has increased the size of their HP 239X Series to include four models. This report provides information on the HP 2392A as well as the three additional members of the HP 239X family (HP 2393A, HP 2394A, and HP 2397A).*

With an installed base exceeding 600,000 terminals, Hewlett-Packard ranks fifth on the list of data entry display terminal suppliers, behind IBM, Digital Equipment Corporation, Wyse, and Applied Digital Data Systems (ADDS), according to International Data Corporation (Framingham, MA). Hewlett-Packard has long been a force in the editing CRT market, first with the 264X family, then the 262X family, and now with the 239X family.

The HP 2392A, unveiled in June of 1984, is the low-end member of a product line that includes a display terminal, a data entry terminal, a graphics terminal, and a color graphics terminal. This compact display unit uses just over a cubic foot of space and can function in the Digital VT100/200 market. It offers character or block mode operation, up to four pages of memory, smooth scrolling, integrated tilt and swivel monitor, and a detached low-profile keyboard.

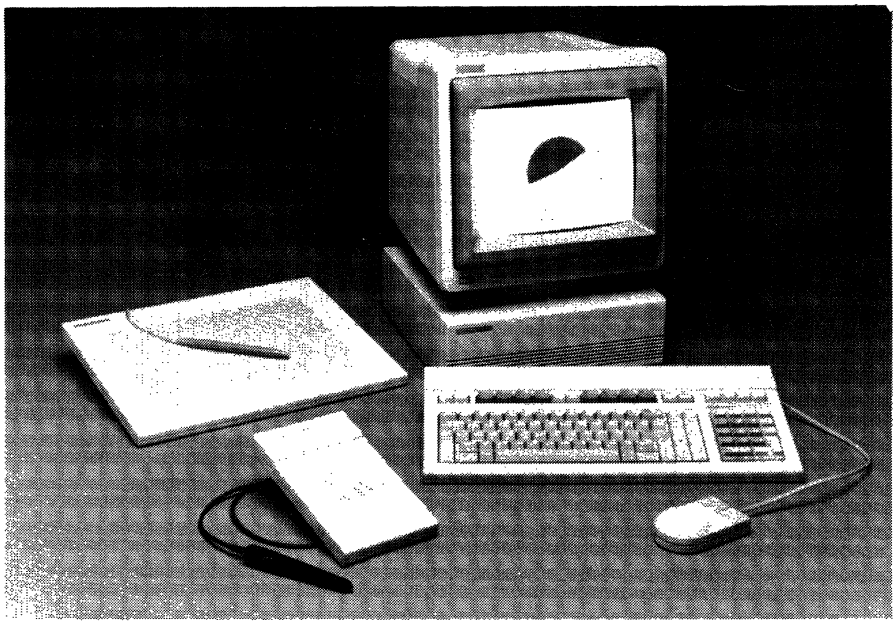
June of 1985 saw the introduction of the second member of the HP 239X family. The HP 2393A Graphics Terminal combines vector graphics with independent alphanumeric capabilities. This model can accommodate four input devices simultaneously: a graphics tablet, touchscreen, mouse, and bar code reader. The HP 2393A features polyline vector graphics, selectable resolution of either 512 H-by-390 V or 640 H-by-400 V pixels, plus a rubber-

Hewlett-Packard is a traditional leader in the market for fully featured, high function editing display terminals. HP terminals are known for their functionality and reliability. The company's current product line consists of models dedicated to data entry, word processing, and graphics.

MODELS: HP 2392A Display Terminal, HP 2393A Graphics Terminal, HP 2394A Data Entry Terminal, and 2397A Color Graphics Terminal.
DISPLAY: All models feature a 12-inch display screen with a 24-line by 80-character display format. The HP 2397A is a color terminal; all other models feature monochrome displays.
KEYBOARD: All models include a low-profile detached keyboard with a typewriter-style key layout and eight soft function keys.
COMPETITION: Several asynchronous terminal vendors.
PRICE: Purchase prices range from $1,375 to $3,095.

CHARACTERISTICS

VENDOR: Hewlett-Packard Company, 3000 Hanover Street, Palo Alto, CA 94304. Contact your local Hewlett-Packard sales office. In Canada: Hewlett-Packard Canada Ltd., 6877 Goreway Drive, Mississauga, Ontario L4V 1M8. Telephone (416) 678-9430.



The Hewlett-Packard HP 2393A graphics terminal is designed to meet a variety of computing needs for scientific and business applications. This modular graphics terminal, with ergonomic features, supports full graphics and alphanumerics functions and provides a wide selection of input/output options.

Hewlett-Packard Display Terminals

band line. The editing features offered on the HP 2393A include local editing, modified data tag, security video for passwords, and double high, double wide display enhancements. These features, coupled with independent alphanumerics, provide the user with a graphics terminal capable of satisfying a broad range of applications.

Next in the lineup is Hewlett-Packard's 2394A Data Entry Terminal. This terminal provides all of the features and functionality of the HP 2392A. In addition, the HP 2394A is equipped with a local forms cache allowing the user to download all necessary forms at the beginning of a work session and retrieve them from terminal memory using a single short command. The forms cache storage should facilitate between 20 and 25 average size forms. The HP 2394A provides data verification through eleven field edit checks which allow the terminal to detect many data entry errors, thus notifying the user when an error is made.

Hewlett-Packard's color graphics terminal is the HP 2397A. This model provides the engineer or scientist with tools to create and display technical applications in color. The HP 2397A supports bit mapped vector graphics on a full-color raster display with a selectable resolution of 512 H-by-390 V pixels or 640 H-by-400 V pixels. The user can select 8 displayable colors from a palette of 64. This color graphics terminal has the intelligence to draw polyline vectors based on end points specified by the host. The user can select from 11 different line types including one that is user defined.

COMPETITIVE POSITION

As we mentioned previously in this report, International Data Corporation, a market research firm based in Framingham, Massachusetts, places Hewlett-Packard fifth in its ranking of the top twenty display terminal suppliers. IDC estimates that HP holds a 3.4 percent share of this lucrative market, and trails only IBM, Digital, Wyse, and ADDS in installed base. Like IBM and Digital, Hewlett-Packard sells chiefly to users of their computer systems. As such, the company has little direct competition. Indirectly, however, Hewlett-Packard competes with virtually every asynchronous terminal vendor.

ADVANTAGES AND RESTRICTIONS

Hewlett-Packard's display terminals are known throughout the industry as fully featured, highly functional, and highly reliable units. HP terminals regularly gather impressive ratings in Datapro's annual Terminal Users Survey. The main reason for this, of course, is that HP terminals boast the most impressive array of features available on the market. Along with high quality, HP terminals have also been associated with high prices. While this is still true to a degree, Hewlett-Packard is following the path of many other terminal users in offering lower prices, though not diminishing the quality of their products. The HP 2392A and 2394A carry list prices of $1,375 and $2,095, respectively. These prices are substantially less than their predecessors. In addition to reduced prices, HP terminals contain a more compact and ergonomic design that is

DATE OF ANNOUNCEMENT: HP 2392A—June 1984; HP 2393A and 2394A—June 1985; HP 2397A—September 1985.

DATE OF FIRST DELIVERY: HP 2392A—June 1984; HP 2393A and 2394A—June 1985; HP 2397A—September 1985.

NUMBER DELIVERED TO DATE: Over 600,000 (all models).

SERVICED BY: Hewlett-Packard.

MODELS

Hewlett-Packard provides four display terminal models, two of which are dedicated to graphics applications.

- **HP 2392A—HP's compact, low-end terminal. The HP 2392A operates in character or block mode, and contains a wide range of smart terminal features, including four pages of display memory, editing, visual attributes, and smooth scrolling. ANSI X3.64 compatibility is optional.**
- **HP 2393A—a monochrome graphics display terminal. The HP 2393A combines the alphanumeric capabilities with Tektronix 4010/4014 and HP-compatible graphics. ANSI X3.64 compatibility and a built-in graphics printer are optional.**
- **HP 2394A—a basic data entry display terminal. Standard features include four pages of display memory, local forms memory for the storage of up to 25 forms, and 11 local edit checks. An integral printer is optionally available.**
- **HP 2397A—a color graphics terminal. The HP 2397A offers color alphanumerics capabilities with color graphics. Eight foreground/background color pairs are selectable from 64 combinations of the 8 basic colors.**

TRANSMISSION SPECIFICATIONS

Full-duplex, point-to-point asynchronous transmission is supported on all models, as are transmission rates from 110 to 19,200 bps. Enq/Ack and X-on/X-off handshaking are provided on the HP 2392A. All other models are X.25-compatible using X-on/X-off when block mode is enabled and when the terminal is connected to an external PAD.

All models are equipped with two data communications interface ports. The system port offers both RS-232-C and RS-422. The peripheral port provides a choice of an optional RS-232-C Serial Interface, a Centronics-type Parallel Interface, or an HP-IB Interface.

DEVICE CONTROL

All models can transmit data in character, block, or line modes. Editing features available for all models include insert/delete character, insert/delete line, and clear line/all. Visual attributes available on all models include underline, inverse, blink, and half bright; security video (blank) is available on all models except the HP 2397A; double high/double wide is available on the HP 2393A and HP 2397A. Protected and unprotected fields can be defined on all models. Operating parameters are selected via keyboard commands; a menu of configuration settings is displayed on the screen, and operating parameters are stored in nonvolatile memory. All Hewlett-Packard display terminals feature eight soft function keys; key functions are screen labeled on the 25th and 26th display lines and stored in nonvolatile memory with a 27th line for terminal status information. Soft function keys can include control codes and escape

Hewlett-Packard Display Terminals

intended to conserve desk space as well as provide more comfort to the operator.

For sheer functionality, the HP terminals have no peer. The 239X terminals provide such attractive features as monochrome and color graphics, windowing, word processing, and dual host capability, depending on the model selected. All of the terminals include a full range of visual attributes, full editing features, eight soft function keys, two communications ports, multiple pages of display memory, and 17 national character sets. ANSI X3.64 compatibility is also standard on HP terminals.

USER REACTION

In the 1985 Terminal Users Survey, conducted by Datapro in conjunction with *Data Communications* magazine, a total of 85 users of Hewlett-Packard display terminals responded. These users reported on their experiences with a variety of HP displays, including 239X and older models. Altogether, these respondents represented a total installed base of 4,429 terminals.

The users were asked to rate their HP terminals with respect to seven specific categories. Their ratings are summarized in the following table.

	Excellent	Good	Fair	Poor	WA*
Overall performance	52	31	2	0	3.6
Ease of operation	41	35	9	0	3.4
Display clarity	47	35	3	0	3.5
Keyboard feel & usability	31	45	8	0	3.3
Ergonomics**	7	1	0	0	3.9
Hardware reliability	55	26	1	0	3.7
Maintenance service/ technical support	53	28	0	0	3.7

*Weighted Average based on a scale of 4.0 for Excellent.

**Reflects 8 responses of HP's ergonomically designed HP 2392A representing an installed base of 141 terminals.

As has been the case in past Terminal Users Surveys, the Hewlett-Packard displays received consistently high ratings from their users. When asked whether or not they would recommend the H-P terminals to others, 61 of the respondents indicated that they would; 8 answered that they would not (the remainder were undecided or did not respond). □

sequences. All Hewlett-Packard display terminals provide support for HP's VPLUS software for HP 3000 computer systems.

The HP 2392A contains four pages of display memory as standard; an additional four pages are optionally available. Jump or smooth scrolling is available to view memory. A line modify mode is available for use during character mode operation; line modify mode enables the user to make changes to a previously entered line without having to retype the entire line. Text and data may be edited with local edit keys during block mode operation. ANSI standard X3.64 compatibility is available as an option; in this mode, the HP 2392A can execute many Digital VT100 and VT52 control sequences. ANSI mode provides additional features including double high/double wide characters and answerback.

The HP 2393A contains twelve pages of display memory. Its video attributes include memory lock, display lock, protected fields, user-selectable margins and tabs, plus jump or smooth scrolling. Four input devices can be accommodated at one time on the HP 2393A which also features local editing, modified data tag, and security video for passwords. This model is supported by a wide variety of HP software. Its Tektronix 4010/4012 compatibility mode allows the HP 2393A to operate with PLOT 10 software and various other popular software packages. ANSI X3.64 compatibility is built into the unit allowing the user to talk to Digital or other ANSI-based systems.

The HP 2394A features a local forms cache which allows the user to download 20 to 25 average size forms at the beginning of a work session. This unit offers eleven field edit checks allowing the terminal user to detect many data entry errors. These checks mean a significant reduction in system overhead and data communications traffic.

The HP 2397A color graphics terminal allows up to 12 pages of text to be stored in display memory and viewed easily using smooth scrolling capabilities. Engineering drawings, charts, and overhead transparencies can be generated on HP plotters, print text and graphics on the Diablo C150 Color inkjet printer and other HP printers to create 35 mm slides on a HP film recorder. In addition, the HP 2397A can be connected to commercial large screen projectors, film recorders, or large monitors. The programmable keys on the HP 2397A can be programmed to tailor the terminal for specific applications. Eight of the function keys have corresponding screen labels at the bottom of the display.

COMPONENTS

HP 2392A, HP 2393A, HP 2394A, HP 2397A DISPLAY UNITS: Include a 12-inch (diagonally measured) display screen and HP's new enclosure design, which boasts a more compact design with a smaller footprint for the conservation of desk space. The terminals have an integral tilt (0 to 20 degrees) and swivel (360 degrees) mechanism. The displays feature a format of 24 lines by 80 columns (1,920 characters); a 25th and 26th line are available for function key labels, while a 27th line displays terminal status information. Characters on the HP 2392A and 2394A are formed using a 7-by-11 dot matrix in a 9-by-14 dot cell with half-dot shift. Characters for the HP 2393A and 2397A are formed using a 7-by-11 dot matrix in a 8-by-14 dot cell with half-dot shift. Green (P31) phosphor characters are standard; refresh rate is 60 Hz. The 128-character ASCII set plus 61 national characters from the extended Roman set are displayable.

HP 2392A, HP 2393A, HP 2394A, and 2397A KEYBOARDS: A detached keyboard with a typewriter-style key layout is standard for all models. The keyboard contains a low-profile design with a two-position tilt adjustment (3 degrees or 11.5 degrees). The keyboard contains a total of 107 keys, including independent user, editing, and cursor

Hewlett-Packard Display Terminals

keys, a separate numeric pad, and eight soft function keys. Keys are sculptured, and feature auto-repeat and N-key rollover. A variety of national keyboard layouts are available: USASCII, Swedish, Norwegian, French, German, United Kingdom, Spanish, French-Canadian, English-Canadian, Italian, Dutch, Finnish, Danish, Swiss-German, Swiss-French, Spanish-Latin American, and Flemish.

PRICING

The Hewlett-Packard display terminals are available for purchase; lease plans are also available. HP provides a variety of maintenance agreements, as well as quantity discounts for volume purchases. For detailed lease and maintenance pricing, contact your local Hewlett-Packard sales office.

EQUIPMENT PRICES

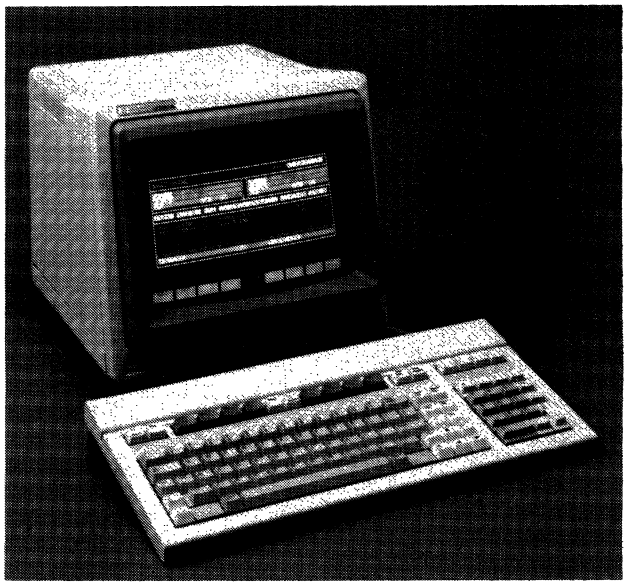
		Purchase Price ($)
HP 2392A	Display Terminal	1,395
HP 2393A	Graphics Terminal	2,095
HP 2394A	Data Entry Terminal	1,875
HP 2397A	Color Graphics Terminal	3,095 ■

Hewlett-Packard Display Terminals

MANAGEMENT SUMMARY

With an installed base exceeding 500,000 terminals, Hewlett-Packard currently ranks fourth on the list of data entry display terminal suppliers, behind IBM, DEC, and AT&T (Teletype), according to International Data Corporation (Framingham, MA). Hewlett-Packard has long been a force in the editing CRT market, first with the 264X family, then with the 262X family. H-P has recently introduced the HP 2392A, a terminal which is intended to be the first member of yet a new generation of displays. Currently, the HP 2392A is the low-end member of a product line that includes data entry models, word processing terminals, monochrome and color graphics units, and a dual-system terminal that provides both H-P and IBM operation.

The HP 2392A was introduced by Hewlett-Packard in June 1984. Heralded as the first member of a new family of displays, the HP 2392A replaced the popular HP 2622A block mode terminal in the H-P product line. The HP 2392A differs from the older 262X terminals in two key areas. First, the HP 2392A features a new display design, somewhat similar to the CRT found on the HP 150 Personal Computer. The display has the same 12-inch screen found on the 262X terminals, but it is enclosed in a more compact casing that sports a smaller footprint. An integral tilt/swivel mechanism is included. The terminal also features a detached keyboard with a low-profile design and a two-position tilt adjustment. Second, the HP 2392A carries the lowest price tag ever offered by H-P; its $1,295 list price ➢



The Hewlett-Packard HP 2392A is the company's newest display terminal. The HP 2392A features a new ergonomic design, including a compact 12-inch display (with integrated tilt/swivel mechanism) that takes up less desk space than previous H-P models. The detached keyboard features a new low-profile design and a two-position tilt adjustment. The HP 2392 also features Hewlett-Packard's lowest price ever for a display terminal—$1,295.

Hewlett-Packard is a traditional leader in the market for fully featured, high function editing display terminals. H-P terminals are known for their functionality and reliability. The company's current product line consists of models dedicated to data entry, word processing, and graphics; also available is an H-P/IBM dual system unit.

MODELS: HP 2392A Display Terminal, HP 2623A Graphics Terminal, HP 2624B Data Entry Terminal, HP 2625A Dual-System Display Terminal, HP 2626A Multi-Window Terminal, HP 2627A Color Graphics Terminal, and HP 2628A Word Processing Terminal.
DISPLAY: All models feature a 12-inch display screen with a 24-line by 80-character display format. The HP 2627A is a color terminal; all other models feature monochrome displays.
KEYBOARD: All models include a detached keyboard with a typewriter-style key layout. The HP 2392A keyboard features a low-profile design. All models contain eight soft/function keys.
COMPETITION: Direct, Inc. manufactures H-P-compatible terminals.
PRICE: Purchase prices range from $1,295 to $5,975.

CHARACTERISTICS

VENDOR: Hewlett-Packard Company, 1820 Embarcadero Road, Palo Alto, CA 94303. Contact your local Hewlett-Packard sales office. In Canada: Hewlett-Packard Canada Ltd., 6877 Goreway Drive, Mississauga, Ontario L4V 1M8. Telephone (416) 678-9430.

DATE OF ANNOUNCEMENT: HP 2626A—July 1980; HP 2623A—August 1981; HP 2624B—September 1981; HP 2627A—November 1982; HP 2625A and HP 2628A—October 1983; HP 2392A—June 1984.

DATE OF FIRST DELIVERY: HP 2626A—July 1980; HP 2623A—August 1981; HP 2624B—September 1981; HP 2627A—November 1982; HP 2625A and HP 2628A—October 1983; HP 2392A—July 1984.

NUMBER DELIVERED TO DATE: Over 500,000 (all models).

SERVICED BY: Hewlett-Packard.

MODELS

Hewlett-Packard provides seven display terminal models, two of which are dedicated to graphics applications.

- **HP 2392A—H-P's compact, low-end terminal. The HP 2392A operates in character or block mode, and contains a wide range of smart terminal features, including ➢**

Hewlett-Packard Display Terminals

is 40 percent below that of the HP 2622A. Hewlett-Packard attributes the lower price to improved VLSI technology and a reduced component count.

Meanwhile, Hewlett-Packard continues to offer several members of its highly-successful 262X terminal family. The basic member of this family is the HP 2624B Data Entry Terminal, a terminal designed to operate with H-P's VPLUS software on HP 3000 computer systems. The HP 2624B includes local forms storage, local edit checks, and a broad range of smart terminal features. Windowing is available with the HP 2626A Multi-Window Terminal; the HP 2626A provides for the division of the display screen into four separate windows, each of which is attached to a different workspace in the terminal's memory. Horizontal scrolling of up to 160 columns is available on the HP 2626A.

The HP 2625A Dual-System Display Terminal provides dual data communications ports; one for H-P mode operation, and one for IBM 3276 display station operation. With this feature, the HP 2625A allows for concurrent operation on both H-P and IBM host systems. Graphics and word processing capabilities can optionally be added to the HP 2625A.

The HP 2628A Word Processing Terminal is designed for use as a dedicated word processing terminal in conjunction with HPWORD software. When not in use for word processing, the HP 2628A provides data entry capabilities as a standard feature; graphics capabilities are an optional feature.

Hewlett-Packard also provides two graphics terminals. The HP 2623A Graphics Terminal combines alphanumeric capabilities with vector graphics capabilities; separate memories are provided for graphics and alphanumerics. The HP 2623A is compatible with a variety of graphics software packages, provided by both H-P and independent suppliers. Tektronix 4010 compatibility is also standard, for support of Tektronix Plot 10 graphics software. ANSI X3.64 compatibility is optional. The HP 2627A Color Graphics Terminal combines all of the features of the HP 2623A with eight-color display capability.

An integral thermal printer is optionally available for all models except the HP 2392A and HP 2627A. Dedicated printers are also available. Hewlett-Packard provides a variety of printers and plotters for use with the graphics terminals.

COMPETITIVE POSITION

As we mentioned previously in this report, International Data Corporation, a market research firm based in Framingham, Massachusetts, places Hewlett-Packard fourth in its ranking of the top twenty display terminal suppliers. IDC estimates that H-P holds slightly more than a four per cent share of this lucrative market, and trails only IBM, DEC, and AT&T (Teletype) in installed base. Like IBM and DEC, Hewlett-Packard sells chiefly to users of their computer systems. As such, the company has little direct competition; Direct, Inc. is really the only independent vendor that manufactures H-P-compatible displays. Indi-

four pages of display memory, editing, visual attributes, and smooth scrolling. ANSI X3.64 compatibility is optional.

- **HP 2623A—a monochrome graphics display terminal. The HP 2623A combines the alphanumeric capabilities of the company's older HP 2622A terminal with Tektronix 4010 and H-P-compatible graphics. Vector graphics generation and independent graphics and alphanumerics memories are standard; ANSI X3.64 compatibility and a built-in graphics printer are optional.**
- **HP 2624B—a basic data entry display terminal. Standard features of the HP 2624B include four pages of display memory, local forms memory for the storage of up to 40 forms, and up to 11 local edit checks. An integral printer is optionally available.**
- **HP 2625A—a dual system display terminal, featuring both H-P and IBM compatibility in a single unit; users can switch from H-P (HP 2622A-compatible) to IBM (3276-compatible) mode by pressing a function key. Options are available for HP 2623A and Tektronix 4014 graphics compatibility, as well as HP 2628A word processing compatibility.**
- **HP 2626A—a multiwindow terminal. The HP 2626A's display screen can be divided into four different windows, each attached to a different workspace in the terminal's memory. An integral printer is optionally available.**
- **HP 2627A—a color graphics terminal. The HP 2627A provides all of the standard features of the HP 2623A, plus eight-color display capability.**
- **HP 2628A—a word processing terminal. The HP 2628A combines the data entry capabilities of the HP 2622A with HPWORD word processing capability. The graphics capabilities found on the HP 2623A are optionally available.**

TRANSMISSION SPECIFICATIONS

Full-duplex point-to-point asynchronous transmission is supported on the HP 2392A, HP 2623A, HP 2625A, HP 2628A, and HP 2627A. Half- and full-duplex point-to-point asynchronous transmission is supported on the HP 2624B and HP 2626A. Multipoint capability is optional on the HP 2624B, HP 2625A, HP 2626A, and HP 2628A. Transmission rates from 110 to 9600 bps are supported on the HP 2623A, HP 2624B, HP 2626A, and HP 2627A; rates from 110 to 19,200 bps are supported on the HP 2392A, HP 2625A, and HP 2628A. Enq/Ack and X-on/X-off handshaking are provided for point-to-point communications; multipoint communications and IBM Bi-sync provide their own handshaking.

All models are equipped with two data communications interface ports. On the HP 2392A, HP 2623A, HP 2624B, HP 2626A, HP 2627A, and HP 2628A, Port 1 is dedicated to communications with a computer and Port 2 is dedicated to driving a printer. On the HP 2625A, Port 1 is for H-P mode operation and Port 2 is for IBM 3276 Bisync mode operation. All ports provide an RS-232-C connection. An H-P RS-422 direct connect interface is standard on the HP 2625A, HP 2627A, and HP 2628A, and optional for all other models. The HP 2392A can be connected to an X.25 PAD (Packet Assembler/Disassembler) network.

DEVICE CONTROL

All models can transmit data in character, block, or line modes. Editing features available for all models include insert/delete character and insert/delete line. Visual attributes available on all models include underline, reverse

Hewlett-Packard Display Terminals

rectly, however, Hewlett-Packard competes with virtually every asynchronous terminal vendor; its HP 2625A dual-system also places it in competition with IBM.

ADVANTAGES AND RESTRICTIONS

Hewlett-Packard's display terminals are known throughout the industry as fully-featured, highly functional, and highly reliable units. H-P terminals regularly gather impressive ratings in Datapro's annual Terminal Users' Survey. The main reason for this, of course, is that H-P terminals boast the most impressive array of features available on the market. However, there is an old adage that says, "You get what you pay for"; this is particularly true with the H-P terminals, which are historically also the highest priced terminals on the market. The good news for users is that, while this is still true, H-P's prices may be coming down. The new HP 2392A carries a list price of $1,295, substantially less than the $2,210 price tag for HP 2622A, the terminal it effectively replaced. The HP 2392A is expected to be the first member of a new generation of displays for Hewlett-Packard, a generation that will eventually replace the 262X line. In addition to its reduced price, the HP 2392A contains a more compact and ergonomic design that is intended to conserve desk space as well as please the operator.

For sheer functionality the H-P terminals have no peer. The existing 262X terminals provide such attractive features as monochrome and color graphics, windowing, word processing, and dual host capability, depending on the model selected. All of the terminals include a full range of visual attributes, full editing features, eight soft/function keys, two communications ports, multiple pages of display memory, and national character sets. ANSI X3.64 compatibility has also been implemented as an option on the HP 2623A, HP 2627A, and the new HP 2392A. These features are sure to be available on any new generation of products that H-P may introduce.

USER REACTION

In the 1983 Terminal Users' Survey, conducted by Datapro in conjunction with *Data Communications* magazine, a total of 28 users of Hewlett-Packard display terminals responded. These users reported on their experiences with a variety of H-P displays, including both 264X and 262X family members. Altogether, these respondents represented a total installed base of 516 terminals.

The users were asked to rate their H-P terminals with respect to seven specific categories. Their ratings are summarized in the following table.

	Excellent	Good	Fair	Poor	WA*
Overall performance	20	8	0	0	3.7
Ease of operation	17	9	2	0	3.5
Display clarity	15	12	1	0	3.5
Keyboard feel & usability	18	9	1	0	3.6
Ergonomics	12	10	5	1	3.3
Hardware reliability	10	9	4	2	3.1
Maintenance service/ technical support	16	9	2	1	3.5

*Weighted Average based on a scale of 4.0 for Excellent.

video, blink, and half bright (except that half bright is not available on the HP 2626A); secure video (blank) is available on all models except the HP 2623A and HP 2627A. Protected and unprotected fields can be defined on all models. Operating parameters are selected via keyboard commands; a menu of configuration settings is displayed on the screen, and operating parameters are stored in nonvolatile memory. All Hewlett-Packard display terminals feature eight soft/function keys; key functions are screen labeled on the 25th and 26th display lines and stored in nonvolatile memory. Soft/function keys can include control codes and escape sequences. All Hewlett-Packard display terminals provide support for H-P's VPLUS software for HP 3000 computer systems.

The *HP 2392A* contains four pages of display memory as standard; an additional four pages are optionally available. Jump or smooth scrolling is available to view memory. A line modify mode is available for use during character mode operation; line modify mode enables the user to make changes to a previously entered line without having to retype the entire line. Text and data may be edited with local edit keys during block mode operation. ANSI standard X3.64-compatibility is available as an option; in this mode, the HP 2392A can execute many DEC VT100 and VT52 control sequences. ANSI mode provides additional features including double high/double wide characters and answerback.

The *HP 2624B* contains four pages of display memory, optionally expandable to nine. The HP 2624B provides a local forms storage capability; up to 40 forms may be stored in the terminal, and transferred to the display screen when needed. The terminal also provides 11 different edit checks for data integrity and verification.

The *HP 2625A* features two standard operating modes: HP 2622A data entry terminal mode, and IBM 3276 display station mode. The user may switch back and forth between the operating modes by pressing a function key; both ports (Port 1 for HP and Port 2 for IBM) remain active at all times, allowing applications to be run concurrently on dual host computer systems. In IBM mode, the HP 2625A supports the bisynchronous communications protocol; up to 32 HP 2625A terminals may be daisy-chained together, emulating a cluster formed by one IBM 3276 control unit/ display station and several IBM 3278 display stations. The HP 2625A in IBM mode can support the screen formats of the IBM 3276/3278 Model 2 (24 lines), Model 3 (32 lines), and Model 4 (43 lines), as selected by the terminal's configuration. The 25th through 43rd lines are viewed using the roll up/down keys on the keyboard. In HP mode, the HP 2625A provides all of the features of the older HP 2622A data entry terminal. The HP 2625A can also optionally support word processing (HP 2628A compatibility) and graphics features (HP 2623A features with Tektronix 4014 emulation). Up to six pages of display memory are available on the HP 2625A.

The *HP 2626A* is a multiwindow terminal; the display screen may be divided into four separate windows, each attached to a different workspace in the terminal's memory. The workspaces can be connected to the two communications ports provided on the HP 2626A, allowing multiple applications to be run concurrently. The HP 2626A provides 119 lines of 80-column display memory; up to 3 edit checks are available. Horizontal scrolling of up to 160 columns is standard.

The *HP 2628A* is a word processing terminal; data entry capabilities are also featured as standard, while graphics capabilities may be added optionally. In word processing

Hewlett-Packard Display Terminals

As has been the case in past Terminal Users' Surveys, the Hewlett-Packard displays received consistently high ratings from their users. When asked whether or not they would recommend the H-P terminals to others, 25 of the respondents indicated that they would; only one answered that they would not (the remainder were undecided or did not respond).□

mode, the HP 2628A operates as a dedicated word processing terminal under the control of H-P's HPWORD word processing software. In data entry mode, the HP 2628A provides compatibility with the older HP 2622A data entry terminal. Up to six pages of display memory are available, and three edit checks are provided. A forms/format mode and smooth vertical scrolling are also standard. The graphics features of the HP 2623A, along with Tektronix 4014 compatibility, may be optionally added.

The *HP 2623A* and *HP 2627A* are Hewlett-Packard's graphics terminals. Both terminals offer a combination of alphanumeric and graphics capabilities, with independent memories dedicated to each. The HP 2623A provides monochrome graphics, while the HP 2627A features an eight-color display. Vector graphics, graphics text, rubberband line, and local polygonal area filling are available on both models for the creation of shapes, symbols, and typestyles. The HP 2623A and HP 2627A are compatible with a variety of H-P and industry graphics packages, including: HP DSG/3000, HP DRAW, HP EASYCHART, and Graphics 1000/II; Precision Visual's DI-3000 and GRAFMAKER; ISSCO's DISSPLA and TELL-A-GRAF; and SAS's SAS/GRAPH. Also available is a Tektronix 4010 compatibility mode, which allows the HP 2623A and HP 2627A to operate with Tektronix Plot 10 software. The HP 2627A allows up to eight color pairs (foreground/background) to be used on a character-by-character basis to differentiate lines of text and highlight fields. In addition to the eight basic colors, the HP 2627A provides for the creation of additional user-defined colors. In alphanumeric mode, the HP 2623A and HP 2627A provide the capabilities of the HP 2622A data entry terminal. Both the HP 2623A and HP 2627A provide two pages of display memory as standard. Hewlett-Packard makes a graphics tablet and a variety of plotters available for use with the HP 2623A and HP 2627A.

COMPONENTS

HP 2392A DISPLAY UNIT: Includes a 12-inch (diagonally measured) display screen. The HP 2392A features H-P's new enclosure design, which boasts a more compact design with a smaller footprint for the conservation of desk space. The terminal has an integral tilt (0 to 20 degrees) and swivel (360 degrees) mechanism. The display features a format of 24 lines by 80 columns; a 25th and 26th line are available for function key labels, while a 27th line displays terminal status information. Characters are formed using a 7-by-11 dot matrix in a 9-by-14 dot cell with half-dot shift. Green (P31) phosphor characters are standard; refresh rate is 60 Hz. The 128-character ASCII set plus 61 national characters and a 64-character line drawing set are displayable.

HP 2624B, HP 2625A, HP 2626A, and HP 2628A DISPLAY UNITS: Include a 12-inch (diagonally measured) display screen. These models feature a pedestal-style display design with tilt/swivel capability. All models contain a display format of 24 lines by 80 columns, with the 25th and 26th lines used for function key labels, and the 27th line for terminal status information. Characters on the HP 2624B and 2626A are formed using a 7-by-9 dot matrix in a 9-by-15 dot cell; characters on the HP 2625A and HP 2628A are formed using a 7-by-11 dot matrix in a 9-by-14 dot cell with half-dot shift. White, green, or amber phosphor characters may be selected. The full 128-character ASCII set, national characters, and a 64-character line drawing set are displayable.

HP 2623A and HP 2627A DISPLAY UNITS: Include a 12-inch (diagonally measured) display screen. These models feature a pedestal-style display with tilt/swivel capability. Both models contain a display format of 24 lines by 80 columns, with the 25th and 26th lines used for function key labeling, and the 27th line for terminal status information. Alphanumeric characters are formed using a 7-by-9 dot matrix in a 9-by-15 dot cell; graphics resolution is 512 by 390 dots. White, green, or amber characters may be selected for the HP 2623A; the 2627A displays up to eight standard colors (red, green, blue, yellow, cyan, magenta, black, and white). For area filling, additional user-definable colors are available through mixing. The full 128-character ASCII set, national characters, and 64-character line drawing set are displayable.

HP 2392A KEYBOARD: A detached keyboard with a typewriter-style key layout is standard. The HP 2392A keyboard contains a new, low-profile design with a two-position tilt adjustment (3 degrees or 11.5 degrees). The keyboard contains a total of 107 keys, including independent user, editing, and cursor keys, a separate numeric pad, and eight soft/function keys. Keys are sculptured, and feature auto-repeat and N-key rollover. A variety of national keyboard layouts are available: USASCII, Swedish, Norwegian, French, German, United Kingdom, Spanish, French-Canadian, English-Canadian, Italian, Dutch, Finnish, Danish, Swiss-German, Swiss-French, Spanish-Latin American, and Flemish.

HP 2623A, HP 2624B, HP 2625A, HP 2626A, HP 2627A, and HP 2628A KEYBOARDS: A detached keyboard with a typewriter-style key layout is standard for all models. The keyboard contains a total of 100 keys, including independent user, editing, and cursor keys, a separate numeric pad, and eight soft/function keys. Keys are sculptured, and feature auto-repeat and N-key rollover. Optional key overlays are available for the HP 2625A (IBM) and HP 2628A (HPWORD and graphics). A variety of national keyboard layouts are available: Danish, Dutch, Finnish, French, French-Canadian, German, Italian, Norwegian, Spanish, Swedish, and United Kingdom.

INTEGRAL PRINTER: A thermal printer, built into the display terminal cabinet, is optionally available for the HP 2623A, HP 2624B, HP 2625A, HP 2626A, and HP 2628A. The printer is a nonimpact serial matrix unit with a print speed of 120 cps (actual throughput is rated at 60 cps). A bidirectional "smart" printhead is featured, which takes the shortest route from the end of the current line to the beginning of the next. The printer features an 80-column print line, prints the 128-character ASCII set with underlining, and forms characters via a 7-by-9 dot matrix in

Hewlett-Packard Display Terminals

a 9-by-15 dot cell. A roll of nonperforated paper 8½ inches wide and 100 feet long is loaded through a door in the top of the cabinet.

PRICING

The Hewlett-Packard display terminals are available for purchase; lease plans are also available. H-P provides a variety of maintenance agreements, as well as quantity discounts for volume purchases. For detailed lease and maintenance pricing, contact your local Hewlett-Packard sales office.

Models	Purchase Price ($)
HP 2392A	1,295
HP 2623A	3,250
HP 2624B	3,035
HP 2625A	3,495
HP 2626A	4,400
HP 2627A	5,975
HP 2628A	3,195
Integral thermal printer	1,210
Graphics feature (HP 2625A and HP 2628A)	640
HPWORD feature (HP 2625A)	400

■

Hewlett-Packard 2645A Display Station

The 2645A is a stand-alone display station with multiple pages of display memory. The keyboard contains eight user-defined soft keys, as well as an edit group, data path group, and control group. A dual cartridge cassette tape drive is optionally available.

A microprocessor-controlled, stand-alone display terminal that accommodates a wide variety of character sets and up to 12K bytes of display memory.

The 2645A features modular construction and provides a 1920-character display and detachable keyboard with a numeric pad and user-defined soft keys. Options include asynchronous or synchronous multipoint communications; RS-232-C or 20 mA current loop communications interface; parallel or serial printer interface; mini-cartridge tape drives; up to four plug-in concurrent character sets; and display enhancements such as blinking, half-bright, and underline.

Purchase prices for the 2645A start at $4,550. Quantity discounts are available.

MANAGEMENT SUMMARY

Hewlett-Packard first entered the display terminal market in 1974 with the introduction of the 2640A Interactive Display Terminal. HP formed a Data Terminals Division to market all of the company's entries in the terminal market. The Data Terminals Division expanded the 2640 Series with new models, then introduced a new family of terminals, the 2620 Series. The 2620 terminals replaced many of the older 2640 models; currently, the 2640 Series consists only of the 2645A Display Station, and a pair of graphics displays, the 2647A and 2648A, which are outside the scope of this report.

The 2645A, introduced in 1976, is a stand-alone display station offering a variety of standard and optional features. The unit consists of an 11-inch (diagonal) display screen and a typewriter-style detachable keyboard. The keyboard arrangement is significant; it consists of the main keygroup, a numeric pad, a cursor/control key group, and four special groups—the edit group, control group, data path group, and soft key group. The soft key group contains eight user-defined soft keys, which can be used to issue a user-defined string of up to 80 characters or several control sequences stored in the terminal. Using these keys, the keyboard can be adapted to specialized applications.

The 2645A also features multiple pages of display memory. Standard memory size is 4K, expandable to 12K in 4K increments. Information can be retrieved by scrolling forward or backward a line or page at a time.

Other standard features of the 2645A include: protected fields; full editing capabilities; and reverse video. A wide range of options are available, including: a line drawing character set; hard copy RS-232-C interface; math/large

CHARACTERISTICS

VENDOR: Hewlett-Packard Company, Data Terminals Division, 974 East Arques Avenue, Sunnyvale, CA 94086. Telephone (408) 735-1550.

DATE OF ANNOUNCEMENT: Model 2645A—September 1976.

DATE OF FIRST DELIVERY: Model 2645A—September 1976.

NUMBER DELIVERED TO DATE: Over 120,000 terminals (all 2640 Series).

SERVICED BY: Hewlett-Packard, worldwide.

MODELS

Model 2645A is a microprocessor-based stand-alone display terminal with a detachable keyboard. The 2645A is available with an integral, dual mini-cartridge tape drive called a Mini Data Station.

The 2645 also comes in foreign language versions, including Katakana (2645K), Norwegian/Danish (2645N), Arabic (2645R), and Swedish/Finnish (2645S). These models are 2645 terminals with special ROM-implemented character sets.

The basic 2645A terminal contains an Intel 8080 (or equivalent) microprocessor with a 22K-byte microprogram memory and a 4K-byte display memory, expandable to 12K bytes in 4K-byte increments.

The 2645A contains a total of seven option slots. Each additional 4K-byte RAM memory module requires one slot. The optional Mini Data Station requires two slots and includes an integral dual mini-cartridge tape drive. The feature includes device support firmware. The mini-cartridge is a 3M Company product.

Hewlett-Packard 2645A Display Station

character sets; and display enhancements (underline, blink, and half-bright). Foreign language character sets are also available.

A dual mini-cartridge tape drive, called a Mini Data Station, is another option available for the 2645A. This feature allows for the storage of up to 110,000 characters.

USER REACTION

In Datapro's 1982 survey of alphanumeric display terminal users, responses were received from five HP 2645A users. These respondents reported on their experiences with a total of 93 2645A terminals (one user had 60 units installed); in addition, all five of the users reported that they had other Hewlett-Packard terminal models installed at their companies.

The ratings that these users gave for their 2645A terminals are summarized in the following table:

	Excellent	Good	Fair	Poor	WA*
Overall performance	5	0	0	0	4.0
Ease of operation	5	0	0	0	4.0
Display clarity	5	0	0	0	4.0
Keyboard feel & usability	4	1	0	0	3.8
Hardware reliability	5	0	0	0	4.0
Maintenance service	5	0	0	0	4.0
Technical support	4	1	0	0	3.8

*Weighted Average based on a scale of 4.0 for Excellent.

Principal applications cited by the 2645A users included: data entry (5 users); program development (5 users); and text editing (4 users). When asked to list the terminal features that played a large part in the selection of the 2645A, four users mentioned the display memory, while two users each cited the detachable keyboard and the terminal's local editing capabilities.

When asked if they would recommend the 2645A to other users with similar applications, all five users answered that they would. One user commented that his company was very pleased with all of the HP terminals that they were using, and had plans to purchase additional units.

As was the case in the 1981 alphanumeric display terminal survey, Hewlett-Packard's display terminal user ratings were among the highest of any vendor with a comparable number of responses.□

Plug-in options for Model 2645A, other than additional memory and the Mini Data Station, include the Display Enhancements feature, the Terminal Duplex Register (provides a parallel printer interface), the Serial Printer Interface, Printer Subsystems, and Communications interfaces. Only one communications interface and only one printer subsystem can be accommodated.

TRANSMISSION SPECIFICATIONS

Transmission is performed in the half- or full-duplex mode character-by-character (as keyed) or by block. The standard interface is asynchronous and is designed for point-to-point transmission. The data transmission rate is switch selectable at 110, 150, 300, 1200, 2400, 4800, and 9600 bits/second. The transmission code is 10- or 11-unit, 8-level ASCII. Odd, even, or no parity checking is switch selectable. Two stop bits are inserted at 110 bps; one stop bit, at all other speeds. Transparency and data communications self test are standard features. An RS-232-C interface is standard. The standard asynchronous interface is compatible with Bell System 103A and 202C, D, S, or T or equivalent modems.

Interface options include Extended Asynchronous Communications, and Asynchronous or Synchronous Multipoint Communications. The Extended Asynchronous Communications interface, contained on a single plug-in card, features standard data rate and parity selections, plus custom data rates, split transmit/receive, a choice of RS-232-C or 20 mA current loop interfaces, and handshake capability.

The Asynchronous and Synchronous Multipoint Communications interfaces support multi-point communications and daisy-chained line-sharing with up to 32 terminals on the same line. The Synchronous Multipoint Communications interface employs binary synchronous protocol, but is not completely compatible with IBM BSC protocol because of differences in text character sequences for controlling advanced features. Asynchronous or Synchronous Multipoint features include ASCII or EBCDIC transmission code, LRC or CRC error checking, auto-answer/disconnect, transparency, data communications self test, group and device addressing, group poll, broadcasting, and variable I/O buffer sizes.

DEVICE CONTROL

The 2645A display terminal features microprocessor control via a microprogram (firmware) that resides in read-only memory (ROM). The terminal performs transmission character-by-character or by block via operator selection. The block mode permits a message or page of data to be entered with or without format control, edited via edit control keys, and transmitted. The complete contents of memory can be printed provided the optional printer is attached. On models equipped with the Mini Data Station, data can be transferred between left and right tape drives, between display or communication line and tape, and between tape and printer and/or communication line.

Cursor control functions are initiated via keyed or received control codes that move the cursor up, down, left, right, home, to the beginning of the next line (return), or to the same position on the next line (line-feed). Cursor addressing and sensing are provided; relative or absolute addresses are sensed. Tab functions include set or clear (at the cursor position), clear all tabs and tab cursor to next tab stop or to the previous tab stop. Backtab, as well as left and right margin set functions, are provided.

Roll and page functions initiated via keyed or received control codes are included on all models. Roll functions roll the contents of memory up or down by one line before the display screen. Page functions display the previous or next 24-line segment (page) of memory.

Edit functions initiated via keyed or received control codes are also provided by all models. These include character and line insert and delete, with or without line wraparound. Models equipped with the Mini Data Station can also perform tape-related line insert and delete functions. Erasure functions erase all data from memory beginning at the cursor position or all data from the cursor to the end of a line.

Format mode operation is also provided. Fixed formats can be created by received or keyed commands that establish protected and unprotected fields and initiate or terminate the format mode. Unprotected fields can be designated as

Hewlett-Packard 2645A Display Station

alphabetic, numeric, or alphanumeric. The format mode disables line insert and delete functions and restricts character insert and delete functions to unprotected fields. When transmitting, only unprotected data is transmitted. Attribute codes can be assigned to a field to specify any one or 16 combinations of the following display attributes: half-intensity, underline, reverse video, and blinking (provided the terminal is equipped with the Display Enhancements feature).

The 2645A is equipped with the Memory Lock feature. Memory lock, when enabled, prevents further entry into memory when memory is full. The operator is alerted to this condition by a flashing indicator and an audible alarm. Data entry/display can continue, but data is lost if data exceeds the screen capacity.

The Caps Lock feature, when enabled, places all alphabetic keys in upper-case mode. The Display Functions feature disables and displays all keyed or received control codes except ENQ, DEL, NULLS, and CR. The Test key initiates a diagnostic test of memory (RAM), ROM, and the display. A standard test pattern indicates no failures; an appropriate message is displayed for each detected failure. The Automatic Line Feed feature initiates an automatic line feed for each received carriage return. The Break feature transmits a 200-millisecond space on the asynchronous data communications line and sets secondary channel transmit low for 200 ms. Eight Special Function keys each generate a specific Escape code sequence of up to 80 characters in length that can be defined by the user program at the host computer.

Other functions initiated by control codes include block transfer initiation, block transfer enable from terminal or computer, record separator (terminates a block transfer), unit separator (separates fields in block mode), keyboard enable or disable, alternate character set definition (1 or 4 sets), alternate character set enable or disable, modem disconnect, transmit terminal status (six bytes of terminal status transmitted as a block), Bell, etc.

The Data Path Group of function keys permit left or right tape drives or the display to be assigned as a source or destination and the printer to be assigned as a destination for data transfer. One source and multiple destinations can be selected. Other controls allow a file to be transferred between two local devices or a local device and the communications facility; to copy all data, a file, or a line from a selected source to a selected destination; and to log data transferred on tape or printer. Tape controls include rewind, write file mark, skip a line, and locate a file.

COMPONENTS

CRT DISPLAY UNIT: Provides a display area that measures 5 inches (127mm) high by 10 inches (254mm) wide (11-inches diagonally measured). The display arrangement is 24 lines of 80 characters each for a maximum screen capacity of 1920 characters. Data is displayed in white (P39 phosphor); reverse video, a standard feature, displays data in black against a white background. Character generation forms each character by a 7-by-9 enhanced dot matrix within a 9-by-15 dot character cell (to allow for conditions such as line descenders). The display technique is a non-interlaced raster scan. The cursor is displayed as a blinking underscore.

The 2645A is equipped with a standard displayable character set of 128 symbols, including upper and lower case alphabetics, numerics, specials, and control codes. The Display Enhancements option, contained on a single plug-in card, accommodates three additional displayable character sets of 128 symbols each, for a total of four 128-character sets of symbols. The first additional character set is standard and provides a 64-character line drawing set. Two optional additional character sets can provide mathematical symbols, large characters, foreign characters, or user-defined symbols. The Display Enhancements option also features blinking, half-intensity, and underline display functions.

KEYBOARD: A four-row, 56-key typewriter-style key arrangement. The keyboard features an 11-key numeric pad (including decimal point) and a 12-key pad of cursor- and display-control keys. All operator controls are located on the detachable keyboard above the keys. Controls are provided for communications, terminal control functions, editing, 8 user-defined functions, and tape control. The standard keyboard can generate any of 128 ASCII characters.

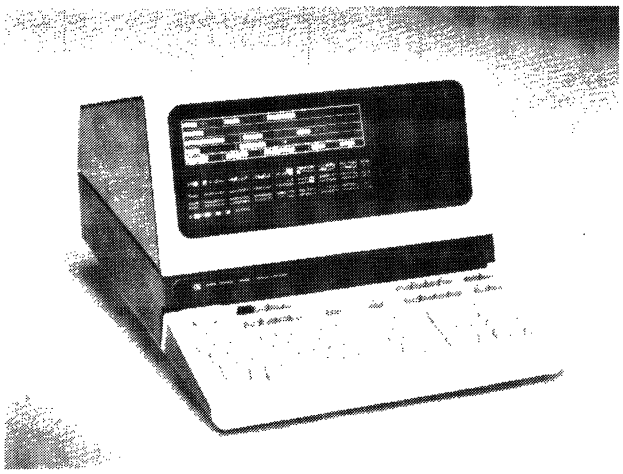
INTEGRATED DUAL CARTRIDGE TAPE: The Mini Data Station includes two individual and integral mini-cartridge tape drives for 3M Mini-Cartridges. A mini-cartridge is recorded at 800 bpi and stores 110,000 bytes. Tape read/write speed is 10 inches/second; search/rewind speed is 60 inches/second.

PRICING

The Hewlett-Packard 2645A is available for purchase, or under rental or lease agreements. Contact a Hewlett-Packard sales office for rental and lease prices. Quantity discounts are available. A variety of maintenance agreements are also available. Maintenance for the 2645A ranges from $22 to $30 per month.

		Purchase Price
2645A	Display Station	$4,550
	Options	
-003	Display Enhancements	325
-004	Display Enhancements w/alternate character sets	525
-007	Integrated Dual Cartridge Tape/ Mini Data Station	1,400
-008	8K Display Memory	315
-009	12K Display Memory	525
-032	Extended Data Communications Interface	205
-033	Asynchronous Multipoint Interface	265
-034	Synchronous Multipoint Interface	290
-054	Video Output Interface	160
-061	Device Support Firmware	180
1232C	RS-232-C Cable	53■

Hewlett-Packard 2640 Series Intelligent Display Terminals



The 2640B is the oldest member of the current 2640 series terminal family. Like the other members of the family, it features a 1920-character display and a detachable keyboard with a ten-key numeric pad. Bilingual versions of the 2640 are available via special ROM-implemented character sets. Languages available are Cyrillic (Russian)/English (2640C), Swedish/Finnish (2640S), and Danish/Norwegian (2640N).

A family of three microprocessor-controlled, stand-alone display terminals that accommodate a wide variety of character sets and up to 12K bytes of display memory.

All three models feature modular construction and provide a 1920-character display and detachable full ASCII or APL keyboard with ten-key numeric pad. Options include asynchronous or synchronous multipoint communications; RS-232C or 20 mA current loop communications interface; parallel or serial printer interface; 3M mini-cartridge tape drives; up to four plug-in concurrent character sets; and display enhancements such as blinking, half-bright, and underline.

Purchase prices for the basic models range from $3,250 to $4,100. Quantity discounts are available.

MANAGEMENT SUMMARY

Hewlett-Packard's first entry into the display terminal market was the microprocsessor-based 2640A Interactive Display Terminal, introduced in November 1974. Since then, Hewlett-Packard has formed the Data Terminals Division to market all of its entries into this field, and the 2640 Series has evolved into the current family of three general purpose alphanumeric data terminals, Models 2640B, 2641A, and 2645A, and three user-programmable graphic display terminals, Models 2647A, 2648A, 2649A, which are outside the scope of this report.

The 2640 data terminals are unusual in the general purpose terminal field for both the wide variety of character sets they can accommodate, and their ability to expand the standard 4K bytes of memory to as much as 8K bytes (on the 2640B) or 12K bytes (on the 2641A and 2645A). A 1920-character display and a detachable keyboard with numeric pad are standard on all three models.

The 2640B and 2645A feature a standard character set of 128 displayable ASCII symbols, including upper and lower case alphabetics, numerics, special symbols, and control codes. The 2641A comes equipped with three character sets: a 128-character set of APL symbols, a 64-character set of APL overstrike characters, and a 64-character set of ASCII upper case symbols, optionally expandable to include lower case as well. Optional sets available for all three models can provide a line drawing set, mathematical symbols, large characters, foreign characters, and user-defined symbols.

CHARACTERISTICS

VENDOR: Hewlett-Packard Company, Data Terminals Division, 19400 Homestead Road, Cupertino, California 95014. Telephone (408) 257-7000.

DATE OF ANNOUNCEMENT: Model 2640B—August 1976; Model 2641A—September 1976; Model 2645A—September 1976.

DATE OF FIRST DELIVERY: Models 2640B and 2645A—September 1976; Model 2641A—November 1976.

NUMBER DELIVERED TO DATE: Over 50,000 terminals including all 2640 Series terminals.

SERVICED BY: Hewlett-Packard, worldwide.

MODELS

Models 2640B, 2641A, and 2645A are microprocessor-based stand-alone display terminals with detachable keyboards. Models 2641A and 2645A are available with an integral, dual mini-cartridge tape drive called a Mini Data Station.

Bilingual versions of the 2640 are available for Cyrillic (Russian)/English (2640C), Swedish/Finnish (2640S), and Danish/Norwegian (2640N). The 2645 also comes in foreign language versions, including Katakana (2645K), Norwegian/Danish (2645N), Arabic (2645R), and Swedish/Finnish (2645S). These models are 2640 and 2645 terminals with special ROM-implemented character sets.

The basic 2640B contains an Intel 8008 (or equivalent) microprocessor with 8K-byte ROM microprogram memory and a 4K-byte display memory expandable to 8K bytes in one 4K-byte increment. The basic terminal occupies 8 of the 9 available plug-in card slots; the one vacant slot is available for a plug-in option. An optional slot extender adds another 5 slots for additional plug-in options.

Hewlett-Packard 2640 Series Intelligent Display Terminals

All three models also offer a variety of plug-in options, including parallel and serial printer interfaces, printer subsystems, and communications interfaces. A display enhancements feature (standard on the 2641A; optional on the other models) offers inverse video, blinking, half bright, and underlining. A dual mini-cartridge tape drive, called a Mini Data Station, is available for both the 2641A and 2645A.

Foreign language versions are available for both the 2640 and 2645 models. All versions of the 2640 Series have the same distinctive physical appearance, as well as the same modular construction to easily accommodate the plug-in options.

USER REACTION

In Datapro's 1979 survey of alphanumeric display terminal users, eight users reported on their experience with a total of 45 2640 Series terminals. Broken down by model numbers, three users reported on a total of 19 2640B's, four users responded with a total of ten 2645A's, and one user had a total of sixteen 2649 (OEM) terminals. Their ratings are summarized below.

	Excellent	Good	Fair	Poor	WA*
Overall performance	7	1	0	0	3.9
Ease of operation	3	5	0	0	3.4
Display clarity	6	2	0	0	3.8
Keyboard feel & usability	5	3	0	0	3.6
Hardware reliability	7	1	0	0	3.9
Maintenance service	6	1	0	0	3.9
Software & technical support	3	3	0	0	3.5

*Weighted Average based on a scale of 4.0 for Excellent.

Structured data entry (a la keypunch), "fill in the blanks" formatted data entry, free form (text) data entry, and extensive editing were all mentioned by at least half of the respondents as applications in which the 2640 Series terminals were being utilized. In all cases the displays were configured as a single station with remote (via communications line) and/or local computer connection.

The ratings obtained indicate a high degree of user satisfaction with the 2640 Series terminals. Five of the users listed the price of the terminals as a disadvantage; no other negative attributes were mentioned.□

The basic 2641A and 2645A terminals contain an Intel 8080 (or equivalent) microprocessor with a 22K-byte microprogram memory and a 4K-byte display memory, expandable to 12K bytes in 4K-byte increments.

The basic 2641A terminal includes the Display Enhancement feature (optional in Models 2640B and 2645A) and provides 5 slots for plug-in options. The basic 2645A terminal provides 7 slots for plug-in options.

Each additional 4K-byte RAM memory module requires one slot. The optional Mini Data Station, available for both the 2641A and 2645A, requires two slots and includes an integral dual mini-cartridge tape drive. The feature includes device support firmware. The mini-cartridge is a 3M Company product.

Plug-in options for Models 2640B, 2641A, and 2645A, other than additional memory and the Mini Data Station, include the Display Enhancements feature, the Terminal Duplex Register (provides a parallel printer interface), the Serial Printer Interface, Printer Subsystems, and Communications interfaces. Only one communications interface and only one printer subsystem can be accommodated.

TRANSMISSION SPECIFICATIONS

Tansmission is performed in the half- or full-duplex mode character-by-character (as keyed) or by block. The standard interface is asynchronous and is designed for point-to-point transmission. The data transmission rate is switch selectable at 110, 150, 300, 1200, and 2400 bits/second; Models 2641A and 2645A also provide 4800 and 9600 bps rates. The transmission code is 10- or 11-unit, 8-level ASCII on Models 2640B and 2645A and ASCII or APL on Model 2641A, which provides switch selection between the two codes. Odd, even, or no parity checking is switch selectable. Two stop bits are inserted at 110 bps; one stop bit, at all other speeds. Transparency and data communications self test are standard features. An RS-232C interface is standard. The standard asynchronous interface is compatible with Bell System 103A and 202C, D, S, or T or equivalent modems.

Interface options include Extended Asynchronous Communications, available for all models, and Asynchronous or Synchronous Multipoint Communications, available for Models 2641A and 2645A only. The Extended Asynchronous Communications interface, contained on a single plug-in card, features standard data rate and parity selections, plus custom data rates, split transmit/receive, a choice of RS-232C or 20 mA current loop interfaces, and handshake capability.

The Asynchronous and Synchronous Multipoint Communications interfaces support multi-point communications and daisy-chained line-sharing with up to 32 terminals on the same line. The Synchronous Multipoint Communications interface employs binary synchronous protocol, but is not completely compatible with IBM BSC protocol because of differences in text character sequences for controlling advanced features. Asynchronous or Synchronous Multipoint features include ASCII or EBCDIC transmission code, LRC or CRC error checking, auto-answer/disconnect, transparency, data communications self test, group and device addressing, group poll, broadcasting, and variable I/O buffer sizes.

DEVICE CONTROL

The 2640 series display terminals feature microprocessor control via a microprogram (firmware) that resides in read-only memory (ROM). The terminals perform transmission character-by-character or by block via operator selection. The block mode permits a message or page of data to be entered with or without format control, edited via edit control keys, and transmitted. The complete contents of memory can be printed provided the optional printer is attached. On Models 2641A and 2645A equipped with the Mini Data Station, data can be transferred between left and right tape drives, between display or communication line and tape, and between tape and printer and/or communication line.

Cursor control functions on all models are initiated via keyed or received control codes that move the cursor up, down, left, right, home, to the beginning of the next line (return), or to the same position on the next line (line-feed).

Hewlett-Packard 2640 Series Intelligent Display Terminals

Cursor addressing and sensing are provided; relative or absolute addresses are sensed. Tab functions include set or clear (at the cursor position), clear all tabs (Models 2641A and 2645A only), and tab cursor to next tab stop or to the previous tab stop. Backtab, as well as left and right margin set functions, are provided on the 2641A and 2645A only.

Roll and page functions initiated via keyed or received control codes are included on all models. Roll functions roll the contents of memory up or down by one line before the display screen. Page functions display the previous or next 24-line segment (page) of memory.

Edit functions initiated via keyed or received control codes are also provided by all models. These include character and line insert and delete. Models 2641A and 2645A perform character insert and functions with or without line wrap-around. Model 2640B restricts character insert and delete functions within the line occupied by the cursor; data is shifted off the end of a line and is lost where data is inserted into a full line. Models 2641A and 2645A equipped with the Mini Data Station can also perform tape-related line insert and delete functions. Erasure functions erase all data from memory beginning at the cursor position or all data from the cursor to the end of a line.

Format mode operation is provided by all models. Fixed formats can be created by received or keyed commands that establish protected and unprotected fields and initiate or terminate the format mode. On Models 2641A and 2645A, unprotected fields can be designated as alphabetic, numeric, or alphanumeric. the format mode disables line insert and delete functions and restricts character insert and delete functions to unprotected fields. When transmitting, only unprotected data is transmitted. Attribute codes can be assigned to a field to specify any one or 16 combinations of the following display attributes: half-intensity, underline, reverse video, and blinking (provided the terminal is equipped with the Display Enhancements feature.)

All models are equipped with the Memory Lock feature. Memory lock, when enabled, prevents further entry into memory when memory is full. The operator is alerted to this condition by a flashing indicator and an audible alarm. Data entry/display can continue, but data is lost if data exceeds the screen capacity.

All models include the Caps Lock feature, which, when enabled, places all alphabetic keys in upper-case mode. The Display Functions feature disables and displays all keyed or received control codes except ENQ, DEL, NULLS, and CR. The Test key initiates a diagnostic test of memory (RAM), ROM, and the display. A standard test pattern indicates no failures; an appropriate message is displayed for each detected failure. The Automatic Line Feed feature initiates an automatic line feed for each received carriage return. The Break feature transmits a 200 millisecond space on the asynchronous data communications line and sets secondary channel transmit low for 200 ms. Eight Special Function keys each generate a specific Escape code sequence of up to 80 characters in length that can be defined by the user program at the host computer.

Other functions initiated by control codes, include block transfer initiation, block transfer enable from terminal or computer, record separator (terminates a block transfer), unit separator (separates fields in block mode), enable or disable the keyboard, define alternate character set (1 or 4), enable or disable alternate character set, modem disconnect, transmit terminal status (six bytes of terminal status transmitted as a block), Bell, etc.

The Data Path Group of function keys on Models 2641A and 2645A permit left or right tape drives or the display to be assigned as a source or destination and the printer to be assigned as a destination for data transfer. One source and multiple destinations can be selected. Other controls allow a file to be transferred between two local devices or a local device and the communications facility; to copy all data, a file, or a line from a selected source to a selected destination; and to log data transferred on tape or printer. Tape controls include rewind, write file mark, skip a line, and locate a file.

COMPONENTS

CRT DISPLAY UNIT: Provides a display area that measures 5 inches (127mm) high by 10 inches (254mm) wide. The display arrangement is 24 lines of 80 characters each for a maximum screen capacity of 1920 characters. Data is displayed in white; reverse video, a standard feature, displays data in black against a white background. Character generation forms each character by a 7-by-9 enhanced dot matrix within a 9-by-15 dot character cell (to allow for conditions such as line descenders). The display technique is a non-interlaced raster scan. The cursor is displayed as a blinking underscore.

The 2640B and 2645A are equipped with a standard displayable character set of 128 symbols, including upper and lower case alphabetics, numerics, specials, and control codes. The Display Enhancements option, contained on a single plug-in card, accommodates three additional displayable character sets of 128 symbols each, for a total of four 128-character sets of symbols. The first additional character set is standard and provides a 64-character line drawing set. Two optional additional character sets can provide mathematical symbols, large characters, foreign characters, or user-defined symbols. The Display Enhancements option also features blinking, half-intensity, and underline display functions.

The standard 2641A is equipped with three character sets including a 128-character set of APL symbols, a 64-character set of APL overstrike characters, and a 64-character set of ASCII upper case symbols; the ASCII set is optionally expandable to include lower case symbols. One additional optional character set can be accommodated and can provide a line drawing set, mathematical symbols, large characters, foreign characters, or user-defined symbols. The 2641A also features blinking, half-intensity, and underline display functions.

KEYBOARD: A four-row, 56-key typewriter-style key arrangement. The keyboard features an 11-key numeric pad (including decimal point) and a 12-key pad of cursor-and display-control keys. All operator controls are located on the detachable keyboard above the keys. Controls are provided for communications, terminal control functions, editing, 8 user-defined functions, and on Models 2641A and 2645A, tape control.

The standard keyboard on Models 2640B and 2645A can generate any of 128 ASCII characters. The standard 2641A keyboard can generate any of 128 APL or ASCII character codes via switch selection.

INTEGRATED DUAL CARTRIDGE TAPE: The Mini Data Station is optional for Models 2541A and 2645A only, and includes two individual and integral mini-cartridge tape drives for 3M Mini-Cartridges. A mini-cartridge is recorded at 800 bpi and stores 110,000 bytes. Tape read/write speed is 10 inches/second; search/rewind speed is 60 inches/second.

9866 PRINTER: A non-impact (thermal) printer with 80 print columns and rated at 240 lines/minute. Accommodates 8¾ inch wide paper for friction-feed platen. Model 9866A provides a 64-character upper case symbol set. Model 9866B provides a 96-character upper and lower case symbol set.

Hewlett-Packard 2640 Series Intelligent Display Terminals

2631A PRINTER: A teleprinter with a bidirectional, matrix printing mechanism. It operates at up to 180 cps and prints 136 to 227 columns. It can generate 128 character symbols. The printer supports three selectable horizontal pitches (normal, expanded, and compressed) and seven vertical line spacings, as well as horizontal tabbing and 8-channel fixed vertical formatting.

PRICING

The Hewlett-Packard 2640 Series display terminals are available for purchase, rental, or lease. Quantity discounts are available for purchased terminals. Rental terms are available for periods of 6, 12, or 18 months and include maintenance. Full pay-out leases are available for periods of 2, 3, 4, or 5 years and do not include maintenance. A separate maintenance contract is available for purchased or leased equipment. There are no installation charges on equipment received and installed by the customer, and the investment tax credit is passed on to the customer for purchased or leased equipment. Training consists of a training tape and manuals for operators and programmers. Factory training is available.

Quantity discounts for purchased terminals are as follows:

5-14 units: 8 percent
15-24 units: 10 percent
25-34 units: 13 percent
35-49 units: 15 percent
50-74 units: 17 percent
75-99 units: 19 percent
100 units and over: contact vendor.

		Monthly Charge*					
		1-Year Rental	2-Year Lease	3-Year Lease	5-Year Lease	Purchase	Monthly Maint.
	Terminals						
2640B	Interactive Display Terminal	$154	$167	$122	$ 87	$3,250	$18
2641A	APL Display Station	195	209	152	107	4,100	20
2645A	Display Station	166	183	135	96	3,500	20
	Options						
-001	128 Character Set (expanded ASCII set for Model 2641A)	4.75	4.61	3.23	2.13	100	0
-007	Integrated Dual Cartridge Tape (Mini Data Station; Models 2641A & 2645A only)	76.00	81.82	59.63	42.00	1,600	6
-013	Pkg. of 5 Mini Cartridges	—	—	—	—	90	—
-020	Extended Asynchronous Communication (2640B only; requires RS-232C or current loop interface cable)	7.13	6.92	4.84	3.19	150	0
-032	Extended Asynchronous Communications (Models 2641A & 2645A only; same as option -020 for Model 2640B.)	7.13	6.92	4.84	3.19	150	0
-033	Asynchronous Multipoint Communications (Models 2641A & 2645A only.)	11.88	11.54	8.07	5.31	250	0
-034	Synchronous Multipoint Communications (Models 2641A & 2645A only.)	13.06	12.69	8.87	5.84	275	0
13231A	Display Enhancements (requires one slot)	11.88	11.54	8.07	5.31	250	0
-201	64-Char. Math Symbol Set	4.75	4.61	3.23	2.13	100	0
-202	64-Char. Line Drawing Set	7.13	6.92	4.84	3.19	150	0
-203	Large Character Set	7.13	6.92	4.84	3.19	150	0
13234A	Terminal Memory Module (4K bytes, requires one slot)	14.25	13.84	9.68	6.38	300	0
13236B	Integrated Dual Cartridge Tape Upgrade kit (field upgrade for adding Mini Data Station to 2641A or 2645A; requires 13261A)	73.63	79.52	58.02	40.94	1,550	6
13238A	Terminal Duplex Register (provides parallel printer interfacing; no interface cable included; requires one slot and 13261A on tapeless 2641A's and 2645A's)	4.75	4.61	3.23	2.13	100	0
13240A	Option Slot Extender (adds 5 option slots; 2640B only)	7.13	6.92	4.84	3.19	150	0
13245A	PROM character Set Accessory (for user-defined custom character sets; requires one slot)	9.50	9.23	6.45	4.25	200	0
13250B	Serial Printer Interface (requires 13261A on tapeless 2641A's and 2645A's)	13.06	12.69	8.87	5.84	275	0
13261A	Device Support Firmware (required by tapeless 2641A's and 2645A's to support printers, tape upgrade, or other I/O devices)	8.08	7.84	5.49	3.61	170	0
13246A	HP 9866A Printer Subsystem (includes interface & cable; all models)	165.06	180.34	132.14	93.84	3,475	20
13246B	HP 9866B Printer Subsystem (includes interface & cable; all models)	174.56	189.56	138.59	98.09	3,675	20
	HP 2631A Printer	159.00	185.57	139.10	102.19	3,350	31

*Includes prime-shift maintenance. Monthly costs are computed as follows: 1-Year Rental: 4.75% of purchase price; 2-Year Lease: 4.614% plus maintenance; 3-Year Lease: 3.227% plus maintenance; 5-Year Lease: 2.125% plus maintenance. Lease rates may vary slightly.■

Hewlett-Packard 2640 Series Intelligent Display Terminals

The 2645A has the same attractive appearance as the other 2640 series models, including detachable full-function ASCII keyboard. The optional Mini Data Station, located beneath the screen, accommodates two 3M-type mini-cartridges such as the one shown at lower left.

A family of intelligent, stand-alone, general-purpose display terminals for point-to-point or multipoint communications.

Standard features include microprogram control; selectable transmission rates up to 9600 bps; block or character transmission; full editing; ASCII or APL codes and character sets; special function keys; numeric keypad; teletype compatibility; etc. Options include dual 3M mini-cartridge tape drives, serial printers, asynchronous or bisynchronous multipoint communications, EBCDIC code, up to four operator-selectable character sets (including user-specified sets), display enhancements, and up to 12K bytes of memory.

Models range in prices from $2,600 to $4,100 plus options. Quantity discounts are available.

MANAGEMENT SUMMARY

Hewlett-Packard, a prominent vendor of minicomputers and well known as a leading manufacturer of high quality electronic test equipment, entered the display terminal market in November 1974 when it introduced its initial product, the microprocessor-based 2640A Interactive Display Terminal. The Data Terminals Division was formed in November 1975.

The 2640A was one of the industry's first microprocessor-based terminals and features an Intel 8008 microprocessor, a 1920-character screen, a separate, full-ASCII keyboard, and an optional printer. Modularity is its key asset. Options are easily added by inserting additional logic boards into vacant slots within the logic card library.

The 2640A was upgraded to Version B in August 1976. The 2640B is virtually identical with the 2640A; it has the same specifications and offers the same options except for the two that were dropped—a simplified keyboard and a 2K-byte expanded memory module. A few minor changes are reflected in the 2640B keyboard.

The 2640 was followed by the 2644, introduced in October 1975. The 2644 was an enhanced version of the 2640; its key attraction was the inclusion of an integral dual tape drive designed to accommodate the 3M minicartridge. Though it remains available, it was superseded by the 2645, introduced in September 1976. The 2645 is essentially an upgraded 2644 and contains the more powerful Intel 8080 microprocessor in place of the 2644's Intel 8008. The memory capacity of the 2645 has also been expanded from the 2644's 4K bytes to a ▷

CHARACTERISTICS

VENDOR: Hewlett-Packard Company, Data Terminals Division, 1501 Page Mill Road, Palo Alto, California 94304. Telephone (415) 493-1501.

DATE OF ANNOUNCEMENT: Model 2640B—August 1976; Model 2641A—September 1976; Model 2645A—September 1976.

DATE OF FIRST DELIVERY: Models 2640B and 2645A—September 1976; Model 2641A—November 1976.

NUMBER DELIVERED TO DATE: Over 30,000 terminals including all 2640 Series terminals.

SERVICED BY: Hewlett-Packard, worldwide.

MODELS

Models 2640B, 2641A, and 2645A are microprocessor-based stand-alone display terminals with detachable keyboards. Models 2641A and 2645A are available with an integral, dual mini-cartridge tape drive called a Mini Data Station.

Bilingual versions of the 2640 are available for Cyrillic (Russian)/English (2640C), Swedish/Finnish (2640S), and Danish/Norwegian (2640N). These models are 2640 terminals with special ROM-implemented character sets.

The basic 2640B contains an Intel 8008 (or equivalent) microprocessor with 8K-byte ROM microprogram memory and a 1K-byte RAM memory expandable to 8K bytes in two 4K-byte increments. The basic 1K RAM provides about 675 displayable character positions provided no display enhancements are added. This restriction results from the use of a portion of the basic RAM for buffering and overhead. The basic terminal occupies 7 of the 9 available plug-in card slots; the two vacant slots are available for plug-in options. An optional slot extender adds another 5 slots for additional plug-in options. ➤

Hewlett-Packard 2640 Series Intelligent Display Terminals

maximum of 12K bytes. The 2645 offers expanded communications flexibility through interchangeable interface options designed for point-to-point or multi-point asynchronous or bisynchronous operations. Although it offers BSC protocol, it is not completely compatible with IBM's BSC. An APL version of the 2645 was also introduced in September 1976 shortly after the original 2645 announcement. The 2641 is identical to the 2645 but provides full APL and ASCII character sets, including a full APL overstrike set. The character sets are switch selectable.

Hewlett-Packard also offers the 2649, an OEM version of the 2645, and several bilingual versions of the 2640 equipped with English/Cryillic (Russian), Swedish/Finnish and Norwegian/Danish character sets.

All models have the same attractive physical appearance, are equipped with the same display screen and a detachable keyboard that contains all operator controls, and provide the modularity of the 2640 to easily add options.

The salient features of the actively marketed terminals are presented as follows:

- 1920 character screen.
- Optional display parameters.
- 64- or 128- (option) character symbol set.
- Up to 3 additional 128-character sets of symbols including math and line drawing symbol sets and custom character sets (implemented via ROM).
- Switch-selectable 128-character APL/ASCII plus 64-character APL overstrike symbols (2641 only).
- Format generation and protection.
- Tabulation between tab settings and unprotected fields.
- Addressable/readable cursor.
- Character, line, and page editing.
- Numeric keypad.
- Function keypad.
- Full cursor controls.
- Paging (previous or next).
- Roll (up or down).
- 8 user-defined program function keys.
- Switch-selectable transmission rates to 2400 bps (2640) or 9600 bps (2641 and 2645).
- Custom transmission rates from 37.5 to 2400 bps (optional on 2640 only).
- Split transmit/receive rates (optional).
- RS-232C or 20 ma dc Teletype interface.
- Daisy chaining.
- Asynchronous or bisynchronous multipoint communications (optional on 2641 and 2645).
- Integral dual cartridge mini tape drives (optional on 2641 and 2645).
- Serial printer options: 30 cps with 120 columns (impact), 180 cps with 132 columns (impact), or 240 lpm with 80 columns (thermal).
- Serial interface for user-supplied printers such as Centronics or GE TermiNet.

The basic 2641A and 2645A terminals contain an Intel 8080 (or equivalent) microprocessor with a 22K-byte microprogram memory and a 4K-byte RAM memory, expandable to 12K bytes in 4K-byte increments.

The basic 2641A terminal includes the Display Enhancement feature (optional in Models 2640B and 2645A) and provides 5 slots for plug-in options. The basic 2645A terminal provides 7 slots for plug-in options.

Each additional 4K-byte RAM memory module requires one slot. The optional Mini Data Station, available for both the 2641A and 2645A, requires two slots and includes an integral dual mini-cartridge tape drive. The feature includes device support firmware. The mini-cartridge is a 3M Company product.

Plug-in options for Models 2640B, 2641A, and 2645A, other than additional memory and the Mini-Data Station, include the Display Enhancements feature, the Terminal Duplex Register, a parallel printer interface, the Asynchronous Data Communications/Serial Printer Interface, Printer Subsystems, and Communications interfaces. Only one communications interface and only one printer subsystem can be accommodated.

TRANSMISSION SPECIFICATIONS

Transmission is performed in the half- or full-duplex mode character-by-character (as keyed) or by block. The standard interface is asynchronous and is designed for point-to-point transmission. The data transmission rate is switch selectable at 110, 150, 300, 1200, 2400, 4800 (Models 2641A and 2645A), and 9600 (Model 2645A) bits/second. The transmission code is 10- or 11-unit, 8-level ASCII on Models 2640B and 2645A and ASCII or APL on Model 2641A, which provides switch selection between the two codes. Odd, even, or no parity checking is switch selectable. Two stop bits are inserted at 110 bps; one stop bit, at all other speeds. Transparency and data communications self test are standard features. An RS-232C interface is standard. The standard asynchronous interface is compatible with Bell System 103A and 202C, D, S, or T or equivalent modems.

Interface options include Extended Asynchronous Communications, available for all models, and Asynchronous or Synchronous Multipoint Communications, available for Models 2641A and 2645A only. The Extended Asynchronous Communications interface, contained on a single plug-in card, features standard selectable data rates from 110 to 9600 bps, custom data rates from 37.5 to 2400 bps, split transmit/receive, and handshake capabiltiy.

The Asynchronous and Synchronous Multipoint Communications interfaces support multi-point communications and daisy-chained line-sharing with up to 32 terminals on the same line. The Synchronous Multipoint Communications interface employs binary synchronous protocol, but is not completely compatible with IBM BSC protocol because of differences in text character sequences for controlling advanced features. Asynchronous or Synchronous Multipoint features include ASCII or EBCDIC transmission code, LRC or CRC error checking, auto-answer/disconnect, transparency, data communications self test, group and device addressing, group poll, broadcasting, and variable I/O buffer sizes.

DEVICE CONTROL

The 2640 series display terminals feature microprocessor control via a microprogram (firmware) that resides in read-only memory (ROM). The terminals perform transmission character-by-character or by block via operator selection. The block mode permits a message or page of data to be entered with or without format control, edited

Hewlett-Packard 2640 Series Intelligent Display Terminals

> USER REACTION

In December 1977, Datapro conducted a survey of alphanumeric display terminal users. Five users reported on their experience with 25 HP 2640 Series terminals. The ratings are as follows:

	Excellent	Good	Fair	Poor	WA*
Overall performance	3	2	0	0	3.6
Ease of operation	2	3	0	0	3.4
Display clarity	4	0	1	0	3.6
Keyboard feel & usability	3	0	2	0	3.2
Hardware reliability	3	2	0	0	3.6
Maintenance service	3	1	1	0	3.4
Software and technical support	1	2	1	1	2.6

*Weighted Average based on 4.0 for Excellent.

Four of those surveyed cited flexibility as a chief advantage; reliability was also mentioned favorably. All users mentioned the high cost of the unit as a disadvantage. These ratings are somewhat lower than those obtained in Datapro's 1976 survey, which covered those users with six terminals when the product was new. The two low ratings on Software and technical support are related to the geographical location of one user and to the application of another. (The application was new, and the user complained about lack of support in getting it up and running.)□

➤ via edit control keys, and transmitted. The complete contents of memory can be printed provided the optional printer is attached. On Models 2641A and 2645A equipped with the Mini DataStation, data can be transferred between left and right tape drives, between display or communication line and tape, and between tape and printer and/or communication line.

Cursor control functions on all models are initiated via keyed or received control codes that move the cursor up, down, left, right, home, to the beginning of the next line (return), or to the same position on the next line (line-feed). Cursor addressing and sensing are provided; relative or absolute addresses are sensed. Tab functions include set or clear (at the cursor position), clear all tabs (Models 2641A and 2645A only), and tab cursor to next tab stop or to the previous tab stop. Backtab, as well as left and right margin set functions, are provided on the 2641A and 2645A only.

Roll and page functions initiated via keyed or received control codes are included on all models. Roll functions roll the contents of memory up or down by one line before the display screen. Page functions display the previous or next 24-line segment (page) of memory.

Edit functions initiated via keyed or received control codes are also provided by all models. These include character and line insert and delete. Models 2641A and 2645A perform character insert and functions with or without line wraparound. Model 2640B restricts character insert and delete functions within the line occupied by the cursor; data is shifted off the end of a line and is lost where data is inserted into a full line. Models 2641A and 2645A equipped with the Mini DataStation can also perform tape-related line insert and delete functions. Erasure functions erase all data from memory beginning at the cursor position or all data from the cursor to the end of a line.

Format mode operation is provided by all models. Fixed formats can be created by received or keyed commands that establish protected and unprotected fields and initiate or terminate the format mode. On Models 2641A and 2645A, unprotected fields can be designated as alphabetic, numeric, or alphanumeric. The format mode disables line insert and delete functions and restricts character insert and delete functions to unprotected fields. When transmitting, only unprotected data is transmitted. Attribute codes can be assigned to a field to specify any one or 16 combinations of the following display attributes: half-intensity, underline, reverse video, and blinking (provided the terminal is equipped with the Display Enhancements option.)

All models are equipped with the Memory Lock feature. Memory lock, when enabled, prevents further entry into memory when memory is full. The operator is alerted to this condition by a flashing indicator and an audible alarm. Data entry/display can continue, but data is lost if data exceeds the screen capacity.

All models include the Caps Lock feature, which, when enabled, places all alphabetic keys in upper-case mode. The Display Functions feature disables and displays all keyed or received control codes except ENQ, DEL, NULLS, and CR. The Test key initiates a diagnostic test of memory (RAM), ROM, and the display A standard test pattern indicates no failures; an appropriate message is displayed for each detected failure. The Automatic Line Feed feature initiates an automatic line feed for each received carriage return. The Break feature transmits a 200 millisecond space on the asynchronous data communications line and sets secondary channel transmit low for 200 ms. Eight Special Function keys each generate a specific Escape code sequence that can be defined by the user program at the host computer.

Other functions initiated by control codes, include block transfer initiation, block transfer enable from terminal or computer, record separater (terminates a block transfer), unit separator (separates fields in block mode), enable or disable the keyboard, define alternate character set (1 of 4), enable or disable alternate character set, modem disconnect, transmit terminal status (six bytes of terminal status transmitted as a block), Bell, etc.

The Data Path Group of function keys on Models 2641A and 2645A permit left or right tape drives or the display to be assigned as a source or destination and the printer to be assigned as a destination for data transfer. One source and multiple destinations can be selected. Other controls allow a file to be transferred between two local devices or a local device and the communications facility; to copy all data, a file, or a line from a selected source to a selected destination; and to log data transferred on tape or printer. Tape controls include rewind, write file mark, skip a line, and locate a file.

COMPONENTS

CRT DISPLAY UNIT: Provides a display area that measures 5 inches (127mm) high by 10 inches (254mm) wide. The display arrangement is 24 lines of 80 characters each for a maximum screen capacity of 1920 characters. Data is displayed in white; reverse video, a standard feature, displays data in black against a white background. Character generation forms each character by a 7-by-9 enhanced dot matrix within a 9-by-15 dot character cell (to allow for conditions such as line descenders). The display technique is a non-interlaced raster scan. The cursor is displayed as a blinking underscore.

The 2640B and 2645A are equipped with a standard displayable character set of 64 ASCII symbols that include upper case alphabetics, numerics, and specials. An optional 128-character set of displayable symbols includes upper and lower case alphabetics, numerics, specials, and control codes. The Display Enhancements option, contained on a single plug-in card, accommodates three additional displayable character sets of 128 symbols each, for a total of four 128-character sets of symbols, including the optional 64 character line drawing set and 64 character mathematical symbol set as well as user-defined symbols. The Display Enhancements option also features blinking, half-intensity, and underline display functions. ➤

Hewlett-Packard 2640 Series Intelligent Display Terminals

The standard 2641A is equipped with three character sets including a 128-character set of APL symbols, a 64-character set of APL overstrike characters, and a 64-character set of ASCII upper case symbols; the ASCII set is optionally expandable to include lower case symbols. The 2641A also features blinking, half-intensity, and underline display functions.

KEYBOARD: A four-row, 56-key typewriter-style key arrangement. The keyboard features an 11-key numeric pad (including decimal point) and a 12-key pad of cursor-and display-control keys. All operator controls are located on the detachable keyboard above the keys. Controls are provided for communications, terminal control functions, editing, and on Models 2641A and 2645A, tape control and 8 user-defined functions.

The standard keyboard on Models 2640B and 2645A can generate any of 128 ASCII characters. The standard 2641A keyboard can generate any of 128 APL or ASCII character codes via switch selection.

INTEGRATED DUAL CARTRIDGE TAPE: The Mini DataStation is optional for Models 2641A and 2645A only, and includes two individual and integral mini-cartridge tape drives for 3M Mini-Cartridges. A mini-cartridge is recorded at 800 bpi and stores 110,000 bytes. Tape read/write speed is 10 inches/second; search/rewind speed is 60 inches/second.

9866 PRINTER: A non-impact (thermal) printer with 80 print columns and rated at 240 lines/minute. Accommodates 8-3/4 inch wide paper for friction-feed platen. Model 9866A provides a 64-character upper case symbol set. Model 9866B provides a 96-character upper and lower case symbol set.

2361A PRINTER: A teleprinter with bidirectional, matrix printing mechanism. It operates at up to 180 cps and prints 136 to 227 columns. It incorporates a full typewriter keyboard with numeric pad and can generate 128 character symbols.

9871 PRINTER: An impact printer with 120 print columns and rated at 30 char./second. The 9871 employs the Diablo HyType I printer mechanism and provides a character set of 128 symbols. Friction feed is standard; tractor feed is optional.

PRICING

The Hewlett-Packard 2640 Series display terminals are available for purchase, rental, or lease. Quantity discounts are available for purchased terminals. Rental terms are available for periods of 6, 12, or 18 months and include maintenance. Full pay-out leases are available for periods of 2, 3, 4, or 5 years and do not include maintenance. A separate maintenance contract is available for purchased or leased equipment. There are no installation charges on equipment received and installed by the customer, and the investment tax credit is passed on to the customer for purchased or leased equipment. Training consists of a training tape and manuals for operators and programmers. Factory training is available.

Quantity discounts for purchased terminals are as follows:

5-9 units: 8 percent
10-19 units: 11 percent
20-49 units: 14 percent
50-99 units: 18 percent
100-199 units: 21 percent
200 units and over: contact vendor

		Monthly Charge*					
	Terminals	1-Year Rental	2-Year Lease	3-Year Lease	5-Year Lease	Purchase	Monthly Maint.
2640B	Interactive Display Terminal	$124	$140	$103	$ 75	$2,600	$20
2641A	APL Display Station	195	209	152	107	4,100	20
2645A	Display Station	166	183	135	96	3,500	22
	Options						
-001	128 Character Set (ASCII)	4.75	4.61	3.23	2.13	100	0
-007	Integrated Dual Cartridge Tape (Mini DataStation; Models 2641A & 2645A only)	76.00	81.82	59.63	42.00	1,600	8
-013	Pkg. of 5 Mini Cartridges	—	—	—	—	90	—
-015	50 Hz Operation	N/C	N/C	N/C	N/C	N/C	—
-020	Extended Asynchronous Communication (same as 13250A; requires RS-232C or current loop interface cable)	7.13	6.92	4.84	3.19	150	0
-030	Delete Standard Asynchronous Communications (Models 2641A and 2645A only)	-7.60	-7.38	-5.16	-3.40	-160	—
13231A	Display Enhancements (requires one slot)	11.88	11.54	8.07	5.31	250	0
-201	64-Char. Math Symbol Set	4.75	4.61	3.23	2.13	100	0
-202	64-Char. Line Drawing set	7.13	6.92	4.84	3.19	150	0
-203	Large Character Set	7.13	6.92	4.84	3.19	150	0
13234A	Terminal Memory Module (4K bytes, requires one slot)	14.25	13.84	9.68	6.38	300	0
13236B	Integrated Dual Cartridge Tape Upgrade kit (field upgrade for adding Mini DataStation to 2641A or 2645A; requires 13261A)	73.63	79.52	58.02	40.94	1,550	8
13238A	Terminal Duplex Register (for HP 9866A or 9871A printer; no interface cable included; requires one slot and 13261A on tapeless 2641A's and 2645A's)	4.75	4.61	3.23	2.13	100	0
13240A	2640 Option Slot Extender (adds 5 option slots)	7.13	6.92	4.84	3.19	150	0

Hewlett-Packard 2640 Series Intelligent Display Terminals

		Monthly Charge*					
		1-Year Rental	2-Year Lease	3-Year Lease	5-Year Lease	Purchase	Monthly Maint.
13245A	PROM character Set Accessory (for user-defined custom character sets; requires one slot)	9.50	9.23	6.45	4.25	200	0
13246A	HP 9866A Printer Subsystem (includes interface & cable; all models)	165.06	180.34	132.14	93.84	3,475	20
13246B	HP 9866B Printer Subsystem (includes interface & cable; all models)	174.56	189.56	138.59	98.09	3,675	20
13250A	Serial Printer Interface (requires 13261A on tapeless 2641A's and 2645A's)	9.50	9.23	6.45	4.25	200	0
	HP 2631A Printer	163.88	190.18	142.33	104.31	3,450	31
13349A	HP 9871 Printer Subsystem (includes interface & cable; all models)	176.94	201.87	150.21	109.15	3,725	30
13260A	Standard Asynchronous Communications (includes RS-232C interface; Models 2641A & 2645A only)	7.60	7.38	5.16	3.40	160	0
13260B	Extended Asynchronous Communications (Models 2641A & 2645A; same as Option- 020 for 2640B)	15.44	15.00	10.49	6.91	325	0
13260C	Asynchronous Multipoint Communications (Models 2641A & 2645A only; requires option -030)	20.66	20.07	14.04	9.24	435	0
13260D	Synchronous Multipoint Communications (Models 2641A & 2645A only; requires option -030)	21.38	20.76	14.52	9.56	450	0
-001	Add Monitor Mode Capability (Models 2641A & 2645A only)	2.38	2.31	1.61	1.06	50	0
13261A	Device Support Firmware (required by tapeless 2641A's and 2645A's to support printers, tape upgrade, or other I/O devices)	8.08	7.84	5.49	3.61	170	0
	Mini Cartridges, each:						
	5 to 54	—	—	—	—	18	—
	55 and over	—	—	—	—	15	—

*Includes prime-shift maintenance. Monthly costs are computed as follows: 1-Year Rental: 4.75% of purchase price; 2-Year Lease: 4.614% plus maintenance; 3-Year Lease: 3.227% plus maintenance; 5-Year Lease: 2.125% plus maintenance. Lease rates may vary slightly. ■

Hewlett-Packard 2640 Series Intelligent Display Terminals

The 2645A has the same attractive appearance as the other 2640 series models, including detachable full-function ASCII keyboard. The optional Mini Data Station, located beneath the screen, accommodates two 3M-type mini-cartridges such as the one shown at lower left.

A family of intelligent, stand-alone, general-purpose display terminals for point-to-point or multipoint communications.

Standard features include microprogram control; selectable transmission rates up to 9600 bps; block or character transmission; full editing; ASCII or APL codes and character sets; special function keys; numeric keypad; teletype compatibility; etc. Options include dual 3M mini-cartridge tape drives, serial printers, asynchronous or bisynchronous multipoint communications, EBCDIC code, up to four operator-selectable character sets (including user-specified sets), display enhancements, and up to 12K bytes of memory.

Models range in prices from $2,600 to $4,100 plus options. Quantity discounts are available.

MANAGEMENT SUMMARY

Hewlett-Packard, a prominent vendor of minicomputers and well known as a leading manufacturer of high quality electronic test equipment, entered the display terminal market in November 1974 when it introduced its initial product, the microprocessor-based 2640A Interactive Display Terminal. The Data Terminals Division was formed in November 1975.

The 2640A was one of the industry's first microprocessor-based terminals and features an Intel 8008 microprocessor, a 1920-character screen, a separate, full-ASCII keyboard, and an optional printer. Modularity is its key asset. Options are easily added by inserting additional logic boards into vacant slots within the logic card library.

The 2640A was upgraded to Version B in August 1976. The 2640B is virtually identical with the 2640A; it has the same specifications and offers the same options except for the two that were dropped—a simplified keyboard and a 2K-byte expanded memory module. A few minor changes are reflected in the 2640B keyboard.

The 2640 was followed by the 2644, introduced in October 1975. The 2644 was an enhanced version of the 2640; its key attraction was the inclusion of an integral dual tape drive designed to accommodate the 3M minicartridge. Though it remains available, it was superseded by the 2645, introduced in September 1976. The 2645 is essentially an upgraded 2644 and contains the more powerful Intel 8080 microprocessor in place of the 2644's Intel 8008. The memory capacity of the 2645 has also been expanded from the 2644's 4K bytes to a ▷

CHARACTERISTICS

VENDOR: Hewlett-Packard Company, Data Terminals Division, 1501 Page Mill Road, Palo Alto, California 94304. Telephone (415) 493-1501.

DATE OF ANNOUNCEMENT: Model 2640B—August 1976; Model 2641A—September 1976; Model 2645A—September 1976.

DATE OF FIRST DELIVERY: Models 2640B and 2645A—September 1976; Model 2641A—November 1976.

NUMBER DELIVERED TO DATE: Over 7500 terminals including all 2640 Series terminals.

SERVICED BY: Hewlett-Packard, worldwide.

MODELS

Models 2640B, 2641A, and 2645A are microprocessor-based stand-alone display terminals with detachable keyboards. Models 2641A and 2645A are available with an integral, dual mini-cartridge tape drive called a Mini Data Station.

Bilingual versions of the 2640 are available for Cyrillic (Russian)/English (2640C), Swedish/Finnish (2640S), and Danish/Norwegian (2640N). These models are 2640 terminals with special ROM-implemented character sets.

The basic 2640B contains an Intel 8008 (or equivalent) microprocessor with 8K-byte ROM microprogram memory and a 1K-byte RAM memory expandable to 8K bytes in two 4K-byte increments. The basic 1K RAM provides about 675 displayable character positions provided no display enhancements are added. This restriction results from the use of a portion of the basic RAM for buffering and overhead. The basic terminal occupies 7 of the 9 available plug-in card slots; the two vacant slots are available for plug-in options. An optional slot extender adds another 5 slots for additional plug-in options. ▷

Hewlett-Packard 2640 Series Intelligent Display Terminals

maximum of 12K bytes. The 2645 offers expanded communications flexibility through interchangeable interface options designed for point-to-point or multi-point asynchronous or bisynchronous operations. Although it offers BSC protocol, it is not completely compatible with IBM's BSC. An APL version of the 2645 was also introduced in September 1976 shortly after the original 2645 announcement. The 2641 is identical to the 2645 but provides full APL and ASCII character sets, including a full APL overstrike set. The character sets are switch selectable.

Hewlett-Packard also offers the 2649, an OEM version of the 2645, and several bilingual versions of the 2640 equipped with English/Cryillic (Russian), Swedish/Finnish and Norwegian/Danish character sets.

All models have the same attractive physical appearance, are equipped with the same display screen and a detachable keyboard that contains all operator controls, and provide the modularity of the 2640 to easily add options.

The salient features of the actively marketed terminals are presented as follows:

- 1920 character screen.
- Optional display parameters.
- 64- or 128- (option) character symbol set.
- Up to 3 additional 128-character sets of symbols including math and line drawing symbol sets and custom character sets (implemented via ROM).
- Switch-selectable 128-character APL/ASCII plus 64-character APL overstrike symbols (2641 only).
- Format generation and protection.
- Tabulation between tab settings and unprotected fields.
- Addressable/readable cursor.
- Character, line, and page editing.
- Numeric keypad.
- Function keypad.
- Full cursor controls.
- Paging (previous or next).
- Roll (up or down).
- 8 user-defined program function keys.
- Switch-selectable transmission rates to 2400 bps (2640) or 9600 bps (2641 and 2645).
- Custom transmission rates from 37.5 to 2400 bps (optional on 2640 only).
- Split transmit/receive rates (optional).
- RS-232C or 20 ma dc Teletype interface.
- Daisy chaining.
- Asynchronous or bisynchronous multipoint communications (optional on 2641 and 2645).
- Integral dual cartridge mini tape drives (optional on 2641 and 2645).
- Serial printer options: 30 cps with 120 columns (impact) or 240 lpm with 80 columns (thermal).
- Serial interface for user-supplied printers such as Centronics or GE TermiNet.

The basic 2641A and 2645A terminals contain an Intel 8080 (or equivalent) microprocessor with a 22K-byte microprogram memory and a 4K-byte RAM memory, expandable to 12K bytes in 4K-byte increments.

The basic 2641A terminal includes the Display Enhancement feature (optional in Models 2640B and 2645A) and provides 5 slots for plug-in options. The basic 2645A terminal provides 7 slots for plug-in options.

Each additional 4K-byte RAM memory module requires one slot. The optional Mini Data Station, available for both the 2641A and 2645A, requires two slots and includes an integral dual mini-cartridge tape drive. The feature includes device support firmware. The mini-cartridge is a 3M Company product.

Plug-in options for Models 2640B, 2641A, and 2645A, other than additional memory and the Mini-Data Station, include the Display Enhancements feature, the Terminal Duplex Register, a parallel printer interface, the Asynchronous Data Communications/Serial Printer Interface, Printer Subsystems, and Communications interfaces. Only one communications interface and only one printer subsystem can be accommodated.

TRANSMISSION SPECIFICATIONS

Transmission is performed in the half- or full-duplex mode character-by-character (as keyed) or by block. The standard interface is asynchronous and is designed for point-to-point transmission. The data transmission rate is switch selectable at 110, 150, 300, 1200, 2400, 4800 (Models 2641A and 2645A), and 9600 (Model 2645A) bits/second. The transmission code is 10- or 11-unit, 8-level ASCII on Models 2640B and 2645A and ASCII or APL on Model 2641A, which provides switch selection between the two codes. Odd, even, or no parity checking is switch selectable. Two stop bits are inserted at 110 bps; one stop bit, at all other speeds. Transparency and data communications self test are standard features. An RS-232C interface is standard. The standard asynchronous interface is compatible with Bell System 103A and 202C, D, S, or T or equivalent modems.

Interface options include Extended Asynchronous Communications, available for all models, and Asynchronous or Synchronous Multipoint Communications, available for Models 2641A and 2645A only. The Extended Asynchronous Communications interface, contained on a single plug-in card, features standard selectable data rates from 110 to 9600 bps, custom data rates from 37.5 to 2400 bps, split transmit/receive, and handshake capabiltiy.

The Asynchronous and Synchronous Multipoint Communications interfaces support multi-point communications and daisy-chained line-sharing with up to 32 terminals on the same line. The Synchronous Multipoint Communications interface employs binary synchronous protocol, but is not completely compatible with IBM BSC protocol because of differences in text character sequences for controlling advanced features. Asynchronous or Synchronous Multipoint features include ASCII or EBCDIC transmission code, LRC or CRC error checking, auto-answer/disconnect, transparency, data communications self test, group and device addressing, group poll, broadcasting, and variable I/O buffer sizes.

DEVICE CONTROL

The 2640 series display terminals feature microprocessor control via a microprogram (firmware) that resides in read-only memory (ROM). The terminals perform transmission character-by-character or by block via operator selection. The block mode permits a message or page of data to be entered with or without format control, edited

Hewlett-Packard 2640 Series Intelligent Display Terminals

USER REACTION

In Datapro's 1976 survey of alphanumeric display terminal users, 3 users reported on their experience with 6 Hewlett-Packard Model 2640A terminals. Their ratings are presented in the following table.

	Excellent	Good	Fair	Poor	WA*
Overall performance	2	1	0	0	3.7
Ease of operation	2	0	1	0	3.3
Display clarity	3	0	0	0	4.0
Keyboard feel & usability	2	1	0	0	3.7
Hardware reliability	2	1	0	0	3.7
Maintenance service	2	1	0	0	3.7
Software & technical support	0	2	0	0	3.0

*Weighted Average on a scale of 4.0 for Excellent.

These users are well satisfied with all aspects of the 2640. Flexibility was cited as the key advantage. It is not surprising that display clarity was given the highest rating in view of H-P's high resolution image, which is one of the best in the industry. □

via edit control keys, and transmitted. The complete contents of memory can be printed provided the optional printer is attached. On Models 2641A and 2645A equipped with the Mini DataStation, data can be transferred between left and right tape drives, between display or communication line and tape, and between tape and printer and/or communication line.

Cursor control functions on all models are initiated via keyed or received control codes that move the cursor up, down, left, right, home, to the beginning of the next line (return), or to the same position on the next line (line-feed). Cursor addressing and sensing is provided; relative or absolute addresses are sensed. Tab functions include set or clear (at the cursor position), clear all tabs (Models 2641A and 2645A only), and tab cursor to next tab stop or to the previous tab stop. Backtab, as well as left and right margin set functions, are provided on the 2641A and 2645A only.

Roll and page functions initiated via keyed or received control codes are included on all models. Roll functions roll the contents of memory up or down by one line before the display screen. Page functions display the previous or next 24-line segment (page) of memory.

Edit functions initiated via keyed or received control codes are also provided by all models. These include character and line insert and delete. Models 2641A and 2645A perform character insert and functions with or without line wraparound. Model 2640B restricts character insert and delete functions within the line occupied by the cursor; data is shifted off the end of a line and is lost where data is inserted into a full line. Models 2641A and 2645A equipped with the Mini DataStation can also perform tape-related line insert and delete functions. Erasure functions erase all data from memory beginning at the cursor position or all data from the cursor to the end of a line.

Format mode operation is provided by all models. Fixed formats can be created by received or keyed commands that establish protected and unprotected fields and initiate or terminate the format mode. On Models 2641A and 2645A, unprotected fields can be designated as alphabetic, numeric, or alphanumeric. The format mode disables line insert and delete functions and restricts character insert and delete functions to unprotected fields. When transmitting, only unprotected data in transmitted. Attribute codes can be assigned to a field to specify any one or 16 combinations of the following display attributes: half-intensity, underline, reverse video, and blinking (provided the terminal is equipped with the Display Enhancements option.)

All models are equipped with the Memory Lock feature. Memory lock, when enabled, prevents further entry into memory when memory is full. The operator is alerted to this condition by a flashing indicator and an audible alarm. Data entry/display can continue, but data is lost if data exceeds the screen capacity.

All models include the Caps Lock feature, which when enabled, places all alphabetic keys in upper-case mode. The Display Functions feature disables and displays all keyed or received control codes except ENQ, DEL, NULLS, and CR. The Test key initiates a diagnostic test of memory (RAM), ROM, and the display A standard test pattern indicates no failures; an appropriate message is displayed for each detected failure. The Automatic Line Feed feature initiates an automatic line feed for each received carriage return. The Break feature transmits a 200 millisecond space on the asynchronous data communications line and sets secondary channel transmit low for 200 ms. Eight Special Function keys each generate a specific Escape code sequence that can be defined by the user program at the host computer.

Other functions initiated by control codes, include block transfer initiation, block transfer enable from terminal or computer, record separater (terminates a block transfer), unit separator (separates fields in block mode), enable or disable the keyboard, define alternate character set (1 of 4), enable or disable alternate character set, modem disconnect, transmit terminal status (six bytes of terminal status transmitted as a block), Bell, etc.

The Data Path Group of function keys on Models 2641A and 2645A permit left or right tape drives or the display to be assigned as a source or destination and the printer to be assigned as a destination for data transfer. One source and multiple destinations can be selected. Other controls allow a file to be transferred between two local devices or a local device and the communications facility; to copy all data, a file, or a line from a selected source to a selected destination; and to log data transferred on tape or printer. Tape controls include rewind, write file mark, skip a line, and locate a file.

COMPONENTS

CRT DISPLAY UNIT: Provides a display area that measures 5 inches (127mm) high by 10 inches (254mm) wide. The display arrangement is 24 lines of 80 characters each for a maximum screen capacity of 1920 characters. Data is displayed in white; reverse video, a standard feature, displays data in black against a white background. Character generation forms each character by a 7-by-9 enhanced dot matrix within a 9-by-15 dot character cell (to allow for conditions such as line decenders). The display technique is a non-interlaced raster scan. The cursor is displayed as a blinking underscore.

The 2640B and 2645A are equipped with a standard displayable character set of 64 ASCII symbols that include upper case alphabetics, numerics, and specials. An optional 128-character set of displayable symbols includes upper and lower case alphabetics numerics, specials, and control codes. The Display Enhancements options, contained on a single plug-in card, accommodates three additional displayable character sets of 128 symbols each, for a total of four 128-character sets of symbols, including the optional 64 character line drawing set and 64 character mathematical symbol set as well as user-defined symbols. The Display Enhancements option also features blinking, half-intensity, and underline display functions.

Hewlett-Packard 2640 Series Intelligent Display Terminals

The standard 2641A is equipped with three character sets including a 128-character set of APL symbols, a 64-character set of APL overstrike characters, and a 64-character set of ASCII upper case symbols; the ASCII set is optionally expandable to include lower case symbols. The 2641A also features blinking, half-intensity, and underline display functions.

KEYBOARD: A four-row, 56-key typewriter-style key arrangement. The keyboard features an 11-key numeric pad (including decimal point) and a 12-key pad of cursor-and display-control keys. All operator controls are located on the detachable keyboard above the keys. Controls are provided for communications, terminal control functions, editing, and on Models 2641A and 2645A, tape control and 8 user-defined functions.

The standard keyboard on Models 2640B and 2645A can generate any of 128 ASCII characters. The standard 2641A keyboard can generate any of 128 APL or ASCII character codes via switch selection.

INTEGRATED DUAL CARTRIDGE TAPE: The Mini DataStation is optional for Models 2641A and 2645A only, and includes two individual and integral mini-cartridge tape drives for 3M Mini-Cartridges. A mini-cartridge is recorded at 800 bpi and stores 110,000 bytes. Tape read/write speed is 10 inches/second; search/rewind speed is 60 inches/second.

9866 PRINTER: A non-impact (thermal) printer with 80 print columns and rated at 240 lines/minute. Accommodates 8-3/4 inch wide paper for friction-feed platen. Model 9866A provides a 64-character upper case symbol set. Model 9866B provides a 96-character upper and lower case symbol set.

9871 PRINTER: An impact printer with 120 print columns and rated at 30 char./second. The 9871 employs the Diablo HyType I printer mechanism and provides a character set of 128 symbols. Friction feed is standard; tractor feed is optional.

PRICING

The Hewlett-Packard 2640 Series display terminals are available for purchase, rental, or lease. Quantity discounts are available for purchased terminals. Rental terms are available for periods of 6, 12, or 18 months and include maintenance. Full pay-out leases are available for periods of 2, 3, 4, or 5 years and do not include maintenance. A separate maintenance contract is available for purchased or leased equipment. There are no installation charges on equipment received and installed by the customer, and the investment tax credit is passed on to the customer for purchased or leased equipment. Training consists of a training tape and manuals for operators and programmers. Factory training is available.

Quantity discounts for purchased terminals are as follows:

5-9 units: 8 percent
10-19 units: 11 percent
20-49 units: 14 percent
50-99 units: 18 percent
100-199 units: 21 percent
200 units and over: contact vendor

		Monthly Cost*					
		1-Year Rental	2-Year Lease	3-Year Lease	5-Year Lease	Purchase	Monthly Maint.
Terminals							
2640B	Interactive Display Terminal	$124	$140	$103	$ 75	$2,600	$20
2641A	APL Display Station	195	209	152	107	4,100	20
2645A	Display Station	166	183	135	96	3,500	22
Options							
-001	128 Character Set (ASCII)	4.75	4.61	3.23	2.13	100	0
-007	Integrated Dual Cartridge Tape (Mini DataStation; Models 2641A & 2645A only)	76.00	81.82	59.63	42.00	1,600	8
-013	Pkg. of 5 Mini Cartridges	—	—	—	—	90	—
-015	50 Hz Operation	N/C	N/C	N/C	N/C	N/C	—
-020	Extended Asynchronous Communication (same as 13250A; requires RS-232C or current loop interface cable)	7.13	6.92	4.84	3.19	150	0
-030	Delete Standard Asynchronous Communications (Models 2641A and 2645A only)	-7.60	-7.38	-5.16	-3.40	-160	—
13231A	Display Enhancements (requires one slot)	11.88	11.54	8.07	5.31	250	0
-201	64-Char. Math Symbol Set	4.75	4.61	3.23	2.13	100	0
-202	64-Char. Line Drawing set	7.13	6.92	4.84	3.19	150	0
-203	Large Character Set	7.13	6.92	4.84	3.19	150	0
13234A	Terminal Memory Module (4K bytes, requires one slot)	14.25	13.84	9.68	6.38	300	0
13236B	Integrated Dual Cartridge Tape Upgrade kit (field upgrade for adding Mini DataStation to 2641A or 2645A; requires 13261A)	73.63	79.52	58.02	40.94	1,550	8
13238A	Terminal Duplex Register (for HP 9866A or 9871A printer; no interface cable included; requires one slot and 13261A on tapeless 2641A's and 2645A's)	4.75	4.61	3.23	2.13	100	0
13240A	2640 Option Slot Extender (adds 5 option slots)	7.13	6.92	4.84	3.19	150	0

Hewlett-Packard 2640 Series Intelligent Display Terminals

		Monthly Cost*					
		1-Year Rental	2-Year Lease	3-Year Lease	5-Year Lease	Purchase	Monthly Maint.
13245A	PROM character Set Accessory (for user-defined custom character sets; requires one slot)	9.50	9.23	6.45	4.25	200	0
13246A	HP 9866A Printer Subsystem (includes interface & cable; all models)	165.06	180.34	132.14	93.84	3,475	20
13246B	HP 9866B Printer Subsystem (includes interface & cable; all models)	174.56	189.56	138.59	98.09	3,675	20
13250A	Serial Printer Interface (no interface cable included, requires 13261A on tapeless 2641A's and 2645A's)	9.50	9.23	6.45	4.25	200	0
13349A	HP 9871 Printer Subsystem (includes interface & cable; all models)	176.94	201.87	150.21	109.15	3,725	30
13260A	Standard Asynchronous Communications (includes RS-232C interface; Models 2641A & 2645A only)	7.60	7.38	5.16	3.40	160	0
13260B	Extended Asynchronous Communications (Models 2641A & 2645A; same as Option- 020 for 2640B)	15.44	15.00	10.49	6.91	325	0
13260C	Asynchronous Multipoint Communications (Models 2641A & 2645A only; requires option -030)	20.66	20.07	14.04	9.24	435	0
13260D	Synchronous Multipoint Communications (Models 2641A & 2645A only; requires option -030)	21.38	20.76	14.52	9.56	450	0
-001	Add Monitor Mode Capability (Models 2641A & 2645A only)	2.38	2.31	1.61	1.06	50	0
13261A	Device Support Firmware (required by tapeless 2641A's and 2645A's to support printers, tape upgrade, or other I/O devices)	8.08	7.84	5.49	3.61	170	0
Cables							
13232A	103/202 Modem Cable (2640B only; adds RS-232C male connector; 15 feet)	2.38	2.31	1.61	1.06	50	0
13232C	RS-232C Cable (adds RS-232C female connector; 5 feet)	2.38	2.31	1.61	1.06	50	0
13232F	Current Loop Connector Kit (5 feet)	2.85	2.77	1.94	1.28	60	0
13232G	Male RS-232C Printer Cable (15 feet)	3.09	3.00	2.10	1.38	65	0
13232H	Female RS-232C Printer Cable (15 feet)	3.09	3.00	2.10	1.38	65	0
13232N	Modem Cable (Models 2641A & 2645A; RS-232C, male, 15 feet)	3.56	3.46	2.42	1.59	75	0
13232P	Modem/Multipoint Cable (Models 2641A & 2645A; RS-232C, male multipoint connector, 30 feet)	5.46	5.31	3.71	2.44	115	0
13232Q	Multipoint Cable (Models 2641A & 2645A; male/female multipoint connector, 30 feet)	4.28	4.15	2.90	1.91	90	0
13232R	Multipoint Extension Cable (Models 2641A & 2645A; male/female multipoint connector, 100 feet)	3.56	3.46	2.42	1.59	75	0
13232S	HP 9866 Printer Cable (Model 2640B only)	2.38	2.31	1.61	1.06	50	0
13232T	Power Protect Multipoint Cable (Models 2641A & 2645A only; male/female multipoint connector with relays, 30 feet)	8.79	8.54	5.97	3.93	185	0
13232U	Modem Bypass Cable (Models 2641A & 2645A only; female/female RS-232C, 5 feet)	2.38	2.31	1.61	1.06	50	0
	Mini Cartridges, each:						
	5 to 54	–	–	–	–	18	–
	55 and over	–	–	–	–	15	–

*Includes prime-shift maintenance. Monthly costs are computed as follows: 1-Year Rental: 4.75% of purchase price; 2-Year Lease: 4.614% plus maintenance; 3-Year Lease: 3.227% plus maintenance; 5-Year Lease: 2.125% plus maintenance. Lease rates may vary slightly. ■

Hewlett-Packard 2620 Series Display Terminals

MANAGEMENT SUMMARY

The 2620 Series is Hewlett-Packard's largest family of display terminals. The series currently consists of six models, offering a wide variety of features and capabilities. Current 2620 family members include: the 2621B, 2622A, 2623A, 2624B, 2626A, and 2626W. All of these models contain the same physical display features, including a 12-inch (diagonally measured) display, a 1920-character screen capacity arranged in 24 lines of 80 characters each, and a detached, typewriter-style keyboard. An integral thermal printer is optionally available with all models.

The low-end model in the 2620 Series is the 2621B, which has replaced the company's earlier 2621A/P models. The 2621B is designed for conversational interaction with the host computer. Terminal functions are implemented through the use of eight user-definable "soft" (function) keys, with eight-character labels displayed on the screen's two additional display lines. Both local and remote functions can be defined and redefined. Editing features, designed to be used in character-mode applications, include character insert/delete and line insert/delete. The 2621B features two pages (48 lines) of display memory. User-selectable display attributes include underline and reverse video.

The 2622A can operate in block mode as well as character mode. Like the 2621B, the 2622A features eight user-definable soft keys, and provides 16-character labels for display on the terminals two additional display lines. Also like the 2621B, the 2622A provides editing features and two pages of display memory. An enhancement on the

A family of keyboard/display terminals offering a wide variety of features and capabilities.

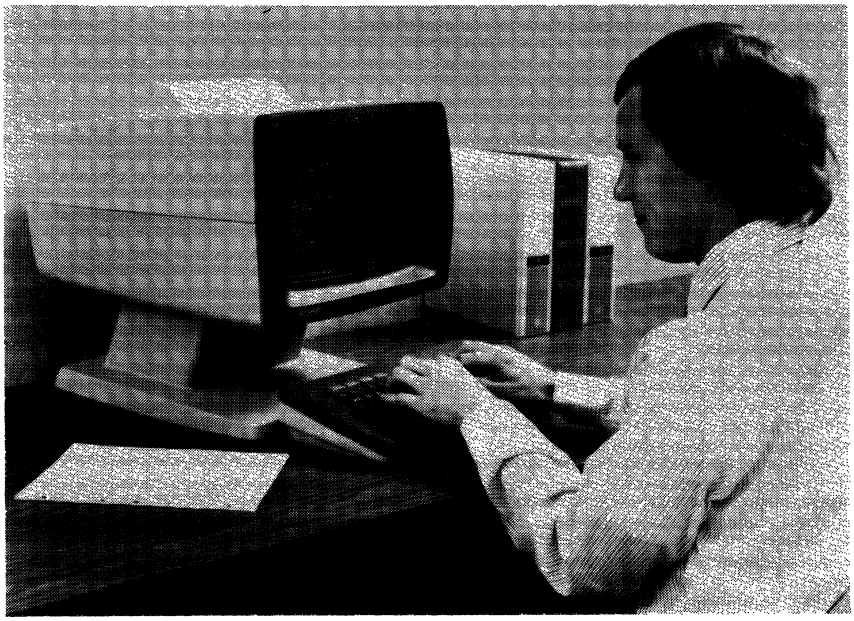
All models contain a 12-inch (diagonal) display screen with a 1920-character capacity arranged in 24 lines of 80 characters each. Also standard is a detached, typewriter-style keyboard. From two to nine pages of display memory are featured, depending on the model selected. Other features available depending on the model selected include: character or block mode transmission; data entry forms capability; multiple display windows; and graphics capability.

A significant feature of the 2620 Series is the integral thermal printer, which can be optionally added to all family members.

Purchase prices for the 2620 Series terminals range from $1,595 to $4,350. The integral thermal printer option is priced at $1,210. Lease plans are also available.

CHARACTERISTICS

VENDOR: Hewlett-Packard, Data Terminals Division, 974 East Arques Avenue, Sunnyvale, CA 94086. Telephone (408) 735-1550.



Hewlett-Packard's 2620 Series of display terminals provide the user with a wide variety of functions and capabilities. The 2621B, shown here, is the low-end model of the series. The 2621B is a character-mode smart terminal featuring two full pages of display memory. The integral thermal printer, contained in the 2621B's display case, is optionally available on all models in the 2620 Series.

Hewlett-Packard
2620 Series Display Terminals

2622A is the provision for protected and unprotected fields. Display attributes selectable by the user include underline, reverse video, blinking, and reduced intensity.

The 2623A is the graphics version of the 2622A. The unit contains all the alphanumeric features of the 2622A, in addition to extensive graphics capabilities. Graphics features include: 512-by-390 displayable/addressable points; rectangular area fills; selective erase; a variety of graphics software support; and independent alpha and graphics memories.

The Model 2624B is a terminal designed for data entry applications. The standard unit is equipped with up to four pages of display memory, a line drawing set, and display enhancements including reverse video, blinking, underline, half bright, and non-display (displayable in all combinations). Protected, unprotected, and transmit only fields are provided. Advanced edit checks are also included to allow the user to detect data entry errors at the terminal; the checks include all characters, alphabetic, alphanumeric, numeric, integer, signed decimal, and implied decimal. Eight user-definable soft keys are included. Like the previous models, the functions that these keys are programmed to perform are displayed on the 25th and 26th status lines on the terminal's screen. The eight soft keys can be redefined and re-labeled by the user as different forms are used. The 25th and 26th status lines are also used to display error messages. Editing on the 2624B can be performed in character and block mode, with character and line insert and delete. Full cursor sensing and positioning, tabulation, margin control, and memory lock are included.

The high-performance 2626A offers two significant features: multiple workspaces and multiple windows. Display memory can be divided into as many as four independent workspaces and the display screen into as many as four separate windows. Independent terminal configurations can be attached to each separate workspace, thus giving the user the flexibility of four independent terminals. In addition, dual communications ports are featured, allowing simultaneous communications with two computers, two different sessions on the same computer, or with a computer and a printer. Each workspace in display memory can be independently viewed, controlled, and configured. Line lengths of up to 160 characters can be set in each workspace, and viewed via horizontal scrolling. The display screen can be divided up into as many as four windows; four horizontal segments and two vertical segments are allowed. To view the entire contents of a workspace, data may be scrolled horizontally or vertically, or the size of the window can be changed from the keyboard.

The 2626A possesses the eight user-defined soft keys found on the other 2620 Series terminals, along with 16-character screen labels. A unique feature found on the 2626A is the programmable audio feedback feature. A programmable tone, with 15 pitches in 16 durations and two volume

DATE OF ANNOUNCEMENT: 2621B—December 1981; 2622A—April 1981; 2623A—August 1981; 2624B—September 1981; 2626A—July 1980.

DATE OF FIRST DELIVERY: 2621B—December 1981; 2622A—April 1981; 2623A—August 1981; 2624B—September 1981; 2626A—July 1980.

NUMBER DELIVERED TO DATE: Information not available.

SERVICED BY: Hewlett-Packard, worldwide.

MODELS

Six models currently comprise the 2620 Series:

- **2621B—a character mode smart editing terminal. Two pages of display memory are standard.**
- **2622A—an enhanced version of the 2621B, with block mode capability, protected fields, and additional display enhancements.**
- **2623A—the graphics terminal member of the 2620 Series. When not in graphics mode, the 2623A has features identical to those of the 2622A.**
- **2624B—a data entry terminal. Four pages of display memory are standard, optionally expandable to nine.**
- **2626A—provides up to four separate display windows and up to four independent memory workspaces.**
- **2626W—a word processing terminal for use with Hewlett-Packard's HPWORD software and HP 3000 computer system. When not operating under HPWORD, the 2626W provides features identical to those of the 2626A.**

All modes can be optionally configured with an integral thermal printer for hard copy output.

TRANSMISSION SPECIFICATIONS

All 2620 Series terminals operate asynchronously, in half- or full-duplex mode, at transmission speeds from 110 to 9600 bits per second. Models 2624B, 2626A, and 2626W can also operate synchronously. Transmission speeds, as well as parity selection, are operator-selectable. RS-232-C/CCITT V.24 interfaces are provided. A 10- or 11-bit 8-level ASCII transmission code is used.

DEVICE CONTROL

The 2621B performs transmission in Character Mode or Line Mode. Transmission mode selection is stored with other communications parameters and can be displayed and changed from the keyboard using Configure commands. In Character Mode, data is normally transmitted character-by-character. In Line Mode, each line of keyed data is stored in a buffer, where it can be edited; a carriage return initiates transmission of the line. When Character Mode is selected but the operator temporarily needs to transmit line-by-line, a Modify Mode function is provided. This permits the operator to switch temporarily to Line Mode, select any line of display memory, edit that line if necessary, and transmit it. After transmission of the line character-by-character operation is restored.

All other models perform transmission in Character Mode, Line Mode, Line Modify Mode, and Block Mode. In Block Mode, data is stored in the buffer, where it can be edited; it is transmitted to the computer when the Enter key is pressed. The block can be either a line or a page.

Hewlett-Packard
2620 Series Display Terminals

levels, alerts the operator to conditions or status within an application program. Escape sequences for the 2626A are software-compatible with escape sequences of the HP 2645A (covered in report #C25-472-101).

The 2626W is a smart terminal designed for use with Hewlett-Packard's HPWORD word processing software, in conjunction with the HP 3000 computer system. When HPWORD is not active, the 2626W has the same features as the 2626A.

The integral thermal printer, optionally available on all 2620 Series models, provides a maximum print speed of 120 cps. Anything that can be displayed on the screen can be printed, including control characters, enhanced characters, national characters, and graphics (2623A). Also optional on all models are a variety of national character sets, including Danish/Norwegian, Finnish/Swedish, French, German, Spanish, or United Kingdom.

All models except the 2621B are HP VPLUS/3000 software-compatible. In addition, the 2623A provides the following graphics software support: HP DSG/3000, HP Graphics 1000/II, ISSCO DISSPLA and TELL-A-GRAF, and Tektronix Plot 10.

A variety of maintenance plans are offered by Hewlett-Packard to support the 2620 Series. The user manuals supplied by HP to document terminal procedures are exceptionally well-written and provide excellent support for the operator.

USER REACTION

In Datapro's 1982 survey of alphanumeric display terminal users, responses were received from a total of 16 Hewlett-Packard 2620 Series terminal users. These users represented an installed base of 137 units. Broken down by model, there were nine users reporting on their experiences with the 2621 (old and new versions), for a total of 78 units; five users reporting on the 2624, for a total of 52 units; and one user each of the 2622 (four terminals) and 2626 (three terminals). The ratings given to the HP terminals by these users are summarized in the following chart.

	Excellent	Good	Fair	Poor	WA*
Overall performance	13	2	0	0	3.9
Ease of operation	12	3	1	0	3.7
Display clarity	11	5	0	0	3.7
Keyboard feel & usability	12	4	0	0	3.8
Hardware reliability	14	2	0	0	3.9
Maintenance service	8	6	0	0	3.6
Technical support	9	5	2	0	3.4

*Weighted Average based on a scale of 4.0 for Excellent.

All but one user listed data entry/interactive inquiry and program development as the principal applications for the 2620 Series terminals. Other applications most frequently mentioned included: text editing/word processing (nine users); as a system console (nine users); intracompany message traffic (seven users); and business graphics (two

Cursor position controls include Up, Down, Left, Right, Home Up, and Home Down. Cursor movement is also provided by the carriage return, and forward and backward horizontal tabs. Automatic line feed with a carriage return can be enabled/disabled using the Configure command. The cursor is both readable and addressable.

Two pages (48 lines) of display memory are provided for the 2621B, 2622A, and 2623A. Stored data can be viewed using the Roll or Home-Up/Home-Down functions. The Roll function rolls the contents of the screen up or down by one line to display the next line of memory. The Home-Up/Home-Down functions, which move the cursor to the beginning or end of memory, permit the user to flip from one page of memory to the other.

The 2624B contains 16K of RAM providing up to two pages of memory; for applications that do not use alternate character sets, display enhancements, and extensive edit checks, up to four pages of memory are available.

The 2626A and 2626W provide up to four individual workspaces, and display memory can be divided between these. Each workspace can be independently configured, controlled, and viewed, and data may be transferred from one workspace to another. The number of lines in a workspace can vary, but the total number of lines in all workspaces must not exceed the total memory available. The total amount of memory available is 9520 characters (80 characters by 119 lines), independent of control codes for display enhancements, field definitions, and edits. The line length for all workspaces may be set from 80 to 160 characters. The display screen may be divided into four windows to view the contents of the workspaces. The screen may be divided into up to four horizontal segments and two vertical segments. Data may be scrolled horizontally or vertically to view the contents of a workspace.

Eight special control/function keys located above the main key group provide three independent levels of use for the 2621B:

- **When unshifted, the keys perform roll functions and cursor movements in accordance with the key top symbols.**
- **A set of eight preprogrammed control functions can be accessed via a special Labels key: Configure, Test, Clear Line, Clear Display, Print (with optional printer only), Display Functions, Tab/Margin and Edit. (The Labels key is an unmarked key located just to the right of the main keygroup.) Whenever these functions are available for use, a corresponding set of 8 labels appear in reverse video on the 25th line of the display screen to identify the functions for the operator.**

  Print functions (for the 2621B with printer only) include paper advance, printer self-test, and copy. When operating on-line, a Data Logging function automatically records data as the memory is scrolled up and is initiated by a line feed command. The user can select either Top Log mode, which copies the first line of the 48-line memory when the 49th line is about to be entered, or Bottom Log mode, which prints the line of data just keyed/received. In off-line mode, the printer can be made to print from the current cursor position to the end of a selected line, to the end of the screen, or to the end of display memory. A Report Mode function sets up a fixed printing format of 3 blank lines then 60 data lines, then 3 blank lines; it also marks a guide on the paper so that it can be cut into 8.5-by-11 inch sheets.

- **When the Labels key is used with the shift key, eight two-character program function sequences can be accessed. These program function sequences are stored in the**

Hewlett-Packard
2620 Series Display Terminals

users). Eleven users cited the terminal's display memory as a factor in the purchase of the HP equipment. The detachable keyboard and editing features were also listed as key factors in the purchase decision.

As has been the case in previous Datapro display terminal user surveys, the Hewlett-Packard terminals received some of the highest ratings given to any terminal manufacturer. When asked whether they would recommend the HP terminals to other users with similar applications, 15 of the 16 users stated that they would—some of them quite emphatically.□

terminal's memory; when transmitted, they initiate user-defined program functions or identify transmitted data at the host end. Whenever these functions are available for use, they are identified in eight labels on the 25th line of the screen.

Eight user-definable soft keys are also included on all other 2620 Series models. These keys' functions are labeled on the screen using the 25th and 26th status lines. The labels display eight characters each, and the keys can be redefined and relabeled as different forms are used. Three groups of function key labels are available: mode function key labels, predefined function key labels, and user-definable function key labels.

- The mode function key labels are accessed by using the Modes key. The set includes the following labels: Line Modify, Modify All, Block Mode, Remote Mode, Terminal Test, Memory Lock, Display Functions, and Auto LF.

- The predefined function key labels are accessed by using the Aids key. Seventeen sets of predefined function key labels are available. Some of the terminal capabilities accessed include: set or clear margins and tabs, enable the keyboard bell and audible key click, select the language characters from the keyboard, vary the size of the windows on the 2626A, send data to the integral printer, and select display enhancements.

- To implement the user-definable function key labels, the Return key, the Enter key, and each function key can be programmed with a character string of up to 80 characters. Each of the eight function keys can be assigned a label of up to 16 characters. The label serves as a reminder of the content of the character string when the string is not displayed. The Return and Enter keys cannot be assigned labels.

Character and block mode editing (character and line, insert and delete) are possible. Several levels of self-test capability are provided, including a "power on test" which provides a complete test of the terminal including memory, a terminal test which does not disturb data, and a printer test. The 2626A provides programmable audio feedback to alert the operator to error conditions or status within an application program. The programmable tone has 15 pitches with 16 durations and two volume levels.

All models except the 2621B support HP VPLUS/3000 software. The 2626W supports HPWORD, Hewlett-Packard's word processing software. The 2623A provides support for the following graphics software: HP DSG/3000; HP Graphics 1000/II; ISSCO DISSPLA and TELL-A-GRAF; and Tektronix Plot 10.

COMPONENTS

DISPLAY UNIT: A 12-inch diagonal CRT with a display capacity of 1920 characters in 24 lines of 80 characters each. Characters are formed by a 7-by-9 dot matrix in a 9-by-15 dot character cell. A 128-character ASCII set, including upper and lower case alphabetics, numerics, and specials, is displayed in white (P4 phosphor) on a dark background; green (P31 phosphor) characters are optional. A character-by-character underline is provided. The cursor is displayed as a blinking underline. A cursor column indicator and eight control/function key labels are displayed on the status line at the bottom of the screen.

A variety of national character sets are optionally available on all models. These include: Danish/Norwegian, Finnish/Swedish, French, German, Spanish, and United Kingdom. A forms line drawing character set is optional on the 2622A and 2623A and standard on the 2624B, 2626A, and 2626W. A math/large character set is optional on the 2624B, 2626A, and 2626W.

The 2623A graphics terminal contains 512-by-390 displayable/addressable points on the display screen. Normal or slant graphics text can be accommodated.

KEYBOARDS: 2621B—A 68-key detachable, typewriter-style keyboard. The keyboard can be located up to four feet from the display unit. A numeric pad is embedded within the main keygroup. A row of eight control/function keys is located above the main keygroup. The Label key (with an unmarked keytop) is located to the right of the main keygroup. The keyboard can generate 128 ASCII characters.

All other models—A 100-key detachable, typewriter-style keyboard. Included are eight screen labeled function keys, cursor controls, a 14-key numeric pad, auto repeat, and an n-key rollover feature.

PRINTER: A non-impact (thermal) serial matrix printer housed in the display unit cabinet. Printing speed is 120 cps. Actual throughput is rated at 60 cps. A bidirectional "smart" printhead minimizes printhead movement by taking the shortest route (right or left) from the end of the current line of print to the beginning of the next, thus eliminating as many full carriage returns as possible. The printer features an 80-column print line; a 128-character ASCII character set, including upper and lower case alphabetics; and a 9-by-7 dot matrix in a 9-by-15 dot character cell, which permits underlining. A roll of nonperforated paper 8½ inches wide and 100 feet long is loaded through a door in the top of the cabinet.

PRICING

The Hewlett-Packard 2620 Series terminals are available for purchase or on a 12-month, 18-month, or 24-month lease. A buy-out option, available at the end of the lease commitment, permits the lessee to purchase the equipment for 30%, 42% or 52% of the list price in effect at the commencement of a 12-month, 18-month, or 24-month lease respectively. A variety of maintenance agreements are available. Quantity purchase discounts are also available. Contact a local HP Sales office for lease prices.

	Purchase	Monthly Maint.
Model 2621B	$1,595	$17
Model 2622A	2,175	24
Model 2623A	3,750	38
Model 2624B	3,000	26
Model 2626A	4,350	33
Model 2626W	4,950	35
Integral thermal printer	1,210	11
National character sets	105	—

Hewlett-Packard
2620 Series Display Terminals

The HP 2621P has an integral thermal printer for hard copy output. Print speed is 120 characters per second.

A series of keyboard/display terminals that offer a variety of features and capabilities.

A significant feature of the 2620 Series is the option to configure the terminal with an integral thermal printer for hard copy output.

All models feature a screen capacity of 1920 characters in a 24-line by 80-character format. Keyboards are detached. Transmission rates are switch-selectable up to 9600 bps. Features and capabilities increase as the user moves from the basic Model 2621 terminals to the intermediate Model 2624 terminals; advanced features such as multiple workspaces and multiple windows can be found on the high-end Model 2626 terminals.

Purchase prices range from $1,495 for the basic 2621A terminal to $5,100 for the 2626A with the integral thermal printer option. Leases for 6, 12, and 18 months are also available.

MANAGEMENT SUMMARY

The Hewlett-Packard 2620 Series of display terminals consists of three basic models: the 2621A/P, 2624A, and 2626A. Enhanced features and increased capabilities can be obtained in the higher numbered units. All of the models in the family feature a display capacity of 1920 characters in a 24-line by 80-character format, a detached keyboard, and switch-selectable transmission rates up to 9600 bps. A feature of the Hewlett-Packard 2620 Series is the option of configuring the terminals with an integral thermal printer for hard copy output.

The Hewlett-Packard Model 2621 terminals, introduced in October 1978, are designed for conversational interaction with the host computer. The key to their design is the implementation of relatively high-level terminal functions via multi-level function keys. Control/function keys can be conditioned to support any or all of three independent levels of operation: simple cursor movement, more sophisticated control functions, and program function sequences. Many of the terminal's features are totally transparent to the operator, who can perform relatively complicated tasks without even thinking about them. Configuration of the user-definable terminal features is designed to be performed by the user, without need for assistance from Hewlett-Packard, using simple keyed commands. All function parameters are stored in non-volatile RAM and are keyboard-selectable.

CHARACTERISTICS

VENDOR: Hewlett-Packard, Data Terminals Division, 19400 Homestead Road, Cupertino, CA 95014. Telephone (408) 257-7000.

DATE OF ANNOUNCEMENT: 2621A/P—October 1978; 2624A—October 1980; 2626A—July 1980.

DATE OF FIRST DELIVERY: 2621A/P—October 1978; 2624A—October 1980; 2626A—July 1980.

NUMBER DELIVERED TO DATE: Over 1000.

SERVICED BY: Hewlett-Packard, worldwide.

MODELS

Three basic models are available: the 2621A/P, 2624A, and 2626A. All are stand-alone display terminals with typewriter-style detachable keyboards. Model 2621P includes a 120 cps thermal printer integrated into the display cabinet; this option is also available with the 2624A and 2626A. User-selected operating parameters are stored in non-volatile (battery powered) RAM. The Model 2621A/P is equipped with two pages of display memory; the Model 2624A is equipped with up to four pages (optionally expandable to nine); Model 2626A features 80 characters by 119 lines of memory. All of the terminals are microprocessor-controlled.

TRANSMISSION SPECIFICATIONS

The 2621 terminals communicate asynchronously in full-duplex mode using ASCII code. Transmission speeds of 110, 150, 200, 300, 600, 1200, 1800, 2400, 3600, 4800, and 9600 bps are operator-selectable. In addition, transmission rates can be externally provided by a host computer clocking signal. A 10- or 11-unit 8-level ASCII transmission code is used. At 110

Hewlett-Packard
2620 Series Display Terminals

Also designed into the terminal are features that help reduce the amount of revision in host software normally required to support conversational terminal interaction. For instance, unlike most "dumb" terminals, the HP 2621 can distinguish between data transmitted by the host and data keyed by the operator. This permits the terminal to transmit a keyed response to the host without sending back the host's prompt or inquiry, thus eliminating the need for host software to sort out the inquiry from the response.

The integral printer in the 2621P also offers several noteworthy features. The automatic Data Logger operates in either Log Top mode, which prints data as it is about to overflow from a full memory, or Log Bottom mode, which prints data as it enters the memory. A Report mode function formats printed copy in 66-line pages that can be cut into 8½-by-11 inch sheets. The printhead employs a "thin-film" technique, designed by Hewlett-Packard, which utilizes a thin glass thermal barrier to control resistor heating and cooling and thus provide cleaner, clearer printing at 120 cps.

HP's newer models, the 2624A and 2626A, offer all of the features found on the 2621 A/P, plus significant enhancements.

The Model 2624A is a terminal designed for data entry applications. The standard unit is equipped with up to four pages of display memory, a line drawing set, and display enhancements including reverse video, blinking, underline, half bright, and non-display (displayable in all combinations). Protected, unprotected, and transmit only fields are provided. Advanced edit checks are also included to allow the user to detect data entry errors at the terminal; the checks include all characters, alphabetic, alphanumeric, numeric, integer, signed decimal, and implied decimal.

Eight user-definable function (or "soft") keys are included. The functions that these keys are programmed to perform are displayed on the 25th and 26th status lines on the terminal's screen. The eight soft keys can be redefined and re-labeled by the user as different forms are used. The 25th and 26th status lines are also used to display error messages.

Editing on the 2624A can be performed in character and block mode, with character and line insert and delete. Full cursor sensing and positioning, tabulation, margin control, and memory lock are included. The 2624A is similar in appearance to the 2621A/P, and also can be configured with the integral thermal printer. Other optional features available with the 2624A include math and large character sets, as well as support for six national character sets: Danish/Norwegian, Finnish/Swedish, French, German, Spanish, and United Kingdom.

The high-performance HP 2626A offers two significant features: multiple workspaces and multiple windows. Display memory can be divided into as many as four independent workspaces and the display screen into as

bps, the unit code structure is 11 bits, including one start bit and two stop bits; at all other data rates, the unit code structure is 10 bits including one start bit and one stop bit. Generation of even or odd parity or a space or mark condition on transmitted data, and parity checking on received data, are also operator-selectable. RS-232-C/CCITT V.24 communications support is provided. Transmission is asynchronous for the 2624A, and asynchronous or synchronous for the 2626A, in half- or full-duplex, at operator-selectable speeds of 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 4800, and 9600 bps. Odd, even, zero, one, or no parity can be selected. RS-232-C/CCITT V.24 interfaces are provided. A 20mA current loop interface is optional.

DEVICE CONTROL

The Model 2621 performs transmission in Character Mode or Line Mode. Transmission mode selection is stored with other communications parameters and can be displayed and changed from the keyboard using Configure commands. In Character Mode, data is normally transmitted character-by-character. In Line Mode, each line of keyed data is stored in a buffer, where it can be edited; a carriage return initiates transmission of the line. When Character Mode is selected but the operator temporarily needs to transmit line-by-line, a Modify Mode function is provided. This permits the operator to switch temporarily to Line Mode, select any line of display memory, edit that line if necessary, and transmit it. After transmission of the line character-by-character operation is restored.

Models 2624A and 2626A perform transmission in Character Mode, Line Mode, Line Modify Mode, and Block Mode. In Block Mode, data is stored in the buffer, where it can be edited; it is transmitted to the computer when the Enter key is pressed. The block can be either a line or a page.

Cursor position controls include Up, Down, Left, Right, Home Up, and Home Down. Cursor movement is also provided by the carriage return, and forward and backward horizontal tabs. Automatic line feed with a carriage return can be enabled/disabled using the Configure command. The cursor is both readable and addressable.

Two pages (48 lines) of display memory are provided for the 2621. Stored data can be viewed using the Roll or Home-Up/Home-Down functions. The Roll function rolls the contents of the screen up or down by one line to display the next line of memory. The Home-Up/Home-Down functions, which move the cursor to the beginning or end of memory, permit the user to flip from one page of memory to the other.

The 2624A contains 16K of RAM providing up to two pages of memory; for applications that do not use alternate character sets, display enhancements, and extensive edit checks, up to four pages of memory are available.

The 2626A provides up to four individual workspaces, and display memory can be divided between these. Each workspace can be independently configured, controlled, and viewed, and data may be transferred from one workspace to another. The number of lines in a workspace can vary, but the total number of lines in all workspaces must not exceed the total memory available. The total amount of memory available is 9520 characters (80 characters by 119 lines), independent of control codes for display enhancements, field definitions, and edits. The line length for all workspaces may be set from 80 to 160 characters. The display screen may be divided into four windows to view the contents of the workspaces. The screen may be divided into up to four horizontal segments and two vertical segments. Data may be scrolled horizontally or vertically to view the contents of a workspace.

Hewlett-Packard
2620 Series Display Terminals

many as four separate windows. Independent terminal configurations can be attached to each separate workspace, thus giving the user the flexibility of four independent terminals. In addition, dual communications ports are featured, allowing simultaneous communications with two computers, two different sessions on the same computer, or with a computer and a printer. Each workspace in display memory can be independently viewed, controlled, and configured. Line lengths of up to 160 characters can be set in each workspace, and viewed via horizontal scrolling. The display screen can be divided up into as many as four windows; four horizontal segments and two vertical segments are allowed. To view the entire contents of a workspace, data may be scrolled horizontally or vertically, or the size of the window can be changed from the keyboard.

The 2626A possesses the eight user-defined soft keys found on the 2624A. The integral thermal printer option is available, as are the national, math, and large character set options. A unique feature found on the 2626A is the programmable audio feedback feature. A programmable tone, with 15 pitches in 16 durations and two volume levels, alerts the operator to conditions or status within an application program. Escape sequences for the 2626A are software-compatible with escape sequences of the HP 2645A (covered in report #C25-472-101).

A variety of maintenance plans are offered by Hewlett-Packard to support their display terminals. The user's manuals supplied by HP to document terminal procedures are exceptionally well-written and provide excellent support for the operator.

USER REACTION

In the 1980 survey of alphanumeric display terminal users, Datapro received responses from five users of the Hewlett-Packard 2621A/P Interactive terminals. No responses were received on the 2624A and 2626A terminals, which were not introduced until late in 1980. Altogether, the users who responded reported on their experiences with a total of 33 terminals. Their ratings are as follows:

	Excellent	Good	Fair	Poor	WA*
Overall performance	4	1	0	0	3.8
Ease of operation	2	3	0	0	3.4
Display clarity	3	2	0	0	3.6
Keyboard feel & usability	3	2	0	0	3.6
Hardware reliability	2	2	1	0	3.2
Maintenance service	2	3	0	0	3.4
Technical support	1	2	1	0	3.0

*Weighted Average based on a scale of 4.0 for Excellent.

All of the users reported that the principal applications of the HP 2621 terminals were interactive data entry, text editing, and program development.□

Eight special control/function keys located above the main key group provide three independent levels of use for the 2621:

- **When unshifted, the keys perform roll functions and cursor movements in accordance with the key top symbols.**
- **A set of eight preprogrammed control functions can be accessed via a special Labels key: Configure, Test, Clear Line, Clear Display, Print (HP 2621P only), Display Functions, Tab/Margin and Edit. (The Labels key is an unmarked key located just to the right of the main keygroup.) Whenever these functions are available for use, a corresponding set of 8 labels appear in reverse video on the 25th line of the display screen to identify the functions for the operator.**

  The Configure function provides access to user-selectable communications and device control parameters set in non-volatile RAM. The Test function permits the operator to initiate terminal self-diagnostic routines. A go/no-go confidence test indicator beeps upon verification of systems components; if problems are detected, defective modules and components are isolated and diagnostic messages displayed on the screen. Display Functions enables the display of the normally non-displayed 33 control code symbols included in the character set. Tab/Margin permits the operator to set or clear horizontal tabs and right and left margins. Edit functions include character and line insertion and deletion.

  Print functions (for the HP 2621P only) include paper advance, printer self-test, and copy. When operating on-line, a Data Logging function automatically records data as the memory is scrolled up and is initiated by a line feed command. The user can select either Top Log mode, which copies the first line of the 48-line memory when the 49th line is about to be entered, or Bottom Log mode, which prints the line of data just keyed/received. In off-line mode, the printer can be made to print from the current cursor position to the end of a selected line, to the end of the screen, or to the end of display memory. A Report Mode function sets up a fixed printing format of 3 blank lines then 60 data lines, then 3 blank lines; it also marks a guide on the paper so that it can be cut into 8.5-by-11 inch sheets.
- **When the Labels key is used with the shift key, eight two-character program function sequences can be accessed. These program function sequences are stored in the terminal's memory; when transmitted, they initiate user-defined program functions or identify transmitted data at the host end. Whenever these functions are available for use, they are identified in eight labels on the 25th line of the screen.**

Eight user-definable soft keys are also included on the 2624A and 2626A. These keys' functions are labeled on the screen using the 25th and 26th status lines. The labels display eight characters each, and the keys can be redefined and re-labeled as different forms are used. Three groups of function key labels are available: mode function key labels, predefined function key labels, and user-definable function key labels.

- **The mode function key labels are accessed by using the Modes key. The set includes the following labels: Line Modify, Modify All, Block Mode, Remote Mode, Terminal Test, Memory Lock, Display Functions, and Auto LF.**
- **The predefined function key labels are accessed by using the Aids key. Seventeen sets of predefined function key labels are available. Some of the terminal capabilities accessed include: set or clear margins and tabs, enable the keyboard bell and audible key click, select the language characters from the keyboard, vary the size of the windows on the 2626A, send data to the integral printer, and select display enhancements.**

Hewlett-Packard
2620 Series Display Terminals

- To implement the user-definable function key labels, the Return key, the Enter key, and each function key can be programmed with a character string of up to 80 characters. Each of the eight function keys can be assigned a label of up to 16 characters. The label serves as a reminder of the content of the character string when the string is not displayed. The Return and Enter keys cannot be assigned labels.

Character and block mode editing (character and line, insert and delete) are possible. Both the 2624A and 2626A provide several levels of self-test capability including a "power on test" which provides a complete test of the terminal including memory, a terminal test which does not disturb data, and a printer test. The 2626A provides programmable audio feedback to alert the operator to error conditions or status within an application program. The programmable tone has 15 pitches with 16 durations and two volume levels.

COMPONENTS

DISPLAY UNIT: A 12-inch diagonal CRT with a display capacity of 1920 charcters in 24 lines of 80 characters each. Characters are formed by a 7-by-9 dot matrix in a 9-by-15 dot character cell. A 128-charcter ASCII set, including upper and lower case alphabetics, numerics, and specials, is displayed in white (P4 phosphorous) on a dark background. A character-by-character underline is provided. The cursor is displayed as a blinking underline. A cursor column indicator and eight control/function key labels are displayed on the status line at the bottom of the screen.

KEYBOARDS: 2621A/P—A 68-key detachable, typewriter-style keyboard. The keyboard can be located up to four feet from the display unit. A numeric pad is embedded within the main keygroup. A row of eight control/function keys is located above the main keygroup. The Label key (with an unmarked keytop) is located to the right of the main keygroup. The keyboard can generate 128 ASCII characters.

2624A and 2626A—A 100-key detachable, typewriter-style keyboard. Included are eight screen labeled function keys, cursor controls, a 14-key numeric pad, auto repeat, and an n-key rollover feature. The following national character sets are optional: Finnish/Swedish, Danish/Norwegian, French, German, Spanish, and United Kingdom.

PRINTER: A non-impact (thermal) serial matrix printer housed in the display unit cabinet of Model 2621P, or the 2624A or 2626A with the printer option. Printing speed is 120 cps. Actual throughput is rated at 60 cps. A bidirectional "smart" printhead minimizes printhead movement by taking the shortest route (right or left) from the end of the current line of print to the beginning of the next, thus eliminating as many full carriage returns as possible. The printer features an 80-column print line; a 128-character ASCII character set, including upper and lower case alphabetics; and a 9-by-7 dot matrix in a 9-by-15 dot character cell, which permits underlining. A roll of nonperforated paper 8½ inches wide and 100 feet long is loaded through a door in the top of the cabinet.

PRICING

The Hewlett-Packard 2621A/P terminals are available for purchase or on a 6-month, 12-month, or 18-month lease. A buy-out option, available at the end of the lease commitment, permits the lessee to purchase the equipment for 30%, 42% or 52% of the list price in effect at the commencement of a 6-month, 12-month, or 18-month lease respectively. A variety of maintenance agreements are available. Quantity purchase discounts are also available.

	Monthly Charge*				
	6-Month Lease	12-Month Lease	18-Month Lease	Purchase	Monthly Maint.
Model 2621A	$115.86	$ 82.23	$ 74.75	$1,495	$20
Model 2621P	205.38	145.75	132.50	2,650	34
Model 2624A	213.13	151.25	137.50	2,750	24
Model 2624A (with integral printer)	302.25	214.50	195.00	3,900	37
National character sets	—	—	—	100	—
Math and large character set	—	—	—	100	—
Model 2626A	306.13	217.25	197.50	3,950	31
Model 2626A (with integral printer)	395.25	280.50	255.00	5,100	44
National character sets	—	—	—	250	—
Math and large character set	—	—	—	250	—
Carton of blue thermal paper—8.5 inches by 100 feet/roll; 24 rolls per carton	—	—	—	100	—
Carton of black thermal paper—8.5 inches by 100 feet/roll; 24 rolls per carton	—	—	—	115	—

*Includes maintenance.■

Hewlett-Packard 2621A/P Interactive Terminals

This Hewlett-Packard 2621A terminal features a 12-inch diagonal CRT display with a screen capacity of 1920 characters and 68-key detachable keyboard. Terminal operation is controlled by a Zentec Z-80 microprocessor.

A pair of stand-alone keyboard/display terminals designed for conversational interaction with the host.

Model 2621P includes a 120 cps thermal printer integrated within the display cabinet; otherwise the two models are identical.

Features include asynchronous full-duplex communications at speeds up to 9600 bps; character or line transmission; horizontal tabulation and margin set/clear functions; character and line insertion and deletion; and eight program function keys. Printer functions include automatic data logging, selective off-line printing, and a Report Mode that formats copy into 8½-by-11-inch pages.

HP 2621 terminals are available for purchase or on a 6-, 12-, or 18-month lease. Purchase prices are $1,450 and $2,550 for the 2621A and 2621P respectively; 18-month lease prices are $65.25 and $114.75, including maintenance. Quantity-purchase discounts are available.

MANAGEMENT SUMMARY

The Hewlett-Packard Model 2621 terminals, introduced in October 1978, are designed for conversational interaction with the host computer. They offer features that were conceived from careful analysis of the applications, and an understanding of differences in operator sophistication. The key to their design is the implementation of relatively high-level terminal functions via multi-level function keys. Consideration of human factors in the terminal design is intended to provide a "friendly interface" between operator and machine that promotes operator confidence and proficiency.

Control/function keys can be conditioned to support any or all of three independent levels of operation: simple cursor movement, more sophisticated control functions, and program function sequences. Many of the terminal's features are totally transparent to the operator, who can perform relatively complicated tasks without even thinking about them. Configuration of the user-definable terminal features is designed to be performed by the user, without need for assistance from Hewlett-Packard, using simple keyed commands. All function parameters are stored in non-volatile RAM and are keyboard-selectable. An exceptionally well-written user's manual documents the terminal operation procedures.

Also designed into the terminal are features that help reduce the amount of revision in host software normally required to support conversational terminal interaction. ➢

CHARACTERISTICS

VENDOR: Hewlett-Packard, Data Terminals Division, 19400 Homestead Road, Cupertino, CA 95014. Telephone (408) 257-7000.

DATE OF ANNOUNCEMENT: October 1978.

DATE OF FIRST DELIVERY: October 1978.

NUMBER DELIVERED TO DATE: Over 1000.

SERVICED BY: Hewlett-Packard, worldwide.

MODELS

The Hewlett-Packard 2621A and 2621P are teletype-compatible interactive terminals. Each is controlled by a Zentec Z-80 microprocessor. User-selected operating parameters are stored in a 256-byte non-volatile (battery-powered) RAM. Model 2621P includes a 120 cps thermal printer integrated into the display cabinet; Model 2621A does not. Both include a detachable typewriter-style keyboard, which may be placed up to four feet from the display. The standard units feature 60 Hz 120V (2621A) or 60 Hz 115V (2621P) operation; other frequency/voltage combinations are also available at no additional charge.

TRANSMISSION SPECIFICATIONS

The 2621 terminals communicate asynchronously in full-duplex mode using ASCII code. Transmission speeds of 110, 150, 200, 300, 600, 1200, 1800, 2400, 3600, 4800, and 9600 bps are operator-selectable. In addition, transmission rates can be externally provided by a host computer clocking signal. A 10- or 11-unit 8-level ASCII transmission code is used. At 110 bps, the unit code structure is 11 bits, ➢

Hewlett-Packard
2621A/P Interactive Terminals

For instance, unlike most "dumb" terminals, the HP 2621 can distinguish between data transmitted by the host and data keyed by the operator. This permits the terminal to transmit a keyed response to the host without sending back the host's prompt or inquiry, thus eliminating the need for host software to sort out the inquiry from the response.

The integral printer in the 2621P also offers several noteworthy features. The automatic Data Logger operates in either Log Top mode, which prints data as it is about to overflow from a full memory, or Log Bottom mode, which prints data as it enters the memory. A Report mode function formats printed copy in 66-line pages that can be cut into 8½-by-11 inch sheets. The printhead employs a "thin-film" technique, designed by Hewlett-Packard, which utilizes a thin glass thermal barrier to control resistor heating and cooling and thus provide cleaner, clearer printing at 120 cps.□

including one start bit and two stop bits; at all other data rates, the unit code structure is 10 bits including one start bit and one stop bit. Generation of even or odd parity or a space or mark condition on transmitted data, and parity checking on received data, are also operator-selectable. Transmission rate, parity, auto line feed and other communications parameters are stored in non-volatile RAM and can be displayed and changed from the keyboard using Configure commands. RS-232C/CCITT V.24 communications support is provided.

DEVICE CONTROL

The Model 2621 performs transmission in Character Mode or Line Mode. Transmission mode selection is stored with other communications parameters and can be displayed and changed from the keyboard using Configure commands. In Character Mode, data is normally transmitted character-by-character. In Line Mode, each line of keyed data is stored in a buffer, where it can be edited; a carriage return initiates transmission of the line. When Character Mode is selected but the operator temporarily needs to transmit line-by-line, a Modify Mode function is provided. This permits the operator to switch temporarily to Line Mode, select any line of display memory, edit that line if necessary, and transmit it. After transmission of the line character-by-character operation is restored.

Two unusual features that operate in Line Mode only are the received/keyed data pointer and the start-column indicator. The terminal automatically sets a "pointer" after the last character of the bottom line of a data transmission received from the host computer. Any data keyed by the operator on that line is separated from the received data by this pointer and thus can be distinguished by the terminal. Only data to the right of the pointer on a line is transmitted back to the host. For example, in an inquiry/response session with the host, the terminal returns only the response to the computer. Lines that have no pointer (whether keyed by the operator or received from the host for editing) are transmitted in full. The pointer is internal to the terminal's logic and in no way interferes with selection or editing of lines to be transmitted. The pointer is stored with the data line in memory and is retained if that line is later accessed by the operator.

The start-column indicator can be selected at any column from 1 to 80 and set in non-volatile RAM logic using a Configure command. The terminal sets a pointer at the selected column on every line of keyed or edited data. Data stored to the left of the indicator is displayed and printed, but not transmitted to the host. The left margin setting (which affects only keyed data) can be set to the same column as the indicator to insure that all keyed data is transmitted. One use for this feature is the visual alignment of received/edited/keyed data in a columnar format in spite of the presence of prompt messages or other extraneous data on certain lines.

Cursor position controls include Up, Down, Left, Right, Home Up, and Home Down. Cursor movement is also provided by the carriage return, and forward and backward horizontal tabs. Automatic line feed with a carriage return can be enabled/disabled using the Configure command. The cursor is both readable and addressable.

Two pages (48 lines) of display memory are provided. Stored data can be viewed using the Roll or Home-Up/Home-Down functions. The Roll function rolls the contents of the screen up or down by one line to display the next line of memory. The Home-Up/Home Down functions, which move the cursor to the beginning or end of memory, permit the user to flip from one page of memory to the other.

Eight special control/function keys located above the main key group provide three independent levels of use:

- When unshifted, the keys perform roll functions and cursor movements in accordance with the key top symbols.

- A set of eight preprogrammed control functions can be accessed via a special Labels key: Configure, Test, Clear Line, Clear Display, Print (HP 2621P only), Display Functions, Tab/Margin and Edit. (The Labels key is an unmarked key located just to the right of the main keygroup.) Whenever these functions are available for use, a corresponding set of 8 labels appear in reverse video on the 25th line of the display screen to identify the functions for the operator.

  The Configure function provides access to user-selectable communications and device control parameters set in non-volatile RAM. The Test function permits the operator to initiate terminal self-diagnostic routines. A go/no-go confidence test indicator beeps upon verification of systems components; if problems are detected, defective modules and components are isolated and diagnostic messages displayed on the screen. Display Functions enables the display of the normally non-displayed 33 control code symbols included in the character set. Tab/Margin permits the operator to set or clear horizontal tabs and right and left margins. Edit functions include character and line insertion and deletion.

  Print functions (for the HP 2621P only) include paper advance, printer self test, and copy. When operating on-line, a Data Logging function automatically records data as the memory is scrolled up and is initiated by a line feed command. The user can select either Top Log mode, which copies the first line of the 48-line memory when the 49th line is about to be entered, or Bottom Log mode, which prints the line of data just keyed/received. In off-line mode, the printer can be made to print from the current cursor position to the end of a selected line, to the end of the screen, or to the end of display memory. A Report Mode function sets up a fixed printing format of 3 blank lines then 60 data lines, then 3 blank lines; it also marks a guide on the paper so that it can be cut into 8.5-by-11 inch sheets.

- When the Labels key is used with the shift key, eight two-character program function sequences can be accessed. These program function sequences are stored in the terminal's memory; when transmitted, they initiate user-

Hewlett-Packard
2621A/P Interactive Terminals

defined program functions or identify transmitted data at the host end. Whenever these functions are available for use, they are identified in eight labels on the 25th line of the screen.

COMPONENTS

DISPLAY UNIT: A 12-inch diagonal CRT with a display capacity of 1920 characters in 24 lines of 80 characters each. Characters are formed by a 7-by-9 dot matrix in a 9-by-15 dot character cell. A 128-character ASCII set, including upper and lower case alphabetics, numerics, and specials, is displayed in white (P4 phosphorous) on a dark background. A character-by-character underline is provided. The cursor is displayed as a blinking underline. A cursor column indicator and eight control/function key labels are displayed on the status line at the bottom of the screen.

KEYBOARD: A 68-key detachable, typewriter-style keyboard. The keyboard can be located up to four feet from the display unit. A numeric pad is embedded within the main keygroup. A row of eight control/function keys is located above the main keygroup. The Label key (with an unmarked keytop) is located to the right of the main keygroup. The keyboard can generate 128 ASCII characters.

PRINTER: A non-impact (thermal) serial matrix printer housed in the display unit cabinet of Model 2621P. Printing speed is 120 cps. Actual throughput is rated at 60 cps. A bidirectional "smart" printhead minimizes printhead movement by taking the shortest route (right or left) from the end of the current line of print to the beginning of the next, thus eliminating as many full carriage returns as possible. The printer features an 80-column print line; a 128-character ASCII character set, including upper and lower case alphabetics; and a 9-by-7 dot matrix in a 9-by-15 dot character cell, which permits underlining. A roll of non-perforated paper 8½ inches wide and 100 feet long is loaded through a door in the top of the cabinet.

PRICING

The Hewlett-Packard 2621A/P terminals are available for purchase or on a 6-month, 12-month, or 18-month lease. A buy-out option, available at the end of the lease commitment, permits the lessee to purchase the equipment for 30%, 42% or 52% of the list price in effect at the commencement of a 6-month, 12-month, or 18-month lease respectively. Quantity purchase discounts are also available.

	Monthly Charge*				
	6-Month Lease	12-Month Lease	18-Month Lease	Purchase	Monthly Maint.
Model 2621A	$112.38	$72.50	$65.25	$1,450	$15
Model 2621P	197.63	127.50	114.75	2,550	25
Carton of thermal paper—8.5 inches by 100 feet/roll; 24 rolls per carton	—	—	—	85	—

*Includes maintenance. ■