HP 9845 Computer Specifications

HEWLETT PACKARD

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System 45 is Hewlett-Packard's top-of-the-line integrated graphics computer. Designed primarily for the scientist and engineer, the System 45 can solve complex computation, design and data acquisition problems. Its unique integrated architecture combines all the essential elements of computation — interactive keyboard, large memory (expandable from 56k to 449k bytes), monochrome or color graphics display, fast central processing unit, built-in line printer and dual tape drives — into a single, compact unit.

This integration is much more than just the compression of power, memory size and graphics capability into a compact configuration. It is the coordination of all these features to work toward a single purpose — the convenient and quick solutions to your application problems.

You can select from many different models of the System 45 depending on your computation and design needs. The 9845B offers two choices of monochromatic displays. The 9845C has a color graphics CRT. Both the 9845B and 9845C are available with a new, high-speed language processor, which provides computational performance that is three times faster than the standard performance 9845.

Both the System 45B and the System 45C are available in expanded, standard and minimum configurations. The expanded configuration has been designed to handle even the most demanding computation, design or I/O applications. The standard configuration has been selected as the system that will best meet most computer needs. The minimum configuration contains those features that are part of every 9845B and 9845C.

Features Features included with unit/option	**HP 9845C Expanded** 190	270	290	**HP 9845B Expanded** 190	270	290	**HP 9845C Standard** 150	250	**HP 9845B Standard** 150	250	**HP 9845C Minimum** 100	200	**HP 9845B Minimum** 100	200
High-resolution color graphics CRT	X	X	X				X	X			X	X		
High-speed language processor		X	X		X	X		X		X		X		X
Color graphics ROM	X	X	X				X	X			X	X		
Standard monochrome CRT				X					X				X	
High-performance monochrome CRT					X	X				X				X
Monochrome graphics ROM				X	X	X			X	X				X
Monochrome Graphics CRT subsystem				X	X	X			X	X				X
Alphanumeric CRT	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Interactive light pen	X	X	X		X	X	X	X		X				
449k bytes r/w memory	X		X	X		X								
318k bytes r/w memory		X			X									
187k bytes* r/w memory							X	X	X	X				
56k bytes* r/w memory											X	X	X	X
Mass storage ROM	X	X	X	X	X	X								
80-column thermal line printer	X	X	X	X	X	X	X	X	X	X				
CRT softkeys	X	X	X		X	X	X	X		X	X	X		X
Dual tape cartridge drives	X	X	X	X	X	X	X	X	X	X				
Single tape cartridge drive											X	X	X	X
Powerful HP enhanced BASIC language	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Advanced Programming ROM	X	X	X	X	X	X								
Structured Programming ROM	X	X	X	X	X	X								
Typewriter-like alphanumeric keyboard	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Dual processors	X	X	X	X	X	X	X	X	X	X	X	X	X	X
15 assignable levels of priority interrupt	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Direct Memory Access	X	X	X	X	X	X	X	X	X	X	X	X	X	X
I/O ROM	X	X	X	X	X	X								
Asynchronous Data Communications capability	X		X	X		X								
Data Base Management capability	X		X	X		X								

*Can be upgraded with memory options.

Note: Minimum and Standard systems can be upgraded to Expanded systems.

General Information

The following specifications are common to both the System 45B and 45C.

POWER REQUIREMENTS

Source ..... 110 Vac + 15%, −20%
(selected by
rear panel switch) ..... 220 Vac+15%, −20%
Line Frequency 48–66Hz
Power Consumption..... 500 watts (max.)
7.5A @ 90–126V
3.5A @ 198–252V

550 watts (max.) add'l for 9845C CRT display only

Powerline Susceptibility..... passes ± 400Vac pulse
(duration = 800 nanoseconds, rise time = 1 nanosecond) with 60Hz pulse repetition

Environmental Range

Operating Temperature ..... 5°C to 40°C
Storage Temperature ..... −40°C to +65°C
Relative Humidity..... 5% to 80% @40°C

Memory

Dynamic Range ..... -10^{99} to -10^{-99},0, $+10^{-99}$ to $+10^{99}$

Internal Calculation

Range..... -10^{511} to -10^{-511},0, $+10^{-511}$ to $+10^{511}$

Tape Cartridge

Capacity (per cartridge)..... 217 000 bytes
Access ..... directory (stored in r/w memory), file-by-name
Search Speed (bidirectional) ..... 2 286 mm/s. (90 in/s.)
Average Access Time ..... 6 s.
Average Transfer Rate ..... 1 440 byte/s.
Rewind Time ..... 19 s. (end to end)
Cartridge Size..... 63.5 x 82.5 x 12.7mm (2.5 x 3.25 x 0.5 in.)

Read/write

Verification ..... program recording
Error Check ..... check sum

For heavy use of mass storage files, such as non-consecutive file sorts or data base management applications, flexible disc drives or hard disc drives are required for optimum performance and reliability.

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Note: Tape cartridges are intended for nominal program or data storage; the typical life cycle is 50-100 hours of use, depending upon the application. It is suggested that tape transports be cleaned regularly and tape cartridges removed from drives after use.

THERMAL LINE PRINTER

Printing Speed..... up to 480 lines/minute
Plotting Speed:
normal mode ..... 25.4 mm/s. (1 in./s.)
CRT transfer..... 3.5 to 25 mm/s. (0.14 to 1 in./s.)
Character Matrix ..... 5 x 7 dots (7 x 12 field)
Noise Level:
9 hours @ 100% duty cycle .... 68 dba (max.)
0.5 hours @ 100% duty cycle..... 55 dba (avg.)
Paper Feed ..... automatic load
Paper Dimensions:
English version ..... 216 mm x 61m (8.5 in. x 200 ft.)
Metric version ..... 210mm x 60m (8.27 in. x 197 ft.)
Paper Types ..... black print, perforated blue print, continuous roll

Note: The 9845 printer is designed to print approximately 20 000 Ft. of paper (about 100 rolls) prior to print head replacement. However, actually print head life may vary widely depending upon usage. If you expect to do a lot of printing, we recommend that you consider purchasing a heavy duty printer such as one of the HP Line Printers.

CRT ALPHANUMERIC MODE

Character Generation ..... 7 x 9 character font in a 9 x 15 character cell
Cursor ..... blinking underline
Highlighting ..... inverse video, blinking and underlining
MOS Memory ..... 7 680 bytes of non-user read/write memory

KEYBOARDS

Standard ASCII,
also available in ..... French, Spanish, German Katakana, Swedish/Finnish

The following specifications vary between the HP 9845B and HP 9845C.

SPECIFICATIONS	HP 9845B (with standard processor and CRT)	HP 9845B (with enhanced processor and CRT)	HP 9845C
SIZE			
Height	478mm (18.8 in.)	546mm (21.5 in.)	546mm (21.5 in.)
Depth	671mm (26.4 in.)	762mm (30 in.)	762mm (30 in.)
Width	478mm (18.8 in.)	482.5mm (19 in.)	482.5mm (19 in.)
Cube	0.15m^3 (5.4 $ft.^3$)	.20m^3 (7.09 $ft.^3$)	.20m^3 (7.09 $ft.^3$)
NET WEIGHT			
Standard Mainframe	18.6 kg (41 lb.)	18.6 kg (41 lb.)	18.6 kg (41 lb.)
Standard CRT	10.43 kg (23 lb.)	18.6 kg (41 lb.)	29.5 kg (65 lb.)
Graphics Option	0.9 kg (2 lb.)	0.9 kg (2 lb.)	
Second Tape Drive	0.9 kg (2 lb.)	0.9 kg (2 lb.)	0.9 kg (2 lb.)
Optional Thermal Printer	5.22 kg (11.5 lb.)	5.22 kg (11.5 lb.)	5.22 kg (11.5 lb.)
SHIPPING WEIGHT (Approximate):	Opt. 100 = 53.6 kg. (118 lb.)	Opt. 200 = 63.5 kg (140 lb.)	Opt. 100, 200 = 75.4 kg. (166 lb.)
(Approximate):	Opt. 150 = 61.4 kg. (135 lb.)	Opt. 250 = 69.9 kg (154 lb.)	Opt. 150, 250 = 81.8kg. (180 lb.)
CRT			
Screen	310mm (12.2 in.) diagonal	310mm (12.2 in.) diagonal	330mm (13 in.) diagonal
Screen Brightness	Manually adjustable from 12 to 30 ft.–Lamberts	Manually adjustable from 12 to 30 ft.–Lamberts	Manually adjustable from 12 to 40 ft.–Lamberts (white)
X-ray Emission	≤0.5mR/hr.	≤0.5mR/hr.	≤0.5mR/hr.
Refresh Rate	60 Hz. (independent of line frequency)	60 Hz. (independent of line frequency)	60 Hz (independent of line frequency)
Tube Phosphor	P31	P31	P22
Implosion Protection	Tension band	Implosion panel	Tension band
Maximum Altitude	4 572m (15 000 ft.)	4 572m (15 000 ft.)	4 572m (15 000 ft.)
ALPHA RASTER SIZE	236 x 122.94mm (9.3 x 4.84 in.)	236 x 149mm (9.3 x 5.9 in.)	247 x 154mm (9.72 x 6.06 in.)
SCREEN CAPACITY	26 lines x 80 characters (2 080 characters)	26 lines x 80 characters (2 080 characters)	26 lines x 80 characters (2 080 characters)
DOT SPACING	0.328mm (0.013 in.)	0.328mm (0.013 in.)	0.343mm (0.0135 in.)
GRAPHICS MODE			
Raster Size	200x162.5mm (7.9x6.4in.)	184x149mm (7.2x5.8in.)	192x156mm (7.5x6.1 in.)
Display Speed (Vectors/s., overlapped and not clipped)			Opt. 100 / Opt. 200
For/Next	~ 50	~270	~95 / ~145
Matrix Plot	N.A.†	~430	~200 / ~240
Absolute Plot	N.A.†	~5000	~5000 / ~5000
Circles/s., not clipped	N.A.†	~240	~2 / ~5
Linearity	1.5% full screen	1.5% full screen	<2% full screen
Array Size	560 x 455 dots	560 x 455 dots	560 x 455 dots
Dot Resolution	0.357mm (0.014 in.)	0.33mm (0.013 in.)	0.034mm (0.013 in.)
CURSOR			
Plotting Mode	Full screen or blinking crosshair	Full screen or blinking crosshair	Full screen or small crosshair
Letter Mode	Blinking underline	Blinking underline	Blinking underline
Character Editing	Overstrike in letter mode	Overstrike in letter mode	Overstrike in letter mode
LIGHT PEN			
Weight	N/A†	125g. (4.4 oz.)	125g. (4.4 oz.)
Diameter		20.2mm (.8 in.)	20.2mm (.8 in.)
Length		157mm (6.18 in.)	157mm (6.18 in.)
Tracking Sampling Rate		60 Hz	60 Hz
Cursor Positioning Accuracy		1 Pixel	
Minimum Intensity for Pick of Single Pixel		10 ft. –Lamberts	10 ft. –Lamberts (white, blue, or green)

†Not applicable.

Options

Mainframe Options

READ/WRITE MEMORY

The System 45's memory is an expandable problem solver. User read/write memory expands from 56k bytes to 449k bytes. Because the System 45's 120k byte operating system resides in its own ROM, the entire read/write memory is available for your programs and data.

9845B Opt. 100, 200

Standard	56 266 total bytes
Opt. 204	187 146 total bytes
Opt. 205	318 026 total bytes
Opt. 206	448 906 total bytes

9845B Opt. 150, 250

Standard	187 146 total bytes
Opt. 215	318 026 total bytes
Opt. 216	448 906 total bytes

9845C Opt. 100, 200

Standard	56 060 total bytes
Opt. 204	186 940 total bytes
Opt. 205	317 820 total bytes
Opt. 206	448 700 total bytes

9845C Opt. 150, 250

Standard	186 940 total bytes
Opt. 215	317 820 total bytes
Opt. 216	448 700 total bytes

LIGHT PEN

The Light Pen (Opt. 775) is available as an option with the 9845C Opt. 100 or 9845B Opt. 200. It is standard equipment with the 9845C Opt. 150 and 9845B Opt. 250, and does not operate with the 9845B Opt. 100 or 150.

This graphics input tool enables the user to interactively pick, move and draw objects directly on the CRT. It features highly accurate picking, and fast tracking accomplished with a predictive firmware algorithm that enables the cursor to move at the same speed the user moves the pen.

GRAPHICS

(System 45B Opt. 100 only. Graphics ROM and CRT hardware are standard with all other models.)

The optional graphics hardware and Graphics ROM expand the System 45B's capabilities for use in complex applications such as circuit design and time series analysis. These separate options (hardware and ROM) allow you to plot, label and digitize on the CRT for easy-to-understand visual presentation. The System 45B graphics can create contour plots, part drawings, histograms, pie charts and Smith charts as well as any graph in the Cartesian coordinate system–all at a fraction of the cost of a large computer system.

Graphics Features

- Rapid plotting on the CRT
- High-level graphics language
- Hard-copy transfer to the optional internal thermal line printer
- Ten different line types on the CRT
- Digitizing data displayed on the CRT
- Output to four-color plotters and printer/plotters

LINE PRINTER

(Standard on the System 45B and C Opt. 150/250)

The System 45's low-cost 80-column thermal line printer (offered as either a field or factory-installed option) fits directly into the unit beneath the CRT. It contains the standard ASCII 128-character set with alternate character sets for German, Spanish, French, and Swedish/Finnish. An optional Katakana (Japanese) character set is also possible. Character highlighting and forms control features are included. The printer precisely duplicates the 560 x 455 dot image of the CRT with a resolution that is unprecedented in a CRT/line printer combination.

To copy the System 45C color CRT displays, the built-in printer can quickly duplicate the image in varying shades of gray.

Features

- ASCII 128-character set (256 total characters), 80 characters/line
- Fast printing, plotting
- Low cost; quiet operation
- Easy-to-read hard copy
- Fast transfer (dump) of graphics from CRT (Graphics option required for 9845B)
- Character generation flexibility
- Nationalized character sets
- Forms control functions
- Two paper sizes, two imprint colors
- Nine special symbols/logos

ROM Options

The System 45's computing power and capability can be greatly expanded by the addition of several Read Only Memories (ROMs) that are available. These ROMs, inserted into special drawers in the side of the unit, extend the BASIC language and permit peripheral and instrument control. The language commands associated with each ROM appear in the Language Technical Supplement (Form No. 5953-4513).

The Graphics ROM provides the statements necessary to plot, label and digitize on the CRT or on an external plotter. The Graphics ROM is optional on the System 45B Opt. 100,

Options

and standard on the 9845B Opt. 250 and Opt. 190. The 9845B Opt. 200/250/290 has as standard equipment the Enhanced Graphics ROM, which provides you with all of the statements of the standard ROM, plus an additional 30 high-powered statements that expand your use of the enhanced monochromatic display and input devices. This ROM is also included in all 9845C models, to which it adds color capability.

The Mass Storage ROM provides the drivers to communicate with flexible ("floppy") discs and cartridge ("hard") disc storage devices. The BASIC language commands for these storage media are identical to those used for the internal tape cartridge drives. These commands are unified so you can address each new device with only a single program line change.

The Input/Output (I/O) ROM provides an extension of the System 45's BASIC language to allow the exchange of data and control information between selected external devices. Data exchange can occur in asynchronous handshake, vectored interrupt, fast handshake or DMA modes. The I/O ROM's 50 statements also include the commands needed for Asynchronous data communications using the 98036A.

The Advanced Programming (AP) ROM provides seven additional BASIC statements which improve the data handling capability of the System 45. Extended matrix data manipulations and upper- and lower case character transformations expand the programming flexibility of the System 45.

Structured Programming ROM provides you with the looping and decision-making capabilities of PASCAL while retaining the friendly interpretive features of HP BASIC. This enhancement allows you to organize your programs more logically and facilitates program documentation, modification and maintenance.

The Datacomm ROMs provide high speed asynchronous as well as synchronous data communications capability including Distributed Systems Networking. There are two ROMs — a Basic Datacomm ROM and an RJE Bisync ROM. The Basic Datacomm ROM provides the drivers for the HP 98046B Datacomm Interface, the BASIC language syntaxing routines and complete asynchronous communication capabilities. The RJE Bisync ROM provides the communication enhancements required for the Bisync protocol. For asynchronous communications, only the Basic Datacomm ROM is required; for Bisync and Distributed Systems, both ROMs are required.

The IMAGE/45 Data Base Management ROMs are part of a complete DBM package offered as a major enhancement to the System 45. The IMAGE/45 ROMs contain 26 BASIC language statements that allow you to access and manipulate data in a desktop data base. They also help you define and build that data base. These ROMs are designed for use with QUERY/45, HP's powerful, interactive inquiry software. Both ROMs are required to perform data base management on the System 45.

The Assembly Language Execution and Development ROMs allow the experienced programmer to gain control of the System 45 Central Processing Unit (CPU). This capability allows you to write, execute, assemble and debug Assembly language programs. The Execution ROM alone allows you to store, retrieve and run Assembly programs. The Execution ROM does not allow you to write, modify or view the assembled code.

ROMs AVAILABLE

- Graphics (Opt. 311 or 98411B)–(System 45B Opt. 100 only, Graphics ROM is standard with all other models)
- I/O (Opt. 312 or 98412A)
- Mass Storage (Opt. 313 or 98413A)
- Advanced Programming (Opt. 314 or 98414A)
- Structured Programming (98415A)
- Basic Data Comm ROM (Opt. 317 or 98417A)
- RJE Bisync Data Comm ROM (Opt. 318 or 98418A)
- IMAGE/45 ROMs only) (98429A)
- DBM System (Includes IMAGE/45, QUERY/45) (98430A)
- Assembly Language Execution and Development ROM (Opt. 439 or 98439A)
- Assembly Language Execution ROM (Opt. 438 or 98438A)
- Structured Programming ROM (Opt. 435 or 98415A)

ROM SPECIFICATIONS

Height	27.9mm (1.1 in.)
Width	10mm (0.4 in.)
Length	96.5mm (3.8 in.)
Weight	40g (1.4 oz.)

Configured System Options

There are several packaged integrated graphics systems of the 9845 that provide powerful capabilities at a price that is substantially lower than the cost of the individual parts.

The Option 190/290 for the 9845B and 9845C Desktop Computer consists of the maximum memory option machine plus a full complement of special function ROMs, interface cards and other powerful features. Here's what each package includes.

The 9845B Option 190:
Expanded System, Standard Performance, Monochrome CRT

- System 45B with 449k bytes r/w memory
- Graphics ROM (Opt. 311 or 98411B)
- I/O ROM (Opt. 312 or 98412A)

- Mass Storage ROM (Opt. 313 or 98413A)
- Advanced Programming ROM (Opt. 314 or 98414A)
- Structured Programming ROM (98415A)
- Second Tape Transport (Opt. 600 or 98460A)
- Graphics Subsystem (Opt. 700 or 98470A)
- Basic Datacomm ROM (98417A)
- Datacomm Interface Card (98046B, Opt. 001)
- High Speed Asynchronous Terminal Emulator software (09845-10180)
- Data Base Management System (98430A)*

The 9845B Option 290:
Expanded System, High Performance, Monochrome Display

- includes all of the above, plus the High-speed Language Processor, Enhanced Monochrome CRT and Light Pen.

The 9845C Option 190:
Expanded System, Standard Performance, Color Display

- System 45C with 449k bytes r/w memory
- I/O ROM (Opt. 312 or 98412A)
- Mass Storage ROM (Opt. 313 or 98413A)
- Light Pen (Opt. 775 or 98775A)
- Advanced Programming ROM (Opt. 314 or 98414A)
- Structured Programming ROM (98415A)
- Basic Datacomm ROM (98417A)
- Datacomm Interface Card (98046B, Opt. 001)
- High Speed Asynchronous Terminal Emulator software (09845-10180)
- Data Base Management System (98430A)*

The 9845C Option 290:
Expanded System, High Performance, Color Display

- Includes all of the above, plus the High-speed Language Processor.

The 9845B Option 270:
Graphics Design System, High Performance, Monochrome Display

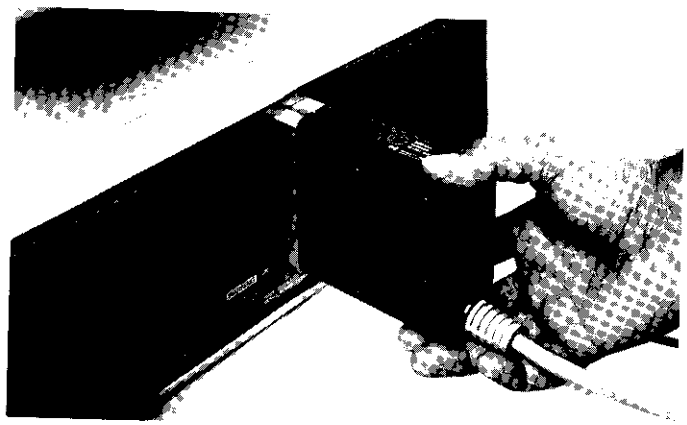
- The System 45B with the high-speed language processor and the enhanced monochromatic CRT.
- 318k bytes R/W memory.
- Enhanced Graphics ROM and CRT graphics subsystem.
- Thermal printer.
- Second Tape Transport (Opt. 600 or 98460A)
- Light Pen (Opt. 775 or 98775A)
- I/O ROM (Opt. 312 or 98412A).
- Mass Storage ROM (Opt. 313 or 98413A)
- Advanced Programming ROM (Opt. 314 or 98414A)
- Structured Programming ROM (98415A).
- Graphics Utility Software.

The 9845C Option 270:
Graphics Design System, High Performance, Color Display:

- Includes all of the above, with a color graphics CRT.

*Note: You must specify appropriate language versions Option 330 English, Option 331 French, and Option 332 German.

Interface Cards



The following input/output cards are designed to meet a variety of interfacing needs for both the System 45B and System 45C. On all of these cards you can choose any one of 12 available select codes via an externally accessible rotary switch. In each case, the electrical power for the card is supplied by the System 45.

Interface Card Specifications (all except disc interface and 98046B card).

Length	163mm (6.4 in.)
Width	89mm (3.5 in.)
Depth	38mm (1.5 in.)
Net Weight	0.65kg (1.4 lb.)
Shipping Weight	2.3kg (5 lb.)

16-BIT PARALLEL I/O (HP 98032A)

This card provides a latched, 16-bit input data bus for bidirectional transfer of information. Operation of the interface requires the System 45 I/O ROM (Opt. 312) for read functions and for advanced capabilities such as vectored interrupt, buffered input and Direct Memory Access (DMA).

Input/output transfers can be a 16-bit word format or in two independent 8-bit words. Enabling/disabling and interrupt priority are controlled by software commands.

Extended control and status lines are available for applications that require more than one signal from the System 45. These signals, combined with full-word or byte-data transfer modes, allow the System 45 to interface with a variety of equipment.

Logic Configuration

Fifteen jumpers within a removable cable boot are provided to control the logic of I/O data, control signals, flag information and peripheral status. Operating modes such as handshake, DMA and word/byte data are also controlled by these jumpers.

Accessories

Standard Cable	4.5m (15 ft.) open ended
Optional Cable (Opt. 001)	2m (6.6 ft.) with specified optional termination
Test Connector (hardware verification)	HP 98241-67932

BCD INPUT INTERFACE (HP 98033A)

This interface connects the System 45 with bit-parallel, digit-parallel binary coded decimal (BCD) devices for data input. Up to nine BCD digits, with overload and sign information, can be input using the I/O ROM (Opt. 312).

The input format is selectable, allowing two instruments to be read from a single interface card. The speed of the slowest device dictates the overall transfer rate.

Data Formats

Data is serialized in a 16-character sequence. Two data formats are switch-selectable on the BCD Interface Card.

8-digit signed mantissa with 1-digit signed exponent
1-digit function code and overload indication

or

4-digit mantissa
5-digit signed mantissa with positive exponent

Accessories

Standard Cable	4.5m (15 ft.) open-ended
Test Connector (hardware verification)	HP 98241-67933

HP-IB INTERFACE BUS (HP 98034A/B)

With this interface card, the System 45 can communicate with many HP-IB compatible instruments. The card uses a microprocessor to provide efficient management of interface bus protocol and, when used with the System 45 optional I/O ROM (Opt. 312), supports the following GP-IB capabilities as defined in IEEE standard 488-1978 Appendix C: SH1, AH1, TS, TE0, L3, LE0, SP1, PL0, PP2, DC1, DT0, C1 C2 C3 C4 C5, E1.

Interrupt Capability

The System 45, equipped with the HP-IB Interface Card and the I/O ROM (Opt. 312), is capable of responding to any or all of the following interrupt requests:

- take active controller status
- take active talker status
- take active listener status
- respond to service request
- input buffer full
- output buffer empty
- interrupt on device-clear message

There are two functionally identical models of the 98034. The 98034A has a plastic case and the 98034B has a metal case. The metal case of the 98034B is designed to help reduce electromagnetic interference as well as susceptibility to static discharge (when connected to a desktop computer with the proper grounding connections) in those applications where these conditions are critical. Without the grounding connections the 98034B is identical to the 98034A. For complete information about proper grounding connections, contact your HP Sales and Service Office.

Accessories

Standard Cable	4m (13 ft.) with standard metric connector
Optional Cable	1m (3.3 ft.) HP 10631A 2m (6.5 ft.) HP 10631B 4m (13 ft.) HP 10631C 0.5m (1.6 ft.) HP 10631D

REAL TIME CLOCK INTERFACE (HP 98035A)

The 98035A Interface provides a real-time reference and time-related control capabilities such as:

- month, day, hour, minute and second
- U.S. (month first) or European (day first) formats, jumper selectable
- four independent timing units for interrupt or counting modes
- synchronization of up to four timing units allowing start-up of multiple operations at the same time
- status monitoring
- direct I/O operations on external lines

When operating the System 45 and the Real Time Clock Interface, the optional I/O ROM (Opt. 312) is required.

Timing Units

Four timing units are available to access the external I/O lines–four external trigger lines (output) and four external gate lines (input). Interrupt can occur at a specified real time, after a time delay, at a periodic interval or at any combination thereof. These units can also be used as counters, incremented every millisecond, to determine time intervals for such things as the duration of an event or the time elapsed between two events.

Accessories

Time Formats	Opt. 001 U.S. Format Opt. 002 European Format
Standard Cable	None
Optional Cable (Opt. 100)	External trigger cable (unterminated), allows 4-bit word output/input from external devices

RS-232-C INTERFACE (HP 98036A)

This interface provides bit-serial communication between the System 45 and asynchronous EIA-RS-232-C devices such as data terminals and modems. Data transmission rates range from 75 to 9 600 baud and are set by an externally accessible rotary switch. Under programmable control of the System 45, the switch-selected data rate can be reduced to half its set value. Allowable data formats include 5, 6, 7 or 8 bits per character with 1, 1.5 or 2 stop bits and odd, even, or no parity. The optional I/O ROM (Opt. 312) is generally required with this interface card. Simple output operations can be performed without it, however.

Interface Configuration

Information can be sent and received in either EIA-RS-232-C voltage specifications or 20 mA current loop configurations. Receive-only capability in a 60 mA current loop is also possible.

Transmitter and receiver sections of this interface have separate one-character buffers that can be interrogated by the System 45. The interface can be programmed by the System 45 to interrupt when either the input buffer is full or the output buffer is empty.

Additionally, the interface will detect framing errors (invalid stop bit), parity errors and overrun errors, all of which are indicated by a status word.

Accessories

Standard Cable (for interfacing to terminals)	2m (6.6 ft.) terminated with female EIA 25-pin connector
Optional Cable (for interfacing to modems) Opt. 001	2m (6.6 ft.) terminated with male EIA 25-pin connector
Test Connector (hardware verification)	HP 98241-67936

INCREMENTAL PLOTTER INTERFACE (HP 98040A)

This interface allows the System 45 to be connected to large drum or flatbed incremental plotters which require unencoded inputs. The optional Graphics ROM (Opt. 311 or 98411A) provides all necessary commands; no additional software drivers are required.

Standard incremental plotter pulsed outputs are +X, −X, +Y, −Y, pen-up and pen-down. Pen selection capability for certain multiple pen plotters is also provided. A list of incremental plotters that work with the System 45 is available from CALCOMP, Houston Instruments and ZETA Research.

Output Levels

There are two output levels for pulsed data and pen lines: +5V or +12V with a 500 Ohm output impedance. The output pulse width may be 20 or 50 microseconds.

Data pulse rates range from approximately 100 to 5 000 pulses/second (max.) in discrete steps of approximately 100 pulses/second. The pen delays are 30 or 60 milliseconds for pen down and 15 or 30 milliseconds for pen up.

Accessories

Standard Cable	Canon SK-19-212C-½ Connector

DISC INTERFACE (HP 98041A)

The Disc Interface gives the System 45 access to large capacity, high speed disc units. Up to four HP 7900 Series Disc Drives (20M byte to 120M byte) can be connected to the System 45 via the 98041A Interface Card.

The 98041A Interface Card contains drivers and receivers as well as the logic for addressing, interrupts and status.

98041A Specifications

Length	345.4mm (13.6 in.)
Width	425.5mm (16.7 in.)
Depth	132.6mm (5.2 in.)
Net Weight	10kg (22 lb.)
Shipping Weight	14.5kg (32 lb.)

Accessories

Standard Cable	None
Optional Cable (Opt. 001)	1m (3 ft.) HP-IB
(Opt. 002)	2m (6.5 ft.) HP-IB
(Opt. 003)	4m (13 ft.) HP-IB

DATA COMMUNICATIONS INTERFACE (HP 98046B)

The key features of this interface are an on-board microcomputer to manage the Datacomm channel, two 32-channel FIFOs to provide extensive buffering of transmitted and received data, and 1k bytes of Random Access Memory (RAM) that can be down-loaded from the desktop computer to configure the interface for a given protocol. This interface is usually ordered as part of a Datacomm package.

Accessories

Standard Cable	female EIA RS-232-C connector, DCE side, for connection to a terminal–2m (6.6 ft.)
Optional Cable (Opt. 001) shipped with the Datacomm packages	male EIA RS-232-C connector, DTE side for connection to a modem–2m (6.6 ft.)

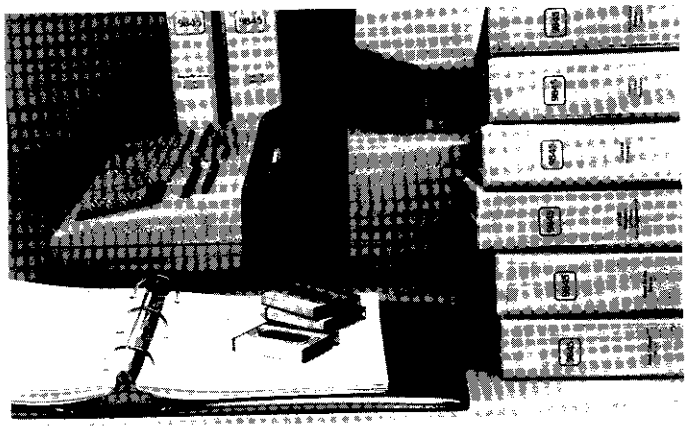
98046B Specifications

Length	180mm (7.1 in.)
Width	97mm (3.8 in.)
Depth	35mm (1.4 in.)
Net Weight	0.88kg (1.94 lb.)
Shipping Weight	2.53kg (5.5 lb.)

Peripherals

Description	To Purchase Peripheral, Order:	Required Interface Cards	Required ROMs
PRINTERS			
Serial Impact Printer (30 CPS)	9871A, Opt. 045	98032A, Opt. 471	
Serial Impact Printer HP-IB (30 CPS)	9871A, Opt. 001	98034A/B, Opt. 045	
Thermal Line Printer	9876A, Opt. 035, Opt. 001-8-bit parallel interface. Opt. 003-Metric paper and 5041-1503 spacer	98034A/B, Opt. 045	
Serial Impact Printer HP-IB (180 CPS)	2631B, Opt. 845 and Opt. 009 (European character set)	98034A/B, Opt. 045	
Serial Impact Printer HP-IB (Graphics, 180 CPS)	2631G, Opt. 845 and Opt. 009 (European character set)	98034A/B, Opt. 045	
Dot Matrix Line Printer HP-IB	2608A, Opt. 845 and Opt. 002 (European character set)	98034A/B, Opt. 045	
PLOTTERS			
Eight-Pen Plotter	9872C, Opt. 045	98034A/B, Opt. 045	98411B
Eight-Pen Plotter (w/paper advance)	9872T, Opt. 045	98034A/B, Opt. 045	98411B
Graphics Plotter HP-IB	7225A/17601A Opt. 045	98034A/B, Opt. 045	98411B
Plotter/Printer HP-IB	7245B, Opt. 045	98034A/B, Opt. 045	98411B
Drafting Plotter	7580A		
HP-IB Interface	Opt. 002		
For 9845C	Option 045	98034A/B	98411B
For 9835A/B or 9845B	Opt. 145	98034A/B	
MASS STORAGE			
Cartridge Disc Drive Master (20Mbyte) Slave (20Mbyte)	7906M, Opt. 102 7906S	98041A, Opt. 045	98413A
Cartridge Disc Drive 12Mbyte	7910H, Opt. 045 (w/IDC)	98034A/B. Opt. 045	
Cartridge Disc Drive Master (50Mbyte) Slave (50Mbyte)	7920M, Opt. 102 7920S	98041A, Opt. 045	98413A
Cartridge Disc Drive Master (120Mbyte)	7925M, Opt. 102	98041A, Opt. 045	98413A
Cartridge Tape Unit (external) Second Drive	9875A, Opt. 045 Opt. 001	98034A/B, Opt. 045	98412A
Flexible Disc Drive Master (.5Mbyte)	9885M, Opt. 045	98032A, Opt. 485	98413A
Flexible Disc Drive Slave (.5Mbyte)	9885S		98413A
Flexible Disc Drive Master (2.36Mbyte)	9895A, Opt. 045 or Opt. 145 (w/IBM Flex. Disc Utilities)	98034A/B, Opt. 045	98413A
MISCELLANEOUS			
Digitizer	9874A, Opt. 045	98034A/B, Opt. 045	98412A or 98411B
I/O Expander	9878A, Opt. 045	Built-in	
Paper Tape Reader	9883A, Opt. 045	98032A, Opt. 483	98412A
Paper Tape Punch	9884A, Opt. 045	98032A, Opt. 484	
Graphics Tablet	9111A, Opt. 045 (System 45B only)	98034A (revised)	98412A or 98411B
9-Track Magnetic Tape Drive	7970E, Opt. 26	98041A, Opt. 045	

Software



Application Packs

The following applications software packs are available (at extra cost) for use on the System 45. For a complete description of each pack, see the System 45 Hardware/Software Price List.

STATISTICAL AND NUMERICAL ANALYSIS
Principal Components and Factor Analysis, 09845-15080
Basic Statistics and Data Manipulation, 09845-15100
Regression Analysis Methods, 09845-15110
General Statistics, 09845-15130
Non-linear Regression, 09845-15140
Monte Carlo Simulation Utilities, 09845-15160
Analysis of Variance, 09845-15170
Statistical Graphics, 09845-15200
Numerical Analysis Library, 09845-10350

ELECTRICAL ENGINEERING
9845/6800 Microprocessor Development, 09845-12530
9845/8085 Microprocessor Development, 09845-12540
9845/Z80 Microprocessor Development, 09845-12550
Complete Microprocessor Development Package, 09845-12560
Waveform Analysis, 09845-12600
Digital Simulation Utilities, 09845-12610
A-C Circuit Analysis, 09845-12620
Linear Systems Analysis, 09845-15190

BUSINESS MANAGEMENT
Graphics Presentation, 09845-10540 (45B)
Linear Programming, 09845-10600
Forecasting, 09845-10610
Text Management, 09845-10620
List Management, 09845-10630
Project Management, 09845-11100
Graphics Presentations, 09845-15230 (45C)

Utility/Special Capability Packs

The following utility software packs are available (at extra cost) for use on the System 45. For a complete description of each pack, see the System 45 Hardware/Software Price List.

2-D Graphics Utilities, 09845-10050
3-D Graphics Utilities, 09845-10060 (System 45B/T)
Hard Disc Utilities, 09845-10070
3-D Graphics Utilities, 09845-10080 (System 45C)
Flexible Disc Utilities, 09845-10090
Computer Games Library, 09845-10110
HPL to 9845 BASIC Translator, 09845-10130
Asynchronous Terminal Emulator, 09845-10140
Utilities II Library, 09845-10150
Terminal Manager, 09845-10160
Forms Utility, 09845-10170
High Speed Asynchronous Terminal Emulator, 09845-10180
2780/3780 Terminal Emulator, 09845-10190
Utility Library, 09845-10200 (included at no charge with 9845B/C)
Distributed Systems Software, 09845-10210
Assembly Programmer's Utility, 09845-10260
IBM Flexible Disc Utilities, 09845-10740
QUERY/45 Data Base Management, 09845-14754 09845-14755, 09845-14756 (3 tapes)
IMAGE/45 Data Base Management Utilities, 09845-14757
DBM/Statistics Linkage, 09845-14830
9111A/9845B Graphics Tablet Utilities, 88100A
7970E Tape Utilities, 09845-15220

UTILITY SOFTWARE LIBRARY Included with each System 45B and 45C mainframe is a collection of general purpose software that provides an introduction to the computer and its HP Enhanced BASIC programming language. With this software, the user can simplify the process of writing initial programs and can begin using the computer immediately.

The Utility Library package includes three program tape cartridges and a manual with program descriptions and operating procedures.

Table of Contents

The System 45 Utility Library contains the following main programs and subprograms.

- **Fast Sort of Numeric Vector*** — allows sorting of a one-dimensional array, into ascending or descending order.
- **Minimal Storage of a Numeric Vector*** — like Fast Sort of a Numeric Vector, but it is slower and occupies less memory space.
- **Fast Sort of a Numeric Array*** — allows sorting a two-dimensional array on any row or column into ascending or descending order, maintaining column or row integrity.
- **Minimal Storage Sort of a Numeric Array*** — like Fast Sort of a Numeric Array, but it is slower and occupies less memory space.
- **Fast Sort of a String Vector*** — allows sorting a one-dimensional string vector into either ascending or descending order.
- **Minimal Storage of a String Vector*** — like Fast Sort of a String Vector, but slower and it occupies less memory space.

* Denotes subprogram.

Software

Numerical Analysis Section

- **Polynomial Rootfinder** * — will find all roots, Z, of polynomials of the form:

  $a_o + ib_o + (a_1 + ib_i)$
  $Z + (a_2 + ib_2)$
  $Z^2 + \ldots + (a_n + ib_n)Z^n = 0$

  These roots are found by expressing the polynomials in terms of Siljak functions using the method of steepest descent to determine the zeros.
- **Bisection Rootfinder*** — will research for solutions of $F(x) = 0$ over an interval [a, b] where you define the continuous real-valued function F(x). The function may be of the form:

  $a_o + a_1x^{e_1} + a_2x^{e_2} + \ldots + a_nx^{en}$ with a_i real and e_i rational (e.g., $x^3 + 3x^{3/2} + \sqrt{x}$) or Transcendental (e.g., sin (x) + cos(x)).
- **Numerical Interpolation*** — computes a curve S(x) that passes through the N data points (x_i, y_i) supplied by you. It then computes the functional value, integral and derivative, at any point t_j on the curve when t_j is in the interval (x_i, x_n) using the Cubic Spline method.
- **Numerical Integration*** — approximates ${}_a\int^b f(x)dx$ for a user-defined continuous function of f(x) on the interval [a,b] using Simpson's rule.
- **Simultaneous Linear Equations*** — solves a set of simultaneous linear equations, or indicates there is no solution.

Information Management Section

- **Backup Program** — allows copying of programs from one storage medium to another (for creation of data bases, increasing speed of file access, etc.).
- **File Initialization** — takes your inputs on the kinds of fields and the expected amounts of data and creates files of the proper length. All overheads, linked lists and directory information are automatically set up for easy maintenance.
- **File Access** — permits you to access data files in a variety of different ways (for data entry, editing, deleting and reporting) after file initialization.

Financial Section

- **Loan Amortization** — computes and prints a complete amortization schedule for a loan.
- **Savings Account/Compound Interest Analyzer** — computes and prints a table of a savings account operated upon by compound interest.
- **Household Budget Analyzer** — helps plan and record your own or your family's household budget for a year.

Statistics Section

- **Array Statistics*** — will take a two-dimensional matrix and return two vectors one containing the means of the rows or columns and the other containing the variances of the rows or columns.
- **Family Regression*** — takes a set of (x,y) coordinates and fits Linear, Logarithmic, Exponential, and Polynomial curves. It also computes Analysis of Variance tables and plots the computed curves. (Plots are optional.)
- **Pie Charts*** — plots pie charts on the CRT and includes raw numbers, percentages, titles and labels.
- **Bar Graphics*** — plots bar graphs on the CRT and includes raw numbers, percentages, titles and labels.

Graphics Section

- **Block Lettering*** — plots alpha and numeric figures intended for creation of overhead transparencies and slide graphics.
- **Simple Function Plot** — plots a defined function between a minimum and maximum x and labels the axes.
- **Iterative Parameter Plot** — like Simple Function Plot but retains previous plot and permits superimposing new functions over and over.
- **Picture Construction and Entity Creation** — permits simple line drawings to be interactively created on the CRT — featuring menu selection and "rubber banding".
- **Dump Graphics Select Code†** — allows you to transfer CRT graphics to selected graphics peripheral devices.
- **Graphic Binaries (GPRINT, GERASE, GEDIT)†** — binary programs enabling the user to selectively erase portions of a graphic image, to position a cursor on the screen and to print high-speed labels.

Miscellaneous

- **Key File Conversion†** — converts 9845A key files to 9845B key files.
- **File Copy** — copies several files from one mass storage device to another
- **String Search** — searches for all occurrences of a string within a saved program.
- **String Search and Replace** — replaces all occurrences of a string with a second string.

* Denotes subprogram.
† Works on System 45B only.

- **Standard Interchange Format** — a Hewlett-Packard standardization of data structure for magnetic tape cartridges. Intended fo facilitate the transfer of data between devices using these cartridges.
- **Data File Dump** — prints the contents (that is, data types and data values) of a data file.
- **Program List** — allows formatted listings of programs.
- **File Compare** — compares two program files, indicating those lines which differ.
- **Screen Addressing** — allows some of the screen addressing to be accessed without constructing escape code sequences.
- **Block Lettering** — generates characters five times the normal size.

ADVANCED COLOR GRAPHICS PACK

Included with each System 45C is the Advanced Color Graphics Pack which consists of the Advanced Graphics Examples Tape, Manual and System 45C Graphics Utilities. The Advanced Graphics Examples Tape is made up of six colorful programming examples that show key applications through the use of a helpful on-screen tutorial and color graphics programming techniques. The System 45C Graphics Utilities is a collection of algorithms and subprograms that perform various graphic functions.

- **Architectural Plot Plan** — provides you with the programmed algorithms to generate 3-D wire frame display. Also illustrates rotation, scaling and translation of 3-D objects and use of the light pen.
- **Stress Analysis of Bridge** — illustrates use of Z-axis color interpolation, use of memory planes, use of PDIR (PLOT DIRECTION).
- **Data Presentation (Energy Production)** — shows techniques for use of MAT SYMBOL and CSIZE, complex information distinction, and lettering.
- **Climatic Regions of Western Europe** — depicts use of memory planes, use of AREA INTENSITY for DUMP GRAPHICS output and use of MAT PLOT.
- **Process Monitoring for Printed Circuit Board Electroplating Line** — portrays techniques to achieve simulated movement, use of Object Generator, use of relative plotting and complex information distinction.
- **Integrated Circuit Layout** — illustrates use of PLOTTER IS A(*), sectioning of CRT, use of GRID, and concurrent use of ALPHA and GRAPHICS.

Color Input Utilities

- **A_ADD**– used to visually select color for use with the AREA INTENSITY statement using the additive system.
- **A_SUB** — used to visually select color for use with AREA INTENSITY statement using the subtractive system.
- **AREA_C** — used to visually select a color for use with the AREA COLOR statement. Hue, saturation and luminosity are returned as parameters to be used with the AREA COLOR statement.
- **GRID** — designed to do grid snapping with the light pen.
- **INK** — designed to do inking on the CRT with the light pen.
- **OBJGEN** — used to help generate objects to be used with the MAT SYMBOL statement.
- **Z_AX_1** — when combined with the Z_INTP_ utility subprogram, provides a way to assign colors to a range of values by manual data entry.
- **Z_AX_2** — this utility combined with Z_INTP_ and Area_C utility subprograms, provide a way to assign colors to a range of values by visual selection.

Color Output Utilities

- **OBJRET** — this subprogram will retrieve an object created and stored by the object generator program.
- **PENCAL** — allows you to determinate the offset of your light pen for the GRAPHICS INPUT IS statement.
- **RUBDRV and RUBBND** — RUBDRV is a subprogram to assist you in using the rubberband binary stored on file RUBBND.
- **SCAN** — provides removal of hidden surfaces on a three-dimensional object. The algorithm will shade the visible surfaces, not just outline them.
- **VCTTRN** — this utility subprogram provides a color hard-copy transfer on the 9872 using the Spectrum Graphics Kit (Part No. 09872-60069).
- **Z_INTP** — this subprogram returns the hue, saturation and luminosity for a specific Z value whose color range was defined by a previous call to either the Z_AX_1 or Z_AX_Z utility subprograms.

* Denotes subprogram.

Accessories

Accessories Supplied

The following items are packaged with each 9845.

Item	Part Number	9845B "100" Models	9845B "200" Models	9845C "100" Models	9845C "200" Models
Operating and Programming Manual	09845-93000	1	1	1	1
Installation Operation and Test Manual	09845-93005	1	1	1	1
Quick Reference	09845-93015	1	1	1	1
Color Graphics Manual	09845-92051			1	1
Monochromatic Graphics	09845-93050		1		
BASIC Language Interfacing Concepts	09835-90600	1	1	1	1
Manual Binder	9282-0898	2	2	2	2
System Exerciser Cartridge #1	09845-92041	1	1	1	1
System Exerciser Cartridge #2	09845-92042	1	1	1	1
9845B Introductory Training Package:	09845-10120	1	1		
9845B Introductory Training Cartridge	09845-10124	1	1		
System 45 Workbook	09845-93090	1	1		
9845C Introductory Training Package:	09845-10220			1	1
9845B Introductory Training Package	09845-10120			1	1
Graphics Training Cartridge	09845-10225			1	1
System 45 Graphics Workbook	09845-93091			1	1
9845C Advanced Color Graphics Pack:	09845-10230			1	1
Color Utilities Tape	09845-10234			1	1
Color Examples Tape	09845-10235			1	1
Advanced Color Graphics Manual	09845-93055			1	1
Utility Library Software Pack	09845-10200	1	1	1	1
Special Function Key Overlays	7120-6164	5	5	5	5
Blank Tape Cartridges	next table	2	2	2	2
Dust Cover	9222-0592	1			
Dust Cover	9222-0728		1	1	1
Magnetic Head Cleaner	8500-1251	1	1	1	1
Spare fuses:					
4 Amp (SB)	2110-0365	1		1	
8 Amp (NB)	2110-0342	1		1	
6 Amp (NB)	2110-0056		1	1	2
10 Amp (NB)	2110-0051		1	1	2

Accessories Available

Single items may be purchased using the appropriate part number. Contact your Sales and Service Office to order.

Peripheral devices, ROMs and interface cards are packaged separately from your 9845; each of these has its own manual or operating note and may also have extra items packaged with it.

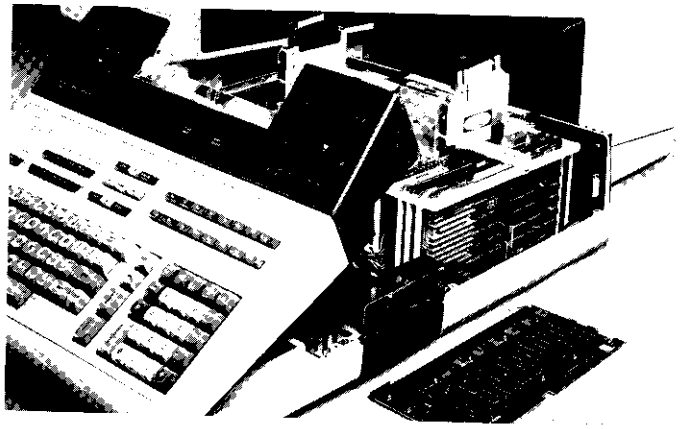
The following items are also available and can be ordered from your Sales and Service Office.

Item	9845B Opt. 100/150/190	9845B Opt. 200/250/270/290	9845C All Options
Carrying Case (soft)			
Computer	09845-64403	09845-64403	09845-64403
CRT	09845-64404	09845-66408	09845-66408
Carrying Case (hard)*			
Computer	09845-64405	09845-64405	09845-64405
CRT	09845-64406	N/A	N/A
Carrying Cases (hard and soft)*			
Computer	09845-64401	09845-64401	09845-64401
CRT	09845-64402	09845-64402	09845-64402

* Hard carrying cases are designed to be used over the soft carrying cases.

Item	9845B/C All Options
Blank Tape Cartridges (package of 5)	98200-67000
Blue-print Continuous Thermal Paper:	
Standard	92161M
Metric	92161A
High-contrast Blue-print Continuous Thermal Paper:	
Standard	92161N
Metric	92161B
High-contrast Black-print Continuous Thermal Paper:	
Standard	92161P
Metric	92161C
Black-print Perforated Thermal Paper:	
Standard	92161Q
Metric	92161D
High-contrast Black-print Perforated Thermal Paper:	
Standard	92161R
Metric	92161E

Miscellaneous



HP 9845 Execution Times

The following math execution times are approximate and represent an average over a number of iterations. These routines all use full 12-digit, floating point data.

Routine	Time (ms) Opt. 100	200	Routine	Time (ms) Opt. 100	200
Addition	0.27	0.04	Arcsine	26.00	3.88
Subtraction	0.33	0.06	Arccosine	26.00	4.00
Multiplication	0.89	0.14	Natural log	7.50	1.39
Division	2.90	0.56	Log base 10	9.70	1.49
Raise to power	17.00	3.21	e^x	6.10	1.00
Square root	2.90	0.43	Integer	0.46	0.24
Tangent	14.00	2.41	Absolute value	0.13	0.03
Sine	21.00	3.68	Fraction	0.35	0.09
Cosine	21.00	3.68	Random number	1.80	0.33
Arctangent	18.00	2.31			

Maintenance Agreements

Maintenance agreements are available for all desktop computer products. Current U.S. rates can be determined by contacting your local HP Sales Office. These agreements represent HP's best level of support. Major advantages to the customer include:

- fixed annual cost,
- priority service response,
- on-site service,
- regular maintenance,
- individualized contract.

Purchase Plans

Contact one of the Hewlett-Packard worldwide sales and service offices for specific prices and plans in your area.

Hewlett-Packard, 3404 E. Harmony Road, Fort Collins, Co. 80525.

In Europe, Hewlett-Packard GMBH, Computer Products, Herrenberger Strasse 110, D-703 Boebingen, Postfach 1430, West Germany.

In Canada, Hewlett-Packard (Canada) Ltd., 6877 Goreway Drive, Mississauga, Ontario, Canada, L4V 1MB.

Elsewhere in the world, Hewlett-Packard Intercontinental, 3495 Deer Creek Road, Palo Alto California, 94304.

HEWLETT PACKARD

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