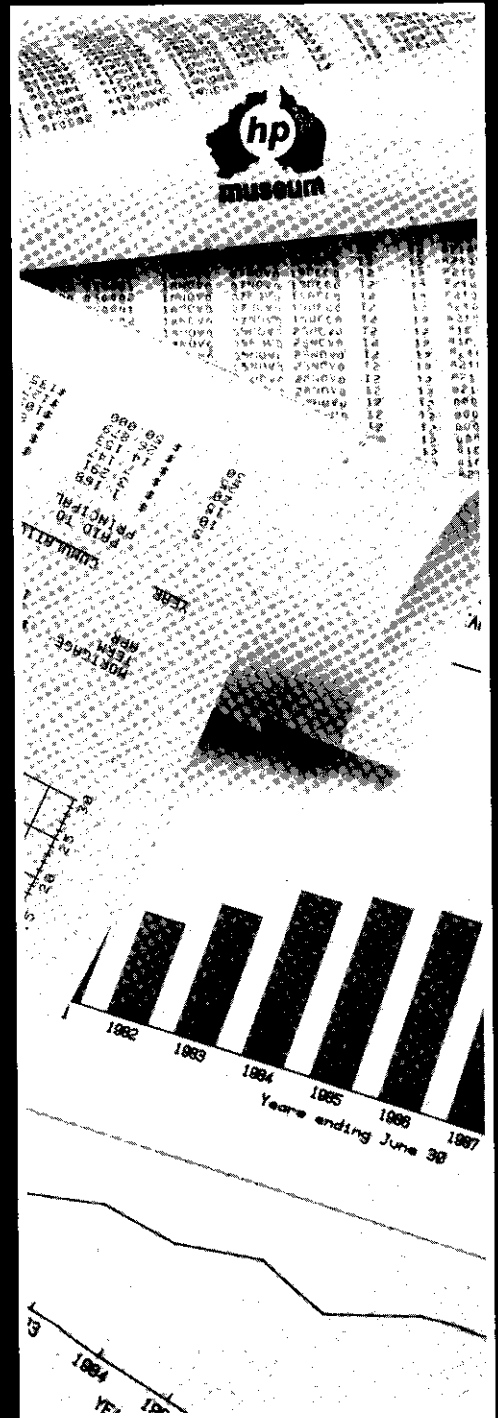
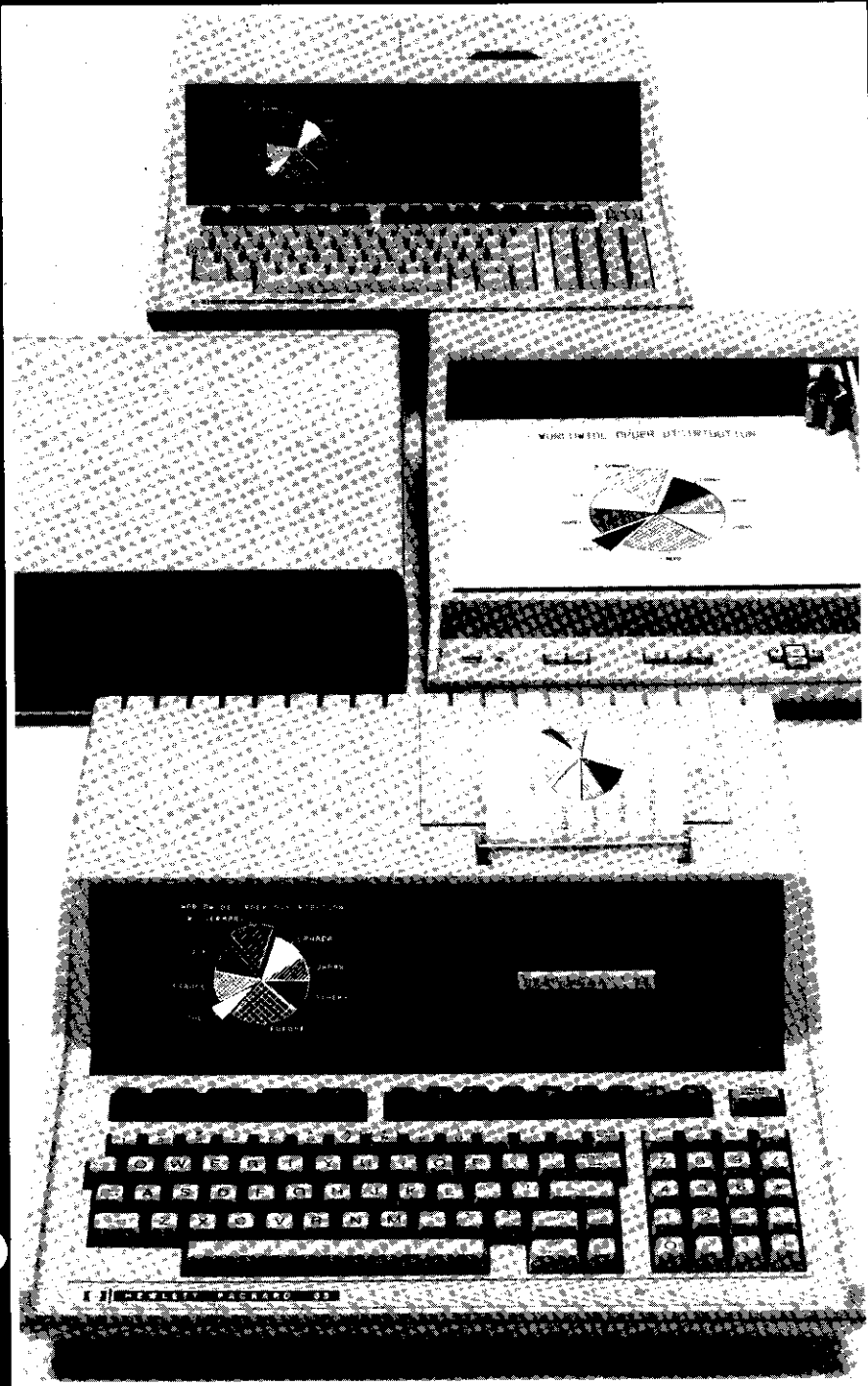
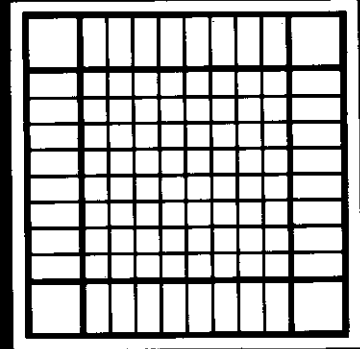


Hewlett-Packard

SERIES 80
HARDWARE

Series 80 Personal Computers



SERIES 80 HARDWARE

You can create the one-on-one computing system that's right for you with Hewlett-Packard's Series 80. This broad line of friendly computer products includes high-performance mainframes, peripherals, firmware, interfacing, and software, all designed to enhance your performance as a working professional. This brochure describes current hardware members of the Series 80 family and lists their technical specifications.

	Page
Series 80 Mainframes	2
Extra Plug-In Memory	4
Series 80 Flexible Mass Storage	5
Series 80 Printing	7
Series 80 Graphics	8
Series 80 Firmware Enhancements	10
Series 80 Interfaces	13

Technical information covered in this brochure is subject to change without notice.

SERIES 80 MAINFRAMES

HP-85 and HP-83

The HP-85 and HP-83 are personal computers for today's professional, designed to be used as analytical computing tools or as system controllers. Their features and benefits will help you solve your problems whether you're in business, science, or engineering.

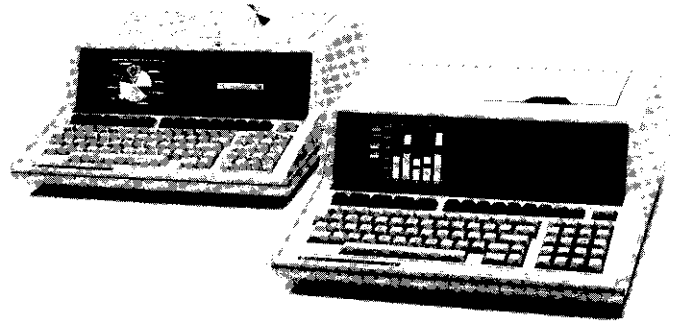
Computing power. A Series 80 Personal Computer gives you enhanced HP BASIC (a superset of ANSI BASIC) with more than 150 commands and statements for problem solving. Enhancement ROM's (read-only memories) extend capability. They add more commands and predefined functions to the mainframe, increase the capabilities of existing commands, or allow you to interface the computer with peripherals. Memory is expandable up to 112K bytes. It includes a 32K ROM operating system, a 16K internal read/write memory that doubles to 32K RAM with a plug-in Memory Module, and the capacity for six 8K ROM's.

Built-in operating system. Because the 32K ROM operating system is built into the computer, you never have to waste time loading it. And, all the read/write memory (except 1,500 bytes used for buffers) remains available to you.

Ease of use. In addition to the operating system, other built-in features include a typewriter-like alphanumeric keyboard, editing keys, debugging tools, and a 20-key numeric keypad. BASIC is easy to learn through HP's friendly manuals and the HP BASIC Training Pac. And, the computer is forgiving—if you make a mistake, you're able to recover quickly and easily.

Small size. One unit the size of an electric typewriter and weighing approximately 20 pounds contains CPU, keyboard, CRT display, operating system, and read/write memory.

Integrated graphics capability. You can create charts, graphs, special characters, patterns, and logos to aid in the analysis and presentation of problems and



solutions. A graphics system is built right into the computer's BASIC language. The high-resolution CRT provides clear, legible images.

User-definable keys. You can define subroutines within program execution using any one of eight soft keys.

Expandability. Four ports on the back of the computer accept a variety of plug-in modules. An add-on memory unit lets you expand to 32K bytes of RAM. Using a ROM Drawer in one of the ports, you can plug in up to six ROM's. And, you can choose from several interfaces to connect a broad range of peripherals or instruments for output, storage, and data acquisition.

Reliability and service. Hewlett-Packard's years of experience with computers and personal calculators assure you of high quality and design excellence. When servicing is required, you can rely on HP's comprehensive service program. You have a choice of plans: an on-site contract for fast service at your location or a bench repair contract.

Compatible software solutions. You can choose from a variety of applications software to help you solve management, statistical, scientific, or engineering problems. For details on HP software, ask to see the Series 80 Software brochure or consult the Series 80 Software Catalog at your HP dealer.

Additional Features and Benefits of the HP-85

The HP-85 is an *integrated* personal computer. With its extras, a tape drive for mass storage and a quiet thermal printer, this compact unit is a complete, **portable** computing system. You can take the HP-85 home or on the road.

What do its extras offer you?

Hard-copy results wherever you're working. The HP-85's quiet bidirectional printer produces quality printing of alphanumeric or graphics with adjustable intensity. It's fast (two 32-character lines per second) and can provide hard copy of program outputs, program listings, or CRT displays.

Tape storage capability. Each magnetic tape cartridge provides high-density digital storage for 210K bytes of data or 195K bytes of programs. When traveling with the HP-85, you can take along both data and software on tape cartridges.

HP-85A/HP-83A Specifications

OPERATING SYSTEM

ROM 32K bytes

USER READ/WRITE MEMORY

Standard 16K bytes
Expansion memory module 16K bytes

DYNAMIC RANGE

Real precision: -9.999999999E499 to -1E-499, 0 and 1E-499 to 9.999999999E499
Short precision: -9.9999E99 to -1E-99, 0, 1E-99 to 9.9999E99
Integer precision: -99999 to 99999

BUILT-IN FUNCTIONS

Mathematical and trigonometric functions are included in the following table with average execution times in msec.

Absolute (ABS)	0.83
Fractional part (FP)	1.01
Integer part (IP)	2.56
Maximum (MAX)	6.42
Minimum (MIN)	6.19
Modules (MOD)	2.21
ln (LOG)	32.11
log (LGT)	26.63
e ^x (EXP)	24.54
Raise to power (Y ^X)	43.92
Random number (RND)	3.54
Sign (SGN)	0.90
Square root (SQR)	8.74
Sine (SIN)	45.62
Cosine (COS)	45.69
Tangent (TAN)	27.27
Arcsine (ASN)	43.23
Arccosine (ACS)	43.98
Arctangent (ATN)	22.76
Cosecant (CSC)	51.68
Secant (SEC)	51.72
Cotangent (COT)	27.29
+	1.08
-	1.12
÷	5.92
*	2.85
Ceiling (CEIL)	2.91
Floor (FLOOR)	3.33

Built-in Operators

Logic: AND, OR, NOT, EXOR
Relational: =, >, <, <=, >=, <> (or #)

CRT DISPLAY

Size 127 mm (5 in.) diagonal
Capacity:
Alphanumeric 16 lines × 32 characters
Graphics 192 × 256 dots
Scrolling capacity 64 lines
Character set 256 characters; set of 128 + same set underscored
Character font 5- × 7-dot matrix
Intensity adjustable to 32 ft-lamberts
Cursor underline

CLOCK AND TIMERS

Time is maintained as seconds since midnight, along with year and day in year. Three timers can be programmed to generate individual interrupts periodically, at intervals from 0.5 msec to 99,999,999 msec (1.16 days).

BEEPER

The beeper is programmable with parameters for duration and tone. The frequency range is approximately 0 to 4,575 Hz.

OPERATING REQUIREMENTS

Source 115 Vac nominal (90-127 Vac)
230 Vac nominal (200-254 Vac)
Line frequency 50-60 Hz
Consumption 40 watts nominal

HP-85A operating temperature 5° to 40°C (40° to 105°F)
HP-85A storage temperature -40° to 65°C (-40° to 150°F)
HP-83A operating temperature 0° to 55°C (32° to 131°F)
HP-83A storage temperature -40° to 75°C (-40° to 167°F)
Ambient humidity 5% to 80% at 40°C

SIZE AND WEIGHT

Height 15.9 cm (6.3 in.)
Width 41.9 cm (16.5 in.)
Depth 45.2 cm (17.8 in.)
HP-85A Weight:
net 9.1 kg (20 lbs)
shipping 16.8 kg (37 lbs)
HP-83A Weight:
net 7.3 kg (16 lbs)
shipping 15.0 kg (33 lbs)

BASIC FUNCTIONS AND STATEMENTS

System Functions

ABS—Absolute value of the numeric expression.
ACS—Principal value (1st or 2nd quadrant) of the arccosine of the numeric expression in the current angular units.
ASN—Principal value (1st or 4th quadrant) of the arcsine of the numeric expression in the current angular units.
ATN—Principal value (1st or 4th quadrant) of the arctangent of the numeric expression in the current angular units.
ATN2—Arctangent of Y/X in proper quadrant.
CEIL—Smallest integer greater than or equal to the numeric expression.
COS—Cosine.
COT—Cotangent.
CSC—Cosecant.
DATE—Julian date in the format YYDDD, assuming system timer was set.
DTR—Converts the value of the numeric expression from degrees to radians.
EPS—A constant equal to the smallest positive real precision number, 1E-499.
ERRL—Line number of latest error.
ERRN—Error number of latest error.
EXP—Value of Napierian e raised to the power of the computed expression.
FLOOR—Largest integer less than or equal to the evaluated expression.
FP—Fractional part of the evaluated expression.
INF—A constant equal to the largest real number possible, 9.999999999999999E499.
INT—Largest integer less than or equal to the evaluated expression (equivalent to FLOOR).
IP—Integer part of the numeric expression.
LGT—Common logarithm (base 10) of a positive numeric expression.
LOG—Natural logarithm (base e) of a positive numeric expression.
MAX—Larger of two values.
MIN—Smaller of two values.
PI—Numerical value of pi.
RMD—Remainder resulting from a division operation according to X-(Y*IP(X/Y)).
RND—Generates a number that is greater than or equal to zero and less than one, using a predetermined, pseudo-random sequence.
RTD—Converts the value of the numeric expression from radians to degrees.
SEC—Secant.
SGN—Returns a 1 if the expression is positive, -1 if negative, and 0 if exactly 0.
SIN—Sine.
SQR—Square root of a positive numeric expression.
TAN—Tangent.
TIME—Returns the time in seconds since midnight if the timer is set, or since machine turn-on otherwise, resetting automatically after 24 hours.

String Functions

CHR\$—Converts a numeric value between 0 and

255 into a character corresponding to that value.

LEN—Returns the number of characters in a string.
NUM—Returns the decimal value corresponding to the first character of the string expression.
POS—Returns the position of the first character of a substring within another string or 0 if the substring is not found.
UPC\$—Converts all lowercase letters in a string to uppercase letters.
VAL—Returns as a numeric value, including exponent, a string of digits so that the value may be used in calculations.
VAL\$—Returns the value of a numeric expression as a string of digits.

General Statements and Programmable Commands

BEEP—Outputs a tone of specified frequency for a specified duration.
CLEAR—Clears the CRT.
COM—Dimensions and reserves memory so chained programs can access the same data.
CRT IS—Allows the definition of either a printer or the actual CRT as the current CRT.
DATA—Provides constants and text characters for use with READ statements.
DEFAULT ON—Makes numeric overflows, underflows, and the use of uninitialized variables non-fatal by substituting an appropriate approximate value.
DEFAULT OFF—Makes numeric overflows, underflows, and the use of uninitialized variables fatal.
DEF FN—Defines a single- or multiple-line function.
DEG—Sets degree mode for evaluation and output of the arguments and results of trigonometric functions.
DIM—Declares the size and dimensions of array and string variables.
DISP—Outputs the values or text on the current CRT.
DISP USING—Displays values and text according to format specified by IMAGE statement or literal IMAGE.
END—Terminates program execution (same as STOP).
FLIP—Changes the keyboard from BASIC mode to typewriter mode or vice versa.
FN END—Terminates a multiple-line function.
FOR/NEXT—Defines a program loop and the number of iterations.
GOSUB—Transfers program control to a subroutine and allows subsequent return of control.
GOTO—Transfers program execution to the specified line.
GRAD—Sets grad mode for evaluation and output of the arguments and results of trigonometric functions.
IF...THEN...ELSE—Allows statements to be either executed or bypassed depending on the outcome of a logical expression.
IMAGE—Specifies the format used with PRINT USING or DISP USING statements.
INPUT—Allows entry of values or text from the keyboard during program execution.
INTEGER—Declares variables as integers as well as the size and dimensions of integer arrays.
KEY LABEL—Displays in the lower portion of the CRT, an eight-character prompt for each Special Function Key defined by an ON KEY statement. Also returns cursor to upper left corner of the CRT.
LET—Assigns a value to a variable or array element.
LIST—Lists the program on the CRT IS device. Also outputs bytes remaining at the end of a program.
NORMAL—Cancels the effect of the PRINT ALL, AUTO, or TRACE statements.
ON ERROR—Sets up a branch to the specified line or subroutine anytime an error occurs.
OFF ERROR—Cancels any ON ERROR statement previously executed.
ON KEY #—Sets up a branch to the specified line or subroutine each time the Special Function Key is pressed.

(continued)

OFF KEY #—Cancels the branch set up by an **ON KEY #** statement.

ON TIMER #—Sets up a branch to the specified line or subroutine on a time-dependent interrupt basis.

OFF TIMER #—Cancels any interrupts from a timer set up by an **ON TIMER #** statement.

OPTION BASE—Allows specifying lower bound of an array as 1 rather than the default of 0.

PAUSE—Suspends program execution.

PLIST—Lists the program on the **PRINTER IS** device.

PRINT—Prints values or text on the current **PRINTER IS** device.

PRINT ALL—Sets a mode such that all inputs, messages, and results are printed on the **PRINTER IS** device.

PRINT USING—Prints values and text according to format specified by an **IMAGE** statement or literal **IMAGE**.

PRINTER IS—Defines the device used for printer output.

RAD—Sets radian mode for evaluation and output of the arguments and results of trigonometric functions.

RANDOMIZE—Re-evaluates the random number seed.

READ—Assigns values from a **DATA** statement to the variables specified.

REAL—Declares full-precision variables as well as the size and dimensions of full-precision arrays.

REM—Declares the subsequent characters as remarks for documentation only.

RESTORE—Resets data pointer to the start of the specified **DATA** statement, or the first **DATA** statement if none is specified.

RETURN—Transfers program control back to the statement following a **GOSUB**.

SETTIME—Sets the system clock with the parameters of seconds since midnight and Julian day in form **YYDDD**.

SHORT—Declares variables as being short-precision as well as the size and dimensions of short-precision arrays.

STOP—Suspends program execution (same as **END**).

TAB—Used in a **DISP** or **PRINT** statement to allow

information to be placed at a specified character position.

TRACE—Traces program logic flow in all or part of a program as specified and prints this information.

TRACE ALL—Traces all program logic flow and variable assignments in all or part of a program as specified and prints this information.

TRACE VAR—Traces all value changes of specified variables and prints this information.

WAIT—Holds program execution for the specified number of milliseconds.

Mass Storage Statements

ASSIGN#—Opens a data file by assigning a buffer number to it.

CAT—Displays a file directory on the **CRT** screen.

CHAIN—Loads a new program from the mass storage device and continues executing while retaining any data in common.

CREATE—Establishes a data file of specified length and record length on mass storage devices.

LOAD—Brings into memory a program previously stored on a mass storage device. (Not programmable.)

LOAD BIN—Brings a binary program into memory.

PRINT #—Records data onto the referenced file.

PURGE—Erases the specified file from the file directory, rendering it inaccessible.

READ #—Retrieves data from a specified file.

RENAME—Changes the name of an existing file.

SECURE—Disallows unauthorized listing, editing, duplicating, or cataloging of a program.

STORE—Records a program onto the mass storage device. (Not programmable.)

STORE BIN—Records a binary program onto the mass storage device.

UNSECURE—Allows files previously secured to be listed, edited, duplicated, and cataloged. (Not programmable.)

Graphics Statements

ALPHA—Puts the **CRT** into its alphanumeric mode.

BPLOT—Allows plotting any series of dots on the **CRT** by conversion to an alphanumeric string.

DRAW—Lowers the pen and draws a line from current pen position to a specified destination position.

GCLEAR—Clears all or a specified lower section of the graphics display.

GRAPH—Sets display to graphics mode.

IDRAW—Lowers the pen and draws a line of specified incremental length from the present position.

MOVE—Lifts the pen and moves the pen an incremental distance from the present position.

LABEL—Allows printing of text in the graphics mode.

LDIR—Specifies horizontal or vertical direction of a label.

MOVE—Lifts the pen and moves the cursor to a specified absolute location.

PEN—Sets pen color.

PEN UP—Raises the pen so that plotting is possible without drawing lines between points.

PLOT—Moves to a specific point if pen is up; draws a line to the point if pen is down.

SCALE—Defines the incremental units and range of x and y on the **CRT**.

XAXIS—Draws a horizontal line of specified length, with or without tic marks, at a specified y-intercept.

YAXIS—Draws a vertical line of specified length, with or without tic marks, at a specified x-intercept.

Non-Programmable Commands

AUTO—Allows automatic generation of line numbers during program entry.

CONT—Allows continuation of a program which has been paused.

DELETE—Deletes program lines specified.

INIT—Initializes a program by allocating memory for the variables required, and performs a check for certain errors.

REN—Renumbers program lines with specified increments.

RUN—Initializes a program and begins its execution.

SCRATCH—Clears memory of all programs and data.

HP-85A Additional Specifications

PRINTER

Imprinting method moving head, thermal

Paper width 108 mm (4.3 in.)

Speed 120 lines/min

Character font 5- × 7-dot matrix; 32 characters/line

Graphics resolution 2.63 dots/mm (67 dots/in.)

Intensity adjustable

TAPE CARTRIDGE

Capacity:

data 210K bytes

programs 195K bytes

File management by name, up to 42 files

Read/write speed 254 mm/sec (10 in./sec)

Search speed 7,800 bytes/sec (1,524 mm/sec or 60 in./sec)

Transfer rate 650 bytes/sec

Average access time 9.3 sec

Rewind time 29 sec (end to end)

Tape length 43 m (140 ft)

Cartridge size 61.2 × 80.9 × 11.9 mm (2.41 × 3.18 × 0.47 in.)

Security programmable and mechanical

NOTE: Tape cartridges are intended for nominal program or data storage; the typical life cycle is 50-100 hours of use, depending on the application. Environmental conditions of 25°C (77°F) and 20 to 50% relative humidity are most favorable for a long tape life. Tape life is decreased by a high-duty cycle (percent of time the tape is accessed during the total time the HP-85 is in use) and continuous use for long periods of time (longer than one-half hour). It is

suggested that tape transports be regularly cleaned and cartridges removed from drives after use.

BASIC FUNCTIONS AND STATEMENTS

General Statements and Programmable Commands

COPY—Prints a copy of **CRT** on the HP-85's printer, in both the alphanumeric and graphics modes.

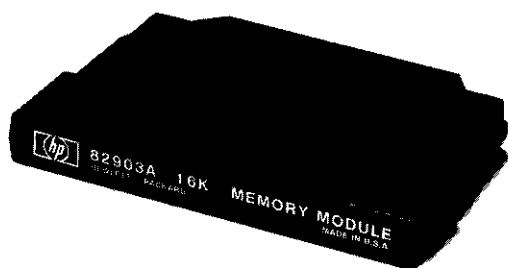
Mass Storage Statements

CTAPE—Conditions the tape by running it to end, then rewinding it to assure smooth operation of the entire tape.

ERASETAPE—Initializes a tape by creating a blank directory.

REWIND—Rewinds tape to its beginning point.

EXTRA PLUG-IN MEMORY



HP 82903A 16K Memory Module

You can double the internal read/write memory in either mainframe with this optional Memory Module. It plugs into any one of the four ports in the back of the computer, adding 16K extra bytes of RAM instantly. Once installed, all operations can automatically access the added capacity. You will find the module useful for handling large data requirements or for writing and running long programs. Several HP Application Pacs require use of the Memory Module. Check the Software/Hardware Matrix in the Series 80 Software brochure or the software section in the Series 80 Configuration Guide for details.

SERIES 80 FLEXIBLE MASS STORAGE

If your applications demand quick, random access to high-speed mass storage, add flexible disc drives to a Series 80 mainframe. You can store large amounts of information on and off line on space-saving, low-cost discs.

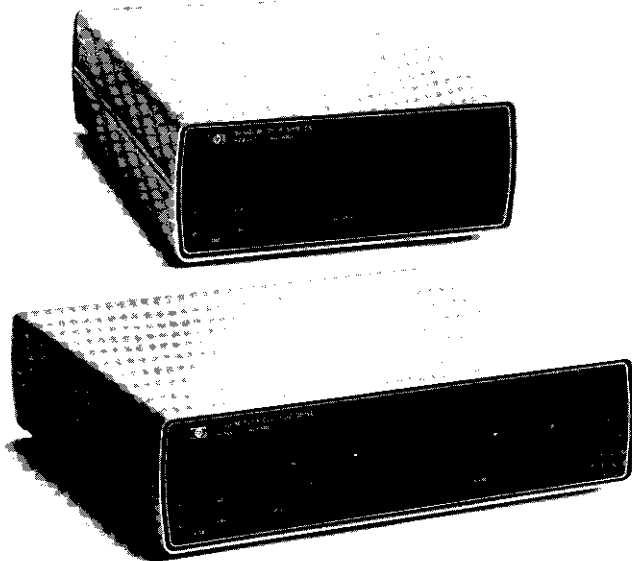
Increase memory in progressive steps. You have a choice of peripherals giving you on-line storage ranging from 270K bytes to 4,720K bytes. Choose the alternative that matches your data needs.

Quick file access. Access a file on any of the discs in less than one-third of a second.

Easy referencing. Reference a file through a directory simply by designating the file name. The command VOLUME establishes a volume label for a disc. To refer to the disc, simply specify its label.

Operating assurance. Each master disc drive automatically performs a self-test every time it is turned on. With this test, you know the hardware is operating properly. Also, the command CHECK READ verifies your data during file read/write operations.

Reliable media. Through extensive testing, selection, and control, HP-qualified flexible discs let you store your programs and data files with confidence. Compared to tape cartridges, these long-lived, double-sided discs provide a lower-cost storage alternative.



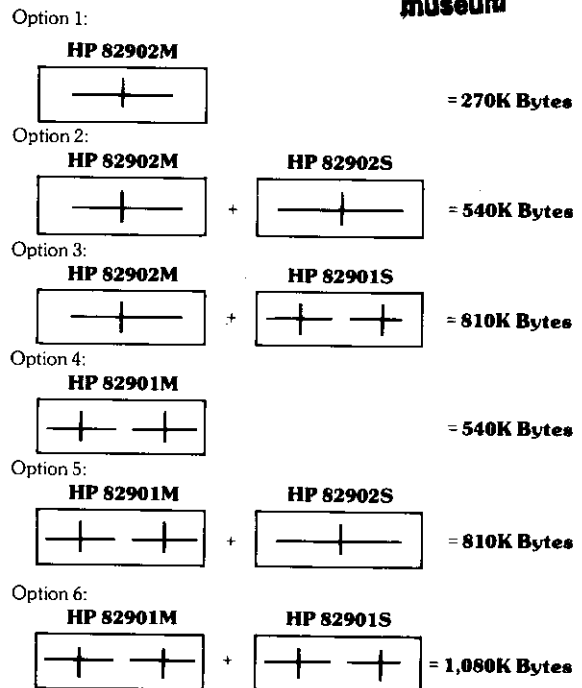
HP 82900-Series Flexible Disc Memory

The four disc drives in this series include a dual (two drives) master unit, a single (one drive) master unit, a dual add-on, and a single add-on. Add-on units must be connected to a master unit. All four drives use double-sided, double-density, 5¼" flexible discs (HP 92190A) each supplying approximately 270K bytes (formatted) of on-line storage.

- HP 82901M—provides 540K bytes through a master controller and two disc drives.
- HP 82902M—provides 270K bytes through a master controller and one drive.
- HP 82901S—provides, as an add-on unit, an additional 540K bytes when connected to one of the two master drives.
- HP 82902S—provides, as an add-on unit, an additional 270K bytes when connected to one of the two master drives.



Disc drive configurations:



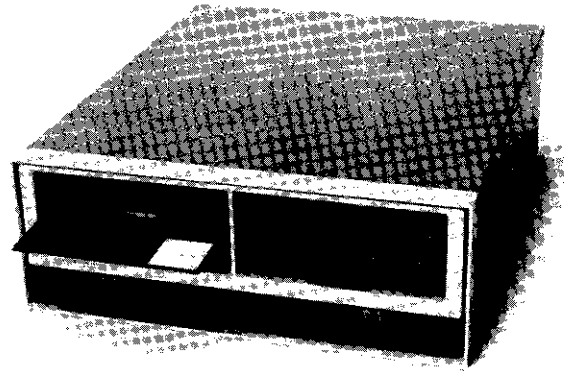
Requirements for interfacing with a Series 80 Personal Computer: HP 82936A ROM Drawer, HP Mass Storage ROM (00085-15001), and HP 82937A HP-IB Interface.

HP 82900-Series Specifications		HP DOUBLE-DENSITY FORMAT	Frequency 50-60 Hz
COMPATIBILITY	HP 82901M/ HP 82902M interface to controlling computer with HP-IB	Recording format double-head, double-density; 48 tracks/in.	Operating temperature 10° to 40°C (50° to 104°F)
	HP 82901S/ HP 82902S connect to HP 82901M/ HP 82902M	Diameter 130 mm (5.12 in.)	
NUMBER OF DISC DRIVES	HP 82901M/ HP 82901S two drives	Recording surfaces two per disc	SIZE AND WEIGHT
	HP 82902M/ HP 82902S one drive	Tracks 70 per disc (35 per side)	Height 11.0 cm (4.3 in.)
MEDIA LIFE	More than 2,500,000 revolutions (140 hours)	Records 16 per track	Width 42.6 cm (16.8 in.) (HP 82901M/HP 82901S); 28.0 cm (11.0 in.) (HP 82902M/HP 82902S)
		Bytes 256 per record	Depth 37.4 cm (14.7 in.)
		Total capacity 286,720 bytes	Weight: net HP 82901M/HP 82901S 9.1 kg (20 lbs) HP 82902M/HP 82902S 6.4 kg (14 lbs)
		ROTATION SPEED 300 rpm	Weight: shipping HP 82901M/HP 82901S 13.9 kg (31 lbs) HP 82902M/HP 82902S 10.2 kg (23 lbs)
		AVERAGE ACCESS TIME 187 msec	
		OPERATING REQUIREMENTS	
		Line 90-127 Vac (115 Vac line), 200-254 Vac (230 Vac line), switchable at rear panel	

HP 9895A Flexible Disc Memory

The four disc drives in this series include a dual master, a single master, a dual add-on, and a single add-on. Add-ons must be connected to masters. The HP 9895A drives use double-density format, 8" flexible discs (HP 92195A) with each disc supplying 1,180K bytes of on-line storage.

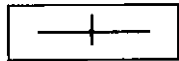
- HP 9895A—provides 2,360K bytes through a master controller and two disc drives.
- HP 9895A Opt. 010—provides 1,180K bytes through a master controller and one disc drive.
- HP 9895A Opt. 011—provides, as an add-on unit, an additional 1,180K bytes when connected to one of the two master drives.
- HP 9895A Opt. 012—provides, as an add-on unit, an additional 2,360K bytes when connected to one of the two master drives.



Disc drive configurations:

Option 1:

HP 9895A Opt. 010

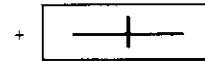
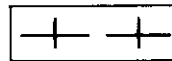


= 1,180K Bytes

Option 5:

HP 9895A

HP 9895A Opt. 011

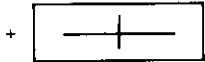
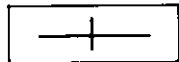


= 3,540K Bytes

Option 2:

HP 9895A Opt. 010

HP 9895A Opt. 011

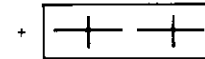
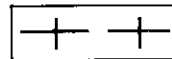


= 2,360K Bytes

Option 6:

HP 9895A

HP 9895A Opt. 012

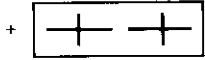
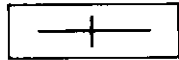


= 4,720K Bytes

Option 3:

HP 9895A Opt. 010

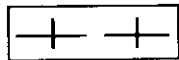
HP 9895A Opt. 012



= 3,540K Bytes

Option 4:

HP 9895A



= 2,360K Bytes

Requirements for interfacing with a Series 80 Personal Computer: HP 82936A ROM Drawer, HP Mass Storage ROM (00085-15001), and HP 82937A HP-IB Interface.

The HP 9895A options can be upgraded to meet future needs. Drive Accessories (either HP 98952A or HP 98952A Opt. 001) will upgrade a one-drive unit to a two-drive unit. The Control Board Assembly (HP 98951A) will upgrade an add-on unit to a master.

HP 9895A Specifications

COMPATIBILITY

HP 9895A/
HP 9895A
Opt. 010 interface to controlling
computer with HP-IB cable

HP 9895A Opt. 011/
HP 9895A
Opt. 012 connect to HP 9895A/
HP 9895A Opt. 010

NUMBER OF DISC DRIVES

HP 9895A/HP 9895A Opt. 012 two drives
HP 9895A Opt. 010/
HP 9895A Opt. 011 one drive

MEDIA LIFE

More than 2,500,000 revolutions (115 hours)

HP DOUBLE-DENSITY FORMAT

Recording format double-density
(M²FM)

Tracks 154 per disc
(77 per side)

Recording surfaces two per disc

Bytes 256 per record

Records 30 per track

Maximum transfer rate
(buffered, interleave of 2) 25,600 bytes/sec
(This is a maximum number. Transfer rate may vary
depending on host computer.)

Total capacity 2,365,440 bytes
(two-drive unit)
1,182,720 bytes
(one-drive unit)

(This is a maximum number. The host system may
utilize a small portion of this storage as overhead.)

ROTATION SPEED 360 rpm ± 3.5%

AVERAGE ACCESS TIME 179 msec

OPERATING REQUIREMENTS

Source (±10%) 100, 120, 220, 240 Vac
Line frequency (±2%) 50 Hz or 60 Hz

Line requirements (maximum):

	9895A	9895A	9895A
	Opt.	Opt.	Opt.
	010	011	012
	Single	Single	Dual
	Drive	Drive	Drive
100 Vac	1.9A	1.3A	1.0A
120 Vac	1.6A	1.1A	0.8A
220 Vac	0.9A	0.6A	0.5A
240 Vac	0.8A	0.5A	0.4A

Operating

temperature 10° to 40°C (50° to 104°F)

SIZE AND WEIGHT

Height 19.2 cm (7.6 in.)
Width 48.3 cm (19.0 in.)
Depth 57.5 cm (22.6 in.)

Weight: net
HP 9895A 26.8 kg (59 lbs)
HP 9895A Opt. 010 20.9 kg (46 lbs)

Weight: shipping
HP 9895A 31.8 kg (70 lbs)
HP 9895A Opt. 010 25.9 kg (57 lbs)

SERIES 80 PRINTING

HP 2631B Printer, Opt. 885

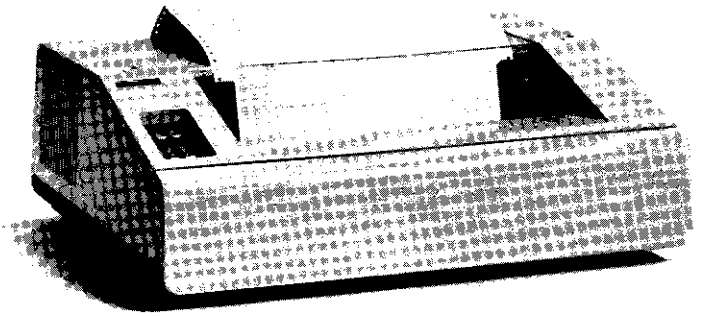
High-quality hard-copy output is a necessity for many applications. Your Series 80 Personal Computer and the HP 2631B Impact Printer are ideal for high-volume commercial printing assignments. This printer provides you with:

High throughput. The HP 2631B optimizes throughput by printing bidirectionally, skipping over embedded blanks, and returning the carriage at high speed. Its peak print speed is 180 characters/sec.

Printing versatility. Seven-by-nine-dot-matrix character cells give you crisp, clean characters. They permit underlining and the printing of all descenders such as j, y, g, p, and q. In addition to the standard English character set, several other character sets are available. Eight selectable print modes range from 4.2 characters/in. for titles and headings, to 16.7 characters/in. for compressed print. With compressed print, you can have a maximum of 132 characters per line on 8½"-wide paper. Programmable line spacings let you print superscripts and subscripts.

Forms handling flexibility. This printer's impact printing technique permits the use of single or multipart forms (up to six parts and a maximum pack thickness of 0.43 mm). Reliable tractors advance the forms and can accommodate sizes between 3.1 cm (1.2 in.) and 40.0 cm (15.8 in.). You can define page length up to a maximum of 255 lines.

Convenience. The printer features a long-life, easy-to-replace cartridge ribbon; a switch that halts the printer and sounds an alarm when paper runs out; and display functions that help programmers during software development.



Reliability. Two years of extensive customer usage of HP 2630-Series products have verified their high reliability. The HP 2631B's durable print head is conservatively rated at 100 million characters. In addition, the printer has internal grounding to provide high immunity to electrostatic discharge.

System Verification. A self-test feature lets you verify proper printer operation.

Requirements for interfacing with a Series 80 Personal Computer: HP 82936A ROM Drawer, HP Plotter/Printer ROM (00085-15002), and HP 82937A HP-IB Interface.

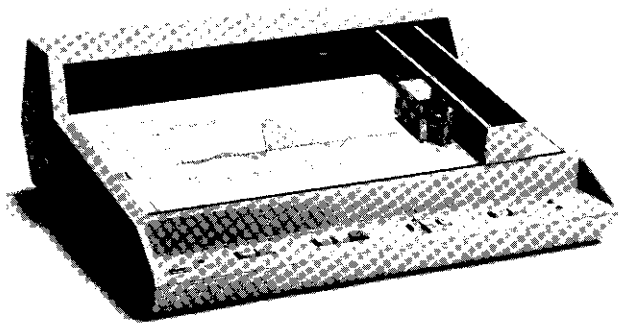
Other Printing Options

Discuss other printing options using Hewlett-Packard interfaces with your HP dealer.

HP 2631B Specifications		FORMS SPECIFICATIONS	Humidity 10% to 90% RH (non-condensing)
PRINTING		Paper widths: Maximum width: 40.0 cm (15.8 in.) edge to edge Minimum width: 3.1 cm (1.2 in.) perforation to perforation	SIZE AND WEIGHT Height 21.5 cm (8.5 in.) Width 64.0 cm (25.2 in.) Depth 46.9 cm (18.5 in.) Weight: net 23.5 kg (51 lb) (without pedestal) shipping 31.0 kg (67 lb) (without pedestal)
Technique 7 × 9-dot-matrix impact Automatic underlining Speed 180 characters/sec (instantaneous)	Print pitch (CPI)	Paper weights: Single part: 20- to 100-pound Multipart: 12-pound; first and subsequent copies up to six total copies. 7-pound carbon; 0.43 mm (0.017 in.) maximum pack thickness. Multipart forms and card stock should be tested for satisfactory feeding, registration, and print quality. If the printer is to be used under conditions approaching the extremes of the humidity specification, all media should be tested to ensure proper handling and stacking.	
Print pitch (CPI)	Line length (characters)		SAFETY COMPLIANCE
16.7 standard character cell	227		The HP 2631B is listed by Underwriter's Laboratories, Inc. in the following categories with respective guide designations: Electronic Data Processing Equipment (EMRT), Teaching and Instruction Equipment (WYFW), and Office Appliances and Business Equipment (QAOT).
12.5 (printed at 180 CPS)	170		The Canadian Standards Association has certified this printer as Data Processing Equipment.
10.0	136		Finally, this product was designed to meet European Safety and RFI/EMC standards for Electronic Data Processing Equipment effective prior to March 1, 1980. Any questions concerning regulatory agency compliance should be directed to your authorized HP dealer or local HP Sales Office.
8.3	113		
8.3 expanded character cell	113		
6.3 (printed at 45 CPS)	85		
5.0	68		
4.2	56		
CHARACTER SET 128 USASCII (standard)		OPERATING REQUIREMENTS	
FORMS HANDLING		Source (+10%, -12%) . . . 100, 120, 220, 240 Vac selectable from rear panel	
Forms tractors		Frequency 48-66 Hz	
16-channel computed VFC		Power consumption . . . 140 VA maximum non-printing; 265 VA maximum printing	
Horizontal and vertical tabbing		Operating temperature 10° to 40°C (50° to 104°F)	
Programmable left and right margins			
Programmable page and text length			
Automatic perforation skip			
Variable vertical line spacing 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, or 72 lines/in.			

SERIES 80 GRAPHICS

Put the visual impact of computer graphics to work for you with the HP 7225 Graphics Plotter and the HP 9111A Graphics Tablet. Often, you can say more with charts, graphics, drawings, diagrams, and plots than with pages of printouts ... and you can say it faster. Grasp important information at a glance. Recognize trends and cycles quickly. With graphics.



HP 7225 Graphics Plotter

The HP 7225 is a compact, efficient plotter that provides a cost-effective solution to the need for hard-copy graphics. With it and a Series 80 Personal Computer, you can produce publication-quality plots to sharpen analyses and add both clarity and professionalism to presentations and reports. The Graphics Plotter must be configured to the mainframe with an HP 17601A Personality Module and an HP Plotter/Printer ROM (00085-15002). The graphics system gives you:

Ease of use through programming simplicity. An HP Plotter/Printer ROM adds over 50 high-level graphics

commands to the computer's resident BASIC language. The ROM accepts a single high-level command and translates it into a string of HP-GL (Hewlett-Packard Graphics Language) commands for the plotter.

Accurate, continuous ink lines. The plotter moves in precise microsteps of 0.032 mm (0.0013 in.) with an accuracy of ± 0.25 mm (± 0.01 in.). Repeatability (returning to previously drawn points) is 0.1 mm (0.004 in.). These tight specifications ensure clean, quality graphics with the accuracy required for true data representation.

Speed. The pen moves 25 cm/sec (10 in./sec) in each axis and 35 cm/sec (14 in./sec) on a 45° angle.

Multicolor capability. Multicolor graphics are easy with quick pen changes.

Overhead transparency capability. You can produce one-color or multicolor plots on acetate as well as on paper. The HP 17055A Overhead Transparency Kit and the Graphics Presentations Pac let you produce smudge-proof, high-quality overhead slides.

Standard size graphics. Plot on paper up to 8½" × 11" or ISO A4 to produce final-copy illustrations for your reports and presentations.

Requirements for interfacing with a Series 80 Personal Computer: HP 17601A Personality Module, HP 82936A ROM Drawer, HP Plotter/Printer ROM (00085-15002), and HP 82937A HP-IB Interface.

HP 7225 Specifications											
PLOTTING AREA	ADDRESSABLE STEP SIZE 0.032 mm (0.0013 in.)										
Y-axis 20.3 cm (8.0 in.)	PEN VELOCITY										
X-axis 28.5 cm (11.2 in.)	Each axis 25.0 cm/sec (10 in./sec)										
Accepts up to ISO A4 or 8½" × 11" paper.	On 45° angle 35.0 cm/sec (14 in./sec)										
PLOTTING ACCURACY	VECTOR LENGTH										
± 0.25 mm (± 0.01 in.), includes linearity and repeatability. Assumes plotter has been zeroed exactly to the lower left (0,0) coordinates.	Any length vector within the plotter's mechanical limits.										
REPEATABILITY 0.1 mm (0.004 in.) from any given point and direction	CHARACTER PLOTTING SPEED										
	Up to 3 characters/sec for 2.5-mm (0.1-in.) characters.										
	OPERATING REQUIREMENTS										
	Source (-10%, +5%) 100, 120, 220, 240 Vac										
	Frequency 48-66 Hz										
	Operating temperature 0° to 55°C (32° to 131°F)										
	POWER OPTIONS										
	Order appropriate power option by option number:										
	<table border="1"> <thead> <tr> <th>Item</th> <th>Option No.</th> </tr> </thead> <tbody> <tr> <td>100 Vac power</td> <td>001</td> </tr> <tr> <td>120 Vac power</td> <td>002</td> </tr> <tr> <td>220 Vac power</td> <td>003</td> </tr> <tr> <td>240 Vac power</td> <td>004</td> </tr> </tbody> </table>	Item	Option No.	100 Vac power	001	120 Vac power	002	220 Vac power	003	240 Vac power	004
Item	Option No.										
100 Vac power	001										
120 Vac power	002										
220 Vac power	003										
240 Vac power	004										
	SIZE AND WEIGHT										
	Height 14.0 cm (5.5 in.)										
	Width 41.3 cm (16.3 in.)										
	Depth 37.9 cm (14.9 in.)										
	Weight:										
	net 8.0 kg (18 lbs)										
	shipping 11.4 kg (25 lbs)										

HP 9111A Graphics Tablet

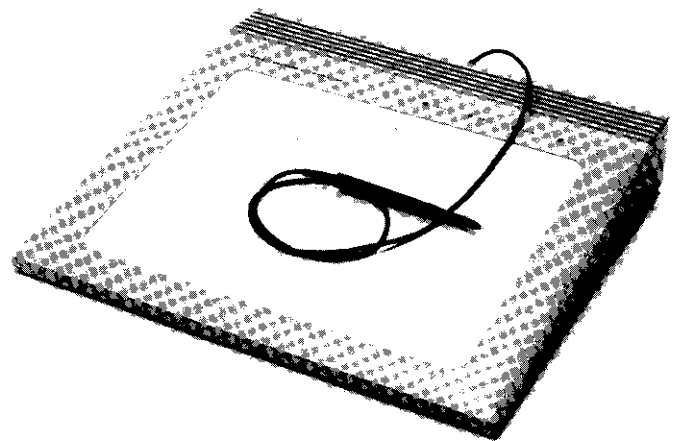
The Graphics Tablet lets you interact with the graphics display on your Series 80 Personal Computer and, if desired, with the HP 7225 Graphics Plotter. As you move a pen-like stylus around the tablet, the tablet translates your movements into digital code and transmits this code to the computer. Points are entered either continuously while you draw, or whenever the stylus is pressed down. Utility software programs interpret these points in ways specific to each program's application. Current applications include:

- **Designing graphics on a CRT**—The HP Drawing Utility lets you trace existing documents, design pictures, add text, create a data base, and plot. The program can be used to interpret a digitized point as the end of a line, the center or circumference of a circle or polygon, or the corner of a rectangle. You can create charts and graphics with ease, on paper or acetate, as illustrations for reports or as overhead transparencies for presentations.
- **Converting graphics into data files**—With the HP Graphics Entry Utility, you can digitize data points from graphs or charts into data files. Then, analyze the data using other Series 80 software.
- **Measurement**—The HP Planimeter Utility lets you measure areas, distances, boundary lines, and curves.

In addition to these applications, you can use the Graphics Tablet to pick from a menu. A menu is a customized keyboard which you design yourself. Simply draw it on paper, and place it on the tablet. Then, write your own utility program to interpret your menu for the computer. For example, you can define one area of the tablet to display a phrase. When using the menu, all you'll have to do is press the stylus once in that area to enter the entire phrase.

Among the Graphics Tablet's many benefits are:

Consistent accuracy. A hard, durable ceramic platen resists scratches, expansion, and contraction, ensuring tablet accuracy.



User-definable keys. You can define any of 16 soft keys.

Easy-to-use stylus. The slim, lightweight stylus fits comfortably in your hand and gives positive tactile feedback as you enter data.

Document protection. A transparent overlay holds documents on the platen and protects them from wear and tear.

Audible positive and negative feedback. A beeper (programmable in pitch, volume, and duration) can let you know if you're using the tablet correctly.

Product assurance. Self-tests assure you that the tablet is operating properly.

Requirements for interfacing with a Series 80 Personal Computer: HP 82903A 16K Memory Module and HP 82937A HP-IB Interface.



HP 9111A Specifications

RESOLUTION 0.100 mm (0.00394 in.)

ACCURACY ±0.600 mm (0.0236 in.)
(20°C, each measured point)
Derate 0.004 mm/°C
deviation from 20°C

DATA RATE Programmable from 1 to 60 coordinate pairs/sec. Average rate ±0.2 Hz from nominal.

ACTIVE DIGITIZING AREA 21.9 × 30.1 cm (8.6 × 11.8 in.) not including menu area

STYLUS MOTION RATE

On paper 50.0 cm/sec
On platen 73.0 cm/sec

DOCUMENT MATERIAL

..... Single sheet, electrically nonconductive, homogeneous, less than 0.5 mm thick

REPEATABILITY ±1 resolution unit from mode of data

PLATEN ARTWORK ACCURACY

..... origin, self-test dot, any border, measured vs. documented ±2.8 mm (0.11 in.)

OPERATING REQUIREMENTS

Source (±10%) 100, 120, 220, 240 Vac
Frequency 48-66 Hz
Consumption 200 mA @ 100 Vac
25W maximum 165 mA @ 120 Vac
90 mA @ 220 Vac
80 mA @ 240 Vac

Operating temperature 0° to 55°C (32° to 131°F)

SIZE AND WEIGHT

Height 8.5 cm (3.4 in.)
Width 44.0 cm (17.3 in.)
Length 44.0 cm (17.3 in.)
Weight:
net 5.8 kg (13 lbs)
shipping 10.8 kg (24 lbs)

SERIES 80 FIRMWARE ENHANCEMENTS

These enhancements include ROM's (read-only memories) and ROM drawers. HP ROM's are used to integrate peripherals into a Series 80 system or to enhance the capabilities of Series 80 software. These firmware

modules plug into the computer via the HP 82936A ROM Drawer. The drawer fits any of the four computer ports and has slots for up to six ROM's. A Series 80 Personal Computer will accept only one ROM Drawer.

Short descriptions of current ROM's and other firmware enhancements follow, along with, where applicable, listings of the extra BASIC statements and functions each adds to your system.

HP Mass Storage ROM (00085-15001)

The Mass Storage ROM lets you interface your Series 80 Personal Computer with HP 82900-Series Flexible Disc Memory or HP 9895A Flexible Disc Memory for powerful mass storage capabilities. With this ROM, disc memory is totally integrated into the system, so you're ready to go when you turn on the computer.

STATEMENTS AND FUNCTIONS

Many of the mass storage statements and functions

are listed under the HP-85A/HP-83A specifications. In addition, this ROM includes:

CHECK READ—Performs record-by-record data verification during file read/write operations.
COPY—Copies files or entire storage media.
ERRORM—Returns the ROM number of the device that issued an error message.
ERRSC—Determines the select code of the interface module that received an illegal operation.
GLOAD—Loads the contents of a special extended-type file into the graphics display.
GSTORE—Stores the contents of the graphics display onto the mass storage system.

INITIALIZE—Clears, tests, and prepares a flexible disc medium for use in the mass storage system.
MASS STORAGE IS—Defines the default mass storage device. Allows use of mass storage ROM commands without specification of a device.
PACK—Removes null files from the disc system.
TRANSLATE—Translates tape-based programs to disc-based programs to allow them to automatically take advantage of the mass storage system.
TYP—Returns the type of the next datum of a data file.
VOLUME—Establishes a volume label for a disc medium. Volume labels let you refer to a disc medium by a name that you specify.

HP Plotter/Printer ROM (00085-15002)

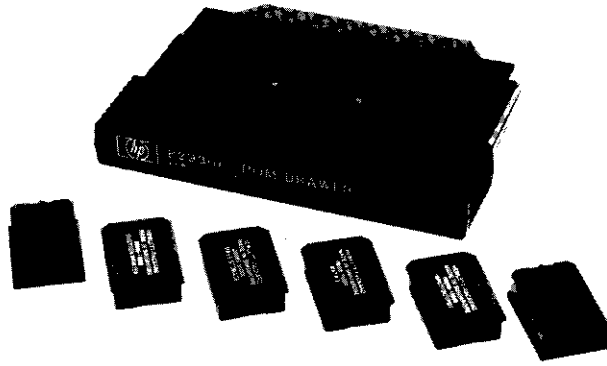
This ROM lets you interface your Series 80 Personal Computer with HP's high-resolution graphics plotter and full-width line printers. It also adds several graphics enhancements to the standard Series 80 CRT graphics.

STATEMENTS AND FUNCTIONS

AXES—Draws a pair of axes with optional tic marks.
BLINK—Turns off the CRT while B PLOT statements write information to the graphics display.
B PLOT—Byte plot. Allows plotting any series of dots on the graphics display by conversion to an alphanumeric string.
BREAD—Byte read. Reads the contents of the graphics display into the specified string variable, enabling you to read and store the entire graphics display in one variable.
CLIP—Defines plotting boundaries (soft-clips) in current units mode, enabling you to highlight or make windows around specified areas of your graph.
CRT IS—Defines default display device, directing all output that defaults to the CRT to the specified device. An optional line length parameter can be used to select line length formatting for the device.
CSIZE—Character size. Specifies the height, width-height aspect ratio, and slant of characters used in labels.
CURSOR—Stores the values of the current cursor coordinates in the specified variable names.
DIGITIZE—Enables point digitizing from an external plotter.
DRAW—Drops the pen and draws to the specified coordinate position.
ERRORM—Returns the number of the ROM that issued an error message.
ERRSC—Returns the select code of the interface module that received an illegal operation.
FXD—Establishes the label format for automatic axes labeling with the LAXES and LGRID statements.

FRAME—Draws a box around current plotting area.
GCLEAR—Clears the graphics display.
GRAPHICS—Switches the CRT to graphics mode if it is not already there.
GRID—Draws a full scale grid with optional tic marks on the grid lines.
IDRAW—Lowers the pen and draws a line of specified incremental length from the current pen position.
IMOVE—Lifts the pen and moves it an incremental distance from the current pen position.
I PLOT—Provides incremental plotting with pen control from the last plotted point.
LABEL—Used like the PRINT statement to draw labels on an external plotter or the graphics display.
LABEL USING—Used like the PRINT USING statement to draw formatted labels on the plotting device. The image format string determines the exact form of the labels.
LAXES—Label axes. Draws and labels a pair of axes. Labels are placed outside the plotting area, within the graphic limits, at each major tic mark.
LDIR—Label direction. Specifies the angle at which subsequent labels will be drawn.
LGRID—Label grid. Draws and labels a grid. Labels are placed outside the plotting boundaries, within the graphic limits, on each grid line.
LIMIT—Defines the graphic limits beyond which the pen is not allowed to move. When the optional parameters are not included, two corner points of the plotting area can be digitized to define the graphic limits.
LINETYPE—Selects one of eight solid or dashed line types.
LOCATE—Specifies the plotting boundaries upon which SCALE or SHOW will map. Lines drawn or plotted in user units will not be allowed to cross the plotting boundaries specified by LOCATE. Useful for creating a window for your plot, saving space outside the window for labels.
LORG—Label origin. Determines where subsequent labels are drawn relative to the current pen location. Useful for positioning or centering labels.
MOVE—Lifts the pen and moves it to the specified coordinate position.
MSCALE—Scales the current plotting area in

millimeters.
NOBLINK—Places the computer in a mode such that B PLOT statements write their information to the CRT with the CRT remaining on.
PDIR—Plot direction. Sets the angle of rotation for relative and incremental plotting.
PEN—Specifies the number or color (1 through 4) of the pen to be used.
PENUP—Lifts the pen.
PLOT—Provides absolute data plotting and pen control.
PLOTTER IS—Specifies the target of all plotter statements and operations.
PRINTER IS—Defines the default printer, directing all output that initially defaults to the internal printer to the specified device. An optional line length parameter can be used to select the line width formatting for the device.
RATIO—Returns a value equal to the ratio of the physical dimensions of the graphic limits, i.e., the x dimension divided by the y dimension.
R PLOT—Relative plot. Enables relative plotting and pen control from the last pen position determined by a statement other than R PLOT. The direction may be rotated with the PDIR statement.
SCALE—Defines the user units that are mapped onto the plotting area or LOCATE rectangle.
SETGU—Sets graphic units as the current units mode.
SET I/O—Enables you to write information directly to the registers in an interface module.
SETUU—Sets user units as the current units mode.
SHOW—Defines an isotropic scale (one unit of x equals one unit of y) in user units within the plotting boundaries.
TRANSLATE—Provides an easy means of translating CRT-directed graphics programs into programs that use the Plotter/Printer ROM routines for plotting to an external device.
UNCLIP—Sets the plotting boundaries (which are set by LOCATE or CLIP) equal to the graphic limits.
WHERE—Assigns the coordinate values of the last plotted or moved-to point and the pen's up or down status to the specified variables.
XAXIS—Draws a horizontal axis at the specified y-intercept.
YAXIS—Draws a vertical axis at the specified x-intercept.



HP I/O ROM (00085-15003)

HP's BASIC language capability in Series 80 Personal Computers is enhanced with straightforward I/O commands by the I/O ROM. It provides all the commands necessary to access the features of each of the Series 80 interfaces. The I/O ROM adds 8,192 bytes of read-only memory to the operating system and uses 416 bytes of read/write memory.

GENERAL STATEMENTS

The I/O ROM adds bit manipulation, base conversion, keyboard masking, and error determination capabilities to Series 80 Personal Computers.

BINAND—Logical AND of two 16-bit values.
BINCMP—Binary complement of a 16-bit value.
BINEOR—EXCLUSIVE OR of two 16-bit values.
BINIOR—INCLUSIVE OR of two 16-bit values.
BIT—Value of a specified bit.
BTD—Decimal value of a binary string.
DTB\$—Returns a string with a binary representation of a decimal number.
DTH\$—Returns a string with a hexadecimal

representation of a decimal number.
DTOS—Returns a string with an octal representation of a decimal number.
ENABLE KBD—Disable/enable sections of the keyboard.
ERROR—Returns number of last option ROM that caused an error.
ERRSC—Returns the select code of the last card that caused an error.
HTD—Returns the decimal value of a hexadecimal string.
OTD—Returns the decimal value of an octal string.

UNIVERSAL I/O STATEMENTS

The I/O ROM adds a set of interfacing capabilities to a Series 80 mainframe which are common to all interfaces. These capabilities provide for data transfers, data conversions, interface control, interrupts, and end-of-line branching.
CONTROL—Access to I/O card control registers or I/O buffer control registers.
CONVERT—Sets up conversion tables for ENTER or OUTPUT on a specified select code or an I/O buffer. The conversion can be an indexed table or a pairs lookup table.
ENABLE INTR—Interrupt on a specified condition.

ENTER—Formatted or free-field data from an I/O card or I/O buffer.
IOBUFFER—Turns a string variable into an I/O buffer.
OFF EOT—Turns off the end of transfer end-of-line branch.
OFF INTR—Turns off the ENABLE INTR end-of-line branch.
OFF TIMEOUT—Turns off the SET TIMEOUT end-of-line branch.
ON EOT—Specifies destination on end of transfer.
ON INTR—Specifies destination on interrupt.
ON TIMEOUT—Specifies destination on handshake timeout.
OUTPUT—Formatted or free-field output to I/O card or buffer.
RESET—Hardware reset of the I/O card.
SET TIMEOUT—Causes handshakes to an I/O card to be timed; if timeout occurs, then branch is taken to service routine.
STATUS—Access to I/O card or buffer.
TRANSFER—Allows for fast handshake (FHS) or interrupt data transfers between an I/O buffer and an I/O card.

Statements specific to interfaces are listed in the section: Series 80 Interfaces.

HP Matrix ROM (00085-15004)

The Matrix ROM gives you a powerful set of statements and functions for working with arrays—both matrices (two-dimensional arrays) and vectors (one-dimensional arrays). It lets you perform calculations with more convenience, speed, and accuracy than you could using your Series 80 Personal Computer alone.

STATEMENTS AND FUNCTIONS

ABSUM—Sum of absolute values of elements in array.
AMAX—Value of largest element in array.
AMAXCOL—Column number of largest element in array most recently specified in AMAX function.
AMAXROW—Row number of largest element in array most recently specified in AMAX function.
AMIN—Value of smallest element in array.
AMINCOL—Column number of smallest element in array most recently specified in AMIN function.
AMINROW—Row number of smallest element in array most recently specified in AMIN function.
CNORM—Largest sum of absolute values of elements in each column of array (column norm).
CNORMCOL—Column number with largest sum of absolute values in array most recently specified in CNORM function.
DET—Determinant of matrix.
DETL—Determinant of last matrix inverted in MAT INV statement or specified as first argument in MAT SYS statement.

DOT—Sum of products of corresponding elements of vectors (dot product or scalar product).
ERROR—Number designating last plug-in ROM to generate error message.
FNORM—Square root of sum of squares of elements in array (Frobenius norm or Euclidean norm).
LBND—Lower bound of array subscript.
MAT =—Assigns value of numeric expression or values of all elements of operand array to elements of result array. Alternatively, assigns specified elements of operand array to specified elements of result array.
MAT (+, -, *, /, or *)—Performs specified arithmetic operation between array and scalar (number, numeric variable, or numeric expression) or between two arrays. Alternatively, performs matrix multiplication.
MAT = * + *—Adds two products of a scalar and an array.
MAT CON—Assigns value 1 to all elements of array.
MAT CROSS—Finds cross product (vector product) of two 3-element vectors.
MAT CSUM—Adds values of elements in each column of array.
MAT IDN—Assigns value 1 to all diagonal elements of matrix, and assigns value 0 to all other elements.
MAT INV—Finds inverse of matrix.
MAT INV *—Multiplies inverse of matrix by another array.
MAT RSUM—Adds values of elements in each row of array.
MAT SYS—Solves linear equation $Ax = B$ for unknown array x , given any square matrix A and any other array B .

MAT ZER—Assigns value 0 to all elements of array.
MAT TRN—Finds transpose of array.
MAT TRN *—Multiplies transpose of array by another array.
MAT = * TRN—Multiplies array by transpose of another array.
MAT DISP—Displays elements of array(s).
MAT DISP USING—Displays elements of array(s) according to format string specified in this statement or in IMAGE statement whose statement number is specified.
MAT INPUT—Assigns values input from keyboard to elements of array(s).
MAT PRINT—Prints elements of array(s).
MAT PRINT USING—Prints elements of array(s) according to format string specified in this statement or in IMAGE statement whose statement number is specified.
MAT READ—Assigns values listed in DATA statement(s) to elements of array(s).
MAXAB—Largest absolute value of any element in array.
MAXABCOL—Column number of element with largest absolute value in array most recently specified in MAXAB function.
MAXABROW—Row number of element with largest absolute value in array most recently specified in MAXAB function.
REDIM—Changes working size of array(s) to size specified.
RNORM—Largest sum of absolute values of elements in each row of array (row norm).
RNORMROW—Row number with largest sum of absolute values in array most recently specified in RNORM function.
SUM—Sum of elements in array.
UBND—Upper bound of array subscript.

HP Advanced Programming ROM (00085-15005)

(Available Spring 1981)

The functions, statements, and commands of this ROM give you extended control over data, programs, and your Series 80 system operations. You can execute subprograms; create string arrays; use the entire keyboard for branching operations; position the cursor during program execution; read string information directly from the display; find and replace program variables; cross-reference both program statements and program variables; merge programs; and set, clear, and test 64 program flags. This additional flexibility when designing programs can enhance your programming productivity.

STATEMENTS AND FUNCTIONS

ALPHA—Moves cursor to a specified row/column on the ALPHA screen.
AREAD—Fills string variable or substring with screen contents.
AWRIT—Displays contents of string.
CALL—Transfers program execution to specified subprogram.
CFLAG—Clears specified flag to 0.
CRT OFF—Turns display screen off. Speeds up PRINT#ing and READ#ing data during mass storage operations.
CRT ON—Turns display screen on.
CURSCOL—Returns number of cursor's column location.
CURSROW—Returns number of cursor's row location.
DATE\$—Returns system clock reading as year/month/day.
DIRECTORY—Displays length of main program, names and sizes of subprograms in memory,

and their relative positions in memory.
ERRM—Displays most recent error message.
ERROR—Returns number of last plug-in ROM that generated an error message.
FINDPROG—Locates specified subprogram.
FLAG—Returns 1 if specified flag (1 through 64) is set, a 0 if not.
FLAG\$—Returns 8-character string whose binary representation shows all 64 flag settings.
GET\$—Returns string array element specified.
HGL\$—Underlines characters in given string.
HMS—Converts hours/minutes/seconds string to equivalent number of seconds.
HMS\$—Converts specified number of seconds to hours/minutes/seconds format.
KEYLAG—Sets time delay before key output starts repeating. Sets rate of repetition.
LINPUT—Assigns input from keyboard to a string or substring.
LWC\$—Converts uppercase letters of a string to lowercase.
MDY—Converts month/day/year string to equivalent Julian day number.
MDY\$—Converts specified Julian day number to month/day/year format.
MERGE—Retrieves specified program from mass storage, rennumbers it, and merges it with current main program.
NPAR—Returns number of parameters passed in CALL statement to the subprogram.
OFF CURSOR—Suppresses cursor while program is running.
OFF KYBD—Deactivates keys in string so they no longer cause immediate branching.
ON KYBD—Declares keys active for branching during a running program.
PAGE—Sets number of lines per page for a PLIST operation.
READTIM—Number of seconds counted by a

system timer after timer has been set in a program.
REPLACEVAR—Replaces variable name with another.
RENUM—Rennumbers program or subprogram.
REV\$—Reverses order of character string.
ROTATE\$—Wraps string around on itself, shifting characters in a specified direction.
RPT\$—Concatenates string with itself a specified number of times.
SARRAY—Declares string variables to be string arrays.
SCAN—Locates and displays next line containing a specified string or variable.
SCRATCHBIN—Clears binary program in memory.
SCRATCHSUB—Deletes specified subprogram.
SFLAG—Sets specified flag (1 through 64) to 1.
SLET—Puts string expression into string array at specified location.
SMAX—Returns highest subscript number of specified string array.
SUB—First line of specified subprogram. Designates parameters whose values are received from calling program.
SUBEND—Last line of subprogram. Returns execution to calling program.
SUBEXIT—Returns execution to calling program from anywhere within a subprogram.
TIME\$—System clock reading in hours/minutes/seconds format.
TRIM\$—Removes leading and trailing blanks from string expressions.
XREF L—Generates cross-reference table of line numbers referenced by other program statements.
XREF V—Generates table of program variables, showing line numbers of statements that reference them.

HP Assembler ROM (00085-15007)

The Assembler ROM provides you with the capability to write customized Assembly language programs that can be executed from RAM memory or burned into EPROM's (erasable programmable ROM's). You can write programs that allow you to: create customized BASIC keywords; redefine existing BASIC commands and functions; expand input/output control; increase speed in various applications; and store both source code and object code on either tape cartridges or discs.

STATEMENTS AND FUNCTIONS

ALOAD—Loads Assembly language source code.
ASSEMBLE—Assembles source code and stores object code.
ASSEMBLER—Enters Assembler mode.
ASTORE—Stores Assembly language source code.
BASIC—Returns to BASIC mode.
BKP—Sets breakpoint.
CLR—Clears breakpoint.
DEC—Decimal value of octal number.
FLABEL—Finds label.

FREFS—Finds label references.
MEM or **MEMD**—Dumps contents of computer RAM or ROM memory to CRT. Optional parameters allow you to address ROM's, to specify number of bytes to dump (default is 64), and to change contents to other values.
OCT—Octal value of decimal number.
REL—Returns absolute address of relative address in a binary program.
SCRATCHBIN—Scratches binary program.
TREM—Toggles remark output on listings.

HP 82928A System Monitor

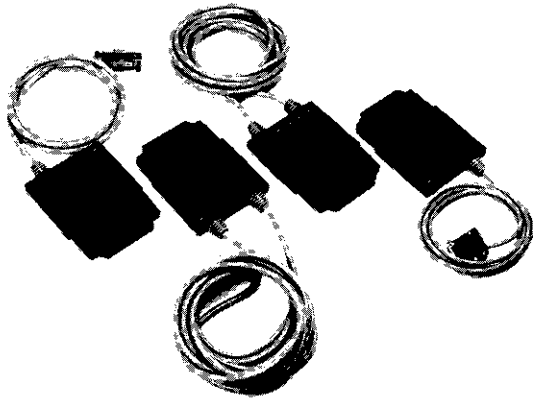
(Available Spring 1981)

The System Monitor provides the necessary hardware to aid in the development and debugging of Assembly language software for HP Series 80 Personal Computers. Together, the Assembler ROM, Programmable ROM Drawer, and System Monitor provide a software development package.

HP 82929A Programmable ROM Drawer

(Available Spring 1981)

This drawer lets you use the firmware created with the Assembler ROM and System Monitor in HP Series 80 Personal Computers.



SERIES 80 INTERFACES

HP interfaces are used to link off-line peripherals to a Series 80 mainframe or to form input/output (I/O) control systems suited to many applications. Currently, Series 80 includes five plug-in interfaces. They relieve you of complex interfacing tasks so you can concentrate on using your system. Each comes with an installation and operation manual.

HP 82937A HP-IB Interface

The HP-IB is an easy-to-use hardware and software interface system that permits bidirectional, asynchronous communication among a wide variety of instruments and peripherals. It implements the IEEE 488-1978 Standard Digital Interface for Programmable Instrumentation and allows your mainframe to communicate with as many as 14 HP-IB compatible instruments per interface, with a total of no more than 20 meters of cable. A unique three-wire handshake allows the bus to communicate at a speed that all listening devices can maintain. (If a slow device is not addressed, it will not hamper the speed of the remaining devices.) The HP-IB uses an interface processor for efficient management of the interface bus protocol.

**DATA INPUT/
OUTPUT** eight bidirectional data lines

CONTROL LINES three-line handshake (DAV, NRD, NDAC)

**INTERFACE
MANAGEMENT** five lines (IFC, ATN, SRQ, REN, EOI)

INTERFACE FUNCTIONS

Level of implementation in terms of IEEE 488-1978 mnemonics follows. The Device Trigger, Device Clear, and Remote/Local state responses are achieved by programming the mainframe for end-of-line interrupts on those conditions.

Source Handshake SH1
 Acceptor Handshake AH1
 Talker T6
 Listener L4
 Service Request SR1
 Remote/Local RL1
 Parallel Poll PP2
 Device Clear DC1
 Device Trigger DT1
 Controller
 System control C1
 IFC & Take charge C2

†The HP-IB allows for interrupts on secondary commands. This lets a user program the mainframe to respond to TE4 and LE2 extended talker and listener.

* Common to all Series 80 I/O interfaces.

REN C3
 Respond SRQ C4
 Miscellaneous control C5
 Extended talker TE0†
 Extended listener LE0†

TRANSFER RATES (maximum)

Type	Input (bytes/sec)	Output (bytes/sec)
TRANSFER INTR ENTER & OUTPUT	400	400
TRANSFER FHS	1.4K	3K
	26.2K	25.5K

ADDRESSING

There are 32 valid addresses, 0 through 31. (Electrically, IEEE 488 systems can support only 15 devices including the controller.)

INTERRUPT CAPABILITY (with I/O ROM)

Active controller Interface clear (IFC)
 Active talker Device clear (DCL, SDC)
 Active listener Device trigger (GET)
 Service request (SRQ) Secondary command (SCG)

SWITCH CONFIGURATION

The following switches can be configured by opening the interface:
 Select Code
 Interface Bus Address
 System Controller

JUMPER CONFIGURATION

The HP 82937A can be configured by a jumper wire to respond to a parallel poll. The designated bit is then asserted in response to a parallel poll when the interface is asserting SRQ. The card is configured with a parallel poll response on bit 0 of the data lines.

ACCESSORIES

The HP 82937A is shipped with a 2-m (6.6-ft)

interface cable terminated with the standard HP-IB connector and metric fasteners. Additional lengths of interface cables can be purchased.

HP-IB INTERFACE STATEMENTS

The I/O ROM adds a set of statements to the mainframe that accesses capabilities determined by the interface being used. The following describes how the HP-IB interface interprets these statements.

ABORTIO—Sends Interface Clear if system controller, else sends My Talk Address if active controller, else stops handshaking data.
 ASSERT—Provides access to bus management lines.
 CLEAR—Sends Selective Device Clear or Device Clear.
 HALT—Stops an interrupt type TRANSFER.
 LOCAL—Go To Local or Remote Disable.
 LOCAL LOCKOUT—Sends Local Lockout message.
 PASS CONTROL—Passes active control.
 PPOLL—Returns the value of a parallel poll.
 REMOTE—Remote Enable.
 REQUEST—Allows the programmer to set service request line and the serial poll response byte.
 RESUME—Drops the attention line (ATN).
 SEND—Allows sending of arbitrary data/command sequences.
 SPOLL—Returns the value of a serial poll.
 TRIGGER—Sends Group Execute Trigger.

STATUS REGISTERS—7

One each for bus address, system controller setting, card state (talker, listener, etc.), received secondary command, state of data and control lines, card identification number* (1 for HP-IB), and interrupt cause register*.

CONTROL REGISTERS—12

One each for parity, HP-IB data lines, control lines, interrupt mask*, end-of-line character count*, and seven registers for the end-of-line characters* (end-of-line sequence is sent at end of each OUTPUT or TRANSFER).



HP 82939A Serial Interface (RS-232C)

The serial interface is the RS-232C compatible interface for Series 80 Personal Computers. It provides bit-serial asynchronous data communication and is a common means of communicating between a computer and

peripherals such as terminals and printers. The serial interface is also common in applications where two computers are communicating, such as remote data acquisition. This interface supports operation with a Series 80 mainframe acting as the computer or as the peripheral. It also supports current-loop operation—a mode of serial operation used by devices such as mechanical teletypes.

Information can be sent and received (in true full duplex mode) in EIA RS-232C compatible voltage levels or with 20-mA current loop configurations. Two 20-mA current sources in the interface allow connection to virtually any current loop device. The HP 82939A uses an interface processor to provide efficient management of the serial interface.

(continued)

DATA RATES AND FORMATS

All signals present at the connector conform electrically to EIA RS-232C and CCITT V.24 specifications. The interface operates in an asynchronous mode providing 5-, 6-, 7- or 8-bit data formats with 1 or 2 stop bits and odd, even, zero, one, and no parity modes.

Standard data rates available are:

50	75	110	134.5
150	200	300	600
1200	1800	2000	2400
3600	4800	7200	9600

In addition to these standard baud rates, the user can select one from a set of 65,533 different baud rates ranging from 1.76 baud to 38,400 baud. The standard baud rates are either switch selectable or programmable. The optional 65,533 baud rates are only programmable.

MODEM CONTROL LINES—6

RTS—Request To Send
 CTS—Clear To Send
 DSR—Data Set Ready
 DTR—Data Terminal Ready
 DCD—Data Carrier Detect
 DRS—Data Rate Select

TRANSFER RATES (maximum)

Type	Input (bytes/sec)	Output (bytes/sec)
TRANSFER INTR ENTER & OUTPUT	1K	400
TRANSFER FHS	1.4K none	1.5K none

These data rates mean that the serial interface can support incoming data rates of 9,600 baud (with interrupt mode transfers) and 15,000 baud with ENTER (into a string variable).

*Common to all Series 80 I/O interfaces.

ADDRESSING

The I/O ROM allows address information to be sent to all interfaces. The HP 82939A Serial Interface does not use this addressing information and will generate an error if used.

INTERRUPT CAPABILITY (with I/O ROM)

BREAK received
 Framing Error
 Parity Error
 Received data available
 Auto disconnect
 Change of modem line DCD or RTS:
 Data Carrier Detect (on Opt. 001 interface)
 Request To Send (on standard interface)
 Change of modem line DSR or DRS:
 Data Set Ready (on Opt. 001 interface)
 Data Rate Select (on standard interface)
 Change of modem line CTS or DTR:
 Clear To Send (on Opt. 001 interface)
 Data Terminal Ready (on standard interface)

SWITCH CONFIGURATION

The following switches can be configured by opening the interface:

Select code	Parity
Baud rate	Auto handshake
Line characteristics	

OPTIONS

The HP 82939A is shipped with a 2-m (6.6-ft) interface cable terminated with the standard RS-232C female (DCE) connector. The HP 82939A Option 001 is shipped with a 2-m (6.6-ft) interface cable terminated with a RS-232C male (DTE) connector. The HP 82939A Option 002 is shipped

with a 4-m (13.1-ft) unterminated interface cable for current loop operation.

SERIAL INTERFACE STATEMENTS

The I/O ROM adds a set of statements to the mainframe that accesses capabilities determined by the interface being used. The following describes how the serial interface interprets these statements.

ABORTIO—Aborts all TRANSFER's in progress (to the specified card) and drops all modem lines.
 ASSERT—Writes to modem control register.
 HALT—Aborts all TRANSFER's in progress (to the specified card) but leaves all modem lines unchanged.
 REQUEST—Sends a BREAK using the parameter to determine the length of the BREAK.
 RESUME—Enables the transmitter.
 SEND—Sends arbitrary data sequences.

CONTROL AND STATUS REGISTERS

The HP 82939A Serial Interface has 12 status registers and 22 control registers implemented. The status registers include direct state of the modem control lines, cable type, line characteristics (parity, number of bits/character, number of stop bits), current 16-bit baud rate divisor, reason for termination of ENTER or TRANSFER, card identification number* (2 for serial) and the interrupt cause register*.

The 22 control registers consist of standard baud rate selection, line characteristics selection, 16-bit baud rate divisor selection (for non-standard baud rates), direct control over the modem lines, termination character selection for up to four different characters, interrupt mask*, seven end-of-line characters*, and the end-of-line character count*. (The end-of-line sequence is sent at the end of each OUTPUT or TRANSFER.) One of the registers allows for a replacement character to be sent to the mainframe when an incoming character has a parity or framing error.

HP 82940A GPIO Interface (Parallel)

The GPIO Interface is a general purpose byte (8-bit) or word (16-bit) oriented interface. It has two output-only 8-bit ports and two bidirectional 8-bit ports. They can be used as separate 8-bit ports or as 16-bit ports. The parallel interface is commonly used with printers, paper tape readers, paper tape punches, card readers, and special instrumentation. The HP 82940A provides the mainframe with 16 bits of latched output data and 16 bits of bidirectional data (latched output, non-latched input). The HP 82940A uses an interface processor for efficient management of the interface.

DATA INPUT/OUTPUT

There are 16 bidirectional data lines and 16 output-only data lines. The output-only lines provide high current capability, using open-collector transistors.

Electrical Characteristics for Bidirectional Lines (Input characteristics also apply to FLG and ST lines)

Parameter	Min.	Max.	Units
Input Low Voltage	0.0	0.8	V
Input High Voltage	2.0	5.0	V
Input Low Current		0.6	mA
Output Low Voltage @ 4.5 mA		0.45	V
Output High Voltage @ -450 μ A	2.4		V
Output Low Current		4.5	mA
Output High Current		-450	μ A

Electrical Characteristics for Output-Only, CTL, OUT, and RES Lines

Parameter	Min.	Max.	Units
Output Low Voltage @ 20 mA		0.5	V
Output High Voltage (open collector)		5.0	V
Output Low Current		20	mA
Output Leakage Current		40	μ A

CONTROL LINES

Twelve lines provide control information between the peripheral and the computer. The outgoing lines are electrically equivalent to the open-collector, output-only data lines. The incoming lines are electrically equivalent to the bidirectional data lines. The control lines and their meanings are:

OUTA, OUTB—Indicates the direction of the data transfer on ports A and B.
 CTLA, CTLB—Indicates that the computer is ready for input or that data is ready for output.
 FLGA, FLGB—Indicates that the peripheral has completed its operation.
 CTL0, CTL1—Indicates that the computer is ready for input or that data is ready for output.
 ST0, ST1—Indicates that the peripheral has completed its operation.
 RESA, RESB—Used to reset peripherals under program control.

TRANSFER RATES (maximum)

Type	Input (bytes/sec)	Output (bytes/sec)
TRANSFER INTR ENTER & OUTPUT	400	400
TRANSFER FHS	1.4K 18K	3K 19K

ADDRESSING

The I/O ROM allows address information to be sent to all interfaces. The HP 82940A GPIO Interface uses this addressing information to select which port is being used for the data transfer, the width of the data path (8 or 16 bits), and which handshake lines are to be used. There are a total of 16 valid addresses—0 through 15.

INTERRUPT CAPABILITY (with I/O ROM)

FLGA	ST1
FLGB	Received parity error
ST0	

SWITCH CONFIGURATION

The following switches can be configured by opening the interface:

Select code	Handshake mode
Data line sense	Output enable
Flag line sense	Address
Control line sense	

(continued)

GPIO INTERFACE STATEMENTS

The I/O ROM adds a set of statements to the mainframe that accesses capabilities determined by the interface being used. The following describes how the GPIO interface interprets these statements.

ABORTIO—Aborts current TRANSFER; returns handshake lines to their idle state.
ASSERT—Allows access to control lines.
CLEAR—Sets RESET-A or RESET-B line.

HALT—Stops an interrupt TRANSFER leaving handshake and data lines undefined.
SEND—Sends arbitrary data sequences.

CONTROL AND STATUS REGISTERS

The HP 82940A GPIO Interface has ten status registers and 18 control registers implemented. The status registers allow for reading back the values of control registers. The interface identification number (4 for parallel) and the interrupt cause

register complete the set. The control registers allow direct access to CTL and RESET lines, logic sense (for FLG, CTL, data lines) and handshake mode. Control registers also allow skipping incoming characters until a character meets a relation (<, =, >, or some combination of conditions) with a trigger character. Also included are the registers for interrupt mask, seven end-of-line characters, and the end-of-line character count. (The end-of-line sequence is sent at the end of each OUTPUT or TRANSFER.)

HP 82941A BCD Interface (Binary Coded Decimal)

The BCD interface supports interfacing with BCD instrumentation. A BCD instrument presents digits on a set of parallel lines. Common instruments with BCD interfaces are voltmeters, multimeters, medical equipment, and weighing systems. The HP 82941A provides the mainframe with 11 digits of 4-bit BCD input or output data plus four sign bits for one or two channels. It uses an interface processor to provide efficient management of the interface and can achieve data transfer rates of up to 1.4K readings/sec.

DATA INPUT/OUTPUT

Twelve bidirectional ports, of four lines each, provide data input and output.

Electrical Characteristics for Data Lines

Parameter	Min.	Max.	Units
Input Low Voltage	0.0	0.8	V
Input High Voltage	2.0	5.0	V
Input Low Current		0.6	mA
Output Low Voltage @ 4.5 mA		0.45	V
Output High Voltage @ -450 μ A	2.4		V
Output Low Current		4.5	mA
Output High Current		-450	μ A

CONTROL LINES

Six lines allow for control information to be passed between the peripherals and the computer. The output control lines are implemented with standard TTL gate 7405 open-collector drivers.

I/OA, I/OB—Indicates the direction of the data transfer on channels A and B.
CTLA, CTLB—Ready for input or output.
FLGA, FLGB—Peripheral has completed its operation.

Electrical Characteristics for CTL and I/O Direction Lines

Parameter	Min.	Max.	Units
Output Low Voltage @ 13 mA		0.4	V
Output High Voltage @ -1.0 mA	2.4		V
Output Low Current		13	mA
Output High Current		-1.0	mA

Electrical Characteristics for FLG Lines

Parameter	Min.	Max.	Units
Input Low Voltage	0.0	0.8	V
Input High Voltage	2.0	5.0	V
Input Low Current		4.0	mA

DATA FORMATS

The HP 82941A supports a wide variety of user-configurable data formats and two predefined data formats:

Single channel8-digit signed mantissa with 1-digit signed exponent and a 1-digit function code
 Dual channeleach channel consists of a 4-digit signed mantissa and a 1-digit function code

TRANSFER RATES (maximum)

Type	Input (bytes/sec)	Output (bytes/sec)
TRANSFER INTR ENTER & OUTPUT	400	400
TRANSFER FHS	1.4K	3K
	20K	22K

ADDRESSING

The I/O ROM allows address information to be sent to all interfaces. The HP 82941A BCD Interface uses this addressing information to select which channel is being used for the data transfer and which of the fields are being read—numeric data (mantissa, exponent, and sign information) or function code. There are a total of seven valid addresses—0 through 6.

INTERRUPT CAPABILITY (with I/O ROM)

Channel A most significant function digit, bit 0
 Channel A most significant function digit, bit 1
 Channel A most significant function digit, bit 2
 Channel A most significant function digit, bit 3
 Channel B most significant function digit, bit 0
 Channel B most significant function digit, bit 1
 Channel B most significant function digit, bit 2
 Channel B most significant function digit, bit 3

DEVICE CONTROL

The HP 82941A Interface allows the user to control a BCD device via one of the BCD digits. To OUTPUT control information to the device would require opening the card and reconfiguring it by setting a switch. To avoid this, Port 10, accessed via ASSERT, allows the user to control the device without this reconfiguration.

SWITCH CONFIGURATION

The following switches can be set by opening the interface:

Select code	Sign bits sense
Format	Control line sense
Handshake	Flag line sense
Data line sense	Output enable

BCD INTERFACE STATEMENTS

The I/O ROM adds a set of statements to the mainframe that accesses capabilities determined by the interface being used. The following describes how the BCD Interface interprets these statements.

ABORTIO—Aborts the current TRANSFER and returns the interface lines to a tri-state high impedance state.
ASSERT—Allows access to control lines and Port 10.
HALT—Stops any TRANSFER; leaves the handshake and data lines unchanged.
SEND—Sends arbitrary data sequences.

CONTROL AND STATUS REGISTERS

The HP 82941A BCD Interface has 11 status registers and ten control registers implemented. The status and control registers allow a user to set and examine the logic sense for the handshake, data digit, function digit, and sign bit lines. The registers also allow access to the number of digits allocated to channels A and B for the mantissa, exponent, and function. There are also two status registers common to all cards that contain the card identification number (3 for BCD) and the interrupt cause register. The common end-of-line count and character registers, and the interrupt mask register are not implemented on the BCD card.

HP 82949A Printer Interface (Available Spring 1981)

This easy-to-use interface lets you connect 8-bit parallel (Centronics-type) printers to Series 80

Personal Computers. The HP 82949A uses an interface processor for efficient management of the printer interface.



WHY BUY HEWLETT-PACKARD?

When you buy a Series 80 system, you receive more than just hardware. Every piece is the product of technical expertise and years of experience. Quality and reliability are built in.

And, Hewlett-Packard's support doesn't end with the sale. An initial warranty period and choice of service agreements assure you that your system will keep on performing. Furthermore, Hewlett-Packard is committed to providing new hardware and software options.

For a closer look, visit your nearest Hewlett-Packard dealer or contact a Hewlett-Packard sales representative. For locations, call toll free 800-547-3400 in the U.S. (except Alaska and Hawaii). In Oregon, call 758-1010.

United States

Hewlett-Packard
Corvallis Division
1000 N.E. Circle Blvd.
Corvallis, Oregon 97330

**Europe, North Africa,
Middle East**

Hewlett-Packard S.A.
7, rue du Bois-du-Lan
P.O. Box,
CH-1217 Meyrin 2
Geneva, Switzerland

Canada

Hewlett-Packard
(Canada) Ltd.
6877 Goreway Drive
Mississauga, Ontario
L4V1M8

Hong Kong

Hewlett-Packard
Hong Kong Ltd.
5th and 6th Floors
Sun Hung Kai Centre
30 Harbour Rd.
Hong Kong

Japan

Yokogawa
Hewlett-Packard Ltd.
29-21, Takaide-Higashi
3-chome
Suginami-ku, Tokyo 168

Singapore

Hewlett-Packard
Singapore (Pty.) Ltd.
Alexandra Post Office
P.O. Box 58, Singapore
9115

Australia

Hewlett-Packard
Australia (Pty.) Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
Australia

South Africa

Hewlett-Packard
SA (Pty.) Ltd.
Private Bag, Wendywood
Sandton, Transvaal, 2144
South Africa

New Zealand

Hewlett-Packard (N.Z.) Ltd.
P.O. Box 9443
Courtenay Place,
Wellington

Other Countries

Hewlett-Packard
Intercontinental
3495 Deer Creek Road
Palo Alto, California 94304
U.S.A.



HEWLETT
PACKARD