HEWLETT PACKARD

A-Series Computer Handbook

for Systems Designers and OEMs

2nd Edition

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HP 1000 A-Series Real-Time Computers

Product Overview

Versatile Design for a Wide Variety of Applications

HP 1000 A-Series computers are open, modular machines that are designed for real-time multiprogramming, multi-user applications in research, communications, manufacturing, and other fields that require real-time response. A choice of four processors and a wide variety of interfaces and software equips HP 1000 A-Series computers to effectively solve many different real-time application problems. Typical uses, many of which are developed and marketed by OEMs and other value-added businesses, include:

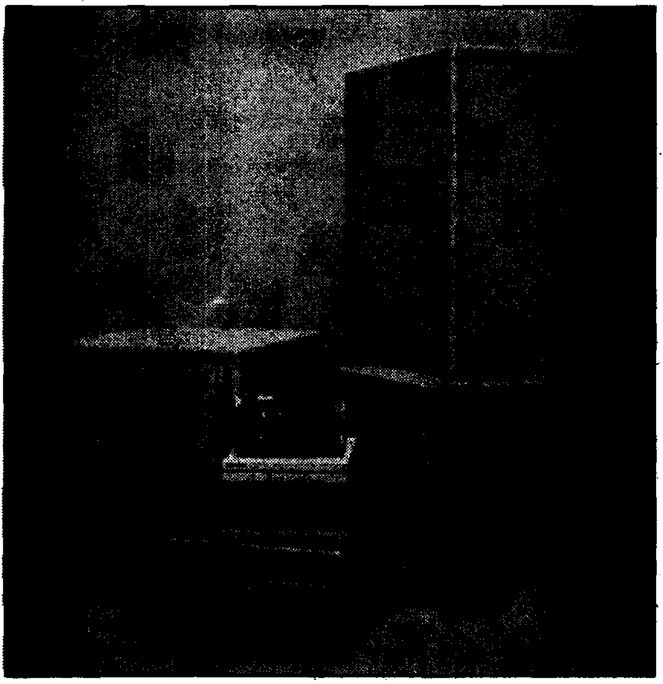
- Monitoring of power distribution or telecommunications networks.
- Control of orbiting satellites.
- Monitoring and control of temperature, lighting, and power consumption in buildings.
- Automatic testing.
- Textile layout and cutting.
- Cartography.
- Lab automation.
- Project management.
- Machine and process control.
- Supervisory control of programmable controllers.

Hardware Engineered for Real-Time Use

HP 1000 A-Series computers achieve true real-time responsiveness with:

Fast, Efficient Handling of I/O. External sensors, measuring instruments, and other I/O devices connect to HP 1000 systems via I/O interfaces and an I/O system with multi-level, vectored hardware interrupt that expedites I/O. Each HP 1000 I/O channel has its own interrupt priority level. Interrupts directly initiate the appropriate service programs with no time wasted in polling I/O channels. Extremely fast interrupt response times are sustained even under heavy system loading. Direct memory access speeds data transfers to/from memory with minimal involvement of the CPU.

Fast Processing of Data. HP 1000 Systems can process data at base instruction rates to 1.3 MIPS and floating point processing speeds to 821 KWIPS-B1D. This shortens the time needed to process input data, evaluate results, and initiate real-time action.



Clocked Operations Timing. A time base generator provides precisely-timed interrupts for maintaining a real-time clock.

Large Main Memory Capacity. Up to 18 megabytes of main memory can be provided to keep most critical programs resident and ready to execute quickly, avoiding the delays inherent in moving programs to and from disc.

Real-Time Operating Software

Multiprogramming simplifies subdivision of the myriad tasks involved in real-time applications into multiple programs. With the multiprogramming supported under the RTE-A operating system for HP 1000 computer systems, the tasks used to collect data from the external environment, process that data, evaluate it, and generate appropriate control outputs, operator messages, reports, or other displays can be programmed individually, then configured into the RTE-A system for coordinated execution.

Inter-Process Communication. Processes executing under RTE-A can exchange data quickly and flexibly via class (mailbox) I/O, RTE-A extended memory areas for data, and/or virtual memory for data.

Price/performance values: the HP A-Series gives more for the money.

	A400	A600+	A700	A900
Base set instruction speed	0.4 MIPS	0.4 MIPS	0.4 MIPS	1.3 MIPS
Starting price† for box computer for board computer	$3,600 $1,500	$4,050 $2,046	$5,896 not avail.	$13,266 not avail.
Floating Point (measured in B1D Whetstones)	122 kwips	113 kwips	340 kwips	821 kwips
Cache memory	No	No	No	Standard
Error Correcting Memory	No	Optional	Optional	Standard
Memory capacity	4 MB	8 MB	8 MB	18 MB
Pipeline architecture	No	No	No	Yes
I/O bandwidth (minimum)	4.3 MB/sec	4.3 MB/sec	4.0 MB/sec	3.7 MB/sec
DMA per channel	Yes	Yes	Yes	Yes
User microprogrammable	No	No	Yes	Yes
Scientific instruction set	No	No	Optional	Standard
Vector instruction set	No	No	Optional	Standard
Integrated 19.4 MB Winchester and 630 kb microfloppy	Optional	Optional	Optional	Optional
Available as:				
System	No	Yes	Yes	Yes
Micro System*	Yes	Yes	Yes	Yes
Box Computer	Yes	Yes	Yes	Yes
Board Computer	Yes	Yes	No	No

†U.S. Prices based on average OEM quantity discounts.

*Can be mounted on a stand with wheels, racked in a 19-in. EIA cabinet, or placed on a benchtop.

Event Interrupt Scheduling is the core of RTE-A's real-time capability. Event interrupts from external devices are connected via I/O interfaces and processed by central interrupt control (CIC) programs. CIC initiates the execution of appropriate application programs and the standard RTE driver routines that control the exchange of data between main memory and external devices.

Time Scheduling uses a real-time clock maintained by RTE-A and time "ticks" from the computer's time base generator. Programs to be run at specific times or intervals are entered into a "time" list that RTE-A checks after each clock tick. The real-time clock also supports I/O timeout and time-slicing allocation of execution time among "background" programs.

Program-to-Program Scheduling is supported via an operating system call that enables one program to initiate execution of another.

User Scheduling. A program can be scheduled by a user command from a terminal.

Priority Control grants execution preference to programs in the order of the relative importance assigned to them, with a choice of 32767 priority levels.

Multi-User Program Development. RTE-A supports multiple users with log-on access control and protected user environments. Individual copies of the editor, compilers or assembler, program linker, and symbolic debugger can be used for program development by different users at the same time.

Program and Data Space Management. RTE-A and the dynamic mapping system support multiple program partitions in up to 18 megabytes of main memory. This makes it possible to keep many different programs resident in main memory, ready to execute, avoiding the millisecond-level delays involved in pulling programs from the disc, and making possible completely memory-based operation.

RTE-A also supports Extended Memory Areas for main memory resident data up to 1.998 megabytes. Larger memory requirements for data are accommodated by the Virtual Memory Area, up to 128 megabytes in main memory and on disc.

Large Program Support. The Virtual Code+ (VC+) extension to RTE-A subdivides large programs into code segments. During execution, VC+ loads the segments into main memory as they are needed, transparently and automatically. VC+ can be used to give the user up to 7.75 megabytes of code space, provided that no subroutine in the program is longer than 62 kilobytes.

Software Operating System:

RTE-A

Capabilities

Disc or memory based

Typical system generation time: 15 min

Hierarchical file system

Power fail auto restart

Priority-based scheduling with time-slicing

VC+ Capabilities

File protection

Multi-user, multi-programming

Logon/Logoff

Sharable code

Outspooling

Maximum Virtual data (VMA): 128 MB

Maximum virtual code: 7.75 MB

Additional Software Supported Capabilities

- Graphics, including 2-D, 3-D, and interactive graphics capabilities, with device independence supported by a library of device handlers.
- Data Base Management with on-line Query capability for interactive access and printout of reports. One of the two systems available provides extensive data base recovery capabilities for protection from data loss.
- Data pairing for protection of data through configuration of disc volumes in mirrored pairs on separate disc drives, connected via separate interfaces.
- LAN Communication with other HP 1000, HP 3000, and HP 9000 systems.
- Point-to-Point Communication with other HP 1000 and HP 3000 systems.
- Remote Job Entry Communication with IBM or plug-compatible systems.
- X.25 communication with other HP 1000 systems, HP 3000 systems, and other computer systems.
- Coordination of Programmable Controllers on the factory floor.
- Quality Management.
- Process Monitoring and Control.

A Choice of Four Capability Levels

To cost-effectively match the widely-varying needs of real-time applications, HP 1000 computers are offered at four different levels of capability, all completely compatible with each other, as listed in the facing table.

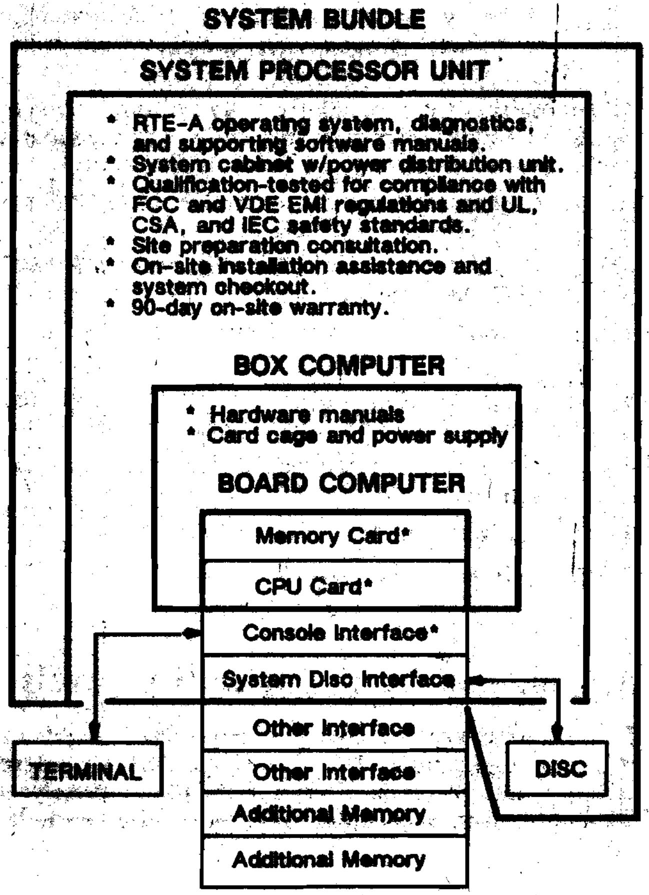
Integration Levels

HP 1000 Systems are available at four levels of integration, as shown in Figure 1-1, next page, and described below.

Bundles typically package a system disc and a software load device with an SPU at an attractive package price for simple ordering.

System Processor Units (SPUs) include a box computer, interfaces to the system console and system disc, the operating system and diagnostics, the system cabinet, site prep consultation and installation/checkout services, and 90-day on-site warranty. The high level of integration of the SPU simplifies design, ordering, and implementation of systems that use a system console and a system disc, both of which are ordered separately. The SPU also complies with FCC and VDE EMI regulations, which gives OEMs a head start on EMI compliance of their HP 1000 processor-based systems.

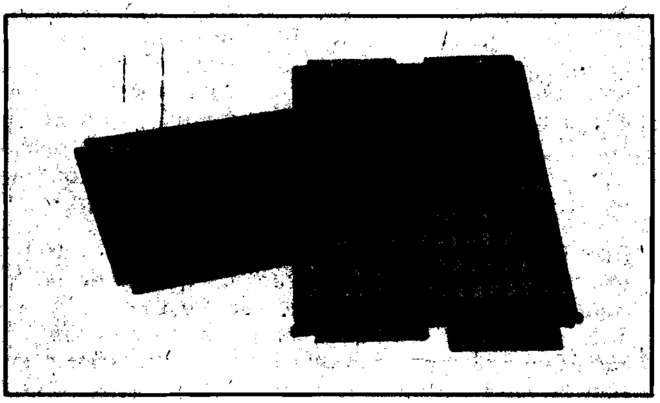
Box Computers incorporate the CPU card(s) and memory in a fully-powered card cage that can be installed in a rack cabinet. Because a system console and system disc are not prerequisites to purchase, the HP 1000 box computer offers OEMs and system designers more configuration flexibility than the SPU.


SYSTEM BUNDLE
SYSTEM PROCESSOR UNIT
* RTE-A operating system, diagnostics, and supporting software manuals.
* System cabinet w/power distribution unit.
* Qualification-tested for compliance with FCC and VDE EMI regulations and UL, CSA, and IEC safety standards.
* Site preparation consultation.
* On-site installation assistance and system checkout.
* 90-day on-site warranty.
BOX COMPUTER
* Hardware manuals
* Card cage and power supply
BOARD COMPUTER
Memory Card*
CPU Card*
Console Interface*
System Disc Interface
Other Interface
Other Interface
Additional Memory
Additional Memory
TERMINAL
DISC

* *NOTE: The A400 Board Computer incorporates the CPU, memory, and console interface cards on a single board, not separate cards as implied here.*

Figure 1-1. HP 1000 A-Series Integration Levels

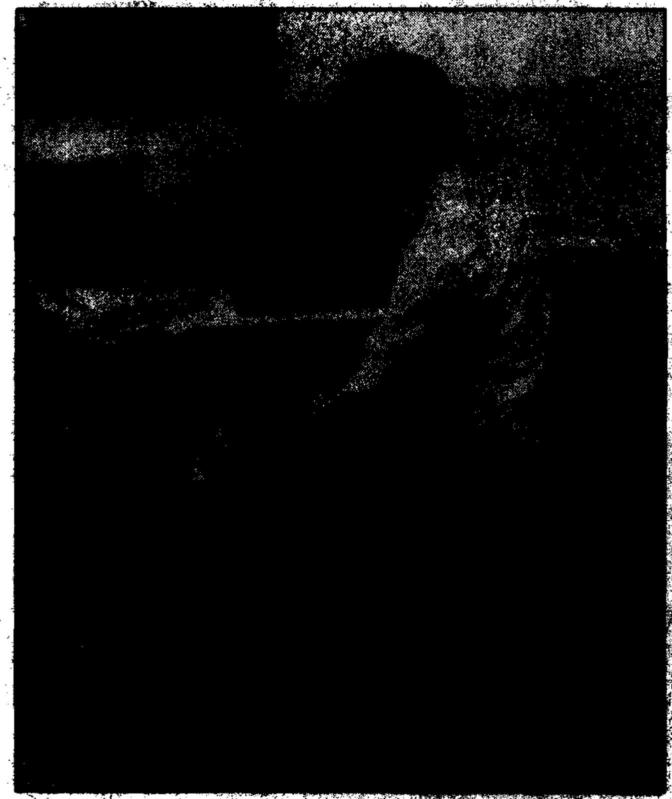
For example, the box computer can be configured to function as a remote distributed systems node without a system console for local operator communication. The operating system, diagnostics, interface cards and peripheral devices required to complete a usable system are ordered separately.



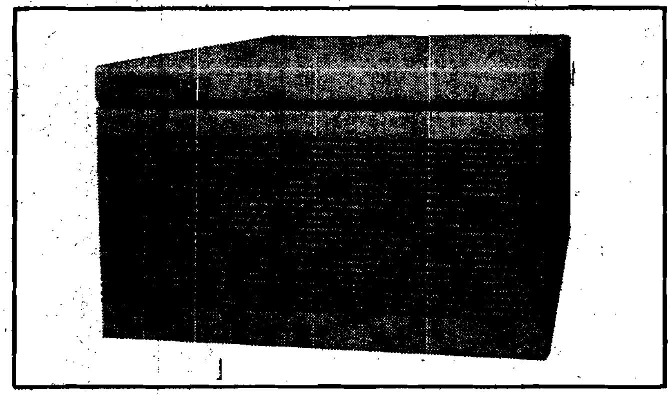
Package Choices

Three basic package choices are offered to enable users to satisfy their needs for memory and I/O capacity economically. They are:

The 20-Slot Box (above) is available as a box computer or packaged as an SPU in a short or tall rack cabinet. This package offers the greatest capacity for memory and I/O cards.



The Micro/1000 Package (above) has 14 card cage slots and is a good choice for medium sized systems because of its compactness and versatility. It can be used atop a table, desk, or workbench, installed in a rack mounting cabinet, or placed in a vertical floor mount that combines convenient under-desk or deskside placement with rollabout mobility on its own casters. The Micro/1000 package is available at both the SPU and box computer levels of integration, and complies with EMI regulations at both levels.



The Micro 14/16 "Cooler" Package (above), with six card cage slots, offers lowest cost packaging for low-end systems based on A400 or A600+ computers. Exceptionally efficient cooling equips computers in this package to operate at ambient temperatures to 60°C. This and its 1.5G operating shock spec make it ideal for use under tough environmental conditions. This package differs from the other two in that it does not support I/O interfaces that require 25 kHz ac supply, or battery backup of memory.

I/O Extenders based on the 20-Slot package and the Micro/1000 package can be used to add 18 or 12 I/O channels to the I/O capacity of HP 1000 computers in the 20-Slot or Micro/1000 package.

Compatibility Across all A-Series Processors

From the A400 through the A900, all A-Series computers operate under the same RTE-A real-time executive system. And they all use exactly the same I/O interfaces. Applications developed on the powerful A900 system can be transported to, and executed on, any of the other A-Series computers without change.

Upward Compatibility with HP 9000 Series 800 Systems

PORT/HP-UX applications migration tools supplied with HP 9000 Series 800 systems promote compatibility of HP 1000 A-Series systems with the Hewlett-Packard's new HP-UX based HP 9000 Series 800 superminicomputer systems.

Applications developed for HP 1000 A-Series computers are thus transportable with relatively little effort to HP 9000 Series 800 systems, which can support up to three times as many users, when a need for more power or capacity develops. An RMTERM/840 Terminal Emulator is available for use in downloading complete RTE-A operating systems from HP 9000 Series 800 systems via an RS-232-C serial link.

Software Tools:

Programmer Productivity Tools

- Interactive screen editor
- Symbolic debugger
- Delta backup utilities
- FORTRAN 77, Pascal, BASIC
- Macroassembler package
- Microprogramming package

Run-time Tool Packages

- Interactive Forms Human I/F Package
- Graphics Interface Library
- Data Base Management Package
- Programmable Controller Interface

Networking Packages

- LAN
- Distributed Systems
- X.25 Communications
- RJE/MRJE
- Multipoint/Multidrop

A-Series Computer Peripherals

Integrated 19.4 MB Winchester and 630 kB microfloppy discs for Micro/1000 package

Terminals:	character/block mode, alpha/graphics, color, touch
Fixed discs:	24 – 132 MB with integral cartridge tape backup 20 – 571 MB without cartridge tape backup
Removable media discs:	20 MB with 20 MB fixed 404 MB
Printers:	dot-matrix, laser
Graphics devices:	plotters, tablets, color graphics displays, printers
Bar code:	wands and printers

Hand held and portable computers

A-Series I/O Interfaces

Communications

Single channel serial
Programmable serial (PSI)
8-channel serial multiplexer
Expanded multiplexer
Color video Monitor RGB
Networking 802.3 LAN

Measurement and Control

HP-IB (IEEE-488)
Sixteen bit parallel
8-channel A/D expandable to 40 channels
4-channel DAC
Digital I/O
Breadboard interface
PROM storage module

Industry-Standard Connection to Other Systems

HP's commitment to industry standards is implemented in A-Series' connectivity options that include:

- HP-IB, our implementation of the IEEE 488 standard for communication; X.25 packet switching network packages.
- Programmable Controller Interfaces (PCIFs).
- IEEE 802.3 and 802.4 (MAP, the industrial automation standard).
- Three ways to link A-Series computers with IBM mainframes, so they can exchange data.

Open System Tools for Customization

The application versatility of HP 1000 A-Series computers depends considerably upon the open system tools that are available for customization. This begins with a complete set of program development tools (editors, compilers, Macro assembler, and debugger). The RTE-A system is modularly configurable to support open I/O on all A-Series computers, with a wide variety of interfaces and peripherals. And open I/O extends to support of customer-written I/O drivers, including a customer training course in RTE I/O driver writing.

The symbolic debugger includes a built-in program profiler that can be used to ferret out the most time-consuming parts of programs for faster, more efficient execution. Other open-system tools include a breadboard interface, a user-programmable communications interface, Engineering Reference Documentation, RTE-A operating system source code, and a logic analyzer interface for detailed analysis of system functions.

Sample Custom Products:

High Speed Buffered Parallel Interface

- I/O rates up to 3 MB/sec
- 600 kB/sec continuous transfer rate

Watchdog Timer and Clock

- Failsafe alarm for detecting CPU failures
- Battery-sustained time-of-day clock

Dual-port Dual-CPU Disc Driver

- Both CPUs can access multiple disc drives
- Building block for redundant systems

Sync/Async 8-Channel Multiplexer

- Programmable SBC, EPROM, and RAM
- Full duplex modem control on all channels

Beyond these tools, HP also offers customization training classes and two additional levels of customer engineering support:

- A worldwide team of knowledgeable Application Engineers, who work with OEMs and system designers on custom solutions and,
- A Custom Engineering Department, which provides custom products for unique needs.

Pace-Setting Reliability

Because HP knows reliability is critical in real-time applications, we've paid a great deal of attention to it. And it shows up as monthly maintenance fees for A-Series products that are half the rate of our closest competitors because A-Series failure rates are LOW. A-Series computers run for YEARS between failures.

Unexcelled Service and Support

In surveys by Datapro Corporation over the past six years, Hewlett-Packard has been rated #1 in service and support categories, and #1 in overall customer satisfaction more consistently than any other vendor. Our worldwide local support teams are comprised of experienced HP hardware and software engineers. One telephone call can produce assistance, whenever and wherever it is needed – from 300 locations in 72 countries.

Hewlett-Packard is committed to support A-Series real-time computers through the year 2010, assuring continuity of HP service and support for a long time to come. During that time, HP's lower maintenance rates will significantly reduce total cost of ownership of HP 1000 A-Series computers.

Training Programs.

HP-sponsored classes, conferences, and user groups provide ongoing information flow and training for HP 1000 A-Series computer users. HP can provide in-depth factory training on driver writing, I/O design, and on operating system internals, and service training classes.

Engineering Assistance

HP also offers complete project management, planning, and implementation services from more than 35 regional Project Centers worldwide. HP project teams can work on integration of all the products, services, training, and vendors needed to achieve a successful solution. Additional custom services are available from HP factory engineering groups and value-added solution suppliers.

HP Programs for OEMs and Other Value-Added Businesses.

HP recognizes that no single vendor can offer complete solutions for all applications. Therefore, we are committed to building strong, ongoing relationships with original equipment manufacturers (OEMs), system designers, and other value-added solutions suppliers. HP offers a variety of programs and services to help make value-added businesses successful and profitable. One example is HP's commitment to provide open I/O on all real-time computers.

HP provides demo/development systems at a substantial discount. Volume discounts are based on units or dollars. OEMs can maximize their discount by leveraging system, component, and peripheral purchases. OEM discounts apply to HP system upgrades as well as new purchases. Trade credits are given to OEMs for system upgrades even if their customers buy an upgrade directly from Hewlett-Packard.

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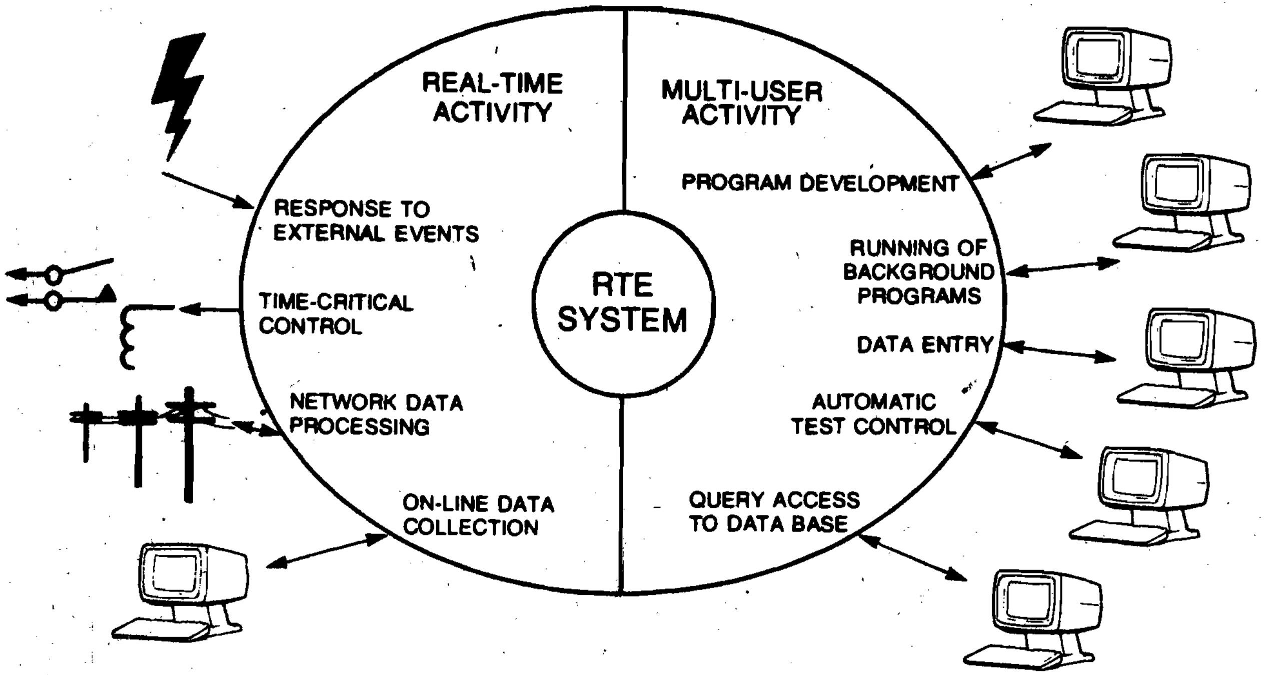
Real-Executive (RTE) Operating Systems

HEWLETT PACKARD

HP 1000 Computer Systems Software


REAL-TIME ACTIVITY
MULTI-USER ACTIVITY
RESPONSE TO EXTERNAL EVENTS
TIME-CRITICAL CONTROL
NETWORK DATA PROCESSING
ON-LINE DATA COLLECTION
RTE SYSTEM
PROGRAM DEVELOPMENT
RUNNING OF BACKGROUND PROGRAMS
DATA ENTRY
AUTOMATIC TEST CONTROL
QUERY ACCESS TO DATA BASE

Features

- **True multiprogramming with concurrent program execution.**
- **Time, event, program-to-program, and user scheduling of program execution.**
- **Time slicing within each priority level.**
- **File management capabilities for creation, maintenance and manipulation of files by users or programs.**
- **Interactive debug and screen Editor to aid program development.**
- **Reliability features such as powerfail/auto restart and device I/O timeout.**
- **On-line system generation.**
- **RTE drivers and device subroutines for supported peripherals, including Hewlett- Packard Interface Bus (HP-IB)* for multiple instrument support.**
- **Support of powerful software, including Graphics/1000-II, Image/1000, and DS/1000-IV.**
- **Multi-lingual programming in assembly language and, optionally, FORTRAN, Pascal and BASIC/1000.**
- **Non-swappable memory-resident programs for fastest response to interrupts.**

Real-Time Executive (RTE) is a disc or memory based software system used for management of operations and resources of HP 1000 computer systems. RTE systems provide true multiprogramming capability for monitoring and controlling concurrent events in real time. The configuration flexibility of RTE systems makes it easy to accommodate a wide variety of application requirements.

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* *The Hewlett-Packard Interface Bus (HP-IB) implements IEEE Standard 488-1978, "Digital Interface for programmable instrumentation", identical ANSI Standard MC1.1, and IEC recommendation 625-1. (The IEC recommendation specifies use of a different connector.)*

Today's RTE family, an outgrowth of the first RTE system introduced in 1969, consists of two different, but closely related systems. The differences of these systems depend on the computer series supported, as summarized in Table 2-1 on the next page. However, program requests and operator commands are functionally compatible between the RTE systems and only a few program calls differ between systems, which simplifies use of multiple HP 1000 computers of different series.

The RTE Operating System Family

RTE-A supports HP 1000 A-Series computers, which have a distributed intelligence I/O architecture. RTE-6/VM supports the HP 1000 E/F*-Series computers, which have a centralized intelligence I/O architecture. Each operating system is briefly discussed below within these categories. For comparison, see Table 2-1.

The RTE-A System for Distributed Intelligence I/O

RTE-A is HP's real-time executive operating system for HP 1000 A-Series distributed intelligence I/O architecture computers. It is configurable for either disc-based or memory-based operation and can manage up to 32 megabytes of memory (physically limited to 18 megabytes). It supports Extended Memory Areas for data, the 92078A VC+ extension package for code and data separation (supporting programs up to 7.75 megabytes), and up to 128 megabytes of Virtual Memory for data. Automatic program cloning and standardized LUs are supported in the RTE-A/VC+ environment for the convenience of multiple users.

The RTE-6/VM System for Centralized Intelligence I/O

RTE-6/VM is HP's real-time executive operating system for HP 1000 E/F*-Series computers. It combines management of up to 2M bytes of memory, and Extended Memory and Virtual Memory-for-data capabilities with a friendly session-monitor environment for multi-user access to the system.

RTE Description

Real Time Multiprogramming

RTE operating systems supervise the execution of multiple programs, which can be used to perform several different functions concurrently. For example, under RTE control, a program can send data to and receive data from peripheral equipment, another program can display information to a user, and a third program can be used for program development. All of these programs, and more, can run concurrently and independently.

Program Scheduling. RTE schedules programs on a priority basis by retrieving them from a scheduled list ordered by program priority. RTE provides these methods of scheduling programs:

- External events recognized by the system as interrupts can cause their individual interrupt-handling programs to be scheduled.
- A program can be scheduled by another program through an operating system call.
- Programs can be scheduled to execute once or repeatedly at a particular time of day or at a specified time interval. A system clock is maintained as part of the operating system functions.
- A program may be scheduled by a user command from a terminal.

The calling program or the user may choose to wait for the scheduled program to complete execution, or may continue with other operations without waiting.

Priority Management. RTE supports 32767 levels of priority, giving a user close control over the order of task execution. When a higher priority program is added to the scheduled list, any lower priority program currently executing will be suspended, and the higher priority program will begin execution.

Real-Time and Background programs are distinguished by their priority, with a background priority boundary value that is identified at system generation time.

Time Slicing. RTE-controlled multiple programs of the same "background" priority can be run on a time-sliced basis. In this scheme, each program of a particular priority is granted the same execution time "slice" as every other program running at the same priority, in a round-robin scheduling arrangement. The basic time slice interval length is set during system generation. This can be used by the system manager to assure an equitable allocation of program execution time. Monopolization of the system by any individual compute-bound background program can thus be avoided.

Real-time programs will not be time-sliced even if more than one is assigned the same priority. A time-critical task can thus execute to completion without interruption.

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* *F-Series computers are discontinued products, noted here for reference only.*

Table 2-1. RTE Specifications Summary

OPERATING SYSTEMS	92077A RTE-A	92084A RTE-6/VM
HP 1000 SERIES SUPPORTED	A-Series	E/F-Series
STANDARD IN HP 1000 MODELS	26, 27, & 29, & Micro 24, 26, 27, & 29	60
MEMORY		
Min. Memory Required	256 kB	256 kB
Primary System Memory Required	512 kB min.	512 kB min.
Max. Memory Supported	32 MB	2 MB
Max. Physical Memory Avail.	24 MB	2 MB
PROGRAM CAPACITY AVAILABLE TO USER		
Maximum Overlay Program Code	7.75 MB w/92078A(A)	
Maximum Length of Resident Program	64 kB	1.8 MB (C)
Maximum Path Length with 92078A	7.75 MB	not appl.
Maximum Path Length without 92078A	62 kB	64 kB
Number of program partitions	255 (D)	64
VIRTUAL MEMORY FOR DATA (VMA)		
Maximum VMA Space Accessible to Program	128 MB	128 MB
Maximum Working Set Size	2 MB	1.8 MB (E)
EXTENDED MEMORY AREAS (EMAs)		
Maximum EMA Data Space	1.99 MB/pgm	1.8 MB (E)
Number of Sharable EMAs/System	15	8 to 60
Number of Programs Sharing EMA	63	256
OTHER SYSTEM CAPACITY SPECIFICATIONS		
Number of logical units	254 (F)	255
Number of I/O Select Codes that can use direct memory access simultaneously	24	2
System Available Memory	64 kB max.	(G)
REAL-TIME PROGRAM SCHEDULING		
By Time	Yes	Yes
By Event	Yes	Yes
By Another Program	Yes	Yes
By User	Yes	Yes
Number of Priority Levels	32767	32767
MULTI-USER SUPPORT		
Log-on Access Control	w/92078A	Yes
Session Accounting	w/92078A	Yes
User Capability Discrimination	w/92078A	Yes
Protected Environment for Users	w/92078A	Yes
By Multi-Terminal Monitor	Yes	Yes
Time Slicing Among Users	Yes	Yes
PROGRAM DEVELOPMENT SUPPORT		
File Manager	Included	Included
Command Interpreter	Included	Included
Input Spooling	No	Yes
Output Spooling	w/92078A (H)	Yes
Batch Processing	No	Yes
Interactive Screen Editor	Included	Included
Symbolic Debug/1000	w/92860A	w/92860A
Link/1000 Linkage Editor	Included	Included
Absolute Program Loader	No	Included

Table 2-1. RTE Specifications Summary, continued

OPERATING SYSTEMS	92077A RTE-A	92084A RTE-6/VM
PROGRAM LANGUAGES		
BASIC Compiler and Interpreter	w/92857A	w/92857A
BASIC Interpreter only	Not avail.	w/92101A
FORTRAN 77 Compiler	w/92836A	w/92836A
Pascal Compiler	w/92833A	w/92833A
Macro Assembler	Included	Included
PERFORMANCE ENHANCEMENT		
Program Activity Profiling	w/92860A	w/92083A or 92860A
Microprogram Development	w/92049A	w/92061A
GRAPHICS		
General Graphics Support	w/92861A	w/92861A
Interactive or 3-D Graphics Support	w/92862A and 92861A	w/92862A and 92861A
DATA MANAGEMENT		
Datapair/1000 Disc Mirroring software	w/92050A	Not avail.
IMAGE/1000 DBMS w/on-line Query	w/92069A	w/92069A
IMAGE/1000-II DBMS with on-line Query and extensive recovery capabilities	w/92081A	w/92081A
MANUFACTURING APPLICATIONS SOFTWARE		
Programmable Controller Link	w/94200B and one of 94202A-94206A	Not avail.
Process Monitoring & Control	w/92121A	Not avail.
Quality Decision Management	w/92131A	Not avail.
SYSTEM-TO-SYSTEM COMMUNICATIONS SOFTWARE		
NS/1000 Network Services	w/91790A	Not Sup.
DS/1000-IV Network Software	w/91750A	w/91750A
DSN/X.25 Packet Switching Communication	w/91751A	w/91751A
Remote Job Entry to IBM 360/370	w/91782A or 91781A	w/91782A or 91781A
Program-Program Comm. to IBM or plug-compatible systems	w/91784A	w/91784A
TERMINAL USER-TO-SYSTEM COMM. SOFTWARE		
8-Ch or 4-Ch Mpxer Comm.	Included	Included
Data Link/Multipoint Comm.	w/91732A	w/91730A

(A) = RTE-A without VC+ supports segmentation of large programs by the user.

(B) = RTE-6/VM Multi-level segmentation, load-on-call capability supports simplified development or conversion, loading, and execution of large programs, within the limits of available disc memory.

(C) = Space available for programs and data in RTE-6/VM is equal to total memory less that used for the system.

(D) = Dynamic partition allocation; the number of fixed partitions is limited to 255.

(E) = Memory available for EMA data in RTE-6/VM equals total memory less that used by the system, resident libraries, programs, and software subsystems.

(F) = The number of logical units supportable in RTE-A depends upon memory available for table space in the particular configuration and may be less than 255.

(G) = System Available Memory in RTE-6/VM depends upon the memory available after provision for drivers, ID Segment Tables, EQT tables, etc.

(H) = Output spooling in RTE-A without 92078A VC+ is to printer only, not to any other device.

Memory Utilization

RTE operating systems vary with respect to memory utilization as discussed below.

RTE-A User Program Areas. RTE-A places all user program space (up to 18M bytes less the space used by the system) above the system. User program space may be subdivided into as many as 255 fixed partitions and an essentially unlimited number of dynamically-allocated partitions.

User memory spaces can be divided at system bootup into fixed partitions and dynamically allocated memory. Critical programs can be assigned to fixed partitions to assure fastest possible response to requests for their execution. Memory partitions are allocated to other programs from a dynamic memory pool as needed. If enough space is not free, the system will swap out inactive or lower priority programs to make space.

Addition of VC+ to RTE-A provides for separation of code and data and for the totally transparent development, loading, and execution of programs as large as 7.75 megabytes. (For more information, see the 92078A VC+ data sheet on page 2-15.)

If the VC+ package is not installed, a program larger than 64k bytes can be segmented into overlays, sharing the same physical memory space when called upon to execute. A main (or root) segment, not overlaid by other segments, contains the static data. Thus, information can be passed from one overlaying segment to another and preserved throughout the execution of the program. Static information can also be maintained in EMA or VMA. Segment load and execute services are provided by RTE-A.

RTE-6/VM User Program Areas. Memory partitions are defined during system generation and can be redefined during system boot-up. The amount of memory available for partitions is equal to the size of total physical memory in the computer, less the memory used for the RTE system (as much as 1.9M bytes is available to the user in a 2M byte system). Partitions can be divided into real-time or back- ground categories. Programs scheduled for execution will be loaded into the smallest partition available. If none is available and the priority of the scheduled program is higher than programs already in memory, the lowest priority program will be swapped out to free a partition.

Extended Memory Areas (EMAs) for data. EMA extends the logical address space of a program up to the available physical memory. EMA can contain arrays or other data, but not code, making it useful for large amounts of data storage, acquisition and processing. Disc access is not necessary, allowing fast data acquisition from real-time devices. Segmented and CDS programs can use EMA. Sharable EMA partitions can be shared by up to 63 programs on RTE-A and up to 256 programs on RTE-6/VM and multiple sharable EMAs can be defined on one system.

Virtual Memory Areas (VMAs). VMA is a demand-paged Virtual Memory Area (VMA) for up to 128M bytes of data. FORTRAN and Pascal/1000 programs require only one additional control statement per module to use VMA. From then on, access to VMA is virtually transparent.

Interrupts

RTE uses the multi-priority level, vectored hardware interrupt system for detection of power failures, protected violations, parity errors, unimplemented instructions and time base ticks, as well as all device I/O interrupts. When one or more interrupts occur simultaneously, the interrupt with the highest hardware priority is recognized first. The hardware maintains all interrupts until they are serviced by the operating system, so no interrupt is forgotten or overlooked.

The A-Series distributed intelligence I/O architecture supported by RTE-A provides simultaneous DMA capability for up to 24 I/O interface cards, thereby minimizing the number of I/O interrupts. Under RTE-A, DMA can be used to transfer data directly into or from memory even for the slowest device connected to an interface, minimizing CPU overhead. Only after a full buffer of data has been transferred will an interrupt be generated.

The E/F-Series centralized intelligence I/O architecture supported by RTE-6/VM can use two program-assignable DMA channels simultaneously.

System Integrity

The integrity of RTE systems is protected by the following features:

- Optional auto restart after power failure.
- Operating system protection from accidental modification by user programs and user program protection from accidental modification by each other.
- Optional "downing" of a failed I/O device with a message to the operator or with a programmatic return of the error status to the calling program.
- Optional locking of certain system resources to user programs for their exclusive use.
- Optional protection of disc files from unauthorized access.
- Return of control to a program that requests I/O from a "down" or locked device.
- Optional deallocation of class numbers "owned" by a program that terminates abnormally.
- Account password control of user access to the system (RTE-A requires VC+ for this capability).
- Isolation of a memory fault to the affected partition (which is "downed" by RTE-6/VM). The program aborts. Execution of programs in other partitions continues without interruption and the affected program can be loaded into another partition.

- Isolation of a memory fault to the affected page (which is flagged by RTE-A). In RTE-A, a memory parity error in a dynamically allocated user partition aborts the program running in that partition. The affected page is flagged and excluded from further use. The affected program can be reloaded into another partition without stopping the system. Programs in other partitions continue to execute normally. A parity error in a reserved partition causes the program to be aborted. RTE-A "downs" the entire partition, not just the bad page. Reboot and change of memory partitioning are required to recover the use of the good pages in a downed reserved partition.
- Protection of disc cartridges and other resources allocated to session users (RTE-A requires VC+).
- Control of command capabilities available to session users (RTE-A requires VC+).
- Optional exclusive assignment protection of disc tracks (RTE-6/VM only).
- Optional user and group file domains (RTE-6/VM only).

How Input/Output in RTE-A Differs from Input/Output in RTE-6/VM

With A-Series distributed intelligence I/O architecture,up to 24 I/O channels have Direct Memory Access (DMA), thereby minimizing system overhead. With E/F-Series centralized intelligence I/O, DMA is dynamically program-assignable to any two I/O channels at a time in the system.

RTE I/O Features

- **Optional timeout on I/O requests** can be used to prevent an inoperative I/O device from halting the entire system.
- **I/O suspend with auto rescheduling at I/O completion** allows other non-I/O bound programs to run.
- **Programmatic use of class I/O** can allow a program to continue execution while an I/O operation is processed.
- **Buffering of output to slow devices** allows a program to be swapped out during an I/O operation.
- **Mailbox I/O between multiple programs** frees programs from reliance upon the integrity of a common data area shared and maintained by all interacting programs.
- **One-driver support of multiple interfaces** of the same kind promotes efficient use of memory.
- **Input buffering** through the use of class I/O.
- **Waiting list of backlogged I/O requests** keeps each I/O device optimally utilized.
- **Automatic "downing"** of an I/O device on a controller in event of an equipment error without affecting other devices on the same controller.
- **Interleaving of requests** to devices on a multi-device interface maximizes system throughput (RTE-A only).
- **Spooling of output to printer** boosts throughput with minimal use of main memory for buffering (RTE-A requires VC+).
- **Write-read request** on an interactive serial device accomplishes two successive I/O operations with only one system call, eliminating 50% of system call overhead. This is especially useful in an operator-prompting scheme where the prompting message is first written out before waiting for a reply (RTE-A only).
- **Standard or user-definable error recovery** (RTE-A only).
- **Class buffer rethreading** for programmatic movement of class buffers from one completed class queue to another without the use of additional SAM or system overhead (RTE-A only).
- **Up to 255 logical units** (individual devices) and up to 255 equipment tables (device controllers), each with up to 64 subchannels.

  NOTE: The number of logical units supportable in RTE-A depends upon memory available for table space in the particular configuration. This number may be less than 254.

- **No-suspend I/O option** can be used to prevent suspension of critical programs because of I/O device malfunctioning (returns control to calling program when device failure is detected).
- **Optional program ownership of class numbers** permits deallocation of class numbers for a program that terminates abnormally.
- **Exclusive assignment of I/O devices** can be used to ensure that a low-priority program completes its use of a printer or other device without having that use preempted by another program.

On-Line Program Development Tools

Command Interpreter and File Manager. The Command Interpreter (CI) and File Manager (FMGR) support creating, deleting, storing, copying, packing, and listing of disc files using interactive user commands. CI and FMGR provide a user interface to I/O devices (including disc files) and system capabilities (such as program scheduling and system status information). CI provides access to both single-level cartridge directories and hierarchical directories, while FMGR provides access to disc files on single-level cartridge directories only.

All disc files are referenced by name under both CI and FMGR. Disc files can be automatically extended to additional storage space when an attempt is made to write beyond the current end of file. A file can be extended up to 255 times.

The hierarchical directory structure accessible from CI also provides time stamping information. The times of creation, last update, and last access of files are recorded in hierarchical directories. Hierarchical file names may use up to 16 characters (versus only 6 characters for FMGR files), and hierarchical path names may contain up to 64 characters. FMGR cartridge directories can be converted to CI hierarchical volumes using RTE utilities.

CI and FMGR both support command files, including powerful test and control statements and control variables. CI has extensive file name masking capabilities, which FMGR has more limited masking capabilities.

File Management Package. Programs may access both CI and FMGR files using File Management Package (FMP) calls. Certain FMP calls can access only FMGR files, but most FMP calls can access both CI (hierarchical) and FMGR files. All the file management capabilities provided by CI and FMGR can be duplicated programmatically using FMP calls.

The Edit/1000 Screen Editor provides a variety of tools for entering and correcting program, data, or text files on the disc. In addition to its convenient screen mode, Edit/1000 provides character string search and correction capabilities that let the user locate and change all occurrences of a particular string of characters throughout a file, or only in specific lines or columns of a file. It also offers powerful line copy, move, break and join capabilities. Of course, these capabilities are in addition to the usual line or character display, insertion, replacement, and deletion capabilities normally expected in a program editor.

Link/1000 collects user's relocatable program files and referenced library routines to produce an executable program file. The output is a memory image of the program with entry points resolved from the snapshot file of the particular generated system. Link/1000 can be operated interactively, from a runstring, or by commands included in a file. The Link run-string supports the running of many loads through a transfer file. (This is especially helpful to a user who has updated RTE under Customer Support Service or Software Subscription Service and must reload user programs for the latest version of the operating system. Certain programs can run on different generations without reloading or relinking.)

Interactive Program Debugger. The optional 92860A Symbolic Debug/1000 package (see page 2-23) provides powerful program debug capabilities.

User and Program Requests (u & p)

See Table 2-2.

Utilities and Libraries Provided in Both RTE-A and RTE-6/VM

- Utilities for formatting, initialization and sparing of disc tracks; saving and restoring of files from disc or cartridge to magnetic tape, and vice versa; and disc-to-disc copying in an efficient, packed format
- Logical Unit and I/O Table information utilities for displaying the current I/O configuration.
- System status reporting utilities for indicating active programs and describing program states, such as down or locked I/O devices and status of memory partitions.
- A relocatable merge program for combining relocatable files together into a single file.
- A fast help utility for on-line explanation of commands.
- A math/utility library for calculations and related processing.
- An HP-IB Library for simplification of HP-IB instrument programming.
- A system library with a variety of system-level subroutine calls, such as resource number requests, (RNRQ), LU lock requests (LURQ), a parsing routine (PARSE), a formatted time routine (FTIME), and a programmatic execution of operator commands routine (MESSS).
- A decimal string arithmetic library for addition, subtraction, multiplication, and division of decimal character string numbers that exceed the integer, floating point, extended, and double precision capabilities of the other libraries.
- A cartridge tape formatting utility for TF, FC, and FST file backup utilities.
- Utilities for converting FMGR files to the hierarchical file system of the Command Interpreter (CI), for repacking CI files, for scanning CI disc directories and reporting inconsistencies, for reporting CI disc space taken by a specific user or directory, and for scanning the free space table of CI discs to report the amount of free space and the largest individual space available.
- A routine for verification of CS/80 pushbutton backup and restore.
- A library index routine for creating indexed user libraries to increase program loading speed.
- A program for displaying status of system class numbers.
- A utility for printing files on any HP 1000 supported system printer.
- File backup utilities with incremental backup capability.
- A utility for managing files in HP's inter-system file interchange (LIF) format.

Table 2-2. RTE User and Program Requests

RTE-A	RTE-6/VM	REQUESTS
		PROGRAM SCHEDULING AND TIME OF DAY CLOCK REQUESTS
u & p	u & p	Schedule programs to be run with or without wait for completion.
u & p	u & p	Terminate or suspend program execution.
u & p	u & p	Activate operator-suspended program.
u & p	u & p	Change program priorities.
u	u	List status of all programs or currently executing programs.
u & p	u & p	Request program execution at a specified time or specified interval.
u & p	u & p	Set the real-time clock.
u & p	u & p	Obtain time (current year, day, and time of day for program; time of day, day of the month, month, year, and day of the week for user).
		PROGRAM DEVELOPMENT REQUESTS
u	u	Compile or assemble programs.
u	u	Enter, test, debug, edit, and run BASIC programs.
u	u	Trace program execution, examine and modify memory and/or register contents, or perform other debugging operations.
u	u	Edit program, data, and text files.
u	u	Install relocatable programs and subroutines into a generated system.
		INPUT/OUTPUT REQUESTS
u	u	List I/O configuration in terms of table description and drivers.
p	p	Read from/write to any I/O device with or with or without wait.
p	p	Get status of queued read requests or the resulting input data.
u & p	u & p	Control functions on mag tape or other peripheral device.
u & p	u & p	Check I/O device/controller status.
u	u	Alter I/O device timeout parameters.
u	u	Alter device logical unit assignment.
u & p	u & p	Control I/O device availability to programs.
u	u	Alter device buffering assignments.
		RESOURCE CONTROL REQUESTS
u	u	Display partition table.
p	p	Allocate/release own disc tracks.
p	p	Allocate/release global disc tracks.
u & p	p	Enable/disable swapping.
p	p	Request resource lock/unlock.
p	p	Request device lock/unlock.
n.a.	p	Request partition status.
u	u	Display or change program size.
p	p	Determine size of own address space.
u	u	Unlock sharable EMA partition.
u	u	Establish working set size.
p	n.a.	Load program code segment from disc.
p	n.a.	Reserve buffer space outside the program space.
p	n.a.	Get current status of memory.

Legend: u = User Request p = Program Request
n.a. = Not available

Table 2-2. RTE User and Program Requests

RTE-A	RTE-6/VM	REQUESTS
		COMMAND INTERPRETER, FILE MANAGER, AND FILE MANAGEMENT PACKAGE REQUESTS
u & p	u & p	Create, locate, open, and close files.
u & p	u & p	Rename and purge files.
u & p	u & p	List or dump contents of a file to another file or to a peripheral device.
u & p	u & p	Copy a file from one disc logical unit to another.
u & p	u & p	List contents of a disc file directory.
u & p	u & p	List contents of a cartridge directory of the disc logical units that are mounted on the system.
u & p	u & p	Unpurge files prior to re-use of the affected file space.
u	u	Pack a disc logical unit.
p	p	Write in a random or sequential file.
p	p	Read from a random or a sequential file using relative record number.
u & p	u & p	Mount and dismount cartridges.
		MISCELLANEOUS REQUESTS
u & p	p	Determine the type of device (such as terminal, cartridge tape unit, or printer), given the device number.
p	n.a.	Determine which terminal was used to run the current program.
p	p	Convert integers from ASCII to binary.
p	p	Pass message or data buffers between programs.
p	p	Retrieve a parameter string entered by the user who runs the program.
p	p	Execute some system requests as if they had been entered by a user.
p	p	Parse a command buffer into ASCII and and integer fields.

Legend: u = User Request p = Program Request
n.a. = Not available

Utilities Provided Only in RTE-A

- A utility for installing the bootup file (BOOTEX) onto the beginning of a disc.
- A utility for conversion of an absolute binary program file to a memory image file, or vice versa.
- A utility for combining memory image program files with a system image to make a memory-based system.

Utilities Provided Only in RTE-6/VM

- Support for an on-line diagnostic and verification package (91711B) for monitoring the functional operation of system hardware.
- Utilities for creating soft-key files and setting up terminal soft-keys.
- A session accounts program (ACCTS) for configuration and control of Session Monitor accounts. A similar capability is available on RTE-A with the 92078A VC+ extension.
- A utility (LGTAT) for reporting the ownership of system disc tracks.

- A utility for on-line loading and replacement of drivers without system regeneration.
- An interface to compilers (COMPL) and interface to compilers and loaders (CLOAD) for one-step compilation and loading of user programs with automatic outspooling.
- A fast command utility for on-line explanation of the syntax of all interactive RTE commands and error messages and support for creation of user-defined message files for interactive user programs.
- A large program segmenter that helps users to prepare Multi-Level Segmentation (MLS) Loader command files for segmentation of large programs (not needed for RTE-A).
- A cross-reference generator for identifying external routines that are called by a specified module and the routines in a specified module and for verifying the integrity of MLS Loader command files.
- A program for comparing two source files and identifying lines that differ and/or lines that are similar between the two files.

Optional software

See Table 1, page 2-3.

Basic specifications

See Table 1, page 2-2.

Operational Requirements

See the individual RTE-A data sheet on succeeding pages.

Ordering Information

See the individual RTE-A data sheet on succeeding pages.

RTE-A Real-Time Executive Operating System

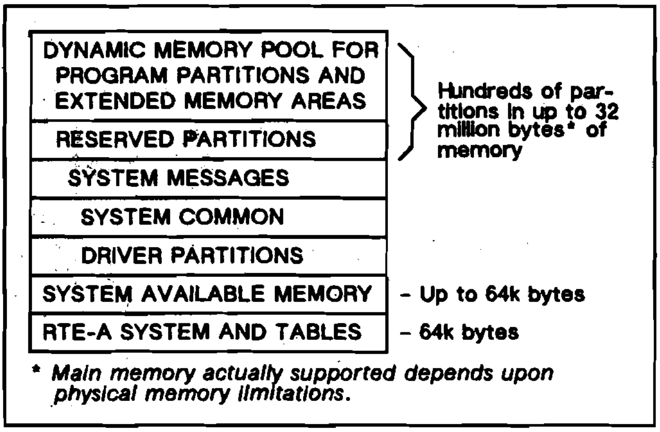
HEWLETT PACKARD

HP 1000 A-Series Software

product number 92077A

The RTE-A Real-Time Executive operating system, product number 92077A, is a Real-Time Executive system for A-Series computers (HP 2137A, 2139A, 2156B, 2424A, 2426E/F, 2436A/E, 2437A, and 2439A) and A-Series Computer Systems (HP 1000 Micro 24, 26, 27, and 29 and Models 26, 27, and 29). This system provides true multiprogramming capability and may be configured as a memory-based or disc-based system. RTE-A can operate in as little as 256k bytes of main memory, but will support up to 32 megabytes*. A minimum of 512k bytes is required for the RTE-A primary system.

RTE-A is the "core" operating system for A-Series computers. Additional products, such as the 92078A Virtual Code+ (VC+) enhancement package, add to the basic functions of RTE-A, but without affecting its basic compatibility across the entire line of A-Series computers.


DYNAMIC MEMORY POOL FOR PROGRAM PARTITIONS AND EXTENDED MEMORY AREAS
RESERVED PARTITIONS
SYSTEM MESSAGES
SYSTEM COMMON
DRIVER PARTITIONS
SYSTEM AVAILABLE MEMORY
RTE-A SYSTEM AND TABLES
Hundreds of partitions in up to 32 million bytes* of memory
- Up to 64k bytes
- 64k bytes
* Main memory actually supported depends upon physical memory limitations.

RTE-A System with 256k bytes to 32M bytes of memory*

Features

- **All base capabilities of an RTE system as defined in the RTE operating systems data sheet on page 2-1, plus these additional features:**
- **Ample capacity for support of applications up to the very largest, with capabilities like:**
  - Management of 256k bytes to 32M bytes* of main memory with DMA access to any part of memory.
  - File system capable of supporting up to 20 gigabytes of disc storage.
  - Support of large programs (up to 7.75 megabytes) with the 92078A Virtual Code+ (VC+) package.
  - Virtual memory for data arrays up to 128 megabytes, divided between main memory and disc.
  - Extended Memory Areas up to 2 megabytes resident in main memory, up to 15 of which are sharable by up to 63 programs.
  - Hundreds of user partitions, which may be reserved and/or efficiently allocated as needed from a dynamic memory pool.
  - Up to 255 logical units if there is sufficient table space in memory.
  - Up to 64 kilobytes of System Available Memory for buffered I/O and other uses.
  - Partitioned operating system, including driver partitions, allowing larger systems.
- **Enhanced multi-user interface with the 92078A Virtual Code+ (VC+) package.**
- **Output spooling to printer.**
- **DS transparency between RTE-A systems.**
- **Command interpreter with on-line help for commands and support for:**
  - 16-character file names
  - Hierarchical directories and subdirectories
  - Time stamping
  - Unpurge capability
  - Files managed under the previous file management system
- **Efficient I/O, with:**
  - Drivers that take advantage of the advanced A-Series I/O design with DMA per channel, minimizing I/O processing overhead
  - Modular device and interface drivers that work together to promote I/O efficiency.

* *Main memory actually supported depends upon physical memory limitations, currently 18 megabytes, maximum.*

RTE-A: A Large-Capacity Multi-User System

Large Main Memory Capacity

Hewlett-Packard's RTE-A system can operate in as little as 256k bytes of memory, but can manage large-system applications in up to 32 megabytes. (Main memory actually supported depends upon physical memory limitations.)

Plenty of Partitions for Programs

RTE-A can manage a number of dynamically allocated partitions for multiple users that is limited by the amount of main memory available. Partitions can be as small as 4 kilobytes or as large as 2 megabytes, of which 64 kilobytes is available for program code. Extensive capacity for data is provided by VMA and EMA as defined below. Critical programs can be made resident in up to 255 fixed partitions to assure the fastest possible response to requests for their execution. Other programs are assigned partition space from the dynamic memory pool according to need, using the smallest suitable block of memory. This makes the most efficient use available memory capacity. If a large enough free block of memory is not available, the system will swap out an inactive or lower priority program to make space.

Support for Large Programs

RTE-A can be extended by the optional 92078A Virtual Code+ (VC+) Package. The VC+ package supports separation of code and data and the totally transparent development, loading, and execution of programs as large as 7.75 megabytes. (See page 2-15 for more information.)

If the VC+ package is not provided, a program too large to fit into available user program space can be divided into multiple segments of code, each of which will overlay another, sharing the same physical memory space when called upon to execute. A main (or root) segment, which is not overlaid by other segments, contains the data area common to the other segments through which information can be passed from one overlaying segment to another. Segment load and execute services are provided by RTE-A.

A Gigabyte Capacity Disc File System

The RTE-A file system can support up to 20 gigabytes of disc memory, based on use of currently available discs. Supportable disc space is limited mainly by card cage spaces available for disc interfaces and the capacity of available disc drives.

Lots of Virtual Memory Space for Data

Up to 2 megabytes of the user's partition can be used as the working set of a disc-Virtual Memory Area (VMA) for data arrays as large as 128 megabytes.

Multiple Extended Memory Areas (EMAs) Sharable Among Multiple Programs

Up to 15 different sharable EMAs (SHEMAs) can be set up, within the limits of available memory. A SHEMA can accommodate up to 2 megabytes of data -- data that is accessed quickly because it is all in main memory.

Each SHEMA can be shared by up to 63 different programs. This is especially useful in multi-task process monitoring and control systems in which one program acquires data, another uses the data to alter control outputs, and yet another analyzes or graphically displays the data. In addition to SHEMAs, any number of other non-sharable EMAs can be set up, each for the exclusive use of one program, within the limits of available main memory.

Separately-Mapped System Available Memory (SAM)

Separate mapping of System Available Memory (SAM) can make up to 64 kilobytes available for buffering I/O requests or other SAM uses. This much SAM can supports a tremendous amount of system I/O activity. In addition, separate mapping of SAM frees up space in the system map for larger system tables, also making possible a much larger system.

Human Engineered for Easy Use

Simplified System Generation and Loading

RTE-A systems are generated by the RTAGN utility program. This program may run concurrently with other programs on a disc-based RTE-A system and can also be executed on RTE-6/VM host systems to generate RTE-A systems for dedicated applications. System generation is done in a semi-automatic mode from a file which the user prepares in advance to provide commands to RTAGN. Extensive use of default options simplifies command file preparation. Further user assistance is provided by command file examples in the RTE-A System Generation and Installation Manual. I/O configuration, often the most complex part of system generation, is simplified by built-in identifiers in the software drivers.

After the command file has been prepared, system generation is typically accomplished in less than 10 minutes. The generator provides a generation list file of all messages and descriptions during the generation process, a generated system file from which the new operating system can be booted up, and a snapshot file that contains all the values of the entry points used by the new system. The snapshot file is used by Link to produce memory image program files.

Transportable Program Files

After initial loading on an RTE-A system, most programs can be transported to another RTE-A system for execution without reloading, relocating, or relinking. A few programs (typically those using system common) are not transportable and require reloading.

A Hierarchical File System With Many User-Requested Enhancements

The RTE-A Command Interpreter (CI) file system supports hierarchical directories. It also supports time stamping of the times of creation, last update, and last access; names up to 16 characters long, files as large as the hundreds of megabytes provided by one disc drive; and file unpurging. To take advantage of most of the CI file system features, user's FMGR file directories must be reformatted and programs must be modified. Directory reformatting can be done by a utility included with RTE-A or as part of a save/restore activity. For users who do not wish to reformat their old file directories, the Command Interpreter also supports FMGR files (but without many features of the enhanced file system) for concurrent use with files accessed via the hierarchical directories.

Disc Access by Name

RTE-A has a unified file structure for all disc space allocations in the system. This includes system and program files and user files for source, relocatable, or executable programs and data. Regardless of how it is used, every disc space allocation can be identified and accessed by a file name because its location is registered in a file directory.

Single-Command Changeover to Another System

To boot an RTE-A system from a disc, the BOOTEX (Boot Extension) program is invoked with a single command to the computer's Virtual Control Panel (VCP) program. BOOTEX locates the operating system file on disc and then configures the system according to a user-defined command file. BOOTEX then loads the operating system into memory and starts it running to complete the boot-up process. With the aid of the VCP ROM and the BOOTEX program, a user may boot-up an RTE-A operating system by name from anywhere on a disc instead of some fixed and reserved physical disc location. This is accomplished via a terminal or distributed systems point-to-point link that temporarily serves as the Virtual Control Panel for the system.

Single-command switchover facilitates switching to an updated RTE-A with the latest revision of software modules generated into it. This same capability also makes it easy to generate and use multiple RTE-A operating systems, each optimized for a specific application. As the need arises to use one of these operating systems for a specific application, it can be easily booted up in less than a minute.

With RTE-A, a new system is booted up using a command file, or through interaction with an operator at the VCP terminal. Memory configuration in RTE-A is done at boot-up and any bad pages can be defined at that time.

Improved Multi-User Environment

RTE-A's command processor helps the user to manage files, programs, and system resources without a detailed knowledge of the operating system. This command processor includes on-line help for each command, easily understood error messages, use of blanks or commas as delimiters, wild card file operations, program and status reports, and command file input. The optional 92078A VC+ package further improves the multi-user environment of RTE-A with logon control, private programs and files to protect users from each other, and standard user and superuser capability levels.

Design and Supportable Capacities of RTE-A

RTE-A is designed to support a maximum of 255 logical units (LUs) and 255 fixed partitions. How- ever, the number of LUs and partitions that can be supported also depends upon the availability and composition of use of the approximately 33k bytes of memory that is available for system tables. For that reason, although very large configurations are supportable, the full design capacities may not be realizable in some configurations.

Functional Specifications

See page 2-3.

Optional Software

See page 2-3.

Operational Requirements

A600 Hardware Revision Code

Model 6* and 16* Systems and 2106AK*, 2136A/B*, and 2156A* Computers with serial prefix earlier than 2326 must be upgraded to work with RTE-A; contact your HP Customer Engineer or your nearest HP Sales Office for more information.

* *Discontinued product listed here for reference only.*

For HP 1000 Systems

System Processor Units (SPUs) for HP 1000 Model 6*†, 16*†, 17†, 19†, 26, 27, and 29 systems and Micro 24, Micro 26, Micro 27, and Micro 29 systems with supported system console and system disc include and satisfy operational requirements of the RTE-A operating system.

* *Discontinued product listed here for reference only.*

† *See paragraph on A600 hardware revision code, above.*

For User-Assembled Stand-Alone Systems

See Table 2-3.

Table 2-3. Requirements for User-Assembled RTE-A Systems

Computer Product Number & Name	Interface(s) Required	Other Requirements
HP 12100A (A400) Single Board Computer (SBC) OR HP 2106BK (A600+) Board Computer WITH appropriate connections and power supply HP 2424A (A400) Micro 14 Computer (based on HP12100A SBC) HP 2434A (A400) Micro 24 Computer (based on HP12100A SBC) HP 2156B (A600+) Computer HP 2137A (A700) Computer HP 2139A (A900) Computer HP2426E/F (A600+) Micro 16 Computer HP2436A/E (A600+) Micro 26 Computer HP 2437A (A700) Micro 27 Computer HP 2439A (A900) Micro 29 Computer	HP 12100A's On-Board I/O or HP 12040D Eight-Channel Multiplexer & HP 12009A HP-IB interface (Optional)	Supported system console; system disc is optional
	OR HP 12100A's On-Board I/O or HP 12040D Eight-Channel Multiplexer	OR Remote HP 1000 system connected via RS-232 link
	OR HP 12007B or HP 12044A DS/1000-IV pt-to-pt interface	OR Remote NS/1000 or DS/1000-IV Network Node
	OR HP 12072A Data Link Slave interface	OR Remote DS/1000-IV Network Node

Supported System Consoles

See the Configuration Checklist in the HP 1000 Ordering Guide, HP Literature Stock Number 5954-8564 or a later revision.

Supported System Discs

Hard discs are required for program development, virtual memory, and/or system generation. For supported system discs, see the Configuration Checklist in the HP 1000 Ordering Guide, HP Literature Stock Number 5954-8564 or a later revision.

Ordering Information

HP 92077A RTE-A Real-Time Executive Operating System (must order one of Use Options 400 through 897)

RTE-A consists of:

1. The following software on Media Option 022, 044, 051, or 061, one of which must be ordered:
   a. A catalog file describing the set of software on the medium by part numbers and revision date codes.
   b. Primary RTE-A operating system, except with Option 051.
   c. On-line system generator.
   d. Macro/1000 Assembler, Edit/1000 interactive screen editor, and LINK linkage editor.
   e. HP-IB, relocatable, and decimal string arithmetic libraries.
   f. Command interpreter and file management package.
   g. System utilities.
2. HP 92077K RTE-A Manuals (see separate product listing).

HP 92077A Media Options

022: Provides software on CS/80 cartridge tape.

044: Provides software on microfloppy disc for HP 12120A*/12122A Integrated Discs in Micro/1000 package or HP 9122D or 9133A*/B*/H*/L, or 9153B Disc.

051: Provides software on 1600 cpi, 9-track mag tape.

061: Provides software on 1600 cpi, 9-track mag tape in CS/80 disc format.

* *Discontinued product listed here for reference only.*

92077A/R/E Use Options

400: Use in HP 12100A Single Board Computer, HP 2424A Micro 14 Computer, or HP 2434A Micro 24 Computer.

600: Use in HP 2106BK Board Computer HP 2156B Computer, HP 2426E/F Micro 16 Computer, or HP 2436A Micro 26 Computer.

601: Upgrade from previous version of 92077A/R/E option 600 to latest version of same for customer not on support service.

700: Use in HP 2137A Computer or HP 2437A Micro 27 Computer.

701: Upgrade from previous version of 92077A/R/E option 700 to latest version of same for customer not on support service.

890: Use in HP 2139A Computer or HP 2439A Micro 29 Computer or in any other A-Series computer. With 92077A, option 890 includes the right to purchase one or more 92077R/E products with Use Option 400, 600, 700, and/ or 890 for use on a corresponding additional computer(s).

891: Upgrade from previous version of 92077A/R/E option 890 to latest version of same for customer not on support service.

894: Upgrade to Use Option 890 from Use Option 400.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

HP 92077R Use of RTE-A for Program Development and Execution on One Additional Computer System (must order one of Use Options 400 through 897)

The 92077R product is available only to customers who have purchased a license to use 92077A. 92077R consists of:

1. The right to make one copy of software purchased with the 92077A RTE-A system for use on an additional system.
2. 92077K RTE-A Manuals (see separate product listing).

NOTE: To assure proper support, we recommend that a user who intends to use copies ("R" products) of other HP software products, such as the Graphics/1000-II Device-Independent Graphics Library, with RTE-A, purchase the 92077R product (above) rather than the 92077E Execute-only product (below).

92077R Option 100

Deletes manuals from the 92077R product.

HP 92077E Right to Execute RTE-A On One Additional Computer System (must order one of Use Options 400 through 897)

This is a low-cost license for an OEM. (Excludes program development and on-line system generation use on the system for which 92077E is purchased.) No manual or software is supplied with this product, which is simply a license to execute RTE-A and user programs developed to run under RTE-A on a dedicated A-Series application system.

HP 92077K RTE-A Manuals Package

The 92077K RTE-A manuals package consists of manuals organized in a set of 10 binders, as follows:

1. RTE-A Binder Volume 1 (92077-64011) with:
   92077-90036 RTE-A Index and Glossary.
   92077-90038 RTE-A Primary System Software Installation Manual.
   92077-90039 Getting Started with RTE-A.
2. RTE-A Binder Volume 2 (92077-64012) with:
   92077-90002 RTE-A User's Manual.
   92074-90001 Edit/1000 User's Guide.
3. RTE-A Binder Volume 3 (92077-64013) with:
   92077-90004 RTE-A Utilities Manual.
4. RTE-A Binder Volume 4 (92077-64014) with:
   92059-90001 Macro/1000 Assembler Reference Manual.
   92077-90050 RTE-A Software Entry Point Directory.
5. RTE-A Binder Volume 5 (92077-64015) with:
   92077-90007 RTE-A Programmer's Reference Manual.
   92077-90035 RTE-A LINK User's Manual.
6. RTE-A Binder Volume 6 (92077-64016) with:
   92077-90037 Relocatable Libraries Reference Manual RTE-A.RTE-6/VM.
7. RTE-A Binder Volume 7 (92077-64017) with:
   92077-90019 RTE-A Driver Designer's Manual.
   92077-90034 RTE-A System Generation and Installation Manual.
8. RTE-A Binder Volume 8 (92077-64018) with:
   92077-90013 RTE-A System Design Manual.
   92077-90011 RTE-A Driver Reference Manual.
   59310-90064 HP-IB User's Manual.
9. RTE-A Binder Volume 9 (92077-64019) with:
   5180-6728 Computer User's Catalog Flyer.
   5954-6304 Interex brochure.
10. RTE-A Binder Volume 10 (92077-64020) with:
    92077-90020 RTE-A Quick Reference Guide.

Software Support Products

See the HP 1000 Ordering Guide, 5954-8564 or later revision, for definitions and availability of software support products for RTE-A.

RTE-A Virtual Code+ (VC+) System Extension

HP 1000 A-Series Software

product number 92078A

HP 92078A Virtual Code+ (VC+) is an extension package for 92077A RTE-A Real-Time Executive operating systems with revision code 2326 or higher. This package extends RTE-A system capabilities to support code and data separation making possible transparent execution of programs up to 7.75 megabytes as well as re-entrant and recursive use of shared program code. Also included is an improved environment for multi-user operations, output spooling, LU redirection, and logging of error messages to a file.

Features

- **Support for separation of code and data, permitting:**
  - Transparent development, loading, and execution of programs as large as 7.75 megabytes
  - Re-entrant and recursive use of shared program code
- **Enhanced environment for multi-user operations on RTE-A**
- **Spooling of output to any device or file in addition to the standard RTE-A system's print program**
- **LU redirection to other LUs or files**
- **Echoing of system error messages to a file**

How VC+ Code and Data Separation Increases RTE-A Capacity and Efficiency

Large Program Capacity on 16-bit Minicomputers. The separation of code from data in the VC+ enhancement package makes handling of large programs easier than ever before. Unlike the method of code overlays used by previous RTE systems, large programs are broken into code segments transparently and automatically. This VC+ service effectively gives the user up to 7.75 megabytes of code space, with the only concern being that no subroutine be longer than 60,000 bytes. In most instances, users will be able to compile, load, and run large programs in any supported language without any special conversion.

More Space for Data Without Using EMA. Programs with up to 60k bytes of code may now run without needing EMA, due to the increased space available for data when it is separated from the code. Such programs will run significantly faster because of reduced data access times when EMA is not used.

Sharing of Code is another advantage of the code and data separation supported by the VC+ package. Multiple programs can share one code partition while owning distinct data partitions, saving memory space that could otherwise be required by multiple copies of code. The number of disc accesses also decreases because a code partition shared by many programs is loaded into main memory only once, which helps to improve overall system performance. It is important to note, however, that shared code is supported only for programs that have separated code and data (new code). A user's application program written in FORTRAN, Pascal, or BASIC must be recompiled to support code sharing. Programs written in Macro/1000 Assembly language can be enhanced to include the instructions to separate the code and data.

A Secure Environment for Multi- User Operations

Log-On Access Control by the VC+ restricts system access to users who have been assigned a log-on name and (optionally) a password. The log-on and password access controls are associated with an individual directory of files that is integrated with the hierarchical file system of RTE-A and a program that executes upon log-on to assist or inform the user.

Two Simple Categories of Users are supported by the VC+ package. The most powerful are "super- users", usually system managers or system analysts, who have unlimited access to develop and upgrade the system. In the other category are standard users, who are given a broad range of capabilities to edit, link, and run application programs. Standard users can use system commands to determine program and I/O status and control programs, but cannot use commands that may adversely affect the system or other users. File protection can be used to further differentiate standard users and superusers.

Private Programs help to prevent interference between users. Private programs are application programs created and run by the user. The private program is uniquely defined by its name and the terminal from which it is run.

System Programs are programs, such as PRINT or EDIT that can be run by anyone on the system. Each system program has a unique name and can be aborted only by a superuser.

Protection of User's Programs is supported by the file read and/or write protection provisions of RTE-A. A program file that is read protected from other users cannot be run by anyone but its owner and superusers.

Extended Output Spooling

The basic capability of RTE-A is restricted to printer outspooling. The VC+ package extends this capability to support outspooling to any device, redirection of input or output from one logical unit (LU) to another LU, and the ability to route data destined for an LU to a file. VC+ also provides spool status, restart capability, spooling control at the user level, and logging of serious error messages (plus a time stamp) to a file. Spooling is both programmatic and interactive.

Functional Specifications

Large Program Support

Maximum Program Length: Up to 128 code segments x up to 31 pages (63,488 bytes) per code segment (7.75 megabytes).

Maximum Module Length: 60 kilobytes.

Large Data Array Support

Within the bounds of available memory, VC+ can be used to support megabyte-sized programs without affecting the program's access or mode of access to data areas larger than 64k bytes. Shared Extended Memory Areas for main memory resident data arrays up to 2 megabytes and Virtual Memory for Data Arrays up to 128 megabytes in main memory and on disc are supported.

Code Sharing

Basic Principle: Multiple programs can share one code partition while owning different data partitions.

Segment Sharing: Shared code segments are not supported; all of a shared program's code segments must be in memory at the same time; only entire programs can be shared.

Requirement: Only programs that have separated code and data can be shared. Existing application programs written in FORTRAN, Pascal, or BASIC must be recompiled to convert them to take advantage of shared code support. Existing programs written in Assembly language must be converted manually, a considerable effort that will normally preclude their shared use. However, assembly language subroutines are often transportable to code and data sharing programs with no changes.

Extended Outspooling

Outspooling to a Device: Output can be routed to an intermediate disc LU and later to the intended LU when it is free.

LU Redirection: Input or output can be routed from one LU to another LU.

Output to a File: Data destined for an LU can be routed to a file.

Error Logging: The extended outspooling capability of VC+ supports the logging of serious errors, plus a time stamp, to a disc file for later analysis by the system manager.

Operational Requirements

For Older HP 1000 A-Series Systems

HP 2186A/B* and 2196A/B* System Processor Units for Model 6* and 16* Systems that have been upgraded with the 12107A* upgrade kit and 2197A/B* and 2199A/B* System Processor Units for Model 17* and 19* Systems satisfy operational requirements of the RTE-A operating system with VC+.

For the Latest HP 1000 A-Series Systems

HP 2186C/D*, 2196C/D, 2197C/D, and 2199C/D System Processor Units (SPUs) for HP 1000 Model 6*, 26, 27, and 29 systems and 2484A, 2486A, 2487A, and 2489A SPUs for HP 1000 Micro 24, 26, 27, and 29 systems with supported system console and system disc satisfy operational requirements of the RTE-A operating system with VC+. (RTE-A is included in all of the SPUs listed above and VC+ is included with the 2197C/D and 2199C/D.)

** Discontinued product listed here for reference only.*

For User-Assembled, Stand-Alone Systems

Any of the computers listed in Table 2-3, page 2-12 in the RTE-A data sheet.

System Console and System Disc

The RTE-A system with VC+ has the same requirement for a system console for operator communication as RTE-A. A supported system disc is an absolute requirement for VC+ support under RTE-A.

Memory Required

At least 512k bytes.

Ordering Information

HP 92078A RTE-A Virtual Code+ System Extension Package (must order one of Use Options 400 through 897)

The Virtual Code+ package consists of:

1. The following software on Media Option 022, 044, or 051, one of which must be ordered:
   a. A catalog file describing the set of software on the medium by part numbers and revision date codes.
   b. Code and data separation and virtual code support software.
   c. Enhanced multi-user environment software.
   d. Extended outspooling software.
2. 92078-90001 RTE-A Virtual Code+ (VC+) System Extension (manual).

92078A Media Options

022: Provides software on CS/80 cartridge tape.

044: Provides software on Microfloppy disc for HP 12120A*/12122A Integrated Discs in Micro/1000 Package or HP 9122D or 9133A*/B*/H*/L or 9153B Disc.

051: Provides software on 1600 cpi, 9-track mag tape.

** Discontinued product listed here for reference only.*

92078A/R/E Use Options

400: Use in HP 12100A Single Board Computer, HP 2424A Micro 14 Computer, HP 2434A Micro 24 Computer, or HP 2484A Micro 24 SPU.

600: Use in HP 2106BK Board Computer, HP 2156B Computer, HP 2426E/F Micro 16 Computer, HP 2436A/E Micro 26 Computer, HP 2196C/D Model 26 SPU, or HP 2486A Micro 26 SPU.

601: Upgrade from previous version of 92078A/R/E option 600 to latest version of same for customer NOT on support service.

700: Use in HP 2137A Computer or HP 2437A Micro 27 Computer.

701: Upgrade from previous version of 92078A/R/E option 700 to latest version of same for customer NOT on support service.

890: Use in HP 2139A Computer or HP 2439A Micro 29 Computer or in any other A-Series computer. With 92078A, option 890 includes the right to purchase one or more 92078R/E products with Use Option 400, 600, 700, and/or 890 for use on a corresponding additional computer(s).

891: Upgrade from previous version of 92078A/R/E option 890 to latest version of same for customer NOT on support service.

894: Upgrade to Use Option 890 from Use Option 400.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

HP 92078R Use Of VC+ Package On One Additional Computer System (must order one of Use Options 400 through 897)

The 92078R product is available only to customers who have purchased a license to use 92078A. 92078R consists of the right to make one copy of software purchased with the 92078A VC+ package for use on an additional system and the 92078-90001 RTE-A Virtual Code+ (VC+) System Extension Manual.

HP 92078E Right to Execute VC+ On One Additional Computer System (must order one of Use Options 400 through 897)

This is a low-cost license for an OEM. No manual or software is supplied with this product, which is simply a license to execute VC+ and user programs that depend upon it under 92077E Right-to-Execute RTE-A on a dedicated A-Series application system.

Software Support Products

See the HP 1000 Ordering Guide, 5954-8564 or later revision, for definitions and availability of software support products for VC+.

Datapair/1000

HEWLETT PACKARD

Reliability Enhancement Software for RTE-A Systems

Product Number 92050A

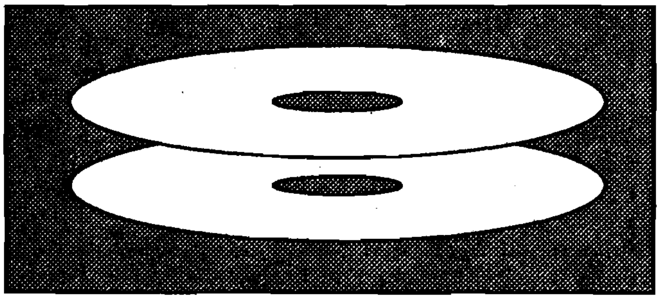
HP 92050A Datapair/1000 supports configuration of disc volumes in mirrored pairs in RTE-A systems for data protection and high availability. These paired volumes are configured on separate disc drives, each connected via its own HP-IB interface for maximum protection against failure. The Datapair package uses a pseudo disc driver as a user-transparent manager for the mirrored pairs, a PAIR utility to create, verify, and restore paired volumes, and a PAIO utility to display the current disc mirroring configuration for the Datapair/1000 system.

Features

- **User-transparent protection from data loss caused by disc failure**
- **Automatic real-time redundancy to assure high availability of data**
- **Down volume restoration**
- **Paired volume verification**
- **Uninterrupted read/write access even if one volume in a pair goes "down"**
- **Support for a variety of discs**
- **Maintenance of mirrored configuration integrity across boots**

Datapair/1000 Software

1. Pseudo driver IDP31, which initiates I/O requests to the disc drivers for each volume of the pair and passes the mirrored configuration of any mirrored volume that changes to MIMON.
2. PAIR Utility, which:
   a. Defines paired relationships between disc volumes.
   b. Controls the state (Up, Down, or Standby) of each volume in a pair.
   c. Restores a "Down" volume of a pair track-by-track from the good volume.
   d. Verifies paired volumes, track-by-track.
   e. Displays current volumes and pair relationships.
3. PAIO Utility, which displays current mirroring configuration for:
   a. A specific mirrored volume.
   b. A range of mirrored volumes.
   c. The entire Datapair/1000 system.
4. PINIT is the Datapair/1000 initialization program. It is used to start up MIMON.



5. PREPAIR Utility, which:
   a. Modifies the system file to set up and determine mirrored volumes at the next boot.
   b. Creates an information file to keep up-to-date information on mirrored volumes. This is used by BOOTEX to assure that the mirrored volumes are up to date at the next boot-up of the system.
6. MIMON Utility, which monitors all mirrored volume activity and updates the information file whenever there is any change to the mirrored volume configuration.

Functional Description

After assignment of the pairing of disc volumes using PAIR, accesses to paired volumes are made via pseudo driver IDP31, using the logical unit number assigned to the pair. IDP31 issues write access requests to both volumes of the pair. Read accesses alternate between the volumes to assure the earliest possible discovery of errors. Control access requests are handled like writes and are issued to both volumes of a pair.

After setup, both write and read accesses are transparent to the user. Disc access calls are the same as would be used to access a single volume. This provides two identical copies of the data. For maximum security, the volumes of a pair are on different drives, each accessed via its own HP-IB interface.

If either volume of a pair goes Down due to a failure, normal read and write accesses to the good volume continue as if nothing had happened. The PAIR utility is used to copy the good volume to restore a Down volume after the Down volume has been repaired. Write operations write into both volumes during the restoration process, thereby assuring continuity of data.

The PAIO Utility can be run by any user to show a table with all of the mirrored volumes on the system, even when PAIR is busy. The PAIO display shows pair relationships and status of the LUs. It also indicates volumes that are NOT defined.

Functional Specifications

Operating Requirements

Operating System: Datapair/1000 operates under the RTE-A Real-Time Executive system, effective with revision 2540.

Supported Disc Memories: Datapair/1000 supports HP 7920M and 7925M disc memories interfaced via HP-IB and the 12745D HP-IB Adapter Kit and also supports all CS/80 and SS/80 discs that use device driver DD*33 to communicate with RTE-A. No other discs are supported.

Volume Matching: Both volumes of a mirrored pair must have the same number of tracks and must be on discs that have the same number of sectors per track and the same number of bytes per sector.

Logical Sectors Per Track: Maximum of 64.

Other Configuration Requirements: One continually used 32 kB partition and one 64 kB partition that must be available for occasional use.

Restrictions on Pairings: Any volume may be be paired, including the bootable volume. However, if a bootable volume is paired, it must be paired with another bootable volume.

Write Access Overlapping

Each volume of a pair is accessed via its own controller (HP-IB interface), so write accesses are overlapped, minimizing the time required for automatic real-time redundancy.

Ordering Information

HP 92050A Datapair/1000 (must order one of Use Options 400 through 897)

Datapair/1000 consists of:

1. The software summarized above, on media option 022 or 051, one of which must be ordered, and a license to use Datapair/1000 on one system.
2. 92050-90001 Datapair/1000 Reference Manual.
3. 92050-90011 Datapair/1000 Self-Study Guide.
4. 92050-90003 RTE-A Quick Reference Guide insert.

92050A Media Options

022: Provides software on CS/80 Cartridge Tape.

051: Provides software on 1600 cpi, 9-track mag tape.

92050A/R Use Options

400: Use in HP 12100A Single Board Computer, HP 2424A Micro 14 Computer, HP 2434A Micro 24 Computer, or HP 2484A Micro 24 SPU.

600: Use in HP 2106BK Board Computer, HP 2156B Computer, HP 2426E/F Micro 14 Computer, HP 2436A/E Micro 26 Computer, HP 2196C/D Model 26 SPU, or HP 2486A Micro 26 SPU.

700: Use in HP 2137A Computer, HP 2437A Micro 27 Computer, HP 2197C/D SPU, or HP 2487A Micro 27 SPU.

890: Use in HP 2139A Computer, HP 2439A Micro 29 Computer, HP 2199C/D Model 29 SPU, or HP 2489A Micro 29 SPU, or in any other A-Series computer. With 92050A, option 890 includes the right to purchase one or more 92050R products with Use Option 400, 600, 700, and/or 890 for use on a corresponding additional computer(s).

894: Upgrade to Use Option 890 from Use Option 400.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

HP 92050R Right to copy Datapair/1000 (must order one of Use Options 400 through 897)

The 92050R product is available only to customers who have purchased a license to use 92050A. 92050R consists of:

1. The right to make one copy of software purchased with the 92050A product.
2. 92050-90001 Datapair/1000 Reference Manual.
3. 92050-90011 Datapair/1000 Self-Study Guide.
4. 92050-90003 RTE-A Quick Reference Guide insert.

Software Support

See the HP 1000 Ordering Guide, 5954-8564, or later revision, for definitions and availability of software support products for Datapair/1000.

Edit/1000

HEWLETT PACKARD

Computer Museum

For Program/Text Entry into RTE-A or RTE-6/VM Systems

Included in RTE-A and RTE-6/VM

Edit/1000 is a powerful screen editor designed to help programmers develop software quickly and accurately with minimal effort. Edit/1000 helps the user to create and manipulate files of upper and lower case ASCII characters. Lines, strings, and characters can be inserted, deleted, copied, or moved within the file. Files to be edited can be source language programs or text material.

Features

- **Convenient screen mode entry and editing of files.**
- **Powerful character string search and replacement capabilities.**
- **Commands for copying and moving lines within the edit file.**
- **Ability to create a new file or back up a partly-edited file without leaving edit mode.**
- **Provision for recovery of edit file after system halt.**
- **On-line command summary, with ability to obtain more information about any command, easily accessible to the user without leaving the editor or having to refer to a manual.**

Functional Description

Operating Modes

Edit/1000 interacts with the user through edit commands and is designed to operate in the following modes:

- Screen mode, in which the user types in a screen of text and modifies the text using any of the HP terminal's editing features.
- Line mode, in which edit commands operate on groups of one or more lines.

Screen Mode

In the screen mode, the editor treats the terminal screen as a window through which the user can view a section of text, such as a subroutine or a paragraph. A cursor within this window indicates the character at which editing will take place. The user controls the cursor with the help of the terminal and can also move the window forward or backward any number of lines within the file. The editing facilities of the terminal are used, which offloads the system substantially. The user is working directly with single keystroke commands, which are often faster and more convenient to use than the line edit commands of the editor.

Advanced Line Editing Capabilities

In addition to the basic text maintenance functions of retrieve, insert, add, change, and delete, Edit/1000 provides sophisticated character string search and replace capabilities that can be used to change any string of characters in the file to another string, or can selectively change character strings within specified columns only. This greatly simplifies the change of variable names throughout a program, or terminology throughout a text file.

Merging of source files, merging and breaking of lines, and powerful copy and move functions facilitate electronic cut and paste rearrangement of program code or text in the edit file. Copying of repeated table headings or copying and editing of similar text to various appropriate places in the edit file can be a particularly powerful time and effort saver.

Display of lines before and after the current line, viewing the previous or next screen, tab setting, and the ability to undo modification are other highly useful capabilities built into Edit/1000.

Interactive Instructions

Edit/1000 provides for on-line interactive explanation of its commands to help the casual user who may have forgotten some of the available commands or how some commands are used.

On-Line File Creation and Edit File Backup

Edit/1000 supports creation and storage of the current edit file without leaving the editor. Similarly, the current state of the edit file can be backed up, also without leaving the editor. This is particularly helpful in safeguarding the time and effort invested in a partly completed edit.

Recovery After System Halt

The current edit file is continually maintained by Edit/1000 in a separate working file. If a system halt has interrupted an edit the request for edit after the has come back on line causes entry into a recovery mode in which the working file is given its original name, or a completely new name. The edit can then be resumed, editing on that file.

Functional Specifications

Environment

HP 1000 Computer System operating under RTE-A.

Character Set

All ASCII characters.

Ordering information

Edit/1000 software and User's Manual (92074-90001) are included in HP 1000 A-Series Computer Systems, in the HP 92077A RTE-A operating system.

Software Support

Software support for Edit/1000 is included with software support for RTE-A. See the HP 1000 Ordering Guide, 5954-8564 or later revision, for definitions and availability of software support products for RTE-A.

Symbolic Debug/1000

HEWLETT PACKARD

For Program Debugging and Profiling

product number 92860A

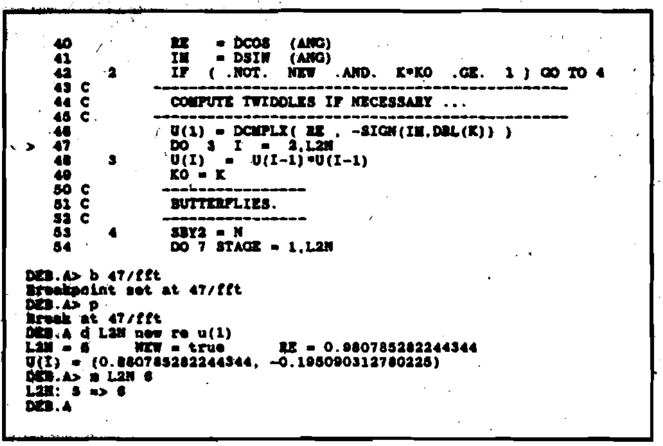
Symbolic Debug/1000 is an interactive symbolic debugger for source-level FORTRAN, Pascal, compiled BASIC, and Macro programs on RTE-A or RTE-6/VM based HP 1000 systems. Variables are displayed or modified using names from the original program. Load maps and program listings are not needed. One and two word integer, two, three, and four word reals, logical, complex, character, Hollerith, and most structured data types are supported. Symbolic Debug resides in a separate partition from the program being debugged to eliminate program code space intrusion. A single-stepping, source-line capability displays the current and adjacent lines during execution. Conditional breakpoints can be used to monitor variable values and stop the program at a specified value. Using the profiling capability, the user can determine which subroutine is using the most program time and optimize the code to decrease execution time. A small, simple command set, the use of dozens of English error messages, and an on-line "help" facility make Symbolic Debug/1000 a friendly and powerful programmer's productivity tool.

Features

- **Interprets all code types and symbols used.**
- **Can display source code during execution.**
- **Non-intrusive debugging -- Symbolic Debug resides in a partition separate from program being debugged.**
- **Support for EMA and RTE segmentation.**
- **Support for all simple and most structured data types.**
- **Profiling capability for isolation of slow subroutines.**
- **Source line-by-line single stepping capability.**
- **Up to 50 conditional breakpoints to stop program at specified variable value.**

Functional Description

Symbolic Debug recognizes the names, types, and locations of all the variables and routines used in the program, eliminating the need for load maps, symbol table dumps, and mixed listings. The value of a variable can be examined as fast as its name can be typed.



```
      40             RE    = DCOS   (ANG)
      41             IM    = DSIN   (ANG)
      42      2      IF  ( .NOT.  NEW  .AND.  K*KO  .GE.  1 ) GO TO 4
      43 C         -----------------------------------------------
      44 C           COMPUTE TWIDDLES IF NECESSARY ...
      45 C         -----------------------------------------------
      46             U(1) = DCMPLX( RE , -SIGN(IM,DBL(K)) )
   >  47             DO  3  I  =  2,L2N
      48      3      U(I)  =  U(I-1)*U(I-1)
      49             KO = K
      50 C          ---------------
      51 C           BUTTERFLIES.
      52 C          ---------------
      53      4      SBY2 = N
      54             DO 7 STAGE = 1,L2N

 DEB.A> b 47/fft
 Breakpoint set at 47/fft
 DEB.A> p
 Break at 47/fft
 DEB.A d L2N new re u(1)
 L2N = 5      NEW = true       RE = 0.980785282244344
 U(I) = (0.980785282244344, -0.195090312780225)
 DEB.A> s L2N 6
 L2N: 5 => 6
 DEB.A
```

The user interacts with the program as it runs and can examine or alter variable values while the program runs without having to insert statements into the code. Bugs can be found fast, since there's no need to recompile and load every time a new bug occurs.

Symbolic Debug resides in a 32-page memory partition separate from the program. No code space is lost and no extra statements are added in order to debug. The program being debugged runs exactly as it would normally. No bugs are introduced by the debugger, and more importantly, bugs don't disappear when the debugger is present, only to reappear when the debugger is not used. There is no need to restructure a program just to debug it.

Symbolic Debug recognizes what line of source code is about to be executed, and identifies it on the CRT display. Programs can be debugged in the language in which they were written, without the need for inverse listings or mixed listings. There is no need to list files at all.

Symbolic Debug detects RTE program violations, such as an attempt to access protected memory. After such a violation, memory locations can be examined to determine the cause of the problem. Symbolic Debug pinpoints the line of source code that caused the error, giving the user an interactive tool for catching and correcting system violations.

Up to 50 breakpoints can be used to monitor program variables and halt the program if a variable reaches a specified value. Many possible paths can be trapped and values quickly tracked through the program to determine where they go wrong.

Non-interactive debugging, in which users submit debug commands in a file and have results logged in another file is also supported. This automates the debugging process, so users don't have to wait for bugs whose symptoms may take hours or even days to appear.

A built-in profile monitor helps to isolate slow parts of programs. High-level analysis of activity distribution within the program helps to identify time-consuming subroutines that should be optimized in order to improve execution time. For example:

```
Profile for program TEST

  Routine           Amount        Histogram

OTEST                39%   ***************************************
SUBR                 27%   ***************************
OTES1                16%   ****************
UTILITY               9%   *********
OTES0                 3%   ***
Other (code)          2%   **
Other (libraries)     3%   ***

Profile for module OTEST  39% of total time spent here

  Line No.          Amount        Histogram
     7               20%   ********************
     8               11%   ***********
     9               33%   *********************************
    13               36%   ************************************
```

Debug Command Summary

B <Location>	Sets breakpoint at specified location.
C <Location>	Clears breakpoint at specified location.
D <Location>	Displays variable.
E	Aborts program and exits debug.
F	Finds string in source file.
H	Displays histogram.
I <f1 [f2]>	Executes a set of commands from file f1 and optionally logs the output to file f2.
L <Location>	Lists a screenful of source code in your program
M <Loc> <val>	Modifies the value of a variable.
O	Requests overview mode for program profiling.
P <line>	Allows your program to proceed to the next breakpoint or a specified line.
S	Steps to the next line of source code.
T <Location>	Shows location executed without stopping the program.
V <number>	Changes the number of source lines displayed on the screen.
W	Shows callers of the current subroutine.
?	Requests help.

Ordering information

HP 92860A Symbolic Debug/1000 (must order one of Use Options 400 through 897)

Symbolic Debug/1000 consists of:

1. The Symbolic Debug/1000 software on media option 022, 044, 050, or 051, one of which must be ordered.
2. 92860-90001 Symbolic Debug/1000 User's Manual.
3. 92860-90002 Symbolic Debug/1000 Configuration Guide.

92860A Media Options

022: Provides software on CS/80 cartridge tape.

044: Provides software on microfloppy disc for HP 12120A*/12122A Integrated Discs in Micro/1000 package or HP 9122D or 9133A*/B*/H*/L, or 9153B Disc.

050: Provides software on 800 cpi, 9-track mag tape.

051: Provides software on 1600 cpi, 9-track mag tape.

* *Discontinued product, listed here for reference only.*

HP 92860R Use of Symbolic Debug/1000 on One Additional Computer System (must order one of Use Options 400 through 897)

The 92860R product is available only to customers who have purchased a license to use 92860A. 92860R consists of:

1. The right to make one copy of software purchased with the 92860A Symbolic Debug/1000 for use on an additional system.
2. 92860-90001 Symbolic Debug/1000 User's Manual.
3. 92860-90002 Symbolic Debug/1000 Configuration Guide.

92860A/R Use Options

400: Use in HP 12100A Single Board Computer, HP 2424A Micro 14 Computer, HP 2434A Micro 24 Computer, or HP 2484A Micro 24 SPU.

600: Use in HP 2106BK Board Computer, HP 2156B Computer, HP 2426E/F Micro 16 Computer, HP 2436A/E Micro 26 Computer, HP 2196C/D Model 26 SPU, or HP 2486A Micro 26 SPU.

601: Upgrade from previous version of 92860A/R option 600 to latest version of same for customer NOT on support service.

700: Use in HP 2137A Computer, HP 2437A Micro 27 Computer, HP 2197C/D Model 27 SPU, HP 2487A Micro 27 SPU, HP 2109E, 2113E, or 2117F* Computer, or HP 2178C Model 60 SPU.

701: Upgrade from previous version of 92860A/R option 700 to latest version of same for customer NOT on support service.

890: Use in HP 2139A Computer, HP 2439A Micro 29 Computer, HP 2199C/D Model 29 SPU, or HP 2489A Micro 29 SPU or in any other A/E/F*-Series computer or SPU. With 92860A, option 890 includes the right to purchase one or more 92860R products with Use Option 400, 600, 700, and/or 890 for use on a corresponding additional computer(s).

891: Upgrade from previous version of 92860A option 890 to latest version of same for customer NOT on support service.

894: Upgrade to Use Option 890 from Use Option 400.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

* *Identifies discontinued product listed here for reference only.*

Software Support

See the HP 1000 Ordering Guide, 5954-8564 or later revision, for definitions and availability of software support products for Symbolic Debug/1000.

FORTRAN 77

HEWLETT PACKARD

For Program Development in RTE-A or RTE-6/VM

product number 92836A

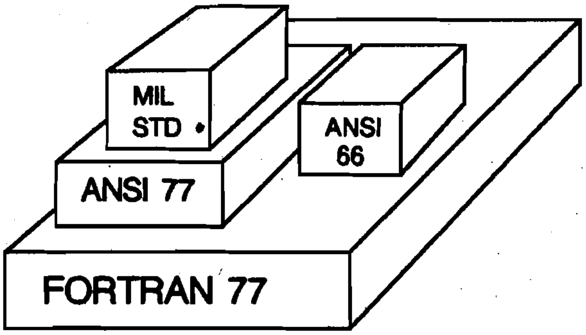
HP 92836A FORTRAN 77 is a full implementation of the latest ANSI Standard for FORTRAN. This powerful language processor includes many extensions for compatibility with mainframe implementations of FORTRAN to simplify program migration to the HP 1000.

HP 92836A FORTRAN 77 operates under HP 1000's RTE-A and RTE-6/VM real-time executive operating systems, taking full advantage of the extended features available such as large data and program capabilities. In addition, FORTRAN 77 programmers can directly call external routines written in Pascal or Macro/1000 Assembler to maximize flexibility and performance yet minimize program development efforts.

HP 92836A FORTRAN 77 supports the Command Interpreter file system in RTE-A and RTE-6/VM and code and data separation for support of large programs under RTE-A/VC+.

Features

- **Full ANSI 77 FORTRAN (X3.9-1978).**
- **Compatibility with ANSI 66 FORTRAN.**
- **Fast compilation.**
- **Support for variables and arrays using up to 128M bytes of virtual storage.**
- **Generation of CDS output code for RTE-A/VC+ systems.**
- **Full MIL-STD-1753 extensions.**
- **Extensions to enhance mainframe compatibility.**
- **Long names with up to 16 significant characters.**
- **Double complex data type.**
- **System programming extensions.**
- **Transparent access to remote files in a distributed systems network.**
- **Local optimization for efficient generated code.**
- **Compatibility with other HP 1000 software subsystems such as Graphics/1000-II, DS/1000-IV, and Image/1000.**



How FORTRAN 77 Provides More Powerful Programming

Structured Control Flow for Simplified Coding

IF THEN ELSE construct: IF(...) THEN, ELSE, ELSEIF(...) THEN, and ENDIF statements are included for enhanced readability.

Faster, more flexible DO loops: DO loops can be specified for zero trip; trip count is pre-computed; and the index can be integer, real or double.

Alternate returns: Allows program flow to return to a statement other than the one following the subroutine statement call (e.g. for error processing).

Alternate entries: Allows multiple entry points to a program increasing program modularity.

STOP and PAUSE: These statements display character strings as well as numbers.

Powerful Data Manipulation

CHARACTER data type: replacing Hollerith constants and data in ANSI 66, CHARACTER data offers easy string manipulation.

Expressions valid in most contexts: In most places where a variable or constant is legal, so is an expression.

Constant expressions in declarations: With PARAMETER statements, programs can be 'parameterized' so that array sizes and other constant values need not be hard coded.

Variable dimensions as run-time expressions: Array upper and lower bounds (for parameters) can be computed from other parameters and COMMON variables.

Additional intrinsic functions: included are functions for rounding, various transcendentals and string manipulation.

Generic intrinsic functions: single names may be used for all versions of an intrinsic (e.g. SIN in place of DSIN) for most FORTRAN library functions.

General-Purpose I/O

OPEN, CLOSE, INQUIRE statements: for disc files and devices. INQUIRE can be used to investigate properties of a file.

Direct access I/O: allows any record in a direct-access file to be read or written quickly by record number.

List-directed I/O: Input data can be 'free-field' and appropriate formats are chosen for output data. In both cases, FORMAT statements are unnecessary.

Internal files: allows the power of FORMAT number conversions to be used with character variables or arrays like the ACSII 'buffer'.

Error handling (ERR=, END=, IOSTAT=): an error specifier enables more control over actions to be taken when an I/O error is detected.

Additional format capabilities: For example, control over printing of leading zeros.

READ and PRINT to standard devices: Logical unit number can be defaulted to (possibly different) standard input and output devices.

New Declarations

PARAMETER statement: to give names to constants. Allows 'parameterization' of programs, including values that can control conditional compilation.

IMPLICIT statement: used to change the default implicit types within a program unit.

SAVE statement: causes the values of local variables in a subprogram to be saved from one call to the next, even if the subprogram is in a disc-resident segment.

Implied DO loops in DATA statements: Portions of arrays can be initialized and subscripts of arrays within the 'DO' can be expressions.

INTRINSIC statement: specifies that a intrinsic function is to be passed to a subprogram. Names declared EXTERNAL will not be intrinsics.

PROGRAM statement: optional statement to name the main program.

Array declarators: Upper and lower bounds of array dimensions can be specified in array declarators.

Array dimensions: Arrays can have up to seven dimensions.

HP 1000 Extensions to ANSI 77 FORTRAN

Mainframe compatibility

Selection of ANSI 66 or 77 semantics: where FORTRAN 77 is incompatible with the previous standard or common industry practice, HP's compiler provides alternative interpretations on a user-selectable basis.

Long names: up to 16 significant characters.

Embedded underscore: allowed in symbolic names.

ENCODE and DECODE statements: provides memory-to-memory formatting.

IBM-style direct access READ and WRITE: may be formatted or unformatted.

Byte-length data types: e.g. INTEGER*4

Embedded comments: an exclamation point can be placed after any statement signifying an end-of-line comment.

Extended-range DO loops: permits transfer of control out of a DO-loop and then back in.

Hollerith data manipulation: Hollerith data can be used in DATA statements, READ/WRITE, and as arithmetic operands.

Double precision COMPLEX data types: As approved by the IFIP WG 2.5 on Numerical Software.

Quoted Hollerith constants in DATA statements: Both character and non-character variables can be initialized with ASCII in DATA statements.

Compliance with MIL-STD 1753

DO WHILE looping construct: allows execution of a DO-loop while a logical expression holds true.

END DO: used as a terminal statement of a DO-loop The matching DO may omit the statement number.

Nested INCLUDE: allows inclusion of text (e.g. COMMON declarations) from another file. INCLUDE is offered as both a statement and directive, and permits nonrecursive nesting.

Bit manipulation intrinsics: Functions for logical and circular shifting, set/clear/test bit, bit field extraction, bit field move, and masking operations.

IMPLICIT NONE statement: removes implicit types so that all variables must be explicitly typed. All implicit types assume the normal default values.

Octal and hexadecimal constants in DATA statements.

System Programming Capabilities

Conditional compilation is achieved through the coordinated use of named constants, constant folding, and dead code removal.

Aliasing of subprogram names to allow special characters.

Specification of non-standard calling sequences.

Extension of .AND.,.OR.,.NOT.,.EQV.,.NEQV., .XOR. to integer data.

Bit shifting, extraction and testing intrinsics.

EQUIVALENCEing of character and non-character data.

Intrinsic function to get actual number of parameters passed to a subprogram.

HP-IB (IEEE 488) device control via secondary addressing and control buffers.

Virtual Data Capabilities

Local variables and common blocks may be used in up to 128M bytes of virtual memory.

Double integer subcripts may be used to access arrays with dimensions greater than 32767 elements.

Program Form

Lower case accepted (mapped to upper case)

Descriptive error messages

Optional compilation of lines beginning with "D"

Integers may be defaulted to single or double length

Functional Specifications

Applicable Standard

HP 1000 FORTRAN 77 is a superset of both ANSI FORTRAN X3.9-1978 and X3.9-1966.

Environment

Operating system: HP 1000 Computer Systems operating under RTE-A or RTE-6/VM that meet the minimum hardware requirements of the operating system, plus a list device.

Memory requirements:

Program size (lines)	Memory required
Up to 1,000	64 Kilobytes (32 pages)
Up to 30,000	140 Kilobytes (70 pages)

Compilation speed (CPU time only)

1500-3000 lines per minute.

Data Types

DATA TYPE	PRECISION (digits)	SIZE (bits)	RANGE
INTEGER*2	5-6	16	-32768 to 32767
INTEGER*4	9-10	32	-2,147,483,648 to 2,147,483,647
LOGICAL*2	--	16	.true, .false
LOGICAL*4	--	32	.true, .false
REAL*4	6.6-6.9	32	$\pm1.47 \times 10^{-39}$ to $\pm1.70 \times 10^{+38}$
REAL*8	16.3-16.6	64	$\pm1.47 \times 10^{-39}$ to $\pm1.70 \times 10^{+38}$
COMPLEX*8	6.6-6.9	64	
COMPLEX*16	16.3-16.6	128	
CHARACTER		1 to 32767	256 char., full ASCII
HOLLERITH		2 to 8 chars.	254 char., full ASCII

Note: For COMPLEX data, table applies to real and imaginary parts separately.

Optimizations by the Compiler

Constant expression folding: Compile-time evaluation of expressions that involve only constant values, named constants, and arithmetic, logical and relational operators. Some folding of character operations is also performed.

Subscript evaluation: Parts of subscripts that can be evaluated at compile time are removed from the generated code; subscript calculations are done with in-line code.

Dead code removal: Unreachable code within IF-THEN-ELSE, DO-WHILE, and DO constructs is removed (i.e. no code is generated).

Logical and arithmetic IF: Branch structure optimizations decrease program size and improve execution speed. For example, the compiler detects if statement numbers in an arithmetic IF statement are not distinct.

DO statements: The compiler takes advantage of constant initial, final and step values.

Compiler Options

L: Produces listing
M: Produces mixed listing
T: Produces table of symbols (type, address, etc.)
C: Produces cross-reference of symbols
D: Compiles debug lines
Q: Adds relative addresses of statements to listing
E: EMA transparency; causes all subroutine parameters to use 32-bit addresses.
X and Y: Selects default double percision size to be 48 or 64 bits, respectively.
I and J: Selects default integer size to be 16 or 32 bits, respectively.
S: Causes symbolic debugging information to be placed in the relocatable file.

FORTRAN Library Functions

Transcendental and Trigonometric		Conv.	Max/Min Mod etc.	Bit Manip.
*SQRT	DSINH	IFIX	*MIN	IAND
DSQRT	*COSH	FLOAT	MINO	IOR
CSQRT	DCOSH	SNGL	MIN1	NOT
*SIN	*TANH	*DBLE	AMINO	IXOR
DSIN	DTANH	*REAL	AMIN1	IEOR
CSIN	*ASIN	*INT	DMIN1	ISHFT
*COS	DASIN	AINT	*MAX	ISHFTC
DCOS	*ACOSN	DINT	MAX0	IBITS
CCOS	DACOS	DDINT	MAX1	BTEST
*TAN	*ATAN	IDINT	AMAX0	IBSET
DTAN	DATAN	*NINT	AMAX1	IBCLR
CTAN *	ATAN2	IDNINT	DMAX1	MVBITS
*EXP	DATAN2	ANINT	*MOD	
DEXP *	ASINH	DNINT	AMOD	
CEXP	DASINH	*IMAG	DMOD	**Chara.**
*LOG10	*ACOSH	AIMAG	*SIGN	
ALOG10	DACOSH	CMPLX	ISIGN	CHAR
DLOG10	*ATANH	DCMPLX	DSIGN	ICHAR
*LOG	DATANH	CONJG	*DIM	INDEX
ALOG	*ABS		IDIM	LEN
DLOG	IABS	**Misc.**	DDIM	LLT
CLOG	DABS			LLE
*SINH	CABS	ISSW		LGE
		DPROD		LGT
		PCOUNT		

* *Identifies generic form*

Ordering Information

HP 92836A FORTRAN 77 (must order one of Use Options 400 through 897)

HP 92836A FORTRAN 77 includes:

1. FORTRAN 77 compiler and library on software media option 020, 022, 044, 050, or 051, one of which must be ordered.
2. 92836-90001 FORTRAN 77 Reference Manual.

92836A Media Options

022: Provides software on CS/80 Cartridge Tape.

044: Provides software on Microfloppy disc for HP 12120A*/12122A Integrated Discs in Micro/1000 Package or HP 9122D or 9133A*/B*/H*/L or 9153B Disc.

050: Provides software on 800 cpi magnetic tape.

051: Provides software on 1600 cpi magnetic tape.

* *Identifies discontinued product listed here for reference only.*

92836A/R Use Options

400: Use in HP 12100A Single Board Computer, HP 2424A Micro 14 Computer, HP 2434A Micro 24 Computer, or HP 2484A Micro 24 SPU.

600: Use in HP 2106BK Board Computer, HP 2156B Computer, HP 2426E/F Micro 16 Computer, HP 2436A/E Micro 26 Computer, HP 2196C/D Model 26 SPU, or HP 2486A Micro 26 SPU.

700: Use in HP 2137A Computer, HP 2437A Micro 27 Computer, HP 2197C/D Model 27 SPU, HP 2487A Micro 27 SPU, HP 2109E, 2113E, or 2117F* Computer, or HP 2178C Model 60 SPU.

890: Use in HP 2139A Computer, HP 2439A Micro 29 Computer, HP 2199C/D Model 29 SPU, or HP 2489A Micro 29 SPU, or in any other A/E/F*-Series computer. With 92836A, option 890 includes the right to purchase one or more 92836R products with Use Option 400, 600, 700, and/or 890 for use on a corresponding additional computer(s).

891: Upgrade from previous version of 92836A/R option 890 to latest version of same for customer NOT on support service.

894: Upgrade to Use Option 890 from Use Option 400.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

* *Identifies discontinued product listed here for reference only.*

HP 92836R Right to Copy FORTRAN 77 Compiler for Use on an Additional Computer System (must order one of Use Options 400 through 897)

The HP 92836R Right to Copy product is available only to customers who have purchased HP 92836A without an upgrade option. 92836R consists of:

1. The license to make one copy of software purchased with 92836A for use on an additional system.
2. 92836-90001 FORTRAN 77 Reference Manual.

Software Support

See the HP 1000 Ordering Guide, 5954-8564 or a later revision, for definitions and availability of software support products for FORTRAN 77.

Pascal/1000

HEWLETT PACKARD

For Program Development in RTE-A or RTE-6/VM

product number 92833A

The HP 92833A Pascal/1000 compiler supports program development in the Pascal high-level, block-structured programming language in HP 1000 Computer Systems operating under Hewlett-Packard's RTE-A, RTE-A/VC+, or RTE-6/VM real-time executive operating system. Pascal/1000 is the implementation of HP Pascal for the HP 1000 computer family. HP Pascal is a superset of ANSI Pascal, and is supported on most HP computer systems. Pascal/1000 also provides some important extensions that take full advantage of HP 1000 capabilities. Pascal/1000 object programs can be executed in HP 1000 Computer Systems operating under HP's RTE-A, RTE-A/VC+, and RTE-6/VM systems as well as in the discontinued RTE-IVB, RTE-IVE, RTE-XL, and RTE-L systems.

HP 92833A Pascal/1000 supports the Command Interpreter and hierarchical directories in RTE-A, RTE-A/VC+, and RTE-6/VM. The HP 92833A compiler also supports Code and Data Separation (CDS) capability for large programs in the RTE-A/VC+ system in addition to support of non-CDS program development. Under RTE-A/VC+, the Pascal compiler itself is a CDS program, so multiple compilations share one copy of the compiler's code.

Features

- **Easily-understood programming.**
- **Powerful, compact syntax.**
- **Modern block-structured language.**
- **Logical organization that facilitates documentation, modification, and maintenance of programs.**
- **Early detection of errors at compile and run time.**
- **Fast debugging with 92860A Symbolic Debug/1000.**
- **Separate compilation of modules with interface checking at compile time.**
- **Improved program reliability.**
- **Clearly defined data structures complemented by flexible user-declared data types.**
- **Generation of CDS output code for RTE-A/VC+ systems.**
- **Access via Command Interpreter file system as well as FMGR file system.**
- **FORTRAN and Macro/1000 Assembly language subroutines.**
- **Files in the Heap.**
- **Fast execution.**
- **String data type.**
- **Hexadecimal, octal, and binary data support.**
- **16- and 32-bit integer, single and double precision real, Boolean, character, text file, and user-defined data types using arrays, records, sets, files, pointers, and variable-length strings.**
- **Shared compiler in RTE-A/VC+ systems.**
- **Compatibility with HP 1000 software subsystems, such as Image/1000, Graphics/1000-II, and DS/1000-IV.**

Pascal Standards

Pascal/1000 is an extension of HP Pascal, which in turn is an extension of ANSI Pascal.

HP Pascal Extensions of ANSI Pascal

1. An OTHERWISE clause may be specified in the CASE statement.
2. Compiler options (ANSI, PARTIAL, EVAL, LIST, PAGE, and INCLUDE) may be specified to control various aspects of the compilation and its output.
3. A constant expression may appear in an HP Pascal program anywhere that a constant may appear in ANSI Pascal.
4. Constants of structured data types may be declared in the CONST section of a block.
5. CONST, TYPE, and VAR sections of a declaration may be intermixed and repeated.
6. Halt procedure may be used for abnormal termination of a program.
7. The underscore (_) may appear in identifiers, but not as the first character.
8. A function may return a structured type (array, record, set, or string), but not a file type or or a structure containing a file type.
9. Longreal numbers identical with type REAL, but providing greater precision, are supported.
10. The standard constant, minint, is defined to be the smallest integer representable on the machine.
11. File I/O includes:
    a. Direct access I/O, using predefined routines open, seek, readdir, writedir, maxpos, and last pos.

b. Append procedure to open a file to write, starting at the end of the file.
c. Close procedure to explicitly close any file.
d. "Deferred get" procedure to support interactive input.
e. Read procedure that accepts variables of enumerated types, PAC types,and string types.
f. Write procedure that accepts expressions of enumerated and string types.
g. Position function that returns index of the current position for any file which is not a textfile.
h. Linepos function that returns the integer number of characters which the program has read from or written to a textfile since the last line marker.
i. Prompt procedure flushes the output buffer of a textfile without writing a line marker.
j. Overprint procedure causes a line to be overprinted when a textfile is printed. A carriage return is performed without line feed.

12. STRING data type, which consists of a packed array of CHAR with a declared maximum length and an actual length that may vary at run time, is supported. Several operators, procedures, and functions manipulate strings. Assignment (:=) operator may be used to assign strings or string literals to strings. Concatenation (+) produces a string composed of two other strings.
13. Record variant declaration in which the variant part of a record field list may have subranges of constant expressions as case constants.
14. String literals support permits the encoding of control characters or any other single ASCII character after the # symbol. The # character may be used to include any ASCII character within a string literal.

Pascal/1000 Extensions to HP Pascal

1. REAL and LONGREAL constant expressions are supported.
2. Subprograms or segments may be separately compiled.
3. Additional compiler options are supported (see Compiler Options section, below).
4. Some user-callable library routines are provided in the Pascal runtime libraries.

Functional Specifications

Supportable Configurations

The HP 92833A Pascal/1000 Compiler supports the following configurations.

CDS Configuration: Code and Data Separation (CDS) minimizes memory requirements for four to six concurrent compilations, as compared to the non-CDS Configuration. The CDS configuration is supportable only in RTE-A systems with VC+

Non-CDS Configuration: The non-CDS configuration does not support Code and Data Separation (CDS). It is supportable in RTE-A systems with or without VC+ and in RTE-6/VM systems.

Requirements

Main Memory: Main memory requirements for HP 92833A Pascal/1000 depend upon the working set size and the number of concurrent compilations to be supported, as listed in tables 2-4 and 2-5, below. Within the limits specified, a larger working set gives faster compilation while using more main memory and less disc memory. Compilation performance is given on the next page.

Disc Memory: A hard disc with at least 40M byte capacity is required to support Pascal/1000 program development.

NOTE: The following information is provided for general guidance only. Memory requirements of new releases of Pascal/1000 may differ from the requirements given in Tables 2-4 and 2-5. The customer is responsible for checking memory requirements of the current release of Pascal/1000 with an HP Systems Engineer to determine the adequacy of system memory.

Table 2–4. Main Memory Requirements for CDS Configurations

WORKING SET PAGES	MEMORY REQUIRED (kilobytes) BY NO. OF CONCURRENT COMPILATIONS SUPPORTED					
	1	2	3	4	5	6
100	564	1126	1388	1650	1912	2174
90	844	1086	1328	1570	1812	2054
80	824	1046	1268	1490	1712	1934
70#	804	1006	1208	1410	1612	1814
60	784	966	1148	1330	1512	1694
50	764	926	1088	1250	1412	1574
40	744	886	1028	1170	1312	1454

# 70 pages is the default size of the working set

Table 2-5. Main Memory Requirements for Non-CDS Configurations

WORKING SET PAGES	MEMORY REQUIRED (kilobytes) BY NO. OF CONCURRENT COMPILATIONS SUPPORTED					
	1	2	3	4	5	6
450	900	1800	2700	3600	4500	5400
425	850	1700	2550	3400	4250	5100
400	800	1600	2400	3200	4000	4800
375	750	1500	2250	3000	3750	4500
350	700	1400	2100	2800	3500	4200
325	650	1300	1950	2600	3250	3900
300	600	1200	1800	2400	3000	3600
275	550	1100	1650	2200	2750	3300
250	500	1000	1500	2000	2500	3000
225	450	900	1350	1800	2250	2700
200#	400	800	1200	1600	2000	2400
175	350	700	1050	1400	1750	2100
150	300	600	900	1200	1500	1800

# 200 pages is the default size of the working set

Character Set

Alphabetic characters: All upper and lower case characters (A through Z and a through z).

Numeric characters: The ten digits 0 through 9.

Special characters: blank; currency symbol ($); apostrophe ('); left and right parentheses; comma (,); plus, minus, equals, less than, and greater than symbols (+,-,=,<, >); decimal point (.); slash; colon and semi-colon; left and right brackets; left and right braces; carat (^); @ symbol; # sign; asterisk (*); and underscore (_).

Compilation Performance

Single-User Compilation Speeds: See Tables 2-6 and 2-7.

Multi-User Compilation Speeds: Compile speeds show less than 10% degradation for up to three concurrent compilations when each compilation is allocated its own working set of 110 pages for CDS use, 350 to 450 pages for non-CDS use.

Table 2-6. Compilation Speeds for CDS Configurations

COMPUTER	NO. OF PROGRAM LINES	COMPILATION SPEED (Lines/Minute) BY NUMBER OF WORKING SET PAGES			
		40	80	60	100
A900	800 5700	n/s 400	1000 800	1100 1300	1100 1400
A400, A600+, & A700	800 5700	n/s 200	600 400	600 600	600 600

Table 2-7. Compilation Speeds for Non-CDS Configurations

COMPUTER	NO. OF PROGRAM LINES	COMPILATION SPEED (Lines/Minute) BY NUMBER OF WORKING SET PAGES				
		200	250	300	350	400
A900	800 5700	500 600	600 500	900 700	1000 1200	1000 1400
A400, A600+, & A700	800 5700	300 400	400 300	500 400	500 600	600 600
E/F*-Series	800 5700	300 400	n/s 300	n/s 400	500 500	500 500

* *F-Series computers are discontinued products, listed here for reference only.*

Data Types

Integer: A 32-bit quantity, including sign, that ranges from -2,147,483,648 to +2,147,483,647.

Real: A 32-bit quantity with sign, exponent, and mantissa that ranges from $\pm 2^{-128}$ to $\pm 2^{127}$, with 6 to 7 decimal digit accuracy.

Longreal: A 64-bit quantity with sign, exponent, and mantissa with same range as Real, above, but with 16 to 17 decimal digit accuracy.

Boolean: A 16-bit variable in which only the low order bit is used to determine the Boolean value true (1) or false (0).

Char: Values are the set of characters defined by the 8-bit ASCII character set.

Subrange type: A data type can be identified as a subrange of another ordinal type (Integer, Boolean, Char, or enumeration type) in which the least and largest values of the subrange are identified.

Array type: A structure consisting of a fixed number of components which are all of the same type, called the component type in which the elements of the array are designated by indices. The array type definition specifies the component type and the index type. Component type may be any type, including another structured type.

String type: An ASCII character series of variable length (up to 32767 characters) represented by a variable.

Record type: A structure consisting of a fixed number of components that can be of different types. For each component, called a field, the record definition specifies its type and an identifier.

Set type: Defines a range of values which is the powerset of a base type, which can be Integer, Boolean, Char, or subrange or any enumeration type.

File type: Defines a structure consisting of a sequence of components that are all of the same type. The number of components (length) of the file is not fixed by the file definition.

Compiler Options

ALIAS: Specifies externally-accessible name of a Pascal program or module.

ANSI: Issues warnings for non-ANSI constructs.

ASMB: Specifies options to the assembler.

AUTOPAGE: Automatically pages before each routine in the listing.

BASIC_STRING: Converts Pascal string parameters to BASIC strings.

BUFFERS: Defines the number of file buffers.

CDS: Requests generation of CDS instructions.

CODE: Enables code generation.

CODE_CONSTANTS: Places structured constants in code space.

CODE_INFO: Requests printing of generated code size information.

CODE_OFFSETS: Prints the code offset of each Pascal line in the listing.

DEBUG: Generates information needed by HP 92860A Symbolic Debug/1000.

DIRECT: Use of faster calling sequence for a given procedure.

EMA: Specifies EMA and MSEG sizes.

EMA_VAR: Allocates selected global variable in EMA/VMA.

ERROREXIT: Specifies error return on an external routine.

FAST_REAL_OUT: Use faster, less precise output routines for real numbers.

FIXED_STRING: Converts Pascal string parameters to FORTRAN7x strings.

HEAP: Chooses small or large heap model for the program.

HEAP_DISPOSE: Chooses heap management algorithm.

HEAPPARMS: Specifies one or two word VAR parameter addresses.

IDSIZE: Specifies the number of significant characters in identifiers (1 to 150)

IMAGE: Reserves buffer space for Image programs.

INCLUDE: Requests inclusion of source from another file for compilation.

INCLUDE_DEPTH: Specifies maximum depth of include file nesting.

KEEPASMB: Saves the generated assembly file after compilation.

LINES: Specifies the number of lines per page in the listing.

LINESIZE: Specifies the maximum number of characters in a textfile line.

LIST: Generates compiler listing.

Ordering Information

HP 92833A Pascal/1000 (must order one of Use Options 400 through 897)

HP 92833A Pascal/1000 includes:

1. Pascal/1000 CDS and Non-CDS compiler, library, and error message file on software media option 022, 044, 050, or 051, **one of which must be ordered.**
2. 92833-90005 Pascal Programmer's Reference Manual.
3. 97082-90002 Programming in Pascal (tutorial manual).
4. 92833-90006 Pascal/1000 Software Numbering Catalog.

92833A Media Options

022: Provides software on CS/80 Cartridge Tape.

044: Provides software on Microfloppy disc for HP 12120A*/12122A Integrated Discs in Micro/1000 Package or HP 9122D or 9133A*/B*/H*/L or 9153B Disc.

050: Provides software on 800 cpi magnetic tape.

051: Provides software on 1600 cpi magnetic tape

* *Identifies discontinued product listed here for reference only.*

92833A/R Use Options

400: Use in HP 12100A Single Board Computer, HP 2424A Micro 14 Computer, HP 2434A Micro 24 Computer, or HP 2484A Micro 24 SPU.

600: Use in HP 2106BK Board Computer, HP 2156B Computer, HP 2426E/F Micro 16 Computer, HP 2436A/E Micro 26 Computer, HP 2196C/D Model 26 SPU, or HP 2486A Micro 26 SPU.

700: Use in HP 2137A Computer, HP 2437A Micro 27 Computer, HP 2197C/D Model 27 SPU, HP 2487A Micro 27 SPU, HP 2109E, 2113E, or 2117F* Computer, or HP 2178C Model 60 SPU.

702: Upgrade from 92832A/R to 92833A/R for use on E/F*-Series system for customer WITH support service for 92832A/R.

890: Use in HP 2139A Computer, HP 2439A Micro 29 Computer, HP 2199C/D Model 29 SPU, or HP 2489A Micro 29 SPU, or in any other A/E/F*-Series computer. With 92833A, option 890 includes the right to purchase one or more 92833R products with Use Option 400, 600, 700, and/or 890 for use on a corresponding additional computer(s).

891: Upgrade from previous version of 92833A/R option 890 to latest version of same for customer NOT on support service.

894: Upgrade to Use Option 890 from Use Option 400.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

* *Identifies discontinued product listed here for reference only.*

HP 92833R Right to Copy Pascal/1000 Compiler for Use on an Additional Computer System (must order one of Use Options 400 through 897)

The HP 92833R Right to Copy product is available only to customers who have purchased HP 92833A without an upgrade option. 92833R consists of:

1. The license to make one copy of software purchased with 92833A for use on an additional system.
2. 92833-90005 Pascal Programmer's Reference Manual.
3. 97082-90002 Programming in Pascal (tutorial manual).
4. 92833-90006 Pascal/1000 Software Numbering Catalog.

BASIC/1000C

HEWLETT PACKARD

For Program Development in RTE-A or RTE-6/VM

product number 92857A

BASIC/1000C is a BASIC language subsystem for multi-user conversational program development, testing, debugging, execution, and compilation in hard disc based HP 1000 Computer Systems operating under RTE-A, RTE-A/VC+, or RTE-6/VM.

Features

- **Interpreter with editor and multifunction debugger for fast, friendly, conversational program development.**
- **Compiler for very fast run-time performance and source security.**
- **Compatible with approximately 100 statements of HP 9826*/9845* Desktop Computer BASIC.**
- **HP-IB statements.**
- **Multi-user system with multi-user interrupt handling.**
- **User-controlled error handling statements.**
- **Labelled common.**
- **15-character variable names and line labels.**
- **Integer, double integer, and two-word and four-word floating point data types.**
- **Interpreter-controlled execution of large BASIC programs in EMA/VMA.**
- **Support of large compiled BASIC programs using segmentation.**
- **Support for large data arrays in EMA/VMA.**
- **Access to compiled subroutines written in BASIC, FORTRAN, Pascal, and Macro/1000.**
- **Compatibility with other HP 1000 software subsystems via subroutine calls.**

Functional Description

The Power of HP 9800 Series Desktop BASIC

The statement and capability set of BASIC/1000C is built upon a kernel set of approximately 100 statements and functions that are compatible with the BASIC used on the HP 9826A* and similar Hewlett-Packard 9800 Series Desktop Computers. Capabilities include single and double integer and two- and four-word floating point data types for a choice of precision, the convenience of multicharacter variable and label names, input/output to specific devices, including HP-IB devices, user-defined interrupt handling, formatted and unformatted I/O, and access to disc file storage for data and programs. In addition to providing very good computational power on HP 1000-originated applications, BASIC/1000C's substantial compatibility with Desktop BASIC facilitates migration of applications from thousands of single-user HP 9800 Series Desktop Computers around the world to the more versatile multi-user environment of HP 1000 Computer Systems.

The Ease and Convenience of Conversational Programming with the Interpreter

BASIC programs are entered into the system via a terminal or a file. The BASIC/1000C Interpreter checks each statement as it is entered. If a statement contains a syntax error, the line editor is invoked and a message is issued to help the user correct that statement. A built-in debugger helps to correct program execution errors. The debugger can be used to display and change variables, trace program flow control, step "n" lines in the program, set breakpoints, and continue program execution from any line number within the program.

The Efficiency and Speed of Compiled Programs

BASIC/1000C is the first BASIC subsystem for HP 1000 Computer Systems to include both an interpreter and a compiler. After BASIC/1000C programs have been entered, tested, and debugged with the interpreter, the compiler can be used to translate the source code to relocatable object code for loading and execution in the same way, and as fast as, compiled FORTRAN or Pascal programs. Using compiled BASIC programs also helps to make the source code more secure, an important consideration for OEMs and software houses.

** Identifies discontinued product listed here for reference only.*

Multi-User Operation With On-Line Program Development

Multi-user operation is supported in the RTE system by individually-identified copies of the BASIC/1000C Interpreter, each serving a different user. The interpreter operates in either conversational (program development) mode or run (program execution) mode. Under RTE, several copies of the BASIC/1000C Interpreter can be used for program development while others are running programs. At the same time, developed programs can be compiled by multiple copies of the BASIC/1000C Compiler and previously-compiled BASIC, FORTRAN, Pascal, or Macro/1000 programs can be executing.

Plenty of Space for Program Development and Data

Within the limits of available main memory and disc memory, the BASIC/1000C Interpreter supports programs of up to megabyte size and data arrays of up to six subscripts, with up to 32767 elements per subscript . This is done using the VMA/EMA and program segmentation facilities of the RTE operating system. To use the large program or large data array capability, interpreted programs require no special action; compiled programs require the use of compiler directives to manage VMA/EMA and the use of BASIC statements to manage program segments. On RTE-A with VC+, program segments are managed by the operating system and no special action is required by the user. These compiler statements and directives are ignored by the interpreter so that a program can be interpreted or compiled.

Plus the Ability to Take Advantage of Existing Software

BASIC/1000C can call subroutines written in other programming languages. Thus, applications in BASIC can take advantage of existing software, or subroutines can be written in the most efficient language, such as Macro/1000 Assembly language, and even optimized through the use of program profiling, where maximum execution speed is required.

How BASIC/1000C Relates to Other BASIC/1000 Subsystems

With respect to capability, BASIC/1000C is generally a superset of BASIC/1000D and BASIC/1000L. BASIC/1000C differs from BASIC/1000D and L in that it offers multi-user, real-time interrupt handling instead of the single-user, real-time task scheduling of BASIC/1000D and L. Also, some BASIC/1000C functions have different keywords and/or different ordering of parameters. Because of these differences, programs written for use with BASIC/1000D or L will require modification for use with BASIC/1000C.

How BASIC/1000C Extends the Scope of Desktop BASIC

BASIC/1000C matches HP 9800 Series Desktop BASIC as closely as is practical. However, unlike Desktop BASIC, which is designed for the single user, BASIC/1000C takes advantage of the more powerful real-time, multi-user environment of the RTE operating system and its subsystems. This results in some differences in program statement repertoire and structure. Also, RTE software subsystems, such as Image, are accessed by program calls, rather than direct, firmware-based BASIC statements as in 9800 Series Desktop BASIC. To accommodate these differences, programs written in Desktop BASIC will require modification to run in BASIC/1000C.

Functional Specifications

Environment

Operating System: HP 1000 A-Series Computer System with hard disc operating under RTE-A or HP 1000 E/F*-Series Computer System operating under RTE-6/VM that meets the minimum hardware requirements of the operating system plus enough memory for all concurrent program development and program compilation sessions.

Interpreter Memory Requirements: The interpreter consists of two programs, the BASIC Editor, which requires a 50-page (100 kB) partition for each user, and the BASIC Executor. Partition requirement for the Executor is 200-pages (400 kB) for each user. Unless a program uses strings or arrays larger than 2 kB, no noticeable performance improvement is realized in a partition larger than 200 pages.

Compiler Memory Requirements: The compiler requires a Virtual Memory partition of 190 pages (380 kB). Compilation speed ranges from 500 to 650 lines per minute.

Compiler Disc Requirements: The compiler, interpreter, and auxiliary files require at least 20 MB of disc space to load and run.

Program Scheduling in the RTE Environment

Interpreter and Compiler Scheduling: The BASIC/1000C Interpreter and Compiler are user-scheduled programs, multiple copies of which can be scheduled at the same time by different users.

Interrupt-Scheduled Execution of Subprograms Within User's Programs: BASIC/1000C includes an ON INTR statement that can be used to cause the execution of a subprogram in response to an HP-IB SRQ interrupt from a specified device in RTE-6/VM or HP-IB SRQ, GPIO, and terminal interrupts in RTE-A.

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* *Identifies discontinued product listed here for reference only.*

Scheduling of Compiled Programs: In addition to having the ON INTR scheduling capability of the interpreter, compiled BASIC/1000C programs can be scheduled within the RTE operating system by the user, time, event, or another program, in the same way as any other compiled or assembled program.

Data Types

DATA TYPE	PRECISION (digits)	SIZE (bits)	RANGE
SINGLE INTEGER	5-6	16	-32768 to 32767
DOUBLE INTEGER	9-10	32	-2,147,483,648 to 2,147,483,647
SHORT	6.6-6.9	32	1.47×10^{-39} to $1.70 \times 10^{+38}$
REAL	16.3-16.6	64	1.47×10^{-39} to $1.70 \times 10^{+38}$
STRING	1 to 32767	8 per char	256 char., full ASCII

Program Data Capacity

BASIC/1000C supports arrays with up to six subscripts, up to 32767 elements per subscript, for a total array size of approximately (2^{27}-600,000) bytes, using the EMA/VMA capability of the RTE system.

Program Form

Acceptability of Lowercase: Except for keywords, which must be in uppercase, all program content can be in uppercase and lowercase. Names resembling keywords which are not keywords must contain at least one lowercase character.

Descriptive Error Messages: Error messages describe the nature of errors, in most cases sparing the user the inconvenience of consulting the manual to interpret error numbers. However, error numbers are included in most error messages to provide a reference to more detailed information.

Numeric Type Defaulting: Floating point constants, and variables that are not specifically given a type in the program, have a default floating point type that may be set by the user.

Variable and Label Names: Names of variables and labels may use up to 15 significant characters, including uppercase and lowercase letters, digits, and underscores. An all caps variable or label must not also be a keyword.

BASIC/1000C and RTE Subsystems

The BASIC/1000C Interpreter and Compiler works with the following RTE subsystems:

1. 92861A Graphics/1000-II Version 2.0 Device-Independent Graphics Library,.
2. 92081A Image/1000-II Data Base Management System.
3. 92069A Image/1000 Data Base Management System.
4. 91750A DS/1000-IV Network Software.
5. 92860A Symbolic Debug/1000 (compiled BASIC programs only).

The BASIC/1000C Interpreter also works with the 92862A Graphics/1000-II Version 2.0 Advanced Graphics Package with a limit of 60k bytes of AGP routines accessible from any one BASIC program.

Compiler Options That Affect the Program Listing

Lines per page.

List on/off.

Page feed for control of program listing.

$BASIC or **$TITLE** for headings on LOAD MAP or LISTING.

Compiler Options That Affect Program Structure or Execution

Default two/four-word floating point for setting size of all floating point constants and default-type variables.

EMA for specifying common blocks to be stored in EMA/VMA.

$PROGRAM directive for specifying program name.

$CDS ON/OFF for specifying VC+ support for A-Series systems.

$DEF for specifying external function, return type, and parameter type.

$SUB for specifying external subroutine parameter type.

$SEGMENT for specifying segment boundaries in single-level disc segmentation.

$REALTIME ON/OFF for specifying interrupt handling (requires extra code).

Program priority designation for RTE system.

Range on/off for control of run-time range checking for expression overflow. Turn-off of range checking significantly improves program execution speed and reduces memory requirements.

Ordering Information

HP 92857A BASIC/1000C (must order one of Use Options 400 through 897)

BASIC/1000C consists of:

1. BASIC/1000C Interpreter and BASIC/1000C Compiler on software Media Option 022, 044, 050, or 051, **one of which must be ordered.**
2. 92857-90001 BASIC/1000C Reference Manual.
3. 92857-90002 BASIC/1000C Configuration Guide.
4. 92857-90003 BASIC/1000C Quick Reference Guide.

92857A Media Options

022: Provides software on CS/80 cartridge tape.

044: Provides software on microfloppy disc for HP 12120A*/12122A Integrated Discs in Micro/1000 package or HP 9122D, 9133A*/B*/H*/L, or 9153B Disc.

050: Provides software on 800 cpi, 9-track mag tape.

051: Provides software on 1600 cpi, 9-track mag tape.

* *Identifies discontinued product listed here for reference only.*

92857A/R Use Options

400: Use in HP 12100A Single Board Computer, HP 2424A Micro 14 Computer, HP 2434A Micro 24 Computer, or HP 2484A Micro 24 SPU.

600: Use in HP 2106BK Board Computer, HP 2156B Computer, HP 2426E/F Micro 16 Computer, HP 2436A/E Micro 26 Computer, HP 2196C/D Model 26 SPU, or HP 2486A Micro 26 SPU.

601: Upgrade from previous version of 92857A/R option 600 to latest version of same for customer NOT on support service.

603: Upgrade from 92076A BASIC/1000L to 92857A for use in A600 system for user on software support service.

604: Upgrade from 92076A BASIC/1000L to 92857A for use in A600 system for user NOT on software support service.

700: Use in HP 2137A Computer, HP 2437A Micro 27 Computer, HP 2197C/D Model 27 SPU, HP 2487A Micro 27 SPU, HP 2109E, 2113E, or 2117F* Computer, or HP 2178C Model 60 SPU.

701: Upgrade from previous version of 92857A/R option 700 to latest version of same for customer NOT on support service.

703: Upgrade from 92076A BASIC/1000L or 92101A BASIC/1000D to 92857A for use in A700 or E/F-Series system for user on software support service.

704: Upgrade from 92076A BASIC/1000L or 92101A BASIC/1000D to 92857A for use in A700 or E/F-Series system for user NOT on software support service.

890: Use in HP 2139A Computer, HP 2439A Micro 29 Computer, HP 2199C/D Model 29 SPU, or HP 2489A Micro 29 SPU or in any other A/E/F*-Series computer or SPU. With 92857A, option 890 includes the right to purchase one or more 92857R products with Use Option 400, 600, 700, and/or 890 for use on a corresponding additional computer(s).

891: Upgrade from previous version of 92857A option 890 to latest version of same for customer NOT on support service.

894: Upgrade to Use Option 890 from Use Option 400.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

HP 92857R Right to copy BASIC/1000C for Use on One Additional Computer System (must order one of Use Options 400 through 897)

The HP 92857R product is available only to customers who have purchased a license to use 92857A without an upgrade option. 92857R consists of:

1. The license to make one copy of software purchased with 92857A for use on an additional system.
2. 92857-90001 BASIC/1000C Reference Manual.
3. 92857-90002 BASIC/1000C Configuration Guide.
4. 92857-90003 BASIC/1000C Quick Reference Guide.

Software Support

See the HP 1000 Ordering Guide, 5954-8564 or later revision, for definitions and availability of software support products for BASIC/1000C.

* *Identifies discontinued product listed here for reference only.*

Ada®/1000

For Program Development in RTE-A

product number 92125A

HP 92125A Ada/1000 is an Ada compiler for use in hard disc based HP 1000 A-Series Computer Systems operating under RTE-A/VC+. This new Ada/1000 compiler, which is based on an Ada compiler technology developed by Alsys, S.A., equips HP 1000 A-Series computer systems to develop and/or execute programs written in the increasingly important Ada programming language. Now, the real-time computational and operational power of HP 1000 A-Series computers can be put to work in mission-critical applications for the U.S. Department of Defense (DoD), the NATO defense community, the U.S. Federal Aviation Agency, and NASA. And, of course, HP 1000 A-Series computers can now also be applied to Ada-programmed applications being developed by a growing number of private users and non-DoD governmental agencies and contractors.

In addition, the new Ada/1000 compiler joins the compiler previously introduced for HP 9000 Series 300 computers and that concurrently being introduced for HP 9000 Series 500 computers. It thereby contributes materially to the transportability of Ada programs to/from those other HP computers, facilitating implementation of one-vendor solutions that take advantage of the relative strengths of several different HP computers.

The Ada programming language was developed from U.S. Department of Defense specifications for a single programming language designed to decrease the development and maintenance costs of large-scale software systems. After six years of international design competition, extensive evaluation, and testing, the Ada language was adopted by the Department of Defense and approved as an American National Standards Institute (ANSI) standard and as an International Standards Organization (ISO) standard.

Ada is a modern programming language which supports the most advanced programming concepts with features contributing to programming flexibility and productivity. Ada is a general-purpose programming language that can be used in commercial, industrial, and educational environments. It is ideal for large-scale applications requiring a great deal of time and human resources for development and maintenance.

Ada Language Benefits

- **Superior readability and maintainability of programs.**
- **Strong typing for early detection of programming errors.**
- **Facilities for development of large applications by teams of programmers, including mechanisms for encapsulation, separate compilation, and library management.**
- **Exception handling at the block level, with program control over the consequences and propagation of error conditions.**
- **Support for data abstraction that enhances program portability.**
- **Support for concurrent programming.**
- **Support for generic program units that encourages reuse of program components.**
- **Support for overloading of both operators and names that allows easy extensibility of predefined operators and functions to user-defined data types.**

Features

- **Software Engineering Support**
  - Packages provide the ability to encapsulate data and procedures by hiding implementation details, facilitating re-use and maintenance of programs.
  - Separate compilation lends itself to subdivision of complex programs into smaller, easier to understand modules, which can be developed separately. The compiler maintains consistent and current interfaces between program modules.
  - Tasks provide high-level language support for concurrent programming, eliminating the need for operating system dependent features that limit program portability.
  - Generics provide a mechanism for creating templates of program units which can be used to generate customized versions via a powerful parameterization mechanism.
  - Overloading (giving multiple meanings to a single symbol or name) allows the reuse of names, such as defining "+" for a new data type; this gives the ability to produce more readable and maintainable programs.

● *Ada is a registered trademark of the U.S. Government (AJPO).*

  - Checking of declared subprogram interfaces for consistency by the compiler enhances program reliability.

- **Control Structures**
  - Support for structured programming with if-then-else, case, loop, and exit constructs makes programs easier to write and easier to understand.
  - Select statement provides structured, high-level control of multi-tasking applications.
  - Exception management features provide the ability to enhance program reliability by detecting and handling run-time exception conditions.

- **Data Structures**
  - Scalar data types include character, Boolean, integer, and float.
  - Composite data types include arrays and array slices (portions of an array), and records and variant records (records that can take one of several different forms). Arrays may have dynamic bounds.
  - Access types provide a mechanism for dynamic creation of data objects.
  - Data type definitions provide high-level support for data abstraction. Private and limited private types provide controlled access to operations on programmer-defined types.
  - Strong typing ensures that objects of a given type take only appropriate values and controls the kinds of operations that can be performed on values of the type.

- **Input/Output**
  - Text input/output provides character stream I/O (e.g., to/from terminals and ASCII files).
  - Sequential input/output provides binary stream I/O (e.g., magnetic tape files).
  - Direct input/output provides direct access binary I/O (e.g., disc files).

- **Predefined Packages**
  - Predefined packages include TEXT_IO, SEQUENTIAL _IO, DIRECT_IO, IO_EXCEPTIONS, CALENDAR, STANDARD, SYSTEM, and MATH_LIB.
  - The Predefined package STANDARD provides definitions for elementary data types and operators (e.g., integers, "+").
  - The Predefined package SYSTEM contains a collection of system-specific constants representing machine-dependent information (e.g., the smallest and largest representable integers).
  - The package MATH_LIB provides trigonometric and hyperbolic functions as well as square root, exponential, and log functions. These functions take advantage of the equivalent microcode on HP 1000 A700 and A900 computers.

- **Multiple Ada Program Libraries**

  Ada/1000 supports multiple program libraries, grouped in families. This facilitates construction of very large programs that can be built from multiple program libraries within a family. Components of large programs can be developed in parallel using separate program libraries.
  - A Family Manager is provided to maintain and control complete families of Ada program libraries. The Family Manager provides commands to:
    - create a family of libraries,
    - remove a family,
    - list libraries in a family,
    - recover a family.
  - The Library Manager is provided to maintain individual Ada program libraries. The Library Manager and utilities provide commands to:
    - create program libraries,
    - remove program libraries,
    - rename program libraries,
    - protect program libraries.
  - The Unit Manager maintains information on dependencies between separate compilation units and ensures that Ada programs always use the most current version of separately compiled units. The Unit Manager provides commands to:
    - list program units in a library,
    - list interdependencies between program units,
    - erase program units and their dependents,
    - link program units in separate libraries,
    - select another library as default library,
    - validate units in a library,
    - display closure of a unit in a library,
    - view all units and links in a library.

- **Access to Non-Ada Programs**
  - Ada/1000 provides a mechanism for making subprogram calls to code written in other languages: Pascal/1000, FORTRAN 7x, and Macro/1000 Assembler. Ada/1000 supports system calls and calls to HP 1000 feature products.

- **Compiler Diagnostics**
  - Comprehensive diagnostic messages indicate the cause of an error and cite the relevant section of the reference manual.
  - Compiler diagnostics also suggest possible corrective action and provide expanded details about program objects (types, variables, etc.) involved in detected errors.

- **Code Optimization**
  - High-level optimization to eliminate redundant run-time checks and low-level optimization are optional.
  - Optional "in-lining" of subprograms, either automatically or selectably.

- **Conditional Compilation**
  - Ada/1000 supports a conditional compilation mechanism.

- **Floating Point Support**
  - Ada/1000 supports both 32-bit and 64-bit floating point numeric representations and operations. The Ada package MATH_LIB provides additional floating point math functions.

- **Representation Specifications**
  Ada/1000 supports representation specifications, with control to the word level. This gives the programmer detailed control over the layout of data in specified data structures, as follows:
  - Record Representation Clauses – to specify the storage layout of record components.
  - Length Clauses – to specify the amount of storage for a collection, an activation of a task, and for objects of a given type. Also, to specify T'small for a fixed point type.
  - Enumeration Clauses – to specify the internal integer codes for literals of an enumeration type.

Compatibility

Ada/1000 conforms to the ANSI and ISO standards for Ada (ANSI/MIL-STD-1815A-1983 and ISO/8652-1987 Programming Languages - Ada). Compliance with these standards requires that no extensions be applied to the Language as defined and that no subset of the language be implemented.

Ada/1000 will be validated by the Ada Joint Program Office (AJPO) with the Ada Compiler Validation Capability (ACVC) version 1.8 prior to its first release. Thereafter, compatibility will be confirmed annually in accordance with the revalidation requirements established and administered by the AJPO.

System Environment

Operating System

HP 92125A Ada/1000 operates under RTE-A/VC+ version 5000 or later.

Main Memory

HP 92125A Ada/1000 requires 6 megabytes of main memory for program development.

Disc Memory

HP 92125A Ada/1000 requires approximately 128 megabytes of hard disc memory for program development, of which approximately 15 megabytes is required for Ada/1000 files.

Ordering Information

HP 92125A Ada/1000 (must order one of Use Options 400 through 897)

Ada/1000 consists of:

1. Ada/1000 Compiler and Libraries on software Media Option 022 or 051, **one of which must be ordered.**
2. 92125-90001 Ada/1000 User's Guide.
3. 97055-90610 Reference Manual for the Ada Programming Language.
4. 92125-90002 Reference Manual for the Ada Programming Language, Appendix F (for HP 1000).
5. 92125-90003 Ada Project Development Guide.
6. 97055-90611 Programming in Ada textbook.

92125A Media Options

022: Provides software on CS/80 cartridge tape.

051: Provides software on 1600 cpi, 9-track mag tape.

92125A/R Use Options

400: Use in HP 12100A Single Board Computer, 2424A Micro 14 Computer, 2434A Micro 24 Computer, or HP 2484A Micro 24 SPU.

600: Use in HP 2106BK Board Computer, 2156B Computer, 2426E/F Micro 16 Computer, 2436A/E Micro 26 Computer, HP 2196C/D Model 26 SPU, or HP 2486A Micro 26 SPU.

700: Use in HP 2137A Computer, 2437A Micro 27 Computer, HP 2197C/D Model 27 SPU, or HP 2487A Micro 27 SPU.

890: Use in HP 2139A Computer, HP 2439A Micro 29 Computer, HP 2199C/D Model 29 SPU, or HP 2489A Micro 29 SPU.

891: Upgrade from previous version of 92125A option 890 to latest version of same for customer NOT on support service.

894: Upgrade to Use Option 890 from Use Option 400.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

HP 92125R Right to copy Ada/1000 for Use on One Additional Computer System (must order one of Use Options 400 through 897)

The HP 92125R product is available only to customers who have purchased a license to use 92125A without an upgrade option. 92125R consists of:

1. The license to make one copy of software purchased with 92125A for use on an additional system.
2. The license to make one copy of any of manual items 2 through 6 furnished with 92125A.

Software Support

Software Support for 92125A/R Ada/1000 is similar to that available for other HP 1000 programming languages. See the HP 1000 Ordering Guide, 5954-8564 or later revision, for definitions and types of software support products available for HP 1000 programming languages. Check software support pricing with your local HP Field Sales Office.

Macro/1000 Assembler

For Program Development in RTE-A or RTE-6/VM

Included in RTE-A and RTE-6/VM

Macro/1000 is an assembler designed to give users complete control over each computer instruction while significantly enhancing productivity through full macro capabilities and high-order language type constructs. At the same time, Macro/1000 offers full upward compatibility with the RTE-IVB* assembler while providing approximately double its assembly performance.

Features

- **Structure.**
- **Macro capabilities that enhance code portability and program readability.**
- **Library of commonly-used macros.**
- **Conditional assembly instructions.**
- **Modularity.**
- **File and string manipulation utilities.**
- **16-character variable names.**
- **Symbolic addressing.**
- **Enhanced error control and reporting.**
- **Extremely fast compilations.**
- **Compatibility with HP 1000 software subsystems, such as Image/1000, Graphics/1000-II, and DS/1000-IV.**

Functional Description

Macro/1000 is a superset of the RTE-IVB* Assembler, with the following extensions:

Powerful Macro Facility

A macro facility supports the passing of constants, labels, expressions, and complete instructions as parameters. Macros can be nested within macros, with the level of nesting limited only by the amount of disc memory. Macro/1000 further allows recursion and cross-recursion between macro definitions to enhance the programmer's capabilities.

String Manipulation Utilities

These four assembly-time string manipulation utilities can be used in expressions:

A Length construct can be used to measure the character count in a string, allowing various changes to the string's content without further edits to the code used for string manipulation.

A Substring utility helps the programmer to operate on segments of a character string.

Upper Case Map changes lower case characters to upper case characters.

A Type attribute can be used to determine whether an assembly time variable has been declared to be integer, character, or not yet declared.

File Manipulation Instructions

Macro/1000 file manipulation instructions can be used to merge separate files and assemble them together as independent macros or subroutines. An INCLUDE statement can be used to copy a designated file of code, macro definitions, or data into the source at a desired point. A MACLIB statement can be used to identify a file as a macro library.

New Pseudo Operations

Macro/1000 provides 23 new pseudo operations which give the programmer more control over assembly time options. These include commands to specify where a table of literal values is located, to repeat a sequence of code, to fix the size of an Extended Memory Area (EMA), or to define an address to EMA.

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* *RTE-IVB is a discontinued product listed here for reference only.*

Functional Specifications

Environment

Operating System: Macro/1000 executes on any HP 1000 Computer System operating under RTE-A or RTE-6/VM.

Memory Requirements: 36k bytes, minimum; best performance is achieved with more memory, up to a maximum of 64k bytes.

Compilation Speed (CPU time): 5000-6000 lines per minute.

Macro Program Execution: Generated code runs under RTE-A or RTE-6/VM, rev code 2140 or later.

Character Set

Alphabetic Characters: All upper and lower case characters (A through Z and a through z).

Numeric Characters: The ten digits 0 through 9.

Special Characters: blank; equal, plus, minus, less than, and greater than symbols; period; comma; asterisk; slash and backslash; left and right parentheses; single and double quotes; left and right brackets; colon and semicolon; currency symbol (e.g., $); percent sign; question mark; exclamation point; ampersand; at sign (@); sharp sign (#); and carat (^).

Program Form

Lower Case: Lower case keywords are accepted and mapped into upper case for improved readability.

Comment Lines: Comments can be transcribed into a source program in various ways. An asterisk in the first position or semicolon as the first nonblank character is accepted as the start of a comment line. Additionally, characters following a backslash (\) in an operand field are interpreted as comments.

Error Directory: Macro/1000 incorporates one of the most descriptive error message directories available on HP 1000 Computer Systems, in addition supporting the declaration and listing of user-defined errors.

Assembler Options

R: Produces relocatable assembly

A: Produces absolute assembly

L: Produces program listing

C: Produces cross-reference table of symbols, labels, and op codes

Q: Omits op code fields from instruction values that appear in the program listing

T: Produces Symbol Table Listing

M: Creates Macro library.

Ordering Information

Macro/1000 software and the Macro/1000 Reference Manual (92059-90001) are included in HP 1000 A-Series Computer Systems, in the HP 92077A RTE-A operating system.

Software Support

Software support for Macro/1000 is included with software support for RTE-A. See the HP 1000 Ordering Guide, 5954-8564 or later revision, for definitions and availability of software support products for RTE-A.

Image/1000-II

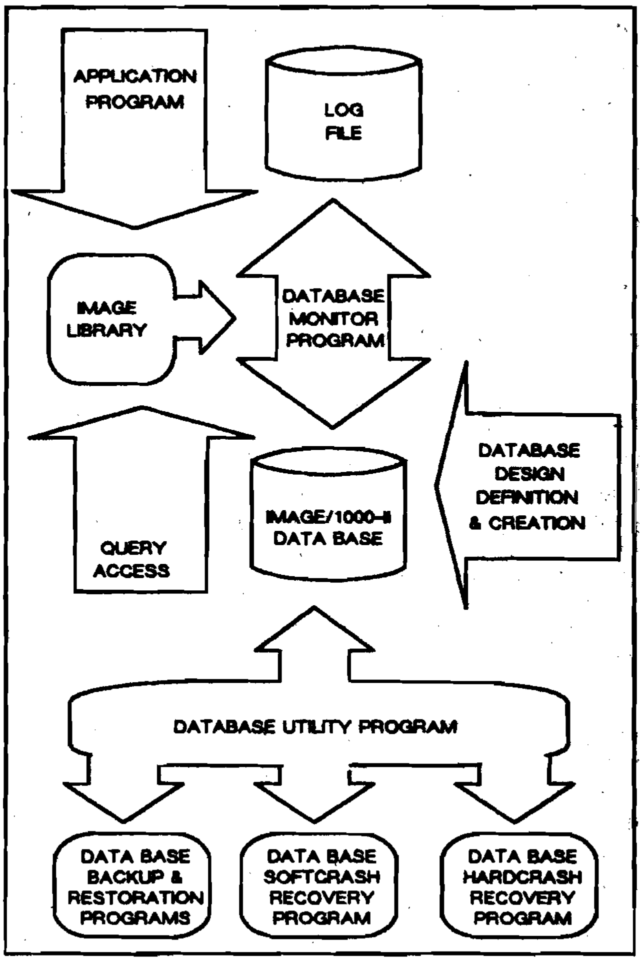
For Data Base Management

product number 92081A

Image/1000-II is a general-purpose data base management software system with Query designed for use in HP 1000 Computer Systems managed by HPs RTE-A and RTE-6/VM operating Systems. Image/1000-II provides a complete software package for consolidating large quantities of data into a single, interrelated data base that can be shared by many different users for a wide variety of purposes. In combination with Distributed Systems/1000-IV software, Image/1000-II services remote data base access requests. Image/ 1000-II includes recovery features that protect data base systems from loss of data, thus ensuring high availability and improved productivity. The product is well suited to applications that are sensitive to data loss, or excessive downtime.

Features

- **Host language subroutines for logical transaction definition and the ability to undo a transaction.**
- **Optional transaction logging and recovery for guaranteed data integrity and high data availability**
- **Roll-back recovery for fact recovery from loss of volatile memory, with minimum downtime**
- **Roll-forward recovery for data protection against disc crash**
- **Data set locking for multi-user, multi-program, concurrent access to multiple data sets within a data base**
- **Single program control of all data base access**
- **Single-word integer, double-word integer, two-word real, four-word read, and ASCII character string data types supported**
- **Concurrent access for up to 100 users per data base**
- **Existing Image/1000-II data bases can by physically restructured as Image/1000-II data bases using a utility program**
- **Host language subroutines callable from Pascal, FORTRAN, BASIC/1000C, HP RTE Assembly or Macro/1000 Assembly Language.**
- **Data base capacity up to 3.2G bytes under RTE-6/VM and RTE-A**
- **Protection against unauthorized access at data base and data item level**


APPLICATION PROGRAM
LOG FILE
IMAGE LIBRARY
DATABASE MONITOR PROGRAM
DATABASE DESIGN DEFINITION & CREATION
QUERY ACCESS
IMAGE/1000-II DATA BASE
DATABASE UTILITY PROGRAM
DATA BASE BACKUP & RESTORATION PROGRAMS
DATA BASE SOFTCRASH RECOVERY PROGRAM
DATA BASE HARDCRASH RECOVERY PROGRAM

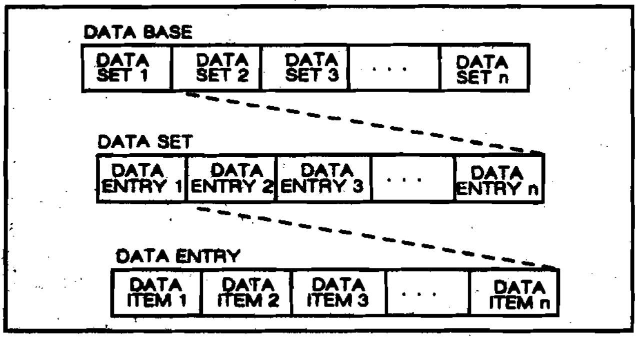
- **Up to 16 search keys per data set for fast data access**
- **Remote data base access via DS/1000-IV**
- **Recovery of allocated Image resources from aborted programs**
- **Query facility that provides the non-programmer with English-like commands to easily retrieve, alter, and report information**
- **Support of Code and Data Separation in RTE-A with VC+**
- **Support of both Command Interpreter (CI) and FMGR file systems**

Functional Description

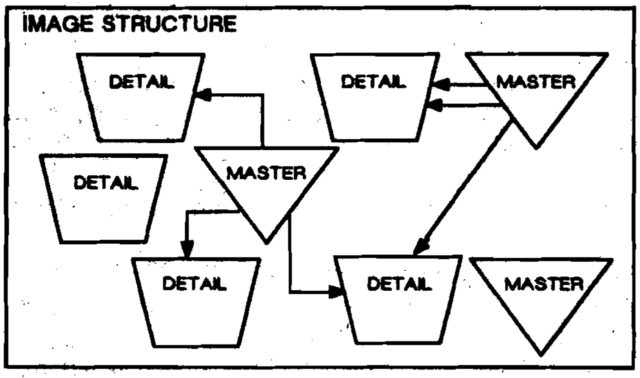
Image/1000-II Data Base Structure

Image/1000-II is primarily a path oriented or chain approach to data retrieval. Pointers are maintained which logically connect records with common attributes into chained lists. This allows cross-referenced access to collections of data down to the smallest unit and makes it possible to access related data very quickly.

An Image/1000-II data base consists of one or more data sets (files) that have some logical relationship to one another. A data set consists of one or more fixed length data entries (records). A data entry consists of one or more data items (fields).



Image/1000-II supports master and detail data sets. Master data sets are a collection of key values used for fast access to information stored either in the master data set or a related detail data set. Master data sets can be linked to more than one item in a detail data set. Access to a data entry in a master data set may be calculated (hashed), based on the key value of the data entry. Access to data entries in a detail data set is usually via a key value that is chained from a related master data set. Data entries can also be accessed serially or directly.



Reasons for Using Image/1000-II

Strong Foundation

Image/1000-II is built on the solid foundation established by the Image Data Base Management software family and the RTE-A and RTE-6/VM Real-Time Executive operating systems. It is 100 percent backward compatible with 92069A Image/1000 on the call level.

High Speed Data Access

Single program (DBMON) control of all data base access and a memory cache for data, decreases the number of disc accesses. Image/1000-II's capacity to service 100 concurrent active programs, and the ability to lock on the data set level provide the means to develop applications with high throughput requirements.

Data Base Integrity

In order to protect against data base corruption, Image/1000-II keeps a file of all "before-images" prior to modifying the data base. A before-image is a copy of a data record made before modification begins. If a system crash occurs, the before-images are restored, ensuring a physically consistent data base.

To ensure logical data base integrity following a program abort or memory failure, Image/1000-II uses a roll-back logging scheme and maintains a disc log file of transactions as they are performed. A transaction is a group of logically related Image calls in which all or none must be completed. In the event of a crash, Image can redo completed transactions and undo incomplete transactions.

To prevent loss of data from disc failure, transactions can be logged to a permanent storage device, such as a magnetic tape, using "roll-forward" logging. This transaction log is available for data base restoration in the event of a disc crash. A utility program is provided which recreates all transactions completed between the time of the last backup and a crash.

Data Independence

The description of the data base is independent of the programs that access the data base. Image/1000- II maintains all the pointers necessary to logically relate the data. Programmers can access the data base without concern for how the data is physically structured. It is possible to reorganize the data without requiring a change to any programs. Application programs can be modified without a need to change the data structure or the physical data storage devices.

Multiple Usage of Data

Common data may be shared between the different application programs that use the data base, thereby reducing data redundancy and physical storage. Independent data files that contain redundant information can be updated simultaneously.

Ease of Data Access

The data base can be accessed by either a user-written application program or by the Query language facility included with Image/1000-II. Application programs can be written in Pascal, FORTRAN, BASIC/1000C, or Macro/1000 Assembler language. The data base can be accessed with a host language, using one of four reading methods: serial (sequential), direct (as with a file management system), calculated (hashed), or chained (using a key item). The data base also allows users to have chained entries alphabetically or numerically ordered by a secondary item value. Query, a program which allows non-programmers to easily locate, report and update data values, is excellent for ad hoc inquiry to the data base, either interactively or in batch mode. Query enhancements include time and date stamping, the implementation of transaction commands, right margin truncating of ASCII files in reports, and select file defaulting.

Data Security

Each data item in the data base can be protected from unauthorized access by the assignment of a security code. By specifying a different privacy level for read and write operations on each data item, users can be permitted read but not change a particular data item.

Remote Data Base Access

Image/1000-II combined with DS/1000-IV allows programs on a local HP 1000 Computer System to access remote Image/1000-II data bases at RTE-6/VM and RTE-A based systems*. Query can also be scheduled at a remote system site using LU mapping if a DS/1000-IV link is available. The remote site would be the location of the data base to be accessed.

**NOTE: The user program on the local system must be loaded with the Image/1000-II library, and the remote system must be executing the Image/1000-II subsystems DBMON and RDBAM.*

Image/1000-II Components

To handle your information needs, Image/1000-II provides easy-to-use software for the following data base tasks:

- Creating the Data Base
- Querying the Data Base
- Host Language Access
- Maintaining the Data Base

Creating the Data Base

Using DBDS, Image/1000-II processes a description of the user data base (called a schema) and produces an internal system description of the data base (called a root file) along with the data sets used by the Image/1000-II system. The user describes the data and their interrelationships, security, and the required storage using a data base definition language.

After creation of the data base, the user can then use the DBBLD (Data Base Build) utility program to load data into the data base. DBBLD can be used for both initially storing large amounts of data into a data base, or adding data to existing data bases.

Querying the Data Base

An Image/1000-II data base can be accessed by Query to allow the non-programmer to retrieve and report data from a data base or to update information in the data base through easy-to-use English-like commands. Query also provides the experienced programmer fast, easy access to the data base to help debug application programs.

Security. Query adheres to all security provisions that are specified during the definition phase of an Image/1000-II data base. A security code must be specified to access a data base. Query returns an error if a user attempts to access a data base or data item without the correct security code and privacy level words.

Multicriteria Data Selection. Precise information can be retrieved from a data set using logical relationships between data items and their values (is, is not, is less than, etc.) using logical connectors (ANDs and ORs).

Reporting Data. After information is retrieved from a data base, Query can format and generate a variety of reports that can be listed to either a device or file. Reports can include page headings, column headings, page numbers, etc. Items of data can appear in a report, can be format edited, averaged, totaled, and subtotaled. Information to be reported can be sorted by multiple categories.

Updating a Data Base. Information retrieved can be modified or deleted from the data base. New records can also be added with automatic linkage. Using Query to update a data base can be a time-saver for one-time changes.

Procedure Capability. Query procedures provide a convenient way of storing particular Query commands in a disc file for repeated use without having to retype them. These procedures aid in finding data entries in the data base, reporting them, and updating the data base.

Batch Capability. Query can also be executed in a batch mode without operator interaction. Query commands that would normally be entered interactively can be stored in a disc file for repeated use. The disc file created for batch Query can also use Query procedures for some of the required responses. One example use of Query in a batch mode would be the creation of a particular report on a regular basis where the development of an application program is not justified.

Query Command Set

DATA-BASE	Identifies data base to be accessed.
SELECT-FILE	Identifies file to be used for retrieving data entries
FIND	Multicriteria data selection
REPORT	Report formatting and generation with sorting
UPDATE	Data modification, addition, and deletion
CREATE	Creates a procedure
DISPLAY	Displays a procedure
EXECUTE	Executes a program
DESTROY	Deletes a procedure
TRANSBEGIN	Starts a transaction
TRANSEND	Ends a transaction
TRANSMEMO	Writes a comment to the transaction log
TRANSUNDO	Allows user to undo a pending transaction
FORM	Displays data base structure
HELP	Explains purpose and form of Query commands
LIST	Changes list device
EXIT	Exits from Query
XEQ	Allows users to enter Query commands from a command file and return to an interactive mode

Remote Query. Image/1000-II combined with DS/1000-IV allows an HP 1000 Computer System to execute Query at a remote DS/1000-IV node that has an RTE-A or RTE-6/VM based Image/1000-II data base. Accessing a remote Image/1000-II data base with Query merely requires executing Query at the Image/1000-II system you wish to access, using LU mapping. With both DS/3000 and DS/1000-IV, an HP 1000 system can become a virtual HP 3000 terminal, with the HP 1000 user gaining access to an Image/3000 data base Query/3000.

Host-Language Access

Up to 20 data bases can be opened to a program. Host language access allows the user to tailor a program to the specific application. Query is actually an application program generalized to serve novice users, but it cannot offer the flexibility and efficiency of an application program written for a particular task. The combination of host language access and Query allows both programmers and novices to access the data base in the most cost-effective way.

The following fifteen subroutines are included for host language access of the data base. Your application programs can be written in Pascal, FORTRAN, BASIC/1000C, HP RTE Assembly or Macro/1000 Assembly language.

DBOPN (Data Base Open). Prepares a data base for subsequent access by other Image/1000-II subroutines. This includes specifying a level word, thereby establishing the data items a particular user can access. Up to 100 users can open the data base.

DBINF(Data Base Information). Provides information about the organization and components of the data base being accessed. The information can be the type and length of data items, the relationships between data, etc.

DBFND (Data Base Find). Locates the beginning of a data chain with a calculated (hashed) value based on the key item. This is done in order to perform subsequent chained reads via DBGET.

DBGET (Data Base Get). Accesses the data base in a variety of ways. A master data set can be accessed in a calculated (hashed), serial, or direct fashion. A detail data set can be accessed in a chained read, serial, or direct fashion.

DBUPD (Data Base Update). Modifies existing data.

DBPUT (Data Base Put). Adds new data.

DBDEL (Data Base Delete). Deletes existing data.

DBLCK (Data Base Lock). Gives the user temporary exclusive use of the data base to update entries.

DBUNL (Data Base Unlock). Releases the data base or data sets to full use by others.

DBCLS (Data Base Close). Closes the data base and prevents further access.

DBBEG (Data Base Transaction Begin). Defines the beginning of a logical transaction.

DBEND (Data Base Transaction End). Defines the end of a logical transaction. Upon completion, the transaction will be logged.

DBMEM (Data Base Transaction Memo). Requests logging of a memo record in the log files. This log record contains user provided text information.

DBUND (Data Base Transaction Undo). Allows program to undo a currently open or incomplete transaction.

DBCTL (Posting Control). Allows the user to have immediate or delayed posting of records for a data base when transactions are not being logged for that data base.

Maintaining the Data Base

A data base maintenance utility, DBUTL, provides functions useful for data base backup, restructuring, defining of log files, defining of log status, cleanup of Image resources held by inactive programs, control of data base access, softcrash recovery and hardcrash recovery. Some of these functions are available through the following programs scheduled through DBUTL.

DBSTR (Data Base Store). Copies the complete data base, including structural information, onto magnetic tape or additional disc, for backup security. DBSTR also allows optional verification of the magnetic tape. No restructuring of the data base is possible using this program.

DBRST (Data Base Restore). Restores a root file and a data base from a magnetic tape or additional disc created by DBSTR.

DBULD (Data Base Unload). Copies data from an existing data base onto magnetic tape or additional disc. Unloading the data base using this routine allows the user to reload the data base into a different data base structure.

DBLOD (Data Base Load). Builds a data base according to a specified root file from a magnetic tape or additional disc created by the DBULD program. DBLOD users have the option to restore the data to the same data base structure or create a new data base structure using a new data base definition.

DBRBR (Data Base Roll-Back Recovery). Performs soft crash recovery.

DBRFR (Data Base Roll-Forward Recovery). Performs hard crash recovery.

DBARC (Roll-Forward Log Archive). Allows archiving of roll-forward log disc files to magnetic tape. DBARC also allows optional verification of the magnetic tape.

DBSPA (Data Base Space). Reports number of entries in use and entries available. DBSPA is scheduled through File Manager, rather than DBUTL.

Functional Specifications

Data Base Capacity and Syntax

Data Base: May contain up to 50 data sets. Total data base size is limited only by the total available storage, which depends upon the capacity of the discs interfaced to the system and the number of I/O channels available for disc interfaces.

Data Set: May contain up to $2^{31}-1$ (>2 billion) data entries. However, a data set cannot span multiple disc sub-channels, limiting the data set size to a maximum 571M bytes under RTE-A, 404M bytes under RTE-6/VM.

Data Entry: May contain up to 4096 bytes. All data entries within a given data set have the same record format. There can be up to 127 unique data item names per data entry.

Data Item Types: Integer number with values −32768 to +32767, double integer numbers with values −2147483648 to +2147483647 two-word real numbers with values $\pm 1.47 \times 10^{-39}$ to $\pm 1.70 \times 10^{38}$, four-word real numbers with values the same as two-word real numbers, but with greater precision, and ASCII character strings with up to 255 characters.

Detail Data Sets per Master Data Set: 16

Search Items (keys) per Detail Data Set: 16

Data Base and Data Set Names: 1-6 characters

Data Item Name: 1-6 characters. A data base may contain up to 255 unique data item names and those names may be repeated in the description of more than one data set.

Security Code: Integer 1 to 32767 or two ASCII characters.

Privacy Level Word: 1-6 character.

Configuration Information

Remote Data Base Access: RTE-A or RTE-6/VM based Image/1000-II data base can be accessed from a remote DS/1000 node by Query and with a Pascal, FORTRAN, or Macro/1000 Assembly language program using Image/1000-II subroutines. Requires software revision 2040 or later for DS/1000-IV (91750A).

Programming Languages: FORTRAN IV, Pascal, Real-Time BASIC, and Macro/1000 Assembly language.

Multi-User Capability: A centralized monitor program, DBMON, accesses the data base and limits the total number of data base opens on a system to 100.

Upgrading from 92069A Image/1000: To upgrade from 92069A to 92081A Image/1000-II, data bases must be unloaded using DBULD and reloaded using DBLOD, 92081A utilities. Existing user programs written with Image/1000 calls can be moved to Image/1000-II without being changed. However, large programs may need to be resegmented, depending on the calls used.

Minimum System Requirements: Same as HP 92077A RTE-A, with B.83 PCO or later, and 92084A RTE-6/VM, revision 2226.

Memory Usage

Minimum system:	304 kB
Additional per local user:	64 kB
Full blown system:	756 kB
Additional per remote user:	48 kB

Image Program		Program Size (Bytes)	Uses Data Base Buffers?
Schema Processor:	DBDS	124k	No
Query		40k*	Yes
Utilities	DBBLD	52k	Yes
	DBSTR	64k	No
	DBRST	64k	No
	DBULD	64k	Yes
	DBLOD	64k	Yes
	DBSPA	22k	Yes
	DBUTL	64k	No
	DBARC	50k	No
Remote Data Base Access:	RDBAM	12k	No
	RDBAP	48k	Yes

** Add 8k bytes for support of execution from a remote DS/1000-IV node.*

The following require EMA partitions for buffers

		Program Size (Bytes)	Minimum Partition Size
Utilities	DBRBR	62k	160k
	DBRFR	62k	160k
Database Monitor:	DBMON**	64k	220k

*** DBMON is a VMA program with a minimum working set of 80 pages (160k bytes). In some cases, its performance may be increased with a larger working partition for internal data buffers.*

Installation

In HP 1000 Computer System: The Image/1000-II Data Base Management System software is an integrated, working part of the primary operating system.

When Purchased as a Software Component: Image/1000-II is a customer-installed product; installation assistance is available from your local Hewlett-Packard Field Service office at prevailing service rates.

NOTE: *Image/1000-II is not supported in a 91747A Datashare environment.*

Ordering Information

HP 92081A Image/1000-II Data Base Management System With Query for RTE-A or RTE-6/VM Use. (Must order one of Use Options 400 through 897.)

Image/1000-II consists of

1. Image/1000-II software on Media Option 022, 044, 050, or 051, **one of which must be ordered.**
2. 92081-90001 Image/1000-II User's Manual.
3. 92081–90002 Image/1000-II Software Numbering Catalog.

92081A Media Options

022: Provides software on CS/80 cartridge tape.

044: Provides software on microfloppy discs for HP 12120A*/12122A Integrated Discs in Micro/1000 package or HP 9122D or 9133A*/B*/H*/L or 9153B Disc.

050: Provides software on 800 cpi mag tape.

051: Provides software on 1600 cpi mag tape.

92081A/R Use Options

400: Use in HP 12100A Single Board Computer, HP 2424A Micro 14 Computer, HP 2434A Micro 24 Computer, or HP 2484A Micro 24 SPU.

600: Use in HP 2106BK Board Computer, HP 2156B Computer, HP 2426E/F Micro 16 Computer, HP 2436A/E Micro 26 Computer, HP 2196C/D Model 26 SPU, or HP 2486A Micro 26 SPU.

601: Upgrade from 92069A/R or previous version of 92081A/R option 600 to latest version of 92081A/R option 600 for customer NOT on software support service.

602: Upgrade from 92069A/R option 600 to 92081A/R option 600 for customer who is on software support service.

700: Use in HP 2137A Computer, HP 2437A Micro 27 Computer, HP 2197C/D Model 27 SPU, HP 2487A Micro 27 SPU, HP 2109E, 2113E, or 2117F* Computer, or HP 2178C Model 60 SPU.

701: Upgrade from 92069A/R or previous version of 92081A/R option 700 to latest version of 92081A/R option 700 for customer NOT on software support service.

702: Upgrade from 92069A/R option 700 to 92081A/R option 700 for customer who is on software support service.

890: Use in HP 2139A Computer, HP 2439A Micro 29 Computer, HP 2199C/D Model 29 SPU, or HP 2489A Micro 29 SPU, or in any other A/E/F*-Series computer. With 92081A, option 890 includes the right to purchase one or more 92081R products with Use Option 400, 600, 700, and/or 890 for use on a corresponding additional computer(s).

891: Upgrade from 92069A/R or previous version of 92081A/R option 890 to latest version of 92081A/R option 890 same for customer NOT on support service.

892: Upgrade from 92069A/R option 890 to 92081A/R option 890 for customer who is on software support service.

894: Upgrade to Use Option 890 from Use Option 400.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

HP 92081R Right to Copy 92081A Image/1000-II Software for Use on an Additional Computer System. (Must order one of Use Options 400 through 897)

The 92081R product is available only to customers who have purchased a license to use 92081A. 92081R consists of:

1. The right to make one copy of software purchased with the 92081A Image/1000-II Data Base Management System for use on an additional system.
2. 92081-90001 Image/1000-II User's Manual.
3. 92081-90002 Image/1000-II Software Numbering Catalog.

Recommended Additional Equipment

In addition to the basic hardware required to support the host RTE operating system, computer systems with the 92081A Image/1000-II Data Base Management System should also include a line printer for fast printout of reports and either a magnetic tape unit or an additional disc drive for data base backup.

Software Support Products Available

See the HP 1000 Ordering Guide, 5954-8564 or later revision, for definition and availability of software support products for Image/1000-II.

** Discontinued product listed here for reference only.*

Image/1000

HEWLETT PACKARD

For Data Base Management

product number 92069A

Image/1000 is a general-purpose data base management software system with Query designed for use in HP 1000 Computer Systems managed by HPs RTE-A, RTE-6/VM, and RTE-IVB* operating Systems. Image/1000 provides a complete software package for consolidating large quantities of data into a single, interrelated data base that can be shared by many different people for a wide variety of purposes. In combination with Distributed Systems/1000 software, Image/1000 services remote data base access requests.

Features

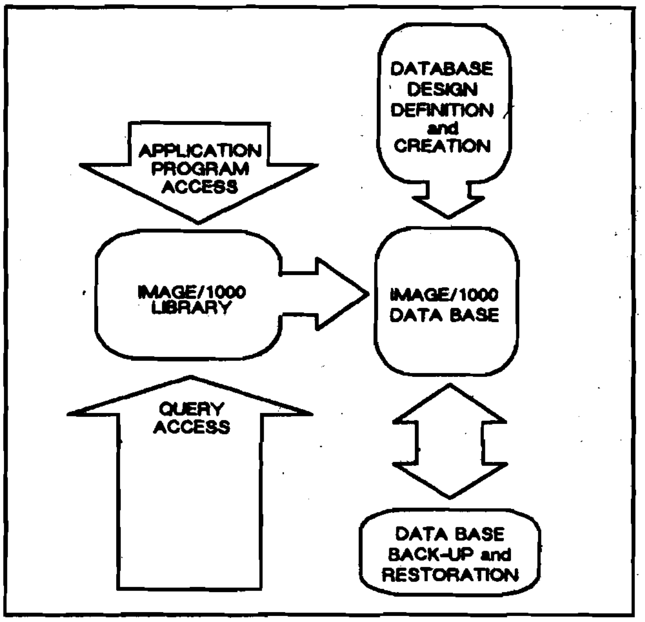
- **Image/1000 data bases can be restructured without needing to change your application programs**
- **Host language subroutines callable from Pascal, FORTRAN, BASIC, and Assembly language**
- **Minimum data redundancy through file consolidation**
- **Protection against unauthorized access at data base and data item level**
- **Data base capacity up to 800M bytes under RTE-A, 3.2G bytes under RTE-6/VM, 960M bytes under RTE-IVB***
- **Up to 16 search keys per data set for fast data access**
- **Sorted chains that order entries by a secondary item value**
- **Utilities that build, maintain, restructure, and backup the data base**
- **Image/1000 data base can be accessed remotely with DS/1000-IV**
- **Query facility that enables the non-programmer to easily retrieve, alter, and report information using English-like commands**

** RTE-IVB is a discontinued product, listed here for reference only*

Reasons for Using an Image/1000 Data Base

Data Independence

The description of the data base is accessible from application programs. Applications can be written which are not dependent on the structure of the data base, making the application data independent.


DATABASE DESIGN DEFINITION and CREATION
APPLICATION PROGRAM ACCESS
IMAGE/1000 LIBRARY
IMAGE/1000 DATA BASE
QUERY ACCESS
DATA BASE BACK-UP and RESTORATION

Programmers can access the data base without concern for how the data is physically structured. It is possible to reorganize the data without requiring a change to any programs. Likewise, application programs can be modified without a need to change the data structure or the physical data storage devices.

Multiple Usage of Data

Common data may be shared between the different groups that use the data base. Use of the same data by different programs reduces data redundancy, since it's not necessary to create and maintain data files for each application program. Physical storage requirements are reduced and only one set of data needs to be maintained. The problem of how to simultaneously update independent data files that contain redundant information is also easily eliminated by using an Image/1000 data base.

Data Security

Data can be security code protected from unauthorized access with Image/1000. Each data item in the data base also has an associated privacy level that limits its access to authorized users. With Image/1000, you can specify a different privacy level for read and write operations on each data item. This is useful when you would like to allow someone to read but not change a particular data item.

Data Access

The data base can be accessed by either a user-written application program or by the Query language facility included with Image/1000. Application programs can be written in Pascal, FORTRAN, or Assembly language. Image/1000 also provides for access from BASIC programs. The data base can be accessed with a host-language using one of four methods: serial, or direct as with a file management system; calculated (hashed); or chained using a key item. The data base also allows users to have chained entries alphabetically or numerically ordered by a secondary item value. Query is a program for non-programmers to easily locate, report and update data values in the data base. Query is excellent for ad hoc inquiry to the data base either interactively or in a batch mode.

Remote Data Base Access

Image/1000 combined with DS/1000-IV allows the user to write programs that run on a local HP 1000 Computer System to access remote Image/1000 data bases at RTE-A, RTE-6/VM, and RTE-IVB*, based systems†. Query can also be scheduled locally to execute at a remote data base. This means that an Image data base can be easily shared with other HP 1000s in the Distributed Systems Network.

†*NOTE: Image/1000 is required on the local system if programs to be used for accessing Remote Data Bases are to be developed on the local system.*

Proven Performance

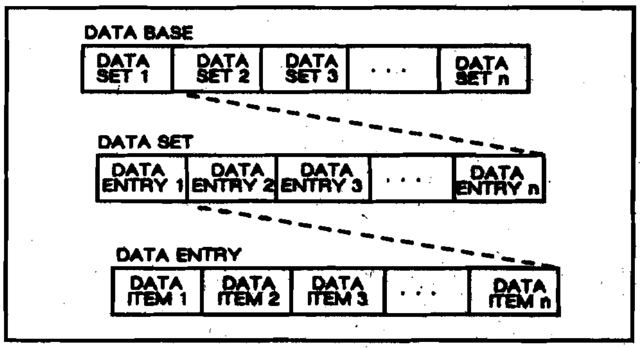
Image/1000 is a member of Hewlett-Packard's Image Data Base Management Software family. Image/3000, selected for Datapro's Honor Roll, Image/300, Image/250, and Image/45 are also members of HPs Image family. Image/1000 has been successfully used by over 1000 HP 1000 Computer System customers since 1976. Image/1000 is based on RTE-A, RTE-6/VM, and RTE-IVB*, the newest and most powerful members of the disc-based, real-time executive operating system family. RTE systems have been put to work in thousands of installations throughout the world since 1968.

* *RTE-IVB is a discontinued product, listed here for reference only.*

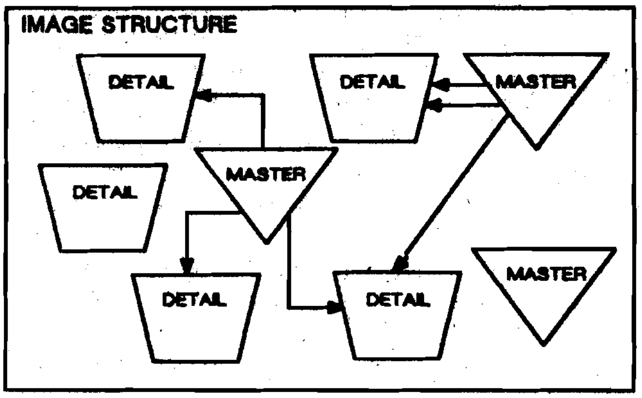
Image/1000 Data Base Structure

Image/1000 is primarily a path oriented or chain approach to data retrieval. Pointers are maintained which logically connect records with common attributes into chained lists. This allows cross-referenced access to collections of data down to the smallest unit and makes it possible to access related data very quickly.

As shown below, an Image/1000 data base consists of one or more data sets (files) that have some logical relationship to one another. A data set consists of one or more fixed length data entries (records). A data entry consists of one or more data items (fields).



Image/1000 supports master and detail data sets. Master data sets are a collection of key values used for fast access to information stored either in the master data set or a related detail data set. Master data sets can be linked to more than one item in a detail data set. Access to a data entry in a master data set may be calculated (hashed), based on the key value of the data entry. Access to data entries in a detail data set is usually via a key value that is chained from a related master data set. Data entries can also be accessed serially or directly. Master and detail data sets can be chained together as shown below.



Image/1000 Components

To handle your information needs, Image/1000 provides easy-to-use software for the following data base tasks:

- Creating the Data Base
- Querying the Data Base
- Host Language Access
- Maintaining the Data Base

Creating the Data Base

Image/1000 processes a description of the user data base (called a schema) and produces an internal system description of the data base (called a root file) along with the data sets used by the Image/1000 system. The user describes the data and their interrelationships, security, and the required storage using a data base definition language.

After creation of the data base, the user can then use the DBBLD (Data Base Build) utility program to load data into the data base. DBBLD can be used for both initially storing large amounts of data into a data base, or adding data to existing data bases.

Querying the Data Base

An Image/1000 data base can be accessed by Query to allow the non-programmer to retrieve and report data from a data base or to update information in the data base through easy-to-use English-like commands. Query also provides the experienced programmer fast and easy access to the data base to help debug an application program.

Security. Query adheres to all security provisions that are specified during the definition phase of an Image/1000 data base. A security code must be specified to access a data base. Privacy level words are required for read and write operations on each data item. Query returns an error if a user attempts to access a data base or data item without the correct security code and privacy level words.

Multicriteria Data Selection. Precise information can be retrieved from a data set using logical relationships between data items and their values (is, is not, is less than, etc.) using logical connectors (ANDs and ORs).

Reporting Data. After information is retrieved from a data base, Query can format and generate a variety of reports that can be listed to either a device or file. Reports can include page headings, column headings, page numbers, etc. Items of data can appear in a report, can be format edited, averaged, totaled, and subtotaled. Information to be reported can be sorted by multiple categories.

Updating a Data Base. Information retrieved can be modified or deleted from the data base. New records can also be added with automatic linkage. Using Query to update a data base can be a time-saver for one-time changes, but an application program will be more efficient for predicable and scheduled changes. Generally, it is desirable to perform most updates via application programs where the data can be checked for validity.

Procedure Capability. Query procedures provide a convenient way of storing particular Query commands in a disc file for repeated use without having to retype them. There are three types of Query procedures that aid in finding data entries in the data base, reporting them, and updating the data base. Query provides commands to help create, edit, and destroy procedures.

Batch Capability. Query can also be executed in a batch mode without operator interaction. Query commands that would normally be entered interactively can be stored in a disc file for repeated use. The disc file created for batch Query can also use Query procedures for some of the required responses. One example usage of Query in a batch mode would be the creation of a particular report on a regular basis where the development of an application program is not justified.

Query Command Set

DATA-BASE	Identifies data base to be accessed.
SELECT-FILE	Identifies file to be used for retrieving data entries
FIND	Multicriteria data selection
REPORT	Report formatting and generation with sorting
UPDATE	Data modification, addition, and deletion
CREATE	Creates a procedure
DISPLAY	Displays a procedure
EXECUTE	Executes a program
DESTROY	Deletes a procedure
FORM	Displays data base structure
HELP	Explains purpose and form of Query commands
LIST	Changes list device
EXIT	Exits from Query
XEQ	Allows users to enter Query commands from a command file and return to an interactive mode

Remote Query. Image/1000 combined with DS/1000-IV allows an HP 1000 Computer System to execute Query at a remote DS/1000-IV node that has an RTE-A, RTE-6/VM, or RTE-IVB* based Image/1000 data base. Accessing a remote Image/1000 data base with Query merely requires executing Query at the Image/1000 system you wish to access, using the DS/1000-IV REMAT program. With both DS/3000 and DS/1000-IV, an HP 1000 system can become a virtual HP 3000 terminal, with the HP 1000 user gaining access to an Image/3000 data base Query/3000.

* *RTE-IVB is a discontinued product, listed here for reference only.*

Host-Language Access

Ten subroutines are included with Image/1000 for host language access of the data base. Your application programs can be written in Pascal, FORTRAN, BASIC, or Assembly language.

More than one data base can be opened to a program. For that reason, there is an access control program (DBCOP) included with Image/1000.

Host language access allows the user to tailor a program to the specific application. Query is actually an application program generalized to serve novice users, but it cannot offer the flexibility and efficiency of an application program written for a particular task. The combination of host language access and Query allows both programmers and novices to access the data base in the most cost-effective way.

Remote Image/1000 data bases can be easily accessed using DS/1000-IV software. The remote data base you wish to access can be specified with a node number when the data base is opened with DBOPN subroutine. Two programs (RDBAM and RDBAP) included with DS/1000-IV for Remote Data Base Access (RDBA) service remote requests from user-written programs.

Ten subroutine calls provide the user with the capability of opening multiple data bases for access; reading, writing, and updating elements; retrieving information about the data base structure; locking and unlocking a data base; and closing a data base. These are:

DBOPN (Data Base Open). Prepares a data base for subsequent access by other Image/1000 subroutines. This includes specifying a level word, thereby establishing the data items a particular user can access. Since multiple users can open the data base, a coordinating program (DBCOP) provides for data base sharing.

DBINF(Data Base Information). Provides information about the organization and components of the data base being accessed. The information can be the type and length of data items, the relationships between data, etc.

DBFND (Data Base Find). Locates the beginning of a data chain with a calculated (hashed) value based on the key item. This is done in order to perform subsequent chained reads via DBGET.

DBGET (Data Base Get). Accesses data in the data base in a variety of ways. A master data set can be accessed in a calculated (hashed), serial, or direct fashion. A detail data set can be accessed in a chained read, serial, or direct fashion.

DBUPD (Data Base Update). Modifies existing data.

DBPUT (Data Base Put). Adds new data to a data base.

DBDEL (Data Base Delete). Deletes existing data.

DBLCK (Data Base Lock). Gives the user temporary exclusive use of the data base to update entries.

DBUNL (Data Base Unlock). Relinquishes exclusive user control and restores the data base to full use by others.

DBCLS (Data Base Close). Closes the data base and prevents further access.

Maintaining the Data Base

Six utility programs in Image/1000 aid in the maintenance of data bases. These utilities are useful for data base backup, data base restructuring, inquiring data base capacity, and recovering a data base closed improperly. Four of the utilities (DBULD, DBLOD, DBSTR, DBRST) can be used in a batch mode. The six utilities and their functions are:

DBSTR (Data Base Store). Copies the data base root file and an existing data base onto magnetic tape or additional disc. This is a physical unload for the purpose of backup security; it cannot be used to restructure the data base.

DBRST (Data Base Restore). Restores a root file and a data base from a magnetic tape or additional disc created by DBSTR. No modification of the data base structure is allowed.

DBULD (Data Base Unload). Copies data from an existing data base onto magnetic tape or additional disc. Unloading the data base using this routine allows the user to reload the data base into a different data base structure.

DBLOD (Data Base Load). Builds a data base according to a specified root file from a magnetic tape or additional disc created by the DBULD program. DBLOD users have the option to restore the data to the same data base structure or create a new data base structure using a new data base definition.

DBSPA (Data Base Space). Reports number of entries in use and entries available.

RECOV (Data Base Recovery). Closes previously opened data bases that were not properly closed and gives status information on data bases which are open.

Functional Specifications

Data Base Capacity and Syntax

Data Base: May contain up to 50 data sets. Total size under RTE-A is a maximum of 800M bytes, which may contain up to 255 unique data items. Total data base size under RTE-6/VM or RTE-IVB* is limited only by the total available storage, presently a maximum of 3.2G bytes in RTE-6/VM (8 HP 7933H Disc Drives), 960M bytes in RTE-IVB* (8 HP 7925* Disc Drives).

Data Set: May contain up to $2^{31}-1$ (>2 billion) data entries under RTE-6/VM or RTE-IVB*. However, a data set cannot span multiple disc sub-channels, limiting the data set size to a maximum of 404M bytes under RTE-6/VM (1 HP 7933H Disc Drive), 120M bytes under RTE-IVB* (1 HP 7925* Disc Drive). Under RTE-A, the data set may contain up to 32,767 data entries, or a total of 4M bytes (including all pointers), whichever is smaller.

Data Entry: May contain up to 4096 bytes. All data entries within a given data set have the same record format. There can be up to 127 unique data item names per data entry.

Data Item Types: Integer number with values −32768 to +32767, Real numbers with values $\pm 1.47 \times 10^{-39}$ to $\pm 1.70 \times 10^{38}$, and ASCII character strings with up to 255 characters.

Data Item Arrays: Array of any single data item type. There may be up to 255 elements in the array. When using Query, the REPORT ALL and UPDATE commands process all the elements of an item array. However, the Query FIND and REPORT commands will only process the first element of an item array.

Detail Data Sets per Master Data Set: 16

Search Items (keys) per Detail Data Set: 16

Data Base and Data Set Names: 1-6 characters

* *Identifies discontinued product, listed here for reference only*

Data Item Name: 1-6 characters. A data base may contain up to 255 unique data item names and those names may be repeated in the description of more than one data set.

Security Code: Integer 1 to 32767 or two ASCII characters.

Privacy Level Word: 1-6 character.

Configuration Information

Remote Data Base Access: RTE-A, RTE-6/VM or RTE-IVB* based Image/1000 data base can be accessed from a remote DS/1000 node by Query and with a Pascal, FORTRAN, or Assembly language program using Image/1000 subroutines. Software revision 2040 or later for DS/1000-IV (91750A) is required.

Programming Languages: FORTRAN IV, Pascal, Real-Time BASIC, and HP RTE Assembly or Macro/1000 Assembly language.

Multi-User Capability: The RTE File Manager limits the user to seven programs opening any one file. Since any program accessing the data base must open the root file, this means that only seven users can access the same data base at any one time unless a program is written that is an interface between the data base and other programs accessing the data base.

Upgrading from 92063A Image/1000: 92069A Image/1000 is not compatible with 92063A Image/1000. However, data bases and programs using the 92063A software can be modified to work with the 92069A software. A DBUP utility in the 92069A software unloads a 92063A data base in a form that allows the 92069A DBLOD utility to reload the data base for access with the 92069A Image/1000. Schema modifications and execution of the 92069A schema processor should take place before reloading the data into the 92069A data base.

Minimum System Requirements: Same as 92077A RTE-A, 92084A RTE-6/VM, or 92068A RTE-IVB* systems.

Memory Usage

Minimum system:	15 kB
Additional per local user:	64 kB
Full blown system:	84 kB
Additional per remote user:	48 kB

Installation

In HP 1000 Computer System: The Image/1000 Data Base Management System software will be an integrated, working part of the primary operating system.

When Purchased as a Software Component: Image/1000 is a customer-installed product; installation assistance is available from your local Hewlett-Packard Field Service office at prevailing service rates.

Ordering Information

HP 92069A Image/1000 Data Base Management System With Query for RTE-A, RTE-6/VM, or RTE-IVB* Use. (Must order one of Use Options 400 through 897.)

Image/1000 consists of

1. Image/1000 software on Media Option 022, 044, 050, or 051, **one of which must be ordered.**
2. 92069-90001 Image/1000 User's Manual.
3. 92069–90002 Image/1000 Software Numbering Catalog.

92069A Media Options

022: Provides software on CS/80 cartridge tape.

044: Provides software on microfloppy discs for HP 12120A*/12122A Integrated Discs in Micro/1000 package or HP 9122D or 9133A*/B*/H*/L or 9153B Disc.

050: Provides software on 800 cpi mag tape.

051: Provides software on 1600 cpi mag tape.

92069A/R Use Options

400: Use in HP 12100A Single Board Computer, HP 2424A Micro 14 Computer, HP 2434A Micro 24 Computer, or HP 2484A Micro 24 SPU.

600: Use in HP 2106BK Board Computer, HP 2156B Computer, HP 2426E/F Micro 16 Computer, HP 2436A/E Micro 26 Computer, HP 2196C/D Model 26 SPU, or HP 2486A Micro 26 SPU.

601: Upgrade from previous version of 92069A/R option 600 to latest version of same for customer NOT on software support service.

700: Use in HP 2137A Computer, HP 2437A Micro 27 Computer, HP 2197C/D Model 27 SPU, HP 2487A Micro 27 SPU, HP 2109E, 2113E, or 2117F* Computer, or HP 2178C Model 60 SPU.

701: Upgrade from previous version of 92069A/R option 700 to latest version of same for customer NOT on software support service.

890: Use in HP 2139A Computer, HP 2439A Micro 29 Computer, HP 2199C/D Model 29 SPU, or HP 2489A Micro 29 SPU, or in any other A/E/F*-Series computer. With 92069A, option 890 includes the right to purchase one or more 92069R products with Use Option 400, 600, 700, and/or 890 for use on a corresponding additional computer(s).

** Identifies discontinued product, listed here for reference only.*

891: Upgrade from previous version of 92069A/R option 890 to latest version of same for customer NOT on software support service.

894: Upgrade to Use Option 890 from Use Option 400.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

HP 92069R Right to Copy 92069A Image/1000 Software for Use on an Additional Computer System. (Must order one of Use Options 400 through 897)

The 92069R product is available only to customers who have purchased a license to use 92069A. 92069R consists of:

1. The right to make one copy of software purchased with the 92069A Image/1000 Data Base Management System for use on an additional system.
2. 92069-90001 Image/1000 User's Manual.
3. 92069–90002 Image/1000 Software Numbering Catalog.

Recommended Additional Equipment

In addition to the basic hardware required to support the host RTE operating system, computer systems with the 92069A Image/1000 Data Base Management System should also include a line printer for fast printout of reports and either a magnetic tape unit or an additional disc drive for data base backup.

Software Support Products Available

The HP 1000 Ordering Guide, 5954-8564 or later revision, for definition and availability of software support products for Image/1000.

Device-Independent Graphics Library (DGL)

Graphics/1000-II Version 2.0 Software
for General-Purpose Graphics Applications

product number 92861A

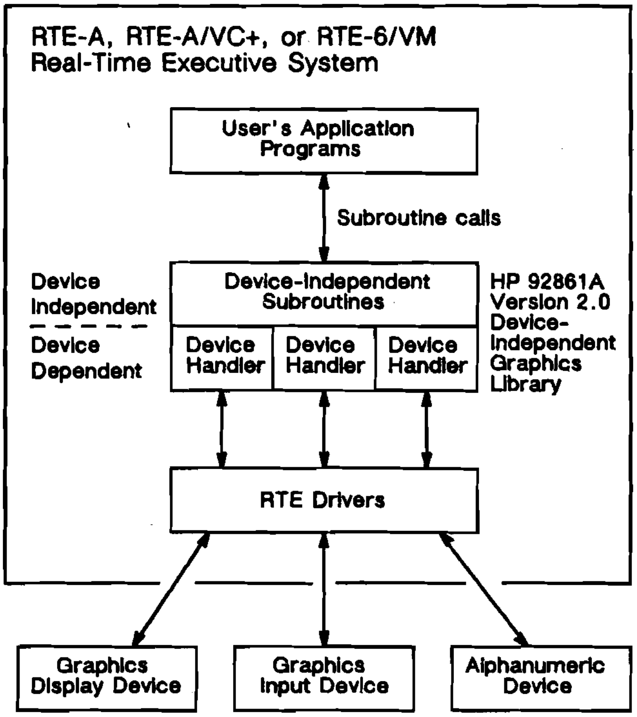
The HP 92861A Device-Independent Graphics Library (DGL) is the basic building block for Graphics/1000-II Version 2.0 applications on HP 1000 Computer Systems operating under RTE-A, RTE-A/VC+, or RTE-6/VM. The DGL provides a device-independent interface which is designed to support the HP 92862A Version 2.0 Advanced Graphics Package (AGP) and to facilitate implementation of other user's graphics applications on HP 1000 Computer Systems.

Features

- **Support under hierarchical Command Interpreter file system.**
- **Optional large program support using code and data separation in RTE-A/VC+.**
- **Efficient design for fast execution, minimal memory requirements.**
- **Device-independent graphics primitives for simplified development of graphics applications.**
- **Multilingual programmability in FORTRAN, Pascal, and Macro/1000.**

Highly-Efficient Support of User's Graphics Applications

DGL software consists of CDS† and non-CDS† graphics subroutines and device handler modules that become a part of the user's application program. By itself, DGL is most valuable for well-defined two-dimensional display applications, such as continuous process control monitors and standardized graphs from dedicated testing applications. OEMs and end users who take advantage of the off-the-shelf DGL package can save the time and cost of developing their own graphics interface software. The DGL routines are designed to make basic graphics image generation and interaction functions available to the user via very efficient device-independent, high-level program calls. Because of the design emphasis on efficiency, OEMs and end users will find these to be fast-executing routines which use relatively little memory and can be applied to a wide variety of applications.


RTE-A, RTE-A/VC+, or RTE-6/VM
Real-Time Executive System
User's Application Programs
Subroutine calls
Device Independent
Device Dependent
Device-Independent Subroutines
Device Handler
Device Handler
Device Handler
HP 92861A Version 2.0 Device-Independent Graphics Library
RTE Drivers
Graphics Display Device
Graphics Input Device
Alphanumeric Device

On a Growing List of Graphics Devices

DGL supports the graphics devices listed in Table 2-8 with the intent to extend support to additional graphics devices. Support service for 92861A will automatically provide new device handlers and other enhancements as they are released.

Functional Specifications

Viewing Transformation Capability

The DGL maps each point in two-dimensional user space to a point on the display surface without software clipping.

Graphics Workstation Definition

Within the Graphics/1000-II environment, the user performs I/O through a graphics workstation. The graphics workstation is a set of logical I/O devices, which can be thought of as a "super device". In

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† *CDS = Code and Data Separation in the RTE-A/VC+ operating system.*

Table 2-8. Supported Graphics Devices

DEVICE PRODUCT NUMBERS	A-SERIES INTERFACE & CABLE	E/F*-SERIES INTERFACE & CABLE	LOGICAL DEVICE CODES
RASTER TERMINALS			
2393A 2397A 2625A+523* 2628A+523*	12040D# & 40242M or 12005B+002	12792C & 40242M or 12966A+106	A,B,D, K,L,V
2623A* 2627A*	12040D# & 13222Y or 12005B+005	12792C & 13222Y or 12966A+105	
2647F*	12040D# & 13232Y or 12005B+004	12792C & 13232Y or 12966A+001@	
2647A* 2648A* 2649C*/G*	Not Supported in A-Series	12792C & 13232Y or 12966A+001@	
RASTER DISPLAY			
13279B	12065A	Not Supported	D
INPUT DEVICES			
9111A*	12009A**	59310B**	B,L,V
9874A*	12009A**	59310B**	A,B,L,V
VECTOR DISPLAYS			
1350S*/51S*	12009A**	59310B**	D
1350S* with 9111A* 1351S* with 9111A*	Not Supported in A-Series	59310B**	
VECTOR PLOTTERS			
7220C*/T* 7221A*/B* 7221C*/S* 7221T*	Not Supported in A-Series	12966A+004@ with 264x* or 2635B+051* terminal	D,L
7225B* with 17501A* 7440A+002 7470A*+002 7475A+002 7550A 7570A with 17570A 758xA+060 9872x*	12009A**	59310B**	
7440A+001 7470A*+001 7475A+001 7570A 758xB+060	12040D# & 13242N	12792C & 17355D	
7550A	12040D# & 17355D	12792C & 17355D	
COLOR FILM RECORDER			
7510A	12009A**	59310B**	D
7510A	12040D# & 17355D	12792C & 17355D	

Table 2-8. Supported Graphics Devices, continued

DEVICE PRODUCT NUMBERS	A-SERIES INTERFACE & CABLE	E/F*-SERIES INTERFACE & CABLE	LOGICAL DEVICE CODES
RASTER PRINTERS			
2563A*+049 2563B+049 2564B+049 2565A*+049 2566A*+049 2566B+049 2932A 2934A	12040D# & 92219G	Not supported in E/F*-Series	D
2563A*+214 2563B+214 2564B+214 2565A*+214 2566A*+214 2566B+214 2608S*+214 2932A+046 2934A+046	12009A**	Not supported in E/F*-Series	
2563A*+210 2563B+210 2564B+210 2565A*+210 2566A*+210 2566B+210	Not Supported in A-Series	12821A+001	
2608A*+210 2608S*+210	Not Supported in A-Series	Option 210 Includes 26099A or 12821A+001 interface	

* *Obsolete product listed here for reference only.*

# *Or four-port multiplexer on the HP 12100A A400 Single-Board Computer.*

@ *Compliance of this product with U.S. or German EMI regulations has not been confirmed.*

** *HP 12009A and 59310B interfaces include cable to the first device on the HP-IB bus; use HP 10833x cables to additional devices.*

Logical Device Codes:

A = Alphanumeric Display
B = Button
D = Graphics Display
K = Keyboard
L = Locator
V = Valuator

DGL, a graphics workstation will usually have a graphics display device and may also include one of each of the other logical functions listed below, some or all of which may be implemented on a single physical device. Workstations may also consist of more than one physical device. See Table 2-8, above, for the logical device functions on the various physical graphics devices supported by DGL.

Four Types of Graphics Input Devices

Button: Returns integer value depending upon key or button actuated.

Keyboard: Returns alphanumeric data entered on a keyboard by a user.

Locator: Returns X-Y coordinate information designated by the user using a terminal cursor, digitizer, or graphics tablet.

Valuator: Returns scalar real value entered by a user as the relative position of a terminal cursor, digitizer, or graphics tablet.

Graphics Output Devices

Graphics Display: Any graphics output device, such as a plotter, CRT display, or printer.

Alphanumeric Display: Any device suitable for displaying or printing alphanumerics.

Graphics Subroutine Capabilities

See Table 2-9.

Compatibility

Operating System: RTE-A, RTE-A/VC+, or RTE-6/VM.

Program Languages: FORTRAN 77, Pascal/1000, and Macro/1000 Assembly language.

Supported Graphics Devices: See Table 2-8.

Extent of Device Support: The 92861A DGL provides a system-level set of graphics subroutines that are device and application independent. Each supported graphics device has its own set of features and capabilities. The 92861A DGL supports those device features that are most important to the majority of HP 1000 application areas. DGL also supports application program access to special features which are available with the graphics device. DGL-supported device features are described in the 92861A manuals.

Table 2-9. DGL Subroutine Capabilities

OUTPUT	
ZALPH	Sends text string to alphanumeric display.
ZDRAW	Draws a line on the graphics display.
ZMARK	Draws a marker on the graphics display.
ZMOVE	Sets starting position.
ZPGDD	Draws a polygon on the graphic display, using device hardware for area fill.
ZPGDI	Draws a polygon on the graphic display, using software-generated area fill unless device has compatible area fill capability.
ZPOLY	Draws connected line sequence on the display.
ZTEXT	Draws graphics text on the graphics display.
PRIMITIVE ATTRIBUTES	
ZCOLM	Chooses color model (RGB or HSL) for interpreting parameters in the color table.
ZCOLR	Sets color attribute.
ZCSIZ	Sets character size attribute.
ZDCOL	Redefines color of an entry in the color table.
ZDPST	Defines entry in polygon interior style table.
ZHIGH	Sets highlight attribute.
ZKSTL	Sets linestyle attribute.
ZLWID	Sets linewidth attribute.
ZPICL	Sets polygon interior color attribute.
ZPILS	Sets polygon interior linestyle attribute.
ZPSTL	Sets polygon interior style attribute.

Table 2-9. DGL Subroutine Capabilities, continued

INPUT	
ZBUTN	Awaits button press, returns value to program.
ZKYBD	Awaits keyboard-entered character string, returns string to program.
ZLOCP	Defines locator echo position on the display.
ZSLOC	Samples locator, returns value to program.
ZSVAL	Samples valuator, returns value to program.
ZWLOC	Awaits operator response, returns locator value to program.
ZWVAL	Awaits operator response, returns valuator value to program.
CONTROL/WORKSTATIONS	
ZAEND	Disables alphanumeric device.
ZAINT	Enables alphanumeric device.
ZBEGN	Initializes the DGL system.
ZBEND	Disables the button device.
ZBINT	Enables the button device.
ZBMOD	Sets batching mode (whether picture changes are immediate or buffered).
ZDEND	Disables the graphics display.
ZDINT	Enables the grpahics display.
ZEND	Terminates the DGL system.
ZKEND	Disables the keyboard device.
ZKINT	Enables the keyboard device.
ZLEND	Disables the locator device.
ZLINT	Enables the locator device.
ZMCUR	Makes the picture current.
ZNEWF	Inititiates a new frame action (clears graphics display or moves the recording medium to a fresh drawing area.
ZVEND	Disables valuator device.
ZVINT	Enables valuator device.
VIEWING TRANSFORMATIONS AND CONVERSIONS	
ZASPK	Defines aspect ratio of virtual coordinate system.
ZDLIM	Defnes logical limits of graphics display.
ZDPMM	Converts world coordinates to millimeters on the graphics display.
ZLLIM	Defines logical limits of locator device.
ZLPMM	Converts world coordinaes to millimeters on the locator device.
ZVIEW	Defines viewport boundaries.
ZWIND	Defines window boundaries.
INQUIRY	
ZIACS	Returns character size which will be used on the graphics display.
ZIPST	Returns polygon style of an entry in the polygon style table.
ZIROL	Returns color modelling parameters associated with a specified index in the current color table.
ZIWS	Returns information about the DGL system.
SPECIAL INTERFACES	
ZIESC	Performs a device-dependent inquiry from a graphics display device.
ZOESC	Performs a device-dependent output to a graphics display device.

Installation

HP 92861A DGL is a customer installed product, which is easily linked from its relocatable libraries to satisfy the graphics communication requirements of the user's applications. It is not generated into the RTE operating system.

Minimum System Requirements

Same as basic 92077A RTE-A, 92077A/92078A RTE-A/VC+, or 92084A RTE-6/VM system, plus one graphics device selected from Table 2-8.

Memory Required for Vector-to-Raster Conversion in Software for Raster Printers

At least 400 pages (800 kB) of EMA or 100 pages (200 kB) of working set for VMA for vector-to-raster conversion using software included in the DGL.

Ordering Information

HP 92861A Graphics/1000-II Device-Independent Graphics Library (DGL) (must order one of Use Options 400 through 897)

HP 92861A DGL includes:

1. The DGL software and a catalog file describing it on Media Option 022, 044, 050, or 051, **one of which must be ordered.**
2. 97084-90000 DGL Programmer's Reference Manual.
3. 92861-18999 DGL Software Numbering Catalog.
4. 92861-90003 Graphics/1000-II Device Handlers Reference Manual.
5. 24998-90010 AGP/DGL Product Demonstration Instruction Sheet.

92861A Media Options

022: Provides software on CS/80 Cartridge Tape.

044: Provides software on Microfloppy disc for HP 12120A*/12122A Integrated Discs in Micro/1000 Package or HP 9122D or HP 9133A*/B*/H*/L or HP 9153B Disc.

050: Provides software on 800 cpi magnetic tape.

051: Provides software on 1600 cpi magnetic tape.

92861A/R Use Options

400: Use in HP 12100A Single Board Computer, HP 2424A Micro 14 Computer, HP 2434A Micro 24 Computer, or HP 2484A Micro 24 SPU.

600: Use in HP 2106BK Board Computer, HP 2156B Computer, HP 2426E/F Micro 16 Computer, HP 2436A/E Micro 26 Computer, HP 2196C/D Model 26 SPU, or HP 2486A Micro 26 SPU.

601: Upgrade from previous version of 92861A/R option 600 to latest version of same for customer NOT on support service.

602: Upgrade from 92841A/R option 600 to 92861A/R option 600 for customer on support service.

603: Upgrade from 92841A/R option 600 to 92861A/R option 600 for customer NOT on support service.

700: Use in HP 2137A Computer, HP 2437A Micro 27 Computer, HP 2197C/D Model 27 SPU, HP 2487A Micro 27 SPU, HP 2109E, 2113E, or 2117F* Computer, or HP 2178C Model 60 SPU.

701: Upgrade from previous version of 92861A/R option 700 to latest version of same for customer NOT on support service.

702: Upgrade from 92841A/R to option 700 92861A/R option 700 for customer on support service.

703: Upgrade from 92841A/R to option 700 92861A/R option 700 for customer NOT on support service.

890: Use in HP 2139A Computer, HP 2439A Micro 29 Computer, HP 2199C/D Model 29 SPU, or HP 2489A Micro 29 SPU, or in any other A/E/F*-Series computer. With 92861A, option 890 includes the right to purchase one or more 92861R products with Use Option 400, 600, 700, and/or 890 for use on a corresponding additional computer(s).

891: Upgrade from previous version of 92861A/R option 890 to latest version of same for customer NOT on support service.

892: Upgrade from 92841A/R option 890 to 92861A/R option 890 for customer on support service.

893: Upgrade from 92841A/R option 890 to 92861A/R option 890 for customer NOT on support service.

894: Upgrade to Use Option 890 from Use Option 400.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

HP 92861R Right to Copy DGL for Use on an Additional Computer System (must order one of Use Options 400 through 897)

The HP 92861R Right to Copy product is available only to customers who have purchased HP 92861A without an upgrade option. 92861R consists of:

1. The license to make one copy of software purchased with 92861A for use on an additional system.
2. 97084-90000 DGL Programmer's Reference Manual.
3. 92861-18999 DGL Software Numbering Catalog.
4. 92861-90003 Graphics/1000-II Device Handlers Reference Manual.
5. 24998-90010 AGP/DGL Product Demonstration Instruction Sheet.

Software Support

See the HP 1000 Ordering Guide, 5954-8564 or a later revision, for definitions and availability of software support products for the Device-Independent Graphics Library.

** Discontinued product, listed here for reference only.*

Advanced Graphics Package (AGP)

HEWLETT PACKARD

Graphics/1000-II Version 2.0 Software for Interactive Three-Dimensional Graphics Applications

product number 92862A

The HP 92862A Advanced Graphics Package (AGP) is an interactive three-dimensional graphics package for use on HP 1000 Computer Systems with the HP 92861A Device-Independent Graphics Library (DGL), both operating under RTE-A, RTE-A/VC+, or RTE-6/VM.

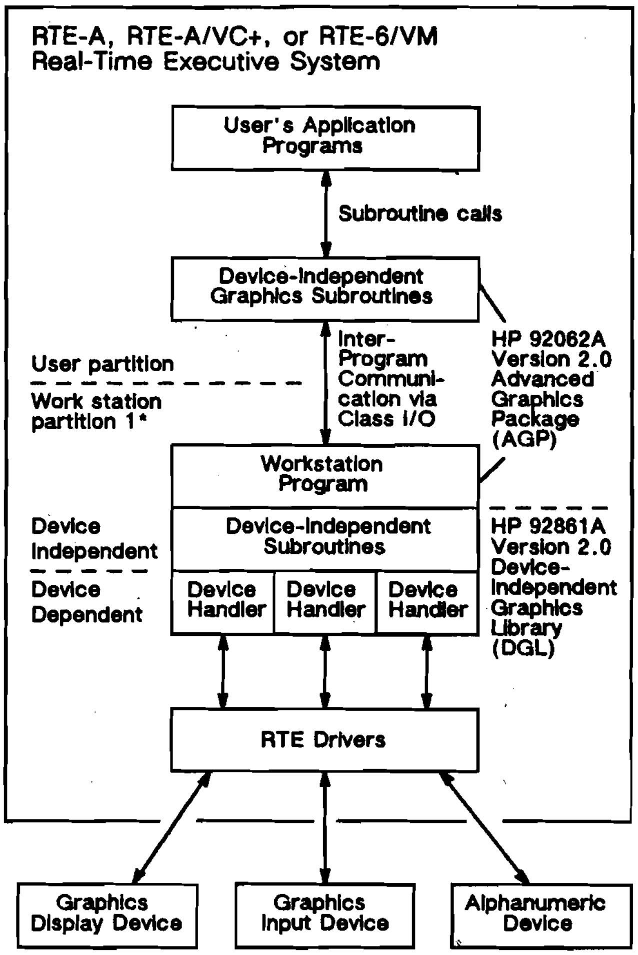
Features

- **Support under hierarchical Command Interpreter file system.**
- **Optional large program support using code and data separation in RTE-A/VC+.**
- **Two and three dimensional viewing transformations.**
- **Perspective and parallel projections.**
- **Full clipping capability.**
- **Picture segmentation for fast interactive manipulation of graphics images.**
- **Pick input function to facilitate user interaction with picture segments to be displayed or changed.**
- **Efficient design for fast execution, minimal memory usage.**
- **Workstation program for coordinated operation of a logical graphics display device, up to five different types of logical graphics input devices (locator, pick, button, keyboard, and valuator), and one alphanumeric device.**
- **Device-independence.**
- **Support for concurrent operation of up to eight workstations for simultaneous graphics input/output.**
- **Six different fonts for graphics text.**
- **Multilingual programmability in FORTRAN, Pascal, and Macro/1000.**
- **Error reporting facilities.**

Three-Dimensional Interactive Graphics Programming Power

Three-Dimensional Viewing Transformations

The Advanced Graphics Package (AGP) provides very sophisticated viewing transformations. These include windowing, clipping, and viewporting with parallel or perspective projections.


RTE-A, RTE-A/VC+, or RTE-6/VM
Real-Time Executive System
User's Application Programs
Subroutine calls
Device-Independent Graphics Subroutines
User partition
Work station partition 1*
Inter-Program Communication via Class I/O
HP 92062A Version 2.0 Advanced Graphics Package (AGP)
Workstation Program
Device Independent
Device Dependent
Device-Independent Subroutines
Device Handler
Device Handler
Device Handler
HP 92861A Version 2.0 Device-Independent Graphics Library (DGL)
RTE Drivers
Graphics Display Device
Graphics Input Device
Alphanumeric Device

* *Each graphics workstation may consist of one display device, one alphanumeric message device, and up to five different logical input devices; AGP supports up to eight concurrently active workstations.*

Figure 2-1. AGP Functional Relationships

Picture Segmentation

Application programs can use AGP to manipulate parts of a picture, called segments, as single entities for operations, such as highlighting or erasure. With the aid of interactive picking, discussed in the next paragraph, this facilitates rapid interactive changing of picture elements by a user.

Interactive Picking

A high-level "picking" function is available for interactive applications. When the user points with the stylus of a graphics tablet or other "pick" input device to the primitives of line, set of lines, or text on the display, AGP returns the segment name and the pick identifier for the specific primitives to the application program. This segment and primitive I.D. return is based on a two-level segmented file, which is similar to the pick recommendations of the SIGGRAPH CORE proposal. Normally, without picking, only the X-Y coordinate of the graphics tablet would be returned to the application program, which would then have to decide what the user was pointing at. Because the AGP software performs this picking function, the application programmer saves considerable programming time and effort needed to implement this complex computer graphics function.

Efficient Operational Structure

The AGP software consists of CDS† and non-CDS† graphics subroutines that are used in application programs, a set of modules for configuring workstation programs, and a sample graphics monitor program. As shown in Figure 2-1, the application program with AGP graphics subroutines and the workstation program are separate. This maximizes the application program's available code and data space. At the same time, this arrangement also makes very effective use of the overall system through concurrent processing in the multitasking RTE system.

The user's application program can communicate with up to eight workstation programs simultaneously, each in its own partition and each driving its own set of graphics devices. At the start of execution, the application program initiates each workstation program. All subsequent graphic commands are automatically transmitted to each enabled workstation for output. The workstation program communicates with the graphics devices comprising the workstation via the device-independent subroutines and device handlers of the HP 92861A Device-Independent Graphics Library (DGL).

† *CDS = Code and Data Separation in the RTE-A/VC+ operating system.*

Functional Specifications

Viewing Capabilities

AGP supports viewing of two-dimensional (2-D) and three-dimensional (3-D) objects from any position.

3-D Projection Choices

AGP supports both perspective and parallel projection of 3-D objects.

Windowing

The user's "window", which is used to clip the picture, can be rotated or otherwise moved in any direction with respect to the object being viewed. Depth clipping is supported so that primitives of a 3-D image that are outside of specified "hither" and "yon" clipping planes can be eliminated.

Segmentation

The transformed images of the AGP output primitives specified by the user can be stored in a Segment Display Area (SDA) from which they can be written onto graphics display devices and in which they may be manipulated, modified, highlighted, etc. Each user-specified block of output primitives that makes up a picture segment results in an image that is part of the total picture. Because each segment has a user-assigned name, it is easily referenced by application programs to selectively display or modify parts of the total image. AGP supports one level of segmentation, which precludes nesting of picture segments. Picking identification within segments provides a second level of picture element selectability.

Picking

AGP supports the use of a logical "pick" device, such as a graphics terminal cursor or a data tablet stylus. Within AGP, the "pick" X-Y coordinates are processed against the SDAs to return to the application program both the picture segment name and any pick identification that has been associated by the user with a specific output primitive (line or series of lines, markers, text, etc.) within that picture segment.

Graphics Output Primitives

Moves: The current position is set to the specified coordinates (moved to a new position) without drawing a line.

Lines: A single straight line is drawn from the current position to a specified point.

Polylines: A connected line sequence from the current position to and through a series of points read from an array in memory.

Markers: At least 19 different marker symbols can be drawn with placement at the current position.

Graphics Text

High-quality Text: High-quality text, which is completely generated, positioned, spaced, modelled, and translated in software, affords a choice of any of the six graphics text fonts provided with AGP (see Figure 2-2). It is completely device independent.

Medium-quality Text: Medium-quality text characters are generated by the hardware character generator of the graphics output device (or device handler software simulating such a hardware generator) and positioned by software. There is no choice of graphics text font and positioning is limited to control of character-to-character, and line-to-line spacing.

Low-quality Text: Low-quality text is generated and spaced entirely by the hardware character generator of the graphics output device (or device handler software simulating such a hardware generator). It is device dependent.

Graphics Font Text Storage: Graphics text fonts, including user-designed fonts, are stored in, and accessed from, font files on the disc.

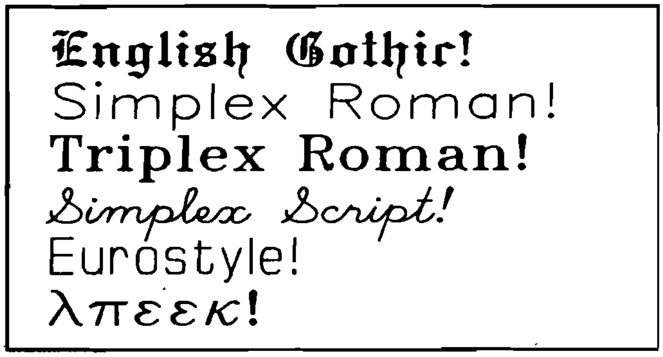

English Gothic!
Simplex Roman!
Triplex Roman!
Simplex Script!
Eurostyle!
λπεεκ!

Figure 2-2. AGP Graphics Text Character Fonts

Workstations

Definition: Within the Graphics/1000-II environment, the user performs I/O through a graphics workstation. The graphics workstation is a set of logical I/O devices which can be thought of as a "super device" which can be physically configured from one or more real devices. A graphics workstation can have a graphics display device and may also include one of each of the other logical devices coded in Table 2-10, some or all of which may be implemented on one physical device, such as an HP 2393A Graphics Terminal. Workstations may also consist of more than one physical device. See Table 2-10 for the logical device functions that are available on the various physical devices supported under AGP and DGL.

Number of AGP Graphics Workstations: Up to eight per AGP application program.

Five Types of Graphics Input Devices

Button: Returns integer value depending upon key or button actuated.

Keyboard: Returns alphanumeric data entered on a keyboard by a user.

Locator: Returns X-Y coordinate information designated by the user using a terminal cursor, digitizer, or graphics tablet.

Valuator: Returns scalar real value entered by a user as the relative position of a terminal cursor, digitizer, or graphics tablet.

Table 2-10. Supported Graphics Devices

DEVICE PRODUCT NUMBERS	USABLE IN A-SERIES	USABLE IN E/F*-SERIES	LOGICAL DEVICE CODES
RASTER TERMINALS			
2393A 2625A*+523 2397A 2628A*+523 2623A* 2647F* 2627A*	YES	YES	A,B,D,K,L,P,V
2647A* 2648A* 2649C*/G*	NO	YES	
INPUT DEVICES			
9111A*	YES	YES	B,L,P,V
9874A*	YES	YES	A,B,L,P,V
RASTER DISPLAY			
13279B	YES	YES	D
VECTOR DISPLAYS			
1350S*/51S*	YES	YES	D
1350S* with 9111A* 1351S* with 9111A*	NO	YES	
VECTOR PLOTTERS			
7220C*/T* 7221T* 7221A*/B* 7221C*/S*	NO	YES	D,L
7225B* 7475A 7440A 7550A 7470A* 7570A	YES	YES	
758xA 9872x*	YES	YES	D,L,P
COLOR FILM RECORDER			
7510A	YES	YES	D
RASTER PRINTERS			
2563A* 2566A* 2563B 2566B 2564B 2932A 2565A* 2934A	YES	YES	D
2608A* 2608S*	NO	YES	

* *Obsolete product listed here for reference only.*

Logical Device Codes:

A = Alphanumeric Display
B = Button
D = Graphics Display
K = Keyboard
L = Locator
P = Pick
V = Valuator

Pick: Returns segment name and pick identifier of output primitive designated by operator using devices, such as a terminal cursor or digitizer.

Graphics Output Devices

Graphics Display: Any graphics output device, such as a plotter, CRT display, or printer.

Alphanumeric Display: Any device suitable for displaying or printing alphanumerics.

Graphics Subroutine Capabilities

See Table 2-11.

Compatibility

Operating System: RTE-A, RTE-A/VC+, or RTE-6/VM.

Program Languages: FORTRAN 77, Pascal/1000, and Macro/1000 Assembly language.

Supported Graphics Devices: Graphics devices are operated through the HP 92861A Device-Independent Graphics Library (DGL), so AGP support is the same as for DGL; see the DGL data sheet for supported graphics devices.

Extent of Device Support: Together, HP 92862A AGP and 92861A DGL provide a system-level set of graphics subroutines that are device and application independent. Each supported graphics device has its own set of features and capabilities. AGP and DGL supports those device features that are most important to the majority of HP 1000 application areas. AGP and DGL also support application program access to special features which are available with the graphics device. AGP-supported device features are described in the 92861A and 92862A manuals.

Memory Requirements

For Vector-to-Raster Conversion in Software for Raster Printers: At least 400 pages (800 kB) of EMA or 100 pages (200 kB) of working set for VMA.

For Monitor Program: 16 kB.

For Each Workstation Program: 20-64 kB non-CDS, 10-56 kB for code segment and 6-38 kB for data segment with CDS.

Installation

HP 92862A AGP is a customer installed product, which is easily linked from its relocatable libraries along with appropriate 92861A DGL subroutines and device handlers to satisfy the graphics requirements of the user's applications. An appropriate workstation program(s) must be configured and linked before an application program(s) is run. A monitor program for communications between the application program(s) and the workstation program(s) must also be linked.

Table 2-11. AGP Subroutine Capabilities

OUTPUT	(Appearance of output is determined by Primitive Attributes, below.)
JnDRW*	Draws absolute positioned line from the current position.
JnMOV*	Sets current position to absolute point.
JnMRK*	Draws absolute positioned marker symbol.
JnPGN*	Draws absolute positioned polygon using coordinates in a buffer.
JnPLY*	Draws absolute positioned sequence of lines from current position, using coordinates in a buffer.
JRnDR*	Draws relative positioned line from the current position.
JRnMK*	Draws relative positioned marker symbol.
JRnMV*	Sets the new current position to the point specified relative to the current position.
JRnPG*	Draws relative positioned polygon using coordinates in a buffer.
JRnPL*	Draws relative positioned sequence of lines from the current position using coordinates from a buffer.
JTEXH	Writes high-quality text generated completely by software, with a choice of fonts.
JTEXL	Writes low-quality text using the hardware character generator of graphics display device.
JTEXM	Writes medium-quality text with each character generated by hardware, but positioned by software.
* n in these calls = 2 for two-dimensional graphics, 3 for three-dimensional graphics.	
PRIMITIVE ATTRIBUTES	
JCOLM	Chooses color model (RGB or HSL) for interpreting parameters in the color table.
JCOLR	Sets color attribute.
JCORI	Defines character orientation.
JCSIZ	Sets current character size attribute.
JDCOL	Redefines color of an entry in the color table.
JDFNT	Associates a character font number with a font file for use with high-quality text.
JDPST	Defines entry in polygon interior style table.
JFONT	Sets current font for writing high-quality text.
JPICL	Sets polygon interior color attribute.
JJUST	Specifies text justification.
JLSTL	Sets linestyle attribute.
JLWID	Sets line width attribute.
JPILS	Sets polygon interior line style attribute.
JPKID	Sets current pick I.D. attribute that is applied to future primitives inside of picture segments.
JPSTL	Sets polygon interior style attribute.
PICTURE SEGMENT ATTRIBUTES	
JGDET	Sets system-maintained detectability attribute that is given to subsequently-created picture segments.
JGHI	Sets system-maintained highlighting attribute that is given to subsequently-created picture segments.
JGVIS	Sets system-maintained visibility attribute that is given to subsequently-created picture segments.
JSDET	Controls detectability of an existing segment.
JSHI	Controls highlighting of an existing segment.
JSVIS	Controls visibility of an existing segment.
JSVAL	Controls visibility of all existing segments.
PICTURE SEGMENTATION AND NAMING	
JCLOS	Closes the open picture segment.
JCLR	Removes all segments from the graphics system and clears the display.
JOPEN	Creates and opens a new, empty picture segment.

Table 2-11. AGP Subroutine Capabilities, continued

PICTURE SEGMENTATION AND NAMING, continued	
JPURG	Purges an existing picture segment.
JRNAM	Renames an existing picture segment.
JSDF	Creates a disc file that the system uses as an extension to the segmented display area.
VIEWING TRANSFORMATIONS	
JASPK	Defines virtual coordinate system aspect ratio.
JCLPD	Controls hither and yon (depth) clipping.
JCLPW	Controls window clipping.
JCMOD	Controls application of the modelling transformation to all subsequent primitives.
JDLIM	Sets user-defined logical display limits of the graphical output device.
JDMOD	Defines a 4 x 4 modelling matrix.
JDPMM	Converts from virtual coordinates to millimeters on the graphics display.
JDPTH	Defines hither and yon clipping planes.
JHAND	Defines world coordinate system to be right or left handed.
JLLIM	Defines limits of locator device.
JLPMM	Converts from virtual coordinates to millimeters on the graphics locator surface.
JPPMM	Converts from virtual coordinates to millimeters on the graphics pick device.
JPROJ	Defines type of 3-D projection (perspective or parallel) and where the center of projection lies.
JRSET	Resets viewing transformation to initialization values.
JVDIS	Defines distance from view reference point to the viewplane along viewplane normal.
JVIEW	Defines the two-dimensional viewport.
JVPLN	Defines viewplane orientation.
JVREF	Defines world coordinate location of the view reference point.
JWTOV	Converts a world point to virtual coordinates.
JVTOW	Converts a virtual point to world coordinates.
JWIND	Defines boundaries of the viewplane clipping window.
INPUT	
JBUTN	Awaits button press, returns value to program.
JKYBD	Awaits keyboard string entry.
JLOCP	Sets locator echo reference position.
JPICK	Invokes logical pick input function and returns picture segment name and pick I.D. of the "picked" primitive within that picture segment.
JPIKP	Sets pick echo position on graphics display.
JSLOC	Samples locator, returns value to program.
JSVAL	Samples valuator, returns value to program.
JWLOC	Awaits user response, returns locator value to program.
JWVAL	Awaits user response, returns valuator value to program.
INQUIRY	
JICOL	Returns color parameters associated with an index in the color field.
JICP	Returns current position in three-dimensional world coordinates (X, Y, and Z).
JIMAT	Returns current value of a specified 4 x 4 transformation matrix.
JInRE	Returns 'n' (1, 2, 3, or 4) real values describing a specified aspect of the current state of the graphic system.
JIPST	Returns polygon style of an entry in a specified workstation's polygon style table.
JISGA	Returns attributes of specified picture segment.
JISGW	Returns workstation names that a picture segment is bound to.

Table 2-11. AGP Subroutine Capabilities, continued

INQUIRY, continued	
JITSZ	Returns size of a text string.
JIWS	Returns infomration on op code specified workstation configuration and capabilities.
JT1IN	Returns an integer value describing a specified aspect of the current state of the graphic system.
JIWND	Returns 3-D untransformed world coordinates of viewplane clipping window.
SPECIAL INTERFACES	
JIESC	Performs a device-dependent inquiry from a graphics display device.
JOESC	Performs a device-dependent output operation to a graphics display device.
CONTROL/WORKSTATIONS	
JALPH	Sends a text string to the system alphanumeric display device.
JBATC	Inititates a batch of updates to the graphics display surface.
JBEGN	Initializes the graphics system.
JDDEV	Disables a logical device other than the graphical display device.
JDINT	Initializes graphics workstation (and output device if present).
JEDEV	Enables a logical device.
JEND	Terminates the graphics system.
JIERR	Returns the most recent AGP error.
JIVOF	Ends immediate-visibility batching mode.
JIVON	Sets batching mode to provide immediate visibility of picture changes.
JMCUR	Updates the displayed picture(s) with the most current information, but without ending system batching mode.
JNEWF	Initiates a new frame action (clears graphics display or moves the recording medium to a fresh drawing area and redraws all segments, removing any primitives outside of segments).
JSERR	Sets error reporting level and graphics aborting levels.
JUPDT	Ends JBATC operation and updates images on the enabled display surfaces.
JWEND	Terminates workstation.
JWOFF	Disables graphical output to a workstation.
JWON	Enables graphical output to a workstation.

Minimum System Requirements

Same as basic 92077A RTE-A, 92077A/92078A RTE-A/VC+, or 92084A RTE-6/VM system, plus the 92861A DGL product and one graphics device selected from Table 2-10.

Ordering Information

HP 92862A Graphics/1000-II Advanced Graphics Package (AGP) (must order one of Use Options 400 through 897)

HP 92862A AGP includes:

1. The AGP software and a catalog file describing it on Media Option 022, 044, 050, or 051, **one of which must be ordered.**
2. 97085-90000 AGP User's Guide.
3. 97085-90005 AGP Reference Manual.
4. 920862-90001 AGP Reference Manual Supplement.

92862A Media Options

022: Provides software on CS/80 Cartridge Tape.

044: Provides software on Microfloppy disc for HP 12120A*/12122A Integrated Discs in Micro/1000 Package or HP 9122D or HP 9133A*/B*/H*/L or HP 9153B Disc.

050: Provides software on 800 cpi magnetic tape.

051: Provides software on 1600 cpi magnetic tape.

92862A/R Use Options

400: Use in HP 12100A Single Board Computer, HP 2424A Micro 14 Computer, HP 2434A Micro 24 Computer, or HP 2484A Micro 24 SPU.

600: Use in HP 2106BK Board Computer, HP 2156B Computer, HP 2426E/F Micro 16 Computer, HP 2436A/E Micro 26 Computer, HP 2196C/D Model 26 SPU, or HP 2486A Micro 26 SPU.

601: Upgrade from previous version of 92862A/R option 600 to latest version of same for customer NOT on support service.

602: Upgrade from 92842A/R option 600 to 92862A/R option 600 for customer on support service.

603: Upgrade from 92842A/R option 600 to 92862A/R option 600 for customer NOT on support service.

700: Use in HP 2137A Computer, HP 2437A Micro 27 Computer, HP 2197C/D Model 27 SPU, HP 2487A Micro 27 SPU, HP 2109E, 2113E, or 2117F* Computer, or HP 2178C Model 60 SPU.

701: Upgrade from previous version of 92862A/R option 700 to latest version of same for customer NOT on support service.

702: Upgrade from 92842A/R option 700 to 92862A/R option 700 for customer on support service.

703: Upgrade from 92842A/R option 700 to 92862A/R option 700 for customer NOT on support service.

890: Use in HP 2139A Computer, HP 2439A Micro 29 Computer, HP 2199C/D Model 29 SPU, or HP 2489A Micro 29 SPU, or in any other A/E/F*-Series computer. With 92862A, option 890 includes the right to purchase one or more 92862R products with Use Option 400, 600, 700, and/or 890 for use on a corresponding additional computer(s).

891: Upgrade from previous version of 92862A/R option 890 to latest version of same for customer NOT on support service.

892: Upgrade from 92842A/R option 890 to 92862A/R option 890 for customer on support service.

893: Upgrade from 92842A/R option 890 to 92862A/R option 890 for customer NOT on support service.

894: Upgrade to Use Option 890 from Use Option 400.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

HP 92862R Right to Copy AGP for Use on an Additional Computer System (must order one of Use Options 400 through 897)

The HP 92862R Right to Copy product is available only to customers who have purchased HP 92862A without an upgrade option. 92862R consists of:

1. The license to make one copy of software purchased with 92862A for use on an additional system.
2. 97085-90000 AGP User's Guide.
3. 97085-90005 AGP Reference Manual.
4. 920862-90001 AGP Reference Manual Supplement.

Software Support

See the HP 1000 Ordering Guide, 5954-8564 or a later revision, for definitions and availability of software support products for the Advanced Graphics Package.

** Discontinued product, listed here for reference only.*

Forms/1000 (F/1000)

HEWLETT PACKARD

Forms Management Package for block mode terminals in HP 1000 systems

product number 94250B

The HP 94250B Forms/1000 (F/1000) package provides a software interface between application programs and users communicating with HP 1000 A-Series computer systems via block mode terminals. F/1000 supports interactive creation, storage, display, and modification of forms used for man-machine communication. Through the medium of the user-defined forms, which are stored in disc files, F/1000 manages all terminal I/O and systematizes data access and data entry.

Features

- **Interactive Forms Builder for design and modification of forms.**
- **Compiled forms for maximum throughput.**
- **Programmatic interface callable from Pascal and FORTRAN 77.**
- **Access to input and output data via named fields.**
- **Automatic data editing and data type checking.**
- **Choice of Integral or Non-Integral Forms Access Library, for normal or small application program partition size.**
- **Support for:**
  - HP block mode terminals, including color terminals.
  - Terminal soft-key and video enhancement features, including color.
  - Point-to-point (including fiber optic) and multiplexer connections.
  - Help screens for user guidance and error recovery.
- **Access of terminals independent of connection and type of terminal.**
- **Support for complete localization for native language use.**

Benefits

- Greatly reduced effort in design, coding, testing, and maintenance of terminal dialog and output sections of application programs.
- Easy localization and personalization of application programs without coding changes.
- Easy access to terminal features, such as color, video enhancements, block mode, softkeys, and cursor positioning.

Functional Description

F/1000 consists of two parts: the Forms Run-Time Environment (Integral or Non-Integral Forms Access Routines) and the Interactive Forms Builder.

The Forms Run-Time Environment

The Forms Run-Time Environment is the software interface between application programs and terminal users. This interface manages terminal I/O for the application program and provides a friendly environment for the user.

The application program can select a form to be displayed, can add variable data by addressing named data fields, and can request its display on the terminal's screen. The application program also can define softkeys or request display of a help screen.

The terminal user's response is also handled by the Run-Time Environment interface. The interface accepts the entered data, makes designer-specified checks of data type, prompts the user to correct the input if necessary, then signals completion of the user's response to the application program. The application program then accesses the entered data by addressing named data fields. If the application program detects a user error, it can highlight the data fields in error with an alternate video enhancement, such as blinking, or request display of an appropriate Help screen.

The Interactive Forms Builder

The Interactive Forms Builder (use not included in the HP 94250E right-to-execute product) provides the application developer with the ability to design data display/entry forms interactively. The layout of fields and the size, type, and name of each field are all definable. Screen design may be completed with definition of softkeys. The forms are displayed as they are "built" and are stored in disc files for later callup and use by application programs.

An extra feature is the simple modification of existing forms. The form to be modified is displayed, modified, and then stored in its own disc file. An optional verification capability can be used to compare modified forms for inconsistencies with existing forms.

The Interactive Forms Builder can execute concurrently with other programs, including application programs that use forms.

Functional Specifications

Environment

Computer System: HP 1000 A-Series system with 512k bytes or more memory operating under the RTE-A real-time executive system.

Currently–Available Supported Terminals: HP 2392A, 2393A†, and 2397A†

† *This terminal is supported in an emulation mode; HP2393A is supported as an emulated HP 2623A Graphics Terminal and HP 2397A is supported as an emulated HP 2627A Color Graphics Terminal.*

Discontinued Supported Terminals Listed Here for Reference Only: HP 2382A, 2622A, 2623A, 2624B, 2625A, 2626A, 2627A, 2628A, 2645A, 2647A/F, 2648A, 3092A, 3093A, and 45610B (HP150).

Supported Terminal Connection Methods:

- Point-to-point, including fiber-optic connection.
- Multiplexer point-to-point connections.

Supported Programming Languages: Pascal/1000 and FORTRAN 77.

Memory Requirements

Interactive Forms Builder: One 84k byte partition.

Integral Forms Access Library: 24k bytes, maximum, not including referenced system routines.

Non-Integral Forms Access Library: 5k bytes, maximum, not including referenced system routines.

Forms Monitor (with Non-Integral Forms Access Library only): 54k bytes.

Field Specifications

Number of Fields: Up to 255 named fields per system.

Field Size: Up to 1840 characters in all fields.

Data Types Supported: Short Integer, Short Real, and Character.

Installation

HP 94250B Forms/1000 is a customer-installed product that is easily loaded from the relocatable modules and libraries that are supplied. A new system generation is not required.

Ordering information

HP 94250B Forms/1000 Software Package (Must order one of Use Options 400 through 897)

Forms/1000 consists of:

1. The Interactive Forms Builder and Run-Time Environment Software described in this data sheet on media option 022, 044, or 051, **one of which must be ordered.**
2. 94250-90005 F/1000 Reference Manual.
3. 94250-90006 Getting Started with F/1000.

94250B Media Options

022: Provides software on CS/80 cartridge tape.

044: Provides software on microfloppy disc for HP 12120A*/12122A Integrated Discs in Micro/1000 package or 9122D or 9133A*/B*/H*/L or 9153B Disc.

051: Provides software on 1600 cpi mag tape.

* *Discontinued product, listed here for reference only.*

94250B/R/E Use Options

400: Use in HP 12100A Single Board Computer or HP 2424A Micro 14 Computer or HP 2434A Micro 24 Computer or HP 2484A Micro 24 System Processor Unit.

600: Use in HP 2106BK Board Computer or HP 2156B Computer or HP 2436A Micro 26 Computer or HP 2196C/D Model 26 SPU or HP 2486A Micro 26 SPU.

601: Upgrade from previous version of 94250B option 600 to latest version of same for customer NOT on support service.

700: Use in HP 2137A Computer or HP 2437A Micro 27 Computer.

701: Upgrade from previous version of 94250B option 700 to latest version of same for customer NOT on support service.

890: Use in HP 2139A Computer or HP 2439A Micro 29 Computer or in any other A-Series computer. With 94250B, option 890 includes the right to purchase one or more 94250R/E products with Use Option 400, 600, 700, and/or 890 for use on a corresponding additional computer(s).

891: Upgrade from previous version of 94250B option 890 to latest version of same for customer NOT on support service.

894: Upgrade to Use Option 890 from Use Option 400.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

HP 94250R Use of F/1000 on One Additional Computer System (Must order one of Use Options 400 through 897)

The 94250R product is available only to customers who have purchased a license to use 94250B. 94250R consists of:

1. The license to make one copy of software purchased with the 94250B product for use on one additional system.
2. 94250-90005 F/1000 Reference Manual.
3. 94250-90006 Getting Started with F/1000.

HP 94250E Right to Execute the F/1000 Run-Time Environment On One Additional Computer System (must order one of Use Options 400 through 897)

This is a low-cost license for an OEM. No manual or software is supplied with this product, which is simply a license to execute the Run-Time Environment of F/1000 and user programs that depend upon it under 94250E Right-to-Execute F/1000 on a dedicated A-Series application system. The use of the F/1000 Forms Builder is expressly NOT licensed under the HP 94250E product.

Software Support Products

See the HP 1000 Ordering Guide, 5954-8564 or later revision, for definitions and availability of software support products for Forms/1000.

Programmable Controller Interface/1000

HEWLETT PACKARD

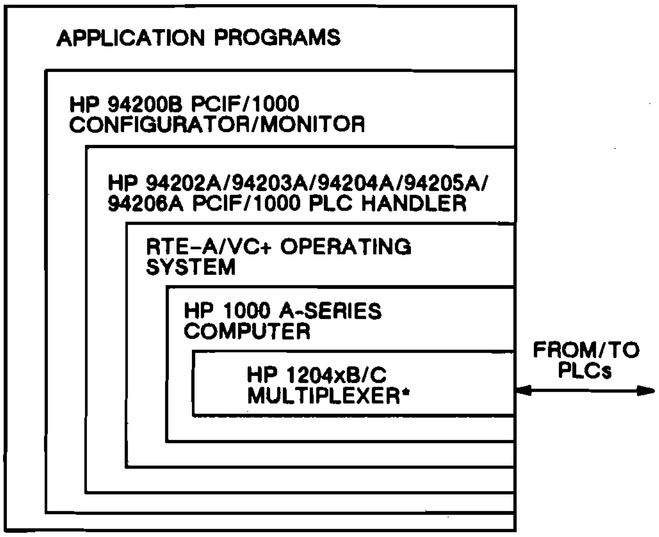
Factory Communications Software

product numbers
94200B and 94202A-94206A

Programmable Logic Controllers (PLCs) provide direct control of the individual stages of manufacturing processes on the factory floor. However, this control must be coordinated and its results monitored by supervisory controllers or LAN gateways to assure effective overall automation of production operations. HP Programmable Controller Interface/1000 (PCIF/1000) software facilitates coordination of PLCs by supporting transparent, high-level communication between HP 1000 A-Series computers and Programmable Logic Controllers (PLCs) on the factory floor. PCIF/1000 is a modular family of software products that consists of the HP 94200B PCIF/1000 Configurator/Monitor and these PLC device handlers:

Device Handler Product Number	Supported PLCs
HP 94202A	Allen-Bradley PLC, PLC-2 and PLC-3
HP 94203A	Gould-Modicon 484, 584, and 984 PLCs
HP 94204A	Siemens S5-Series PLCs
HP 94205A	Telemecanique TSX60/80/90 PLCs
HP 94206A	General Electric Series Six, Model 60, 600, and 6000 PLCs

The modular design of the PCIF/1000 family accommodates itself to any combination of supported PLCs. This design minimizes software and support costs while making efficient use of memory in the host computer. The high-level command facilities of PCIF/1000 provide an easy-to-use foundation for development of PLC supervisory application programs. PCIF/1000 functional relationships are shown in Figure 2-3.


APPLICATION PROGRAMS
HP 94200B PCIF/1000 CONFIGURATOR/MONITOR
HP 94202A/94203A/94204A/94205A/ 94206A PCIF/1000 PLC HANDLER
RTE-A/VC+ OPERATING SYSTEM
HP 1000 A-SERIES COMPUTER
HP 1204xB/C MULTIPLEXER*
FROM/TO PLCs

**Each PLC handler requires its own multiplexer(s).*

Figure 2-3. PCIF/1000 Functional Relationships

Features

- **Downloading of programs, data or process parameters, and commands for coordinated changeover of production operations.**
- **Uploading of status, data, and programs facilitates checking and monitoring of production operations.**
- **On-line, menu-driven configuration of PCIF/1000 communications facilitates changes to the PLC network topology.**
- **Common commands for all four types of supported PLCs simplifies user programming.**
- **Protocol-dependent routines are executed by intelligent, microprocessor-based multiplexer interface*, minimizing host computer overhead.**
- **Individual definition of the level of interaction allowable between any PLC and the programs accessing it, for protection of critical PLC functions.**
- **Communication with PLCs from multiple programs in the host computer for simplified implementation of complex applications.**
- **Transparent access to PLCs using high-level commands programmable in FORTRAN 77 or Pascal.**
- **Individually settable timeouts for each PLC for predictable system operation.**
- **PLC accesses can bypass the standard functions of PCIF where ultra-fast action is necessary or special, native highway commands must be used.**
- **Diagnostics for system fault isolation.**

** Except with Gould-Modicon PLCs.*

Part of a growing set of CIM tools

PCIF/1000 is an integral part of Hewlett–Packard's commitment to serve the Computer Integrated Manufacturing (CIM) needs of companies throughout the world. Fundamental to CIM is communication between the supervisory-level and managerial–level systems that share data and workloads and integrate the manufacturing operations of a factory or an entire company. The HP 1000 A-Series computer that supervises PLCs via PCIF/1000 has all the communication capability needed. It can communicate with:

- IBM and plug–compatible systems
- DEC VAX/VMS systems
- Other HP 1000 systems, which also support
  - A process monitoring and control package (92121A)
  - A quality management package (92131A)
- HP 3000 Systems, which support these managerial-level manufacturing software packages:
  - Materials Mangement with work order control
  - Material Requirements Planning
  - Master Production Scheduling
  - Standard Product Costing
  - Factory Order Entry
  - Lot Control and Traceability Reporting
  - Machine Maintenance Management
  - Production Management
  - Capacity Requirements Planning
  - Just-In-Time Manufacturing Management

Additional tools are being developed to help contribute to your productivity and success with CIM. These tools will support the Manufacturing Application Protocol (MAP).

Further evidence of Hewlett-Packard's commitment to your productivity and success with CIM is HP's Advanced Manufacturing Systems Operation, which offers specialized expertise and assistance with implementation of large CIM-related projects. Our business is your success with Computer–Integrated Manufacturing.

Effective coordination of PLCs

PCIF/1000 software provides an indispensible communications link between supervisory controllers or LAN gateways and PLCs, which may number over a hundred. In addition to PCIF communication, the following qualities are important in supervisory systems used to coordinate PLCs.

Capacity

The supervisory system must be able to accommodate the application programs it uses for PLC coordination and data processing, as well as the programs, commands, and data it exchanges with the PLCs. The multi-megabyte main memory capacity of HP 1000 A-Series computers and their powerful multiprogrammability amply satisfy capacity requirements for supervision of multiple PLCs.

Real-Time Responsiveness

Manufacturing processes require quick response to high-priority events encountered by the PLCs. HP 1000 A-Series systems and their RTE-A operating system build on over 18 years experience with real-time applications in an installed base of 100,000 systems. A-Series real-time capabilities are complete. They include event-interrupt, time, program-to-program, and user scheduling of multiple programs. User-specified priorities give execution preference to the most urgent programs, so the most urgent tasks get done before less important ones. System responsiveness can be assured by keeping critical programs in main memory, ready to run at a millisecond's notice, with no waiting for program transfer from disc.

The high performance RTE-A software is matched by fast hardware processing at rates to 3 MIPS and up to 500,000 FLOPs. This speeds completion of processing and action by the system.

HP 94200B PCIF/1000 Modules

Configurator

The configurator uses information from the system manager for integrating the required PLC device handlers with the run-time monitor. It also checks for completeness and coherence of the configuration and issues a warning if it detects an error. A modified configuration can be prepared on-line at any time, even while the Monitor is supervising a current configuration. Restart with an alternate configuration typically interrupts PCIF/1000 communications for less than a minute. The configurator requires the following information.

- types of PLCs to be connected and multiplexer ports used for the connections;
- communication characteristics of the links;
- PLC system configuration.

Monitor

After configuration and startup, the monitor dispatches requests from the user's supervisory application program to the proper PLCs for action. All monitor actions are transparent to the user.

Subroutine Library

The subroutine library provides access to the standard commands of PCIF/1000. The subroutines in the library are called from FORTRAN 77 or Pascal programs.

HP 9420xA Device Handlers

The HP 94202A through 94206A Device Handlers adapt requests and replies exchanged between the Monitor and the PLCs to the protocol requirements of the different PLCs connected to the system. Device handlers to support other PLCs may be available as a special. Contact the HP 1000 Sales Center in Cupertino, CA for more information.

HP 94200B Specifications

Supported PLCs

Allen-Bradley: PLC, PLC-2, and PLC-3 families connected as shown in Figure 2-4 when the HP 94202A Allen-Bradley PLC Device Handler is configured with the HP 94200B PCIF/1000 Configurator/Monitor.

Gould-Modicon: 484, 584, and 984 PLCs connected as shown in Figure 2-5 when the HP 94203A Gould-Modicon PLC Device Handler is configured with the HP 94200B PCIF/1000 Configurator/Monitor.

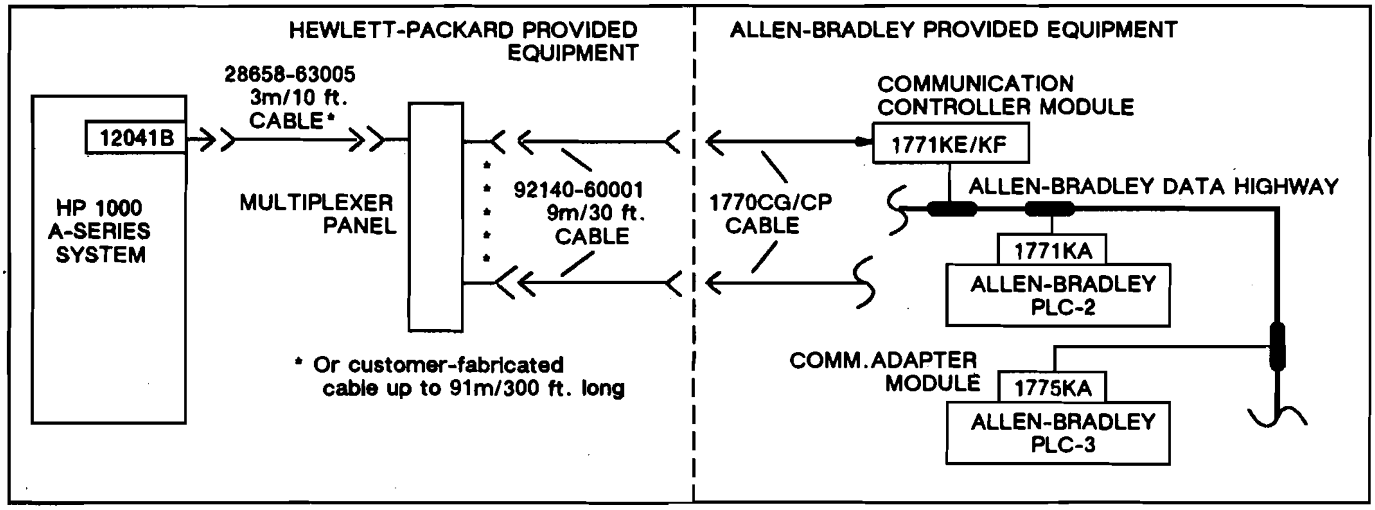

HEWLETT-PACKARD PROVIDED EQUIPMENT
ALLEN-BRADLEY PROVIDED EQUIPMENT
28658-63005
3m/10 ft.
CABLE*
12041B
HP 1000
A-SERIES
SYSTEM
MULTIPLEXER
PANEL
92140-60001
9m/30 ft.
CABLE
1770CG/CP
CABLE
COMMUNICATION
CONTROLLER MODULE
1771KE/KF
ALLEN-BRADLEY DATA HIGHWAY
1771KA
ALLEN-BRADLEY
PLC-2
COMM.ADAPTER
MODULE
1775KA
ALLEN-BRADLEY
PLC-3
* Or customer-fabricated cable up to 91m/300 ft. long

Figure 2-4. Connection of Allen–Bradley PLCs to HP 1000 A-Series Systems

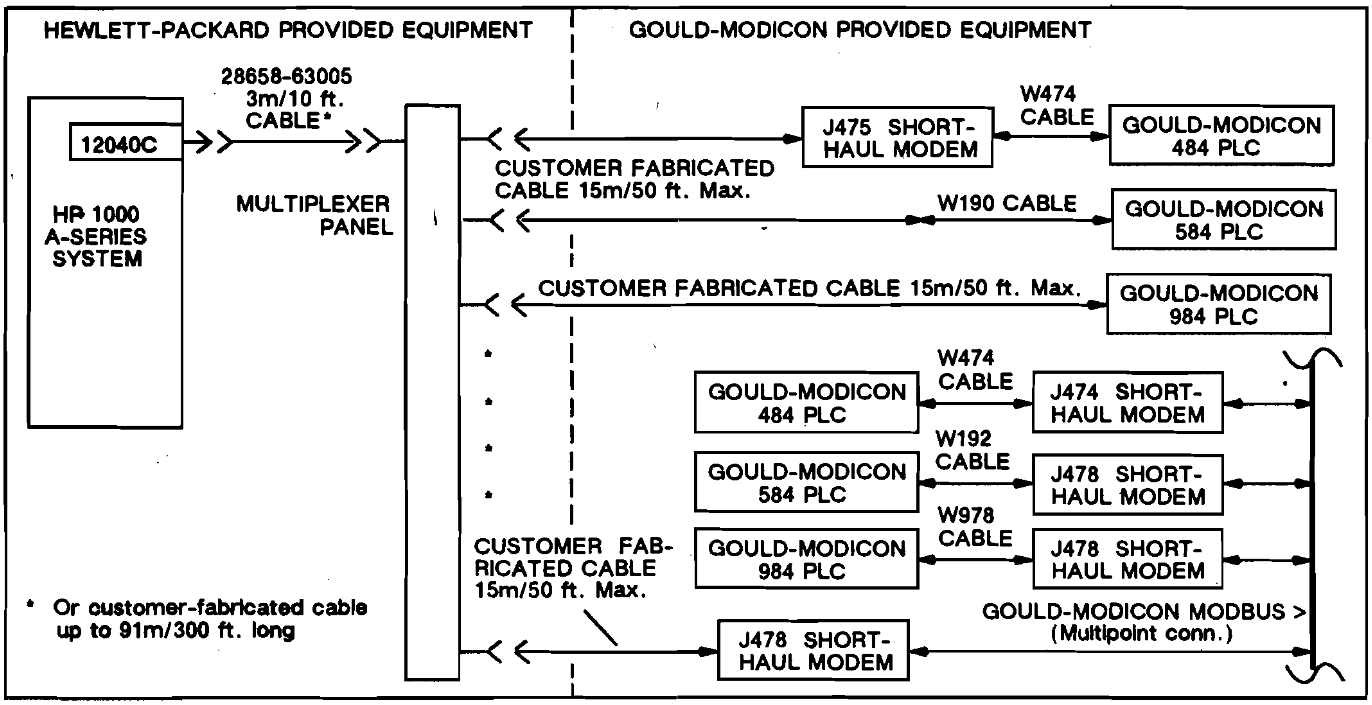

HEWLETT-PACKARD PROVIDED EQUIPMENT
GOULD-MODICON PROVIDED EQUIPMENT
28658-63005
3m/10 ft.
CABLE*
12040C
HP 1000
A-SERIES
SYSTEM
MULTIPLEXER
PANEL
CUSTOMER FABRICATED
CABLE 15m/50 ft. Max.
J475 SHORT-
HAUL MODEM
W474
CABLE
GOULD-MODICON
484 PLC
W190 CABLE
GOULD-MODICON
584 PLC
CUSTOMER FABRICATED CABLE 15m/50 ft. Max.
GOULD-MODICON
984 PLC
GOULD-MODICON
484 PLC
W474
CABLE
J474 SHORT-
HAUL MODEM
GOULD-MODICON
584 PLC
W192
CABLE
J478 SHORT-
HAUL MODEM
GOULD-MODICON
984 PLC
W978
CABLE
J478 SHORT-
HAUL MODEM
CUSTOMER FAB-
RICATED CABLE
15m/50 ft. Max.
J478 SHORT-
HAUL MODEM
GOULD-MODICON MODBUS >
(Multipoint conn.)
* Or customer-fabricated cable up to 91m/300 ft. long

Figure 2-5. Connection of Gould–Modicon PLCs to HP 1000 A-Series Systems

Siemens: S5-110S, -115S, -130W, -150A, -150K, -150S, and -150U PLCs connected as shown in Figure 2-6 when the HP 94204A Siemens PLC Device Handler is configured with the HP 94200B PCIF/ 1000 Configurator/Monitor.

Telemecanique: TSX60, TSX80, and TSX90 PLCs connected as shown in Figure 2-7 when the HP 94205A Telemecanique PLC Device Handler is configured with the HP 94200B PCIF/1000 Configurator/ Monitor.

General Electric: Series Six, Model 60, Model 600, and Model 6000 PLCs connected as shown in Figure 2-8 when the 94206A General Electric PLC Device Handler is configured with the HP 94200B PCIF/1000 Configurator/Monitor.

Operational Requirements for HP-Provided Equipment

1. HP 1000 A-Series Computer or Micro/1000 Computer ordered as component or in 219xC/D or 248xA System Processor Unit, with:
   a. HP 92077A RTE-A operating system. The HP 92078A VC+ enhancement is also required for the Gould-Modicon device handler or concurrent execution of more than one device handler and is strongly recommended for all use of PCIF.
   b. At least 1 megabyte of main memory.
   c. At least 20 megabytes of disc memory.
2. HP 92836A FORTRAN 77 or 92833A Pascal/ 1000.
3. An HP block mode display terminal (HP 2392A, 2393A, 2397A, 2623A*, 2624B*, 2625A*, 2626A*, 2627A*, 2628A*, or 45610B*).

** Discontinued product listed here for reference only.*

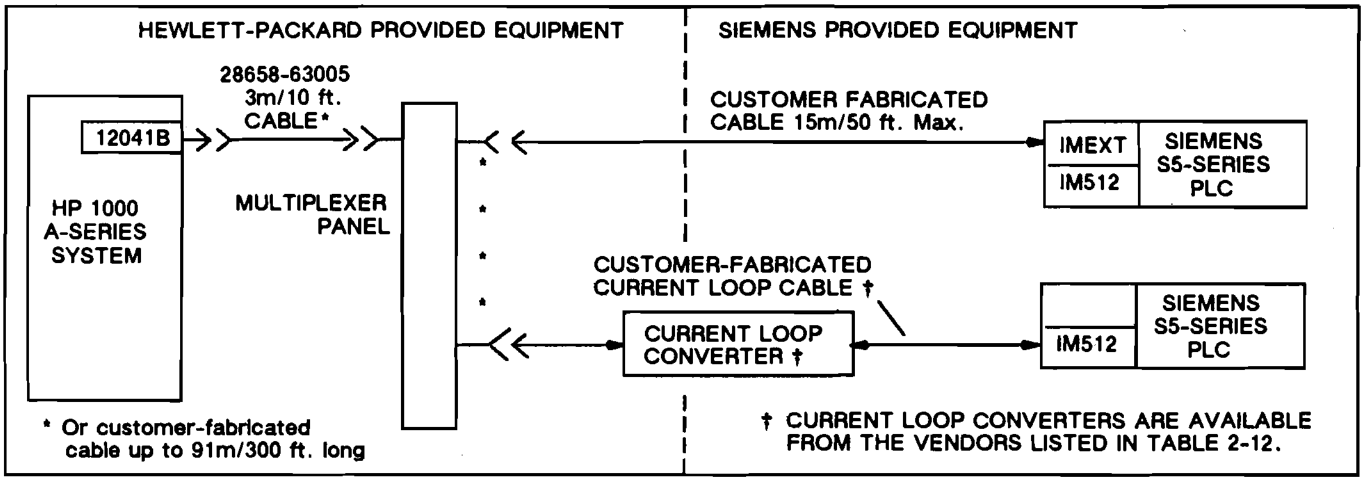

HEWLETT-PACKARD PROVIDED EQUIPMENT
SIEMENS PROVIDED EQUIPMENT
28658-63005
3m/10 ft.
CABLE*
12041B
HP 1000
A-SERIES
SYSTEM
MULTIPLEXER
PANEL
CUSTOMER FABRICATED
CABLE 15m/50 ft. Max.
IMEXT
IM512
SIEMENS
S5-SERIES
PLC
CUSTOMER-FABRICATED
CURRENT LOOP CABLE †
CURRENT LOOP
CONVERTER †
IM512
SIEMENS
S5-SERIES
PLC
* Or customer-fabricated
cable up to 91m/300 ft. long
† CURRENT LOOP CONVERTERS ARE AVAILABLE
FROM THE VENDORS LISTED IN TABLE 2-12.

Figure 2-6. Connection of Siemens PLCs to HP 1000 A-Series System

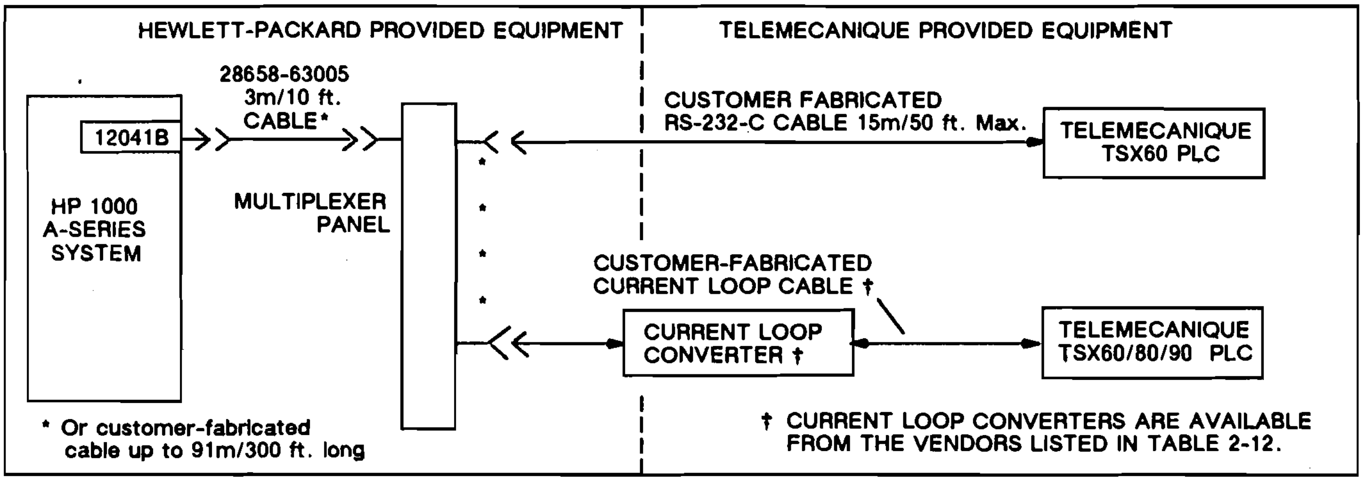
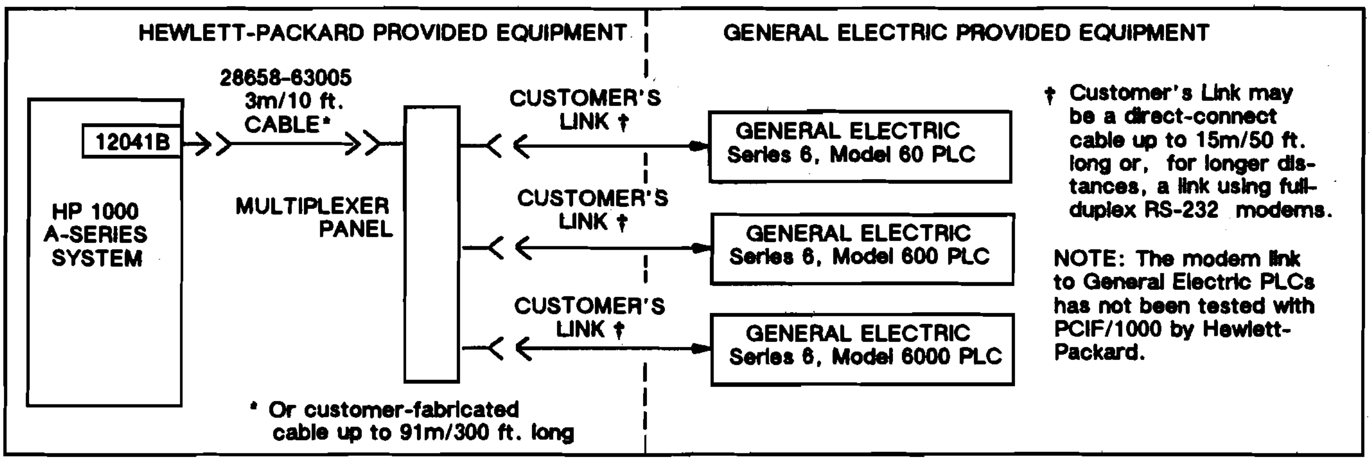

HEWLETT-PACKARD PROVIDED EQUIPMENT
TELEMECANIQUE PROVIDED EQUIPMENT
28658-63005
3m/10 ft.
CABLE*
12041B
HP 1000
A-SERIES
SYSTEM
MULTIPLEXER
PANEL
CUSTOMER FABRICATED
RS-232-C CABLE 15m/50 ft. Max.
TELEMECANIQUE
TSX60 PLC
CUSTOMER-FABRICATED
CURRENT LOOP CABLE †
CURRENT LOOP
CONVERTER †
TELEMECANIQUE
TSX60/80/90 PLC
* Or customer-fabricated
cable up to 91m/300 ft. long
† CURRENT LOOP CONVERTERS ARE AVAILABLE
FROM THE VENDORS LISTED IN TABLE 2-12.

Figure 2-7. Connection of Telemecanique PLCs to HP 1000 A-Series System


HEWLETT-PACKARD PROVIDED EQUIPMENT
GENERAL ELECTRIC PROVIDED EQUIPMENT
28658-63005
3m/10 ft.
CABLE*
12041B
HP 1000
A-SERIES
SYSTEM
MULTIPLEXER
PANEL
CUSTOMER'S
LINK †
GENERAL ELECTRIC
Series 6, Model 60 PLC
CUSTOMER'S
LINK †
GENERAL ELECTRIC
Series 6, Model 600 PLC
CUSTOMER'S
LINK †
GENERAL ELECTRIC
Series 6, Model 6000 PLC

† Customer's Link may be a direct-connect cable up to 15m/50 ft. long or, for longer distances, a link using full-duplex RS-232 modems.

NOTE: The modem link to General Electric PLCs has not been tested with PCIF/1000 by Hewlett-Packard.

* Or customer-fabricated cable up to 91m/300 ft. long

Figure 2-8. Connection of General Electric PLCs to HP 1000 A-Series System

Table 2-12. Current Loop Converters and Maximum Cable Lengths for Siemens and Telemecanique PLCs

VENDORS OF TESTED CURRENT LOOP CONVERTERS	CONVERTER TYPE	NO. OF CHAN.	MAXIMUM CABLE LENGTH TESTED*, BY DATA RATES		
			9600 BITS/SEC	4800 BITS/SEC	2400 BITS/SEC
BLACK BOX Mayview road park drive Box 12800 Pittsburgh, Pa 15241	B-CL050 (CLIC) B-CL204 B-CL208 B-CL212 B-CL216	1 4 8 12 16	150m/490 ft.	450m/1475 ft.	750m/2460 ft.
CYBERSIS Chemin Malacher Zirst 38240 Meylan, France	BCI-010	1	300m/984 ft.	750m/2460 ft.	750m/2460 ft.
EUROTERMINAL 19 Place Loire Silic 182 94563 Rungis, France	ET-80	1	150m/490 ft.	600m/1968 ft.	750m/2460 ft.

Current Loop Converters from other manufacturers may also be usable but have not been tested.

* *These cable lengths provide an indication of capability; longer lengths may be usable, but Hewlett-Packard assumes no responsibility for performance of equipment or cables manufactured by other manufacturers or customers.*

4. One to three HP 12041B multiplexer(s) and/or 12040C multiplexer(s), as appropriate (the multiplexers include an 8-channel connector panel).
5. Cables to PLC hardware (Fig. 2-4 through 2-8).

Performance Parameters

PCIF/1000 performance with respect to the following parameters varies with buffer size as shown in Figure 2-9.

Transfer Time: Elapsed time between a read/write request(s) to a PLC (or group of PLCs) and its (their) completion.

Data Throughput: Total number of bytes read from or written to the PLC(s) divided by the transfer time.

CPU Utilization: The average percentage of CPU capacity used during actual PCIF/1000 program/data transfers to/from PLCs is greatest with short transfers (small buffers) because the CPU is involved more frequently than with long transfers (large buffers). Overall CPU utilization by PCIF/1000 depends upon message traffic density.

Performance with Allen-Bradley, Gould-Modicon, and General Electric PLCs

See Table 2-13, next page.

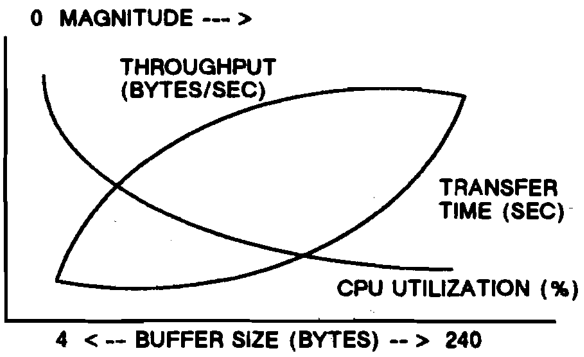


Figure 2-9. PCIF/1000 Performance Parameter Relationships

Performance with Siemens and Telemecanique PLCs

Throughput rates and transfer times for Siemens and Telemecanique PLCs will be about the same as listed in Table 2-13 for Allen-Bradley PLCs, since the Siemens and Telemecanique PLCs use the same microprocessor based, intelligent HP 12041B multiplexer interface that is used for communication with the Allen-Bradley PLCs.

Table 2-13. PCIF/1000 READD/WRITED performance with Allen-Bradley, Gould-Modicon, and General Electric PLCs

PROGRAMMABLE LOGIC CONTROLLER (PLC)	BUFFER SIZE (bytes)	AVERAGE TRANSFER TIME (Seconds)	THRUPUT PER PLC (bytes per second)
READD Performance with one PLC on one comm. hiway			
Allen-Bradley PLC-2	4	0.15	26.84
	240	0.78	308.28
Gould-Modicon 484, 584, and 984	4	0.1#	40.0#
	240	0.79#	303.22#
General Electric Series 6	4	0.09	42.78
	240	0.43	558.14
WRITED Performance with one PLC on one comm. hiway			
Allen-Bradley PLC-2	4	0.15	27.3
	240	n/t	n/t
Gould-Modicon 484, 584, and 984	4	0.11#	35.72#
	240	0.87#	275,54#
General Electric Series 6	4	0.1	41.24
	240	0.44	549.2
READD Performance w/five comm. hiways, one PLC/hiway			
Allen-Bradley PLC-2	4	0.63	6.32
	240	0.96	249.74
Gould-Modicon 484, 584, and 984	4	0.3	13.28
	240	1.35	177.18
General Electric Series 6	4	0.25	16.1
	240	0.79	549.2
WRITED Performance w/five comm. hiways, one PLC/hiway			
Gould-Modicon 484, 584, and 985	4	0.81	4.94
	240	3.65	65.76
General Electric Series 6	4	0.1	41.22
	240	0.44	549.2

n/t = not tested

# These figures differ no more than 5% from one model of Gould-Modicon PLC to another.

HP 94202A-94206A Device Handler Specifications

See Table 2-14.

Command Set

PCIF/1000 supports access to programmable controllers as if they were files on disc, using the following commands, which can be called from application programs written in FORTRAN 77 or Pascal:

PCIF_OPEN/CLOSE initiates/terminates a dialog between an application program and PCIF/1000.

PC_CONNECT/DISC establishes/breaks a link between a PLC and PCIF/1000.

PC_READD reads data from PLC memory.

PC_WRITED downloads data into PLC memory.

PC_READP reads program(s) from PLC memory.

PC_WRITEP downloads program(s) into PLC memory.

PC_LOCK restricts PLC access to a specific application program.

PC_UNLOCK frees access to a LOCKed PLC.

PC_PCSTAT requests status (run, program, or test mode) of a PLC.

PC_SYSTAT provides logical status of the system, relative to a PLC.

PC_CANCEL cancels all previous requests sent to a PLC that have not yet terminated.

PC_START/STOP starts/stops a program already resident in a PLC (not supported by Allen-Bradley PLCs).

PC_ENQUIRY retrieves data from requests made without wait or from unsolicited messages from PLCs.

PC_IDENT identifies PLC manufacturer and model.

PC_GETKEY/RELKEY obtains/releases system resources needed for managing asynchronous (requests made without wait) from application programs.

PC_ENUNSOL/DIUNSOL enables/disables receipt by application program of unsolicited messages from a PLC (not supported by Gould-Modicon or Telemecanique PLCs).

PC_TRANS accesses PLC without using the standard functions of PCIF/1000.

Table 2-14. HP 94202A-94206A PLC Device Handler Specifications

DEVICE HANDLER PRODUCT NUMBER	SUPPORTED PLCs	PLCs NOT SUPPORTED	PROTOCOL	COMPUTER TO PLC I/O INTERFACE	LINK DATA RATE	PLCs PER MULTIPLEXER	MULTIPLEXERS PER SYSTEM
94202A	Allen-Bradley PLC, mini-PLC-2, PLC-2/15, PLC-2/20, PLC-2/30, and PLC-3	Not specified	Allen-Bradley (ANSI Std X.3.28-1978)	12041B Multiplexer	9600 bps	Up to 256 (Note A)	Up to 3 (Note B)
94203A	Gould-Modicon 484-2x1 through 2x6, 584A, 584L, 584M, and 984	Not specified	Gould-Modicon Modbus ASCII mode (RS-232-C)	12040C Multiplexer	9600 bps	Up to 256 (Note A)	Up to 3 (Note B)
94204A	Siemens S5-110S, S5-115U, S5-130W, S5-150A, 150K, 150S, and 150U	Not specified	Siemens 3964 communication protocol	12041B Multiplexer	9600 bps#	Up to 8	Up to 3 (Note B)
94205A	Telemecanique TSX60, TSX80, and TSX90	TSX27 & TSX47	Proprietary to Telemecanique	12041B Multiplexer	9600 bps#	Up to 8	Up to 3 (Note B)
94206A	General Electric Series Six Models 60, 600, and 6000	Series One and Three	GE CCM2 Peer-to-peer communications protocol. Master-slave mode is not supported	12041B Multiplexer	9600 bps	Up to 8	Up to 3 (Note B)

# The maximum usable data rate for Siemens or Telemecanique PLCs depends upon current loop cable length (see Table 2-12).

NOTE A: The number of PLCs actually usable per system depends upon system performance requirements.

NOTE B: Supportability of three multiplexers depends upon overall RTE–A table space usage of the particular system.

NOTE C: The 12040C Multiplexer can be used for the A–Series system console AND connection of Gould–Modicon PLCs.

Ordering Information

HP 94200B Programmable Controller Interface/1000 (PCIF/1000) (Must order one of Use Options 400 through 897)

PCIF/1000 includes:

1. Relocatable configurator/monitor and diagnostic software and Forms/1000 software with execute only license, all on software Media Option 022, 044, or 051, **one of which MUST be ordered.**
2. 94200Z PCIF/1000 Manuals Set (see listing below).

HP 9420xA/B/Z Media Options

022: Provides software on CS/80 cartridge tape.

044: Provides software on microfloppy disc for HP 12120A*/12122A Integrated Discs in Micro/1000 package or HP 9122D or 9133A*/B*/H*/L, or 9153B Disc.

051: Provides software on 1600 cpi, 9-track mag tape.

** Identifies discontinued product, listed here for reference only.*

9420xA/B/R Use Options

400: Use in HP 12100A Single Board Computer, 2424A Micro 14 Computer, or 2434A Micro 24 Computer or HP 2484A SPU.

600: Use in HP 2106BK Board Computer, 2156B Computer, 2426E/F Micro 16 Computer, or 2436A Micro 26 Computer or HP 2196C/D or 2486A SPU.

700: Use in HP 2137A Computer or 2437A Micro 27 Computer or HP 2197C/D or 2487A SPU.

890: Use in HP 2139A Computer or 2439A Micro 29 Computer or HP 2199C/D or 2489A SPU.

894: Upgrade to Use Option 890 from Use Option 400.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

HP 94200R Right to Copy PCIF/1000 (Must order one of Use Options 400 through 897)

HP 94200R is available to customers who have purchased the HP 94200B product and includes:

1. A license to make one copy of HP 94200B PCIF/1000 software for use on one additional system.
2. 94200Z PCIF/1000 Manuals Set (see listing below); must specify 94200R Media Option 022, 044, or 051 to obtain the Getting Started familiarization program on appropriate media.

HP 94200Z PCIF/1000 Manuals Set

The PCIF/1000 Manuals Set includes:

1. 94200-90002 PCIF/1000 Reference Manual.
2. 94200-17500 Getting Started with PCIF/1000, a self-paced on-line familiarization program on Media Option 022, 044, or 051, **one of which MUST be ordered.** (Media Option ordered for 94200B/R, also specifies media for familiarization program included in those products).

HP 94202A PCIF/1000 Device Handler for Allen-Bradley PLCs (Must order one of Use Options 400 through 897)

The Allen-Bradley PLC handler includes:

1. Relocatable software on software Media Option 022, 044, or 051, **one of which MUST be ordered.**
2. 94202Z Using PCIF/1000 with Allen-Bradley Programmable Controllers Reference Manual.

HP 94202R Right to Copy the Allen-Bradley PLC Device Handler (Must order one of Use Options 400 through 897)

HP 94202R is available to customers who have purchased the HP 94202A product and includes:

1. A license to make one copy of HP 94202A PLC Device handler software for use on one additional system.
2. 94202Z Using PCIF/1000 with Allen-Bradley Programmable Controllers Reference Manual.

HP 94203A PCIF/1000 Device Handler for Gould-Modicon PLCs (Must order one of Use Options 400 through 897)

The Gould-Modicon PLC handler includes:

1. Relocatable software on software Media Option 022, 044, or 051, **one of which MUST be ordered.**
2. 94203Z Using PCIF/1000 with Gould-Modicon Programmable Controllers Reference Manual.

HP 94203R Right to Copy the Gould-Modicon PLC Device Handler (Must order one of Use Options 400 through 897)

HP 94203R is similar to 94202R for the Allen-Bradley PLC Device Handler, described above, but applies to right to copy 94203A software and includes the 94203Z manual.

HP 94204A PCIF/1000 Device Handler for Siemens PLCs (Must order one of Use Options 400 through 897)

The Siemens PLC handler includes:

1. Relocatable software on software Media Option 022, 044, or 051, **one of which MUST be ordered.**
2. 94204Z Using PCIF/1000 with Siemens Programmable Controllers Reference Manual.

HP 94204R Right to Copy the Siemens PLC Device Handler (Must order one of Use Options 400 through 897)

HP 94204R is similar to 94202R for the Allen-Bradley PLC Device Handler, described above, but applies to right to copy 94204A software and includes the 94204Z manual.

HP 94205A PCIF/1000 Device Handler for Telemecanique PLCs (Must order one of Use Options 400 through 897)

The Telemecanique PLC handler includes:

1. Relocatable software on software Media Option 022, 044, or 051, **one of which MUST be ordered.**
2. 94205Z Using PCIF/1000 with Telemecanique Programmable Controllers Reference Manual.

HP 94205R Right to Copy the Telemecanique PLC Device Handler (Must order one of Use Options 400 through 897)

HP 94205R is similar to 94202R for the Allen-Bradley PLC Device Handler, described above, but applies to right to copy 94205A software and includes the 94205Z manual.

HP 94206A PCIF/1000 Device Handler for General Electric PLCs (Must order one of Use Options 400 through 897)

The General Electric PLC handler includes:

1. Relocatable software on software Media Option 022, 044, or 051, **one of which MUST be ordered.**
2. 94206Z Using PCIF/1000 with General Electric Programmable Controllers Reference Manual.

HP 94206R Right to Copy the General Electric PLC Device Handler (Must order one of Use Options 400 through 897)

HP 94206R is similar to 94202R for the Allen-Bradley PLC Device Handler, described above, but applies to right to copy 94206A software and includes the 94206Z manual.

Software Support Products

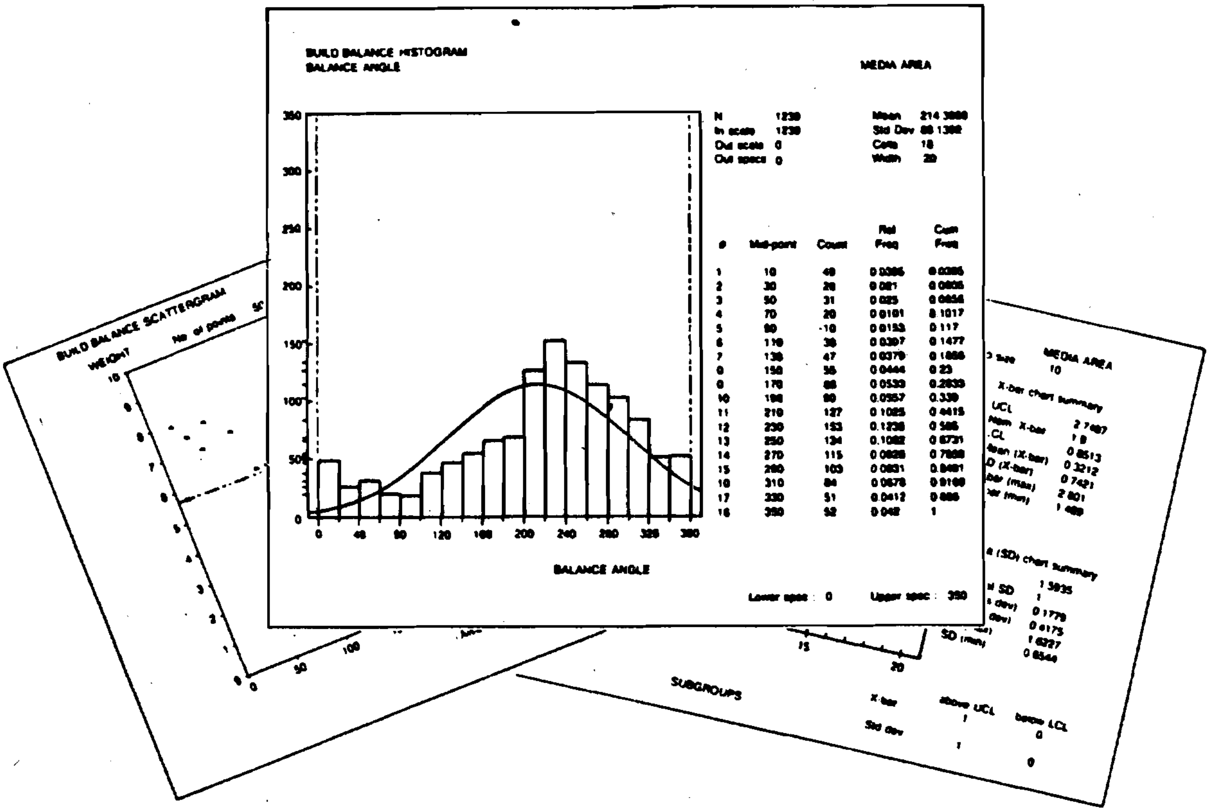
See the HP 1000 Ordering Guide, 5954-8564 or later revision, for definitions and availability of software support products for PCIF/1000 and its related device handlers.

HP Quality Decision Management/1000

HEWLETT PACKARD

Manufacturing Software for HP 1000 Computer Systems

product number 92131A



HP Quality Decision Management/1000 is an applications software package for analyzing manufacturing processes and product quality. Control charts and Pareto charts can be generated to help production and quality assurance engineers identify statistically significant product defects and process problems. Data collected on-line can also be used to generate scattergrams, histograms, and tabular reports. These outputs identify the manufacturing process causes of product quality deviations.

A menu and prompt/response approach facilitates configuration of data collection transactions, report and graph formats, and data archival and system maintenance functions, all without the need for programming experience. Extensive "hooks" for user programs provide additional data input, output, and analysis flexibility.

Features

- **Powerful, menu-driven report and graph writer for precise selection and analysis of collected data.**
- **Menu or prompt/response driven user interface for easy configuration, modification and system use by non-programmers.**
- **Controlled access via password assignments.**

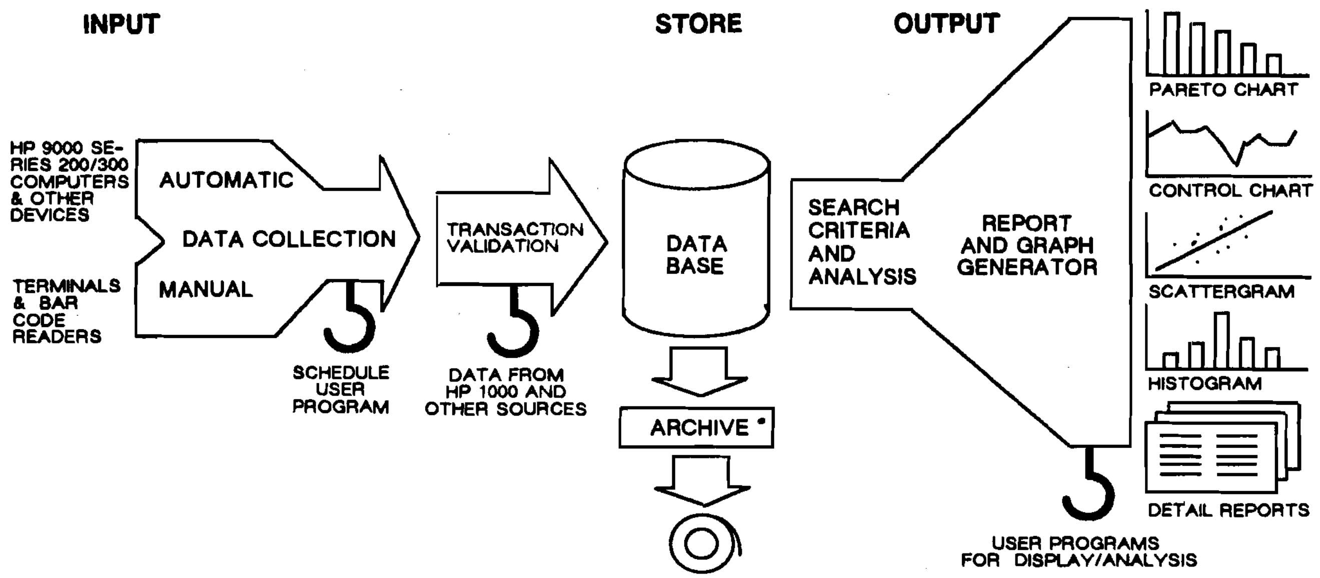

INPUT
STORE
OUTPUT
HP 9000 SERIES 200/300 COMPUTERS & OTHER DEVICES
AUTOMATIC
DATA COLLECTION
MANUAL
TERMINALS & BAR CODE READERS
SCHEDULE USER PROGRAM
TRANSACTION VALIDATION
DATA FROM HP 1000 AND OTHER SOURCES
DATA BASE
ARCHIVE *
SEARCH CRITERIA AND ANALYSIS
REPORT AND GRAPH GENERATOR
PARETO CHART
CONTROL CHART
SCATTERGRAM
HISTOGRAM
DETAIL REPORTS
USER PROGRAMS FOR DISPLAY/ANALYSIS

Figure 2-10. HP Quality Decision Management/1000 Functional Diagram

- **Pre-defined data base for simplifying system design efforts.**
- **User-defined data collection prompts for system customization to specific application requirements.**
- **Data base editor for modification of data in the data bases.**
- **Extensive user-defined data validation for parametric (numerical) and attribute (descriptive) data.**
- **Data collection supported from HP display terminals and HP 9000 Series 200/300 Computers.**
- **Flexible user extensions for data collection from any device that can transfer a formatted ASCII file to an HP 1000 computer.**
- **Data integrity through data base utilities and system management programs.**
- **Monochrome or color graphic terminal output.**

Functional Description

HP Quality Decision Management/1000 provides data collection, validation and storage to a data base, which is central to the system. Engineers can statistically analyze the data and output the results in tabular or graphical format. A functional diagram is shown in Figure 2-10.

The pre-defined data base is transparently configured by the user during the menu-driven transaction design process. Manual data collection follows a prompt/response sequence on a terminal, while automatic data collection occurs on HP 9000 Series 200/300 Computers that accumulate data via user-written BASIC programs. These programs format the data, then forward the entire transaction to HP Quality Decision Management/1000. Transactions are validated and added to the data base. Invalid transactions are posted to an error log. Parameters and attributes are validated in both manual and automatic transactions.

User extensions are illustrated by the hooks in Figure 2-10. The left hook enables a user to activate an external program from both automatic and manual data collection. In its simplest form, this hook can be used to collect an input automatically. For example, instead of requiring an operator to key in a reading from a digital voltmeter, the value can be collected automatically. Another use in manual and automatic data collection modes is to schedule a program that pre-processes data or diverts it to some specialized storage or validation routine. The transaction validation hook accepts any formatted file.

Users also define search criteria as well as report and graph formats via menus. Once search criteria, analysis requirements, and output formats have been defined, they can be stored as a procedure name. An unsophisticated user can request one of these predefined reports. Conversely, a manufacturing engineer or other sophisticated user could interactively define a new report linking various parameters and attributes from different workstations in order to isolate and identify defect causes.

The right hook illustrates the capability of storing the result of a search into a disc file. The user can then access the file through user-written programs that perform specialized data analysis and display functions or return modified data to the QDM graph generator. For example, costs per failure type might be added to a Pareto of cost of non-conformance.

Model of Production

The HP Quality Decision Management/1000 data base is designed for workstation oriented production environments. The data base implicitly defines a model of production described in the diagram on the next page.

Parts → WORKSTATION → Parts

OPERATIONS

Multiple parts go through the workstation and different operations are performed on the parts.

For each combination of workstation, part number, and operation, a data collection transaction can be identified.

Each data collection transaction can have up to three sections:

- Transaction data (e.g., who, what, where)
- Process Common data (common to all of the parts)
- Unit Specific data (specific to an individual part)

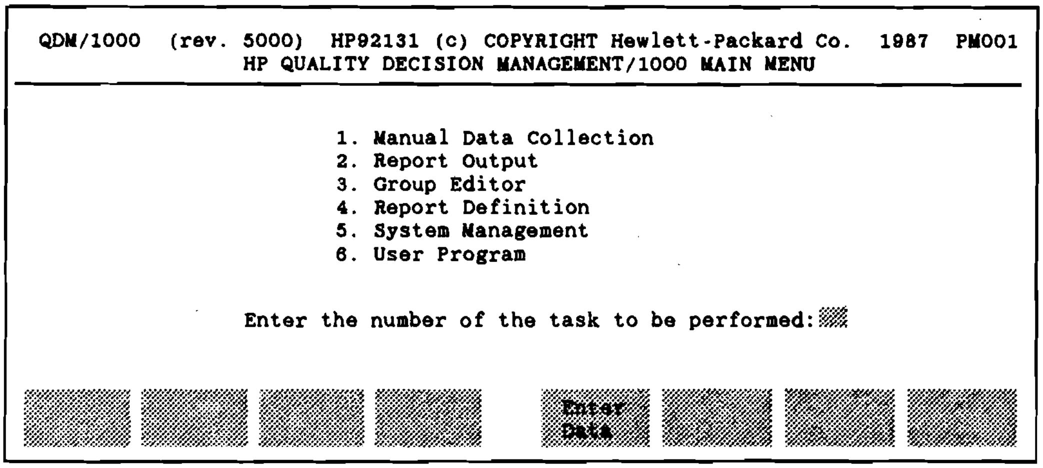
The table at right illustrates the three types of data from a spray painting operation. A workorder, A234-22, for five 0142-2009 parts is being painted by Joe Worker at spray station 2. The individual parts have unique serial numbers. 1, 2, 3, 4, and 5. The parts are spray painted different colors and then placed in a 500-degree F drying oven for 20 minutes. This example includes just one workstation. An actual application would have multiple workstations, such as Receiving/Incoming Inspection, Final Test, Fabrication, Assembly, etc.

USER CONFIGURABLE PROMPT	OPERATOR RESPONSE
Transaction Data (identifies the transaction)	
Workstation ?	:Spray station 2
Part number ?	:0142-2009
Operation ?	:Paint
Unit ID No. ?	:1,2,3,4,5
Workorder No.?	:A234-22
Process Common Data (all parts)	
Drying temperature ?	500 degrees F
Drying time ?	20 minutes
Unit Specific Data (unique to unit ID number)	
Unit 1 Color ?	Blue
Unit 2 Color ?	Red
Unit 3 Color ?	Green
Unit 4 Color ?	Yellow
Unit 5 Color ?	Vermillion

Using HP Quality Decision Management/1000

The matrix below indicates some key application areas for HP Quality Decision Management/1000 and the product features and benefits of each area.

Application Area	Features	Benefits
Incoming Inspection	Displays inspection instructions, generates vendor rating reports, control charts of defect rates, vendor quality.	Prioritize vendors, reduce number of vendors, and increase vendor responsiveness to quality demands.
Product Test: Electronic, Electro-mechanical, final, in-process, component	Manual and automatic on-line data collection, test procedure display. Provides statistical monitoring of defect levels and decision support graphics and reports.	■ Optimize test process, schedule calibrations, determine minimum number of readings needed, identify tester vs product defects. ■ Reaction to statistically significant defect rates. ■ Production defect data available for correlation to manufacturing process data, identification of causes of quality problems.
History tracking/ Audit Trail	On-line data collection of pertinent traceability facts, archived but available for recall to satisfy regulatory requirements.	■ Responsiveness to regulatory requirements.
Statistical process/ product monitoring	On-line data collection from incoming inspection, manufacturing process, and test areas. Statistical graphs/reports to monitor manufacturing process quality and product defects. Correlation between product defect data and defect cause data allows identification of specific defect causes: ■ poor workmanship ■ faulty material ■ weak manufacturing process execution ■ wrong manufacturing process definition ■ faulty product design	■ High, predictable yields ■ Lower production costs ■ Reduced rework costs ■ Lower scrap levels ■ Reduced labor content ■ Accurate vendor quality feedback/correlation ■ Reduced cycle times and inventory levels



```
QDM/1000  (rev. 5000)  HP92131 (c) COPYRIGHT Hewlett-Packard Co.  1987  PM001
                 HP QUALITY DECISION MANAGEMENT/1000 MAIN MENU

                          1. Manual Data Collection
                          2. Report Output
                          3. Group Editor
                          4. Report Definition
                          5. System Management
                          6. User Program

                 Enter the number of the task to be performed:
```

Product Details

System functions are accessed via the menu-driven user interface screens (see main menu above). One or more of the six functions can be offered on each terminal. The user can select any one of these choices, perform their task, and then return the terminal to the main menu. The functional capability for each of these modes is described below.

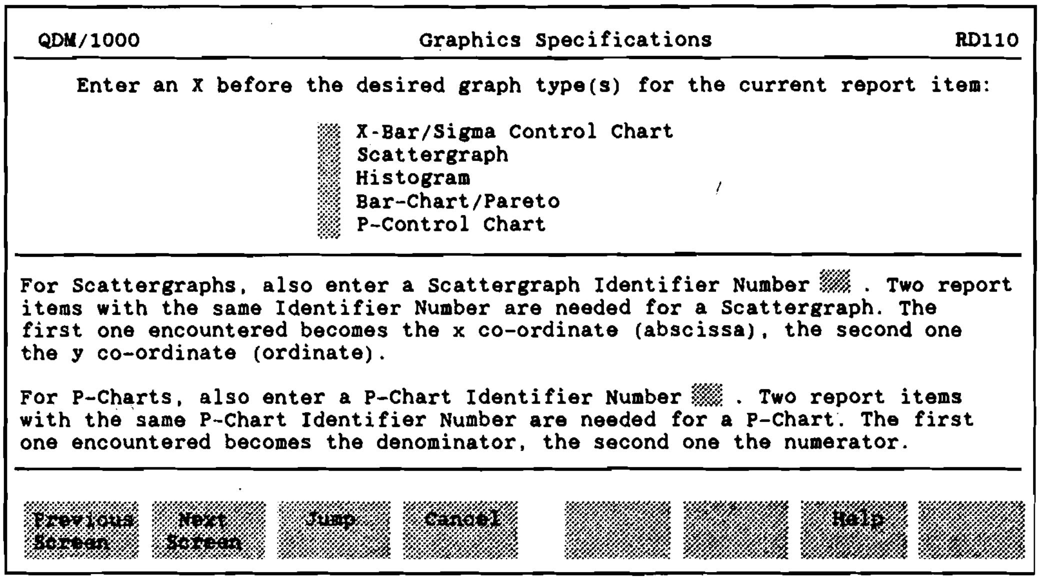
MANUAL DATA can be collected from a terminal keyboard or optional bar code wand, for both parametric and attribute data. The transaction format follows the prompt/response sequence described in the Model of Production. Prompts are user-defined via the CONFIGURATOR function (a subset of the System Management function).

REPORT OUTPUT can be pre-defined or customized by the user.

- P-charts, to monitor defect rates of products with pass/fail defect distribution, based on attribute data.
- X-bar and sigma charts, with user-definable titles and subtitles.
- Histograms, of parametric data autoscaled or user specified, with optional normal curve superimposed.
- Scattergrams of parametric data. Correlation coefficient and line of regression can be optionally requested.
- Pareto charts of attribute data.
- Bar charts of attribute data.
- Tabular Reports, with format and content user-specifiable.

GROUP EDITOR defines arbitrary groups of up to 24 unit IDs in order to avoid re-entering individual IDs for each transaction.

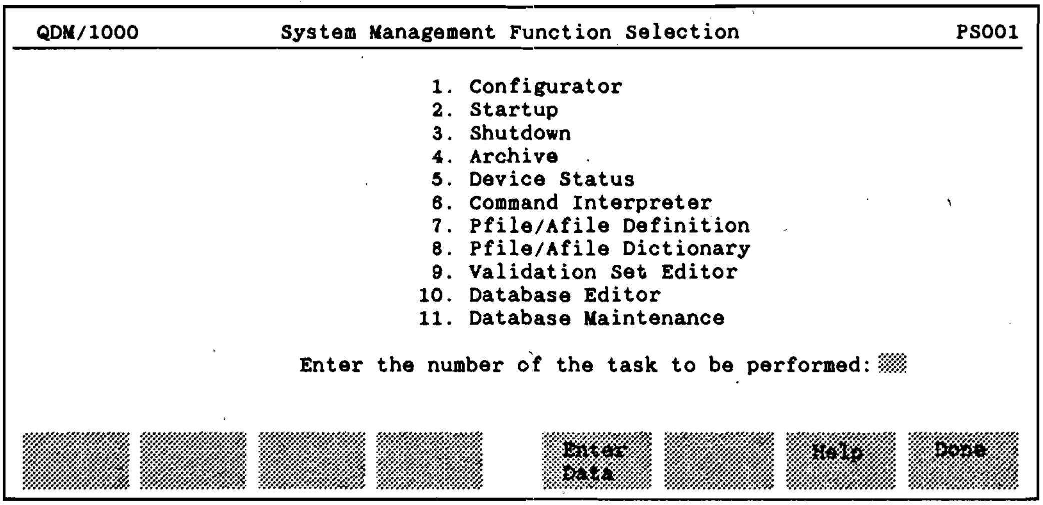
REPORT DEFINITION specifies data selection criteria and report/graph formats. The user can create or modify a report definition, or obtain a listing of currently defined reports with comments.



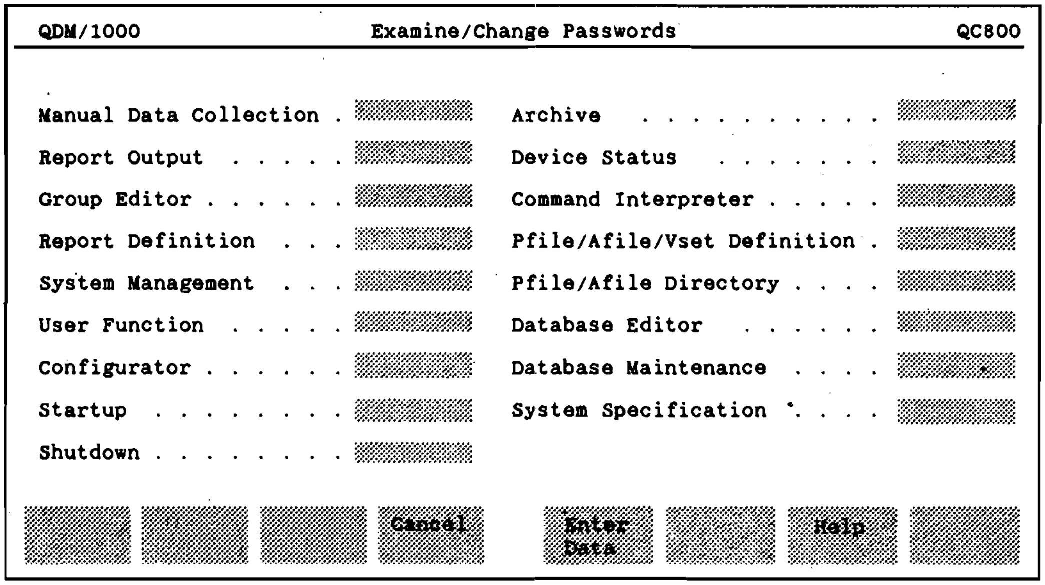
```
QDM/1000                    Graphics Specifications                    RD110

    Enter an X before the desired graph type(s) for the current report item:

                     X-Bar/Sigma Control Chart
                     Scattergraph
                     Histogram
                     Bar-Chart/Pareto
                     P-Control Chart

For Scattergraphs, also enter a Scattergraph Identifier Number  . Two report
items with the same Identifier Number are needed for a Scattergraph. The
first one encountered becomes the x co-ordinate (abscissa), the second one
the y co-ordinate (ordinate).

For P-Charts, also enter a P-Chart Identifier Number  . Two report items
with the same P-Chart Identifier Number are needed for a P-Chart. The first
one encountered becomes the denominator, the second one the numerator.
```

SYSTEM MANAGEMENT function manages eleven sub-functions:

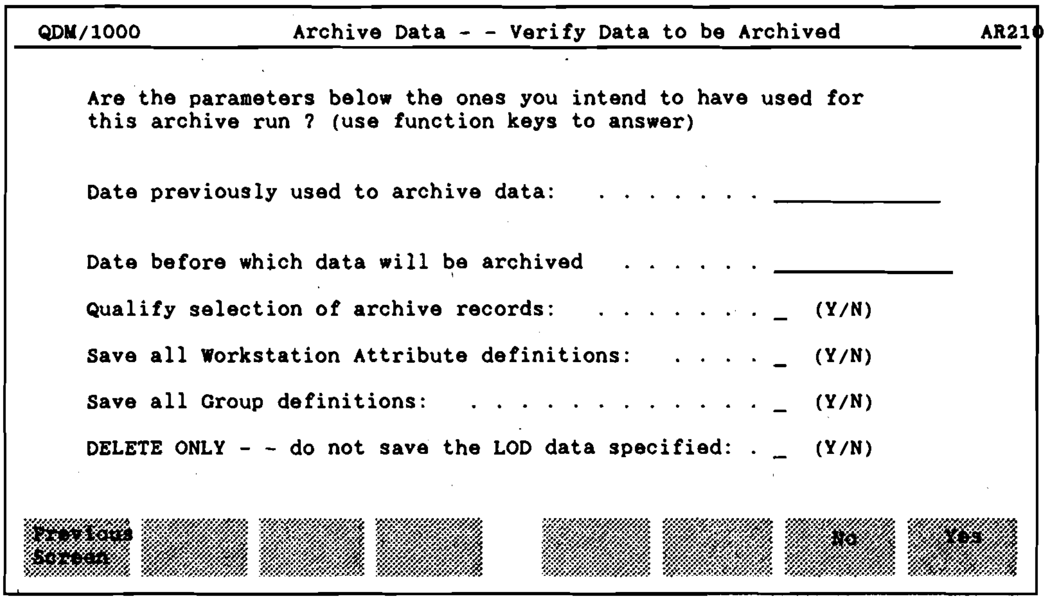
- **Configurator:** Menu-driven user interface to help non-programmers configure, modify and implement the system. Specifies transaction data, prompt strings and validation criteria. Identifies passwords and input/output devices.
- **Startup** program: Brings system on-line with assured data and programmatic integrity
- **Shutdown** program: Shutdown is used to halt data base activity for archive and maintenance functions.
- **Archive**: Defines selection criteria and schedules data extraction program.



```
QDM/1000          System Management Function Selection          PS001

                                1. Configurator
                                2. Startup
                                3. Shutdown
                                4. Archive
                                5. Device Status
                                6. Command Interpreter
                                7. Pfile/Afile Definition
                                8. Pfile/Afile Dictionary
                                9. Validation Set Editor
                               10. Database Editor
                               11. Database Maintenance

                  Enter the number of the task to be performed:
```



```
QDM/1000                  Examine/Change Passwords                 QC800

Manual Data Collection .            Archive . . . . . . . . . .
Report Output . . . . .             Device Status . . . . . . .
Group Editor . . . . . .            Command Interpreter . . . . .
Report Definition . . .             Pfile/Afile/Vset Definition .
System Management . . .             Pfile/Afile Directory . . . .
User Function . . . . .             Database Editor . . . . . .
Configurator . . . . . .            Database Maintenance . . . .
Startup . . . . . . . .             System Specification . . . .
Shutdown . . . . . . . .
```



```
QDM/1000           Archive Data - - Verify Data to be Archived          AR21

     Are the parameters below the ones you intend to have used for
     this archive run ? (use function keys to answer)


     Date previously used to archive data:  . . . . . . . ____________


     Date before which data will be archived  . . . . . . ______________

     Qualify selection of archive records:  . . . . . . . . _  (Y/N)

     Save all Workstation Attribute definitions:  . . . . . _  (Y/N)

     Save all Group definitions:  . . . . . . . . . . . . . _  (Y/N)

     DELETE ONLY - - do not save the LOD data specified: . _  (Y/N)
```

- **Device Status**: Provides "snapshot" of what is happening in the system.
- **Command Interpreter**: Allows access to operating system for system maintenance, data base maintenance, or direct use of HP 1000 utilities and capabilities.
- **Pfile/Afile Definition**: Defines validation criteria and prompts for parameters and attributes in the Process Common and Unit Specific portions of the data collection transaction.

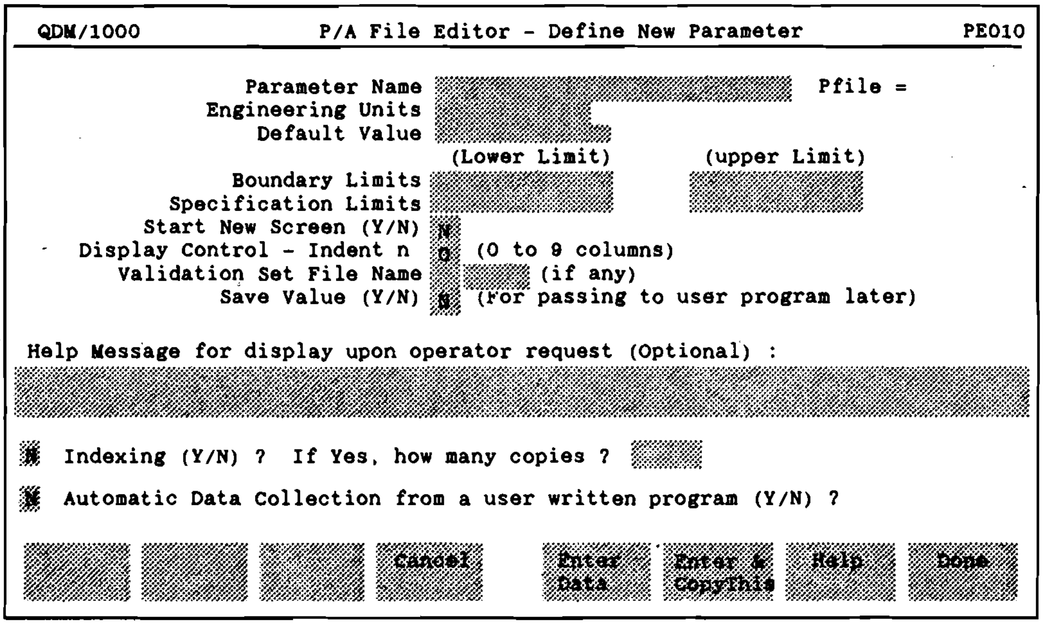
Parametric Data

Units, degrees F, lbs, cm, etc.
Default value
Upper and lower bounds
Upper and lower specifications
Validation set (user-defined table lookup)
160-character help message

Attribute Data

Format
Default value
Validation set (user-defined table lookup)
160-character help message

- **Pfile/Afile Dictionary**: Lists names of parameters and attributes in any PFILE or AFILE.
- **Validation Set Editor**: Allows easy creation and maintenance of validation sets for PFILEs and AFILEs.
- **Data-base Maintenance**: Accesses Image/1000-II data base subsystem utilities.
- **Data-base Editor**: Supports modification of the data base.



```
QDM/1000             P/A File Editor - Define New Parameter              PE010

                  Parameter Name                        Pfile =
               Engineering Units
                   Default Value
                                  (Lower Limit)      (upper Limit)
                 Boundary Limits
            Specification Limits
            Start New Screen (Y/N) N
      -  Display Control - Indent n 0  (0 to 9 columns)
         Validation Set File Name      (if any)
               Save Value (Y/N) N  (For passing to user program later)

 Help Message for display upon operator request (Optional) :


 N  Indexing (Y/N) ?  If Yes, how many copies ?

 N  Automatic Data Collection from a user written program (Y/N) ?
```

User Program supports scheduling of user application programs from within QDM. One program can be scheduled from each QDM terminal. The menu item name is configurable for each terminal as well.

Data Input Auto Schedule. Parametric and attribute data collected in both manual and automatic transactions can trigger user-written programs. These user-written programs can be used in several ways:

- Data can be collected by a program, thus eliminating the need for manual keyboard entry.
- Both manual and automatic transactions can start a program that manipulates or reduces raw data. For example, an alarm capability can be implemented by passing data to a program that compares the data to a limit. Exceeding the limit could generate an alarm.
- Data can be pre-processed by having a program calculate summary statistics of certain parameters prior to being added to the data base. This reduces the number of records that have to be searched to generate a report.
- Data can be diverted before it is added to the application data base. Data of interest to other MIS/EDP departments, such as WIP, labor vouchering and production sequence data can be "stripped out" of transactions for transfer to another MIS/EDP system.

Other Automatic Collection Devices. Any device with file transfer and data formatting ability that can be interfaced to an HP 1000 computer is a potential system for data collection device. The system validates the transaction prior to processing the data.

User-defined Output. The report output function generates a specially formatted data file, according to user specified search criteria and analysis. A graphing module is auto-scheduled for creation of the graphical output. Two programmatic extensions are:

- Data file. Instead of graphing the data file, it can be given a name. Specialized analysis and display programs then can be written to manipulate it.
- Graphing user-specified data files. If file data is properly formatted, the graphing module will create a graph of data from the user's file.

Specifications

Number of Devices

This is highly dependent upon the system configuration. Factors which affect the maximum number of devices are:

- number of ID segments
- number of memory descriptors
- power fail driver
- DS/1000; LU mapping, size of network
- Data Link

A good rule of thumb is a maximum of forty MUX devices. This can be increased; contact the local HP Software Engineer for details.

Performance

Direct Report/Graph Search Response Time: 1 to 10 minutes.

NOTE: Once a search has been completed, the time required for actual hard copy graph generation is a function of the speed of the graphics device and the volume of data.

Automatic Data Collection Transactions/Hour, A900: 620, maximum.

Automatic Data Collection Units/Hour, A900: 2950, maximum (with 50 units/transaction)

NOTE: In general, as the number of units/transaction increases and/or the number of specific parameters, attributes and comments per unit increases, the transactions/hr decreases. Refer to the HP QDM/1000 Performance Brief 5954-0305.

Archiving Deletions/hour, A900: 4700 units, maximum

92131A System Requirements

1. **HP 1000 Micro 24, 26, or 29 or Model 26, 27, or 29 RTE-A and VC+ Computer System** with supported system console and appropriate media option, selected from the following:

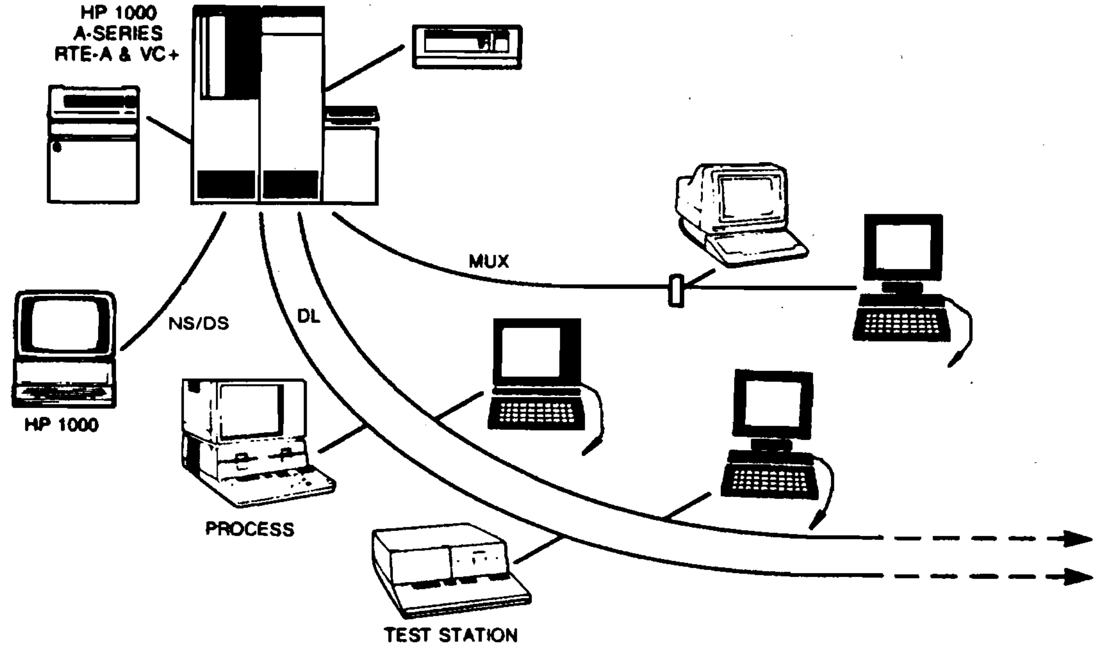
   022: CS/80 (7914) cartridge tape

   051: 1600 cpi magnetic tape

   Suggested system console is 2392A.
2. **Main memory.** At least 3 megabytes of main memory (a detailed application analysis may determine a need for more than 3 megabytes of memory).
3. **Software subsystems,** which must be included in the system.
   a. Order the following subsystems:
      (1) 92081A/R Image/1000-II with Query
      (2) 92861A/R Graphics/1000-II (DGL)
      OR
   b. A development pack that provides those subsystems.
4. **Hard disc:**

   Any A-Series compatible system disc(s) that can provide at least 132 megabytes of disc storage capacity. More may be needed for large user data bases and other user requirements. (See the HP 1000 Ordering Guide, 5954-8564 or later revision, for disc choices.)
5. **Printer:**
   a. 2563B Option 214 Line Printer, 233-300 LPM.
      OR
   b. 293xA Option 046 Printer.

6. **Plotter:**
   a. 7440A Option 002 Colorpro plotter
   AND/OR
   b. 7470A Option 002 Two-pen plotter (discontinued product)
   AND/OR
   c. 7580B/85B Option 060, D/E-size drafting plotter
   AND/OR
   d. 7475A Opt 002 Six-pen plotter
   AND/OR
   d. 7550A Eight-pen plotter with Automatic Sheet Feed
7. **Interface cards:**
   a. One 12009A HP-IB card for printer/plotter interface
   AND/OR
   b. One 12040D 8-Channel Multiplexer Interface for every 8 devices
   c. One 12092A Interface for automatic data collection devices that must be connected to the system via data link
8. **Magnetic Tape Subsystem,** for data base backup and logging. Must specify cabinet option, selected from the following:
   a. 7974A magnetic tape unit with appropriate option
   OR
   b. 7978B magnetic tape unit
9. **Assorted manual and automatic data collection and output devices,** as follows:
   a. **Manual Data Input and Devices.** HP Quality Decision Management/1000 (QDM/1000) supports all HP Display or Graphics terminals that can be connected to HP 1000 A-Series systems via multiplexer, as listed in the HP 1000 Ordering Guide, 5954-8564 or a later revision, except for the HP 2621B Display Terminal, which does not support block mode operation. QDM/1000 also supports the HP 92916A Bar Code Reader when connected via HP 239xA Terminals.
   b. **Automatic Data Input Devices.** HP Quality Decision Management/1000 includes user subroutines written in BASIC for automatic data collection by HP 9000 Series 200/300 computers. Other automatic data collection devices can be used, but the user must program the subroutines needed to transmit the data to the HP 1000 system executing QDM/1000.



HP Quality Decision Management/1000 Configuration

Ordering Information

92131A HP Quality Decision Management/1000 Software

The 92131A product includes:

1. 92131A relocatable software package. Media option must be selected from the following:
   - **022:** CS/80 cartridge tape
   - **051:** 1600 cpi magnetic tape
2. HP 92131Z QDM/1000 Manuals Set (see separate product listing, below).

92131R Right to Copy HP Quality Decision Management/1000 For Use on One Additional Computer System

92131R Right to Copy product is available only to customers who have purchased the 92131A product. 92131R consists of:

1. A license to make one copy of software purchased with 92131A for use on one additional computer system.
2. A license to make one copy of the HP 92131Z QDM/1000 Manuals Set.

92131Z HP Quality Decision Management/1000 Manuals Set

The 92131Z Manuals Set consists of:

1. 92131-90001 User Reference Manual.
2. 92131-90002 System Manager Manual.
3. 92131-90003 Installation Guide.

NOTE: HP Quality Decision Management/1000 has been modified to support certain local languages. Contact your local sales office concerning availability.

Software Support Products

99102D+H00 Response Center Support (RCS) for Factory Automation products.

99102D+P00 Adds One Caller to Response Center Support or Account Management Support for Factory Automation products.

99102D+T00 Account Management Support (AMS) for Factory Automation products (subject to local availability and approval.

99102D+V00 Extended Factory Automation Family Support for use on one additional system licensed under 92131R to extend RCS or AMS (subject to local availability and approval).

92131A+S00 Software Material Subscription service for QDM/1000.

92131A+Q00 Manual Update Service for QDM/1000 for one set of manuals purchased under 92131A/Z.

92131A+W00 Extended Software Material Subscription service for QDM/1000 for use on one additional system licensed under 92131R.

NOTE: The support products listed above cover only the 92131A/R software. Support services for other software in the system, such as RTE-A and VC+ must also be ordered.

HP QDM-Assist Products

92131A+61A	Implementation Analysis
92131A+63A	Implementation Team Training
92131A+65A	Project Implementation Assistance
92131A+65Z	Additional Project Implementation Assistance Unit

RTE Microprogramming Package

HEWLETT PACKARD

For HP 1000 A900 Computer Systems

product number 92049A

HP 92049A is an RTE Microprogramming Package for HP 1000 A900 computers. Supported under the RTE-A real-time operating system, this package provides all the software tools needed for development by the user of customized microprogrammed instructions for HP 1000 A900 Computers.

Features

- **On-line operation in RTE-A operating system.**
- **PROM code generator for outputting production microcode to PROM "burn-in" equipment.**
- **Dynamic Writable Control Store overlay utilities that load Writable Control Store from memory.**
- **Support for HP 1000 microprogram development.**

What Microprogramming Can Do for the User

The availability of microprogramming gives users maximum control over the performance of their applications. Computers often spend 90% of execution time in less than 10% of the program code. With microprogramming, software routines that are frequently used or especially time consuming can be converted to microcoded routines, called as single instructions on the macrocoded level, that typically run 3 to 10 times faster. This can significantly accelerate the execution speed of applications. In addition, custom-designed microprogrammed instructions can make it practical to perform applications that could not be satisfactorily supported using the basic instruction set of the computer. And, key routines from value-added software suppliers can be microcoded to prevent uncontrolled copying from one machine to others.

Functional Description

The HP 92049A package provides a powerful and friendly microprogramming capability using the free-format syntax of a Paraphraser. The Paraphraser includes many Pascal-like features that facilitate microprogram development and simplify maintenance.

The RTE Paraphraser (MPARA) converts a source microprogram into binary object code in a standard microinstruction format for the WCS I/O Utility routine (WLOAD). The source may be entered from a standard RTE text file or from a peripheral device. Editing of the source microprogram is accomplished using the Edit/1000 screen editor that is included with the RTE operating system.

The WCS I/O Utility Routine (WLOAD) uses an ID driver to transfer microprogram object code prepared by MPARA from a file or input device into the HP 12205A A900 Control Store Board.

RTE Driver ID.42 provides software linking between MPARA, WLOAD, and the HP 12205A Control Store Board. The driver is configured into the RTE operating system during system generation and can be called directly with an EXEC call or through the WLOAD routine. Because it uses Direct Memory Access, ID.42 can load 4,096 microinstructions from main memory into WCS in less than 33 milliseconds.

WLOAD also translates MPARA binary object code into binary code formatted for ROM firmware. This output can be used for "burning" PROMs for mounting in the PROM control store area of the Control Store Board.

The profile monitor capability of the HP 92860A Symbolic Debug/1000 package is available to aid in identifying those crucial areas that can most significantly benefit from being microcoded. Executing under an RTE-A or RTE-6/VM operating system, the profile monitor plots the percent of time spent in various parts of a program.

Functional Specifications

Environment

The HP 92049A RTE Microprogramming Package operates in an HP 1000 A900 system with 768k bytes or more memory and hard disc operating under the HP 92077A RTE-A operating system. Supported computers and SPUs include the HP 2139A, 2199C/D, 2439A, and 2489A.

Memory Usage

A 64k byte partition is required to support MPARA and all other HP 92049A software modules.

Control Store Hardware Required

The HP 92049A RTE Microprogramming Package requires one HP 12205A Control Store Board.

Control Store Available to the User

The HP 12205A Control Store Board provides 4k 48-bit words of Writable Control Store plus space for mounting 2k 48-bit words of PROM control store ROMs.

Ordering Information

HP 92049A RTE Microprogramming Package

The HP 92049A RTE Microprogramming Package consists of:

1. The MPARA, WLOAD, and ID.42 software modules on Media Option 022, 044, or 051, **one of which must be ordered.**
2. 92049-90001 RTE Microprograming Package Reference Manual.
3. 92049-90002 RTE Driver ID.42 Programming and Operation Manual.

92049A Media Options

022: Provides software on CS/80 cartridge tape.

044: Provides software on Microfloppy disc for HP 12120A*/12122A Integrated Discs in Micro/1000 Package or HP 9122D or 9133A*/B*/H*/L or 9153B Disc.

051: Provides software on 1600 cpi magnetic tape.

** Discontinued product, listed here for reference only.*

HP 92049R Use Of RTE Microprogramming Package On One Additional Computer System

The HP 92049R product is available only to customers who have purchased HP 92049A. HP 92049R consists of:

1. The right to make one copy of software purchased with the 92049A RTE Microprogramming Package for use on an additional system.
2. 92049-90001 RTE Microprograming Package Reference Manual.
3. 92049-90002 RTE Driver ID.42 Programming and Operation Manual.

Software Support Products

See the HP 1000 Ordering Guide, 5954-8564 or a later revision, for definitions and availability of software support products for the HP 92049A RTE Microprogramming Package.

Device Drivers

HEWLETT PACKARD

For Peripheral Device Software Interfacing to A-Series Systems

Included in RTE-A

The HP 92077A RTE-A operating system includes relocatable driver routines for supported peripheral devices, as listed in Table 2-15, below.

Table 2-15. Device Drivers Supplied with RTE-A for A-Series Computer Systems

NOTE: Currently-available devices and interfaces are listed below in BOLD FACE type; all other devices and interfaces, in the lighter typeface and flagged with an asterisk (*), are discontinued products listed here for reference only.

SUPPORTED DEVICES OR CAPABILITIES		DEVICE DRIVER	SUPPORTED INTERFACE	INTERFACE DRIVER
TERMINALS				
2382A*	Office Display Terminal	DD*00	**12005A*/12005B Async Serial Interface**	ID*00 ID*01 †
2392A	**Display Terminal**			
2393A	**Graphics Terminal**			
2397A	**Color Graphics Terminal**		**12040A*/B*/12040C◇ Eight-Channel Async Multiplexer**	**IDM00**
2621A*/B*	Display Terminal			
2622A*	Display Terminal			
2623A*	Graphics Terminal	DDC00	**12040D Eight-Channel Async Multiplexer**	**ID800** **ID801 ‡**
2624A*/B*	Display Terminal			
2625A*	Dual System Terminal			
2626A*	Display Station		**12100A Single-Board Computer Four-Channel On-Board I/O Multiplexer**	**ID400**
2627A*	Color Graphics Terminal			
2628A*	Word Processing Terminal			
2645A*#	Display Station			
2648A*#	Graphics Terminal		**12005A*/12005B Async Serial Interface**	**ID100** **ID101 †**
2647A*#	Intelligent Graphics Terminal			
45610B*	Touchscreen Terminal			
72425A	**Vectra Model 25 PC****			
72435A*	Vectra Model 35 PC**	DD*00	37222A* Integral Modem Interface	IDM00
72425A	**Vectra Model 25 PC****			
PRINTERS connected via Multiplexer				
2225D	**Thinkjet Printer**	DD*00	**12040A*/B*/12040C◇ Eight-Channel Async Multiplexer**	**IDM00**
2227A	**Quietjet Plus Printer**			
2228A	**Quietjet Printer**			
2563A+049*	Line Printer			
2563B+049	**Line Printer**			
2564B+049	**Line Printer**			
2565A+049*	Line Printer	DDC00	**12040D Eight-Channel Async Multiplexer**	**ID800**
2566A+049*	Line Printer			
2566B+049	**Line Printer**			
2631A*	Printer			
2686A	**Laserjet Printer**			
2686A+300	**Laserjet Plus Printer**			
2932A	**General-Purpose Printer**		**12100A Single-Board Computer Four-Channel On-Board I/O Multiplexer**	**ID400**
2933A*	Factory Data Printer			
2934A	**Business Printer**			

* Discontinued product listed here for reference only.

◇ The 12040C Multiplexer is not recommended for new applications.

† Driver ID*01 or ID101 supports both modem and direct connect communication with terminals.

‡ Driver ID801 is required instead of ID800 for 12040D used with the 37214A Systems Modem.

# Cartridge tape units in 2645A, 2648A, and 2647A Terminals require Device Driver DD*20 w/DD*00 and DDC01 w/DDC00.

** 724xxA Vectra PCs require monochrome or color monitor connected via appropriate adapter card, serial-parallel, or dual serial interface, disc operating system, and AdvanceLink 2392 software to function as an HP 1000 A-Series terminal. See HP 1000 Ordering Guide, 5954-8564 or a later revision for more information.

Table 2-15. Device Drivers Supplied with RTE-A for A-Series Computer Systems, continued

NOTE: Currently-available devices and interfaces are listed below in **BOLD FACE** type; all other devices and interfaces, in the lighter typeface and flagged with an asterisk (*), are discontinued products listed here for reference only.

SUPPORTED DEVICES OR CAPABILITIES		DEVICE DRIVER	SUPPORTED INTERFACE	INTERFACE DRIVER
PRINTERS connected via HP-IB				
2563A+214*	Line Printer	DDC12	**12009A HP-IB Interface**	ID*37
2563B+214	**Line Printer**			
2564B+214	**Line Printer**			
2565A+214*	Line Printer			
2566A+214*	Line Printer			
2566B+214	**Line Printer**			
2608S+214*	Line Printer			
2631A*	Printer	DD*12	**12009A HP-IB Interface**	ID*37
2932A	**General-Purpose Printer**			
2933A*	Factory Data Printer			
2934A	**Business Printer**			
2671A*	Thermal Printer	NOTE A	**12009A HP-IB Interface**	ID*37
2671G*	Graphics (thermal) Printer			
2673A*	Intelligent Graphics Printer			
GRAPHICS DEVICES				
7440A+001	**Colorpro Plotter**	DD*00 NOTE B	**12040A*/B*/12040C◇ Eight-Channel Async Multiplexer**	IDM00
7470A+001*	Two-pen Plotter			
7475A+001	**Six-pen Plotter**			
7510A	**Color Film Recorder**	DDC00 NOTE B	**12040D Eight-Channel Async Multiplexer**	ID800
7550A	**Auto Sheet Feed Plotter**			
7570A	**Draftpro Plotter**			
7580B+060	**Drafting Plotter**		**12100A Single-Board Computer Four-Channel On-Board I/O Multiplexer**	ID400
7585B+060	**Drafting Plotter**			
7586B+060	**Drafting Plotter**			
7225B	Plotter with 17501A HP-IB Interface	NOTES B and C	**12009A HP-IB Interface**	ID*37
7440A+002	**Colorpro Plotter**			
7475A+002	**Six-pen Plotter**			
7510A	**Color Film Recorder**			
7550A	**Auto Sheet Feed Plotter**			
7570A	**Draftpro Plotter with 17570A HP-IB Interface**			
7580B+060	**Drafting Plotter**			
7585B+060	**Drafting Plotter**			
7586B+060	**Drafting Plotter**			
9111A*	Graphics Tablet			
9872A*/B*/S*	Graphics Plotter			
9872C*/T*	Graphics Plotter			
INDUSTRIAL WORKSTATION TERMINALS				
3081A	**Industrial Workstation Terminal**	None	**12040A*/B*/12040C◇ Eight-Channel Async Multiplexer**	IDM00
			12040D Eight-Channel Async	ID800
			12100A Single-Board Computer Four-Channel On-Board I/O Multiplexer	ID400

* Discontinued product listed here for reference only.

◇ The 12040C multiplexer is not recommended for new applications.

NOTE A: 2671A, 2671G, and 2673A Printers are supported only by HP-IB interface driver ID.37, so all output to those printers must transfer character strings at the interface level.

NOTE B: Device handlers for graphics devices are provided in the 92861A Version 2.0 Graphics/1000-II Device-Independent Graphics Library.

NOTE C: HP-IB connected plotters and other graphics devices are supported by HP-IB interface driver ID.37 and device handlers in the 92861A Version 2.0 Graphics/1000-II Device-Independent Graphics Library, which is required for operation.

Table 2-15. Device Drivers Supplied with RTE-A for A-Series Computer Systems, continued

NOTE: Currently-available devices and interfaces are listed below in BOLD FACE type; all other devices and interfaces, in the lighter typeface and flagged with an asterisk (*), are discontinued products listed here for reference only.

SUPPORTED DEVICES OR CAPABILITIES	DEVICE DRIVER	SUPPORTED INTERFACE	INTERFACE DRIVER
DISCS AND CARTRIDGE TAPE DRIVES (CTDs)			
12120A* 20 MB Fixed Disc + 630 kB Microfloppy for integration in Micro/1000 CPU/SPU	None	12022A* Interface included with integrated Discs product or option	ID*27
12121A* 20 MB Fixed Disc for integration into Micro/1000 CPU/SPU			
263xA/E/248xA Option 110* 10 MB Fixed Disc + 270 kB Microfloppy for integration in Micro/1000 CPU/SPU			
263xA/E/248xA Option 111* 15 MB Fixed Disc + 270 kB Microfloppy for integration in Micro/1000 CPU/SPU			
12122A 20 MB Fixed Disc + 630 kB Microfloppy for integration into Micro/1000 CPU/SPU	DD*33	**12009A HP-IB Interface**	ID*37
35401A+100 Autochanger Cartridge Tape Subsystem			
7907A 40 MB Fixed/Removable Disc			
7908P/R* 16 MB Fixed Disc with CTD			
7911P/R 28 MB Fixed Disc with CTD			
7912P/R 65 MB Fixed Disc with CTD			
7914CT 131 MB Fixed Disc with CTD			
7914P/R 131 MB Fixed Disc with CTD			
7914ST 131 MB Fixed Disc + 1600 cpi Magnetic Tape Unit**			
7933H/XP 404 MB Fixed Disc			
7935H/XP 404 MB Removable Media Disc			
7936H/XP 307 MB Fixed Disc			
7937H/XP 571 MB Fixed Disc			
7941A 24 MB Fixed Disc			
7942A 24 MB Fixed Disc + Cartridge Tape Drive			
7945A 55 MB Fixed Disc			
7946A 55 MB Fixed Disc + Cartridge Tape Drive			
7957A 81 MB Fixed Disc			
7958A 130 MB Fixed Disc			
9122D Dual 630 kB Microfloppy Discs			
9133D* 15 MB Fixed Disc + 630 kB Microfloppy			
9133H* 20 MB Fixed Disc + 630 kB Microfloppy			
9133L 40 MB Fixed Disc + 630 kB Microfloppy			
9134D* 15 MB Fixed Disc			
9134H* 20 MB Fixed Disc			
9134L 40 MB Fixed Disc			
9144A Cartridge Tape Subsystem			
9153B 20 MB Fixed Disc + 630 kB Microfloppy			
9154B 20 MB Fixed Disc			
7906M+102* 19 MB MAC Master Cartridge Disc	DDM30	**12009A HP-IB Interface**	ID*37
7920M+102* 50 MB MAC Master Disc			
7925M+102* 120 MB MAC Master Disc			

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* Discontinued product listed here for reference only.

** The 1600 cpi magnetic tape unit in the 7914ST product requires a separate 12009A HP-IB interface and uses magnetic tape device driver DD*24.

Table 2-15. Device Drivers Supplied with RTE-A for A-Series Computer Systems, continued

NOTE: Currently-available devices and interfaces are listed below in BOLD FACE type; all other devices and interfaces, in the lighter typeface and flagged with an asterisk (*), are discontinued products listed here for reference only.

SUPPORTED DEVICES OR CAPABILITIES	DEVICE DRIVER	SUPPORTED INTERFACE	INTERFACE DRIVER
DISCS AND CARTRIDGE TAPE DRIVES, continued			
9121A* Dual 270 kB Microfloppy Discs 9133A* 4.6 MB Fixed Disc + 270 kB Microfloppy 9133B* 9.2 MB Fixed Disc + 270 kB Microfloppy 9133V+004* 4.5 MB Fixed Disc + 270 kB Microfloppy 9133XV+010* 9.6 MB Fixed Disc + 270 kB Microfloppy 9134A* 4.6 MB Fixed Disc 9134B* 9.2 MB Fixed Disc 9134XV+010* 9.6 MB Fixed Disc 9895A* Dual 1.2 MB Flexible Discs	DD*30	12009A HP-IB Interface	ID*37
MAGNETIC TAPE UNITS			
7970E+626/636* 1600 cpi Magnetic Tape Unit 7971A+140/144* 1600 cpi Magnetic Tape Unit	DD*23	12009A HP-IB Interface	ID*37
7974A 1600 cpi Magnetic Tape Unit 7978A* 6250/1600 cpi Magnetic Tape Unit 7978B 6250/1600 cpi Magnetic Tape Unit	DD*24	12009A HP-IB Interface	ID*37
NON-DEVICE DRIVER-SUPPORTED CAPABILITIES			
Disc emulation for read-in of programs from PROM storage	None	12008A PROM Storage Module	ID*36
Power fail/auto restart of system operations	None	12013A, 12154A, 12157A*, or 12157B Battery Backup Card	ID*43
Interfacing of various parallel I/O devices	None	12006A Parallel Interface	ID*50
CPU-to-CPU communication via parallel link	None	12006A Parallel Interface	ID*52
Digitizing of Analog Input signals	None	12060A*/12060B A-to-D Converter	ID*50
Analog Output	None	12062A D-to-A Converter	ID*50
Interfacing of digital inputs and outputs	None	12063A Isolated Digital I/O Interface	ID*50

* Discontinued product listed here for reference only.

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10. Discs and Tape Units

Table 3-1. HP 1000 A-Series Performance-Packaging Summary

COMPARISON ITEMS	A900 Computer	A700 Computer	A600+ Computer	A400 Computer
BASE PROCESSING SPEED				
- Average	1.3 MIPS	0.4 MIPS	0.4 MIPS	0.4 MIPS
- Fastest Instructions	3 MIPS	1 MIPS	1 MIPS	1 MIPS
FLOATING POINT SPEED	Hardware FPP is Standard	12156A Hardware FPP is Optional	Floating Point is Firmware Based	Floating Point is Firmware Based
- B1D Whetstones	821 kwips	340 kwips	113 kwips	122 kwips
- Single-precision, F/W	Not applicable	54,400 FLOPS	64,000 FLOPS	54,400 FLOPS
- Single-precision, H/W	500,000 FLOPS	204,000 FLOPS	Not applicable	Not applicable
- Double-precision, H/W	245,000 FLOPS	99,700 FLOPS	Not applicable	Not applicable
SCIENTIFIC INSTRUCTION SET	Standard	With 12156A FPP	Software equivalent routines	Software equivalent routines
- Single-precision	50,000 oper/sec	36,000 oper/sec	Not specified	Not specified
VECTOR INSTRUCTION SET	Standard	With 12156A FPP	Software equivalent routines	Software equivalent routines
- Single-precision speed	688,000 oper/sec	245,000 oper/sec	Not specified	Not specified
- Single-precision setup	4.9 microsec	13.5 microsec	Not specified	Not specified
- Double-precision speed	421,000 oper/sec	144,000 oper/sec	Not specified	Not specified
- Double-precision setup	6.2 microsec	13.5 microsec	Not specified	Not specified
MAIN MEMORY CAP.				
- ECC (256K RAMs)	3 MB to 18 MB	1 MB to 8 MB	512 kB to 8 MB	Not supported
- ECC (64K RAMs)	768 kB to 4.5 MB	512 kB to 2 MB	Not supported	Not supported
- Parity (64K RAMs)	Not supported	512 kB to 4 MB	512 kB to 4 MB	512 kB to 4 MB
CARD CAGE SLOTS USED BY CPU & BASE MEMORY	5	4 (5 w/FPP)	2	1
MEMORY CYCLE TIME	181 nanosec, avg effective at 88% cache hit rate	500 nanosec	454 nanosec	454 nanosec
I/O BANDWIDTH				
- Output	2.5 MB/sec	4.0 MB/sec	4.27 MB/sec	4.27 MB/sec
- Input	3.7 MB/sec	4.0 MB/sec	4.27 MB/sec	4.27 MB/sec
AVAILABLE CARD CAGE SLOTS				
- In 20-slot computer	15	16 (15 w/FPP)	18	Not available
- In Micro/1000 comp.	9	11 (10 w/FPP)	12	13
- In "Cooler" Package	Not supported	Not supported	4	5
USER MICROPROGAMMABILITY	Yes. 4k words of WCS and 2k words of PCS are available.	Yes. 8k words of control store are available.	Not supported	Not supported
PACKAGING				
- Rack cabinet systems	Model 29 (2199C/D)	Model 27 (2197C/D)	Model 26 (2196C/D)	Not available
- Micro/1000 systems	Micro 29 (2489A)	Micro 27 (2487A)	Micro 26 (2486A)	Micro 24 (2484A)
- 20-slot box computers	2139A	2137A	2156B	Not available
- Micro/1000 computers	2439A	2437A	2436A/E	2434A
- "Cooler" pkgd computers	Not available	Not available	Micro 16 (2426E/F)	Micro 14 (2424A)

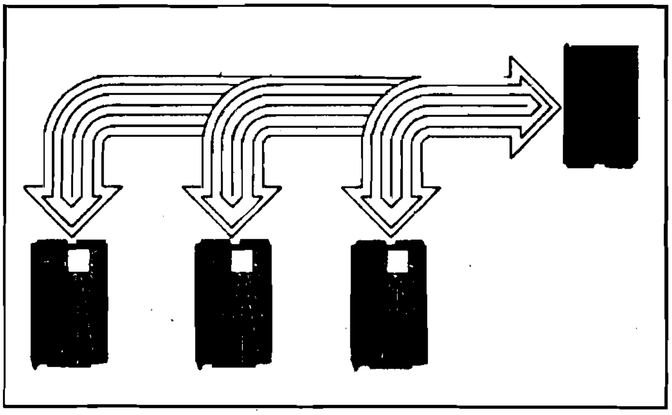
HP 1000 A-Series Computer Design and Specifications

HP 1000 A-Series Computer Systems

The HP 1000 A-Series comprises a compatible family of computers that feature distributed intelligence input/output. This design uses an I/O processor on each interface to maximize I/O efficiency and minimize CPU involvement with I/O operations, thereby optimizing overall processor price/performance for a wide variety of applications. This section covers the A400, A600+, A700, and A900 computers.

Features

- **Total compatibility of comparable instructions in all A-Series computers.**
- **A wide choice of computer performance levels from 0.4 to 1.3 million instructions/sec and 64k to 500k floating point operations/sec.**
- **Distributed intelligence I/O design for DMA per channel efficiency.**
- **High reliability and maintainability through the use of simple packaging, self test, and board level diagnostics.**
- **Built-in dynamic mapping system, memory protect, and time base generator.**
- **Memory capacity up to 18 MB in A900, up to 8 MB in A600+ and A700, up to 4 MB in A400.**
- **Support for Virtual Memory for data to 128M bytes and up to 15 Extended Memory Areas for data up to 2M bytes, each accessible to as many as 63 different programs.**
- **Extensive software support including operating system, FORTRAN and Pascal compilers, BASIC interpreter and compiler, Macroassembler, screen editor, data base management system, graphics software, distributed systems networking, and manufacturing applications.**
- **Boot loaders included for boot-up from:**
  - Adjacent computer system in an NS/1000 or DS/1000-IV Distributed Systems Network.
  - Disc drive
  - Magnetic tape
  - PROM Storage Module
- **Remote loading and diagnosis for programming and operation of systems from remote sites**



Overview (See Table 3-1, facing.)

The A900 Computer

The A900 is Hewlett-Packard's fastest HP 1000 Computer. Pipeline technology with cache memory, boosted even more by a fast hardware floating point processor with scientific and vector instruction sets, provides unmatched computation speed. Base set speed of 1.3 million instructions per second and 500,000 floating point operations per second provide enough computational power to conquer thousands of applications that have previously been far beyond the reach of minicomputers. A sizable 768k bytes of Error Correcting Code (ECC) memory is standard and battery backup is optional to maximize system integrity The base 768k bytes can be replaced with 3M bytes, which is expandable to a total of 18M bytes, providing enough capacity for very large applications. User microprogramming is supported, for the development of special instructions or the conversion to firmware of frequently-used software routines for significantly-faster execution.

The A700 Computer

The A700 is a microprogrammed and user microprogrammable computer that offers the user exceptional flexibility. For applications that require higher speed calculations than are possible with firmware and software in the base A700 computer, an optional hardware floating point processor with scientific and vector instruction sets provides 6 to 12 times faster floating point math, up to 31 times faster trigonometric and transcendental calculations, and 8 to 20 times faster vector and matrix arithmetic.

The A600+ Computer

The A600+ is a full-function microcomputer that offers the HP 1000 user 0.4 million instructions per second performance at surprisingly low cost. Although the A600+ is a microprogrammed computer, it is not designed to support microprogramming by the user. This two-board microcomputer can support up to 8 MB of ECC memory.

The A400 Computer

The new A400 computer is a single-board microcomputer with 0.5 MB of on-board parity memory, a four-port on-board I/O multiplexer, and performance about 10% faster than the A600+ microcomputer. Because it is a single-board design that accommodates only parity memory, its maximum capacity is 4 MB of parity memory.

Packaging

Rack Cabinet Systems. The A600+, A700, and A900 Computers are available in free-standing Model 26, 27, and 29 Systems configured around a set of basic system elements, called the System Processor Unit (SPU). These systems are managed by the RTE-A Real-Time Executive Operating System, which supports multi-programming, high-level program languages, virtual memory and sharable extended memory areas for data, data base management, distributed systems networking, graphics software, and up to 18 megabytes of main memory in the Model 29, up to 8 megabytes in the Model 26 or 27.

All of these systems support the VC+ enhancement to RTE-A for execution of programs up to 7.75 megabytes. The VC+ software is included in the Model 27 and 29 systems.

The SPU hardware consists of the A-Series Computer as described below, HP-IB disc interface and serial (system console) interface, with 13 to 16 card cage slots available for additional memory and 1/0 cards. This is housed in either a tall cabinet with extra rack space for additional equipment or a short cabinet without extra space.

To the SPU, OEMs and end users add an operator terminal, one or more hard-discs, and other peripheral devices as needed for their applications. Multiple fixed discs with 24 to 571 megabyte capacity, some with built-in tape cartridge backup, can be used on the system. Over 2.2 gigabytes of disc capacity can be connected via a single disc interface.

Micro/1000 systems. For applications that require A400, A600+, A700, or A900 performance in a small space, the respective processors are available in a Micro/1000 package as the Micro 24, 26, 27, and 29 systems.These systems, which have a 14-slot card cage (vs 20 slots in the larger systems) can include integral 19.4M byte fixed and 630k byte microfloppy discs or any of the discs available with the Model 26, 27, and 29 systems. The Micro/1000 systems support 92078A VC+ for programs to 7.75 megabytes.

Computers. The A600+, A700, and A900 computers are available in packaged form as the 2156B, 2137A, and 2139A (box) Computers for users who desire to package their own hardware and software. These box computers include a 20-slot card cage, of which 15 to 18 card cage slots are available after provision for computer and memory circuit boards of the base configuration.

The A400, A600+, A700, and A900 computers are also available in the Micro/1000 package as the 2434A, 2436A/E, 2437A, and 2439A Computers.

For smaller systems, the A400 and A600+ computers are available as the 2424A Micro 14 Computer and as the 2426E/F Micro 16 Computer, in a 6-slot "cooler" package with 4 or 5 slots available for additional memory and I/O cards.

Board Computer. The A400 computer is available as the 12100A Single-Board Computer for packaging into small OEM applications. The A600+ computer is available as the 2106BK two-board set for packaging into OEM products.

Memory System

The memory array cards available for A-Series computers includes ECC memory cards based on 256K RAMs for all A600+, A700, and A900 computers, ECC memory cards based on 64K RAMs for A700 and A900 computers, and parity memory cards based on 64K RAMs for A400, A600+ and A700 computers. High-density memory cards based on 256K RAMs can provide up to 8 megabytes of ECC memory in A600+ or A700 computers, up to 18 megabytes of ECC memory without battery backup, 12 megabytes of ECC memory with battery backup in A900 computers. The parity memory cards based on 64K RAMs can provide up to 4 megabytes of parity memory in A400, A600+, and A700 computers.

Within the limitation of a maximum of four array cards in A600+ and A700 computers and systems, ECC memory systems can incorporate both 1 MB or 2 MB ECC memory array cards and existing parity memory cards (or ECC memory cards in A700 computers). Similarly, within the limitation of a maximum of eight array cards (four with battery backup), A900 computers can use a combination of 3 MB ECC memory array cards and 768 kB ECC memory cards.

Interfaces and Peripherals

A full line of HP manufactured interfaces and peripheral devices support the highly flexible configuration of one-vendor systems to satisfy a wide variety of application requirements.

Central Processor

A900 Processor Description

Cache memory for fast processing. Pipeline technology gives the A900 computer a superfast 133 nsec cycle time for each successful cache memory access. The cache incorporates hardware address create logic for fast next-address generation and supports a 32-bit data bus to the memory controller. With a hit rate typically 88%, memory access time averages about 181 nanoseconds.

A hardware floating point processor speeds floating point calculations. An integrated set of floating point chips accelerates processing for single and double precision floating point operations to real-time speeds – over 575,000 single precision additions or subtractions per second, over 535,000 multiplications per second, and over 250,000 divisions per second.

A Scientific Instruction Set (SIS) of nine single precision and nine double precision trigonometric and transcendental functions and a polynomial evaluation instruction uses the fast floating point computational power of the A900 to solve complex scientific and engineering calculations quickly and accurately. For example, the A900 can make over 65,000 single-precision square root calculation per second and over 38,000 hyperbolic tangent calculations per second.

$$Z = \frac{a + a_1 x + a_2 x^2 + \ldots + a_n x^n}{b + b_1 x + b_2 x^2 + \ldots + b_n x^n}$$

at hardware speeds. This capability is useful for function approximation, such as curve fitting or or correction for non-linear response of a strain gage, thermocouple, or other transducer.

A Vector Instruction Set (VIS) applies the A900's floating point processing power to highly-efficient repetitive processing of vectors and matrices. Because they take advantage of the inherent efficiency of vector processing, the VIS instructions can achieve rates ranging from over 267,000 operations per second for single-precision vector divide to over 830,000 operations per second for vector add, subtract,and multiply, after initial setup times of 4 to 5 microseconds.

Error Correcting Code (ECC) Memory. A sizable 768k bytes of ECC memory, expandable to 18M bytes without battery backup, to 12M bytes with battery backup, is standard. The ECC capability corrects all single-bit errors without interrupting the operating system, which maximize system integrity and reliability

User microprogrammability is supported by an optional control store board and an easy-to-use, Pascal-like Paraphraser.This gives the user the ability to convert software routines that are frequently used or especially time consuming to microcoded routines that typically run 2 to 10 times faster.

A700 Processor Description

Bit-slice central processor. The A700 computer is a bit-slice,microprogrammed machine on two CPU cards. Its memory controller supports one to four parity or Error Correcting Code (ECC) memory cards. Up to 8 megabytes of ECC memory can be provided.

User microprogrammability is supported by optional Writable and PROM Control Store cards and an easy-to-use Pascal-like Paraphraser*. This gives user the ability to convert software routines that are frequently used or especially time consuming to microcoded routines that typically run 2 to 10 times faster

An optional computation acceleration processor may be ordered as the 12156A Hardware Floating Point Processor card. This card provides hardware floating point computation speeds about 40% of A900 speeds plus Scientific and Vector Instruction Sets similar to those of the A900 with speeds about half as fast.

* *The paraphraser is part of the HP 92045A RTE Microprogramming Package for user microprogramming of A700 Computers, which is a discontinued product.*

A600+ Processor Description

Bit-Slice Central Processor. The A600+ computer is implemented on a single card with bipolar bit-slice microprocessors. The processor is a horizontally microprogrammed CPU with a 56-bit wide microword format. The wide microword format eliminates the need for time-consuming decode logic so the A600+ computer responds to microinstructions with maximum speed and efficiency and provides high performance at surprisingly low cost.

1M bytes of memory and controller on a single card. The A600+ Memory Controller includes 128k bytes or 512k bytes of parity memory or 512k bytes or 1M byte of Error Correcting Code (ECC) memory on one card. Up to 8M bytes of ECC memory can be provided by adding memory cards to an A600+ computer with a 1M byte ECC memory controller.

NOTE: Hardware floating point and user microprogramming are not supported in the A600+ computer.

A400 Processor Description

The A400 computer, 0.5 megabytes of parity memory, and four on-board serial I/O channels are all packed compactly onto a single board. VLSI techniques make possible the high packaging densities required while also providing about 10% faster performance than the A600+ two-board computer. Because it can use only parity memory, however, the A400 can support only 4 megabytes of main memory vs 8 megabytes of ECC memory in the A600+ or A700.

NOTE: Hardware floating point and user microprogramming are not supported in the A400 computer.

High-Level Program Accelerator Instructions

The A-Series computers all include instructions designed to accelerate the execution speed of programs written in FORTRAN or Pascal. These microcoded routines speed up parameter passing and other commonly used high-level program operations 2 to 20 times, compared to the same routines in software.

Virtual Control Panel

A ROM-based Virtual Control Panel (VCP) program enables an operator to perform control panel functions via a local or remote-connected terminal or an adjacent HP 1000 Computer System through a standard serial, multiplexer (channel 1) or NS/1000 or DS/1000-IV I/O interface card. Only one 1/0 interface card in the system can be given this capability at any one time. That I/O card can connect to a terminal or other computer system accessible only to the system manager or the maintenance department. The operator at the VCP terminal or system can examine and change the contents of registers and memory locations, control program execution, initiate the self test, and select a bootstrap loader and initiate the boot-up of a system.

Because of its remote operating ability the VCP can be used for remote isolation of system faults, which can help to minimize support costs for OEM products that use the A-Series components. When not being used as the VCP, the VCP-assigned terminal can be used in the same way as any other terminal on the system, except for the break key.

Boot-up Sources and Auto Boot-up

The A-Series computers support boot-up from the following sources, of which sources 1 through 3 can be used for auto boot-up.

1. An adjacent HP 1000 System in an NS/1000 or DS/1000-IV network via the 12007A/B or 12044A interface.
2. A disc memory via the 12009A HP-IB interface or other disc interface.
3. 12008A PROM Storage Module.
4. A 797xA/E Magnetic Tape Unit via the 12009A HP-IB interface.

Self Test and Diagnostics

Microcoded and macrocoded self tests check the CPU, memory, and the 1/0 masters of installed interfaces, either automatically on power-up or when requested by an operator via the Virtual Control Panel. HP 24612A and 24398B diagnostic packages are also available for stand-alone testing of all computer hardware, including 1/0 interfaces. A BASIC-like interpreter is provided in the 24612A package to help the user prepare diagnostics for user-designed interfaces.

Extensive Software Support

Operating System Software

92077A RTE-A Real-Time Executive operating system (for 512 kB to 18 MB memory-included in 219xC/D Systems and 248xA Micro/1000 Systems)

92078A VC+ Enhancement to RTE-A operating system (included in 2197C/D and 2199C/D Systems)

Program Development Software

92836A FORTRAN 77 Compiler

92833A Pascal/1000 Compiler

92857A BASIC/1000C Interpreter-Compiler package.

Macro/1000 Assembler (included in RTE-A).

Edit/1000 Interactive Screen Editor (included in RTE-A).

92860A Symbolic Debug/1000.

Microprogram Development Software

92045A RTE Microprogramming Package for A700*.

92049A RTE Microprogramming Package for A900.

** HP 92045A RTE Microprogramming Package is a discontinued product listed here for reference only.*

Data Management Software

Command Interpreter (included in RTE-A).

File Manager (included in RTE-A).

96081A Image/1000-II Data Base Management System.

92069A Image/1000 Data Base Management System.

Graphics Software

92861A Version 2.0 Graphics/1000-II Device-Independent Graphics Library for general graphics support.

92862A Version 2.0 Graphics/1000-II Advanced Graphics Package for interactive and/or 3-D graphics support.

Communications Software

91750A DS/1000-IV Network software for communication with other HP 1000 systems or HP 3000 systems.

91751A DSN/X.25 software for communication with other systems via packet-switching networks.

91781A RJE/1000-II software for remote job entry to IBM or IBM plug-compatible systems.

91782A DSN/MRJE software for multileaving remote job entry to IBM or IBM plug-compatible compatible systems.

91784A PMF/1000 Programmable Mainframe facility software for program-to-program communication with IBM or IBM plug-compatible systems.

91790A NS/1000 Software for system-to-system communication via LAN, X.25, or point-to-point links.

91732A Data Link Software for communication with multiple terminals and/or multiple systems via multipoint or data link lines.

Manufacturing Applications Software

92121A PMC/1000 Process Monitoring and Control Software

92131A QDM/1000 Quality Decision Management Software.

94200B through 94206B PCIF/1000 Programmable Controller Interface Software.

Communications Support

A-Series computers can communicate with terminals and other systems in the following ways:

- With terminals via single-channel interface, eight-channel multiplexer interface, or data link/multipoint interface.
- With other HP 1000 systems via DS/1000-IV HDLC point-to-point interface or multidrop Data Link.
- With HP 3000 systems via DS/1000-IV Bisync point-to-point interface.
- With HP 1000 A-Series, HP 3000, HP 9000, and other systems via LAN.
- With HP 1000, HP 3000, and other systems via DSN/X.25 interface to packet-switching networks.
- With IBM or IBM plug-compatible system via Multi-Use Programmable Serial interface and remote job entry or program-to-program communications software.

Input/output

Distributed Intelligence Architecture Boosts I/O Efficiency and Simplifies Programming

Computation and input/output are often both entirely controlled by the central processor. In A-Series computers, the central processor has been relieved of I/O DMA processing.That function has instead been assigned to an individual processor (IOP) on each interface card. Thus, the CPU is freer to process data. The CPU, the IOPs on each interface, and memory all communicate with each other via a common bus, except in the A900, which has a separate I/O bus.

Low-Overhead I/O

I/O Processor-Managed DMA. The built-in intelligence of each IOP supports autonomous control of I/O operations. This includes high-speed direct memory access (DMA) and can even include chained multiple DMA transfers with CPU involvement only at the start and completion of the entire chain.

DMA Per Channel. The standard IOP is provided on every A-Series interface, supporting direct memory access (DMA) on all I/O channels.

I/O Access Priority. Priority of I/O interrupt and access to memory is controlled by interface card position on the card cage bus with respect to the CPU. The interface closest to the CPU has the highest priority those farther down the bus have successively lower priority

Simplified I/O Programming. The same level of intelligence that supports DMA-per-channel operation also simplifies I/O programming. The master IOP logic recognizes interface I/O addressing independently of I/O card position on the card cage bus. This supports standardization of I/O addresses and functions in programs without requiring any particular arrangement of I/O cards in the card cage.

Compatibility with other HP 1000 Computers

Compatibility with HP 1000 M/E/F-Series. A-Series computers execute the same HP 1000 base set instructions as HP 1000 M, E, and F-Series. Except for dynamic mapping instructions, virtual memory instructions, and I/O instructions, other A-Series instructions beyond the base set as defined have the same mnemonics and format as in HP 1000 M, E, and F-Series computers, which facilitates program transportability between HP 1000 A-Series computers and HP 1000 M/E/F-Series computers.

I/O drivers written for use with the RTE-6/VM or RTE-IVB operating system will have to be rewritten for use with RTE-A.

Compatibility with HP 1000 L-Series. A-Series computers execute the entire L-Series instruction set. Programs written for use under RTE-L or RTE-XL will run without change under RTE-A.

Specifications

Central Processor

Implementation: Microprogrammed LSI and MSI hardware.

Data path width: 16 bits.

A400, A600+, and A700 Bus structure: Single backplane bus for memory, processor, and I/O.

A900 Bus structure: Single backplane bus for I/O, which accesses processor and memory via the cache memory.

VCP-Accessible Registers:

A-Register = 16-bit accumulator
B-Register = 16-bit accumulator
X-Register = 16-bit index register
Y-Register = 16-bit index register
Q-Register = 15-bit base register
P-Register = 15-bit program counter
T-Register = 16-bit memory transfer register
M-Register = 15-bit manual data register
E-Register = 1-bit extend register
O-Register = 1-bit overflow register
CIR-Register = 6-bit Central Interrupt register
V-Register = 16-bit memory Violation register
Z-Register = 16-bit bounds register
I-Register = 1-bit Interrupt System status register
ES-Register = 32-bit memory Error Syndrome register*
PE-Register = 24-bit Parity Error address register**
WMAP-Register = 16-bit logical map select register

Register access: All registers can be selected for display or modification via the Virtual Control Panel.

Instruction formats: Combined single word, Single word, and Double word

Addressing modes: Direct multilevel-indirect, single word, double word, and register implicit, indexed, and indirect indexed.

A900 Microcontrol Processor

Implementation: Hardwired MSI, with pipelined data paths.

Instruction Cycle Time: 133 nanoseconds.

Control Path: 48 bits

Data Path: 16 bits.

Registers:

Standard registers = 5 (A, B, X, Y, & Z) x 16 bits and 2 (P and Q) x 15 bits.

Scratch registers = 2 x 16 bits, non-pipelined, 12 x 16 bits, pipelined, and 896 x 16 bits cache memory locations addressable as scratch registers.

Instruction register = 1 x 16-bits.

Switch register = 1 x 8-bits.

Status flag registers = 2 x 1-bit.

LED register = 1 x 8-bits.

Processor control = 4 x 16-bits.

Processor status = 4 x 16-bits and 3 x 8-bits.

Subroutine levels stack = 16 x 15-bits and 3 x 16-bits.

Memory address = 3 x 8-bits.

Microaddress vector = 1 x 15-bits and 1 x 8-bits.

Microinstruction formats:

Type 1 Conditional special field execution or conditional return, all special fields available.

Type 2 Conditional jump, conditional jump subroutine, 8-bit target address.

Type 3 Unconditional jump, unconditional jump subroutine, 15-bit target address.

Type 4 16-bit immediate data operations.

Bus structure: Two-address architecture. Three or four addresses allowed for some operands and registers. Multiple register stores available in the same cycle. Two separable store buses allow splitting of data paths. Separate data path for memory address registers. Main memory and I/O transactions are conducted on separate buses and are arbitrated by the cache.

Control memory structure:

Type = Bipolar LSI Semiconductor read/write or PROM.
Address space = 32,768 words.
Word size = 48 bits.
Cycle time = 133 nanoseconds.

Control processor instructions:

Number = 265 total, up to 13 combinable in one instruction word.
Operations = 8 total.
Special = 45 total.
ALU = 18 total.
Conditional = 35 total.
Store = 20 total.
Memory operations = 8 total.
L Bus (source/store) = 64 total.
R Bus (source/store) = 64 total.

A700 Microcontrol processor

Implementation: Hardwired MSI.

Instruction Cycle Time: 250 nanoseconds.

Control Path: 32 bits.

Data Path: 16 bits.

Registers:

Standard registers = 5 (A, B, X, Y, & Z) x 16-bits and 2 (P and Q) x 15-bits.

Scratch registers = 43 x 16-bit registers available to the microprogrammer.

Instruction register = 1 x 16-bits.

Switch/Ind. register = 1 x 16-bits.

Status flag = 1 x 1-bit.

Subroutine levels stack = 4 x 14-bits.

Microinstruction Formats:

Type 1 Macroinstruction decode and NOP, unconditional return.

Type 2 Conditional return and conditional operation.

Type 3 Conditional jump and jump to Subroutine.

Type 4 Unconditional jump and jump to Subroutine.

Type 5 Long jump and jump to Subroutine.

Type 6 16-bit Immediate Data Operations.

Control Memory Structure:

Type = Bipolar LSI Semiconductor read/write or PROM.

Address space = 16,384 words.

Word size = 32 bits.

Cycle time = 250 nanoseconds.

Control Processor Instructions:

Number = 198 total, up to 7 combinable in one instruction word.

Operations = 14 total.

Special = 56 total.

ALU and Conditional = 48 total.

Store (destination) = 32 total.

B Bus (source) = 32 total.

A Bus = 16 total.

Memory

Memory Products: See Table 3-2.

ECC Memory in A600+ Computer: The 12110A/B 512 kB/1 MB ECC Memory Controller is required for support of ECC memory in A600+ computers.

Memory Additions in A400 and A600+ Computers: Memory added to an A400 or A600+ computer cannot exceed the memory already installed. The following table shows the combinations required for maximum parity/ECC memory in the respective computers. Note that in the A400/A600+, the 512 kB parity memory in the controller must be supplemented by a 512 kB memory array card before a 1 MB memory array card can be added. The same principle applies to ECC memory in the A600+.

A400/A600+ PARITY MEMORY	A600+ ECC MEMORY
1 MB Memory Array Card	2 MB Memory Array Card
1 MB Memory Array Card	2 MB Memory Array Card
1 MB Memory Array Card	2 MB Memory Array Card
512 kB Memory Array Card	1 MB Memory Array Card
512 kB Memory Controller	1 MB Memory Controller

Table 3-2. A-Series Memory Products and Implementation

MEMORY PRODUCT	CYCLE TIME (Nanosec) IN:			
	A400	A600+	A700	A900
The following ECC Memory Products are implemented with 256K Dynamic NMOS RAMs				
12110A 512 kB ECC Memory Controller 12110B 1 MB ECC Memory Controller	Not Supp.	454	Not Supported	
12111A 512 kB ECC Memory Array Card 12111B 1 MB ECC Memory Array Card 12111C 2 MB ECC Memory Array Card	Not Supp.	454	500	Not Supp.
12221A* 3 MB ECC Memory Array Card	Not Supported			181, avg. eff.*
The following Parity and ECC Memory Products are implemented with 64K Dynamic NMOS RAMs				
12102A 128 kB Parity Memory Controller 12102B 512 kB Parity Memory Controller	Not Supp.	454	Not Supported	
12103A 128 kB Parity Memory Array Card	Not Supp.	454	500	Not Supp.
12103C 512 kB Parity Memory Array Card 12103D 1 MB Parity Memory Array Card	454			
12103B 256 kB Parity Memory Array Card 12104A 512 kB ECC Memory Array Card	Not Supported			
12221A 768 kB ECC Memory Array Card	Not Supported			181, avg. eff.*

* 181 nanosec average cycle time in A900 assumes 88% cache "hit" rate; hit rate depends upon program locality..

Intermixing of Memory Cards: ECC memory cards based on 256K RAMs can be mixed with parity or ECC memory cards based on 64K RAMs, if the cards based on 256K RAMs are installed between the memory controller (or CPU card in A600+ computers) and the cards based on 64K RAMs.

A900 Cache Size: 4k bytes.

A900 Cache Cycle Time: 133 nanoseconds.

A900 Cache Fault Processing Time: Typically 539 nanoseconds.

Memory Structure: 32 pages of 2048 bytes with direct access to current or base page (page 00), indirect or indexed access to all other pages.

A900 Memory Expansion: To 9k pages (18 MB) using 12221A 3 MB ECC Memory Array Cards.

A600+ or A700 Memory Expansion: To 4k pages (8 MB) using ECC memory cards based on 256K RAMs.

A400 Memory Expansion: To 2k pages (4 MB) using parity memory cards based on 64K RAMs.

Maximum A-Series Memory Supported by 12157B Battery Backup System: Four memory array cards (12M bytes in A900).

Memory Protection: Write or read or read/write on a page-by-page basis.

Error Correction: A modified Hamming code is generated on all memory writes and stored for checking.All reads are monitored to check the accuracy of the stored data. All single-bit errors are corrected and all double-bit errors are detected. The system ignores single-bit (corrected) errors. Other detected errors are signalled as a memory error interrupt.

Floating point data formats

Single-Precision: 32 bits (4 bytes), providing at least 6 significant decimal digits in mantissa.

Double-Precision: 64 bits (8 bytes), providing at least 16 significant decimal digits in mantissa.

Exponent Range: 2^{-128} to 2^{+127} in all floating point numbers.

Decimal Equivalent: Approximately 10^{+38}.

Fixed point data formats

Single-Precision: 16 bits (2 bytes), twos complement integer.

Double-Precision: 32 bits (4 bytes), twos complement integer.

Scientific Instruction Set Data Formats and Accuracy (A700 Opt 001 and A900 only)

Scientific Instruction Set Data Formats: Single- and double-precision floating point.

Scientific Instruction Set Accuracy: See Table 3-3.

Table 3-3. Scientific Instruction Set Accuracy

Scientific Instruction Set Functions	RMS Relative Error	
	Single-Precision	Double-Precision
Sine	9 .2E-8	1. 2E-16
Cosine	7 .7E-8	1. 3E-16
Tangent	1 .5E-7	1. 9E-16
Arc Tangent	1 .5E-7	2. 3E-16
Hyperbolic Tangent	2 .2E-7	5. 5E-16
Square Root	6. 7E-8	1. 6E-17
Exponentiation	3. 2E-7	8. 8E-17
Natural Logarithm	1. 2E-7	1. 3E-16
Base 10 Logarithm	1. 6E-7	1. 3E-16

Interrupt system

Vectored priority interrupt structure with the following priority assignments and select codes. Note that select codes do not necessarily match priorities.

Priority	Select Code	Interrupt Function
1	00005	Parity Error
2	00010	Unimplemented Instruction
3	00007	Memory Protect Violation
4	00004	Power Fail Warning
5	00017	VCP Break
6	00006	Time Base Generator "Tick"
7	00011-00016	Reserved for special functions
8+	00020-00077	I/O Device Interrupts

Power Fail Provisions: When primary line power falls below a predetermined level while the CPU is running, a power fail warning signal from the power supply causes an interrupt to memory location 00004. Memory location 00004 is intended to contain a jump-to-subroutine (JSB) instruction to a power fail subroutine, such as that included in RTE-A. A minimum of 5 milliseconds is available to execute the power fail subroutine.

Battery Backup and Auto Restart: Battery backup of memory by the 12154A Battery Backup Card in Micro/1000 systems or the 12157B Battery Backup System in the A-Series systems or computers makes possible auto restart after power failure. Restoration of power triggers a memory saved signal if the backup battery has not fully discharged. The memory saved signal enables the CPU to automatically jump to and resume execution of the program that was running when the power failed.

1. Protects memory on a page-by-page basis against alteration or entry by programmed instructions, except those involving the A and B registers. A memory protect violation instruction will interrupt the CPU and the address of the violating will be saved in a register on the memory controller card, from which it can be made accessible in the A or B register by a single Assembly language instruction.
2. Prohibits execution of privileged instructions (mapping instructions and all I/O instructions except those referencing select code 01, the CPU status register and the overflow register). This limits control of I/O and mapping operations to the operating system or other privileged programs.

Time Base Generator Interrupt: A time base generator interrupt is provided for maintaining a real-time clock. The interrupt request is made when the CPU signals, at 10-millisecond intervals, that its internal clock is ready to roll over. Timing accuracy of the time base generator is ± 2.16 seconds per (24 hour) day.

Unimplemented Instruction Interrupt: An unimplemented instruction interrupt is requested when the CPU signals that the last instruction fetched was not recognized. This interrupt provides a straightforward entry to software routines for the execution of instruction codes not recognized by the CPU.

I/O Master Processor

Purpose: To maintain the high performance of the CPU, an I/O Master Processor is used as the standard input/output interface circuit to the A-Series system backplane. The I/O Master includes an I/O processor chip, which executes I/O instructions, and other circuits that make high speed transfer possible. Every A-Series I/O interface card has the I/O Master processor.

Determination of I/O Address: I/O address select code is set for each interface by select code address switches on the interface and is therefore independent of interface card position along the backplane bus.

I/O Addressing: An I/O interface is pre-addressed by presetting its select code into a Global Register (GR). Thereafter, this leaves the six select code bits of I/O instructions available for addressing registers or for other functions on the interface.

I/O Device Interrupt Priority: Priority depends upon I/O interface card position along the backplane, with respect to the CPU card.

I/O Interrupt Procedure:

1. One or more I/O interfaces requests an interrupt.
2. The CPU responds to the interrupt request of the highest priority interface (that closest to the CPU) by executing the instruction in a memory location that corresponds to the select code of the interface.

Interrupt Masking: The I/O Master logic includes an interrupt mask register which provides for selective inhibition of interrupts from specific interfaces under program control. This capability can be programmed to temporarily cut off undesirable interrupts from any combination of interfaces when they could interfere with crucial transfers.

Interrupt Latency When There is No DMA Interference:

Computer	Specifications	
A900	3.7 to 13 µsec,	4 µsec, typical
A700	8 to 29.75 µsec,	10 µsec, typical
A600+	4.7 to 40 µsec,	5.1 µsec, typical
A400	4.2 to 36 µsec,	4.6 µsec, typical

• *Interrupts cannot be serviced until a DMA cycle or an instruction in progress has completed execution. The worst-case latency is based on time to complete the longest uninterruptible instruction. Instructions with longer execution times are interruptible.*

Self-Configured, Chained DMA: The IOP chip also supports a self-configuring mode of operation. In this mode, instead of interrupting after a block transfer, the IOP fetches a new set of control words for the next transfer, reconfigures itself, and initiates a block transfer. This process continues as long as additional sets of control words are available.

Data Packing Under DMA: When byte mode is specified in control word instructions, the IOP automatically packs or unpacks bytes.

Maximum Achievable DMA Rate (I/O) Bandwidth):

Computer	Input		Output	
	MB/sec	MW/sec	MB/sec	MW/sec
A900	3.7	1.85	2.5	1.25
A700	4	2	4	2
A600+	4.27	2.13	4.27	2.13
A400	4.27	2.13	4.27	2.13

Self-Configured DMA Timing Between Successive Block Transfers of a Chained Series:

Computer	Timing
A900	5.2 to 8.1 microseconds
A700	5.0 to 7.7 microseconds
A600+	4.5 to 7.1 microseconds
A400	4.5 to 7.1 microseconds

I/O Master Signals and Timing: See the HP 1000 L-Series I/O interfacing guide (02103-90005).

Instruction Repertoire and Execution Times: See Table 3-4.

Safety and EMI qualification

See the Microsystem, System, Computer, and Board Computer data sheets.

Physical characteristics

See the Microsystem, System, Computer, and Board Computer data sheets.

Ordering information

See the Microsystem, System, Computer, and Board Computer data sheets.

Table 3-4. Instruction Repertoire and Execution Times

Instruction	Execution Time (microseconds) in				
	A900	A700	A700 w/FPP	A600+	A400
Memory Reference Instructions					
ADA/B, IOR, XOR, and - LDA/B	0.267	1.00	1.00	0.908	0.817
STA/B - STA/B,I	0.400	1.00-1.50	1.00-1.50	1.362-1.589	1.226-1.43
CPA/B without skip - with skip	0.533	1.50-1.75	1.50-1.75	1.135	1.022
ISZ without skip - with skip	0.533	1.50-1.75	1.50-1.75	1.362	1.226
JSB/JSB, I	0.533/0.667	1.50	1.50	1.362/1.589	1.226/1.43
JMP/JMP,I	0.133/0.267	0.75/1.50	0.75/1.50	0.681/1.362	0.613/1.226
Each indirect address level, except the first for JSB, I or JMP, I or STA/B, I	0.133	0.50	0.50	0.454	0.409
Alter-Skip Instructions					
All instructions and combinations	0.267-0.533	0.75-2.25	0.75-2.25	1.35-1.362	1.215-1.226
Shift-Rotate Instructions					
All instructions and combinations	0.267	0.75-3.00	0.75-3.00	1.35-2.270	1.215-2.043
Extended Arithmetic Instructions					
DLD/DST	0.533	2.50/2.25	2.50/2.25	1.816/2.043	1.634/1.839
MPY	2.267	6.25	6.25	5.498	4.948
DIV	6.267	8.50-9.50	8.50-9.50	2.497-10.44	2.247-9.396
ASL with one shift	0.800	2.25	2.25	1.816	1.634
Per additional ASL shift	Zero	0.50	0.50	0.454	0.409
LSL/RRL with one shift	0.400	2.00	2.00	1.135	1.022
ASR/LSR with one shift	0.677	2.00	2.00	1.362/1.135	1.226/1.022
RRR with one shift/RRR 16 (Swap)	0.677	2.25/1.50	2.25/1.50	1.589/1.816	1.43/1.634
Per additional LSL/RRL/ASR/LSR/ RRR shift	Zero	0.25	0.25	0.227	0.204
JLA/B	0.533	1.50	1.50	1.362	1.226
Input/Output Instructions					
HLT,xx	3.067	30.00	30.00	17.49	15.74
Select code 00: STF/CLF	0.667/0.933	5.75/3.50	5.75/3.50	1.362	1.226
SFC, SFS skip/no skip	0.933	4.25	4.25	1.589	1.43
LIA/B - OTA/B	3.067-3.867	6.75-6.50	6.75-6.50	6.356-4.944	5.72-4.45
CLC - STC	2.000-0.400	8.50 - N/A	8.50 - N/A	1.362	1.226
Select code 01: STF,CLF-STC,CLC	0.267	2.00 - N/A	2.00 - N/A	1.362	1.226
SFC, SFS skip/no skip	0.400	2.75/2.50	2.75/2.50	1.362	1.226
LIA/B - OTA/B	1.867-0.400	16.75-2.75	16.75-2.75	1.362	1.226
Select code 02: STF,CLF	0.800	4.75/4.00	4.75/4.00	2.043	1.839
STC	0.800	3.50	3.50	2.043	1.839
CLC	0.800	N/A	N/A	N/A	N/A
SFC,SFS skip/no skip	0.800	4.75/4.50	4.75/4.50	1.589	1.43
LIA/B - OTA/B	3.067-3.600	6.75-6.00	6.75-6.00	6.356-4.767	5.72-4.29
Select code 03: CLC - STC,	0.400	N/A	N/A	N/A	N/A
CLF, SFS, and SFC	0.400	N/A	N/A	N/A	N/A
STF	1.067	N/A	N/A	N/A	N/A
LIA/B - OTA/B	3.067-3.333	6.75-6.00	6.75-6.00	6.356-5.488	5.72-4.939
Select code 04: STF	2 millisec*	N/A	N/A	N/A	N/A
CLF - SFC/SFS	0.400-0.800	N/A	N/A	N/A	N/A
LIA/B - OTA/B	0.533	2.75-3.00	2.75-3.00	1.362	1.226
STC/CLC	0.667	4.50/3.50	4.50/3.50	1.589	1.43
Select code 05: (Memory Error) STF/CLF	0.400	2.50/2.75	2.50/2.75	1.362	1.226
SFC,SFS skip/no skip	0.400	3.25/3,00	3.25/3,00	1.589	1.43
LIA/B - OTA/B	0.800-2.133	3.00 - N/A	3.00 - N/A	1.589	1.43
STC/CLC	0.800	2.75	2.75	1.362	1.226
Select code 06: (Time Base Generator "Tick") STF/CLF	0.800	5.00/3.25	5.00/3.25	1.362	1.226
SFC,SFS skip/no skip	0.800	3.75/3.50	3.75/3.50	1.589	1.43
LIA/B - OTA/B	0.400	N/A	N/A	1.362-1.816	1.226-1.634
STC/CLC	0.800	3.00/4.50	3.00/4.50	2.951/3.632	2.656/3.269

N/A = Not Applicable N/S = Not Specified * = Flushes cache

Table 3-4. Instruction Repertoire and Execution Times continued

Instruction	Execution Time (microseconds) in				
	A900	A700	A700 w/FPP	A600+	A400
Input/Output Instructions continued					
Select code 07: CLF/CLC - STF	0.400-0.800	N/A	N/A	N/A	N/A
(Memory STC	0.933	3.00	3.00	1.362	1.226
Protect LIA/B - OTA/B	0.533-0.400	3.25 - N/A	3.25 - N/A	1.362	1.226
Violation) SFC,SFS skip/no skip	0.400	N/A	N/A	N/A	N/A
Select code>=20: STC,CLC	1.333-2.667	3,50	3,50	2.951	2.656
(I/O STF,CLF	1.200	3.50	3.50	2.951	2.656
Interfaces) SFC,SFS skip/no skip	2.400/1.333	5.25/3.50	5.25/3.50	4.086/2.951	3.677/2.656
LIA/B,MIA/B-OTA/B	3.067-3.333	6.00-5.25	6.00-5.25	5.902-4.994	5.312-4.495
Operating System Instructions					
.WFI (Basic = Loop)	Until interrupt	Until interrupt	Until interrupt	Until interrupt	Until interrupt
.SIP/.CPUID	0.667/0.400	1.50/1.25	1.50/1.25	0.908	0.817
.FWID	1.733	2.50	2.50	0.908	0.817
High Level Program Execution Accelerator Instructions					
.ENTR/.ENTP (basic, see "Add'1 per word")	1.600	4.75/5.25	4.75/5.25	2.724/2.951	2.452/2.656
.ENTN/.ENTC (basic, see "Add'1 per word")	1.200	4.00/4.25	4.00/4.25	2.270	2.043
Additional per word, assuming no indirects	0.267	1.00	1.00	0.908	0.817
Additional per indirect address level	0.133	1.00	1.00	0.454	0.409
.CPM	1.200	3.50-4.25	3.50-4.25	2.951	2.656
.SETP + Additional per word	1.067+0.267	3.25+0.50	3.25+0.50	2.724+0.454	2.452+0.409
..FCM	1.600	1.50-6.50	1.50-6.50	1.135-5.448	1.022-4.903
..TCM	2.267	N/A	7.00	9.761-10.44	8.785-9.396
.NGL	2.400	N/A	6.75	4.540-8.399	4.086-7.559
.BLE	1.600	N/A	6.25	5.221	4.699
.DFER/.CFER	1.600/1.867	5.75/7.00	5.75/7.00	4.767/5.675	4.29/5.108
.ZFER/.XFER	2.933/1.333	11.00/4.50	11.00/4.50	9.761/3.859	8.785/3.473
.FLUN	N/A	N/A	N/A	1.362	1.226
.PACK	N/A	N/A	N/A	1.816-9.988	1.634-8.989
.PWR2	N/A	N/A	N/A	1.362-3.178	1.226-2.86
Extended Instruction Group					
ADX,ADY/LDX,LDY	0.400	1.75	1.75	1.589/1.362	1.43/1.226
CAX,CBX,CAY,CBY,CXA,CXB	0.400	0.75	0.75	0.908	0.817
CYA,CYB	0.400	0.75	0.75	0.908	0.817
DSX,DSY,ISX,ISY skip/no skip	0.667	1.25	1.25	1.135	1.022
LAX,LBX,LAY,LBY/STX,STY	0.533	2.25/1.75	2.25/1.75	1.589	1.43
SAX,SAY,SBX,SBY	0.533	2.25	2.25	1.816	1.634
XAX,XAY,XBX,XBY	0.533	1.25	1.25	1.135	1.022
JLY/JPY	0.533/0.400	1.75	1.75	1.135	1.022
Each indirect address level	0.133	0.50	0.50	0.454	0.409
Bit Manipulation Instructions					
CBS,SBS	0.800	3.50	3.50	2.724	2.452
TBS skip/no skip	0.800	3.50	3.50	2.951	2.656
Byte Manipulation Instructions					
CBT	1.467	4.25	4.25	2.270	2.043
Additional for 2 bytes in A900	0.400	N/A	N/A	N/A	N/A
Additional per byte in A700 or A600+	N/A	2.33	2.33	3.589	3.23
LBT, odd/even byte	0.667/0..800	1.75	1.75	1.816/2.270	1.634/2.043
MBT	1.333	4.25	4.25	4.313-6.129	3.882-5.516
Additional per byte	0.133	2.33	2.33	0.454-1.022	0.409-.92
SBT	0.933	2.50	2.50	2.270-2.724	2.043-2.452
SFB, compare exit/terminal exit	1.733	1.50	1.50	2.497-2.724	2.247-2.452
Additional for 2 bytes in A900	0.400	N/A	N/A	N/A	N/A
Additional per byte in A700 or A600+	N/A	1.50	1.50	1.135	1.022

N/A = Not Applicable N/S = Not Specified

Table 3-4. Instruction Repertoire and Execution Times continued

Instruction	Execution Time (microseconds) in				
	A900	A700	A700 w/FPP	A600+	A400
Word Manipulation Instructions					
CMW	1.733	3.75	3.75	2.755	2.48
Additional for four words in A900	1.200	N/A	N/A	N/A	N/A
Additional per word in A700 or A600+	N/A	1.25	1.25	1.135	1.022
MVW+Additional per word	0.933+0.267	3.75+1.00	3.75+1.00	2.270+0.908	2.043+0/817
Dynamic Mapping Instructions					
XLA1/B1,XSA1/B1,XLA2/B2	0.800	2.75	2.75	1.589-1.816	1.43-1.634
XSA2/B2	0.800	2.75	2.75	1.589-1.816	1.43-1.634
XCA1/B1 skip/no skip	1.067	3.25	3.25	1.816	1.634
XCA2/B2 no skip	1.067	3.25	3.25	1.816	1.634
MB00/01/02/10/11/12/20/21/22	1.600+0.133	3.50-5.00	3.50-5.00	1.589-3.405	1.43-3.065
Additional per byte	0.133	1.00-1.25	1.00-1.25	2.270-2.724	2.043-2.452
MW00/11/22 + Additional per word	1.067+0.267	3.50+1.00	3.50+1.00	2.724+0.908	2.452+0.817
MW01/02/10/12/20/21 + Additional per word	1.067+0.267	3.50+1.00	3.50+1.00	2.724+1.135	2.452+1.022
LPMR/SPMR	0.933	1.50/1.25	1.50/1.25	3.632	3.269
LDMP/STMP	9.200/9.333	20.0	20.0	38.14/38.36	34.33/34.52
LWD1/LWD2	1.333/1.200	2.5	2.5	1.362	1.226
SWMP/SIMP	0.667	5.0/2.0	5.0/2.0	3.859/2.724	3.23/2.452
XJMP	1.867	5.75	5.75	4.086	3.677
XJCQ	2.000	7.25	7.25	5.448	4.903
Virtual Memory Instructions NOTE: The following times do not include access time to bring in data from the disc.					
.LBP/.LBPR	1.733/2.000	6.25/7.00	6.25/7.00	10.67/11.80	9.603/10.62
.LPX/.LPXR	2.133/2.533	7.75/9.00	7.75/9.00	12.03/13.85	10.83/12.47
.IMAP (Basic)	3.600	9.75	9.75	23.15#	20.84#
.IRES (Basic)	1.733	5.00	5.00	13.39#	12.05#
Add'l per .IMAP or .IRES parameter	2.000	9.75-14.75	9.75-14.75	10.44	9.396
.JMAP (Basic)	3.200	9.75	9.75	36.09#	32.48#
.JRES (Basic)	1.333	5.50	5.50	26.11	23.5
Add'l per .JMAP or JRES parameter	2.000	11.00-26.00	11.00-26.00	9.307	8.376
.PMAP	1.600	5.00	5.00	7.264	6.538
Code and Data Separation (VC+) Instructions					
CACQ,CBCQ	0.533	1.50	1.50	1.362-1.589	1.226-1.43
CCQA,CCQB	0.533	1.00	1.00	0.908	0.817
CAZ,CBZ,CZA,CZB,ADQA,ADQB	0.533	1.00	1.00	0.908	0.817
CIQA,CIQB	0.667	1.50	1.50	1.589	1.43
SDSP (Base + Add'l per element of display)	0.933+0.400	2.75+1.00	2.75+1.00	2.043+0.908	1.839+0.817
PCALI (Base, see add'l per parameter)	1,867	5.50	5.50	4.540	4.086
PCALX (Base, see add'l per parameter)	7.84	21.50	21.50	22.70	20.43
PCALV (Base, see add'l per parameter)	7.98	23.00	23.00	23.15	20.84
PCALR (Base, see add'l per parameter)	2.667	8.75	8.75	7.264	6.358
PCALN (Base, see add'l per parameter)	2.667	8.00	8.00	6.810	6.129
Additional per PCAL_parameter)	0.400	1.50	1.50	0.908	0.908
EXIT without/with segment mapping	0.931/6.11	2.50/15.00	2.50/15.00	2.270/19.52	2.043/17.57
EXIT1 without/with segment mapping	0.931/6.11	2.75/15.25	2.75/15.25	2.497/19.75	2.247/17.78
EXIT2 without/with segment mapping	1.064/6.11	2.75/15.25	2.75/15.25	2.730/19.98	2.457/17.98
Double Integer Instructions					
.DAD	0.800	2.50-3.50	2.50-3.50	2.497	2.247
.DSB, .DSBR	0.800	3.25-3.50	3.25-3.50	2.497	2.247
.DIM, .DDE/.DNG	0.667/0.933	1.75	1.75	1.135/1.589	1.022/1.43
.DIS	0.933	2.75-3.25	2.75-3.25	3.859	3.23
.DDS	0.933	3.00	3.00	3.859	3.23
.DCO	1.333	3.25-3.50	3.25-3.50	2.497-2.951	2.247-2.656
.DMP	2.400	16.75-27.00	5.0	3.178-13.85	2.86-12.47
.DDI	5.200	9.25-73.10	9.25-10.25	3.632-16.34	3.269-14.71
.DDIR	5.333	9.50-73.50	9.00-10.00	4.450-17.48	4.005-15.73

N/A = Not Applicable N/S = Not Specified # = With one parameter

Table 3-4. Instruction Repertoire and Execution Times continued

Instruction	Execution Time (microseconds) in				
	A900	A700	A700 w/FPP	A600+	A400
Single-Precision Floating Point Instructions	Times listed are for built-in floating point hardware in A900, for floating point firmware and optional floating point processor in A700 and for floating point firmware in A600+ and A400.				
.FAD	1.733	7.75-26.00	4.75	8.853-17.71	7.75-26.00
.FSB	1.733	7.75-26.00	4.75	9.534-18.84	7.75-26.00
.FMP	1.867	13.75-25.25	4.50	17.03-21.11	13.75-25.25
.FDV	4.000	18.25-29.75	7.00	5.448-27.92	18.25-29.75
Conv from single integer (FLOAT)	1.867	1.75-6.50	3.50	2.270-5.675	1.75-6.50
Conv from double integer (.FLTD)	2.000	N/S	3.75	1.589-7.037	N/S
Conv to single integer (FIX)	1.733	1.50-6.50	1.75-3.50	2.497-6.356	1.50-6.50
Conv to double integer (.FIXD)	2.133	N/S	4.00	1.816-7.945	N/S
Double-Precision Floating Point Operations	Times listed are for built-in floating point hardware in A900, for optional floating point processor (FPP) in A700, and for floating point firmware in A600+ and A400.				
.TADD	3.467	N/A	9.50	11.35-27.92	23-26
.TSUB	3.467	N/A	9.50	12.94-29.51	23-26
.TMPY	3.467	N/A	9.50	11.35-64.01	57-59
.TDIV	8.533	N/A	14.75	12.94-65.15	68-72
Conv from single integer (.TFTS)	1.867	N/A	5.00	4.540-8.853	9.5-10.4
Conv from double integer (.TFTD)	2.000	N/A	5.25	5.221-9.988	10-11.1
Conv to single integer (.TFXS)	2.267	N/A	5.00	4.086-8.626	8.0-9.5
Conv to double integer (.TFXD)	2.400	N/A	5.25	4.313-9.761	9.5-10.7
Single-Precision Scientific Instruction Set Instructions	Times listed are for built-in Scientific Instruction Set in A900 or Scientific Instruction Set that is included with the optional floating point processor in A700.				
Sine/Cosine	18 - 20	N/A	25 - 29	N/A	N/A
Tangent	21 - 25	N/A	27 - 32	N/A	N/A
Arc Tangent	14 - 22	N/A	18 - 28	N/A	N/A
Hyperbolic Tangent	10 - 26	N/A	3 - 39	N/A	N/A
Exponentiation	19	N/A	29.5	N/A	N/A
Natural or Base 10 Logarithm	19	N/A	28	N/A	N/A
Square Root	15	N/A	21	N/A	N/A
Single-Precision Vector Instruction Set (VIS) Instructions	Setup Times (listed first) and times per Vector/Matrix element (listed second follwing the + sign) are for built-in Vector Instruction Set in A900 and Vector Instruction Set that is included with the optional hardware floating point processor in A700.				
.VADD, .VSUB	4.9 +1.2	N/A	13.5 +3.75	N/A	N/A
.VMPY	5.1 +1.2	N/A	13.5 +3.75	N/A	N/A
.VDIV	4.3 +3.7	N/A	13.5 +7.00	N/A	N/A
.VSAD, .VSSB	4.8 +1.1	N/A	14.0 +2.50	N/A	N/A
.VSMY	5.1 +1.2	N/A	14.0 +2.25	N/A	N/A
.VSDV	3.7 +3.7	N/A	14.0 +5.25	N/A	N/A
.VPIV	6.8 +1.6	N/A	14.5 +4.50	N/A	N/A
.VABS	4.8 +1.1	N/A	11.5 +2.75	N/A	N/A
.VSUM	4.0 +2.4	N/A	12.8 +3.00	N/A	N/A
.VNRM	4.4 +2.4	N/A	13.3 +3.00	N/A	N/A
.VDOT	8.0 +3.2	N/A	16.3 +6.50	N/A	N/A
.VMAX, .VMIN	4.1 +0.7-2.7	N/A	11 +2.3-5.3	N/A	N/A
.VMAB, .VMIB	4.1 +2.1-2.5	N/A	11 +4.3-5.5	N/A	N/A
.VMOV	2.8 +0.7	N/A	8.5 +2.00	N/A	N/A
.VSWP	2.8 +1.2	N/A	8.5 +4.00	N/A	N/A

N/A = Not Applicable N/S = Not Specified

Table 3-4. Instruction Repertoire and Execution Times continued

Instruction	Execution Time (microseconds) in				
	A900	A700	A700 w/FPP	A600+	A400
Double-Precision Vector Instruction Set (VIS) Instructions	**Setup Times (listed first) and times per Vector/Matrix element (listed second follwing the + sign) are for built-in Vector Instruction Set in A900 and Vector Instruction Set that is included with the optional hardware floating point processor in A700.**				
.DVADD, .DVSUB	6.1 +2.0	N/A	13.5 +6.25	N/A	N/A
.DVMPY	6.1 +2.0	N/A	13.5 +6.50	N/A	N/A
.DVDIV	4.7 +7.2	N/A	13.5 +12.25	N/A	N/A
.DVSAD, .DVSSB	5.7 +1.6	N/A	14.8 +4.50	N/A	N/A
.DVSMY	5.9 +1.6	N/A	14.8 +4.75	N/A	N/A
.DVSDV	4.0 +7.2	N/A	15.8 +10.25	N/A	N/A
.DVPIV	8.4 +2.7	N/A	17.8 +8.00	N/A	N/A
.DVABS	5.6 +1.6	N/A	12.5 +4.75	N/A	N/A
.DVSUM	4.1 +2.1	N/A	15.0 +3.25	N/A	N/A
.DVNRM	4.5 +2.1	N/A	15.5 +3.25	N/A	N/A
.DVDOT	7.4 +2.5	N/A	18.0 +6.50	N/A	N/A
.DVMAX, .DVMIN	4.3 +0.7-3.3	N/A	13 +2.3-6.3	N/A	N/A
.DVMAB, .DVMIB	4.3 +2.5-3.2	N/A	13 +5.3-6.5	N/A	N/A
.DVMOV	3.1 +1.2	N/A	9.5 +4.00	N/A	N/A
.DVSWP	3.1 +2.3	N/A	9.5 +8.00	N/A	N/A

N/A = Not Applicable N/S = Not Specified

Model 26, 27, and 29 Rack-Mounted Computer Systems

HEWLETT PACKARD

HP 1000 A-Series Computer Systems

product numbers
2196C/D, 2197C/D, and 2199C/D

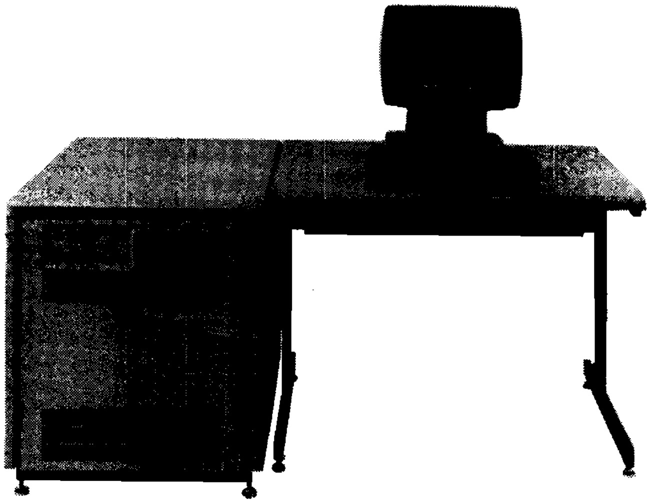
The Model 26, 27, and 29 are identically-packaged Rack-Mounted Computer Systems that are configured around the A600+, A700, and A900 computers and other basic system elements, which make up System Processor Unit (SPU), product numbers 2196C/D, 2197C/D, and 2199C/D. (See the A-Series Computer Design and Specifications data sheet on page 3-1 for comparison of A600+, A700, and A900 capabilities.) These computer systems are managed by the RTE-A operating system, which supports multiprogramming, high-level program languages, the 92078A VC+ extension for large-program support, (included in 2197C/D and 2199C/D), virtual memory and sharable extended memory areas for data, data base management, distributed systems networking, graphics software, and memory up to 18 megabytes.

The SPU hardware consists of the A600+ CPU, A700 CPU with 12156A Hardware Floating Point Processor, or A900 CPU; 512 kilobytes or 768 kilobytes of memory, HP-IB disc interface card, and serial interface card in a 20-slot card cage. The 219xC SPU is housed in a 1.6m (63-inch) cabinet with rack space available for additional equipment. The 219xD SPU is housed in a 72cm (28.3-inch) cabinet without spare rack space.

To the SPU, OEMs and end users add one or more display terminals, one or more hard discs, and other peripheral devices as needed for their applications. Multiple fixed discs with 24 to 571 megabyte capacity, some with built-in tape cartridge backup, can be used on the system. Over 2.2 gigabytes of disc capacity can be connected via a single disc interface.

System Model	26	27	29
Product Number	2196C/D	2197C/D	2199C/D
Av. Card Cage Slots	16	13	13
Serial I/O Channels	1 incl.	1 incl.	1 incl.
Base Memory Included	512 kB Parity	512 kB Parity	768 kB ECC
Max. Parity Memory†	4.0 MB	4.0 MB	Not Sup.
Max. ECC Memory†	8.0 MB	8.0 MB	18.0 MB
Av. Card Cage Slots w/Max. Memory	12	10	8

† *Maximum memory sizes listed assume use of only parity or only ECC memory array cards, and a 1 MB ECC memory controller in the Model 26 to support ECC memory. Parity and ECC memory array cards can be used together in the same Model 26 or Model 27 System, up to a maximum of four memory array cards (maximum memory will be less).*



Features

- **Integrated system building block for OEMs and end users designing their own A-Series based application products.**
- **1.6m cabinet with rack space for additional user equipment (219xC only).**
- **20-slot card cage for maximum memory and I/O capacity.**
- **Disc memory expandable to over 2.2 gigabytes on one card cage slot with multiple discs.**
- **Power fail detection and auto restart with optional 12157B Battery Backup System.**
- **Front-to-rear air flow cabinet maximizes system cooling efficiency and equipment reliability.**
- **Compliance with UL, CSA, and IEC-380 safety standards and with FCC Class A and VDE Level A EMI regulations.**

Computer Description and Specifications

For functional description and specifications of the A600+, A700, and A900 computers, memory systems, input/output system, software and diagnostic support, compatibility, and specifications, see the A-Series Computer Design and Specifications data sheet on page 3-1.

Available HP-IB Capacity

The 12009A HP-IB interface included in Model 26, 27, and 29 systems can support up to four hard discs. Although the HP-IB interface can address up to a total of 14 devices, it is advisable to use a different HP-IB interface to connect non-disc devices to the system to assure optimum performance.

Compatible System Consoles and System Discs

See Tables 3-5 and 3-6.

Electrical Specifications

AC Power Requirements of 219xC/D System Processor Unit

System Processor Unit and Rack Mounting Disc Line Voltage and Frequency:

Product	Line Voltage	Line Freq.
219xC/D Std	115V -25%/+20% (86-138V)*	47.5-66 Hz
219xC/D+015	230V -23%/+20% (178-276V)	47.5-66 Hz
7911/2/4R Std	120V -10%/+5% (108-126V)	54 -66 Hz
7911/2/4R Std†	100V -10%/+5% (90-105V)†	54 -66 Hz
7911/2/4R+015	220V -10%/+5% (198-231V)	47.5-55 Hz
7911/2/4R+015‡	240V -10%/+5% (216-252V)	47.5-66 Hz

* *219xC standard System Processor Unit requires split-phase input with the line voltage listed here applied to both phases.*

† *100V/60 Hz is provided by restrapping a 7911/2/4R standard disc in the field.*

‡ *240V/50 Hz is provided by restrapping a 7911/2/4R Option 015 disc in the field.*

Maximum Operating Current. 16A per phase for 219xC, 16A for 219xD.

Power Cable: The standard 219xC/D System Processor Unit (SPU) includes a 3 m (10 ft.) power cable with power plug (NEMA type L14-20P with 219xC, NEMA type 5-20P with 219xD). No power cable is provided with the 219xC/D SPU ordered with option 015.

Peripherals Power Requirements

See Table 3-10 on page 3-55.

DC Current Available and Required for I/O Interfaces and Accessories

The SPU power supply provides enough current for any combination of A-Series interfaces or other A-Series plug-ins that can be accommodated in the SPU card cage.

Table 3-5. Compatible System Consoles and SPU Connection Options

TERMINAL	CONNECT OPTION		
	005	006	008 Plus 12040C/D & this Cable
2392A Display Terminal	No	Yes	40242M
2393A Graphics Terminal	No	Yes	40242M
2397A Color Graphics Terminal	No	Yes	40242M
NOTE: The following additional terminals are discontinued products listed here for reference only.			
2382A Office Terminal	No	Yes	40242M
2621B Display Terminal	No	Yes	40242M
2622A Display Terminal	Yes	No	13222Y
2623A Graphics Terminal	Yes	No	13222Y
2624B Display Terminal	Yes	No	13222Y
2625A Dual-System Terminal	No	Yes	40242M
2626A Display Station,	Yes	No	13222Y
2627A Color Graphics Terminal	Yes	No	13222Y
2628A Word Processing Terminal	No	Yes	40242M
45610B Touchscreen Terminal	No	Yes	40242M

Table 3-6. Compatible System Discs

At least one 79xxR, 793xH/XP, 794xA, or 795xA Disc is required with 219xC/D SPU.

PRODUCT NUMBER	TYPE	DISC CAP (MB)	AVG XFER RATE (kB/s)	AVG ACC TIME (ms)
7911R	Hard, fixed with CS/80	28.1	983	35
7912R	cartridge tape drive for	65.6	983	35
7914R	s/w loading & backup	131.2	983	36
7914ST or 7914TD*	Hard, fixed with 1600 cpi mag tape drive	131.2	983	36
7942A	Hard, fixed with built-in	23.8	625	49
7946A	9144A tape drive for s/w loading & backup	55.5	625	49
NOTE: The following discs require a separate software loading and backup device, such as a 797xA/B/E Mag Tape Unit or 35401A Autochanger Tape Subsystem or 9144A Cartridge Tape Subsystem.				
7933H/XP	Hard, fixed	404.4	1000	32
7935H/XP	Hard, removable	404.4	1000	32
7936H/XP	Hard, fixed	307	1000	31
7937H/XP	Hard, fixed	571	1000	31
7941A*	Hard, fixed	23.8	625	49
7945A*		55.5	625	49
7957A	Hard, fixed	81	853	42
7958A		130	853	42

NOTE: Average transfer rate is based on the minimum time required to transfer one track without overrun.

* Discontinued product listed here for reference only.

Environmental Specifications

Temperature

Operating (SPU and disc): 10° to 40°C (50° to 104°F).

Rate of Change: < 10°C (18°F) per hour for 7911R, 7912R, or 7914R Disc.

Non-operating temperature: -40° to 60°C (-40° to 140°F).

Relative Humidity

20% to 80% non-condensing (applies to both 219xC/D SPU and 791xR Disc.

Altitude

Operating: To 4.6 km (15,000 ft).

Non-operating: To 15.3 km (50,000 ft).

Vibration and Shock

HP 219xC/D System Processor Units are type tested for normal shipping and handling shock and vibration (contact factory for review of any application that requires operation under continuous vibration).

Safety and EMI Compliance

Safety Qualification

The Model 26, 27, and 29 Systems meet Underwriter's Laboratory (UL), Canadian Standards Association (CSA), and International Electrotechnical Commission (IEC) safety standards.

EMI Compliance

The Model 26, 27, and 29 Systems comply with Federal Communications Commission (FCC) Class A and Verband Deutscher Elektrotechniker (VDE) Level A regulations for Electro Magnetic Interference (EMI).

Physical Characteristics

Dimensions in cm and (inches)

	219xC SPU	219xD SPU
Height:	161.3 (63.4)	72.0 (28.3)
Width:	63.5 (25.0)	63.5 (25.0)
Depth:	81.3 (32.0)	81.3 (32.0)

Net Weight

219xC SPU only (without disc): 139.7 kg (307.5 lb).

219xD SPU only (without disc): 94.3 kg (207.5 lb).

7911/12R/14R Disc adds: 67.3 kg (148 lb).

219xC/D SPU Ventilation

For Computer and Rack-Mounted System Disc: Perforations in the 219xC/D cabinet front and rear doors facilitate front-to-rear ventilation provided by the fans in the computer and system disc. This maximizes cooling efficiency and equipment reliability.

For Equipment in Upper Compartment of 219xC Cabinet: Four fans at the top rear of the system cabinet provide a bottom-to-top airflow of approximately 11.3 cubic meters per minute (400 CFM). The actual value of air flow depends upon the configuration of equipment racked in the upper section of the cabinet. If equipment with front-to-rear airflow is to be installed in the upper section, 219xC option 051 must be ordered to replace the front door with a trim kit.

Systems Ordering Information

NOTE: 219xC/D SPUs require a terminal and a disc (not included) for operator communication and for operating system and program development support.

HP 2196C System Processor Unit for HP 1000 Model 26 Computer System

The 2196C System Processor Unit includes:

1. CPU and memory as follows:
   a. 12102B Memory Controller Card with 512 kB parity memory.
   b. 12105-60001 A600+ CPU Card, instruction set and VCP ROMs, and 12038A Memory frontplane connector
2. Disc and terminal interfaces as follows:
   a. 12009A-D01 HP-IB Interface to Disc.
   b. 12005B-010 Async Serial (terminal) Interface.
3. 29431G 1.6m (63-in.) system cabinet with 12151A (12151-60024) 20-slot card cage, power supply, and space for 7911R, 7912R, or 7914R disc in lower compartment, space for other equipment in upper compartment, power distribution module, 3m (10 ft.) power cable with NEMA L14–20P power plug, and anti-tip feet.
4. Software and supporting documentation as follows:
   a. RTE-A Master, RTE-A Primary system, and 24612A and 24398B diagnostics, on user-specified media.
   b. License to use RTE-A on one System.
   c. RTE-A and diagnostics manuals (see RTE-A data sheet, page 2-13 and Diagnostics data sheet, page 3-61 in this handbook for manuals furnished).
5. 02156-90002 HP 1000 A600+ Computer Installation and Service Manual.
6. 02156-90001 HP 1000 A600+ Computer Reference Manual.
7. 02196-90002 HP 1000 Model 26/27/29 Computer System Installation and Service Manual.

8. 02103-90005 Computer I/O Interfacing Guide.
9. 12005-90002 HP 12005A/B Asynchronous Interface Reference Manual.
10. 12009-90001 HP 12009A HP-IB Interface Reference Manual.
11. 59310-90064 HP-IB User's Guide.
12. 02172-90009 System Support Log.
13. Site preparation consultation.
14. On-site installation assistance and checkout by a Hewlett-Packard service engineer, including integration and test with primary system.
15. 90-day on-site warranty.
16. Four 93285A Engineering Units incorporated in the SPU in the course of manufacturing by Hewlett-Packard.

HP 2196D System Processor Unit for HP 1000 Model 26 Computer System

The 2196D System Processor Unit (SPU) is similar to the 2196C SPU, but is housed in a 29429A 72 cm (28.3-in.) cabinet that does not have an upper compartment for other equipment. Standard 2196D includes 3m (10 ft.) power cable with NEMA 5-20P plug.

HP 2196C/D Options

NOTE: Must order one of system console connect options 005, 006, or 008 and media option 022 or 061.

005: Provides 15m (49 ft.) fiber optic cable connection to system console as specified in Table 3-8 (excludes option 006 or 008).

006: Provides 5m (49 ft.) electrical cable connection to system console as specified in Table 3-8 (excludes option 005 or 008).

008: Deletes 12005B interface and 12005-90002 manual to permit their replacement with a 12040D multiplexer and a connect cable as specified in Table 3-8 for the various compatible terminals (excludes option 005 or 006).

014: Deletes 12102B 512kB parity memory controller permitting its replacement with a 12110A 512kB or 12110B 1MB ECC memory controller. (Must order 12110x ECC memory controller, and memory array cards and 12038x connector if appropriate.)

015: Operation from 230V ac power. Power options for system console, disc, and other peripherals must be ordered separately.

022: Software on CS/80 cartridge tape for use with 791xR disc or 35401A or 9144A Tape Cartridge Subsystem (excludes option 061).

051: Magnetic tape trim instead of upper door of 2196C cabinet to accommodate a 7970E Mag tape unit or equipment that uses front-to-rear ventilation in the upper compartment (2196C only).

053: Lower door in 2196C without cutout for system that does not have 791xR disc (2196C only).

061: Software on 1600 bpi mag tape (excludes option 022).

070: Deletes cabinet from 2196C SPU to permit racking in cabinet of 7914ST or 7914TD Disc-Mag Tape Unit package, provides slide rails for mounting computer, and adds a second 12009A interface for connection to the Mag Tape Unit of the 7914ST/TD (2196C only).

HP 2197C System Processor Unit for HP 1000 Model 27 Computer System

The 2197C System Processor Unit includes:

1. CPU and memory as follows:
   a. 12103C 512 kB Memory array card.
   b. 12038A Memory frontplane connector assembly.
   c. A700 CPU, including 12152-60001 and 60051 processor cards, 12152-60052 memory controller, and instruction set and VCP PROMs.
   d. 12156A Hardware Floating Point Processor Card with Scientific Instruction Set and Vector Instruction Set firmware and floating point front plane connector.

2 and 3. Same as for 2196C, above.

4. Software and supporting documentation as follows:
   a. RTE-A Master with VC+ enhancement for large program support, RTE-A/VC+ Primary system, and 24612A and 2439B diagnostics, on user-specified media.
   b. License to use RTE-A with VC+ on one System.
   c. RTE-A, VC+, and diagnostics manuals (see RTE-A data sheet page 2-13, VC+ data sheet page 2-17/2-18, and Diagnostics data sheet page 3-61 in this handbook for manuals furnished).
5. 02137-90002 HP 1000 A700 Computer Installation and Service Manual.
6. 02137-90001 HP 1000 A700 Computer Reference Manual.

7 through 16. Same as for 2196C, above.

HP 2197D System Processor Unit for HP 1000 Model 27 Computer System

The 2197D System Processor Unit (SPU) is similar to the 2197C SPU, but is housed in a 29429A 72 cm (28.3-in.) cabinet that does not have an upper compartment for other equipment. Standard 2197D includes 3m (10 ft) power cable with NEMA 5-20P plug.

HP 2197C/D Options

NOTE: Must order one of system console connect options 005, 006, or 008 and media option 022 or 061.

005 through 008: Same as for 2196C/D, above.

014: Deletes standard 512 kB parity memory array card and front plane connector, permitting their replacement with other memory array cards. (Must order other A700 compatible memory card(s) and appropriate 12038x connector)

015, 022, 051,, 053, 061, and 070: Same as for 2196C/D, above.

HP 2199C System Processor Unit for HP 1000 Model 29 Computer System

The 2199C System Processor Unit includes:

1. CPU and memory as follows:
   a. 12201A Sequencer card with ROMs.
   b. 12202A Data Path card with Floating Point Processors.
   c. 12203A Cache Control card with VCP ROMs.
   d. 12204A Memory Controller card.
   e. 12220A 768 kB ECC Memory Array card.
   f. 12222A Memory Array Connector
2. Disc and terminal interfaces as follows:
   a. 12009A-D01 HP-IB Interface to Disc.
   b. 12005B-010 Async Serial (terminal) Interface.
3. 29431G 1.6m (63-in.) system cabinet with 12210A (12210-60009) 20-slot card cage, power supply, and space for 7911R, 7912R, or 7914R disc in lower compartment, space for other equipment in upper compartment, power distribution module, 3m (10 ft.) power cable with NEMA L14–20P power plug, and anti-tip feet.
4. Same as for 2197C, above.
5. 02139-90002 HP 1000 A900 Computer Installation and Service Manual.
6. 02139-90001 HP 1000 A900 Computer Reference Manual.

7 through 16. Same as for 2196C, above.

HP 2199D System Processor Unit for HP 1000 Model 29 Computer System

The 2199D System Processor Unit (SPU) is similar to the 2199C SPU, but is housed in a 29429A 72 cm (28.3-inch) cabinet that does not have an upper compartment for other equipment. Standard 2199D includes 3m (10 ft.) power cable with NEMA 5-20P plug.

HP 2199C/D Options

NOTE: Must order one of system console connect options 005, 006, or 008 and media option 022 or 061.

005 through 008: Same as for 2196C/D, above.

014: Deletes standard 768 kB ECC memory array card and front plane connector, permitting their replacement with other memory array cards. (Must order other A900 compatible memory card(s) and appropriate 12222x connector).

015, 022, 051,, 053, 061, and 070: Same as for 2196C/D, above.

Optional Software

See Extensive Software Support listings on pages 3-4 and 3-5 of this handbook.

Memory Expansion and Array Connectors

ECC Memory Controllers for 2196C/D

12110A	**512 kB ECC Memory Controller**
12110B	**1 MB ECC Memory Controller**

Memory Array Cards and Array Connectors for 2196C/D and 2197C/D

12103B	**512 kB Parity Memory Array Card**
12103C	**1 MB Parity Memory Array Card**
12111A	**512 kB ECC Memory Array Card**
12111B	**1 MB ECC Memory Array Card**
12111C	**2 MB ECC Memory Array Card**
12038A	**Connector to 1 array card**
12038B	**Connector to 2 array cards**
12038C	**Connector to 3 array cards**
12038D	**Connector to 4 array cards**

Memory Array Cards and Array Connectors for 2199C/D

12220A	**768 kB ECC Memory Array Card**
12221B	**3 MB ECC Memory Array Card**
12222A	**Connector to 1 array card**
12222B	**Connector to 2 array cards**
12222C	**Connector to 3 array cards**
12222D	**Connector to 4 array cards**
12222E	**Connector to 5 array cards**
12222F	**Connector to 6 array cards**

Accessories

Plug-In Accessories

12157B Battery Backup System using sealed lead-acid batteries (provides 15 to 90 minutes of sustaining power for up to four memory array cards), depending upon the system configuration, state of charge, and temperature; additional hold-up time can be achieved by connecting an external battery NOTE: This accessory is installed in the computer power supply and does NOT use a card cage slot.

12153A A700 Writable Control Store card provides 4k words of control store space for HP 1000 Model 27 System.

12155A A700 PROM Control Store card provides mounting for up to 8k words of PROMs in HP 1000 Model 27 System.

12205A A900 Control Store Board provides 4k words of writable control store and mounting space for 2k words of 2k control store PROMs in HP 1000 Model 29 System.

Interfaces

The HP 219xC/D SPU can use all of the interfaces listed in section 4 of this handbook, including those that require 25 kHz power.

Peripheral Devices

HP 1000 Model 26, 27, and 29 Systems support the peripheral devices listed and described in sections 7 through 10 of this handbook.

Engineering Reference Documentation

For Model 26 (A600+): 02156-90003 HP 1000 A600 Computer Engineering and Reference Documentation.

For Model 27 (A700): 02137-90005 HP 1000 A700 Computer Engineering and Reference Documentation.

For Model 29 (A900): 02139-90003 HP 1000 A900 Computer Engineering and Reference Documentation.

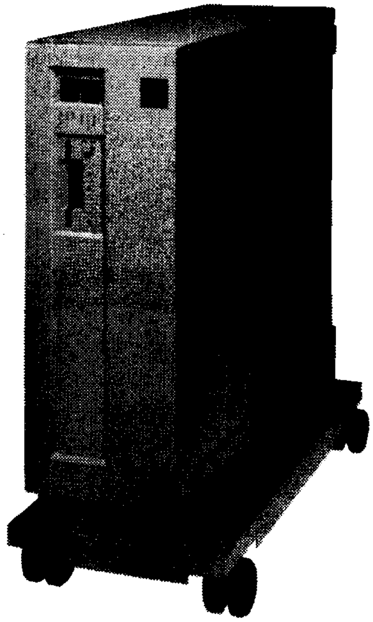
Micro 24, 26, 27, and 29 Computer Products

HEWLETT PACKARD

product numbers
2434A, 2484A, 2436A/E, 2486A,
2437A, 2487A, 2439A, and 2489A

HP 1000 A-Series Computer Systems

The Micro 24, 26, 27, and 29 Computer Products offer a choice of A400, A600+, A700, and A900 processors housed in a rugged, compact, versatile Micro/1000 package at the computer and System Processor levels of integration. The Micro/1000 package can be mounted in a standard 19-inch EIA rack cabinet, placed on a table, workbench, or desk, or in a vertical mounting accessory on casters for moving it where necessary. The Micro/1000 package includes cabinet, power supply, 14 card cage slots for CPU, memory, control store, and I/O cards, and dedicated slots for 25 kHz sine wave and battery backup cards. The Micro/1000 package can also accommodate integrated discs for software installation and backup. See Table 3-7, below, for a summary of the Micro 24-29 computers and systems and the A-Series Computer Design and Specifications data sheet on page 3-1 for comparison of A400, A600+, A700, and A900 capabilities.



Micro/1000 Computer with 12122A Integrated Discs

Features

- **Rugged, compact, versatile Micro/1000 package.**
- **14-slot card cage plus dedicated slots for 25 kHz and battery backup cards.**

Table 3-7. Micro/1000 Computers and Systems Summary

	COMPUTERS (Include only CPU and memory, all other components, software, and services must be ordered separately.)				SYSTEM PROCESSOR UNITS (SPUs) (Include CPU, memory, disc and system console interfaces, RTE-A operating system, site prep consultation, on-site installation, and 90-day on-site warranty. Requires system console and system disc.)			
Processor	A400	A600+	A700	A900	A400	A600+	A700	A900
Product Number	2434A	2436A/E	2437A	2439A	2484A	2486A	2487A	2489A
Name	Micro 24 Computer	Micro 26 Computer	Micro 27 Computer	Micro 29 Computer	Micro 24 SPU	Micro 26 SPU	Micro 27 SPU	Micro 29 SPU
Serial I/O Channels	4 included	None included	None included	None included	4 included	1 included	1 included	1 included
Base Memory	512 kB Parity	128/512 kB Parity	128 kB Parity	768 kB ECC	512 kB Parity	512 kB Parity	512 kB Parity	768 kB ECC
Maximum Memory	4 MB Parity	4 MB Parity/ 8 MB ECC	4 MB Parity/ 8 MB ECC*	6 MB ECC	4 MB Parity	4 MB Parity/ 8 MB ECC	4 MB Parity/ 8 MB ECC*	6 MB ECC
Av. Card Cage Slots	13; 9 with max. mem.	12; 8 with max. mem.	10; 7 with max. mem.	9; 8 with max. mem.	12; 8 with max. mem.	10; 6 with max. mem.	8; 5 with max. mem.	7; 6 with max. mem.

* *The Option 001 Floating Point Processor card and/or each control store card in 2437A or 2487A decreases maximum parity memory capacity by 1 MB, maximum ECC memory capacity by 2 MB.*

- **Choice of integrated discs or external discs.**
- **Power fail detection and auto restart with optional 12154A Battery Backup Card.**
- **Disc memory expandable to over 2.2 gigabytes on one card cage slot with multiple external discs.**
- **Compliance with UL, CSA, and IEC-380 safety standards and with FCC Class A and VDE Level A EMI regulations.**

Description and Specifications

For functional description and specifications of the A400, A600+, A700, and A900 computers, memory systems, input/output system, software and diagnostic support, compatibility, and specifications, see the A-Series Computer Design and Specifications data sheet on page 3-1.

Card Cage Considerations

How Battery Backup Reduces Card Cage Capacity

The 12154A Battery Backup Card extends up from its dedicated card cage slot 16 into slots 14 and 15, making them unusable for I/O interface cards. See Figure 3-1, below. If the included voltage jumper card is installed in slot 16 instead of the battery backup card, slots 14 and 15 may be usable for I/O interface cards, provided that total power supply used by all cards does not exceed power supply capacity.

Slot No.	Left-hand side of card cage seen from rear	Slot No.	Right-hand side of card cage seen from rear
9	Available for I/O Card	1	Available for memory, CPU, Control Store, and I/O Cards
10	Available for I/O Card	2	
11	Available for I/O Card	3	
12	Available for I/O Card	4	
13	Available for I/O Card	5	
14	Batt Backup or I/O Cd	6	
15	Batt Backup or I/O Cd	7	
16	Battery Backup Card	8	25 kHz Sine Wave Card

Figure 3-1. General Layout of Micro/1000 Card Cage

Main Memory Capacity in Micro 27 and 29

As shown in Figure 3-1, above, the Micro/1000 is designed to support memory, CPU, and control store cards in the right-hand seven slots of its card cage. The base Micro 27 uses four of these slots for its two CPU cards, its memory controller card, and one memory array card. Three card cage slots are available for an optional (option 001) floating point processor (FPP) card, WCS and/or PROM Control Store card(s), and additional memory array cards. If all three additional slots can be used for memory array cards, the Micro 27 can support up to 4 megabytes of parity memory or 8 megabytes of ECC memory. Each space used for an FPP, WCS, or PROM control store card reduces maximum parity memory capacity by 1 megabyte, maximum ECC memory capacity by 2 megabytes.

The Micro 29 uses five card cage slots for its CPU and memory control cards, and one memory array card. Slot number 1 can be used for either a 12205A A900 control store card or an I/O interface but no other card. One slot is thus left available for a second memory array card, limiting maximum ECC memory in the Micro 29 to 6 megabytes (two 12221A 3 MB memory array cards).

Card Cage Configuration Examples

See figures 3-2 through 3-5.

Slot No.	Left-hand side of card cage seen from rear	Slot No.	Right-hand side of card cage seen from rear
9	Other I/O Card	1	12103D 1 MB parity mem
10	Other I/O Card	2	12103D 1 MB parity mem
11	Other I/O Card	3	12103C 0.5 MB par mem
12	Other I/O Card	4	12100A Single Bd Comp.
13	Other I/O Card	5	12009A HP-IB disc I/O
14	Batt Backup or I/O Cd	6	Other I/O card
15	Batt Backup or I/O Cd	7	Other I/O card
16	Battery Backup Card	8	25 kHz Sine Wave Card

Figure 3-2. Micro 24 Card Cage Layout Example

Slot No.	Left-hand side of card cage seen from rear	Slot No.	Right-hand side of card cage seen from rear
9	Other I/O Card	1	12111C 2 MB ECC mem
10	Other I/O Card	2	12111C 2 MB ECC mem
11	Other I/O Card	3	12111B 1 MB ECC mem
12	Other I/O Card	4	12110B 1 MB ECC Ctrlr
13	Other I/O Card	5	A600+ CPU card
14	Batt Backup or I/O Cd	6	12009A HP-IB disc I/O
15	Batt Backup or I/O Cd	7	12005B console I/O
16	Battery Backup Card	8	25 kHz Sine Wave Card

Figure 3-3. Micro 26 Card Cage Layout Example

Slot No.	Left-hand side of card cage seen from rear	Slot No.	Right-hand side of card cage seen from rear
9	12005B console I/O	1	12111C 2 MB ECC mem
10	Other I/O Card	2	Memory Control Card
11	Other I/O Card	3	Upper CPU Card
12	Other I/O Card	4	Floating Point Proc. Card
13	Other I/O Card	5	Lower CPU Card
14	Batt Backup or I/O Cd	6	12153A WCS Card
15	Batt Backup or I/O Cd	7	12009A HP-IB disc I/O
16	Battery Backup Card	8	25 kHz Sine Wave Card

Figure 3-4. Micro 27 Card Cage Layout Example

Slot No.	Left-hand side of card cage seen from rear	Slot No.	Right-hand side of card cage seen from rear
9	12009A HP-IB disc I/O	1	12205A Control Store Cd
10	12005B console I/O	2	12201A Sequencer Card
11	Other I/O Card	3	12202A Data Path Card
12	Other I/O Card	4	12203A Cache Control Cd
13	Other I/O Card	5	12204A Memory Ctrlr Cd
14	Batt Backup or I/O Cd	6	12221A 3 MB ECC Mem
15	Batt Backup or I/O Cd	7	12221A 3 MB ECC Mem
16	Battery Backup Card	8	25 kHz Sine Wave Card

Figure 3-5. Micro 29 Card Cage Layout Example

Available HP-IB Capacity

The 12009A HP-IB interface included in Micro 24, 26, 27, and 29 SPUs can support up to four hard discs. Although the HP-IB interface can address up to a total of 14 devices, it is advisable to use a different HP-IB interface to connect non-disc devices to the system to assure optimum performance.

Compatible System Consoles

See Table 3-8, below. Note, however, that connection options 005 and 006 in Table 3-8 do not apply to the 2484A Micro 24 SPU. Direct cable connections to the four-port On-Board I/O multiplexer of the 2484A's single-board computer MUST use 40242Y cables instead of the 40242M cables listed in Table 3-8 for connecting to the 12040C/D eight-channel multiplexer. The 13222Y cable connections listed in Table 3-8 work equally well for the 2484A's On-board I/O multiplexer and the 12040C/D multiplexer.

Table 3-8. Compatible 248xA System Consoles and SPU Connection Options

TERMINAL	CONNECT OPTION*		
	005	006	008 Plus 12040C/D & this Cable
2392A Display Terminal	No	Yes	40242M*
2393A Graphics Terminal	No	Yes	40242M*
2397A Color Graphics Terminal	No	Yes	40242M*
NOTE: The following additional terminals are discontinued products listed here for reference only.			
2382A Office Terminal	No	Yes	40242M*
2621B Display Terminal	No	Yes	40242M*
2622A Display Terminal	Yes	No	13222Y
2623A Graphics Terminal	Yes	No	13222Y
2624B Display Terminal	Yes	No	13222Y
2625A Dual-System Terminal	No	Yes	40242M*
2626A Display Station,	Yes	No	13222Y
2627A Color Graphics Terminal	Yes	No	13222Y
2628A Word Processing Terminal	No	Yes	40242M*
45610B Touchscreen Terminal	No	Yes	40242M*

* Connect options 005 and 006 do not apply to the 2484A SPU; a 40242Y cable MUST be substituted for 40242M for direct connection to any of the four On-Board I/O channels of the single-board computer in the 2484A Micro 24 SPU.

Compatible System Discs

See Table 3-9.

Electrical Specifications

AC Power Requirements of 243xA/E Computer or 248xA SPU

Std Line Voltage: 115V -25%/+20% (86-138V).

Opt 015 Line Voltage: 230V -23%/+20% (178-276V).

Line Frequency: 47.5-66 Hz.

Maximum Operating Current. 6A in 115V configuration, 3A in 230V configuration.

Power Cable: The standard 243xA/E computer or 248xA SPU includes a 2 m (6.5 ft.) power cable with NEMA type 5-15P power plug). Units ordered with option 015 are provided with a power cable appropriate for the destination country.

Peripherals Power Requirements

See Table 3-10 on page 3-55.

DC Current Available and Required for I/O Interfaces and Accessories

See Table 3-11 on page 3-57.

Table 3-9. Compatible System Discs

At least one 12122A, 791xP/R, 793xH/XP, 794xA, 795xA, 913xL, or 915xB Disc is required with 248xA SPU.

PRODUCT NUMBER	TYPE	DISC CAP (MB)	AVG XFER RATE (kB/s)	AVG ACC TIME (ms)
12122A	Integrated, hard, fixed w/microfloppy drive for s/w loading & backup	19.4 0.6	150 17	75 225
9133L	Hard, fixed with microfloppy drive for s/w loading & backup	39.9 0.6	187 17	40 430
9153B	Hard, fixed with microfloppy drive for s/w loading & backup	19.4 0.6	150 17	85 225
7911P/R	Hard, fixed with CS/80 cartridge tape drive for s/w loading & backup	28.1	983	35
7912P/R		65.6	983	35
7914CT/R		131.2	983	36
7914ST or 7914TD*	Hard, fixed with 1600 cpi mag tape drive	131.2	983	36
7942A	Hard, fixed with built-in 9144A tape drive for s/w loading & backup	23.8	625	49
7946A		55.5	625	49
NOTE: The following discs require a separate software loading and backup device, such as a 797xA/B/E Mag Tape Unit or 35401A Autochanger Tape Subsystem or 9144A Cartridge Tape Subsystem.				
7933H/XP	Hard, fixed	404.4	1000	32
7935H/XP	Hard, removable	404.4	1000	32
7936H/XP	Hard, fixed	307	1000	31
7937H/XP	Hard, fixed	571	1000	31
7941A*	Hard, fixed	23.8	625	49
7945A*		55.5	625	49
7957A	Hard, fixed	81	853	42
7958A		130	853	42
9134L	Hard, fixed	39.9	187	40
9154B	Hard, fixed	19.4	150	85

NOTE: Average transfer rate is based on the minimum time required to transfer one track without overrun.

* Discontinued product listed here for reference only.

Environmental Specifications

Temperature

Operating (without 12122A Integral Discs): 0° to 55°C (32° to 131°F) to 3048m (10,000 ft.). Maximum temperature is linearly derated 2°C (3.6°F) for each 304.8m (1,000 ft.) increase in altitude. Resulting temperature range is 0° to 45°C (32° to 113°F) at 4572m (15,000 ft.).

Operating (with12122A Integral Discs): 5° to 45°C (40° to 113°F); maximum rate of change < 10°C (18°F) per hour.

Non-operating Temperature with 12122A Integral Discs: -40° to 60°C (-40° to 140°F).

Non-operating Temperature without 12122A Integral Discs: -40° to 75°C (-40° to 167°F).

Relative Humidity

Operating without 12122A Integral Disc: 5% to 95%, non-condensing.

Operating with 12122A Integral Disc: 20% to 80% non-condensing.

Altitude

Operating: To 4.6 km (15,000 ft).

Non-operating: To 15.3 km (50,000 ft).

Vibration and Shock

2434A Computer/2484A SPU Operating Vibration: 0.43G rms, distributed as follows:

Frequency (Hz)	Power Spectral Density (G^2/Hz)
5	0.002
5 - 15	-1.5 dB/octave
15	0.0015
12 - 200	-6.0 dB/octave
200 - 350	0.00012
350 - 500	-6.0 dB/octave

2434A Computer/2484A SPU Operating Shock: 1.5G peak, 1/2 sine, 6 to 9 ms duration, 45 Hz crossover.

2434A Computer/2484A SPU Non-operating Shock: 7.0G peak, 1/2 sine, 6 to 9 ms duration, 45 Hz crossover.

2436A/E, 2437A, and 2439A Computers and 2486A, 2487A, and 2489A SPUs Vibration and Shock: These products are type tested for normal shipping and handling vibration and shock (contact factory for review of any application that requires operation under continuous vibration).

Safety and EMI Compliance

Safety Qualification

HP 243xA/E and 248xA computers and SPUs meet Underwriter's Laboratory (UL), Canadian Standards Association (CSA), and International Electro-technical Commission (IEC) safety standards.

EMI Compliance

HP 243xA/E and 248xA computers and SPUs comply with Federal Communications Commission (FCC) Class A and Verband Deutscher Elektrotechniker (VDE) Level A regulations for Electro Magnetic Interference (EMI).

Physical Characteristics

Package

HP 243xA/E and 248xA Micro/1000 computers and SPUs are housed in a standard 19-inch EIA rack mountable package.

Dimensions in cm and (inches)

Rack Mounting Micro/1000 Package: 17.8 cm (7 in.) high x 48.3 cm (19 in.) wide x 64.8 cm (25.5 in.) deep.

Micro/1000 Package in 40025A Vertical Floor Mount: 67.3 cm (26.5 in.) high x 34.7 cm (13.6 in.) wide x 64.8 cm (25.5 in.) deep.

Net Weight

2434A or 2484A: 16 kg (35.2 lb).

2436A/E or 2486A: 16.3 kg (36 lb).

2437A or 2487A: 16.8 kg (37 lb).

2439A or 2489A: 18.1 kg (40 lb).

12122A Integrated Discs Adds: 2.27 kg (5 lb).

40025A Vertical Floor Mt Adds: 5.68 kg (12 lb).

Cooling

Four fans provide left-to-right airflow through the Micro/1000 card cage and for the power supply and 12122A integrated discs. A dual-speed feature allows the fans to operate at lower speed, reducing noise when cooling requirements permit.

Systems Ordering Information

NOTE: 248xA SPUs require a terminal and a disc (not included) for operator communication and for operating system and program development support.

HP 2484A System Processor Unit for HP 1000 Micro 24 Computer System

The 2484A System Processor Unit includes:

1. 12100A A400 Single-Board computer with 512 kB of parity memory and four-channel On-Board I/O multiplexer.
2. 12100-60002 Four-channel On-Board I/O breakout cable.
3. 2430A (02430-60022) rack-mountable Micro/1000 package with power supply and 14-slot card cage plus dedicated slots for 25 kHz sine wave and battery backup cards.
4. 02430-90001 Micro/1000 Computer System Installation and Service Manual.
5. 02424-90001 A400 Computer Reference Manual.
6. 02103-90005 Computer I/O Interfacing Guide.
7. 12009A+D01 HP-IB Interface to system disc.
8. 12009-90001 HP 12009A HP-IB Interface Reference Manual.
9. Software and supporting documentation as follows:
    a. RTE-A Master, RTE-A Primary system, and 24612A and 24398B diagnostics, on user-specified media.
    b. License to use RTE-A on one System.
    c. RTE-A and diagnostics manuals (see RTE-A data sheet, page 2-13 and Diagnostics data sheet, page 3-61 in this handbook for manuals furnished).
10. On-site installation assistance and checkout by a Hewlett-Packard service engineer, including integration and test with primary system.
11. 90-day on-site warranty.
12. Four 93285A Engineering Units incorporated in the SPU in the course of manufacturing by Hewlett-Packard.

HP 2484A Options

NOTE: Must order media option 022, 044, or 061.

015: Operation from 230V ac power. Power options for system console, disc, and other peripherals must be ordered separately.

022: Software on CS/80 cartridge tape for use with 791xR disc or 35401A or 9144A Tape Cartridge Subsystem (excludes options 044 and 061).

044: Software on 270 kB Microfloppy discs for use with 12122A Integral Discs or 9133L or 9153B external discs (excludes options 022 and 061).

061: Software on 1600 cpi mag tape (excludes options 022 and 044).

150: Installation preparation kit for 12122A Integrated Discs and deletion of the 12009A HP-IB interface from the 2484A SPU.

151: Installation preparation kit for 12122A Integrated Discs without deletion of the 12009A HP-IB interface from the 2484A SPU.

HP 2486A System Processor Unit for HP 1000 Micro 26 Computer System

The 2486A System Processor Unit includes:

1. 12105-60001 A600+ CPU Card, instruction set and VCP ROMs, and 12038A Memory frontplane connector.
2. 12102B Memory Controller Card with 512 kB parity memory.
3. 2430A (02430-60022) rack-mountable Micro/1000 package with power supply and 14-slot card cage plus dedicated slots for 25 kHz sine wave and battery backup cards.
4. 02430-90001 Micro/1000 Computer System Installation and Service Manual.
5. A600+ computer manuals, as follows:
    a. 02156-90002 HP 1000 A600+ Computer Installation and Service Manual.
    b. 02156-90001 HP 1000 A600+ Computer Reference Manual.
6. 02103-90005 Computer I/O Interfacing Guide.
7. Disc and terminal interfaces as follows:
    a. 12009A-D01 HP-IB Interface to Disc.
    b. 12005B-010 Async Serial (terminal) Interface.
8. Interface manuals as follows:
    a. 12005-90002 HP 12005A/B Asynchronous Interface Reference Manual.
    b. 12009-90001 HP 12009A HP-IB Interface Reference Manual.

9 through 12. Same as for 2484A SPU, above.

HP 2486A Options

NOTE: Must order one of system console connect options 005, 006, or 008 and media option 022, 044, or 061.

005: Provides 15m (49 ft.) fiber optic cable connection to system console as specified in Table 3-8 (excludes options 006 and 008).

006: Provides 5m (49 ft.) electrical cable connection to system console as specified in Table 3-8 (excludes options 005 and 008).

008: Deletes 12005B interface and 12005-90002 manual to permit their replacement with a 12040D multiplexer and a connect cable as specified in Table 3-8 for the various compatible terminals (excludes options 005 and 006).

014: Deletes 12102B 512kB parity memory controller permitting its replacement with a 12110A 512kB or 12110B 1MB ECC memory controller. (Must order 12110x ECC memory controller, and memory array cards and 12038x connector as appropriate.)

015, 022, 044, 061, 150, and 151: Same as for 2484A, above.

HP 2487A System Processor Unit for HP 1000 Micro 27 Computer System

The 2487A System Processor Unit includes:

1. A700 CPU cards, including 12152-60001 and 60051 processor cards, 12152-60052 memory controller, and instruction set and VCP PROMs.
2. 12103C 512 kB Memory array card and 12038A Memory frontplane connector assembly.
3. 2430A (02430-60022) rack-mountable Micro/1000 package with power supply and 14-slot card cage plus dedicated slots for 25 kHz sine wave and battery backup cards.
4. 02430-90001 Micro/1000 Computer System Installation and Service Manual.
5. A700 computer manuals, as follows:
   a. 02137-90002 HP 1000 A700 Computer Installation and Service Manual.
   a. 02137-90001 HP 1000 A700 Computer Reference Manual.
6. 02103-90005 Computer-I/O Interfacing Guide.
7. Disc and terminal interfaces as follows:
   a. 12009A-D01 HP-IB Interface to Disc.
   b. 12005B-010 Async Serial (terminal) Interface.
8. Interface manuals as follows:
9. Software and supporting documentation as follows:
   a. RTE-A Master, RTE-A Primary system, and 24612A and 24398B diagnostics, on user-specified media.
   b. License to use RTE-A on one System.
   c. RTE-A and diagnostics manuals (see RTE-A data sheet, page 2-13 and Diagnostics data sheet, page 3-61 in this handbook for manuals furnished).
10. On-site installation assistance and checkout by a Hewlett-Packard service engineer, including integration and test with primary system.
11. 90-day on-site warranty.
12. Four 93285A Engineering Units incorporated in the SPU in the course of manufacturing by Hewlett-Packard.

HP 2487A Options

NOTE: Must order one of system console connect options 005, 006, or 008 and media option 022, 044, or 061.

001: Adds 12156A Floating Point Processor Card with Scientific and Vector Instruction Sets (including the 12156-90001 A700 Floating Point Processor Installation Manual) and replaces 12160A two-connector frontplane connector assembly with a 12156-60002 three-connector frontplane assembly (uses one card cage slot).

005 through 008: Same as for 2486A, above.

014: Deletes standard 512 kB parity memory array card and front plane connector, permitting their replacement with other memory array cards. (Must order other A700 compatible memory card(s) and appropriate 12038x connector.)

015: Operation from 230V ac power. Power options for system console, disc, and other peripherals must be ordered separately.

022: Software on CS/80 cartridge tape for use with 791xR disc or 35401A or 9144A Tape Cartridge Subsystem (excludes options 044 and 061).

044: Software on 270 kB Microfloppy discs for use with 12122A Integral Discs or 9133L or 9153B external discs (excludes options 022 and 061).

061: Software on 1600 cpi mag tape (excludes options 022 and 044).

150: Installation preparation kit for 12122A Integrated Discs and deletion of the 12009A HP-IB interface from the 2486A SPU.

151: Installation preparation kit for 12122A Integrated Discs without deletion of the 12009A HP-IB interface from the 2486A SPU.

HP 2489A System Processor Unit for HP 1000 Micro 29 Computer System

The 2489A System Processor Unit includes:

1. CPU cards, as follows:
   a. 12201A Sequencer card with ROMs.
   b. 12202A Data Path card with Floating Point Processors.
   c. 12203A Cache Control card with VCP ROMs.
   d. 12204A Memory Controller card.
2. 12220A 768 kB ECC Memory Array card and 12222A Memory frontplane connector assembly.
3. 2430B (02430-60023) rack-mountable Micro/1000 package with power supply and 14-slot card cage plus dedicated slots for 25 kHz sine wave and battery backup cards.

4. 02430-90001 Micro/1000 Computer System Installation and Service Manual.
5. A900 computer manuals, as follows:
   a. 02139-90002 HP 1000 A900 Computer Installation and Service Manual.
   b. 02139-90001 HP 1000 A900 Computer Reference Manual.

6 through 12. Same as for 2487A SPU, above.

HP 2489A Options

NOTE: Must order one of system console connect options 005, 006, or 008 and media option 022, 044, or 061.

005 through 008: Same as for 2486A, above.

014: Deletes standard 768 kB ECC memory array card and front plane connector, permitting their replacement with other memory array cards. (Must order other A900 compatible memory card(s) and appropriate 12038x connector.)

015, 022, 044, 061, 150, and 151: Same as for 2487A, above.

Computers Ordering Information

NOTE: 243xA/E computers require the RTE-A operating system and a terminal interface and a compatible terminal or a DS/1000-IV interface linked to another HP 1000 Computer System for operation.

HP 2434A HP 1000 Micro 24 Computer

The 2434A Computer includes:

1. 12100A A400 Single-Board computer with 512 kB of parity memory and four-channel On-Board I/O multiplexer.
2. 12100-60002 Four-channel On-Board I/O breakout cable.
3. 2430A (02430-60022) rack-mountable Micro/1000 package with power supply and 14-slot card cage plus dedicated slots for 25 kHz sine wave and battery backup cards.
4. 02430-90001 Micro/1000 Computer System Installation and Service Manual.
5. 02424-90001 A400 Computer Reference Manual.
6. 02103-90005 Computer I/O Interfacing Guide.
7. 92077E Right to Execute RTE-A.

HP 2434A Options

015: Operation from 230V ac power. Power options for system console and other peripherals must be ordered separately.

151: Installation preparation kit for 12122A Integrated Discs.

HP 2436A HP 1000 Micro 26 Computer

The 2436A Computer includes:

1. 12105-60001 A600+ CPU Card, instruction set and VCP ROMs, and 12038A Memory frontplane connector.
2. 12102A Memory Controller Card with 128 kB parity memory.
3. 2430A (02430-60022) rack-mountable Micro/1000 package with power supply and 14-slot card cage plus dedicated slots for 25 kHz sine wave and battery backup cards.
4. 02430-90001 Micro/1000 Computer System Installation and Service Manual.
5. A600+ computer manuals, as follows:
   a. 02156-90002 HP 1000 A600+ Computer Installation and Service Manual.
   b. 02156-90001 HP 1000 A600+ Computer Reference Manual.
6. 02103-90005 Computer I/O Interfacing Guide.

HP 2436E HP 1000 Micro 26 Computer

The 2436E Computer includes:

1. 12105-60001 A600+ CPU Card, instruction set and VCP ROMs, and 12038A Memory frontplane connector.
2. 12102B Memory Controller Card with 512 kB parity memory.

3 through 6. Same as for 2436A, above.

7. 92077E Right to Execute RTE-A.

HP 2436A/E Options

014: Deletes standard 128 kB or 512 kB memory controller, permitting its replacement with a parity or ECC memory controller with equal or greater capacity, which must be ordered.

015 and 151: Same as for 2434A, above.

HP 2437A HP 1000 Micro 27 Computer

The 2437A Computer includes:

1. A700 CPU cards, as including 12152-60001 and 60051 processor cards, 12152-60052 memory controller, and instruction set and VCP PROMs.
2. 12103A 128 kB Memory array card and 12038A Memory frontplane connector assembly.
3. 2430A (02430-60022) rack-mountable Micro/1000 package with power supply and 14-slot card cage plus dedicated slots for 25 kHz sine wave and battery backup cards.
4. 02430-90001 Micro/1000 Computer System Installation and Service Manual.

5. A700 computer manuals, as follows:
   a. 02137-90002 HP 1000 A700 Computer Installation and Service Manual.
   a. 02137-90001 HP 1000 A700 Computer Reference Manual.
6. 02103-90005 Computer I/O Interfacing Guide.

HP 2437A Options

001: Adds 12156A Floating Point Processor Card with Scientific and Vector Instruction Sets (including the 12156-90001 A700 Floating Point Processor Installation Manual) and replaces 12160A two-connector frontplane connector assembly with a 12156-60002 three-connector frontplane assembly (uses one card cage slot).

014: Deletes standard 128 kB parity memory array card and front plane connector, permitting their replacement with other memory array cards. (Must order other A700 compatible memory card(s) and appropriate 12038x connector.)

015: Operation from 230V ac power. Power options for system console and other peripherals must be ordered separately.

151: Installation preparation kit for 12122A Integrated Discs.

HP 2439A HP 1000 Micro 29 Computer

The 2439A Computer includes:

1. CPU cards, as follows:
   a. 12201A Sequencer card with ROMs.
   b. 12202A Data Path card with Floating Point Processors.
   c. 12203A Cache Control card with VCP ROMs.
   d. 12204A Memory Controller card.
2. 12220A 768 kB ECC Memory Array card and 12222A Memory frontplane connector assembly.
3. 2430B (02430-60023) rack-mountable Micro/1000 package with power supply and 14-slot card cage plus dedicated slots for 25 kHz sine wave and battery backup cards.
4. 02430-90001 Micro/1000 Computer System Installation and Service Manual.
5. A900 computer manuals, as follows:
   a. 02139-90002 HP 1000 A900 Computer Installation and Service Manual.
   b. 02139-90001 HP 1000 A900 Computer Reference Manual.
6. 02103-90005 Computer I/O Interfacing Guide.

HP 2439A Options

014: Deletes standard 768 kB ECC memory array card and front plane connector, permitting their replacement with other memory array cards. (Must order other A900 compatible memory card(s) and appropriate 12038x connector.)

015 and 151: Same as for 2437A, above.

Optional Software

See Extensive Software Support listings on pages 3-4 and 3-5 of this handbook.

Memory Expansion and Array Connectors

Memory Controllers for 2436A/E and 2486A

12102B	**512 kB Parity Memory Controller**
12110A	**512 kB ECC Memory Controller**
12110B	**1 MB ECC Memory Controller**

Parity Memory Array Cards for 2434A, 2436A/E, 2437A, 2484A, 2486A, and 2487A

12103B	**512 kB Parity Memory Array Card**
12103C	**1 MB Parity Memory Array Card**

ECC Memory Array Cards for 2436A/E, 2437A, 2486A, and 2487A

12111A	**512 kB ECC Memory Array Card**
12111B	**1 MB ECC Memory Array Card**
12111C	**2 MB ECC Memory Array Card**

Memory Array Connectors for 2434A, 2436A/E, 2437A, 2484A, 2486A, and 2487A

12038A	**Connector to 1 array card**
12038B	**Connector to 2 array cards**
12038C	**Connector to 3 array cards**
12038D	**Connector to 4 array cards**

Memory Array Cards and Array Connectors for 2439A and 2489A

12220A	**768 kB ECC Memory Array Card**
12221B	**3 MB ECC Memory Array Card**
12222A	**Connector to 1 array card**
12222B	**Connector to 2 array cards**

Micro/1000 Accessories

Integrated Discs and Vertical Floor Mount

12122A Integrated Discs: 19.4 MB fixed, hard disc and 630 kB microfloppy disc (see 12122A data sheet on page 10-81/10-82 for more information).

40025A Vertical Floor Mount provides a convenient base on casters for compact vertical desk-side or under-table mounting and mobility of Micro 24, 26, 27, or 29 systems.

Plug-in Hardware Accessories

12153A A700 Writable Control Store card provides 4k words of control store space for HP 1000 Micro 27 System.

12154A Battery Backup Card provides 45 to 210 minutes of sustaining power for up to four memory array cards, depending upon the system configuration, state of charge, and temperature; additional hold-up time can be achieved by connecting an external battery.

12155A A700 PROM Control Store card provides mounting for up to 8k words of PROMs in HP 1000 Micro 27 System.

12159A 25 kHz Sine Wave Card provides up to 30W of 39V rms ac power (two phases) at 25 kHz, which is filtered from the output of the power supply switcher.

12205A A900 Control Store Board provides 4k words of writable control store and mounting space for 2k words of 2k control store PROMs in HP 1000 Micro 29 System.

Interfaces

The HP 243xA/E computers and 248xA SPUs can use all of the interfaces listed in section 4 of this handbook, including those that require 25 kHz power when the Micro/1000 computer or SPU is equipped with the 12159A 25 kHz Sine Wave Card.

Peripheral Devices

HP 1000 Micro 24, 26, 27, and 29 Systems support the peripheral devices listed and described in sections 7 through 10 of this handbook.

Engineering Reference Documentation

For Micro 24 (A400): 02424-90003 HP 1000 A400 Computer Engineering and Reference Documentation.

For Micro 26 (A600+): 02156-90003 HP 1000 A600 Computer Engineering and Reference Documentation.

For Micro 27 (A700): 02137-90005 HP 1000 A700 Computer Engineering and Reference Documentation.

For Micro 29 (A900): 02139-90003 HP 1000 A900 Computer Engineering and Reference Documentation.

20-Slot Computers

HP 1000 A-Series Computer Systems

product numbers
2156B, 2137A, and 2139A

The HP 2156B, 2137A, and 2139A are identically-packaged A600+, A700, and A900 box computers for OEMs and end users designing their own rack-mounted systems (see the A-Series Computers and Specifications data sheet on page 3-1 for comparison of A600+, A700, and A900 capabilities.) In a rack-mountable cabinet 26.6 cm (10.5 in.) high by 61.2 cm (24 in.) deep these computers house the CPU and base memory capacity with space to spare for memory expansion and I/O interfaces, as summarized below. At least one I/O interface and associated terminal or remote computer system is required in addition to the box computer for a usable system.

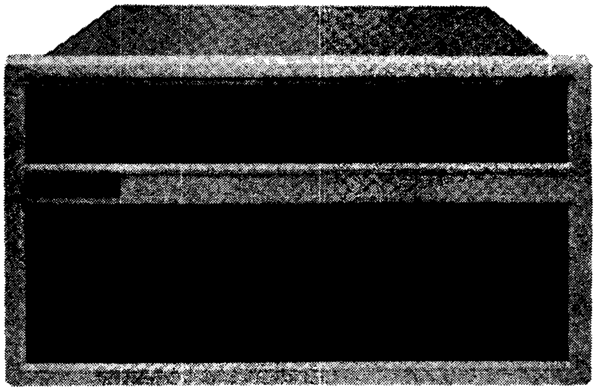
Product Number	2156B	2137A	2139A
Av. Card Cage Slots	18	16	15
Serial I/O Channels	0 incl.	0 incl.	0 incl.
Base Memory Included	128 kB Parity	128 kB Parity	768 kB ECC
Max. Parity Memory†	4.0 MB	4.0 MB	Not Sup.
Max. ECC Memory†	8.0 MB	8.0 MB	18.0 MB
Av. Card Cage Slots w/Max. Memory	14	13	10

† *Maximum memory sizes listed assume use of only parity or only ECC memory array cards, and a 1 MB ECC memory controller in the 2156B to support ECC memory. Parity and ECC memory array cards can be used together in the same 2156B or 2137A Computer, up to a maximum of four memory array cards (maximum memory will be less).*

HP 2156B, 2137A, or 2139A Computer operations can be managed by the 92077A RTE-A operating system. The RTE-A system supports multiprogramming, high-level program languages, the 92078A VC+ enhancement for large programs to 7.75 megabytes, virtual memory and extended memory areas for data, data base management, distributed systems networking, graphics software and main memory up to 18 megabytes.

Features

- **Spacious 20-slot card cage with good capacity for memory expansion and I/O interfaces in addition to the CPU and base memory.**
- **Power fail detection and auto restart with optional 12157B Battery Backup System.**
- **Front-to-rear air flow cabinet maximizes system cooling efficiency and equipment reliability.**
- **Disc memory expandable to over 2.2 gigabytes on one card cage slot with multiple discs.**



Description and Specifications

For functional description and specifications of the A600+, A700, and A900 computers, memory systems, input/output system, software and diagnostic support, compatibility, and specifications, see the A-Series Computer Design and Specifications data sheet on page 3-1.

Electrical Specifications

AC Power Requirements of 2156B, 2137A, and 2139A Computers

Std Line Voltage: 115V -25%/+20% (86-138V).

Opt 015 Line Voltage: 230V -23%/+20% (178-276V).

Line Frequency: 47.5 to 66 Hz.

Maximum Power Required: 700W.

Power Cable: The standard 2156B, 2137A, or 2139A Computer includes a 3m (10 ft.) power cable with NEMA 5-15P power plug. No power cable is provided with the option 015 version of these computers.

Peripherals Power Requirements

See Table 3-10 on page 3-55.

DC Current Available and Required for I/O Interfaces and Accessories

The computer power supply provides enough current for any combination of A-Series interfaces or other A-Series plug-ins that can be accommodated in the 20-slot card cage.

Environmental Specifications

Temperature

Operating : 0° to 55°C (32° to 131°F) to 3048m (10,000 ft.). Maximum temperature is linearly derated 2°C (3.6°F) for each 304.8m (1,000 ft.) increase in altitude. Resulting temperature range is 0° to 45°C (32° to 113°F) at 4572m (15,000 ft.).

Non-operating Temperature: –40° to 75°C (–40° to 167°F).

Altitude

Operating: To 4.6 km (15,000 ft).

Non-operating: To 15.3 km (50,000 ft).

Relative Humidity

5% to 95% non-condensing.

Vibration and Shock

HP 2156B, 2137A, and 2139A Computers are type tested for normal shipping and handling shock and vibration (contact factory for review of any application that requires operation under continuous vibration).

Safety and EMI Compliance

Safety Qualification

HP 2156B, 2137A, and 2139A Computers meet Underwriter's Laboratory (UL), Canadian Standards Association (CSA), and International Electrotechnical Commission (IEC) safety standards.

EMI Compliance

HP 2156B, 2137A, and 2139A Computers comply with Federal Communications Commission (FCC) Class A and Verband Deutscher Elektrotechniker (VDE) Level A regulations for Electro Magnetic Interference (EMI) when incorporated in the HP 1000 Model 26 (2196C/D), 27 (2197C/D), and 29 (2199C/D) Computer Systems.

Physical Characteristics

Dimensions

26.6 cm (10.5 in.) high, 48.3 cm (19 in.) wide, 61.2 cm (24 in.) deep.

Net Weight

29.1 kg (64 lb).

Ventilation

Four fans provide 10.7 cubic meters per minute (380 CFM) air flow through the computer card cage from front to rear.

Ordering Information

NOTE A: HP 2156B, 2137A, and 2139A Computers require the RTE-A operating system and a 12005B terminal interface or 12040C/D Multiplexer, cable, and a compatible terminal or a DS/1000-IV interface linked to another HP 1000 Computer System for operation.

NOTE B: Support services, such as installation, site prep consulting, and on-site warranty service are NOT included with 2156B, 2137A, or 2139A Computers, but may be purchased separately from your local HP field office.

HP 2156B Computer

The 2156B Computer includes:

1. CPU and memory as follows:
   a. 12102A Memory Controller Card with 128 kB parity memory.
   b. 12105-60001 A600+ CPU Card, instruction set and VCP ROMs, and 12038A Memory frontplane connector
2. 12151A (12151-60024) 20-Slot box with power supply and ventilation.
3. 02156-90002 HP 1000 A600+ Computer Installation and Service Manual.
4. 02156-90001 HP 1000 A600+ Computer Reference Manual.
5. 02103-90005 Computer I/O Interfacing Guide.

HP 2156B Options

014: Deletes 12102A 128 kB parity memory controller permitting its replacement with a parity or ECC memory controller with greater capacity, which MUST be ordered.

015: Operation from 220V ac power. Power options for terminals and other peripherals must be ordered separately.

HP 2137A Computer

The 2137A Computer includes:

1. CPU and memory as follows:
   - a. 12103A 128 kB parity memory array card.
   - b. 12038A Memory frontplane connector assembly.
   - c. A700 CPU, including 12152-60001 and 60051 processor cards, 12152-60052 memory controller, and instruction set and VCP PROMs.
2. 12151A (12151-60024) 20-Slot box with power supply and ventilation.
3. 02137-90002 HP 1000 A700 Computer Installation and Service Manual.
4. 02137-90001 HP 1000 A700 Computer Reference Manual.
5. 02103-90005 Computer I/O Interfacing Guide.

HP 2137A Options

001: Adds 12156A Hardware Floating Point Processor card and Scientific and Vector Instruction Set firmware (including the 12156-90001 A700 Floating Point Processor Installation Manual) and 2k words of available PROM control store mounting space. Also replaces 12160A two-connector Front plane assembly with a 12038B three-connector Front plane assembly (uses one card cage slot).

014: Deletes standard 128 kB parity memory array card and front plane connector, permitting their replacement with other memory array cards. (Must order other A700 compatible memory card(s) and appropriate 12038x connector)

015: Operation from 220V ac power. Power options for terminals and other peripherals must be ordered separately.

HP 2139A Computer

The 2139A Computer includes:

1. CPU and memory as follows:
   - a. 12201A Sequencer card with ROMs.
   - b. 12202A Data Path card with Floating Point Processors.
   - c. 12203A Cache Control card with VCP ROMs.
   - d. 12204A Memory Controller card.
   - e. 12220A 768 kB ECC Memory Array card.
   - f. 12222A Memory Array Connector
2. 12210A (12210-60009) 20-Slot box with power supply and ventilation.
3. 02139-90002 HP 1000 A900 Computer Installation and Service Manual.
4. 02139-90001 HP 1000 A900 Computer Reference Manual.
5. 02103-90005 Computer I/O Interfacing Guide.

HP 2139A Options

014: Deletes standard 768 kB ECC memory array card and front plane connector, permitting their replacement with other memory array cards. (Must order other A900 compatible memory card(s) and appropriate 12222x connector).

015: Operation from 220V ac power. Power options for terminals and other peripherals must be ordered separately.

Optional Software

See Extensive Software Support listings on pages 3-4 and 3-5 of this handbook.

Memory Expansion and Array Connectors

Memory Controllers for 2156B

12102B	**512 kB Parity Memory Controller**
12110A	**512 kB ECC Memory Controller**
12110B	**1 MB ECC Memory Controller**

Memory Array Cards and Array Connectors for 2156B and 2137A

12103B	**512 kB Parity Memory Array Card**
12103C	**1 MB Parity Memory Array Card**
12111A	**512 kB ECC Memory Array Card**
12111B	**1 MB ECC Memory Array Card**
12111C	**2 MB ECC Memory Array Card**
12038A	**Connector to 1 array card**
12038B	**Connector to 2 array cards**
12038C	**Connector to 3 array cards**
12038D	**Connector to 4 array cards**

Memory Array Cards and Array Connectors for 2139A

12220A	**768 kB ECC Memory Array Card**
12221B	**3 MB ECC Memory Array Card**
12222A	**Connector to 1 array card**
12222B	**Connector to 2 array cards**
12222C	**Connector to 3 array cards**
12222D	**Connector to 4 array cards**
12222E	**Connector to 5 array cards**
12222F	**Connector to 6 array cards**

Accessories

Plug-In Accessories

12157B Battery Backup System using sealed lead-acid batteries (provides 15 to 90 minutes of sustaining power for up to four memory array cards), depending upon the system configuration, state of charge, and temperature; additional hold-up time can be achieved by connecting an external battery NOTE: This accessory is installed in the computer power supply and does NOT use a card cage slot.

12153A A700 Writable Control Store card provides 4k words of control store space for HP 2137A Computer.

12155A A700 PROM Control Store card provides mounting for up to 8k words of PROMs in HP 2137A Computer.

12205A A900 Control Store Board provides 4k words of writable control store and mounting space for 2k words of 2k control store PROMs in HP 2139A Computer.

Interfaces

HP 2156B, 2137A, and 2139A Computers can use all of the interfaces listed in section 4 of this handbook, including those that require 25 kHz power.

Peripheral Devices

HP 2156B, 2137A, and 2139A Computers support the peripheral devices listed and described in sections 7 through 10 of this handbook.

Engineering Reference Documentation

For 2156B (A600+): 02156-90003 HP 1000 A600 Computer Engineering and Reference Documentation.

For 2137A (A700): 02137-90005 HP 1000 A700 Computer Engineering and Reference Documentation.

For 2139A (A900): 02139-90003 HP 1000 A900 Computer Engineering and Reference Documentation.

Micro 14 and 16 Computers

HEWLETT PACKARD

HP 1000 A-Series Computer Systems

product numbers
2424A, 2426E, and 2426F

The HP 2424A Micro 14 and 2426E and 2426F Micro 16 Computers provide A400 and A600+ processing power in HP's smallest, lowest cost box computer package. These computers combine a six-slot card card cage with highly-efficient ventilation for cell control or other applications in the heat of the factory floor. They include a license to execute HP's powerful RTE-A operating system for economical application to low end real-time applications.

Despite their relatively small card cage, the Micro 14 and Micro 16 computers, coupled with efficient multichannel interfaces and cost-effective HP peripheral devices, offer users surprising power and excellent value for many different applications. Best of all, these computers execute the same programs as the larger A400, A600+, A700, and A900 Computer Systems. This facilitates transfer of applications from central development systems to the Micro 14 or 16.

Product Number	2424A	2426E	2426F
Av. Card Cage Slots	5	4	4
Serial I/O Channels	4 incl.	0 incl.	0 incl.
Base Memory Included	512 kB Parity	512 kB Parity	1 MB ECC
Max. Parity Memory†	4.0 MB	3.0 MB	3.0 MB
Max. ECC Memory†	Not Sup.	Not Sup.	6.0 MB
Av. Card Cage Slots w/Max. Memory	1	1	1

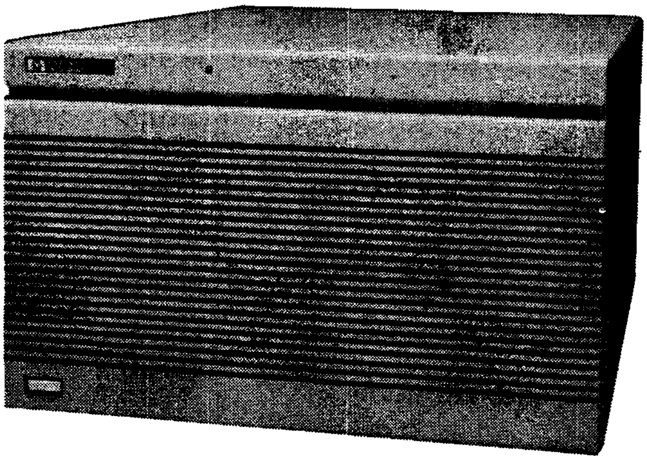
† Maximum memory sizes listed assume use of only parity or only ECC memory array cards. Parity and ECC memory array cards can be used together in the same 2426F Computer, up to a maximum of three memory array cards (maximum memory will be less).

Features

- **Compact computer with 6-slot card cage offers a low priced package for low-end applications.**
- **Highly-efficient ventilation with front-to-rear air flow cabinet provides superior tolerance of high operating temperatures.**

Description and Specifications

For functional description and specifications of the A400 and A600+ computers, memory systems, input/output system, software and diagnostic support, compatibility, and specifications, see the A-Series Computer Design and Specifications data sheet on page 3-1.



Exclusions

- Battery backup is not supported; and uninterruptible power supply is recommended for application that would otherwise use battery backup.
- 25 kHz power is not available, so interfaces that require 25 kHz ac power are not supported.
- Support services, such as installation, site prep consulting, and on-site warranty service are NOT included with 2424A or 2426E/F Computers, but may be purchased separately from your local HP field office.
- Right to execute RTE-A, included with the 2424A and 2426E/F Computers, does NOT include the right to develop programs or generate systems.

Electrical Specifications

AC Power Requirements

Line Voltage: 120V -28%/+17% (86-140V) or 240V -28%/+15% (172- 276V).

Line Frequency: 47.5 to 66 Hz.

Maximum Power Required: 216W (300 VA).

Power Cable: 3m (10 ft.) power cable with NEMA 5-15P power plug.

Peripherals Power Requirements

See Table 3-10 on page 3-55.

DC Current Available and Required for I/O Interfaces and Accessories

See Table 3-11 on page 3-57.

Environmental Specifications

Temperature

Operating: 0° to 60°C (32° to 140°F) to 3048m (10,000 ft.). Maximum temperature is linearly derated 2°C (3.6°F) for each 304.8m (1,000 ft.) increase in altitude. Resulting temperature range is 0° to 50°C (32° to 122°F) at 4572m (15,000 ft.).

Non-operating Temperature: –40° to 75°C (–40° to 167°F).

Altitude

Operating: To 4.6 km (15,000 ft.).

Non-operating: To 15.3 km (50,000 ft.).

Relative Humidity

5% to 95% non-condensing.

Shock and Vibration

Operating Shock: 1.5G peak, 1/2 sine, 6 to 9 milliseconds duration, 45 Hz crossover.

Non-Operating Shock: 7G peak, 1/2 sine, 6 to 9 milliseconds duration, 45 Hz crossover.

Operating Vibration: 0.43G rms, distributed as follows:

Frequency (Hz)	Power Spectral Density (G^2/Hz)
5	0.002
5 - 15	-1.5 dB/octave
15	0.0015
12 - 200	-6.0 dB/octave
200 - 350	0.00012
350 - 500	-6.0 dB/octave

Safety and EMI Compliance

Safety Qualification

HP 2424A and 2426E/F Computers meet Underwriter's Laboratory (UL), Canadian Standards Association (CSA), and International Electrotechnical Commission (IEC) safety standards.

EMI Compliance

HP 2424A and 2426E/F Computers comply with Federal Communications Commission (FCC) Class A and Verband Deutscher Elektrotechniker (VDE) Level A regulations for Electro Magnetic Interference (EMI).

Physical Characteristics

Dimensions

20.5 cm (8.1 in.) high, 32.5 cm (12.8 in.) wide, 50 cm (19.7 in.) deep.

Net Weight

13.2 kg (29 lb).

Ventilation

One fan provides balanced air flow through the computer card cage from front to rear with a flow design that assures even cooling of all components.

Ordering Information

NOTE: HP 2424A and 2426E/F Computers require the RTE-A operating system and a compatible terminal connected via serial interface (included in 2424A computer) and cable or a DS/1000-IV interface linked to another HP 1000 Computer System for operation.

HP 2424A Computer

The 2424A Computer includes:

1. 12100A CPU card including 512 kB of on–board parity memory and four On-Board serial I/O channels.
2. 12100-60002 Four-channel On-Board I/O breakout cable.
3. 02420-60101 6-Slot box with power supply and ventilation.
4. 02420-90001 Micro 14/16 Installation and Service Manual.
5. 02424-90001 HP 1000 A400 Computer Reference Manual.
6. 02103-90005 Computer I/O Interfacing Guide.
7. 92077E+400 Right to Execute RTE-A.

HP 2426E Computer

The 2426E Computer includes:

1. CPU and memory as follows:
    a. 12102B Memory Controller Card with 512 kB parity memory.
    b. 12105-60001 A600+ CPU Card, instruction set and VCP ROMs, and 12038A Memory frontplane connector
2. 02420-60101 6-Slot box with power supply and ventilation.
3. 02156-90002 HP 1000 A600+ Computer Installation and Service Manual.
4. 02156-90001 HP 1000 A600+ Computer Reference Manual.
5. 02103-90005 Computer I/O Interfacing Guide.
6. 92077E+400 Right to Execute RTE-A.

HP 2426F Computer

The 2426F Computer includes:

1. CPU and memory as follows:
    a. 12110B ECC Memory Controller Card with 1 MB ECC memory.
    b. 12105-60001 A600+ CPU Card, instruction set and VCP ROMs, and 12038A Memory frontplane connector

2 through 6. Same as for 2626E, above.

Optional Software

See Extensive Software Support listings on pages 3-4 and 3-5 of this handbook.

Memory Expansion and Array Connectors

Parity Memory Array Cards for 2424A and 2426E/F

12103B	**512 kB Parity Memory Array Card**
12103C	**1 MB Parity Memory Array Card**

ECC Memory Array Cards for 2426F

12111A	**512 kB ECC Memory Array Card**
12111B	**1 MB ECC Memory Array Card**
12111C	**2 MB ECC Memory Array Card**

Array Connectors for 2424A and 2426E/F

12038A	**Connector to 1 array card**
12038B	**Connector to 2 array cards**
12038C	**Connector to 3 array cards**
12038D	**Connector to 4 array cards**

Accessories

Interfaces

HP 2424A and 2426E/F Computers can use the interfaces listed in section 4 of this handbook, excepting those that require 25 kHz power.

Cabinets

HP 2424A and 2426E/F Computers are especially designed to rack in any of the following cabinets:

HP 92211L Taboret Cabinet - provides 52.3 cm (20.6 in.) of vertical mounting height.

HP 92211R Minirack Cabinet - provides 57.5 cm (22.6 in.) of vertical mounting height. An HP 92211S Slide Rail Kit is also required for mounting the 2424A or 2426E/F Computer in the 92211R Cabinet.

HP 12905A 19-inch Adaper - for rack mounting 2424A or 2426E/F Computers in standard 19-inch EIA rack cabinets.

Peripheral Devices

HP 2424A and 2426E/F Computers support the peripheral devices listed and described in sections 7 through 10 of this handbook.

Engineering Reference Documentation

For 2424A (A400): 02424-90003 HP 1000 A400 Computer Engineering and Reference Documentation.

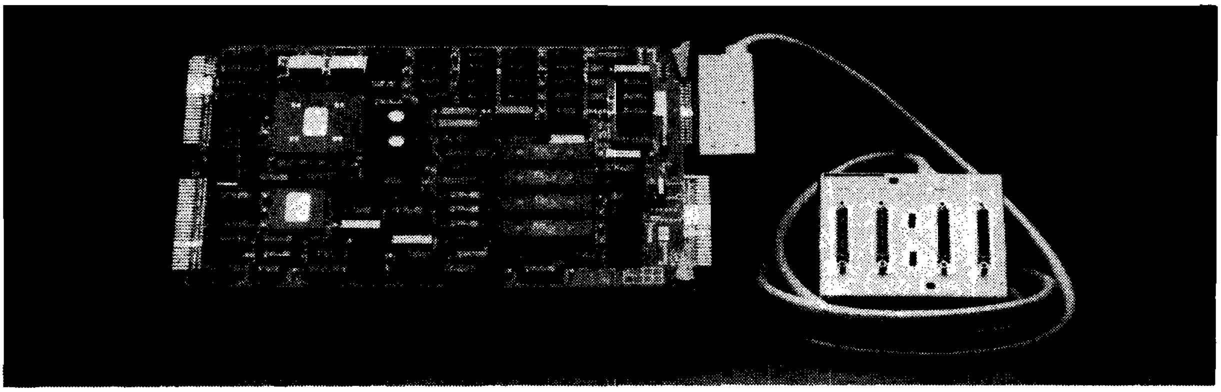
For 2426E/F (A600+): 02156-90003 HP 1000 A600+ Computer Engineering and Reference Documentation.

A400 Single Board Computer

HEWLETT PACKARD

HP 1000 A-Series Computer Systems

product number 12100A



The HP 12100A is a single-board computer (SBC) designed for applications that require a rugged, reliable, low-cost, compact real-time computer.

On a single plug-in card, the 12100A provides an 0.4 MIPS CPU, 512 kB of parity memory, and a four-port serial I/O multiplexer, two ports of which support modem control. It is a completely compatible member of the HP 1000 A-Series computer family capable of operating under RTE-A, with or without VC+, in the same way as any other member of the HP 1000 A-Series family. It is thus especially well suited as the brains of low-cost target systems for applications developed on larger A-Series based program development systems.

Because of its completeness, including both memory and serial I/O with the CPU on a single board, the 12100A does not require a backplane or a box. It thus lends itself well to special packaging in systems developed by OEMs. However, the 12100A will plug into any existing A600+/A700 six or fourteen slot backplane with up to four memory cards and as many A-Series I/O cards as the backplane will hold. It is available packaged in the fourteen slot backplane as the 2434A Micro 24 Computer or the 2484A Micro 24 System Processor Unit (data sheet on page 3-21). It is also available packaged in the six slot backplane as the 2424A Micro 14 Computer (data sheet on page 3-31). In either the six or fourteen slot backplane, the on-board memory of the 12100A can be expanded from its base 512 kB to 4 MB of parity memory, using additional memory array cards.

Features

- **Maximum packaging flexibility for OEMs and other systems designers.**
- **512 kB of on-board parity memory, expandable to 4 MB of parity memory with additional memory array cards.**
- **Four-port On-Board I/O multiplexer.**
- **High reliability and maintainability through the use of reduced circuit area.**

Description and Specifications

For functional description and specifications of the A400 computer, memory systems, input/output system,software and diagnostic support, compatibility, and specifications, see the A-Series Computer Design and Specifications data sheet on page 3-1.

On-Board I/O (OBIO)

The 12100A SBC includes OBIO circuits consisting of an I/O Processor (IOP), I/O master logic, and four serial ports. The serial ports provide the following capabilities:

- Asynchronous, full-duplex operation.
- Two channels support modems with CTS, RTS, DSR, CD, DTR, and RI control-status lines.
- 300, 1200, 9600, and 19.2k baud rates individually selectable for each port. 76.8k baud is supportable via RS–422 connection.

- ENQ/ACK or XON/XOFF protocol.
- 300, 1200, 9600, and 19.2k baud rates individually selectable for each port. 76.8k baud is supportable via RS–422 connection.
- Cable length to 15 meters for RS–232 connection, to 50 meters for RS-423 connection, to 1200 meters for RS-422 connection.

Electrical Specifications

DC Voltage and Current Requirements

DC Voltages:	+5V	+12V	−12V
Tolerance:	±5%	±10%	±10%
Current:	5.7A	0.065A	0.09A

Maximum DC Power Required

32W.

DC Regulation Requirement

Less than 2% periodic and random deviation, including distribution losses, switching noise, and noise injected into the line from other sources.

Additional Electrical Requirements for Stand-alone Operation

PON+: A power reset line that should be held low for at least 5 milliseconds after the +5V supply reaches steady-state regulation, as defined above. At the end of the 5 millisecond delay PON+ should go high, signalling that power to the A400 processor is usable. PON+ should go low just after the +5V supply goes out of regulation.

Sample Power Supply Circuit: Figure 3-6 shows a simple circuit that meets normal requirements of the 12100A SBC, including the PON+ signal.

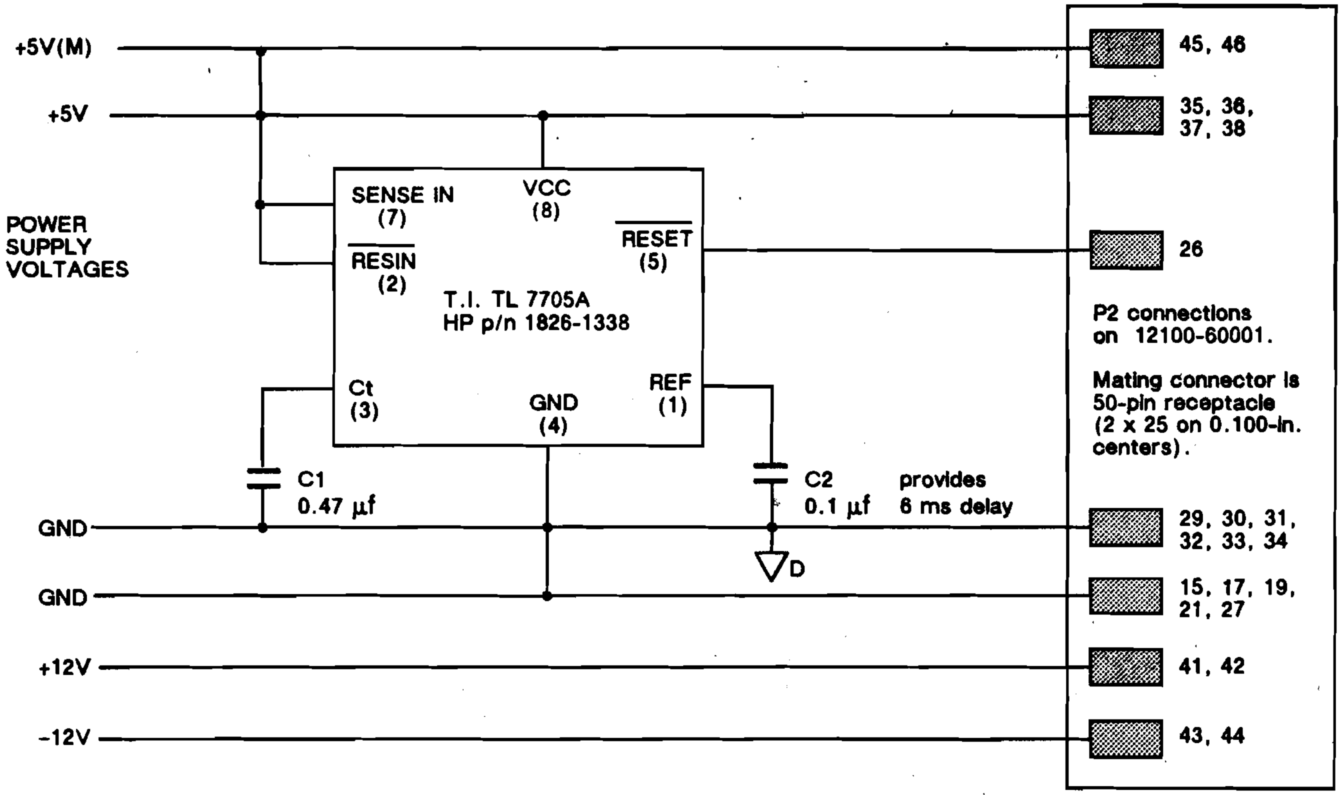

+5V(M)
+5V
POWER SUPPLY VOLTAGES
SENSE IN (7)
VCC (8)
$\overline{\text{RESET}}$ (5)
$\overline{\text{RESIN}}$ (2)
T.I. TL 7705A
HP p/n 1826-1338
Ct (3)
GND (4)
REF (1)
C1 0.47 µf
C2 0.1 µf
provides 6 ms delay
D
GND
GND
+12V
-12V
45, 46
35, 36, 37, 38
26
P2 connections on 12100-60001.
Mating connector is 50-pin receptacle (2 x 25 on 0.100-in. centers).
29, 30, 31, 32, 33, 34
15, 17, 19, 21, 27
41, 42
43, 44

Figure 3-6. Sample Power Supply Circuit for Stand-alone HP 12100A SBC

Battery Backup: If power supplied to the 12100A SBC and its on-board memory fails, processing stops and any data and code in RAM memory is lost. Although the operating system and application program can be recovered by rebooting the system, critical real-time data may be lost. This problem can be avoided by providing power through an uninterruptible power supply to maintain the entire system through a power failure.

If an inactive system is tolerable during a power failure, but the code and data must be maintained, the 12100A supports battery backup of its memory only. This function is necessary only if the application code and data must be maintained in memory during a power outage. Otherwise, memory can be reloaded when power is restored.

To implement battery backup and auto restart of the operating system, two additional signals, PFW– and MLOST– are needed. The +5V(M) pins on P2 must be connected to an uninterruptible +5V supply. The power fail warning signal (PFW–) should be generated at least 500 microseconds before the +5V supply leaves regulation.

PFW– is used with the memory lost signal (MLOST–), which should remain high as long as +5V(M) is in regulation. PON+, described earlier, determines whether the 12100A is active or inactive. PFW– signals the operating system to stop all operations in an orderly fashion prior to PON+ going low. For more detailed information, consult the Power Supply Control Signals Manual (A-5955-4390-1), which is available from Hewlett-Packard.

DC Current Required for I/O Interfaces and Accessories

See Table 3-11 on page 3-57.

Radio Frequency Interference

The 12100A SBC, like all electronic products, emits radio frequency interference (RFI) during normal operation. The RFI signature typical of the 12100A is illustrated in Figures 3-7 and 3-8.

Mounting, enclosure, power supply, and cabling all affect the amplitude and frequency of radiated emissions. In addition to other aspects of design directed toward minimization of RFI, the ground button on the 12100-60002 On-Board I/O breakout cable should be connected to the enclosure in which the 12100A SBC is installed. This connection can be made through conductive foam rubber on the hood retention bracket which supports the cable hood used for external cable connections.

Environmental Specifications

Temperature

Operating in Still Air: 0° to 60° C (32° to 140°F) to 3048m (10,000 ft.). Maximum temperature is linearly derated 2°C (3.6°F) for each 304.8m (1,000 ft.) increase in altitude. Resulting temperature range is 0° to 50°C (32° to 122°F) at 4572m (15,000 ft.).

Operating with Airflow of 100 Lineal Feet/Min.: 0° to 65° C (32° to 149° F) to 3048m (10,000 ft.). Maximum temperature is linearly derated 2°C (3.6°F) for each 304.8m (1,000 ft.) increase in altitude. Resulting temperature range is 0° to 55°C (32° to 131°F) at 4572m (15,000 ft.).

Non-Operating: –55° to 75° C (–67° to 167° F).

Altitude

Operating: To 4572 meters (15,000 feet).

Non-Operating: To 15300 meters (50,000 feet).

Relative Humidity

5% to 95% with minor condensation.

Maximum Heat Dissipation

112 BTU/hr.

Shock and Vibration

Operating Shock: 3G peak, 1/2 sine, 6 to 9 milliseconds duration, 45 Hz crossover.

Non-Operating Shock: 14 G peak, 1/2 sine, 6 to 9 milliseconds duration, 45 Hz crossover.

Operating Vibration: 0.86G rms, distributed as follows:

Frequency (Hz)	Power Spectral Density (G^2/Hz)
5	0.004
5 - 15	-1.5 dB/octave
15	0.003
12 - 200	-6.0 dB/octave
200 - 350	0.00024
350 - 500	-6.0 dB/octave

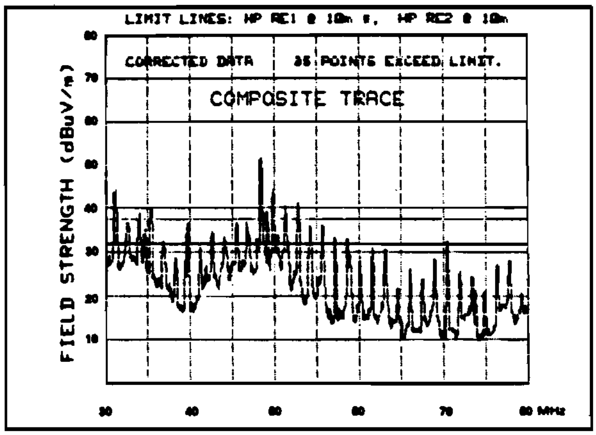


Figure 3-7. HP 12100A RFI Signature, 30-80 MHz

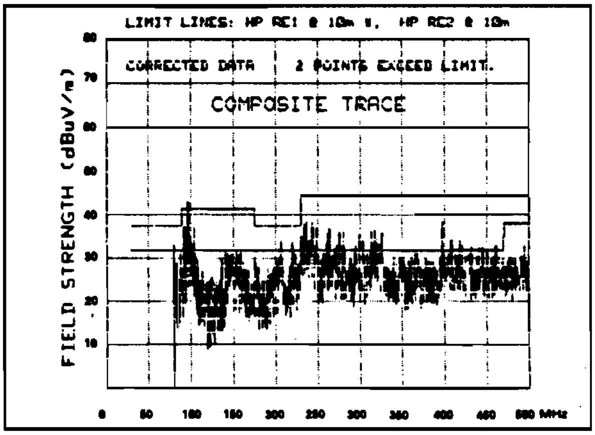


Figure 3-8. HP 12100A RFI Signature, 0-500 MHz

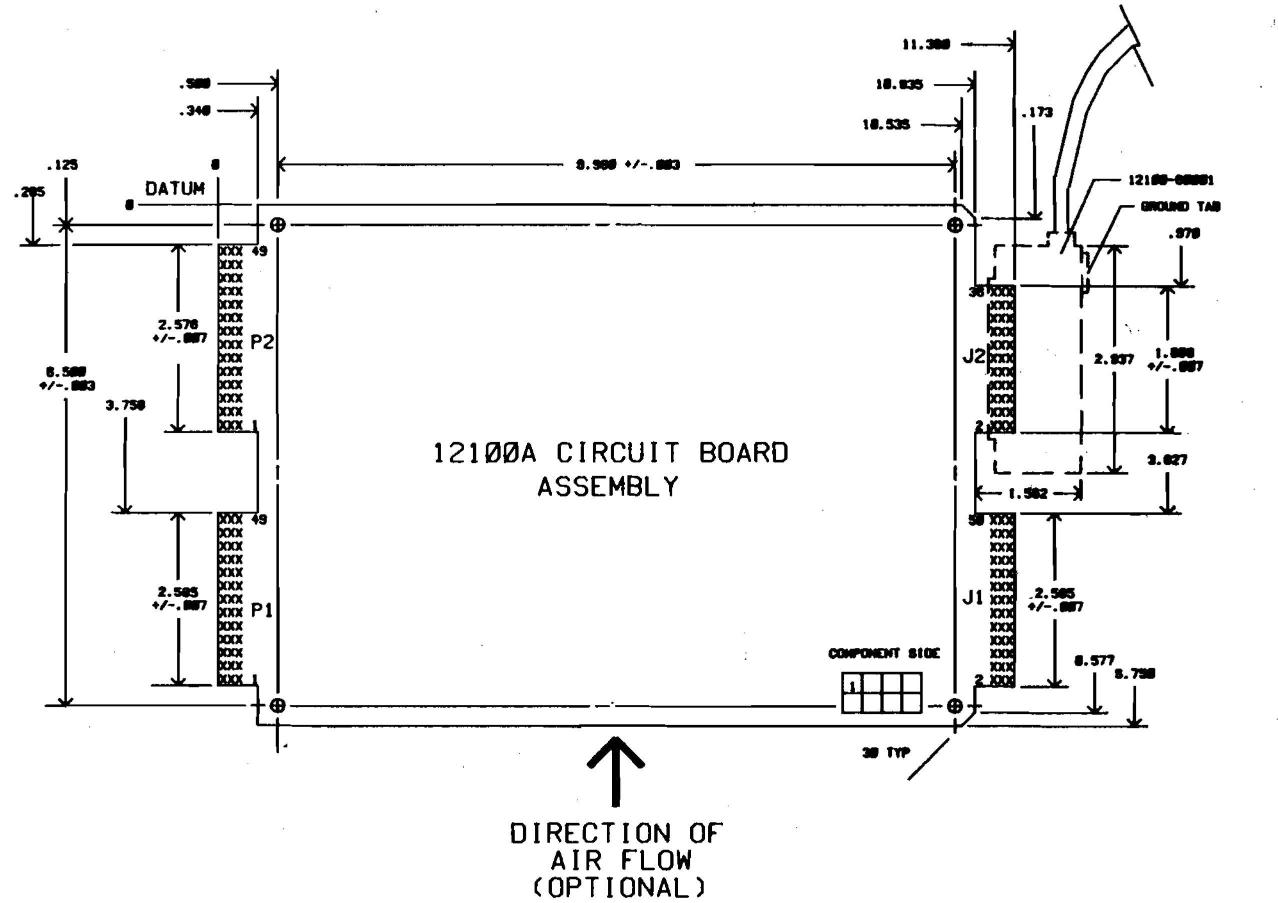

.500
.340
.125
.205
0
DATUM
0
9.900 +/-.003
11.300
10.835
10.535
.173
12100-60001
GROUND TAB
.970
49
2.570 +/-.007
P2
1
6.500 +/-.003
3.750
49
2.585 +/-.007
P1
1
12100A CIRCUIT BOARD ASSEMBLY
30
J2
2
2.937
1.000 +/-.007
3.027
1.582
50
J1
2
2.585 +/-.007
0.577
0.750
COMPONENT SIDE
1
30 TYP
DIRECTION OF AIR FLOW (OPTIONAL)

Figure 3-9. HP 12100A SBC Measurements and Air Flow

Physical Characteristics

Dimensions

17.15 cm (6.75 in.) wide, 29.85 cm (11.75 in.) long, 1.27 cm (0.5 in.) thick.

Net Weight

0.455 kg (1 lb).

Installation

The 12100A SBC can plugged into a card cage or mounted on a panel or chassis, using four mounting holes provided at each corner, as shown in Figure 3-9, above. For panel/chassis mounting, the mounting holes are sized to accept M3, three millimeter screws. A minimum standoff of 8 millimeters from a flat panel is required under the board to permit cable access to connector J2. The I/O cable and power connector should also be mounted in place with a simple bracket. Forcing connectors onto a board easily damages them.

Cooling

The 12100A SBC is designed to operate in ambient temperatures to 60°C in still air. Provision of air flow across the SBC at a rate of 100 lineal feet per second permits operation at temperatures to 65°C.

Stand-alone Memory-Based Operation under RTE-A

An RTE-A operating system that requires less than 32k bytes of memory can be generated for the 12100A SBC. This multitasking system supports all four channels of On-Board I/O and leaves approximately 480k bytes of memory for user's application software. Complete documentation including system generation build and answer files are included in the RTE-A System Generation Manual (92077-90034).

Downloading Software to the SBC

The 12100A SBC contains 512k bytes of RAM memory which can be downloaded with an RTE-A operating system and applications programs from another HP 1000 A-Series computer, from an HP 9000 Model 840 Computers, or from an HP 150 Personal Computer. Either the Model 840 or the A-Series system may be connected via an autoanswer modem.

Model 840 and A-Series

Program RMTERM performs the download operation from the host computer by communicating with a boot loader resident in ROM on the 12100A SBC. RMTERM for A-Series computers is included with the RTE-A operating system. RMTERM/840 for the HP 9000 Model 840 can be obtained with the HP-UX operating system and is documented in the RMTERM/840 Terminal Emulator Application Brief on page 6-5 of this handbook.

Typically, a 512k byte transfer from the Model 840 at 19.2k baud requires about 9 minutes. When two A400 systems are connected, code and data can be transferred between them at a rate of 76.8k baud, reducing the transfer time by 75%.

HP 150 Personal Computers

The HP 150 can be used as a terminal and a file download device with the 12100A SBC. Files are transferred to/from the HP 150 using the 9356H Cassette Tape Emulator program (manual part number 93564-90003), Because the HP 150 acts as a terminal in this mode, the 12100A SBC can be booted up from the HP 150 connected to its Virtual Control Panel (VCP) port via one of its four serial On-Board I/O channels. Also, an RTE-A operating system can be downloaded from an HP 150 microfloppy and booted up on the 12100A.

Ordering Information

HP 12100A Single Board Computer

The 12100A Single Board Computer includes:

1. 12100A CPU card (12100-60001) with 512 kB of on–board parity memory and four On-Board serial I/O channels.
2. 12100-60002 Four-channel On-Board I/O breakout cable.
3. 02424-90001 HP 1000 A400 Computer Reference Manual.

Accessories

Hardware, Software, and Peripherals

When appropriately packaged and provided with appropriate peripheral devices, the 12100A Single Board Computer can use any of the accessories that are available for the 2434A/2484A Micro 24 Computer/SPU or the 2424A Micro 14 Computer, as listed on pages 3-28, 3-29/3-30, and 3-37/3-38.

Engineering Reference Documentation

02424-90003 HP 1000 A400 Computer Engineering and Reference Documentation.

A600+ Board Computer

HEWLETT PACKARD

HP 1000 A-Series Computer Systems

product number 2106BK

The A600+ computer is offered at the board level of integration as the HP 2106BK Board Computer for OEMs and other designers who choose to design their own packaging for their system products. The 2106BK consists of a CPU card and a memory controller with 128 kB parity memory, which can be replaced with a 512 kB parity or ECC memory controller or a 1 MB ECC memory controller. Up to four memory array cards can be added to provide up to 4 MB of parity memory, up to 8 MB of ECC memory.

The 2106BK is a completely compatible member of the HP 1000 A-Series computer family capable of operating under RTE-A, with or without VC+, in the same way as any other member of the HP 1000 A-Series family. It is thus especially well suited as the brains of low-cost target systems for applications developed on larger A-Series based program development systems.

The 2106BK is also available in twenty-slot rack mounting computers and SPUs, fourteen-slot micro/1000 computers and SPUs, and in the six-slot Micro 16 Computer. Because it is a two-card board computer, it will require a user-furnished backplane if not ordered in an HP box computer or SPU.

Features

- **Maximum packaging flexibility for OEMs and other systems designers.**
- **128 kB of parity memory, expandable to 4 MB of parity memory or 8 MB of ECC memory with memory controller substitutions and additional memory array cards.**
- **High reliability and maintainability through the use of reduced circuit area.**

Description and Specifications

General

For functional description and specifications of the A600+ computer, memory systems, input/output system, software and diagnostic support, compatibility, and specifications, see the A-Series Computer Design and Specifications data sheet on page 3-1.

Memory

Memory Included in Standard 2106BK: 128 kB of parity memory.

Memory Supportable by 12013A Battery Backup Card: 128 kB or 512 kB parity memory controller or 512 kB or 1 MB ECC memory controller. Additional memory array cards cannot be supported.

Maximum Parity Memory: 4 MB if 512 kB parity memory controller is substituted for standard 128 kB parity memory controller.

Maximum ECC Memory: 8 MB if 1 MB ECC memory controller is substituted for standard 128 kB parity memory controller.

Electrical Specifications

DC Voltage and Current Requirements

DC Voltages:	+5V
Tolerance:	±5%
Current:	10.7A

Maximum DC Power Required

53.5W.

DC Regulation Requirement

Less than 2% periodic and random deviation.

DC Current Required for I/O Interfaces and Accessories

See Table 3-11 on page 3-57.

Environmental Specifications

Ventilation and Temperature

Ventilation: Airflow of 1.13 cubic metres per minute (40 CFM) across the CPU and memory cards at the operating temperatures listed below is required to maintain 2106BK board temperature within proper operating range.

Operating Temperature: 0° to 55° C (32° to 131° F) to 3048m (10,000 ft.) altitude; maximum temperature thereafter is linearly derated 2° C (3.6° F) for each 304.8m (1,000 ft.) increase of altitude. Resulting temperature range is 0° to 45° C (32° to 113° F) at 4572m (15,000 ft.) above sea level.

Non-Operating Temperature: –40° to 60° C (–40° to 140° F).

Altitude

Operating: To 4572 meters (15,000 feet).

Non-Operating: To 15300 meters (50,000 feet).

Relative Humidity

5% to 95% with minor condensation.

Maximum Heat Dissipation

184 BTU/hr.

Physical Characteristics

Dimensions (Each Board)

17.15 cm (6.75 in.) wide, 29.85 cm (11.75 in.) long, 1.27 cm (0.5 in.) thick.

Net Weight (Both Boards)

0.682 kg (1.5 lb).

Ordering Information

HP 2106BK Board Computer

The 2106BK Board Computer includes:

1. 12105-60001 A600+ CPU Card and instruction set and VCP ROMs.
2. 12102A Memory Controller Card with 128 kB parity memory.
3. 10238A Memory Frontplane connector.
3. 02424-90001 HP 1000 A400 Computer Reference Manual.

HP 2106BK Option 014

Deletes 12102A Memory Controller to provide for substitution of a parity or ECC memory controller with greater capacity.

HP 12013A Battery Backup Card

When fully charged, provides 60 minutes of sustaining power for a 12102A/B 128 kB/512 kB Parity Memory Controller or a 12110A/B 512 kB/1 MB ECC Memory Controller.

Accessories

Hardware, Software, and Peripherals

When appropriately packaged and provided with appropriate peripheral devices, the 2106BK A600+ Board Computer can use any of the accessories that are available for the 2196C/D Model 26 SPU, 2436A/E/2486A Micro 26 Computer/SPU, 2156B Computer, or the 2426E/F Micro 16 Computer, as listed on pages 3-19, 3-20, 3-28, 3-29/3-30, 3-33, 3-34, and 3-37/3-38.

Engineering Reference Documentation

02156-90003 HP 1000 A600+ Computer Engineering and Reference Documentation.

A700 Control Store Cards

HEWLETT PACKARD

HP 1000 A700 Computer Systems

product numbers 12153A and 12155A

Two control store cards offer comprehensive hardware support for user's microprograms in HP 1000 A700 computer systems. One of these is the 12153A 4k word Writable Control Store (WCS) card, which supports development, testing, dynamic overlaying, and output of user's microprograms to the A700 Control Processor. The other card is the 12155A PROM Control Store (PCS) card, which provides mounting for PROMs containing user's microcode. In addition to hardware support provided by these control store cards, development of user's microprograms and dynamic loading and overlaying of WCS are software supported in a disc-based RTE-A environment by the 92045A RTE Microprogramming package (recently discontinued -- rights to copy continue to be available).

Features

- **Writable Control Store (WCS) support for microcode development, testing, dynamic overlaying, and output in 4k words of WCS.**
- **PROM Control Store (PCS) card with capacity for 8k words of stable user microcode.**
- **WCS can override installed PROM-based microcode.**
- **Control processor programs sharable among multiple users.**

NOTE: The 12156A Floating Point Processor counts as one PROM control store card, with space available for 2k words of user's control store PROMs.

WCS Description

The 12153A WCS card is a dual-port memory. One port connects to the control processor's control store interface and the other to the A700 computer backplane. Control processor instructions can be loaded into the 12153A using DMA transfers from memory at a 319k words/second rate, via the computer backplane. Standard I/O instructions are then used to configure control store module addresses and enable the control processor's control store interface, thereby granting access to the loaded subroutines by the control processor.

PCS Description

The 12155A PCS card provides up to 8k words of non-volatile control memory storage capacity for user-written instruction set enhancements. Module addresses are switch selectable, with a given module configurable to any address within control store address space. Users can supply recommended vendors with necessary information for generating PROM chips that are compatible with the 12155A, or can "burn" their own. The microprograms in PROMs are mounted on the PCS card, which is conveniently installed in the card cage of the A700 computer system.

Functional Specifications

Capacity

12153A WCS Card: 4k words, four modules of 1024 words.

12155A PCS Card: Mounting for 8k words, eight modules of 1024 words, four PROMs per module.

Word Size

32 Bits.

Microinstruction Cycle Time

250 nanoseconds.

Recommended PROMs for 12155A PCS Card

Signetics 82S181, Harris HM-7681-5, or equivalent 1k x 8 PROM with address access time ≤70 nsec, chip enable access time ≤40 nsec, and power supply current ≤175 mA.

Computer Control Store Card Capacity

Up to four WCS/PCS cards (three if the 12156A Floating Point Processor is included in the A700 system, since it counts as a PCS card).

NOTE: Although a maximum of 8k words of control store is available to the user, two sets each of two 12153A 4k word WCS cards could be used to advantage in some applications as dynamically overlayable control stores for alternate sets of microcode. With two set of WCS cards, one set can be receiving overlay code from memory while the other is supplying microcode to the control processor. This minimizes the time required to change from one set of microcode to *the other. Another alternate arrangement might be to use three 12153A WCS cards and one 12155A PCS card.*

Configuration Information

Card Cage Slots Required: One for each WCS/PCS card.

Software Recommended: 92045A A700 RTE Microprogramming Package, a discontinued product for which it is still possible to purchase software support and rights to copy.

Installation: Set the select code switches on the WCS card to the appropriate select code I/O address, or the microaddress range switches on the PCS card to the appropriate microaddresses and plug the card into the I/O slot immediately adjacent to the A700 lower CPU card. Disconnect the frontplane from the memory controller and processor cards and connect the flexible jumper cable to the WCS/PCS card(s). Any unused connectors on the jumper cable should be cut off prior to installation.

DC Voltage and Current Requirements

12153A WCS: 4.1A at +5Vdc, 0.1A at +12Vdc.

12155A PCS: 6.3A at +5Vdc.

Weight

12153A WCS card: 0.469 kg (1.03 lb).

12155A PCS card: 0.384 kg (0.84 lb).

Flexible Cable: 0.384 kg (0.84 lb).

Ordering Information

HP 12153A WCS Card

The 12153A WCS Card includes:

1. 12153-60001 WCS Card.
2. 1AF5-6001 I/O Processor.
3. 5061-3480 Flexible Cable.
4. 02137-90003 User Control Store Installation and Service Manual.

HP 12155A PCS Card

The 12155A PCS Card includes:

1. 12155-60001 PCS Card.
2. 5061-3480 Flexible Cable.
3. 02137-90003 User Control Store Installation and Service Manual.

A900 Control Store Board

HEWLETT PACKARD

HP 1000 A900 Computer Systems

product number 12205A

The 12205A Control Store Board offers both writable control store and PROM control store support for user microprograms in HP 1000 A900 computer systems. For development, testing, dynamic overlaying, and output of user's microprograms to the A900 control store board provides 4k of writable control store (WCS). For stable microcode, the control store board also provides space for mounting 2k words of 2k PROMs containing user's microcode. In addition to the hardware support provided by the 12205A Control Store Board, development of user's microprograms and dynamic loading and overlaying of WCS are software supported in a disc-based RTE-A environment by the 92049A RTE Microprogramming package (see the 92049A data sheet on page 2–89).

Features

- **Software support with 92049A RTE Microprogramming Package in disc-based RTE-A operating system.**
- **Writable Control Store (WCS) support for microcode development, testing, dynamic overlaying, and output in 4k words of WCS.**
- **Fast loading of WCS overlays at 166k instruction words per second DMA transfer rate using WLOAD utility of 92049A Microprogramming Package.**
- **PROM Control Store (PCS) support for up to 2k words of stable user microcode.**
- **WCS can override installed PROM-based microcode.**
- **Control processor programs sharable among multiple users.**

WCS Description

WCS on the 12205A Control Store Board is a dual-port memory. One port connects to the control processor's control store interface and the other to the A900 computer backplane. Control processor instructions can be loaded into the 12205A WCS section using DMA transfers from memory via the computer backplane. Standard I/O instructions are then used to configure control store module addresses and enable the control processor's control store interface, thereby granting access to the loaded subroutines by the control processor.

PCS Description

The PCS section on the 12205A Control Store Board provides mounting for 2k words of non-volatile control memory storage capacity for user-written instruction set enhancements, when 2k PROMs are used. Control store module addresses are switch selectable, with a given module configurable to any even 2k address block within control store address space. Users can supply recommended vendors with necessary information for generating PROM chips that are compatible with the 12205A, or can "burn" their own. The microprograms in PROMs are mounted on the PCS section of the 12205A board, which is conveniently installed in the card cage of the A900 computer system.

Functional Specifications

Environment

The 12205A Control Store Board is usable only in 2139A Computers, 2199C/D Model 29 System Processor Units (SPUs), and 2439A/2489A Micro 29 Computers/SPUs.

Capacity

WCS: 4k words, one module of 4096 words.

PCS: Mounting for 2k words, one module of 2048 words, six PROMs per module.

Word Size

48 Bits.

Microinstruction Cycle Time

133 nanoseconds.

Recommended PROM for 12205A Control Store Board

AMD 27S291.

Configuration Information

Card Cage Slots Required: The 12205A Control Store Board is installed in card cage slot 1 (maximum of one 12205A Control Store Board per system).

Software Recommended: 92049A A900 RTE Microprogramming Package.

Installation: Set the select code switches on the WCS card to the appropriate select code I/O address and plug the card into card cage slot 1. Connect the front plane between the control store board and the sequencer card.

DC Voltage and Current Requirements

Base, for WCS: 3.7A at +5Vdc, 0.06A at +12Vdc.

PCS Adds: 0.7A at +5Vdc.

Weight

0.455 kg (1 lb).

Ordering Information

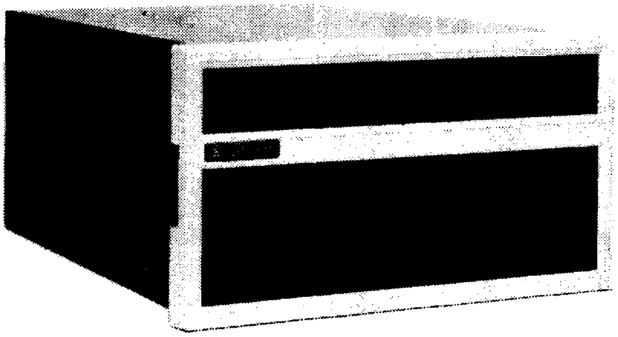
HP 12205A Control Store Board

The 12205A Control Store Board includes:

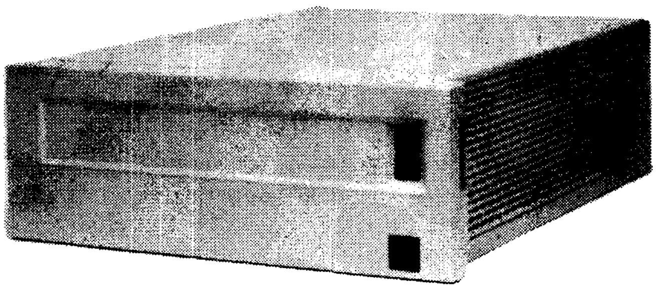
1. 12205-60001 WCS Card.
2. 1AF5-6001 I/O Processor.
3. 12205-60002 Frontplane.
4. 12205-90001 A900 Control Store Installation and Service Manual.

Input/Output Extenders

HP 1000 A-Series Computer Systems   product numbers 12025A and 12025B



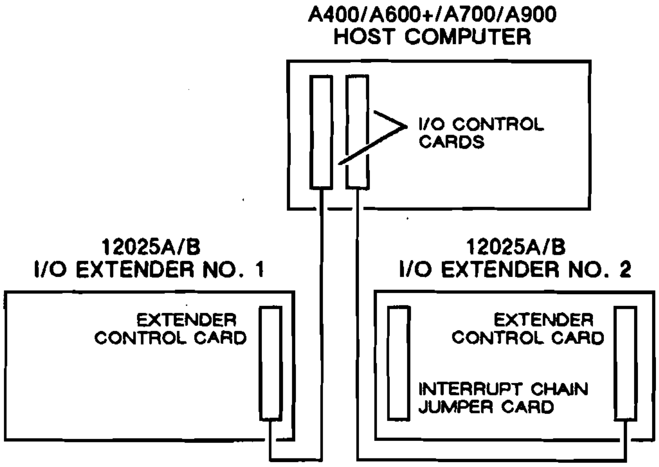
HP12025B I/O Extender



HP 12025A I/O Extender

Two I/O Extenders are offered for use with HP 1000 A-Series Computers. The HP 12025A I/O Extender adds 12 I/O channels to system capacity and the HP 12025B adds 18 I/O channels. With multiple I/O Extenders, up to 48 I/O channels can be provided.

The I/O Extenders connect to the host computer as if they were peripheral devices (see diagram at right). Each extender thus uses one I/O channel in the host computer while adding 13 or 19 card cage slots for I/O for a net addition of 12 or 18 I/O channels.


A400/A600+/A700/A900
HOST COMPUTER
I/O CONTROL CARDS
12025A/B
I/O EXTENDER NO. 1
EXTENDER CONTROL CARD
12025A/B
I/O EXTENDER NO. 2
EXTENDER CONTROL CARD
INTERRUPT CHAIN JUMPER CARD

Host Computer – I/O Extender Connections

Features

- **Support on all A-Series computers and SPUs.**
- **Compatibility with A-Series distributed intelligence architecture.**
- **Software transparency (I/O Extenders are designed to permit use of existing software without modification where applications are not time critical).**
- **Up to 48 I/O channels with multiple I/O extenders.**
- **Choice of 12 or 18 additional I/O channels per I/O Extender.**

Functional Specifications

I/O Channels Added by I/O Extenders

	CHANNELS ADDED		
EXTENDER	BY 1 EXT	BY 2 EXT	BY 3 EXT
12025A	12	24	36
12025B	18	35*	52**

* If the I/O Control Card is not the last one in the computer, a jumper card is required in the second extender, reducing the number of net I/O channels it adds from 18 to 17.

** The HP 1000 instruction set limits the number of I/O I/O channels usable by the host computer to 48, including those added by I/O extenders.

Maximum Number of I/O Channels

Effective with RTE-A revision 2440, a maximum of 48 I/O channels is supported in computer and I/O extenders. However, the number of usable I/O channels may be limited by RTE-A system table space. An HP Systems Engineer should check the supportability of any proposed system that is to use more than 16 I/O interface cards or 24 multiplexer channels.

Extender Usage Recommendation

I/O interfaces critical to system performance, such as the disc interface, should be installed in the computer, not the extender. This avoids potential impairment of performance resulting from the fact that an interrupt to an interface in the extender interrupts DMA in the extender.

Compatibility

COMPUTER SERIES	SERIAL PREFIX	12025A/B COMPATIBILITY STATUS
A400 & A600+	ALL	Unconditionally compatible
A700	2500+	Compatible
A700	< 2500	Requires an upgrade obtainable through Specials Engineering if part numbers of the ROMs on the A700 lower CPU card are not 12152-80053 through 80056 or a group with higher 800xx numbers.
A900	2500+	Compatible
A900	< 2500	Requires an upgrade obtainable through Specials Engineering if the cache board part number is not 12203-60011 or higher and may also require updated firmware.
A600	ALL	Not tested and not supported
L-Series	ALL	Not compatible

Maximum DMA Data Rates in Host CPUs and I/O Extenders

PRO-CESSOR	DMA I/O BANDWIDTH (MB/SEC) FOR:			
	Input in Host CPU	Input in Extender	Output in Host CPU	Output in Extender
A400	4.27	4.27	4.27	1.7
A600+	4.27	4.27	4.27	1.7
A700	4.0	4.0	4.0	1.6
A900	3.7	3.7	2.5	1.25

Exclusions

The Battery Backup Card (12154A or 12157B) is not supported in the 12025A or 12025B I/O Extender.

Control Store Cards (12153A, 12155A, and 12205A) are not supported in the 12025A or 12025B I/O Extender.

Electrical Specifications

AC Power Requirements

Std Line Voltage: 115V -25%/+20% (86-138V).

Opt 015 Line Voltage: 230V -23%/+20% (178-276V).

Line Frequency: 47.5 to 66 Hz.

Power Consumption

12025A: 500W, maximum.

12025B: 700W, maximum.

Power Cable: The standard 12025A/B I/O Extender includes a 3m (10 ft.) power cable with NEMA 5-15P power plug. No power cable is provided with the option 015 version of either of these extenders.

Environmental Specifications

Temperature

Operating : 0° to 55°C (32° to 131°F) to 3048m (10,000 ft.). Maximum temperature is linearly derated 2°C (3.6°F) for each 304.8m (1,000 ft.) increase in altitude. Resulting temperature range is 0° to 45°C (32° to 113°F) at 4572m (15,000 ft.).

Non-operating Temperature: –40° to 60°C (–40° to 140°F).

Altitude

Operating: To 4.6 km (15,000 ft).

Non-operating: To 15.3 km (50,000 ft).

Relative Humidity

5% to 95% non-condensing.

Vibration and Shock

HP 12025A and B I/O Extenders are type tested for normal shipping and handling shock and vibration (contact factory for review of any application that requires operation under continuous vibration).

Safety

HP 12025A and 12025B I/O Extenders comply with recognized international safety standards.

Physical Characteristics

Dimensions

12025A: 22.2 cm (8.75 in.) high, 48.3 cm (19 in.) wide, 64.8 cm (25.5 in.) deep.

12025B: 31.1 cm (12.25 in.) high, 48.3 cm (19 in.) wide, 61.2 cm (24 in.) deep.

Weight

12025A: 14.1 kg (31 lb).

12025B: 26.8 kg (59 lb).

Ventilation

Four fans provide cooling airflow for the 12025A/B I/O Extenders.

12025A Airflow Direction: Left-to-right.

12025B Airflow Direction: Front-to–rear.

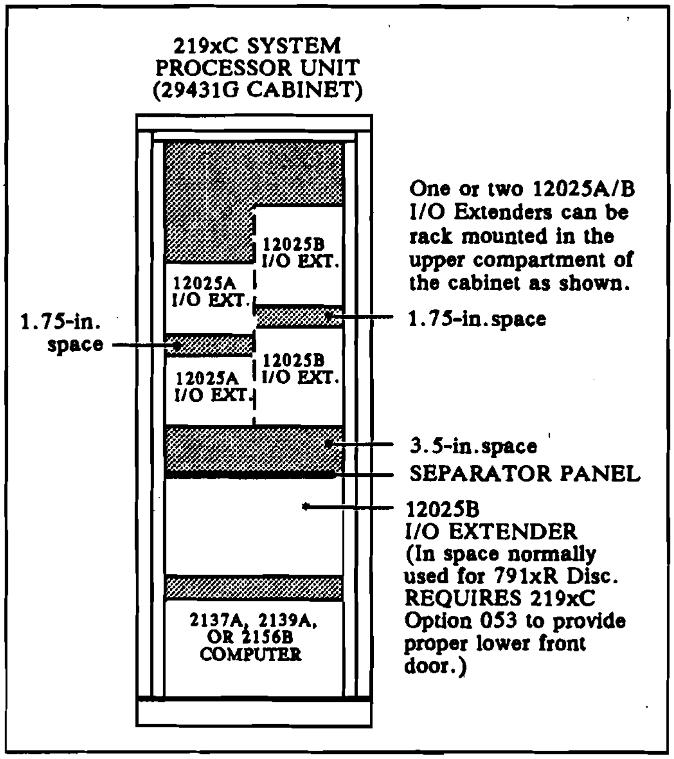
Installation

Rack Mounting in A-Series System Cabinets

Installation of HP 12025A/B I/O Extenders in 219xC (29431G) SPU Cabinets is illustrated in Figure 3-10. The I/O Extenders can be installed:

In Place of 791xR Disc. In an A-Series system that does not use a 791xR CS/80 disc, a 12025B I/O Extender can be installed in the cabinet space normally occupied by the 791xR Disc. This requires replacement of the standard disc-computer compartment front door, which is cut out for access to the disc's cartridge tape unit, with a 219xC Option 053 door, which has louvers instead of the cutout for the disc. A set of 12679C Support Rails is also required.

NOTE: Because it does not use front-to-rear ventilation, the 12025A I/O Extender cannot be installed in the 791xR Disc mounting space in 219xC Option 053 SPU cabinets.



One or two 12025A/B I/O Extenders can be rack mounted in the upper compartment of the cabinet as shown.

12025B I/O EXTENDER (In space normally used for 791xR Disc. REQUIRES 219xC Option 053 to provide proper lower front door.)

Figure 3-10. A-Series I/O Extender Rack Mounting Positions in 219xC SPUs (29431G Cabinets)

In the Upper Compartment of the 219xC Cabinet. One or two 12025A or 12025B I/O Extenders can be installed in the upper compartment of the 219xC (29431G) SPU cabinet, provided that:

1. Only 12025A or only 12025B I/O Extenders are installed in the upper compartment. A 12025A I/O Extender cannot be installed in the upper compartment with a 12025B because they differ with respect to the direction of ventilating airflow through them.
2. The upper front door of the cabinet is deleted for installation of 12025B I/O Extenders (but not fory 12025A I/O Extenders) by ordering 219xC Option 051. This permits the front-to-rear airflow required for self-ventilation of the 12025B I/O Extenders. For details of trim installation, see the 40027A Door Trim Kit Installation Manual (40027-90002).
3. All unoccupied vertical mounting space is covered by filler panels.

Cable Management in Older 219xA/C or 29431F Cabinets

HP 219xA/C or 29431F Cabineets shipped before May 1, 1985 may not be able to accommodate more than 24 cabinets exiting the cabinet. Systems expanded so that 24 or more cables are exiting the cabinet may have to be racked in a 29431G Cabinet, which can accommodate 48 cables.

12025A Installation Versatility

The 12025A I/O Extender is based on the versatile Micro/1000 package. It can be placed atop a table, desk, or workbench, mounted upright in a 40025A Vertical Floor Mount with convenient roll-about mobility, or installed in the upper compartment of a 29431G Cabinet, as shown in Figure 3-10 (page 3-53).

Installation of 12025A/B in non-HP Cabinet

If rack mounted in a non-HP cabinet, the 12025A I/O Extender must be spaced at least 1.75 inches above any rack-mounted 791xR CS/80 Disc, or a steel panel must be interposed between the disc and the 12025A I/O Extender.

A non-HP cabinet for rack mounting the 12025A/B I/O Extender must have enough space to house the 12025A/B (see Dimensions specification under Physical Characteristics, page 3-53) and must support, or at least not interfere with, the ventilation airflow in the 12025A/B I/O Extender (left-to-right in the 12025A, front-to-rear in the 12025B), to assure long life and trouble-free operation. Compliance with EMI regulations cannot be specified by HP for systems, with or without I/O Extenders, that are installed in non-HP rack cabinets.

Ordering Information

HP 12025A I/O Extender

The 12025A I/O Extender includes:

1. 02430-60014 I/O Extender Box Assembly with 0950-1646 Power Supply.
2. 8120-1378 2.28m (7.5 ft.) power cord.
3. 12025-60001 I/O Control Card.
4. 12025-60002 Extender Control Card.
5. 12025-60003 Jumper Card.
6. 12025-60007 2.5m (8.2 ft.) CPU-to-Extender Cable.
7. 12025-90001 HP 12025A/B I/O Extender Hardware Support Manual.

HP 12025B I/O Extender

The 12025B I/O Extender includes:

1. 12151-60001 I/O Extender Box Assembly with 0950-1671 Power Supply.
2. 8120-1378 2.28m (7.5 ft.) power cord.
3. 12025-60001 I/O Control Card.
4. 12025-60002 Extender Control Card.
5. 12025-60004 Jumper Card.
6. 12025-60007 2.5m (8.2 ft.) CPU-to-Extender Cable.
7. 12025-90001 HP 12025A/B I/O Extender Hardware Support Manual.

12025A/B Option

015: Operation from 230V ac power.

12025A/B Accessories

12159A	25 kHz Sine Wave Card for 12025A.
12679C	Support Rails for Rack Mounting.
40025A	Vertical Floor Mount for 12025A.

Computers and Peripherals Reference Tables

Tables 3-10, 3-11, 3-12, and 3-13 in this section respectively summarize ac power requirements, computer power supply and card cage slot availability and requirements, physical characteristics, and Environmental specifications for HP 1000 Computers, Peripheral Devices, and Computer Plug-ins.

Table 3-10. System Processor Unit, Computer, and Peripheral Power Requirements

PRODUCT NUMBER AND NAME		MAX. AC POWER (Note A)	VOLTAGE LIMITS (V)		FREQ. LIMITS (Hz)	
			115V	230V	60 Hz	50 Hz
SYSTEM PROCESSOR UNITS (SPUs)	(Excludes requirements of system console terminal and (hard) non-integrated system disc, which are ordered separately.)					
219xC	MODEL 26/27/29 SPU (tall cabinet)	2760W@	86-138	178-276	48-66	48-66
219xD	MODEL 26/27/29 SPU (short cabinet)	1380W	86-138	178-276	48-66	48-66
248xA	MICRO 24/26/27/29 SPU	500W	86-138	178-276	48-66	48-66
COMPUTERS (CPUs)						
213xA/2156B	COMPUTER	700W	86-138	178-276	48-66	48-66
2424A/2426E/F	COMPUTER	216W	86-138	178-276	48-66	48-66
243xA/E	MICRO 24/26/27/29 COMPUTER	500W	86-138	178-276	48-66	48-66
PERIPHERAL DEVICES						
13279B	19-INCH COLOR MONITOR	170W	90-128	180-257	54-66	45-55
2225D	THINKJET PRINTER	18W	108-126	216-252	48-63	46-63
2227A/2228A	QUIETJET PLUS/QUIETJET PRINTER	18W	90-132†	198-264‡	48-63	46-63
2334A	MULTIMUX	115Wt	86-127	195-253	48-66	48-66
2382A*	OFFICE DISPLAY TERMINAL	80W	90-126†	198-252	59-61	49-51
2392A	DISPLAY TERMINAL	50W	86-126	173-253	47-66	47-66
2393A	GRAPHICS TERMINAL	95W	100-120	200-240	47-66	47-66
2397A	COLOR GRAPHICS TERMINAL	115W	100-120	200-240	47-66	47-66
2563A*/B	LINE PRINTER	230W(t)	90-126†	198-252‡	48-66	48-66
2564B	LINE PRINTER	240W(t)	90-126†	198-252‡	48-66	48-66
2565A*/66A*	LINE PRINTER	550W(t)	90-126†	198-252‡	48-66	48-66
2566B	LINE PRINTER	575W(t)	90-126†	198-252‡	48-66	48-66
2601A*	DAISYWHEEL PRINTER	180W	85-132†	187-264‡	49-61	49-61
2608A*/S*	LINE PRINTER	1500VA	90-126†	198-252	48-66	48-66
2627A*	COLOR GRAPHICS TERMINAL	250W	90-126†	198-252	57-63	47,5-52.5
Other 262x*	TERMINAL	120W	90-126†	198-252	57-63	47.5-52.5
262x Opt 050*	INTEGRAL PRINTER	50W	90-126†	198-252	57-63	47.5-52.5
2645A*	DISPLAY STATION	140W	89-126†	196-253	59-61	49-51
2648A*	GRAPHICS TERMINAL	150W	89-126†	196-253	59-61	49-51
2671A*/G*	THERMAL/GRAPHICS PRINTER	50W	90-126†	198-252‡	47-66	47-66
2673A*	INTELLIGENT GRAPHICS PRINTER	75W	90-126†	198-252‡	47-66	47-66

Note A: Power Factor (PF) is typically about 0.75 with a range of 0.7 to 0.78. Use of a power factor of 0.7 to 0.72 to estimate ac input requirements in Volt-Amps (VA) from Watts (W) is recommended to assure sufficient total input power (VA = W/PF). To estimate ventilation or air conditioning requirements in BTU per hour, multiply Watts by 3.418. To determine heat dissipation requirements in kilogram-calories per hour, multiply Watts by 0.8598.

@ Split-phase power is required for this System Processor Unit.

* Identifies discontinued product, listed here for reference only.

† Range shown for 115V here includes user-selectable choice of 100V or 120V input plus the voltage tolerance; there may be a gap between 105V and 108V.

‡ Range shown for 230V here includes user-selectable choice of 220V or 240V input plus the voltage tolerance.

t Denotes typical power consumption, not maximum.

Table 3-10. System Processor Unit, Computer, and Peripheral Power Requirements, continued

PRODUCT NUMBER AND NAME		MAX. AC POWER (Note A)	VOLTAGE LIMITS (V)		FREQ. LIMITS (Hz)	
			115V	230V	60 Hz	50 Hz
PERIPHERAL DEVICES, continued						
2674A*	INTERNAL PRINTER FOR 45610B	20W	See 45610B	See 45610B	See 45610B	See 45610B
2686A	LASERJET PRINTER	850W	104-126	198-264‡	59.4-60.6	49.5-50.5
2687A*	DESKTOP LASER PAGE PRINTER	840W	104-126	198-264‡	59.4-60.6	49.5-50.5
2932A/2934A	PRINTER	300VA	90-126†	198-252‡	48-66	48-66
3074A/M	DATA LINK ADAPTER	11W	87-126	173-253	48-66	48-66
35401A	AUTOCHANGER TAPE CARTRIDGE S/S	125W	90-125	180-250	48-66	48-66
35731A	MONOCHROME MONITOR	45W	90-132†	180-264‡	57-63	47.5-52.5
35741A	COLOR MONITOR	65W	90-132†	180-250‡	57-63	47.5-52.5
35743A	ENHANCED GRAPHICS DISPLAY	75W	108-132		54-66	
35745A	IND. ENHANCED GRAPHICS DISPLAY	Note B				
37214A	SYSTEMS MODEM CARD CAGE	53W	90-126†	198-252‡	48-66	48-66
39301A	FIBER OPTIC MULTIPLEXER	14W	90-126†	198-252‡	48-66	48-66
45610B	HP TOUCHSCREEN TERMINAL	110W	86-126	173-253	57-63	47.5-52.5
72411A	VECTRA INDUSTRIAL PC	300W	90-140	180-264	57-63	47.5-52.5
724xxA	VECTRA MODEL xx PC	450W	92-126.5	184-253	57-63	47.5-52.5
7440A	COLORPRO PLOTTER	20W	90-126†	198-252‡	48-66	48-66
7470A*	2-pen PLOTTER	25W	90-126†	198-252‡	48-66	48-66
7475A	6-pen PLOTTER	35W	90-126†	198-252‡	48-66	48-66
7510A	COLOR FILM RECORDER	150W	90-126†	198-252‡	48-66	48-66
7550A	PLOTTER with Auto Sheet Feed	100W	90-126†	198-252‡	48-66	48-66
7570A	DRAFTPRO PLOTTER	80W	90-126†	198-252‡	48-66	48-66
7580B/85B/86B	DRAFTING PLOTTER	182W	90-126†	198-252‡	48-66	48-66
7907A	FIXED/REMOVABLE DISC SUBSYSTEM	200W	90-132	180-264	48-66	48-66
7908P*/R *	FIXED DISC w/CARTRIDGE TAPE UNIT	400W	88-127	180-255	48-66	48-66
791xP/R	FIXED DISC w/CARTRIDGE TAPE UNIT	700W	90-126†	198-252‡	54-66	48-55
7914CT*	FIXED DISC w/CARTRIDGE TAPE UNIT	700W	90-126†	198-252‡	54-66	48-55
7914ST*	FIXED DISC w/1600 cpi MAG TAPE UNIT	1220W	90-125†	198-250‡	54-66	48-55
7914TD*	FIXED DISC w/1600 cpi MAG TAPE UNIT	1100W	104-126	207-252	54-66	48-55
7933H/XP	FIXED DISC	1400W	90-132†	198-264‡	48-66	48-66
7935H/XP	REMOVABLE MEDIA DISC	1400W	90-132†	198-264‡	48-66	48-66
7936/37H/XP	FIXED DISC	440W	90-132†	198-264‡	48-66	48-66
7941A*/7945A*	FIXED DISC	65W(t)	90-132†	198-264‡	48-66	48-66
7942A/7946A	FIXED DISC w/CARTRIDGE TAPE UNIT	120W(t)	90-132†	198-264‡	48-66	48-66
7957A/7958A	FIXED DISC	97VA(t)	90-132†	198-264‡	48-66	48-66
7970E*/7971A*	1600 cpi MAGNETIC TAPE UNIT/SUBSYS	400W	104-126	207-252	48-66	48-66
7974A	1600 cpi MAGNETIC TAPE UNIT	520W	90-125†	198-250‡	48-66	48-66
7978B	6250/1600 cpi MAGNETIC TAPE UNIT	636W	90-125†	198-250‡	48-66	48-66
82905B*	IMPACT PRINTER	100W	90-132†	198-264‡	48-66	48-66
82906A*	DOT-MATRIX PRINTER	70W	90-132†	198-264‡	48-66	48-66
9111A*	GRAPHICS TABLET	25W	90-132†	198-264‡	48-66	48-66
9122D	Dual MICROFLOPPY DISC	72W	86-127	180-253	48-66	48-66
9133D*/H*/L	FIXED + MICROFLOPPY DISC	100W	86-127	180-253	48-66	48-66
9134D*/H*/L	FIXED DISC	100W	86-127	180-253	48-66	48-66
9144A	TAPE CARTRIDGE SUBSYSTEM	125W	90-125	180-253	48-66	48-66
9153B	FIXED + MICROFLOPPY DISC	50W	86-127	180-253	48-66	48-66
9154B	FIXED DISC	50W	86-127	180-253	48-66	48-66
9666A	OPERATOR INTERFACE UNIT	270W	90-132†	198-264‡	48-66	48-66

Note A: Power Factor (PF) is typically about 0.75 with a range of 0.7 to 0.78. Use of a power factor of 0.7 to 0.72 to estimate ac input requirements in Volt-Amps (VA) from Watts (W) is recommended to assure sufficient total input power (VA = W/PF). To estimate ventilation or air conditioning requirements in BTU per hour, multiply Watts by 3.418. To determine heat dissipation requirements in kilogram-calories per hour, multiply Watts by 0.8598.

* Identifies discontinued product, listed here for reference only.

† Range shown for 115V here includes user-selectable choice of 100V or 120V input plus the voltage tolerance; there may be a gap between 105V and 108V.

‡ Range shown for 230V here includes user-selectable choice of 220V or 240V input plus the voltage tolerance.

t Denotes typical power requirement, not maximum.

Table 3-11. Computer Power Supply and Card Cage Slot Availability (+) and Requirements (–)

PRODUCT NUMBER AND NAME		CARD CAGE SLOTS	DIRECT CURRENT AT				25 kHz AC PWR at 39V RMS	TOTAL POWER SUPPLY
			+5V	+5V(M)	+12V	-12V		
COMPUTERS								
12100A	A400 SINGLE-BD COMP w/512 kB	- 1	- 4.2A	-1.5A	- 0.07A	-0.09A	0.0W	- 32.0W
2106BK	A600+ BD COMPUTER w/128 kB	- 2	- 9.6A	-1.1A	0.0A	0.0A	0.0W	- 53.5W
Opt 014	Deletes std 128 kB Memory	+ 1	+ 2.8A	+0.9A	nnc	nnc	n/a	+ 18.5W
2137A	A700 COMPUTER w/128 kB	+16	+42.8A	+8.6A	+ 5.6A	+3.5A	+50.0W	n/s
Opt 001	Hardware Floating Point Processor	- 1	- 4.0A	nnc	nnc	nnc	nnc	n/s
Opt 014	Deletes std 128 kB Memory	+ 1	+ 1.1A	+1.0A	nnc	nnc	nnc	n/s
2139A	A900 COMPUTER w/768 kB ECC	+15	+41.8A	+7.0A	+ 5.5A	+3.5A	+50.0W	n/s
Opt 014	Deletes std 768 kB ECC Memory	+ 1	+ 1.0A	+2.0A	nnc	nnc	nnc	n/s
2156B	A600+ COMPUTER w/128 kB	+18	+50.4A	+8.8A	+ 5.6A	+3.5A	+50.0W	n/s
Opt 014	Deletes std 768 kB ECC Memory	+ 1	+ 2.8A	+1.0A	nnc	nnc	nnc	n/s
2424A	MICRO 14 COMPUTER w/512 kB	+ 5	+17.3A†	0.0A	+ 2.03A†	+1.01A†	Not Sup.	+119.0W
2426E	MICRO 16 COMPUTER w/512 kB	+ 4	+12.3A†	0.0A	+ 2.1A†	+1.1A†	Not Sup.	+ 83.9W
2426F	MICRO 16 COMP w/1 MB ECC	+ 4	+11.9A†	0.0A	+ 2.1A†	+1.1A†	Not Sup.	+ 82.4W
2434A	MICRO 24 COMPUTER w/512 kB	+13	+38.8A‡	+5.4A‡	+ 6.93A‡	+2.91A‡	0.0W	+268.0W
2436A	MICRO 26 COMPUTER w/128 kB	+12	+33.4A‡	+5.9A‡	+ 7.0A‡	+3.0A‡	0.0W	+246.5W
Opt 014	Deletes std 128 kB Memory	+ 1	+ 2.8A	+0.9A	nnc	nnc	n/a	+ 18.5W
2436E	MICRO 26 COMPUTER w/512 kB	+12	+33.4A‡	+5.8A‡	+ 6.7A‡	+3.0A‡	0.0W	+246.0W
Opt 014	Deletes std 512 kB Memory	+ 1	+ 2.8A	+1.0A	nnc	nnc	n/a	+ 19.0W
2437A	MICRO 27 COMPUTER w/128 kB	+10	+25.9A‡	+5.6A‡	+ 7.0A‡	+3.0A‡	0.0W	+207.5W
Opt 001	Hardware Floating Point Processor	- 1	- 4.0A	nnc	nnc	nnc	nnc	- 20.0W
Opt 014	Deletes std 128 kB Memory	+ 1	+ 1.1A	+1.1A	nnc	nnc	n/a	+ 11.0W
2439A	MICRO 29 COMPUTER w/768 kB	+ 9	+26.8A‡	+1.0A‡	+ 7.0A‡	+3.0A‡	0.0W	+207.5W
Opt 014	Deletes std 768 kB ECC Memory	+ 1	+ 1.1A	+2.0A	nnc	nnc	n/a	+ 15.0W
SYSTEM PROCESSOR UNITS (SPUs)								
2196C/D	MODEL 26 SPU w/512 kB	+16	+46.3A	+8.8A	+ 5.3A	+3.4A	+50.0W	n/s
Opt 014	Deletes std 512 kB Memory	+ 1	+ 2.8A	+1.0A	nnc	nnc	nnc	n/s
2196C Opt 070	Comp w/7914ST disc+MTU	- 1	- 2.1A	nnc	- 0.1A	nnc	nnc	n/s
2197C/D	MODEL 27 SPU w/512 kB	+13	+35.1A	+8.6A	+ 5.3A	+3.4A	+50.0W	n/s
Opt 014	Deletes std 512 kB Memory	+ 1	+ 1.1A	+1.0A	nnc	nnc	nnc	n/s
2197C Opt 070	Comp w/7914ST disc+MTU	- 1	- 2.1A	nnc	- 0.1A	nnc	nnc	n/s
2199C/D	MODEL 29 SPU w/768 kB ECC	+13	+38.1A	+7.0A	+ 5.2A	+3.4A	+50.0W	n/s
Opt 014	Deletes std 512 kB Memory	+ 1	+ 1.0A	+2.0A	nnc	nnc	nnc	n/s
2199C Opt 070	Comp w/7914ST disc+MTU	- 1	- 2.1A	nnc	- 0.1A	nnc	nnc	n/s
2484A	MICRO 24 SPU w/512 kB	+12	+36.7A‡	+5.4A‡	+ 6.83A‡	+2.91A‡	0.0W	+256.3W
2486A	MICRO 26 SPU w/512 kB	+11	+29.7A‡	+5.8A‡	+ 6.7A‡	+2.9A‡	0.0W	+222.7W
Opt 014	Deletes std 512 kB Memory	+ 1	+ 2.8A	+1.0A	nnc	nnc	n/a	+ 19.0W
2487A	MICRO 27 SPU w/512 kB	+ 8	+22.7A‡	+5.6A‡	+ 6.7A‡	+2.9A‡	0.0W	+184.2W
Opt 001	Hardware Floating Point Processor	- 1	- 4.0A	nnc	nnc	nnc	nnc	- 20.0W
Opt 014	Deletes std 128 kB Memory	+ 1	+ 1.1A	+1.1A	nnc	nnc	n/a	+ 11.0W
2489A	MICRO 29 COMPUTER w/768 kB	+ 7	+23.1A‡	+1.0A‡	+ 6.7A‡	+2.9A‡	0.0W	+165.7W
Opt 014	Deletes std 768 kB ECC Memory	+ 1	+ 1.1A	+2.0A	nnc	nnc	n/a	+ 15.0W
A400 MEMORY ARRAY CARDS								
12103C	512 kB PARITY MEMORY ARRAY	- 1	- 1.1A	-1.0A	0.0A	0.0A	0.0W	- 11.0W
12103D	1 MB PARITY MEMORY ARRAY	- 1	- 1.3A	-1.6A	0.0A	0.0A	0.0W	- 14.5W

FOOTNOTES: n/s = not specified; nnc = no net change; n/a = not applicable

† = Total power output from the 2424A/2426E/F computer power supply cannot exceed 151W, maximum, nor can the maximum available current from any power supply output be exceeded; subtract the current/power usage from the available current/power in the table to confirm that the maximums will not be exceeded.

‡ = Total power output from the 243xA/E/248xA power supply cannot exceed 300W, maximum, nor can the maximum avail able current from any power supply output be exceeded; subtract the current/power usage from the available current/ power in the table to confirm that the maximums will not be exceeded.

Table 3-11. Computer Power Supply and Card Cage Slot Availability (+) and Requirements (–), continued

PRODUCT NUMBER AND NAME	CARD CAGE SLOTS	DIRECT CURRENT AT				25 kHz AC PWR at 39V RMS	TOTAL POWER SUPPLY
		+5V	+5V(M)	+12V	-12V		
A600+ MEMORY CONTROLLER AND MEMORY ARRAY CARDS							
12102B 512 kB PARITY MEM CTRLR	- 1	- 2.8A	-1.0A	0.0A	0.0A	0.0W	- 19.0W
12110A 512 kB ECC MEMORY CTRLR	- 1	- 2.9A	-1.1A	0.0A	0.0A	0.0W	- 20.0W
12110B 1 MB ECC MEMORY CTRLR	- 1	- 2.9A	-1.2A	0.0A	0.0A	0.0W	- 21.0W
12103C 512 kB PARITY MEMORY ARRAY	- 1	- 1.1A	-1.0A	0.0A	0.0A	0.0W	- 11.0W
12103D 1 MB PARITY MEMORY ARRAY	- 1	- 1.3A	-1.6A	0.0A	0.0A	0.0W	- 14.5W
12111A 512 kB ECC MEMORY ARRAY	- 1	- 1.6A	-0.93A	0.0A	0.0A	0.0W	- 12.7W
12111B 1 MB ECC MEMORY ARRAY	- 1	- 1.6A	-1.0A	0.0A	0.0A	0.0W	- 13.0W
12111C 2 MB ECC MEMORY ARRAY	- 1	- 1.6A	-1.6A	0.0A	0.0A	0.0W	- 16.0W
A700 MEMORY ARRAY CARDS							
12103C 512 kB PARITY MEM ARRAY, Addr	- 1	- 1.1A	-1.0A	0.0A	0.0A	0.0W	- 11.0W
12103C Unaddressed	- 1	- 1.1A	-0.6A#	0.0A	0.0A	0.0W	- 8.5W
12103D 1 MB PARITY MEM ARRAY, Addr	- 1	- 1.3A	-1.6A	0.0A	0.0A	0.0W	- 14.5W
12103D Unaddressed	- 1	- 1.3A	-1.0A#	0.0A	0.0A	0.0W	- 11.5W
12111A 512 kB ECC MEM ARRAY, Addr	- 1	- 1.6A	-0.93A	0.0A	0.0A	0.0W	- 12.7W
12111A Unaddressed	- 1	- 1.6A	-0.3A#	0.0A	0.0A	0.0W	- 9.5W
12111B 1 MB ECC MEMORY ARRAY, Addr	- 1	- 1.6A	-1.0A	0.0A	0.0A	0.0W	- 13.0W
12111B Unaddressed	- 1	- 1.6A	-0.37A#	0.0A	0.0A	0.0W	- 9.9W
12111C 2 MB ECC MEMORY ARRAY, Addr	- 1	- 1.6A	-1.6A	0.0A	0.0A	0.0W	- 16.0W
12111C Unaddressed	- 1	- 1.6A	-0.65A#	0.0A	0.0A	0.0W	- 11.3W
A900 MEMORY ARRAY CARDS							
12220A 768 kB ECC MEM ARRAY, Addr	- 1	- 1.0A	-2.0A	0.0A	0.0A	0.0W	- 15.0W
12220A Unaddressed	- 1	0.0A	-1.0A#	0.0A	0.0A	0.0W	- 5.0W
12222A 3 MB ECC MEMORY ARRAY, Addr	- 1	- 1.0A	-2.0A	0.0A	0.0A	0.0W	- 15.0W
12222A Unaddressed	- 1	0.0A	-1.0A#	0.0A	0.0A	0.0W	- 5.0W
INTERFACES							
12005A*/B ASYNC SERIAL INTERFACE	- 1	- 1.6A	0.0A	- 0.2A	-0.1A	0.0W	- 11.6W
12006A PARALLEL INTERFACE	- 1	- 1.9A	0.0A	- 0.2A	0.0A	0.0W	- 11.9W
12007B HDLC MODEM I/FTO HP 1000	- 1	- 2.6A	0.0A	- 0.4A	0.0A	0.0W	- 20.2W
12009A HP-IB INTERFACE	- 1	- 2.1A	0.0A	- 0.1A	0.0A	0.0W	- 11.7W
12040C/D 8-CH ASYNC MULTIPLEXER	- 1	- 2.5A	0.0A	- 0.1A	-0.1A	0.0W	- 15.2W
12041A 8-CH ASYNC MULTIPLEXER	- 1	- 2.5A	0.0A	- 0.1A	-0.1A	0.0W	- 15.2W
12042B PROGRAMMABLE SERIAL I/F	- 1	- 2.6A	0.0A	- 0.4A	-0.2A	0.0W	- 20.2W
12043A PROGRAMMABLE SERIAL I/F	- 1	- 2.6A	0.0A	- 0.4A	-0.2A	0.0W	- 20.2W
12044A HDLC DIR CONN I/F TO HP 1000	- 1	- 2.4A	0.0A	- 0.3A	-0.1A	0.0W	- 16.8W

FOOTNOTES: n/s = not specified; nnc = no net change; n/a = not applicable

* = Discontinued product listed here for reference only.

# = In A700 and A900 systems and computers, unaddressed memory cards draw only standby current from the +5V(M) power supply.

† = Total power output from the 2424A/2426E/F computer power supply cannot exceed 151W, maximum, nor can the maximum available current from any power supply output be exceeded; subtract the current/power usage from the available current/power in the table to confirm that the maximums will not be exceeded.

‡ = Total power output from the 243xA/E/248xA power supply cannot exceed 300W, maximum, nor can the maximum available current from any power supply output be exceeded; subtract the current/power usage from the available current/power in the table to confirm that the maximums will not be exceeded.

Table 3-11. Computer Power Supply and Card Cage Slot Availability (+) and Requirements (–), continued

PRODUCT NUMBER AND NAME	CARD CAGE SLOTS	DIRECT CURRENT AT				25 kHz AC PWR at 39V RMS	TOTAL POWER SUPPLY
		+5V	+5V(M)	+12V	-12V		
INTERFACES, continued							
12060B HIGH-LEVEL ANALOG I/P CARD □	- 1	- 1.1A	0.0A	0.0A	0.0A	-7.3W‡	- 12.8W
12061A EXPANSION MULTIPLEXER CARD □	- 1	- 0.1A	0.0A	0.0A	0.0A	-2.0W‡	- 2.5W
12062A ANALOG OUTPUT CARD □	- 1	- 1.2A	0.0A	0.0A	0.0A	-7.6W‡	- 13.6W
12063A 16/16 ISOLATED DIGITAL I/O CD □	- 1	- 1.0A	0.0A	0.0A	0.0A	-11.4W‡	- 16.4W
12065A COLOR VIDEO MONITOR I/F	- 1	- 3.7A	0.0A	- 0.5A	-0.02A	0.0W	- 24.0W
12072A DS/1000-IV DATA LINK SLAVE I/F	- 1	- 1.5A	0.0A	- 0.2A	-0.1A	0.0W	- 11.1W
12073A BISYNC MODEM I/FTO HP 3000	- 1	- 2.6A	0.0A	- 0.4A	-0.2A	0.0W	- 20.2W
12075A DSN/X.25 (LAP-B NETWORK I/F	- 1	- 2.6A	0.0A	- 0.4A	-0.2A	0.0W	- 20.2W
12076A LAN/100 LINK INTERFACE	- 1	- 4.5A	0.0A	- 0.5A	-0.38A	0.0W	- 33.5W
12082A BISYNC DIR CONN I/FTO HP 3000	- 1	- 2.4A	0.0A	- 0.3A	-0.1A	0.0W	- 16.8W
12092A DATA LINK MASTER INTERFACE	- 1	- 2.6A	0.0A	- 0.4A	-0.2A	0.0W	- 20.2W
37203L* HP-IB EXTENDER CARD □	- 1	- 0.8A	0.0A	- 0.4A	-0.2A	-0.8W	- 4.8W
37203L*+001 HP-IB EXTENDER CARD using fiber optic cable comm.	- 1	- 0.8A	0.0A	- 0.4A	-0.2A	0.0W	- 4.0W
37222A* INTEGRAL MODEM INTERFACE	- 1	- 1.2A	0.0A	- 0.1A	-0.1A	-0.8W	- 8.4W
I/O EXTENDERS -- Power supply in I/O Extenders is only available to interfaces installed in the I/O Extender.							
12025A I/O EXTENDER	+12	+38.9A	0.0A	+ 7.0A	+3.0A	0.0W	+300.0W
12025B I/O EXTENDER	+18	+58.0A	0.0A	+ 5.6A	+3.5A	+50.0W	+448.0W
MISCELLANEOUS PLUG-IN ACCESSORIES							
12008A PROM STORAGE MODULE	- 1	- 2.0A	0.0A	- 0.1A	0.0A	0.0W	- 11.2W
12010A BREADBOARD INTERFACE♦	- 1	- 0.8A	0.0A	- 0.1A	0.0A	0.0W	- 5.2W
12011A EXTENDER CARD	- 1	0.0A	0.0A	0.0A	0.0A	0.0W	n/a
12012A PRIORITY JUMPER CARD	- 1	0.0A	0.0A	0.0A	0.0A	0.0W	n/a
12013A* BATTERY BACKUP CARD	- 1	0.0A	0.0A	- 0.1A	0.0A	0.0W	n/s
12153A A700 WRITABLE CONTROL STORE	- 1	- 4.1A	0.0A	- 0.1A	-0.02A	0.0W	- 21.7W
12154A BATTERY BACKUP for 243xA/248xA	- 2	0.0A	0.0A	- 0.1A	-0.02A	0.0W	- 8.0W
12155A A700 PROM CONTROL STORE, fully loaded	- 1	- 6.3A	0.0A	0.0A	0.0A	0.0W	- 31.5W
12156A A700 HARDWARE FLOATING POINT PROCESSOR CARD	- 1	- 4.0A	0.0A	0.0A	0.0A	0.0W	- 20.0W
12157B BATTERY BACKUP for 213xA, 2156B, or 219xC/D	- 1	0.0A	-3.0A	- 0.1A	-0.02A	0.0W	n/s
12159A SINE WAVE CARD for 243xA/248xA	- 1	- 1.5A	0.0A	0.0A	0.0A	+30.0W	- 6.0W

FOOTNOTES: n/s = not specified; nnc = no net change; n/a = not applicable

* = Discontinued product listed here for reference only.

□ = This card requires 25 kHz power, which precludes its use in the 2122A*/B*, 2136A*/B*, 2142A*/B*, or 2186C*/D* Microsystem or the 2424A, 2426E, or 2426F Micro 14/16 Computer and requires the addition of the 12159A Sine Wave Card in 243xA/E Micro 24/26/27/29 Computers or 248xA Micro 24/26/27/29 System Processor Units.

♦ = The requirements listed here for the Breadboard Interface do not include power for circuits added by the user.

‡ = Total power output from the 243xA/E/248xA power supply cannot exceed 300W, maximum, nor can the maximum available current from any power supply output be exceeded; subtract the current/power usage from the available current/power in the table to confirm that the maximums will not be exceeded.

Table 3-12. System Processor Unit, Computer, and Peripheral Physical Characteristics

PRODUCT NUMBER AND NAME		DIMENSIONS HEIGHT x WIDTH x DEPTH Centimeters and	(Inches)	RECOMMENDED FLOOR SPACE meters and (feet)	NET WEIGHT kg and (lb)
SYSTEM PROCESSOR UNITS (SPUs) (Excludes system console terminal and non-integrated system disc)					
219xC	MODEL 26/27/29 SPU	161.3x69.9x81.3	(63.4x27.5x32)	3 x 3 (9 x 9)	139.5 (307.5)
219xD	MODEL 26/27/29 SPU	72x69.9x81.3	(28.3x27.5x32)	3 x 3 (9 x 9)	94 (207.5)
248xA	MICRO 24/26/27/29 SPU	17.8x48.3x64.8	(7x19x25.5)	Rack or table mtg	18.1 (40)
248xA	MICRO 24/26/27/29 SPU in 40025A Vertical Floor Mount	67.3x34.7x64.8	(26.5x13.6x25.5)	0.5 x 1 (1.5 x 3)	23.8 (52.5)
COMPUTERS (CPUs)					
213xA	COMPUTER	26.6x48.3x61.2	(10.5x19x24)	Rack mounting	29.1 (64)
2156B	COMPUTER	26.6x48.3x61.2	(10.5x19x24)	Rack mounting	29.1 (64)
2424A	MICRO 14 COMPUTER	20.5x32.5x50	(8.1x12.8x19.7)	Rack or table mtg	13.2 (29)
2426E/F	MICRO 16 COMPUTER	20.5x32.5x50	(8.1x12.8x19.7)	Rack or table mtg	13.2 (29)
243xA/E	MICRO 24/26/27/29 CPU	17.8x48.3x64.8	(7x19x25.5)	Rack or table mtg	18.1 (40)
243xA/E	MICRO 24/26/27/29 CPU in 40025A Vertical Floor Mount	67.3x34.7x64.8	(26.5x13.6x25.5)	0.5 x 1 (1.5 x 3)	23.8 (52.5)
PERIPHERAL DEVICES					
12122A	INTEGR. DISCS for Micro 24/26/27/29 SPU/Computer	No change	No change	No change	2.3 (5)
12131A	KEYBOARD RACK for 72411A	8.6x48.2x59	(2.4x19x23.2)	Rack mounting	6.9 (15)
13279B	19-INCH COLOR MONITOR	39.9x48.2x59.8	(15.7x19x23.6)	Rack or table mtg	36.7 (81)
2225D	THINKJET PRINTER	8.9x29.2x20.6	(3.5x11.5x8.1)	Table mounting	3.1 (6.8)
2227A	QUIETJET PLUS PRINTER	12.1x52.7x22.1	(4.8x20.8x8.7)	Table mounting	4.7 (10.34)
2228A	QUIETJET PRINTER	11.8x39.5x21.4	(4.7x15.5x8.4)	Table mounting	3.9 (8.6)
2334A	MULTIMUX	14x42.5x54	(5.5x16.8x21.3	Rack or table mtg	13 (29)
2382A*	OFFICE DISPLAY TERMINAL	28.7x30.5x48.5	(11.3x8x15.1)	Table mounting	10.0 (22)
2392A	DISPLAY TERMINAL	31.7x45.5x58.2	(12.5x17.9x22.9)	Table mounting	13.0 (28.7)
2393A	GRAPHICS TERMINAL	44.5x45.6x55	(17.5x18x21.7)	Table mounting	16.4 (36.1)
2397A	COLOR GRAPHICS TERM	44.5x45.6x55	(17.5x18x21.7)	Table mounting	20.3 (44.8)
2563B	LINE PRINTER	100x59.5x76.2	(39.4x23.4x30)	1 x 3 (3 x 9)	160 (352)
2563B	LINE PRINTER w/Opt 114	27x60x45	(10.75x23.3x17.8)	Table mounting	75 (165)
2564B	LINE PRINTER	100x59.5x76.2	(39.4x23.4x30)	1 x 3 (3 x 9)	160 (352)
2564B	LINE PRINTER w/Opt 114	27x60x45	(10.75x23.3x17.8)	Table mounting	75 (165)
2565A*	LINE PRINTER	110x98.3x63.5	(43.3x38.7x25)	1 x 3 (3 x 9)	204 (450)
2566B	LINE PRINTER	110x98.3x63.5	(43.3x38.7x25)	1 x 3 (3 x 9)	211 (465)
2601A*	DAISYWHEEL PRINTER	25.3x61x48.1	(10x24x19)	Table mounting	34 (75)
2608x*	LINE PRINTER	104.2x68x55.5	(41x26.5x21.8)	1 x 3 (3 x 9)	97.7 (215)
262x*	TERMINALS	44x38x66.5	(17.3x15x26)	Table mounting	22.3 (49)
264xA*	TERMINALS	34.2x44.4x64.8	(13.5x17.5x25.5)	Table mounting	22.8 (50)
2671x*	PRINTER/GRAPHICS PRTR	10.5x42.8x42.4	(4.1x16.9x16.7)	Table mounting	12.7 (28)
2673A*	INTELL. GRAPHICS PRTR	10.5x42.8x42.4	(4.1x16.9x16.7)	Table mounting	14.1 (31)
2674A*	INTEGR. PRTR for 45610B	See 45610B	See 45610B	See 45610B	2.9 (6.4)
2686A	LASERJET PRINTER	29.3x47.5x72.3	(11.4x18.5x28.2)	Table mounting	32 (71)
2687A*	DESKTOP LASER PRINTER	28x51x50	(11x20x19.5)	Table mounting	62.7 (138)
	Controller included w/2687A	28x15x50	(11x6x19.5)	Table mounting	5.5 (12)
293xA	PRINTERS	18.5x60x36.5	(7.3x23.9x14.4)	Table mounting	20.4 (45)
3074x	DATA LINK ADAPTER	5x25x11	(2x9x4.4)	Table mounting	1 (2.2)
35401A	AUTOCHGR TAPE CART S/S	26x32.5x57.5	(10.2x12.8x22.6)	Rack or table mtg	22.5 (50.5)
35731A	MONOCHROME MONITOR	33.2x34x24	(13.1x13.4x9.4)	Mounts on PC	10 (22)
35741A	COLOR MONITOR	34.5x32.8x39	(13.6x12.9x15.4)	Mounts on PC	13.9 (20.6)
35743A	ENHANCED GRAPHICS DISP	30.4x35.4x38	(12x13.9x15)	Mounts on PC	12 (26.4)
35745A	IND ENH'D GRAPHICS DISP	31.5x48.2x48	(12.4x19x18.9)	Rack mounting	15.9 (35)
37214A	SYST MODEM CARD CAGE	17.8x43.8x33	(7x17.3x13)	Rack mounting	7.5 (16.5)
39301A	FIBER OPTIC MPXER	7.2x42.5x8.9	(2.9x16.8x3.5)	Table mounting	3.5 (7.5)
45610B*	TOUCHSCREEN TERMINAL	28.7x45.6x53	(11.3x18x20.9)	Table mounting	12.2 (27)

* Identifies discontinued product, listed here for reference only.

Table 3-12. System Processor Unit, Computer, and Peripheral Physical Characteristics, continued

PRODUCT NUMBER AND NAME		DIMENSIONS HEIGHT x WIDTH x DEPTH Centimeters and	(Inches)	RECOMMENDED FLOOR SPACE meters and (feet)	NET WEIGHT kg and (lb)
PERIPHERAL DEVICES, continued					
72411A	VECTRA INDUSTRIAL PC	31.5x48.2x52	(1.24x19x20.5)	Rack mounting	29 (64)
724xxA	VECTRA MODEL xx PC	16x52.5x61.5	(6.3x20.6x24.2)	Table mounting	13.7 (30.2)
7440A	COLORPRO PLOTTER	12.5x46x30.8	(4.9x18.1x12.1)	Table mounting	5.5 (12)
7470A*	2-pen PLOTTER	12.7x43.2x34.3	(5x17.3x13.5)	Table mounting	6 (13.5)
7475A	6-pen PLOTTER	12.7x56.8x36.7	(5x22.4x14.5)	Table mounting	7 (16)
7510A	COLOR FILM RECORDER	21.5x60.9x45.7	(8.5x24x18)	Table mounting	20.8 (46)
7550A	PLOTTER w/Auto Sheet Feed	21.5x67x89.6	(8.5x26.4x35.3)	Table mounting	17.3 (38)
7570A	DRAFTPRO PLOTTER	103x114x52	(40.6x44.9x20.5)	2 x 2 (6 x 6)	30 (66)
7580B	DRAFTING PLOTTER	118.8x108.7x55.7	(46.8x42.8x21.9)	2 x 2 (6 x 6)	63.6 (140)
7585B	DRAFTING PLOTTER	118.8x139.2x55.7	(46.8x54.8x21.9)	2 x 2 (6 x 6)	70.4 (155)
7586B	DRAFTING PLOTTER	118.8x139.2x55.7	(46.8x54.8x21.9)	2 x 2 (6 x 6)	86.4 (190)
7907A	FIXED/REM DISC SUBSYS	18x32.5x46.7	(7.1x12.8x18.4)	Rack or table mtg	25 (55)
7908P*	S-A FIXED DISC w/CTU	72x35.4x74	(28.4x14x29.1)	1 x 2 (3 x 6)	72.7 (160)
7908R*	R/Mtg FIXED DISC w/CTU	17.7x48.3x68.7	(7x19x27.1)	Rack mounting	37.1 (87.6)
791xP	S-A FIXED DISC w/CTU	72x35.4x74	(28.4x14x29.1)	1 x 2 (3 x 6)	85.4 (188)
791xR	R/Mtg FIXED DISC w/CTU	31.1x48.3x70.5	(12.25x19x27.8)	Rack mounting	67.3 (148)
7914CT*	S-A FIXED DISC w/CTU	72x37.5x77.7	(28.4x14.8x30.5)	1 x 2 (3 x 6)	109 (239)
7914ST*	FIXED DISC w/1600 cpi MTU	160x60x80	(63x23.6x31.5)	3 x 3 (9 x 9)	261 (574)
7914TD*	FIXED DISC w/1600 cpi MTU	161.3x63.5x81.3	(63.4x25x32)	3 x 3 (9 x 9)	272.2 (600)
7933x	FIXED DISC	82.5x55.2x83.4	(32.5x21.7x32.8)	1 x 3 (3 x 9)	154 (339.5)
7935x	REMOVABLE MEDIA DISC	82.5x55.2x83.4	(32.5x21.7x32.8)	1 x 3 (3 x 9)	154 (339.5)
7936x	FIXED DISC	27.2x32.4x74.1	(10.7x12.8x29.2)	Rack mounting	56.7 (125)
7937x	FIXED DISC	27.2x32.4x74.1	(10.7x12.8x29.2)	Rack mounting	56.7 (125)
7941A*	FIXED DISC	13x32.5x28.5	(5.1x12.8x11.2)	Table or rack mtg	9.9 (21.8)
7942A	FIXED DISC w/CTU	20.8x32.5x28.5	(8.2x12.8x11.2)	Table or rack mtg	15.8 (34.8)
7945A*	FIXED DISC	13x32.5x28.5	(5.1x12.8x11.2)	Table or rack mtg	9.9 (21.8)
7946A	FIXED DISC w/CTU	20.8x32.5x28.5	(8.2x12.8x11.2)	Table or rack mtg	15.8 (34.8)
795xA	FIXED DISC	13.2x32.5x28.5	(5.2x12.8x11.2)	Table or rack mtg	9.9 (21.8)
7970E*	1600 cpi MTU	66.7x48.3x30.4	(26.3x19x12)	Rack mounting	68.2 (150)
7971A*	1600 cpi MAG TAPE SUBSYS	158.5x62.3x90.5	(62.4x24.5x35.6)	3 x 3 (9 x 9)	195 (430)
	Additional Drive in 7971A	No change	No change	No change	59 (130)
7974A	1600 cpi MTU	160x60x77.5	(63x23.6x30.5)	3 x 3 (9 x 9)	181.8 (400)
7978B	6250/1600 cpi MTU	160x60x78	(63x23.6x30.7)	3 x 3 (9 x 9)	188 (414)
82905B*	IMPACT PRINTER	10.7x37.4x30.5	(4.2x14.7x12)	Table mounting	5.5 (12.1)
82906A*	DOT-MATRIX PRINTER	10x42x34.7	(3.9x16.5x13.7)	Table mounting	7.5 (16.5)
9111A*	GRAPHICS TABLET	8.5x44x44	(3.4x17.3x17.3)	Table mounting	5.8 (12.8)
9122D	Dual MICROFLOPPY DISC	7.6x32.5x28.5	(3x12.8x11.2)	Table or rack mtg	4.5 (10)
9133D*	FIXED + MICROFLOPPY DISC	13.2x32.5x28.5	(5.2x12.8x11.2)	Table or rack mtg	10.5 (23)
9133H*	FIXED + MICROFLOPPY DISC	13.2x32.5x28.5	(5.2x12.8x11.2)	Table or rack mtg	10.5 (23)
9133L	FIXED + MICROFLOPPY DISC	13.2x32.5x28.5	(5.2x12.8x11.2)	Table or rack mtg	10.5 (23)
9134D*	FIXED DISC	13.2x32.5x28.5	(5.2x12.8x11.2)	Table or rack mtg	9.5 (21)
9134H*	FIXED DISC	13.2x32.5x28.5	(5.2x12.8x11.2)	Table or rack mtg	9.5 (21)
9134L	FIXED DISC	13.2x32.5x28.5	(5.2x12.8x11.2)	Table or rack mtg	9.5 (21)
9144A	TAPE CARTRIDGE SUBSYS	12.5x32.5x28.5	(5x12.8x11.2)	Table or rack mtg	8.6 (19)
9153B	FIXED + MICROFLOPPY DISC	10.7x32.5x28.5	(4.2x12.8x11.2)	Table or rack mtg	7.7 (16.2)
9154B	FIXED DISC	10.7x32.5x28.5	(4.2x12.8x11.2)	Table or rack mtg	6.8 (14.9)
9666A	OPERATOR INTERFACE UNIT	43.8x42.9x49.7	(17.3x16.9x19.5)	Bench or rack mtg	?? (??)
9895A*	FLEXIBLE DISC MEMORY	19.2x48.3x57.5	(7.6x19x22.6)	Table or rack mtg	26.8 (59)

* Identifies discontinued product, listed here for reference only.

Table 3-13. System Processor Unit, Computer, and Peripheral Environmental Specifications

PRODUCT NUMBER AND NAME	TEMPERATURE °C (°F)		RELATIVE HUMIDITY (Non-condensing)	MAXIMUM ALTITUDE Meters (Feet)	
	OPERATING	NON-OPERATING		OPERATING	NON-OPER
SYSTEM PROCESSOR UNITS (SPUs) (Excludes system console terminal and non-integrated system disc)					
219xC/D MODEL 26/27/29 SPU	0-40 (32-104)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
248xA MICRO 24/26/27/29 SPU	0-45 (32-113)	-40-60 (-40-140)	5% - 95%	4572 (15,000)	15240 (50,000)
COMPUTERS (CPUs)					
213xA COMPUTER, 15,000 ft spec	0-40 (32-104)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
213xA COMPUTER, 10,000 ft spec	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	3048 (10,000)	15240 (50,000)
2156B COMPUTER, 15,000 ft spec	0-40 (32-104)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
2156B COMPUTER, 10,000 ft spec	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	3048 (10,000)	15240 (50,000)
2424A MICRO 14 COMPUTER	0-60 (32-140)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
2426E/F MICRO 16 COMPUTER	0-60 (32-140)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
243xA/E MICRO 24/26/27/29 CPU	0-45 (32-113)	-40-60 (-40-140)	5% - 95%	4572 (15,000)	15240 (50,000)
PERIPHERAL DEVICES					
12122A INTEGR. DISCS for Micro 24/26/27/29 SPU/Computer	5-45 (32-113)	-40-60 (-40-140)	20% - 80%	4572 (15,000)	15240 (50,000)
13279B 19-INCH COLOR MONITOR	0-50 (32-122)	Not specified	10% - 90%	3048 (10,000)	Not specified
2225D THINKJET PRINTER	10-40 (50-104)	-20-60 (-4-140)	10% - 90%	Not specified	Not specified
2227A QUIETJET PLUS PRINTER	10-40 (50-104)	-20-60 (-4-140)	10% - 90%	Not specified	Not specified
2228A QUIETJET PRINTER	10-40 (50-104)	-20-60 (-4-140)	10% - 90%	Not specified	Not specified
2334A MULTIMUX	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
2382A* OFFICE DISPLAY TERMINAL	0-55 (32-131)	-40-60 (-40-140)	5% - 95%	4572 (15,000)	15240 (50,000)
239xA TERMINALS	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
2563A* LINE PRINTER	10-50 (50-122)	-40-75 (-40-167)	30% - 80%	4572 (15,000)	15240 (50,000)
2565A* LINE PRINTER	10-40 (50-104)	-40-75 (-40-167)	30% - 80%	4572 (15,000)	15240 (50,000)
2566A* LINE PRINTER	10-40 (50-104)	-40-75 (-40-167)	30% - 80%	4572 (15,000)	15240 (50,000)
256xB LINE PRINTERS	10-50 (50-122)	-40-75 (-40-167)	30% - 80%	4572 (15,000)	15240 (50,000)
2601A* DAISYWHEEL PRINTER	7-41 (45-105)	-29-57 (-20-135)	10% - 80%	2438 (8,000)	7620 (25,000)
2608x* LINE PRINTER	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
262x* TERMINALS without printer	0-55 (32-131)	-40-60 (-40-140)	5% - 95%	4572 (15,000)	15240 (50,000)
262x* TERMINALS with printer	5-40 (41-104)	-40-60 (-40-140)	5% - 80%	4572 (15,000)	15240 (50,000)
264xA* TERMINALS without CTUs	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	7620 (25,000)
264xA* TERMINALS with CTUs	5-40 (41-104)	-10-60 (-15-140)	20% - 80%	4572 (15,000)	7620 (25,000)
2671x* PRINTER/GRAPHICS PRTR	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
THERMAL PAPER for 267x	0-40 (32-104)	-40-40 (-40-104)	20% - 90%	4572 (15,000)	15240 (50,000)
2686A LASERJET PRINTER	10-32 (50-91)	0-35 (32-95)	20% - 80%	2500 (8,200)	15240 (50,000)
2687A* DESKTOP LASER PRINTER	10-30 (50-86)	-40-40 (-40-104)	20% - 90%	2500 (8,200)	15240 (50,000)
293xA PRINTERS	0-55 (32-131)	-40-75 (-40-167)	10% - 70%	4572 (15,000)	15240 (50,000)
3074x DATA LINK ADAPTER	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
35401A AUTOCHANGER TAPE CARTRIDGE SUBSYSTEM	5-40 (41-104)	-40-75 (-40-167)	20% - 80%	4572 (15,000)	Not specified
357x1A MONITORS	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
35743A ENH'D GRAPHICS DISPLAY	10-40 (50-104)	-10-55 (14-131)	10% - 95%	2133 (7,000)	12192(40,000)
35745A IND ENH'D GRAPHICS DIS	0-60 (32-140)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
37214A SYST MODEM CARD CAGE	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
39301A FIBER OPTIC MPXER	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
45610B* TOUCHSCREEN TERMINAL	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
72411A VECTRA INDUSTRIAL PC	0-60 (32-140)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
724xxA VECTRA MODEL xx PC	5-40 (41-104)	-40-70 (-40-158)	8% - 80%	4572 (15,000)	15240 (50,000)

* Identifies discontinued product, listed here for reference only.

Table 3-13. System Processor Unit, Computer, and Peripheral Environmental Specifications, continued

PRODUCT NUMBER AND NAME		TEMPERATURE °C (°F)		RELATIVE HUMIDITY (Non-condensing)	MAXIMUM ALTITUDE Meters (Feet)	
		OPERATING	NON-OPERATING		OPERATING	NON-OPER
PERIPHERAL DEVICES						
7440A	COLORPRO PLOTTER	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
7470A*	2-pen PLOTTER	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
7475A	6-pen PLOTTER	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
7510A	COLOR FILM RECORDER	0-55 (32-131)	-40-75 (-40-167)	Not specified	Not specified	Not specified
7550A	PLOTTER	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
	Auto Sheet Feed w/7550A	10-40 (50-104)	-40-75 (-40-167)	20% - 80%	4572 (15,000)	15240 (50,000)
7570A	DRAFTPRO PLOTTER	0-55 (32-131)	-40-75 (-40-167)	5% - 95%	Not specified	Not specified
758xB	DRAFTING PLOTTER	0-40 (32-104)	-40-75 (-40-167)	5% - 95%	4572 (15,000)	15240 (50,000)
	Roll Feed w/7586B	10-30 (50-86)	-40-75 (-40-167)	30% - 70%	4572 (15,000)	15240 (50,000)
7907A	FIXED/REM DISC SUBSYS	10-40 (50-104)	-40-75 (-40-167)	5% - 95%	3000 (9,840)	15240 (50,000)
7908P*	S-A FIXED DISC w/CTU	10-40 (50-104)	-40-65 (-40-149)	20% - 80%	4572 (15,000)	15240 (50,000)
7908R*	R/Mtg FIXED DISC w/CTU	10-40 (50-104)	-40-65 (-40-149)	20% - 80%	4572 (15,000)	15240 (50,000)
791xP/R	FIXED DISC w/CTU	10-40 (50-104)	-40-60 (-40-140)	20% - 80%	4572 (15,000)	15240 (50,000)
7914ST*	FIXED DISC w/1600 cpi MTU	15-32 (59-90)	-10-60 (14-140)	20% - 80%	3000 (9,840)	15240 (50,000)
7914TD*	FIXED DISC w/1600 cpi MTU	10-40 (50-104)	-10-60 (14-140)	20% - 80%	3000 (9,840)	3000 (9,840)
7933x	FIXED DISC	10-40 (50-104)	-40-65 (-40-149)	8% - 80%	3000 (9,840)	15240 (50,000)
7935x	REMOVABLE MEDIA DISC	10-32 (50-90)	-40-65 (-40-149)	8% - 80%	3000 (9,840)	15240 (50,000)
7936x	FIXED DISC	0-55 (32-131)	-40-70 (-40-158)	5% - 95%	4572 (15,000)	15240 (50,000)
7937x	FIXED DISC	0-55 (32-131)	-40-70 (-40-158)	5% - 95%	4572 (15,000)	15240 (50,000)
7941A*	FIXED DISC	5-45 (41-113)	-40-60 (-40-140)	8% - 80%	4572 (15,000)	15240 (50,000)
7942A	FIXED DISC w/CTU	5-45 (41-113)	-40-60 (-40-140)	20% - 80%	4572 (15,000)	15240 (50,000)
7945A*	FIXED DISC	5-45 (41-113)	-40-60 (-40-140)	8% - 80%	4572 (15,000)	15240 (50,000)
7946A	FIXED DISC w/CTU	5-45 (41-113)	-40-60 (-40-140)	20% - 80%	4572 (15,000)	15240 (50,000)
795xA	FIXED DISC	5-45 (41-113)	-40-65 (-40-149)	8% - 90%	4572 (15,000)	15240 (50,000)
7970E*	1600 cpi MTU	0-55 (32-131)	-40-75 (-40-167)	20% - 80%	3000 (9,840)	15240 (50,000)
7971A*	1600 cpi MAG TAPE SUBSYS	0-55 (32-131)	-40-75 (-40-167)	20% - 80%	3000 (9,840)	15240 (50,000)
7974A	1600 cpi MTU	15-32 (59-90)	-40-75 (-40-167)	20% - 80%	3000 (9,840)	15240 (50,000)
7978B	6250/1600 cpi MTU	15-32 (59-90)	-40-75 (-40-167)	10% - 90%	3000 (9,840)	15240 (50,000)
82905B*	IMPACT PRINTER	5-35 (41-95)	-30-65 (-22-149)	10% - 80%	3048 (10,000)	15240 (50,000)
82906A*	DOT-MATRIX PRINTER	5-35 (41-95)	-30-65 (-22-149)	10% - 80%	3048 (10,000)	15240 (50,000)
9111A*	GRAPHICS TABLET	0-55 (32-131)	-40-65 (-40-149)	5% - 90%	4572 (15,000)	15240 (50,000)
9122D	Dual MICROFLOPPY DISC	10-45 (50-113)	-40-60 (-40-140)	20% - 80%	4572 (15,000)	15240 (50,000)
9133D*	FIXED + MICROFLOPPY DISC	10-45 (50-113)	-40-60 (-40-140)	20% - 80%	4572 (15,000)	15240 (50,000)
9133H*	FIXED + MICROFLOPPY DISC	10-45 (50-113)	-40-60 (-40-140)	20% - 80%	4572 (15,000)	15240 (50,000)
9133L	FIXED + MICROFLOPPY DISC	10-45 (50-113)	-40-60 (-40-140)	20% - 80%	4572 (15,000)	15240 (50,000)
9134D*	FIXED DISC	10-45 (50-113)	-40-60 (-40-140)	5% - 95%	4572 (15,000)	15240 (50,000)
9134H*	FIXED DISC	10-45 (50-113)	-40-60 (-40-140)	5% - 95%	4572 (15,000)	15240 (50,000)
9134L	FIXED DISC	10-45 (50-113)	-40-60 (-40-140)	5% - 95%	4572 (15,000)	15240 (50,000)
9144A	TAPE CARTRIDGE SUBSYS	5-40 (41-104)	-40-75 (-40-167)	20% - 80%	4572 (15,000)	15240 (50,000)
9153B	FIXED + MICROFLOPPY DISC	10-45 (50-113)	-40-60 (-40-140)	20% - 80%	4572 (15,000)	15240 (50,000)
9154B	FIXED DISC	10-45 (50-113)	-40-60 (-40-140)	5% - 95%	4572 (15,000)	15240 (50,000)
9666A	OPERATOR INTERFACE UNIT	0-60 (32-140)	-40-70 (-40-158)	5% - 95%	4572 (15,000)	15240 (50,000)
9895A*	FLEXIBLE DISC MEMORY	10-40 (50-104)	-40-60 (-40-140)	20% - 80%	4572 (15,000)	15240 (50,000)

* Identifies discontinued product, listed here for reference only.

For HP 1000 A-Series systems

Basic HP 219xC/D System Processor Unit Racking

HP 1000 A-Series HP 219xC and HP 219xD System Processor Units (SPUs) are rack mounted in HP 29431G and HP 29429A cabinets as shown in Figure 3-11, below. The basic SPU includes an HP 2137A, 2139A or 2156B Computer, which is housed in a 20-slot card cage. Space immediately above the computer is designed to be occupied by a separately-ordered HP 7911R, 7912R, or 7914R CS/80 disc memory with built-in cartridge tape unit for convenient software installation and backup. A door with cutout for access to the disc's cartridge tape unit is standard in the 29431G and 29429A cabinets for HP 219xC/D SPUs.

Computer-Disc Compartment Ventilation

The computer and HP 791xR disc both provide their own front-to-rear ventilation. Louvers in the front and rear doors facilitate self-ventilation by the computer and disc.

Upper Compartment in HP 29431G Cabinet

Above the computer-disc compartment, the HP 29431G cabinet provides a panel-separated upper compartment with 80 cm (31.5 in.) of vertical space for rack mounting other equipment.

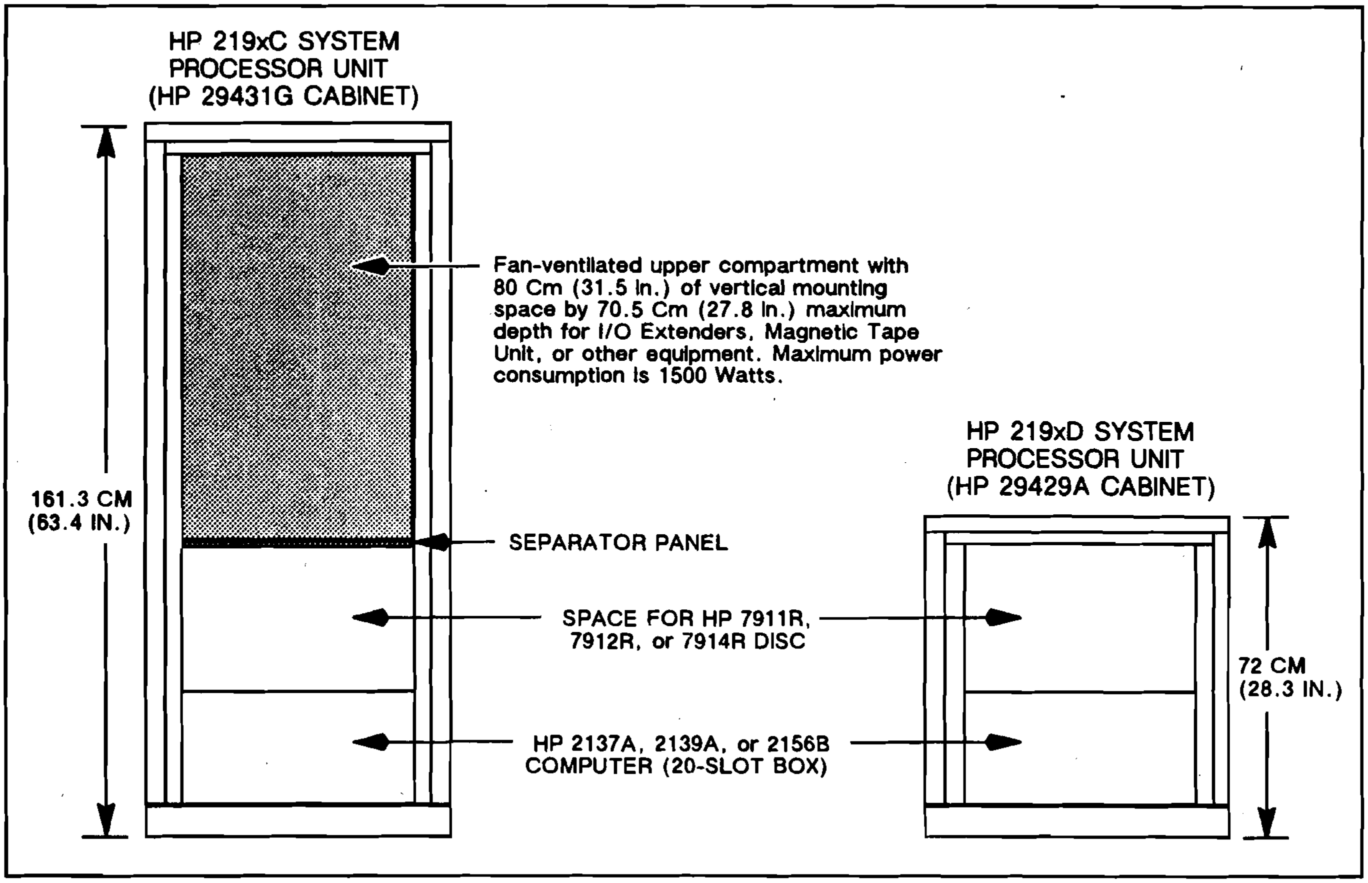

HP 219xC SYSTEM PROCESSOR UNIT (HP 29431G CABINET)
Fan-ventilated upper compartment with 80 Cm (31.5 In.) of vertical mounting space by 70.5 Cm (27.8 In.) maximum depth for I/O Extenders, Magnetic Tape Unit, or other equipment. Maximum power consumption is 1500 Watts.
161.3 CM (63.4 IN.)
SEPARATOR PANEL
HP 219xD SYSTEM PROCESSOR UNIT (HP 29429A CABINET)
SPACE FOR HP 7911R, 7912R, or 7914R DISC
72 CM (28.3 IN.)
HP 2137A, 2139A, or 2156B COMPUTER (20-SLOT BOX)

Figure 3-11. HP 1000 A-Series System Processor Unit Racking

Upper Compartment Ventilation

Air circulation fans in the upper compartment support equipment with left-to-right ventilation OR right-to-left ventilation OR front-to-rear ventilation. To assure proper heat dissipation, all equipment in the upper compartment must use the same type of ventilation. For proper front-to-rear ventilation, the HP 29431G cabinet must be ordered with Option 051, which substitutes trim for rack mounting a magnetic tape unit for the upper compartment front door that is standard. Details of trim installation are given in the HP 40027A Trim Kit Installation Manual (40027-90002). All unoccupied vertical mounting space must be covered by blank panels. A maximum of 1500 watts can be dissipated by the upper compartment ventilation.

Safety Qualification of Equipment for the Upper Compartment of the HP 219xC SPU

The customer is responsible for the safety of equipment installed in the upper compartment of the HP 219xC SPU. Pertinent safety issues include susceptability of the cabinet to tipping, especially with equipment that may be slid part-way out of the upper compartment for servicing, and the possibility of fire hazard from overheating.

Variations on Basic HP 219xC SPU Racking in the HP 29431G Cabinet

Louvered Lower Door

If an HP 791xR disc will not be installed in the computer-disc compartment of the HP 29431G cabinet, the lower door that is cut out to facilitate access to the cartridge tape unit of the HP 791xR disc must be replaced with a door that has louvers in place of the cutout. This louvered lower door is substituted by ordering Option 053 to the HP 219xC SPU or the HP 29431G Cabinet.

Installation of Other Equipment in Place of the HP 791xR Disc

Other equipment can be installed in HP 29431G Option 053 Cabinets in the space designed for the HP 791xR Disc, if:

1. It is self-ventilated, using front-to-rear ventilation.
2. It fits into 31.1 cm (12.25 in.) of vertical mounting space to a maximum depth of 70.5 cm (27.8 in.).
3. It consumes no more than 700 watts.
4. The customer is prepared to assume responsibility for the safety of equipment installed in the space designed for the HP 791xR Disc.

HP 219xC Option 070 SPU Racking in HP 7914ST Cabinet

The HP 7914ST Disc-Tape Subsystem combines the large capacity of a 1600 cpi magnetic tape unit with a 132.1 MB disc in a tall cabinet. Enough space is available in the HP 7914ST cabinet to house the HP 2137A, 2139A, or 2156B Computer of the HP 219xC SPU in addition to the tape and disc drive units.

HP 219xC Option 070. Customers who want to save the cost of unneeded cabinetry can order HP 219xC Option 070, which deletes the HP 29431G Cabinet from the HP 219xC SPU. HP 219xC Option 070 then includes the computer and an additional HP 12009A HP-IB interface to the magnetic tape unit, which are installed in the HP 7914ST Cabinet.

Appearance of the HP 7914ST Cabinet differs noticeably from the HP 219xC SPU cabinet with respect to cabinet height, color of finish, and means of unlatching the front door of the cabinet. Customers to whom uniformity of appearance in their computer installation is important should compare the 7914ST with the 219xC before deciding to rack a 219xC Option 070 SPU in a 7914ST cabinet.

Racking of Micro/1000-Packaged Products in the HP 29431G Cabinet

As with all equipment that does not use front-to-rear ventilation, Micro/1000-packaged products, such as HP 243xA/E Computers, HP 248xA SPUs, or HP 12025A I/O Extenders, must be rack mounted in the upper compartment of the HP 29431G Cabinet. Two Micro/1000-packaged products can be racked in the upper compartment of the HP 29431G Cabinet.

Racking of Cooler-Packaged Computers in the HP 29431G Cabinet

The HP 2424A Micro 14 Computer and HP 2426E/F Micro 16 Computers are housed in the "cooler" package. Rack mounting of these cooler-packaged computers in the HP 29431G Cabinet requires an HP 12905A Rack Mount Adapter. Because these computers use front-to-rear ventilation, they can be mounted in either the computer-disc compartment or the upper compartment of the 29431G Cabinet.

Bolting Cabinets Together

Two HP 29431G Cabinets can be secured to each other using an HP 40026A Tie-Together Kit. However, the HP 29431G Cabinets are not designed to be bolted or otherwise tied together with other cabinets of any kind. Bolting more than two 29431G Cabinets together requires special engineering.

Rack-Mountable Equipment for HP 1000 A-Series Systems.

Rack mountable equipment available for HP 1000 A-Series Systems is listed in Table 3-14, along with related information.

Table 3-14. HP 1000 A-Series Systems Equipment Rack Mounting in HP 29431G/29429A Cabinet

PRODUCT NUMBER AND NAME	VERTICAL PANEL SPACE REQUIRED	MAX. POWER (Watts)	INTERNAL AIR FLOW DIRECTION	COMMENTS
HP 12025A I/O EXTENDER	22.3 Cm (8.75 in.)	500	Left-to-right	Mounts in lowest part of the upper compartment of the HP 29431G Cabinet (max. of two 12025As per 29431G Cabinet)
HP 12025B I/O EXTENDER	31.3 Cm (12.25 in.)	700	Front-to-rear	Mounts in computer-disc compartment in HP 29431G Option 053 Cabinet or in lowest part of upper compartment in 29431G Option 051 Cabinet or 29431G Option 051,053 Cabinet (max. of two 12025Bs in upper compartment of 29431G Cabinet)
HP 2137A, 2139A, or 2156B COMPUTER	31.3 Cm (12.25 in.)	700	Front-to-rear	Mounts in computer-disc compartment of HP 29431G or HP 29429A Cabinet (see Figure 3-11).
HP 2424A, 2426E, or 2426F COMPUTER with HP 12905A Rack Mount Adapter	22.3 Cm (8.75 in.)	190	Front-to-rear	Mounts in computer-disc compartment in HP 29431G Option 053 Cabinet or upper compartment of 29431G Option 051 Cabinet using an HP 12905A Rack Mount Adapter.
HP 243xA/E COMPUTER or HP 248xA SPU	22.3 Cm (8.75 in.)	500	Left-to-right	Mounts in lower 53.5 cm (21 in.) of upper compartment of the HP 29431G Cabinet.
HP 35401A CARTRIDGE AUTOCHANGER TAPE SUBSYSTEM with HP 35490A Rackmount Kit	26.7 Cm (10.5 in.)	125	Front-to-rear	*Safety in HP 29431G Option 053 Cabinet has not been qualified by HP and is the customer's responsibility.*Access for tape cartridge loading requires opening a cabinet door.
HP 7907A FIXED/REMOVABLE MASS STORAGE SUBSYSTEM with HP 19507A Rackmount Kit	22.3 Cm (8.75 in.)	145	Front-to-rear	*Safety in HP 29431G Option 053 Cabinet has not been qualified by HP and is the customer's responsibility.* Access to removable disc requires opening a cabinet door.
HP 7911R, 7912R, or 7914R CS/80 FIXED DISC	31.3 Cm (12.25 in.)	700	Front-to-rear	Mounts in computer-disc compartment of HP 29431G or HP 29429A Cabinet (see Figure 3-11); if the dedicated space for the HP 791xR disc is not used, HP 219xC/HP 29431G Option 053 must be ordered to replace the lower door cutout with lower door louvers. HP 29429A Special Option 738 replaces the cut out door with a louvered door.
HP 7936H/XP or 7937H/XP FIXED DISC with HP 19512A Adapter Kit	26.7 Cm (10.5 in.)	320	Front-to-rear	*Safety in HP 29431G Option 053 Cabinet has not been qualified by HP and is the customer's responsibility.*
HP 7941A or 7945A DISC DRIVE with HP 19500A Rack Slides Kit	13.3 Cm (5.25 in.)	85	Front-to-rear	*Safety in HP 29431G Option 053 Cabinet has not been qualified by HP and is the customer's responsibility.*
HP 7942A or 7946A DISC-TAPE DRIVE with HP 19501A Rack Slides Kit	22.2 Cm (8.75 in.)	120	Front-to-rear	*Safety in HP 29431G Option 053 Cabinet has not been qualified by HP and is the customer's responsibility.*Access for tape cartridge loading requires opening a cabinet door.
HP 7957A or 7958A DISC DRIVE with HP 19500B Rack Slides Kit	13.3 Cm (5.25 in.)	85	Front-to-rear	*Safety in HP 29431G Option 053 Cabinet has not been qualified by HP and is the customer's responsibility.*
HP 7970ER Option 636 Remarketed MAGNETIC TAPE UNIT	66.7 Cm (26.3 in.)	400	By convection	Mounting in upper compartment of HP 219xC SPU/HP 29431G Cabinet requires cabinet adaptation option 051.
HP 9133H/L DISC PLUS MICROFLOPPY or 9134H/L DISC with HP 19500B Rack Mounting Kit	13.3 Cm (5.25 in.)	100	Front-to-rear	*Safety in HP 29431G Option 053 Cabinet has not been qualified by HP and is the customer's responsibility.* Access for microfloppy loading in the HP 9133H/L or 9153B disc requires opening a cabinet door.
HP 9153B DISC PLUS MICROFLOPPY or 9154B DISC with HP 19500B Rack Mounting Kit	13.3 Cm (5.25 in.)	100	Front-to-rear	

Table 1. HP 1000 A-Series Systems Equipment Rack Mounting in HP 29431G/29429A Cabinet, continued

PRODUCT NUMBER AND NAME	VERTICAL PANEL SPACE REQUIRED	MAX. POWER (Watts)	INTERNAL AIR FLOW DIRECTION	COMMENTS
HP 9144A TAPE CARTRIDGE SUBSYSTEM with HP 19500A Rack Slides Kit	13.3 Cm (5.25 in.)	125	Front-to-rear	*Safety in HP 29431G Option 053 Cabinet has not been qualified by HP and is the customer's responsibility.* Access for tape cartridge loading requires opening a cabinet door.

Rack Mounting of Cooler-Packaged Computers in HP Design-Plus Cabinets

Although they can be adapted to rack mount in the HP 29431G 19-inch wide Cabinet, the HP 2424A Micro 14 Computer and HP 2426E/F Micro 16 Computer are designed to rack in HP Design-Plus Cabinets, including the HP 92211L Taboret Cabinet and the HP 92211R Mini Rack Cabinet. Most of the rack mountable devices listed in Table 3-14 can also be rack mounted in HP 92211L/R cabinets. These include the HP 35401A, 7907A, 7936H/XP, 7937H/XP, 7941A, 7942A, 7945A, 7946A, 7957A, 7958A, 9133H/L, 9134H/L, 9144A, 9153B, and 9154B.

Rack Mounting of A-Series Systems in Non-HP Cabinets

If A-Series computers and compatible peripheral devices are rack mounted in a non-HP cabinet, that cabinet must have enough space to house the components and must support, or at least not interfere with, the ventilation air flow of the rack mounted equipment to assure long life and trouble-free operation. Compliance with EMI regulations and safety standards cannot be supported by Hewlett-Packard for systems that are installed in non-HP cabinets.

Diagnostic Packages

For HP 1000 A-Series Computers

product numbers 24398B and 24612A

The HP 24398B and 24612A Diagnostic Packages support stand-alone testing of A-Series computers, memory, interface cards, and CS/80 and other HP-IB connected discs and magnetic tape units. See Table 3-15 on the next page.

Features

- **Checkout of A400, A600/A600+, A700, and A900 CPUs, memory, most interfaces, and the Floating Point Processor in A700 and A900.**
- **Checkout of discs and mag tape units.**
- **A "BASIC-like" Diagnostic Design Language for easy design of diagnostics for user-developed interfaces based on the 12010A Breadboard Interface or for specialist-level analysis.**
- **Test hoods for complete verification of interface cards.**
- **Support for remote diagnosis via telephone lines and Bell 103 or equivalent modem and the computer's Virtual Control Panel.**

Configuration Requirements

Processor and Memory

Any A-Series computer or System Processor Unit with at least 128k bytes of memory.

Loading Devices

For 24612A: Any disc or subsystem capable of reading CS/80 cartridge tape (Media Option 022), microfloppy discs (Media Option 044), or 1600 cpi magnetic tape (Media Option 051).

For 24398B: Any disc or subsystem capable of reading CS/80 cartridge tape (Media Option 022, the only media choice).

Console Device

Any A-Series compatible system console as listed in the Configuration Checklist of the HP 1000 Ordering Guide (5954-8564, or later revision). A console device is required for running the Diagnostic Design Language Interpreter, the 24398B diagnostics, and the 12072A Data Link Slave Interface. The console device is optional for running any of the other interface diagnostics.

Ordering Information

In System Processor Units

The HP 24398B and 24612A Diagnostic Packages are included with A-Series System Processor Units (2196C/D, 2197C/D, 2199C/D, 2484A, 2486A, 2487A, and 2489A).

For Computers

The HP 24398B and 24612A Diagnostic Packages must be ordered separately for A-Series Computers (12100A, 2106BK, 2137A, 2139A, 2156B, 2424A, 2426E/F, 2434A, 2436A/E, 2437A, and 2439A).

HP 24612A A-Series Processor and Interface Diagnostics Package

See Table 3-15, next page, for diagnostics and learning products included in the 24612A product.

HP 24612A Media Options

022: Diagnostics on CS/80 Cartridge Tape.

044: Diagnostics on microfloppy discs for HP12120A*/12122A Integrated Discs in Micro/1000 package or HP 9122D or 9133A*/B*/H*/L or 9153B Disc.

051: Diagnostics on 1600 cpi Magnetic Tape.

* *Discontinued product listed here for reference only.*

HP 24398B A-Series Disc, Mag Tape, and Systems Modem Diagnostics Package

See Table 3-15, next page, for diagnostics and learning products included in the 24398B product.

HP 24398B Media Option

022: Diagnostics on CS/80 Cartridge Tape.

Diagnostics Support Products

See the HP 1000 Ordering Guide, 5954-8564 or later revision, for definitions and availability of software support products for the 24612A and 24398B A-Series Diagnostic Packages.

Table 3-15. A-Series Diagnostics Packages Summary

SUPPORTED FUNCTION OR PRODUCT	SOFTWARE ITEM	MANUAL PART NO.	TEST HOOD PART NO(S).
HP 24612A A-SERIES PROCESSOR AND INTERFACE DIAGNOSTICS			
Diagnostic operation and troubleshooting.	Diagnostic control system with Basic Control Module	24612-90001	Not applicable
Development of diagnostics for user-designed interfaces or specialist-level diagnosis.	Diagnostic Design Language Interpreter	24612-90002	Not applicable
Checking'of CPU instructions, memory, A700 Floating point processor, and I/O logic and processing functions such as interrupt handling, time base generator, dynamic mapping, memory protect, parity checking, and direct memory access (DMA).	Kernel diagnostic	24612-90003	Not applicable
Checking of these basic A-Series computer interfaces: - 12005A/B Asynchronous Serial Interface - 12006A Parallel Interface - 12008A PROM Storage Module - 12009A HP-IB Interface - 12100A A400 On-Board I/O	Individual diagnostics for each interface	24612-90011	24397-60003 24397-60004 12100-60003
Checking of these NS/1000 (DS/1000-IV) interfaces based on the Programmable Serial Interface Card: - 12007B HDLC Modem Interface to HP 1000 - 12044A HDLC Direct-Connect Interface to HP 1000 - 12073A Bisync Modem Interface to HP 3000 - 12082A Bisync Direct-Connect Interface to HP 3000	Diagnostic	24612-90011	5061-3453 and 5061-3460
Checking of 12040B/C/D or 12041A 8-Channel Asynchronous Multiplexer	Diagnostic	24612-90011	5061-4901
Checking of 12072A DS/1000-IV Data Link Slave I/f	Diagnostic	24612-90011	5061-4909
Checking of 12153A A700 Writable Control Store Card	Diagnostic	24612-90011	Not applicable
Checking of 12060B and 12061A High-Level Analog Input and Expansion Multiplexer Cards	Diagnostic	24612-90011	12060-60003 and 12061-60002
Checking of 12062A Analog Output Card	Diagnostic	24612-90011	12062-60002
Checking of 12063A Digital I/O Card	Diagnostic	24612-90011	12063-60002
HP 24398B A-SERIES DISC, MAG TAPE, AND SYSTEMS MODEM DIAGNOSTICS			
Checking of 79xxM MAC Discs	Diagnostic	5955-4355	Not applicable
CS/80 Discs Exerciser	Diagnostic	5955-3462	Not applicable
7974A/7978A/B Mag Tape Drive Exerciser	Diagnostic	5958-9137	Not applicable
7970E Mag Tape Drive Verifier	Diagnostic	24398-90008	Not applicable
Checking of 37214A Systems Modem	Diagnostic	24398-90008	Not applicable

Development Packs

For HP 1000 A-Series Computer Systems

product numbers
91156A/B and 91157A/B

HP 91156A/B and 91157A/B provide a convenient means of ordering packs of popular software items at attractive package prices. These development packs replace previously-offered value pack options and development packs that included memory and software.

Prerequisites

A minimum of 1 megabyte of memory (1.5 megabytes in A900) is prerequisite to ordering the HP 91156A/B and 91157A/B Development Packs, but 3 megabytes or more is recommended for best performance.

Features

- **Easily-ordered packages of software used by application developers.**
- **Availability for all A-Series System Processor Units.**
- **FORTRAN 77, Pascal/1000, and BASIC/1000C programming languages and Symbolic Debug/1000 for program development support.**
- **Choice of Image/1000-II or Image/1000.**
- **Device-Independent Graphics Package for graphics programming.**
- **Choice of packages with or without VC+.**

Description

Items in All of the Development Packs

- HP 92836A FORTRAN 77 Compiler.
- HP 92833A Pascal/1000 Compiler.
- HP 92857A BASIC/1000C Interpreter and Compiler.
- HP 92860A Symbolic Debug/1000.
- HP 92861A Graphics/1000-II Device Independent Graphics Library, Version 2.0.

Items Selectable by the Development Pack Ordered

- HP 92078A VC+ Enhancement to RTE-A (provided only in HP 91156A/B Development Packs).
- HP 92081A Image/1000-II Data Base Management System (provided only in HP 91156A and 91157A Development Packs).
- HP 92069A Image/1000 Data Base Management System (provided only in HP 91156B and 91157B Development Packs).

Licensing and Rights to Copy

The development packs include the right to use the included software on one system. They do NOT include the right to purchase right to copy licenses for any of the included software.

Ordering Information

HP 91156A Development Pack with VC+ and Image/1000-II (Must order one of Use Options 400-890 and one of Media Options 022-051)

The HP 91156A Development Pack includes:

1. HP 92836A FORTRAN 77 Compiler.
2. HP 92833A Pascal/1000 Compiler.
3. HP 92857A BASIC/1000C Interpreter and Compiler.
4. HP 92860A Symbolic Debug/1000.
5. HP 92861A Graphics/1000-II Device Independent Graphics Library, Version 2.0.
6. HP 92078A VC+ Enhancement to RTE-A.
7. HP 92081A Image/1000-II Data Base Management System.

HP 91156B Development Pack with VC+ and Image/1000 (Must order one of Use Options 400-890 and one of Media Options 022-051)

The HP 91156B Development Pack includes:

1. HP 92836A FORTRAN 77 Compiler.
2. HP 92833A Pascal/1000 Compiler.
3. HP 92857A BASIC/1000C Interpreter and Compiler.
4. HP 92860A Symbolic Debug/1000.
5. HP 92861A Graphics/1000-II Device Independent Graphics Library, Version 2.0.
6. HP 92078A VC+ Enhancement to RTE-A.
7. HP 92069A Image/1000 Data Base Management System.

HP 91157A Development Pack with Image/1000-II (Must order one of Use Options 600-890 and one of Media Options 022-051)

The HP 91157A Development Pack includes:

1. HP 92836A FORTRAN 77 Compiler.
2. HP 92833A Pascal/1000 Compiler.
3. HP 92857A BASIC/1000C Interpreter and Compiler.
4. HP 92860A Symbolic Debug/1000.
5. HP 92861A Graphics/1000-II Device Independent Graphics Library, Version 2.0.
6. HP 92081A Image/1000-II Data Base Management System.

HP 91157B Development Pack with Image/1000 (Must order one of Use Options 600-890 and one of Media Options 022-051)

The HP 91157B Development Pack includes:

1. HP 92836A FORTRAN 77 Compiler.
2. HP 92833A Pascal/1000 Compiler.
3. HP 92857A BASIC/1000C Interpreter and Compiler.
4. HP 92860A Symbolic Debug/1000.
5. HP 92861A Graphics/1000-II Device Independent Graphics Library, Version 2.0.
6. HP 92069A Image/1000 Data Base Management System.

Development Pack Use Options

400: Use in HP 12100A Single Board Computer, HP 2424A Micro 14 Computer, HP 2434A Micro 24 Computer, or HP 2484A Micro 24 SPU.

600: Use in HP 2106BK Board Computer, HP 2156B Computer, HP 2426E/F Micro 14 Computer, HP 2436A/E Micro 26 Computer, HP 2196C/D Model 26 SPU, or HP 2486A Micro 26 SPU.

700: Use in HP 2137A Computer, HP 2437A Micro 27 Computer, HP 2197C/D SPU, or HP 2487A Micro 27 SPU.

890: Use in HP 2139A Computer, HP 2439A Micro 29 Computer, HP 2199C/D Model 29 SPU, or HP 2489A Micro 29 SPU.

Development Pack Media Options

022: Software on CS/80 Cartridge Tape.

044: Software on microfloppy discs for HP12120A*/12122A Integrated Discs in Micro/1000 package or HP 9122D or 9133A*/B*/H*/L or 9153B Disc.

051: Software on 1600 cpi Magnetic Tape.

** Discontinued product listed here for reference only.*

Software Support

See the HP 1000 Ordering Guide, 5954-8564 or later revision, for definitions and availability of software support products for the software items that are included in the respective Development Packs.

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Asynchronous Serial Interface

HEWLETT PACKARD

HP 1000 A-Series Computer Interfaces

product number 12005B

The HP 12005B Asynchronous Serial Interface provides an asynchronous serial communications link between the HP 1000 A-Series Computer and RS-449, RS-422, or RS-232 compatible devices. The connection can be made through a fiber optic or electrical cable. Modem control signals through the electrical cable are also available.

Features

- **Includes fiber optic interface and 15 meter cable to minimize electrical interference.**
- **EIA RS-232-C, RS-422, RS-423, and a subset of RS-449 compatibility.**
- **Complies with European standard CCITT V.28.**
- **Sixteen data transfer rates from 50 to 19.2K baud.**
- **56K baud data rate with external clock.**
- **Choice of half–duplex, full–duplex, or echoplex operation.**
- **Built-in DMA capability for optimum I/O efficiency.**
- **Selectable special character recognition capability for termination of indeterminate length DMA transfers by an End of Transmission character.**
- **Virtual control panel support.**
- **Built-in framing error, overrun error, and parity error checking.**
- **Hardware break detection.**
- **Voltage level and current loop outputs.**
- **I/O driver support with RTE–A operating system.**

Functional Specifications

Formats, Parity, and Format Control

Data Code: 7-bit ASCII or 8-bit binary.

Serial Data Transfer Format: Each 7-bit or 8-bit data code is preceded by a start bit, accompanied by an odd or even parity bit, and followed by one or two stop bits.

Parity Selection: Odd, even, or no parity.

Stop Bit Selection: One or two stop bits.

Interface Level

EIA Standards: Complies with EIA Standard RS-232-C, RS-422, RS-423, and a subset of RS-449.

CCITT Recommendations: Complies with CCITT Recommendation V.28.

Transfer Rates

Interface-Clocked Rates: 50, 75, 110, 134.5, 150, 300, 600, 900, 1200, 1800, 2400, 3600, 4800, 7200, 9600, and 19200 baud.

Externally-Clocked Rate: Up to 56,000 baud, with external clock signal (requires fabrication of an interface cable).

Character Buffering

Two characters.

Teleprinter Interface

A 20 mA current loop interface is provided for interfacing to teleprinters; connection to this interface requires that a cable be fabricated for the device used.

Virtual Control Panel Support

The 12005B interface can be set to support a terminal to function as the Virtual Control Panel of HP 1000 A-Series computers.

Direct Memory Access Operation

DMA Accessibility: The 12005B can transfer data directly to or from computer memory. DMA control is performed on the card, reducing the overhead of handling DMA operations.

Termination of Indeterminate Length Transfers: Special hardware on the 12005B has the capability of monitoring the incoming serial data stream for the occurrence of a specific 7 or 8-bit pattern. This pattern can be used to terminate a DMA block data transfer of indefinite length.

Break Detection

Hardware on the 12005B monitors the incoming serial data stream for BREAK characters, which are defined as spaces occurring over 12 successive bit times. When the line returns a MARK condition, the computer is informed of receipt of the BREAK.

Table 4-1. 12005B Signals

PCA J1, PIN	SIGNAL NAME	SIGNAL DEFINITION	RS-232	RS-449	SIGNAL SOURCE
A	GND				
1	GND				
B	IC(A)*	Incoming Call (A)	CE	IC	Device
2	RS(B)*	Request to Send (B)	CA	RS	Interface
C	RIC	Used by Diagnostics Only			
3	RS(A)*	Request to Send (A)	CA	RS	Interface
D	TTYI	Teleprinter Input			
4	TTYI	Teleprinter Input			
E	RS(U)**	Request to Send (B)	CA	***	Interface
5	DRST	Reset Line Used by Diagnostics Only			
F	IC(B)	Incoming Call (B)	CE	IC	Device
6	RDM	Used by Diagnostics Only			
H	RCS	Used by Diagnostics Only			
7	EXTCLK	Clock from External Device (If any)(16X)			
J	+5V	+5V to Terminal			
8	ECHOM	Used by Diagnostics Only			
K	SPC2	Used by Diagnostics Only			
9	SD(B)*	Send Data (B)	BA	SD	Interface
L	RRR	Used by Diagnostics Only			
10	SD(A)*	Send Data (A)	BA	SD	Interface
M	TR	Terminal Ready	CD	TR	Interface
11	SB	Stop Bit Select			
N	TTY+12	+12V to Teleprinter			
12	TTY+12	+12V to Teleprinter			
P	RDRCNTL	Reader Control (GND)			
13	RDRCNTL	Reader Control (GND)			
R	TTY-12	-12V to Teleprinter			
14	TTY-12	-12V to Teleprinter			
S	RD(B)*	Receive Data (B)	BB	RD	Device
15	SRD(A)*	Secondary Receive Data (A)	SBB	SRD	Device
T	TTYO	Output to Teleprinter			
16	TTYO	Output to Teleprinter			
U	RD(A)*	Receive Data (A)	BB	RD	Device
17	SRD(B)*	Secondary Receive Data (A)	SBB	SRD	Device
V	RR(A)*	Receive Ready (A)	CF	RR	Device
18	RR(B)*	Receiver Ready (B)	CF	RR	Device
W	SD(U)**	Send Data (U)	BA	***	Interface
19	MSB-	Most Significant Bit of Baud Rate Select			
X	CS(A)*	Clear to Send (A)	CB	CS	Device
20	NMSB-	Next to Most Significant Bit of Baud Rate Select			
Y	CS(B)*	Clear to Send (B)	CB	CS	Device
21	NLSB+	Next to Least Significant Bit of Baud Rate Select			
Z	DM(A)*	Data Mode (A)	CC	DM	Device
22	LSB+	Least Significant Bit of Baud Rate Select			
AA	DM(B)*	Data Mode (B)	CC	DM	Device
23	SSD	Secondary Send Data	SBA	SSD	Interface
BB	O/E	Optical/Electrical Select			
24	GND				

NOTES:
* Differential Driver or Receiver used on this signal.
** Single-ended Driver used on this signal.
*** RS-449 recommends the use of Differential Drivers.

Configuration Information

Computer and System Compatibility: The 12005B Asynchronous Serial Interface is compatible with all HP 1000 A-Series Computers and Systems.

Software Support: The 12005B interface uses RTE-A interface drivers ID*00 and ID*01. RTE-A device drivers DD*00 (keyboard-display I/O) and DD*20 (264xA minicartridge I/O) which will operate with ID*00 to support Hewlett-Packard Terminals.

Modem Capability: The 12005B interface with RTE-A driver ID*00 and ID*01 is designed to be compatible with Bell Type 103 and 212 Data Sets and equivalent modems.

Diagnostic Support: A diagnostic test and test connector for the 12005B interface are provided in the HP 24612A A-Series Processor and Interfaces Diagnostic Package.

DC Current Requirements

1.6A (+5V), 0.145A (+12V), 0.11A (−12V).

Switch-Selectable Options

Operation as a Virtual Control Panel
Baud Rate Selection
Select Code Setting
Stop Bit Selection (1 or 2)
Parity Sense (Even or Odd)

Physical Characteristics

Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Net Weight

795 grams (28 oz).

Ordering Information

HP 12005B Asynchronous Serial Interface

The 12005B Asynchronous Serial Interface includes:

1. 12005-60012 Asynchronous serial interface assembly.
2. 12005-90002 Installation and Reference manual.
3. 5061-5798 15 meter Fiber Optic Cable.

NOTE: If the intended terminal does not include a built-in fiber-optic interface, ONE of options 001-006 MUST be ordered.

Options

001: Substitutes a 5 meter 5061-6604 filtered cable for 5061-5798 for interfacing to HP terminals using a 50-pin connector.

002: Substitutes a 5 meter 5061-6634 filtered cable for 5061-5798 for interfacing to terminals which require a 25-pin DB25P male RS-232-C DTE connector.

003: Substitutes a 5 meter 12005-60004 RS-232-C cable for 5061-5798 for interfacing to modems which require a 25-pin male connector.

004: Substitutes a 5 meter 12005-60005 cable for 5061-5798 for interfacing to HP terminals that require a hooded connector.

005: Adds a fiber-optic interface, 5061-5800, for interfacing via fiber optic cable to HP terminals having 50-pin connectors.

006: Substitutes a 48-pin edge connector kit (5061-3426) for user fabricated cables instead of 5061-5798.

Computer Museum

Parallel Interface

HP 1000 A-Series Computer Interfaces — product number 12006A

The HP 12006A is a multi-purpose interface for 8 or 16 bit bidirectional data transfers between external devices and HP 1000 A-Series Computers and Systems.

Features

- **TTL (+5V) and +12V interface compatibility.**
- **Separate 16-bit input and output storage registers.**
- **Built-in DMA capability offering maximum data rates to 850K words per second on inputs, 730K words per second on outputs**
- **Wide choice of programmable operating modes for easy use with instrumentation.**
- **8 or 16-bit operation with hardware packing of bytes into or from words.**
- **Pin compatibility with 12566B/C interface used in other HP 1000 Computers and Systems.**

Functional Specifications

Data Transfer

Protocol: Transfers either 8 or 16 parallel bits at a time.

Maximum Rates: The following transfer rates can be attained in a quiescent RTE-A environment with the 12006A interface in the highest priority position.

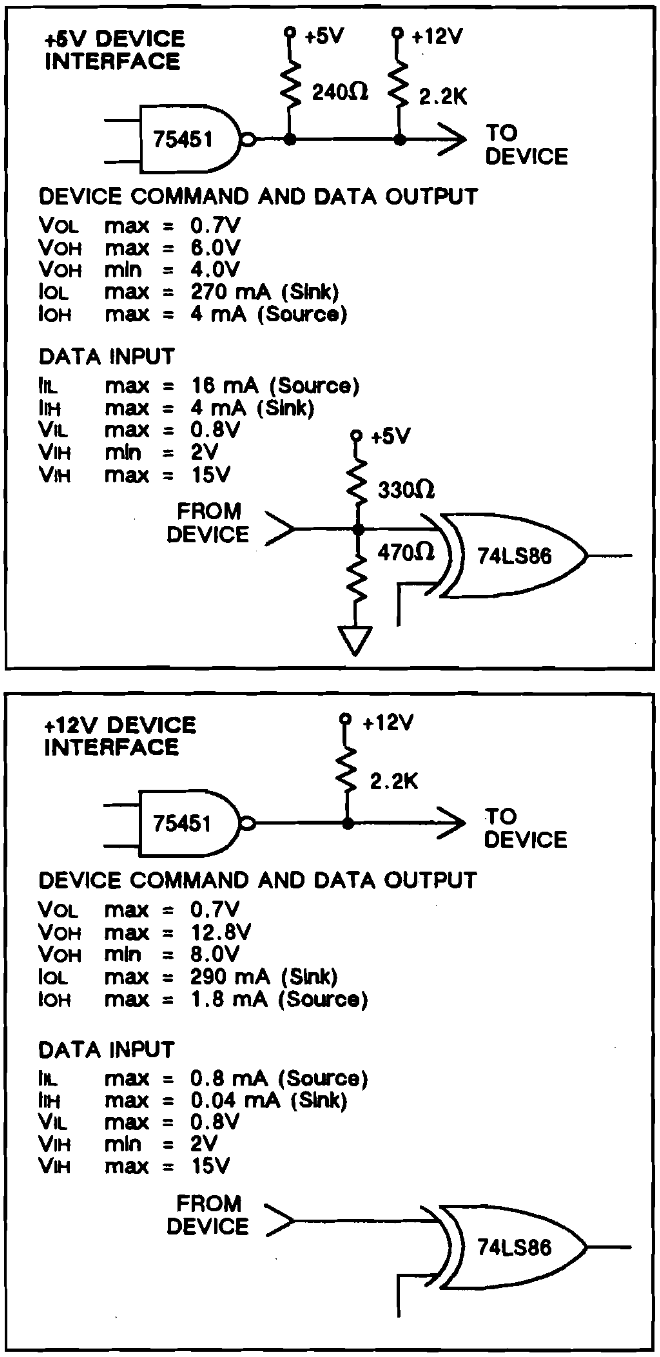
Processor	Input	Output
A400/A600+	850k Words/sec	730k Words/sec
A700	790k Words/sec	650k Words/sec
A900	740k Words/sec	500k Words/sec

Typical CPU-to-CPU Transfer Rate: Less than 50% of the output rate.

Circuits and Logic Levels: See Figure 4-1, at right.

Logic Level Choices: TTL (+5V) is standard; removal of six resistor packages converts the interface to +12V level.

Byte Packing: For use with 8-bit devices, such as tape readers, tape punches, and some line printers, the interface may be programmed to automatically pack/unpack bytes into/from 16-bit computer words.



DEVICE COMMAND AND DATA OUTPUT

V_{OL} max = 0.7V
V_{OH} max = 6.0V
V_{OH} min = 4.0V
I_{OL} max = 270 mA (Sink)
I_{OH} max = 4 mA (Source)

DATA INPUT

I_{IL} max = 16 mA (Source)
I_{IH} max = 4 mA (Sink)
V_{IL} max = 0.8V
V_{IH} min = 2V
V_{IH} max = 15V

DEVICE COMMAND AND DATA OUTPUT

V_{OL} max = 0.7V
V_{OH} max = 12.8V
V_{OH} min = 8.0V
I_{OL} max = 290 mA (Sink)
I_{OH} max = 1.8 mA (Source)

DATA INPUT

I_{IL} max = 0.8 mA (Source)
I_{IH} max = 0.04 mA (Sink)
V_{IL} max = 0.8V
V_{IH} min = 2V
V_{IH} max = 15V

Figure 4-1. 12006A Circuits and Logic Levels

Device Command Sense Selection: The interface can be set to respond to either high-true or low-true device command from the interfaced device for card-device synchronization.

Clocked Mode: The parallel interface supports a clocked mode in which data transfers to/from external devices are synchronized by a flag-to-device handshake that is clocked by the external device.

Transparent (asynchronous) Mode: The parallel interface can also be used to send data to or receive data from one or several devices, such as indicators or switches, that do not provide or use any type of clocking signal. Information is output to the destination device(s) exclusively under program control and input information may be read at any time.

Control and Status Bit Communication

Control Output: Four control bits may be sent to the interfaced device via an output control word for use as control, command, or address bits. For instance, they can be decoded to address any of 16 device registers or actions, or to address any of 16 devices connected to the same parallel interface.

Status Input: Four status bits may be received from the interfaced device via an input control word.

Direct Memory Access (DMA) Operation

DMA Accessibility: The 12006A can access memory under control of its I/O master processor, regardless of how many other interfaces in the system are also accessing memory via DMA.

Self Configured, Chained DMA Mode: The I/O master processor on the 12006A interface supports a self configuring mode of operation. In this mode, instead of interrupting the central processor after a block transfer, the I/O processor fetches a new set of control words for the next transfer. This process continues as long as additional sets of control words are available. Chained DMA transfer is particularly useful for storing several sequential scans of measurement channels from an instrumentation subsystem into memory, which can be accomplished without interrupting computations or other processing by the central processor.

Configuration Information

Computer and System Compatibility: The 12006A Parallel Interface is compatible with all HP 1000 A-Series Computers and Systems.

Connector Compatibility: The 12006A interface printed circuit cable connector is pin-compatible with the 12566B/C Microcircuit Interface, permitting direct substitution of an HP 1000 A-Series Computer or System with the 12006A interface for an HP 1000 M/E/F-Series System with 12566B/C interface.

Software Support: The 12006A interface is supported by RTE-A interface driver ID*50.

Diagnostic Support: A diagnostic test and test connector for the 12006A interface are provided in the HP 24612A A-Series Processor and Interfaces Diagnostic Package.

Installation: Set device command sense switch to appropriate level; set the interface's I/O address on the select code switches; turn off power to the computer and interfaced device; plug the interface into the computer backplane; connect an appropriate cable from the interface to the device; and integrate the interface driver into the operating system if that has not been accomplished previously.

NOTE: The I/O address setting of the interface select code switches is independent of the interface card's position in the computer backplane.

DC Current Requirements

Configured as a +5V Device Interface: 1.94A (+5V), 0.179A (+12V).

Configured as a +12V Device Interface: 1.61A (+5V), 0.175A (+12V).

Physical Characteristics

Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Net Weight

370 grams (13 oz).

Ordering Information

HP 12006A Parallel Interface

The 12006A Parallel Interface includes:

1. 12006-60003 Parallel interface card.
2. 5061-3426 48-pin Connector Kit.
3. 12006-90001 Installation and Reference manual.

HDLC Interfaces for NS/1000 and DS/1000-IV Communication

HEWLETT PACKARD

HP 1000 A-Series Computer Interfaces

product numbers 12007B and 12044A

The HP 12007B and 12044A are interfaces for communication between NS/1000 or DS/1000-IV network nodes based on HP 1000 A-Series Computers. They also support DS/1000-IV communication to/from 12794B and 12825A counterpart interfaces in remote HP 1000 M/E/F-Series Computers. The 12007B interface is used for communication via modems and telephone lines and the 12044A is used for communication via direct, hardwired link.

The 12007B and the 12044A are microprocessor-based interfaces that use the widely accepted, full-duplex High Level Data Link Control (HDLC) protocol to maximize communications efficiency and reliability. The interfaces handle all HDLC protocol generation, including CRC-CCITT error checking, on-board buffer management, and all modem control tasks (12007B interface only). In conjunction with 91790A NS/1000 or 91750A DS/1000-IV software, the HDLC interfaces support high-level user access between HP 1000 computers.

Features

- **Availability of both modem and direct connect interfaces maximizes network flexibility.**
- **On-board microprocessor off-loads the computer, making possible larger networks and leaving more CPU capacity for processing user's applications.**
- **16K bytes of RAM memory for extensive on-board message buffering.**
- **Firmware-controlled automatic power-up self-test to help assure interface integrity.**
- **Supports remote Forced Cold Load (FCL) over NS/1000 and DS/1000-IV links.**
- **Supports remote Virtual Control Panel access to A-Series NS/1000 and DS/1000-IV network nodes.**
- **Long term communication line statistics and message logs are available through user request via DS/1000-IV software to facilitate checks of line quality and assist link troubleshooting.**
- **HDLC interface for NS/1000 or DS/1000-IV to NS/1000 or DS/1000-IV communication links with microprocessor management of HDLC protocol, CRC-CCITT error checking, buffer management, DMA transfers, and modem control tasks.**
- **Data rates to 257K bps.**
- **12007B interface supports synchronous full duplex modems.**
- **12044A interface supports hardwired links up to 2.2 km (1.36 miles).**
- **12044A optically isolated input breaks ground loops, maximizing noise immunity for direct connect links.**

Functional Description

On-Board Microprocessor Off-loads Host Computer

A powerful microprocessor on the HDLC network interface manages routine communications processing, freeing the host computer for applications oriented tasks. Under control of on-board firmware, the microprocessor converts command words into actions, such as establishing the communications link and loading/unloading data between the on-board buffers and the host CPU. The microprocessor also performs the protocol generation and interpretation, error checking, and error recovery by retransmission tasks, all without the attention of the host computer.

Numerous user-programmable parameters are available to tailor the interface to specific applications and configurations, which are also managed by the microprocessor. For example, the number of retransmissions of frames in error can be set by the user, or a default of 10 may be used. Frame size is accessible, as are controllable communication line timeouts to promote maximum use and efficiency of the communication links.

Interface buffer tasks, also microprocessor managed, include packing bytes into words for Direct Memory Access transfers to the host CPU and unpacking words into bytes for transmission.

Finally, on the 12007B interface, the microprocessor handles the synchronous modem control signals and is capable of setting additional modem control lines, such as Rate Select.

Firmware Controlled Self Tests

On-board, firmware-controlled self-tests, performed at power-up, help to assure reliable operation of the HDLC network interface and minimize troubleshooting time. These tests check out the RAM and ROM memories, the Direct Memory Access operations, baud rate generators, and the I/O ports of the communication interface.

Communication Line Statistics

Eleven long-term statistics are accumulated automatically and buffered on the interface. These statistics can be easily read by the user to help determine the quality of the communication line and to aid link troubleshooting. All statistics are cleared when read, facilitating use, since they are 16-bit unsigned integers (0-65535) that will roll over if not cleared or reset. The eleven long term statistics are:

1. Information frames correctly received.
2. Receiver Ready frames received.
3. Receiver Not Ready frames received.
4. Reject frames received.
5. Receive process overruns.
6. CRC errors.
7. Abort sequences received.
8. Receive buffer overflows.
9. SIO chip receiver overruns.
10. Frames with incorrect address field.
11. CMDR frames received.

Remote Forced Cold Load Capability

The HDLC network interfaces support Remote Forced Cold Load (FCL) in which a remote HP 1000 A-Series Computer is forced to accept and run a new program load regardless of its current state. In this way, the HDLC interfaces and the 91790A or 91750A software provide a capability that supports completely unattended remote NS/1000 or DS/1000-IV nodes.

Remote Virtual Control Panel Capability

The 12007B and 12044A interfaces can be set to support Virtual Control Panel (VCP) access to an HP 1000 A-Series System from the system console at any remote but adjacent HP 1000 System in the same network. With VCP capability, an operator at the remote console can examine and change the contents of registers and memory locations, control execution of diagnostics and other programs, and select a bootstrap loader and initiate the boot-up of the RTE-A System. By making possible a considerable degree of remote fault diagnosis and maintenance, this VCP capability greatly augments the support for completely unattended NS/1000 and DS/1000-IV A-Series nodes.

Functional Specifications

Communications

Interface Level: EIA RS-232-C and EIA RS-449, and CCITT V.28, V.10, and V.11.

Internally-Clocked Data Rates: 300, 1200, 2400, 4800, 9600, 19200, 57600, and 230000 bits/second.

Externally-Clocked Data Rates: To 257,000 bits/second.

Transmission Mode: Full-duplex, bit-serial synchronous.

Message Buffering: Seven frames in either direction (14 frames total, with up to 1024 bytes per frame) may be buffered using the 16k byte onboard RAM memory.

Error Detection and Correction: Errors are detected using CRC-CCITT cyclic redundancy checking on all frames sent or received. The interface retransmits, or requests retransmission of all frames with errors to attain error-free data transfer. The maximum number of retransmissions may be user specified. If not user specified, the maximum number of retransmissions initiated by the interface defaults to 10.

12007B Interface Signals: See Table 4-2.

Usable 12044A Data Rates and Direct Connect Cable Length: Usable direct connect data rate depends on the length of the cable used for data transfer, as shown below:

DATA RATE TO	CABLE LENGTH
257,000 bits/sec	1.0 km (0.621 miles/3279 feet)
57,600 bits/sec	2.2 km (1.367 miles/7218 feet)

Line Protocol: The HDLC network interfaces implement a superset of the High Level Data Link Control (HDLC) communications protocol, which is not suitable for general-purpose HDLC communications. It should be used only for HP 1000-to-HP 1000 communications links in the NS/1000 or DS/1000-IV environment.

European Licensing of HDLC Modem Interface

The 12007B HDLC Modem Interface has been granted an FTZ license for use in Germany and a GPO license for use in the United Kingdom.

Configuration Information

Computer and System Compatibility: The 12007B and 12044A HDLC Interfaces are compatible with all HP 1000 A-Series Computers and Systems.

Software Support: Operation of HDLC network interfaces is supported by HP 91790A NS/1000 software and HP 91750A DS/1000-IV software, as described in the respective data sheets on pages 5-1 and 5-15.

Table 4-2. HP 12007B Interface Signals

CCITT V.24 SIGNAL	EIA RS-232-C SIGNAL	EIA RS-449 SIGNAL	SOURCE	DEFAULT	FUNCTION
104	BB	RD	DCE	None	Receive Data
103	BA	SD	DTE	None	Send Data
106	CB	CS	DCE	DCE dep	Clear to Send
105	CA	RS	DTE	F/W	Request to Send
108	CD	TR	DTE	F/W	Data Terminal Ready
109	CF	RR	DCE	DCE dep	Receiver Ready (data carrier detect)
114	DB	ST	DCE	None	Send Timing (transmit clock)
115	DD	RT	DCE	None	Receive Timing (receive clock)
113	DA	TT	DTE	None	Terminal Timing
125	CE	IC	DCE	DCE dep	Incoming Call (Ring Indicator)
107	CC	DM	DCE	DCE dep	Data Set Ready
142	--	TM	DTE	DCE dep	Test Mode
141	--	LL	DTE	F/W	Local Loop-back
140	--	RL	DTE	F/W	Remote Loop-back
110	CG	SQ	DCE	DCE dep	Signal Quality
111	CH	SF/SR	DTE	F/W	Select Frequency/Select Rate
--	--	IS	DTE	F/W	In Service
--	--	NS	DTE	F/W	New Signal
119	SBB	SRD	DCE	None	Secondary Receive Data
118	SBA	SSD	DTE	None	Secondary Send Data
120	SCA	SRS	DTE	F/W	Secondary Request to Send
121	SCB	SCS	DCE	DCE dep	Secondary Clear to Send
122	SCF	SRR	DCE	DCE dep	Secondary Receiver Ready

Where: DCE dep = Depends upon external DCE device and connection.
F/W = Set by interface firmware.

Computer I/O Channels Required: One per HDLC network interface.

Diagnostic Support: A diagnostic test and test connectors for the 12007B and 12044A interfaces are provided in the HP 24612A A-Series Processor and Interfaces Diagnostic Package.

Compatible U.S. Modems and Communication Lines: The 12007B interface is compatible with modems listed in Table 4-3. Strapping requirements and recommendations for U.S. modems used with the 12007B are given in the HDLC Firmware Installation Manual (5955-7626).

Table 4-3. HP 12007B Connections, Modems, and Data Rates

CONNECTION VIA	MODEM TYPE	MAX SYNCHRONOUS DATA RATE
Private Lines	Bell 201C Bell 208A Bell 209A HP 37230A*	to 2400 bits/second to 4800 bits/second to 9600 bits/second to 19200 bits/second
Dial-Up	Bell 212A GDC 212A	to 1200 bits/second to 1200 bits/second

* Discontinued product, listed here for reference only.

European Modems: Contact local European HP sales office for information. European modems and interfaces should have approval of PTT in each country.

Counterpart Interfaces in Other HP 1000 Systems:

	A-SERIES INTERFACE	M/E/F-SERIES INTERFACE
Modem Conn.	12007B	12794B
Direct Conn.	12044A	12825A

12007B Installation: Set the interface configuration switch for baud rate, 128 or 1024 byte maximum buffer size, and forced cold load enable/disable. Set I/O address on the select code switches and VCP enable/disable. With power off, plug the interface into the computer I/O backplane, connect the supplied cable to the compatible customer-furnished modem, and integrate the interface card and 91790A or 91750A software into the RTE-A operating system.

12044A Installation: Set the interface configuration switch for baud rate, 128 or 1024 maximum buffer size, and forced cold load enable/disable. Set I/O address on the select code switches and VCP enable/disable. With power off, plug the interface into the computer I/O backplane, fabricate any necessary direct connect extension cables, connect cables between the local 12044A interface and the remote 12044A/12825A interface, and integrate the interface card and 91790A or 91750A software into the RTE-A operating system.

NOTE: The I/O address setting of the interface select code switches is independent of the interface card's position in the computer backplane.

DC Current Requirements

12007B: 2.6A (+5V), 0.35A (+12V), 0.18A (–12V).

12044A: 2.4A (+5V), 0.31A (+12V), 0.04A (–12V).

Physical Characteristics

Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Ordering Information

NOTE: The, 12007B and 12044A interfaces are for use only in the 91790A NS/1000 or 91750A DS/1000-IV environment for HP 1000-to-HP 1000 communication links. They are not general-purpose HDLC interfaces.

HP 12007B HDLC Network Modem Interface

The 12007B HDLC Interface includes:

1. 5061-4940 A-Series Programmable Serial Modem Interface card.
2. 91750-80008 and 91750-80009 Network Firmware ROMs.
3. 5061-4914 5 meter (17 ft.) RS-232-C Modem Interface Cable
4. 5061-3425 RS-232-C Loop-Back Verifier Hood.
5. 5955-7626 HDLC Firmware Installation Manual.
6. 12042-91001 PSI Modem Connection from A-Series Computers Installation and Service Manual

HP 12007B Options

001: Provides one set of updated firmware ROMs.

002: Substitutes 5061-4923 5 meter (17 ft.) RS-449 Modem Interface Cable and 5061-4915 RS-449 Loop-Back Verifier Hood for 12007B Cable and hood (5061-4914 and 5061-3425) listed above.

HP 12044A HDLC Direct Connect Network Interface

The 12044A HDLC Interface includes:

1. 5061-4938 A-Series Programmable Serial Direct Connect Interface card.
2. 91750-80008 and 91750-80009 Network Firmware ROMs.
3. 5061-3422 5 meter (17 ft.) Direct Connect Interface Cable with a male connector and 5061-4908 5 meter (17 ft.) Direct Connect Interface Cable with a female connector. Together, these cables complete a link between HDLC direct connect interfaces in two different HP 1000 systems, although extension cables made with 91712A, 91713A, or 91714A accessories may also be required.
4. 5061-3421 Direct Connect Loop-Back Verifier Hood.
5. 5955-7626 HDLC Firmware Installation Manual.
6. 12042-91002 PSI Direct Connection from A-Series Computers Installation and Service Manual

HP 12044A Options

001: Provides one set of updated firmware ROMs.

002: Deletes cables and loop-back verifier hoods (items 3 and 4) from the 12044A (for second HDLC direct connect interface in an NS/1000 or DS/1000-IV link).

HP 12044A Accessories

91712A: Assembled 75 meter (255 ft.) extension cable with 24-pin connectors for NS/1000 or DS/1000-IV direct connections.

91713A: Pair of 24-pin cable connectors for user fabricated cable-to-cable direct connect extension cable (cable part number 8120-3096 not supplied).

91713A Opt 001: Pair of edge connectors for user fabricated card-to-card direct connect cable (cable part number 8120-3096 not supplied).

91714A: 300 meters (984 ft.) of 8120-3096 direct connect cable with 24-pin cable connectors and a connector kit for user fabricated direct connect extension cable.

NOTE: HP 8120-3096 cable is equivalent to Belden YR19169. No other cable is supported.

PROM Storage Module

HEWLETT PACKARD

HP 1000 A-Series Computer Interfaces

product number 12008A

The HP 12008A PROM Storage Module provides mounting for up to 64K bytes of off-line PROM storage for HP 1000 A-Series Computers and Systems. For applications in which operating system and user software can be stored in PROMs, the use of the 12008A PROM Storage Module offers the following advantages:

1. Non-volatile storage, unaffected by loss of power regardless of duration.
2. Rugged storage medium that is usable in environments too harsh for flexible or hard disc or other mechanical storage devices.
3. For minimal storage requirements, the PROM module is more compact and less costly than disc storage.

I/O Master Processor and PROM interface logic on the PROM module can load software into main memory at up to 1.7M bytes/second in blocks that can range in size from 2 bytes up to 64K bytes. This can include automatic bootup of PROM-resident programs at power on. The size and destination of the transfer into main memory is dynamically determined under software control. Multiple PROM modules can be used to keep several different software systems resident inside the A-Series Computer. Any of these systems can be loaded extremely quickly under program control or under Direct Memory Access. NOTE: Programs may not be executed directly from PROM, but must be loaded into main memory for execution.

Features

- **Capacity for 64K bytes of PROM storage.**
- **Automatic program load on power-up capability.**
- **Multi-system storage with multiple PROM modules.**
- **Dynamic control of transfer size and destination.**
- **1.7M byte/second transfer rate into main memory.**
- **Direct memory access capability.**

Functional Specifications

Organization

Capacity: 32 sockets for 16K PROMs; 64K bytes, maximum.

Minimum Block Size: 2 bytes.

PROM Selection and Programming

Recommended PROMs: Intel 2716 or equivalent UV-erasable 16K PROMs.

PROM Burners: PROMs may be programmed using any commercial PROM burner.

Transfer Characteristics

Minimum Transfer: 2 bytes under program control, 10 bytes under DMA control.

Maximum Transfer: 64K bytes under DMA or program control.

Maximum Transfer Rate: 1.7M bytes/second under DMA control.

Configuration Information

Computer and System Compatibility: The 12008A PROM Storage Module is compatible with all HP 1000 A-Series Computers and Systems.

Card Cage Slots Required: One per 12008A PROM Module.

Diagnostic Support: A diagnostic test for the 12008A PROM Storage Module is provided in the HP 24612A A-Series Processor and Interfaces Diagnostic Package.

Installation: Set the select code switches on the PROM module to the appropriate select code I/O address and plug the PROM module into an I/O slot in the computer backplane.

NOTE: The I/O address setting of the interface select code switches is independent of the interface card's position in the computer backplane.

DC Current Requirements

2.18A (+5V), 0.06A (+12V).

Physical Characteristics

Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Net Weight

340 grams (12 oz).

Ordering Information

HP 12008A PROM Storage Module

The 12008A PROM Storage Module includes:

1. 12008-60002 PROM Storage Module.
2. 12008-90001 PROM Storage Module Reference manual.

HP-IB* Interface

HEWLETT PACKARD

HP 1000 A-Series Computer Interfaces

product number 12009A

The HP 12009A HP-IB* Interface provides for connection of up to 14 Hewlett-Packard Interface Bus compatible devices to HP 1000 A-Series Computers or Systems. HP-IB interfaceable devices include flexible and hard disc drives, printers, magnetic tape drives, plotters, graphics digitizers, and an extensive list of measurement instruments.

Features

- **Interface to low cost peripherals.**
- **Capacity of up to 14 devices.**
- **Simple software control of HP-IB based instrumentation systems.**
- **Built-in DMA capability for optimum I/O efficiency.**
- **Burst transfer rates to 940K bytes/second.**
- **Concurrent operation of multiple HP-IB buses under control of the RTE-A operating system.**
- **I/O driver support with RTE-A operating system.**

HP-IB Capabilities

The 12009A HP-IB Interface connects to the signal lines shown in Figure 4-2, acting as DEVICE A. Eight bidirectional data bus lines carry coded messages in bit-parallel, byte-serial to/from other devices on the bus, with each byte transferred from one "talker" to one or more "listeners". Data is exchanged asynchronously using interface messages to set up, maintain, and terminate an orderly flow of device-dependent messages. Three data byte transfer control lines control the transfer of each byte of coded data on the eight data lines. The five general interface management lines ensure an orderly flow of information within the HP-IB.

The HP-IB functions of the 12009A interface are largely embodied in a CMOS/SOS LSI integrated circuit chip that works with the I/O master processor LSI chip and circuits to manage HP-IB control and communications.

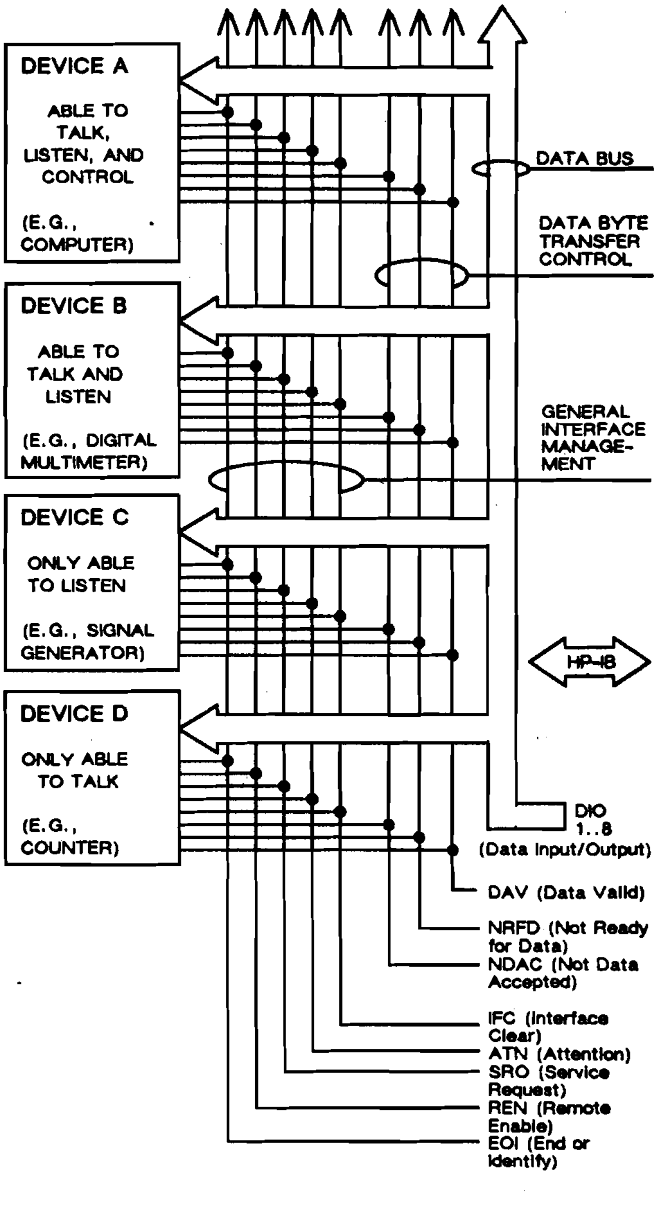

DEVICE A
ABLE TO TALK, LISTEN, AND CONTROL
(E.G., COMPUTER)
DEVICE B
ABLE TO TALK AND LISTEN
(E.G., DIGITAL MULTIMETER)
DEVICE C
ONLY ABLE TO LISTEN
(E.G., SIGNAL GENERATOR)
DEVICE D
ONLY ABLE TO TALK
(E.G., COUNTER)
DATA BUS
DATA BYTE TRANSFER CONTROL
GENERAL INTERFACE MANAGEMENT
HP-IB
DIO 1..8 (Data Input/Output)
DAV (Data Valid)
NRFD (Not Ready for Data)
NDAC (Not Data Accepted)
IFC (Interface Clear)
ATN (Attention)
SRQ (Service Request)
REN (Remote Enable)
EOI (End or Identify)

Figure 4-2. HP-IB Interface Bus Concept

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* *The Hewlett-Packard Interface Bus (HP-IB) is HP's implementation of IEEE Standard 488-1978: "Digital Interface for programmable instrumentation" and identical ANSI Standard MC1.1. The term "HP-IB is used to identify Hewlett-Packard instruments and peripheral devices conforming with this standard.*

Functional Specifications

Capacity

Discs per 12009A Interface: See HP 1000 Ordering Guide, 5954-8564 or later revision.

Other HP-IB Devices/Interface: Up to 14.

Switch-Selectable Operating Modes

High Speed Mode: Selects operation at data rates to 940K bytes/second, maximum. Only 7 high speed devices plus the 12009A are supported on the bus.

Normal Mode: Selects operation at data rates to 500K bytes/second, maximum. Up to 14 normal speed devices may be on the bus.

Matching Requirement: All devices connected to the same bus must be compatible with the selected mode For that reason, separate 12009A interfaces will be required to interface both high speed mode and normal mode devices to the same A-Series Computer or System.

System Controller Mode: A two position switch enables or disables 12009A operation as system controller.

Bus Characteristics

Bus Signal Lines: See Figure 4-2, page 4-13.

Logic Levels, Line Terminations, Line Drivers, and Line Receivers: All characteristics conform to IEEE Standard 488-1978.

Maximum Cable Length for Normal Mode Operation: 2 meters (6.5 ft.) per device connected, with a 20 meter (65 ft.) total length. The maximum number of devices is accommodated by using shorter than maximum cable length between devices.

Maximum Cable Length for High Speed Operation: 2 meters (6.5 ft.) per device connected, with a 15 meter (48.75 ft.) total length. Additional load resistors, provided with the interface, are required.

Direct Memory Access (DMA) Operation

The 12009A can directly access computer memory under control of its I/O master processor regardless of how many other interfaces in the system are also accessing memory via DMA.

Transfer Rates

High Speed Mode: Up to 940K bytes per second via Direct Memory Access when HP-IB interface is plugged into the highest priority I/O slot (next to the central processor board) in the card cage.

Normal Mode: Up to 500K bytes per second via Direct Memory Access.

Configuration Information

Computer and System Compatibility: The 12009A HP-IB Interface is compatible with all HP 1000 A-Series Computers and Systems.

Software Support: The 12009A interface is supported by RTE-A interface driver ID*37. Use of Hewlett-Packard printers, magnetic tape units, and disc memories with the 12009A interface is supported by RTE-A device drivers DDC12, DD*12, DD*23, DD*24, DD*33, and DDM30, which work with interface driver ID*37.

Diagnostic Support: A diagnostic test for the 12009A interface is provided in the HP 24612A A-Series Processor and Interfaces Diagnostic Package.

Installation: Set interface card switches to select (or unselect) operation as bus controller, normal or fast settling time, appropriate HP-IB bus address and control functions, and appropriate I/O address select code; turn off power to the computer and interfaced devices; plug the interface into the computer backplane*; connect the bus cable from the interface to HP-IB devices; and integrate the interface driver into the operating system if that has not been accomplished previously.

* *NOTE: To achieve maximum data rate in high speed mode, the HP-IB interface must be plugged into the card cage slot next to the central processor; I/O address setting of the interface select code switches is independent of the interface card's position in the computer backplane.*

DC Current Requirements

2.1A (+5V), 0.084 (+12V).

Physical Characteristics

Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Net Weight

710 grams (25 oz) with HP-IB cable.

Ordering Information

HP 12009A HP-IB Interface

The 12009A HP-IB Interface includes:

1. 12009-60020 HP-IB interface card.
2. 12009-60014 2 meter (6.5 ft.) HP-IB RFI filter Cable.
3. 12009-90001 Reference manual.

HP 12009A Option 001

Replaces 12009-60014 2 meter cable with 12009-60015 4 meter (13.1 ft.) HP-IB RFI filter cable.

Breadboard Interface

HEWLETT PACKARD

HP 1000 A-Series Computer Interfaces

product number 12010A

The HP 12010A Breadboard Interface provides the standard A-Series I/O master circuit along with space for sixty 16-pin wire wrap sockets for user-designed custom interfaces. The printed circuit layout is based on a 2.5 mm (0.1 in.) by 7.6 mm (0.3 in.) matrix, which accommodates any mix of dual or single in-line integrated circuits. All signals needed by the user are brought along with dc power supply voltages to convenient, labelled connection pads along the edge of the I/O master circuit area.

Features

- **Standard A-Series I/O master interface to computer backplane.**
- **Built-in DMA capability for optimum I/O efficiency.**
- **60-socket space for user's circuits.**
- **TTL-compatible signals.**

Functional Specifications

I/O Master

Purpose: To assure compatibility of user-designed interfaces with the high performance I/O design of A-Series Computers, the Breadboard Interface includes the same I/O master circuit as other A-Series interfaces. This includes the CMOS LSI I/O Processor chip, which executes I/O instructions, and other circuits that make high speed transfers possible.

Determination of I/O Address: I/O address select code is set by select code switches and is independent of interface card position along the A-Series backplane bus.

I/O Addressing: The Breadboard Interface may be pre-addressed by presetting the select code into its Global Register (GR), which leaves the six select code bits of I/O instructions available for addressing registers or other functions on the interface. Alternatively, the GR can be turned off and the select code bits in each instruction can be used to address the user-designed custom interface.

I/O Device Interrupt Priority: Depends upon I/O interface position in the card cage with respect to the processor board.

Interrupt Masking: Under program control an interrupt mask register provides selective inhibition of interrupts from specific interfaces under program control. This capability can be programmed to temporarily cut off undesirable interrupts from any combination of interfaces when they could interfere with crucial transfers.

Direct Memory Access (DMA): The I/O master supports DMA capability for user's circuits on the Breadboard Interface. This feature reduces the number of interrupts from one per data item (byte or word) to one per complete DMA block transfer, greatly reducing overhead and increasing throughput.

Self-Configured, Chained DMA: A self-configuring mode of DMA operation is available for series of DMA transfers. In this mode, instead of interrupting after a block transfer, the I/O master fetches a new set of DMA control words for the next transfer, reconfigures itself, and initiates another block transfer. This chained process continues as long as additional control word sets are available.

Data Packing under DMA: When byte mode is specified in control word instructions, the I/O master automatically manages byte packing or unpacking.

Maximum Achievable DMA Rate: 700,000 words/second (1.4M bytes/second).

Virtual Control Panel Support: The I/O master supports the provision of virtual control panel interface capability on user-designed custom interfaces based on the Breadboard Interface.

I/O Master Signals and Timing: Refer to the HP 1000 A/L-Series I/O Interfacing Guide (02103-90005).

User's Circuit Space

Area: 133 mm (5.25 in.) by 146 mm (5.75 in.).

Organization: The user's circuit area is organized into ten column pairs of 53 circuit pads each for mounting up to 60 16-pin wire wrap integrated circuit sockets or any other combination of dual in-line integrated circuit sockets with different numbers of pins.

Maximum Component Height above board surface: 10 mm (0.4 in.) for an interface capable of being installed in any circuit card position in any A-Series computer.

Maximum Permissible Depth below board for leads or attaching hardware: 5 mm (0.2 in.).

Power Dissipation

Maximum per A-Series Interface Card: 17W, determined by air flow provided through A-Series computer card cages.

I/O Master Dissipation: 5.29W.

Power Dissipation Capacity available for user's circuits: 11.7W.

Configuration Information

Computer and System Compatibility: The I/O master on the 12010A Breadboard Interface is compatible with all HP 1000 A-Series Computers and Systems.

Software Support: User's custom-designed interfaces based on the 12010A Breadboard Interface will require user-written RTE-A driver software,which can be modeled on general purpose RTE-A driver ID*50.

Diagnostic Support: Diagnostics for user's custom-designed interfaces must be written by the user. A kernel diagnostic, supplemented by a BASIC-like interactive diagnostic test and design language is provided in the 24612A Diagnostic Package to assist the user's diagnostic development efforts.

Installation: Build user's custom interface on the Breadboard Interface; establish control settings as required for the user's custom application; set select code switches to the appropriate I/O address; turn off power to the computer and the interfaced device; plug the custom interface into the computer backplane; connect an appropriate cable from the interface to the external device; and integrate the interface and its user-written driver into the RTE-A operating system if that has not been accomplished previously.

NOTE: The I/O address setting of the interface select code switches is independent of the interface card's position in the computer backplane.

Electrical Specifications

DC Current Requirements

The I/O master requires 0.912A (+5V) and 0.061A (+12V).

Standard Backplane Power Connections

DC/AC Voltages	Interface Card P2 Pins
+5V dc	35, 36, 37
+12V dc	41, 42
−12V dc	43, 44
19.5V rms, 25 kHz*	47, 48
Common	2, 15, 17, 21, 27, 34
19.5V rms, 25 kHz*	49, 50

* *The 19.5V rms, 25 kHz power is available for meeting unique power supply requirements, such as for isolation of grounds. Micro 24, 26, 27, and 29 Computers and SPUs require the 12159A 25 kHz Sine Wave Card for support of 25 kHz ac to interfaces. Micro 14 and 16 Computers cannot supply 25 kHz ac to interfaces. 25 kHz ac is standard without any additions in 2137A, 2139A, and 2156B Computers and Model 26, 27, and 29 SPUs.*

Physical Characteristics

Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Net Weight

313 grams (11 oz) with mating connector.

Ordering Information

HP 12010A Breadboard Interface

The 12010A Breadboard Interface includes:

1. 12010-60003 Breadboard Interface card.
2. 5061-3426 48-pin Connector Kit.
3. 02103-90005 A/L-Series I/O Interfacing Guide.

Extender and Priority Jumper Cards

HEWLETT PACKARD

HP 1000 A-Series Computer Interfaces

product numbers 12011A and 12012A

The HP 12011A and 12012A are, respectively, the Extender Card for out-of-card cage access to system-connected A-Series plug-in cards and the Priority Jumper Card for continuation of the HP 1000 A-Series hardware priority chain through an otherwise unoccupied card cage slot.

Functional Specifications

Computer and System Compatibility

The 12011A Extender Card and the 12012A Priority Jumper Card are compatible with all HP 1000 A-Series computers, systems, and card cages.

Installation

12011A Extender Card: Remove the plug-in card to be accessed, plug the extender card into the card cage in its place, and plug the card into the extender board.

12012A Priority Jumper Card: Plug the priority jumper card into the vacant card cage slot through which the priority chain is to be continued.

Net Weight

12011A Extender Card: 426 grams (15 oz).

12012A Priority Jumper Card: 170 grams (6 oz).

Ordering Information

HP 12011A Extender Card

The 12011A includes:

12011-60001 Extender card.

HP 12012A Priority Jumper Card

The 12012A includes:

12012-60001 Priority Jumper card.

8-Channel Asynchronous Multiplexer Interface

HEWLETT
PACKARD

HP 1000 A-Series Computer Interfaces

product number 12040D

The HP 12040D is an Asynchronous Multiplexer Interface that can connect up to eight asynchronous terminal, printer, or "black box" devices to an HP 1000 A-Series Computer System using a single I/O slot.

Features

- **EIA RS-423-A and RS-232-C/CCITT V.24 compatibility.**
- **On-board microprocessor off-loads computer.**
- **On-board buffering with DMA capability.**
- **Programmable data rates using two baud rate generators to eliminate hardware speed strapping.**
- **Automatic baud rate generator configuration.**
- **Programmable character size, parity checking, termination character, and number of stop bits for flexible control of transmission format.**
- **Parity, overrun, and framing error detection.**
- **Bi-directional X-on, X-off control during multiplexer data transmission.**
- **Two of ten baud rate groups may be simultaneously selected.**
- **HP 37214A Systems Modem support, which can provide up to 7 ports having full modem control capabilities.**
- **Virtual Control Panel (VCP) support.**
- **Full Duplex or Echoplex transmission.**
- **Capability to edit data prior to passing it to computer memory, featuring backspace erase.**
- **An 8-port Distribution Panel for RS-232 connections.**

Functional Description

The 12040D Asynchronous Multiplexer Interface provides multiplexed terminal support for up to eight asynchronous RS-232-C compatible devices connected directly, or through full-duplex asynchronous modems*, to the multiplexer. The multiplexer interface can operate at programmable data rates up to 38.4K bits/second on a given channel. For a description of the overall throughput performance for the 12040D, see the 12040D Performance Brief on page 4-21.

The 12040D includes an eight-port multiplexer panel to provide for convenient connection of EIA 25-pin cable connectors from terminals or other devices.

Functional Specifications

Capacity

Channels: Eight full-duplex (transmit and receive) communications channels.

Buffering: Two 254 byte transmit buffers and two 254 byte receive buffers for each channel.

Communications

Interface Level: RS-423-A/RS-232-C or CCITT V24.

Program-selectable Data Rates: 50, 75, 110, 134.5, 150, 300, 1200, 1800, 2400, 4800, 9600, 19.2K, and 38.4K bits/second.

Communication Mode: Asynchronous, bit serial.

Programmable Communications Parameters: Character length from 5 to 8 bits; 1, 1-1/2, or 2 stop bits; and odd, even, or no parity.

Maximum Connector Panel Cable Length: 91 meters (300 ft.). Included cable is 3 meters (9.84 ft.) long; longer cable must be fabricated by the user from the included 1252-0508 connector kit and separately-purchased HP Part Number 8120-4510 cabling).

Virtual Control Panel Support

The 12040D interface can be set to support a terminal connected to multiplexer channel 0 to function as the Virtual Control Panel of HP 1000 A-Series computers.

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* *Modem control lines are passed through to the multiplexer panel to allow passive full-duplex modem support. Active modem control may be achieved by adding the HP 37214A System Modem.*

Direct Memory Access Operation

The 12040D can transfer data directly to or from computer memory. DMA control is performed on the card, reducing the overhead of handling DMA operations.

Configuration Information

System Compatibility: The 12040D Asynchronous Multiplexer Interface is compatible with HP 1000 A-Series Computer Systems operating under the RTE-A real-time executive system, Version 4.1 or later.

The 12040D incorporates firmware designed specifically for RTE-A interface drivers ID800 (and ID801 for use with 37214A Systems Modem). The 12040D will be compatible with pre-version 4.1 versions of RTE-A if interface driver IDM00 is replaced with either ID800 or ID801. Consult the RTE Driver Reference Manual (p/n 92077-90011) for more information about compatibility and upgrade.

Software Support: RTE-A interface drivers IDM800 and IDM801 (for use with 37214A Systems Modem) and device driver DDC00.

Computer I/O Slots Required: 1 per 12040D interface.

HP Terminals and Peripheral Devices Supported: See the HP 1000 Ordering Guide, 5954-8564 or later revision.

Diagnostic Support: A diagnostic test and test connector for the 12040D interface are provided in the HP 24612A A-Series Processor and Interfaces Diagnostic Package.

DC Current Requirements

2.5A (+5V), 0.1A (+12V), 0.05A (−12V).

Physical Characteristics

Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Net Weight

481 grams (17 oz) with mating connector.

Ordering Information

HP 12040D 8-Channel Asynchronous Multiplexer Interface

The 12040D Asynchronous Multiplexer Interface includes:

1. 12040-60214 8-Channel Multiplexer Interface assembly.
2. 28658-60005 8-Channel RS-232-C panel with 3 meter (9.8 ft.) cable.
3. 5001-5278 Mounting Bracket.
4. 1252-0508 Multiplexer Cable Extender Kit (a set of male and female connectors for fabrication of an extension cable up to 91 meters (300 ft.) long, using separately-purchased cabling, HP Part Number 8120-4510).
5. 12040-90123 Interface Reference manual.

Options

001: Firmware upgrade from 12040C Multiplexer. Provides 5180-7262 Firmware ROMs, a 12040-90114 Instruction Sheet, and the 12040-90123 Interface Reference manual.

002: Substitutes a 12828-60002 cable for items 2 through 4 of 12040D, listed above.

003: Substitutes a 5061-3467 Edge Connector Kit for items 2 through 4 of 12040D, listed above.

HP 12040D and 12100A (A400) SBC Multiplexers Serial I/O

HEWLETT PACKARD

Performance Brief

Introduction

This performance brief summarizes results of tests designed to compare the data transfer performance of the current HP 12040C 8-Channel Multiplexer with two new releases – the improved HP 12040D 8-Channel Multiplexer and the four-port On-Board I/O (OBIO) multiplexer on the HP 12100A A400 Single-Board Computer (SBC). The multiplexers on the HP 12040D and the HP 12100A SBC both use new firmware that has been designed to work with enhanced drivers in RTE-A revision 4.1. This gives performance significantly better than that available with the HP 12040C multiplexer. Tests checked:

1. Overall throughput with writes followed by block mode reads (80 characters) and block mode page reads (approximately 700 characters).
2. N-byte writes for lengths of 1, 80, and 32000 characters.

Throughput Performance

The overall throughput performance test was designed to determine firmware and driver efficiency. The tests demonstrated throughput performance improvements of 11% to 53% for four HP 12100A channels vs four HP 12040C channels at both 9600 and 19200 baud data rates. Comparing eight HP 12040D channels to HP 12040C channels, performance improvements ranged from 8% to 100%. At 9600 baud, all eight HP 12040D channels could be run vs only six of the HP 12040C channels. Similar results were obtained at 19200 baud, where six HP 12040D channels could be run vs only four of the HP 12040C channels. These data indicate only relative performance. They do not preclude the support of more than six terminals on the HP 12040C at 9600 baud, or more than six terminals on the 12040D multiplexer at 19200 baud. This is true because the test conditions of continuous block mode communication simultaneously on all channels is most unlikely to ever occur under actual operating conditions.

New Features

The greatest advantage that both the HP 12040D multiplexer and the A400 4-channel multiplexer have with respect to the HP 12040C multiplexer is superior flow control. This includes supporting the feature of bi-directional Xon/Xoff, which empowers the multiplexer to pace an external device, if necessary. If an external device sends data too quickly, the newer multiplexers send an Xoff to the device. The external device then stops transmitting (within ten characters) and waits until the multiplexer sends an Xon to ask for more data. This new capability considerably expands the choice of external devices that can communicate with HP 1000 systems via multiplexer without concern for data loss. The range of choice includes all newer style terminals that support bi-directional Xon/Xoff along with Enq/Ack. Both modes can be used concurrently, so the newer multiplexers should be able to support eight devices at 19200/9600 baud in any environment as long as Xon/Xoff flow control is used.

Avoidance of Incoming Data Loss

The improved HP 12040D multiplexer incorporates a buffering scheme for data management on the interface which is simpler and more flexible than that used in the HP 12040C multiplexer. The firmware for this (12040D) multiplexer has also been designed to give highest priority to reads rather than writes. This change from previous designs results in a relative degradation of large (32000 byte) write performance when compared to previous versions. This is a small price to pay for significantly reducing the potential for losing incoming data.

Overall Throughput Tests

Description

The overall throughput tests used the same program to gather time-to-run data for the 12040D multiplexer, the 12040C multiplexer, and the four-port multiplexer on the 12100A SBC. The test program cycled through the following actions 20 times:

1. 80 write requests to an HP2392A terminal using ENQ-ACK protocol, with lengths from 0 to 80 characters.
2. Reads of each line in block line mode.
3. Rewrite of 80 lines.
4. Read of the entire screen using block page mode.

Results

1. Performance of HP12040D Eight-Channel Multiplexer versus HP12040C Multiplexer

Data Rate	No. of ports	Program Time (ms) w/12040C	Program Time (ms) w/12040D	Performance Improvement with 12040D
9600 Baud	1	388340	347980	10.4%
	2	419100	370790	11.5%
	3	467790	428660	8.4%
	4	559060	505090	9.7%
	5	680350	580870	14.6%
	6	802860	655160	18.4%
	7	N/A	725900	100.0%
	8	N/A	798020	100.0%
19200 Baud	1	292860	239220	18.3%
	2	333690	275460	17.4%
	3	416450	318380	23.5%
	4	539480	456940	15.3%
	5	N/A	525869	100.0%
	6	N/A	621342	100.0%
	7	N/A	N/A	N/A
	8	N/A	N/A	N/A

2. Performance of HP12100A (A400) Four-Channel Multiplexer versus HP12040C Multiplexer

Data Rate	No. of ports	Program Time (ms) w/12040C	Program Time (ms) w/12100A	Performance Improvement with 12100A
9600 Baud	1	388340	344940	11.2%
	2	419100	347630	17.1%
	3	467790	349250	25.3%
	4	559060	353190	36.8%
19200 Baud	1	292860	240630	17.8%
	2	333690	243610	27.0%
	3	416450	246370	40.8%
	4	539480	250560	53.6%

Write Comparison Tests

Description

The write comparison tests used the same program to gather time-to-run data for the 12040D multiplexer, the 12040C multiplexer, and the four-port multiplexer on the 12100A SBC. For the 1-byte case, the number of iterations was set to assure consistent sampling. The test was performed at 19200 baud for that number of iterations for all of the 1-byte, 80-byte, and 32000-byte write lengths.

Results

1. Performance of HP12040D Eight-Channel Multiplexer versus HP12040C Multiplexer

No. of Char.	No. of ports	Program Time (ms) w/12040C	Program Time (ms) w/12040D	Performance Improvement with 12040D
1	1	82420	49070	40.5%
	2	156460	86310	44.8%
	3	242590	131680	45.7%
	4	320840	175760	45.2%
	5	401200	219950	45.2%
	6	480440	264410	45.0%
	7	560940	308650	45.0%
	8	640140	346920	45.8%
80	1	191570	185000	3.4%
	2	241870	226160	6.5%
	3	314270	306260	2.5%
	4	417800	390620	6.5%
	5	519670	475210	8.6%
	6	622090	560290	9.9%
	7	724770	644950	11.0%
	8	826900	723240	12.5%

2. Performance of HP12100A (A400) Four-Channel Multiplexer versus HP12040C Multiplexer

No. of Char.	No. of ports	Program Time (ms) w/12040C	Program Time (ms) w/12100A	Performance Improvement with 12100A
1	1	82420	42260	48.7%
	2	156460	87960	43.8%
	3	242590	131790	45.7%
	4	320840	176650	44.9%
80	1	191570	189950	0.8%
	2	241870	190060	21.4%
	3	314270	190100	39.5%
	4	417800	190160	54.5%
32000	1	337860	351610	-4.1%
	2	339260	351610	-3.6%
	3	404630	351710	13.1%
	4	536810	351690	34.5%

Programmable Serial Interface

HEWLETT PACKARD

HP 1000 A-Series Computer Interfaces

product number 12042B

The HP 12042B is a microprogrammable interface for HP 1000 A-Series Computers. This card is intended to be used by sophisticated OEMs or End-Users as a foundation for designing their own application oriented communications products.

The 12042B is a Z-80A based intelligent interface with two available EPROM/ROM sockets. User developed firmware modules are required for use. By designing firmware unique to a particular application, the user has almost unlimited scope in the number of customized products that are feasible. The HP 24602A PSI Firmware Development Package provides reference material to guide users in the task of creating their own firmware. In conjunction with the 24602A, the 12042B offers a flexible solution to complex data communication problems.

Features

- **Z-80A CPU microprocessor control.**
- **One Z-80A SIO/2 dual channel serial I/O "USART" controller offering:**
  - Full or half duplex mode
  - Synchronous or asynchronous features
  - CRC-16 or CCITT block frame check for synchronous operation
  - Two modem control inputs and two modem control outputs per channel
  - Optional vectored interrupts per channel
  - Capability for two independent RS-232-C primary channels
- **Two Z-80A DMA direct memory access controllers.**
- **16K bytes of Dynamic RAM for tables, buffers, and/or firmware.**
- **Capability for EIA RS-449, EIA RS-232-C (on one channel).**
- **Internal loop-back of clocks and transmitted data under firmware control for self-test.**
- **Two EPROM/ROM sockets capable of using any combination of 2716's, 2732's, 2764's, 2516's, 2532's, and similar devices up to a maximum of 8K bytes per socket.**
- **One Z-80A CTC Counter Timer Chip providing one system timer, an independent, programmable baud rate for each SIO channel, and a programmable DMA backplane transfer rate.**
- **Multidrop capability.**
- **Forced Cold Load capability.**
- **Four programmable indicator lights (LEDs).**
- **Eight switches, accessible as a single byte.**

Functional Description

On-Board Microprocessor Off-loads Host Computer

A powerful microprocessor on the interface manages routine communications processing, relieving the host computer for applications oriented tasks. Under control of customer supplied firmware, the microprocessor converts command words into actions, such as establishing a communications link or loading/unloading data from the on-board buffers to the host CPU. The microprocessor can also perform protocol generation and interpretation, error checking, error recovery by retransmission, or general purpose I/O interfacing, all without the attention of the host computer.

16K Bytes of RAM Memory

On-board memory can buffer messages and associated information on the card either for transmission, reception, or temporary program storage. Thus, interrupts to the host processor can be kept at a minimum so the host CPU can be put to better use processing applications.

Direct Memory Access Transfers

Each interface card has its own DMA intelligence to control transfers of data between the interface buffer and the host CPU backplane. DMA reduces the time and overhead required to move messages between interface and host CPU memory.

EPROM-Based Self Tests

A go/no-go self test (which can be optionally deleted), performed at power up or reset of the card helps to assure reliable operation of the interfaces and minimize troubleshooting time. These tests check out the RAM memory, the Direct Memory Access operations, baud rate generators, and the I/O parts of the communication interface and signal self-test results via LED indicators. The self test can also be run with the supplied diagnostic hood. The diagnostic hood plugs onto the edge connector of the PSI card and tests more of the card than is possible with self test alone.

Functional Specifications

Transmission Mode

Full or half duplex, bit-serial, synchronous or asynchronous.

Z-80A SIO/2 Characteristics

Data Buffering: Received data is quadruple buffered; transmitted data is double buffered.

Synchronous Features for Character-Oriented Protocol:

- One or two Sync characters
- Automatic Sync character insertion
- Cyclic Redundancy Check generation and checking
- Received data overrun detection

Synchronous Features for Bit-Oriented Protocol:

- Abort sequence generation and checking
- Automatic Zero insertion and detection
- Automatic Flag insertion between messages
- Address field recognition
- Supports one to eight bits per character
- Cyclic Redundancy Check generation and checking
- Valid receive message overrun detection

Asynchronous Features:

- 5, 6, 7, or 8 bits per character
- 1, 1-1/2, or 2 stop bits
- Even, odd, or no parity
- X1, X16, X32, or X64 clock modes
- Break generation and detection
- Parity overrun and framing error detection
- Valid receive message overrun

Optional Generation of a Vectored Interrupt per Channel When:

- the state of an SIO modem control input changes
- the transmit buffer is empty
- a receive character is available
- a special receive condition occurs for parity error, Rx overrun error, CRC or Framing error, or End of Frame

Z-80 DMA Characteristics

Three Classes of Operation: Transfer only, Search only, Search and Transfer.

Three Modes of Operation: Byte-at-a-Time, Burst (continuous as long as both sides are ready), Continuous (locks out CPU until done). Read and write port addresses can independently increment, decrement, or stay fixed.

Interrupts: On Match Found, End of Block, or Port Ready (each can be its own interrupt vector).

Address and Block Length Register Loading: Registers may be loaded for the next operation without disturbing the current operation.

Operation Restart: Last operation can be restarted automatically or on command.

DMA Signalling: DMA can signal when a specified number of bytes has been transferred without disturbing the current system.

DMA Status: CPU can read the current channel status, Read or Write address registers or the length register.

Z-80 Counter Timer Chip Characteristics

Channels: Four independently programmed channels used for dynamic RAM timing, Zilog chip main system clock, and baud rate generator for each SIO channel. The baud rate limits are:

Asynchronous:	57.6K, max.	50 min.
Synchronous:	460.8K, max.	50 min.
Synchronous, ext:	810K, max.	

The speed of transmission depends upon, and may be limited by, the type of firmware protocol implemented. The best practical board rates that can be expected with sophisticated protocols are 230K baud synchronous and 57.6K baud asynchronous.

Modes: Operates in Counter or Timer mode.

Interrupt: On the zero count condition (each channel has its own interrupt vector).

Restart: Automatically restarts the last operation in either mode.

Output: gives the Z-80A CPU the number of counts to go until a zero count condition.

Communications Interface Characteristics

Number of Input Lines: Six input lines with balanced receivers and eight input lines with unbalanced receivers.

Output Lines: Four output lines that can be driven by unbalanced or balanced line drivers; eight output lines with unbalanced line drivers.

Configuration Information

System Compatibility: The 12042B Programmable Serial Interface is compatible with all HP 1000 A-Series Computers.

Computer I/O Slots Required: 1 per 12042B interface.

Compatible Modems: The 12042B interface is compatible with Bell Type 201C, 208A, 208B, and 209A modems for connection via private lines, and may be usable with other modems that are compatible with both the interface hardware and user-developed firmware. Modem compatibility is highly dependent upon the firmware that is implemented on the interface card. Further information on modems is given in the 12042B Hardware Manual (12042-91001).

DC Current Requirements

2.6A (+5V), 0.35A (+12V), 0.18A (−12V).

Interface Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Support Policy

Because the 12042B interface is a customizable system, the customer must assume responsibility for its support. Consequently, there is no Service Contract applicable to the 12042B product. Hewlett-Packard Computer Engineers will accept contracts for HP 1000 systems containing 12042B interfaces upon verification of the system by the responsible HP field office. However, the 12042B interface itself will not be diagnosed, repaired, or examined at the customer's site. If the 12042B interface develops problems, it will be the customer's responsibility to diagnose and replace both its hardware and firmware. The Self Test EPROM is provided as a diagnostic tool to be used at the customer's discretion.

Customers must be prepared to develop their own support strategy for the 12042B card. A good plan is to keep spare cards available for swapping if a problem arises in the field. Board Repair and Exchange programs are available for the 12042B to assist customers in their support. People at the nearest Hewlett-Packard field sales and service office can provide more information.

Ordering Information

NOTE: Concurrent purchase of the HP 24602A Programmable Serial Interface Firmware Development Package with the 12042B interface is strongly recommended.

HP 12042B Programmable Serial Interface

The 12042B Programmable Serial Interface includes:

1. 5061-4940 Programmable Serial Interface assembly.
2. 5061-4914 5 meter (17 ft.) RS-232-C Modem Interface cable.
3. 5061-4916 Diagnostic Test Hood.
4. 5180-1951 Self-Test EPROM.
5. 5955-7628 OEM/PSI manual.

Options

001: Substitutes 5061-4923 5 m (17 ft.) RS-449 Modem Interface cable for item 2, above.

002: Substitutes a 5061-3440 custom cable kit (edge connector only) for item 2, above.

003: Deletes Diagnostic Hood and Self-Test EPROM (items 3 and 4, above).

Multi-Use Programmable Serial Interface

HEWLETT PACKARD

HP 1000 A-Series Computer Interfaces

product number 12043A

The HP 12043A is a microprogrammable interface for HP 1000 A-Series Computers. This card is intended to be used with HP software or user-developed software that downloads the characterizing protocol firmware into 16K bytes of on-board RAM memory. The principal use of this card is with various HP software packages for communication with IBM systems.

Features

- **Z-80A CPU microprocessor control.**
- **One Z-80A SIO/2 dual channel serial I/O "USART" controller offering:**
  - Full or half duplex mode
  - Synchronous or asynchronous features
  - CRC-16 or CCITT block frame check for synchronous operation
  - Two modem control inputs and two modem control outputs per channel
  - Optional vectored interrupts per channel
  - Capability for two independent RS-232-C primary channels
- **Two Z-80A DMA direct memory access controllers.**
- **16K bytes of Dynamic RAM for tables, buffers, and downloaded firmware.**
- **Capability for EIA RS-449 or EIA RS-232-C.**
- **Multidrop capability.**
- **Internal loop-back of clocks and transmitted data under firmware control for self-test.**
- **Four programmable indicator lights (LEDs).**
- **Eight switches, accessible as a single byte.**
- **EPROM-based developmental debug monitor.**
- **EPROM-based self test.**
- **Off-line RAM dump to host.**
- **EPROM-based program for loading and executing downloaded code.**
- **Fully supported by Hewlett-Packard.**

Functional Description

On-Board Microprocessor Off-loads Host Computer

A powerful microprocessor on the interface manages routine communications processing, relieving the host computer for applications oriented tasks. Under control of downloaded firmware, the microprocessor converts command words into actions, such as establishing a communications link or loading/unloading data from the on-board buffers to the host CPU. The microprocessor can also perform protocol generation and interpretation, error checking, error recovery by retransmission, or general purpose I/O interfacing, all without the attention of the host computer.

16K Bytes of RAM Memory

On-board memory can buffer messages and associated information on the card for transmission, reception, or temporary program storage. Thus, interrupts to the host processor can be kept at a minimum so the host CPU can be put to better use processing applications.

Direct Memory Access Transfers

Each interface card has its own DMA intelligence to control transfers of data between the interface buffer and the host CPU backplane. DMA reduces the time and overhead required to move messages between the interface and memory in the host CPU.

EPROM-Based Self Tests

A go/no-go self test performed at power up or reset of the card helps to assure reliable operation of the interface and minimize troubleshooting time. These tests check out the RAM memory, the Direct Memory Access operations, baud rate generators, and the I/O parts of the communication interface, and signal self-test results via LED indicators. The self test can also be run with the supplied diagnostic hood. The diagnostic hood plugs onto the edge connector of the PSI card and tests more of the card than is possible with self test alone.

EPROM-Based Developmental Debug Monitor (DDM)

The Developmental Debug Monitor (DDM) program serves as a monitor to aid in the development of user firmware. After a firmware program has been cross-assembled on a minicartridge tape, the DDM can load that program into the 12043A card's RAM through the minicartridge tape drive of an HP 2645A* or 2648A* terminal and a terminal-to-card-to-link cable supplied with the DDM. The DDM can then support these functions:

- Display and/or modification of memory locations.
- Display and/or modification of registers.
- Control of program flow by:
  - Transferring control to firmware entry points.
  - Setting and removing break points.
  - Single-step simulation with trace.
- Reading and writing through all I/O ports.
- Creating ("punching") modified code into 264x minicartridge tape.
- Help facility providing information about the command set.

** The 2645A and 2648A Terminals are discontinued products, listed here for reference only.*

Functional Specifications

Transmission Mode

Full or half duplex, bit-serial, synchronous or asynchronous.

Z-80A SIO/2 Characteristics

Data Buffering: Received data is quadruple buffered; transmitted data is double buffered.

Synchronous Features for Character-Oriented Protocol:

- One or two Sync characters
- Automatic Sync character insertion
- Cyclic Redundancy Check generation and checking
- Received data overrun detection

Synchronous Features for Bit-Oriented Protocol:

- Abort sequence generation and checking
- Automatic Zero insertion and detection
- Automatic Flag insertion between messages
- Address field recognition
- Supports one to eight bits per channel
- Cyclic Redundancy Check generation and checking
- Valid receive message overrun detection

Asynchronous Features:

- 5, 6, 7, or 8 bits per character
- 1, 1-1/2, or 2 stop bits
- Even, odd, or no parity
- X1, X16, X32, or X64 clock modes
- Break generation and detection
- Parity overrun and framing error detection

Optional Generation of a Vectored Interrupt per Channel When:

- the state of an SIO modem control input changes
- the transmit buffer is empty
- a receive character is available
- a special receive condition occurs for parity error, Rx overrun error, CRC or Framing error, or End of Frame

Z-80 DMA Characteristics

Three Classes of Operation: Transfer only, Search only, Search and Transfer.

Three Modes of Operation: Byte-at-a-Time, Burst (continuous as long as both sides are ready), Continuous (locks out CPU until done). Read and write port addresses can independently increment, decrement, or stay fixed.

Interrupts: On Match Found, End of Block, or Port Ready (each can be its own interrupt vector).

Address and Block Length Register Loading: Registers may be loaded for the next operation without disturbing the current operation.

Operation Restart: Last operation can be restarted automatically or on command.

DMA Signalling: DMA can signal when a specified number of bytes has been transferred without disturbing the current system.

DMA Status: CPU can read the current channel status, Read or Write address registers or the length register.

Z-80 Counter Timer Chip Characteristics

Channels: Four independently programmed channels used for dynamic RAM timing, Zilog chip main system clock, and baud rate generator for each SIO channel. The baud rate limits are:

Asynchronous:	57.6K, max.	50 min.
Synchronous:	460.8K, max.	50 min.
Synchronous, ext:	810K, max.	

The speed of transmission depends upon, and may be limited by, the type of firmware protocol implemented. The best practical board rates that can be expected with sophisticated protocols are 230K baud synchronous and 57.6K baud asynchronous.

Modes: Operates in Counter or Timer mode.

Interrupt: On the zero count condition (each channel has its own interrupt vector).

Restart: Automatically restarts the last operation in either mode.

Output: gives the Z-80A CPU the number of counts to go until a zero count condition.

Communications Interface Characteristics

Number of Input Lines: Six input lines with balanced receivers and eight input lines with unbalanced receivers.

Output Lines: Four output lines that can be driven by unbalanced or balanced line drivers; eight output lines with unbalanced line drivers.

Configuration Information

System Compatibility: The 12043A Multi-Use Programmable Serial Interface is compatible with all HP 1000 A-Series Computers.

Computer I/O Slots Required: 1 per 12043A interface.

Software Support: Use of the 12043A interface for communication with IBM and plug-compatible systems is supported by the following software products:
- HP 91781A RJE/1000-II Remote Job Entry Software, data sheet on page 5-59.
- HP 91782A MRJE/1000 Multileaving Remote Job Entry Software, data sheet on page 5-63.
- HP 91784A PMF/1000 Programmatic Mainframe Facility Software, data sheet on page 5-67.

Compatible Modems: The 12043A interface is compatible with Bell Type 201C, 208A, 208B, and 209A modems for connection via private lines, and may be usable with other modems that are compatible with both the interface hardware and downloaded firmware. Modem compatibility is highly dependent upon the firmware that is downloaded to the interface card. For modem compatibility with the IBM software packages listed above, see the respective data sheets in section 5.

DC Current Requirements

2.6A (+5V), 0.35A (+12V), 0.18A (−12V).

Physical Characteristics

Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Ordering Information

HP 12043A Multi-Use Programmable Serial Interface

The 12043A Interface includes:

1. 5061-4940 Programmable Serial Interface assembly.
2. 5061-4914 5 meter (17 ft.) RS-232-C Modem Interface cable.
3. 5061-4916 Self-Test Hood.
4. 5180-1966 Self-Test/Download EPROM (installed).
5. 12042-91001 PSI for Modem Connection Installation and Service Manual.

Options

001: Substitutes 5061-4923 5 meter (17 ft.) RS-449 Modem Interface cable for item 2, above.

Measurement and Control Interfaces for A-Series Computers with 25 kHz Power

product numbers 12060B and 12061A

The HP 12060B and 12061A are plug-in cards for low-cost, high-performance analog input in small distributed measurement and control applications. The 12060B High Level Analog Input Card provides the capability of converting analog input voltages, multiplexed from eight different inputs, to digital form. The HP 12061A Expansion Multiplexer Card provides an additional 32 channels of differential input for a total capability of 40 channels.

Both of these cards use 25 kHz filtered ac power from the computer power supply to provide isolated dc power that permits isolation of the low-level input circuits for maximum immunity from common mode noise and other noise sources. However, the requirement for 25 kHz ac power precludes the use of these cards in Micro 14 and Micro 16 (2424A and 2426E/F) Computers and requires an HP 12159A 25 kHz Sine Wave card in Micro 24, 26, 27, and 29 Computers or System Processor Units.

Features

- **8 Differential inputs, expandable to 40.**
- **Up to 55 kHz throughput to memory.**
- **Auto scanning or single-channel sampling.**
- **12-bit resolution including sign.**
- **4 programmable input ranges: ±1.28 to ±10.24V full scale.**
- **Input overvoltage protection.**
- **External pacing/triggering.**
- **Separate zero reference for error correction.**
- **Easy connection via prewired cables and optional screw termination.**

Functional Description

HP 12060B Analog Input Card

The 12060B Analog Input Card is capable of acquiring up to 55,000 readings per second with 12-bit resolution. Auto scanning or single–channel sampling is possible at rates to 55 kHz. External pacing/triggering of sampling and scanning is supported. The 12060B includes four programmable full scale ranges from ±1.28V to ±10.24V. Maximum resolution is 0.625 mV on the ±1.28V range to 5 mV on the ±10.24V range. A separate "zero reference" on the card allows the user to measure actual offset due to temperature drift, and digitally correct readings on all 40 channels for maximum accuracy.

HP 12061A Expansion Multiplexer Card

The 12061A Expansion Multiplexer Card provides 32 additional differential inputs for the 12060B card. The 12061A card fastens directly onto the 12060B card, creating a two-board unit that occupies two I/O slots in an HP 1000 A-Series computer. Programming information is passed from the 12060B directly to the 12061A. Analog signals on the additional 32 channels are in turn scanned to the 12060B for digitizing. The 12061A includes removable plug-in headers so the user can add current sense resistors for current loop measurements. These headers allow the board to be adapted to the specific application without soldering components directly on the board and are easily removable for repair.

HP 12060BC and 12061AC Cables

The 12060BC 8-Channel Analog Input Cable and the 12061AC 32-channel Analog Input Cable provide for easy connection of your application to the 12060B and 12061A, respectively. Both cables provide a 3-meter cable prewired to the appropriate card compatible edge connector/hood assembly. Each channel is an individually shielded twisted pair for optimal analog performance. The "remote" end of the cable is unterminated, ready for direct wiring to the application. Alternately, the cable may be wired to the easy-to-use 12064A Termination Accessory, providing electrician-compatible heavy-duty screw terminals and a built-in wiring tray (see the 12064A data sheet, page 4-41).

User Programming

Programming of the 12060B and 12061A cards uses RTE-A parallel interface I/O driver ID*50. A simple RTE EXEC call controls both cards:

```
CALL EXEC (1, LU#, Data Buffer, #Readings, Control Word)
```

The control word specifies:

1. **Gain** (1, 2, 4, or 8).
2. **Start Channel:** First channel in a sequence from start channel "N" to the highest channel available (8 for the 12060B alone or 40 with both the 12060B and the 12061A).

3. **Auto Scan:** First channel plus number of readings to be made through one or more complete scans.
4. **Single Channel:** Number of readings to be made on a designated single channel.
5. **Internal Pacing:** Takes all readings at the maximum rate of about 1 reading every 18 microseconds, either scanning or reading a single channel.
6. **External Pacing:** Starts to take readings when the external pace input goes high and stops when it goes low. This supports readings shorter than a full conversion time (nominally >15μsec) by using a narrower pace pulse for each of a series of successive readings. In Autoscan mode, external pacing controls the start of a series of "N" scan readings with "N" determined by the duration of the pace pulse.

Calibration

The 12060B is calibrated at the factory and may require recalibration by the customer on arrival by using a voltage source and optional calibration software.

Functional Specifications

Analog Input

Gain-Dependent Specifications: See Table 4-4.

Maximum Input Voltage: ±10.24V to ground.

Common Mode Rejection: >70 dB, dc to 100 Hz with 1kΩ source impedance and 1kΩ source imbalance. Example: 20V p-p common mode voltage produces <6 mV p-p noise RTI.

Crosstalk: <80 dB, dc to 100 Hz. Example: 20V p-p adjacent channel input produces <2 mV p-p noise RTI.

Throughput to Memory: 55,000 samples per second.

Sample and Hold Aperture Time: <20 nanoseconds.

Steady State Input Overload Protection: Up to ±25 volts on any one input line to ground or to another input without damage.

Transient Input Overload Protection: ±42 volts for 500 ms without damage.

Effective Input Impedance: > 5MΩ with power on. 1.2kΩ (±10%) to ground, 2.4kΩ (±10%) to any other channel with power off.

Source Impedance: Up to 1 kΩ.

Source Imbalance: Up to 1 kΩ.

Common Mode Return: Up to 10 kΩ.

External Trigger

TTL compatible handshake, not protected (operates at up to full 55kHz rate, jumper selectable pull-up, pull-down, or TTL).

Configuration Information

Computer and System Compatibility: The 12060B and 12061A Interfaces are compatible with HP 1000 A-Series Computers and Systems that can provide 25 kHz ac power to them, as listed below.

Supporting Computers and System Processor Units		Computers that Do Not Support 12060B & 12061A
2156B	2196C/D	2424A and 2426E/F
2137A	2197C/D	
2139A	2199C/D	
2434A*	2484A*	
2436A*		
2436E*	2486A*	
2437A*	2487A*	
2439A*	2489A*	

* *Requires 12159A 25 kHz Sine Wave Card*

Software Support: The 12060B and 12061A interfaces are supported by RTE-A interface driver ID*50.

Diagnostic Support: A diagnostic test and test connectors for the 12060B and 12061A interfaces are provided in the HP 24612A A-Series Processor and Interfaces Diagnostic Package.

Table 4-4. 12060B-12061A Gain-Dependent Specifications

SPECIFICATION	GAIN = 1	GAIN = 2	GAIN = 4	GAIN = 8
Full Scale Range	±10.24V	±5.12V	±2.56V	±1.28V
Resolution (12 bits)	5 mV	2.5 mV	1.25 mV	0.625 mV
Accuracy (@25°C, RTI)	±5 mV	±2.5 mV	±1.25 mV	±0.625 mV
Temperature Coefficient	±0.38 mV/°C	±0.38 mV/°C	±0.095 mV/°C	±0.048 mV/°C
Overall Accuracy, 0°C to 55°C, Referred To Input, Worst Case: Inputs at 12060B Inputs at 12061A	 ±16.4 mV ±24.6 mV	 ± 8.2 mV ±12.3 mV	 ±4.1 mV ±6.1 mV	 ±2.1 mV ±3.1 mV

Installation: Set the interface's I/O address on the select code switches; turn off power to the computer; plug the interface into the computer backplane; connect an appropriate cable from the interface to the signal sources; and integrate the interface driver into the operating system if that has not been accomplished previously.

NOTE: The I/O address setting of the interface select code switches is independent of the interface card's position in the computer backplane.

Power Requirements

12060B Interface: 1.1A (+5V) and 7.25W from 25 kHz ac power supply.

12061A Interface: 0.01A (+5V) and 2W from 25 kHz ac power supply.

Environmental Specifications

Temperature

Operating: 0° to 55°C (32° to 131°F).

Storage: −40° to 75°C (−40° to 167°F).

Relative Humidity

5% to 95% at 40°C (104°F), without condensation.

Altitude

Operating: Up to 4.6 km (15,000 ft.).

Non-Operating: Up to 15.3 km (50,000 ft.).

Physical Characteristics

Dimensions

12060B/12061A Interface Card: 289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

12060BC and 12061AC Cable Length: 3 meters (9.84 ft.).

Net Weight

12060B Interface: 0.4 kg (14 oz).

12061A Interface: 0.27 kg (9.3 oz).

Ordering Information

HP 12060B High-Level Analog Input Interface

The 12060B Interface includes:

1. 12060-60101 High-Level Analog Input interface card.
2. 12060-90004 Hardware Reference Manual.
3. 12060-90003 Programming Manual.

HP 12060B Options

001: Adds edge connector kit and extra edge connector.

020: Provides calibration software on CS/80 Cartridge Tape.

044: Provides calibration software on 270 kB microfloppy disc.

HP 12061A Expansion Multiplexer Interface

The 12061A Interface consists of the 12061-60001 Analog Input Expansion Interface.

HP 12061A Option 001

Adds edge connector kit and extra edge connector.

HP 12060BC Analog Input Cable

3 meter (9.84 ft.) cable with 8 individually shielded twisted pairs and one drain common to all shields, with mating connector to 12060B/B interface, but unterminated at the signal source end.

HP 12061AC Analog Input Cable

3 meter (9.84 ft.) cable with 32 individually shielded twisted pairs and one drain common to all shields, with mating connector to 12061A interface, but unterminated at the signal source end.

Analog Output Interface

Measurement and Control Interfaces for A-Series Computers with 25 kHz Power

product number 12062A

The HP 12062A is a plug-in card for low-cost, high-performance analog output capability in small distributed measurement and control applications.

This card uses 25 kHz filtered ac power from the computer power supply to provide isolated dc power that permits isolation of the individual output circuits. However, the requirement for 25 kHz ac power precludes the use of the 12062A card in Micro 14 and Micro 16 (2424A and 2426E/F) Computers and requires an HP 12159A 25 kHz Sine Wave card in Micro 24, 26, 27, and 29 Computers or System Processor Units.

Features

- **4 channels of voltage output/card.**
- **Output range of ±10.24 volts.**
- **12-bit resolution including sign.**
- **Short circuit and overvoltage protection.**
- **One undedicated digital output per channel.**
- **90 kHz output from memory.**
- **Programmable data rates.**
- **Easy connection via prewired cables and optional screw termination.**

Functional Description

HP 12062A Analog Output Card

The 12062A Analog Output Card provides four independent, bipolar voltage outputs. Remote sensing per channel provides accurate output voltages compensating for long lengths of field wiring.

Undedicated digital outputs may be used in pen up/down control, CRT display, or X-Y plotters. DMA compatibility provides fast analog updates on a per channel basis or between channels. Programmable time delay between DMA updates provides signal reconstruction capability with a full power bandwidth of 20 kHz.

HP 12062AC Cable

The 12062AC 4-Channel Analog Output Cable provides for easy connection of your application to the 12062A. The 12062AC is a 3-meter cable prewired to the appropriate card compatible edge connector/hood assembly. Each channel is an individually shielded twisted pair for optimal analog performance. The "remote" end of the cable is unterminated, ready for direct wiring to the application. Alternately, the cable may be wired to the easy-to-use 12064A Termination Accessory, providing electrician-compatible heavy-duty screw terminals and a built-in wiring tray (see the 12064A data sheet, page 4-41).

User Programming

Programming of the 12062A card uses RTE-A parallel interface I/O driver ID*50. A simple RTE EXEC call controls the card:

CALL EXEC (2, LU#, Data Buffer, #Readings, Control Word)

The control word specifies a time delay between successive DMA word transfers. Each increment up to 255 in the control word adds a 1.085 microsecond time delay to the 10.85 microsecond base interval.

Calibration

The 12062A is calibrated at the factory and may require recalibration by the customer on arrival by using a voltage source and optional calibration software.

Functional Specifications

Analog Output

Number of Channels: Four.

Resolution: 12 bits, LSB = 5 mV.

Voltage Output Range: −10.24V to +10.23V at 20 mA.

Short Circuit and Overvoltage Protection: Protected against short to common or overvoltage up to ±15V dc.

Linearity error (0°to 70°C): ±2.5 mV maximum.

Monotonicity Temperature Range: 0°to 70°C.

Offset and Gain Drift: Each is 0.0015% of FSR per °C, maximum.

Total Error (0°to 70°C): 0.15% of FSR, maximum.

Output Slew Rate: 10V per microsecond, resistive load.

Settling Time for FSR Change: 5 microseconds, typical with resistive load.

Full Power Bandwidth: 20 kHz with resistive load.

Ripple and Output Noise: 2.5 mV p-p, maximum, dc to 500 kHz, no load.

Fastest Update Time: 10.85 microseconds.

Programmable Update Times: 10.85 to 288.61 microseconds in 1.085 microsecond increments.

Digital Outputs

TTL Level Per Channel: One.

Load Per Channel: Ten standard TTL Loads.

Configuration Information

Computer and System Compatibility: The 12062A Interface is compatible with HP 1000 A-Series Computers and Systems that can provide it with 25 kHz ac power, as listed below.

Supporting Computers and System Processor Units		Computers that Do Not Support 12062A
2156B	2196C/D	2424A and 2426E/F
2137A	2197C/D	
2139A	2199C/D	
2434A*	2484A*	
2436A*		
2436E*	2486A*	
2437A*	2487A*	
2439A*	2489A*	

* *Requires 12159A 25 kHz Sine Wave Card*

Software Support: The 12062A interface is supported by RTE-A interface driver ID*50.

Diagnostic Support: A diagnostic test and test connector for the 12062A interface are provided in the HP 24612A A-Series Processor and Interfaces Diagnostic Package.

Installation: Set the interface's I/O address on the select code switches; turn off power to the computer; plug the interface into the computer backplane; connect an appropriate cable from the interface to the signal destinations; and integrate the interface driver into the operating system if that has not been accomplished previously.

NOTE: The I/O address setting of the interface select code switches is independent of the interface card's position in the computer backplane.

Power Requirements

1.2A (+5V) and 7.6W from 25 kHz ac power supply.

Environmental Specifications

Temperature

Operating: 0° to 55°C (32° to 131°F).

Storage: −40° to 75°C (−40° to 167°F).

Relative Humidity

5% to 95% at 40°C (104°F), without condensation.

Altitude

Operating: Up to 4.6 km (15,000 ft.).

Non-Operating: Up to 15.3 km (50,000 ft.).

Physical Characteristics

Dimensions

12062A Interface Card: 289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

12062AC Cable Length: 3 meters (9.84 ft.).

Net Weight

0.36 kg (12.75 oz).

Ordering Information

HP 12062A Analog Output Interface

The 12062A Interface includes:

1. 12062-60011 Four-Channel Analog Output interface card.
2. 12062-90001 Hardware Reference Manual.
3. 12060-90003 Programming Manual.

HP 12062A Options

001: Adds edge connector kit and extra edge connector.

020: Provides calibration software on CS/80 Cartridge Tape.

044: Provides calibration software on 270 kB microfloppy disc.

NOTE: Calibration requires an HP 12011A Extender card and an HP 3455A or equivalent Multimeter.

HP 12062AC Analog Output Cable

3 meter (9.84 ft.) cable with 9 individually shielded twisted pairs, with mating connector to 12062A interface, but unterminated at the signal output end.

16-Input/16-Output Isolated Digital I/O Interface

Measurement and Control Interfaces for A-Series Computers with 25 kHz Power

product number 12063A

The HP 12063A is a plug-in digital I/O card for sensing events or status and activating devices in measurement and control applications.

This card uses 25 kHz filtered ac power from the computer power supply to provide isolated dc power that permits isolation of the individual relay output circuits. However, the requirement for 25 kHz ac power precludes the use of the 12063A card in Micro 14 and Micro 16 (2424A and 2426E/F) Computers and requires an HP 12159A 25 kHz Sine Wave card in Micro 24, 26, 27, and 29 Computers or System Processor Units.

Features

- **16 optically-isolated digital inputs.**
- **16 isolated Form-C relay outputs.**
- **Resistor-set input voltage levels: 5 to 42V dc, 6 to 29V ac.**
- **Programmable event detection and debounce delay.**
- **Provision for relay arc suppression.**
- **On-card isolated power supply for relay coil power.**
- **Easy connection via prewired cables and optional screw termination.**

Functional Description

HP 12063A Isolated Digital I/O Card

Input: The 12063A Isolated Digital I/O Card provides 16 fully-isolated digital inputs via voltage threshold opto-couplers. Input voltage levels are set for each channel by installing appropriately valued resistors on plug-in headers (8 resistors per header = 8 channels). These headers support adaptation of the board to the specific application without soldering components directly on the board, and are easily removed for repair. Plug-in opto-couplers (supplied) can be installed in an ac position or a dc position to adapt the input channels individually to the types of inputs they will receive. For ac coupling, a plug-on jumper provided for each channel can be used to select 60 Hz ac filtering of the rectified input if desired.

Event Detection: In addition to status, any input may be user programmed to function as an event interrupt input by use of the mask, sense, and sense override registers on the card. These registers control whether the interrupt is generated on the rising edge or falling edge of the input or either (whichever occurs first). This capability is easily activated by the user by loading the appropriate pattern into the three registers. The on-card microprocessor takes over to cause the interrupt to be generated when that event occurs. User programming is required to service the interrupt.

Debounce Delay: The microprocessor also provides user programmable debounce delay up to 246 milliseconds for monitoring contact closure inputs. Debounce delay may be used in both status mode and event sense mode and applies to all inputs.

Output: Sixteen Form-C (SPDT) relay outputs are provided on the 12063A card. Both the normally open (NO) and normally closed (NC) contacts are available to users. Two removable headers provide for addition of arc suppression devices for each channel without soldering directly to the board. Arc suppression reduces noise and extends relay contact life. Each header supports 8 output channels. Plug-on jumpers select arc suppression across the NO or NC contacts. An on-card isolated power supply derived from the 25 kHz ac supply in the A-Series computer powers the relay coils. This technique minimizes coupling of relay contact noise into the computer itself. Plug-in relays are used to facilitate servicing.

HP 12063AC Cable

The 12063AC Cable provides for easy connection of your application to the 12063A. The 12063AC is a 3-meter cable prewired to the appropriate card compatible edge connector/hood assembly. Each channel is an individually shielded twisted pair for reliable performance. The "remote" end of the cable is unterminated, ready for direct wiring to the application. Alternately, the cable may be wired to the easy-to-use 12064A Termination Accessory, providing electrician-compatible heavy-duty screw terminals and a built-in wiring tray (see the 12064A data sheet, page 4-41).

User Programming

Programming of the 12063A cards uses RTE-A parallel interface I/O driver ID*50. A simple RTE EXEC call controls the card:

CALL EXEC (R/W, LU#, Data Buffer, #Data Words, Control Word)

The control words:

- Open or Close relays or read their present state.
- Read status of inputs.
- Write to the Mask Register to enable or disable event interrupt.
- Write to the Sense Register to select interrupt on rising or falling edge of digital input.
- Write to the Sense Override Register to select response to whichever edge occurs first.
- Read from the Mask, Sense, or Sense Override Register.
- Read from Interrupt Status Register.

Functional Specifications

Input

Number and Type of Inputs: 16, optically isolated.

Voltage Levels: 5 to 42V dc or 6 to 29V rms ac, user selectable on removable headers, level determined by values of resistors mounted on the headers; see level selection examples, below.

Level	Resistor Value	Threshold Voltages Turn-Off	Threshold Voltages Turn-On
5V dc	None	2.0V min.	3.4V min.
		2.8V max.	4.0V max.
12V dc	909Ω	4.3V min.	6.5V min.
		5.6V max.	8.2V max.
16V rms ac	3.48kΩ	8.1V min.	8.1V min.
		11.4V max.	11.4V max.

Debounce Timer: 0 to 246 milliseconds, user programmable with 960 microsecond resolution.

Maximum Voltage Between any Two Input Channels: 250V dc or 110V rms ac.

Minimum Detectable Input Signal ON Time (without debounce timer): 1 millisecond, with or without filter capacitor.

Minimum Detectable Input Signal OFF Time (without debounce timer): 1 millisecond, without filter capacitor, 53 milliseconds with filter capacitor.

Output

Number and Type of Outputs: 16, relay isolated, with Form-C (SPDT) contacts.

Maximum Contact Rating (UL rating at 42V peak): 1.0A at 28V dc, 1.0A at 120V rms ac.

Contact Pull-in Time: Approximately 2 milliseconds.

Contact Release Time: Approximately 3 milliseconds.

Contact Resistance: <50mΩ initially (relay only).

Insulation Resistance: $10^7\Omega$ at 250V dc.

Contact Lifetime: 10^5 operations, minimum at 1A, resistive load.

Arc Suppression Voltage Levels: User selectable on removable headers. Transient voltage suppressors are separately available from 5V and up. Arc suppression should be used with inductive loads (including long cables).

Configuration Information

Computer and System Compatibility: The 12063A interface is compatible with HP 1000 A-Series Computers and Systems that can provide 25 kHz ac power to them, as listed below.

Supporting Computers and System Processor Units		Computers that Do Not Support 12063A
2156B	2196C/D	2424A and 2426E/F
2137A	2197C/D	
2139A	2199C/D	
2434A*	2484A*	
2436A*		
2436E*	2486A*	
2437A*	2487A*	
2439A*	2489A*	

* *Requires 12159A 25 kHz Sine Wave Card*

Software Support: The 12063A interface is supported by RTE-A interface driver ID*50.

Diagnostic Support: A diagnostic test and test connector for the 12063A interface are provided in the HP 24612A A-Series Processor and Interfaces Diagnostic Package.

Installation: Set the interface's I/O address on the select code switches; turn off power to the computer; plug the interface into the computer backplane; connect an appropriate cable from the interface to the signal sources and destinations; and integrate the interface driver into the operating system if that has not been accomplished previously.

NOTE: The I/O address setting of the interface select code switches is independent of the interface card's position in the computer backplane.

Power Requirements

1.0A (+5V) and 11.4W from 25 kHz ac power supply.

Environmental Specifications

Temperature

Operating: 0° to 55°C (32° to 131°F).

Storage: −40° to 75°C (−40° to 167°F).

Relative Humidity

5% to 95% at 40°C (104°F), without condensation.

Altitude

Operating: Up to 4.6 km (15,000 ft.).

Non-Operating: Up to 15.3 km (50,000 ft.).

Physical Characteristics

Dimensions

12063A Interface Card: 289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

12063AC Cable Length: 3 meters (9.84 ft.).

Net Weight

0.54 kg (1.2 lb).

Ordering Information

HP 12063A Isolated Digital I/O Interface

The 12063A Interface includes:

1. 12063-60010 Digital Multifunction interface card.
2. 12063-90001 Hardware Reference Manual.
3. 12060-90003 Programming Manual.

HP 12063A Option 001

Adds edge connector kit and extra edge connector.

HP 12063AC Digital I/O Cable

3 meter (9.84 ft.) cable with 32 individually shielded twisted pairs, with mating connector to 12063A interface, but unterminated at the signal input/output end.

68-Circuit Termination Accessory

HEWLETT PACKARD

For Use With HP 1000 A-Series Measurement and Control Interfaces

product number 12064A

The HP 12064A Termination Accessory provides screw terminations for connection of 68 circuit lines from 12060BC, 12061AC, 12062AC, and/or 12063AC cables that connect to their respective measurement and control interface cards.

Features

- **68 circuits.**
- **Insulation displacement connection of circuits from the computer side.**
- **Heavy duty screw terminals on the field wiring side.**
- **Built-in wiring tray for field wiring.**
- **Safety door with labelling surface.**
- **19-inch EIA rack mounting.**
- **Compatible with 12060BC, 12061AC, 12062AC, and 12063AC cables.**

Description

The HP 12064A Termination Accessory provides an easy way for users of A-Series measurement and control interfaces and cables to get electrician-compatible screw terminations. Each 12064A has 68 circuit lines which can be used in any configuration the application demands. Insulation displacement connection to the computer side of each circuit assures quick and easy attachment of 12060BC, 12061AC, 12062AC, and 12063AC cables to the 12064A, speeding installation. Many combinations of 12064As and cables are possible and entirely up to the user.

On the field wiring side, heavy-duty screw terminals provide a reliable, strip-insert-tighten, gas tight (non-corrosive) connection suitable for electrical installers. Included in the assembly is a convenient wiring tray to keep the installation neat and serviceable. A removable hinged door encloses the wiring compartment, giving the final installation a safe, professional finish. The 12064A mounts easily in any 19 inch EIA rack.

Functional Specifications

Number of Circuits

The 12064A supports connection of 68 circuits.

Computer Side Terminations

Type: Insulation Displacement.
Compatible Wire Sizes: 26 to 22 gauge wire.

Field Wiring Terminations

Type: Screw Terminal.
Compatible Wire Sizes: 22 to 10 gauge wire.

Environmental Specifications

Temperature

Operating: 0° to 55°C (32° to 131°F).
Storage: −40° to 75°C (−40° to 167°F).

Relative Humidity

5% to 95% at 40°C (104°F), without condensation.

Altitude

Operating: Up to 4.6 km (15,000 ft.).
Non-Operating: Up to 15.3 km (50,000 ft.).

Physical Characteristics

Dimensions

483 mm (19 in.) wide, 121 mm (4.75 in.) deep, 89 mm (3.5 in.) high.

Net Weight

1.08 kg (2.38 lb).

Ordering Information

HP 12064A Termination Accessory

The 12064A Termination Accessory includes:

1. 12064-00001 68-Circuit Termination Accessory.
2. 12064-90001 Termination Accessory Manual.

Color Video Output Interface

HEWLETT PACKARD

HP 1000 A-Series Computer Interfaces

product number 12065A

The HP 12065A is a plug-in interface card providing full color video output capability for the HP 1000 A-Series family of real time computers.

Features

- **Graphics/1000-II Version 2.0 compatibility.**
- **Red-Green-Blue (RGB) RS-343 compatible video output.**
- **512 x 512 pixel resolution for 1 : 1 aspect ratio displays.**
- **576 x 455 pixel resolution for 4 : 3 aspect ratio displays.**
- **16 colors selected from a palette of 4096.**
- **Alphanumeric text overlay.**
- **On-card, independent blink control of each color.**
- **Polygon area fill.**
- **Scrolling capability.**
- **Two RS-232-C ports for keyboards, touch screens, and mice.**

Functional Description

The 12065A Video Output Interface provides full color video output to color displays from HP 1000 A-Series computers. The 12065A has been designed to specifically address the needs of the computer aided manufacturing marketplace. This video interface offers medium resolution and unique display features that will dramatically increase your productivity.

The card utilizes a Motorola 68008 16 bit microprocessor for system control and backplane communications. It also provides supervisory control over a specialized graphics processor, pixel memory and video circuits. Four pixel memory planes provide for two combinations of color and character capability. In one mode, three pixel memory planes are used to produce 8 colors from a palette of 4096, leaving the fourth plane for overlay of characters, cursors and prompts. In the second color mode, all four planes are used to produce 16 colors from a palette of 4096. In both modes, independent blink control of each color is possible on-card. A standard character set is provided in ROM with user specified size and orientation for maximum flexibility. In addition, the card will support user defined characters, for example, foreign languages, which can be downloaded to local RAM from the A-Series CPU.

The on-card intelligence and the DMA per I/O card A-Series architecture provide flexible drawing capabilities. In an Update mode, an existing screen is added to, either with characters or vectors, with immediate display of results. This is the mode you would use to change data or to perform limited animation, such as increasing or decreasing tank levels in a process control flow application. Using the Frame Buffer Read/Write capability, entire screens can be downloaded via DMA to pixel display memory (frame buffer) and then to the screen. The whole screen image is displayed within seconds. This feature is particularly useful in applications where several displays are used frequently as operators execute sequences of control or track down process problems flagged with alarms. Frame Buffer Reads/Writes automatically takes advantage of *flash-fill*, where data is written to display memory while the screen is continuously blanked. The screen is then unblanked to display the image. Update mode can also be configured for flash-fill to take advantage of the higher performance realized.

In general, display images used frequently will be initially created in Update mode. Once in frame buffer memory, the image will be stored in A-Series memory, or on disc, via Frame Buffer Reads. Later, the A-Series can redisplay the image using Frame Buffer Writes; additional modifications can be made in Update mode.

Finally, the 12065A also supports two RS-232-C serial ports to allow for the direct attachment of graphics input accessories. Devices like custom keyboards and keypads, touch screens, trackballs, joy sticks or mice can thus be interfaced through one graphics subsystem. This saves money and I/O slots.

Functional Specifications

Video Output

Compatible with RGB RS-343. Three BNC connectors for RED, GREEN, and BLUE.

Resolution

567 x 455 (4:3 aspect ratio) or
512 x 512 (1:1 aspect ratio).

Polygon Area Fill

8 unique styles.

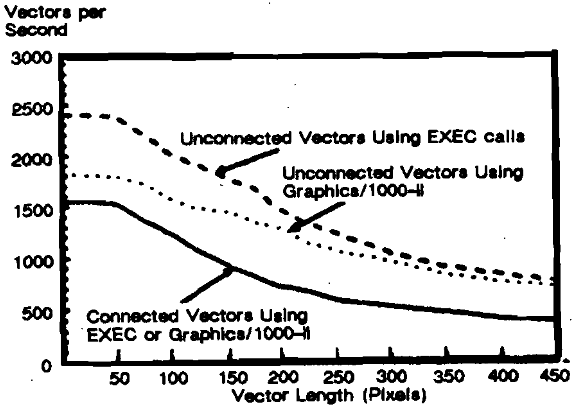
Write Modes

Flash Fill: Blanks the screen, writes vectors, pixels, and characters, then displays the screen.

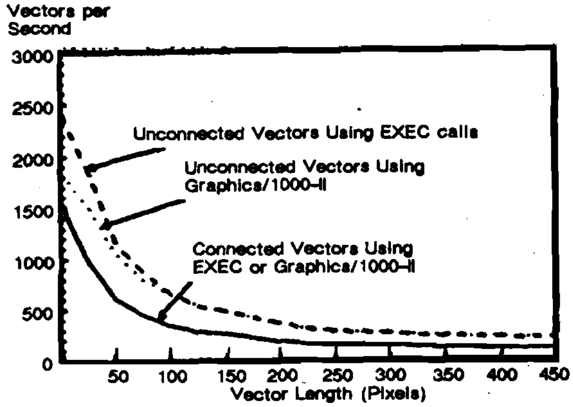
Update: Writes single characters or vectors to existing display.

Hardware Vector Generation

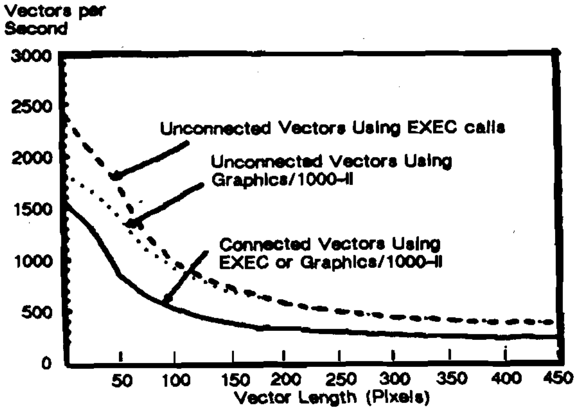
Vector Performance with Screen Blanked:



Vector Performance with 60 Hz Refresh Rate:



Vector Performance with 50 Hz Refresh Rate:



Character Display

Size: Variable.

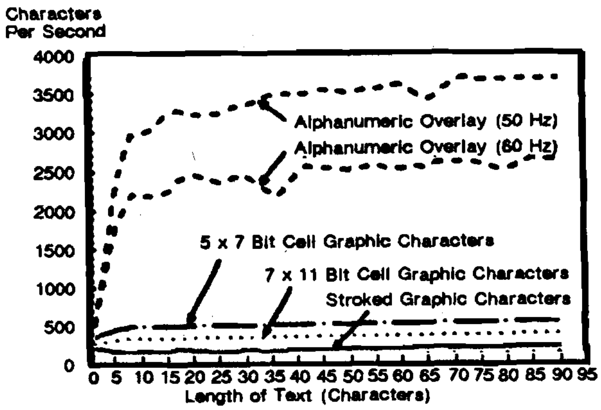
Orientation: Variable in 90 degree increments.

Standard Character Sets: Stored in on-board ROM.

User-Developed Character Sets: Downloadable to on-board RAM.

Character Field Blinking: Character field blinking support is standard.

Character Overlay Rates:



Memory Maps

Four planes partitioned as:

Three planes producing 8 colors from a palette of 4096 and 1 overlay plane for alphanumeric text.

Or

Four plans producing 16 colors from a palette of 4096

Plus

On-board blink control of all memory planes.

Scrolling Capability

The 12065A Interface supports direct pixel memory frame buffer reads and buffer writes.

Accessory Data Communication

Two three-wire RS-232-C ports with user programmable data rate to 9600 baud are provided for interfacing graphics accessories.

Configuration Information

Computer and System Compatibility: The 12065A Color Video Output Interface is compatible with all HP 1000 A-Series Computers and Systems, operating under the same environmental conditions.

Software Support: Software support for the 12065A interface is provided in the 92061A Version 2.0 Graphics/1000-II Device Independent Graphics Library.

DC Current Requirements

3.76A (+5V), 0.062 (+12V), 0.018 (−12V).

Interface Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Ordering Information

HP 12065A Color Video Output Interface

The 12065A Color Video Output Interface includes:

1. 12065-60001 Video Output interface assembly.
2. 12065-63001 Set of three 3-meter (9.84 ft.) BNC Video Output Cables.
3. 12065-90001 Video Output Interface Reference manual.
4. 12065-90003 Color Video Device Handlers manual.

HP 12065A Option 001

Adds a 3 meter (9.84 ft.) RS-232-C input cable (12065-63002) with edge connector to 25-pin female RS-232-C connector for connection of keyboard, touchscreen, or a mouse.

Self Test Loop-Back Connector

The 12065-67001 Loop-Back Connector is available for optional use with on-card self test.

Data Link Slave Interface for DS/1000-IV Communication

HEWLETT PACKARD

HP 1000 A-Series Computer Interfaces

product number 12072A

The HP 12072A is a slave interface for connecting HP 1000 A-Series Computers to the data link. This microprocessor based interface, together with 91750A DS/1000-IV software supports high-level user access between slave computers and an HP 1000 A-Series master computer connected to the Data Link via a 12092A interface. Except for remote Virtual Control Panel (VCP) access, the full set of DS/1000-IV features is supported by the 12072A interface.

Features

- **Supports slave computer access to master computer via low cost Data Link.**
- **Supports all DS/1000-IV software features except for remote Virtual Control Panel (VCP) access.**
- **Z-80 microprocessor-based intelligence.**
- **Microprocessor management of Bisync protocol and on-board data buffer, leaving more CPU capacity for processing user applications.**
- **1K byte of data memory and 4K bytes of program memory.**
- **Firmware-controlled automatic power-up self test to check interface integrity.**
- **Asynchronous communication at rates up to 19,200 bits/second.**
- **Optically isolated interface for noise immunity.**
- **Two 8-bit switch-packs to program device address, baud rate, and datacomm operating mode.**

Functional Description

Multiple Computer Access to Factory Data Link

A number of HP 1000 computers can now be connected to the Data Link, using multidropped computer connection in the DS/1000-IV network environment. Data Link is an extremely cost effective, low-speed local area network for industrial automation, control, and data collection. The link provides flexible configurability and growth potential for distributed networking needs over distances up to 4 km (2.5 miles). See the Data Link Multidrop Communication data sheet on page 5-39 for more information.

On-Board Microprocessor Off-loads Host Computer

A powerful microprocessor on the Data Link Slave interface manages routine communications processing, freeing the host computer for applications oriented tasks. The protocol used throughout the link is HP Multipoint Bisync, which is similar to IBM Bisync. Under control of on-board firmware, the microprocessor converts command words into actions, such as loading/unloading data to/from the on-board buffers and the host CPU. The microprocessor also performs the protocol generation and interpretation, error checking, and error recovery by retransmission tasks, all without the attention of the host computer.

Numerous user-programmable parameters are available to tailor the interface to specific applications and configurations, which are also managed by the microprocessor. For example, the number of retransmissions of frames in error can be set by the user, or a default of 10 may be used. Frame size is accessible, as are controllable communication line timeouts to promote maximum use and efficiency of the communication links.

Microprocessor-managed interface buffer tasks include packing bytes into words for Direct Memory Access transfers to the host CPU and unpacking words into bytes for transmission. The basic Data Link slave interface uses 4K bytes of program space and 1K byte of buffer memory, of which two 192 byte buffers are for data transmission and two 250 byte buffers are for data reception.

Firmware Controlled Self Tests

On-board, firmware-controlled self-tests, performed at power-up, help to assure reliable operation of the Data Link Slave interface and minimize troubleshooting time. These tests check out most of the LSI components, including the ROM, RAM, SIO, and CTC.

Functional Specifications

DS/1000-IV Compatibility

Operation of the 12072A slave interface is supported by 91750A DS/1000-IV software as described in the 91750A data sheet on page 5-15. All DS/1000-IV networking features are supported by the Data Link slave interface except remote Virtual Control Panel (VCP) access.

Communications

Data Link Driver Output: High level = 4V, minimum, Low level = 0.4V maximum, Differential voltage = 7.2V peak-to-peak, minimum, Drive current = 100 mA, minimum.

Internally Clocked Programmable Data Rates: 300, 600, 1200, 2400, 4800, 9600, and 19,200 bits/sec; the selected rate must be that of the slowest device on the Data Link.

Transmission Mode: Bit-serial asynchronous, half-duplex.

Error Detection and Correction: Errors are detected using CRC-16 cyclical redundancy error checking on blocks received or sent. The interface retransmits, or requests retransmission of, the block with error, to attain error free data transfer.

Configuration Information

Computer and System Compatibility: The Data Link Slave Interface is compatible with all HP 1000 A-Series Computers and Systems.

Software Support: Operation of the Data Link Slave interface is supported by HP 91570A DS/1000-IV software, as described in the DS/1000-IV data sheet on page 5-15.

Computer I/O Channels Required: One per 12072A Data Link Slave interface.

Diagnostic Support: A diagnostic test and test connector for the 12072A interface are provided in the HP 24612A A-Series Processor and Interfaces Diagnostic Package.

Counterpart Interfaces in Other HP 1000 Systems: 12092A Data Link Master Interface in A-Series systems, 12790A Multipoint (master) Interface and 12830A Data Link Slave Interface in E/F-Series systems.

Installation: Set the interface configuration switches for baud rate, device ID, and group ID. With power off, plug the interface into the computer I/O backplane, connect the supplied cable, configure the master and the slave. Connect the slave computer cable into the Data Link connector box, and power up the slave computer.

NOTE: The I/O address setting of the interface select code switches is independent of the interface card's position in the computer backplane.

DC Current Requirements

1.5A (+5V), 0.16A (+12V), 0.07A (−12V).

Interface Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Ordering Information

HP 12072A Data Link Slave Interface

The 12072A Interface includes:

1. 5061-4942 A-Series Data Link Slave Interface card.
2. 5180-1974 Data Link ROM.
3. 5061-4903 Twin 5 meter (17 ft.) Cable, terminated with a hood connector at the interface end and a 6-contact male connector at the Data Link connection box end.
4. 12072-90001 Data Link Slave Interface Reference Manual.

HP 12072A Option 001

Provides the latest Data Link ROM.

Additional Equipment Required for Operation

Data Link Slave Computer with 91750A DS/1000-IV software package. Data Link Master Computer, 3074A Data Link Adapter, Data Link cable, Data Link connection boxes, 12092A A-Series Data Link Master Interface and 91732A Data Link Software or 12790A E/F-Series Multipoint Master Interface and 91730A Multipoint Software Package. For more information, see the 12092A data sheet on page 4-61, Data Link Multidrop Communication data sheet on page 5-39, and the 91732A and 91730A data sheets on pages 5-49 and 5-53.

Bisync Interfaces for NS/1000 and DS/1000-IV Communication

HEWLETT PACKARD

HP 1000 A-Series Computer Interfaces product numbers 12073A and 12082A

The HP 12073A and 12082A are Bisynchronous (Bisync) interfaces for communication between NS/1000 or DS/1000-IV network nodes based on HP 1000 A-Series Computers and NS/3000 or DS/3000 nodes based on HP 3000 Systems. The 12073A interface is used for communication via modems and telephone lines and the 12082A is used for communication via hardwired link.

The 12073A and the 12082A are microprocessor-based interfaces that use the Binary Synchronous (BSC) protocol. The interfaces handle all BSC protocol generation, including CRC-16 error checking, on-board buffer management, and all modem control tasks (12073A interface only). In conjunction with 91790A NS/1000 or 91750A DS/1000-IV software, these interfaces support high-level user access between HP 1000 computers and HP 3000 systems, up to and including HP 3000 Series 70 systems.

Features

- **Availability of both modem and direct connect interfaces maximizes network flexibility.**
- **On-board microprocessor off-loads the computer, making possible larger networks and leaving more CPU capacity for applications processing.**
- **16K bytes of RAM memory for extensive on-board message buffering.**
- **Firmware-controlled automatic power-up self-test to help assure interface integrity.**
- **Long term communication line statistics and message logs are available through user request via DS/1000-IV software to facilitate checks of line quality and assist link troubleshooting.**
- **Bisync interface for NS/1000 or DS/1000-IV to NS/3000 or DS/3000 communication links with microprocessor management of BSC protocol, CRC-16 error checking, buffer management, DMA transfers, and modem control tasks.**
- **Data rates to 57.6K bps.**
- **12073A interface supports synchronous full duplex modems.**
- **12082A interface supports hardwired links up to 1 km (0.62 miles).**
- **12082A optically isolated input breaks ground loops, maximizing noise immunity for direct connect links.**

Functional Description

On-Board Microprocessor Off-loads Host Computer

A powerful microprocessor on the interface manages routine communications processing, freeing the host computer for applications oriented tasks. Under control of on-board firmware, the microprocessor converts command words into actions, such as establishing the communications link and loading/unloading data between the on-board buffers and the host CPU. The microprocessor also performs the protocol generation and interpretation, error checking, and error recovery by retransmission tasks, all without the attention of the host computer.

Numerous user-programmable parameters are available to tailor the interface to specific applications and configurations, which are also managed by the microprocessor. For example, from 0 to 255 retransmissions of blocks in error can be set by the user, or a default of 7 may be used. Transmission block size can also be specified.

Microprocessor-managed interface buffer tasks include packing bytes into words for Direct Memory Access transfers to the host CPU and unpacking words into bytes for transmission.

Finally, on the 12073A interface, the microprocessor handles the synchronous modem control signals.

Firmware Controlled Self Tests

On-board, firmware-controlled self-tests, performed at power-up, help to assure reliable operation of the Bisync network interface and minimize troubleshooting time. These tests check out the RAM and ROM memories, the Direct Memory Access operations, baud rate generators, and the I/O channel control.

Communication Line Statistics

Eleven long-term statistics are accumulated automatically and buffered on the interface. These statistics can be easily read by the user to help determine the quality of the communication line and to aid link troubleshooting. The eleven long term statistics are:

1. Good blocks sent.
2. Good blocks received.
3. Bad blocks received.
4. NAKs received.

5. WACKS sent.
6. WACKS received.
7. TTDs sent.
8. TTDs received.
9. Response errors.
10. Three-second timeouts.
11. Line errors.

Functional Specifications

Communications

Interface Level: EIA RS-422, Direct Connect; RS-232-C and EIA RS-449, and CCITT V.28, Modem Connect.

Internally-Clocked Data Rates: 300, 1200 , 2400, 4800, 9600, 19200, and 57600 bits/second.

Transmission Mode: Half-duplex, bit-serial synchronous.

Message Buffering: A maximum of 6432 bytes in each direction (12864 bytes total) may be buffered using the 16K byte on-board RAM memory.

Error Detection and Correction: Errors are detected using CRC-16 cyclic redundancy checking on all blocks sent or received. The interface retransmits, or requests retransmission of, all blocks with errors to attain error-free data transfer. The user can specify 0 to 255 retransmissions. If a number is not specified, the maximum number of retransmissions initiated by the interface defaults to 7.

Line Protocol: The 12073A and 12082A implement an extended subset of the IBM Binary Synchronous Communications Line protocol. They are NOT general-purpose Binary Synchronous interfaces and should be used only for HP 1000-to-HP 3000 communications links in the HP AdvanceNet environment.

European Licensing of Bisync Modem Interface

The 12073A Bisync Modem Interface has been granted an FTZ license for use in Germany and a GPO license for use in the United Kingdom.

Configuration Information

Computer and System Compatibility: The 12073A and 12082A Bisync Interfaces are compatible with all HP 1000 A-Series Computers and Systems.

Software Support: Operation of Bisync network interfaces is supported by HP 91790A NS/1000 software and HP 91750A DS/1000-IV software, as described in the respective data sheets on pages 5-1 and 5-15.

Computer I/O Channels Required: One per Bisync network interface; uses two EQTs and two LUs in the RTE-A system.

Diagnostic Support: A diagnostic test and test connectors for the 12073A and 12082A interfaces are provided in the HP 24612A A-Series Processor and Interfaces Diagnostic Package.

Compatible U.S. Modems and Communication Lines: The 12073A interface is compatible with modems listed in Table 4-5.

Table 4-5. HP 12073A Connections, Modems, and Data Rates

CONNECTION VIA	MODEM TYPE	MAX SYNCHRONOUS DATA RATE
Private Lines	Bell 209A	to 9600 bits/second
Dial-Up	Bell 212A Bell 208B	to 1200 bits/second to 4800 bits/second

European Modems: Contact local European HP sales office for information. European modems and interfaces should have approval of PTT in each country.

DC Current Requirements

12073A: 2.6A (+5V), 0.35A (+12V), 0.18A (−12V).

12082A: 2.4A (+5V), 0.31A (+12V), 0.04A (−12V).

Physical Characteristics

Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Ordering Information

NOTE: The, 12073A and 12082A interfaces are for use only in the 91790A NS/1000 or 91750A DS/1000-IV environment for HP 1000-to-HP 3000 communication links. They are not general-purpose Bisync interfaces.

HP 12073A Bisync Network Modem Interface

The 12073A Bisync Interface includes:

1. 5061-4940 A-Series Programmable Serial Modem Interface card.
2. 91750-80016 and 91750-80017 Network Firmware ROMs.
3. 5061-4914 5 meter (17 ft.) RS-232-C Modem Interface Cable
4. 5061-3425 RS-232-C Loop-Back Verifier Hood.
5. 5955-7627 Bisync Firmware Installation Manual.
6. 12042-91001 PSI Modem Connection from A-Series Computers Installation and Service Manual

HP 12073A Options

001: Provides one set of updated firmware ROMs.

002: Substitutes 5061-4923 5 meter (17 ft.) RS-449 Modem Interface Cable and 5061-4915 RS-449 Loop-Back Verifier Hood for 12073A Cable and hood (5061-4914 and 5061-3425) listed above.

HP 12082A Bisync Direct Connect Network Interface

The 12082A Bisync Interface includes:

1. 5061-4938 A-Series Programmable Serial Direct Connect Interface card.
2. 91750-80016 and 91750-80017 Network Firmware ROMs.
3. 5061-3422 5 meter (17 ft.) Direct Connect Interface Cable with a male connector. This cable, together with a direct connect cable from the HP 3000 Bisync interface, provides a complete link between the Bisync direct connect interfaces in the local HP 1000 system and the remote HP 3000 system, although extension cables made with 91712A, 91713A, or 91714A accessories may also be required.
4. 5061-3460 Direct Connect Loop-Back Verifier Hood.
5. 5955-7627 Bisync Firmware Installation Manual.
6. 12042-91002 PSI Direct Connection from A-Series Computers Installation and Service Manual

HP 12082A Option 001

Provides one set of updated firmware ROMs.

HP 12082A Accessories

91712A: Assembled 75 meter (255 ft.) extension cable with 24-pin connectors for NS/1000 or DS/1000-IV direct connections.

91713A: Pair of 24-pin cable connectors for user fabricated cable-to-cable direct connect extension cable (cable part number 8120-3096 not supplied).

91713A Opt 001: Pair of edge connectors for user fabricated card-to-card direct connect cable (cable part number 8120-3096 not supplied).

91714A: 300 meters (984 ft.) of 8120-3096 direct connect cable with 24-pin cable connectors and a connector kit for user fabricated direct connect extension cable.

NOTE: HP 8120-3096 cable is equivalent to Belden YR19169. No other cable is supported.

LAP-B Modem Interface for X.25 Communication

HP 1000 A-Series Computer Interfaces

product number 12075A

The HP 12075A is an interface for modem communication which implements the CCITT X.25 recommendation for physical interface (X.21 bis) and frame interface (LAP-B) levels. This interface provides access to packet switching wide-area networks which use the X.25 interface standards.

The 12075A interface supports the internationally adopted full-duplex Link Access Protocol-Balanced (LAP-B) protocol and handles all LAP-B protocol generation (including CCITT compatible CRC error checking), on-board buffer management, and all modem control tasks. The 12075A operates in conjunction with HP 91751A DSN/X.25 and HP 91790A NS/1000 or HP 91750A DS/1000-IV Software to support higher level user communication through a packet-switching network.

Features

- **Incorporates international recommendations for physical and frame level CCITT X.25 Packet-Switching Networks.**
- **DSN/X.25 (HP 91751A) software support.**
- **On-board microprocessor off-loads the computer, making possible larger networks and leaving more CPU capacity for processing user's applications.**
- **On-board message buffering.**
- **Firmware-controlled automatic power-up self-test checks interface integrity.**
- **Synchronous full-duplex modem support.**
- **LAP-B interface for communication link with microprocessor management of LAP-B protocol, CCITT compatible CRC error checking, buffer management, DMA transfers, and modem control tasks.**

Functional Description

On-Board Microprocessor Off-loads Host Computer

A powerful microprocessor on the interface manages routine communications processing, freeing the host computer for applications oriented tasks. Under control of on-board firmware, the microprocessor converts command words into actions, such as establishing the communications link and loading/unloading data between the on-board buffers and the host CPU. The microprocessor also performs the protocol generation and interpretation, error checking, and error recovery by retransmission tasks, all without the attention of the host computer.

Numerous user-programmable parameters are available to tailor the interface to specific applications and configurations, which are also managed by the microprocessor. For example, the number of retransmissions of a frame before error recovery can be set by the user through 91750A network software. Maximum frame size and communication line timeouts are accessible for optimizing the efficiency of each communications link.

Microprocessor managed interface buffer tasks include packing bytes into words for Direct Memory Access transfers to the host CPU and unpacking words into bytes for transmission. The microprocessor handles the synchronous modem control signals and is capable of setting or sensing additional modem control lines by software request.

Firmware Controlled Self Test

An on-board, firmware-controlled self-test performed at power-up assures reliable operation of the LAP-B network interface and minimize troubleshooting time. RAM and ROM memories, Direct Memory Access operations, baud rate generators, and the I/O drivers and receivers are tested.

Communication Line Statistics

Long-term statistics are accumulated automatically and buffered on the interface to assist in verifying the quality of the communication line and to aid link troubleshooting. Statistics are:

1. Information frames received.
2. Receiver Ready frames received.
3. Receiver Not Ready frames received.
4. Reject frames received.
5. Receive process overruns.
6. CRC errors.
7. Abort sequences received.
8. SIO chip receiver overruns.
9. Receive buffer overflows.
10. Frames with incorrect address field.
11. FRMR frames received.

Functional Specifications

Communications

Interface Level: EIA RS-232-C and EIA RS-449, and CCITT X.21 bis compatibility.

Transmission Mode: Full-duplex, bit-serial synchronous.

Internally-Clocked Data Rates: 300, 1200, 2400, 4800, 9600, 19200, and 57600 bits/second.

Externally-Clocked Data Rates: To 57,600 bits/second.

Message Buffering: 14k bytes available for data buffering.

Error Detection and Correction: Errors are detected with CCITT compatible CRC cyclic redundancy checks on all frames sent or received. The interface retransmits, or requests retransmission of all frames with errors to attain error-free data transfer. The maximum number of retransmissions is specified by the user.

12075A Interface Signals: See Table 4-6.

Table 4-6. HP 12075A Interface Signals

SIGNAL	SOURCE	DEFAULT	FUNCTION
RD	DCE	None	Receive Data
SD	DTE	None	Send Data
CS	DCE	DCE dep	Clear to Send
RS	DTE	F/W	Request to Send
TR	DTE	F/W	Data Terminal Ready
RR	DCE	DCE dep	Receiver Ready (data carrier detect)
ST	DCE	None	Send Timing (transmit clock)
RT	DCE	None	Receive Timing (receive clock)
TT	DTE	None	Terminal Timing
IC	DCE	DCE dep	Incoming Call (Ring Indicator)
DM	DCE	DCE dep	Data Set Ready
TM	DTE	DCE dep	Test Mode
LL	DTE	F/W	Local Loop-back
RL	DTE	F/W	Remote Loop-back
SQ	DCE	DCE dep	Signal Quality
SF/SR	DTE	F/W	Select Frequency/ Select Rate
IS	DTE	F/W	In Service
NS	DTE	F/W	New Signal
SRD	DCE	None	Sec. Receive Data
SSD	DTE	None	Sec. Send Data
SRS	DTE	F/W	Sec. Request to Send
SCS	DCE	DCE dep	Sec. Clear to Send
SRR	DCE	DCE dep	Sec. Receiver Ready

Where: DCE dep = Depends upon external DCE device and connection.
F/W = Set by interface firmware.

European Licensing of 12075A Interface

The 12075A LAP-B Modem Interface has been granted an FTZ license for use in Germany and a GPO license for use in the United Kingdom.

Configuration Information

Computer and System Compatibility: The 12075A LAP-B Interface is compatible with all HP 1000 A-Series Computers and Systems.

Software Support: Operation of LAP-B network interfaces is supported by HP 91751A DSN/X.25 software and HP 91790A NS/1000 and HP 91750A DS/1000-IV software, as described in the respective data sheets on pages 5-33, 5-1 and 5-15.

Computer I/O Channels Required: One per LAP-B network interface.

Compatible U.S. Modems and Communication Lines: The 12075A interface is compatible with modems listed in Table 4-7. Strapping requirements and recommendations for U.S. modems used with the 12075A are given in the LAP-B Firmware Installation Manual (5955-7625).

Table 4-7. HP 12075A Connections, Modems, and Data Rates

CONNECTION VIA	MODEM TYPE	MAX SYNCHRONOUS DATA RATE
Private Lines	Bell 201C	to 2400 bits/second
	Bell 208A	to 4800 bits/second
	Bell 209A	to 9600 bits/second
	HP 37230T*	to 9600 bits/second
Dial-Up	Bell 212A	to 1200 bits/second

* Discontinued product, listed here for reference only.

European Modems: Contact local European HP sales office for information. European modems and interfaces should have approval of PTT in each country.

12075A Installation: Set the interface configuration switch for baud rate. Set I/O address on the select code switches. With power off, plug the interface into the computer I/O backplane, connect the supplied cable to the compatible customer-furnished modem, and integrate the interface card and software into the RTE-A operating system.

NOTE: The I/O address setting of the interface select code switches is independent of the interface card's position in the computer backplane.

Interface Current Requirements

2.6A (+5V), 0.35A (+12V), 0.18A (−12V).

Interface Card Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Ordering Information

HP 12075A LAP-B X.25 Network Modem Interface

The 12075A Interface includes:

1. 5061-4940 A-Series Programmable Serial Modem Interface card.
2. 5180-7220 and 5180-7221 LAP-B Network Firmware ROMs.
3. 5061-4914 5 meter (17 ft.) RS-232-C Modem Interface Cable
4. 5061-3425 RS-232-C Loop-Back Verifier Hood.
5. 5955-7625 LAP-B Firmware Installation Manual.
6. 12042-91001 PSI Modem Connection from A-Series Computers Installation and Service Manual

HP 12075A Options

001: Provides one set of updated firmware ROMs.

002: Substitutes 5061-4923 5 meter (17 ft.) RS-449 Modem Interface Cable and 5061-4915 RS-449 Loop-Back Verifier Hood for 12007B Cable and hood (5061-4914 and 5061-3425) listed above.

LAN/1000 Link Interface to Local Area Network

HEWLETT PACKARD

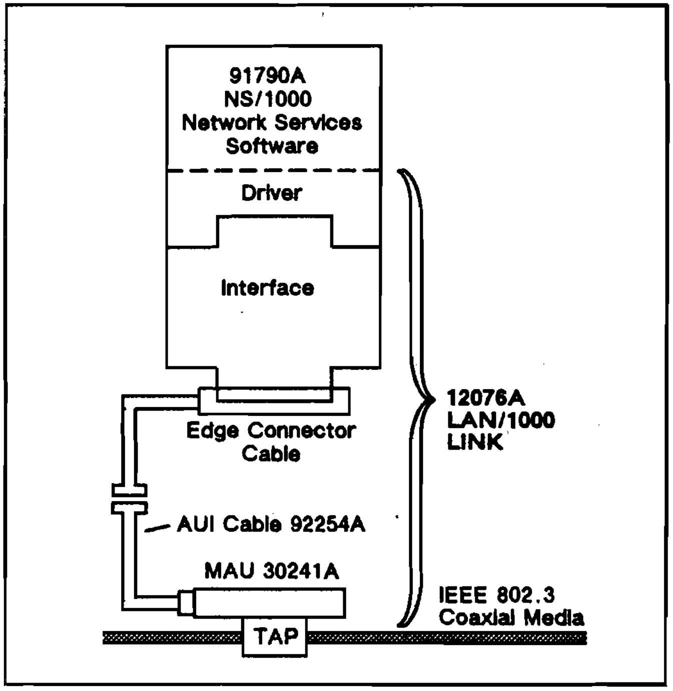
HP 1000 A-Series Computer Interfaces

product number 12076A

The HP 12076A LAN/1000 Link is an interface for connecting HP 1000 A-Series Computers to Local Area Networks (LANs). This microprocessor based interface, together with 91790A NS/1000 Network Services software, supports high-level user access between the LAN/1000 Linked HP 1000 A-Series computers and other computers on the Local Area Network, including other HP 1000 A-Series computers, HP 3000 Systems, HP 9000 computers, and DEC VAX™ computers.

Features

- **NS/1000 software supports high-level communication with other systems via the LAN/1000 Link connected Local Area Network.**
- **10M bits/second Burst Transfer Rate.**
- **Single card interface.**
- **1500 byte frame size.**
- **Operational compatibility with IEEE standard 802.3 and Ethernet Rev.1.**
- **Provides 0.5A at 12V for MAU.**
- **Provides physical signalling layer and media access control sublayer.**
- **Interface adds preamble, Source Address and CRC to transmit packets and strips preamble and CRC from receive packets.**
- **32K bytes of on-board RAM for buffering of transmit and receive packets.**
- **Ability to receive multiple back-to-back packets.**
- **Supports Multicast, Broadcast, and Individual Addressing.**
- **Collection of Link Statistics (collided packets, bad packets, etc.).**
- **On-board loopback of transmit packets addressed to self.**
- **Card configuration stored in non-volatile memory.**
- **Generation of response packets for TEST and XID packets for specific DSAP.**
- **Power-on self test.**



Functional Description

Versatile LAN Connectibility

The LAN/1000 Link product provides the interface between an A-Series computer and an IEEE 802.3 Local Area Network (LAN). The 12076A equips an A-Series computer to communicate with other computers at a 10M bits/second transfer rate along the LAN. The product consists of a printed circuit assembly, a card connector cable, an Attachment Unit Interface (AUI) cable, and an installation guide. Interface driver and node management software are structured to the RTE-A operating system (92077A), version 4.1 or later. The diagram above shows the 12076A as it connects to an IEEE 802.3 type 10 Base 5 backbone ("thick") coaxial cable. The product can also be connected to an IEEE 802.3 Type 10 base 2 ThinLAN ("thin") coaxial cable via an HP 28641A ThinMAU.

The 12076A can connect to Ethernet Rev. 1 baseband local area networks using an optional card connector cable. The LAN/1000 Link transmits and receives both IEEE 802.3 and Ethernet Rev. 1 type packets.

Capabilities

The LAN/1000 Link product provides the signaling layer and the media access control sublayer protocols as defined in the IEEE 802.3 and Ethernet Rev. 1 standards. This capability allows the interface to prepare packets for transmission by adding preamble and Cyclic Redundancy Check (CRC) transmit packets according to link access protocol, receive incoming packets addressed to the node, and check them for correctness before transmitting them to the host CPU. The LAN/1000 Link also provides diagnostic and link management functions such as self test, loopback, promiscuous mode addressing, and statistics gathering. Higher level protocols are handled by HP 91790A NS/1000 Network Services software or user's custom networking software in the host system.

For customers who prefer to use the 12076A LAN/1000 Link Interface with their own customized networking software, Hewlett-Packard offers the 12079A Direct Driver Access (DDA) product. The 12079A product provides the necessary information to interface the user's customized networking software to the driver contained in the LAN/1000 Link product.

Communication Line Statistics

As packets are transmitted and received from the link, the interface firmware tabulates occurrences of particular events and returns these counts as statistics when requested. When reading the statistics, a user has the capability of resetting them all. Good received packets, good transmitted packets, good bytes transmitted, and good bytes received, are all 32-bit unsigned integers All other statistics are 16-bit unsigned integers.

The following statistics are collected:

1. Interface firmware revision code (not resettable).
2. Total number of good bytes transmitted.
3. Total number of good bytes received.
4. Total number of good packets transmitted.
5. Total number of good packets received.
6. Total number of errors on transmit.
7. Total number of bad frames received.
8. Total number of times no heartbeat was indicated after a transmission.
9. Total number of times a packet was missed due to a lack of resources.
10. Total number of memory errors.
11. Total number of receive framing errors.
12. Number of packets discarded by driver (on card).
13. Number of packets received with a CRC error.
14. 802.3 length field errors.
15. Total number of times the transmission of a packet was completed after 2 to 15 retries.
16. Number of times exactly one retry was needed to transmit.
17. Number of times any packet was deferred while trying to transmit.
18. Total number of underflow errors on transmit.
19. Number of times the interface detected a late collision on transmit.
20. Number of times the carrier was lost when transmitting a frame.
21. Number of times the transmission of a frame failed after 16 retries.
22. TDR information from last valid TDR.

User Configurable Address

Each interface is shipped with a unique link level (node) address. In order to allow the user the most flexibility, the nodal address may be changed from the factory set address. This is an important feature for OEMs who may want their devices to have specific addresses or may not have software which can be easily updated as nodes are moved around in the network.

Remote Forced Cold Load Capability

The A-Series LAN interface supports Virtual Control Panel/Remote Forced Cold Load modes of operation. Hence, the host may be downloaded and booted from a remote node over the LAN. However, this capability is NOT supported by NS/1000. It must be implemented in user-developed software.

Functional Specifications

NS/1000 Compatibility

High level communication via the 12076A LAN/1000 Link interface is supported by 91790A NS/1000 software as described in the 91790A data sheet on page 5-1. All NS/1000 networking features are supported by the LAN/1000 Link interface except remote Virtual Control Panel (VCP) access.

General Characteristics

Network Topology: Bus.

Network Medium: Digital baseband IEEE 802.3 Type 10 base 5 backbone ("thick") coax.

Maximum Distance Between Nodes per Segment: 500 meters (excluding AUI cables).

Minimum Distance Between Nodes: 2.5 meters.

Maximum Number of Nodes: 100.

Maximum AUI Length: 42 meters.

Transmission Characteristics

Transmission Mode: Baseband Digital.

Access Methods: Carrier Sense Multiple Access with Collision Detection (CSMA/CD).

Impedance: 50Ω.

Configuration Information

Computer and System Compatibility: The LAN/1000 Link Interface is compatible with all HP 1000 A-Series Computers and Systems, operating under the same environmental conditions.

Software Support: Operation of the LAN/1000 Link interface is supported by HP 91790A NS/1000 software, under RTE-A revision 4.1, as described in the NS/1000 data sheet on page 5-1.

Computer I/O Channels Required: One per 12076A interface.

DC Current Requirements

4.5A (+5V), 0.5A (+12V), 0.38A (–12V).

Interface Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Ordering Information

HP 12076A LAN/1000 Link Interface

The 12076A Interface includes:

1. 12076-60001 LAN/1000 Link Interface card.
2. 12076-63001 802.3 Card Connector Cable.
3. 30241-60101 Medium Attachment Unit.
4. 0362-0819 Coaxial Cable Tap Kit.
5. 99254A 6 meter FEP AUI.
6. 12076-90001 Installation Manual.
7. 12076-90002 Node Manager User's Guide.

HP 12076A Options

001: Substitutes an Ethernet Rev. 1 Card Connector Cable for the standard IEEE 802.3 compatible cable. This option also deletes the AUI and the MAU. Since there are grounding differences between the two types of hardware, it is important to distinguish the type of media hardware being used at a node. If the media access hardware conforms to Ethernet Rev. 1, then Option 001 should be ordered.

002: Provides only the latest firmware EPROMs. Customers on support subscriptions will receive updates automatically.

241: Deletes the 6 meter FEP AUI cable and the Medium Attachment Unit.

NOTE: Software for Node Management interface and driver are incorporated into the 92077A RTE-A operating system, Version 4.1 or later.

Related Products

12079A Direct Driver Access provides 12079-90001 Driver Reference Manual.

28641A ThinMAU with integral 1 meter AUI cable, is available from Direct Marketing Division. This product is used to connect the 12076A interface to IEEE 802.3 Type 10 Base 2 ThinLAN coaxial cable.

30241A Medium Access Unit can be ordered separately through HP Direct Marketing Division. This product is for attachment to 802.3 backbone "thick" coax cable only.

Attachment Unit Interface (AUI) Cables are available from Direct Marketing Division. They come in various sizes up to a maximum length of 48 meters. Both PVC and Teflon cables are available. PVC should be used when the cable will be installed in a conduit. Teflon (FEP) cable should be used when installing into ceilings and walls. Due to local and municipal codes, the customer is responsible for proper cable selection. AUI cables cannot be used with the 28641A ThinMAU.

IEEE 802.3 Coaxial Cable and Installation Kits are available from Direct Marketing Division for both "thin" and "thick" coaxial cable environments. The cables are offered in lengths that have been determined to be optimum for minimizing impedance problems when connecting multiple cables.

Data Link/Multipoint Master Interface

HEWLETT PACKARD

HP 1000 A-Series Computer Interfaces

product number 12092A

The HP 12092A Data Link/Multipoint Master is a controller for the HP Data Link (HPDL) communications network, and for HP terminals connected in Multipoint configurations. It provides a low-speed, low-cost communications alternative for a large number of HP devices. The 12092A interface provides the controller capability for the HP 91732A Data Link/ Multipoint Subsystem and equips an HP 1000 A-Series Computer to act as a network controller. See the Data Link Multidrop Communication data sheet on page 5-39 and the 91732A data sheet on page 5-49 for more information.

Features

- **Multipoint protocol (similar to Bisync).**
- **Support for up to 64 terminals in a Multipoint configuration.**
- **EIA RS-232-C and CCITT V.28 compatibility.**
- **Support for RS-232-C compatible asynchronous modems.**
- **Automatic polling of up to 64 devices.**
- **Selectable data rates to 19,200 bits/second.**
- **Independent block sizes up to 2032 bytes for each device.**
- **Special character handling capabilities, including optional removal of ASCII Rs, Gs, and/or control characters from character strings.**
- **CRC-16 error check of incoming data.**
- **Configurable protocol timeouts.**
- **Built-in firmware self test to check interface integrity.**
- **Long-term statistics to facilitate checks of line quality and assist troubleshooting.**
- **Diagnostic mode with loopback hood.**

Functional Description

On-Board Microprocessor Off-loads Host Computer

A microprocessor on the interface manages routine communications processing, freeing the host computer for applications-oriented tasks. Firmware residing on the board manages the character-oriented Bisync protocol which controls all communications activity.

Automatic Polling

The interface polls all devices on its polling list, determines which has a message to be sent, and initiates transfer. When a device is selected to transfer data, detection of an error will automatically initiate a retry. When the maximum number of retries is reached, the request is aborted. The firmware will then notify the driver that the request is aborted.

Normal polling operation involves continuously scanning a list of all devices until one requests a data transfer, and then initiating the transfer. If a device is taken out of service, the list is modified to exclude it, and the device is polled at a slower rate by a separate "background" list. When it is brought back into service, the device is returned to the main list. This technique enables devices to be disconnected from the network without degrading overall performance.

Character Buffering

A unique character block size can be selected for each device on the link to attain optimum data transfer rates for each. The card contains two 2032 byte buffers for reading characters and three 2032 byte buffers for writing characters.

Communication Statistics

Major events, including successful transmission of data, NAK retries, WACK retries, successful receipt of data, TX overruns, RX overruns, TTD's received, and RVI's transmitted and received are accumulated and stored on the interface and made accessible to the user.

Firmware Controlled Self Tests

The HP 12092A has a built-in self test, initiated by power turn-on, which indicates whether the card is operating properly. Test results are displayed by an array of light emitting diodes that indicate successful completion of the test, or provide a code referencing error messages found in the firmware manual. If the included test hood is connected to the edge connector during a self test, the test includes serial input-output circuits and line drivers and receivers.

Functional Specifications

Hardware

Interface Compatibility: EIA RS-449, RS-232-C, and CCITT V.28.

Voltage Level: 5V differential.

Ground Isolation: 120V DC.

Inputs and Outputs: See Table 4-8 for standard RS-232-C lines. Front edge connectors meet RS-422 and RS-423 electrical standards, which allows compatibility with RS-232-C.

Table 4-8. Standard RS-232-C Lines

SIGNAL NAME	DCE PIN	BOARD EDGE PIN	FUNCTION
AA	1	38A	Protective Ground
AB	7	25A	Signal Ground
BA	2	8A	Transmitted Data
BB	3	23A	Receive Data
CA	4	9A	Request to Send
CB	5	17A	Clear to Send
CC	6	27A	Data Set Ready
CD	20	11B	Data Terminal Ready
CE	22	24B	Ring Indicator
CF	8	26A	Received Line
CG	21	18A	Signal Quality Detector
CH	23	28A	Data Signal Rate
DA	24	9B	Transmitter Signal Element Timing (DTE)
DB	15	20B	Transmitter Signal Element Timing (DCE)
DD	17	30B	Receive Timing Element Timing (DCE)
SBA	14	3A	Sec. Transmitted Data
SBB	16	32A	Sec. Received Data
SCA	19	7A	Sec. Request to Send
SCB	13	31A	Sec. Clear to Send
SCF	12	22A	Sec. Received Line Signal Detector

Firmware

Message Protocol: Asynchronous HP Multipoint (similar to Bisync).

Number of Devices: 64.

Data Rates, switch selectable: 19.2K, 9600, 4800, 2400, 1800, 1200, 600, and 300 bits/second. *NOTE: Multipoint configuration cannot use 19.2K bits/second.*

Message Block Sizes: 16 to 2032 message characters.

Statistics Measured: Successful transmissions, NAK retries, WACK retries, successful receipt of data, CRC errors on input.

Configuration Information

Computer and System Compatibility: The 12092A Interface is compatible with all HP 1000 A-Series Computers and Systems.

Software Support: Operation of the 12092A interface is supported by HP 91732A Data Link Software, page 5-49. Use as data link master interface in computer networks also requires HP 91790A NS/1000 software or HP 91750A DS/1000-IV software pages 5-1 and 5-15.

Computer I/O Channels Required: One per 12092A interface.

Counterpart Interfaces in Other HP 1000 Systems: HP 12072A Data Link Slave Interface in A-Series system or HP 12830A Data Link Slave Interface in E/F-Series system, either of which must be supported by 91750A DS/1000-IV network software.

DC Current Requirements

2.6A (+5V), 0.4A (+12V), 0.2A (−12V).

Interface Dimensions

289 mm (11.38 in.) long, 172 mm (6.75 in.) wide, 1.6 mm (0.063 in.) board thickness, with 10.2 mm (0.4 in.) top-of-board parts clearance and 5.1 mm (0.2 in.) beneath-board clearance.

Ordering Information

HP 12092A Data Link/Multipoint Master Interface

The 12092A Interface includes:

1. 5061-4940 A-Series Programmable Serial Interface Assembly.
2. 12092-80003 and 12092-80004 Firmware ROMs.
3. 5061-4914 5 meter (16.4 ft.) Interface Cable, terminated with a hood connector at the interface end and a 25-pin male RS-232-C connector at the DCE end.
4. 5061-4916 Test connector.
5. 12092-91001 Programmable Serial Interface Operating and Service Manual.
6. 5955-7632 12092A Firmware Manual.

HP 12092A Option 001

Provides the latest firmware ROMs and the latest 12092A firmware manual.

Table of Contents

1. Introduction

2. Software

3. Computers

4. I/O Interfaces

5. Networking

6. Host Support Software

7. Terminals

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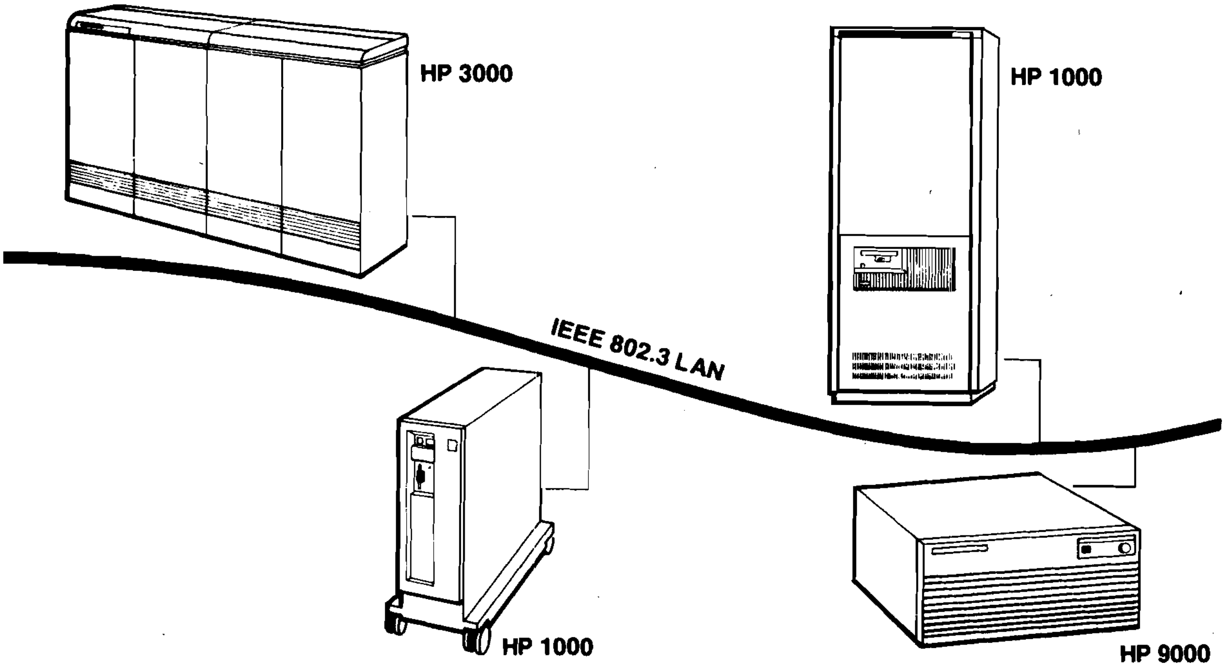
9. Printers

10. Discs and Tape Units

NS/1000
Network Services Software

HP AdvanceNet product number 91790A



Network Services for the HP 1000 (NS/1000) software is a robust set of high level networking protocols. NS/1000 is the first networking product on the HP 1000 A-Series processors to support the high speed IEEE 802.3 LAN/1000 Link product. NS/1000 is the RTE-A based version of the NS Common Services now available on the HP 3000 and HP 9000 computers. NS/1000 also provides an easy method of transferring files between processes running on the HP 1000 A-Series, HP 3000, and HP 9000 (HP-UX) computer families. NS/1000 allows processes running on HP 1000 A-Series processors to communicate on a peer-to-peer basis. NS/1000 is compatible with DS/1000-IV except in those configurations including HP Data Link.

NS/1000 is a functional superset of DS/1000-IV and is superior to the older product in the following areas:

- High speed, high reliability system-to-system communication from an HP 1000 A-Series computer to the HP 3000 and HP 9000 computer families makes implementation of distributed systems casier and more cost effective than ever before.
- HP 1000 A-Series users can now use either HP Common Services or DS/1000-IV Backward Compatible Services over the high speed IEEE 802.3 Local Area Network Link (12076A) for A-Series to A-Series communication.
- The network transport used by NS/1000 is based on the Defense Advanced Research Projects Agency (DARPA) standard Transmission Control Protocol (TCP). TCP is a byte stream oriented protocol and can deliver multiple messages before an explicit acknowledgment is required. (NS/1000 has not been certified DARPA compatible.)
- Most of the networking tables currently maintained by DS/1000-IV in System Available Memory (SAM) have been placed in a special memory partition known as Distributed SAM (DSAM). This partition is managed by its own networking optimized memory manager. This feature allows the implementation of larger networks than is possible with DS/1000-IV.

NS/1000 requires an HP 1000 A-Series computer with at least 1 megabyte of main memory, one disk drive and one of the following data communication link products:

- LAN/1000 Link
- HDLC Network Modem Interface
- HDLC Direct Connect Interface
- BSC Network Modem Interface
- BSC Direct Connect Interface
- LAP-B Network Modem Interface and X.25/1000
- Data Link/Multipoint Master Interface

Functional Description

NS/1000 functionality is the result of combining the facilities of the NS Common Services and the NS transport with the facilities of the DS/1000-IV Backward Compatible Services and its transport. Each of these facilities is described in detail below. Figure 1 shows the relationship between the NS Common Services, DS/1000-IV Backward Compatible Services and the links with which these services may be used. Not all user level services operate on all links or all systems. Please see Tables 1, 2 and 3 for a detailed description of the operational links and services.

NOTE: Table 3 outlines the link types available with the services described in Tables 1 and 2.

NS/1000 User Level Services

NS Common Services allow users of HP 1000, HP 3000, and HP 9000 (HP-UX) computers to share data. The HP Common Services available on the HP 1000 are Network File Transfer and Network Interprocess Communication.

Network File Transfer

Network File Transfer allows users to copy files between any two NS nodes on a network. The HP NFT protocol is common to all HP Network Services implementations. Files can be copied interactively or programmatically. Network File Transfer (NFT) includes features that allow users to:

- **Copy Remote Files.** Files can be copied between any two NS nodes. Using NFT at a local HP 1000 system, a user can copy files from a local node to a remote node, from a remote node to local node, and between remote nodes,
- **Copy Groups of Files.** Entire groups of files can be copied between HP 1000 and HP 3000 computers with a single command using wildcard designators. Directories can also be copied between HP 1000 computer systems.
- **Translate File Attributes.** Translation of file attributes is performed transparently and on demand when files are copied between heterogeneous systems. This means that when an RTE-A format file is copied to an HP 3000 or HP 9000 computer, the file attributes will be translated into MPE or HP-UX file format. NS/1000 accomplishes this by translating the file from RTE-A format to NS Interchange format prior to copying the file onto the target network node. Once the file has been received by the target node, the NS software running on that node translates the file from NS Interchange format to MPE, or HP-UX, format.
- **Access Remote Accounts.** Files under any account can be accessed if the user provides the correct logon and password.
- **Copy All Types of Files.** FMGR files as well as files in the hierarchical file system can be copied using NFT. Sparse files (files that are missing intermediate records) can also be copied.

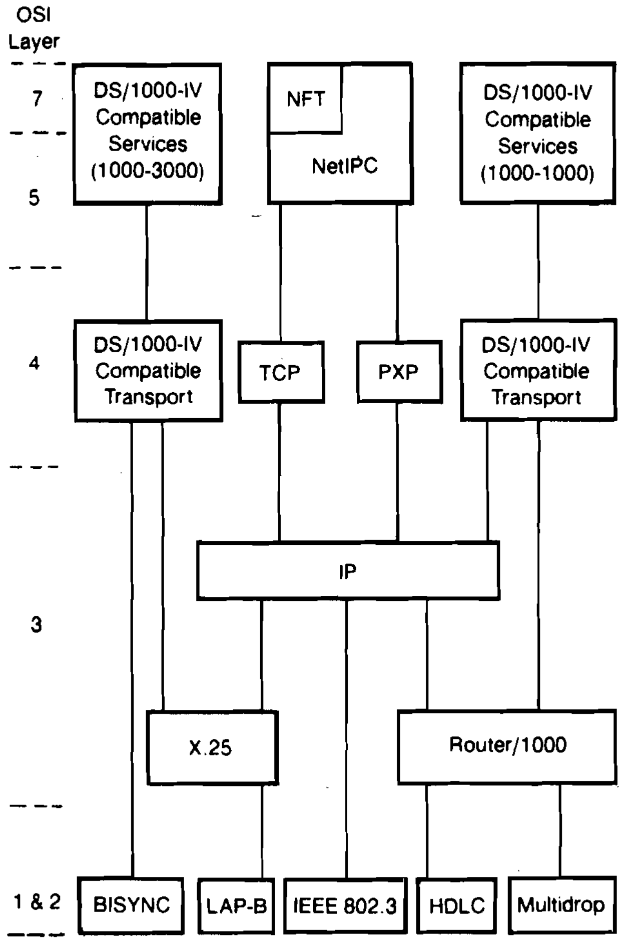

OSI Layer
7
5
4
3
1 & 2
DS/1000-IV Compatible Services (1000-3000)
NFT
NetIPC
DS/1000-IV Compatible Services (1000-1000)
DS/1000-IV Compatible Transport
TCP
PXP
DS/1000-IV Compatible Transport
IP
X.25
Router/1000
BISYNC
LAP-B
IEEE 802.3
HDLC
Multidrop

Figure 1. NS/1000 Architecture

Table 1. 91790A/R Communication Capabilities (NS Common Services)

LEGEND: Y = Yes, feature is supported by NS/1000 for this communication link. N = Feature Not supported.

NS/1000 to NS/1000	NS/1000 to NS/3000	NS/3000 to NS/1000	NS/1000 to NS/9000	NS/9000 to NS/1000	CATEGORIES AND DESCRIPTION OF FEATURES
					NETWORK FILE TRANSFER (NFT) Copy remote files. Using NFT, users can copy files from their local node to a remote node, from a remote node to a local node and between remote nodes interactively, (using DSCOPY) and programmatically.
Y	Y	Y	Y	Y	Translate file attributes. Translation of file attributes is performed transparently when files are copies between heterogeneous systems (HP-UX files transferred to the HP 1000 become type 4 files.)
Y	Y	Y	N	N	Copy groups of files. Entire groups of files can be copied between computers with a single command.
Y	N	N	N	N	Copy directories. Directories of files may be transferred between HP 1000 systems.
Y	Y	Y	Y	Y	Access remote accounts. Files in any account can be accessed if the user provides the correct security passwords and possesses the correct user attributes (i.e. account manager, system manager, super user, etc.)
Y	Y	N	Y	N	Copy all types of files. FMGR files as well as files in the hierarchical file system can be copied. Spares files (files missing intermediate records) can also be copied.
Y	Y	Y	Y	Y	Help facility. An on-line help facility is available allowing users to obtain information on any NFT command or copy descriptor option.
Y	Y	Y	Y	Y	Establish default copy descriptors to be used by subsequent DSCOPY commands.
Y	Y	Y	N	N	Set defaults for portions of subsequently issued copy descriptors.
Y	Y	Y	Y	Y	Cause commands to be echoed on the list file or list device.
Y	Y	Y	Y	Y	Change the list file or list device.
Y	Y	Y	Y	Y	Run programs from DSCOPY.
Y	Y	Y	N	N	Display all currently active copy descriptor defaults.
Y	Y	Y	N	N	Transfer control to a command file or device.
Y	Y	Y	N	Y	Display or change the current working directory.
					NETWORK INTERPROCESS COMMUNICATION (NetIPC) Peer-to-peer communication between processes running on different nodes. NetIPC allows more flexible program design than the DS/1000-IV service PTOP.
Y	N	N	N	N	Determine remote socket names. NetIPC can determine the address of a remote process given the socket name.
Y	N	N	N	N	Establish a Virtual Circuit between remote processes. When two Virtual Circuit sockets are connected, they form the virtual circuit required for peer-to-peer communication to occur.
	Y	N	N	N	Peer-to-peer interprocess communication with or without wait by the calling process. A process requesting data (client) may either suspend a waiting reply by the server process if it is busy or continue processing and retry at a later time.

Network Interprocess Communication

Network Interprocess Communication (NetIPC) allows processes at different nodes to share data and send or receive messages. NetIPC encompasses thirteen programmatic calls that can be used to identify and communicate with remote processes. Using a series of these calls, NetIPC processes running on the same or different NS/1000 nodes can communicate.

The form of process communication offered by NetIPC is more flexible than that provided by the DS/1000-IV Compatible Services' Program to Program communication (PTOP). Because the relationship between NetIPC processes is peer-to-peer rather than master-slave, NetIPC processes are more independent and flexible than PTOP processes.

NetIPC processes communicate with each other via sockets. The DARPA standard based Transmission

Control Protocol (TCP) regulates the transmission of data to and from sockets. Although data must pass through the control of lower level protocols and, if necessary, through intervening nodes, these details are transparent to NetIPC processes when they send and receive messages.

Table 2. 91790A/R Communication Capabilities (DS/1000-IV Compatible Services)

LEGEND:
Y = Yes, feature is supported.
N = Feature is Not supported.
n/a = Not applicable to this communications link
R = REMAT(Remote Command Processor Capability)
* = Node 1 and/or Node 2 can be either local or remote.

NS/1000 to NS/1000	NS/1000 to NS/3000	NS/3000 to NS/1000	CATEGORIES AND DESCRIPTION OF FEATURES
			REMOTE COMMANDS (Local operator's requests to local or remote NS/1000 nodes or HP 3000 systems.
Y	n/a	Y	Local operator can issue select RTE system commands to remote HP 1000 system. LU mapping between HP 1000s makes it possible to include running the file manager in this category.
n/a	Y	n/a	Local HP 1000 operator can issue MPE commands to remote HP 3000 system, including access to HP 3000 subsystems, such as Cobol and Query/3000.
R	Y	Y	Attach or log on to remote account.
R	N	N	Send a message to all other nodes.
R	N	N	List mounted FMGR cartridges at Node 1* on LU at node 2*.
R	N	N	Create, close, purge, or rename file at node 1*.
R	N	N	List file directory at node 1* on LU at node 2*.
R	N	N	Dump a file or LU input from Node 1* to LU at node 2*.
R	N	Y	Terminate Remote Command Processor.
R	N	N	Display local node number and both local and remote session identification numbers.
R	N	N	List file at node 1* on LU at node 2*.
R	N	N	Load absolute program from node 1* file or LU into node 2 RTE-A system.
R	N	N	List all programs resident in RTE-A system at node 1*.
R	N	N	List all program-to-program "slave" programs at node 1*.
R	N	N	Terminate a "slave" program at node 1*.

Table 2. 91790A/R Communication Capabilities (DS/1000-IV Compatible Services), continued

NS/1000 to NS/1000	NS/1000 to NS/3000	NS/3000 to NS/1000	CATEGORIES AND DESCRIPTION OF FEATURES
			REMOTE COMMANDS, continued
R	N	N	Store all records from a file or LU at node 1* to a file at node 2*.
R	N	N	Transfer execution of subsequent commands to/from specified nodes.
			REMOTE QUERY ACCESS TO IMAGE/1000 DATA BASE (Local operator's requests to Query at remote HP 1000 System)
Y	N	N	Give remote data base access name and select file name to remote Query.
Y	N	N	Create procedure file at remote node for repetitive data base access operations.
Y	N	N	Display previously created Query procedure file.
Y	N	N	Run interactive editor at remote node for editing procedure files, or run any other specified program.
Y	N	N	Delete previously created Query procedure at remote node.
Y	N	N	Locate one or a group of data item names and/or a data item.
Y	N	N	Add, change, or delete a data item(s) that have been located in the remote data base by the Query find command.
Y	N	N	Display or print out data item(s) that have been located in the remote data base by the Query find command.
Y	N	N	List remote data base structure.
Y	N	N	Explain form and purpose of specified types of Query commands or all Query commands.
Y	N	N	Terminate remote Query execution.
Y	N	N	Transfer command input to a file.
Y	N	N	Change list device.
			PROGRAM-TO-PROGRAM (PTOP) INTRINSICS (Program requests for communication between programs at local and remote HP 1000 and/or HP 3000 systems)
Y	Y	Y	From master program, initiate PTOP communications and schedule slave program in the remote node, if necessary.
Y	Y	Y	Read data block from remote program and exchange tags.
Y	Y	Y	Send data block to remote program and exchange tags.

Table 2. 91790A/R Communication Capabilities (DS/1000-IV Compatible Services), continued

NS/1000 to NS/1000	NS/1000 to NS/3000	NS/3000 to NS/1000	CATEGORIES AND DESCRIPTION OF FEATURES
			PROGRAM-TO-PROGRAM (PTOP) INTRINSICS, continued
Y	Y	Y	Exchange user-defined tag field with remote slave program for user-defined control functions.
Y	Y	Y	Disconnect remote slave program from the master and initiate its termination. control functions.
Y	Y	Y	Get next request from the remote master program.
Y	Y	Y	Accept and complete master program's. request.
Y	Y	Y	Reject master program's request.
Y	Y	Y	From slave program, terminate communication with all master programs. Communication can be re-established by the master program by re-initiating PTOP.
			REMOTE DATA BASE ACCESS (RDBA) INTRINSICS (Program requests for access to data base in a remote HP 1000 system)
Y	N	N	Initiate access to the data base.
Y	N	N	Get information on the organization and components of the data base.
Y	N	N	Locate master data set entry containing a specified key item value.
Y	N	N	Read data item values.
Y	N	N	Modify values of data in existing records.
Y	N	N	Add new records.
Y	N	N	Delete existing data records.
Y	N	N	Lock data base temporarily to provide exclusive access.
Y	N	N	Unlock previously locked data base.
Y	N	N	Close the data base files.
			REMOTE FILE ACCESS (RFA) INTRINSICS (Program requests for access to files in a remote HP 1000 or HP 3000 system)
Y	n/a	Y	Send control request to peripheral device identified at a type 0 file.
Y	Y	N	Control file or terminal device.
Y	Y	Y	Reset file to first record.
Y	Y	Y	Return file status.
Y	Y	Y	Request details on file I/O status.

Table 2. 91790A/R Communication Capabilities (DS/1000-IV Compatible Services), continued

NS/1000 to NS/1000	NS/1000 to NS/3000	NS/3000 to NS/1000	CATEGORIES AND DESCRIPTION OF FEATURES
			REMOTE FILE ACCESS (RFA) INTRINSICS, continued
Y	n/a	Y	Return status of mounted discs.
Y	Y	Y	Determine if file pair is interactive or duplicative.
			REMOTE EXEC CALLS (DEXEC) INTRINSICS (Program requests for action by executive in remote HP 1000 or HP 3000 system connected via BISYNC)
Y	n/a	Y	Read from/write to I/O device at remote system.
Y	n/a	Y	Control I/O device at remote system.
Y	n/a	Y	Terminate remote program.
Y	n/a	Y	Schedule remote program, with or without wait.
Y	n/a	Y	Request time from system clock in remote system.
Y	n/a	Y	Set execution interval or start time of remote program.
Y	n/a	Y	Request status of remote system I/O device.
Y	n/a	Y	Queue schedule remote program with wait.
Y	n/a	Y	Queue schedule remote program without wait.
Y	n/a	Y	Request partition status from remote system.
Y	n/a	Y	Request remote program status.
			DS/1000 UTILITY CALLS (Network utility program requests)
Y	N	N	Send message to remote operator's console or to remote system's message processor.
Y	N	N	Obtain node number of local system.
Y	N	N	Down-load absolute program into remote RTE-A node.
Y	N	N	Copy file from one node to another.
Y	N	N	Provide interactive access to RTE editor at remote disc-based node.
Y	N	N	Establish destination node for formatted FORTRAN I/O statements.
Y	N	N	Send command from program to remote command processor
Y	N	N	Return information on DS/1000-IV errors.

DS/1000-IV Compatible User Level Services

DS/1000-IV Compatible Services have been included in NS/1000 to provide complete backward compatibility with DS/1000-IV. Further information on DS/1000-IV (91750A/R) is available in the DS/1000-IV data sheet.

Remote File Access (RFA)

RFA allows users to perform I/O operations on files and peripherals located at remote nodes. This capability facilitates the establishment, maintenance, and use of distributed data files. RFA between DS/1000-IV nodes supports transfer of FMGR files with up to 2^{31} logical records.

Distributed Executive (DEXEC)

DEXEC allows users to control I/O devices located at remote HP 1000 computers. DEXEC calls can be used to write to, read from, control, or obtain the status of I/O devices. Other DEXEC calls can be used to request partition, and/or program status, schedule programs with or without wait, request system clock time, and to set executive interval or start time of a program.

Remote Attach (REMAT)

REMAT allows users to send RTE commands or special REMAT commands to any HP 1000 on a network. A Network Security Code is required to direct commands to a remote system, which protects the network from unauthorized access.

Program-to-Program Communication (PTOP)

PTOP allows a "master" program on one node to exchange information with and control the execution of a "slave" program on a remote node. Using high level distributed system calls, a Pascal, FORTRAN, or Assembly language program in an NS/1000 node can initiate a data exchange with a named Pascal, FORTRAN, or Assembly language program in a remote DS/1000-IV node or a FORTRAN, SPL, or Pascal program in a remote HP 3000 system. A program m the HP 3000 can also initiate the PTOP exchange.

Multiple PTOP exchanges can be active on the same network concurrently and, in DS/1000-IV nodes, one program can communicate with more than one remote node concurrently. PTOP between DS/1000-IV nodes and to HP 3000 systems supports data buffers up to 8K bytes long.

In addition to exchanging data, PTOP can be used to implement access by remote programs to IMAGE/3000 data bases. The records can be transferred to/from the remote requesting program, using PTOP intrinsics.

Remote Data Base Access (RDBA)

RDBA allows a user at a disc based system to interactively or programmatically access data in an IMAGE/1000 or IMAGE/1000-II data base. Remote access is essentially as easy as local access, since all command mnemonics and parameters are the same. The one exception is that the RU, QUERY request is issued from REMAT in the local system to the remote system and must include the node number of the local system.

DS Transparency File Access

The RTE-A hierarchical file system allows users to access a file at a remote node by including a " > " character and the node number or name in the file's name. The way in which RTE-A performs this function is by using the DS transparency capabilities included in the DS/1000-IV Compatible Services.

System Download

The System Download utility included in the DS/1000-IV Backward Compatible Services allows a user to programmatically force cold load a remote HP 1000 A-Series processor The local and remote nodes must be connected via an HDLC Link.

Virtual Control Panel

Virtual Control Panel (VCP) allows a user on an NS/1000 node to interactively access memory, load programs, perform memory dumps and break program execution on a remote node. The local and remote nodes must be connected via an HDLC Link.

NS/1000 Transport Protocol

The NS/1000 transport is based on the Defense Advanced Research Projects Agency (DARPA) Transmission control Protocol (TCP) standard. TCP provides end-to-end reliable connection oriented services with flow control and multiplexing. TCP also provides mechanisms for detecting duplicate, lost, or out-of-sequence packets. (NS/1000 has not been certified DARPA compatible.)

NS/1000 also provides a low overhead transport protocol for use by certain NetIPC intrinsics. Packet Exchange Protocol (PXP) also provides reliable connection oriented services while detecting lost or out of sequence packets. PXP does not, however, suppress duplicates as the upper level services supported by PXP do not require this capability.

NS/1000 Internet Protocol

The network layer of NS/1000 is based on the DARPA Internet Protocol (IP). IP allows network designers to implement large networks (catenets) by inter-connecting a series of smaller subnets. IP then routes messages between the subnets and performs any message segmentation and reassembly required. Segmentation and reassembly may be needed if a message must be routed through a subnet with different packet size restrictions than the source and/or destination network.

Link Interfaces

Use of NS/1000 on the HP 1000 A-Series computer family requires one of the following link interfaces:

LAN/1000 Link (12076A)

The LAN/1000 Link interface allows HP 1000 A-Series computers to communicate over an IEEE 802.3 Carrier Sense Multiple Access with Collision Detection (CSMA/CD) local area network. LAN/1000 Link is based on the IEEE 802.2/802.3 standard. The LAN/1000 Link enables an A-Series computer to communicate with other A-Series computers, HP 3000 computers, and HP 9000 computers at a data rate up to 10 megabits per second. The product consists of a printed circuit assembly which meets all the mechanical requirements for an HP-AIO device adapter, an edge connector to connect the card edge to the Attachment Unit Interface (AUI) cable, AUI cable, Medium Attachment Unit (MAU or Thin MAU), LANIC installation guide, software consisting of a driver and Node Manager Software and documentation.

HDLC Direct Connect Interface (12044A)

The HDLC Direct Connect Interface allows HP 1000 A-Series computers to communicate via the widely accepted, full duplex High Level Data Link Control protocol. The HDLC Direct Connect Interface allows two A-Series computers to communicate over distances up to 1 kilometer at data rates up to 257 kilobits per second or 2.2 kilometers at data rates up to 57.6 kilobits per second. The HDLC Direct Connect I/F supports dynamic rerouting around down nodes. The product consists of a printed circuit assembly, network firmware ROMs, two five meter direct connect interface cables, direct connect loop-back verifier hood, and documentation.

HDLC Modem Interface (12007B)

The HDLC Modem Connect Interface allows HP 1000 A-Series computers to communicate via the HDLC protocol over synchronous, full duplex modems. The HDLC Modem Connect Interface enables two A-Series computers to communicate over point to point modem links at speeds up to 19.2 kilobits per second. The HDLC Modem Connect I/F supports dynamic rerouting around down nodes. The HDLC Modem Connect Interface supports the following modem types: Bell 201C, 208A, 209A, 212A; HP 37220T, 37230A; and GDC 212A. The product consists of a printed circuit assembly, network firmware ROMs, a five meter modem interface cable, an RS-232-C loop-back verifier hood, and documentation.

HP Data Link/Multipoint Master (12092A)

The HP Data Link/Multipoint Master allows HP 1000 A-Series computers to communicate with each other and to HP terminals connected in multipoint configurations. The HP Datalink/Multipoint master supports system-to-system communication over local and remote links at data rates up to 19.2 kilobits per second. The product consists of a printed circuit card assembly, network firmware ROMs, interface cable, test connector and documentation. (Note: Only DS/1000-IV Backward Compatible Services are supported over the 12092A).

Binary Synchronous Direct Connect Interface (12082A)

The Binary Synchronous Direct Connect Interface allows an HP 1000 A-Series computer to communicate with an HP 3000 computer over distances up to one kilometer at data rates up to 57.6 kilobits per second. The product consists of a printed circuit assembly, network interface firmware ROMs, five meter direct connect interface cable, diagnostic test hood, and documentation. (Note: Only DS/1000-IV Backward Compatible Services are supported over the 12082A.)

Binary Synchronous Modem Interface (12073A)

The Binary Synchronous Modem Connect Interface allow HP 1000 A-Series computers to communicate with other A-Series computers and HP 3000 computers via synchronous, half duplex modem links. Data rates up to 9.6 kilobits per second are supported. The product consists of a printed circuit assembly, network interface firmware ROMs, five meter modem connect interface cable, diagnostic test hood, and documentation. (Note: Only DS/1000-IV Backward Compatible Services are supported over the 12073A).

LAP-B Modem Interface (12075A)

The LAP-B Modem Interface allows HP 1000 A-Series computers to communicate over public and private data networks which implement the CCITT X.25 recommendation for physical interface (X.21 bis) and frame interface (LAP-B). The LAP-B Modem Interface supports data rates up to 9.6 kilobits per second. The product consists of a printed circuit assembly, network firmware ROMs, a five meter modem interface cable, a loop-back verifier hood, and documentation. Use of this interface requires the X.25/1000 product (P/N 91751A/R).

NS/1000-DS/1000-IV Compatibility

Applications written using DS/1000-IV are compatible within certain constraints defined by Table 3. "NS" indicates that the NS Common Services Network File Transfer is available over the specified network interface. "DS" indicates that the DS/1000-IV Compatible Services are available over the specified network interface. The last two rows of Table 3 indicate which links support Remote System Download and Remote Virtual Control Panel.

Table 3. NS/1000 Supported Links and Services

	HDLC	X.25	LAN	BISYNC	DATA LINK
NS/1000 TO NS/1000	NS & DS Services	NS & DS Services	NS & DS Services	N/A	N/A
NS/1000 TO NS/3000	N/A	DS Services Only	NS Services Only	DS Services Only	N/A
NS/1000 TO DS/1000-IV	DS Services Only	DS Services Only	N/A	N/A	DS Services Only
NS/1000 TO DS/3000	N/A	DS Services Only	N/A	DS Services Only	N/A
REMOTE SYSTEM DOWN-LOAD	Yes	No	No	No	Yes
REMOTE VIRTUAL CONTROL PANEL	Yes	No	No	No	No

NS/1000 Configurations

NS/1000 network nodes can be connected using a variety of interfaces, enabling users to tailor the network for particular application needs. Local area network and point-to-point configurations are supported in the NS/1000 network environment.

LAN Connection

Using the LAN/1000 Link (12076A), HP 1000 A-Series computers can communicate with each other or with other HP NS products via a single, high speed coaxial cable. Up to 100 computers may communicate over a single LAN cable segment. The maximum distance between processors is a function of the length of the LAN cable itself (maximum length: 1500 meters, repeatered) and the length of the Attachment Unit Interface (AUI) cable which connect the LAN Interface card in the HP 1000 to the LAN cable. The maximum AUI cable length is 42 meters. The burst data rate on the LAN cable is 10 million bits per second. LAN configurations are, therefore, best suited to data collection and process control applications requiring very high throughput over limited distances.

Communication with non A-Series computers over the LAN requires that the remote system be equipped with a LAN interface and Network Services software. Specific requirements for A-Series and non A-Series processors are described in Table 4 and Figure 2.

Point to Point Connection

Point to point NS/1000 interfaces are designed to provide medium speed communication between network nodes. HDLC interfaces provide efficient, full duplex communication particularly suited for applications requiring communication to one or two other processors with low computer overhead. Interfaces are available for HP 1000 to HP 1000 connection, as well as HP 1000 to HP 3000 connection in both direct connect and modem versions. (Note: DS/1000-IV Backward Compatible Services only are available in HP 1000 to HP 3000 point-to-point configurations.) Any type of topological configuration such as a star, string, ring, or combination is supported via NS/1000 point-to-point interfaces. For specific information about using point to point interfaces, see Figure 3. For hardware data rates and specifications on each NS/1000 interface, see individual interface product data sheets in Section 4 of this handbook and the Technical Interface Products Sales Guide (P/N 5953-5007).

Table 4. HP Network Services and LAN Links

System	Network Software	LAN Link
HP 1000	NS/1000 (91790A/R)	LAN/1000 Link (12076A)
HP 3000	NS/3000 (32344A/R)	LAN/3000 Link (30242A)
HP 9000-300	NS/9000-300 (505952B)	LAN/300 (98643A)
HP 9000-500	NS/9000-500 (50953A/R or 50954A/R)	LAN/500 (27125B)
HP 9000-800	NS/9000-800 (98195A/R)	LAN/800 (98194A)
DEC/VAX Computer	NS for the DEC/VAX Computer	See FTM

X.25 Packet Switched Network NS/1000 Connections

X.25 LAP-B modem interfaces provide the physical interface (X.25 bis, level 1) and the frame interface (LAP-B, level 2) of the the CCITT X.25 recommendation. These microprocessor based interfaces handle all LAP-B protocol generation including CCITT compatible CRC error checking), onboard buffer management, and all modem control tasks. X.25 based configurations are most desirable when connecting HP 1000s to public or private X.25 packet switched networks. The bandwidth sharing nature of X.25 networks causes them to be highly cost effective wide area network solutions. For specific information on using X.25 interfaces, see Figure 4. For supported modems and X.25 software, see the X.25/1000 data sheet in Section 4 of this handbook and the Technical Interface Products Sales Guide (P/N 5953-5007).

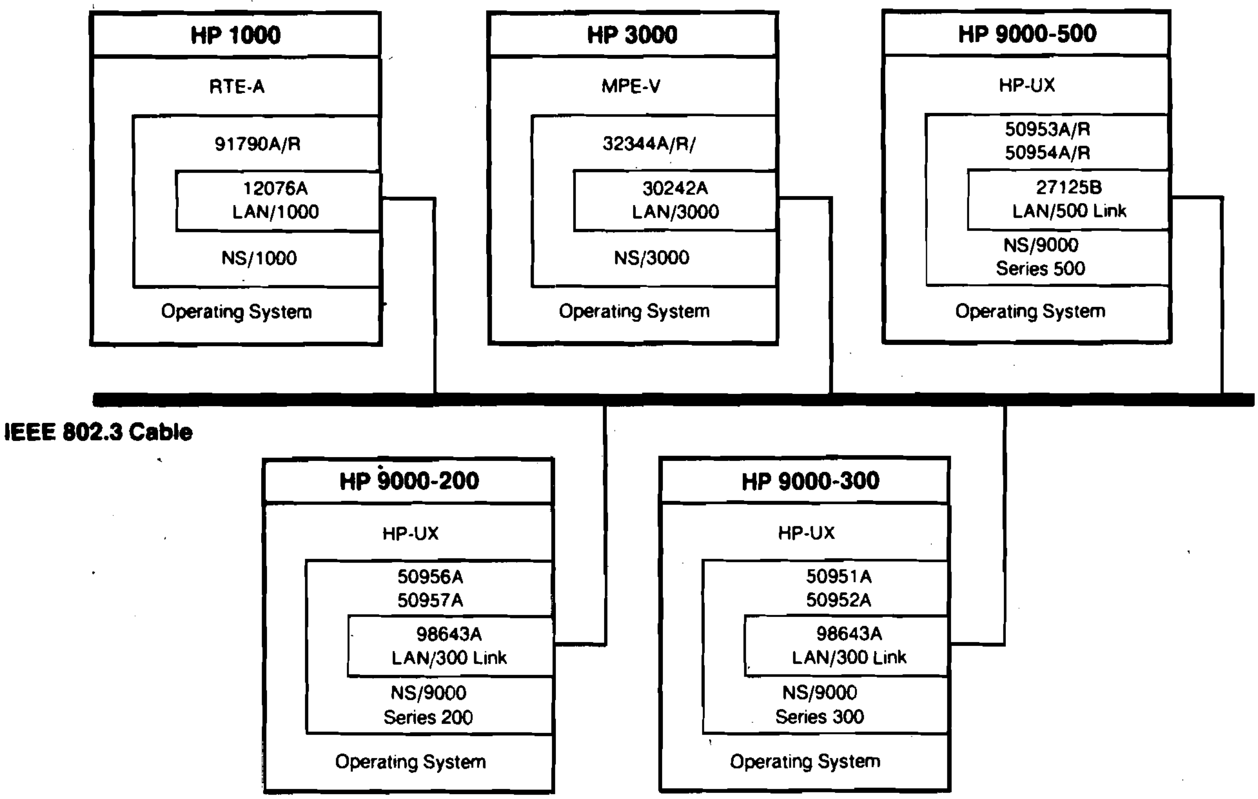

HP 1000
RTE-A
91790A/R
12076A
LAN/1000
NS/1000
Operating System
HP 3000
MPE-V
32344A/R/
30242A
LAN/3000
NS/3000
Operating System
HP 9000-500
HP-UX
50953A/R
50954A/R
27125B
LAN/500 Link
NS/9000
Series 500
Operating System
IEEE 802.3 Cable
HP 9000-200
HP-UX
50956A
50957A
98643A
LAN/300 Link
NS/9000
Series 200
Operating System
HP 9000-300
HP-UX
50951A
50952A
98643A
LAN/300 Link
NS/9000
Series 300
Operating System

Figure 2. Local Area Network Connections

Multidrop NS/1000 Connections

NS/1000 software also provides limited support of multidrop connections over the HP 1000 Data Link.NS/1000 nodes can act as the master node in a multidrop configuration based on the HP Data Link Master Interface (12092A). In this configuration, slave computers can be multidropped anywhere along the Data Link, creating a logical star network. The slave nodes must run DS/1000-IV (91750A/R) and all communication between the master node and its slaves must utilize the DS/1000-IV Compatible Services included in NS/1000. This type of configuration allows an A-Series processor on a LAN to act as a master node to a currently installed multidrop network. For specific information on HP Data Link and DS/1000-IV, refer to the individual data sheets in Section 4 of this handbook and the Technical Interface Products Sales Guide (P/N 5953-5007).

NS/1000 System Compatibility

NS/1000 Network File Transfer

NS/1000 Network File Transfer communicates with the following products:

- NS/1000 (91790A/R)
- NS/3000 (32344A/R)
- NS-ARPA Services/300 (50952B
- NS/9000-500 (50953A/R or 50954A/R)
- NS/9000-800 (98195A/R)
- NS for the DEC/VAX computer (50950A/R)

when using the NS Common Services. NS/1000 is compatible with DS/3000 (32185A/R) when using the DS/1000-IV Compatible Services (see Tables 1, 2 and 3).

Backward Compatibility with DS/1000-IV Nodes

NS/1000 is backward compatible with DS/1000-IV (91750A/R) running on HP 1000 A, M, E, or F Series computers. All communication between A-Series computers running NS/1000 and nodes running DS/1000-IV must utilize the DS/1000-IV Backward Compatible Services included in NS/1000. All communication between NS/1000 nodes and DS/1000-IV nodes must also use HDLC, LAP-B, or HP Data Link interfaces.

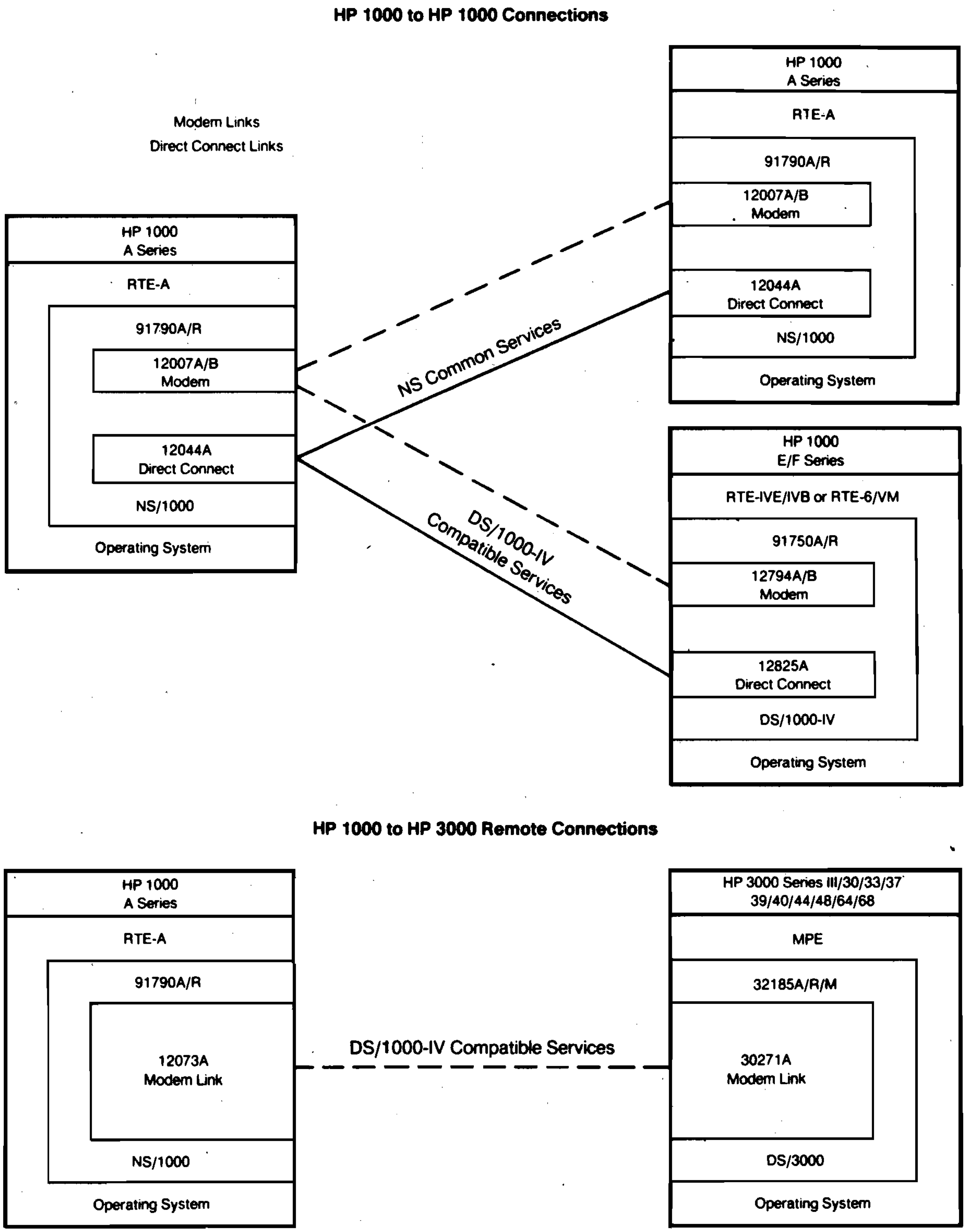

HP 1000 to HP 1000 Connections
Modem Links
Direct Connect Links
HP 1000
A Series
RTE-A
91790A/R
12007A/B
Modem
12044A
Direct Connect
NS/1000
Operating System
NS Common Services
DS/1000-IV
Compatible Services
HP 1000
A Series
RTE-A
91790A/R
12007A/B
Modem
12044A
Direct Connect
NS/1000
Operating System
HP 1000
E/F Series
RTE-IVE/IVB or RTE-6/VM
91750A/R
12794A/B
Modem
12825A
Direct Connect
DS/1000-IV
Operating System
HP 1000 to HP 3000 Remote Connections
HP 1000
A Series
RTE-A
91790A/R
12073A
Modem Link
NS/1000
Operating System
DS/1000-IV Compatible Services
HP 3000 Series III/30/33/37
39/40/44/48/64/68
MPE
32185A/R/M
30271A
Modem Link
DS/3000
Operating System

Figure 3. Point to Point NS/1000 Network Connections

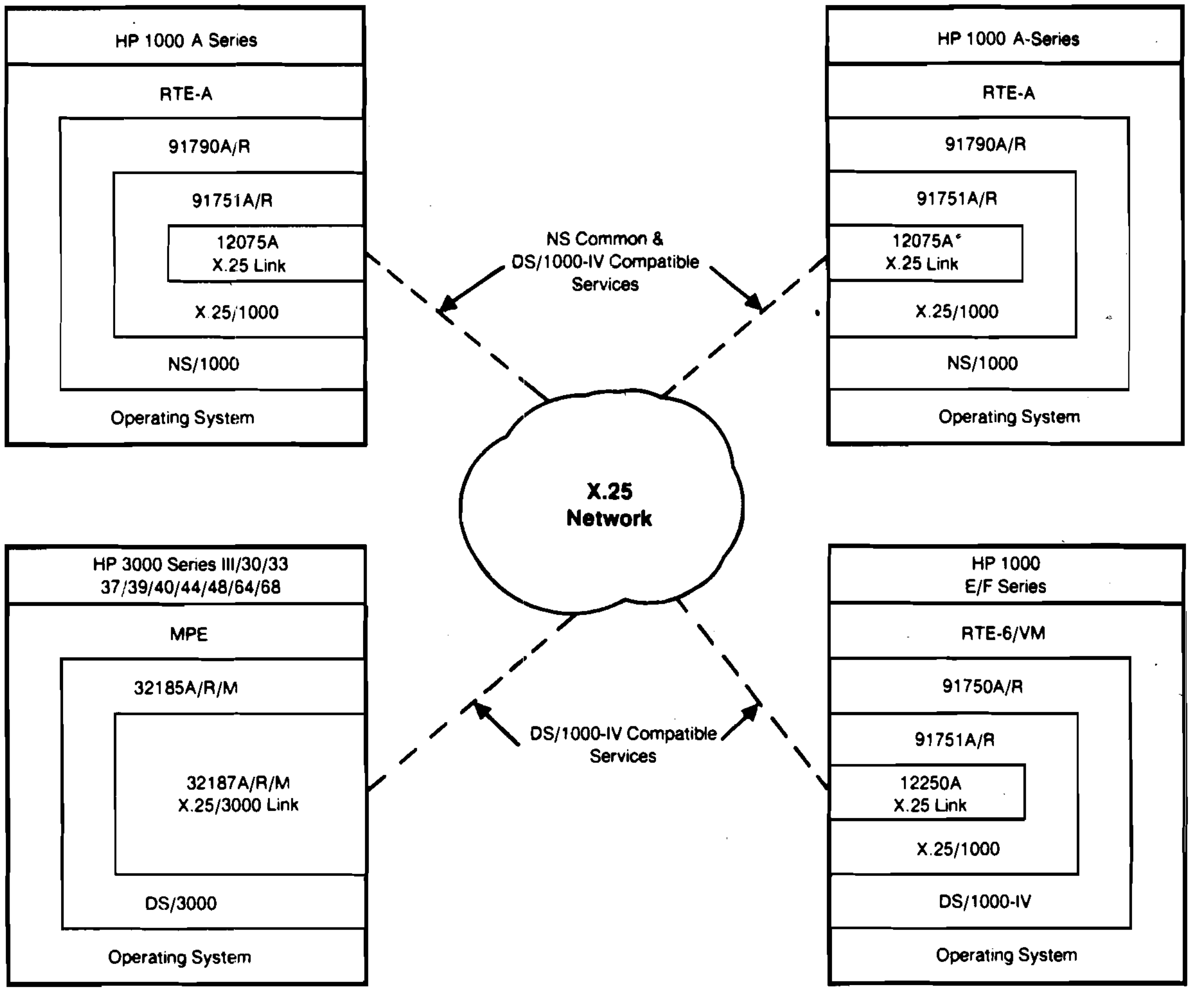

HP 1000 A Series
RTE-A
91790A/R
91751A/R
12075A
X.25 Link
X.25/1000
NS/1000
Operating System
NS Common &
DS/1000-IV Compatible
Services
HP 1000 A-Series
RTE-A
91790A/R
91751A/R
12075A*
X.25 Link
X.25/1000
NS/1000
Operating System
X.25
Network
HP 3000 Series III/30/33
37/39/40/44/48/64/68
MPE
32185A/R/M
32187A/R/M
X.25/3000 Link
DS/3000
Operating System
DS/1000-IV Compatible
Services
HP 1000
E/F Series
RTE-6/VM
91750A/R
91751A/R
12250A
X.25 Link
X.25/1000
DS/1000-IV
Operating System

Figure 4. X.25 Connections

Operating System and Hardware Requirements

HP 1000 A-Series computers running NS/1000 must be running RTE-A PCO 4.0 or later. NS/1000 requires 1 megabyte of main memory and RTE-A requires 256 kilobytes main memory. Thus, a minimal configuration for an NS/1000 node must have at least 1 megabyte of memory, HP recommends installing at least 1.5 megabytes of memory in NS/1000 nodes, All NS/1000 nodes must also have at least one disk drive attached.

A maximum of six pages of system common memory may be used when running NS/1000.

Required Software

NS/1000 requires that Virtual Code capability be available on the HP 1000. Users without Virtual Code on their systems must purchase the RTE-A VC+ System Enhancement Package (92078A/R/E). Users purchasing 91790A must purchase 92078A. Users purchasing 91790R for network nodes on which software development is done must purchase 92078R. Users purchasing 91790R for network nodes on which no software development is done should purchase 92078E. Application programs utilizing NFT or NetIPC intrinsics must be compiled with Code/Data Separation option turned on.

Customer Installation Responsibility

Customer Installation Responsibility The NS/1000 customer must assume the following responsibilities with the purchase of 91790A/R:

1. Installation of communication facilities (cables and/or modems) and their connection to the HP 1000 Computer Systems equipped with NS/1000. The establishment of successful communication between HP 1000 A-Series computer systems with NS/1000 is the customer's responsibility
2. One person in the customer's organization must be designated as the Network Manager This person will assume responsibility for configuration and generation of the customer's systems and will function as the focal point for Hewlett-Packard's support of the network.
3. NS/1000 software is a customer installed product unless it is ordered with an HP 1000 system.
4. Hewlett-Packard strongly recommends that the customer purchase Account Management Support (AMS) or Response Center Support (RCS) for NS/ 1000 and related hardware and software support products.

Ordering Information

HP 91790A HP Network Services/1000 (must order one of Use Options 400 through 897)

HP 91790A consists of:

1. NS/1000 software on software Media Option 022 or 051, **one of which must be ordered.**
2. 91790-90020 NS/1000 User/Programmer Reference Manual.
3. 91790-90030 NS/1000 Generation and Initialization Manual.
4. 91790-90031 NS/1000 Maintenance and Principles of Operation Manual.
5. 91790-90040 NS/1000 Quick Reference Manual.
6. 91790-90045 NS/1000 Error Message and Recovery Manual.
7. 5958-8523 NS Message Formats Reference Manual.
8. 5958-8563 Cross System NFT Reference Manual.
9. 5958-8564 Cross System Network Manager Reference Manual.

91790A Media Options

022: Provides software on CS/80 cartridge tape.

051: Provides software on 1600 cpi, 9-track mag tape.

91790A/R Use Options

400: Use in HP 12100A Single Board Computer, 2424A Micro 14 Computer, 2434A Micro 24 Computer, or HP 2484A Micro 24 SPU.

600: Use in HP 2106BK Board Computer, 2156B Computer, 2426E/F Micro 16 Computer, 2436A/E Micro 26 Computer, HP 2196C/D Model 26 SPU, or HP 2486A Micro 26 SPU.

700: Use in HP 2137A Computer, 2437A Micro 27 Computer, HP 2197C/D Model 27 SPU, or HP 2487A Micro 27 SPU.

890: Use in HP 2139A Computer, HP 2439A Micro 29 Computer, HP 2199C/D Model 29 SPU, or HP 2489A Micro 29 SPU.

896: Upgrade to Use Option 890 from Use Option 600.

897: Upgrade to Use Option 890 from Use Option 700.

HP 91790R Right to copy HP Network Services/1000 for Use on One Additional Computer System and Sublicense (must order one of Use Options 400 through 897)

NOTE: The HP 91790R product is available only to customers who have purchased a license to use 91790A without an upgrade option. 91790R does NOT include manuals.

Software Support

For all new customers and customers without an existing contract, the available support services include Account Management Support (AMS), Software Materials Subscription (SMS), and Response Center Support (RCS) which includes all materials (SMS) and telephone assistance through the Response Centers.

For customers choosing AMS or RCS on their operating system, NS/1000 is supported by purchasing Datacom B category support. Only one datacom category support product need be purchased for the "highest" datacom category required on a system (A = lowest, C = highest). SMS must also be purchased by customers with AMS or RCS support.

For customers choosing SMS on their operating system, NS/1000 is supported by purchasing SMS only. For additional systems, the extended datacom category support and extended SMS are used, Manual Update Service (MUS) is available as well.

Support Products Numbers

91790A+S00 Software Materials Subscription (SMS)
91790A+W00 Extended SMS (ESMS)
99086D+C00 Datacom Category B Support
99086D+V00 Extended Datacom Category B Support
99086D+Q00 Manual Update Service (MUS)

DS/1000-IV

HEWLETT PACKARD

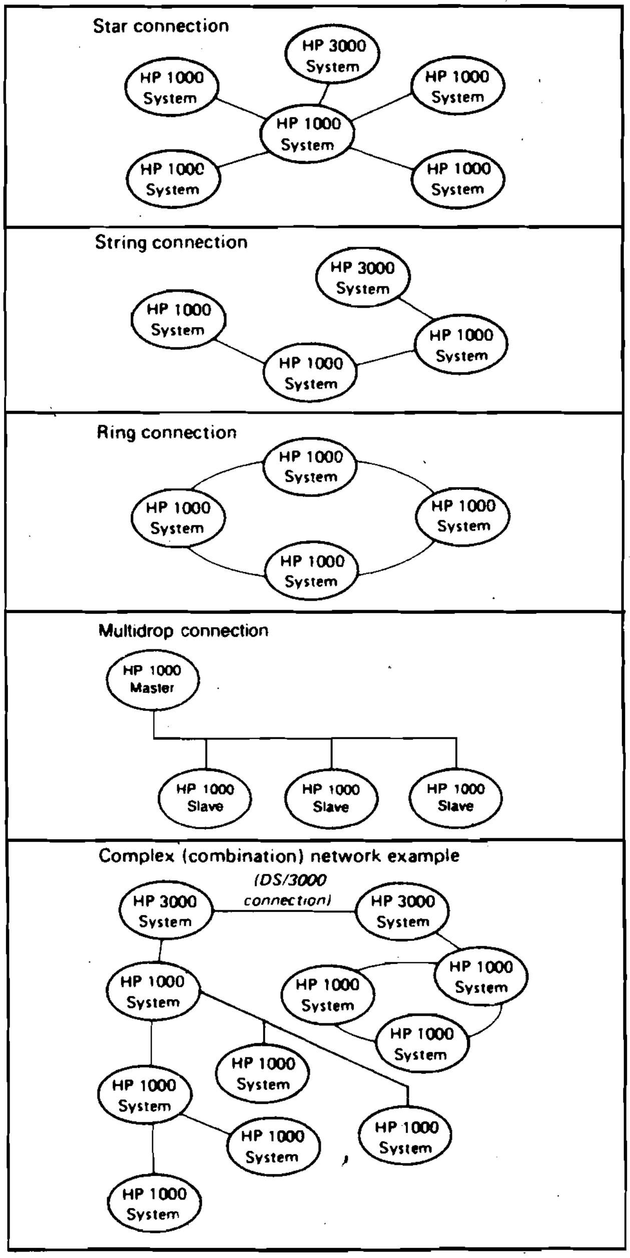
HP AdvanceNet

Product Number 91750A
For HP 1000 Computers

Distributed Systems/1000-IV (DS/1000-IV) software provides an integrated set of high-level network facilities and procedures for HP 1000 A/E/F-Series Computer Systems. These facilities and procedures support network resource sharing, remote data base access, distributed data file management, communication between application programs, and the coordinated distribution of processor workloads to other HP 1000 Computer Systems in the network and/or to HP 3000 Series III/30/33/37/39/40/44/48/64/68 Systems.

Features

- **Complete backward compatibility with 91740A/B DS/1000 nodes so applications software which runs on them may be transported and run in 91750A DS/1000-IV nodes and so that existing DS/1000 nodes can communicate with new DS/1000-IV nodes**
- **Transparent dynamic message rerouting between HP 1000 systems to bypass a "down" node or communications link**
- **Transparent Message Accounting which guarantees delivery of a message once and only once, provided a path exists between the nodes (between HP 1000 systems only)**
- **Transaction logging to facilitate network traffic analysis and fault isolation**
- **Generalized DS/1000-IV network architecture**
- **Network support of all HP 1000 Computer Series (A, E, and F) operating under RTE-A, RTE-IVE, RTE-IVB, and RTE-6/VM**
- **Full network communication with HP 3000 Series II/III/30/33/37/39/40/44/48/64/68 Systems equipped with DS/3000 software, via hardwired and modem links**
- **HP 1000 to HP 3000 communications allow multiple HP 3000 links from a single HP 1000 computer system**
- **Support for high-efficiency microprocessor-based, fully-buffered HDLC and Bisync network interfaces**
- **DS/1000-IV modem interface cards providing compatibility with the V.28 specification for European modem support**
- **Network-wide nodal addressing with store-and-forward between HP 1000 systems for maximum configuration flexibility**
- **Remote HP 1000 system generation and remote program development**
- **Remote command processing between any DS/1000-IV network nodes and between DS/1000-IV nodes and HP 3000 Systems**
- **Remote access to IMAGE/1000 data bases at HP 1000 Systems**
- **HP 1000 virtual terminal capability to HP 3000 Series III/30/33/37/39/40/44/48/64/68 Systems**
- **Remote I/O mapping enables unit-record I/O to be directed to/from any unit-record device at any HP 1000 System in the network, thereby offering substantial savings in overall network hardware costs**
- **Support for Multidrop connections using Data Link**
- **Full set of DS/1000-IV features available over X.25 Packet Switched Networks via the combination of DS/1000-IV and the X.25/1000 communication products (except DSVCP and download)**


Star connection
HP 3000 System
HP 1000 System
HP 1000 System
HP 1000 System
HP 1000 System
HP 1000 System
String connection
HP 3000 System
HP 1000 System
HP 1000 System
HP 1000 System
Ring connection
HP 1000 System
HP 1000 System
HP 1000 System
HP 1000 System
Multidrop connection
HP 1000 Master
HP 1000 Slave
HP 1000 Slave
HP 1000 Slave
Complex (combination) network example
(DS/3000 connection)
HP 3000 System
HP 3000 System
HP 1000 System
HP 1000 System
HP 1000 System
HP 1000 System
HP 1000 System
HP 1000 System
HP 1000 System
HP 1000 System
HP 1000 System

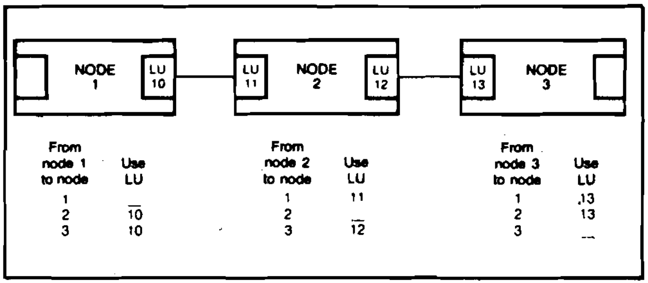
DS/1000 Network Configuration Choices

Topologically-independent network architecture

Nodal addressing (Between HP 1000 computers only)

Within a network of interconnected HP 1000 Computer Systems, each system is assigned a unique node identification number by the user. Remote operator commands and user program requests reference the number(s) of the node(s) to which they are directed.

Node numbers for DS/1000 network connections are specified after an RTE operating system has been generated and loaded. A Nodal Routing Vector (NRV), which specifies the Logical Unit (LU) number through which a DS/1000 transaction goes from the local node to the target node, can be specified interactively or read from a file at each DS/1000 node. In each node, this file specifies the logical unit connections required to get to any accessible node, as shown in Figure 1.



From node 1 to node	Use LU
1	—
2	10
3	10

From node 2 to node	Use LU
1	11
2	—
3	12

From node 3 to node	Use LU
1	13
2	13
3	—

Figure 1. Nodal Addressing in DS/1000-IV Network

Store and forward operations (Between HP 1000 Computers only)

Using the example of Figure 1, a transaction goes from node 1 to node 2 or 3 via LU10. At node 2, the DS/1000 communications management modules examine the destination node address in the message and either route the message to the local network interface monitors for processing if addressed to node 2, or forward the message to node 3 via LU12. In this way a single communications path is established between any two DS/1000 nodes, regardless of whether there is a direct, neighbor connection between them. Store-and-forward communications are not limited to a specified number of levels. However, store and forward to or through an HP 3000 system is not supported.

Nodal addressing with store-and-forward offers important advantages. Hardwired or modem links can be shared in a string or ring configuration, reducing initial costs for hardwired connections or operating costs for data communications. A program can be written, debugged, and tested in one node and then transported to any other DS/1000 node in the network while accessing the same local or remote peripheral logical units, or slave application programs. No user application programs are required to perform store-and-forward functions in any node.

DS/1000-IV Network Features

Dynamic message rerouting (DS/1000-IV to DS/1000-IV only)

In a network set up with alternate communication paths, DS/1000-IV supports dynamic rerouting of messages that are blocked by failure of a node or communications link. When a node or link failure is detected, the dynamic message rerouting software attempts to locate and set up an alternate communications path. If more than one alternate path exists, the best available route will be selected, using a relative "cost" table prepared by the network manager. As part of this operation, the originating node sends updated routing information to other network nodes. If no alternate path exists, an error message is sent to the user. When the "down" communications path is brought back up, the original message routing is automatically restored. (At "down" nodes using the 12771A and 12773A interfaces for the link, operator intervention will be required to re-enable the link.) Dynamic message rerouting can be omitted from network nodes that cannot take advantage of it, to minimize memory requirements.

Message accounting (DS/1000-IV to DS/1000-IV only)

In process control, order processing, stock re-ordering, and many other applications, it is critically important to assure that each message is received once and only once by the user level task to which it is directed. Optionally-usable DS/1000-IV subroutines provide this assurance by setting up an end-to-end protocol that both prevents duplication of messages and retransmits messages lost due to severe line failure. In addition, the message accounting function makes channel status information available to the user. Because it is optional, the message accounting function can be used selectively for only those channels that require maximum reliability, without incurring the additional memory requirements and CPU overhead for all nodes in the network.

Transaction logging and reporting

Transaction logging and reporting gives the user a powerful tool for analyzing and optimizing network traffic as well as isolation of communications link faults. With this facility enabled, all message request and reply buffers are logged on disc or magnetic tape. This includes transactions between the local DS/1000-IV node and remote nodes and/or remote HP 3000 Systems. On request, the user can have the recorded information translated, edited, and reported in a format that facilitates analysis.

Remote I/O mapping and unattended network nodes (DS/1000-IV to DS/1000-IV only)

Remote I/O mapping can be used in DS/1000-IV networks to transparently map any local unit record device to another unit record device anywhere in the network. In this way, messages that would normally be exchanged with a local CRT terminal, printer, or mag tape unit can instead be exchanged with a similar device at another node. This can significantly reduce overall network hardware and programming costs and, along with the forced cold load capability of HP 1000 A, E, and F-Series Computers, enables unattended operation.

Remote Virtual Control Panel access to HP 1000 A-Series network nodes*

DS/1000-IV includes two programs that work through the 12007A/B or 12044A A-Series HDLC interface in a neighboring A-Series network node to give an operator remote access to the Virtual Control Panel (VCP) program in that node. These programs in the accessing node provide control access to the VCP program and also monitor and display messages from the VCP program. With this capability, the remote operator can examine and change the contents of registers and memory locations, control the execution of diagnostics and other programs, and select a bootstrap loader and initiate the boot-up of the neighboring A-Series System. By making possible a considerable degree of remote fault diagnosis and maintenance, this remote VCP capability greatly enhances the supportability of completely unattended DS/1000-IV A-Series network nodes. It is important to understand, however, that remote VCP access cannot take advantage of the store-and-forward capability of the DS/1000-IV network. For that reason, remote VCP access can only be from neighboring DS/1000-IV network nodes.

Multidrop configuration using Data Link (DS/1000-IV to DS/1000-IV only)

DS/1000-IV capabilities are now available in multidrop configurations using the Data Link. The Data Link provides a flexible, low speed communication facility, allowing DS/1000-IV communication between an HP 1000 E/F-Series master computer and A-Series or E/F-Series slave computers attached to the link or between an A-Series master computer and A-Series slave computers attached to the link. The Data Link supports the full set of DS/1000-IV features (except Remote Virtual Control Panel to an A-Series computer) at a lower cost per network node than point-to-point connections.

Table 1. 91750A Network communications capabilities

LEGEND:

Y = Yes, is supported by DS/1000-IV for this communications link.
N = Not supported by DS/1000-IV for this communications link.
n/a = Not applicable to this communications link.
R = REMAT (DS/1000 Remote Command Processor) capability.
* = Node 1 and/or Node 2 can be either local or remote.

DS/1000-IV to DS/1000-IV	DS/1000-IV to DS/3000	DS/3000 to DS/1000-IV	Categories and descriptions of capabilities
			REMOTE COMMANDS (Local operator's requests to local or remote DS/1000 nodes or HP 3000 System)
Y	n/a	Y	Local operator can issue any RTE system command to remote HP 1000 system. LU mapping now makes it possible to include running the file manager in this overall capability.
n/a	Y	n/a	Local HP 1000 operator can issue MPE commands to remote HP 3000 system, including access to HP 3000 sub systems, such as Cobol and Query/3000.
R	Y	Y	Attach or log on to remote account.
R	N	N	Send a message to all other nodes.
R	N	N	List mounted cartridges at node 1* on LU at node 2*.
R	N	N	Create, close, purge, or rename file at node 1*.
R	N	N	List file directory at node 1* on LU at node 2*.
R	N	N	Dump a file or LU input from node 1* to LU at node 2*.
R	N	Y	Terminate remote command processor.
R	N	N	Display local node number and both local and remote session identification numbers.
R	N	N	List file at node 1* on LU at node 2*.
R	Y	N	Change local list or log device.
R	N	N	Load absolute program from node 1* file or LU into node 2 RTE-A system.
R	N	N	List all programs resident in RTE-A system at node 1*.
R	N	N	List all program-to-program "slave" programs at node 1*.
R	N	N	Terminate a "slave" program at node 1*.
R	Y	N	Store all records from a file or LU at node 1* to a file at node 2*.
R	N	N	Transfer execution of subsequent commands to/from specified nodes.
R	Y	N	Send message to operator at node 1*.
R	Y	N	Transfer control of remote command processing to file or LU at a DS/1000 node.
			REMOTE QUERY ACCESS TO IMAGE/1000 DATA BASE (Local operator's requests to Query at remote HP 1000 System)
Y	N	N	Give remote data base access name and select file name to remote Query.
Y	N	N	Create procedure file at remote node for repetitive data base access operations.
Y	N	N	Display previously-created Query procedure file.
Y	N	N	Run interactive editor at remote node for editing procedure files, or run any other specified program.
Y	N	N	Delete previously-created Query procedure at remote node.
Y	N	N	Locate one or a group of data item names and/or data item.
Y	N	N	Add, change, or delete a data item(s) that have been located in the remote data base by the Query find command.
Y	N	N	Display or print out data item(s) that have been located in the Query data base by the find command.

** Because the 12007A/B or 12044A A-Series HDLC interfaces are required for remote VCP operation, this feature is not available on Multidrop DS/1000-IV connections using the 12072A A-Series interface and DSN/X.25 connections.*

Table 1. 91750A Network Communications Capabilities (Continued)

DS/1000-IV to DS/1000-IV	DS/1000-IV to DS/3000	DS/3000 to DS/1000-IV	Categories and descriptions of capabilities
			REMOTE QUERY ACCESS TO IMAGE/1000 DATA BASE (Local operator's requests to Query at remote HP 1000 System) (continued)
Y	N	N	List remote data base structure.
Y	N	N	Explain form and purpose of specified types of Query commands or all Query commands.
Y	N	N	Terminate remote Query execution.
Y	N	N	Transfer command input to a file.
Y	N	N	Change list device.
			PROGRAM-TO-PROGRAM (PTOP) INTRINSICS (Program requests for communication between programs at local and remote HP 1000 and/or HP 3000 systems)
Y	Y	Y	From master program, initiate PTOP communications and schedule a slave program in the remote node, if necessary.
Y	Y	Y	Read data block from remote program and exchange tags.
Y	Y	Y	Send data block to remote program and exchange tags.
Y	Y	Y	Exchange user-defined tag field with remote slave program for user-defined control functions.
Y	Y	Y	Disconnect remote slave program from the master and initiate its termination.
Y	Y	Y	Get next request from the remote master program.
Y	Y	Y	Accept and complete master program's request.
Y	Y	Y	Reject master program's request.
Y	N	Y	From slave program, terminates communication with all master programs. Communication can be re-established by the master program by re-initiating PTOP.
			REMOTE DATA BASE ACCESS (RDBA) INTRINSICS (Program requests for access to data base in a remote HP 1000 system)
Y	N	N	Initiate access to data base.
Y	N	N	Get information on the organization and components of the data base.
Y	N	N	Locate master data set entry containing a specified key item value.
Y	N	N	Read data item values.
Y	N	N	Modify values of data in existing records.
Y	N	N	Add new records.
Y	N	N	Delete existing data records.
Y	N	N	Lock data base temporarily to provide exclusive access.
Y	N	N	Unlock previously locked data base.
Y	N	N	Close the data base files.
			REMOTE FILE ACCESS (RFA) INTRINSICS (Program requests for access to files in a remote HP 1000 or HP 3000 system) (Continued)
Y	n/a	Y	Send control request to peripheral device identified as type 0 file.
Y	Y	N	Control file or terminal device.
Y	Y	Y	Reset file to first record.
Y	Y	Y	Return file status.
N	Y	N	Request details on file I/O status.
Y	n/a	Y	Return status of mounted discs.
N	Y	N	Determine if file pair is interactive or duplicative.
			REMOTE EXEC CALLS (DEXEC) (Program requests for action by executive in remote HP 1000 or HP 3000 system)
Y	n/a	Y	Read from or write to I/O device at remote system.
Y	n/a	Y	Control I/O device at remote system.
Y	n/a	Y	Terminate remote program.
Y	n/a	Y	Schedule remote program with or without wait.
Y	n/a	Y	Request time from system clock in remote system.
Y	n/a	Y	Set execution interval or start time of remote program.
Y	n/a	Y	Request status of remote system I/O device.
Y	n/a	Y	Queue schedule remote program with wait.
Y	n/a	Y	Queue schedule remote program without wait.
Y	n/a	Y	Request partition status from remote system.
Y	n/a	Y	Request remote program status.
			DS/1000 UTILITY CALLS (Network utility program requests)
Y	N	N	Send message to remote operator's console or to remote system's message processor.
Y	N	N	Obtain node number of local system.
Y	N	N	Down-load absolute program into remote RTE-A, or RTE-IVE node.
Y	Y	N	Copy file from one node to another.
Y	N	N	Provide interactive access to RTE editor at remote disc-based node.
Y	N	N	Establish destination node for formatted FORTRAN I/O statements.
Y	N	N	Send command from program to remote command processor.
Y	N	N	Return information on DS/1000-IV errors.

DS/1000-IV Communication over X.25 Packet Switched Networks

DS/1000-IV Networking Software can now be utilized over public or private X.25 Packet Switched Networks. This new connection to X.25 networks can provide:

- Potential communications cost savings with X.25 connections, since costs are proportional to the volume of data transmitted
- Increased communications reliability inherent in X.25 Public Packet Switched Networks
- Increased network flexibility with fewer connections required for geographically dispersed networks
- Communication with HP 3000s connected via DS/3000 and X.25/3000 to X.25 networks

All DS/1000-IV features (except A-Series remote front panel, system download, and forced cold load) are supported over X.25 packet switched network connections. The same DS/1000-IV user interface is maintained for all DS/1000-IV connections including point-to-point, multidrop Data Link, and X.25 packet switched networks. This stable and common user interface allows programs to be written independent of the network topology and particular transport layer utilized.

For operation of DS/1000-IV over X.25 packet switched networks, the X.25/1000 Communication Software product (91751A) must be purchased for use with DS/1000-IV (X.25 capability is NOT bundled with the 91750A DS/1000-IV software package).

For more information on the X.25/1000 Communication product, refer to the 91751A X.25/1000 data sheet.

DS/1000-IV capabilities

DS/1000-IV capabilities with respect to communication with other HP 1000 Systems and with HP 3000 Systems are summarized in Table 1, and discussed in the following paragraphs.

Remote command processing

DS/1000-IV to DS/1000-IV. DS/1000-IV remote command processing makes it possible for a user at a local terminal to interactively access any HP 1000 system in the DS/1000-IV network, via the nodal addressing and store-and-forward capabilities of DS/1000-IV. The local operator can use the entire RTE command set of the remote node as well as special network-oriented commands provided by the DS/1000 remote command processor, REMAT, which provide the capabilities tagged by R's in the DS/1000-IV to DS/1000-IV column of Table 1. A Network Security Code (NSC) is required to direct commands to a remote system, which protects the network from unauthorized access. Remote command processing is initiated as easily as:

```
RU,REMAT
$SW,N1,N2,NSC
```

This two-command sequence runs REMAT and directs subsequent RTE and/or REMAT commands to Node 1 (N1) or from Node 1 (N1) to Node 2 (N2). The accompanying Network Security Code (NSC) is always required to run REMAT, but not thereafter. By providing for Node 1 to Node 2 actions, DS/1000-1000-IV remote command processing supports the direction of activities at unattended DS/1000-IV nodes.

HP 1000 virtual terminal to HP 3000. The operator at an HP 1000 system communicating with an HP 3000 system can execute local HP 3000 MPE commands. The HP 1000 system thereby becomes a virtual HP 3000 terminal, gaining access to facilities not available on the HP 1000, such as the COBOL compiler and Query/3000. Security is controlled by the requirement for an account (and, optionally, a password) in the HELLO sign-on command addressed to the HP 3000. Access to the HP 3000 from the HP 1000 is obtained by these three simple commands:

```
RU,RMOTE
$SW
#HELLO (account)
```

HP 3000-to-DS/1000-IV. An operator at an HP 3000 system using DS/3000 can execute any RTE system command, which supports control of an unattended HP 1000 satellite system.

Remote data base access between HP 1000 Systems

Remote Query access now makes it possible for an operator at a memory-based or disc-based system to interactively access data in a 92069A Image/1000 or 92081A Image/1000-II data base in a remote HP 1000 System operating under RTE-A, RTE-IVB or RTE-6/VM. Remote access is essentially as easy as local access, since all command mnemonics and parameters are the same. The one exception is that the RU, QUERY request is issued from REMAT in the local system to the remote system and must include the node number of the local system.

Remote access from programs is accomplished with similar ease and can access both 92069A and 92081A data bases. All data base access calls, both local and remote, include an IBASE array parameter. The only difference between a local data base call and a remote one is that one of the words in the IBASE array in the DBOPN call for remote access contains the node number of the system whose data base is to be accessed. This provides total program transportability among systems in the DS/1000 network and supports network-wide data base data entry and retrieval with respect to one or several data bases.

Program-to-Program data exchange (PTOP)

Using high-level distributed system calls (Table 1), a Pascal, FORTRAN, or Assembly language program in a DS/1000-IV node can initiate a data exchange with a named Pascal, FORTRAN, or Assembly language program in a remote DS/1000-IV node or a FORTRAN or SPL program in a remote HP 3000 System. A program in the HP 3000 can also initiate the PTOP exchange.

Multiple PTOP exchanges can be active on the same network connection concurrently, and in DS/1000-IV nodes one program can communicate with more than one remote node concurrently. PTOP between DS/1000-IV nodes and to HP 3000 Systems supports data buffers up to 8k bytes long.

In addition to its use for exchanging data to be processed, the PTOP capability can be used to implement access by remote programs to Image/3000 data bases. The records can be transferred to/from the remote requesting program, using PTOP intrinsics.

Remote file access

High-level DS/1000-IV calls analagous to standard RTE-FMP or FS/3000 calls can be used by Pascal/FORTRAN/Assembly language programs in HP 1000 Systems and FORTRAN/SPL programs in HP 3000 Systems to define, access, control, and query the status of named files in a remote DS/1000 node or HP 3000 System. This capability facilitates the establishment, maintenance, and use of distributed data files using the intrinsics described in Table 1. Remote file access between DS/1000-IV nodes supports transfers of very large files, with up to 2^{31} logical records.

Remote calls to the RTE system executive

Pascal/FORTRAN/Assembly language programs in a DS/1000-IV node or FORTRAN/SPL programs in an HP 3000 System can make calls to the system executive in a remote DS/1000-IV node to write to, read from, control, or get status of I/O devices. Other calls can be used to request partition and/or program status, schedule programs with or without wait, request system clock time, and to set execution interval or start time of a program. A single DS/1000-IV node can concurrently service multiple system executive request calls which are listed in Table 1.

Remote FORTRAN read/write (DS/1000-IV to DS/1000-IV only)

The FORTRAN formatter for RTE systems supports locally programmed FORTRAN read/write statements to read from or write to any logical unit (LU) specified peripheral device at any specified remote node, with programming as simple as:

```
C WRITE A MESSAGE ON LU6 AT NODE 21
    OPEN (UNIT=1,NODE=21)
    WRITE(6,10)
  10 FORMAT(``DS/1000 SUPPORTS REMOTE
            FORTRAN I/O'')
```

With LU mapping set up, remote FORTRAN read/write is even simpler, since the OPEN call is not necessary.

Remote DS/1000-IV node system generation

Operating systems for RTE-A, RTE-IVB, RTE-IVE, or RTE-6/VM based DS/1000-IV nodes can be generated at a single RTE-A, RTE-IVB, or RTE-6/VM based DS/1000-IV node and copies distributed using REMAT and loaded locally. RTE-A and RTE-IVE systems can also be generated elsewhere and loaded directly into neighboring RTE-A or RTE-IVE based nodes from RTE-A, RTE-IVB or RTE-6/VM based DS/1000-IV nodes using the built-in DS loader on the A/L-Series processor in the RTE-A based system or the Communications Bootstrap Loader in the RTE-IVE based system.

It is most convenient to generate all systems at one RTE-A, RTE-IVB or RTE-6/VM based node and send system files through the network to the node in which they will reside. The same gen file can be sent to several RTE-A, RTE-IVB or RTE-6/VM nodes at which each would be switched and, if necessary, slow booted for the appropriate memory and I/O configuration. With disc-based RTE-A nodes, the gen file can be sent to the system disc using REMAT and later loaded from the local file. For RTE-IVE nodes and memory based RTE-A nodes, the gen file can be sent to a neighboring disc-based node and stored in a file on the disc there for later loading into the memory-based node. Optionally, the gen file can be downloaded from a non-adjacent node by utilizing store and forward.

Remote DS/1000-IV node program development

Program development for an entire DS/1000-IV network of HP 1000 systems can be accomplished at a single DS/1000-IV node. At an RTE-A, RTE-IVB, or RTE-6/VM node, programs for other DS/1000-IV nodes can be developed on-line, relocated off-line, and loaded on-line into other RTE-A or RTE-IVE nodes by operator command or program call. If necessary, these programs can be relocated into RTE-IVB or RTE-6/VM nodes by operator command. At an RTE-IVB or RTE-6/VM node, programs can be developed and relocated on-line and loaded into any target RTE-IVE node using an operator command or program call. Programs can also be relocated into any target RTE-IVB or RTE-6/VM node by operator command.

Network utilities (DS/1000-IV to DS/1000-IV)

Network utilities provide single-call programming for such network tasks as sending messages to remote DS/1000-IV nodes, retrieving local node numbers, copying files from any DS/1000-IV node to any other DS/1000-IV node, and retrieving any DS execution errors. The interactive RTE Editor can be run at remote RTE-A, RTE-IVB or RTE-6/VM nodes. These capabilities make the network manager's and application programmer's jobs easier.

Remote sessions under RTE-IVB and RTE-6/VM

Remote access to a DS/1000-IV node operating under RTE-IVB or RTE-6/VM with Session Monitor is possible with the same control as a local session at that node. Session Monitor access control requires all users, including remote users, to log on under a pre-defined user name that has been given specific capabilities by the system manager. All RFA, DEXEC, PTOP, and operator command access to a remote RTE-IVB or RTE-6/VM Session Monitor node thus requires a prior log-on. This is accomplished in one of the following ways:

1. Utility program DLGON that creates a specific remote, non-interactive session, or
2. REMAT "ATTACH" command, or
3. REMAT "SWITCH" command, with a user-name qualifier appended to the requested node number, or
4. HP 3000 REMOTE HELLO command, or
5. No specific assignment request; if no specific session log-on has been issued, the system will set up a session for the default user name that was specified during network initialization.

Once logged on, each user is assigned a unique session ID, which is that user's key to access the remote node. A user can have a session at any of up to 16 different HP 1000 nodes. Sessions are non-interactive in the sense that remote session (FMGR) commands to the remote node are not supported. However, REMAT commands are supported and can be used to remotely perform various program development and program testing tasks, or to remotely run applications. Because remote session commands are not supported, and because there is no REMAT-type support in the HP 3000 environment, HP 3000 virtual terminal access to a remote HP 1000 session is not supported.

All accessed files must reside on an existing and mounted private, group, or system disc cartridge. "System discs" also include session monitor global discs, which can be read/written by any user in the system.

A default account can be set up for use by all requesting nodes that do not explicitly log on. "Old" nodes (those using 91740A/B DS/1000 Network software-firmware) will be assigned to a single shared default session, which, once created, will be permanently active. Old node shared access to this session will appear to the user as a non-session monitor system.

DS/1000-IV to DS/1000-IV network description

Layered architecture

The DS/1000-IV software and hardware for DS/1000-IV to DS/1000-IV connections in each system, or network node, consists of several layers, as shown in Figure 2. The Network Service Intrinsics are called by the user's application programs or operator commands to generate the transaction format for master requests to remote nodes, with data as required. The master requests generated are those for PTOP, RFA, DEXEC, Remote operator command, and utility program capabilities described in Table 1.

The Network Interface Monitors process incoming master requests received from Communications Management software (CM) and link them as required to user's slave PTOP programs, file management routines or the RTE EXEC. The CM layer routes network transactions, queues them, and manages the local system resources necessary for network communications. CM also manages the store-and-forward operations, and dynamic message re-routing and message accounting if these optional capabilities are used.

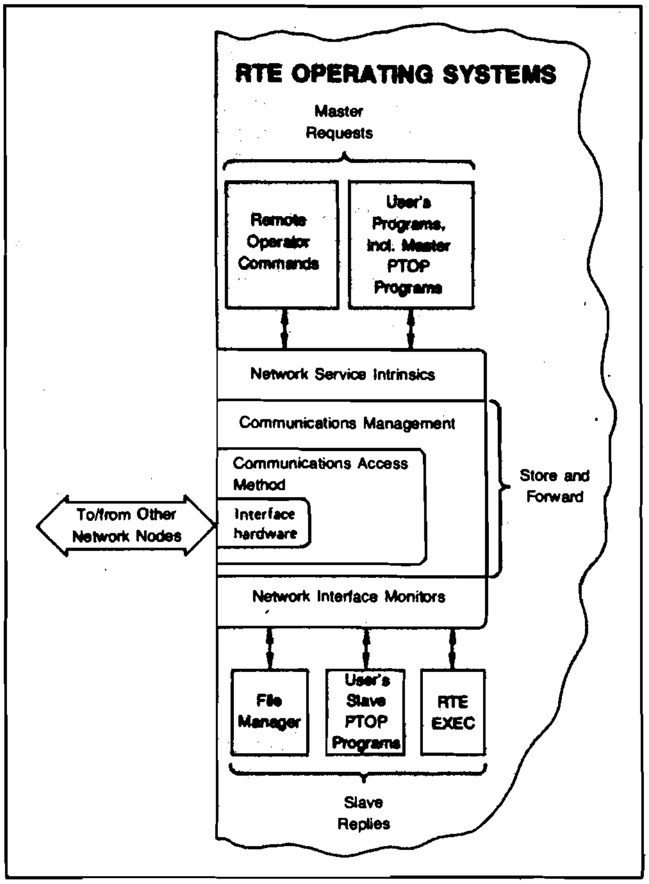

RTE OPERATING SYSTEMS
Master Requests
Remote Operator Commands
User's Programs, incl. Master PTOP Programs
Network Service Intrinsics
Communications Management
Communications Access Method
Interface hardware
To/from Other Network Nodes
Store and Forward
Network Interface Monitors
File Manager
User's Slave PTOP Programs
RTE EXEC
Slave Replies

Figure 2. DS/1000 Layered Network Communications Architecture

The CM layer communicates with the link-level software drivers, which in turn communicate with the interface hardware, which may be several hardwired and/or modem interface cards, via the Communications Access Method (CAM) firmware. The CAM firmware is located in the computer's control store for use with the older 12771A/12773A interfaces, and in the interface control store on the 12007A/B, 12044A, 12794A/B, and 12825A HDLC interfaces and the 12072A and 12830A Data Link Slave interfaces. The CAM firmware provides a line protocol for the control of communications input and output, including error detection and correction by retransmission. The lower layers are managed such as to be completely transparent to the user. Changes to these layers of the network can be made with little or no effect on user's application programs.

Modular software supports many levels of DS/1000-IV node capability

Another advantage of Hewlett-Packard's layered approach to network communications software and firmware is its modularity. Modularity allows network node capability to be tailored to meet a wide range of application requirements, using the RTE operating system most appropriate.

RTE-A nodes are memory or disc-based systems that use HP's powerful A-Series computers with distributed intelligence I/O for fast, efficient communication. These nodes have a memory capacity of 256k bytes to 24M bytes.

In disc-based nodes, the primary system supports 14.5 Mb to 3.2 Gb of disc memory. Virtual memory for data supports data arrays up to 128M bytes. Code and data separation for virtual code up to 7.75M bytes is optional for support of very large programs. RTE-A nodes thus have the power and capacity to provide network-wide support for HP 1000 system generation and program development, and high-speed computation and data file facilities to other DS/1000-IV nodes in the network. All DS/1000-IV capabilities, including DS/1000-IV to HP 3000 communication, are supported.

RTE-IVE nodes are memory based systems with a memory capacity of 256k to 2.048 million bytes. Being an execute-only subset of the powerful RTE-IVB disc-based operating system, RTE-IVE supports full DS/1000-IV capabilities between HP 1000 systems, as well as between an HP 1000 and HP 3000 system. Using the features of Remote Forced Cold Load and Remote I/O Mapping, an RTE-IVE node can also operate unattended to provide an economical solution in environments where a disc-based node would be inappropriate.

RTE-IVB nodes are powerful disc-based systems requiring 128k bytes of memory, expandable to 2.048 million bytes, and supporting 19.6 million to 960 million bytes of disc memory storage. RTE-IVB nodes can support all DS/1000-IV capabilities, including system generation and down load to other DS/1000-IV nodes, and DS/1000-IV to HP 3000 communication.

RTE-6/VM nodes are the most capable E/F-Series nodes. These disc-based nodes require at least 256k bytes of memory, and are expandable to 2.048 million bytes. Disc memory support of 19.6 Mb to 3.2 Gb is provided by the primary system. Virtual Memory Areas and a Multi-Level Segmentation/Load-On-Call loader provide large program and data capabilities which make RTE-6/VM nodes the most powerful in the DS/1000-IV network environment. RTE-6/VM nodes can provide network-wide support for HP 1000 system generation and program development, and high speed computation and data file facilities to other DS/1000-IV nodes in the network. Full DS/1000-IV capabilities, including DS/1000-IV to HP 3000 communication, are supported.

NOTE: See the "Memory Requirements" section of this data sheet for specific memory size recommendations using DS/1000-IV with a particular RTE Operating System.

Transaction request buffering

The Network Interface Monitors in DS/1000-IV (for PTOP, RFA, RDBA, remote operator command, remote I/O, and remote program scheduling functions) interface to CM/1000 communications management processors via complete requests and replies with data buffers as required. Therefore, the Network Interface Monitors can service multiple requests or replies concurrently, though working on only one request at a time. The monitors themselves can be swapped in RTE-A, RTE-IVB or RTE-6/VM while the system performs the data transfer, thereby freeing up memory for other programs or tasks.

DS/1000-IV architecture for DS/1000-IV to HP 3000 communication

DS/1000-IV software for DS/1000-IV to HP 3000 communications is layered similarly to Figure 2. The important differences appear in the bottom two layers. The CM/1000 layer includes translators for conversion of DS/1000-IV requests and replies to/from DS/3000 format. CM/1000 software is designed to work with remote HP 3000 systems but does not provide for nodal addressing or store-and-forward operation to/from the HP 3000. Communications Access Method functions are performed by CAM firmware on the microprocessor-controlled 12793B or 12073A Bisync Modem Interfaces, the 12834A or 12082A Bisync Direct Connect Interfaces, or a software-only synchronous line controller with the 12889A Hardwired Serial Interface.

Hardware interfaces available

Point-to-point communication:

The 12825A, 12007A/B, 12044A, and 12794A/B interfaces utilize HDLC protocol to provide maximum throughput with a minimum of CPU overhead, between HP 1000s. The

12044A and 12825A are direct connect interfaces, whereas the 12007A/B and 12794A/B are provided for modem connections.

The 12793A/B and 12073A (modem) or 12834A and 12082A (direct connect) interfaces utilize binary synchronous protocol to provide connection between HP 1000s and an HP 3000, with minimum CPU overhead.

The 12771A or 12773A interfaces provide high throughput for communication between HP 1000s, using hardwired direct connection or modem connection. Available for backward compatibility to older 91740A nodes, the 12771A and 12773A incur higher CPU overhead then the newer HDLC interfaces.

X.25 communication:

The 12250A and 12075A interfaces provide LAP-B modem connection to X.25 packet switched networks.

Multidrop communication:

The 12092A, 12830A, 12072A and 12790A provide multidropped master-slave computer connection over the Data Link for lower cost, lower speed network configurations than point-to-point connections.

V.28 Standard Support for modem interfaces

All DS/1000-IV modem interfaces now support the V.28 electrical signal interface standard for leased line communications as specified by European PTT's. The V.28 compatible interfaces are as follows:

E/F-Series	12250A	X.25/1000 interface
	12794B	DS/1000-1000 interface
	12793B	DS/1000-3000 interface
A600/A700/A900	12075A	X.25/1000 interface
	12007B	DS/1000-1000 interface
	12073A	DS/1000-3000 interface

Efficient error control

HP 1000-to-HP 1000 communication via HDLC interfaces

On both the direct connect and modem HDLC interfaces, CRC-16 cyclic redundancy checking detects errors, and the interface retransmits frames sent or received in error. This maximizes transmission accuracy while only rarely requiring intervention by the CPUs at the respective DS/1000-IV network nodes.

HP 1000-to-HP 1000 communication via 12771A/12773A interfaces

The 12771A and 12773A interfaces uses LRC/VRC/DRC (longitudinal, vertical, and diagonal redundancy checking) for error detection. Longitudinal parity is checked by the interface card at the receiving node. Vertical and diagonal parity words are generated by the microcoded CAM/1000 drivers (91740R DS/1000 firmware), which must be installed in the control store of the computers in the transmitting and receiving nodes. The receiving node returns its parity words to the transmitter for comparison. A parity word mismatch causes retransmission of the block. Because error control is accomplished mostly by HP 1000 microcode in the control store of the computer, system overhead is kept low, though not as low as with the HDLC interfaces.

HP 1000-to-HP 1000 via Data Link

In communications via Data Link using the 12830A or the 12072A, errors are detected using CRC-16 cyclical redundancy error checking on blocks received or sent. The interface retransmits or requests retransmission of the block containing the error, to attain error free data transfer.

HP 1000-to-HP 3000 communication

Both direct-connect and modem communications between HP 1000 and HP 3000 systems are monitored for errors by CRC-16 cyclic redundancy checking on all blocks sent or received. Error detection is implemented in hardware on the 12793A/B, 12073A, and 12834A interfaces. Detection of an error results in a request for retransmission. The 12793A/B, 12082A and 12834A interface automatically respond to retransmission requests from the HP 3000, thereby minimizing error control overhead at the HP 1000 system.

Functional specifications

Network capacity and performance

Usable transfer rates and the maximum number of star-connected nodes that can be serviced by a central node are complex functions of the following factors:

- The type and speed of communications links in use.
- The way in which a user's application program uses a particular type of DS/1000-IV Network Service Intrinsic, such as PTOP or RFA.
- The processing time required by the DS/1000-IV software and the user's application in a particular HP 1000 Computer.
- The resources, such as System Available Memory, available in the computer at each node.
- The impact on system resources of local activity that must also be supported at the nodes.

Because of the complexity of the interrelationships of these factors, Network capacity and performance are discussed in a separate DS/1000-IV Performance Brief, which is available from your Hewlett-Packard representative.

Configuration information

DS/1000-IV network nodes can be connected using a variety of interfaces, enabling one to tailor the network for particular application needs. Point-to-point direct connect or modem connection, as well as multidrop configurations using the HP 1000 Data Link, are supported in the DS/1000-IV network environment. Interconnection of point-to-point nodes with multidrop nodes in the same DS/1000-IV network is also supported, providing maximum configuration flexibility to the network designer.

Point-to-Point DS/1000-IV connections

Point-to-point DS/1000-IV interfaces are designed for providing high throughput communication between network nodes. HDLC interfaces provide efficient, full duplex communication particularly suited for applications requiring high volume data transfers with low computer overhead. Interfaces are available for HP 1000 to HP 1000 connection, as well as HP 3000 to HP 1000 in both direct connect and modem versions. Any type of topological configuration such as a star, string, ring, or combination, is supported via DS/1000-IV Point-to-Point interfaces.

For specific configuration information using point-to-point interfaces, see Figure 3. For hardware data rates and specifications of each DS/1000-IV interface, see individual interface product data sheets.

X.25 Packet Switched Network DS/1000-IV connections

X.25 LAP-B modem interfaces provide the physical interface (X.25 bis, level1) and the frame interface (LAP-B, level 2) of the CCITT X.25 recommendation. These microprocessor-based interfaces handle all LAP-B protocol generation (including CCITT compatible CRC error checking), onboard buffer management, and all modem control tasks. For specific configuration information using X.25 interfaces, see Figure 4. For supported modems and X.25 software, see X.25/1000 data sheet.

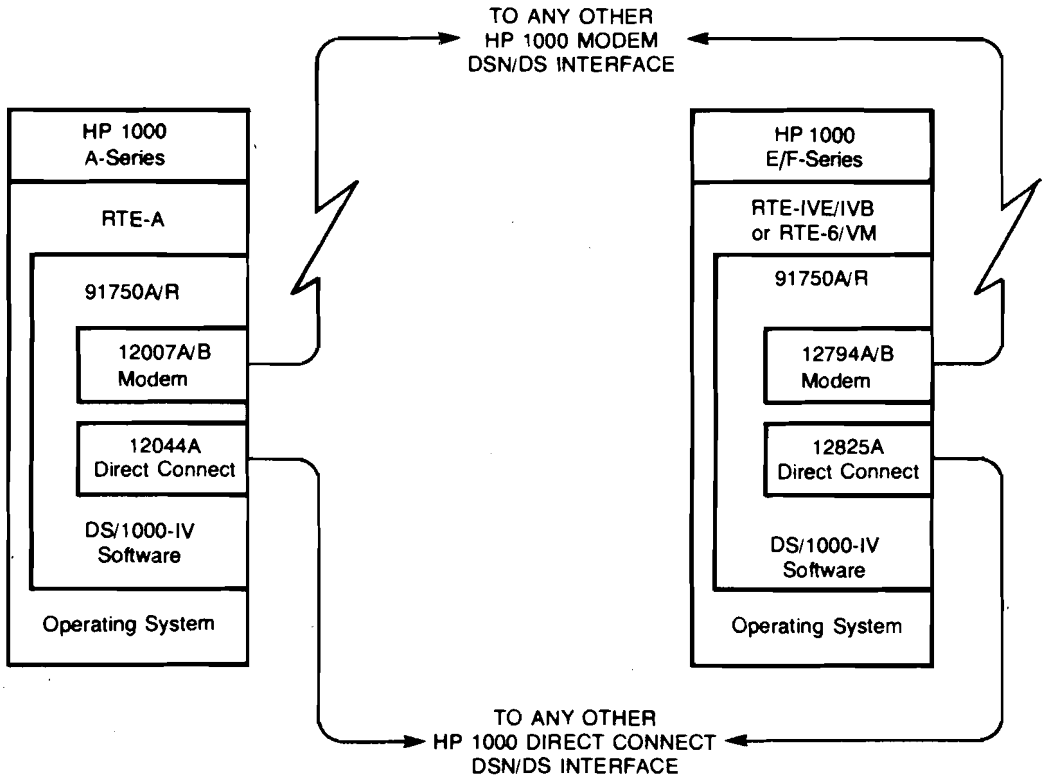
Multidrop DS/1000-IV connections

HP 91750A Network Software also supports multidrop configurations over the HP 1000 Data Link. This provides a low cost network solution (for applications where lower communication speed is acceptable) and greater connection flexibility than point-to-point, using the 12790A or 12092A Multipoint interface as a master in an E-Series or F-Series computer. HP 12072A and 12830A Data Link Slave interfaces allow A/L-Series and M/E/F-Series computers, respectively, to communicate to the master computer over the Data Link. In this configuration, slave computers can be multidropped anywhere along the Data Link, creating a logical star network. Multidrop DS/1000-IV nodes can be added or deleted from the Data Link without affecting network operation.

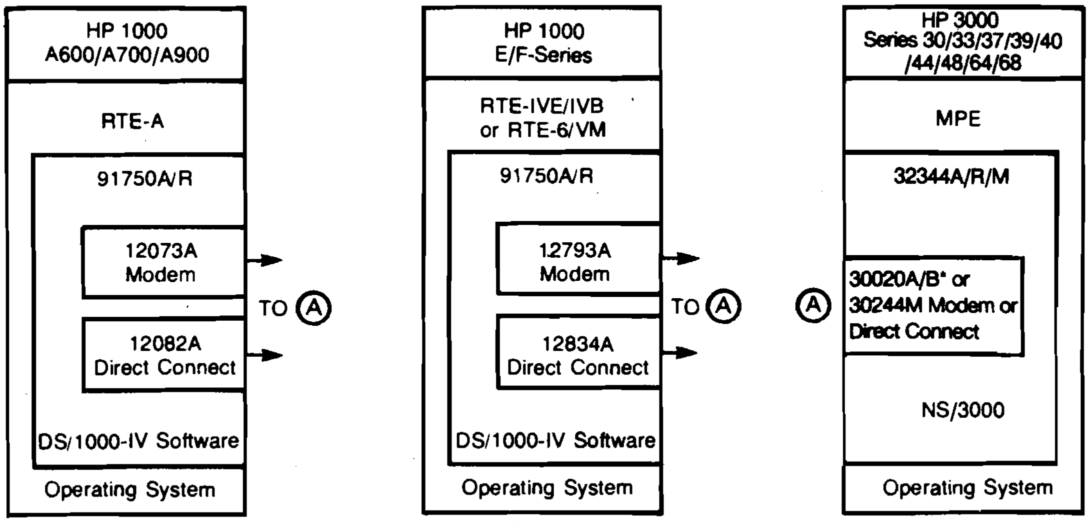
The master computer controls the Data Link, using a half-duplex Bisync protocol to poll the slave computers. Since DS/1000-IV is a layered architecture, all networking features (except Remote Virtual Control Panel to an L-Series computer) are fully supported in multidrop configuration. Using the low cost, twisted pair Data Link cabling and only one interface per incremental slave node (versus two for point-to-point), Multidrop DS/1000-IV provides a lower cost alternate to point-to-point connection where lower performance is appropriate. For specific multidrop configuration information using Data Link interfaces, see Figures 5 and 6. For hardware data rates and specifications of the respective Data Link interfaces, see their specific data sheets in this data book.

Point-to-Point DS/1000-IV Connections

HP 1000 to HP 1000 Connections


TO ANY OTHER
HP 1000 MODEM
DSN/DS INTERFACE
HP 1000
A-Series
RTE-A
91750A/R
12007A/B
Modem
12044A
Direct Connect
DS/1000-IV
Software
Operating System
HP 1000
E/F-Series
RTE-IVE/IVB
or RTE-6/VM
91750A/R
12794A/B
Modem
12825A
Direct Connect
DS/1000-IV
Software
Operating System
TO ANY OTHER
HP 1000 DIRECT CONNECT
DSN/DS INTERFACE

HP 1000 to HP 3000 Connections


HP 1000
A600/A700/A900
RTE-A
91750A/R
12073A
Modem
12082A
Direct Connect
DS/1000-IV Software
Operating System
TO Ⓐ
HP 1000
E/F-Series
RTE-IVE/IVB
or RTE-6/VM
91750A/R
12793A
Modem
12834A
Direct Connect
DS/1000-IV Software
Operating System
TO Ⓐ
Ⓐ
HP 3000
Series 30/33/37/39/40
/44/48/64/68
MPE
32344A/R/M
30020A/B* or
30244M Modem or
Direct Connect
NS/3000
Operating System

* The 30020B must be used on the HP 3000 Series 39-68 and the 30244M must be used with HP 3000 Series 37

Figure 3. Point-to-Point DS/1000-IV Network Connections

X.25 DS/1000-IV Connections

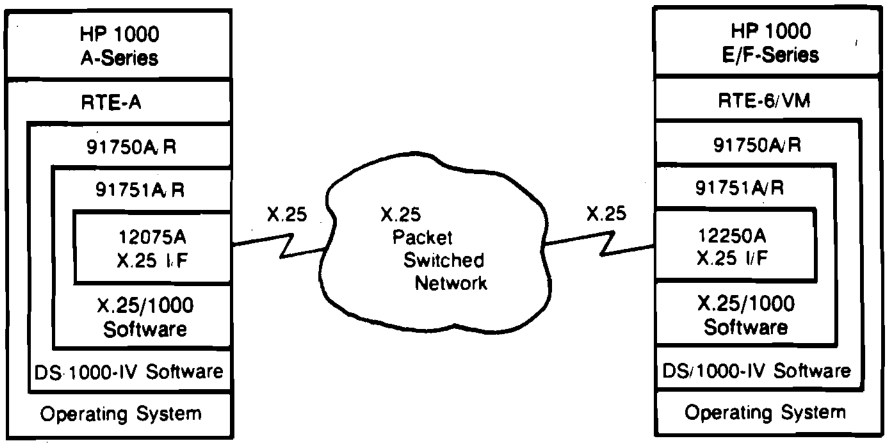
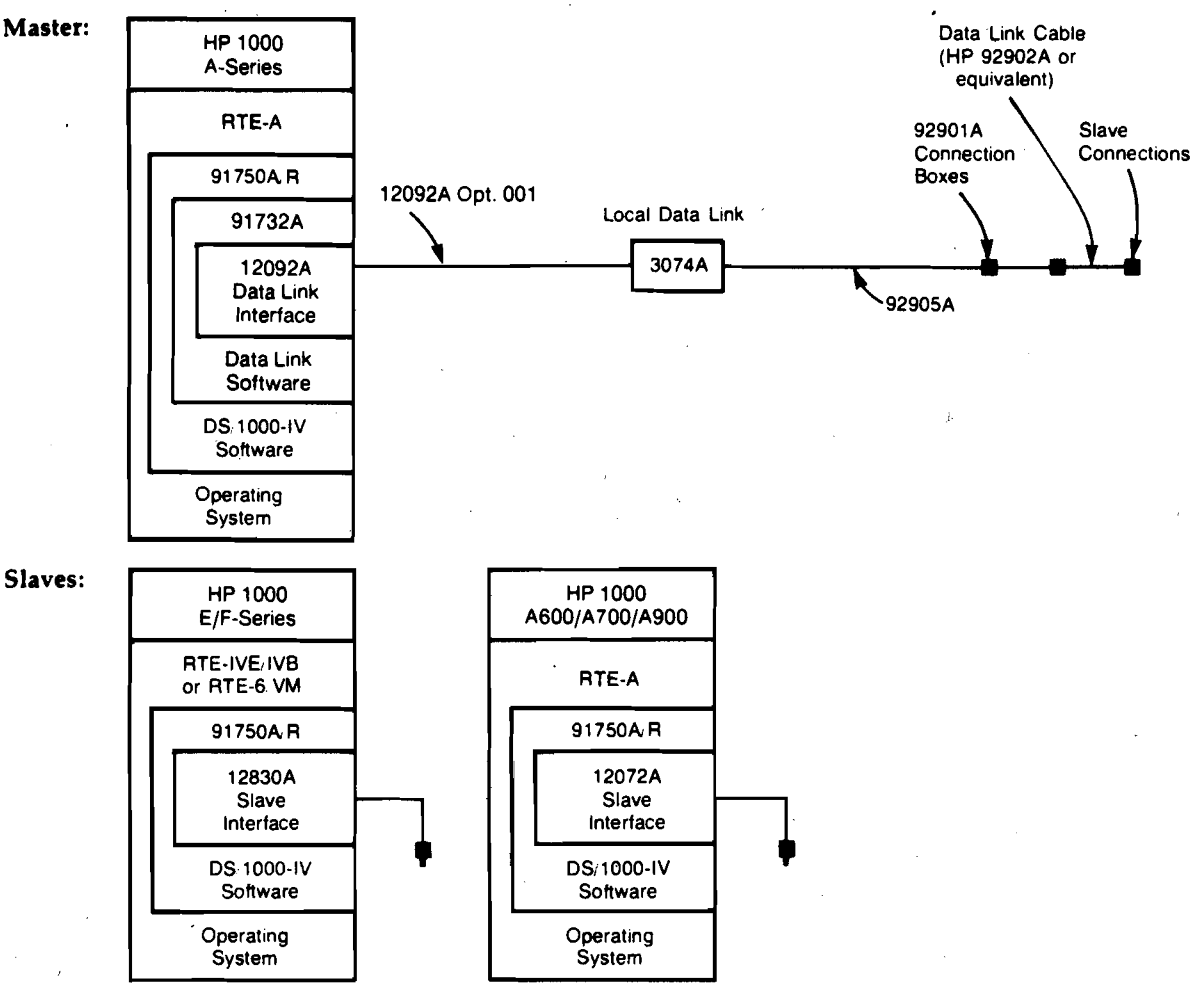

HP 1000
A-Series
RTE-A
91750A/R
91751A/R
12075A
X.25 I/F
X.25/1000
Software
DS/1000-IV Software
Operating System
X.25
X.25
Packet
Switched
Network
X.25
HP 1000
E/F-Series
RTE-6/VM
91750A/R
91751A/R
12250A
X.25 I/F
X.25/1000
Software
DS/1000-IV Software
Operating System

Figure 4. X.25 DS/1000-IV Connections

Multidrop DS/1000-IV Connections from A-Series Master


Master:
HP 1000
A-Series
RTE-A
91750A/R
91732A
12092A
Data Link
Interface
Data Link
Software
DS/1000-IV
Software
Operating
System
12092A Opt. 001
Local Data Link
3074A
92905A
Data Link Cable
(HP 92902A or
equivalent)
92901A
Connection
Boxes
Slave
Connections
Slaves:
HP 1000
E/F-Series
RTE-IVE/IVB
or RTE-6/VM
91750A/R
12830A
Slave
Interface
DS/1000-IV
Software
Operating
System
HP 1000
A600/A700/A900
RTE-A
91750A/R
12072A
Slave
Interface
DS/1000-IV
Software
Operating
System

NOTE: For more information regarding maximum cable length see the Communications Interface Summaries.

Figure 5. Multidrop DS/1000-IV Connections

Multidrop DS/1000-IV Connections from E/F-Series Master

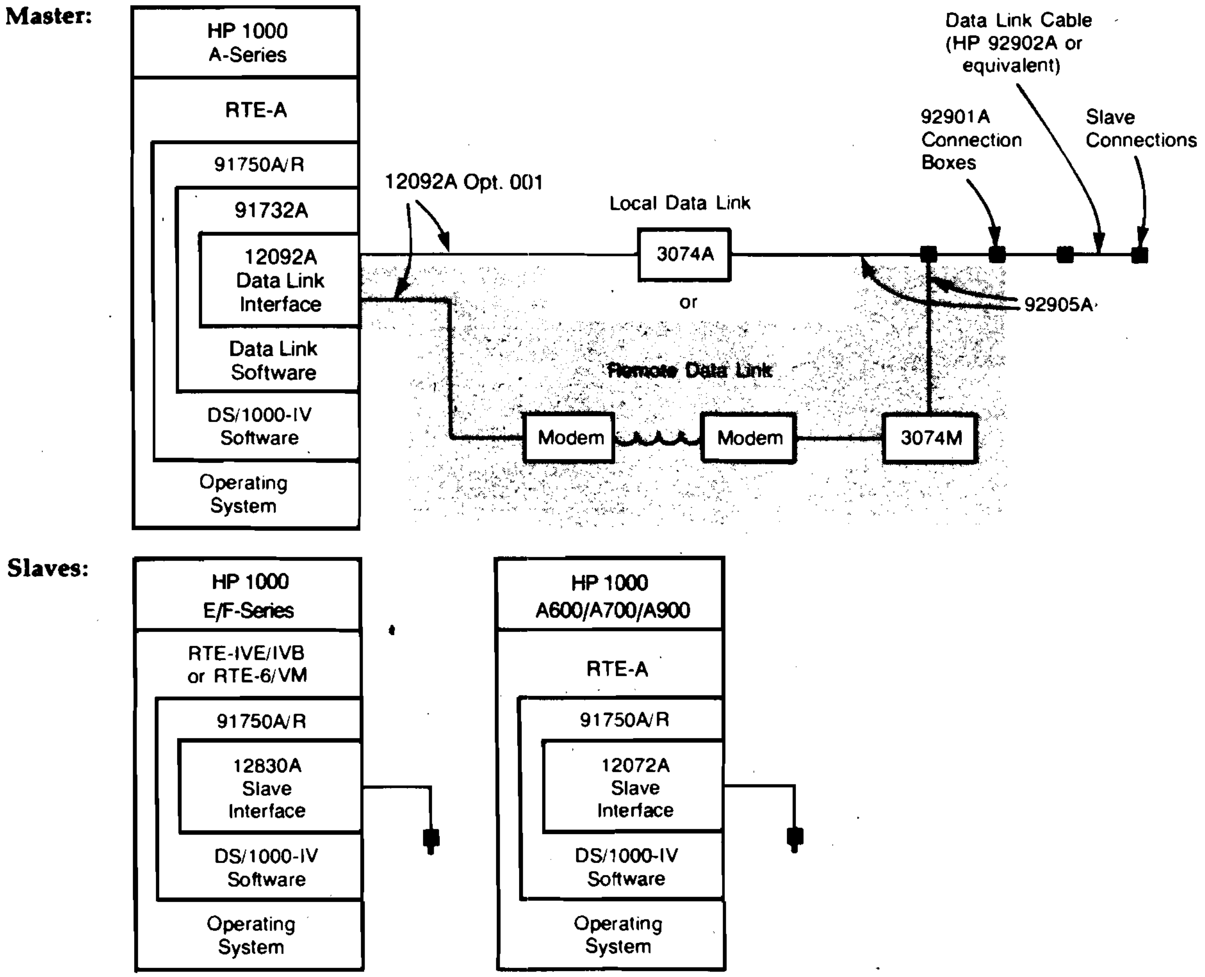

Master:
HP 1000
A-Series
RTE-A
91750A/R
91732A
12092A
Data Link
Interface
Data Link
Software
DS/1000-IV
Software
Operating
System
12092A Opt. 001
Local Data Link
3074A
or
Remote Data Link
Modem
Modem
3074M
Data Link Cable
(HP 92902A or
equivalent)
92901A
Connection
Boxes
Slave
Connections
92905A
Slaves:
HP 1000
E/F-Series
RTE-IVE/IVB
or RTE-6/VM
91750A/R
12830A
Slave
Interface
DS/1000-IV
Software
Operating
System
HP 1000
A600/A700/A900
RTE-A
91750A/R
12072A
Slave
Interface
DS/1000-IV
Software
Operating
System

Figure 6. HP 1000 E/F-Series Master, Multidrop DS/1000-IV Connections

System Compatibility

For complete compatibility information regarding DS/1000-IV interfaces with various HP 1000 computers and RTE operating systems, see Table 2. Information on compatibility with inactive operating systems is available from your Hewlett-Packard representative.

Table 2. 91750A DS/1000-IV System Compatibility

INTERFACE PRODUCT NUMBERS	COMPATIBLE COMPUTERS	COMPATIBLE SYSTEM PROC UNITS	COMPATIBLE OPERATING SYSTEMS	REMOTE SYSTEM
Point-to-Point DS/1000-IV Connections:				
12007A/B A-Series Modem I/F 12044A A-Series Direct Connect I/F	2106BK, 2156B, 2137A, 2139A, 2436A/E, 2437A, 2439A	2196C/D, 2197C/D, 2199C/D, 2486A, 2487A, 2489A	RTE-A (92077A/E)	HP 1000 A/E/F-Series Systems using 91750A software and appropriate interface.*
12073A A-Series Modem I/F 12082A A-Series Direct Connect I/F	2106BK, 2156B, 2137A, 2139A, 2436A/E, 2437A, 2439A	2196C/D, 2197C/D, 2199C/D, 2486A, 2487A, 2489A	RTE-A (92077A/E)	HP 3000 Series II/III/30/33/37/39/40/42/44/48/64/68 System and appropriate interface.*
12794A/B E/F-Series Modem I/F 12825A E/F-Series Direct Connect I/F	2109E, 2113E, 2117F	2176E, 2177F, 2178C, 2179C	RTE-6/VM (92084A) RTE-IVB (92068A) RTE-IVB (92068E)	HP 1000 A/E/F-Series Systems using 91750A software and appropriate interface.*
12793A/B E/F-Series Modem I/F 12834A E/F-Series Direct Connect I/F	2109E, 2113E, 2117F	2176E, 2177F, 2178C, 2179C	RTE-6/VM (92084A) RTE-IVB (92068A) RTE-IVB (92068E)	HP 3000 Series II/III/30/33/37/39/40/42/44/64/68 System and appropriate interface.*
12773A E/F-Series Modem I/F 12771A E/F-Series Direct Connect I/F Note A	2109E, 2113E, 2117F	2176E, 2177F, 2178C, 2179C	RTE-6/VM (92084A) RTE-IVB (92068A) RTE-IVB (92068E)	HP 1000 E/F-Series Systems using 91740R or 91750A software, 91740R firmware, and appropriate interface.*

**Appropriate interface means that interface in remote system must match communication mode and protocol (direct connect or modem and WASP, Bisync or HDLC) of interface in local system. For appropriate counterpart interfaces, see Figure 3.*

NOTE A: The 12771A and 12773A are provided for backward compatibility only and are not recommended for new applications. 91740R DS/1000 firmware is required with 12771A and/or 12773A interfaces used in a DS/1000-IV node. With the 12773A Modem interface, a 12620A Breadboard interface used as a privileged interrupt control card is also required.

NOTE C: For information on system compatibility within a X.25 Packet Switched Network with DS/1000-IV connections, please refer to the 91751A X.25 data sheet.

Table 2. 91750A DS/1000-IV System Compatibility (Continued)

INTERFACE PRODUCT NUMBERS	COMPATIBLE COMPUTERS	COMPATIBLE SYSTEM PROC UNITS	COMPATIBLE OPERATING SYSTEMS	REMOTE SYSTEM
Multidrop DS/1000-IV Connections:				
12790A E/F-Series Data Link Master I/F	2109E, 2113E, 2117F	2176E, 2177F, 2178C, 2179C	RTE-6/VM (92084A) RTE-IVB (92068A) RTE-IVB (92068E)	Any HP 1000 A/E/F-Series System using 91750A software and 12830A or 12072A Data Link Slave Interface.
12830A E/F-Series Data Link Slave I/F	2109E, 2113E, 2117F	2176E, 2177F, 2178C, 2179C	RTE-6/VM (92084A) RTE-IVB (92068A) RTE-IVB (92068E)	Any HP 1000 E/F-Series Systems using 91750A and 91730A Software and the 12790A Interface.
A-Series Data Link Slave I/F 12092A A-Series Data Link Master I/F	2106BK, 2156B, 2137A, 2139A, 2436A/E, 2437A, 2139A	2196C/D, 2197C/D, 2199C/D, 2486A, 2487A, 2489A	RTE-A (92077A/E)	Any HP 1000 A-Series System using 91750A and 91737A Software and 12072A Interface or and HP 1000 E/F-Series System using 91750A and 91730A Software and the 12790A Interface.
12072A A-Series Data Link Slave I/F	2106BK, 2156B, 2137A, 2139A, 2436A/E, 2437A, 2139A	2196C/D, 2197C/D, 2199C/D, 2486A, 2487A, 2489A	RTE-A (92077A/E)	Any HP 1000 A-Series System using 91750A and 91737A Software and 12092A Interface or and HP 1000 E/F-Series System using 91750A and 91730A Software and the 12790A Interface.

Compatibility with other active HP network products

91750A DS/1000-IV Network software is compatible with 32190A DS/3000 software in HP 3000 Series II/III/30/33/37/39/40/42/44/48/64/68 Systems and the 91780A RJE/1000 IBM 360/370 Remote Job Entry package.

Backward compatibility with "old" DS/1000 network nodes

The 91750A DS/1000-IV Network software is backward compatible with 91740B (inactive) network software-firmware at "old" DS/1000 network nodes. All DS/1000 features supported between 91740B nodes are supported between a 91750A node and a 91740B node, but some new DS/1000-IV features, such as Dynamic Message Rerouting and direct communication between HP 1000 A-Series and E/F-Series computers, are not supported. In addition, communication between a 91750A node and a 91740B node must use 12771A direct connect interfaces or 12773A modem interfaces in both nodes. In the 91750A node, 91740B DS/1000 firmware must be provided to support communication via the 12771A/12773A interface. When the 12773A interface is used, a 12620A Breadboard interface must be provided in each node as a privileged interrupt control card.

Operating system and DS/1000-IV software for DS/1000-IV network nodes

The operating system (92084A RTE-6/VM, 92068A RTE-IVB, or 92077A RTE-A) software and 91750A DS/1000-IV network software with appropriate processor option must be purchased for the first network node. Systems generated from this software may then be copied to additional network nodes provided that the customer has purchased an appropriate right to copy product (92084R, 92068R, 92077R/E, and 91750R with appropriate processor option) for each additional node supported. Purchase of an operating system included in a 217xC/E/F, 219xC/D, or 2484A system processor unit product does not qualify the customer to purchase a right to copy that operating system.

Requirements for remote data base access

The remote data base to be accessed must be managed by the 92069A or 92081A Image/1000 Data Base Management System operating under the 92084A RTE-6/VM, 92068A RTE-IVB, or 92077A RTE-A real-time executive system.

Memory requirements

For RTE-A memory based node: The RTE-A memory based operating system and minimum required DS/1000-IV programs use about 256k bytes of memory. An additional 256k bytes of memory would be required for a DS/1000-IV system with complete capabilities. It is therefore recommended that at least 512k bytes of memory should be provided for a fully capable DS/1000-IV system.

For RTE-A disc-based node: The RTE-A disc based operating system and minimum required DS/1000-IV programs use about 90k bytes of memory. For a DS/1000-IV system with complete capabilities, an additional 100k bytes of memory would be required. It is recommended, therefore, that 256k bytes should be the minimum memory size for a fully capable DS/1000-IV system. For operation of DS/1000-IV over X.25 PSN's, the X.25/1000 communication software product (91751A) must be purchased for use with DS/100-IV. For specific configuration information regarding X.25 connections, see Figure 4. For additional information, refer to the 91751A X.25/1000 data sheet.

For RTE-IVE based node: The RTE-IVE operating system and minimum required DS/1000-IV programs use about 90k bytes of memory (100k bytes with rerouting and message accounting). Because RTE-IVE is a memory based system, all the capabilities required must reside in memory. For a DS/1000-IV system with full capabilities, an additional 100k bytes of memory would be required. It is therefore recommended that at least 256k bytes of memory should be provided for a fully capable DS/1000-IV system. A system of 384k bytes or 512k bytes is preferred. Other software and user applications may require additional memory.

For RTE-IVB based node: The RTE-IVB operating system and minimum required DS/1000-IV programs use about 90k bytes of memory (100k bytes with rerouting and message accounting). Because an RTE-IVB based node will usually support most, if not all, of the optional capabilities of DS/1000-IV, at least 256k bytes of memory, and preferably 384k bytes or 512k bytes, should be provided so that a reasonable number of DS/1000-IV capabilities can reside in their partitions at the same time. This minimizes swapping and assures fastest possible network response. Of course, addition of other capabilities with large memory requirements, such as Pascal/1000 or DATACAP/1000, would necessarily require more memory.

For RTE-6/VM based node: RTE-6/VM operating system and minimum required DS/1000-IV programs use about 110k bytes of memory (120k bytes with re-routing and message accounting). Because an RTE-6/VM based node will usually support most, if not all, of the optional capabilities of DS/1000-IV, at least 256k bytes of memory, and preferably 384k or 512k bytes, should be provided so that a reasonable number of DS/1000-IV capabilities can reside in their partitions at the same time. This minimizes swapping and assures fastest possible network response. Of course, addition of non-DS capabilities with large memory requirements, such as Pascal/1000 or DATACAP/1000, would necessarily require even more memory.

Responsibilities of the customer

The DS/1000-IV user must assume the following responsibilities with the purchase of 91750A DS/1000-IV Network software:

1. Installation of communication facilities (cables and/or modems) and their connection to the HP 1000 Computer Systems equipped with DS/1000-IV. The establishment of successful communication between HP 1000 Computer Systems equipped with DS/1000-IV is the customer's responsibility.
2. One person in the customer's organization must be designated as the Network Manager. This person will assume responsibility for configuration and generation of the customer's systems and will function as the focal point for Hewlett-Packard's support of the network. This person must be knowledgeable in HP's RTE operating system and must have taken the DS/1000-IV User's and Theory of Operation Courses.
3. DS/1000-IV software is a customer-installed product unless it is ordered with an HP 1000 System.
4. Hewlett-Packard strongly recommends that the customer purchase Customer Support Service or Software Subscription Service for DS/1000-IV and related hardware and software support products.

Ordering information

91750A DS/1000-IV Network Software

The 91750A DS/1000-IV Network Software includes:

1. Must order one of Use Options 600, 601, 700, 701, 890, or 891 and one of Media Options 022-051.
2. 91750-80007 Communications Bootstrap Loader (CBL) ROM.
3. 91750-90001 DS/1000-IV Software Numbering Catalog.
4. 91750-90002 DS/1000-IV User's Manual.
5. 91750-90004 Getting Started with DS/1000-IV.
6. 91750-90005 DS/1000-IV Quick Reference Guide.
7. 91750-90006 DS/1000-IV Communications Bootstrap Loader ROM Installation Manual.
8. 91750-90010 DS/1000-IV Network Managers Manual Volume I.
9. 91750-90011 DS/1000-IV Network Managers Manual Volume II.

91750A Options

600: Use in A600 Systems (2156B, 2196C/D, or 2486A).

601: Upgrade to latest version of 91750 for use on A600 System for customer not on Software support service.

700: Use in A700 or E/F-Series Systems (2137A, 2197C/D, 2176E, 2177F, 2178C, 2179C, 2487A, 2109/13E, or 2117F).

701: Upgrade to latest version of 91750 for use on A700 or E/F-Series System for customer not on Software support service.

890: Use in A900 System (2139A, 2199C/D, or 2489A).

891: Upgrade to latest version of 91750 for use on A900 System for customer not on Software support service.

022: Provides DS/1000-IV software on CS/80 cartridge tapes.

041: Provides DS/1000-IV software on 8 inch flexible disc.
044: Provides DS/1000-IV software on 3.5 inch flexible disc.
050: Provides DS/1000-IV software on 800 bpi, 9-track magnetic tape.
051: Provides DS/1000-IV software on 1600 bpi, 9-track magnetic tape.

91750R Right to Copy DS/1000-IV software for use on an additional Computer System

The 91750R Right to copy product is available only to customers who have purchased a license to use 91750A. 91750R consists of:

1. The right to make one copy of software purchased with the 91750A DS/1000-IV Network software product for use on an additional system.

2-9. Same as items 2 through 9 of 91750A, above.

91750R Options

001: Discount for right to copy 91750A+001 product or 91750T/S updates for customer who has previously purchased 91750R product.

Support Services

New Support Contracts

Support services include Account Management Support (AMS, similar to CSS), Software Materials Subscription (SMS, similar to SSS), and a new level called Response Center Support (RCS) which includes all materials (SMS) and telephone assistance through the Response Centers. Customers with existing contracts may also take advantage of these services by converting their entire contract to the new program.

For customers choosing AMS or RCS on their operating system, DS/1000-IV is supported by purchasing Datacomm category support. (Only one datacomm category support need be purchased — for the "highest" datacomm category (A = lowest, C = highest)). SMS must also be purchased. For customers choosing SMS on their operating system, DS/1000-IV is supported by purchasing SMS only. For additional systems, the extended datacomm category support and extended SMS are used. MUS is available as well.

Support Products:

99086D+C00	Datacomm B/1000
99086D+V00	Extended Datacomm B/1000
99086D+Q00	MUS Datacomm B/1000
91750A+S00	SMS
91750A+W00	Extended SMS

DS/1000-IV operation on older HP 1000 E/F-Series computers

For proper operation of the remote Forced Cold Load feature after a system halt, over a DS/1000-IV line, on HP 1000 E/F-Series computers shipped **prior** to November 1, 1980 (serial prefix 2043 or less), the current revision Base Set Instruction ROMs are required. These ROMs are available as the following products:

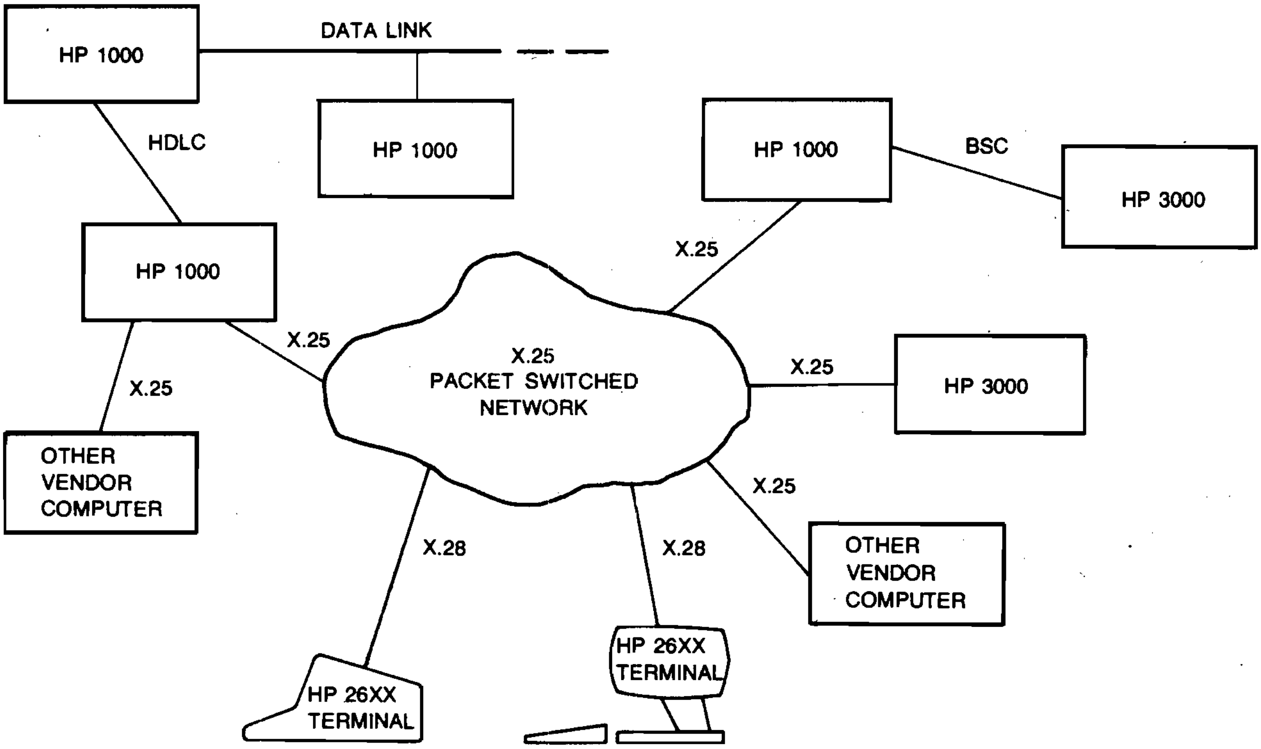
E-Series	Base Set Instructions	12728H
F-Series	Base Set Instructions	12728K

X.25/1000

HEWLETT PACKARD

Product Number 91751A
For HP 1000 Computers

HP AdvanceNet



X.25/1000 for the HP 1000 family of computers is a communication software package which provides access for HP 1000 computers to private or public X.25 packet switched networks. This software package can be used with Distributed Systems Network Software (DS/1000-IV) for communication to other HP 1000 and HP 3000 computers via an X.25 packet switched network (PSN), or standalone with user implemented upper level communication software. When X.25/1000 is combined with Distributed Systems, the same powerful networking services available in high speed point-to-point and low cost multidrop Data Link connections are now available across private or public X.25 packet switched networks, without any changes to existing programs. For standalone configuration without DS, direct user access to X.25 level 3 allows possible connection to other vendor computers and devices which implement the international CCITT X.25 standard. In this case the packet level may be configured to operate either as a Data Terminal Equipment (DTE) or as a Data Communication Equipment (DCE).

In addition to system-to-system communications over X.25 networks, X.25/1000 allows asynchronous character-mode HP terminals to communicate with HP 1000 computers via the X.3/X.28/X.29 communication standards. This enables HP terminal users to transparently access any HP 1000 system connected to the X.25 network.

Features

- **Compatible with November 1980 CCITT X.25 standard, providing both Switched and Permanent Virtual Calls for use with both public and private packet switched networks.**
- **Potential cost savings and increased communication reliability through use of packet switched networks for communication.**
- **Certified for Telenet (USA), Tymnet (USA), RTT (Belgium), Datapac (Canada), PSS (UK), and Transpac (France) X.25 public networks. Contact your local Hewlett-Packard Sales Representative for the current list of supported X.25 public packet switched networks.**
- **Compatible across the HP 1000 family of A/E/F-Series Computers.**
- **Two operating modes — Direct user access to X.25 level 3, or communication through Distributed Systems Network Software. Both capabilities can coexist in a single HP 1000 system.**

- **Direct user access to X.25 level 3 provides simplified connectivity to other vendor computers and devices using the same X.25 interface standard. Inter-vendor user-level services, such as remote file access, virtual terminal or program-to-program communication, can be implemented by user written programs in the HP 1000 computer with this direct X.25 level 3 access capability.**
- **Full DS/1000-IV Networking between HP 1000 computers over X.25 packet switched networks (except A-Series virtual control panel and forced cold load) provides powerful communication capabilities. This includes DS/1000-IV features such as: message accounting, network inter-program communication, network file access and transfer, network data base access, network terminal access, network peripheral access, store-and-forward, and automatic rerouting.**
- **Full Distributed Systems Networking between HP 1000 and HP 3000 computes over X.25 networks.**
- **X.3/X.28/X.29 standards for connection of asynchronous character-mode HP terminals connected to X.25 networks via a Packet Assembler/Disassembler (PAD).**
- **Flexible network configuration. All Distributed Systems transport connections, including HP 1000 to 1000 and HP 1000 to 3000 point-to-point, HP 1000 multidrop Data Link, and HP 1000 X.25 packet switched network connections can be configured into a single HP 1000 network computer system.**
- **Comprehensive network maintenance utilities are used to record and analyze communication activity over the X.25 link.**

Functional specifications

X.25/1000 implementation

X.25 for HP 1000 computer systems is compatible with the November 1980 version of CCITT recommendation X.25 for synchronous host-to-network connections, as well as recommendations X.3, X.28 and X.29 for asynchronous terminal connections to remote X.25 hosts via the network.

The X.25 standard is implemented for the HP 1000 computer by using the 12250A or 12075A LAP-B modem interface card (X.25 levels 1 and 2) and the 91751A software package (X.25 level 3 and X.29 standard) as shown below.

HP Product	HP Implementation	CCITT Level
91751A DSN/X.25	Software	Level 3 (X.25/X.29)
12075A or 12250A LAP-B Interface	Firmware	Level 2 (LAP-B)
	Hardware	Level 1 (X.21 bis)

The specific capabilities supported are:

Level 1: Physical Interface

- X.21 bis (RS-232-C, CCITT V.24/V.28) at speeds up to 19,200 bits/sec for network connections or up to 57,600 bits/sec for point-to-point connections (the X.21 and V.35 standards are not supported).

Level 2: Data Link Protocol

- Compatible with November 1980 version of CCITT X.25 recommendation
- LAP-B protocol (LAP is not supported)
- Programmable level 2 parameters including:
  Window sizes: 1-7
  Frame sizes: as required for level 3 packet sizes
  Retransmission timer period
  Maximum number of retransmissions

Level 3: Packet Level

- Compatible with November 1980 version of CCITT X.25 recommendation
- Switched Virtual Circuits (SVCs)
- Permanent Virtual Circuits (PVCs)
- Window sizes: 1-7
- Packet sizes: 16-1024 bytes
- Possibility to specify end-to-end or local acknowledgement of data packets (D bit)

The maximum number of Virtual Circuits (VCs) supported is 64 in any combination of PVCs and SVCs.

The following parameters should be taken into account when fixing the number of VCs per system: type of operating system, available partition size, System Available Memory, and available I/O Table Entries (EQTs under RTE-6/VM, DVTs under RTE-A.1). Two EQTs/DVTs are required for each system-to-system connection, and one EQT/DVT for each PAD connection. Each connection to a remote system or PAD connected terminal uses one VC. Multiple program-to-program communications to other systems or PADs are multiplexed on one VC.

For DS/1000-IV connections over X.25, the EQT/DVT requirements are:

HP 1000 to HP 1000: 2 EQTs/DVTs per system to system connection. Multiple users are multiplexed on a single VC.

HP 1000 to HP 3000: 2 EQTs/DVTs per user to system connection (session to session). Each HP 1000 user communicating to the same or different HP 3000 computers requires a VC and the corresponding two EQTs/DVTs.

Note that if more than one physical line is used, each line must have a different Data Terminal Equipment (DTE) address.

DSN/X.25 for the HP 1000 supports the following user facilities:

- Closed user groups (single or multiple)
- Reverse charging (acceptance and generation)
- Per-call flow control parameter negociation (window and packet sizes, throughput classes)
- One-way incoming/outgoing and two-way SVCs
- Non standard default flow control parameters for PVCs and SVCs
- Call barring

To determine which facilities are supported on a specific X.25 public packet switched network, consult with your Administrator.

X.3/X.28/X.29 implementation

An HP 1000 computer with X.25/1000 can transmit or receive data to and from asynchronous character-mode HP terminals connected to X.25 networks via a X.3/X.28/X.29 compatible Packet Assembler/Disassembler (PAD).

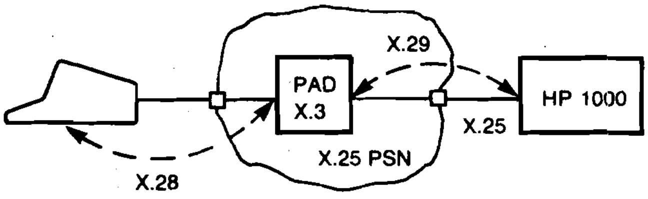
Connections can be established only from the terminal to the host. No host to terminal connections can be established.

Supported HP terminals include all of those supported on the HP 1000 system over asynchronous point-to-point links in character-mode (2392A and 262X terminals).

PAD connected terminals do not support the following communications with host HP 1000 computer systems:

- Binary and block mode transfers. Consequently HP 1000 programs which use these transfers are not supported.
- 264X mini-cartridge communication.
- System console operation.

X.25 PADs have programmable parameters which are used to configure the PAD for the specific terminal characteristics. These parameters are initially set by the PAD itself (X.3 protocol) when the user logs on and identifies the terminal type. They are changed as necessary by X.25/1000 to manage the PAD.



X.25/1000 LAP-B modem interface

The 12075A (A-Series) and 12250A (E/F-Series) X.25 LAP-B modem interfaces provide the physical interface (X.21 bis, level 1) and the frame interface (LAP-B, level 2) of the CCITT X.25 recommendation. These microprocessor-based interfaces handle all LAP-B protocol generation (including CCITT compatible CRC error checking), on-board buffer management, and all modem control tasks.

The LAP-B interfaces contain an on-board firmware controlled self test, and also maintain 11 long term communication line statistics to monitor line quality and help in troubleshooting.

Supported Modems

Connection Via	Modem Type	Maximum Synchronous Data Rate
Switched Telephone Lines	Bell 212A	to 1200 bits/sec
Private Lines	Bell 201C Bell 208C Bell 209A	to 2400 bits/sec to 4800 bits/sec to 9600 bits/sec
Public Packet Switched Networks	Standard RS-232-C modems supplied by PSNs	to 19200 bits/sec

In Europe, contact your local Hewlett-Packard Sales Representative for supported modems in each particular country.

Hewlett-Packard is applying for licensing in European countries where required. Consult your local Hewlett-Packard Sales Representative on the status of these licenses.

See the appropriate HP 1000 Interface Technical Data booklet for additional specifications and ordering information on the X.25 modem interface cards.

X.25 level 3 direct user access capability

X.25 for HP 1000 computers may be accessed by a user program at packet level (level 3) independently of DS software.

X.25/1000 provides for program-to-program and program-to-terminal communication. For interprogram communication, user application programs issue RTE EXEC calls to set-up and clear virtual circuits, and then send and receive data over the X.25 link. For access to terminals connected via a PAD, a user application program issues RTE EXEC calls identical to those for local terminals. The application program need not be aware that it is accessing a terminal or remote computer via the X.25/1000 software.

Users can develop their own higher level service programs for communication between an HP 1000 computer and other vendor computers on devices which support the 1980 CCITT X.25 standard. These connections can utilize either public packet switched networks or direct point-to-point connections.

DS Networking over X.25 packet switched networks

In addition to direct access capability, X.25 can function as the lower three communication levels for HP 1000 Distributed Systems Network Software (DS/1000-IV, product number 91750A). This combination provides high level networking communication services over packet switched networks. The inherent reliability and potential cost benefits of packet switched networks are available to network users along with full networking capabilities.

All DS/1000-IV features (except A-Series remote front panel, and forced cold load) are supported over X.25 packet switched network connections. The same DS user interface is maintained for all DS/1000-IV connections, including point-to-point, multidrop Data Link, and X.25 packet switched networks, allowing user programs to be written independent of the topology and particular transport media.

See the 91750A DS/1000-IV Data Sheet for additional information regarding Distributed Systems Networking for HP 1000 computer systems.

Hardware and software compatibility

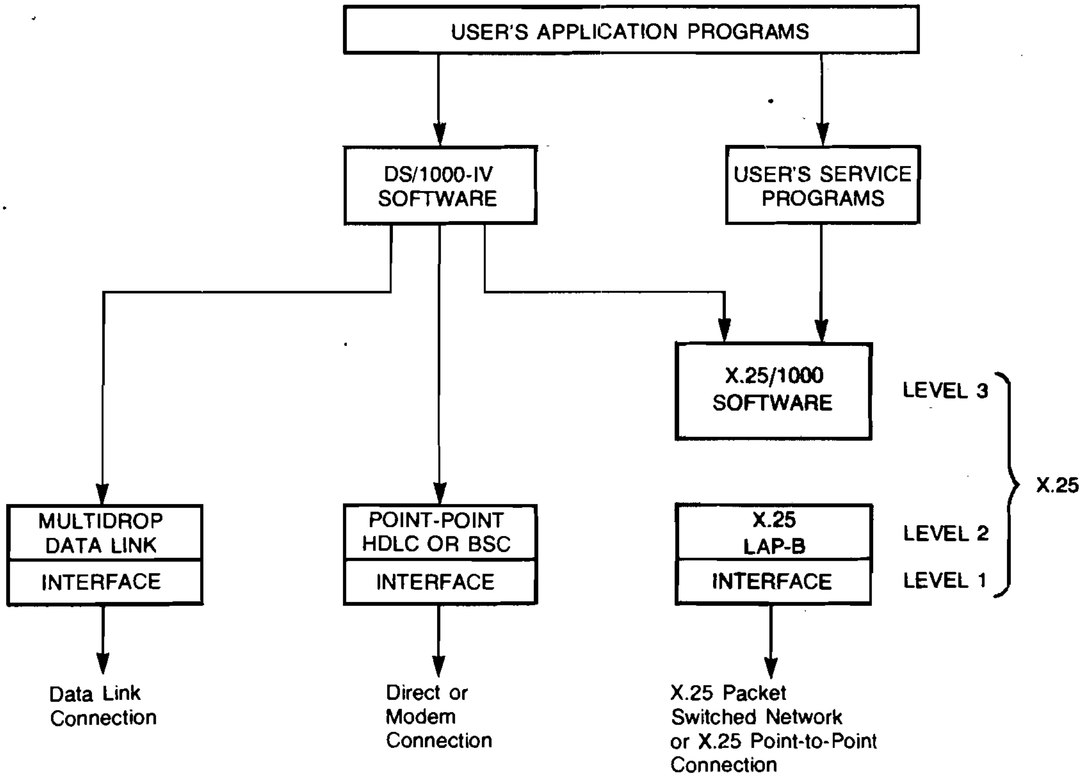
HP 1000 Series	Computer Boxes	Computer Systems	Interface Cards	Operating Systems
F-Series E-Series	2117F 2109E/2113E	Model 65 2179C Model 60 2178C	12250A	RTE-6/VM
A-Series	2137A 2139A 2156B	Model 26 2196C/D Model 27 2197C/D Model 29 2199C/D Micro 26 2486A Micro 27 2487A Micro 29 2489A	12075A	RTE-A

NOTES:

DATACAP/1000 (92080A) and any other user application programs which require a 28 page partition and cannot be linked with the Extended Background (EB) option, are not supported in systems utilizing X.25/1000 due to the 3 page driver requirement for X.25/1000.

Up to 16 X.25 LAP-B modem interface cards (12075A, 12250A) can be installed in one computer system.

Software interrelation diagram


USER'S APPLICATION PROGRAMS
DS/1000-IV SOFTWARE
USER'S SERVICE PROGRAMS
X.25/1000 SOFTWARE
LEVEL 3
X.25
MULTIDROP DATA LINK
INTERFACE
POINT-POINT HDLC OR BSC
INTERFACE
X.25 LAP-B
INTERFACE
LEVEL 2
LEVEL 1
Data Link Connection
Direct or Modem Connection
X.25 Packet Switched Network or X.25 Point-to-Point Connection

Installation and support

Before installation of X.25/1000 software, the customer must previously have installed all prerequisite hardware. The customer should also obtain, install and demonstrate as operational any modems and other equipment and facilities necessary to interface to Hewlett-Packard communication equipment.

Hewlett-Packard is liable only for correct execution of self-tests for the X.25 LAP-B interface card on the HP 1000 computer. All hardware and software connections to packet switched networks and other vendor computers are the customer's responsibility.

Ordering information

91751A X.25/1000 Communication Software for HP 1000 computers

The 91751A X.25/1000 Communication Software includes:

1. X.25/1000 software for HP 1000 computers on one of software media options 022, 041, 044, 050 or 051, which must be ordered.
2. 91751-90001 X.25 Software Numbering Catalog.
3. 91751-90002 X.25 User's Reference Manual.
4. 91751-90003 X.25 Advanced Guide.

91751A Options

001: Provides discount for upgrade from previous revision of 91751A to latest revision for customers without 91751T/S services.

Prerequisite: Purchase of 91751A

022: Provides X.25 software on CS/80 cartridge tape.

041: Provides X.25 software on 8.0 inch flexible disc.

044: Provides X.25 software on 3.5 inch flexible disc.

050: Provides X.25 software on 800 bpi, 9-track magnetic tape.

051: Provides X.25 software on 1600 bpi, 9-track magnetic tape.

91751R Right to Copy X.25 for use on an additional HP 1000 Computer System

The 91751R right to copy product is available only to customers who have purchased a licence to use 91751A without an upgrade discount option. 91751R consists of:

1. The licence to make one copy of software purchased with 91751A for use on an additional HP 1000 system.

2-4. Same as items 2 through 4 of 91751A, above.

91751R Options

001: Discount for right to copy 91751A+001 product or 91751T/S updates to an HP 1000 computer for customers who have previously purchased the 91751R product. Updates a system with previously purchased 91751R product.

Prerequisite: Purchase of 91751R and either 91751A+001 or current and up to date 91751S or 91751T services.

91751X Source Code of 91751A software for use on one HP 1000 computer

This product requires a computer system purchase agreement and as well as a source code licence agreement.

Prerequisite: Prior purchase of 91751A binary code (media option must be specified). Source code licence agreement required. 91751X consists of:

1. 91751A source code for HP 1000 computers on one of software media option 022, 050, 051, which must be ordered.

2-4. Same as items 2 through 4 of 91751A.

91751X Options

001: Provides discount for upgrade from previous revision of 91751X to latest revision for customers without 91751Z.

022: Provides 91751X source code on CS/80 cartridge tape.

050: Provides 91751X source code on 800 bpi, 9-track magnetic tape.

051: Provides 91751X source code on 1600 bpi, 9-track magnetic tape.

91751Y Right to Copy binary code derived from 91751X sources on one HP 1000 computer

Prerequisite for purchase of 91751Y is purchase of 91751X without an upgrade discount option. 91751Y consists of:

1. The licence to make one copy of binary code derived from software purchased with the 91751X for use on an additional HP 1000 system.

2-4. Same as items 2 through 4 of 91751A above.

91751Y Options

100: Delete all manuals furnished with 91751Y, items 2-4 above.

Support Services

Effective April 1984, HP's software support structure was reorganized. Customers with existing support contracts for the HP 1000 may continue with their contracts and buy support for new software products coterminous with their existing contracts. *All other customers may only buy the new support contracts.*

Existing Contracts

Customers with existing contracts may buy MUS, SSS or CSS. MUS provides manual updates only; SSS provides software/firmware updates and software problem reporting plus MUS; CSS provides SSS plus an account assigned SE, on-site assistance and telephone assistance through the Response Centers. The product numbers for these services are listed below.

91751T	CSS	91751W	SSS - EXTENDED
91751V	CSS - EXTENDED	91751Q	MUS
91751S	SSS		

New Support Contracts

For all new customers and customers without an existing contract, the new support services include Account Management Support (AMS, similar to CSS), Software Materials Subscription (SMS, similar to SSS), and a new level called Response Center Support (RCS) which includes all materials (SMS) and telephone assistance through the Response Centers. Customers with existing contracts may also take advantage of these services by converting their entire contract to the new program.

For customers choosing AMS or RCS on their operating system, X.25/1000 is supported by purchasing Datacomm C category support. (Only one datacomm category support need be purchased — for the "highest" datacomm category. (A = lowest, C = highest)). SMS must also be purchased. For customers choosing SMS on their operating system, X.25/1000 is supported by purchasing SMS only. For additional systems, the extended datacomm category support and extended SMS are used. MUS is available as well.

Support Products:

99087D+C00	Datacomm C/1000
99087D+Q00	MUS Datacomm C/1000
99087D+V00	Extended Datacomm C/1000
91751A+S00	SMS
91751A+W00	Extended SMS

91751T/V/S/W interface firmware update options

Firmware update support for the 12250A and 12075A LAP-B modem interface cards is provided by the following 91751T/V/S/W options. The same firmware supports both the 12250A and 12075A interfaces. Since a single software copy may support multiple interface cards, order the appropriate options to provide support for all X.25 LAP-B modem interfaces in a single HP 1000 computer system.

101: Firmware update support for one X.25 LAP-B modem interface.

102: Firmware update support for two X.25 LAP-B modem interfaces.

104: Firmware update support for four X.25 LAP-B modem interfaces.

108: Firmware update support for eight X.25 LAP-B modem interfaces

Data Link Multidrop Communication

HEWLETT PACKARD

Product Numbers:
12092A, 12790A, 91730A, 91737A,
3074A/M, 92901A, 92902A,
92905A, 92908A, 92909A

HP AdvanceNet

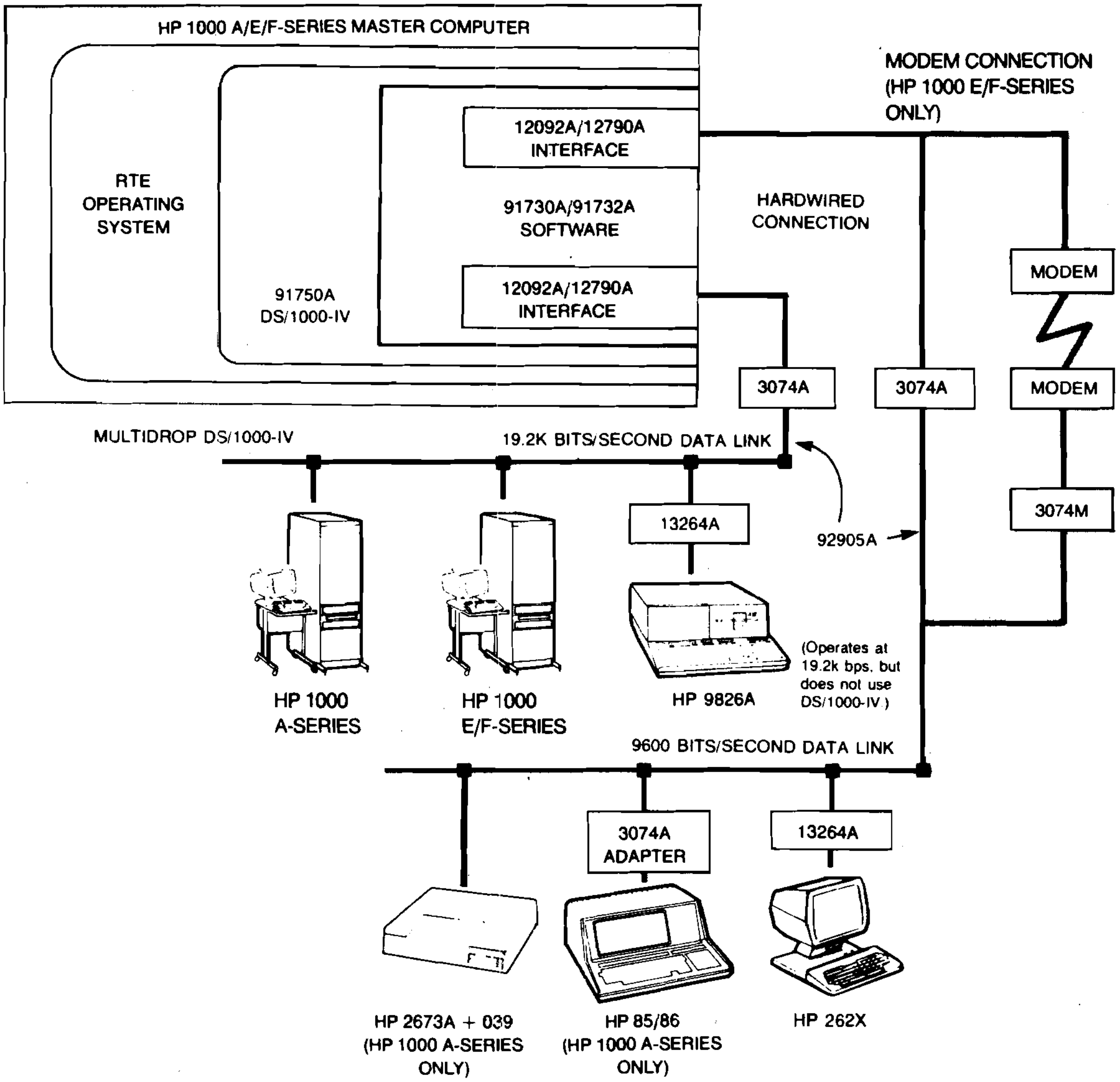

HP 1000 A/E/F-SERIES MASTER COMPUTER
RTE OPERATING SYSTEM
91750A DS/1000-IV
12092A/12790A INTERFACE
91730A/91732A SOFTWARE
12092A/12790A INTERFACE
MODEM CONNECTION (HP 1000 E/F-SERIES ONLY)
HARDWIRED CONNECTION
MODEM
MODEM
3074A
3074A
3074M
MULTIDROP DS/1000-IV
19.2K BITS/SECOND DATA LINK
13264A
92905A
HP 1000 A-SERIES
HP 1000 E/F-SERIES
HP 9826A
(Operates at 19.2k bps, but does not use DS/1000-IV)
9600 BITS/SECOND DATA LINK
3074A ADAPTER
13264A
HP 2673A + 039 (HP 1000 A-SERIES ONLY)
HP 85/86 (HP 1000 A-SERIES ONLY)
HP 262X

Figure 1. Data Link Overview

The HP 1000 Data Link is a datacommunications capability used to interface a wide variety of devices to an HP 1000 computer system. The Data Link is a low speed, rugged, flexible, and inexpensive multidrop communications link designed for operator data capture, automatic data capture, distributed processing, and distributed control applications. The wide range of devices supported on the Data Link includes E/F-Series Computers, A-Series Computers, Desktop Computers, Personal Computers, and CRT Terminals.

A minimal Data Link communications capability is formed by the combination of 12092A/12790A Interface, 91730A/91732A Software, 3074A/M Data Link Adapter, and 92909A Data Link Starter Cable, together with a host HP 1000 A/E/F-Series computer system. The host computer is designated the Data Link master, and all other devices installed on the Data Link are designated as slave stations.

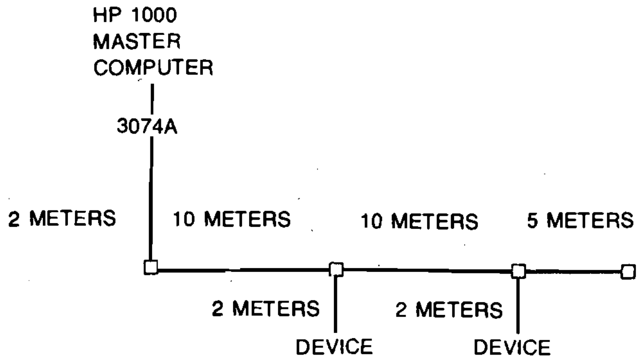
The high reliability due to CRC-16 error checking, optical isolation, and RS-422 differential voltages, combined with multidrop link configuration flexibility, makes the Data Link for HP 1000's an ideal low speed, local communication link for factory and plant automation applications.

Features

- **Master computer and slave stations can be installed at any location on the Data Link**
- **Up to 128 physical connections per Data Link, subject to system software and performance considerations**
- **Rugged wiring and connectors for harsh industrial environments**
- **Bit rates up to 19.2k bits per second**
- **High noise immunity due to double-shielded, twisted-pair cable**
- **CRC-16 error checking**
- **Up to 4 km (2.5 miles) total Data Link length**
- **Device connections are "make before break" — plugging or unplugging a device does not affect other devices on the link**
- **Multidrop topology provides low cost per additional device connection**
- **Wide selection of link compatible slave stations**
- **Ground isolation provided by opto-isolation of the Data Link from attached slave stations**
- **System Functional Tests for verification of communication between the master computer and slave stations connected to the Data Link**
- **Compatible with data communications analyzers**

Functional description

A Data Link network consists of one master computer and one or more slave stations connected to the Data Link. All stations can be installed at any location on the Data Link by plugging into a connection box on the cable or wiring directly into the cable. The maximum Data Link length is 4 km (2.5 miles). This distance includes the length of the main Data Link cable and twice the distance from the Data Link cable to all slave stations.



This sample Data Link would have a total length of:
(2×2) +10 + (2×2) + 10 + (2×2) +5 = 37 meters

Communication on the Data Link is controlled by the master computer, using multipoint asynchronous Bisync (BSC) protocol with CRC-16 error checking for data integrity. This is similar, but not identical to, IBM Bisync. See the Multipoint Software (91730A) data sheet or Data Link Software (91732A) data sheet and the HP 1000 A-Series and E/F-Series Interfaces Technical Data booklets for more information on the communication software and hardware.

Excellent ground loop isolation noise immunity is provided by the optical isolation of the Data Link master from all slave stations connected to the Data Link, RS-422 electrical levels, sensitive signal receivers and drivers, and the 100 ohm termination of the twisted pair cable itself.

The Data Link can operate at bit rates up to 19.2k bits/second. All slave stations connected to the Data Link must operate at the same bit rate. Maximum speeds for the supported devices are given below:

Computers	**Speed**
HP 1000 A/E/F-Series computers	19.2k bps
9826A Desktop Computer	19.2k bps
85/86 Personal Computers*	9600 bps
Terminals	
2624B/2626A CRT Terminal	9600 bps
2673A Opt 039 Printer*	9600 bps

*Supported only with A-Series.

HP Distributed Systems/1000-IV (91750A) Network Software provides high level network communication between E/F-, and A-Series computers connected to the Data Link. For more information concerning this Multidrop DS/1000-IV capability, see the DS/1000-IV Network Software Data Sheet (91750A).

With 91730A software in E/F-Series computers, but not with A-Series computers, the 3074M allows remote installation of either the entire Data Link, or individual slave stations as shown below.

Remoting individual Data Link sections and use with multipoint phone lines as shown below are not supported as Data Link configurations.

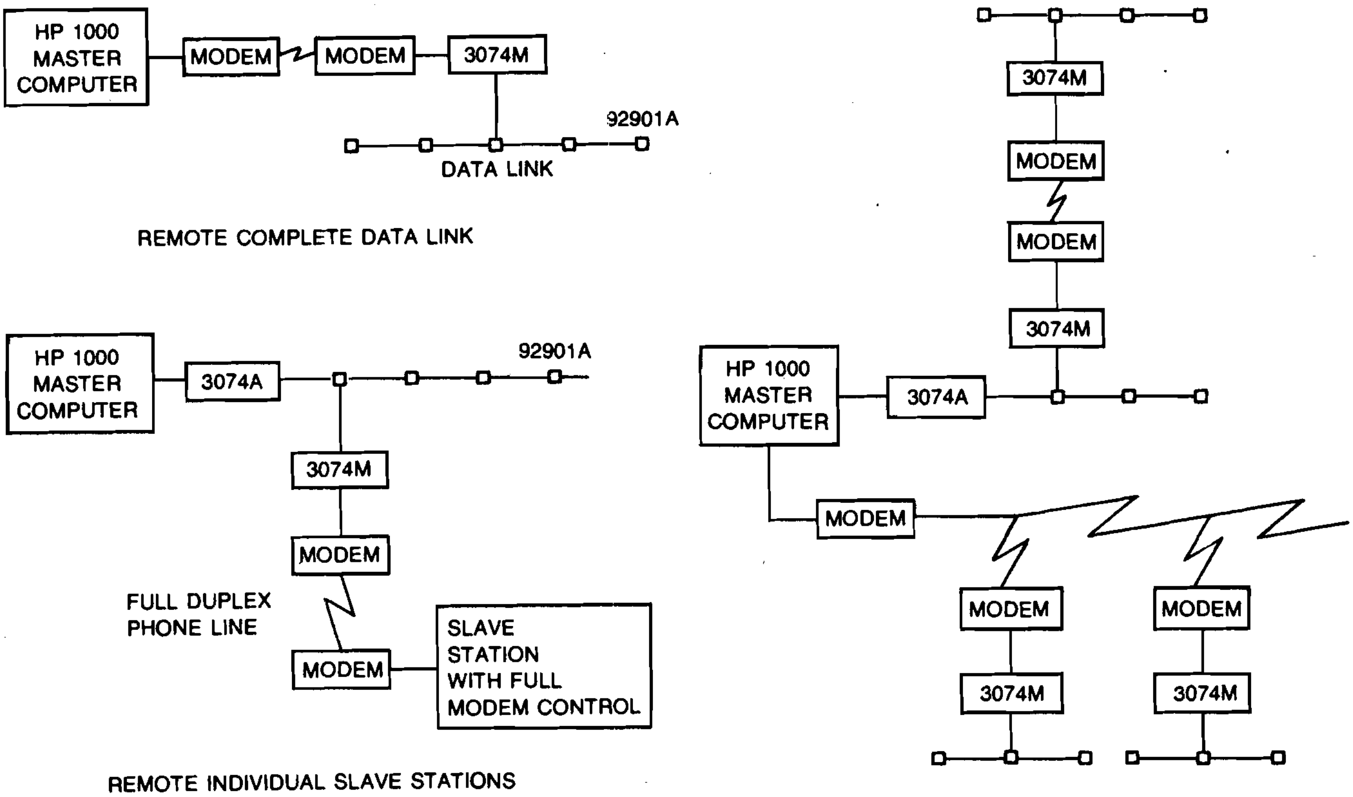

HP 1000 MASTER COMPUTER
MODEM
MODEM
3074M
92901A
DATA LINK
REMOTE COMPLETE DATA LINK
HP 1000 MASTER COMPUTER
3074A
92901A
3074M
MODEM
FULL DUPLEX PHONE LINE
MODEM
SLAVE STATION WITH FULL MODEM CONTROL
REMOTE INDIVIDUAL SLAVE STATIONS
3074M
MODEM
MODEM
3074M
HP 1000 MASTER COMPUTER
3074A
MODEM
MODEM
MODEM
3074M
3074M

Figure 2. Modem Configurations

3074M Compatible Modems

Bell 202T	300 or 1200 bps*
Bell 212A	300 or 1200 bps*
Vadic VA 3400 series	300 or 1200 bps*
Gandalf LDS 120	9600 bps

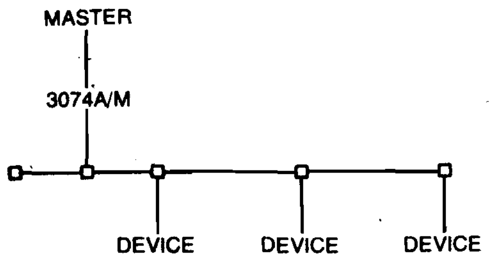
**Due to performance considerations, the 1200 bps Bell and Vadic modems are recommended over the 300 bps versions.*

Performance

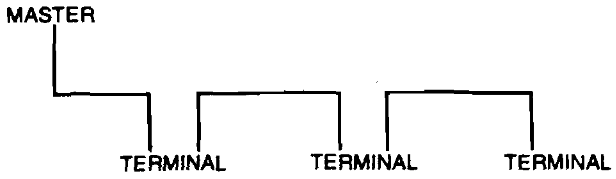
The aggregate throughput of the Data Link is limited to 19.2k bps maximum. The effective data throughput is approximately 1500 characters per second at 19.2k bps, and 850 characters per second at 9600 bps for buffers greater than 2000 bytes. Refer to the Data Link Application Note to determine data throughput for the particular buffer size utilized. As more devices are installed on the Data Link, the proportionate share of the total bandwidth available for each slave station decreases. With additional slave stations requiring access to the Data Link communication line, the response and transit time per slave stations will increase.

Data Link components

NOTE: The terms Multipoint and Multidrop are similar but not identical in meaning. Below are examples of a multidrop and multipoint configuration.



MULTIDROP



MULTIPOINT DAISY CHAIN

The 12092A/12790A Data Link/Multipoint Interface and 91732A/91730A Data Link/Multipoint software are used in both the Multipoint configuration for terminals, and the Multidrop Data Link configuration. In multidrop configurations the 3074A/M converts the RS-232 Multipoint signal levels to Data Link compatible levels, allowing all slave stations to connect to a single data link.

Only 2624B and 2626A terminals operate in a multipoint daisy-chain configuration. See the Software data sheets (91730A and 91732A) for additional information regarding multipoint terminal configurations.

HP 12092A/12790A Data Link/Multipoint Interface. The 12092A Data Link interface is installed in the master HP 1000 A-Series computer and the 12790A multipoint interface is installed in the master HP 1000 M/E/F-Series computer. These interfaces provide front end protocol handling and error control for the multipoint communication line. An on-board proprietary microprocessor with 1k byte of on-board RAM buffering off-loads the protocol handling and buffering from the CPU. Interface output is an RS-232-C communications line using a Multipoint Binary Synchronous (BSC) protocol. See the 12092A Data Link Interface entry in the HP 1000 A-Series Computer Interfaces Technical Data booklet or the 12790A Multipoint Interface entry in the HP 1000 E/F-Series Computer Interfaces Technical Data booklet for additional information.

HP 91732A/91730A Data Link/Multipoint Software. The 91732A/91730A software packages, for A-Series and E/F-Series respectively, contain a driver and support software for communication between the master computer and slave stations connected to the Data Link. All multipoint software features except Group polling and "Who Are You" are supported on the Data Link.

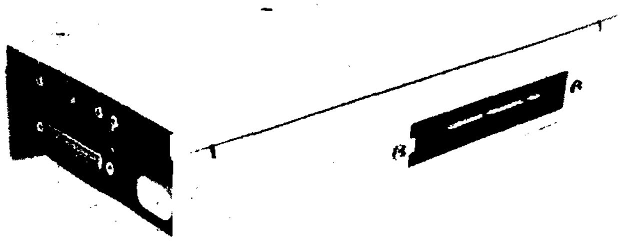
This software is utilized by Hewlett-Packard supplied software products, such as DS/1000-IV, in Data Link configurations and also allows user written application programs in the master computer to communicate with slave stations connected to the Data Link. For more detailed information, refer to the 91732A Data Link Software data sheet and the 91730A Multipoint Software data sheet.

HP 3074A/M Data Link Adapter. The 3074A connects Asynchronous/Bisync-compatible devices with an RS-232-C or CCITT V24 interface to the Data Link. When connecting the master computer to the Data Link, the 3074A acts as a half-duplex modem and requires the Request To Send signal to be set high whenever data is to be transmitted to the Data Link. The 3074A in return provides a non-delayed Clear To Send signal, a Data Set Ready signal, and has Carrier Detect line processing.

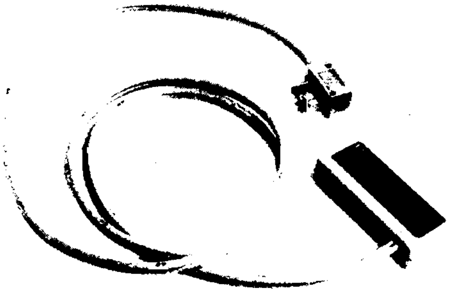
The 3074A contains a power on/off detection feature which prevents transients of the slave device from interfering with link operation when the slave station is turned on or off. Electrical isolation (500V/μS) between devices and the link adapter is ensured by optocouplers.

A Data Link connector compatible with the 92905A Data Link-to-Device cable, an RS-232-C connector for computer or terminal connection, and a device power connector are part of the 3074A. The adapter can be easily mounted on any flat surface of at least 250 mm by 110 mm (9.8 inches by 4.3 inches).

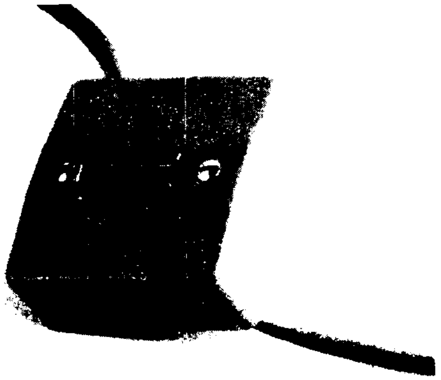
From E/F-Series systems only, remote installation of the Data Link is available via full-duplex asynchronous modems. It should be ordered with the 92905A Data Link-to-Device cable and the 30062C Modem extender cable.



HP 13264A Data Link Adapter. The 13264A converts the RS-232-C standard electrical levels for 9826A Desktop Computers and 2624B and 2626A terminals devices to the Data Link standard levels and vice-versa.



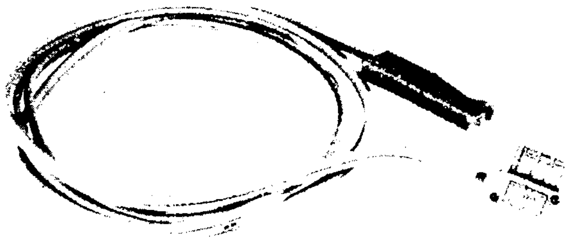
HP 92901A Data Link Connection Box. One connection box (product number 92901A for a pack of 5) is required for each device. The box is constructed of plastic, measuring 6.5 cm (2.6 inches) square and contains a set of six metal contacts with screw terminations. The contacts are designed so that a slave station can be connected and removed without disturbing link communications. Spare boxes can be installed on the cable where needed, and a security feature enables each device cable to be physically locked into the connection box.



HP 92902A Data Link Cabling. The Data Link Cable (HP 92902A or Belden 9463) is a twisted-pair, double-shielded cable which can be ordered in lengths of 100 or 300 meters. For longer distances, additional 100 or 300 meter sections may be ordered and added to the link through the use of the Data Link Connection Boxes (92901A).

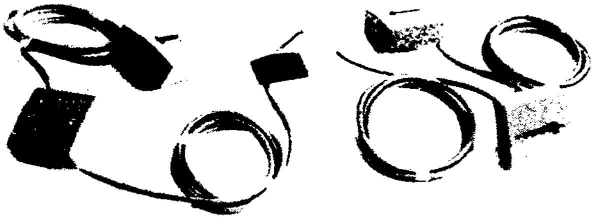
The Data Link Cable may not be run outside a building. For Data Link communication between buildings, 3074M modem adapters are available.

HP 92905A Data Link-to-Device Cable. This cable extends the Data Link to the device (or adapter). It is two meters (6.5 feet) long and is fitted with a Data Link connector at one end and a connector for a 3074A/M at the other end.



HP 92908A Data Link Tester. This diagnostic tool plugs into a Data Link connection box. LED indicators on the tester can monitor communications traffic on the Data Link, and are used to locate cable faults.

HP 92909A Data Link Test Cable. Pre-configured Data Link cable consisting of a 4 meter length of 92902A cable with five equally spaced 92901A connection boxes installed. This cable is used for initial Data Link installation and verification by the HP Customer Engineer. Subsequent cabling of the Data Link for the final network can be connected to the end of the 92909A cable. In this manner, the 92909A can be used for troubleshooting and initial verification of device operation before the complete Data Link is installed.



Specifications

General

Maximum length: 4 km (2.5 miles)

Maximum data rates: 19.2k bps (maximum rate of the Data Link master computer. Maximum Data Link operational speed must not exceed that of the slowest slave station connected to the Data Link)

Protocol: Binary Synchronous Communication in an asynchronous environment

Data Link interface circuit electrical characteristics: 5V differential signals

Maximum common mode slew rate: 500V/µS

Common mode noise immunity: 500 mV

Differential noise immunity: 100 mV

Electrical isolation of 3074A: 500V/µS

Maximum capacities: 64 devices per Data Link
- 8 Data Links per HP 1000 E/F-Series Master Computer (9600 bps)
- 4 Data Links per HP 1000 A/E/F-Series Master Computer (up to 19.2k bps)

Cable (mechanical)

Cable: HP 92902A or Belden 9463

Construction: two conductor, twisted pair shielded cable, per UL style 2464

Conductor: 20 AWG stranded tinned copper

Insulation: PVC per UL style 1007

Outer shield: Braid of 36 AWG tinned copper for 90% (physical) coverage

Inner shield: Aluminum mylar for 100% coverage

Cable lay: Twisted pair of conductors

Jacket: PVC rated for 105°C (220°F) at 300V (HP 92902A)
PVC rated for 60°C (140°F) at 150V (Belden 9463)

Cable (electrical)*

Voltage rating: 300 Vrms

Resistance: 0.032 ohm/m

Capacitance (between conductors): 130 pF/m

Inductance (between conductors): 0.65 µH

**Data Link voltage levels are compatible with RS-422 test equipment.*

A-Series Data Link Master Support Adapter Summary

SUPPORTING SYSTEM	MASTER DEVICES	PRODUCT NUMBERS	DATA LINK ADAPTER	SLAVE DEVICES	PRODUCT NUMBERS	DATA LINK ADAPTER
A-Series Master System Operating Under RTE-A and using 12092A Data Link Master Interface	SYSTEM PROCESSOR UNITS (SPUs)	2196C/D 2197C/D 2199C/D 2486A 2487A 2489A	3074A	A-Series SPUs using 12072A Data Link Slave Interface	2196C/D, 2197C/D, 2486A, 287A, 2489A	None required
				A-Series COMPUTERS using 12072A Data Link Slave Interface	2137A, 2139A, 2156B, 2436A/E, 2437A, 2439A	
				DESKTOP COMPUTERS	9826A	13264A
	COMPUTERS	2137A 2139A 2156B 2436A/E 2437A 2439A		PERSONAL COMPUTERS	85B, 86B	3074A
				TERMINALS	2624B, 2626A	13264A
				PRINTERS	2673A Option 039 Intelligent Graphics Printer	None required

E/F-Series Data Link Master Support Adapter Summary

SUPPORTING SYSTEM	MASTER DEVICES	PRODUCT NUMBERS	DATA LINK ADAPTER	SLAVE DEVICES	PRODUCT NUMBERS	DATA LINK ADAPTER
E/F-Series Master Systems Operating Under RTE-6/VM or RTE-IVB and using 12790A Multipoint Interface	SYSTEM PROCESSOR UNITS (SPUs)	2176E 2177F 2178C 2179C	3074A or 3074M	A-Series SPUs using 12072A Data Link Slave Interface	2196C/D, 2197C/D, 2199C/D, 2486A, 2487A, 2489A	None required
				E/F-Series SPUs using 12830A Data Link Slave Interface	2176E, 2177F, 2178C, 2179C	
				A-Series COMPUTERS using 12072A Data Link Slave Interface	2137A, 2139A, 2156B, 2436A/E, 2437A, 2439A	
	COMPUTERS	2109E 2113E 2117F		E/F-Series COMPUTERS using 12830A Data Link Slave Interface	2109E, 2113E, 2117F	
				DESKTOP COMPUTERS	9826A	13264A
				TERMINALS	2624B, 2626A	13264A

Ordering information

A-Series master computer

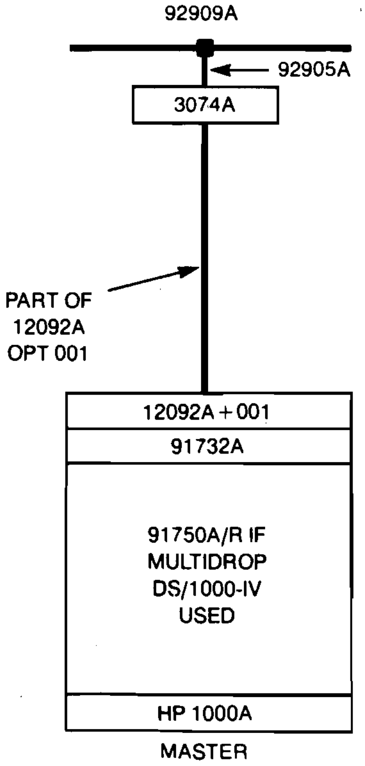
12092A Data Link Master Interface (includes interface, 5.17m (17 ft) 5061-5914 cable, and technical manual)
Opt. 001 (required) Substitutes 7.6m (25 ft) 5061-1391 modem cable

91732A Data Link Software with one of Use Options 600, 700, or 890 (includes software and technical manuals; must specify a media option)
Opt. 022 CS/80 cartridge tape
Opt. 041 1.2 Mb Flexible disc media
Opt. 044 Microfloppy disc media
Opt. 050 9-track 800 bpi magnetic tape
Opt. 051 9-track 1600 bpi magnetic tape
Opt. 600 Use in A600/A600+ Computer
Opt. 700 Use in A700 Computer
Opt. 890 Use in A900 or any other A-Series Computer

92905A Data Link-to-Device Cable (one required for 3074A connection)

92909A Data Link Test Cable

92908A Data Link Tester



E/F-Series master computer

12790A Multipoint Interface (includes interface, 10.6m (35 ft) 5061-1393 cable, and technical manual)
  Opt. 001 (required) Substitutes 7.6m (25 ft) 5061-1391 modem cable

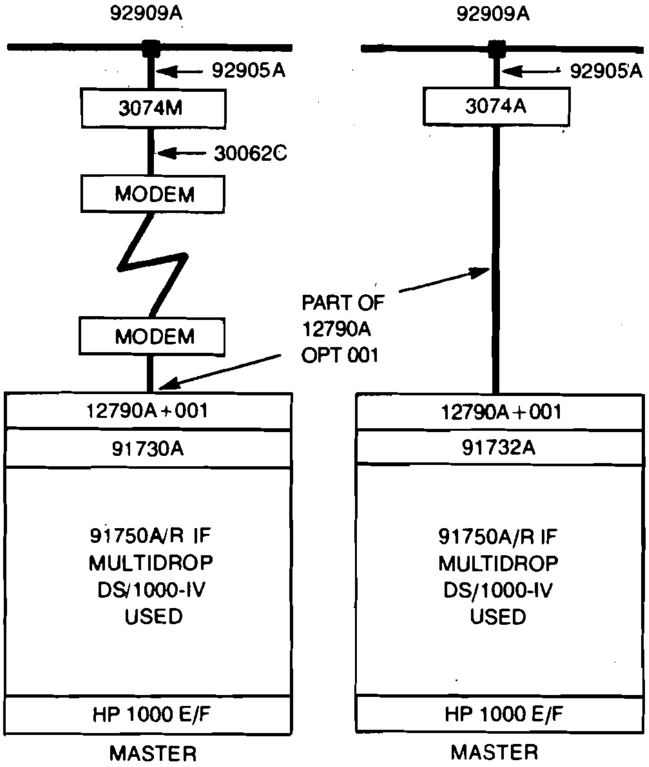
91730A Multipoint Software (includes software and technical manuals; must specify a media option)
  Opt. 022 CS/80 cartridge tape
  Opt. 050 9-track 800 bpi magnetic tape
  Opt. 051 9-track 1600 bpi magnetic tape

3074A or 3074M Data Link Adapter (30062C Modem Extender Cable must be ordered with the 3074M for modem operation)

92905A Data Link-to-Device Cable (one required for 3074A/M connection)

92909A Data Link Test Cable

92908A Data Link Tester


92909A
92905A
3074M
30062C
MODEM
MODEM
12790A+001
91730A
91750A/R IF
MULTIDROP
DS/1000-IV
USED
HP 1000 E/F
MASTER
PART OF
12790A
OPT 001
92909A
92905A
3074A
12790A+001
91732A
91750A/R IF
MULTIDROP
DS/1000-IV
USED
HP 1000 E/F
MASTER

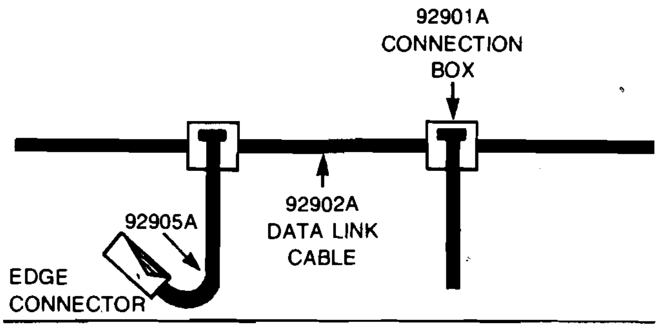
Data Link components

92901A Five Data Link Connection Boxes

92902A* Shielded Twisted Pair Data Link Cable
  opt. 001 100 meters
  opt. 002 300 meters

92905A Data Link-to-Device Cable

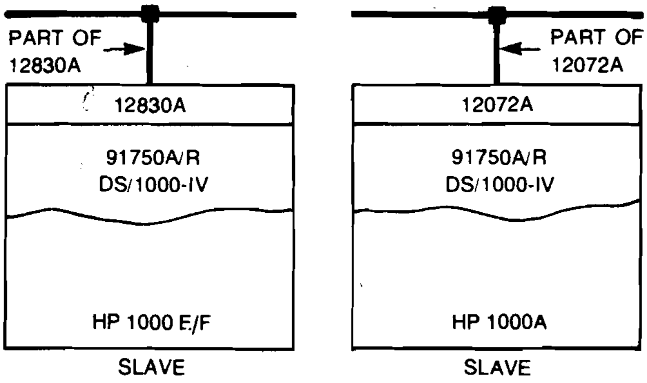
Belden cable, product number 9463, can be used in place of the HP 92902A cable.


92901A
CONNECTION
BOX
92905A
92902A
DATA LINK
CABLE
EDGE
CONNECTOR

To connect an A/E/F-Series Slave computer order:

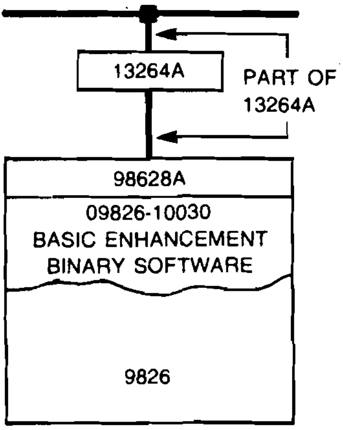
12830A Slave Card Interface for E/F-Series
12072A Slave Card Interface for A-Series
91750A/R Distributed Systems 1000-IV Network Software for master and all slave computers

Connection of A/E/F-Series computers as slave devices on the Data Link is only supported when used in conjunction with DS/1000-IV software for communication between the master and slave computers. See the DS/1000-IV Network Software data sheet for information concerning Multidrop DS/1000-IV. E/F-Series slave computers are NOT supported by A-Series Master systems.


PART OF
12830A
12830A
91750A/R
DS/1000-IV
HP 1000 E/F
SLAVE
PART OF
12072A
12072A
91750A/R
DS/1000-IV
HP 1000A
SLAVE

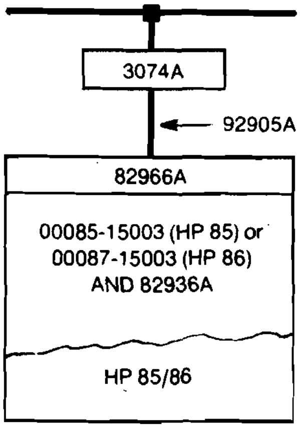
To connect a 9826A order:

92628A opt. 100 Data Link Datacomm Interface
opt. 001 Male modem connector
09826-10030 Basic Enhancement Binary
13264A Data Link Adapter
92901A Five Data Link Connection Boxes, if needed


13264A
PART OF 13264A
98628A
09826-10030 BASIC ENHANCEMENT BINARY SOFTWARE
9826

To Connect HP 85 or 86 (from A-Series Master only) Order:

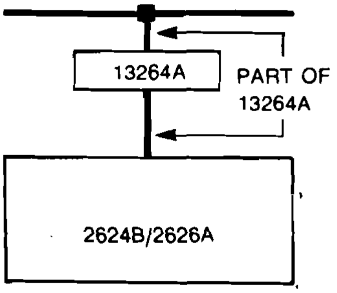
00085-15003 I/O ROM for HP 85
00087-15003 I/O ROM for HP 86 or HP 87
82936A ROM Drawer
82966A Series 80 Data Link Interface
3074A Data Link Adapter
92905A Data Link-to-Device Cable
92901A Five Data Link Connection Boxes, if needed


3074A
92905A
82966A
00085-15003 (HP 85) or 00087-15003 (HP 86) AND 82936A
HP 85/86

To connect CRT terminals order:

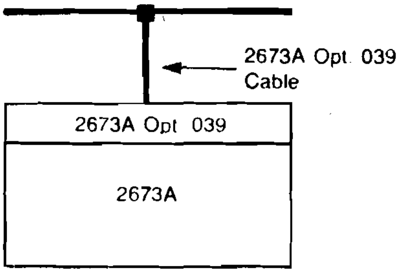
2624B/2626B Series:

2624B/2626A CRT Display Terminal
13264A Data Link Adapter
91901A Five Data Link Connection Boxes, if needed

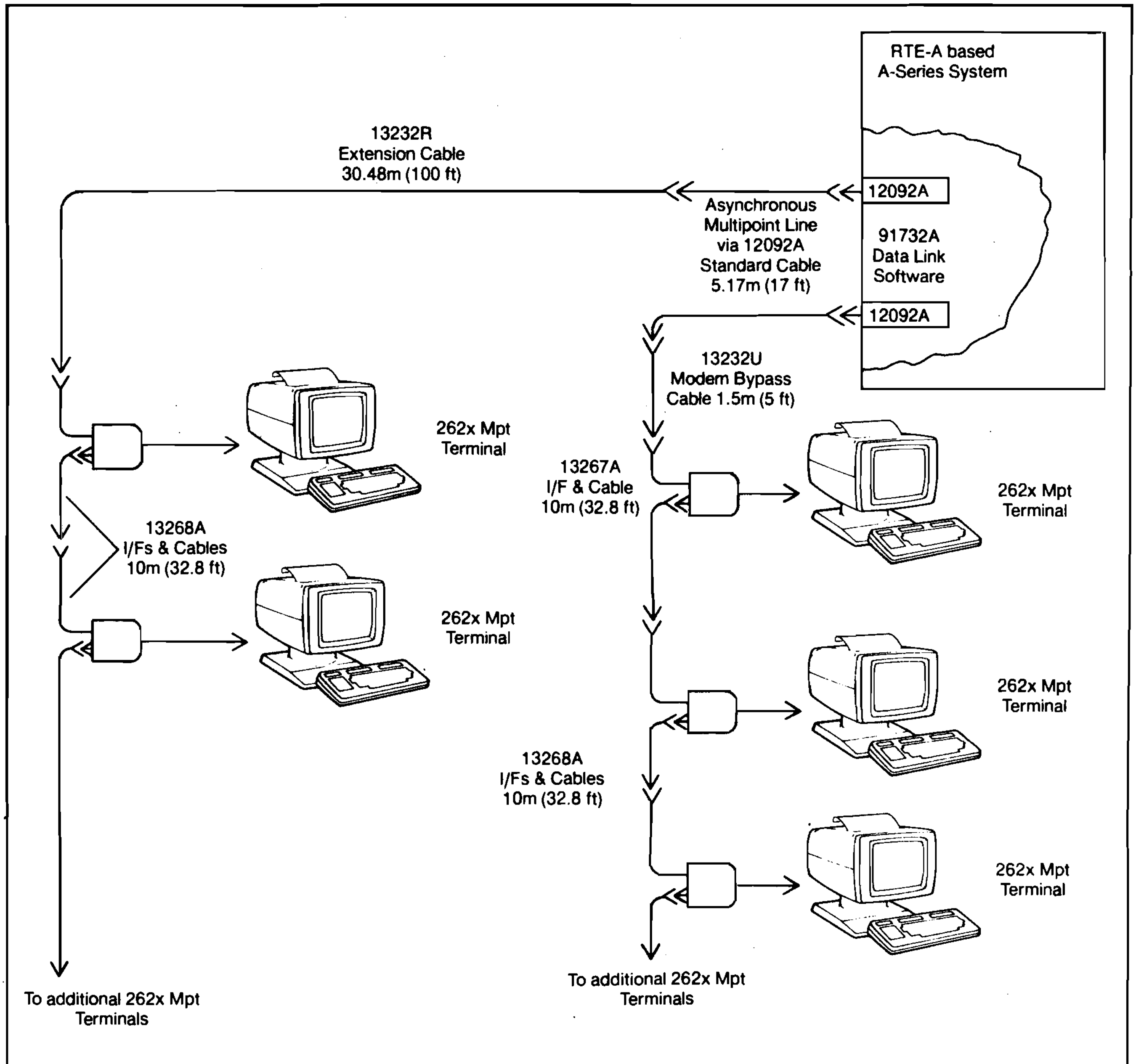

13264A
PART OF 13264A
2624B/2626A

To connect HP 2673A (from A-Series Master only) Order:

2673A Intelligent Graphics Printer with Option 039 DSN Data Link Interface instead of standard HP-IB interface (includes cable)
92901A Five Data Link Connection Boxes, if needed


2673A Opt 039 Cable
2673A Opt 039
2673A

HP 1000 A-Series Sample Multipoint Line Connection Configurations


RTE-A based
A-Series System
12092A
91732A
Data Link
Software
12092A
13232R
Extension Cable
30.48m (100 ft)
Asynchronous
Multipoint Line
via 12092A
Standard Cable
5.17m (17 ft)
13232U
Modem Bypass
Cable 1.5m (5 ft)
262x Mpt
Terminal
13268A
I/Fs & Cables
10m (32.8 ft)
262x Mpt
Terminal
13267A
I/F & Cable
10m (32.8 ft)
262x Mpt
Terminal
262x Mpt
Terminal
13268A
I/Fs & Cables
10m (32.8 ft)
262x Mpt
Terminal
To additional 262x Mpt
Terminals
To additional 262x Mpt
Terminals

LEGEND:

262x Mpt = 2624B or 2626A terminal with 13267A Async multipoint interface pod for first terminal on the line, 13268A Async multipoint interface pod for each additional terminal on the line.

Data Link Software

HP AdvanceNet

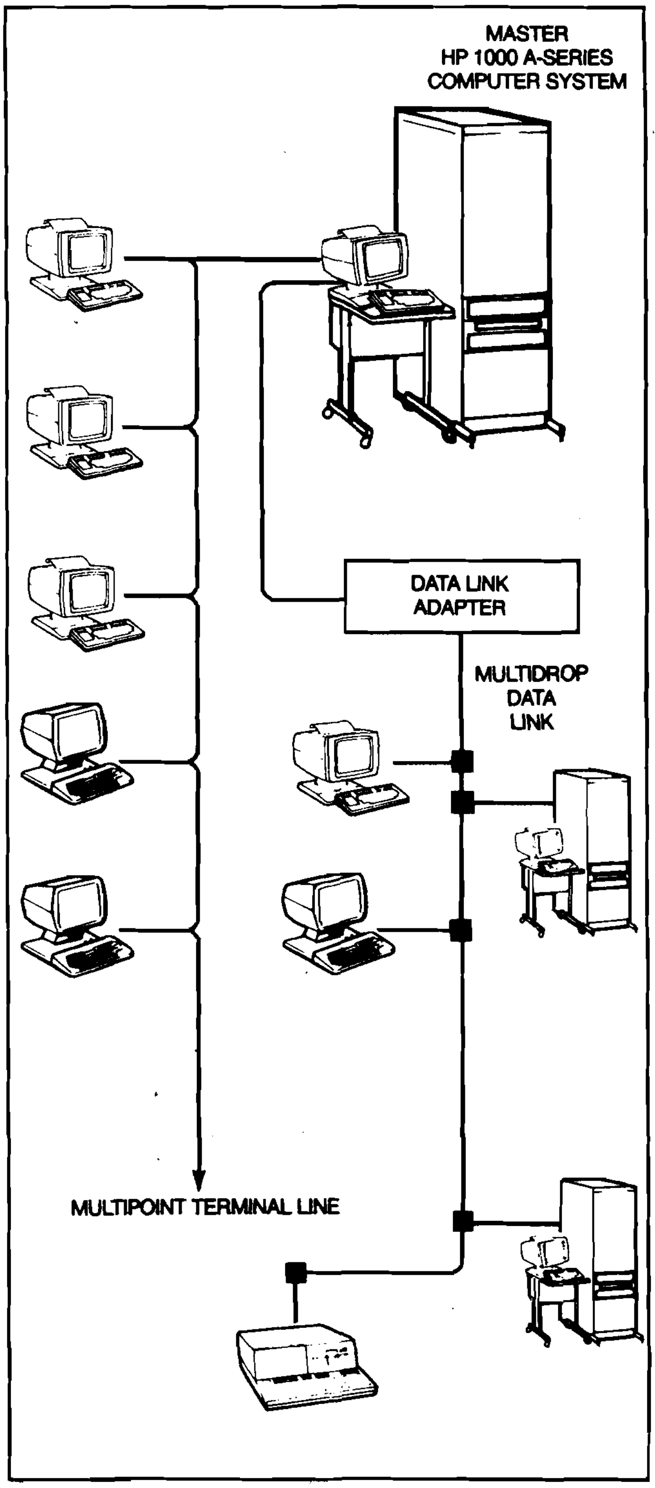
Product Number 91732A
For HP 1000 A-Series Computers

The 91732A is a software package for multidrop Data Link Communication or multipoint terminal communication.

The multidrop Data Link communication link utilizes the 91732A software and 12092A Data Link Master Interface for communication and protocol handling. This data sheet covers the features of 91732A software common to multidrop Data Link and multipoint terminal communications as well as those only pertaining to the multipoint terminal communications. In a multipoint configuration, HP 2624B and 2626A display terminals can be connected to an HP 1000 A-Series based computer system using the 12092A Data Link Master Interface. For detailed information on the Data Link, refer to the Data Link data sheet.

Features

- **Supports single I/O channel communication with multiple stations on a single communication line**
- **Program development and application program execution at terminals in both multipoint terminal and multidrop Data Link configurations on disc-based RTE-A systems**
- **Application program execution on memory-based RTE-A systems**
- **Computer-to-interface block transfers up to 2046 characters long at direct memory access rates**
- **Support for up to four 12092A Data Link Master Interfaces at 19.2k baud in an A-Series computer**
- **Multipoint master application program capability**
- **Multipoint network status program**
- **"Who-Are-You" command identification of terminals in a multipoint terminal connection (not available with multidrop Data Link connections)**
- **Automatic acknowledgement of data entry on multipoint terminals on both multipoint terminal lines and multidrop Data Link connections**
- **Group and line message broadcast capability**
- **Intelligent priority polling algorithm**
- **Power fail/auto restart program**
- **System functional tests for multipoint terminal lines and multidrop Data Link connections**
- **Supports communication with HP 1000 computers, and 9826 desktop computers and/or HP 85/86 personal computers in a multidrop Data Link configuration**



The 91732 software supports connection of multiple devices to HP 1000 Computers, via single hardwired, multidropped, modems, or Data Link communications lines, and the 12092A Data Link Master Interface.

Functional description

Multidrop Data Link

The HP 1000 Data Link is a multidrop communications link which utilizes the 91732A Software and 12092A Data Link Master Interface for communication between the master computer and slave stations connected to the Data Link. HP 9826 Desktop Computers, HP 85/86 Personal Computers, 2624B and 2626A Terminals, and 2673A+039 Printers can be connected to the Data Link. For more information about the Data Link, refer to the Data Link data sheet.

Multipoint and Data Link Usage

User-written application programs access devices connected either in multipoint terminal or multidrop Data Link configuration by their Logical Unit (LU) number. Reading from and writing to devices is supported from both FORTRAN 77 READ/WRITE statements and RTE EXEC calls. Each device can be running under the control of its own unique application program for read and write only. Therefore, a single communications line can be shared and effectively utilized. The multipoint interface queries the status of all devices in sequence such that: (1) Pending Read, Write, and Control requests to a device can be serviced, and (2) an enabled device can be "routinely polled" and thereby get RTE system attention or can schedule a program in the multipoint master computer. This querying process is TRANSPARENT to the user's application program. Users of multipoint line and multidrop Data Link terminals can utilize programs such as RTE File Manager, Edit/1000 (screen mode not supported), and the FORTRAN 77, Pascal/1000, and BASIC/1000C compilers.

Data Transfer Mode

All data transfers between the buffer on the 12092A interface and the user's application program are done via direct memory access. All devices operate in block mode.

Support of User-Written Master Application Programs

The 91732A software supports user-written master application programs for communication and control of devices in both a multipoint terminal line or a multidrop Data Link configuration.

Auto Acknowledgement

The 91732A software optionally provides for an audible auto acknowledgement at any terminal in both a multipoint line and multidrop Data Link configuration. As soon as the 12092A interface has unloaded a message to the computer system, an audible response is sounded at the terminal, alerting the operator that data can now be entered.

Multipoint Status Display

The 91732A software includes a dynamic status program (DYNST) which displays pertinent information about all currently active multipoint lines and multidrop Data Links and stations. By data link lines, it displays available LUs, line configuration, and cumulative statistics on line performance, including numbers of good blocks received and transmitted, NAKs transmitted, and received, etc. It also displays device status, including the LUs on each line, DVT and IFT availability, and request type. The station used by DYNST can be a terminal on a multipoint line or multidrop Data Link.

Terminal Status Querying and Initialization

A "Who-Are-You" command is available to the application programmer. It obtains the device identification and status of every operational (power turned on) terminal within a group of terminals. This is NOT available on a multidrop Data Link configuration, only on a multipoint terminal line. A Group is a logical subset of all terminals connected to the multipoint line. The terminals respond in the sequence of their physical position within the group. If the system is suitability generated, it is possible to programmatically initialize all the terminals within the group.

Alternatively, all devices and terminals in multipoint line and multidrop Data Link configurations can be initialized by FMGR commands from a system terminal.

Message Broadcasting

The 91732A software provides the capability to broadcast a message simultaneously to all terminals in a group, or all of the terminals on a multipoint line or multidrop Data Link.

Transparent Transmission

The 91732A software and interface card firmware support the transparent transmission of binary files as well as ASCII characters.

Intelligent Terminal Servicing

The 12092A interface firmware includes a priority polling algorithm. The user configures each device to be at one of four priority levels. The 12092A firmware polls each priority level twice as often as the next lower level. Completion of communication for a device being serviced has higher priority than all polling.

Data Link Utilities

AUTO7	Power fail restart program.
CONFG	Configuration report program.
VERDL	Program for verifying operation of devices on the data link.
DYNST	Program for reporting status of devices on the data link.
AEXMP	Program for exercising terminals on the data link.

System Level Exerciser

A system-level exerciser program (AEXMP) is supplied with the 91732A software. The exerciser sends a specified terminal one or more lines of data, and causes the same lines of data to be transmitted back to the exerciser program for verification.

System Functional Tests

The system functional tests (VERDL) supplied with the 91732A software are designed for verification of communication between the master computer and stations connected to either the multidrop Data Link or multipoint terminal line.

Functional specifications

Interfaces and Data Rates

Number of 12092A interfaces supported: 4

Maximum data rate (k bps): 19.2

Compatible Multipoint terminals

2624B and 2626A display terminals.

Multipoint Modem Support

Multidropped Bell 202T Modems are supported over leased Bell System Multipoint Lines, with the restriction that group I.D.s cannot go across multiple drops.

Supported multidrop Data Link devices

See the Data Link data sheet.

Number of Terminals Per Multipoint Line

Normally, up to 32 terminals can be connected to the 12092A interface via a single multipoint line. The following three factors determine the number of terminals which can be connected:

1. The number of terminals that can be *physically* connected depends upon the transmission mode. Asynchronously, up to 32 terminals can be *physically* connected; the distance between any two terminals can be 609 metres (2000 ft), provided that the total line length does not exceed 4876 metres (16000 ft), regardless of transmission speed up to a maximum distance between any two terminals is also 609 metres (2000 ft) and maximum total line length is also 4876 metres (16000 ft), but the number of terminals per line depends upon the average distance between terminals and line speed, as summarized in Table 1.
2. The maximum number of *logically connectable* terminals may be constrained by the logical unit number capacity of the RTE operating system in which the 12092A and its supporting 91732A software are operated.
3. Finally, the number of terminals that can be *realistically* supported depends upon the amount of text character I/O generated by each terminal on the line, the length of those text blocks, the speed of the line itself, and other user-dependent requirements, such as response time.

Table 1. Average line lengths between multipoint terminals on a synchronous line

Terminals per line	Average line length versus line speeds of: 2400 bps	4800 bps	9600 bps
4	609m (2000 ft)	609m (2000 ft)	609m (2000 ft)
8	609m (2000 ft)	609m (2000 ft)	365m (1200 ft)
16	609m (2000 ft)	365m (1200 ft)	146m (480 ft)
32	365m 91200 ft)	146m (480 ft)	36.5m (120 ft)

RTE System Capabilities Accessible From Multipoint Line and Multidrop Data Line Terminals

The 91732A software gives multipoint line and multidrop Data Link stations the same access to system capabilities as non-multipoint terminals, except that:

1. Intra-line character edits (CTRL/R,I,C,T to Replace, Insert, Cancel, or Truncate characters) are not effective in the multipoint environment wherein whole lines are transmitted to Edit/1000 at a time. However, the multipoint terminals have the intelligence, buffering, and predefined keys to support selective forward tab spacing and backspacing, and the replacement, insertion, or deletion of characters within a line without interrupting the 12092A interface. The screen mode of Edit/1000 is not available on multipoint line and multidrop Data Link terminals.
2. Terminal peripherals, such as Mini cartridges, are addressed as subchannels to the Terminals Logical Unit. Therefore, while user-written multipoint subroutines can access the terminal peripherals, there is no direct interface between the RTE File Manager and those peripherals.

Power Fail Restart

Working in conjunction with the RTE power fail/auto restart driver ID.43, a power fail restart program (AUTO7) furnished with the multipoint software resets each 12092A interface in the system so that I/O may resume after a power failure. A power failure message is broadcast to all multipoint terminals on the system.

Approximate Memory Requirements

AUTO7:	10 kb
CONFG:	30 kb
VERDL:	10 kb
DYNST:	32 kb
AEXMP:	14 kb

Ordering information

91732A Data Link Software (Must order Use Option 600, 700, or 890)

The 91732A product includes:

1. Software on media option 022, 041, 042, 044, or 51, one of which must be ordered.
2. 91732-90001 Data Link/Multipoint Subsystem Reference Manual

91732A Media Options

022: Provides 91732A Software on CS/80 cartridge tape.

041: Provides 91732A Software on 1.2M byte flexible disc for 9895A.

044: Provides 91732A Software on 270k byte microfloppy disc.

051: Provides 91732A Software on 1600 bpi, 9-track magnetic tape.

91732A/R Use Options

600: Use in A600/A600+ Computer.

700: Use in A700 Computer.

890: Use in A900 Computer or any other A-Series Computer.

91732R Right to Copy 91732A Software For Use on an Additional Computer System

The 91732R Right to Copy product is available only to customers who have purchased a license to use 91732A. 91732R, which must be ordered with one of Use Options 600, 700, or 890, consists of:

1. The right to make one copy of software purchased with the 91732A product for use on an additional system.
2. 91732-90001 Data Link/Multipoint Subsystem Reference Manual.

Support Services

Effective April 1984, HP's software support structure was reorganized. Customers with existing support contracts for the HP 1000 may continue with their contracts and buy support for new software products coterminous with their existing contracts. *All other customers may only buy the new support contracts.*

Existing Contracts

Customers with existing contracts may buy MUS, SSS or CSS. MUS provides manual updates only; SSS provides software/firmware updates and software problem reporting plus MUS; CSS provides SSS plus an account assigned SE, on-site assistance and telephone assistance through the Response Centers. The product numbers for these services are listed below.

91732T	CSS
91732V	CSS - EXTENDED
91732S	SSS
91732W	SSS - EXTENDED
91732Q	MUS

New Support Contracts

For all new customers and customers without an existing contract, the new support services include Account Management Support (AMS, similar to CSS), Software Materials Subscription (SMS, similar to SSS), and a new level called Response Center Support (RCS) which includes all materials (SMS) and telephone assistance through the Response Centers. Customers with existing contracts may also take advantage of these services by converting their entire contract to the new program.

For customers choosing AMS or RCS on their operating system, Data Link Software is supported by purchasing Datacomm B category support. Only one datacomm category support need be purchased for the "highest" datacomm category. (A = lowest, C = highest)). SMS must also be purchased. For customers choosing SMS on their operating system, Data Link Software is supported by purchasing SMS only. For additional systems, the extended datacomm category support and extended SMS are used. MUS is available as well.

Support Products:

99086D+C00	Datacomm B/1000
99086D+V00	Extended Datacomm B/1000
99086D+Q00	MUS Datacomm B/1000
91732A+S00	SMS
91732A+W00	Extended SMS

Multipoint Software

HEWLETT PACKARD

Product Number 91730A
For HP 1000 E/F-Series Computers

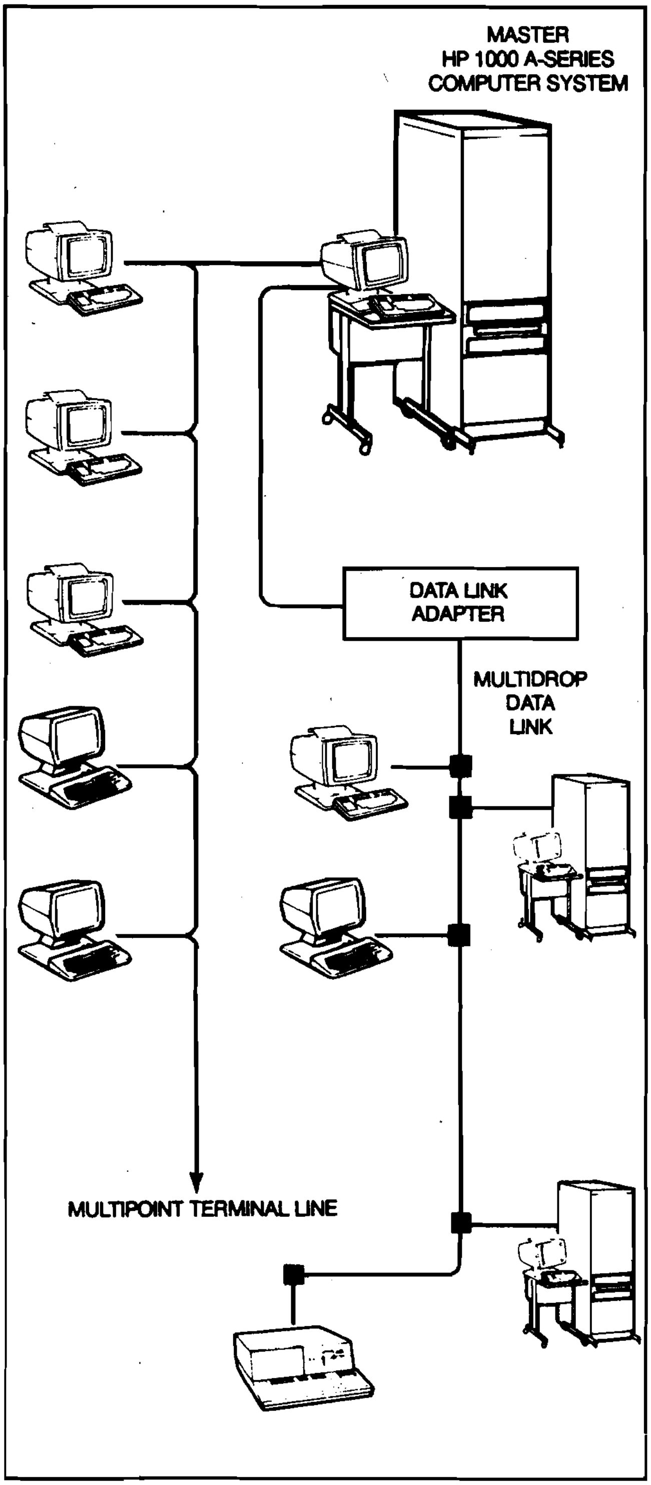
HP AdvanceNet

The 91730A is a software package for multipoint terminal communication and multidrop Data Link communication. In a multipoint configuration, HP 2624B and 2626A display terminals can be connected to a master HP 1000 E/F-Series based computer system using the 12790A Multipoint Interface.

The multidrop Data Link communication link utilizes the 91730A software and 12790A interface for communication and protocol handling. This data sheet covers the features of 91730A software common to multipoint terminal and multidrop Data Link as well as those only pertaining the multipoint terminal communications. For detailed information on the Data Link, refer to the Data Link data sheet.

Features

- **Supports single I/O channel communication with multiple stations on a single communication line**
- **Program development and application program execution at terminals in both multipoint terminal and multidrop Data Link configurations on RTE-IVB and RTE-6/VM based systems**
- **Application program execution on RTE-IVE based systems**
- **Computer-to-interface block transfers up to 1000 characters long at DCPC (direct memory access) rates**
- **Support for up to eight 12790A Multipoint interfaces at 9600 baud and four at 19.2k baud in an E/F-Series computer**
- **Multipoint master application program capability**
- **Multipoint network status program**
- **"Who-Are-You" command identification of terminals in a multipoint terminal connection (not available with multidrop Data Link connections)**
- **Automatic acknowledge of data entry on multipoint terminals on both multipoint terminal lines and multidrop Data Link connections**
- **Group and line message broadcast capability**
- **Intelligent polling algorithm**
- **Power fail restart subroutine**
- **System functional tests for multipoint terminal lines and multidrop Data Link connections**
- **Supports communications with auxiliary printers on display terminals in both multipoint terminal and multidrop Data Link configurations.**



The 91730 Multipoint Software supports connection of multiple devices to HP 1000 Computers, via single hardwired, modem, or Data Link communications lines, and the 12790A Multipoint interface.

- **Supports communication with HP 1000 computers and 9826 desktop computers in a multidrop Data Link configuration**

Functional description

Multidrop Data Link

The HP 1000 Data Link is a multidrop communications link which utilizes the 91730A software and 12790A interface for communication between the master computer and slave stations connected to the Data Link. HP 1000 E/F and A-Series computers, 9826 series desktop computers and 2624B/2626A terminals can be connected to the Data Link. For more information about the Data Link, refer to the Data Link data sheet.

Multipoint and Data Link usage

User-written application programs access devices connected either in multipoint terminal or multidrop Data Link configuration by their Logical Unit (LU) number. Reading from and writing to devices is supported from both FORTRAN READ/WRITE statements and RTE EXEC calls. Each device can be running under the control of its own unique application program for read and write only. Therefore, a single communications line can be shared and effectively utilized. Multipoint software driver queries the status of all devices in sequence such that: (1) Pending Read, Write, and Control requests to a device can be serviced, and (2) an enabled device can be "routinely polled" and thereby get RTE system attention or can schedule a program in the multipoint master computer. This querying process is TRANSPARENT to the user's application program. Users of multipoint line and multidrop Data Link terminals can utilize programs such as RTE File Manager, Edit/1000 (screen mode not supported), and FORTRAN compiler.

Data transfer mode

All data transfers between the buffer on the 12790A Multipoint interface and the user's application program are done via direct memory access under the control of the Dual Channel Port Controller (DCPC). All devices operate in block mode.

Support of user-written master application programs

Multipoint software supports user-written master application programs for communication and control of devices in both a multipoint terminal line or a multidrop Data Link configuration.

Auto acknowledgement

Multipoint software optionally provides for an audible auto acknowledgement at any terminal in both a multipoint line and multidrop Data Link configuration. As soon as the 12790A Multipoint interface has unloaded a message to the computer system, an audible response is sounded at the terminal, alerting the operator that data can now be entered.

Multipoint status display

The multipoint software includes a program which displays pertinent information about all currently active multipoint lines and multidrop Data Links and stations. By device LU, it displays parameters such as station ID and availability, EQT number and status, and whether routine polling is enabled. The display station can be a terminal on the multipoint line or multidrop Data Link.

Terminal status querying and initialization

A "Who-Are-You" command is available to the application programmer. It obtains the device identification and status of every operational (power turned on) terminal within a group of terminals. This is NOT available on a multidrop Data Link configuration, only on a multipoint terminal line. A Group is a logical subset of all terminals connected to the multipoint line. The terminals respond in the sequence of their physical position within the group. If the system is suitably generated, it is possible to programmatically initialize all the terminals within the group.

Alternatively, all devices and terminals in multipoint line and multidrop Data Link configurations can be initialized by FMGR commands from a system terminal.

Message broadcasting

The multipoint software provides the capability to broadcast a message simultaneously to all terminals in a group, or all of the terminals on a multipoint line or multidrop Data Link.

Access to terminal auxiliary printers

A multipoint software subroutine provides for direct output to an auxiliary printer connected to multipoint line and multidrop Data Link terminals.

Transparent transmission

Multipoint software and interface card firmware support the transparent transmission of binary files as well as ASCII characters.

Intelligent terminal servicing

Multipoint software driver DVR07 implements an intelligent device servicing algorithm which prevents line monopolization by a single station while prioritizing activity on the multipoint line or multidrop Data Link. DVR07 queries the status of each station sequentially and directs the 12790A to generate Bisync Poll Messages (for Reads and Routine Polls) or Bisync Select Messages (for Write or Control requests), as determined by the algorithm. In a status inquiry at a given station, DVR07 checks for active Write, Read, or Control requests from a system or user program. A Control request or a Write to a station, if pending, is serviced immediately. A Read from a given station is done after the status of all other stations on the multipoint line has been queried once. No more than 1000 characters of text can be written to or read from a given station before a status inquiry is performed on all stations in sequence. Likewise, if a status inquiry for a device shows no active Write, Read, or Control requests, then that station will, if enabled, be "routinely polled" for operator intervention to get RTE system attention or schedule the multipoint master application program **after** a status inquiry of all other stations on the multipoint line has been performed once. In this way, the intelligent station servicing algorithm gives Writes and Control requests priority over Reads and Routine Polls. It also prevents one station from monopolizing the line by doing a status inquiry at all other stations (and potentially servicing them) before more than 1000 characters in a long message are transmitted to or from that one station. Each station thus has equal access to the resources of the system.

System level exerciser

A system-level exerciser program is supplied with the multipoint software. The exerciser sends a specified terminal one or more lines of data, and causes the same lines of data to be transmitted back to the exerciser program for verification.

System functional tests

The system functional tests supplied with the multipoint software are designed for verification of communication between the master computer and stations connected to either the multidrop Data Link or multipoint terminal line.

Functional specifications

Compatible multipoint line terminals

2624B and 2626A display terminals.

For compatible multidrop Data Link devices, see the Data Link data sheet.

Interfaces per system

Up to eight.

Number of terminals per multipoint line

Normally, up to 32 terminals can be connected to the 12790A interface via a single multipoint line. The following three factors determine the number of terminals which can be connected:

1. The number of terminals that can be *physically* connected depends upon the transmission mode. Asynchronously, up to 32 terminals can be *physically* connected; the distance between any two terminals can be 609 metres (2000 ft), provided that the total line length does not exceed 4876 metres (16000 ft), regardless of transmission speed up to a maximum distance between any two terminals is also 609 metres (2000 ft) and maximum total line length is also 4876 metres (16000 ft), but the number of terminals per line depends upon the average distance between terminals and line speed, as summarized in Table 1.
2. The maximum number of *logically connectable* terminals may be constrained by the logical unit number capacity of the RTE operating system in which the 12790A and its supporting 91730A software are operated.
3. Finally, the number of terminals that can be *realistically* supported depends upon the amount of text character I/O generated by each terminal on the line, the length of those text blocks, the speed of the line itself, and other user-dependent requirements, such as response time.

Table 1. Average line lengths between multipoint terminals on a synchronous line

Terminals per line	**Average line length versus line speeds of:**		
	2400 bps	**4800 bps**	**9600 bps**
4	609m (2000 ft)	609m (2000 ft)	609m (2000 ft)
8	609m (2000 ft)	609m (2000 ft)	365m (1200 ft)
16	609m (2000 ft)	365m (1200 ft)	146m (480 ft)
32	365m (1200 ft)	146m (480 ft)	36.5m (120 ft)

Maximum system usage per 12790A interface

The maximum requirement for time that would otherwise be available to a compute-bound user program in the RTE system occurs during the limiting case of transferring one byte buffers. As the buffer size increases, the overhead decreases, dropping below the background polling overhead for sufficiently large buffer sizes. Routine polling overhead is realized when there are no transfers to stations. System usage is essentially independent of the number of devices on the multipoint line or multidrop Data Link, but is a direct function of the number of 12790A interfaces and is also dependent upon the transmission mode, line speed and buffer size. The following usage figures apply to operation of the 91730A Multipoint software in an HP 1000 E-Series Computer with standard performance memory operating under RTE-IVB;

Multipoint Line	Asynchronous	Synchronous
Line speed	9600 bps	9600 bps
Approximate requirement for otherwise user-available processing time, worst case with 1 byte buffers	10%	6%

Multidrop Data Link	Asynchronous	Asynchronous
Line speed	9600 bps	19.2k bps
Approximate requirement for otherwise user-available processing time, worst case with 1 byte buffers	10%	20%
Background routine polling	6%	11%

RTE system capabilities accessible from multipoint line and multidrop Data Link terminals

The multipoint software gives multipoint line and multidrop Data Link stations the same access to system capabilities as non-multipoint terminals, except that:

1. Intra-line character edits (CTRL/R,I,C,T to Replace, Insert, Cancel, or Truncate characters) are not effective in the multipoint environment wherein whole lines are transmitted to Edit/1000 at a time. However, the multipoint terminals have the intelligence, buffering, and predefined keys to support selective forward tab spacing and backspacing, and the replacement, insertion, or deletion of characters within a line without interrupting the 12790A interface. The screen mode of Edit/1000 is not available on multipoint line and multidrop Data Link terminals.
2. Terminal peripherals, such as auxiliary printers, are addressed as subchannels to the Terminal Logical Unit. Therefore, while multipoint subroutines can access the terminal peripherals, there is no direct interface between the RTE File Manager and those peripherals.

Power fail restart

Working in conjunction with the RTE power fail/auto restart routines, a power fail restart subroutine furnished with the multipoint software resets each 12790A interface in the system so that I/O may resume after a power failure. This subroutine also runs the 12790A firmware-controlled self test. If the power failure occurred during a phase of the I/O operation from which recovery is not possible, an I/O error message is sent to the system console. A power failure message is broadcast to all multipoint terminals on the system.

Approximate memory requirements

Multipoint driver DVR07: 4k bytes
Terminal peripheral subroutine: 964 bytes
Power fail restart subroutine: 512 bytes*
System-level exerciser program: 3446 bytes*
System status program: 1732 bytes*

**These subroutines and programs can be placed in the resident library or appended to a user's application program.*

Ordering information

91730A Multipoint Software

The 91730A Multipoint Software includes:

1. One of software media options 022, 050, or 051 which must be ordered.
2. Multipoint Software Numbering Catalog (91730-90001).
3. Multipoint User's Guide (91730-90002).
4. Data Link Manager's Manual (91730-90006).

91730A Options

022: Provides Multipoint Software on CS/80 cartridge tape.
050: Provides Multipoint Software on 800 bpi, 9-track magnetic tape.
051: Provides Multipoint Software on 1600 bpi, 9-track magnetic tape.

Software support products available

92730T Customer Support Service for 91730A software (same media option as 91730A)

91730V Central support for additional copy of 91730A

91730S Software Subscription Service for 91730A software (same media option as 91730A)

91730Q Manual Update Service for 91730A software manuals

Support Services

Effective April 1984, HP's software support structure was reorganized. Customers with existing support contracts for the HP 1000 may continue with their contracts and buy support for new software products coterminous with their existing contracts. *All other customers may only buy the new support contracts.*

Existing Contracts

Customers with existing contracts may buy MUS, SSS or CSS. MUS provides manual updates only; SSS provides software/firmware updates and software problem reporting plus MUS; CSS provides SSS plus an account assigned SE, on-site assistance and telephone assistance through the Response Centers. The product numbers for these services are listed below.

91730T	CSS
91730V	CSS - EXTENDED
91730S	SSS
91730W	SSS - EXTENDED
91730Q	MUS

New Support Contracts

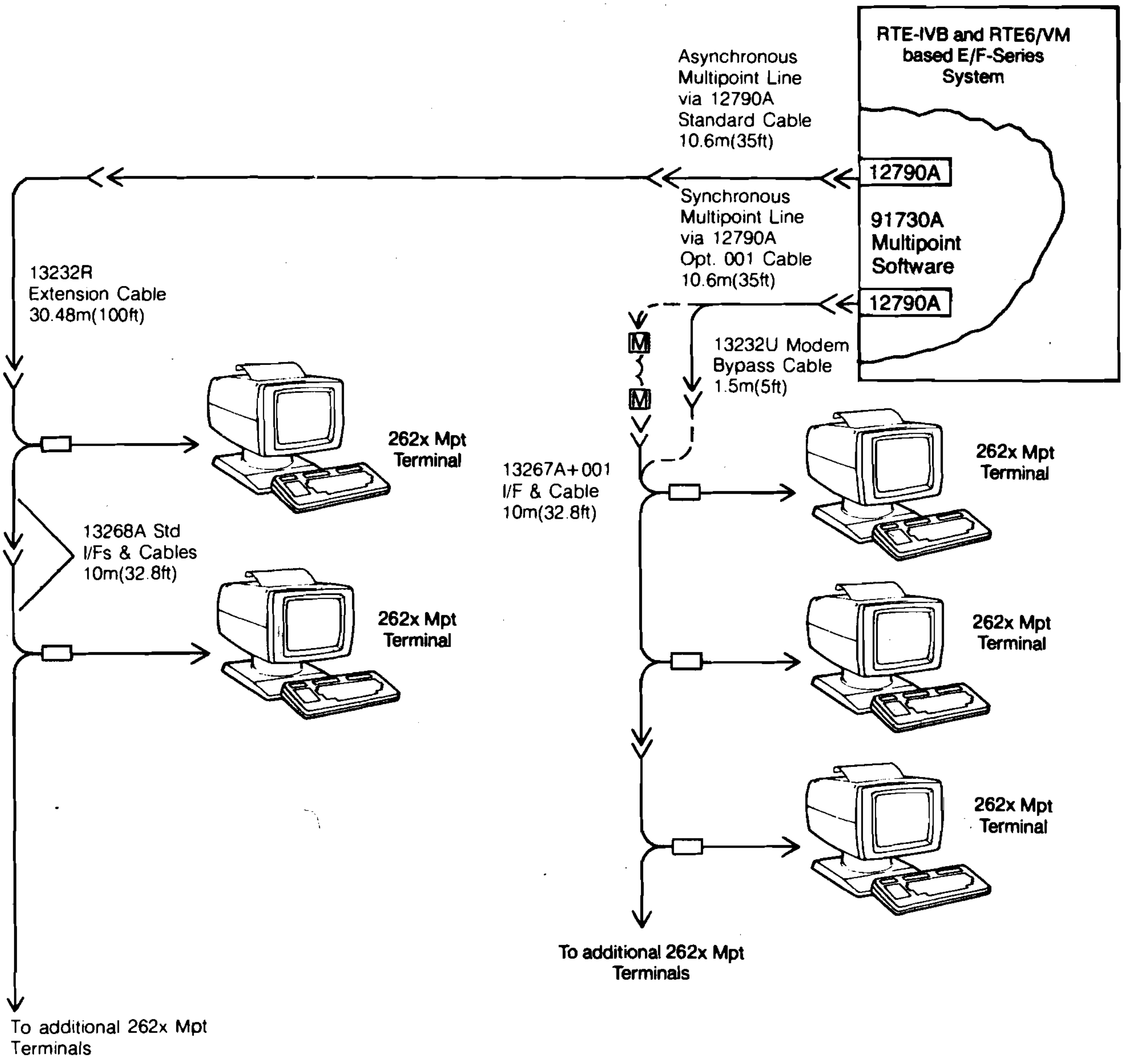
For all new customers and customers without an existing contract, the new support services include Account Management Support (AMS, similar to CSS), Software Materials Subscription (SMS, similar to SSS), and a new level called Response Center Support (RCS) which includes all materials (SMS) and telephone assistance through the Response Centers. Customers with existing contracts may also take advantage of these services by converting their entire contract to the new program.

For customers choosing AMS or RCS on their operating system, Multipoint Software is supported by purchasing Datacomm B category support. (Only one datacomm category support need be purchased — for the "highest" datacomm category. (A = lowest, C = highest)). SMS must also be purchased. For customers choosing SMS on their operating system, Multipoint Software is supported by purchasing SMS only. For additional systems, the extended datacomm category support and extended SMS are used. MUS is available as well.

Support Products:

99086D+C00	Datacomm B/1000
99086D+V00	Extended Datacomm B/1000
99086D+Q00	MUS Datacomm B/1000
91730A+S00	SMS
91730A+W00	Extended SMS

HP 1000 E/F-Series Sample Multipoint Line Connection Configurations


RTE-IVB and RTE6/VM based E/F-Series System
12790A
91730A Multipoint Software
12790A
Asynchronous Multipoint Line via 12790A Standard Cable 10.6m(35ft)
Synchronous Multipoint Line via 12790A Opt. 001 Cable 10.6m(35ft)
13232R Extension Cable 30.48m(100ft)
M
M
13232U Modem Bypass Cable 1.5m(5ft)
262x Mpt Terminal
13268A Std I/Fs & Cables 10m(32.8ft)
262x Mpt Terminal
13267A+001 I/F & Cable 10m(32.8ft)
262x Mpt Terminal
262x Mpt Terminal
262x Mpt Terminal
To additional 262x Mpt Terminals
To additional 262x Mpt Terminals

• Communications mode of line (synchronous or asynchronous) is determined by choice of modem. Direct connect line, either via 12790A Std cable or 12790A Opt. 001 cable and 13232U Modem bypass•cable will always be asynchronous, requiring the use of 13267A/13268A Standard 262x multipoint interface pods and 264x Option 033.

LEGEND:

262x Mpt	**= 2624B/2626A terminal with 13267A Async multipoint interface pod or 13267A+001 Sync multipoint interface pod for first terminal on the line, 13268A Async multipoint interface pod or 13268A+001 Sync multipoint interface pod for each additional terminal on the line.**

Remote Job Entry-II (RJE/1000-II)

HEWLETT PACKARD

HP AdvanceNet

Product Number 91781A
For HP 1000 Computers

Description

RJE/1000-II provides batch communications capability between HP 1000 computers and other computers emulating the widely implemented IBM 2780/3780 protocol.

This capability can be utilized in a wide variety of applications. Listed below are some typical uses of RJE/1000-II.

- Up or down loading of jobs from a host computer
- Submission of jobs for remote processing
- File transfer to other computers emulating the 2780/3780 workstation
- Remote spooling of files

RJE/1000-II replaces the existing RJE product (#91780) on the HP 1000 E/F-Series computer. A discount is being offered on the new RJE/1000-II software for customers who want to trade up from RJE (91780) to RJE/1000-II (91781A) on a particular E/F-Series computer. Please contact your sales representative for details.

Along with HP's other batch datacomm product, MRJE, and PMF/1000 (Programmatic Mainframe Facility), which emulates an IBM 3270 cluster controller, the HP 1000 offers a full complement of Bisync IBM data communications products.

Features

- **2780/3780 emulation**
- **Up to 19.2 Kbps**
- **Greater than 90% line efficiency**
- **Less than 10% CPU overhead (even at 19.2 Kbps)**
- **Interactive use**
- **Programmatic use**
- **Automatic post processor scheduling of user programs**
- **Background use**
- **Multiple users**
- **Disc file transfer**
- **File queuing**
- **Automatic data conversion (EBCDIC/ASCII)**
- **Bisync protocol (contention)**
- **Intelligent microprocessor based I/O card**
- **Diagnostic utilities**
- **Communicates with JES2, JES3, and HASP II**
- **Communicates with accurate emulations of 2780/3780 workstations**
- **Switched (dial-up) or leased (dedicated) communication lines**
- **No dedicated console required**

Functional description

2780/3780 Emulation

RJE/1000-II is a software package that lets HP 1000 E,F and A-Series computers emulate the IBM 2780/3780 workstation. This product allows HP 1000 users to send and receive files (jobs) from remote job entry subsystems on IBM and IBM plug compatible hosts. The job entry subsystems that are supported currently are JES2, JES3, and HASP II. Contact your support engineer for the latest list of supported job entry subsystems.

RJE/1000-II also enables HP 1000 users to transfer files with other computers that have accurately implemented the 2780/3780 protocol. This capability is supported on the HP 1000, HP 3000 and HP 9000 computers (RJE/1000-II only on the HP 1000 computers). Your support engineer will be informed as additional systems are known to work with RJE/1000-II.

Interactive Use

RJE/1000-II allows users to interactively send and receive files using a set of powerful but simple commands. In addition RJE/1000-II gives powerful diagnostic tools to trace and check status. Additional tools are provided to abort and reroute HP 1000 destinations for files which are already in transmission.

Custom Interface

RJE/1000-II may be invoked from a user's program. It will return status parameters to the calling program. This gives the user the flexibility to design custom interfaces to suit his own needs. Optionally, the user may write special programs which send and receive files via RJE/1000-II, allowing unattended operation. On completion of transmission RJE/1000-II can schedule a program to handle the file received. The program scheduled will run independently of RJE/1000-II and perform post processing upon the received file; e.g. route files to the appropriate device or program as required.

Background Use

RJE/1000-II can operate in background mode. This frees up the user terminal for other uses while RJE/1000-II programmatically sends and receives files.

Flexible Usage

RJE/1000-II allows multiple users to send and receive files through one copy of executing code. The users may send multiple requests which are queued up for transmission. Data files may be Binary or ASCII. RJE/1000-II performs automatic data conversion from ASCII to EBCDIC for transmission; it also converts received data from EBCDIC to ASCII. Automatic queuing and data conversion provide a user friendly interface.

Distributed Processing

RJE/1000-II uses a microprocessor based intelligent I/O card to handle the Bisync protocol to the host computer. This Programmable Serial Interface (PSI) card offloads much of the I/O handling and task scheduling thus lowering CPU usage and increasing effective throughput.

High Performance/Low Overhead

RJE/1000-II is designed for high throughput and extremely low CPU overhead. Using a 19.2 Kbps line, RJE/1000-II has greater than 90% line efficiency and typically less than 10% CPU usage. With compressible data the effective throughput can increase to over 100%.

Functional Specifications

Workstations

The following IBM workstations are emulated:

- 2780
- 3780

Remote Systems

The host computer must run with one of the following job entry subsystems using the Bisync contention protocol:

- JES2
- JES3
- HASP II

or

- HP 3000 with RJE
- HP 9000 with RJE
- HP 1000 with RJE/1000-II
- HP 1000 with RJE
- Please contact your SE for the latest list of supported systems.

Communications Link

The Communications Link must have the following features:

Switched or non-switched

Up to 19,200 bps

2780/3780 Protocol — (EBCDIC and Transparent line codes are supported, ASCII line code is not supported)

Binary synchronous contention protocol

Point to point lines

Modems Supported

Connection to the communications line is made through a modem obtained and installed independently of RJE/1000-II. One modem links the Programmable Serial Interface card in the HP 1000 and the communications line. Another modem connects the communications line to the host computer. The modems must be compatible with each other and must be strapped properly.

The following modems are supported:

Bell 201C (2400 bps)
Bell 208A (4800 bps)
Bell 208B (4800 bps)
Bell Dataphone II 2024 (2400 bps)
Bell Dataphone II 2048 (4800 bps)
Bell Dataphone II 2096 (9600 bps)

Modems operating at 19.2 Kbps may be used if they meet the following criteria:

1. Provide, transmit and receive clocks for the PSI card
2. Ensure ground isolation between the communicating systems
3. Support the DTR, DSR, RTS, CTS, CD and RI handshake signals

RJE/1000-II Commands

The following commands are supported by RJE/1000-II:

Command	Description
Send	Send a file to remote site
Route	Reroute file to another HP 1000 output (file classification)
Trace	Modify trace control and remote logfile
Status	Check status of monitor, PSI card or data link
Abort	Stop data transmission or reception
Close	Drop data communications link and terminate

Product Requirements

- An HP 1000 E/F-Series or A-Series disc based system
- RTE-6/VM for E/F-Series; RTE-A for A-Series (rev 2340 or later)
- PSI card (see hardware requirements for details)
- Switched or non-switched Bisync line to the host computer
- Matched compatible modems
- A supported job entry subsystem configured to emulate a 2780/3780 workstation
- Enough memory on the HP 1000 for work area, program area, memory area and the operating system: 128 Kb minimum (66 Kb for RJE/1000-II plus 16 Kb per user).

Installation and Customer Responsibilities

- Installation is not included with RJE/1000-II. It is the responsibility of the customer to install the product. HP will provide installation service at the prevailing service rates.
- Installation of all communication facilities (cables and modems) and their connection to the HP 1000 computer system for RJE/1000-II is the customer's responsibility.
- The establishment of successful communication between the HP 1000 computer system running RJE/1000-II and the host computer is the customer's responsibility.
- Prior to the customer's installation of RJE/1000-II on the HP 1000, the customer is responsible for installation of a switched or non-switched Bisync communications line between the HP 1000 and the host computer. This line must be matched with a pair of modems that are compatible with RJE/1000-II at each end of the line. The customer should verify the functioning of the line and modems.
- Prior to installation of RJE/1000-II the customer should install the necessary host computer system software and hardware to support RJE/1000-II. The customer should insure the host software is compatible with RJE/1000-II and consistent with the specifications of RJE/1000-II. Modifications may prevent operation of RJE/1000-II. Hewlett-Packard does not warrant the successful operation of RJE/1000-II if modifications have been made.

Ordering Information

To order RJE/1000-II the customer must order the PSI card and RJE/1000-II software.

RJE/1000-II Hardware Requirements

One of the following PSI cards must be used with RJE/1000-II, depending on the processor owned:

A-Series	E/F-Series
12043A	12260A

RJE/1000-II Software Requirements

The RJE/1000-II software must be ordered with one of the processor options listed below:

Product	Description
91781A	Right to use RJE/1000-II on HP 1000. Must order one processor option and one media option
-600	Use on A600
-601	Upgrade to latest version of 91781A for 91781A customers not on support services
-700	Use on A700 or E/F-Series
-701	Upgrade to latest version of 91781A for 91781A customers not on support services Customers using RJE (91780) may use this option to upgrade to 91781A
-890	Use on A900
-891	Upgrade to latest version of 91781A for 91781A customers not on support services

Media Options

-022	7908/11/12/14 Cartridge
-042	5.25″ Flexible Disc
-044	3.5″ Flexible Disc
-050	800 bpi Mag Tape (E/F-Series only)
-051	1600 bpi Mag Tape
91781R	Right to Copy RJE/1000-II to one system. Must order one processor option
-600	Use on A600
-601	Upgrade to latest version of 91781R for 91781R customers not on support services
-700	Use on A700 or E/F-Series
-701	Upgrade to latest version of 91781R for 91781R customers not on support services
-890	Use on A900
-891	Upgrade to latest version of 91781R for 91781R customers not on support services

RJE/1000-II Documentation

91781-90001 RJE/1000-II Reference Manual

RJE/1000-II Support Services

Effective April 1984, HP's software support structure was reorganized. Customers with existing support contracts for the HP 1000 may continue with their contracts and buy support for new software products coterminous with their existing contracts. *All other customers may only buy the new support contracts.*

Existing Contracts

Customers with existing contracts may buy MUS, SSS or CSS. MUS provides manual updates only; SSS provides software/firmware updates and software problem reporting plus MUS; CSS provides SSS plus an account assigned SE, on-site assistance and telephone assistance through the Response Centers. The product numbers for these services are listed below.

91781T	CSS
91781V	CSS - EXTENDED
91781S	SSS
91781W	SSS - EXTENDED
91730Q	MUS

New Support Contracts

For all new customers and customers without an existing contract, the new support services include Account Management Support (AMS, similar to CSS), Software Materials Subscription (SMS, similar to SSS), and a new level called Response Center Support (RCS) which includes all materials (SMS) and telephone assistance through the Response Centers. Customers with existing contracts may also take advantage of these services by converting their entire contract to the new program.

For customers choosing AMS or RCS on their operating system, RJE/1000-II is supported by purchasing Datacomm B category support. (Only one datacomm category support need be purchased — for the "highest" datacomm category. (A = lowest, C = highest)). For RJE/1000-II SMS must also be purchased. For customers choosing SMS on their operating system, RJE/1000-II is supported by purchasing SMS only. For additional systems, the extended datacomm category support and Extended SMS are used. MUS is available as well.

For example, if RCS is purchased for the operating system, the software support products for RJE/1000-II are:

99086D+C00	Datacomm B/1000
91781A+S00	SMS for RJE/1000-II

Additional support product numbers:

99086D+V00	Extended Datacomm B/1000
91781A+W00	Extended RJE/1000-II SMS
99086D+Q00	MUS Datacomm B/1000

Multileaving Remote Job Entry (MRJE/1000)

HEWLETT PACKARD

HP AdvanceNet

Product Number 91782A
For HP 1000 Computers

Description

MRJE/1000 (Multiple Remote Job Entry) provides batch communications capability between the HP 1000 and IBM mainframe computers. With the MRJE facility, the HP 1000 emulates workstations that work with one of the following job entry subsystems: HASP II, JES2 or JES3.

MRJE allows up to seven HP 1000 users concurrent batch access to the IBM host. This capability results in MRJE being used in applications where:

- A large number of users, some with very large jobs, all need access to the IBM mainframe
- HASP protocol is required

Along with HP's other batch datacomm product, RJE, and PMF/1000 (Programmatic Mainframe Facility), which emulates an IBM 3270 cluster controller, the HP 1000 offers a full complement of Bisync IBM data communications products.

Features

- **Emulation of an IBM HASP multileaving workstation**
- **Support for connections to HASP II (version 4 or later), JES2, and JES3 job entry subsystems**
- **Support under RTE-A and RTE-6/VM**
- **Queued mode device assignment for output**
- **Standard mode device assignment for input and output**
- **Interactive scheduling of batch jobs**
- **Concurrent access to the host for up to seven users**
- **Any supported input/output devices or file on the HP 1000 may be used to submit job input/receive job output**
- **Workstation console commands may be issued from any MRJE session terminal, which can be any terminal connected to the HP 1000 system**
- **Tracing of link-level activity**
- **Logging of subsystem events**
- **Switched (dial-up) or leased (dedicated) communication lines**
- **Multileaving Bisync protocol**

Functional Description

MRJE/1000 provides two modes of device assignment, standard and queued output. In standard mode each assigned HP 1000 output device (LU or file) can receive a single job from the host automatically. After job output returns, the HP 1000 device is unlocked (unassigned). The user reassigns the device to receive another job output. Standard mode is used to submit all jobs to the host.

Queued output mode allows MRJE/1000 users to queue HP 1000 supported output devices (LU or a set of files). Once a device is queued multiple users' output can return automatically to the queued device. Queued output mode eliminates the need for user intervention in receiving multiple jobs to an output device.

Output can be received by HP 1000 supported output devices or files and jobs can be submitted to the host via HP 1000 supported input devices or files.

With MRJE/1000, users can interactively or, in a limited manner, programmatically schedule the transfer of batch jobs to the host and receipt of batch output from the host. Use of MRJE/1000 does not require the dedication of the entire system; other subsystems of the HP 1000 can be used concurrently with MRJE/1000. An extensive help facility prompts the user with an explanation of what inputs are expected. Users can issue workstation console commands for monitoring host job activity from any terminal on the HP 1000 system.

Link level tracing allows MRJE/1000 to keep a record of the activity on the link for maintenance purposes. The subsystem logging, separate from tracing, maintains a record of subsystem activities and commands.

Functional Specifications

Workstations

The following IBM workstations are emulated:

- HASP Multileaving

Remote Systems

The host computer must run with one of the following job entry subsystems using the multileaving Bisync protocol:

- HASP II (version 4 or later)
- JES2
- JES3
- Please contact your SE for the latest list of supported systems

Communications Link

The Communications Link must have the following features:

- Switched or non-switched
- Up to 9600 bps
- HASP — (EBCDIC and Transparent line codes are supported, ASCII line code is not supported)
- Multileaving binary synchronous protocol
- Point to point lines

Job Stream Capacity

There can be 17 job streams interleaved on a single line, including:

- Seven card reader streams
- Eight printer/card punch streams
- One console device (one input stream and one output stream)

Modems Supported

Connection to the communications line is made through a modem obtained and installed independently of MRJE/1000. One modem links the Programmable Serial Interface card in the HP 1000 and the communications line. Another modem connects the communications line to the host computer. The modems must be compatible with each other and must be strapped properly.

The following modems are supported:

- Bell 201C (2400 bps)
- Bell 2024A (2400 bps)
- Bell 208A (4800 bps leased line)
- Bell 208B (4800 bps switched line)
- Bell 209A (9600 bps leased line)

Printers Supported

(Must use Dxx12 drivers)

A-Series	2631B with option 214 2608S with option 214
E/F-Series	2608A with option 210 or 26099A interface 2608S with option 210 2617A with option 100 or 12845B interface 2619A with option 100 or 12845B interface 2613B with option 210

Supported carriage control features: MRJE/1000 with Drive type Dxx12, provides the following carriage control features, subject to the capabilities of the particular printer used:

1. Spacing before or after print
2. Page eject before or after print
3. Overprint and printer channel control

MRJE/1000 Commands

The following commands are supported by MRJE/1000 (MRJE):

Command	Function
Assign	Associates an MRJE virtual device with an RTE file name or device for transferring a data set to or from the host
Configure	Defines or modifies MRJE configuration
Display	Displays MRJE configuration information
Console	Assigns user's terminal to be the MRJE console
Exit	Terminates the MRJE session
Signoff	Shuts down the communications link with the host processor
Signon	Establishes communications with the host
Transfer	Reads MRJE commands from a file until an EXIT command or end of file is read
Use	Sets MRJE to the configuration specified in a configuration file
Help	Provides a brief description of an MRJE command or about help itself

MRJE/1000 Subsystem Utilities

The following subsystem utilities are supported by MRJE/1000 (MRJE):

Subsystem Utility	Description
FMTRA	Formats a trace file generated by MLTRA
MRLOG	Logs subsystem events and command responses
MRKIL	Used to abort the MRJE subsystem and stop the MRLOG
STOPL	Stops the logging process without affecting the rest of the MRJE subsystem

Product Requirements

- An HP 1000 E/F-Series or A-Series disc based system
- RTE-6/VM for E/F-Series; RTE-A for A-Series (rev 2340 or later). MRJE/1000 works only with data files on the old File Manager (FMGR) in RTE-A and RTE-6/VM
- PSI card (see hardware requirements for details)
- Switched or non-switched Bisync line to the host computer
- Matched compatible modems
- A supported job entry subsystem configured to emulate a HASP workstation
- Enough memory on the HP 1000 for work area, program area, memory area and the operating system: 320 Kb minimum (256 Kb for MRJE/1000 plus 16 Kb per user).
- Driver type Dxx12 is required for carriage control

Installation and Customer Responsibilities

- Installation is not included with MRJE/1000. It is the responsibility of the customer to install the product. HP will provide installation service at the prevailing service rates.
- Installation of all communication facilities (cables and modems) and their connection to the HP 1000 computer system for MRJE/1000 is the customer's responsibility.
- The establishment of successful communication between the HP 1000 computer system running MRJE/1000 and the host computer is the customer's responsibility.
- Prior to the customer's installation of MRJE/1000 on the HP 1000, the customer is responsible for installation of a switched or non-switched Bisync communications line between the HP 1000 and the host computer. This line must be matched with a pair of modems that are compatible with MRJE/1000 at each end of the line. The customer should verify the functioning of the line and modems.
- Prior to installation of MRJE/1000 the customer should install the necessary host computer system software and hardware to support MRJE/1000. The customer should insure the host software is compatible with MRJE/1000 and consistent with the specifications of MRJE/1000. Modifications may prevent operation of MRJE/1000. Hewlett-Packard does not warrant the successful operation of MRJE/1000 if modifications have been made.

Ordering Information

To order MRJE/1000 the customer must order the PSI card and MRJE/1000 software.

MRJE/1000 Hardware Requirements

One of the following PSI cards must be used with MRJE/1000, depending on the processor owned:

A-Series	E/F-Series
12043A	12260A

MRJE/1000 Software Requirements

The MRJE/1000 software product must be ordered with one of the processor options listed below:

Product	Description
91782A	Right to use MRJE/1000 on HP 1000. Must order one processor option and one media option
−600	Use on A600
−601	Upgrade to latest version of 91782A for 91782A customers not on support services
−700	Use on A700 or E/F-Series
−701	Upgrade to latest version of 91782A for 91782A customers not on support services
−890	Use on A900
−891	Upgrade to latest version of 91782A for 91782A customers not on support services

Media Options

−022	7908/11/12/14 Cartridge
−042	5.25″ Flexible Disc
−044	3.5″ Flexible Disc
−050	800 bpi Mag Tape (E/F-Series only)
−051	1600 bpi Mag Tape
91782R	Right to copy MRJE/1000 on HP 1000. Must order one processor option
−600	Use on A600
−601	Upgrade to latest version of 91782R for 91782R customers not on support services
−700	Use on A700 or E/F-Series
−701	Upgrade to latest version of 91782R for 91782R customers not on support services
−890	Use on A900
−891	Upgrade to latest version of 91782R for 91782R customers not on support services

MRJE/1000 Documentation

91782-90001	MRJE/1000 User's/Programmer's Reference Manual
91782-90003	MRJE/1000 Customer Course "A Guide to New Users"

MRJE/1000 Support Services

Effective April 1984, HP's software support structure was reorganized. Customers with existing support contracts for the HP 1000 may continue with their contracts and buy support for new software products coterminous with their existing contracts. *All other customers may only buy the new support contracts.*

Existing Contracts

Customers with existing contracts may buy MUS, SSS, or CSS. MUS provides manual updates only; SSS provides software/firmware updates and software problem reporting plus MUS; CSS provides SSS plus an account assigned SE, on-site assistance and telephone assistance through the Response Centers. The product numbers for these services are listed below.

91782T	CSS
91782V	CSS – Extended
91782S	SSS
91782W	SSS – Extended
91782Q	MUS

New Support Contracts

For all new customers and customers without an existing support contract, the new support services include Account Management Support (AMS, similar to CSS), Software Materials Subscription (SMS, similar to SSS), and a new level called Response Center Support (RCS) which includes all materials (SMS) and telephone assistance through the Response Centers. Customers with existing contracts may also take advantage of these services by converting their entire contract to the new program.

For customers choosing AMS or RCS on their operating system, MRJE/1000 is supported by purchasing Datacomm C category support. (Only one datacomm category support need be purchased for the "highest" datacomm category (A=lowest, C=highest)). For MRJE/1000 SMS must also be purchased. For customers choosing SMS on their operating system, MRJE/1000 is supported by purchasing SMS only. For additional systems, the extended datacomm category support and Extended SMS are used. MUS is available as well.

For example, if RCS is purchased for the operating system, the software support products for MRJE/1000 are:

99087D+C00	Datacomm C/1000
91782A+S00	SMS for MRJE/1000

Additional support product numbers:

99087D+V00	Extended Datacomm C/1000
91782A+W00	Extended SMS
99087D+Q00.	MUS Datacomm C/1000

Programmatic Mainframe Facility (PMF/1000)

HEWLETT PACKARD

HP AdvanceNet

Product Number 91784
For HP 1000 Computers

Description

PMF/1000 (Programmatic Mainframe Facility) is an application program which emulates an IBM 3270 cluster controller on an HP 1000. This allows programs on the HP 1000 to communicate interactively with an IBM host computer. Now HP 1000 application programs can exchange data in real time with IBM mainframes.

PMF/1000 allows HP 1000 application programs to communicate to an IBM mainframe via subroutine calls. The data is accessed through 3278 screen images or through 3284 print buffers. PMF/1000 is designed for interactive communications where rapid response is required. Along with HP's batch communication products, RJE and MRJE, the HP 1000 now offers a full complement of Bisync IBM data communications products.

Features

- **3270 controller emulation**
- **User programmed 3284 printer emulation**
- **User programmed 3278 printer emulation**
- **Interactive communication with IBM**
- **Bisync protocol (multipoint)**
- **Intelligent interface card**
- **Support of VTAM, TCAM, BTAM on IBM host**
- **Access program products such as CICS and IMS**
- **Twenty Intrinsics (subroutine calls) for ease of programming**
- **Fortran, Pascal and Assembler supported**
- **Bisync transparent mode supported**

Functional description

PMF/1000 running on the HP 1000 emulates a 3271/3274/3276 IBM cluster controller. Application programs written in Pascal, Fortran and Macro Assembler can access screen images of 3277 and 3278 display stations and retrieve data from 3284, 3286, 3287, 3288 and 3289 printer buffers.

User application programs can access data through one of 20 intrinsics (subroutine calls) which allow flexible data extraction of information from 3278 screen images. With the printer emulation the user program can read from a print buffer. This allows the user to get data from a 3270 data stream using a high level interface.

PMF/1000 communicates to an IBM mainframe via a non-switched Bisync line. The line can have speeds up to 9600 bits per second. The Bisync communications protocol is handled through a microprocessor based Programmable Serial Interface card. The microprocessor offloads the protocol conversion from the HP 1000 CPU, speeding up actual throughput in the process.

On the IBM host side, PMF supports Virtual Telecommunications Access Method (VTAM), Basic Telecommunications Access Method (BTAM) and Telecommunications Access Method (TCAM). The IBM host must have one of these access methods to use PMF/1000. This allows HP 1000 programs to access host program products such as CICS and IMS.

A separate program with "Pass Through" capability is available in the User Contributed Library (unsupported by HP). Pass Through allows HP 1000 terminals to act as 3278 terminals on an IBM host.

Functional specifications

Controller

The following IBM 3270 Control Units are emulated:

- 3271 Models 1 and 2
- 3274 Models 1c (BSC only)
- 3276 Models 1, 2, 3 and 4

Display Station

User programs can emulate the following IBM 3270 display stations:

- 3277 (1920 byte screens)
- 3278 Models 2, 3 and 4 (480 and 1920 byte screens)

Printers

User programs can emulate the following IBM 3270 printers:

- 3284
- 3286 Models 1 and 2
- 3287 Models 1 and 2
- 3288 Model 2
- 3289 Models 1 and 2

IBM Host

The host computer must run with one of the following access methods:

- Virtual Telecommunications Access Method (VTAM)
- Basic Telecommunications Access Method (BTAM)
- Telecommunications Access Method (TCAM)
- The Advanced Communications Function (ACF) versions of VTAM (ACF/VTAM) and TCAM (AFC/TCAM) are also supported.

Communications Link

The Communications Link must have the following features:

Non-switched
Up to 9600 bps
Multipoint binary synchronous protocol
Multidrop lines or point-to-point lines

Modems Supported

Connection to the communications line is made through a modem obtained and installed independently of PMF/1000. One modem links the Programmable Serial Interface and the communications line. Another modem connects the communications line to the host computer. The modems must be compatible with each other and must be strapped properly.

The following modems are supported:

Bell 201C (2400 bps)
Bell 208A (4800 bps)
Bell 208B (4800 bps)
Bell Dataphone II 2024
Bell Dataphone II 2048
Bell Dataphone II 2096

PMF/1000 Commands

The following 3270 commands are supported:

Command	Description
Read Buffer	All data in the addressed buffer to be transferred to the host
Read Modified	All fields that have been modified in the addressed buffer to be transferred to the host
Read	Transfer data from a 3270 device to the host
Write	Transfer data from the host to a 3270 device
Erase Write	Same function as Write but causes the complete erasure of the selected device buffer before the Write operation is started
Erase All Unprotected	Erase all the unprotected fields of the specified data buffer
Copy	Transfer data buffer from one device to another device connected to the same unit

The following 3270 orders are supported:

Order	Description
Start Field	Indicates start of a field
Set Buffer Address	Specifies a new buffer address from which write operations are to start or continue
Insert Cursor	Repositions the cursor to the location specified by the current buffer address
Program Tab	Advances the current buffer address to the address of the first character position of the next unprotected field
Repeat to Address	Stores a specified alphanumeric or null character in all buffer locations, starting at the current buffer address and ending at (but not including) the specified stop address
Erase Unprotected to Address	Inserts nulls in all unprotected buffer character locations, starting at the current buffer address and ending at (but not including) the specified stop address

The following 3270 commands and orders are not supported:

Erase Write Alternate, No Op, Structured Field Orders, Programmed Symbols Capability

Product Requirements

- An HP 1000 Series E/F or Series A
- RTE-6/VM for E/F-Series, RTE-A for A-Series (rev. 2340 or later)
- PSI card (see hardware requirements for details)
- Non-switched bisync line to the host communications controller
- Matched compatible modems
- An IBM mainframe configured to support a 3270 cluster controller
- Enough memory on the HP 1000 for the application program, program area, shared extended memory area and the operating system: 450 Kb minimum (360 Kb for PMF/1000 and 2 Kb per user).

Installation and Customer Responsibilities

- Installation is not included with PMF/1000. It is the responsibility of the customer to install the product. HP will provide installation service at the prevailing service rates.
- Installation of all communication facilities (cables and modems) and their connection to the HP 1000 computer system for PMF/1000 is the customer's responsibility.
- The establishment of successful communication between the HP 1000 computer system running PMF/1000 and the host computer is the customer's responsibility.
- Prior to the customer's installation of PMF/1000 on the HP 1000, the customer is responsible for installation of a non-switched Bisync communications line between the HP 1000 and the host mainframe. This line must be matched with a pair of modems that are compatible with

PMF/1000 at each end of the line. The customer should verify the functioning of the line and modems.

- Prior to installation of PMF/1000 the customer should install the necessary host mainframe system software and hardware to support PMF/1000. The customer should insure the host software is compatible with PMF/1000 and consistent with the specifications of PMF/1000. Nonstandard modifications may prevent operation of PMF/1000. Hewlett-Packard does not warrant the successful operation of PMF/1000 if modifications have been made.

Ordering Information

To order PMF/1000 the customer must order the PSI card and PMF/1000 software.

PMF/1000 Hardware Requirements

One of the following PSI cards must be used with PMF/1000 depending on the processor owned:

A-Series	E/F-Series
12043A	12260A

PMF/1000 Software Requirements

The PMF software must be ordered with one of the processor options listed below:

Product	Description
91784A	Right to use PMF/1000 on HP 1000. Must order one processor option and one media option
-600	Use on A600
-601	Upgrade to latest version of 91784A for customers not on support services
-700	Use on A700 or E/F-Series
-701	Upgrade to latest version of 91784A for customers not on support services
-890	Use on A900
-891	Upgrade to latest version of 91784A for customers not on support services

Media Options

-022	7908/11/12 Cartridge
-042	5.25" Flexible Disc
-044	3.5" Flexible Disc
-050	800 bpi Mag Tape (E/F-series only)
-051	1600 bpi Mag Tape
91784R	Right to copy PMF/1000 to one system. Must order one processor option
-600	Use on A600
-601	Upgrade to latest version of 91784R for customers not on support services
-700	Use on A700 or E/F-Series
-701	Upgrade to latest version of 91784R for customers not on support services
-890	Use on A900
-891	Upgrade to latest version of 91784R for customers not on support services

PMF/1000 Documentation

91784-90001	PMF/1000 Reference Manual

PMF/1000 Support Services

Effective April 1984, HP's product support structure was reorganized. Customers with existing support contracts for the HP 1000 may continue their contracts and buy support for new software products coterminus with their existing contracts. *All other customers may only buy the new support contracts.*

Existing Contracts

Customers with existing contracts may buy MUS, SSS or CSS. MUS provides manual updates only; SSS provides software/firmware updates and software problem reporting plus MUS; CSS provides SSS plus an account assigned SE, on-site assistance and telephone assistance through the Response Centers. The product numbers for these services are listed below.

91784T	CSS
91784V	CSS - Extended
91784S	SSS
91784W	SSS - Extended
91784Q	MUS

New Support Contracts

For all new customers and customers without an existing contract, the new support services include Account Management Support (AMS, similar to CSS) Software Materials Subscription (SMS, similar to SSS), and a new level called Response Center Support (RCS) which includes all materials (SMS) and telephone assistance through the Response Centers. Customers with existing contracts may also take advantage of these services by converting their entire contract to the new program.

For customers choosing AMS or RCS on their operating system, PMF/1000 is supported by purchasing Datacomm B category support. (Only one datacomm category support need be purchased once — for the "highest" datacomm category. (A = lowest, C = highest). For PMF/1000, SMS must also be purchased. For customers choosing SMS on their operating system, PMF/1000 is supported by purchasing SMS only. For additional systems, the extended datacomm category support and extended SMS are used. MUS is available as well.

For example, if RCS is purchased for the operating system, the software products for PMF/1000 are:

99087D+C00	Datacomm C/1000
91784A+S00	SMS for PMF/1000

Additional support product numbers:

99087D+V00	Extended Datacomm C/1000
91784A+W00	Extended SMS
99087D+Q00	MUS Datacomm C/1000

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Computer Museum

PORT/HP-UX

HEWLETT PACKARD

For migration from HP 1000 RTE to HP Precision Architecture HP-UX

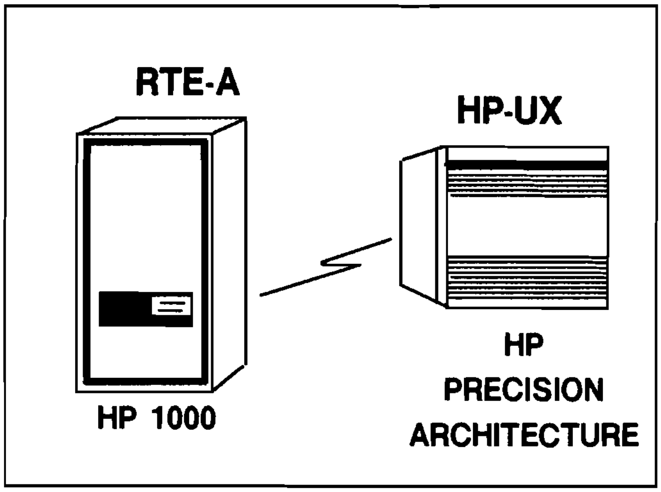
PORT/HP-UX is a collection of utilities for migrating applications from HP 1000 RTE-6/VM and RTE-A to HP Precision Architecture with HP-UX. PORT/HP-UX utilities minimize the porting effort for high level applications and data. Key elements of PORT/HP-UX include a Migration Analysis Utility, file and data transport utilities, and RTE intrinsics emulation routines on HP-UX. These utilities are complemented by compatible high level languages and translators to ease the migration of subsystem dependent code.

Features

- **Migration and Coexistence Documentation**
- **Migration Analysis Utility**
- **RTE Emulation Software**
- **RTE Interactive Environment on HP-UX**
- **RTE to HP-UX Data Transfer Utilities**
- **IMAGE Migration Utilities**
- **FORTRAN Conversion Utilities**
- **Compatible Subsystems:**
  - FORTRAN
  - Pascal
  - C
  - IMAGE/ALLBASE
  - Network Services
  - AGP/DGL Graphics
  - FORMS

The Migration Process

The objectives of PORT/HP-UX migration are to maximize performance in the new operating environment and to minimize the migration effort. PORT/HP-UX supports source level migration to fulfill those objectives. There are three steps in the migration process: Evaluation, Transport, and Conversion.



Evaluation/Preparation

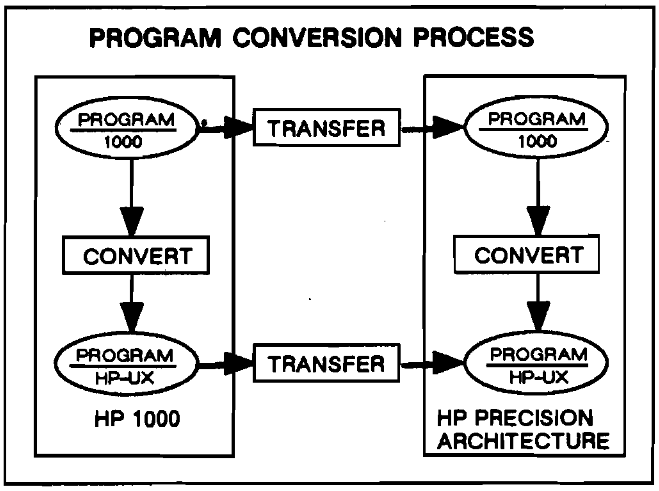
Using the Migration Evaluation Kit Manuals as a guide, applications currently being developed can be designed for maximum portability to HP Precision Architecture systems. The Migration Analysis Utility scans source code and identifies RTE system and subsystem dependencies and notes whether or not they are emulated with PORT/HP-UX. This information, along with error messages from the HP-PA compiler, will indicate the areas in the application which will require modification.

Application Transport

Programs (source code) and data (ASCII or binary) are transported to the HP Precision Architecture system via tape. PORT/HP-UX utilities correct for operating system differences to accomplish the application transport.

Conversion

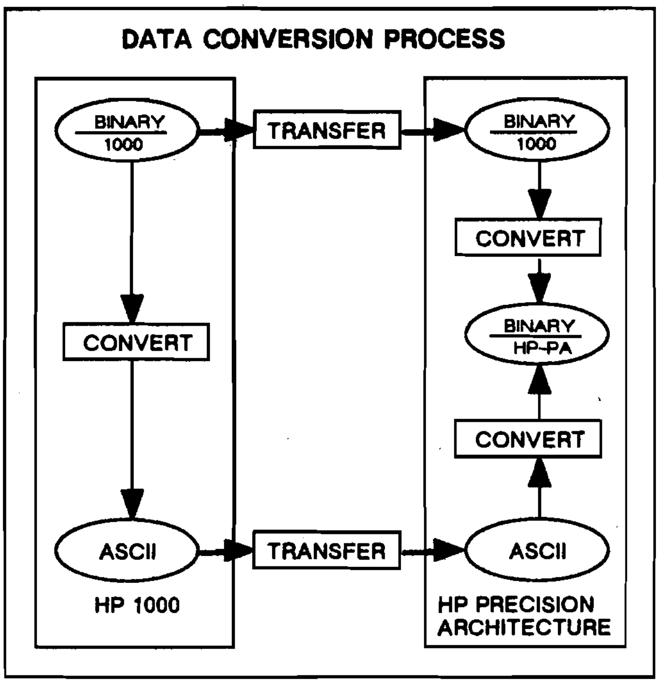
Programs are compiled on the HP-UX system, which allows non-emulated code to run in native mode. Most RTE file system, EXEC, and system library routines are emulated. RTE dependencies not emulated must be rewritten by the user, using equivalent HP-UX intrinsics.



PROGRAM CONVERSION PROCESS

Syntactic and semantic differences in HP 1000 FORTRAN programs are converted to the HP FORTRAN equivalents either programmatically or by the user. A FORTRAN conversion utility translates those differences or they are identified by the compiler. The Language Migration Guides also help identify language differences and provide conversion details.

ASCII data needs no conversion. Binary data is converted using instructions in the PORT/HP-UX Migration User's Guide and associated utilities. Data in floating point format must be converted to IEEE format via a user program using the floating point conversion subroutines provided in PORT/HP-UX.



DATA CONVERSION PROCESS

PORT/HP-UX and Migration Tools

Programming for Portability

The ease with which software is ported from one architecture to another depends on the emphasis placed on portability during the design and implementation of the application. Programming for Portability is a set of documented guidelines for ensuring portability from RTE-6/VM and RTE-A applications to HP Precision Architecture HP-UX. Language, Operating System, and Subsystem considerations are described in Programming for Portability.

Migration Analysis Utility (MAU)

The Migration Analysis Utility is a utility that scans source code for HP 1000 system and subsystem dependencies. It generates a report pointing out the lines that contain non-emulated, partially emulated, and fully emulated RTE calls. The MAU scans programs written in C, Pascal, and FORTRAN and flags RTE system library, FMP, EXEC, IMAGE, DS, and Graphics call dependencies on the HP 1000 or HP 9000 Series 800. The MAU and the HP-PA compilers can be used to estimate and plan the migration effort.

RTE System Library Emulation

Over 80% of RTE System Library calls are emulated in HP-UX. Non-emulated calls include those used for session accounting and programmatic spooling, which are not used frequently in RTE. The 80% that are emulated typically account for approximately 98% of user's calls to system library routines. Recoding for some non-emulated calls is documented in the PORT/HP-UX User's Guide.

RTE EXEC Emulation

Most RTE EXEC calls are emulated under PORT/HP-UX. The emulated EXEC calls include calls for I/O operations, to terminate or suspend programs, to load program segments into memory, to schedule other programs, to perform class I/O, and to time schedule programs. PORT/HP-UX supports EXEC calls to HPIB, GPIO, RS232, 9-track tape, and line printers. Discs are supported through the file system; programs which make EXEC calls to disc will have to be modified to use HP-UX directly.

RTE File System Emulation

PORT/HP-UX contains an emulated RTE file system that includes both the FMGR and CI file systems. Over 85% of the RTE file system calls are emulated under PORT/HP-UX.

The System Library, EXEC, and File System emulation included in PORT/HP-UX provide a very comprehensive RTE environment and support an estimated 95%-100% of the occurrences of RTE calls in typical HP 1000 applications.

Assembly Language Programs

Due to the architectural dependencies of assembly language, programs written in HP 1000 assembler must be rewritten to port to HP Precision Architecture systems. Often, raw application speed can be maintained by rewriting assembly-language routines in an optimized high level language, such as C.

Interactive RTE Services

Entering the command "rtesh" at the HP-UX prompt will put the user in a "CI-like' environment for controlling RTE emulated programs and supporting the creation and maintenance of an emulated RTE file system. The following RTE commands are emulated under rtesh:

AT	BR	CL	CO	CR
DL	CRDIR	EX	GO	IO
LI	MO	OF	OWNER	PR
PROT	PU	RN	RP	RU
SS	WD	WH	XQ	??

In addition, an EDIT/1000-like screen editor is provided, which supports most EDIT/1000 features.

Database Migration Utilities

Although the HPIMAGE interface of ALLBASE is quite similar to IMAGE/1000, architectural differences make 100% compatibility impossible. Migration utilities can be used to port application programs and databases. IMAGE/1000 applications can be recompiled and executed on HP-UX with a run-time translator intercepting IMAGE/1000 calls and making the appropriate call to HPIMAGE. Only 1% of the calls are architecturally dependent and will have to be changed or removed for translator compatibility. The MAU flags those incompatible calls.

Two tools are used in moving the database from RTE to HP-UX. The Database Migration Unload utility unloads and simultaneously converts IMAGE/1000 databases into HPIMAGE format. A Rootfile Decompiler utility converts IMAGE/1000 root files into HPIMAGE schema files. A manual conversion is necessary to convert IMAGE/1000-I rootfiles. The database migration utilities come standard with ALLBASE.

Subsystem Compatibility

FORTRAN

FORTRAN on HP Precision Architecture systems is compatible with HP 1000 FORTRAN. Both are based on the ANSI77 standard. Ninety percent of the HP 1000 FORTRAN feature set is compatible with FORTRAN on HP Precision Architecture. A FORTRAN conversion utility on HP-UX is run on source programs prior to compilation on the HP Precision Architecture System. This utility increases feature set compatibility to 98%.

Pascal

HP Pascal is a superset of HP Standard Pascal. HP Standard Pascal is based on the ANSI standard. Pascal/1000 is based on HP Standard Pascal and includes some extensions. These extensions are flagged by the Pascal/1000 compiler.

C

Corporate Computer Systems (CCS) provides a C compiler for the HP 1000 that is 99% feature set compatible with HP C/HP-UX on HP Precision Architecture. Both HP C/HP-UX and HP 1000/C conform with the emerging ANSI standard.

Graphics

Graphics support for HP Precision Architecture HP-UX systems includes AGP/DGL, which differs slightly from AGP/DGL on HP 1000 systems. The differences relate primarily to error handling and the use of device file names in HP-UX vs LU parameters in RTE. The MAU flags differences. PORT/HP-UX documentation provides instructions for recoding. The AGP/DGL documentation further identifies areas of difference and offers instructions for porting.

Networking

Networking on HP Precision Architecture/HP-UX systems is based on Network Services software and LAN/Link hardware. HP Precision Architecture HP-UX systems can communicate via the LAN with HP 1000 A-Series systems and HP 9000 Series 200/300/500 systems running Network Services Software. HP 1000 A-Series can thus serve as gateways between HP 1000 E/F-Series systems running DS/1000-IV and HP Precision Architecture systems running Network Services Software.

HP 1000 A-Series applications using Network Services calls can be ported to HP Precision Architecture systems since the Precision Architecture networking products are also based on Network Services. A- and E/F-Series applications using DS/1000-IV can be evaluated using the MAU to flag calls that don't map directly to NS/1000 and HP Precision Architecture NS. DS/1000-IV to NS/1000 migration documentation explains how to recode to achieve DS/1000-IV functionality on NS/1000.

Forms

An emulated implementation of FORMS/1000 is provided on HP Precision Architecture. F1000/HP-UX is 100% compatible with FORMS/1000, so no changes to Forms calls are required when moving an application from an HP 1000 system to an HP Precision Architecture system.

Migration Consulting

Migration consulting for your specific application is available through HP's Applications Engineering Organization. Contact your local HP Sales Office for details.

Migration Documentation

92561-90001	Programming for Portability Guide
92561-90002	PORT/HP-UX Migration Analysis Utility Manual
92561-90003	PORT/HP-UX Migration User's Guide
92561-90004	PORT/HP-UX Reference Manual
92430-90003	HP FORTRAN 77/HP-UX Migration Guide
92431-90004	HP Pascal Migration Guide
36217-90008	Migrating to ALLBASE/HP-UX
92561-90009	NS/9000 Series 800 Migration Guide
92012-90001	F1000/HP-UX Reference Manual

Ordering Information

PORT/HP-UX consists of utilities which run under both RTE and HP-UX. For that reason, these utilities are distributed separately, as follows:

The Migration Evaluation Kit, product number 92561A, contains the utilities that run on the HP 1000. The Migration Analysis Utility, database migration utilities, and some transport utilities are part of the Migration Evaluation Kit. The Migration Evaluation Kit also includes a full set of migration documentation, as listed above.

RTE emulation, the floating point conversion utility, some transport utilities, and F1000/HP-UX are included in HP-UX on HP Precision Architecture.

The FORTRAN conversion utility is included with HP FORTRAN on HP Precision Architecture.

The database translation utility is included in ALLBASE/HP-UX.

Contact your local Hewlett-Packard sales office for further information.

RMTERM/840 Terminal Emulator

HEWLETT PACKARD

Downloading an RTE-A Operating System

Application Brief

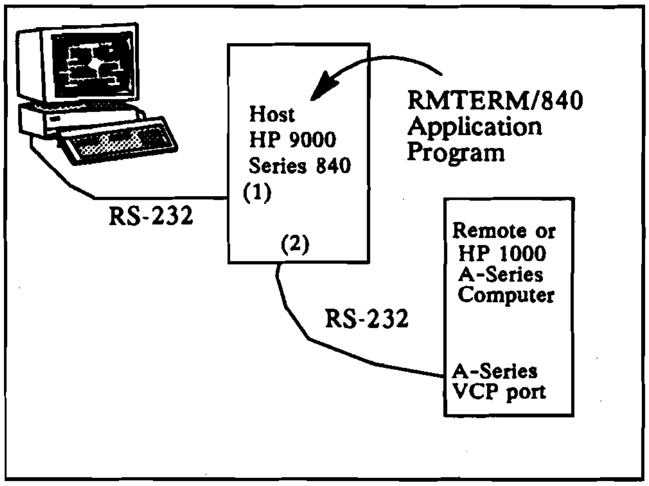
RMTERM/840 (ReMote TERM) allows an HP 9000 Model 840 user terminal to act as a virtual terminal to a remote computer system. Communication takes place from the Model 840 via a second RS-232 port connected to the remote system. RMTERM/840 is a C Language program which executes on the HP 9000 Model 840.

RMTERM/840 can be used to download and boot an HP 1000 RTE-A operating system (type 1 file) if the Model 840 is connected to the Virtual Control Panel (VCP) port of the target HP 1000 A-Series computer. Once the operating system is downloaded, RMTERM acts as the system console on the A-Series computer. This allows remote HP 1000 A-Series systems to be controlled by a terminal on the Model 840. Other ASCII and binary files may also be transferred.

RMTERM/840 will run from any terminal connected to the model 840, and will connect to an HP 1000 with a transfer rate up to 19.2K baud. The file "rmterm.c" is the source for RMTERM/840 and is included in the Appendix of this application brief. The "rmterm.c" source code is also available from the HP 1000 Contributed Library.

Features

- **Download and boot RTE-A Operating Systems from HP-UX**
- **Boot remote disc based RTE-A operating systems from HP-UX**
- **Log continuous data to an HP-UX file from a remote A-Series computer**
- **Terminal connection to remote HP 1000 A-Series computer System**
- **Transfer ASCII files between HP-UX and RTE-A (RTE-A file types 3 and 4)**
- **Transfer RTE-A Operating System files from RTE-A to HP-UX**
- **Transfer binary files from HP-UX to RTE-A (using a simple program on the A-Series)**



NOTE: The information presented in this application brief is provided as a convenience to HP Customers. With regard to the information presented, Hewlett-Packard disclaims any and all liability and makes no warranties, express or implied, including fitness for a particular purpose. The information may be subject to change without notice.

Hardware Requirements

The program requires two RS-232 ports, one connected to the terminal on the Model 840 host computer (connection 1 in the diagram), and another port connected between the Model 840 and a remote system (connection 2 in the diagram). RMTERM/840 will make the Model 840 terminal appear physically connected to the remote system.

See the HP-UX System Administration Manual (92453-90004) for details describing the standard HP-UX terminal connection 1.

Connection 2 requires a male-to-male 3 wire RS-232 cable with pins 2 and 3 reversed. When the A-Series is used as the remote computer a modem cable is used (HP part number 92218A).

NOTE: Overrun problems can occur if the remote system's baud rate is faster than the host system's baud rate and flow control is disabled. This occurs because data comes in faster than it can be displayed on the terminal. Eventually the buffers will be overrun.

ENQ/ACK handshaking controls the flow of data between the Model 840 terminal and an A-Series computer. ENQ is a byte of data sent from the A-Series approximately every 80 characters. Once an ENQ is sent, additional data will not be sent until ACK is received by the A-Series, or a time out occurs in the A-series. Although the XON/XOFF protocol is normally used in HP-UX systems, HP terminals support the ENQ/ACK protocol. See the HP terminal configuration manual and enable the ENQ/ACK protocol inside the terminal. Because ENQ and ACK are ASCII data, they will be sent through the Model 840 directly to the terminal thus enabling flow control. XON/XOFF protocol in the remote computer can be enabled in the same manner. Using the RTE-A CN34B request, disable XON/XOFF flow control in HP-UX and enable XON/XOFF protocol inside the terminal.

Software Configuration

The HP 1000 A-Series or other remote computer will need no special software, because RMTERM/840 will emulate a standard terminal.

In the Model 840, HP-UX normally places a "getty" on a terminal, producing interactive prompts for the user. The "getty" will not be needed during the operation of RMTERM. Reconfigure the communication port which will connect the Model 840 to the remote system by changing the "/etc/inittab" file (example in Figure 6-1).

```
# The bold line removes the
# "getty" from the 840 communication
# port to the remote system ( this example:
# tty4p4. "9600f" is a baud rate defined
# in "/etc/gettydefs" but "rmterm" will
# force a reconfiguration of the port

  g1:2:respawn:/etc/getty -h tty4p1 9600f
  g2:2:respawn:/etc/getty -h tty4p2 9600f
  g3:2:respawn:/etc/getty -h tty4p3 9600f
                    .
                    .
                    .

g4:2:off:/etc/getty -h tty4p4 9600f
                    .
                    .

g5:2:respawn:/etc/getty -h tty4p5 9600f
```

Figure 6-1. "/etc/inittab" example.

After /etc/inittab has been modified, the system may be rebooted, or "telinit -q" can be used to inform the system of the change. Now, there is no terminal "getty" to interfere with RMTERM communications.

Running RMTERM/840

To start RMTERM, type,

```
rmterm TTY [-sSPEED]
```

where TTY is the port on the host system which is connected to the remote system, and "SPEED" is the baud rate of the link. RMTERM changes TTY to /dev/TTY, so do not enter the full path name.

Using the "tty4p1" connection configured in Figure 6-1, the following command line could be entered:

```
rmterm tty4p4 -s9600
```

Once executing in remote terminal mode, RMTERM clears the screen and shows a status line highlighted across the top. To leave remote terminal mode and enter command mode, touch the break key. At this point you may generate a break ("b" command), leave RMTERM ("l" command), enter the RTE-A System download sequence ("d" command), or transfer files between the host and remote systems ("r" for RTE to HP-UX or "h" for HP-UX to RTE).. Touching any other key returns you to remote terminal mode. Figure 6-2, page 6-9, is an example of an RMTERM session.

Exiting RMTERM reconfigures the ports, and returns control back to the shell which started the RMTERM process.

Note: *In remote terminal mode, touching the "break" key sends a break to HP-UX returning RMTERM to command mode. In command mode entering the break command ("b") sends a break to the remote system (like touching the "break" key on the actual HP 1000 terminal).*

RMTERM A-Series Download Mode

RMTERM/840 contains a download subroutine, which allows an HP1000 type 1 system file to be downloaded to any A-Series remote system via the remote's VCP (Virtual Control Panel) port. This allows a remote A-Series system without a disc to be booted and controlled by a terminal on the Model 840. The RMTERM remote terminal mode also allows access to the VCP so that the desired VCP command may be used to boot a remote disc based system.

All handshakes with the HP1000 Virtual Control Panel are handled automatically by the download routine. If the first handshake completes normally, a message will indicate this fact. Download progress information (the number of 64k byte chunks transmitted) will be sent to the host terminal. See Figure 6.2 for a sample download session. To stop the download process, use the QUIT function (usually the "ctrl |" key defined by "stty" on HP-UX systems).

Download mode will transfer a memory based system of 0.5 MB in approximately 9 minutes at 19.2k baud, or 18 minutes at 9600 baud.

Download in non-interactive batch mode by using,

```
rmterm TTY [-sSPEED] -d SELECTCODE DOWNLOADFILE -b
```

The "-b" is used to generate a break, which satisfies HP 1000 speed sensing selection (so downloading will occur at the desired baud rate).

RMTERM Continuous Data Logging

By using the "-l" option in the RMTERM shell command string continuous data logging may be initiated on the HP-UX system,

```
rmterm TTY [-sSPEED] -lLOGFILE [-a [ok]]
```

The process is first initiated on HP-UX. Afterwards, any output from the A-Series I/O port will be logged to LOGFILE, continuously, until the RMTERM process is terminated. During data logging, ACK/ENQ handshaking (satisfying the ENQ/ACK handshaking of the HP 1000) is handled by RMTERM using the "-a" option. Previous log files can be overwritten by using the "ok" option.

Running RMTERM in background will make the user terminal available for other tasks during the logging operation. As a convenience, RMTERM returns it's process ID which can later be used to terminate the program:

```
rtmterm -qPID
```

PID is the process ID previously returned by RMTERM when the continuous logging mode was initiated.

The following is an example logging session:

```
% rmterm tty4p4 -llgfl &
[1] 14
% PID: 14 To quit logging to "lgfl", use "rmterm -q14".
% rmterm -q14
Created "lgfl": 509 bytes
[1]  +Stopped (tty output) rmterm tty4p4 -llgfl
%
```

RMTERM File Transfer Mode

RMTERM/840 contains a file transfer subroutine, which can be used to transfer files in batch mode from the HP-UX shell command line (without entering remote terminal mode), or during a remote terminal session.

File transfer mode is entered implicitly by using the RMTERM run string. Another method requires touching the "BREAK" key while in RMTERM in remote terminal mode and selecting either (R)te for an RTE to HP-UX file transfer, or (H)pux for an HP-UX to RTE file transfer. During the process, the amount of data transferred will be displayed.

In batch mode the following RMTERM command strings are used:

```
rmterm TTY [-sSPEED] -r RTEFILE HPUXFILE [ok]
```

will transfer a file from RTE to HP-UX (overwriting the HP-UX file if "ok" is added); or by using

```
rmterm TTY [-sSPEED] -u HPUXFILE RTEFILE TYPE [ok]
```

will transfer a file from HP-UX to RTE (overwriting the RTE file if "ok" is added).

How the file transfer process works

RTE to HP-UX

RTE-A file types 1, 3, 4, or 6 can be copied. RMTERM first requests a directory list ("DL" command) from RTE. If the file exists and is type 3 or 4 (ASCII), RMTERM then requests a copy using the RTE Command SP Interpreter "CO" command. Each "CRLF" record terminator is converted to a "\n" (newline in HP-UX). If the RTE-A file type is 1 (memory image such as a system file) or type 6 (program files) the data is transferred verbatim.

HP-UX to RTE

RTE-A destination file types 3 or 4 can be copied. ASCII file type 4 transfers from HP-UX to RTE-A will be forced to type 3. Any ^D characters will be stripped.

Other file types may be transferred with some additional effort. Suppose for example, that the remote system is disc based and you wish to move several type 1 system files from HP-UX to the target. RMTERM cannot use the RTE-A command interpreter CO command because it expects ASCII data. In this case, a special program is needed on the RTE-A system to receive the data and put it in the proper file.

Embedded in the RMTERM source in the Appendix is a FORTRAN program (hpux1.run) which will perform this function.

The RMTERM.C Source Code

The RMTERM source is shown in the Appendix. The download subroutine included, is designed to transfer a type 1 RTE-A system to a VCP port but the remote system could be another computer, a robot, or a black box. A specific download subroutine may be written which will perform any special file transfer, which is required for a particular application. The data logging routine may be modified to force an action when a specific data stream (such as AUTOR's "powerfail" message) is detected.

After the RMTERM source is edited, recompile it using,

```
cc rmterm.c -o rmterm
```

RMTERM Functional Description

RMTERM.C is divided into six parts: initialization, remote terminal mode, break key processing, file transfer, data logging, and download. Each of these functions are briefly described below. For further information consult the source code.

Initialization

In this section, the parameters passed to RMTERM are verified, with the "DEFAULT_BAUD" substituted if none is passed. The current state of each I/O port is saved (using TCGETA and ioctl), then converted as desired. The SIGINT signal is enabled, so that the BREAK key enters the sigint_handler. Finally the process suspends, waiting for input, using the select call.

Remote Terminal Mode

If no activity occurs for a fixed time (set by the #define INACTIVITY_TO statement) RMTERM will stop, allowing another user to gain access. Otherwise whenever data is available at the communication port or the local terminal port, the data is routed to the local terminal or communication port, respectively.

Break Key Processing

When the break key is depressed, the "sigint_handler" signal handler routine executes. Here the user is prompted for the choice. If a "B" is entered the appropriate subroutine is executed (see next section); if an "L" is entered, the ports are restored and the process terminates. An "R" or a "U" will initiate file transfer. Any other key causes RMTERM to re-enter remote terminal mode.

File Transfer

If the "–u" option is chosen, all parameters are passed to the "HPUXtoRTE" subroutine. In the other case, when the "–r" option is chosen, parameters are passed to the "RTEtoHPUX" subroutine. If any parameters are not included, they default to null, and the subroutine will prompt the user for the proper values. "–" may be used for file names where appropriate to allow stdin and stdout.

Each of the file transfer routines invoke subroutine called "init_ci" to guarantee that a copy of CI is running on the remote system, and to determine if the RTE-A file exists.

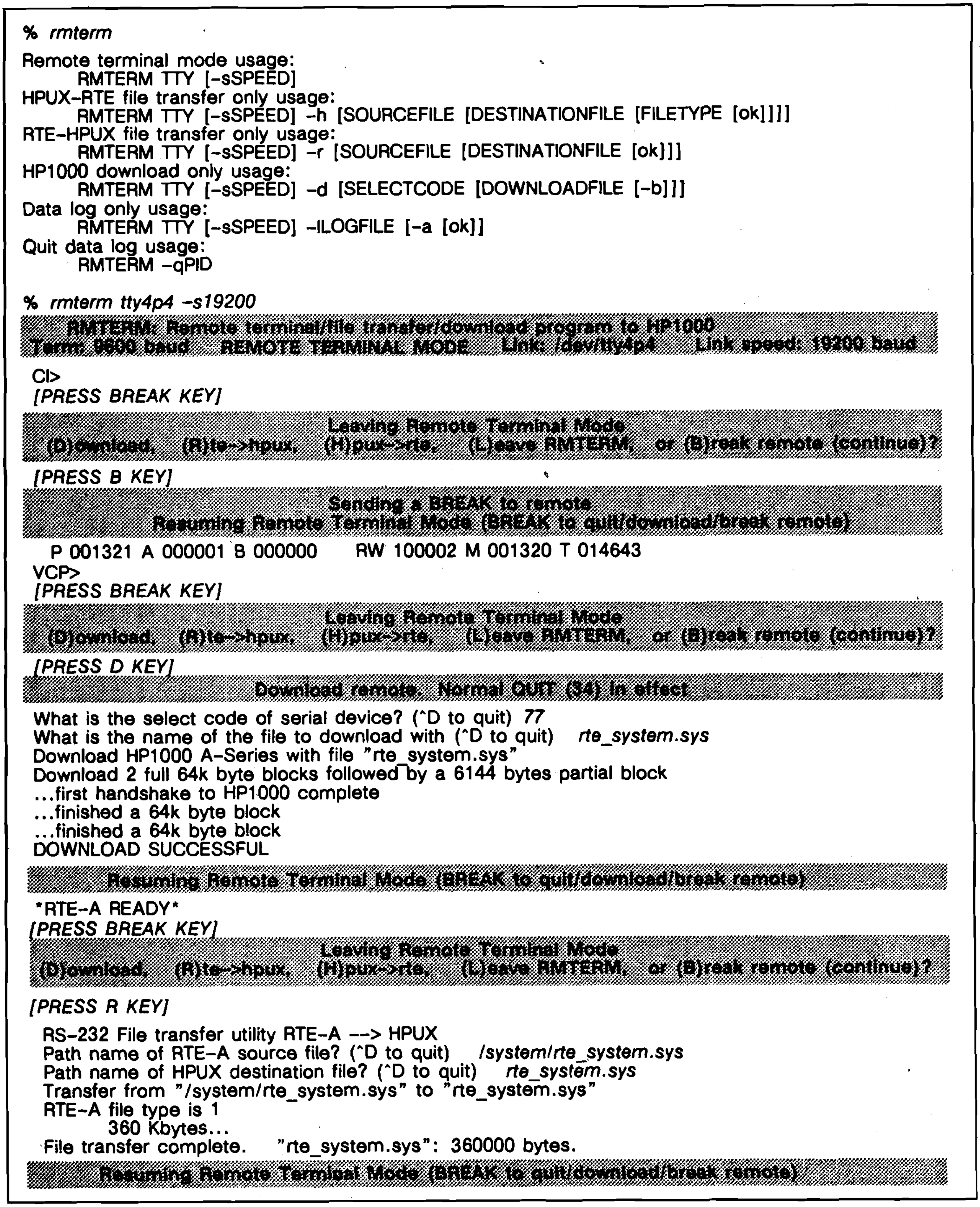
Next, depending on the file type, handshaking is performed to allow the file transfer. Note that no data checksums are used, so if data validity is required use a comparator such as HP-UX's "cmp" to guarantee the data.

Data Logging

The "datalog" routine processes the "–q" and the "–l" options. If the "–l" option is selected, the file is opened and all data, until the SIGUSR1 signal is received, is routed to the file. Note that the file may be accessed by other processes during the logging operation. If "–q" is selected, the SIGUSR1 signal is sent to the process ID whose ID number is associated with the "–q" option.

Download

This subroutine performs all the necessary handshakes to facilitate an RTE-A system download (including a %bctSC command to VCP, where SC is the HP 1000 serial port select code). A complex handshake occurs, and the file (the name of which the user inputs) is downloaded, 510 bytes at a time followed by a checksum. When this is finished, RMTERM reverts back to remote terminal mode.



```
% rmterm
Remote terminal mode usage:
     RMTERM TTY [-sSPEED]
HPUX-RTE file transfer only usage:
     RMTERM TTY [-sSPEED] -h [SOURCEFILE [DESTINATIONFILE [FILETYPE [ok]]]]
RTE-HPUX file transfer only usage:
     RMTERM TTY [-sSPEED] -r [SOURCEFILE [DESTINATIONFILE [ok]]]
HP1000 download only usage:
     RMTERM TTY [-sSPEED] -d [SELECTCODE [DOWNLOADFILE [-b]]]
Data log only usage:
     RMTERM TTY [-sSPEED] -lLOGFILE [-a [ok]]
Quit data log usage:
     RMTERM -qPID

% rmterm tty4p4 -s19200
    RMTERM: Remote terminal/file transfer/download program to HP1000
Term: 9600 baud   REMOTE TERMINAL MODE   Link: /dev/tty4p4   Link speed: 19200 baud
 CI>
 [PRESS BREAK KEY]
                        Leaving Remote Terminal Mode
 (D)ownload,  (R)te->hpux,  (H)pux->rte,  (L)eave RMTERM,  or (B)reak remote (continue)?
 [PRESS B KEY]
                        Sending a BREAK to remote
          Resuming Remote Terminal Mode (BREAK to quit/download/break remote)
  P 001321 A 000001 B 000000    RW 100002 M 001320 T 014643
 VCP>
 [PRESS BREAK KEY]
                        Leaving Remote Terminal Mode
 (D)ownload,  (R)te->hpux,  (H)pux->rte,  (L)eave RMTERM,  or (B)reak remote (continue)?
 [PRESS D KEY]
                  Download remote.  Normal QUIT (34) in effect
 What is the select code of serial device? (^D to quit) 77
 What is the name of the file to download with (^D to quit)   rte_system.sys
 Download HP1000 A-Series with file "rte_system.sys"
 Download 2 full 64k byte blocks followed by a 6144 bytes partial block
 ...first handshake to HP1000 complete
 ...finished a 64k byte block
 ...finished a 64k byte block
 DOWNLOAD SUCCESSFUL
     Resuming Remote Terminal Mode (BREAK to quit/download/break remote)
  *RTE-A READY*
 [PRESS BREAK KEY]
                        Leaving Remote Terminal Mode
 (D)ownload,  (R)te->hpux,  (H)pux->rte,  (L)eave RMTERM,  or (B)reak remote (continue)?
 [PRESS R KEY]
  RS-232 File transfer utility RTE-A --> HPUX
  Path name of RTE-A source file? (^D to quit)   /system/rte_system.sys
  Path name of HPUX destination file? (^D to quit)   rte_system.sys
  Transfer from "/system/rte_system.sys" to "rte_system.sys"
  RTE-A file type is 1
        360 Kbytes...
  File transfer complete.   "rte_system.sys": 360000 bytes.
     Resuming Remote Terminal Mode (BREAK to quit/download/break remote)
```

Figure 6-2. RMTERM Sample Session.

Appendix: RMTERM Source, Version 1.0. (Version 2.0, a superset of Version 1.0, is available).

```
/* RMTERM (ReMoteTerminal) is a program which allows a remote terminal/file
transfer, and download to an HP1000 A-Series system connected via RS-232.
Remote terminal mode is exited by hitting the break key, when one has the
option to generate a break, transfer files, download via RS-232, or exit.


***************************************************************
* Note: This is given in source format, and is intended as an      *
*       aid to Hewlett-Packard Customers.  Although features       *
*       described have been proven, Hewlett-Packard does not       *
*       support the use of this program.  It is given as a         *
*       starting point for customers who need this type of         *
*       application.                                               *
*                                                                  *
***************************************************************/


#include <stdio.h>
#include <signal.h>
#include <fcntl.h>
#include <errno.h>
#include <time.h>
#include <termio.h>
#define BUFSIZE 1024                    /* max size for each remote terminal read */
#define PATH_LEN 80                     /* max pathname length for file names */
#define INACTIVITY_TO 900               /* 15 minute auto log off */
#define TTY 0                           /* for array referencing */
#define COM 1                           /* for array referencing */
#define TTYPATH "/dev/tty"              /* the path name for terminal TTY */
#define DEFAULT_BAUD B9600              /* the default baudrate if no "-sSPEED" */
#define SDEFAULT_BAUD "9600"            /* default baudrate string */
#define REC_BYTE_SIZE 510               /* number of characters per download record */
#define RTEBLOCKSIZE 256                /* number of characters per RTE-A file record */
#define CIXDELAY 50000                  /* length of delay loop to compensate for CIX */
#define RETRYMAX 5                      /* number of times to try to get CI prompt */
#define BREAKCOUNT 8                    /* number of ACK's to send after break */
#define MASK(f) (1<<f)     /* perform the bit shift on "1" "f" bits left */
#define SUPSHIFT(string,cptr) for(cptr = string;*cptr != '\0';cptr++) if(*cptr >= 'a' && *cptr <= 'z') *cptr
+= 'A'-'a'
#define SDOWNSHIFT(string,cptr) for(cptr = string;*cptr != '\0';cptr++) if(*cptr >= 'A' && *cptr <= 'Z')
*cptr += 'a'-'A'
#define DELAY(t)            for(t=0;t<CIXDELAY;t++)t += (10*(t/2)) % 10;


extern int errno;
int fd[2];                              /* filedescriptors for TTY and communication TTY */
int justdownloaded;                     /* flag to prevent timeout messages */
short baudrate;                         /* the baud rate value for communication port */
char prognam[16];
struct termio io[2];                     /* the original configuration of the two ports */
int logfiledescriptor;                  /* the file descriptor of the log file name */
char logfilename[PATH_LEN];             /* the file name of log file */
int sigint_handler();                   /* signal handler for SIGINT */
int logPID = 0;                         /* the process ID of the logging process */
int logcount = 0;                       /* the number of bytes written to logfile */
struct sigvec sigint_vec = {
            sigint_handler,0,0};
int sigusr1_handler();                  /* signal handler for SIGUSR1 in data log subroutine */
struct sigvec sigusr1_vec = {
            sigusr1_handler,0,0};


main(argc,argv)
int argc;
char **argv;
{
            int nfound,readfds,writefds,exceptfds;
            int filemask[2],l,nbytes,temp,error;
            char *c,buf[BUFSIZE],compath[PATH_LEN],termbaud[6],linkbaud[6];
            struct timeval timeout;
```

```
strcpy(prognam,*argv);
SUPSHIFT(prognam,c);    /* Case fold */
if (argc == 1) show_runstring();            /* exit, showing runstring */
if (argv[1][0] == '-' && argv[1][1] == 'q') {
        if((error = datalog(0,argv[1])) != 0)
                fprintf(stderr,"%s %s returned error: %d\n",
                   prognam,argv[1],error);
        exit(-1);
        exit(0);
}
sprintf(compath,"/dev/%s",argv[1]);
temp = 2;
if ((argc > 2) && argv[2][0] == '-' && argv[2][1] == 's') {
        if (strcmp(argv[2],"-s9600") == 0) baudrate = B9600;
        else if (strcmp(argv[2],"-s19200") == 0) baudrate = B19200;
        else if (strcmp(argv[2],"-s4800") == 0) baudrate = B4800;
        else if (strcmp(argv[2],"-s2400") == 0) baudrate = B2400;
        else if (strcmp(argv[2],"-s1200") == 0) baudrate = B1200;
        else if (strcmp(argv[2],"-s300") == 0) baudrate = B300;
        else {
                fprintf(stderr,"Invalid baud rate\n");
                show_runstring();               /* exit, showing runstring */
        }
        temp++;                 /* show that we used this */
        strcpy(linkbaud,argv[2]+2);
}
else {
        baudrate = DEFAULT_BAUD; /* If no baud given, use default */
        strcpy(linkbaud,SDEFAULT_BAUD);
}
/* Try to open the selected device, and flush it */
if ((fd[COM] = open(compath, O_RDWR)) == -1) {
        perror(compath);
        show_runstring();
}
if ((fd[TTY] = open(TTYPATH, O_RDWR)) == -1) pexit(TTYPATH);
/* Get the current configurations of both ports */
if (ioctl(fd[TTY],TCGETA,&io[TTY]) == -1)
        pexit("ioctl on fd[TTY]");
if (ioctl(fd[COM], TCGETA, &io[COM]) == -1)
        pexit("ioctl on fd[COM]");
/* following errors must restore_ttys_exit, to restore terminal ports */
/* setup the communication TTY */
rawmode_tty(fd[COM],io[COM],baudrate);
/* setup the tty (interactive terminal) */
/* Be sure the line is not configured as a modem, or logged off */
io[TTY].c_cflag &= -HUPCL;
io[TTY].c_cflag |= CLOCAL;
for (i=argc+1;i<=6;i++)argv[i][0] = '\0'; /* null invalid strings */
if (argc > temp) {
        if (argv[temp][0] == '-' && argv[temp][1] == 'h')
                error  =  HPUXtoRTE(fd[COM],fd[TTY],argv[temp+1],
                            argv[temp+2],argv[temp+3],argv[temp+4]);
        else if (argv[temp][0] == '-' && argv[temp][1] == 'r')
                error  = RTEtoHPUX(fd[COM],fd[TTY],argv[temp+1],
                            argv[temp+2],argv[temp+3]);
        else if (argv[temp][0] == '-' && argv[temp][1] == 'd')
                error  =  download(fd[COM],fd[TTY],argv[temp+1],
                            argv[temp+2],argv[temp+3]);
        else if (argv[temp][0] == '-' && argv[temp][1] == 'l')
                error  =  datalog(fd[COM],argv[temp],argv[temp+1],
                            argv[temp+2]);
        else show_runstring();          /* exit, showing runstring */
        if(error == 0) restore_ttys_exit("");
        sprintf(buf,"File transfer returned error %d",error);
        restore_ttys_exit(buf);
}
/* set up the terminal for remote terminal mode */
rawmode_tty(fd[TTY],io[TTY],io[TTY].c_cflag&CBAUD);
if((io[TTY].c_cflag & CBAUD) == B9600) strcpy(termbaud,"9600");
else if((io[TTY].c_cflag & CBAUD) == B19200) strcpy(termbaud,"19200");
else if((io[TTY].c_cflag & CBAUD) == B2400) strcpy(termbaud,"2400");
else if((io[TTY].c_cflag & CBAUD) == B1200) strcpy(termbaud,"1200");
```

```
        else strcpy(termbaud,"????");
        /* enable signals.  Watch for the break cond. (exit remote term mode) */
        sigvector (SIGINT,&sigint_vec,0);
        for (i=0;i<=1;i++) {
                filemask[i] = MASK(fd[i]);
                if(ioctl(fd[i],TCFLSH,0)==-1) /* flush the input Queue */
                        restore_ttys_exit("Error during TCFLSH");
        }
        /* home up, clear screen, and send a memory lock to terminal */
        printf("\n\033m\033H\033J                  %s: Remote ",prognam);
        printf("terminal/file transfer/download program to HP1000  \r\n");
        printf("Term: %s baud  REMOTE TERMINAL MODE  Link: %s ",termbaud,compath);
        printf("Link speed: %s baud\r\n",linkbaud);
        printf("\033&dJ     Remote Terminal Mode (");
        printf("BREAK to quit/download/file/break remote");
        printf(")        \r\n l\r");  /* memory lock screen (NL/cursor up)*/
        fflush(stdout);                         /* let the output drain */


        for (;;){
retry_select:
                readfds = 0;
                for (i=0;i<=1;i++) readfds |= filemask[i];
                timeout.tv_sec = INACTIVITY_TO;       /* inactivity timer */
                timeout.tv_usec = writefds = exceptfds = 0;
                if ((nfound = select(5,&readfds,&writefds,&exceptfds,
                  &timeout)) <= 0)
                        if ((errno & EINTR) && (nfound == -1)) {
                                /* It is okay for us to re-enter select */
                                goto retry_select;
                        }
                        else if (nfound == 0) {
                            if (justdownloaded != 0) goto retry_select;
                            else {
                                fprintf(stderr,"\r\nInactivity timer expired\r\n");
                                restore_ttys_exit("");
                            }
                        }
                        else {
                                fprintf(stderr,"Select returned %d\r\n",nfound);
                                restore_ttys_exit("Select failed");
                        }
                justdownloaded = 0;             /* indicate entrance since download */
                for(i=0;i<=1;i++)
                        if (readfds & filemask[i]) {
                                if((nbytes = vread(fd[i],buf,BUFSIZE)) > 0)
                                        vwrite(fd[(i+1)%2],buf,nbytes);
                                else restore_ttys_exit("Select Read ERROR");
                        }
        } /* End of infinite for loop */

}


sigint_handler()
{
        char choice[1];
        int error;


        /* restore the terminal before we write to it */
        printf("\r\n\033&dJ                     Leaving");
        printf(" Remote Terminal Mode                    \r\n");
        printf("\033&dB(D)ownload,(R)te->hpux,(H)pux->rte,(L)eave %s,",prognam);
        printf("or (B)reak remote (continue)?\r\n");
        vioctl(fd[TTY],TCFLSH,0);               /* flush the input queue */
        nonblocking_io(fd[TTY],0);              /* disable non-blocking I/O */
        vread(fd[TTY],choice,1);
        tolower(choice[0]);         /* convert to lower case */
        if (choice[0] == 'b') {
                printf("\033&dJ  Sending a BREAK to ");
                printf("remote   \r\n");
                vioctl(fd[COM],TCSBRK,0);               /* send a break via COM */
        }
        else if (choice[0] == 'd') {                    /* download remote */
                justdownloaded = 1;             /* flag that we may timeout here */
                printf("\033&dJ  Download remote.  Normal QUIT");
                printf(" (%o) in effect  \r\n",io[TTY].c_cc[1]);
                if (download(fd[COM],fd[TTY],"","","") != 0)
                        restore_ttys_exit("Download failed");
                /* Reset the ports as we like them */
        }
        else if (choice[0] == 'l') {
                printf("\033&dJ  LEAVING");
                printf(" %s PROGRAM ",prognam);
                restore_ttys_exit("");          /* we will not return from this */
        }
        else if (choice[0] == 'r') {
                if((error = RTEtoHPUX(fd[COM],fd[TTY],"","","")) != 0)
                        fprintf(stderr,"RTEtoHPUX returned error %d\n\r",error);
        }
        else if (choice[0] == 'h')
                if((error = HPUXtoRTE(fd[COM],fd[TTY],"","","","")) != 0)
                        fprintf(stderr,"HPUXtoRTE returned error %d\n\r",error);
        /* Restore the ports as needed for remote terminal mode */
        rawmode_tty(fd[COM],io[COM],baudrate);
        rawmode_tty(fd[TTY],io[TTY],io[TTY].c_cflag&CBAUD);
        printf("\r\n\033&dJ      Resuming Remote Terminal Mode (");
        printf("BREAK to quit/download/break remote)        \r\n");
}

rawmode_tty(filedescriptor,tty_termio,newbaud)

/* Enable the TTY device (indicated by filedescriptor) for the
        proper communication parameters.  Guarantee that it is performing
        non-blocking I/O.  Do not affect the current contents of "tty_termio",
        so that it may be used for restoration.  If fails, perform PEXIT.  */

struct termio tty_termio;
int filedescriptor,newbaud;

{
        /* enable interrupts on break, ignore parity errors */
        tty_termio.c_iflag = BRKINT | IGNPAR;
        /* do not do any output processing of data */
        tty_termio.c_oflag = 0;
        /* set up the port according to the requested baud rate */
        tty_termio.c_cflag = newbaud | CS8 | CREAD | CLOCAL;
        /* disable signals and do not flush data on breaks */
        tty_termio.c_lflag = NOFLSH;
        /* set up the special characters */
        tty_termio.c_cc[0] = 0;                 /* VINTR character */
        tty_termio.c_cc[1] = 0;                 /* VQUIT character */
        tty_termio.c_cc[2] = 0;                 /* VERASE character */
        tty_termio.c_cc[3] = 0;                 /* VKILL character */
        tty_termio.c_cc[4] = 1;       /* VEOF = MIN = 1 char min to satisfy reads */
        tty_termio.c_cc[5] = 0;       /* VEOL = TIME = 0 = no timeout */
        if (ioctl(filedescriptor,TCSETAW,&tty_termio) == -1)
                pexit(stderr,"rawmode_tty ERROR in ioctl using TCSETAW:");
        /* Enable non-blocking I/O */
        nonblocking_io(filedescriptor,1);       /* enable non-blocking I/O */
}

restore_ttys_exit(s)

char *s;
/* this restores the terminal ports to their original states, then does an
        exit after closing both files, and sending an error message
        if a string was passed.  */
{
        int i;


        for (i=0;i<=1;i++) {
                if (ioctl(fd[i], TCSETAW, &io[i]) == -1)
```

```
                                        perror("TCSETAW in restore_ttys_exit failed\n");
                                if(close(fd[i])==-1)
                                        perror("close failed in restore_ttys_exit\n");
                }
                if (*s == '\0') exit(0);        /* stop the program normally */
                pexit(s);                                /* stop the program abnormally */
}


pexit(s)
char *s;
{
                perror(s);
                exit(1);
}


download(com_fd,tty_fd,selectcode,downloadfile,sendbreak)
int com_fd,tty_fd;
char *selectcode,*downloadfile,*sendbreak;
/*
Send a break to remote, then perform download to A-Series HP-1000 via
RS-232 port (file com_fd).  Perform necessary handshakes, as required.
*/
{
                struct termio com_io;
                unsigned short downloadaddr,checksum;
                int i,error,filedescriptor,try;
                int num32kblocks,residue,orignum32k;
                int xfer_len,lastrecord,length;
                unsigned char buf[REC_BYTE_SIZE+6];
                char cpath[PATH_LEN];
                char initbuf[9],sc[3];


                /* Setup both ports for normal input */
                cannonical_tty(tty_fd,io[TTY],0,0); /* cannonical, and map CR to NL */
                cannonical_tty(com_fd,io[TTY],baudrate,1); /* no echo */
                if (*selectcode == '\0') {
                                printf("What is the select code of serial device? (^D to quit) ");
                                fflush(stdout);                         /* Be sure this message gets out first
*/
                                if (scanf("%2s",sc) == -1) return(0);   /* test for ^D */
                }
                else strcpy(sc,selectcode);
                sc[2] = '\0';                                           /* only allow two characters */
                if (sendbreak[0] != '\0') {
                                if (strcmp(sendbreak,"-b") != 0) {
                                                fprintf(stderr,"Must use \"-b\" option for break\n");
                                                return(-1);
                                }
                                cannonical_tty(com_fd,io[TTY],B1200,1); /* no echo */
                                vioctl(com_fd,TCSBRK,0); /* send a break via COM */
                                cannonical_tty(com_fd,io[TTY],baudrate,1); /* no echo */
                                DELAY(i);                               /* let break finish */
                                for(try=BREAKCOUNT;try>0;try--) {       /* satisfy speed sense */
                                                vwrite(com_fd,"\006",1);
                                                for(i=0;i<5000;i++) length = i+1;       /* delay */
                                }
                                DELAY(i);                               /* let VCP message finish */
                }
                DELAY(i);
                vioctl(com_fd,TCFLSH,0); /* Flush the incoming data line */
                try = 0;
wait4file:
                if (try++ == 5) {
                                printf("Too many tries, quitting\n");
                                return(0);
                }
                if (*downloadfile == '\0') {
                                printf("What is the name of the file to download with (^D to quit) ");
                                fflush(stdout);                         /* Be sure this message gets out first
*/
                                if (scanf("%s",cpath) == -1) return(0); /* test for ^D */
                }
```

```
else strcpy(cpath,downloadfile);
printf("Download HP1000 A-Series with file \"%s\"\n",cpath);
if ((filedescriptor = open(cpath,O_RDONLY)) == - 1)
                if ((errno & ENOENT) == ENOENT) {
                                printf("%s: cannot open %s\n",prognam,cpath);
                                goto wait4file;
                }
                else restore_ttys_exit("Opening file");
if(vread(filedescriptor,buf+4,REC_BYTE_SIZE) != REC_BYTE_SIZE) {
                fprintf(stderr,"READ of %s returned %d, requesting %d\n",
                   cpath,length,REC_BYTE_SIZE);
                fprintf(stderr," file may be too small\n");
                return(0);
}
orignum32k = num32kblocks = *(buf+4) * 0400 + *(buf+5);
residue = *(buf+6) * 0400 + *(buf+7);
printf("Download %d full 64K byte blocks followed by a %d bytes partial block\n",
   num32kblocks,residue);
/* All of the records sent to the HP1000 (buf) are in the following
format:


+--------------------+-----------------------------+
| \#words (byte pairs)   |              don't care          |
+--------------------+-----------------------------+
|  16 bit word of starting address for HP1000 load        |
+--------------------+-----------------------------+
|                              download word \#1 (16 bits)   |
+--------------------+-----------------------------+
|                              download word \#2 (16 bits)   |
+--------------------+-----------------------------+
                     .                    .            .

                     .                                 .

                     .                                 .
+--------------------+-----------------------------+
|                             download word \#n-1 (16 bits)  |
+--------------------+-----------------------------+
|                              download word \#n (16 bits)   |
+--------------------+-----------------------------+
| arithmetic 16 bit checksum of address -> word \#n        |
+--------------------+-----------------------------+


*/


/* Initiate download by sending the bootstring to VCP */


nonblocking_io(com_fd,0); /* disable non-blocking I/O */
com_io.c_iflag = IGNBRK | IGNPAR;
com_io.c_oflag = 0;
com_io.c_cflag = baudrate | CS8 | CREAD | CLOCAL;
com_io.c_lflag = NOFLSH;
com_io.c_cc[0] = 0;
com_io.c_cc[1] = 0;
com_io.c_cc[2] = 0;
com_io.c_cc[3] = 0;
com_io.c_cc[4] = 9;         /* VEOF = MIN = 9 char min to satisfy reads */
com_io.c_cc[5] = 150;       /* VEOL = TIME = 15.0 second timeout */
vioctl(com_fd,TCSETAW,com_io);
sprintf(initbuf,"%%BCT%s\r",sc);
vwrite(com_fd,initbuf,7);   /* send %BCTsc, sc is select code */
initbuf[9] = '\0';                        /* place a null in buffer */
if((error = vread(com_fd,initbuf,9)) != 9) {
                fprintf(stderr,"Read length error. Length: %d\n",error);
                return(0);
}
if (strcmp(initbuf,"%BCT77\r\r\n") != 0) {
                fprintf(stderr,"Did not get correct echo from VCP\n");
                return(0);
}
xfer_len = REC_BYTE_SIZE;                 /* number of bytes we are sending */
```

```
            buf[1] = 0;
            downloadaddr = 0;
            printf("...first handshake to HP1000 complete\r\n");
            goto firstentry;              /* start in middle of loop */
            /* download loop */
nextrecord:
            if (num32kblocks == 0)
                    if (downloadaddr + (REC_BYTE_SIZE/2) >= residue)  {
                            lastrecord = 1;
                            xfer_len = (residue - downloadaddr)*2;   /* last record*/
                    }
                    else
                            xfer_len = REC_BYTE_SIZE;                /* near the end */
            else if (downloadaddr + REC_BYTE_SIZE/2 > 0100000) {
                    /* this many bytes will overflow us, send less */
                    xfer_len = (0100000 - downloadaddr)*2;           /* starting addr */
            }
            else
                    xfer_len = REC_BYTE_SIZE;             /* we can go max size */
            if(vread(filedescriptor,buf+4,xfer_len) != xfer_len) {    /* get next record */
                    fprintf(stderr,"\r\nERROR! READ length = %d, expected %d\r\n\n",
                       error,xfer_len);
                    fprintf(stderr,"downloadaddr = %d, num32kblocks = %d\n\r",
                       downloadaddr,num32kblocks);
                    return(0);
            }
firstentry:
            buf[0] = xfer_len/2;                    /* number of words to send */
            checksum = downloadaddr;                /* initialize checksum */
            buf[2] = downloadaddr / 256;            /* MSB addr */
            buf[3] = downloadaddr % 256;            /* LSB addr */
            if (handshake(com_fd) != 0) return(-1);
            for (i=1;i<xfer_len;i=i+2)              /* xfer_len+3 is last byte */
                    checksum = checksum + (buf[i+3] * 256) + buf[i+4];
            buf[xfer_len+4] = checksum / 256;       /* MSB of checksum */
            buf[xfer_len+5] = checksum % 256;       /* LSB of checksum */
            vwrite(com_fd,buf,xfer_len+6);
            downloadaddr = downloadaddr + xfer_len/2;          /* get new address */
            if ((xfer_len != REC_BYTE_SIZE) && (lastrecord == 0))  {
                    switch (orignum32k-num32kblocks+1){
                    case 64:
                         printf("...finished a 64K byte block (4 megabyte boundary)\n");
                         break;
                    case 32:
                         printf("...finished a 64K byte block (2 megabyte boundary)\n");
                         break;
                    case 16:
                         printf("...finished a 64K byte block (1 megabyte boundary)\n");
                         break;
                    case 8:
                         printf("...finished a 64K byte block (0.5 megabyte boundary)\n");
                         break;
                    case 4:
                         printf("...finished a 64K byte block (0.25 megabyte boundary)\n");
                         break;
                    default:
                         printf("...finished a 64K byte block\n");
                         break;
                    }
                    /* Send the null record to indicate a map set change */
                    for(i=0;i<=5;i++)buf[i] = 0; /* 3 null words to send */
                    if (handshake(com_fd) != 0) return(-1);
                    vwrite(com_fd,buf,6);
                    downloadaddr = 0;
                    num32kblocks--;
            }
            if (lastrecord == 0) goto nextrecord;       /* ...and continue on */

            /* WE ARE FINISHED WITH THE DOWNLOAD! send a RS-CR & wait for esc */

            if(read_esc_seq(com_fd) != 0)return(-1); /* wait for esc...dc1 */
            vwrite(com_fd,"\036\r",2);              /* indicate finished */
            printf("DOWNLOAD SUCCESSFUL"); /* FINISHED */
```

```
		return(0);
}


handshake(comm_filedesc)
/* Perform the proper handshaking to the port (which is connected to
		an RS-232 cable, connected to the VCP port of an HP1000.
		This handshake involves reading 8 bytes, which will be "ESC-&-
		p-1-s-2-R-DC1", then sending 5 bytes (which are ignored
		by VCP), then receiving a DC1.  "comm_filedesc" is the filedescriptor
		returned by an open call to the communication port.  Sets minimal
		read size (MIN) to 1 character.  */
{
		char handshake_buf[8];
		int length;
		struct termio handio;
		vioctl(comm_filedesc,TCGETA,handio);
		handio.c_cc[4] = 8;		/* VEOF = MIN = 8 char min to satisfy reads */
		vioctl(comm_filedesc,TCSETA,handio);
		handshake_buf[8] = '\0';	/* initialize with NULL */
		if((length = vread(comm_filedesc,handshake_buf,8)) != 8) {
				printf("Handshake failed! length = %d\n",length);
				return(-1);
		}
		if(strcmp(handshake_buf,"\033&p1s2R\021") != 0) {
				printf("Handshake failed! receive buf = %s\n",handshake_buf);
				return(-1);
		}
		vwrite(comm_filedesc,"Ignor",5);
		handio.c_cc[4] = 1;		/* VEOF = MIN = 1 char min to satisfy reads */
		vioctl(comm_filedesc,TCSETA,handio);
		handshake_buf[1] = '\0';	/* initialize with NULL */
		if (vread(comm_filedesc,handshake_buf,1) != 1) {
				printf("DC1 Handshake failed! length = %d\n",length);
				return(-1);
		}
		if(strcmp(handshake_buf,"\021") != 0) {
				printf("DC1 handshake failed,receive buf = %s\n",handshake_buf);
				return(-1);
		}
		return(0);
}


read_esc_seq(comm_filedesc)
/*  Verify the esc...dc1 handshake  */
{
		char handshake_buf[8];
		int length;
		struct termio handio;
		vioctl(comm_filedesc,TCGETA,handio);
		handio.c_cc[4] = 8;		/* VEOF = MIN = 8 char min to satisfy reads */
		vioctl(comm_filedesc,TCSETAW,handio);
		if((length = vread(comm_filedesc,handshake_buf,8)) != 8) {
				printf("Handshake failed! length = %d\n",length);
				return(-1);
		}
		return(0);
}


bufcmp(buf,string)
char *buf,*string;
/* This routine is much like strcmp, but allows the buffer to
be of anylength, and just requires that all the characters in buf
match that of string, else return -1.  Note that it is not
a requirement that the first string end in '\0'.  */
{
		int i;
		for(i=0; *buf == *string; buf++,string++,i++);
		if (i == 0) return(-1);		/* failed on first char */
		if((*(string-1) == '\0') || (*string == '\0')) return(0);
		return(-1);
}
```

```
vwrite(filedescriptor,buffer,charlen)
int filedescriptor,charlen;
char *buffer;
/* this subroutine does a VERIFY write.  It checks the error code from
the write, and if fails, prints the appropriate message and exits after
restoring ports.  If passes, it returns the number of characters.  */
{
                int char_count;
                if((char_count = write(filedescriptor,buffer,charlen)) == -1)
                                restore_ttys_exit("VWRITE failed");
                if (char_count == charlen) return;
                fprintf(stderr,"VWRITE count failed.  Charlen: %d, char_count: %d\n",
                   charlen,char_count);
                restore_ttys_exit();
}


vread(filedescriptor,buffer,maxcharlen)
int filedescriptor,maxcharlen;
char *buffer;
/* this subroutine does a VERIFY read.  It checks the error code from
the read, and if fails, prints the appropriate message, restores terminal
ports, and exits.  If passes, it returns the number of characters.  */
{
                int char_count;
                if((char_count = read(filedescriptor,buffer,maxcharlen)) == -1)
                                restore_ttys_exit("VREAD failed");
                return(char_count);
}


vioctl(filedescriptor,options,parameter)
int filedescriptor,parameter;
/* this subroutine does a VERIFY read.  It checks the error code from
the read, and if fails, prints the appropriate message, restores terminal
ports, and exits.  If passes, it returns the number of characters.  */
{
                int error;
                if((error = ioctl(filedescriptor,options,parameter)) == -1)
                                restore_ttys_exit("VIOCTL failed");
                return(error);
}


pick(message,choices,CRvalue)
char *message,*choices,CRvalue;
/* send message until receive valid choice.  "choices" is a character string,
all of which must be in lower case letters.  If invalid choice, send the valid
choices and re-prompt.  */
{
                char choice,*c;
sendmsg:
                c = choices;
                printf("%s",message);
                fflush(stdout);                 /* Be sure this message gets out first */
                vread(1,&choice,2);
                if (choice == '\n') choice = CRvalue;
                if (choice >= 'A' && choice <= 'Z')choice+=('a'-'A');
                tolower(choice);
                while(*c != '\0')
                                if (*(c++) == choice) return(choice);
                printf("Valid choices: %s\n",choices);
                goto sendmsg;
}


cannonical_tty(filedescriptor,tty_termio,baud,noecho)
/* Enable the TTY device (indicated by filedescriptor) for the
                proper communication parameters.  Guarantee that it is performing
                non blocking I/O.  Do not affect the current contents of "tty_termio",
                so that it may be used for restoration.  Output CRLF for NL.  Use
                current baud rate.  This is what should be used for interactive
                terminal I/O.  If error, exit.  If noecho == 0, do not perform echos,
                or post-process output data.  Disable non-blocking I/O.  Make
                baudrate from baud, unless 0, then use from tty_termio.  */
```

```
struct termio tty_termio;
int filedescriptor,baud,noecho;
{
        /* Set up terminal port (see man page on TERMIO) */
        tty_termio.c_oflag = ONLCR | OPOST;
        if (baud == 0)
                tty_termio.c_cflag=(tty_termio.c_cflag&CBAUD)|CS8|CREAD|CLOCAL;
        else tty_termio.c_cflag = baud | CS8 | CREAD | CLOCAL;
        If (noecho != 0) {
                tty_termio.c_iflag = IGNPAR;
                tty_termio.c_oflag = 0;
                tty_termio.c_lflag = ICANON;
                tty_termio.c_line = '\000';
                tty_termio.c_cc[0] = 0;                 /* VINTR character */
                tty_termio.c_cc[1] = 0;                 /* VQUIT character */
                tty_termio.c_cc[2] = 0;                 /* VERASE character */
                tty_termio.c_cc[3] = 0;                 /* VKILL character */
                tty_termio.c_cc[4] = 1;                 /* VEOF = 1 */
                tty_termio.c_cc[5] = 0;                 /* VEOL = 0 */
        }
        else {
                tty_termio.c_lflag = ISIG | ICANON | ECHO | ECHOE |ECHOK;
                tty_termio.c_oflag = ONLCR | OPOST;
                tty_termio.c_iflag = IGNPAR | ICRNL;
        }
        /* use users's pre-defined EOF, EOL, erase, kill, and QUIT characters */
        vioctl(filedescriptor,TCSETAW,&tty_termio);
        nonblocking_io(filedescriptor,0);          /* disable non-blocking I/O */
        return(0);
}

nonblocking_io(filedescriptor,enable)
int filedescriptor,enable;
/* This routine enables/disables non blocking I/O according to "enable".
If enable != 0, non-blocking I/O is enabled. If non-blocking I/O is
enabled, ERRNO can give the error message: "operation would block". */
{
        vioctl(filedescriptor,FIOSNBIO,&enable);
        return;
}

show_runstring()
/* perform an exit after displaying the run string. */
{
        fprintf(stderr, "Remote terminal mode usage:\n\t%s TTY [-sSPEED]\n",prognam);
        fprintf(stderr, "HPUX-RTE file transfer only usage:\n\t%s TTY [-sSPEED] -h
[SOURCEFILE [DESTINATIONFILE [FILETYPE [ok]]]\n",
           prognam);
        fprintf(stderr, "RTE-HPUX file transfer only usage:\n\t%s TTY [-sSPEED] -r
[SOURCEFILE [DESTINATIONFILE [ok]]]\n",
           prognam);
        fprintf(stderr, "HP1000 download only usage:\n\t%s TTY [-sSPEED] -d [SELECTCODE
[DOWNLOADFILE [-b]]]\n",prognam);
        fprintf(stderr,"Data log only usage:\n\t%s TTY [-sSPEED] -lLOGFILE [-a
[ok]]\n",prognam);
        fprintf(stderr,"Quit data log usage:\n\t%s -qPID\n",prognam);
        exit(-1);  /* Stop program */
}

RTEtoHPUX(com_fd,tty_fd,rtesource,hpuxdest,ok)
int com_fd,tty_fd;          /* file descriptors of communication and term. ports */
char   *rtesource,*hpuxdest,*ok;
{
        FILE  *fopen(),*fp;
        int temp,bytecount;
        int i,length,type;
        char buf[RTEBLOCKSIZE],initbuf[PATH_LEN];
        char  *c,spath[PATH_LEN],dpath[PATH_LEN];
        cannonical_tty(tty_fd,io[TTY],0,0);      /* cannonical, and map CR to NL */
        printf("RS-232 File transfer utility RTE-A --> HPUX\n");
        if (*rtesource == '\0') {
                printf("Path name of RTE-A source file? (^D to quit) ");
                fflush(stdout);                         /* Be sure this message gets out first */
                if (scanf("%s",spath) == -1) return(0);  /* test for ^D */
        }
        else strcpy(spath,rtesource);
        if (*hpuxdest == '\0') {
                printf("Path name of HPUX destination file? (^D to quit) ");
                fflush(stdout);                         /* Be sure this message gets out first */
                if (scanf("%s",dpath) == -1) return(0);  /* test for ^D */
        }
        else strcpy(dpath,hpuxdest);
        printf("Transfer from \"%s\" to \"%s\"\n",spath,dpath);
        /* we will assume the RTE-A system we are talking to is running
           a copy of CI.  We will create a "co" command to send the file
           out to the RS232 link, and save all input.  Trap the error
           message that the file does not exist.  Send a ^D first in case
           we are in copy mode.  */
        if ((type = init_ci(com_fd,spath)) < 0) return(-99);
        if (type == 0) {
                fprintf(stderr,"No such RTE-A file, \"%s\"\n",spath);
                return(1);
        }
        printf("RTE-A file type is %d\n",type);
        if ((fp = fopen(dpath,"r")) != NULL) {
                if (*ok == '\0') {
                        sprintf(buf,"\"%s\" already exists, ok to overwrite? [y] ",
                           dpath);
                        if (pick(buf,"yn",'y') == 'n') return(0);
                }
                else if (strcmp(ok,"ok") != 0) {
                        fprintf(stderr,"Must specify \"ok\" to overwrite file\n");
                        return(0);
                }
        }
        if ((fp = fopen(dpath,"w")) == NULL) {
                perror(dpath);
                return(0);
        }
        sprintf(initbuf,"co %s 1;cn $session 34b 2;cn $session 33b 100000b\r",spath);
        vwrite(com_fd,initbuf,strlen(initbuf));
        vread(com_fd,buf,RTEBLOCKSIZE);
        if(strpbrk(buf,initbuf) == NULL) return(-48);
        SUPSHIFT(spath,c);
        vread(com_fd,buf,RTEBLOCKSIZE);
        if (bufcmp(buf,"Copying ") != 0) return(-47);
        printf("\n");
        bytecount = 0;
        if (type == 4 || type == 3) {                   /* Ascii file.  Remove CR's */
                for(;;){
                        if((length = vread(com_fd,buf,RTEBLOCKSIZE)) == 0)
                                return(-55);
                        i = 0;
                        while(i < length) {
                                if (iscopy_done(com_fd,buf,i,&length) == 0)
                                        goto finished;
                                /* Place all characters but CR in file */
                                if(buf[i] != '\r') fputc(buf[i],fp);
                                i++;
                                if(++bytecount % 1000 == 0)
                                        printf("\033A\t%d Kbytes...\n",
                                                bytecount/1000);
                        }
                }
        }
        else if ((type == 1) || (type == 6)) {
                rawmode_tty(com_fd,io[COM].baudrate);        /* place in raw mode */
                nonblocking_io(com_fd,0);                  /* disable non-blocking I/O */
                for(;;) {
                        if((length = vread(com_fd,buf,RTEBLOCKSIZE)) == 0) {
                                DELAY(temp);                 /* wait for data */
                                if((length = vread(com_fd,buf,RTEBLOCKSIZE))
                                                                        == 0)
                                        return(-55);
                        }
                        i = 0;
                        while(i < length) {
                                if (iscopy_done(com_fd,buf,i,&length) == 0)
                                        goto finished;
                                fputc(buf[i++],fp);
                                if (++bytecount % 1000 == 0)
                                        printf("\033A\t%d Kbytes...\n",
                                                bytecount/1000);
                        }
                }
        }
        else {
                printf("Invalid file type\n");
                return(-7);
        }
finished:
        fflush(fp);
        fclose(fp);
        printf("File transfer complete.  \"%s\": %d bytes.\n",dpath,bytecount);
        return(0);
}

iscopy_done(filedescriptor,buffer,i,length)
int filedescriptor,i,*length;
char *buffer;
/* Test for the "[ok]\r\n" message in the incoming data stream, indicating
that the RTE-A "co" program is finished.  Return(0) if it is.  If "length"
is not long enough for test, a read for the additional characters will be
made, and appended to buffer */
{
        int diff;

        if (buffer[i] != '[') return(-1);
        if ((diff = *length - l) <= 5)
                *length += vread(filedescriptor,buffer+*length,diff);
        return(bufcmp(buffer+i,"[ok]\r\n"));
}

HPUXtoRTE(com_fd,tty_fd,hpuxsource,rtedest,ftype,ok)
int com_fd,tty_fd;          /* file descriptors of communication and term. ports */
char *hpuxsource,*rtedest,*ftype,*ok;
/* Transfer a file from a HPUX system to an RTE-A system running CI */
{
        FILE  *fopen(),*fp;
        unsigned short checksum;
        int temp,bytecount,ctrl_d;
        int i,type;
        char buf[RTEBLOCKSIZE+2],initbuf[PATH_LEN],fgetc(),toupper();
        char  *c,spath[PATH_LEN],dpath[PATH_LEN];

        cannonical_tty(tty_fd,io[TTY],0,0); /* cannonical, and map CR to NL */
        printf("RS-232 File transfer utility HPUX --> RTE-A\n");
        if (*hpuxsource == '\0') {
                printf("Path name of HPUX source file? (^D to quit) ");
                fflush(stdout);                 /* Be sure this message gets out first */
                if (scanf("%s",spath) == -1) return(0);
        }
        else strcpy(spath,hpuxsource);
        if ((fp = fopen(spath,"r")) == NULL) {          /* Verify HPUX file exists */
                perror(spath);
                return(0);
        }
        if (*rtedest == '\0') {
                printf("Path name of RTE-A destination file? (^D to quit) ");
                fflush(stdout);                 /* Be sure this message gets out first */
                if (scanf("%s",dpath) == -1) return(0);
        }
        else strcpy(dpath,rtedest);
        for(i=0;dpath[i] != '\0';i++)if (dpath[i] == ':') {
                fprintf(stderr,"Invalid character ':' in \"%s\"\n",dpath);
                return(-1);
        }
```

```
printf("Transfer from \"%s\" to \"%s\"\n",spath,dpath);
if (*ftype == '\0')
        type = pick("RTE-A file type of destination file? (3) ","1346",'3')-'0';
else {
        if (*ftype == '1') type = 1;
        else if (*ftype == '3') type = 3;
        else if (*ftype == '4') type = 4;
        else if (*ftype == '6') type = 6;
        else {
                fprintf(stderr,"Invalid file type, \"%s\"",ftype);
                exit(-11);
        }
}
if ((temp = init_ci(com_fd,dpath)) < 0) return(-99);
if (temp > 0) { /* guarantee running CI program */
        if (*ok == '\0') {      /* File exists ! */
                sprintf(buf,"\"%s\" already exists, ok to overwrite? [y] ",
                  dpath);
                if (pick(buf,"yn",'y') == 'n') return(0);
        }
        else
                if(strcmp(ok,"ok") != 0) {
                        fprintf("Specify \"ok\" to overwrite file\n");
                        return(-1);
                }
                else printf("Overwriting RTE-A file \"%s\"\n",dpath);
}
if (type == 4) {
        fprintf(stderr,"Final file type will be RTE-A type 3\n");
        type = 3;
}
printf("\n"); /* go down a line for data transfer progress display */
if (type == 3) {
        sprintf(initbuf,"co 1 %s d;cn $session 34b 2;cn $session 33b\r",dpath);
        vwrite(com_fd,initbuf,strlen(initbuf));
        vread(com_fd,buf,RTEBLOCKSIZE);
        SUPSHIFT(dpath,c);
        vread(com_fd,buf,RTEBLOCKSIZE);
        if (bufcmp(buf,"Copying 1 to ") != 0) return(-33);
        bytecount = i = ctrl_d = temp = 0;
        rawmode_tty(fd[COM],io[COM],baudrate);
        nonblocking_io(fd[COM],0);      /* disable non-blocking I/O */
        sleep(1);       /* let the RTE-A copy program catch up */
        while ((buf[i]=fgetc(fp)) != EOF) {
                if(buf[i] == '\004') {
                        if(++ctrl_d == 1)
                             printf("Warning: ^D byte(s) removed\n");
                }
                else if(buf[i] == '\n') {
                        buf[i++] = '\r';
                          /*    DELAY(j);       */
                        vwrite(com_fd,buf,i);
                        buf[i++] = '\n';
                        buf[i] = '\0';
                        if(get_rte_resp(com_fd,buf)!=0)return(-21);
                        i = 0;
                }
                else {
                        if(i++ > RTEBLOCKSIZE-2) {
                                printf("File buffer overflow\n");
                                return(-4);
                        }
                        if(++bytecount % 1000 == 0)
                                printf(" A\t%d Kbytes...\n",
                                        bytecount/1000);
                }
        }
        buf[0] = '\004';                /* a EOT tells RTE we are finished */
        vwrite(com_fd,buf,1);
        if(get_rte_resp(com_fd,"\004[ok]\r\n") != 0)return(-22);
        if (temp != 0) printf("Transferred %d bytes, deleted %d ^D bytes\n",
          bytecount,ctrl_d);
        else printf("Transferred %d bytes\n",bytecount);
```

```
            }
            else if (type == 1 || type == 6) {

/*   to transfer a type 1 or a type 6 file, a program "/PROGRAMS/HPUX1.RUN" is
     required on the HP1000 system.  Below is an example source for this file:

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

ftn7x,q,d
$files 0,0
$cds off
      program HPUX1(4,25),RMTERM/840 type 1 file transfer program<861209.1033>
*
* This program allows a type 1 file to be transferred between a HP9000
*  model 840 (running HP-UX) and an HP-1000 A-Series (running RTE-A).  It
*  is used in place of CI's CO command, to handle binary data.
*
* It is invoked using the string: "RU,HPUX1.RUN,RTE_A_FILE,SIZE,TYPE"
*  Where RTE_A_FILE is the destination file name
*        SIZE is the destination file size (defaults to 10 blocks)
*        TYPE is the destination file type (defaults to type 1)
*
      implicit none
      integer wlen,FmpWrite,areg,breg,i,prams(5),tlog,prambuf(40),val
      integer type,FmpOpen,dcb(144),ichecksum(2),prompt,error,buf(129)
      integer*4 dchecksum
      character*63 filedesc,cpram,name
      equivalence (ichecksum,dchecksum),(cpram,prambuf)

      data prompt/5137B/            ! make prompt character a "LF_"

      call rmpar(prams)
      if (prams(1) .eq. 1) then
        write(1,'("Usage: HPUX1 FILENAME [size] [type]")')
        write(1,'("  Where LU 1 is the input LU and FILENAME is out")')
        write(1,'("  size is number of blocks [10]")')
        write(1,'("  type is file type [1]")')
        stop
      endif
      if (prams(2) .le. 0)prams(2) = 10   ! default = 10 blocks
      if (prams(3) .le. 0)prams(3) = 1    ! default is type 1 file
      call getst(prambuf,-80,tlog)
*
* create the RTE-A file name
*
      call SplitCommand(cpram,name,cpram,',')
      call FmpBuildName(filedesc,name,' ',0,' ',prams(3),prams(2),0,' ')
*
* Try to open the RTE-A file for writing
*
      call FmpPurge(filedesc)        ! be sure file is gone, for type change
      type = FmpOpen(dcb,error,filedesc,'WC',1)
      if (error .lt. 0) then
        call FmpReportError(error,filedesc)
        stop
      endif
*
* Transfer the data
*
      do while (1 .eq. 1)           ! loop forever
        call exec(1,50101B,buf,-258,prompt,-2)
        call abreg(areg,breg)
        if ((iand(areg,377b) .ne. 0) .or. (breg .ne. 258)) then
          write(1,'("ERR: areg: ",o6,"B, breg: ",o6,"B")')areg,breg
          stop
        endif
        dchecksum = 0
        do i=1,128
          val = iand(buf(i),77777B)
          if (buf(i) .lt.0) dchecksum = dchecksum + 100000b
          dchecksum = dchecksum + val
        end do
        if ((buf(129) .eq. 177777B) .and. (ichecksum(2) .eq. 0)) then
        call FmpClose(dcb,error)
        if (error .lt. 0) call FmpReportError(error,filedesc)
        call exec(2,2001B,3012B,-2)  !send an "ACK,LF" to show done
        stop
       else if (ichecksum(2) .ne. buf(129)) then
        write(1,'("Checksum error: ",i6,"vs",i6)')
     +    buf(129),ichecksum(2)
        stop
       endif
       wlen = FmpWrite(dcb,error,buf,256)
       if (error .lt. 0) then
        call FmpReportError(error,filedesc)
        stop
       endif
       if (wlen .ne. 256) then
        write(1,'("FmpWrite ERROR: WLEN:",i4)')wlen
        stop
       endif
      end do
      end
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%     / *

                /* find how many blocks we need to create */
                bytecount = 0;
                while (fgetc(fp) != EOF) bytecount++;
                if ((fclose(fp) == EOF) || (fp = fopen(spath,"r")) == NULL) {
                        perror(spath);
                        return(-8);
                }       /* close...and re-open file */
                sprintf(initbuf,"HPUX1 %s %d %d;cn $session 34b 2;cn $session 33b\r",
                   dpath,(bytecount+RTEBLOCKSIZE-1) / RTEBLOCKSIZE,type);
                vwrite(com_fd,initbuf,strlen(initbuf));
                vread(com_fd,buf,RTEBLOCKSIZE);
                bytecount = 0;
                rawmode_tty(fd[COM],io[COM],baudrate);
                nonblocking_io(fd[COM],0);              /* disable non-blocking I/O */
                for (;;) {
                        if(get_rte_resp(com_fd,"\n") != 0)return(-3);
                        i = 0;
                        if(temp == EOF) break; /* Send end of file record */
                        while ((temp=fgetc(fp)) != EOF) {
                                buf[i++] = temp;
                                if (i == RTEBLOCKSIZE) break;
                        }
                        if (temp == EOF) {
                                if(i == 0) break;       /* Send end of file record */
                                printf("Added %d pad bytes\n",
                                        RTEBLOCKSIZE-i);
                                while(i<RTEBLOCKSIZE)buf[i++]=0;
                        }
                        for(checksum=i=0;i<RTEBLOCKSIZE;i+=2) {
                                checksum += (buf[i]&0377)*0400;
                                checksum += buf[i+1]&0377;
                                if ((bytecount += 2) % 1000 == 0)
                                        printf(" A\t%d Kbytes...\n",
                                                bytecount/1000);
                        }
                        buf[RTEBLOCKSIZE] = checksum/256;
                        buf[RTEBLOCKSIZE+1] = checksum & 255;
                        vwrite(com_fd,buf,RTEBLOCKSIZE+2);
                }
                for(i=0;i<RTEBLOCKSIZE;buf[i++]=0);
                buf[i++]=0377;
                buf[i++]=0377;          /* make invalid: End of File */
                vwrite(com_fd,buf,RTEBLOCKSIZE+2);
                /* Wait for "ACK LF" from HPUX1 program */
                if(get_rte_resp(com_fd,"\006\n") != 0)return(-3);
                printf("Transferred %d bytes (%d RTE-A blocks)\n",
                   bytecount,bytecount/RTEBLOCKSIZE);
        }
        else {
                printf("Invalid type, %d\n",type);
                sprintf(initbuf,"cn $session 34b 2;cn $session 33b\r");
```

```
                        vwrite(com_fd,initbuf,strlen(initbuf));
                        vread(com_fd,buf,RTEBLOCKSIZE);         * remove the echo */
                        return(-30);
                }
                fclose(fp);
                printf("Successful file transfer HPUX --> RTE\n");
                return(0);
}


get_rte_resp(filedescriptor,expected)
int filedescriptor;
char *expected;
/* Verify that RTE-A responded as predicted, else output message and
     display RTE-A message up to a LF.  */
{
                int len,length,i;
                char buf[RTEBLOCKSIZE];


                len = strlen(expected);
                if (len > RTEBLOCKSIZE) restore_ttys_exit("Request length error");
                /*      printf("get_rte_resp(filedescriptor,%s), len = %d\n",expected,len);*/
                length = vread(filedescriptor,buf,len);
                while(length < len)
                        length += vread(filedescriptor,buf+length,len-length);
                i = 0;
                while(*expected != '\0')
                        if ((buf[i] != *expected++) || (i++ == length)) {
                                buf[length+1] = '\0';           /* make it a string */
                                printf("ERROR: RTE-A message: ");
                                while(buf[length] != '\n') {
                                        for(i=0;i<length;i++)if(buf[i] == '\n') {
                                                buf[i+1] = '\0';        /* shorten */
                                                printf("%s",buf);
                                                return(-1);
                                        }
                                        printf("%s",buf);
                                        length = vread(filedescriptor,buf,79);
                                        buf[length+1] = '\0';           /* make it a string */
                                }
                                return(-1);
                        }
                return(0);
}


init_ci(filedescriptor,rtefilename)
int filedescriptor;
char *rtefilename;
/* Initialize and verify CI is running.  Send a ^D first in case we are
     currently performina a "co" command.  If file exists, returns integer file type.
     Returns a 0 if does not exist, and returns -1 if improper CI communication.  */
{
                int length,i,retry;
                long available;
                char resp[RTEBLOCKSIZE],buf[RTEBLOCKSIZE];


                /* set up the communication line */
                cannonical_tty(filedescriptor,io[TTY],baudrate,1); /* no echo */
                /* guarantee have CI.  Send a ^D to terminate any "co" command */
                vioctl(filedescriptor,TCFLSH,0);                /* remove any input */
                vwrite(filedescriptor,"\004",1);
                DELAY(i);   /* allow the ^D to satisfy CI or the CO command */
                vwrite(filedescriptor,"\r",1);
                vioctl(filedescriptor,FIONREAD,&available);
                if (available == 0) DELAY(i);                   /* give it some more time */
                vioctl(filedescriptor,FIONREAD,&available);
                if (available == 0) {
                        vwrite(filedescriptor,"\06",1);                 /* send an ACK */
                        DELAY(i);
                        vwrite(filedescriptor,"\06",1);                 /* send an ACK */
                        vioctl(filedescriptor,FIONREAD,&available);
                        if (available == 0) return(-3);                 /* no data is available */
```

```
        }
        length = vread(filedescriptor,buf,RTEBLOCKSIZE);
        while ((bufcmp(resp+length-3,"\004\r\n") != 0)&&
            (bufcmp(resp+length-4,"\04\021\r\n") != 0)&&
            (bufcmp(resp+length-5,  "\06\04\021\r\n") != 0)){
                if (retry-- == 0) return(-2);
                DELAY(i);   /* allow the line to settle */
                vioctl(filedescriptor,TCFLSH,0);            /* remove any input */
                vwrite(filedescriptor,"\006",1);
                DELAY(i);   /* allow the ACK to satisfy any ENQ-ACK */
                vwrite(filedescriptor,"\004",1);
                DELAY(i);   /* allow the ^D to cause a new read */
                vwrite(filedescriptor,"\r",1);
                vioctl(filedescriptor,FIONREAD,&available);
                if (available == 0) DELAY(i);               /* give it some more time */
                vioctl(filedescriptor,FIONREAD,&available);
                if (available == 0) return(-3);             /* no data is available */
                length = vread(filedescriptor,resp,RTEBLOCKSIZE); /* read CRLF echo */
        }
        sprintf(buf, "cn $session 34b;cn $session 33b 100000b;dl %s f\r",
           rtefilename);
        vwrite(filedescriptor,buf,strlen(buf));
        vread(filedescriptor,resp,RTEBLOCKSIZE);
        if(strpbrk(resp,buf) == NULL) goto invalid;
        vread(filedescriptor,resp,RTEBLOCKSIZE);
        if (bufcmp(resp,"directory ") == 0) {
                vread(filedescriptor,resp,RTEBLOCKSIZE);
                if(strpbrk(resp,"name") == NULL) goto invalid;
                if(strpbrk(resp,"type") == NULL) goto invalid;
                if(get_rte_resp(filedescriptor,"  \r\n") != 0)return(-1);
                length = vread(filedescriptor,resp,RTEBLOCKSIZE);
                if(get_rte_resp(filedescriptor,"  \r\n") != 0)return(-1);
                if (length <= 2) return(-1);
                i = resp[length-3] - '0';    /* find file type */
                if (i <= 0 || i >= 7) goto invalid;         /* valid file types */
                return(i);
        }
        else if (bufcmp(resp,"No ") == 0) return(0);        /* file doesn't exist */
        else {
invalid:
                fprintf(stderr,"Invalid RTE response: %s\n",resp);
                return(-1);
        }
}


datalog(com_fd,option,ackenq,ok)
int com_fd;
char *option,*ackenq,*ok;
/* If first two characters of option are '-l': Go into logging mode. Log all
incoming data from the "com_fd" port to the file described in "option" as
-lLOGFILE. This data will now become available to any outside process. Note
that if two ports log to the same file, the writes will be interleaved. If
"ackenq" is "-a", then ACK-ENQ protocol will be used to satisfy ENQ-ACK
handshaking from the HP1000 when logged, and ENQ's will not be logged.


If the first two characters of option are '-q': Quit the logging mode. Close
the file described in "option" by -qLOGFILE. Issue any appropriate messages.
Note that in the '-q' case, the ports are not affected, so error exits are
not through "restore_ttys_exit" routine.


NOTE: it is the */
{
        char buffer[RTEBLOCKSIZE];
        int char_count,pid,ack,i,j;


        if (option[1] == 'q') {
                /* Quit logging */
                pid = atoi(option+2);
                if (kill(pid,0) == -1) {
                        perror(option[2]);          /* display invalid pid number */
                        exit(-1);
                }
                if (kill(pid,SIGUSR1) == -1) {
                        perror(option[2]);              /* display invalid pid number */
                        exit(-1);
                }
                return(0);
        }
        /* must be a log request */
        strcpy(logfilename,option+2);           /* copy the logging name */
        rawmode_tty(com_fd,io[COM],baudrate);           /* set up for raw data input */
        nonblocking_io(com_fd,0); /* disable non-blocking I/O */
        if (strcmp(ackenq,"ok") == 0) {         /* no ackenq */
                if (strcmp(ok,"-a") == 0)  /* its backwards */
                        ackenq = "-a";
                else ackenq = "";
                ok = "ok";                      /* patch it up */
        }
        if (strcmp(ok,"ok") == 0) {
                if ((logfiledescriptor =
                     open(logfilename,O_CREAT|O_WRONLY|O_APPEND)) == -1) {
                        perror(logfilename);
                        return(-1);
                }
        }
        else if ((logfiledescriptor =
                 open(logfilename,O_EXCL|O_CREAT|O_WRONLY|O_APPEND)) == -1) {
                perror(logfilename);
                return(-1);
        }
        if(chmod(logfilename,0666) != 0) {      /* set for Read/Write all */
                perror(logfilename);
                return(-1);
        }
        logPID = getpid();
        printf("PID: %d  To quit logging to \"%s\", use \"%s -q%d\"\n",
          logPID,logfilename,prognam,logPID);
        sigvector (SIGUSR1,&sigusr1_vec,0);
        if (*ackenq == '\0') ack = 0;
        else if (strcmp(ackenq,"-a") == 0) {
                printf("ACK-ENQ handshake mode\n");
                ack = 1;
        }
        else {
                fprintf(stderr,"Invalid option \"%s\".  Use \"-a\"\n",ackenq);
                return(-1);
        }
        for(;;) {
                char_count = vread(com_fd,buffer,RTEBLOCKSIZE);
                if (ack == 1 && buffer[char_count-1] == '\005') { /* ENQ-ACK */
                        vwrite(com_fd,"\006",1);  /* send an ACK */
                        for(i=0;i<char_count;i++)
                                if (buffer[i] == '\005') {
                                        char_count--;  /* ignore the ENQ */
                                        for(j=i;j<char_count;j++)
                                                buffer[j]=buffer[j+1];
                                }
                }
                vwrite(logfiledescriptor,buffer,char_count);
                logcount += char_count;
        }
}


sigusr1_handler()
{
        if(logPID == 0) restore_ttys_exit("NO PID ASSIGNED");
        if (close(logfiledescriptor) == -1) {
                perror(logfilename);
                restore_ttys_exit("SIGUSR1 handler");
        }
        printf("Created \"%s\": %d bytes\n",logfilename,logcount);
        restore_ttys_exit("");
}
```

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Terminal Selection and Interfacing

For HP 1000 A-Series Computer Systems

Introduction

This peripherals section contains information on the selection and interfacing of system consoles, additional display terminals, and industrial terminals for HP 1000 A-Series Computer Systems.

System Console Selection

A display terminal must be provided for operator communication with HP 1000 A-Series Computer Systems:

1. in any HP 1000 A-Series Computer System based on a 219xC/D, or 248xA SPU;
2. in any HP 1000 A-Series System based on a box or board computer that is not connected in a DS/1000-IV Distributed Systems network.

Any of the 239xA display terminals listed in this section can be used as the system console. However, you should specify a minimum-capability terminal for the system console, because extra capability, such as graphics, usually cannot be put to good use on a system console. The other main consideration in selecting a system console is to specify one that uses the same type of cable as most of the other terminals in the system to facilitate connection of another terminal to the system console interface if the system console fails. An industrial terminal, such as the HP 3081A, cannot be used as a system console.

Display Terminal Selection

All display terminals for HP 1000 Computer Systems have an 80 character by 24 line screen. All of the display terminals support character and block modes and display enhancements, such as underline, inverse video, and blink.

The data sheets in this section describe display features, keyboard features, data communications specifications, power requirements, physical characteristics, and the environmental specifications. Table 7-1 lists the currently available terminals that are supported on HP 1000 A-Series Computer Systems.

Table 7-1. Display Terminals that are Supported in HP 1000 A-Series Computer Systems

Terminal	Name/Description
2392A	Display Terminal
2393A	Graphics Terminal
2397A	Color Graphics Terminal
72425A	Vectra Model 25 PC
72445A	Vectra Model 45 PC

Using Vectra PC as a Terminal

To use the Vectra PC as a terminal requires:

1. HP 68333F HP AdvanceLink software for emulation of 239xA terminal.
2. HP 45951A Vectra Disc Operating System.
3. HP 24540A Serial/Parallel Interface card or HP 24541A Dual Serial RS-232/422 Interface card.
4. HP 40242Y cable from item 3, above, to A400 On-Board I/O Multiplexer Port or HP 24542M cable from item 3 to 12040C/D Multiplexer Port.
5. Appropriate adapter-monitor combination, selected from those listed below.

Vectra PC Product Number	Monitor	Required Adapter
72425A 72445A	35431A Monochrome Monitor	45981A Multimode Video Adapter
	35741A Color Monitor	45981A Multimode Video Adapter and 45984A Color Adapter
	35743A Enhanced Graphics Display	45983A Enhanced Graphics Adapter

Character Set Availability

The character sets are built into the firmware of the terminal. The ordering option shown in Table 7-2 indicates appropriate keyboard.

Table 7-2. Character Sets Available for Display Terminals

	2392A	2394A	2397A	72425A 72445A
NATIONAL CHARACTER SETS				
U.S. English	Std.	Std.	Std.	AB
Swedish	-101	-101	-101	AS
Norwegian	-102	-102	-102	AN
French	-103	-103	-103	AF
German	-104	-104	-104	AD
U.K. English	-105	-105	-105	AU
European Spanish	-106	-106	-106	AE
Canadian French	-107	-107	-107	n/a
Canadian English	-108	-108	-108	n/a
Italian	-109	-109	-109	AZ
Dutch	-110	-110	-110	AH
Finnish	-111	-111	-111	AX
Danish	-112	-112	-112	AY
Swiss German	-113	-113	-113	AP
Swiss French	-114	-114	-114	AQ
Latin Spanish	-115	-115	-115	AM
Flemish	-116	-116	-116	AW
OTHER CHARACTER SETS				
Math	n/a	Std.	Std	n/a
Large Characters	n/a	Std	Std.	n/a
Line Drawing	Std.	Std	Std.	Std.

Display Terminal Interfacing

A Choice of Interfaces

Display terminals can be connected to HP 1000 Computer Systems via:

1. Point-to-point, single-terminal interface (usable for system console).
2. Four-channel On-Board Interface on the A400 CPU card or Eight-channel multiplexer interface.
3. X.25 interface for connection to remote terminals via modem and packet-switching network (not usable for system console).

Each of these interfacing choices is discussed in the following paragraphs.

Single-Terminal, Point-to-Point Interface

The HP 12005B is a single-terminal, point-to-point interface that supports data rates up to 1920 characters per second. Only 2392A, 2393A, and 2397A, Terminals and operator interface units have been tested via the 12005B interface. Connect options differ for direct and modem connections, as follows:

- Direct connect via 12005B option 002 cable, 5 meters (16.4 ft.), HP Part Number 5061-6634.
- Connect to modem using 12005B option 003 cable, 5 meters (16.4 ft.), HP Part Number 5061-5798.

Multiplexer Interfaces

The 12040C/D multiplexer interface can be used to connect up to eight terminals to the system via a single I/O channel. The A400 on-board I/O interface (12100A) can be used for connection to the system console and three additional terminals. In addition to making more efficient use of the system's available I/O channel capacity, multiplexers provide interfacing at a lower cost per channel than point-to-point interfacing whenever more than two terminals are to be connected. Data rates to 1920 characters per second are supported, but all terminals connected to a 12040C multiplexer must operate at the same rate.

The HP 219xC/D and 248xA System Processor Units have an option 008 that deletes the 12005B interface to permit its replacement with the 12040C/D Multiplexer and the appropriate cable. See Figures 7-1 and 7-2.

For modem connection to remote terminals, the 12040C/D multiplexer should be used with the 37214A Systems Modem, especially if program control of modem is desired. See Figure 7-3.

The 39301A Fiber Optic Multiplexer can extend transmission distance between the SPU and terminals to 1.25 km (4100 feet). The use of an optical circuit instead of an electrical circuit overcomes the effects of severe electrical noise and permits connection between buildings without concern for lightening hazards. The 39301A Fiber Optic Multiplexer can support up to 16 terminals (the capacity of two 12040C/D multiplexers.) See Figure 7-4, next page, and the 39301A data sheet on page 7-49.

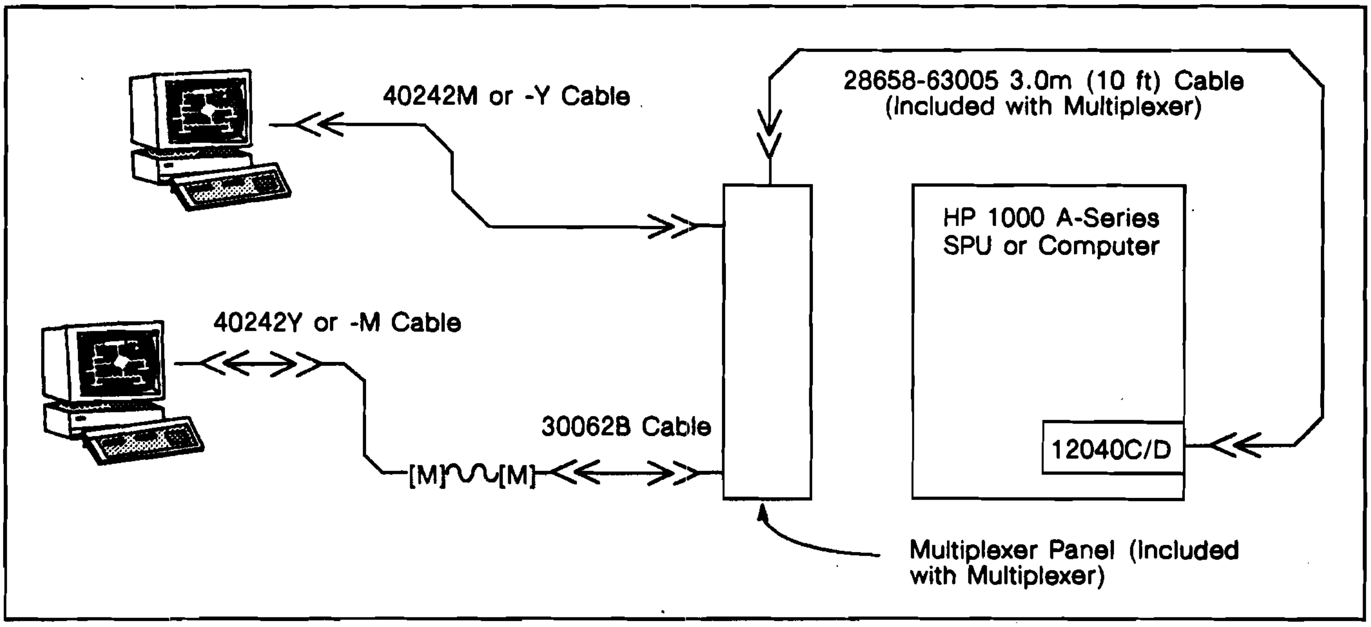

40242M or -Y Cable
40242Y or -M Cable
30062B Cable
[M]∿∿[M]
28658-63005 3.0m (10 ft) Cable (Included with Multiplexer)
HP 1000 A-Series SPU or Computer
12040C/D
Multiplexer Panel (Included with Multiplexer)

Figure 7-1. Interfacing Terminals to HP 1000 A-Series Computer Systems via 12040B/D/C Multiplexer

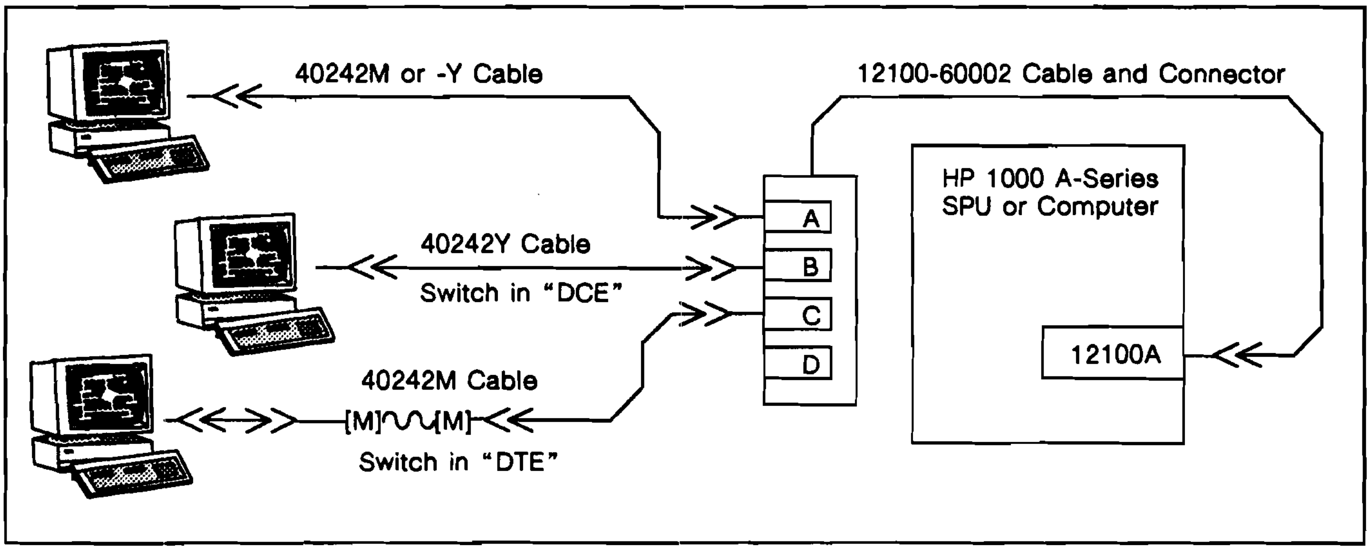
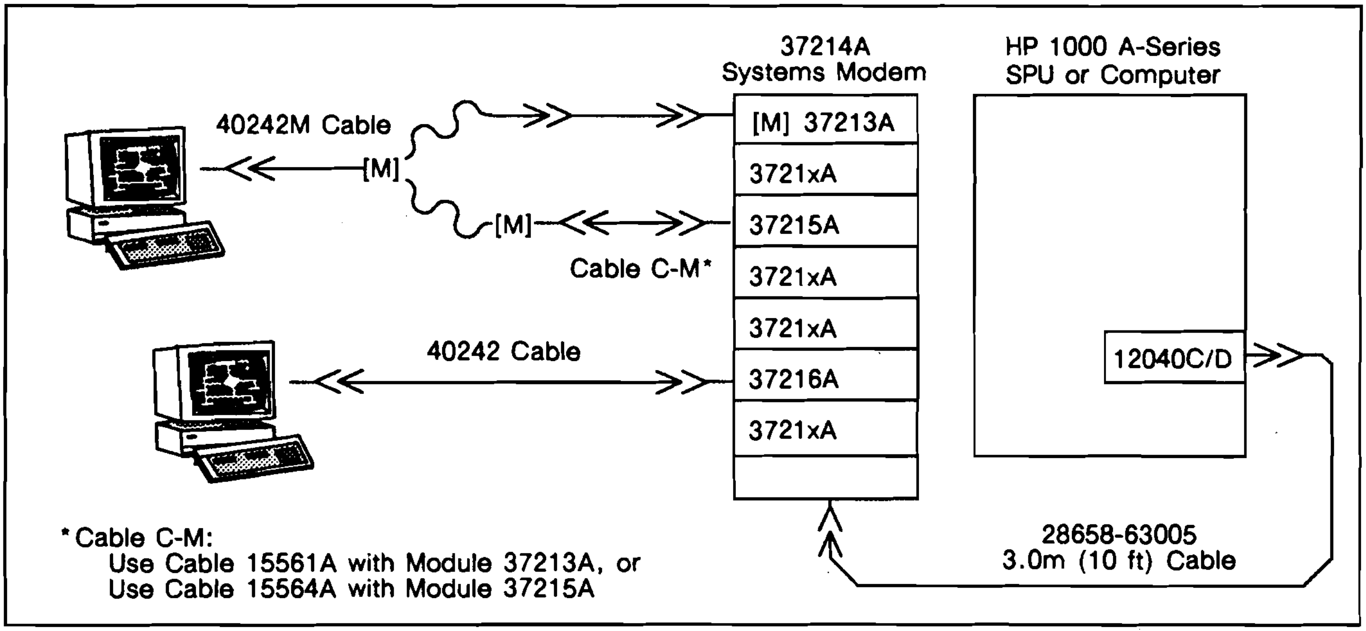
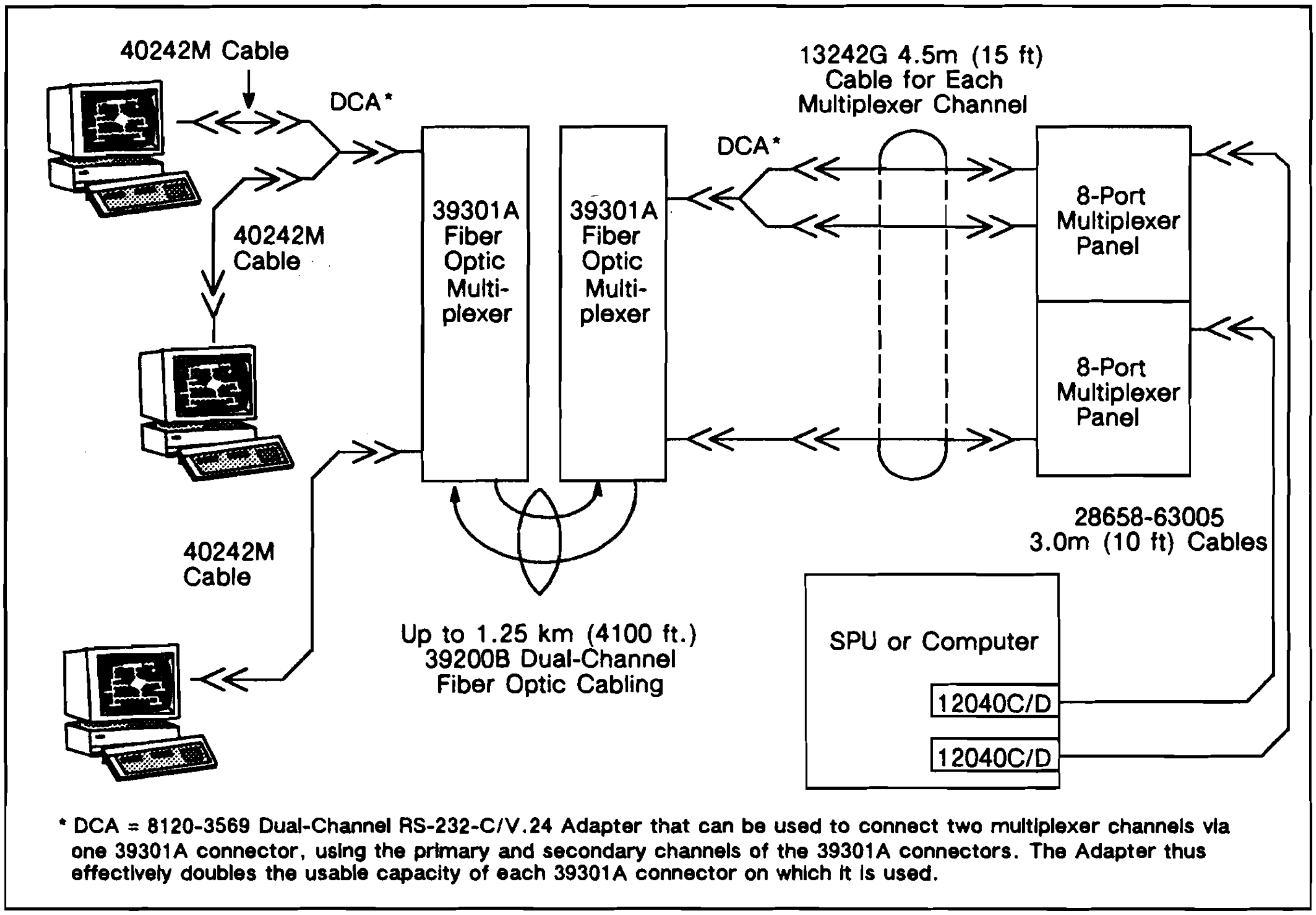

40242M or -Y Cable
12100-60002 Cable and Connector
40242Y Cable
Switch in "DCE"
40242M Cable
[M]∿∿[M]
Switch in "DTE"
A
B
C
D
HP 1000 A-Series SPU or Computer
12100A

Figure 7-2. Interfacing Terminals to HP 1000 A400 Computer System Four-Channel On-Board I/O Multiplexer


37214A
Systems Modem
HP 1000 A-Series
SPU or Computer
40242M Cable
[M]
[M] 37213A
3721xA
[M]
37215A
Cable C-M*
3721xA
3721xA
40242 Cable
37216A
3721xA
12040C/D
28658-63005
3.0m (10 ft) Cable

*Cable C-M:
Use Cable 15561A with Module 37213A, or
Use Cable 15564A with Module 37215A

Figure 7-3. Multiplexer Interfacing of Terminals to HP 1000 A-Series Computer Systems via 37214A Systems Modem


40242M Cable
DCA*
13242G 4.5m (15 ft)
Cable for Each
Multiplexer Channel
DCA*
40242M
Cable
39301A
Fiber
Optic
Multi-
plexer
39301A
Fiber
Optic
Multi-
plexer
8-Port
Multiplexer
Panel
8-Port
Multiplexer
Panel
28658-63005
3.0m (10 ft) Cables
40242M
Cable
Up to 1.25 km (4100 ft.)
39200B Dual-Channel
Fiber Optic Cabling
SPU or Computer
12040C/D
12040C/D

* DCA = 8120-3569 Dual-Channel RS-232-C/V.24 Adapter that can be used to connect two multiplexer channels via one 39301A connector, using the primary and secondary channels of the 39301A connectors. The Adapter thus effectively doubles the usable capacity of each 39301A connector on which it is used.

Figure 7-4. Multiplexer Interfacing of Terminals via 39301A Fiber Optic Multiplexer

X.25 Interface

An X.25 interface for the A-Series, HP 12075A, supports connection to remote terminals via modem, packet-switching network, and an HP 2334A Multimux, which functions as a packet assembler/disassembler for up to 16 terminals. Terminals connect to the remote HP 2334A with the same cable that would be used to connect to the multiplexer panel. For other information on configuration of the X.25 link to the HP 2334A, see the HP 2334A Plus Multimux data sheet on page 7-55.

Packet-switching connection to terminals offers the advantage of transmission charges that are proportional to actual message traffic, not connect time. The disadvantages of packet-switching connection are:

1. Only character mode operation is supported, which may preclude use with some software packages.
2. Additional software is required (HP 91751A).

Modems for Linking to Remote Terminals

Communication with terminals over considerable distances usually requires a modem-telephone line link. This link consists of two compatible modems, one interfaced to the computer, the other connected to the terminal. The modems convert the bit streams exchanged between the computer and terminal to a modulated audio signal, which is transmitted over a dial-up telephone connection or a dedicated line leased from the telephone company. The different modems that can be used for connecting remote terminals to HP 1000 A-Series Computer Systems are listed in Table 7-3.

Auxiliary Printers for A-Series Terminals

An extensive choice of auxiliary printers can be connected to most HP 1000 A-Series compatible display terminals to provide local hardcopy output, as shown in Table 7-4.

Table 7-3. Modems for HP 1000 A-Series Terminals

A-SERIES INTERFACE	DATA RATE (bits per sec)	MODEMS AT INTERFACE	MODEMS AT TERMINAL
Point-to-point 12005B+003	1200	HP 92205A* or Bell Type 212 or Vadic VA3400	HP 92205A* or Bell Type 212 or Vadic VA3400
	2400	HP 92205B	HP 92205B
Four-Channel OBIO Multiplexer in 12100A A400 SBC	1200	HP 92205A* or Bell Type 212 or Vadic VA3400	HP 92205A* or Bell Type 212 or Vadic VA3400
Eight-Channel 12040C/D Multiplexer	1200	HP 37214A plus one 37213A modem card per channel or Vadic VA3400 per channel	HP 92205A* or Bell Type 212 or Vadic VA3400
X.25 12075A	1200	Bell Type 212A	Bell Type 212A
	2400	Bell Type 201C	Bell Type 201C
	4800	Bell Type 208C	Bell Type 208C
	9600	Bell Type 209A	Bell Type 209A
	19200	Supplied by Public Packet Switched Network	Supplied by Public Packet Switched Network

* Use HP 92205C in Canada.

Table 7-4. Auxiliary Printers for HP 1000 A-Series Terminals

PRINTER PRODUCT NUMBER	CABLES USED FOR CONNECTION BY TERMINAL AND INTERFACE			
	239xA Opt 092 (RS-232-C Interface)	**239xA Opt 093 (Parallel Centronics Interface)**	**Vectra (24540A Serial/Parallel Interface)**	**Vectra (24541A Dual Serial Interface)**
2225C	Not supported	40242D	24542D	Not supported
2225D	40242G	Not supported	24542G	24542G
2227A/2227D	40242G	40242D	24542G or 24542D	24542G
2671A*/G*+040 or 2673A*+040	40242G	Not supported	Not supported	Not supported
2671A*/G*+042 2673A*+042	Not supported	40242D	Not supported	Not supported
2932A/2934A	40242G	Not supported	24542G	24542G
2932A+042 2934A+042	Not supported	40242D	24542D	Not supported

* Discontinued product, listed here for reference only.

Bar Code Reader Input

Manual keystroke entry of data is time consuming and subject to typographical errors. Fortunately, the time and error potential in the entry of routine data can be minimized by using bar coded labels, tags, badges, or cards. Information as diverse as product part or stock numbers, patient identification numbers for hospital records, personal identification numbers on employee badges, and property identification numbers on machines, instruments, or office equipment can be imprinted in an appropriate bar code. Thereafter, the single sweep of a wand or slow reader can scan and enter the encoded data in about one-third of the time required for keystroked entry by a skilled operator, and with monotonous accuracy.

Recognizing the time savings and accuracy gains accruing to applications that can use bar codes for data entry, Hewlett-Packard offers printers that can print bar coded labels as well as bar code readers to provide a complete hardware solution to information transfer via bar code media.

Bar code printing is optional on the HP 2563A, 2565A, and 2566A Line Printers and standard on the 2934A Printer. Bar code readers can be interfaced to HP 1000 Computer Systems in two ways. See Table 7-5. The HP 9291xA Bar Code Readers emulate the terminal keyboard in that the bar coded characters it reads are sent to the display and the computer as if they had been keystroked. HP 39800A and 39801A Bar Code Readers support eavesdrop connection between a terminal and an HP 1000 Computer System, but the terminal is not necessary for successful operation of the 3980xA Bar Code Readers.

Table 7-5. Bar Code Readers Supported by A-Series Computers

TERMINAL	BAR CODE READER	BAR CODES SUPPORTED	INTERFACING METHOD
2392A	92915A	3 of 9, Interleaved 2 of 5, Codabar, and UPC/EAN/JAN	Connects between keyboard and terminal using supplied cables.
2393A, 2397A, 72425A, and 72445A	92916A	3 of 9, Interleaved 2 of 5, Codabar, and UPC/EAN/JAN	Connects to HP-HIL port on keyboard using supplied cable.
Not applicable	39800A Programmable 39801A Non-programmable	3 of 9 and Interleaved 2 of 5 standard Industrial 2 of 5 optional, Codabar optional, and UPC/EAN/JAN optional	Connect with 12040D Multiplexer and 13242Y cable or 12005B+002 Interface and supplied cable.

Industrial Terminals

For data collection in factory environments, HP offers the HP 3081A Industrial Workstation Terminal and the Vectra Industrial PC system.

The HP 3081A is a compact, rugged, low-priced terminal with 32-character display and numeric keyboard. Full alphanumeric keyboard and bar code reader are optional. The bar code reader can be equipped with six different input options, including a slot reader, which uses infrared light to read "black on black" codes on badges for security applications.

For more information, see the HP 3081A data sheet on page 7-43.

HP 2392A
Display Terminal

HEWLETT PACKARD

Features

- **Complete Alphanumerics**
  - Up to 4 Pages of Display Memory Optionally Expandable to 8 Pages
  - Smooth Vertical Scrolling
  - Display Enhancements and Line Drawing Character Set
  - Line Modify Mode
  - Block Mode
  - Format Mode and Local Editing Capabilities
- **Ergonomics**
  - Compact Design
  - Integrated Tilt and Swivel
  - Anti-Glare Green Phosphor Screen
  - Front Panel Power and Brightness Controls
  - Detachable Low-Profile Keyboard
- **Ease of Use**
  - Screen-Labeled Function Keys for Terminal Control
  - Nonvolatile User-Definable Soft Keys with 16-Character Labels
  - Nonvolatile Configuration Menus
  - 17 National Keyboard Layouts
  - 27th Screen Line Indicates Status of Terminal
  - Self-Test Capability
- **High Performance Data Communications**
  - Character, Line or HP Block Mode Transmission
  - Port 1 offers both RS232C and HP422 with data rates up to 19.2 kbps with handshaking
  - Port 2 provides either an optional RS232C Serial Interface or Centronics® -type Parallel Interface
  - Supports X.25 PAD connection
- **Optional ANSI* Compatibility**

The HP 2392A

The HP 2392A is a compact, easy-to-use terminal designed for applications ranging from data entry to program development. Maintaining Hewlett-Packard's traditional standards for reliability and support, the HP 2392A provides additional features that increase productivity and ease of use.

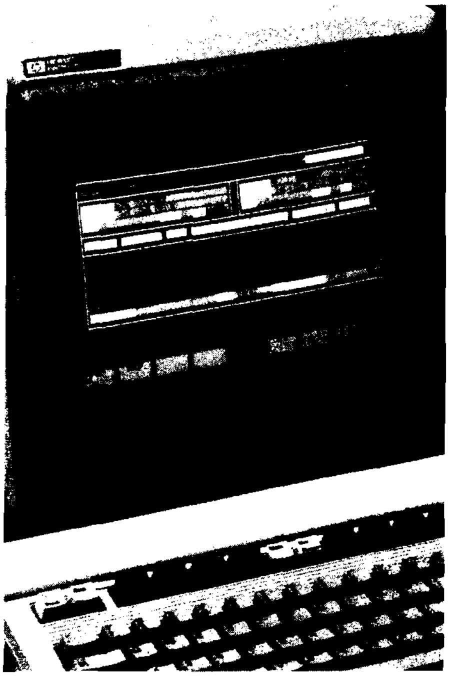
The HP 2392A occupies a minimum of desk space, while the integral tilt and swivel mechanism enables it to be positioned at an optimum viewing angle. For user convenience, power and brightness controls are located on the front of the terminal.

The HP 2392A offers the powerful capabilities typical of Hewlett-Packard alphanumeric display terminals, with further enhancements like additional memory, smooth scrolling, faster data communication rates, a variety of printer interfaces and optional ANSI* compatibility.

The HP 2392A is one of the most comprehensive terminals in its price range, providing the quality and features that people have come to expect from Hewlett-Packard products.

® Centronics is a registered trademark of Centronics Data Computer Corporation

* American National Standards Institute



Complete Alphanumerics

The 2392A has a 12-inch diagonal CRT that displays 24 lines of 80 characters on a high-resolution green phosphor screen. The characters are formed in a 9 by 14 dot character cell with half-dot shifting to create smooth, well-defined characters—like those of a typewritten page.

Up to 4 pages of text can be stored in display memory and viewed easily with the smooth scrolling capabilities. Additional memory can be ordered to give a total of up to 8 pages.

Display enhancements—underline, inverse video, blinking and half-bright— can be used in conjunction with the 64-character line drawing set to emulate existing paper forms. Security video, an additional enhancement, allows passwords and other confidential data to be input to the system without being displayed on the screen.

To save time and effort, the user can enable line modify mode while in character mode to make changes to a previously entered line without having to retype the entire line.

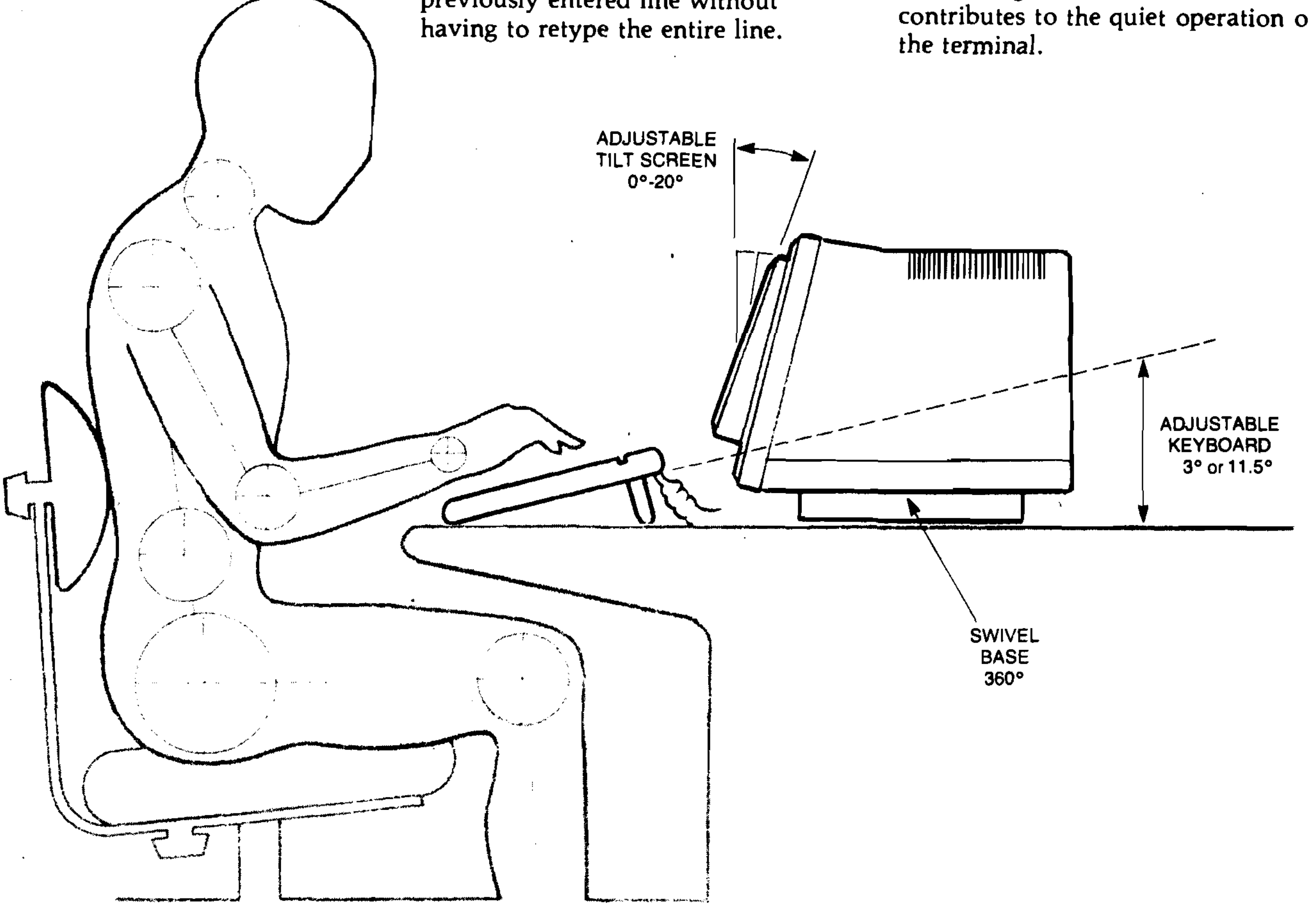
In block mode, forms, text and data can be edited with the local edit keys before the information is transmitted to the computer for processing. On HP 3000 systems the 2392A provides full compatibility with VPLUS applications.

With format mode enabled, protected and unprotected fields make filling out forms an easy task. Only the user-entered data in the unprotected fields is sent to the host.

Ergonomics

The 2392A offers a contemporary design with standard ergonomic features. These features include an integral tilt and swivel mechanism, front panel power and brightness controls, and an anti-glare display screen. In addition, the new low profile detachable keyboard can be adjusted for use in either a flat or an angled position. The sculptured keys are color-coded and conveniently clustered by function.

The 2392A is convection-cooled, eliminating the need for a fan. This contributes to the quiet operation of the terminal.


ADJUSTABLE TILT SCREEN 0°-20°
ADJUSTABLE KEYBOARD 3° or 11.5°
SWIVEL BASE 360°

Ease of Use

The 2392A has eight function keys that can be used to simplify the operation of the terminal. Each function key has a corresponding screen label at the bottom of the display. These keys can be programmed to tailor the terminal for specific applications, eliminating the need for typing repetitive or complex commands. The content of these keys is not lost when the terminal is turned off, since the settings are stored in nonvolatile memory.

Screen menus containing user-selected or default settings are provided to simplify configuring the terminal. Configuration settings can be saved in nonvolatile memory.

The 2392A provides a choice of 17 national language keyboards. For a complete list of the keyboards available, refer to the Product Specifications section.

Terminal status information appears on the 27th line of the screen display. The status line indicates, for example, when the terminal is set for Insert Character, CAPS lock or ANSI operation.

The 2392A offers extensive self-test capabilities which allow the user to check if the terminal is functioning properly.

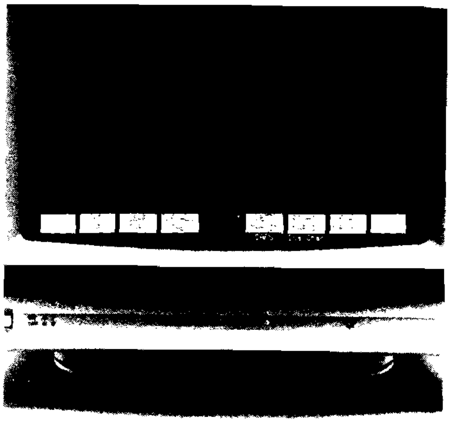
Data Communications

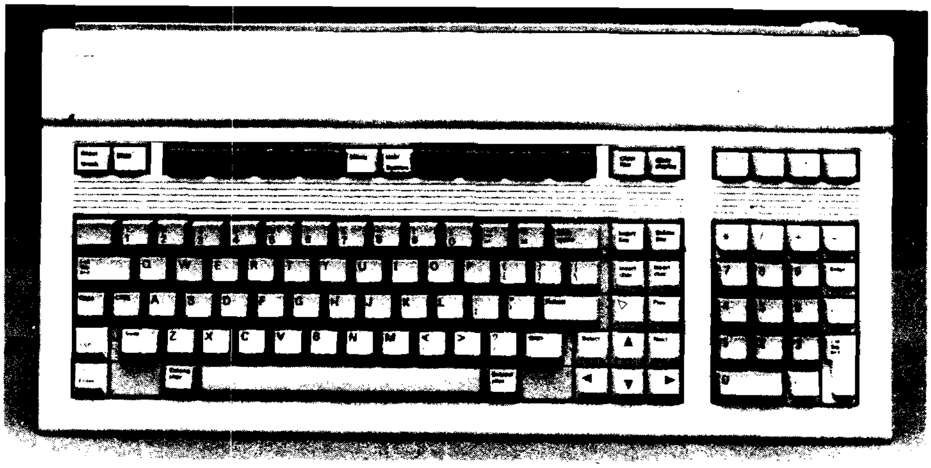
The 2392A offers block, line or character mode communications. Full duplex point-to-point asynchronous transmission is supported with flexible hardware and software handshaking to interface with a variety of computer systems and printers.

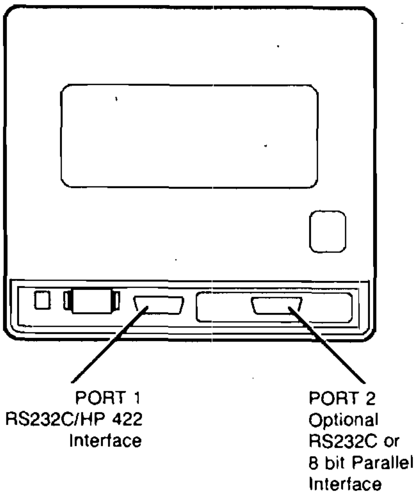
Port 1 offers both RS232C and HP422 capabilities at data transmissions rates up to 19.2 kbps with handshaking.

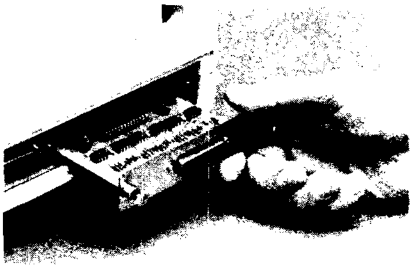
For additional flexibility, an optional port 2 offers either an RS232C serial printer interface or a Centronics-type parallel printer interface. These modules are easily installed by the user.

The 2392A also connects to an X.25 PAD (Packet Assembler/ Disassembler) network.









ANSI Compatibility

The 2392A optionally provides a subset of the ANSI X3.64 standard for those users requiring a device-independent environment. In addition, the 2392A can execute many DEC® VT100® and VT52® control sequences. The user can select this mode via the terminal's configuration menu or programmatically from the host system. While in ANSI character mode operation, the user has access to additional features like double-high, double-wide characters and answerback.

Reliability/Serviceability

The 2392A, using state-of-the-art VLSI technology to minimize component count, has been engineered to provide years of trouble-free service. For support services, Hewlett-Packard has a world-wide network of sales and service offices staffed by highly qualified customer engineers and system engineers.

® DEC, VT100 and VT52 are registered Trademarks of Digital Equipment Corporation.

HP 2392A Product Specifications

DISPLAY

CRT Type:	Etched anti-glare, with implosion protection
Phosphor:	Green P31
CRT Size:	30 cm (12 inches) diagonal
Display Area:	150 mm × 215 mm (6 inches × 8.5 inches)
Refresh Rate:	60Hz
Character Generation:	7 × 11 dot matrix in 9 × 14 dot cell with half-dot shift
Character Size:	2.4 mm × 3.5 mm (0.094 inch × 0.138 inch)
Screen Capacity:	24 lines × 80 columns (1920 characters). 25th and 26th lines for function key labels. 27th line for terminal status information.
Character Set:	ROMAN 8 comprising 128 ASCII character set and 61 national characters from the extended Roman set. National characters include United Kingdom, Danish, Dutch, Finnish, French, German, Italian, Norwegian, Spanish and Swedish. Plus the 64-character Line Drawing Set.
Cursor:	Blinking-underline.
Display Enhancements:	Inverse, underline, blinking, halfbright and security video in any combination.
Video Attributes:	Memory lock, display lock, protected fields, user selectable margins and tabs, plus jump or smooth scrolling (8 lines per second.)
Editing:	Insert character/line, delete character/line, clear line/all
Page Control:	Next/previous page
Display Memory:	Memory is allocated dynamically. Up to 4 pages standard (1.5 to 4 pages). Up to 8 pages optional (3.5 to 8 pages). Depending on the number of display enhancements and security video fields used, memory allocation can vary.

KEYBOARD

Style:	Detachable typewriter keyboard with 2 meter (6.6 ft.) fully extended coiled cable.
Layout:	107 sculptured keys. Separate numeric keypad, and independent user, editing and cursor keys. 17 national layouts are available: USASCII, Swedish, Norwegian, French, German, UK, Spanish, French-Canadian, English-Canadian, Italian, Dutch, Finnish, Danish, Swiss-German, Swiss-French, Spanish-Latin American and Flemish.
Operation:	Auto-repeat; N-key rollover
Function Keys:	8 screen-labeled user-definable function keys; screen labels up to 16 characters and function key definitions up to 80 characters in length. Can include control codes and escape sequences. Definitions are saved in nonvolatile memory.

DATA COMMUNICATIONS

Data Rates:	Port 1: 110, 134.5, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200 baud. Operation with control codes, escape sequences, or baud rates above 9600 may require handshaking or CPU-supplied delays. Optional Port 2 with the RS232C interface: 110, 134.5, 150, 300, 600, 1200, 1800, 2400, 4800, 9600 baud. Operation with control codes or escape sequences may require handshaking or CPU-supplied delays.
Handshake:	Port 1: selectable software ENQ/ACK and XON/XOFF (transmit and receive), and hardware CS (Clear to Send). Optional Port 2: selectable software XON/XOFF (transmit only), hardware CS (Clear to Send) and SRR (secondary Receiver Ready).
Parity:	Selectable in 7-bit operation: even, odd, zero, one . Always none in 8-bit operation.
Operating Modes:	Local, remote, character, line, block, page, format, and optional ANSI operation. X.25 compatible using XON/XOFF when block mode is enabled and when the terminal is connected to an external PAD.

DATA COMMUNICATIONS (Continued)

Transmission Modes:	Full duplex, asynchronous point-to-point. Compatible with Bell 103A, Bell 212A, Vadic VA3400 or equivalent full duplex modem.
Electrical Interface:	Port 1: combined RS232C/HP422 data communications. Optional Port 2: RS232C serial interface or Centronics-type parallel 8-bit interface.

POWER REQUIREMENTS

Input Voltage:	115 V (+10%, −25%) at 47-66 Hz. 230 V (+10%, −15%) at 47-66 Hz.
Power Consumption:	50 watts

PHYSICAL CHARACTERISTICS

Display Monitor Weight:	10.8 kg (23.8 pounds).
Display Monitor Dimensions:	325 mm wide x 362 mm deep x 317 mm high (12.8 inches x 14.2 inches x 12.5 inches).
Keyboard Weight:	2.2 kg (4.9 pounds).
Keyboard Height: (at center row):	34 mm (1.3 inches) flat; 43 mm (1.7 inches) on stand.
Keyboard Dimensions:	455 mm wide x 220 mm deep x 35 mm high (17.9 inches x 8.7 inches x 1.4 inches).

ENVIRONMENTAL CONDITIONS

Parameter	**Condition**	**Specification**
Altitude	Operating	0 to 4,600 meters (15,000 ft)
	Nonoperating	0 to 15,300 meters (50,000 ft)
Humidity	Operating	5 to 95% Relative Humidity at 40°C
	Nonoperating	90% Relative Humidity at 65°C
Radiation susceptibility	Both operating and nonoperating	Maximum 10V/m (tested from 30 MHz to 520 MHz)
Shock	Operating	30g, 11ms, ½ sine
Temperature (free ambient)	Operating	0°C to +55°C (+32°F to +131°F)
	Nonoperating	−40°C to +75°C (−40°F to +167°F)
Vibration	Both operating and nonoperating	Maximum peak-to-peak 0.38 mm (0.015 in.) at 5-55 Hz 3 axis for 15 minutes, with resonance dwell for 10 minutes at greatest resonance

PRODUCT REGULATIONS

Safety:

United States - UL listing under standards 478 and 114
Canada - CSA certification under standard C.22.2 154
Germany - TUV GS mark pending
Finland - FEI approval pending
International - IEC 380/435 Safety of Electrically Energized Office Machine Compliance

RFI:

United States - FCC Docket 20780 Part 15 for class A equipment
Germany - VDE 0871 level B Radio Protection Mark pending

Datacomm:

CCIT V.24 interchange, V.28 Electrical Recommendations

Australia - Authorized
Belgium - Approval pending
Germany - Approved: license number: FTZ 03013D
Nordic network - Approval pending
Sweden - Approved
UK - Approved

HP 2392A ORDERING INFORMATION

Product Number	Description
2392A	DISPLAY TERMINAL
Opt. -015	230 V operation
-049	ANSI operation
-092	Port 2: 25-pin RS232C interface
-093	Port 2: 8-bit parallel Centronics-type interface
-160	Extended memory - adds up to 4 pages of display memory

National Keyboards

-101	Swedish
-102	Norwegian
-103	French
-104	German
-105	UK
-106	Spanish
-107	Canadian-French
-108	Canadian-English
-109	Italian
-110	Dutch
-111	Finnish
-112	Danish
-113	Swiss-German
-114	Swiss-French
-115	Spanish-Latin American
-116	Flemish

Cables

-301	U.S. modem cable, same as cable accessory 40242M
-302	European modem cable, same as cable accessory 40242M
-303	RS232C cable, same as cable accessory 40242C
-304	HP direct connect type 232 cable, same as cable accessory 40242X
-305	EMP (Electro-Magnetic Pulse) protect cable, same as cable accessory 40242Y
-306	HP direct connect type 422 cable, same as cable accessory 40242P

Accessories

40210R	Port 2 25-pin RS232C interface
40210P	Port 2 8-bit parallel Centronics-type interface
40242A	RS232C/HP422 cable. Male (25-pin)/female (50-pin), 1 m (3 ft)
40242C	RS232C cable. Female (25-pin)/male (25-pin), 5 m (16 ft)
40242M	U.S./European modem cable. Male (25-pin)/male (25 pin) 5 m (16 ft)
40242P	HP direct connect type 422 cable. Male (25-pin)/male (5-pin), 5 m (16 ft)
40242X	HP direct connect type 232 cable. Male (25-pin)/male (3-pin), 5 m (16 ft)
40242Y	EMP protect cable. Male (25-pin)/male (25-pin) 5 m (16 ft)
40242Z	RS232C modem bypass cable. Male (25-pin)/female (25-pin), 5 m (16 ft)
40242D	Parallel printer cable. Amphenol male (36-pin)/male (36-pin), 1.2 m (6.6 ft)
40242G	Serial (RS232C) printer cable. Male (25-pin)/male (25-pin), 5 m (16 ft)

Note: All cables provide RFI filtering. The 2392A complies with RFI regulations only when used with these cables.

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Palo Alto, CA 94304 USA

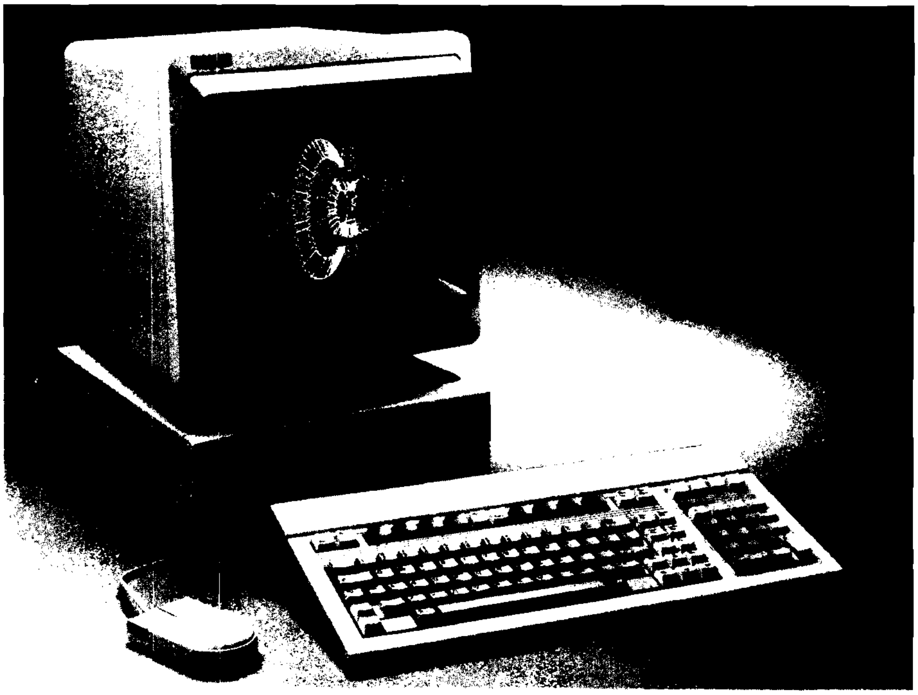
Printed in U.S.A. 7/85

HP 2393A
Graphics Terminal

HEWLETT PACKARD

Features

- **Bit Mapped Vector Graphics**
  - Selectable 512H x 390V or 640H x 400V pixels resolution
  - Primitives: Polyline, Area Fill and Text
  - Rubberband Line
  - TEXTRONIX® 4010/4014 Compatibility
- **Input Devices Supported**
  - Touchscreen
  - Graphics Tablet
  - Mouse
  - Bar Code Reader
- **Output Devices Supported**
  - Printers
  - Plotters
  - Film Recorders
  - Large Screen Projectors
  - Large Screen Monitors
- **Graphics Software Support**
  - HP Graphics/1000 II
  - HP DSG/3000, HPDRAW, HPEASYCHART, HPMAP
  - TEKTRONIX PLOT 10®
  - Graphics Software from Independent Software Vendors
- **Complete Independent Alphanumerics**
  - Up to 12 pages of Display Memory
  - Horizontal Scrolling to 160 Columns
  - Smooth Vertical Scolling
  - Display Enhancements including Double High Double Wide Characters
  - Line Drawing, Math, Italics and Bold Character Sets
  - Block Mode
  - Format Mode and Local Editing Capabilities
  - Edit Checking/Transmit-only Fields/ Modified Data Tag



HP 2393A Graphics Terminal with HP Mouse

- **Ergonomics**
  - Modular, Compact Design
  - Integrated Tilt and Swivel
  - Anti-Glare Green Phosphor Screen
  - Inverse Video Display in Alphanumeric Mode selectable
  - Front Panel Power, Brightness and Contrast Controls
  - Detachable Low-Profile Keyboard
- **Ease of Use**
  - Screen Labelled Function Keys for Terminal Control
  - 8 User-Definable Function Keys with 16-Character Labels
  - 8 Pre-defined Function Keys
  - 4 Non-volatile User-Definable Function Keys
  - Non-volatile Configuration Menus
  - 17 National Keyboard Layouts
  - 27th Line for Terminal Status
  - Self-Test Capability
  - Screen Saver
- **High Performance Data Communications**
  - Character, Line or Page Mode Transmission
  - System Port offers both RS232C and HP422 with data rates up to 19.2 kbps with handshaking
  - Peripheral Port provides a choice of an optional RS232C Serial Interface, a Centronics®-type Parallel Interface, or an HP-IB Interface
  - Supports X.25 PAD connection
- **ANSI* X3.64 Compatibility**

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Centronics® is a registered trademark of Centronics Data Computer Corporation
*American National Standards Institute.

The HP 2393A

The HP 2393A — the graphics workstation designed to offer you flexibility. Set it up the way you want it - select from an impressive array of user-friendly input devices like HP Touch, connect to the output peripherals of your choice, choose from a list of software packages and even adjust the tilt and swivel on your display.

The HP 2393A, with its range of input devices, provides the engineer or scientist with the tools to create and display graphics — in process control, industrial automation, preview design and other technical applications.

The HP 2393A gives the manager or professional the ability to graphically display business data for analysis, reports and presentations using a variety of output devices like printers, plotters, film recorders and large screen projectors.

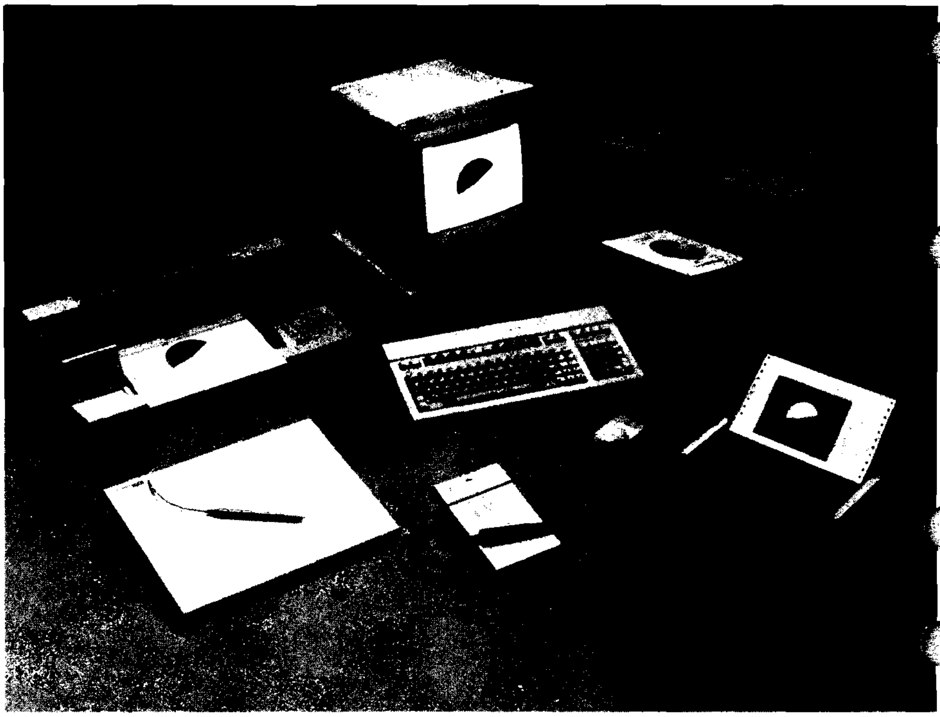
In addition, the HP 2393A offers comprehensive alphanumeric capabilities as well as optional ANSI compatibility at no cost.

The HP 2393A is one of the most flexible graphics terminals in its class, providing quality and reliability that you have come to expect of Hewlett Packard display terminals.

Graphics Features

The 2393A supports bit mapped vector graphics on a raster display with a selectable resolution of 512 pixels horizontally by 390 pixels vertically or 640 pixels horizonatally by 400 pixels vertically.

The 2393A has the intelligence to draw polyline vectors based on end points specified by the host. The user can select from 11 different line types including one that is user defined. The terminal allows the user to fill complex shapes with up to 105 sides selecting from 10 different area fill patterns including one defined by the user. These features increase drawing speed while reducing data communications and system overhead.

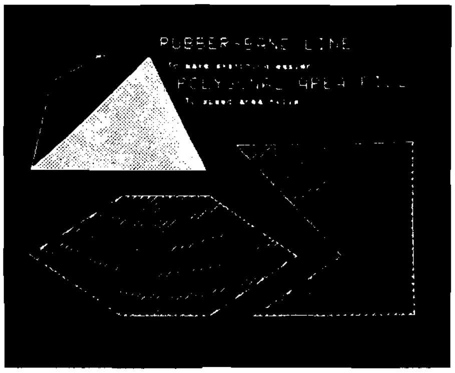


HP 2393A offers remarkable input/output flexibility

The 2393A allows the user to add vector drawn graphics text to images. Graphics text can be normal or slanted, in one of 8 sizes and 4 different orientations.

The rubberband line feature allows the user to preview a vector before it is stored in graphics memory. This interactive feature used in conjunction with a touchscreen, mouse or graphics tablet, significantly increases user productivity and minimizes system overhead.

The 2393A has a TEKTRONIX 4010/4014 compatibility mode that allows images designed for those terminals to be displayed in scaled or unscaled modes.



Local features reduce system overhead

Input Device Support

With the unique HP-HIL (Human Interface Link) interface on the 2393A, the user can connect input devices and hardcopy devices simultaneously. The 2393A allows the user to daisy chain up to three input devices to the keyboard, thus offering considerable flexibility in the input configuration and freeing the auxiliary port for hardcopy devices. Supported graphics input devices include HP Touch, Mouse, Graphics tablet and Bar Code reader. These accessories may be ordered separately.

The touchscreen can be used in alphanumeric as well as graphics applications. To facilitate data entry and speed data inquiry in alphanumeric mode, the touchscreen can be used to select softkeys, user-defined fields or to move the cursor to a desired location. In graphics mode, the touchscreen duplicates the functions of a mouse. For example, you can use your finger to draw lines.

HP Touch — A natural way to communicate with your computer

The mouse can be used in graphics operations to move, draw and pick objects. As a positioning device, it is faster than graphics cursor keys on the keyboard, and hence an aid to productivity.

The graphics tablet is ideal for digitizing and sketching drawings. It is useful in interactive graphics, graphics entry and menu selection applications.

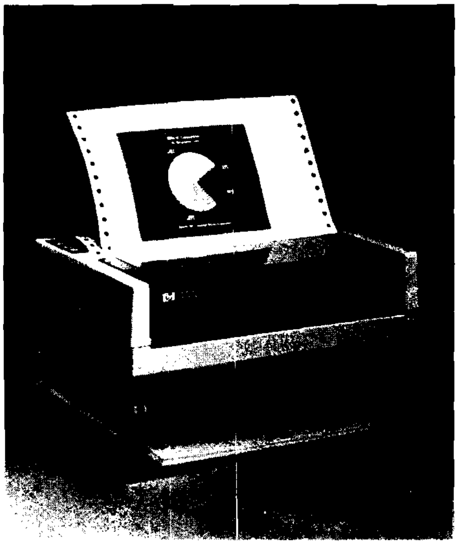
The bar code reader is well suited for rapid data entry applications, e.g. inventory tracking, point of sale terminals, etc.

Output Device Support

The 2393A offers a broad range of output options. This allows the user flexibility in connecting to a host of HP peripherals.

The user can generate engineering drawings, charts and overhead transparencies on HP plotters, print text and graphics on Thinkjet and other HP printers, and create 35mm slides on a HP film recorder.

In addition, the 2393A can be connected to commercial large screen projectors, film recorders or large monitors.

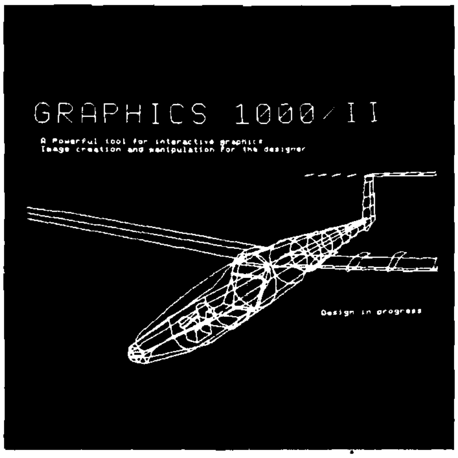


HP Thinkjet — Affordable graphics hardcopy

Graphics Software Support

The 2393A is supported by a wide variety of Hewlett-Packard software.

Graphics 1000/II and Graphics 9000 are high level graphics application development tools designed for use on HP1000 and HP9000 computer systems respectively and can provide a solution to a range of technical display graphics applications.


GRAPHICS 1000/II
A Powerful tool for interactive graphics image creation and manipulation for the designer
Design in progress

Software solutions for graphics applications

DSG/3000, HPDRAW, HPEASYCHART and HPMAP are designed specifically for business applications on HP3000 computer systems.

The TEKTRONIX 4010/4014 compatibility mode allows the 2393A to operate with TEKTRONIX Inc's PLOT 10 software.

In addition to Hewlett-Packard software, the 2393A operates with Precision Visual's™ DI-3000™and GRAFMAKER™, ISSCO's® DISSPLA® and TELL-A-GRAF® , SAS Institute's SAS/GRAPH™, and Megatek's TEMPLATE® . These packages run on HP as well as. non-HP systems.

Complete Independent Alphanumerics

The 2393A has a 12-inch diagonal CRT that displays 24 lines of 80 characters on a high-resolution green phosphor screen. The characters are formed in a 8 by 14 dot character cell with half-dot shifting to create smooth, well-defined characters.

Up to 12 pages of text can be stored in display memory and viewed easily using smooth scolling capabilities. The display memory can be configured to support up to 160 columns. This is useful in running applications written for 132 column displays. Columns beyond the 80th can be viewed via horizontal scrolling.

The 2393A has character sets that include Line Drawing, Math, Italics and Bold characters. Display enchancements - underline, inverse video, blinking, half-bright and Double High Double Wide - can be used with the character sets to emulate existing paper forms. Security video, an additional enhancement, allows passwords and other confidental data to be input to the system without being displayed on the screen.

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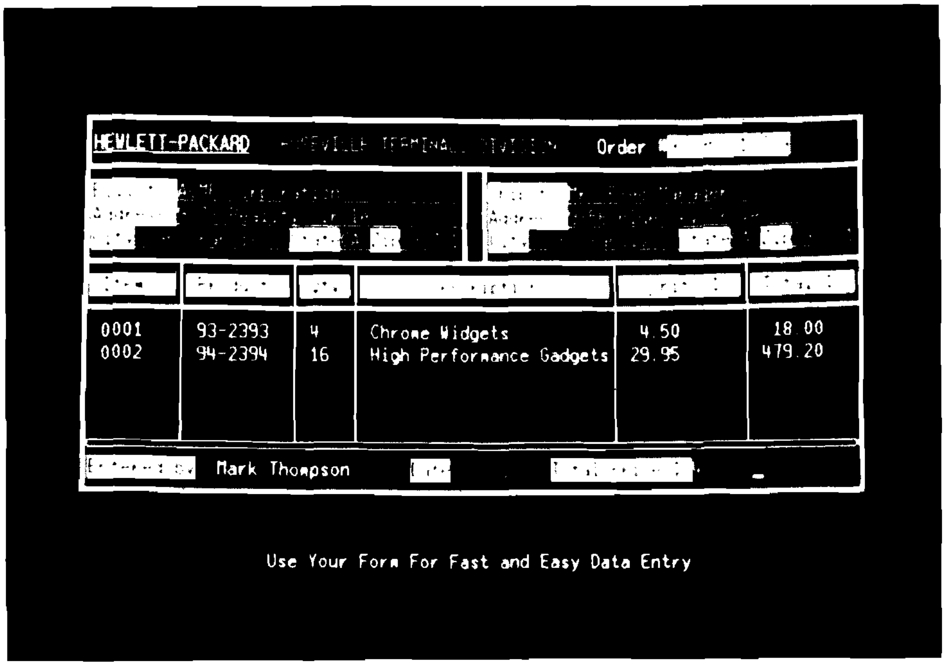
SAS/GRAPH™ is a trademark of SAS Institute Inc.



HEWLETT-PACKARD Order

0001	93-2393	4	Chrome Widgets	4.50	18.00
0002	94-2394	16	High Performance Gadgets	29.95	479.20

Mark Thompson

Use Your Form For Fast and Easy Data Entry

HP 2393A — A complete alphanumeric terminal too

In block mode, forms, text and data can be edited with the local edit keys before the information is transmitted to the computer for processing. On HP1000 and HP3000 systems the 2393A provides full compatibility with FORMS/1000 and VPLUS applications.

With format mode enabled, protected and unprotected fields make filling out forms an easy task. Three edit checks (alpha, numeric and alphanumeric), transmit-only fields and modified data tag give the 2393A powerful data entry/inquiry capabilities.

Ergonomics

The 2393A offers a modular design with standard ergonomic features. These features include an integral tilt and swivel mechanism, front panel power, brightness and contrast controls, and an anti-glare display screen. In addition, the low profile detachable keyboard can be adjusted for use in either a flat or an angled position. The sculptured keys are color-coded and conveniently clustered by function.

For quiet operation, the 2393A is convection cooled, eliminating the need for a fan.

Ease of Use

The 2393A has twenty function keys that can be used to simplify the operation of the terminal. These keys can be programmed to tailor the terminal for specific applications. Eight of the function keys have corresponding screen labels at the bottom of the display. In shifted mode, these keys perform pre-defined functions. The settings of the remaining four keys can be stored in novolatile memory, thereby retaining the contents of these keys when the terminal is turned off.

Screen menus containing user-selected or default settings are provided to simplify configuring the terminal. Configuration settings can be saved in nonvolatile memory.

The 2393A provides a choice of 17 national language keyboards. For a complete list of the keyboards available, refer to the Product Specifications section.

Terminal status information appears on the 27th line of the screen display. The status line indicates, for example, when the terminal is set for Graphics Pad, CAPS lock or ANSI mode operation.

The 2393A offers extensive self-test capabilities which allow the user to verify that the terminal is functioning properly.

A built-in screen saver shuts off the display after a period of inactivity. The inactive period of time to trigger the shut-off can be preset by the user. This feature prolongs the life of the display.

Data Communications

The 2393A offers page, line or character mode communications. Full duplex point-to-point asynchronous transmission is supported with flexible hardware and software handshaking to interface with a variety of computer systems and peripherals.

The Systems Port offers both RS232C and HP422 capabilities at data transmission rates up to 19.2 kbps with handshaking.

For additional flexibility, an optional Peripheral Port offers a choice of an RS232C serial interface, a Centronics-type parallel interface or an HP-IB interface. These modules are easily installed by the user.

The 2393A also connects to an X.25 PAD (Packet Assembler/Disassembler) network.

ANSI X3.64 Compatibility

The 2393A optionally provides at no cost a subset of the ANSI X3.64 standard for those users requiring a device-independent environment. In addition, the 2393A can execute many DEC® VT100® and VT52® control sequences. The user can select this mode via the terminal's configuration menu or programmatically from the host system. While in ANSI character mode operation, the user has access to TEKTRONIX compatibility mode in order to run PLOT 10 software.

Reliability/Serviceability

The 2393A has been engineered to provide years of trouble-free service. For support services, Hewlett-Packard has a world-wide network of sales and service offices staffed by highly qualified customer engineers and systems engineers.

DEC® , VT100® and VT52® are registered trademarks of Digital Equipment Corporation

HP2393A Product Specifications

GRAPHICS

Addressability:	32K x 32K points in HP mode 4096 x 4096 points in TEK 4014 mode 1024 x 1024 points in TEK 4010 mode
Viewable Resolution:	512(H) x 390(V) pixels, or 640(H) x 400(V) pixels, selectable
Display Area:	160 mm x 214 mm (6.3 inches x 8.4 inches) or 131mm x 201mm (5.2 inches x 7.9 inches), selectable
Cursor:	Crosshair
Primatives:	Polyline; 11 line types Area fill; fill polygons up to 105 sides using 10 patterns Text; 8 sizes, normal or slant, 4 orientations, 10 fully supported national character sets.

ALPHANUMERICS

splay Area:	155 mm x 201 mm (6.1 inches x 7.9 inches) or 124 mm x 201 mm (4.9 inches x 7.9 inches), selectable
Charater Generation:	7 x 11 dot matrix in 8 x 14 dot cell with half-dot shift
Character Size:	1.9 mm x 3.7 mm (0.075 inch x 0.146 inch)
Screen Capacity:	24 lines x 80 columns (1920 characters). 25th and 26th line for function key labels. 27th line for terminal status information.
aracter Set:	ROMAN 8 comprising 128 ASCII character set and 61 national characters from the extended Roman set. National characters include United Kingdom, Danish, Dutch, Finnish, French, German, Italian, Norwegian, Spanish, and Swedish. Plus Line Drawing, Math, Italics, and Bold characters. Total of 768 characters.
Cursor:	Blinking-underline or blinking-block.
Display Enchancements:	Inverse, underline, blinking, halfbright, security video, and double high double wide in any combination.
deo Attributes:	Memory lock, display lock, protected fields, user selectable margins and tabs, plus jump or smooth scrolling.
iting:	Insert character/line, delete character/line, clear line/all. Insert/delete line character with wraparound.
Page control:	Next/previous page (top, bottom, right, left).
Display Memory:	Memory is allocated dynamically. Up to 12 pages standard (288 lines x 80 columns or 144 lines x 160 columns) Depending on the number of display enhancements and security video fields used, memory available can vary.

DISPLAY

CRT Type:	Etched anti-glare, with implosion protection
Phosphor:	Green P31
CRT Size:	30 cm (12 inches) diagonal
Refresh Rate:	60 Hz Non-interlaced
Brightness Control:	User accessible
Contrast Control:	User accessible

KEYBOARD

Style:	Detachable typewriter keyboard with 2.4 meter (8 ft.) fully extended coiled cable.
Layout:	107 sculptured keys. Separate numeric keypad, and independent user, editing and cursor keys. 17 national layouts are available: USASCII, Swedish, Norwegian, French, German, UK, Spanish, French-Canadian, English-Canadian, Italian, Dutch, Finnish, Danish, Swiss-German, Swiss-French, Spanish-Latin American and Flemish.
Operation:	Auto-repeat; N-key rollover.
Function Keys:	8 screen labeled user-defined function keys; screen labels up to 16 characters and function key definitions up to 80 characters in length. Can include control codes and escape sequences. 4 additional user-defineable auto-executable function keys; definitions can be saved in non-volatile memory. 8 predefined function keys.
Included overlays:	An overlay is included for the numeric pad which labels the graphics functions active when the graphics pad is enabled. Other overlays are included with the corresponding options.

DATA COMMUNICATIONS

Data Rates:	System Port: 110, 134.5, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200 baud. Operation with control codes or escape sequences may require handshaking or CPU-supplied delays. Optional Peripheral Port with RS232C interface: 110. 134.5, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200 baud. Operation with control codes or escape sequences may require handshaking or CPU-supplied delays.
Handshake:	System Port: selectable software ENQ/ACK and XON/XOFF (transmit only), hardware CS (Clear to Send), TR (Terminal Ready), DM (Data Set Ready), and RR (Receiver Ready). Optional Peripheral Port: selectable software XON/XOFF (transmit only), hardware CS (Cle to Send), SRR (secondary Receiver Ready), and DM (Data Set Ready).
Parity:	Selectable in 7-bit operation: even, odd, zero, one. Always none in 8-bit operation.
Operating Modes:	Local, remote, character, block line or page, format, and optional ANSI operation. X.25 compatible using XON/XOFF when block mode is enabled and when the terminal is connected to an external PAD.
Transmission Modes:	Full duplex, asynchronous point-to-point. Compatible with Bell 103A, Bell 212A, Vadic VA3400 or equivalent full duplex modem.
Electrical Interface:	System Port: combined RS232C/HP422 data communications. Optional Peripheral Port: RS232C serial interface, Centronics-type parallel 8-bit interface , o HP-IB interface.

POWER REQUIREMENTS

Input Voltage:	100-120V (+10%, −10%) at 47-66 Hz, or 200-240V (+10%, −10%) at 47-66 Hz, switch selectable.
Power Consumption:	50 watts, Terminal Processing Unit 45 watts, Display Monitor

PHYSICAL CHARACTERISTICS

Display Monitor Weight:	10.0 kg (22 pounds)
Display Monitor Dimensions:	328 mm wide x 351 mm deep x 345 mm high (12.9 inches x 13.8 inches x 13.6 inches).
Terminal Processing Unit Weight:	4.3 Kg (9.5 pounds)
Terminal Processing Unit Dimensions:	325 mm wide x 325 mm deep x 100 mm high (12.8 inches x 12.8 inches x 3.9 inches).
Keyboard Weight:	2.1 kg (4.7 pounds)
Keyboard height: (at center row)	30 mm (1.2 inches) flat; 58 mm (2.3 inches) on stand.
Keyboard Dimensions:	456 mm wide x 225 mm deep x 30 mm high (18.0 inches x 8.9 inches x 1.2 inches).

ENVIRONMENTAL CONDITIONS

PARAMENTER	CONDITION	SPECIFICATION
Altitude	Operating	0 to 4,600 meters (15,000 ft)
	Non-operating	0 to 15,300 meters (50,000 ft)
Humidity	Operating	5 to 95% Relative Humidity at 40°C
	Non-operating	90% relative Humidity at 65°C
Temperature (free ambient)	Operating	0°C to +55°C (+32°F to +131°F)
	Non-operating	−40°C to +75°C (−40°F to +167°F)

PRODUCT REGULATIONS

Safety:	United States	UL Listing under standards 478 and 114
	Canada	CSA Certification under standard C22.2 154
	Germany	TUV GS mark pending
	Finland	FEI approval pending
	International	IEC 380 Safety of Electrically Energized Office Machine compliance IEC 435 Safety of Data Processing Equipment Compliance
FI:	United States	FCC Docket 20780 Part 15 for class A equipment
	Germany	VDE 0871 level B Radio Protection Mark pending
Acoustics:		Less than 4.0 Bels sound per A-weighted
Datacomm:	CCITT V.24 interchange, V.28 electrical Recommendations	
	Belgium	Approval pending
	Germany	Approved
	Japan	Approved
	Nordic network	Approval pending
	Sweden	Approval pending
	UK	Approval pending

Contact the local HP Sales Office for current status of datacom approval in your country.

PRODUCT SUPPORT

Hardware Supplied:	HP 2393A Graphics Terminal
Documentation Supplied:	HP 2393A User's Manual (02393-90001) HP 2393A Reference Manual (02393-90002)
Documentation Available:	HP 2393A Service manual (02393-90003)
HP Systems Support:	Refer to approriate HP system data sheet for use and support of the HP 2393A on systems. When this product is used in a customer-assembled system, the overall operational responsibility of the system rests with customer.
Warranty:	The HP 2393A is warranted against defects in material and workmanship. Contact the local HP Sales Office for terms and conditions.
Maintenance:	HP maintenance agreements are available for HP 2393A support after the warranty period. Contact the local HP Sales Office for terms and conditions.

Corporate Headquarters:
Hewlett-Packard
000 Hanover Street
Palo Alto, CA 94304 USA

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

International Headquarters
Hewlett-Packard
3495 Deer Creek Rd.
Palo Alto, CA 94304 USA

HP 2393A ORDERING INFORMATION

Product Number	Description
2393A	Graphics Terminal
OPTIONS	
-049	ANSI X3.64 Operation
-060	Delete Monitor
User Installable Options	
-046	Port 2: HP-IB Interface
-092	Port 2: 25 pin RS232C Interface
-093	Port 2: 8 bit parallel Centronics Interface
Localization Options	
-015	Delete US Monitor, add International Monitor
-101	Swedish
-102	Norwegian
-103	French
-104	German
-105	UK
-106	Spanish
-107	Canadian-French
-108	Canadian-English
-109	Italian
-110	Dutch
-111	Finnish
-112	Danish
-113	Swiss-German
-114	Swiss-French
-115	Spanish-Latin American
-116	Flemish
Cable Options	
-301	US Modem cable, same as cable accessory 40242M
-302	European modem cable, same as cable accessory 40242M
-303	RS232C cable, same as cable accessory 40242C
-304	HP direct connect RS232C cable, same as cable accessory 40242X
-305	EMP protect cable, same as cable accessory 40242Y
-306	HP direct connect RS422 cable, same as cable accessory 40242P

HP 2393A ACCESSORIES

Product Number	Description
Port 2 Interfaces	
40210H	Port 2: HP-IB Interface
40210R	Port 2: 25 pin RS232C Interface
40210P	Port 2: 8 bit parallel Centronics Interface
Datacomm Cables	
40242A	RS232C/HP422 cable. Male (25-pin)/female (50-pin)
40242C	RS232C cable. Female (25-pin)/male (25-pin), 5m (16 ft)
40242M	U.S./European modem cable. Male (25-pin)/male (25 pin), 5m (16 ft)
40242P	HP direct connect type 422 cable. Male (25-pin)/male (5-pin), 5m (16 ft)
40242X	HP direct connect type 232 cable. Male (25-pin)/male (3-pin), 5m (16 ft)
40242Y	EMP protect cable. Male (25-pin)/male (25-pin), 5m (16 ft)
40242Z	RS232C modem bypass cable. Male (25-pin)/female (24-pin), 5m (16 ft)
Peripheral Cables	
40242D	Parallel printer cable. Amphenol male (36-pin)/male (36-pin), 2m (6.6 ft)
40242G	Serial (RS232C) printer cable. Male (25-pin)/male (25-pin), 5m (16 ft)
40242V	Composite video cable, 0.4m (1.5 ft)
45529A	HP-IB cable, 1m (3.3 ft)

HP 2393A SUPPORTED DEVICES

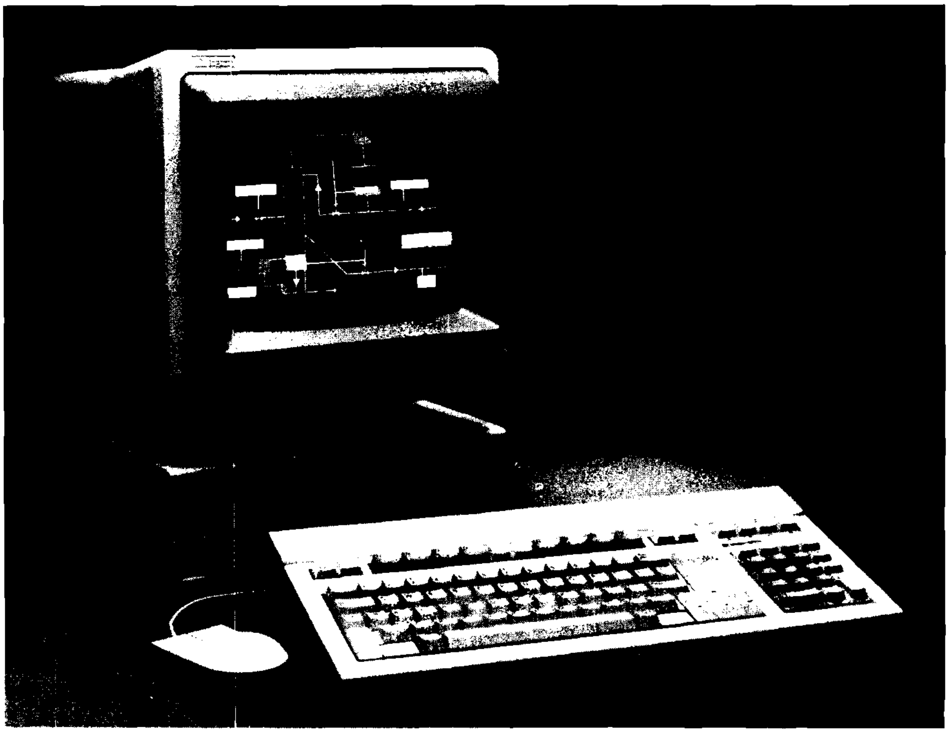
Product Number	Description	Interface
Input Devices		
35723A	Touchscreen	HP-HIL
46060A	Mouse	HP-HIL
46087A	A-size Tablet	HP-HIL
92916A	Bar code reader	HP-HIL
Monitors		
35731A/B	12″ Monochrome	Composite Video
35721A/B	14″ Monochrome	Composite video
Printers/ Copiers		
2225D/C/A	Thinkjet	RS232C/Centronics/HP-IB
2686A	Laserjet	RS232C
2932A	Dot matrix serial	RS232C/HP-IB
2934A	Letter quality	RS232C/HP-IB
Plotters/ Recorders		
7470A	Graphics 2-pen	RS232C/HP-IB
7475A	Graphics 6-pen	RS232C/HP-IB
7550A	Graphics 8-pen	RS232C/HP-IB
7510A	Film Recorder	RS232C/HP-IB

Note: The above list is by no means exhaustive. Contact your local HP Sales Office for information about other supported devices.

HP 2397A
Color Graphics Terminal

Features

- **Bit Mapped Color Graphics**
  - 8 Colors from Palette of 64
  - Selectable 512H x 390V or 640H x 400V pixels resolution
  - Primitives: Polyline, Area Fill and Text
  - Rubberband Line
  - TEKTRONIX® 4010/4014 Compatibility
- **Input Devices Supported**
  - Touchscreen
  - Graphics Tablet
  - Mouse
  - Bar Code Reader
- **Color Output Devices Supported**
  - Printers
  - Plotters
  - Film Recorders
  - Large Screen Projectors
  - Large Screen Monitors
- **Graphics Software Support**
  - HP Graphics/1000 II
  - HP DSG/3000, HPDRAW, HPEASYCHART, HPMAP
  - TEKTRONIX PLOT 10®
  - Graphics Software from Independent Software Vendors
- **Independent Color Alphanumerics**
  - 8 Foreground, 8 Background Colors
  - Up to 12 pages of Display Memory
  - Horizontal Scrolling to 160 Columns
  - Smooth Vertical Scolling
  - Display Enhancements including Double High Double Wide Characters
  - Line Drawing, Math, Italics and Bold Character Sets
  - Block Mode
  - Format Mode and Local Editing Capabilities
  - Edit Checking/Transmit-only Fields/ Modified Data Tag



HP 2397A Color Graphics Terminal with HP Mouse

- **Ergonomics**
  - Modular, Compact Design
  - Integrated Tilt and Swivel
  - Anti-Glare Color Phosphor Screen
  - Front Panel Power, Brightness and Contrast Controls
  - Detachable Low-Profile Keyboard
- **Ease of Use**
  - Screen Labelled Function Keys for Terminal Control
  - 8 User-Definable Function Keys with 16-Character Labels
  - 8 Pre-defined Function Keys
  - 4 Non-volatile User-Definable Function Keys
  - Non-volatile Configuration Menus
  - 17 National Keyboard Layouts
  - 27th Line for Terminal Status
  - Self-Test Capability
  - Screen Saver
- **High Performance Data Communications**
  - Character, Line or Page Mode Transmission
  - System Port offers both RS232C and HP422 with data rates up to 19.2 kbps with handshaking
  - Peripheral Port provides a choice of an optional RS232C Serial Interface, a Centronics®-type Parallel Interface, or an HP-IB Interface
  - Supports X.25 PAD connection
- **ANSI* X3.64 Compatibility**

TEKTRONIX® and PLOT10® are registered trademarks of TEKTRONIX, Inc.
Centronics® is a registered trademark of Centronics Data Computer Corporation
* American National Standards Institute

The HP 2397A

The HP 2397A — the color graphics workstation designed to offer you flexibility. Set it up the way you want it - select from an impressive array of user-friendly input devices like HP Touch, connect to the output peripherals of your choice, choose from a list of software packages and even adjust the tilt and swivel on your display.

The HP 2397A, with its range of input devices, provides the engineer or scientist with the tools to create and display graphics in color — in process control, industrial automation, preview design and other technical applications.

The HP 2397A gives the manager or professional the ability to graphically display business data for analysis, reports and presentations using a variety of color output devices like printers, plotters, film recorders and large screen projectors.

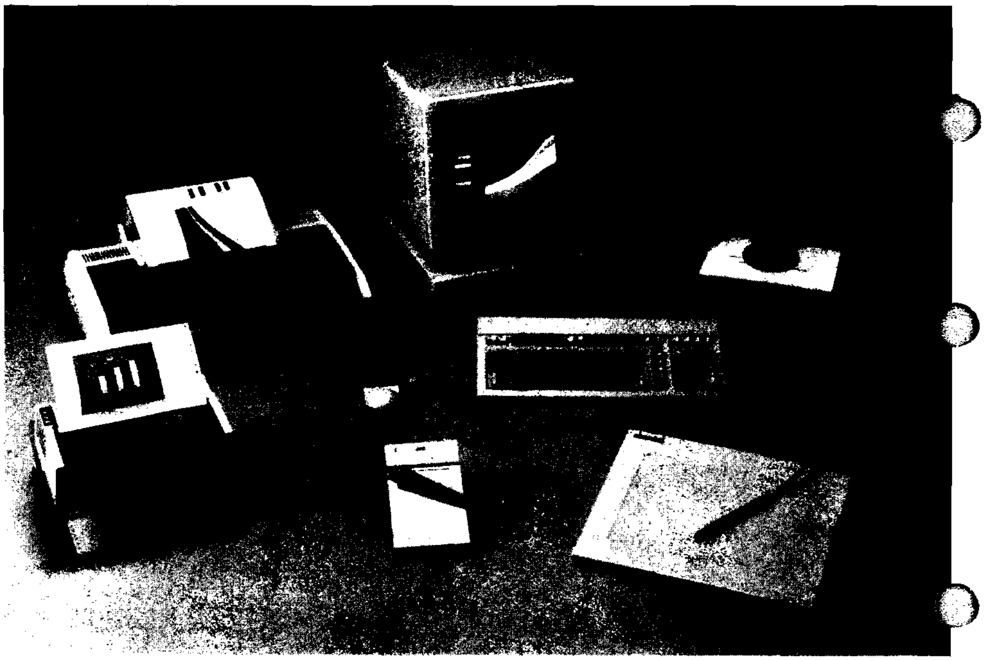
In addition, the HP 2397A offers comprehensive color alphanumeric capabilities as well as optional ANSI compatibility at no cost.

The HP 2397A is one of the most flexible color graphics terminals in its class, providing quality and reliability that you have come to expect of Hewlett Packard display terminals.

Graphics Features

The 2397A supports bit mapped vector graphics on a full color raster display with a selectable resolution of 512 pixels horizontally by 390 pixels vertically or 640 pixels horizontally by 400 pixels vertically. The user can select 8 displayable colors from a palette of 64. The default colors are red, green, blue, cyan, magenta, yellow, black and white.

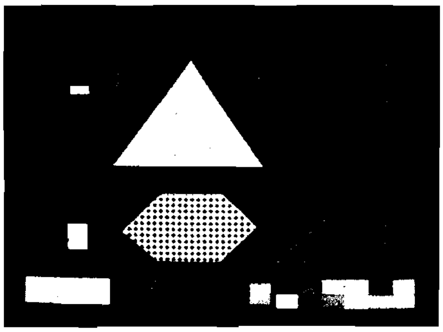
The 2397A has the intelligence to draw polyline vectors based on end points specified by the host. The user can select from 11 different line types including one that is user defined. The terminal allows the user to fill complex shapes with up to 148 sides selecting from 11 different area fill patterns including one defined by the user. The 8 selected colors can be mixed programmatically (dither) to create additional user defined colors for use with area fills. These features increase drawing speed while reducing data communications and system overhead.



HP 2397A offers remarkable input/output flexibility

The 2397A allows the user to add vector drawn graphics text to images. Graphics text can be normal or slanted, in one of 8 sizes and 4 different orientations.

The rubberband line feature allows the user to preview a vector before it is stored in graphics memory. This interactive feature used in conjunction with a touchscreen, mouse or graphics tablet, significantly increases user productivity and minimizes system overhead.



Local features reduce system overhead

The 2397A has a TEKTRONIX 4010/4014 compatibility mode that allows images designed for those terminals to be displayed in scaled or unscaled modes.

Input Device Support

With the unique HP-HIL (Human Interface Link) interface on the 2397A, the user can connect input devices and hardcopy devices simultaneously. The 2397A allows the user to daisy chain up to three input devices to the keyboard, thus offering considerable flexibility in the input configuration and freeing the auxiliary port for hardcopy devices. Supported graphics input devices include HP Touch, Mouse, Graphics tablet and Bar Code reader. These accessories may be ordered separately.

The touchscreen can be used in alphanumeric as well as graphics applications. To facilitate data entry and speed data inquiry in alphanumeric mode, the touchscreen can be used to select softkeys, user-defined fields or to move the cursor to a desired location. In graphics mode, the touchscreen duplicates the functions of a mouse. For example, you can use your finger to draw lines.

HP Touch — A natural way to communicate with your computer

The mouse can be used in graphics operations to move, draw and pick objects. As a positioning device, it is faster than graphics cursor keys on the keyboard, and hence an aid to productivity.

The graphics tablet is ideal for digitizing and sketching drawings. It is useful in interactive graphics, graphics entry and menu selection applications.

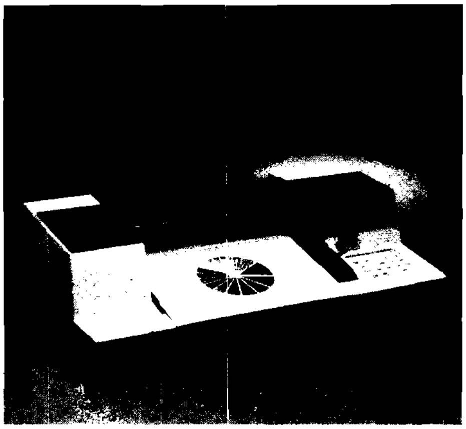
The bar code reader is well suited for rapid data entry applications, e.g. inventory tracking, point of sale terminals, etc.

Color Output Device Support

The 2397A offers a broad range of output options. This allows the user flexibility in connecting to a host of HP peripherals.

The user can generate engineering drawings, charts and overhead transparencies on HP plotters, print text and graphics on the Diablo C150 Color inkjet printer and other HP printers, and create 35mm slides on a HP film recorder.

In addition, the 2397A can be connected to commercial large screen projectors, film recorders or large monitors.



HP Plotters — Affordable color hardcopy

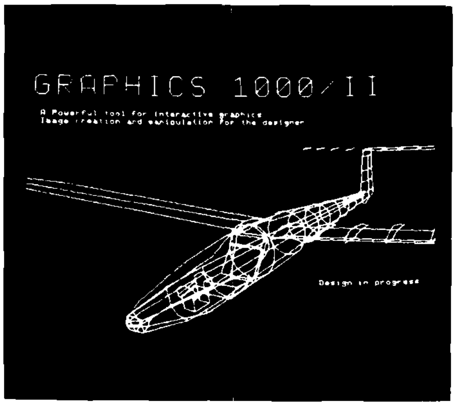
Graphics Software Support

The 2397A is supported by a wide variety of Hewlett-Packard software.

Graphics 1000/II and Graphics 9000 are high level graphics application development tools designed for use on HP1000 and HP9000 computer systems respectively and can provide a solution to a range of technical display graphics applications.

DSG/3000, HPDRAW, HPEASYCHART and HPMAP are designed specifically for business applications on HP3000 computer systems.

The TEKTRONIX 4010/4014 compatibility mode allows the 2397A to operate with TEKTRONIX Inc's PLOT 10 software.


GRAPHICS 1000/II
A Powerful tool for interactive graphics
Image creation and manipulation for the designer
Design in progress

Software solutions for graphics applications

In addition to Hewlett-Packard software, the 2397A operates with Precision Visual's™ DI-3000™and GRAFMAKER™, ISSCO's® DISSPLA® and TELL-A-GRAF® , SAS Institute's SAS/GRAPH™, and Megatek's TEMPLATE® . These packages run on HP as well as non-HP systems.

Independent Color Alphanumerics

The 2397A has a 12-inch diagonal CRT that displays 24 lines of 80 characters on a high-resolution full color screen. The characters are formed in a 8 by 14 dot character cell with half-dot shifting to create smooth, well-defined characters. Using 8 predefined colors, the user can define foreground/background color combinations (pairs) for each character cell in the alphanumeric plane. At any one time, the user can display 8 color pairs from a total of 64 possible pairs.

Up to 12 pages of text can be stored in display memory and viewed easily using smooth scrolling capabilities. The display memory can be configured to support up to 160 columns. This is useful in running applications written for 132 column displays. Columns beyond the 80th can be viewed via horizontal scrolling.

The 2397A has character sets that include Line Drawing, Math, Italics and Bold characters. Display enchancements - underline, inverse video, blinking, and Double High Double Wide - can be used with the character sets to emulate existing paper forms.

In block mode, forms, text and data can be edited with the local edit keys before the information is transmitted to the computer for processing. On HP1000 and HP3000 systems the 2397A provides full compatibility with FORMS/1000 and VPLUS applications.

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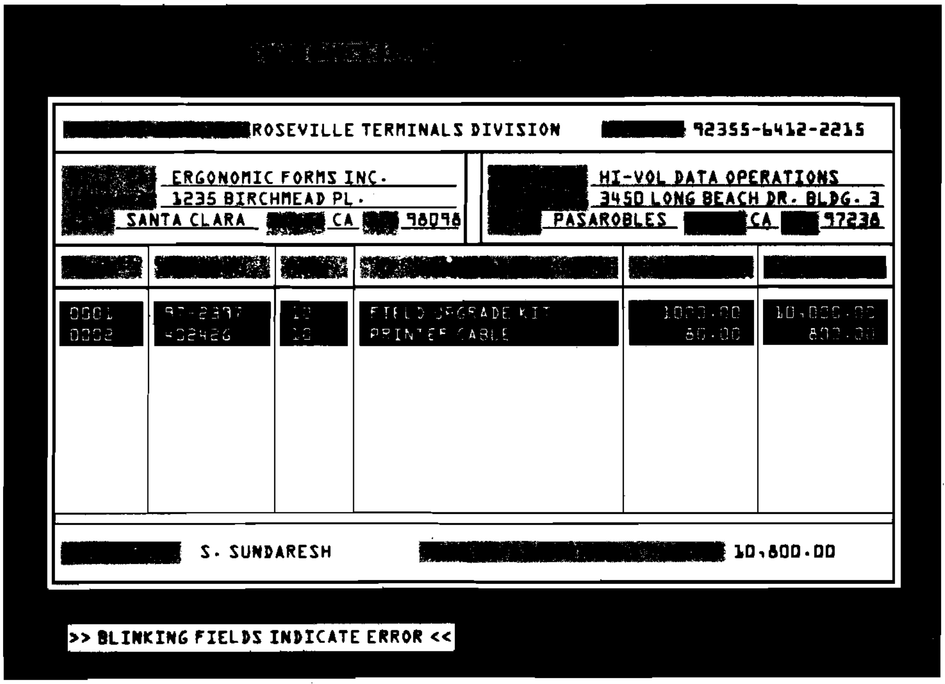
SAS/GRAPH™ is a trademark of SAS Institute Inc.
TEMPLATE® is a registered trademark of Megatek Corporation.
Precision Visuals™, DI3000™ and GRAFMAKER™ are trademarks of Precision Visuals Inc.



ROSEVILLE TERMINALS DIVISION 92355-6412-2215

ERGONOMIC FORMS INC.
1235 BIRCHMEAD PL.
SANTA CLARA CA 98098

HI-VOL DATA OPERATIONS
3450 LONG BEACH DR. BLDG. 3
PASAROBLES CA 97238

0001	97-2397	10	FIELD UPGRADE KIT	1000.00	10,000.00
0002	402426	10	PRINTER CABLE	80.00	800.00

S. SUNDARESH 10,800.00

>> BLINKING FIELDS INDICATE ERROR <<

HP 2397A — A color alphanumeric terminal too

With format mode enabled, protected and unprotected fields make filling out forms an easy task. Three edit checks (alpha, numeric and alphanumeric), transmit-only fields and modified data tag give the 2397A powerful data entry/inquiry capabilities.

Ergonomics

The 2397A offers a modular design with standard ergonomic features. These features include an integral tilt and swivel mechanism, front panel power, brightness and contrast controls, and an anti-glare display screen. In addition, the low profile detachable keyboard can be adjusted for use in either a flat or an angled position. The sculptured keys are color-coded and conveniently clustered by function.

For quiet operation, the 2397A is convection cooled, eliminating the need for a fan.

Ease of Use

The 2397A has twenty function keys that can be used to simplify the operation of the terminal. These keys can be programmed to tailor the terminal for specific applications. Eight of the function keys have corresponding screen labels at the bottom of the display. In shifted mode, these keys perform pre-defined functions. The settings of the remaining four keys can be stored in novolatile memory, thereby retaining the contents of these keys when the terminal is turned off.

Screen menus containing user-selected or default settings are provided to simplify configuring the terminal. Configuration settings can be saved in nonvolatile memory.

The 2397A provides a choice of 17 national language keyboards. For a complete list of the keyboards available, refer to the Product Specifications section.

Terminal status information appears on the 27th line of the screen display. The status line indicates, for example, when the terminal is set for Graphics Pad, CAPS lock or ANSI mode operation.

The 2397A offers extensive self-test capabilities which allow the user to verify that the terminal is functioning properly.

A built-in screen saver shuts off the display after a period of inactivity. The inactive period of time to trigger the shut-off can be preset by the user. This feature prolongs the life of the display.

Data Communications

The 2397A offers page, line or character mode communications. Full duplex point-to-point asynchronous transmission is supported with flexible hardware and software handshaking to interface with a variety of computer systems and peripherals.

The Systems Port offers both RS232C and HP422 capabilities at data transmission rates up to 19.2 kbps with handshaking.

For additional flexibility, an optional Peripheral Port offers a choice of an RS232C serial interface, a Centronics-type parallel interface or an HP-IB interface. These modules are easily installed by the user.

The 2397A also connects to an X.25 PAD (Packet Assembler/Disassembler) network.

ANSI X3.64 Compatibility

The 2397A optionally provides at no cost a subset of the ANSI X3.64 standard for those users requiring a device-independent environment. In addition, the 2397A can execute many DEC® VT100® and VT52® control sequences. The user can select this mode via the terminal's configuration menu or programmatically from the host system. While in ANSI character mode operation, the user has access to TEKTRONIX compatibility mode in order to run PLOT 10 software.

Reliability/Serviceability

The 2397A has been engineered to provide years of trouble-free service. For support services, Hewlett-Packard has a world-wide network of sales and service offices staffed by highly qualified customer engineers and systems engineers.

DEC®, VT100® and VT52® are registered trademarks of Digital Equipment Corporation

HP2397A Product Specifications

COLOR GRAPHICS

Addressability:	32K x 32K points in HP mode 4096 x 4096 points in TEK 4014 mode 1024 x 1024 points in TEK 4010 mode
Viewable Resolution:	512(H) x 390(V) pixels, or 640(H) x 400(V) pixels, selectable
Display Area:	160 mm x 214 mm (6.3 inches x 8.4 inches) or 131mm x 201mm (5.2 inches x 7.9 inches), selectable
Cursor:	Crosshair
Primitives:	Polyline; 11 line types Area fill; fill polygons up to 148 sides using 11 patterns and color dithering. Text; 8 sizes, normal or slant, 4 orientations, 10 fully supported national character sets.
Color:	8 colors from a palette of 64.

COLOR ALPHANUMERICS

Display Area:	155 mm x 201 mm (6.1 inches x 7.9 inches) or 124 mm x 201 mm (4.9 inches x 7.9 inches), selectable
Character Generation:	7 x 11 dot matrix in 8 x 14 dot cell with half-dot shift
Character Size:	1.9 mm x 3.7 mm (0.075 inch x 0.146 inch)
Screen Capacity:	24 lines x 80 columns (1920 characters). 25th and 26th line for function key labels. 27th line for terminal status information.
Character Set:	ROMAN 8 comprising 128 ASCII character set and 61 national characters from the extended Roman set. National characters include United Kingdom, Danish, Dutch, Finnish, French, German, Italian, Norwegian, Spanish, and Swedish. Plus Line Drawing, Math, Italics, and Bold characters. Total of 768 characters.
Cursor:	Blinking-underline or blinking-block.
Display Enhancements:	Color, inverse, underline, blinking, halfbright (color pair 3) and double high double wide in any combination.
Video Attributes:	Memory lock, display lock, protected fields, user selectable margins and tabs, plus jump or smooth scrolling.
Editing:	Insert character/line, delete character/line, clear line/all. Insert/delete line character with wraparound.
Page control:	Next/previous page (top, bottom, right, left).
Display Memory:	Memory is allocated dynamically. Up to 12 pages standard (288 lines x 80 columns or 144 lines x 160 columns) Depending on the number of display enhancements used, memory available can vary.
Color:	8 foreground/background color pairs selected from 64 combinations of the 8 basic colors — red, green, blue, yellow, cyan, magenta, black and white.

COLOR DISPLAY

CRT Type:	Etched anti-glare, with implosion protection, self converged, 0.31 mm dot trio pitch.
Phosphor:	P22 RGB
CRT Size:	30 cm (12 inches) diagonal
Refresh Rate:	60 Hz Non-interlaced
Brightness Control:	User accessible
Contrast Control:	User accessible
Degauss:	Line operated, automatic at power-up

KEYBOARD

Style:	Detachable typewriter keyboard with 2.4 meter (8 ft.) fully extended coiled cable.
Layout:	107 sculptured keys. Separate numeric keypad, and independent user, editing and cursor keys. 17 national layouts are available: USASCII, Swedish, Norwegian, French, German, UK, Spanish, French-Canadian, English-Canadian, Italian, Dutch, Finnish, Danish, Swiss-German, Swiss-French, Spanish-Latin American and Flemish.
Operation:	Auto-repeat; N-key rollover.
Function Keys:	8 screen labeled user-defined function keys; screen labels up to 16 characters and function key definitions up to 80 characters in length. Can include control codes and escape sequences. 4 additional user-defineable auto-executable function keys; definitions can be saved in non-volatile memory. 8 predefined function keys.
Included overlays:	An overlay is included for the numeric pad which labels the graphics functions active when the graphics pad is enabled. Other overlays are included with the corresponding options.

DATA COMMUNICATIONS

Data Rates:	System Port: 110, 134.5, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200 baud. Operation with control codes or escape sequences may require handshaking or CPU-supplied delays. Optional Peripheral Port with RS232C interface: 110. 134.5, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200 baud. Operation with control codes or escape sequences may require handshaking or CPU-supplied delays.
Handshake:	System Port: selectable software ENQ/ACK and XON/XOFF (transmit and receive), hardware CS (Clear to Send), TR (Terminal Ready), DM Data Set Ready), and RR (Receiver Ready). Optional Peripheral Port: selectable software XON/XOFF (transmit only), hardware CS (Clear to Send), SRR (secondary Receiver Ready), and DM (Data Set Ready).
Parity:	Selectable in 7-bit operation: even, odd, zero, one. Always none in 8-bit operation.
Operating Modes:	Local, remote, character, block line or page, format, and optional ANSI operation. X.25 compatible using XON/XOFF when block mode is enabled and when the terminal is connected to an external PAD.
Transmission Modes:	Full duplex, asynchronous point-to-point. Compatible with Bell 103A, Bell 212A, Vadic VA3400 or equivalent full duplex modem.
Electrical Interface:	System Port: combined RS232C/HP422 data communications. Optional Peripheral Port: RS232C serial interface, Centronics-type parallel 8-bit interface , or HP-IB interface.

POWER REQUIREMENTS

Input Voltage:	100-120V (+10%, −10%) at 47-66 Hz, or 200-240V (+10%, −10%) at 47-66 Hz, switch selectable.
Power Consumption:	50 watts, Terminal Processing Unit 65 watts, Color Display Monitor

PHYSICAL CHARACTERISTICS

Display Monitor Weight:	13.9 kg (30.6 pounds)
Display Monitor Dimensions:	328 mm wide x 390 mm deep x 345 mm high (12.9 inches x 15.4 inches x 13.6 inches).
Terminal Processing Unit Weight:	4.3 Kg (9.5 pounds)
Terminal Processing Unit Dimensions:	325 mm wide x 325 mm deep x 100 mm high (12.8 inches x 12.8 inches x 3.9 inches).
Keyboard Weight:	2.1 kg (4.7 pounds)
Keyboard height: (at center row)	30 mm (1.2 inches) flat; 58 mm (2.3 inches) on stand.
Keyboard Dimensions:	456 mm wide x 225 mm deep x 30 mm high (18.0 inches x 8.9 inches x 1.2 inches).

ENVIRONMENTAL CONDITIONS

PARAMETER	CONDITION	SPECIFICATION
Altitude	Operating	0 to 4,600 meters (15,000 ft)
	Non-operating	0 to 15,300 meters (50,000 ft)
Humidity	Operating	5 to 95% Relative Humidity at 40°C
	Non-operating	90% relative Humidity at 65°C
Temperature (free ambient)	Operating	0°C to +55°C (+32°F to +131°F)
	Non-operating	-40°C to +75°C (-40°F to +167°F)

PRODUCT REGULATIONS

Safety:	United States	UL Listing under standards 478 and 114
	Canada	CSA Certification under standard C22.2 154
	Germany	TUV GS mark per VDE 0806 pending
	Finland	FEI approval pending
	International	IEC 380 Safety of Electrically Energized Office Machine compliance
		IEC 435 Safety of Data Processing Equipment Compliance
RFI:	United States	FCC Docket 20780 Part 15 for class A equipment
	Germany	VDE 0871 level B Radio Protection Mark pending
Ray:	Germany	PTB Licensed
Acoustics:		Less than 4.0 Bels sound power A-weighted
Datacomm:	CCITT V.24 interchange, V.28 electrical Recommendations	
	Australia	Approved
	Belgium	Approval pending
	Germany	Approved
	Japan	Approved
	Nordic network	Approved
	Sweden	Approved
	UK	Approval pending

Contact the local HP Sales Office for current status of datacom approval in your country.

PRODUCT SUPPORT

Hardware Supplied:	HP 2397A Color Graphics Terminal
Documentation Supplied:	HP 2397A User's Manual (02397-90001) HP 2397A Reference Manual (02397-90002)
Documentation Available:	HP 2397A Service manual (02393-90003)
HP Systems Support:	Refer to approriate HP system data sheet for use and support of the HP 2397A on systems. When this product is used in a customer-assembled system, the overall operational responsibility of the system rests with customer.
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HP 2397A ORDERING INFORMATION

Product Number	Description
2397A	Color Graphics Terminal
OPTIONS	
-049	ANSI X3.64 Operation
-060	Delete Monitor
User Installable Options	
-046	Port 2: HP-IB Interface
-092	Port 2: 25 pin RS232C Interface
-093	Port 2: 8 bit parallel Centronics Interface
Localization Options	
-015	Delete US Monitor, add International Monitor
-101	Swedish
-102	Norwegian
-103	French
-104	German
-105	UK
-106	Spanish
-107	Canadian-French
-108	Canadian-English
-109	Italian
-110	Dutch
-111	Finnish
-112	Danish
-113	Swiss-German
-114	Swiss-French
-115	Spanish-Latin American
-116	Flemish
Cable Options	
-301	US Modem cable, same as cable accessory 40242M
-302	European modem cable, same as cable accessory 40242M
-303	RS232C cable, same as cable accessory 40242C
-304	HP direct connect RS232C cable, same as cable accessory 40242X
-305	EMP protect cable, same as cable accessory 40242Y
-306	HP direct connect RS422 cable, same as cable accessory 40242P

HP 2397A ACCESSORIES

Product Number	Description
Port 2 Interfaces	
40210H	Port 2: HP-IB Interface
40210R	Port 2: 25 pin RS232C Interface
40210P	Port 2: 8 bit parallel Centronics Interface
Datacomm Cables	
40242A	RS232C/HP422 cable. Male (25-pin)/female (50-pin)
40242C	RS232C cable. Female (25-pin)/male (25-pin), 5m (16 ft)
40242M	U.S./European modem cable. Male (25-pin)/male (25 pin), 5m (16 ft)
40242P	HP direct connect type 422 cable. Male (25-pin)/male (5-pin), 5m (16 ft)
40242X	HP direct connect type 232 cable. Male (25-pin)/male (3-pin), 5m (16 ft)
40242Y	EMP protect cable. Male (25-pin)/male (25-pin), 5m (16 ft)
40242Z	RS232C modem bypass cable. Male (25-pin)/female (24-pin), 5m (16 ft)
Peripheral Cables	
40242D	Parallel printer cable. Amphenol male (36-pin)/male (36-pin), 2m (6.6 ft)
40242G	Serial (RS232C) printer cable. Male (25-pin)/male (25-pin), 5m (16 ft)
40242V	Composite video cable, 0.4m (1.5 ft)
40242R	RGB video cable, 0.4m (1.5ft)
45529A	HP-IB cable, 1m (3.3 ft)
92241A	HP-HIL cable

HP 2397A SUPPORTED DEVICES

Product Number	Description	Interface
Input Devices		
35723A	Touchscreen	HP-HIL
46060A	Mouse	HP-HIL
46087A	A-size Tablet	HP-HIL
92916A	Bar code reader	HP-HIL
Monitors		
35741A/B	12" Color	RGB
13279B	19" Color	RGB
Printers/ Copiers		
2225D/C/A	Thinkjet	RS232C/Centronics/HP-IB
2686A	Laserjet	RS232C
2932A	Dot matrix serial	RS232C/HP-IB
2934A	Letter quality	RS232C/HP-IB
C150	Diablo Color Inkjet	Centronics
Plotters/ Recorders		
7470A	Graphics 2-pen	RS232C/HP-IB
7475A	Graphics 6-pen	RS232C/HP-IB
7550A	Graphics 8-pen	RS232C/HP-IB
7510A	Film Recorder	RS232C/HP-IB

Note: The above list is by no means exhaustive. Contact your local HP Sales Office for information about other supported devices.

The Vectra PC

Reliable, Compatible and Complete

As Versatile as Business Itself

The Hewlett-Packard Vectra PC is the personal computer that can be tailored to your business needs. With the Vectra PC, you can put together the exact combination of hardware and software that best meets your individual requirements. For your personal productivity, the compact Vectra PC is powerful, fast, and easy to use.

It is designed to run off-the-shelf IBM PC/AT application software. So you can choose from among the most popular programs for word processing, business graphics, spreadsheet analysis, database management, and communications.

And the Vectra PC's seven industry standard accessory slots are designed to accept any accessory card that will work in the IBM PC/AT as well. This allows the many IBM PC/AT compatible accessories and peripherals to be used.

You can put together the exact combination of hardware components and software that's best for your business today, OR you can choose from easy-to-order preassembled systems. Select from a range of popular configurations that are most frequently required in demanding applications. And as your needs grow and change, you can expand and alter your system. The Vectra Personal Computer keeps your options open.

A Complete System

While the Vectra PC will operate with the thousands of hardware and software products available for use with the IBM PC/AT, it is much more than an industry standard personal computer. It is part of a complete family of HP personal business solutions, which include the HP LaserJet and ThinkJet printers, the ColorPro as well as other versatile HP plotters, and sophisticated personal productivity software. You can also choose from a complete offering of HP display, mass storage, input devices, and many more accessories.

Common to this family of products is HP's uncommon commitment to product excellence in performance, value, and usability. HP is one of the only vendors that can offer this range and quality of hardware and software solutions.

This broad product family allows you to purchase a complete system with assurance that each of the components is tuned for maximum performance when integrated with the Vectra PC. And, for convenience and value, choose from a variety of HP's new pre-assembled solutions.

As flexible as you need it to be

You will have plenty of choices when it comes to software. There are many to choose from the large number of third party software packages designed for business and industry. In addition, there's software created to take advantage of special Hewlett-Packard features such as HP plotters and input devices.

Hewlett-Packard's Graphics Gallery brings you professional-quality graphics that you can create yourself. Executive MemoMaker is an easy-to-learn managerial word processor that can also integrate Graphics Gallery images with your text. For the more sophisticated user, AdvanceWrite provides word processing features to rival even the best of dedicated word processors. Executive Card Manager is an easy-to-use file manager with a built-in report writer, autodialing, and more. And HP's AdvanceLink 2392 is a powerful data communications application.

As sophisticated as you need it to be

But application software is only one of the ways you can tailor the sophistication level of the Vectra PC to your needs.

Our Personal Application Manager software (PAM), which comes with the MS™-DOS operating system, is a good example. When you're using PAM, you don't have to type complex commands (or any commands at all) to start a program running. Instead, the screen identifies the single function key you press to start any given application. The more applications you use, the more time and trouble PAM can save you. And of course, PAM makes learning much easier for beginners.

Pick the input devices that work best with the software you use. HP-HIL, the Hewlett-Packard Human Interface Loop, lets you connect a variety of input devices without using accessory slots. The HP Mouse, HP Touch Accessory, and keyboard can all be attached this way. And all these input devices may be connected without the use of an accessory slot.

Communications, too, can be as sophisticated as your business needs. For example, the Vectra PC can communicate with Hewlett-Packard, IBM, and other host computers, network with other vendors' PCs, and also talk to the Portable PLUS from Hewlett-Packard.

As crisp and colorful as you need it to be

The Vectra PC is not only easier to use, it's easier to look at with its multiple display offerings. The display systems support all the existing industry standards including:

- MDA – Monochrome Display Adapter
- CGA – Color Graphics Adapter
- EGA – Enhanced Graphics Adapter
- PGC – Professional Graphics Controller

The Multimode Video Adapter and Color Adapter enable you to display high resolution text and IBM CGA compatible software on either a HP Monochrome or Color monitor. HP EGA provides a color video system compatible with the standard EGA while offering backwards compatibility with existing software that supports CGA.

Or, for increased drawing speed, resolution and more colors, choose the Color Professional-level Graphics Controller (PGC). The PGC equips the Vectra PC for demanding two- and three-dimensional CAD applications and is fully compatible with IBM's PGC.

So, whether it's text or graphics, monochrome or color, HP offers the capabilities and quality you need in your display systems.

As powerful as you need it to be

The Vectra Personal Computer starts you out with all the performance you need, and lets you add more later.

It comes equipped with the Intel 80286 microprocessor — a powerful enough engine for just about any personal computer application. And when you add the optional 80287 co-processor, you have the ideal combination for applications involving a great deal of arithmetic or complex mathematics.

You start with a choice of 256K bytes or 640K bytes of memory without using any accessory slots, and you can expand to more than three megabytes, giving you plenty of room to create RAM discs that let your programs run even faster.

The Vectra PC is ready to accommodate up to three half-height internal data storage devices. You can start with a 360K byte or 1.2M byte, 5-1/4 inch flexible disc and add more later including an industry standard hard disc controller, and 20Mb or 40Mb hard disc subsystem.

The HP proprietary technology 20M byte subsystem (45816A) is rugged and compact (two of these 3-1/2 inch drives fit on just one half height storage shelf). The 45896A 20M byte subsystem provides an extra measure of IBM PC/AT compatibility and is included in the Vectra PC Model 50. The 45897A 40M byte subsystem is available stand alone and is included in the Vectra PC Model 60 preassembled system.

And that's in addition to the many Hewlett-Packard products you can use, such as external disc and tape drives, ThinkJet and LaserJet Printers, and our high-quality precision plotters.

Buy what you need now, and add what you need when you need it

Believe it or not, we've only begun to describe the versatility of the Vectra PC.

The following specifications detail even more ways the Vectra Personal Computer can be tailored to your business needs.

Hardware

System Processing Units

- Vectra Model 25 Personal Computer including 256K bytes RAM and one 360K byte 5-1/4 inch flexible disc (HP 72425A).
- Vectra Model 35 Personal Computer including 256K bytes RAM and one 1.2M byte 5-1/4 inch flexible disc (HP 72435A).
- Vectra Model 45 Personal Computer including 640K bytes RAM and one 1.2M byte 5-1/4 inch flexible disc (HP 72445A).
- Vectra Model 50 Personal Computer including all of Model 45 plus a serial/parallel card and the 45896A internal hard disc subsystem (HP 72450A).
- Vectra Model 60 Personal Computer including all of Model 45 plus a serial/parallel card and the 45897A internal hard disc subsystem (HP 72460A).

Features

- Intel 80286 16-bit microprocessor running at 8 Megahertz clock rate.
- Flexible disc controller.
- Socket for Intel 80287 numeric co-processor.
- Sockets for two additional Read Only Memory (ROM) chips.
- System clock/calendar/system configuration with CMOS Random Access Memory (RAM) and battery backup.
- Audio speaker system.
- Three half-height data storage cartridge shelves: two shelves with access from the front, suitable for flexible disc drives; a third shelf is suitable for hard disc drive only.
- Seven IBM PC/AT-compatible accessory slots:
  - Two 8-bit slots.
  - Five 16-bit slots.

- One HP-Human Interface Loop (HP-HIL) port allows one or more HP-HIL device, such as the keyboard and optional HP-HIL accessories, to be connected simultaneously.
- Optional keylock provides system security.

Compatibility

The Hewlett-Packard Vectra Personal Computer is compatible with the IBM PC/AT. Based on the Intel 80286 microprocessor it is designed to run all the off-the-shelf MS™-DOS software and hardware accessories available for the IBM PC/AT.

Internal Memory

- 64K bytes of Read Only Memory (ROM).
- 256K bytes of Random Access memory (RAM), with parity, expandable to 640K bytes on the processor board on Model 25 and Model 35, or 640K bytes as standard on the processor board on the Model 45.
- RAM expandable up to 3.64M bytes.

Note: DOS 3.1 can directly address a maximum of 640K bytes RAM.

Keyboard

- Detachable, typewriter-style, 103-key enhanced IBM PC/AT-format keyboard with adjustable tilt.
- Full-travel, step-sculptured keys with tactile feedback and color-coded legends.
- Eighteen function keys.
- HP-HIL port.
- Numeric and cursor keypads.

Data Storage

Internal Flexible Discs:

- 360K byte internal 5-1/4 inch flexible disc (HP 45811A).
- 1.2M byte internal 5-1/4 inch flexible disc (HP 45812A).

Hard Disc Controller:

- IBM PC/AT Compatible Hard Disc Controller Kit. Includes controller card, hard disc mounting bracket, cabling and documentation (HP 45895A).

Internal Hard Discs:

- 20M byte Internal Hard Disc Subsystem. Includes AT-compatible Controller Kit, HP 45895A above, and a 65ms average access time, half height hard disc. (Provided in Vectra model 50.) For use with Vectra units, serial number prefix 2623A and later only (HP 45896A).
- 20M byte Internal Hard Disc Subsystem. Includes HP-proprietary controller and 75ms average access time, rugged, 3-1/2" half height hard disc; a second disc mechanism may be added, yielding 40M bytes capacity on a single half height shelf (HP 45816A).
- 40M byte Internal Hard Disc Subsystem. Includes AT-compatible Controller Kit, HP 45895A above, and a 40ms average access time, full height hard disc. For use with Vectra units, serial number prefix 2623A and later only. (Provided in Vectra Model 60.) (HP 45897A).

External Storage:*

- 20M byte stand-alone hard disc (HP 9134H)
- 40M byte stand-alone hard disc (HP 9134L)
- Low cost 1/4-inch backup tape drive (HP 9142A)
- Dual 710K byte stand-alone 3-1/2 inch flexible disc (HP 9122D)

**Require the HP 88500A disc/tape interface.*

Physical Characteristics

System weight: 26 lbs. (11.8 kg), with one flexible disc drive, not including keyboard. (Model 45)
Keyboard weight: 4.2 lbs. (1.9 kg).
System dimensions: 16.7 in. wide × 15.4 in. deep × 6.3 in. high (42.5 cm × 39.0 cm × 16.0 cm) without keyboard.
System footprint: 1.8 sq. ft. (.17m²), without keyboard.
Keyboard dimensions: 20.6 in. wide × 8.8 in. deep × 1.3 in. (2.4 in.) high in flat (standing) position (52.5 cm × 22 cm × 3.5 cm × (6.5 cm)).

Environmental Conditions

Operating temperature: 5° to 40°C (41° to 104°F).
Nonoperating temperature: −40° to 70°C (−40° to 140°F).
Humidity: 8% to 80% (noncondensing).
Operating altitude: 15,000 ft. (4.6km).
Nonoperating altitude: 50,000 ft. (15.2km).

Note: Operating temperature and humidity range may vary with data storage media.

Radio Frequency Interference

- FCC Class B.
- VDE Level B (Radio Protection Mark - 0871B).
- SABS

Safety Approvals

- UL Listed.
- CSA, TUV, NEMKO, FEI Certified.
- IEC 380/435 Compliance.
- KEMA pending.

Input Voltage

- Switchable worldwide power supply.
- 115V (+10%, −20%) at 50/60 Hz (±5%).
- 230V (+10%, −15%) at 50/60 Hz (±5%).

Power Consumption

- 360W (450W) maximum with 110V (220V) supply, convenience outlet unused.
- 510W (600W) maximum with 100V (220V) supply, convenience outlet used.

Heat

- 710 BTUs/hour maximum.

Power Availability

- 176W available peak.
- Accessory cards: 7.2A at 5V; 390A at 12V; .250A at −5V; .250A at −12V total.

Ergonomics

- Complies with German Standard ZH1/618.

Software

System Software

- Vectra Disc Operating System with MS-DOS 3.1, PAM, and Documentation (HP 45951A).
- Vectra BASIC Interpreter (HP 45952A).
- Vectra MS-DOS Macro Assembler from Microsoft (HP 45953A).

Application Software*

- AdvanceLink 2392 (HP 68333F).
- Executive Card Manager (HP 68331F).
- Executive Card Manager: Templates (HP 68335F).
- Executive MemoMaker (HP 68330F).
- Executive Spreadsheet (HP 68332F).
- AdvanceWrite I (HP 27506F).
- AdvanceWrite II (HP 27507F).
- AdvanceWrite III (HP 27508F).
- TextCharts (HP 45406E).
- Gallery Collection (HP 68352F).
- Charting Gallery (HP 68350F).
- Drawing Gallery (HP 68351F).
- Office Activity Portfolio (HP 68324F).
- Business Management Portfolio (HP 68326F).
- Office Talk (Software and Hardware) (HP 24520A).

**For additional information on applications software for the Vectra PC (both Hewlett-Packard and tested third-party packages), please see Hewlett-Packard's quarterly Software and Accessory List.*

Peripherals

Monitors

- 13-inch Enhanced Graphics Display (HP 35743A).
- 13-inch Professional-level Graphics Display (HP 82959A).
- 12-inch monochrome monitor (HP 35731A).
- 12-inch color monitor (HP 35741A).

Input Devices

- HP Touch Accessory (HP 35723A).
- HP Mouse (HP 46060A).
- HP-HIL Extension Module (HP 46080A).
- A-Size Digitizer (HP 46087A).
- B-Size Digitizer (HP 46088A).

Plotters

- Six-pen A3/B-size technical plotter with serial interface (option 001) (HP 7475A).
- Eight-pen A3/B-size auto-feed plotter with serial interface (HP 7550A).
- Eight-pen ColorPro A4/A plotter with serial interface (option 001) (HP 7440A).
- Eight-pen DraftPro A2/C-A1/D-size plotter with serial interface (HP 7570A).

Printers

- ThinkJet Printer with parallel interface (HP 2225C).
- ThinkJet Printer with serial interface (HP 2225D).
- QuietJet Plus wide-carriage near letter quality printer with combined serial/parallel interface (HP 2227A).
- Daisywheel Printer with serial interface for letter quality printing (HP 2603A).
- LaserJet Printer with serial interface (HP 2686A).
- LaserJet Plus Printer with serial and parallel interface (HP 2686A-option 300).
- LaserJet 500 Plus Printer with serial and parallel interface (HP 2686D).

Accessories

- Serial/Parallel Interface (HP 24540A).
- Dual RS-232/422 Interface (HP 24541A).
- 128K byte Memory Expansion Kit (HP 45971A).
- 1/2M byte Memory Expansion Card (HP 45973A).
- 1M byte Memory Expansion Card (HP 45974A).
- Enhanced Graphics Adapter (HP 45983A).
- Professional-level Graphics Controller (HP 82960A).
- Multimode Video Adapter (HP 45981A).
- Multimode Color Adapter (HP 45984A).
- Numeric Co-processor (HP 45987A).
- HP-IL Portable-Desktop Link (HP 82973A).
- Disc/Tape Interface for external data storage (HP 88500A).
- IBM 3278 Emulation Accessory (HP 50920A).
- Internal 1200-Baud Modem plus Crosstalk XVI communication software (HP 24550A).
- Internal 2400-Baud Modem plus Crosstalk XVI communication software (HP 24551A).
- Internal 2400-Baud Modem (HP 24551B).
- Security Lock (HP 45986A).

Documentation

- Vectra PC Technical Reference Manual (HP 45961A).
- Vectra PC MS-DOS Programmer's Reference Manual from Microsoft (HP 45962A).

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MS™-DOS is a U.S. trademark of Microsoft, Inc.

Technical information in this document is subject to change without notice.

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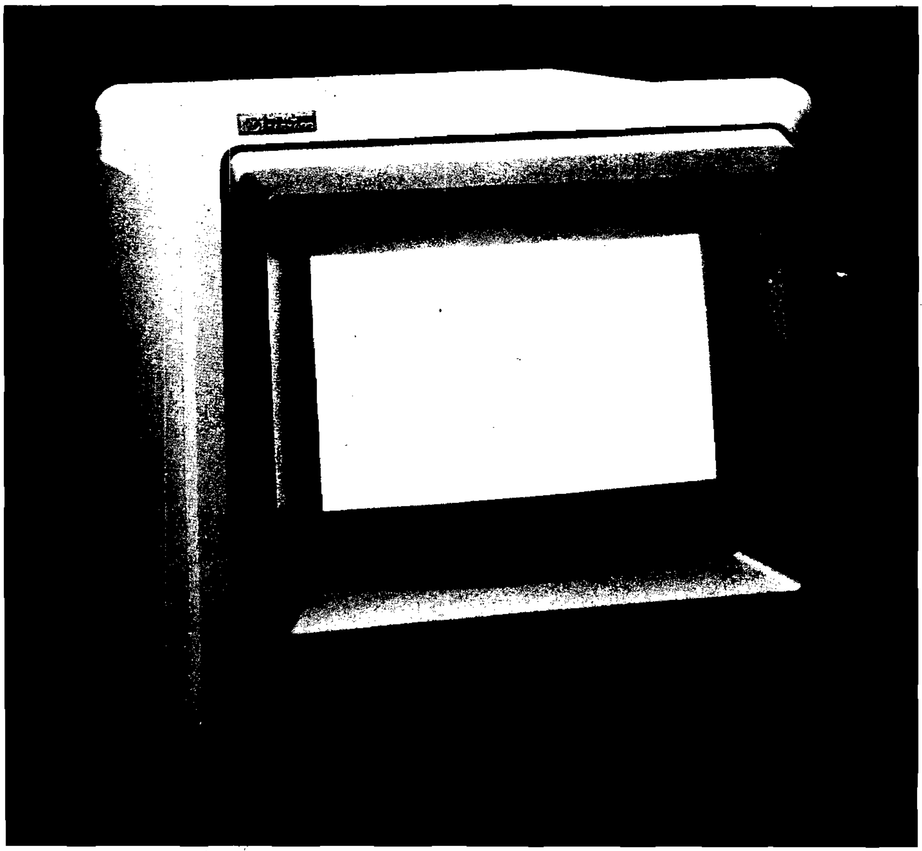
HEWLETT-PACKARD

The HP 35731 Monochrome Monitor

The HP 35731 Monochrome Monitor is a 12" high-resolution monochrome video display monitor. An excellent choice for use with your Hewlett-Packard computer system or workstation, the Monochrome Monitor features an innovative ergonomic design and Hewlett-Packard quality and reliability at an affordable price. Support for the 35723A HP Touch Accessory is included as a standard feature of the Monochrome Monitor. (The HP Touch Accessory must be purchased separately.)



Ergonomic Design

The Monochrome Monitor offers contemporary design with standard ergonomic features. The display is adjustable so that you can tilt and swivel the screen to get the best viewing angle. Separate brightness and contrast controls, conveniently located on the front panel of the monitor, allow you to adjust the display to the light level of your workplace.

Features

Display:
The Monochrome Monitor uses an easy to read P31 green phosphor. To give you a more readable display, its 12" screen has been finely etched to reduce glare.

Resolution:
The Monochrome Monitor has an available resolution of 800 dots x 400 lines. The actual image produced on the screen depends on the graphics resolution of the computer system driving the monitor. Most Hewlett-Packard systems will generate a resolution of 512 x 390, while others generate a resolution of 640 x 400. Consult your computer system literature to determine its resolution capability.

Display Interfaces:
The Monochrome Monitor is an analog composite video display capable of providing 16 gray levels. There is also an audio input for those systems which utilize the Monitor's integral speaker. Both of these interfaces require phono jacks for physical connections.

HP-HIL Support for HP Touch Accessory.

The Monochrome Monitor provides, as a standard feature, the HP-HIL (HP Human Interface Link), enabling you to use the 35723A HP Touch Accessory. The system which the monitor is connected to must be able to interface with the HP Touch Accessory.

Installation of the HP Touch Accessory is quick and easy. You simply remove the bezel of the Monochrome Monitor, connect a ribbon cable to the monitor, then snap in the HP Touch Accessory!

Certain HP software has been specially enhanced to take advantage of HP Touch. Consult HP software listings for those programs which use HP Touch.

One Year Warranty

The Monochrome Monitor continues the Hewlett-Packard tradition of quality and reliability. It comes with a full one-year warranty. If the monitor should fail during the warranty period, the failed piece of equipment should be returned to an authorized HP Personal Computer Dealer Repair Center or an HP Field Repair Center.

For more information, see your local Hewlett-Packard authorized dealer or sales office.

Specifications

Display

CRT Type	Monochrome 90-degree deflection
Phosphor	Green (P31)
CRT Size	12"
Display Area	219(x) x 164(h)mm (actual display area depends on switch setting and video source.)
Screen Capacity	800 dots x 400 lines
Audio Input	Phono Jack

Video Input Signal

Type	Composite Video
Polarity	Negative sync
Level	1.0 V P-P Composite Signal Level
Input Impedance	75 ohms
Input Terminal	Phono Jack

Electrical Performance

Video Bandwidth	30 Hz to 24 MHz (+/−3dB)
Horizontal Scan Frequency	24.9 - 25.8 KHz
Refresh Rate	50 Hz (20.00 ms) or 60Hz (16.67 ms)

Power Requirements

AC Power Requirements	35731A: 60 Hz (108-132V) 35731B: 50 or 60 Hz (90-132V, or 180-264V)
Power Usage	45 Watts maximum

Physical Characteristics

Monitor Weight	10.0 Kg
Monitor Dimensions	340(w) x 332(h) x 240(d) mm

Environmental Conditions

Parameter	Condition	Specification
Altitude	Operating	0 to 4600 meters (15000 ft)
	Non-operating	0 to 15300 meters (50000 ft)
Humidity	Operating	5 to 95% relative humidity at 40 C (non-condensing)
	Non-operating	90% relative humidity at 65 C (non-condensing)
Temperature (free ambient)	Operating	0 C to +55 C (+32 F to +131 F)
	Non-operating (Storage)	−40 C to +75 C (−40 F to +167 F)

Safety Approvals

35731A	UL Listed. CSA, IEC International 380/435
35731B	UL Recognized, CSA. TUV, NEMKO, SEV, FEI (pending)

Radio Frequency Interference

35731A	FCC Class B
35731B	FCC Class B, VDE Level B

Ergonomics

German Standard	ZH1/618 (pending)

HP35731 Ordering Information

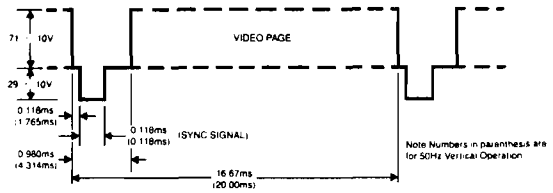
35731A	Monochrome Monitor (108-132V) 60Hz, U.S. power cord
35731BB	Monochrome Monitor — Switch selectable voltage, European power cord
35731BK	Monochrome Monitor — Switch selectable voltage, no power cord
35731BM	Monochrome Monitor — Switch selectable voltage, U.S. power cord
35731BU	Monochrome Monitor — Switch selectable voltage, U.K power cord
35731BQ	Monochrome Monitor — Switch selectable voltage, Swiss power cord
35731BY	Monochrome Monitor — Switch selectable voltage, Danish power cord

Note: The 35731B versions are UL recognized, but not UL labeled.

Accessories

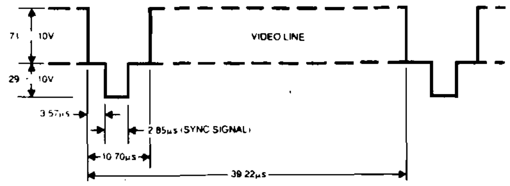
35723A	12 inch user installable touchscreen bezel. Installation instruction manual included.
46020-60001	HP-HIL cable (consult literature of the HP system being used to determine if you need this cable.)

Horizontal and Vertical Sync Signals



Note Numbers in parenthesis are for 50Hz Vertical Operation

Vertical Sync Signal



Horizontal Sync Signal

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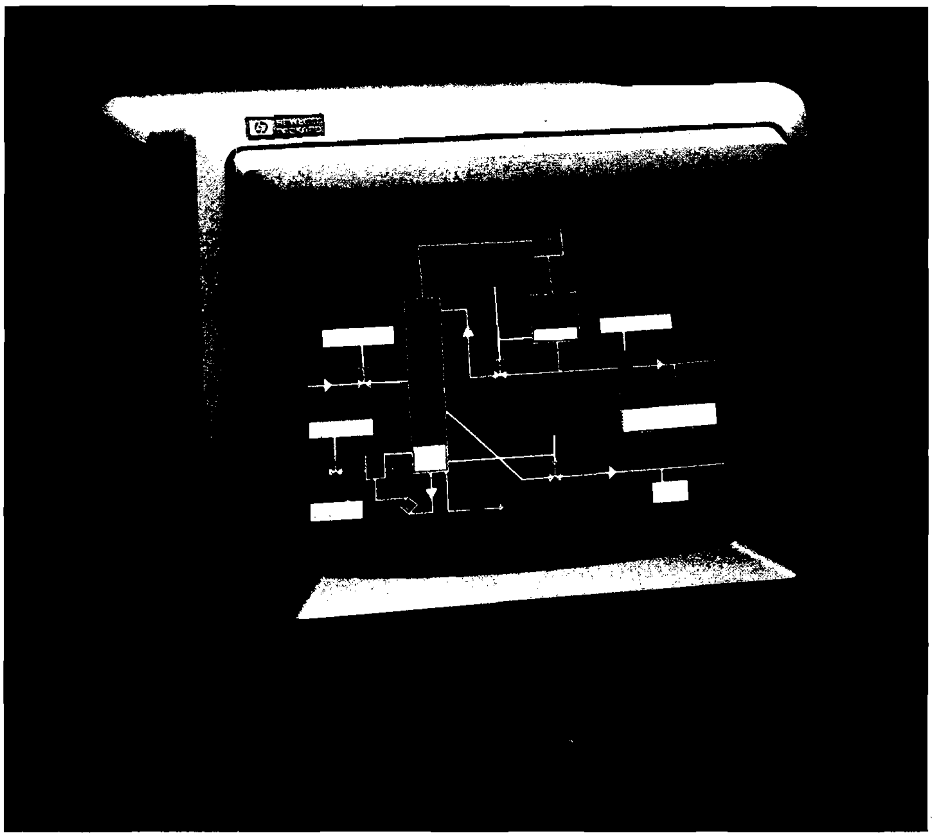
HEWLETT-PACKARD

HP 35741 Color Monitor

The HP 35741 Color Monitor is a 12" 640x400 resolution RGB analog color video display monitor. An excellent choice for use with your Hewlett-Packard computer system or workstation, the Color Monitor features an innovative ergonomic design and Hewlett-Packard quality and reliability at a competitive price. Support for the 35723 HP Touch Accessory is included as a standard feature of the Color Monitor. (The HP Touch Accessory must be purchased separately.)



Ergonomic Design

The Color Monitor offers contemporary design with standard ergonomic features. The display is adjustable so that you can tilt and swivel the screen to get the best viewing angle. Separate brightness and contrast controls, conveniently located on the front panel of the monitor, allow you to adjust the display to the light level of your workplace.

Quality Display

The Color Monitor has an available resolution of 640 dots x 400 lines. The actual image produced on the screen depends on the graphics resolution of the computer system driving the monitor. Most Hewlett-Packard systems will generate a resolution of 512 x 390 or 640 x 400, while others may generate a different resolution. Consult your computer system literature to determine its resolution capability.

The Color Monitor uses an RGB standard persistence phosphor (P22) with a 0.31mm dot pitch. A continuous spectrum of colors is available from this analog Color Monitor (limited by the capabilities of the host system). To give you a more readable display, its 12" screen has been finely etched to reduce glare. The Color Monitor's 640 x 400 resolution, combined with its fine 0.31mm dot pitch and excellent convergence, allows you to display clean, sharp images in both graphics and alphanumerics.

The Color Monitor comes standard with an integral speaker for use by systems with audio output capability.

HP Touch Support

The Color Monitor provides, as a standard feature, the HP Human Interface Link (HP-HIL), enabling you to use the 35723 HP Touch Accessory. The system which the monitor is connected to must be able to interface with the HP Touch Accessory.

Installation of the HP Touch Accessory is quick and easy. You simply remove the bezel of the Color Monitor, connect a ribbon cable to the Monitor, then snap in the HP Touch Accessory!

Certain HP software has been specially enhanced to take advantage of HP Touch. Consult HP software listing for those programs which use HP Touch.

One Year Warranty

The Color Monitor continues the Hewlett-Packard tradition of quality and reliability. It comes with a full one year warranty. If the monitor should fail during the warranty period, the failed piece of equipment should be returned to an authorized HP Personal Computer Dealer Repair Center or an HP Field Repair center.

For more information see your local Hewlett-Packard authorized dealer or sales office.

Specifications

Display

CRT Type	90-degree, .31mm dot pitch black matrix tube non-glare etched screen, dark glass
Phosphor	RGB standard persistence (P22)
CRT Size	12" diagonal
Display Area	210(w) x 164(h)mm
Screen Capacity	640 dots x 400 lines
Audio Input	RCA Phono Jack (8 ohm internal speaker)
Colors	All Colors
Misconvergence	< = 0.3mm(center), 0.5mm(corners)
Display Linearity	<7% Non-linearity
Display Geometry	<1.5% Distortion

Video Input Signal

Type	Analog RGB, composite sync on green
Polarity	Negative sync
Level	0.8 VP-P Signal level (min.)
Input Impedance	75 ohms
Input Terminal	BNC

Electrical Performance

Video Bandwidth	35 Mhz (14ns rise & fall time. 5.4ns skew)
Horizontal Scan Frequency	24.9-25.8 KHz
Refresh Rate	60Hz (16.67ms)

Power Requirements

AC Power Req.	50 or 60 Hz (90-132V, 180-250V)
Power Consumption	65 Watts maximum

Physical Characteristics

Monitor Weight	13.9Kg
Monitor Dimensions	328(w) x 345(h) x 390(d)mm

Environmental Conditions

Parameter	Condition	Specification
Altitude	Operating	0 to 4600 meters (15000 ft)
	Non-operating	0 to 15300 meters (50000 ft)
Humidity	Operating	5-95% relative humidity at 40C (non-condensing)
	Non-operating	90% relative humidity at 65C (non-condensing)
Temperature	Operating	0C to +55C (+32F to +131F)
	Non-operating (storage)	-40C to +65C (-40F to +167F)

Product Regulations

Safety Approvals

35741A	UL Listed. CSA, IEC 380/435
35741B	TUV, NEMKO, SEV, FEI (pending)

Radio Frequency Interference

35741A	FCC Class B (pending)
35741B	VDE 0871 level B

X-Ray

German Standard	PTB License (pending)

Ergonomics

German Standard	ZH1/618 (pending)

HP35741 Ordering Information

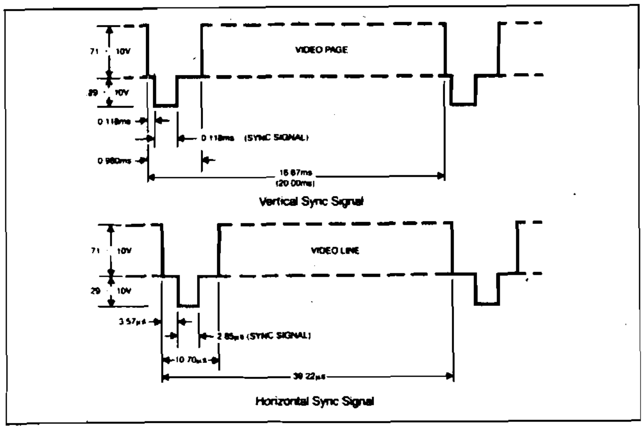
35741A	Color Monitor for USA and Canada only • switch selectable voltage • includes U.S. power cord
35741BA	Color Monitor — switch selectable voltage • includes South African power cord
35741BB	Color Monitor — switch selectable voltage • includes European power cord
35741BK	Color Monitor — switch selectable voltage • no power cord included
35741BM	Color Monitor — switch selectable voltage • includes U.S. power cord
35741BQ	Color Monitor — switch selectable voltage • includes Swiss power cord
35741BU	Color Monitor — switch selectable voltage • includes U.K. power cord
35741BY	Color Monitor — switch selectable voltage • includes Danish power cord

Note: The 35741B versions are UL recognized, but not UL labeled.

Accessories

35723A	12 inch user installable touchscreen bezel. Installation instruction manual included.
92241A (46020-60001)	HP-HIL cable (consult literature of the HP system being used to determine if you need this cable.)

Horizontal and Vertical Sync Signals



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5953-8626

HEWLETT-PACKARD

The Enhanced Graphics Display System

Industry Standards with HP Quality

Hewlett-Packard has long been a leader in graphics products for business, science, and engineering. The HP Enhanced Graphics Display System (EGDS) continues this tradition with graphics display components designed to complement the Vectra PC, and IBM PC-AT™ compatibles. Going beyond support of established graphics software standards, the HP EGDS provides an extra measure of quality and usability.

The Hewlett-Packard EGDS consists of two components:

- The HP Enhanced Graphics Adapter (HP EGA), HP 45983A
- The HP Enhanced Graphics Display (HP EGD), HP 35743A

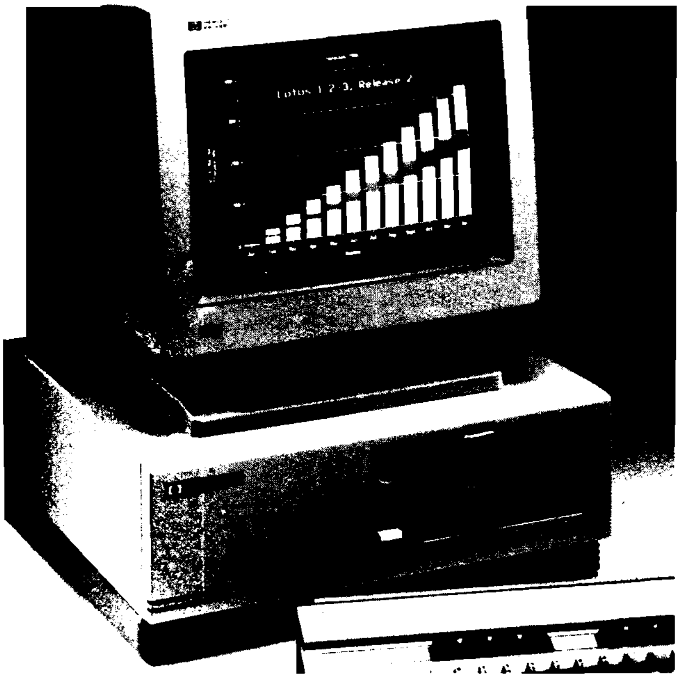
Together these components provide an excellent solution for Vectra PC and IBM PC-AT compatible users who need high-quality color display systems for purposes including

- Decision Support and Analysis
- Presentation Graphics
- CAD/CAM

and other graphics-intensive design applications. The HP EGDS meets these demanding needs by providing a video system compatible with the industry standard IBM EGA while offering an expanded feature set and an attractive, ergonomically complete display. With the HP EGDS you need not concern yourself with whether your graphics software applications are designed for the older IBM Color Graphics Adapter (CGA) or the newer Enhanced Graphics Adapter (EGA); the HP system will run both of them. Whether it be your personal computer's first display system, or an enhancement to your existing system, the HP EGDS spans the gap created by the evolution of PC graphics software.

The Enhanced Graphics Display

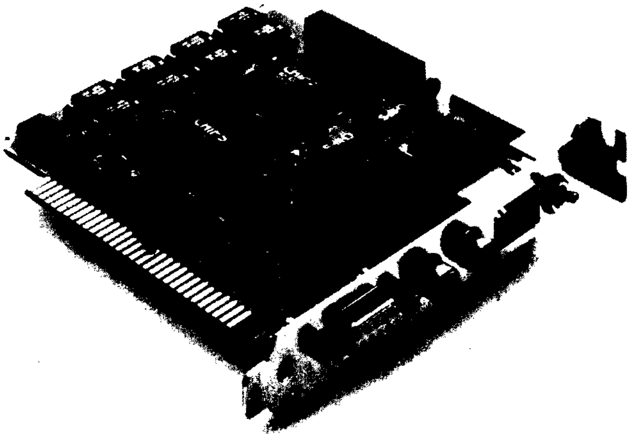
The Enhanced Graphics Display (EGD) is a 13" high-resolution color display with performance and resolution to support HP's Enhanced Graphics Adapter. This attractive display is bright, crisp, and is compatible with the Enhanced Color Display from IBM. The HP EGD is an excellent choice for users requiring color graphics solutions with Hewlett-Packard quality and reliability.



HP EGD Features

- Dual mode design supports both the EGA and the CGA standards
- Direct plug compatible with IBM's Enhanced Color Display
- 640 x 350 screen resolution in EGA mode, 16 colors displayable out of a palette of 64
- 640 x 200 screen resolution in EGA mode, 16 colors displayable
- 640 x 200 screen resolution in CGA mode, 2 color, or 320 x 200 screen resolution in CGA mode, 4 colors
- TTL input
- High-resolution 0.31 shadow mask
- Anti-glare screen
- External Tilt/Swivel (optional) (HP 82959S)
- User adjustable brightness
- User adjustable contrast (200 line mode only)
- Independent Vertical Height Adjustment for each display mode

HP Enhanced Graphics Adapter



Despite its small "half-size" format which fits in either an eight-bit or sixteen-bit Vectra accessory slot, the HP EGA combines several valued graphics capabilities all in one card. Not only does it offer compatibility with software written for the IBM EGA, it will also function with virtually all applications designed for the IBM CGA. When used with an IBM Monochrome Display, or compatible, the HP Enhanced Graphics Adapter will also operate with software designed for the popular Hercules™ Graphics Card. All of these capabilities smooth the transition of users who want the benefits the EGA software standard provides without obsoleting their existing applications.

The HP EGA comes with a full complement of display memory allowing full 16 color display from a palette of 64 colors at full EGA resolution. This standard 256K bytes of memory also benefits applications taking advantage of downloadable fonts or the storage of additional graphics screens.

But for all its power and sophistication, the HP EGA is easy to use. Configuration switches are easily accessible from the back of the card, so there is no need to open your system when changing display modes. Even easier, these mode changes are also executable via software.

Included with the HP EGA is a flexible disc with software which facilitates operation of the adapter by providing help in: setting-up, changing display mode, loading fonts, and using HP international character sets.

HP EGA Features

- Compatible with software written for IBM EGA, CGA & Monochrome Display Adapter (MDA)
- Compatible with software written for Hercules Graphics
- 256K Video RAM Standard
- Half-size card
- For use with individual display monitors:
  - HP Enhanced Graphics Display (HP 35743A)
  - IBM Enhanced Color Display (or compatible)
  - IBM Color Graphics Display (or compatible)
  - IBM Monochrome Display (or compatible) (required for use in Hercules Graphics Card emulation)
- Light pen interface
- IBM EGA Feature Connector Compatible
- Utility/Set-Up disc

Specifications

The HP Enhanced Graphics Display

CRT Type: 90 degree, .31mm dot pitch black matrix tube, non-glare, etched screen, dark glass
Phosphor: RGB standard persistence (P22)
CRT Size: 13" diagonal viewable
Display Area: 256mm (w) x 178mm (h)
Screen Capacity: 640 dots x 350 lines
Misconvergence: < =0.4mm (center), 0.5mm (corners)
Display Linearity: < =10% Non-linearity Horizontal, < =7% Vertical
Display Geometry: <2.5% Distortion

Video Input Signal:
200 Line Mode: RGB, Intensity, Hsync, Vsync
350 Line Mode: RGB (2 bits each), Hsync, Vsync
Level: TTL Low 0 to 0.5 volts, TTL High 2.5 to 5.0 volts
Input Cable: D sub-miniature 9-pen male

Electrical Performance:
Video Amplifier Risetime: 32 nsec
Horizontal Scan Frequency: 15.70 and 21.85 KHz, automatically selected
Refresh Rate: 60Hz (16.67ms)

Power Requirements:
AC Power Requirement: 60HZ 120V ±10%

Power Consumption: 75 Watts maximum

Physical Characteristics:
Display Weight: 12Kg
Display Dimensions: 354(w) x 304(h) x 380(d) mm

Environmental Conditions:

Parameter	**Condition**	**Specification**
Altitude:	Operating	0 to 12000 ft (3657m) at 20C 0 to 7000 ft (2133m) at 40C
	Non-operating	0 to 40000 ft (12192m)
Humidity:	Operating	10-95% relative humidity at 40C (non-condensing)
Temperature:	Operating	+10C to +40C
	Non-operating	−10C to +55C

Safety Approvals: UL listed, CSA certified

RFI: FCC Class B

The HP Enhanced Graphics Adapter

Video Output Signal:
200 Line Mode: RGB, Intensity, Hsync, Vsync
350 Line Mode: RGB, (2 bits each), Hsync, Vsync
Level: TTL Low 0 to 0.5 volts, TTL High 2.5 to 5.0 volts
Output connector: 0 sub miniature 9-pin female

Electrical Performance: Operates under Vectra PC — 8 megahertz system bus or industry standard PC/XT/AT bus.

Power Requirements: Power consumption is 7.5 watts maximum

Physical Characteristics: The board is a half-size (8-bit) card 5.0 inches in length and 4.2 inches high.

Environmental Conditions:

Parameter	**Condition**	**Specification**
Altitude:	Operating	15,000 ft.
	Non-operating	50,000 ft.
Humidity:	Operating	5% to 80% relative humidity
	Non-operating soak	90% relative humidity/24 hr
Temperature:	Operating	+5C to +40C
	Non-operating	−40C to +70C

Safety Approvals: UL listed

RFI: FCC Class B

Emulation Configurations

Some graphic modes require the use of special monitors. The following tables show the different configurations, their attributes, and the corresponding monitor.

Text Modes

Format[1]	Char. Cell Size	Colors	Equiv. Video Adapter	Monitor
80 × 25	9 × 14	4[3]	MDA, HGC	MD
40 × 25	8 × 8	16	CGA[2]	CD, ED
80 × 25	8 × 8	16	CGA[2]	CD, ED
40 × 25	8 × 14	16/64	EGA	ED
80 × 25	8 × 14	16/64	EGA	ED

Graphics Modes

Graphics Resolution	Colors	Equiv. Video Adapter	Monitor
720 × 348	2	HGC[4]	MD
640 × 350	4[3]	EGA	MD
320 × 200	4	CGA	CD, ED
640 × 200	2	CGA	CD, ED
320 × 200	16	EGA	CD, ED
640 × 200	16	EGA	CD, ED
640 × 350	16/64	EGA	ED

Notes

[1] Horizontal Characters × Vertical Lines.

[2] Some CGA software may require HPEGA.COM.

[3] Attributes on MD = Black, White, Intensified, Blinking.

[4] HPEGA.COM program is needed to emulate HGC.

The following definitions are used in the tables:

EGA	HP Enhanced Graphics Adapter (HP 45983A)
CGA	HP Multimode Card (HP 45981A) or Industry Standard Color Graphics Display Adapter
MDA	Industry Standard Monochrome Display Adapter
HGC	Hercules Graphics Card
ED	HP Enhanced Graphics Display (HP 35743A) or Industry Standard Enhanced Color Display
CD	Industry Standard Color Display
MD	Industry Standard Monochrome Display

Tilt/Swivel Base

HP also offers an optional tilt/swivel base (HP 82959S) that allows you to adjust your new display to the position most comfortable for you.

Ordering Information

- HP Enhanced Graphics Adapter (HP 45983A)
- HP Enhanced Graphics Display* (HP 35743A)
- HP EGD Tilt/Swivel Base (HP 82959S)

Support

Contact your authorized Hewlett-Packard dealer for details of support. Telephone assistance is available from the worldwide network of Hewlett-Packard Response Centers for the HP Enhanced Graphics Display System.

For telephone assistance outside the U.S., call your Hewlett-Packard Sales and Service Office and ask for the Personal Computer Response Center. In the U.S. the telephone assistance program is called HP HelpLine. The toll-free HelpLine number is 1-800-858-8867.

HP HelpLine is open Monday through Friday from 7 a.m. to 9 p.m. Eastern Standard Time (to 6 p.m. Pacific Standard Time).

A one-year limited warranty is included. For more information about the warranty consult your local sales/service office.

**Power cord and connection cable permanently attached.*

IBM is a registered trademark of International Business Machines Corporation.
Lotus 1-2-3 is a registered trademark of Lotus Development Corporation.
Hercules Graphics Card is a trademark of Hercules Computer Technology.

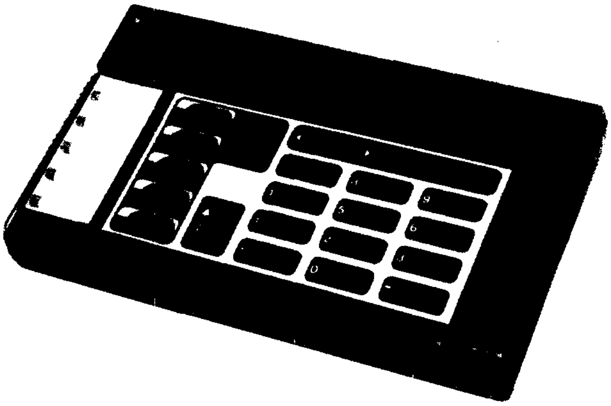
Printed in U.S.A. 5/86
5954-7491

Industrial Workstation Terminal

HEWLETT PACKARD

Model 3081A

Plus models 92922A/92923A



Introduction

The 3081A INDUSTRIAL WORKSTATION TERMINAL is a compact, low cost personal terminal specially designed for data collection applications in factory environments. Its robust plastic casing ensures maximum rigidity and sturdiness as well as excellent resistance to a wide range of chemicals. Gasket seals along the casing halves and cable feed-throughs guarantee total protection from dust and liquid penetration.

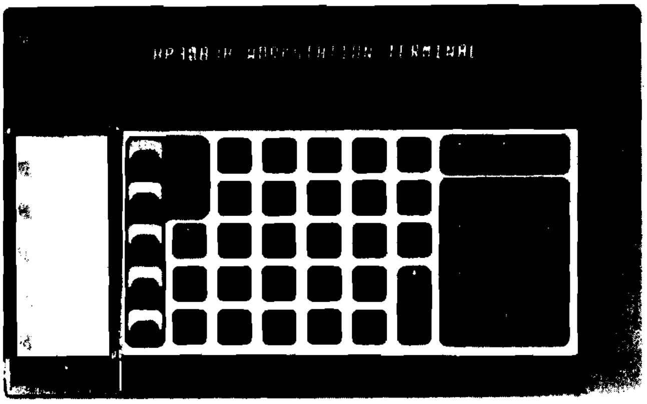
The terminal features function keys and a choice of bar code readers (six options). These simplified data entry techniques allow people unfamiliar with terminals to perform fast, accurate data entry with a minimum of training.

The versatility of the 3081A allows it to be used singly or as a component in a distributed network of terminals in factory or office applications. For example, in a typical manufacturing process application it may be used for work in process tracking, labor reporting, or access control.

Features

- **Rugged, sealed moulded plastic casing**
- **Compact size**
- **Total protection against dust penetration and liquid jets from all directions**
  - **Meets IEC Standard IP 65 (Publication 529)**
- **One line display:**
  - **Bright, crisp display under wide range of lighting conditions**
  - **32 alphanumeric characters**
  - **Wide viewing angle**
- **Keyboards:**
  - **Numeric keyboard standard**
  - **Optional full alphanumeric keyboard**
  - **Membrane type with audible and tactile feedback**
  - **10 function keys with protected area for user labels**
- **Optional bar code readers:**
  - **2 general purpose wands – medium and high resolution**
  - **2 industrial wands – low and high resolution**
  - **2 slot readers – low and high resolution**
  - **2 popular industrial codes**
  - **Check digit verification**
  - **Field length check**
  - **Autodiscrimination**
- **Power supply:**
  - **External DC power routed through the datacomm cable (from point-to-point adapter)**
- **Data communications:**
  - **Character mode**
  - **Asynchronous 2400 baud**
  - **Programmable software handshake**
  - **High noise immunity 20 mA current loop interface with conversion to RS232 / RS422 at host side**

3081A Specifications



3081A, Alpha Keyboard

In its standard configuration, the 3081A is supplied with a numeric keypad with 5 function keys (10 with "shift" key), a 32 character alphanumeric display, and 2400 baud current loop datacomm.

The display is of the vacuum fluorescent technology, with bright green characters 6 x 3 mm (.24 x .12 in).

An internal beeper may be programmed from application software to 2 different frequencies and durations ranging from 0,02 through 4 seconds.

For applications requiring alphabetic keyboard input, an optional full alphanumeric keyboard is available.

The optional bar code reader is designed to provide efficient data entry by greatly reducing the time and errors associated with keyboard entry. Typically, entry time can be reduced by a factor of 10 over typing while accuracy is increased by 1000!

An optional mounting bracket is available for securing the terminal to any suitable vertical or horizontal surface (e.g. wall, bench). This bracket also provides attachments for a wand or a slot reader.

The 3081A can be connected to a computer in a number of configurations (see following pages):

- When used with a 92922A 4-Channel Adapter or a 92923A Single Channel Adapter, the 3081A is powered by a DC voltage routed though the datacomm cable from the adapter or the controller.
- When the 3081A is used as a stand alone (OEM) terminal, an external DC power supply is required (see power requirements below).

Environmental

Temperature (free space ambient):
- Operating : 0°C to 55°C (32°F to 131°F)
- Nonoperating: - 40°C to 75°C (- 40°F to 167°F)

Humidity/dust: rated IP 65 according to IEC Standard 529
- Impervious to dust whatever the particle sizes
- Protected from water jets (.3 bar-12.5 l/min at 3 m, all directions)

Material: Display window – Polycarbonate
Keyboard – Silicone rubber
Casing – ABS

Chemicals: terminal and bar code readers resistant to most chemical vapors or droplets, except for some petroleum based hydrocarbons and solvents such as acetone, benzene, chloroform

Electrical: tested to the following limits with no impact on operation
- Radiation: 10 V/m from 14 kHz to 1 GHz
- Magnetic field: 1 gauss p-p from 47.5 Hz to 198 Hz
- Static discharge: up to 15 kV onto casing

Magnetic field interference: < 5 gauss p-p

Altitude:
- Operating : 4600 m (15000 ft)
- Nonoperating: 15300 m (50000 ft)

Vibration: 0.38 mm p-p, 5-55 Hz, 3 axis for 10 min

Shock: 30 G for 11 ms

Bench handling : 100 cm (39 in) drop on every side
Transportation handling: 200 cm (79 in) drop on every side in its packaging

Power requirements: DC voltage 12 V to 36 V
5 W maximum consumption
(6 W max. with bar code reader)
maximum ripple 0.5 V, 0 to 10 kHz
(at 12 V dc)

Physical

3081A dimensions: 30 x 18 x 4.5 cm (12 x 7 x 1.8 in)
3081A + bracket + slot reader: 34.5 x 20.5 x 6 cm (13.6 x 8.1 x 2.4 in)

Datacomm:
- Shielded 4 wire cable (transmit data, receive data, DC power, ground), external diameter: 3.5 to 6.5 mm (.14 to .26 in) Recommended : HP 92179H
- 150 m (490 ft) range with remote power supply (92922A/ 92923A)
- 600 m (1960 ft) range with local power supply*

* *Note : Not supplied. OEM or customer designed (must conform to CSA Class 2 and IEC 380 SEL V circuit requirements). See technical data 5953-5954 for details of electrical interface.*

3081A net weight: 1.5 kg (3.3 lbs)
shipping weight: 2 kg (4.4 lbs)
3081A + bracket + slot reader:
net weight: 3.8 kg (8.4 lbs)
shipping weight: 4.3 kg (9.5 lbs)

Approvals

Safety: – UL listed for EDP and office machines
– CSA listed for EDP equipment
– Designed in accordance to IEC 380 and IEC 435

RFI (Radio Frequency Interference):
– Complies with FCC Class A and VDE Level B regulations

Connections

The 3081A uses a 20 mA current loop interface to achieve the noise immunity and datacom cable lengths necessary for industrial applications. The current loop is converted to more commonly-available RS232/RS422 levels by the 92923A Single-Channel Adapter, and RS232 levels (not RS422) by the 92922A 4-Channel Adapter for interfacing to a host CPU. The protocol uses a general ENQ/ACK, X-ON/X-OFF, DC1 (optionally) software handshake on 3 (RS232) or 5 (RS422) wires.

The 92923A is intended for small applications requiring one or two terminals, while the 92922A may be more cost-effective for larger installations. Both adapters supply DC power to the 3081A in addition to performing the interface conversion. Note that the 92922A is NOT a multiplexer. It has 4 separate channels, and requires 1 host computer port for each 3081A connected.

For connecting the 92922A and 92923A to HP systems, consult Table 2 for correct cables. Table 1, describing the connectors and signals is to assist in evaluating the interfacability to systems not listed in Table 2.

Between the 92922A/92923A Adapters and the 3081A Terminals, use HP 92179H cable or equivalent (shielded, 4-wire cable, 20 gauge, 0.038 ohm/m max, outside diameter 3.5 to 6.5 mm (.14 to .26 in). Purchased cut-to-length from HP Direct Marketing. Maximum distance between 3081A and Adapter : 150 m (490 feet). At 3081A end, cable is wired directly into screw-block terminations. At Adapter end, solderless connector kit is supplied.

ADAPTER	CONNECTOR TYPE	PIN	SIGNAL	
92922A (RS232)	3-pin Female Canon DE68051	1	Ground	
		2	Data Out (to system)	
		3	Data In (from system)	
92923A RS232/ RS422	25-pin Female	1	Shield	RS232
		2	Data Out (to system)	
		3	Data In (from system)	
		4	RTS (tied to + 12 V)	
		20	DTR (tied to + 12 V)	
		7	Signal ground	
		1	Shield	
		9	Data out + (to system)	RS422
		10	Data out - (to system)	
		3	Data in + (from system)	
		18	Data in - (from system)	

TABLE 1. 92923A/92922A System-side Connectors and Signals

HOST CPU	INTERFACE	92923A	92922A
3000/4X 3000/6X	ADCC (25-PIN RS232)	40242M/Y OR 13242M/Y	40242X OR 13242X
	ATP (30145A) (5-PIN RS422)	40242P OR 13242P	N/A
	ATP (30145A-002) (3-PIN RS232)	40242X OR 13242X	NOTE 1
3000/37	ATP37 (30460A) (3-PIN RS232)	40242X OR 13242X	NOTE 1
	ATP37/M (40290A) (3-PIN RS232)	40242X OR 13242X	NOTE 1
	ATP37/M (40290A) (25-PIN RS232)	40242M/Y OR 13242M/Y	40242X OR 13242X
	ATP37/M (40290A) (5-PIN RS422)	40242P OR 13242P	N/A
1000/M 1000/E 1000/F	12792C (25-PIN RS232)	40242M/Y OR 13242M/Y	40242X OR 13242X
	12966A-106 (RS232)	PART OF 12966A-106 (25-PIN M)	30152A
1000/A 1000/L	12005B-002 (RS232)	PART OF 12005B-002 (25-PIN M)	30152A
	12005B-006 (DEL RS232 CABLE, ADD EDGE CONN) (RS422)	NOTE 2	N/A
	12040C (25-PIN RS232)	40242M/Y OR 13242M/Y	40242X OR 13242X
	12040C-003 (DEL RS232 PANEL) + 93581T (ADDS RS422 PANEL)	NOTE 3	N/A

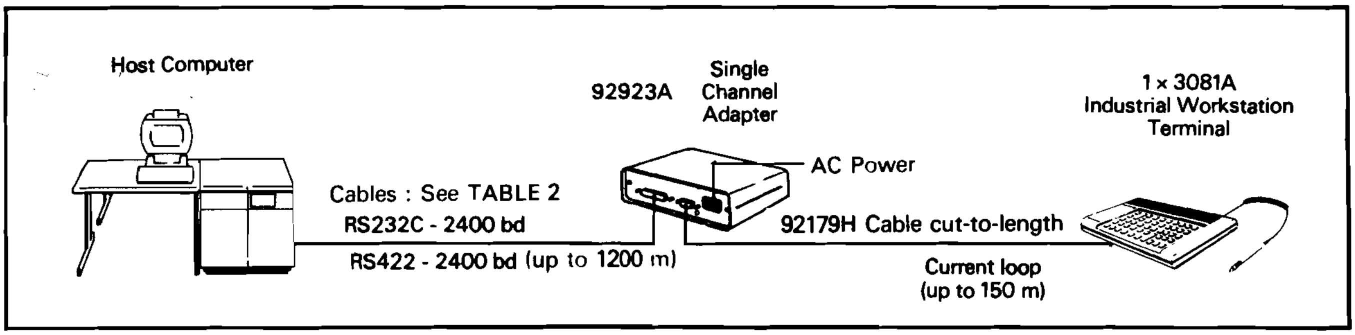
NOTE 1 : This configuration requires a 3-pin male/3-pin male cable which is not available ready-made. Can be fabricated from the following available components :

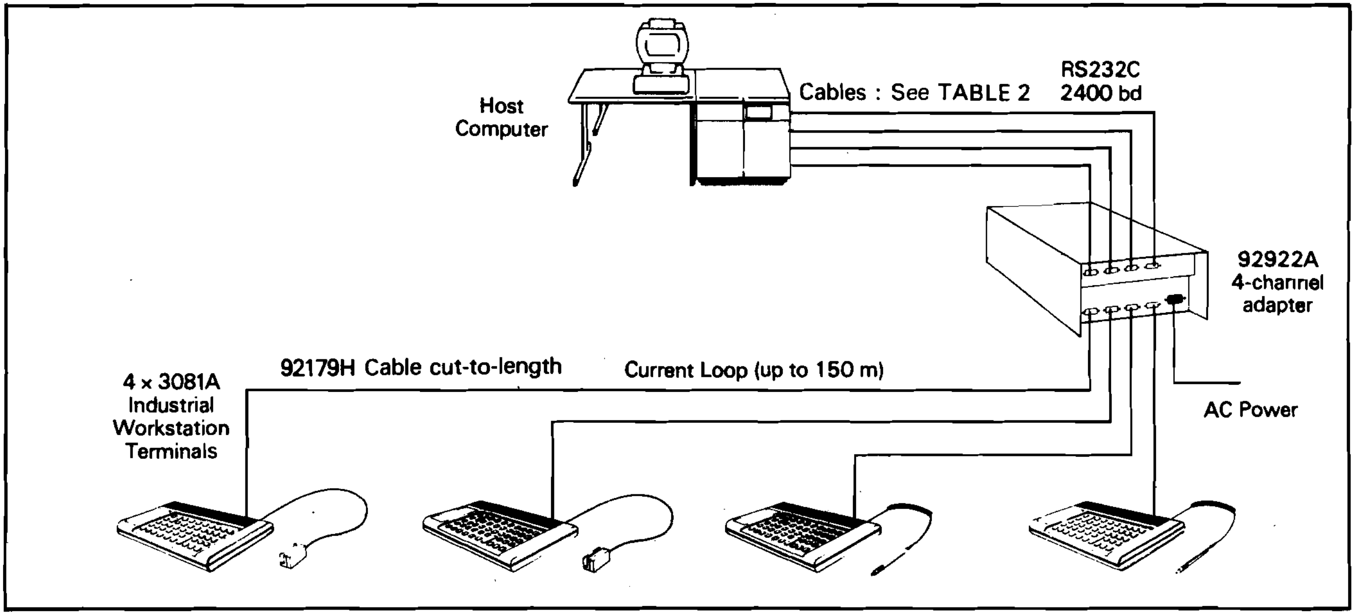
92224A	Set of 4 3-pin male connectors
92179C	3-wire shielded cable (sold by meter).
92229A	Crimp tool

NOTE 2 : Requires customer-fabricated cable.
Order :

92178A	Set of 2 25-pin male connectors.
92179D	5-wire shielded cable (sold by meter).

TABLE 2. 92923A/92922A System-side Cables


Host Computer
92923A
Single Channel Adapter
1 x 3081A Industrial Workstation Terminal
AC Power
Cables : See TABLE 2
RS232C - 2400 bd
RS422 - 2400 bd (up to 1200 m)
92179H Cable cut-to-length
Current loop (up to 150 m)


Host Computer
Cables : See TABLE 2
RS232C 2400 bd
92922A 4-channel adapter
AC Power
4 x 3081A Industrial Workstation Terminals
92179H Cable cut-to-length
Current Loop (up to 150 m)

Environmental (92923A/92922A)

Temperature: operating 0°C to 55°C (32°F to 131°F)
nonoperating – 40°C to 75°C (– 40°F to 167°F)
Humidity: 5% to 95% at 40°C (104°F), non condensing
Altitude: operating 4600 m (15000 ft)
nonoperating 15300 m (50000 ft)
Vibration: 0.38 mm p-p, 5-55 Hz, 3 axis for 10 min
Shock: 30 G for 11 ms
Power consumption (max.) :
92922A – 69 VA (with 4 terminals)
92923A – 15 VA (with 1 terminal)

Physical

92922A: 14.5 x 35.5 x 21.5 cm (5.7 x 14 x 8.5 in)
net weight 4.5 kg (10 lbs)
92923A: 6.5 x 14.9 x 20.6 cm (2.5 x 5.9 x 8 in)
net weight 1.7 kg (3.7 lbs)

Approvals (92923A/92922A)

Safety: – UL listed for EDP and office machines
– CSA listed for EDP equipment
– Designed in accordance to IEC 380 and IEC 435
RFI (Radio Frequency Interference):
– Comply with FCC Class A and VDE Level B regulations

Bar Code Reader Options

Entering repetitive data (such as a series of part numbers) on a keyboard is tedious, time consuming and subject to human error. A bar code reader allows fast, accurate data entry, and requires much less training than a keyboard.

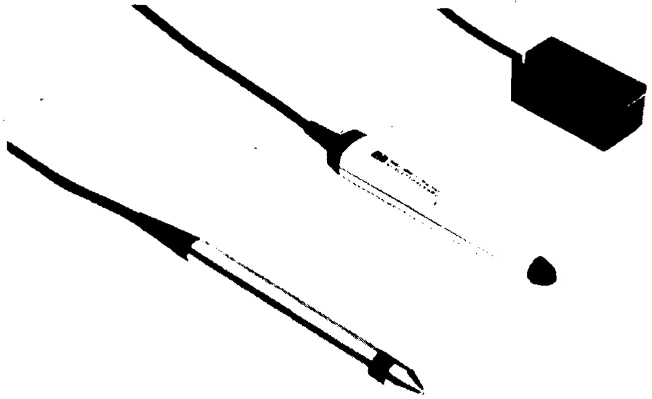
The 3081A can be fitted with one of six different bar code readers. The choice of reader depends on the application, the density of the code, and the type of environment:

- Wands are hand-held devices used when the bar code pattern is attached to an item (e.g. using self-adhesive labels), or embedded in a document (e.g. catalogs and job sheets). The reading is done by moving the wand tip across the length of the code. Typical applications are item tracking and labor reporting.

  Slot readers are fixed devices used to read bar coded badges or edge coded documents (generally a card or a medium weight paper with the code printed along one of the edges). The reading is done by sliding the document by hand through the slot in the reader. Typical uses include personnel identification (with plastic badges) and job identification with labor cards.
- Each reader is available in two resolutions, enabling it to read codes produced by different techniques. Low and medium resolution readers are for low density bar codes produced on dot matrix printers. High resolution readers are for use with high density labels produced on either specialized impact printers or by traditional printing techniques, such as offset or photocomposition.
- The two general purpose wands are suitable for clean environments, while the two industrial wands and the two slot readers are ruggedized for use in harsh environments.

The slot reader can either be integrated in the terminal's mounting bracket or separately positioned within its cable range.

When the wand is not in use, it can be placed in its holder, which can be attached to the bracket or any suitable surface.



Industrial Wand, general Purpose Wand, Slot Reader

Code Specifications

For complete information on bar code applications, including code specifications, refer to "Elements Of A Bar Code System" application note 5953-7732.

The 3081A decoder can decode the two most popular industrial codes, namely:

- Interleaved 2 out of 5 (or USD-1), a numeric-only code.
- 3 of 9 code (or USD-3), an alphanumeric code. (Including Extended Code 3 of 9 - a superset encoding all 128 ASCII characters).

These two codes are bi-directional (they can be read left-to-right and right-to-left), and the 3081A can read codes up to 32 characters long (including check digit). Internal check digit and a field length verifications provide additional data integrity, beyond the inherent checks in the code symbology.

Code selection and data checking parameters are controlled by application software. Autodiscrimination between 2/5 and 3/9 can be invoked from application software.

Reader Specifications

		Gen. purpose wands		Industrial wands		Slot readers	
	Units	**Opt. 052**	**Opt. 053**	**Opt. 054**	**Opt. 055**	**Opt. 056***	**Opt. 057**
Minimum resolution	mm in	0.30 0.012	0.15 0.006	0.38 0.015	0.19 0.0075	0.15 0.006	0.38 0.015
Depth of field (or slot width)	mm in	0.25 0.010	1 0.040	1.5 0.060	1.5 0.060	1.25 0.050	1.25 0.050
Tilt angle	maxi. pref.	30° 15°	30° 15°	45° 15°	45° 15°	N/A N/A	N/A N/A
Scan speed	cm/s in/s	8 to 80 3 to 30	8 to 80 3 to 30	6 to 100 2 to 40	6 to 51 2 to 20	7 to 70 3 to 28	7 to 70 3 to 28
Wand/Slot reader width	mm in	23 0.9	23 0.9	13 0.5	13 0.5	31 1.2	31 1.2
Wand/Slot reader length	mm in	133 5.2	133 5.2	148 5.8	148 5.8	62 2.4	62 2.4
Cable length (fully extended)	m ft	2.5 8	2.5 8	1.8 6	1.8 6	2 6.5	2 6.5
Light wavelength	nm	700	820	660	660	950	660
Minimum bar/space print contrast	%	70	70	70	70	60	70
Environmental conditions (IEC standard)		IP 30	IP 30	IP 64	IP 64	IP 65	IP 65
Temperature (operating)	°C °F	0+55 +32+131	0+55 +32+131	−20+55 +32+104	−20+55 +32+104	−20+40 −4+104	−20+40 −4+104
Humidity	%	5 to 95	5 to 95	sealed	sealed	sealed	sealed
Shock				30g-11ms	30g-11ms		

* *Note:*

The high resolution slot reader uses infrared light, which enables reading of invisible "black-on-black" codes on badges for security applications.

Ordering Information

Model	Option	Description
3081A	Std	Character mode Industrial Workstation Terminal, Numeric keyboard, 2400 bd 20 mA current loop datacomm
	004	Alphanumeric keyboard
	020	Mounting bracket for 3081A, wand or slot reader
	052	Gen. purpose medium res. wand (12 mils)
	053	Gen. purpose high res. wand (6 mils)
	054	Industrial low res. wand (15 mils)
	055	Industrial high res. wand (7.5 mils)
	056	High res. slot reader (6 mils, IR)
	057	Low resolution slot reader (15 mils)
92179H ★	Std	Current loop + power cable. Maximum length: 150 m per terminal Minimum order 50 m
92923A	Std	Single Channel current loop to RS232/422 Adapter + power supply for the 3081A 115 V, 50/60 Hz operation
	015	230 V, 50/60 Hz operation
92922A	Std	4-channel RS232C adapter+power supply 115 V , 50/60 Hz operation
	015	230 V , 50/60 Hz operation

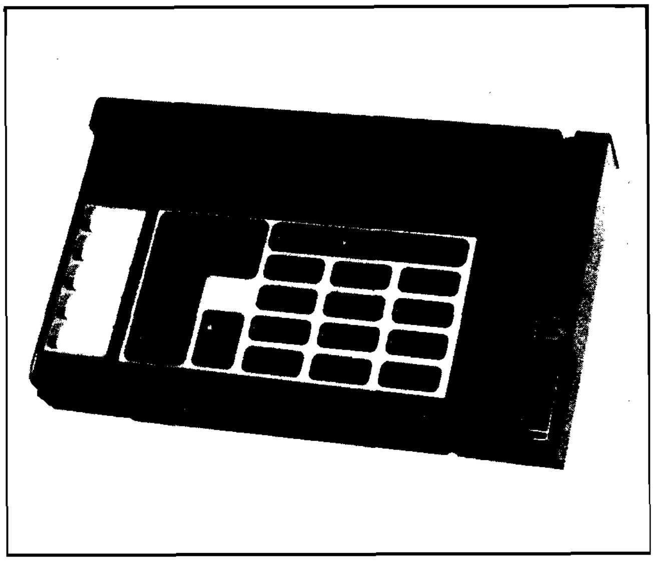
Documentation References

Part Number	Description
03081-90001	3081A/92922A/92923A Operating and service manual
5953-5954	HP3081A technical data brochure
5953-7732	Elements of a bar code system – Application note

Accessories/Replacement-Parts

Part Number	Description
03081-80015	Pack of 5 function key labels
03081-60110	Mounting bracket for 3081A
03081-40007	Numeric keyboard overlay
03081-40006	Alphanumeric keyboard overlay
03081-40005	Function keys label cover
5061-3855 ★	Gen. purpose medium res. wand (12 mils)
5061-3856 ★	Gen. purpose high res. wand (6 mils)
5040-9906 ★	Replacement tip for Opt. 052/053 wands
03075-40006 ★	Wand holder for Opt. 052/053
0950-1663 ★	Low resolution industrial wand (15 mils)
0950-1662 ★	High res. industrial wand (7.5 mils)
1535-4474 ★	Replacement tip for Opt. 054/055 wands
03075-40010 ★	Wand holder for Opt. 054/055
0950-1681 ★	Low res. slot reader (15 mils)
0950-1665 ★	High res. slot reader (6 mils, infrared)
5061-3858 ★	Connector kit (1 current loop channel) for 92922A, 92923A
03081-90056	Bar-coded test badge
92911-90101 ★ to -90120	Pack of self-adhesive numeric bar code labels, code 3 of 9 and Interleaved 2 out of 5

★ Available through HP Direct Marketing (Check latest Catalog)



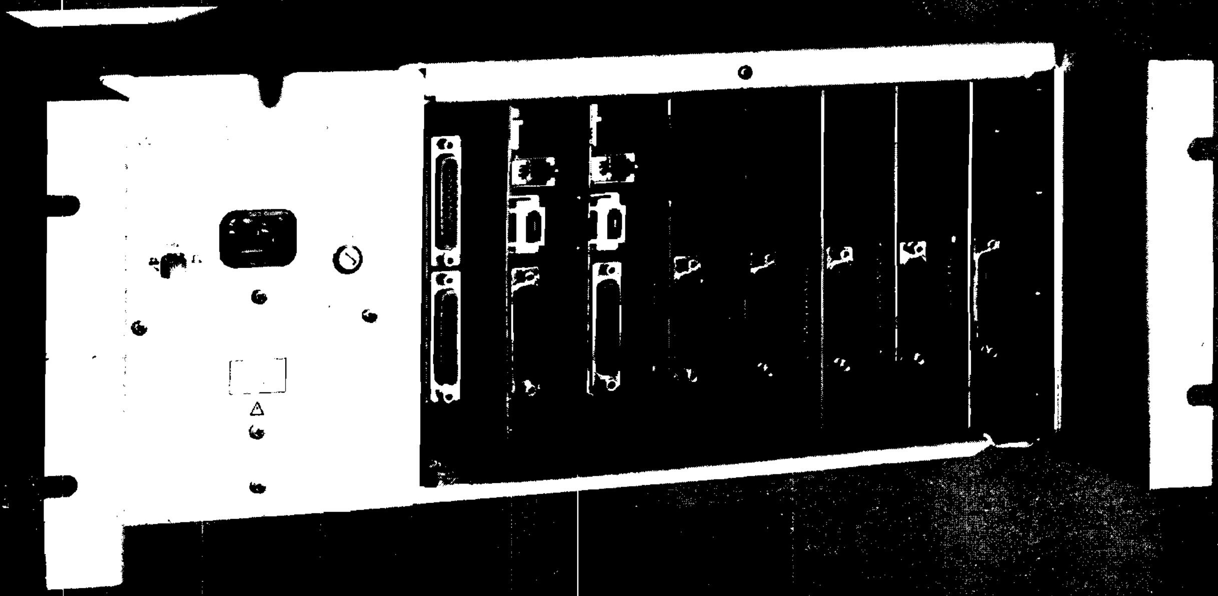
3081A With Mounting Bracket And Slot Reader

Data Subject to change

5953-5919

Printed in France (63) 11/85
5953-5919EN

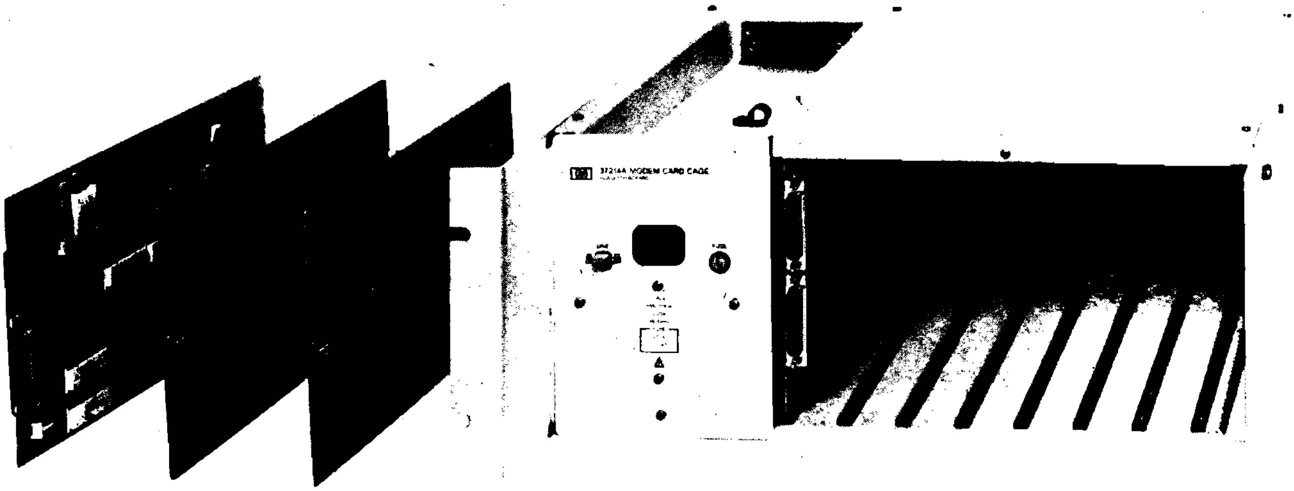
- Full-duplex
- 300/1200 bits/s
- Bell 212A/CCITT V.22 compatible



- Auto-dial
- Auto-answer
- Auto-data rate recognition/configuration
- User program controlled

The Systems Modem

The HP Systems Modem comprises the 37214A Card Cage and 37213A, 37215A and 37216A family of plug-in cards. Designed for use with all HP 1000 computers, the Systems Modem makes use of custom LSI and thick film hybrid circuits to achieve high performance and reliability.



Features	Benefits
● Full-duplex, sync or async, 300/1200 bits/s on dial-up lines.	■ Flexibility, good data throughput with low error rate.
● Full intelligence, auto-dial, auto-answer with auto-speed configuration, program controlled.	■ Unattended operation, no complicated strapping, no telephone handset required.
● Compatible with Bell 212A and CCITT V.22 Alternatives A and B at 1200 bits/s.	■ Can communicate with other modems compatible with these major North American and European standards.
● Up to 7 modems per computer I/O channel.	■ Hardware efficient, upgradable systems.
● Interfaces for external modems and local terminals.	■ Usable with telephone company supplied modems, local terminals easily added.
● General purpose control protocol.	■ Permits use with any computer or calculator.
● Program or local terminal controlled diagnostics and loopback testing.	■ Simplified service, minimum downtime, low cost of ownership.

Description

The HP Systems Modem in conjunction with the 12792B or 12040B 8-Channel Multiplexers provides 300/1200 bits/s full-duplex modem support on dial-up lines for all HP 1000 computers.

37214A Modem Card Cage

The 37214A is a rack mount card cage with integral power supply and microprocessor based controller. It accepts up to seven 37213A Modem Cards or other optional interface cards. The 37214A connects to the 8-Channel Multiplexer via a single multiway cable.

The controller is connected to port 7 of the multiplexer and communicates with the user program by emulating a terminal. It continuously monitors and controls the status of the modem cards by sequential polling. It provides modem control signals, both pulse and DTMF (tone) dialing control, and loopback control for up to 7 modem cards. The controller has two RS232C/V.24 asynchronous terminal connections. One connection is used as a diagnostic port allowing temporary connection of a terminal for use in commissioning or testing. The other RS232C/V.24 port allows an alternative connection to the CPU for applications where an 8-Channel Multiplexer is not required. This permits the Systems Modem to function as a rack of intelligent modems in any data systems application. The general purpose control protocol permits use with any computer or calculator which does not support auto-dialing modems.

Diagnostic facilities include local analog and remote digital loopback under user program or diagnostic terminal control.

37213A Modem Card

The 37213A is a single card full-duplex modem. It will communicate with any Bell 212A compatible modem at 1200 bits/s, synchronous or asynchronous, or 300 bits/s asynchronous, and CCITT V.22 Alternatives A and B compatible modems at 1200 bits/s. The modem is compatible with Racal-Vadic VA3450 Series Triple Modems and the HP 35016A Remote Support Modem (212 and 103 modes).

The modem can perform both pulse and DTMF (tone) dialing under user program control. It also incorporates auto-answer operation with auto-speed detection and configuration of the port speed.

An RS232C DTE connector provides a synchronous or asynchronous interface for applications other than with the 8-Channel Multiplexer.

37215A

Modem Interface Card

For applications where telephone company (PTT) supplied modems must be used, or a modem is already available, the 37215A Modem Interface Card may be used in place of a 37213A Modem Card.

The interface card provides buffered RS232C and CCITT V.24/V.28 compatible lines for controlling all common switched-line full-duplex modems. With auto-answer modems, the interface card provides auto-configuration of the port speed.

Auto-dialing is not possible with the 37215A and an external modem.

37216A

Terminal Interface Card

The 37216A Terminal Interface Card allows the connection of local hardwired terminals to unused card slots in the 37214A Modem Card Cage. Each terminal interface card permits the connection of one terminal to one port of the 8-Channel Multiplexer.

Approval Information

In most countries, only telephone company (PTT) approved modems may be connected to the public switched telephone network. Hewlett-Packard has applied for approval of the Systems Modem in several countries.

The HP Systems Modem is approved for use in the USA and UK with approval pending in several other countries. For the most up-to-date information consult your local HP Sales and Service Office.

Safety Information

The product meets:

UL Requirements for : EDP equipment
Office appliances
Business equipment

CSA Requirements for : EDP equipment

UL and CSA labels are applied to equipment shipped to the USA and Canada.

Configuration Information

Computer Compatibility

The HP Systems Modem is hardware compatible with the 12792A/B Multiplexer installed in the HP 1000 M/E/F-Series Computer Systems, and with the 12040A/B Multiplexer installed in the HP 1000 A/L-Series Computer Systems.

Racking Compatibility

The HP Systems Modem can be mounted in the 29402B upright cabinets or in HP 1000 Systems with upright cabinet configurations.

Software Support

Support for the HP Systems Modem is included in the firmware of the 12792B and 12040B Multiplexers. The 12792A and 12040A Multiplexers require firmware update kits 12792B opt 001 and 12040B opt 001 respectively.

37215A Modem Interface Compatibility

The 37215A Modem Interface Card is compatible with the following modems:

Bell 212A
Penril 300/1200
Rixon T212A
Racal Vadic 3450 Series Triple Modems
General Datacom 212A
British Telecom Modem 27
Racal Milgo MPS 1222

Additional Equipment Required for Installation

For the 37214A:
12828-60002 Interface Cable
(This cable is included in Option 002 of the 12792B and 12040B 8-Channel Multiplexers).

For the 37213A:
15561A Telephone cable, Bell modular telephone jack
or 15562A Telephone cable, British Telecom modular telephone jack
or 15563A Telephone cable, Spade terminals

For the 37215A:
15564A Modem Interface cable

For the 37216A:
The 37216A accepts the same terminal interface cables as would be used with the RS232C Connector Panel of the 8-Channel Multiplexer.

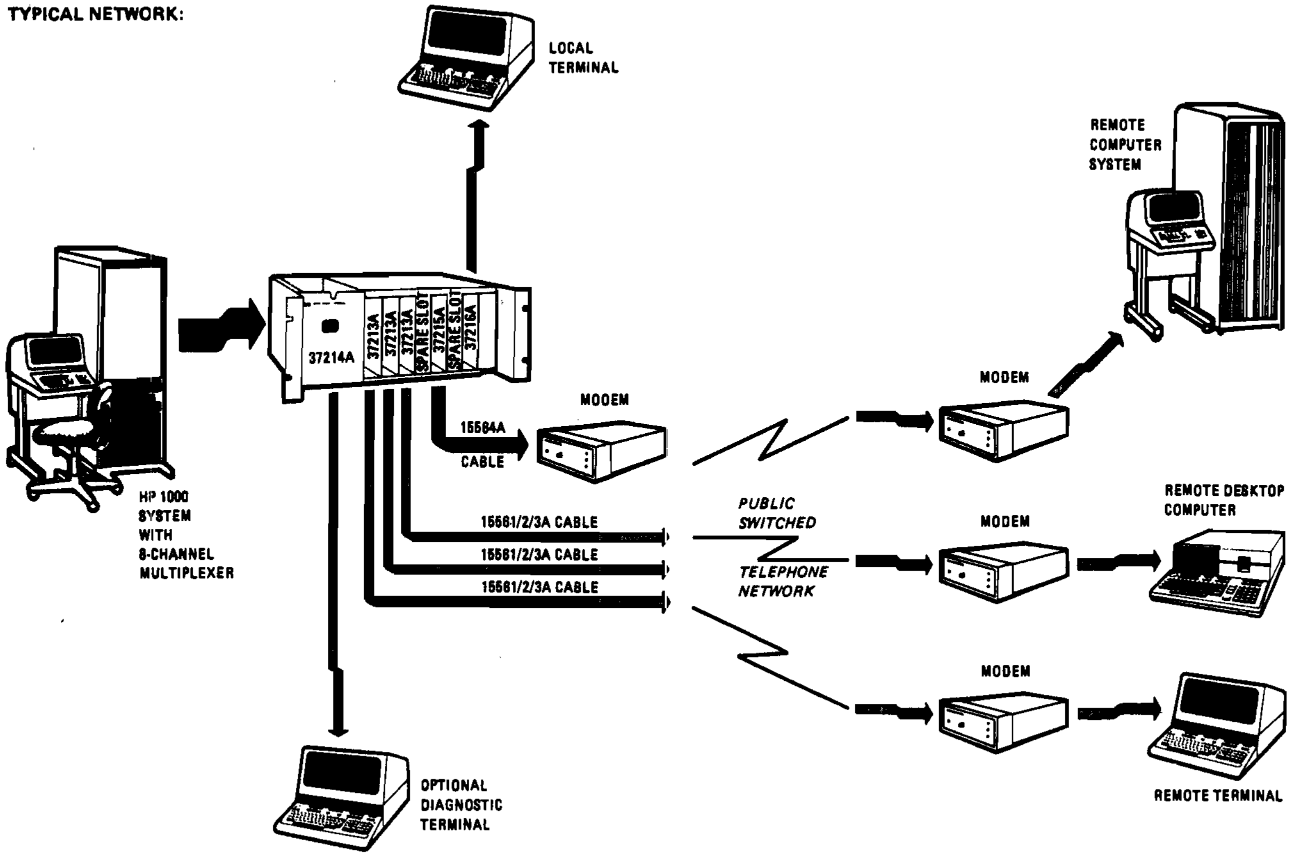
Installation

No complicated modem strapping is necessary on installation since all modem control and operating modes are under user program control.

Applications

- Distributed processing.
- Remote data acquisition – financial, engineering, scientific.

TYPICAL NETWORK:


LOCAL TERMINAL
REMOTE COMPUTER SYSTEM
37214A
37213A
37213A
37213A
SPARE SLOT
37215A
SPARE SLOT
37216A
HP 1000 SYSTEM WITH 8-CHANNEL MULTIPLEXER
MODEM
15564A CABLE
MODEM
15561/2/3A CABLE
15561/2/3A CABLE
15561/2/3A CABLE
PUBLIC SWITCHED TELEPHONE NETWORK
MODEM
REMOTE DESKTOP COMPUTER
MODEM
REMOTE TERMINAL
OPTIONAL DIAGNOSTIC TERMINAL

- Off-hour (night) data retrieval for order entry and inventory control.
- Automatic call back of remote terminals for added security and centralised phone billing.
- Electronic mail.

Specifications

37213A Modem Card

Modes: Full-duplex on Dial-up lines.

Bell 212A and CCITT V.22 Alternatives A and B compatible at 1200 bits/s.

Data Rates: Synchronous

212 or V.22 mode; 1200 bits/s ± 0.01%.

Asynchronous

103 mode; 0 to 300 bits/s.

212 or V.22 mode; 1200 bits/s nominal.
(Character Length; 9 or 10 bits)

Transmit Level: –9 dBm maximum (600Ω impedance).

V.22 Mode Guard Tone: 6 dB ± 1 dB below main power level.

Carrier Detect Threshold: Carrier detect OFF < –48 dBm.
Carrier detect ON > –45 dBm.

Connect Methods: Automatic Originate by pulse dialing or DTMF (tone) dialing. Call aborts after 45s if no answer received.

Automatic Answer with automatic speed detection and configuration. Disconnects after 16 - 18s if no carrier received.

Automatic Disconnect in loss of carrier situations, response time < 1s.

DTE Interface Connector: EIA RS232C and CCITT V.24/V.28 compatible; 25-pin female D-type connector.

37215A Modem Interface Card

Modem Interface: EIA RS232C and CCITT V.24/V.28 compatible; 25-pin female D-type connector.

37216A Terminal Interface Card

Terminal Interface: EIA RS232C and CCITT V.24 compatible; 25-pin female D-type connector.

37214A Modem Card Cage

Card Slots: 7 card slots available for Modem or alternative Interface Cards.

Diagnostic Terminal Connector: EIA RS232C and CCITT V.24/V.28 compatible; 25-pin female D-type connector.

Diagnostics: Local analog loopback, remote digital loopback and self test under user program or diagnostic terminal control.

Dimensions:

Height: 178 mm (7 in).
Width: 438 mm (17.25 in).
Depth: 330 mm (13 in).
(Excluding mounting ears)

Weight:

Net: 7.5 kg (16.5 lb).
Shipping: 10.3 kg (22.7 lb).

Power:

Voltages: 100/120/220/240V.
Tolerance: +5%, –10%.
Frequency: 48 to 66 Hz.
Power Consumption: 70 VA (max).

Accessories

15561A Modem Telephone Cable: Bell modular telephone jack. 2.1m (7 ft).

15562A Modem Telephone Cable: British Telecom modular telephone jack. 3m (9.8 ft).

15563A Modem Telephone Cable: Spade Terminals. 3m (9.8 ft).

15564A Modem Interface Cable: 5m (16.4 ft).

Ordering Information

37213A Modem Card

37214A Modem Card Cage: Option 001 UK Auto-dial operation.
Option 910 Extra operating and service manual.

37215A Modem Interface Card

37216A Terminal Interface Card

For more information, contact your local HP Sales Office or –
In US: Call • East (301) 258-2000 • Midwest (312) 255-9800 • South (404) 955-1500 • West (213) 877-1282
Or, write Hewlett-Packard, 3000 Hanover Street, Palo Alto, California 94304.
In Europe: Hewlett-Packard S.A., 7 rue du Bois-du-Lan, P.O. Box, CH-1217 Meyrin 2 - Geneva, Switzerland.
In Japan: Yokogawa-Hewlett-Packard Ltd., 3-29-21 Takaido-Higashi, 3-chome, Suginami-ku, Tokyo, 68, Japan.

Printed in U.K. Data subject to change 5953-5400

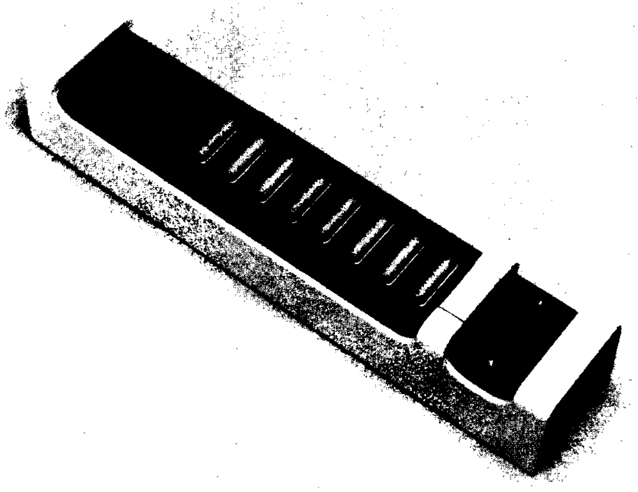
RS-232-C/V.24 TO FIBER OPTIC MULTIPLEXER

Model 39301A

TECHNICAL DATA DECEMBER 1983

Features

- **EXTEND UP TO 16 RS-232-C/V.24 CHANNELS TO 1.25 km STANDARD, 2.5 km WITH SELECTED CABLE**
- **DATA UP TO 19.2 kbps ON EACH OF 16 CHANNELS SIMULTANEOUSLY**
- **SYSTEM IMMUNITY TO EMI SOURCES SUCH AS LIGHTNING STRIKES**
- **SECURE DATA TRANSMISSION**
- **ELIMINATION OF SPARK HAZARDS IN VOLATILE ATMOSPHERES**
- **BUILT-IN FAULT ISOLATION CAPABILITY**
- **LOW INSTALLATION COSTS DUE TO LIGHTWEIGHT FIBER OPTIC CABLE**



Description

A pair of HP 39301A Multiplexers interconnected with Hewlett-Packard HFBR-3000 Series Fiber Optic Cable, may be used to extend up to 16 full duplex RS-232-C/V.24 channels up to 2.5 km (8200 ft.). Figure 1 shows a typical link configuration between a host CPU and a cluster of 16 terminal devices.

This link provides an easy way to incorporate the advantages of fiber optic links into local area terminal communications. These advantages include immunity to electromagnetic interference of all types, from lightning strikes to noisy electric motors, and freedom from static discharge and crosstalk. The fiber optic cable also provides security for data as it will not radiate electromagnetic signals. In volatile atmospheres, there is no need for special cable

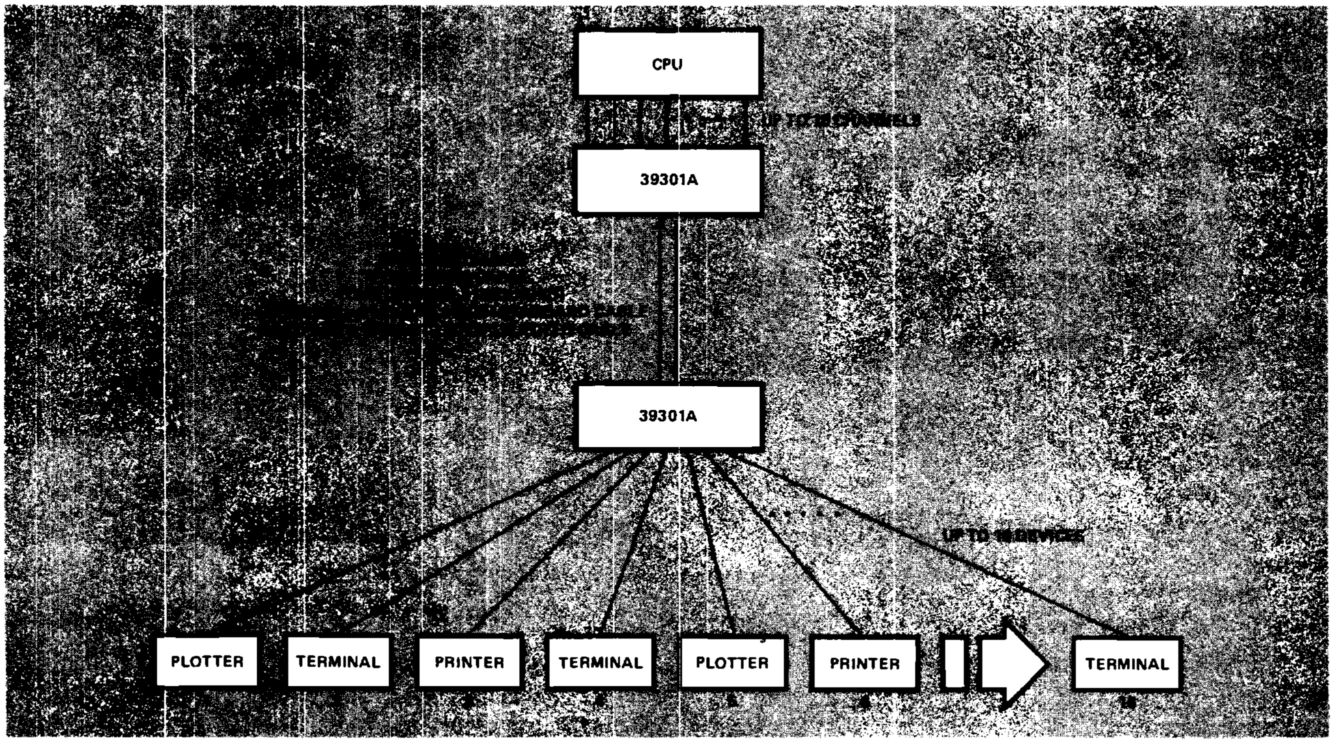


Figure 1. Typical Link Configuration

shielding because no sparks can be generated by this totally dielectric medium.

Each HP 39301A Multiplexer has eight RS-232-C/V.24 connectors. Each connector has both the Primary and Secondary Data channels available. This provides for a variety of possible configurations. These configurations include: sixteen independent asynchronous channels, eight independent asynchronous channels with handshake control lines, or eight independent synchronous channels with Data Terminal Equipment (DTE) supplied clock signals. The cables required to accomplish any combination of these connections are described in the Typical Configurations Section of this Data Sheet.

Each of the Primary and Secondary Data channels may operate any asynchronous protocol up to 19200 bps. Each channel may be used independently with different protocols and data rates without adjustments to the Multiplexer. This is possible because the 39301A operates as a time division multiplexer, sampling each of the 16 data channels at a 200 kHz rate. This sampled data is serialized and transmitted in real time at a rate of 7 Mbaud over the interconnecting HFBR-3000 Series Fiber Optic Cable to the companion 39301A. This serial data is then reconverted to 16 parallel channels and distributed to the respective Primary or Secondary Data channels.

Specifications

SYSTEM PERFORMANCE

A system consists of two or more 39301A's interconnected by fiber optic cable assemblies.

Transmission Distance: The usable distance between 39301A's is determined by the optical fiber and connectors used.

[illegible]

NOTES:
1. Guaranteed with HFBR-3000 Series cable assemblies.
2. Contact HP Sales Office for expected performance of specific fiber and connectors used.

System Bit Error Rate: One error in 10^9 bits typical.

ENVIRONMENTAL

Storage Temperature: -40°C to +75°C
Operating Temperature: 0°C to +55°C
Relative Humidity: 95%

PHYSICAL CHARACTERISTICS

Size: 42.5 x 8.9 x 7.2 cm
(16.75 x 3.5 x 2.85 inches)
Weight: 2.2 kg (4.75 lbs)
Shipping Weight: 3.4 kg (7.5 lbs)
Power Requirements: 18 VA Maximum
Power Cord Length: 2.3 m (7.5 ft.)

REGULATION COMPLIANCE

RFI/EMI:
- VDE 0871 level A
- FCC Class A

Safety Approvals:
- UL478, UL114 for EDP and office equipment
- CSA C22.2-154 for EDP equipment
- VDE 0730 part 2P for EDP and office equipment
- Complies with IEC standard #380 and #435 for EDP and office equipment

ELECTRICAL CHANNEL INTERFACE

Electrical: Conforms to EIA standard RS-232-C Section 2 (CCITT V.24) for the assigned pins.

Pulse Width Distortion: +/− 6 μs maximum at data rates to 19.2 kbps
(Operated with RS-232-C load of 3K ohms and 2500 pF).

Electrical Connector: Female 25 pin subminiature "D"

PIN ASSIGNMENTS

[illegible]

Notes:
1. Pins 1 and 7 are internally connected.
2. Pin 6 is internally hardwired "on" to +12V through a 316 ohm resistor.
3. Data to 39301A.
4. Data from 39301A.

OPTICAL CHANNEL INTERFACE

Transmitter Optical Output Flux: −13 dBm
(50 μW) minimum at 820 nm

Receiver Optical Input Flux: -31 dBm
(0.8 μW) minimum at 820 nm

Fiber Optic Port Connector: HFBR-4000 compatible. (HFBR-4000 installed on HFBR-3000 Series Fiber Optic Cables. Optional SMA style connector adapters are available from HP sales offices.)

INDICATORS AND SWITCHES

AC Line Indicator: When ON indicates that AC power is on.

Carrier Received Indicator: When ON, indicates that the 39301A is receiving a modulated signal from the remote transmitter.

Loopback Switch: In the TEST position, enables an electrical loopback at the interface between the multiplexer electronics and the fiber optic transceiver circuitry. The "Carrier Received Indicator" is disabled when this switch is in the TEST position.

DTE Interface Configurations

Each RS-232-C/V.24 connector on the HP 39301A Multiplexer can be interfaced to a variety of Data Terminal Equipment (DTE) by use of properly configured interconnecting RS-232-C/V.24 data cables. Each connector provides two independent full duplex asynchronous channels on the Primary and Secondary Data lines. Therefore, 16 total channels are available on any 39301A link. The following figures will describe the cable configurations for four typical DTE connections. Only one end of the full 39301A link is shown in each figure. The opposite end will be a mirror image in all cases, therefore, two of the illustrated RS-232-C/V.24 data cables will be required to complete each link. Shielded RS-232-C/V.24 cables are recommended in all cases to minimize radio frequency emissions. Any of the DTE configurations described may be intermixed and connected to a 39301A link simultaneously with the only limitation being that no more than 16 full duplex channels are available.

ASYNCHRONOUS DATA ONLY DTE

It is possible to connect one or two "Data Only" DTEs to each connector on the 39301A. Figure 2 shows the configuration for a single DTE connection utilizing the Primary Transmitted/Received Data pins on the 39301A connector. Figure 3 shows the configuration of HP's 8120-3569 Dual Channel RS-232-C/V.24 Adapter Cable. This 8120-3569 Cable can be used to separately access both the Primary and Secondary Data channels on each 39301A connector. Then two of the cables shown in Figure 2 can be used to extend these channels out to two separate "data only" DTEs. This 8120-3569 Cable will enable up to 16 "data only" DTEs to be connected to each 39301A link.

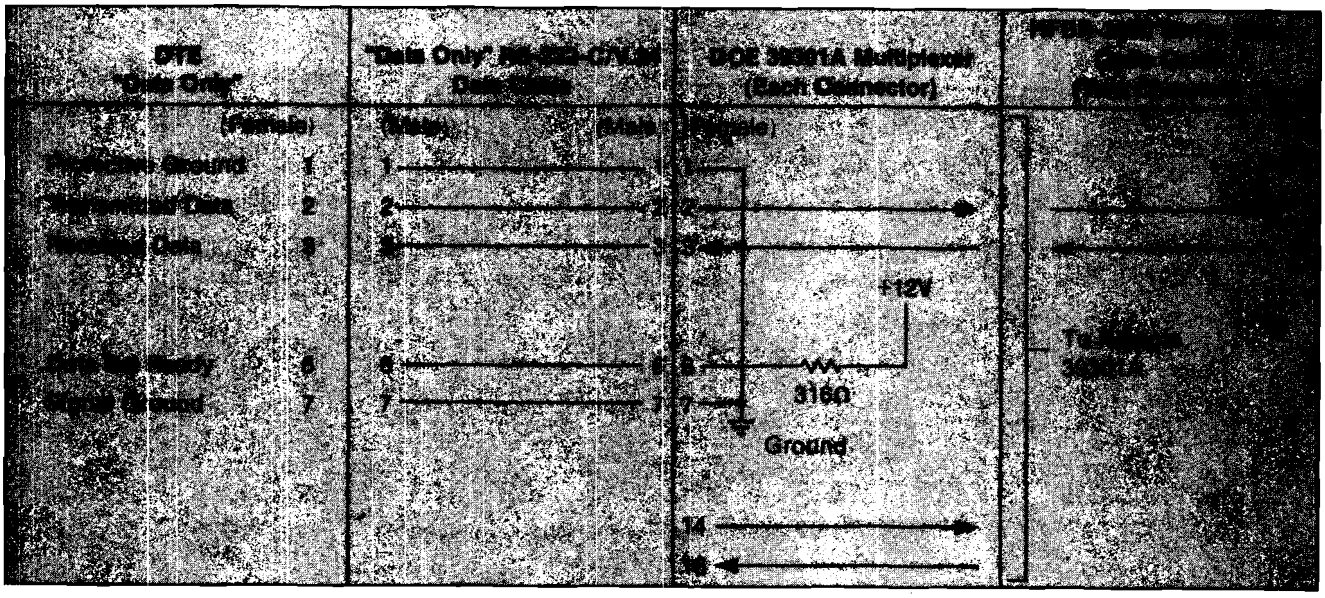
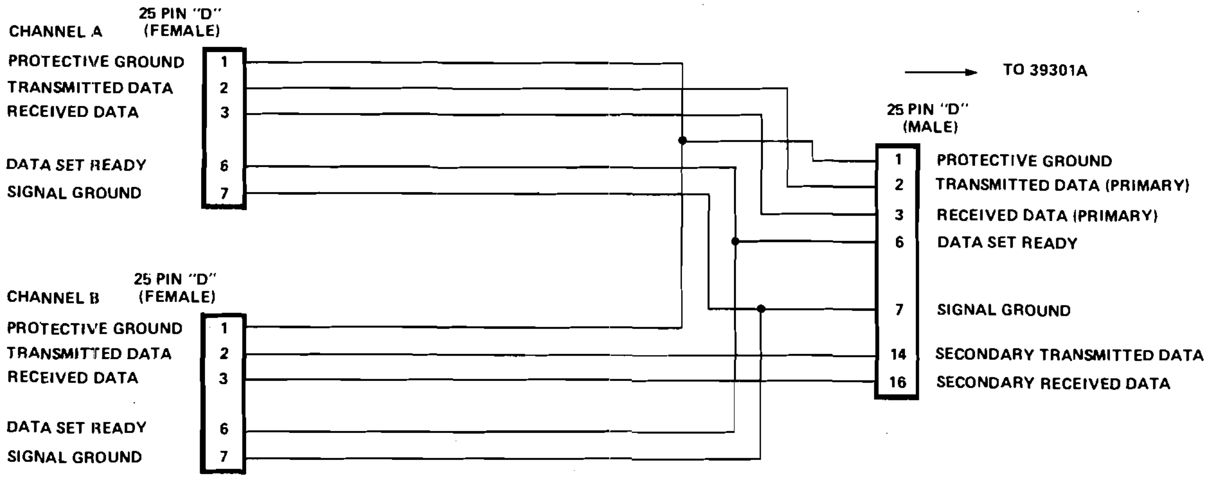

DTE
"Data Only"
(Female)
"Data Only" RS-232-C/V.24
(Male)
(Male)
(Female)
1
2
3
6
7
+12V
316Ω
Ground
14
16

Figure 2. Asynchronous Data Only Configuration


CHANNEL A
25 PIN "D" (FEMALE)
PROTECTIVE GROUND 1
TRANSMITTED DATA 2
RECEIVED DATA 3
DATA SET READY 6
SIGNAL GROUND 7
CHANNEL B
25 PIN "D" (FEMALE)
PROTECTIVE GROUND 1
TRANSMITTED DATA 2
RECEIVED DATA 3
DATA SET READY 6
SIGNAL GROUND 7
TO 39301A
25 PIN "D" (MALE)
1 PROTECTIVE GROUND
2 TRANSMITTED DATA (PRIMARY)
3 RECEIVED DATA (PRIMARY)
6 DATA SET READY
7 SIGNAL GROUND
14 SECONDARY TRANSMITTED DATA
16 SECONDARY RECEIVED DATA

NOTE: THE SEPARATION BETWEEN MALE AND FEMALE CONNECTORS IS 0.6m (2 ft).

Figure 3. HP 8120-3569: Dual Channel RS-232-C/V.24 Adapter Cable

ASYNCHRONOUS DATA PLUS HANDSHAKE DTE

If a DTE requires that normal modem handshake lines be active for control purposes, the Secondary Data channel on each HP 39301A connector can be used to establish this connection between the host CPU and the remote terminal. Figure 4 shows one possible cable configuration using the Secondary Data channel to interconnect the DTE's Request to Send/Clear to Send handshake lines. Up to eight DTEs with handshake lines may be connected to a 39301A link in this way.

Note that pin 6, Data Set Ready, on each 39301A connector is hardwired "on" to +12V through a 316 ohm resistor. If the connected DTE does not require this signal, it may be eliminated from the RS-232-C/V.24 data cable.

SYNCHRONOUS DATA WITH DTE SUPPLIED CLOCK

Although the 39301A does not provide a clock for synchronous data transmission, synchronous DTE may be interconnected by the 39301A link if the DTE can supply the necessary clock signal. Figure 5 illustrates the use of a 39301A connector's Secondary Data channel to accomplish this type of DTE connection. Up to eight synchronous data DTEs with their own clock lines may be connected to a 39301A link.

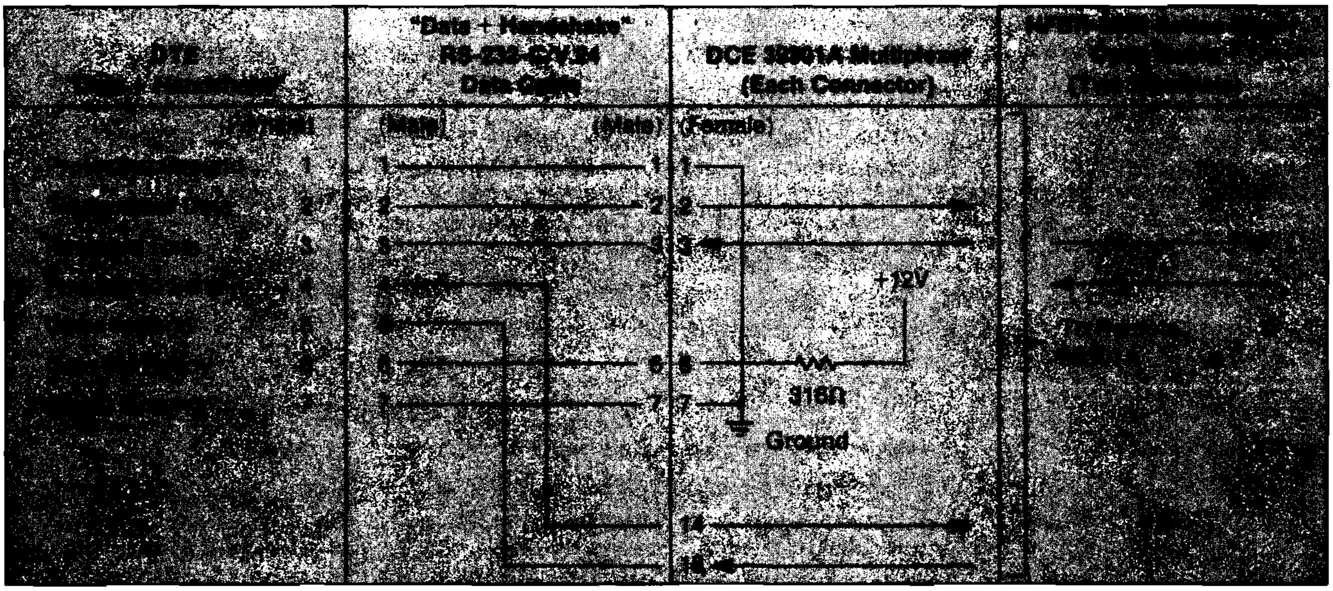

DTE
"Data + Handshake"
RS-232-C/V.24
Data Cable
DCE 39301A Multiplexer
(Each Connector)
(Male)
(Male)
(Female)
1
2
3
4
5
6
7
14
15
+12V
316Ω
Ground

Figure 4. Asynchronous Data Plus Handshake Configuration

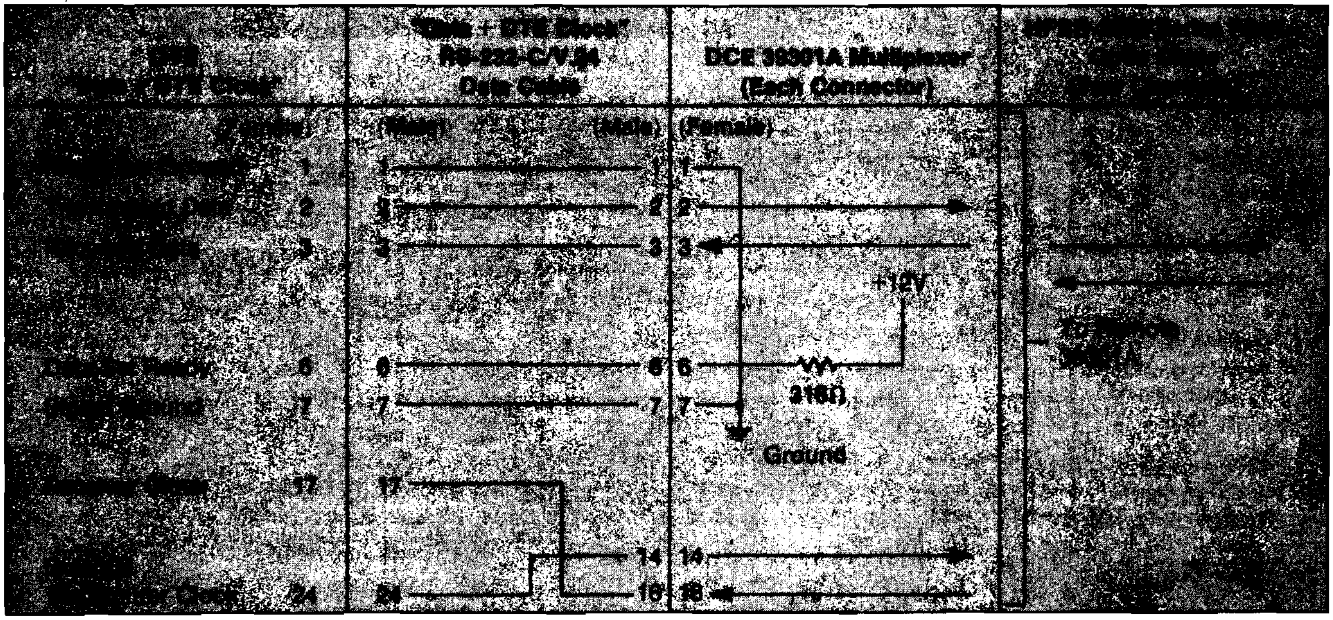

DTE
"Data + DTE Clock"
RS-232-C/V.24
Data Cable
DCE 39301A Multiplexer
(Each Connector)
(Male)
(Male)
(Female)
1
2
3
6
7
17
14
24
15
+12V
316Ω
Ground

Figure 5. Synchronous Data with DTE Supplied Clock Configuration.

System Configurations

Point-to-Point: See Figure 1

The HP 39301A's can be configured in a normal point-to-point fashion utilizing a two channel fiber optic cable assembly to interconnect them.

Multiple Node Loop:

Several 39301A's can be interconnected in a simple closed loop configuration using single channel fiber optic cable assemblies to interconnect the transmitter of each 39301A to the receiver of the subsequent 39301A. This configuration allows one multiplexer at the computer center to address several different groups of terminals at different locations in a local facility. A maximum of 16 asynchronous "Data Only" DTE connections can be made around the loop. The unused channels at each multiplexer must be externally looped back on the 25 pin connectors, (i.e., tie pins 2 to 3 and 14 to 16). The maximum data rate of any channel in the loop is determined by the number of multiplexers in the loop and the amount of distortion that the interconnected DTE's can tolerate.

Number of 39301A's	Maximum Channel Data Rate
Up to 3	19.2 Kbps
Up to 6	9.6 Kbps
Up to 15	4.8 Kbps

This data rate limit is due to the accumulated distortion thru the loop. The accumulated distortion will be within the 25% limits of EIA Standard RS-404, Standard for Start-Stop Signal Quality Between Data Terminal Equipment and Non-Synchronous Data Communications Equipment.

Installation

The 39301A Multiplexer and the interconnecting HFBR-3000 Series Fiber Optic Cable is designed for easy installation. Complete details are provided in the Installation, Operating, and Service Manual supplied with each 39301A.

It is recommended that the 39301A Multiplexer be securely mounted to protect the attached data cables. The 39301A is designed for surface or EIA standard 19 inch width rack mounting. Standard Rack/Surface Mounting Hardware supplied with each 39301A allows installation in a standard open rack or flush mounting on any convenient flat surface. Optional Recessed Rack Mounting Hardware (Option 001) allows mounting inside standard racks with closed doors without damage to the attached cables.

The HFBR-3000 Series Fiber Optic Cable required to interconnect the 39301A Multiplexers is available in several configurations. These configurations are detailed in the Support Products Section of this Data Sheet. Two channels of this cable are required to operate the link. This cable is suitable for installation in cable trays, conduits and ducts. The cable will operate in environments from -20°C to +70°C and 95% Relative Humidity. Standard cable installation techniques and equipment may be used with the minor precautions stated in the 39301A Installation, Operating, and Service Manual. The precautions include maintaining the minimum bend radius of 25mm (1 in.) and maximum tensile load of 300N (67 lb) per channel during installation.

If junction box or bulkhead splices are required in a cable run, or a link is reconfigured to a longer distance requiring additional fiber optic cable to be added to the original installation, HFBR-3099 Cable Coupling Hardware may be used to splice these cables together. The HFBR-3099 is supplied with each factory connectored HFBR-3000 Series Cable or may be ordered separately. Each in-line HFBR-3099 Coupler produces a 2 dB optical power loss in the cable run. This loss will affect the maximum separation between 39301A's by the distance equal to 2 dB ÷ cable attenuation in dB/km. For example, if standard HFBR-3000 series cable is used the maximum link length will be reduced by 2 dB ÷ 8 dB/km = 250 m for each intermediate HFBR-3099 used.

The RS-232-C/V.24 data cables required for connection to various Data Terminal Equipment are detailed in the Typical Configurations Section of this Data Sheet. It is recommended that shielded cables are used for these connections for maximum suppression of radio frequency emissions. These cables should be no longer than 15m (50 ft.) for compliance with the EIA and CCITT Standards, unless low capacitance cable is used.

Service

The 39301A is designed with easy-to-use link fault isolation facilities. Loopback techniques utilizing the built-in loopback switch and fiber optic loopback cable supplied with each 39301A Multiplexer are used to quickly isolate link failures to either 39301A Multiplexer, the HFBR-3000 Series Fiber Optic Cable, or the interconnected Data Terminal Equipment. These procedures are described in the Installation, Operating, and Service Manual supplied with each 39301A. 39301A Multiplexers or HFBR-3000 Series Fiber Optic Cables may be self-serviced by the customer or returned to the nearest Hewlett-Packard Sales Office for service.

Customer self-service may be accomplished for the Multiplexer by following the procedures outlined in the Installation, Operating and Service Manual to identify the failed subassembly. Replacement subassemblies are available through HP Sales Offices. HFBR-3000 Series Fiber Optic Cables may be repaired by using the HP HFBR-0100 Connector Assembly Tool kit to splice or reconnector a damaged cable.

Hewlett-Packard service is available for the 39301A by returning the Multiplexer to the nearest HP Sales Office. This service is available either on Monthly Contract basis or for a Time and Materials charge. The HFBR-3000 Series Cable will be repaired on a Time and Materials basis upon return to the nearest HP Sales Office.

Support Products for the HP 39301A

39301A MOUNTING HARDWARE

Rack/Surface Mounting Hardware:
Supplied standard with each 39301A. Available separately as part HP 1600-1090.

Recessed Rack Mounting Hardware:
Supplied as Option 001 to the 39301A. Available separately as part HP 1600-1092.

39301A FIBER OPTIC LOOPBACK CABLE

Supplied standard with each 39301A. Available separately as part HP 5061-2694.

39301A INSTALLATION, OPERATING, AND SERVICE MANUAL

Supplied standard with each 39301A. Extra copies available as part HP 39301-90001.

HP 8120-3569 DUAL CHANNEL RS-232-C/V.24 ADAPTER CABLE

Enables two Data Terminal Equipment devices to be connected to each 39301A RS-232-C/V.24 connector port. A wiring diagram is shown in Figure 3 of this Data Sheet. The length is 0.6m (2 ft.)

HFBR-3000* SERIES FIBER OPTIC CABLE

	Single Channel (Two Req.) OR	Dual Channel (One Req.)
With Factory Installed HFBR-4000 Fiber Optic Connectors	HFBR-3000* or HP 39200A*	HFBR-3100* or HP 39200B*
Without Factory Installed Connectors	HFBR-3200*	HFBR-3300*

Two channels of HFBR-3000 Series Fiber Optic Cable are required to interconnect the HP 39301A Multiplexers. This cable is available in several forms as shown in the table above. It may be ordered in any length in one metre increments up to 1000 metres (3280 ft.)

*Detailed specifications for these products are available from HP sales offices.

HFBR-0100* CONNECTOR ASSEMBLY TOOLING KIT

This kit allows the installation of HFBR-4000 Fiber Optic Connectors onto HFBR-3000 Series Fiber Optic Cables in the field. It is used for system installation purposes if HFBR-3200/3300 unconnectored cables are used. It may also be used for field repair of HFBR-3000 Series Fiber Optic Cables.

HFBR-4000* FIBER OPTIC CONNECTORS

These connectors are compatible with the HFBR-3000 Series Fiber Optic Cable and the fiber optic ports on the 39301A.

HFBR-3099* FIBER OPTIC CABLE COUPLING HARDWARE

This hardware enables two cables with HFBR-4000 connectors to be coupled together for link extension or repair splices. See Installation Section of this Data Sheet for limitations on use of the HFBR-3099.

Ordering Information

HP 39301A: RS-232-C/V.24 TO FIBER OPTIC MULTIPLEXER

Two are required per link. Each 39301A is supplied with standard Rack/Surface Mounting Hardware, a Fiber Optic Loopback Cable and an Installation, Operating, and Service Manual.

Option 001: Recessed Rack Mounting Hardware

Required Power Supply Option: One required per 39301A

Option 210:	100V 50/60Hz Operation
Option 212:	120V 50/60Hz Operation
Option 222:	220V 50/60Hz Operation
Option 224:	240V 50/60Hz Operation

HP 8120-3569: DUAL CHANNEL RS-232-C/V.24 ADAPTER CABLE

This cable may be used to separately access both Primary and Secondary Data channels on each 39301A connector. Eight of these cables will enable up to 16 "data only" DTE to be connected to each 39301A.

HFBR-3000 SERIES FIBER OPTIC INTERCONNECTING CABLE

Two channels are required per link.

See Support Products Section of this Data Sheet for product choices.

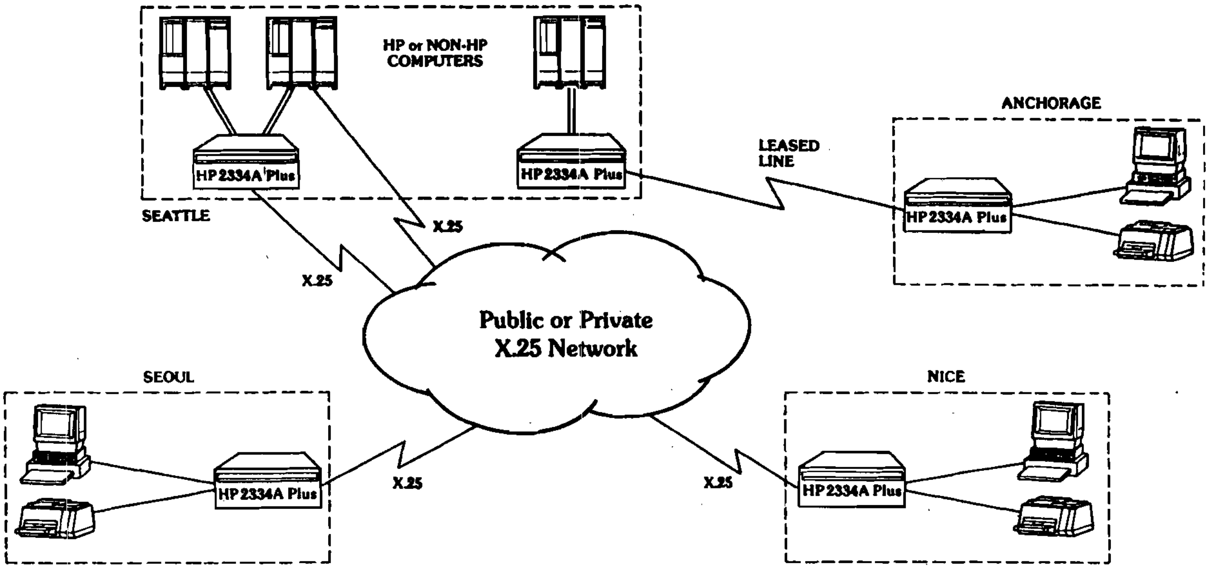
HEWLETT PACKARD

HEWLETT-PACKARD

Product Number HP 2334A

HP 2334A Plus – X.25 Multiplexer

HP AdvanceNet



The HP 2334A Plus – X.25 MULTIPLEXER is designed to connect up to 16 remote workstations (terminals, personal computers, printers, plotters) to a host computer. Two types of configuration are supported for each HP 2334A Plus: X.25 Statistical Multiplexer and X.25 Cluster Controller.

Features and Benefits

- **Reduce communication cost**
  - Remote connection of up to 16 RS-232-C workstations expandable from 4 to 16 devices in groups of 4.
  - Can work in Statistical Multiplexer or in Cluster controller configuration over a leased line or an X.25 Packet Switching Network.
  - Implementation of X.25, X.3, X.28, X.29, X.121 November 1980 CCITT recommendations. The HP 2334A Plus is certified on most X.25 Public Packet Switching Networks.
  - Host computer port contention.
- **Transparent user access (in Statistical Multiplexer)**
  - Support of HP applications like HPWORD, HPDESK, Advancemail, etc.
  - New design results in high performance for remote terminals and printers.
  - Multiple computer access.
- **Friendly configuration**
  - Default configuration for statistical Multiplexers using a leased line.
  - Menu-driven configuration.
  - Online modifiable parameters.

Functional Specifications

Asynchronous Ports Specifications

The HP 2334A Plus uses a 4-port interface that supports full-duplex, asynchronous RS-232-C, CCITT V.24/V.28 point to point connections at 110,150,300,1200,2400,4800, 9600 or 19200 bps.

The 4-port interface has modem control capability with seven signals (TX, RX, signal ground, RTS, CTS, DCD, DTR).

Up to four interfaces can be installed in the same HP 2334A Plus, allowing up to 16 connections. These connections can be made to workstations or hosts, that are local or remote.

Auto-parity (odd, even) and auto-speed (up to 19200 bps) are available on each HP 2334A Plus port.

Binary transfer with no flow control can be done in blocks of maximum 128 bytes. For all HP applications (e.g. Advancelink, HPWord, Advancemail) using binary transfer, more details are given in the HP 2334A Plus Configuration Guide.

X-ON/X-OFF or ENQ/ACK flow control and HP block mode handshake methods can be chosen.

Synchronous Port Specifications

The HP 2334A has one RS-232-C, CCITT V24/V28 synchronous full-duplex composite interface to connect it to a remote site via an:

- Analog leased line
- Digital leased line
- Dial-up line
- X.25 Packet Switching Network (Public or Private)

Hardwired connection for the synchronous composite link is not supported; synchronous, full-duplex, short-haul modems or a modem eliminator should be used.

The synchronous interface is supported at any speed between 1200 bps and 19200 bps with external clocking. Speeds of 4800, 9600 or 19200 bps can be selected with internal clocking (modems supported and recommended are described later in this datasheet).

X.3,X.28,X.29 Specifications

The HP 2334A Plus follows the CCITT X.3/X.28/X.29 recommendations (November 1980) which allow it to act as a private Packet Assember/Disassembler (PAD). The standard 18 X.3 parameters are supported and additional HP-defined local parameters are available for enhanced functionality with HP devices. These local HP parameters are:

- Parity
- Local block mode control
- Compatibility with ATP/ADCC (cluster only)
- Block mode terminator (forward packet)
- Data compaction
- Error message to host
- Break at application level
- Information message
- Asynchronous modem signal flexible control
- Auto-speed and auto-parity
- Block mode buffer size
- Asynchronous modem signal timer
- HP 2334A Plus byte count
- Define remote profile

X.25 Specifications

The HP 2334A Plus has an X.25 interface which is fully compatible with the November 1980 version of the CCITT X.25 recommendation :

Level 1: Physical layer

- X.21 bis, RS-232-C, CCITT V24/V28 (up to 19200 bps).

Level 2: Data link layer

- LAP-B protocol.
- Modulo 8 sequence number.
- Window size (1-7).
- Operates as DCE or as DTE.

Level 3: Network level

- Switched Virtual Circuit (SVC) or Permanent Virtual Circuit (PVC).
- Up to 17 virtual circuits simultaneously.
- Window size (1-7).
- Packet size (128 bytes).
- Supports D,M and Q bits.

X.25 and other supported facilities:

- Window size negotiation.
- Incoming calls barred.
- Outgoing calls barred.
- One way outgoing SVC.
- One way incoming SVC.
- Closed user group.
- Closed user group outgoing.
- Closed user group incoming.
- Closed group incoming barred.
- Closed group outgoing barred.
- Bilateral closed user group.
- Bilateral closed outgoing.
- Reverse charging request.
- Reverse charging acceptance.
- Packet size negotiation.
- Flow control parameter negotiation.
- Throughput class negotiation.

Additional Functionalities

- Automatic connection to pre-configured computer port.
- Symbolic host computer addressing, up to 16 names.
- Up to 3 groups of pool ports can be defined.
- Test port for configuration and diagnostics (password protected) accessible from any terminal connected on the HP 2334A Plus.
- Single port reset command and HP 2334A Plus reset command available.
- User-defined welcome message with maximum 20 characters and user-defined PAD message header with 10 characters.
- Default configuration for Statistical Multiplexer configuration.
- Local User Group definition.
- Host computer port contention.
- Data compaction.

Supported and Recommended Products (Statistical Multiplexer)

(Refer to point "Supported Computer Interfaces" for more details on Cluster Controller configuration).

Supported Workstations

- *Terminals*
  - HP 2382A
  - HP 2392A
  - HP 2393A
  - HP 2394A
  - HP 2397A
  - HP 2621B
  - HP 2622A
  - HP 2623A
  - HP 2624B
  - HP 2625A
  - HP 2626A
  - HP 2626W
  - HP 2627A
  - HP 2628A
  - HP 2645A
  - HP 2648A
  - HP 3081A
- *PC's*
  - HP 150A
  - HP 150B
  - HP 150 II
  - HP 110
  - HP 110 Plus
  - VECTRA
- *Printers*[1]
  - HP 2563A
  - HP 2564A
  - HP 2565A
  - HP 2566A
  - HP 2602A
  - HP 2603A
  - HP 2631B
  - HP 2686A
  - HP 2686A Plus
  - HP 2687A
  - HP 2932A
  - HP 2933A
  - HP 2934A
- *Plotters*
  - HP 7440A
  - HP 7450A
  - HP 7470A
  - HP 7475A

Supported Applications

- *PC Applications*
  - Advancelink (150)
  - Advancemail (150)
  - Advancelink 2392
  - Advancemail (VECTRA)
- *HP 1000 Applications*

Forms 1000	4.1	QDM	4.0

- *HP 3000 Applications*

HPDESK	A.03.00	DICTIONARY	A.02.00
HPDRAW	A.03.00	DSG/3000	A.04.00
HPEASYCHART	A.03.00	HPFA	A.02.02
IDS	A.01.00	IFS	A.02.01
IMF	A.51.90	HPLIST	A.00.02
HPMENU	A.01.00	MM	A.07.06
HPMNT	A.00.01	PM	A.03.01
RAPID	A.01.09	HPSLATE	A.04.03
HPTELEX	A.02.00	TDP	A.03.11
HPTOOLSET	A.01.03	VISICALC	A.00.02
VPLUS	B.03.25	HPWORD	A.05.04
		HPACCESS	In progress

- *HP 9000 Applications*
  - UUCP with UNIX 5.0 or later

Supported Computer Interfaces

- HP 3000-ATP
- HP 1000-MUX
- HP 9000-MUX
- ADCC
- PSI
- INP

The HP 2334A Plus in Cluster Controller configuration is supported when connected to an HP 3000 computer used with MPE-VE, MPE-VR or a later release and the X.25 link/3000 (HP 32187A). For products supported in Cluster Controller configuration please refer to the datasheet of Product Number 32187A.

The HP 2334A Plus in Cluster Controller configuration is supported when connected to an HP 1000 computer used with RTE-A (A series) or RTE-6/VM (E/F series).

The X.25 interface on the HP 1000 is supported with LAP-B interface card (HP 12075A/12250A) and HP 1000 X.25 software (HP 91751A/R). For products supported in Cluster Controller configuration please refer to the datasheet of Product Number 91751A.

The HP 9000 computer is only supported in Statistical Multiplexer configuration with HP 27128A, HP 27140A, HP 98626A, HP 98228A, HP 98644A interfaces.

Non-HP computers may be connected to the HP 2334A Plus in Cluster Controller configuration via an X.25 interface supporting X.29 which complies with the 1980 CCITT recommendations.

Verified Modems

- *ASYNC modems*
  - HP 37212A
  - HP 35141A
  - HP 92205J
  - Racal Milgo MPS 1222
- *SYNC modems*
  - Codex 2620, 2640, 2680
  - Racal Milgo Alpha 96
  - Bell 2096A

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[1] *The ATP Term Type 26 is available with MIT UB delta 1 and can be used with the HP 2334A Plus. The term type 18 is available for the ADCC. The maximum combined throughput for the printers attached to one HP 2334A Plus is 600 lines per minute.*

Certified X.25 Packet Switching Networks

NORTH AMERICA	
– Canada	Datapac[2]
– US	Infonet
– US	Telenet
– US	Tymnet
– US	DDN
EUROPE	
– Austria	Datex-P
– Belgium	DCS
– Denmark	Datapak
– Finland	Datapak
– France	Transpac
– Germany F.R.	Datex-P
– Ireland	Eirpac
– Italy	Itapac[1]
– Luxemburg	Luxpac[2]
– Netherlands	Datanet1[1]
– Norway	Datapak
– Spain	Iberpac
– Sweden	Datapak
– Switzerland	Telepac
– UK	PSS
OTHER COUNTRIES	
– Australia	Austpac
– Brasil	Renpac
– Hong Kong	Datapak[1], Intelpak
– Israel	Isranet
– Japan	Venus-P
– Malaysia	Maypac
– Singapore	Telepac[1]
– South Africa	Saponet-P[2]
– South Korea	Datacom-net
– Taiwan	Pacnet

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[1] *Certification in progress. Please contact your Local HP Representative for latest certification status.*

[2] *The product has a temporary approval.*

Verified X.25 Switching Equipment

- HP Private Packet Network
- Dynapac model 8 (US only)

Customer Installation and Configuration

The customer is responsible for the installation of the HP 2334A Plus. The HP 2334A Plus Reference Manual and Configuration Guide are needed to install and configure the HP 2334A Plus (see references under "Documentation").

The initial configuration may be set up by a Hewlett-Packard Customer Engineer or System Engineer by ordering the HP 2334A Plus option 100. Before installing the HP 2334A Plus, the customer should obtain, install and verify the correct operation of any communication line, X.25 PSN access or any other equipment and facilities necessary to interface to the HP 2334A Plus.

Hewlett-Packard is liable only for the correct execution of the loop-back and self diagnostic tests. All hardware and software connections to the communication line, the X.25 PSN and non-HP computers are the customer's responsibility.

The add-on HP 40261A four-port interface or any upgrade kit may be installed by the customer or by any Hewlett-Packard Customer Engineer on a time and material basis.

Environmental Characteristics

Temperature Free Space Characteristics
- Operating: 0° to +55°C
- Non-operating: −40° to + 75°C

Relative Humidity (non-condensing)
- Operating: 5% to 95% at 40°C
- Non-operating: 90% at 65°C to 95% at 40°C

Altitude
- Operating: 4,600 meters (14,700 ft)
- Non-operating: 15,300 meters (49,000 ft)

Vibration
- Up to 0.38 mm ptp, 5-55-5 Hz, 3 axis for 15 minutes
- Dwell at resonance: 10 minutes

Shock
- Bench handling: 102 mm bench drop
- Transport handling: 762 mm drop 30 g for 11ms

Physical characteristics
- Size: 135 mm H (140 mm with feet) × 425 mm W × 540 mm L (5.25 in. H (5.45 in. with feet) × 16.75 in. W × 21.25 in. L).
- Net weight: 13 Kg (29 lbs).
- Shipping Weight: 17 Kg (38 lbs).
- Input voltage: 86 to 127 volts.
  With option 015: 195 to 253 volts.
- Input frequency: 47.5 to 66 Hz.
- Power consumption: 115 watts typical.

Approvals
- RFI (Radio Frequency Interference):
  VDE 0871 level A and FCC class A. Configurations including peripherals with high RFI levels may not be supported or may require on-site verification in some countries.
- Safety:
  UL 478, UL 114 for EDP and office equipment,
  CSA C22.2-154 for EDP equipment. Compliance with international standard IEC380, IEC435.
- Data communication approvals
  Complies with CCITT requirements. Datacomm certification approval in Australia, Belgium, UK, Germany, Japan and Scandinavia.

Some datacomm regulations may restrict the use of all possible HP 2334A Plus connections. Check with your local datacomm regulation agency.

Ordering Information

Product Number	Description
2334A	HP 2334A Plus - X.25 multiplexer
Opt 123	4 modem connect ports
Opt 015	220 V
Opt 100	Initial configuration
40261A	Additional 4 modem connect ports
Opt 001	Upgrade 4 direct connect ports to modem connect ports HP 2334A Plus.
40220A	Cable between HP 2334A Plus and ADCC printer ports
40221A[1]	Cable between HP 2334A Plus and ATP ports or ADCC terminal ports.
40223B	Upgrade kit from HP 2333A to HP 2334A Plus
Opt 001[2]	Power supply change
Opt 020	RS-232-C interface card for HP 2333A installed with Data Link
Opt 122	Upgrade 4 direct connect ports to 4 modem connect ports HP 2334A Plus
40224B	Upgrade kit from HP 2334A to HP 2334A Plus
Opt 023	Upgrade 4 direct connect ports to 4 modem connect ports HP 2334A Plus.
Opt 123	Upgrade 4 modem connect ports to 4 modem connect ports HP 2334A Plus

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[1] *Cable between HP 2334A Plus and ATP printer ports using term type 18 is HP 40220A.*

[2] *Order must include serial number of HP 2333A power supply, under "special instructions".*

Documentation

Document Number	Description
02334-90013	HP 2334A Plus Reference Manual
02334-90018	HP 2334A Plus Configuration Guide
5958-3402	X.25, The PSN Connection
5957-4635	Networking with X.25

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6. Host Support Software

7. Terminals

8. Graphics Devices

9. Printers

10. Discs and Tape Units

Graphics Devices Selection and Interfacing

HEWLETT PACKARD

For HP 1000 A-Series Computer Systems

Introduction

This section contains information on the selection and connection of graphics display, input, and output devices that are supported under the HP 92861A Device-Independent Graphics Library (DGL).

Graphics Display, Terminals and Monitors

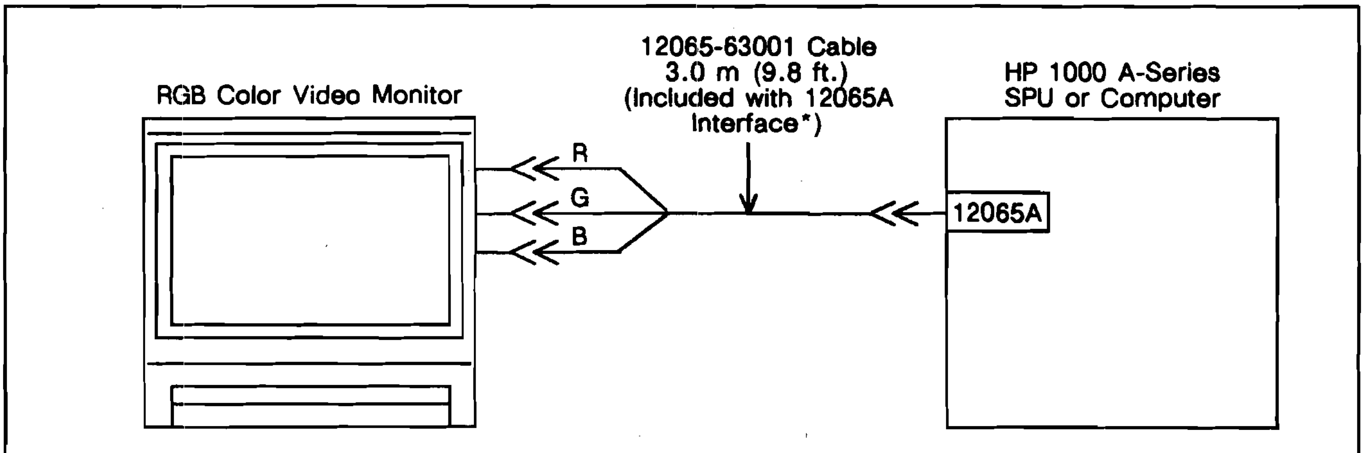
Most graphics applications involve interaction, at least during their development. This requires display of a picture with which the user can interact. In addition, displays can simplify complex real-time data relationships, such as those involved in process control, for better operator apprehension and response.

For graphics display on HP 1000 systems, Hewlett-Packard offers monochrome and color graphics terminals and color monitors. Data sheets and the description of the connection of graphics terminals to A-Series Computers are covered in the terminal section.

An RGB color monitor is connected to HP 1000 A-Series systems as shown in Figure 8-1.

Table 8-1. Graphics Display Terminals

Product Number and Name	**Display Area, inches (mm)**	**Addressable Resolution (Points)**	**Features**
2393A Monochrome Graphics Terminal	6.3 x 8.4 (160 x 214)	512 (h) x 390 (v) or 640 (h) x 400 (v), selectable	Polygon fill, 11 line types
2397A Color Graphics Terminal	6.3 x 8.4 (160 x 214)	512 (h) x 390 (v) or 640 (h) x 400 (v), selectable	Polygon fill, 11 line types, 8 colors from a palette of 64


12065-63001 Cable
3.0 m (9.8 ft.)
(Included with 12065A Interface*)
RGB Color Video Monitor
HP 1000 A-Series SPU or Computer
R
G
B
12065A

* Usable length can be up to 152 m/500 ft. with RG-11/U (Belden #9212) coaxial cabling, up to 76 m/250 ft. with RG-59/U (Belden #9259) coaxial cabling.

Figure 8-1. Color Video Monitor Connection to HP 1000 A-Series

Graphics Input

The Device-Independent Graphics Library supports various methods of entering graphics information into HP 1000 Systems. A picture can be created or changed on a graphics terminal screen by using the graphics cursor control keys or the HP Mouse (HP 46060A) to move, draw, or pick objects. The graphics tablet (HP 46087A for A-size and HP 46088A for A3 size) is ideal for digitizing and sketching drawings. With the HP-HIL interface on 239xA graphics terminals, you can connect input devices and hardcopy devices simultaneously because up to three input devices can be daisy chained to the keyboard, leaving the auxiliary port free for hardcopy devices.

The 4608xA Graphics tablets and 46060A HP Mouse are connected to HP 239xA graphics terminals as shown in Figure 8-2.

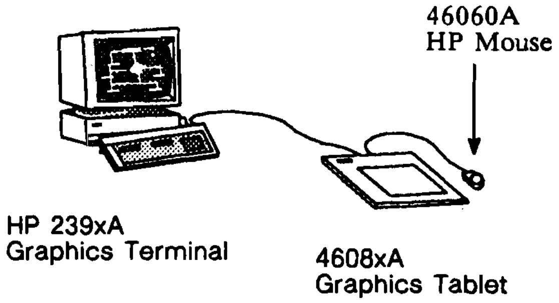


Figure 8-2. Connection of HP-HIL Graphics Devices to HP 239xA Graphics Terminals

Graphics Hardcopy Output

Graphics Plotters

Graphics plotters provide the most precise hardcopy output. In addition, they offer the means to produce output in multiple colors on plotter paper or on transparent media for projection. A brief list of the plotter capabilities as they are supported in the HP Device-Independent Graphics Library is presented in Table 8-2. Plotter connection to HP 1000 Computer Systems is shown in Table 8-3.

Table 8-2. Graphics Plotters

Plotter Product Number	Number of Pens	Maximum Plot Area Inches (mm)	Maximum Pen Velocity (Pen Down) inches/sec (cm/sec)
7440A	8	7.5 x 10.7 (191 x 272)	15.7 (40)
7470A*	2	7.5 x 10.7 (191 x 272)	15.0 (38)
7475A	6	16.3 x 10.8 (414) x 275)	15.0 (38)
7550A	8	16.2 x 10.7 (411 x 272)	31.5 (80)
7570A	8	24.8 x 37.9 (630 x 964)	15.7 (40)
7580B	8	24.5 x 48.5 (622 x 1232)	24.0 (60)
7585B	8	36.5 x 48.5 (927 x 1232)	24.0 (60)
7586B	8	36.5 x 48.5 (927 x 1232)	24.0 (60)

* *Discontinued product, listed here for reference only.*

Color Film Recorder

The HP 7510A Color Film Recorder can automatically produce 35-mm slides or 3 x 5-inch instant prints of the image on the monitor screen. If the CRT has high resolution, the image is sharp and of high quality. See Table 8-3 for connection information.

Graphics Printers

Most of the dot-matrix printers supported on HP 1000 A-Series Computer Systems can be used to print graphics as well as alphanumeric output. In applications for which monochrome graphics output is satisfactory and precision is relatively unimportant, a printer with graphics capability may provide adequate graphics hardcopy.

There are two different types of graphics printing. The first type is a printer that prints a "raster dump" copy of a graphics terminal's graphics display. Interfacing is simple and no system overhead is incurred to get the hard copy output.

The second type of graphics printing uses a vector-to-raster conversion routine from the HP 92861A Device-Independent Graphics Library to generate the raster graphics output for a printer that is connected to the HP 1000 Computer System. Because the graphics data can be processed prior to output, this type of graphics printing provides more control of size and aspect ratio than a simple raster dump from a terminal. Type 2 graphics printers are compared in Table 8-4.

Table 8-3. Graphics Plotter and Film Recorder and Connections

Plotter	**Interface Type**	**Interface Required on Host**	**Cables Required**	**Other Host Requirements**
7440A Opt 001 7470A* Opt 001 7475A Opt 001 7570A 7580B Opt 060 7585B Opt 060 7586B Opt 060	RS-232 Direct	12040C/D Multiplexer or 4-port On-Board I/O Multiplexer on 12100A A400 Single-Board Computer	13242N	Interface and Device Drivers included with RTE-A (see Device Drivers data sheet on page 2-92) and 92861A Device-Independent Graphics Library (see data sheet on page 2-57)
7510A 7550A		12040C/D Multiplexer or 4-port On-Board I/O Multiplexer on 12100A A400 Single-Board Computer	17355D	
7440A Opt 002 7470A* Opt 002 7475A Opt 002 7510A 7550A 7570A w/17570A HP-IB Interface 7580B Opt 060 7585B Opt 060 7586B Opt 060	HP-IB	12009A HP-IB interface	Order 10833B/C cables as needed for 2nd through nth devices connected to same HP-IB bus	

** Discontinued product, listed here for reference only.*

Table 8-4. Printers Supported by Graphics/1000-II DGL

Printer	**Interface**	**Cable**	**Print Rate (in./minute)**	**Resolution (Dots/inch)**
2563B+049 Line Printer	12040C/D or 12100A	92219G	29	70 x 72
2563B+214 Line Printer	12009A Opt 001	Incl. w/interface		
2564B+049 Line Printer	12040C/D or 12100A	92219G	66	70 x 72
2564B+214 Line Printer	12009A Opt 001	Incl. w/interface		
2566B+049 Line Printer	12040C/D or 12100A	92219G	50	70 x 72
2566B+214 Line Printer	12009A Opt 001	Incl. w/interface		
2932A Printer	12040C/D or 12100A	92219G	8	90 x 90
2932+046 Printer	12009A Opt 001	Incl. w/interface		
2934A Printer	12040C/D or 12100A	92219G	8	90 x 90
2934A+046 Printer	12009A Opt 001	Incl. w/interface		

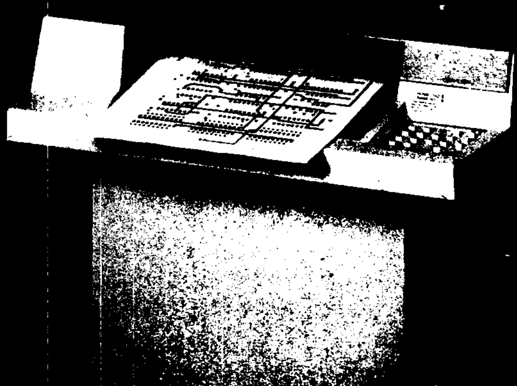
HEWLETT-PACKARD

Technical Data, March 1986

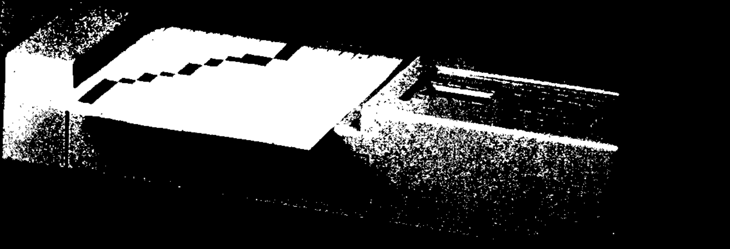
HP Graphics Plotters

The quality solution for your graphics needs!

HP 7475A Plotter
for Technical Professionals



HP 7550A Plotter
for High-Volume and Shared Environments



HP ColorPro Plotter
for Business Professionals

Hewlett-Packard — your assurance of top-quality graphics plotters

If you need top-quality color graphics, look to Hewlett-Packard — the world's leading manufacturer of small-format graphics plotters. HP has the plotter to fit your application, your computer system, and your budget.

- For the business professional, the HP ColorPro 8-pen plotter makes impressive, colorful A4/A-size* presentation graphics on regular and glossy paper and on overhead transparency film.
- For the technical professional, the HP 7475A 6-pen plotter offers high-quality A4/A- and A3/B-size** graphics in a variety of media — polyester drafting film, overhead transparency film, and paper.
- The high-performance HP 7550A 8-pen plotter is perfect for both shared resource environments and high-volume individual users. Equipped to produce both A4/A- and A3/B-size graphics, HP's top-of-the-line small-format plotter uses automatic sheet feed plus fast acceleration and speed to handle heavy graphics workloads. The HP 7550A accepts a full range of media, too, from paper to drafting film.
- In laboratory and testing environments, HP's small-format graphics plotters will provide professional-quality hardcopy of acquired data, either directly from smart instruments or using a computer and software.

Designed with your needs in mind

Quality first — Clear, colorful overhead transparencies take just minutes to produce with an HP plotter, and can be updated at the last minute to incorporate new information. An HP plotter offers advantages not available with other methods of preparing overheads; see the matrix on the bottom corner opposite for a comparison.

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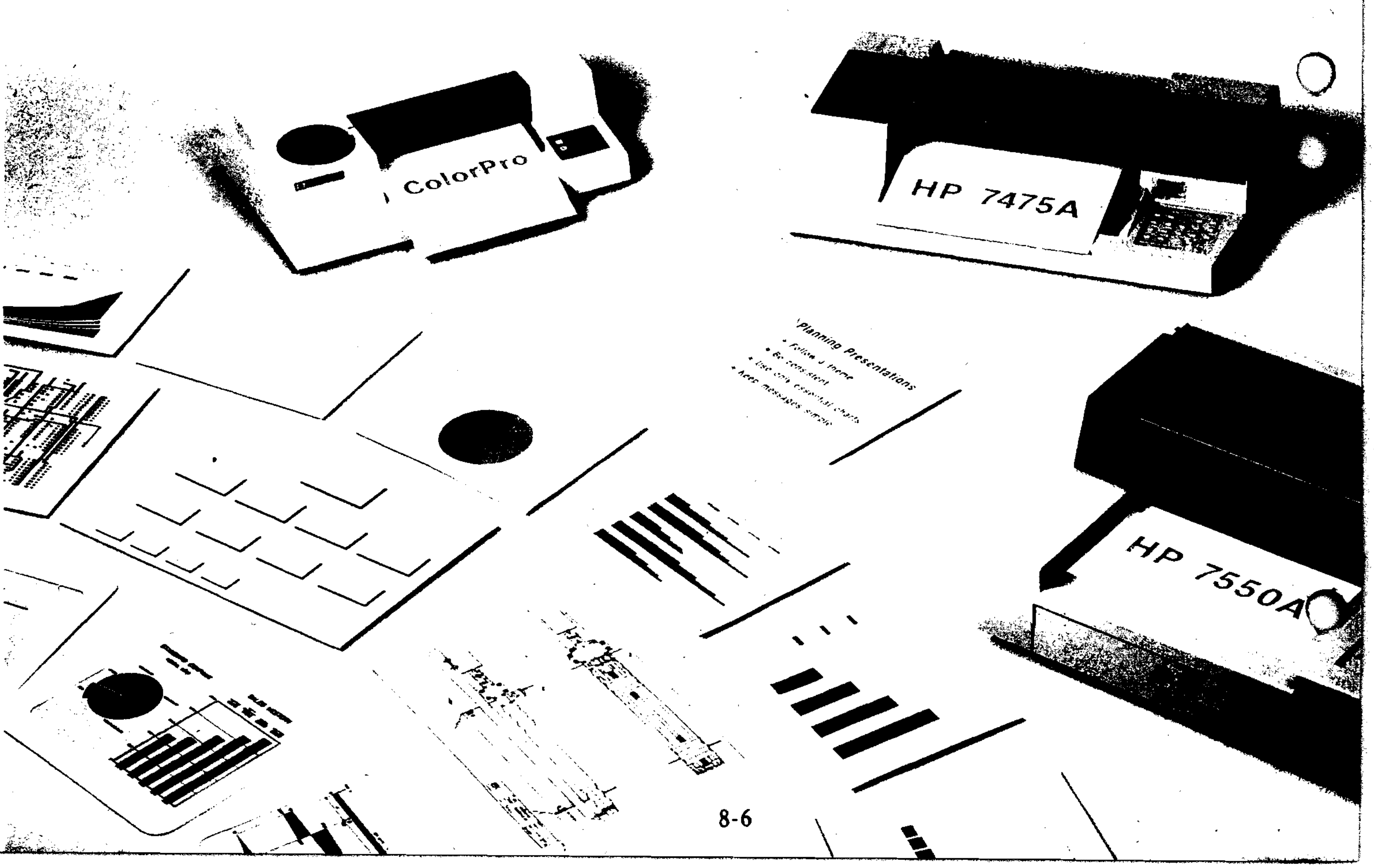
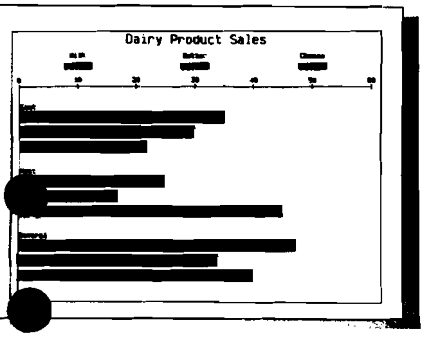
*A4 size is 210 × 297 mm; A size is 8½ × 11 in.
**A3 size is 297 × 420 mm; B size is 11 × 17 in.





Creating this plot took:

HP 7550A	1½ minutes
HP 7475A	3¼ minutes
HP ColorPro	3½ minutes

Convenient — HP's multiple-pen pl[illegible]ers make multicolor graphics easy. T[illegible] HP 7475A offers a 6-pen carousel; oth the ColorPro and the HP 7550A lotters use 8-pen carousels. To keep nks fresh and lengthen pen life, all HP lotters have automatic pen capping.

Adaptable — HP plotters interface [illegible] virtually all personal computers [illegible] can also be connected to mini or nainframe computers and technical [illegible]kstations. The operating manual [illegible]ped with each plotter offers step-y-step interfacing instructions.

Versatile — HP plotters offer a hoice of media types and sizes. A andy matrix on the back cover lists he media and pen capabilities of each lotter.

HP graphics plotters are known worldwide for exceptional line quality. Hewlett-Packard sets high standards for resolution and repeatability, so curves and circles are smooth, diagonal lines are straight, and letters are crisp.

Yes, line quality is essential — and so is speed. Fast turnaround time is important in the office, factory, or lab, where time is limited. HP plotters give you the high-quality graphics you need *when* you need them — in just minutes.

Reliability is another sign of HP quality. HP plotters are built to last, so maintenance costs are low. And if your HP plotter should need service, Hewlett-Packard has over 180 service facilities in 31 countries.

Clearly written user manuals that follow a practical, task-oriented approach reflect HP's concern for quality. You can count on HP quality, every step of the way.

Top-quality supplies

Your ideas and effort deserve the best — and that means HP supplies for your HP plotter. HP supplies are designed to provide optimum performance on HP plotters. For example, HP's overhead transparency film has a special surface that allows ink to dry in seconds; and HP's glossy presentation paper makes colors look especially rich and vibrant.

Solid software support

Hewlett-Packard plotters are supported with software packages for personal, mini, desktop, and mainframe computers. You'll find integrated packages with graphics such as 1-2-3™ and Symphony™ from Lotus™, and Framework; presentation graphics packages such as Chart-Master, Graphwriter, SAS/Graph, Graphics Gallery, TELL-A-GRAF, and DISSPLA; computer-aided design/drafting packages such as AutoCAD 2, Robo CAD-1, and VersaCAD; scientific/statistical analysis packages such as Scientific Plotter and SPSS Graphics; plus many more. Your HP representative can provide more complete software information.

When you think graphics, think HP

When it comes to graphics plotters, HP is clearly the quality choice. Firmly committed to technological excellence and innovation, Hewlett-Packard has a worldwide, time-proven reputation for quality and reliability.

1-2-3, Symphony, and Lotus are U.S. trademarks of Lotus Development Corp.

Methods of Preparing Overhead Transparencies

	HP Plotter	Black & White Dot Matrix Printer	Hand-drawn by User	In-house Art Dept.	Outside Graphics Service
Color Overhead Transparency Capability					
Smooth Lines					
Crisp Lettering					
Confidentiality					
Fast Turnaround					
Reasonable Cost per Overhead					

For effective, high-impact presentations, choose the ColorPro plotter!

Ideally suited for the business professional, HP's ColorPro plotter lets you give every presentation an extra quality edge with colorful overhead transparencies. And to add color and variety to written reports, use the HP ColorPro plotter to create fast, high-quality graphics on A4/A-size* paper.

Quality graphics created with the ColorPro plotter help convey your message faster, and with more impact. Graphics help your audience see relationships, discern trends, and draw conclusions. Use text-only overheads to highlight key points in your presentation.

Graphics at your fingertips

With a ColorPro plotter on your graphics team, you can save the time and money of having an outside graphics service prepare your overheads. And data remains confidential when your ColorPro plotter does the job.

Colors add vitality

Color begins with pens — and you can choose from HP's spectrum of fiber-tip pens for paper and for transparency film, each available in two line widths. With the ColorPro plotter, every chart has that finished, professional look of multicolor graphics on quality media.

Quality — little things mean a lot

Resolution and repeatability are the two major components of line quality. The ColorPro plotter's resolution lets it produce smooth circles, straight diagonal lines, and crisp characters.

Repeatability refers to the plotter's ability to return to a given starting point. The ColorPro plotter's high repeatability means precise alignmen in pie and bar charts.

Designed to work with your computer

From the Apple IIe to the IBM PC, the Compaq Deskpro to the HP Touchscreen computer — whatever your p sonal computer, chances are excellen that the ColorPro plotter will fit neatly into your system. Choose between the HP-IB (IEEE 488-1978) or the RS-232-C/CCITT V.24 interface.

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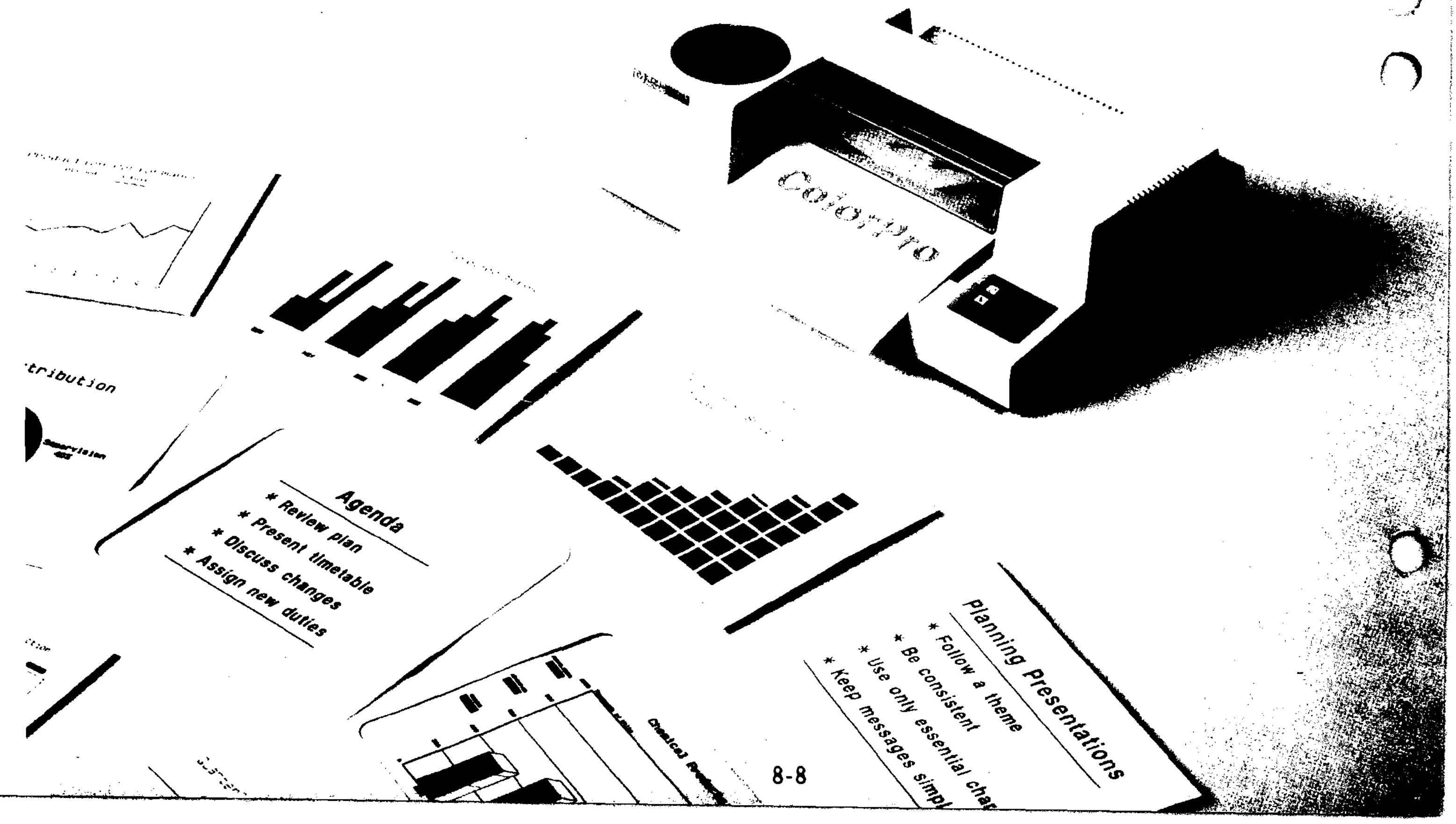
*A4 size is 210 × 297 mm; A size is 8½ × 11 in.



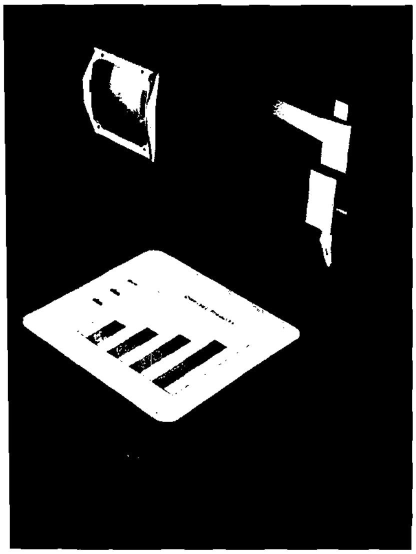
ColorPro Plotter — Technical Information

cessory cartridge boosts phics power

Vhen your graphics needs expand, a
)M cartridge slot lets the ColorPro
tter keep up with your changing
such as emerging graphics stand-
s). The Graphics Enhancement Car-
dge, available as an accessory, adds
re advanced capabilities to your
o plotter, such as a larger
-C buffer and handshaking simi-
to the HP 7475A (see the chart
ow right). Although most software
itten for the HP 7475A will run on
ColorPro plotter, the addition of the
aphics Enhancement Cartridge lets
u run virtually any software program
for the HP 7475A — particu-
y packages for technical applications
d mainframe graphics — on your
lorPro plotter.

in all . . .

entation materials you'll be proud
play — impressive full-color over-
d transparencies and high-quality
graphics — can be yours with
lorPro plotter.



Description	ColorPro Plotter	Cartridge-Enhanced ColorPro Plotter
Model	HP 7440A	HP 7440A with HP 17440A
Character sets	5 sets	19 sets — Similar to HP 7475A
HP-GL (Hewlett-Packard Graphics Language) commands	44 commands	58 commands (similar to HP 7475A) plus polygon commands
RS-232-C handshaking	Reduced implementation of escape sequences compared to HP 7475A	Handshaking protocols similar to HP 7475A
RS-232-C buffer	60 bytes	Default — 1024 [illegible] to 1974 bytes
	No [illegible]	

The HP 7475A offers you two media sizes — plus drafting capability!

When you need A3/B-size drawings, you need the HP 7475A graphics plotter. This 6-pen plotter produces fast, high-quality graphics in *both* A4/A and A3/B sizes*, and on a variety of media — including polyester drafting film.

The HP 7475A is ideal for technical and business professionals who need the larger A3/B-size drawings for PERT charts, flow charts, project schedules, Gantt charts, and design applications.

And when you need to *present* your findings, the HP 7475A is there to generate quality overhead transparencies for your presentation, and colorful summary charts for handouts and reports.

A3/B-size drafting capability

Whether you need quick working drawings or drafting-quality final drawings, the HP 7475A is ready when you are. Use the HP 7475A to create clear CAD drawings on durable double-matte polyester film — ideal for frequently handled master copies.

Easy to interface

For connection to computers from personals to mainframes, and to smart instruments, the HP 7475A offers your choice of two interface options — the HP-IB (IEEE 488-1978) or RS-232-C/CCITT V.24. With the optional eavesdrop cable, you can connect the RS-232-C plotter in series with a computer and a terminal.

Designed for versatility

With the HP 7475A's front panel, you can quickly change the size of the drawing area when switching media sizes. If your chart would look better in a vertical format, use the front panel keys to rotate the chart 90 degrees. You can also digitize charts from the front panel.

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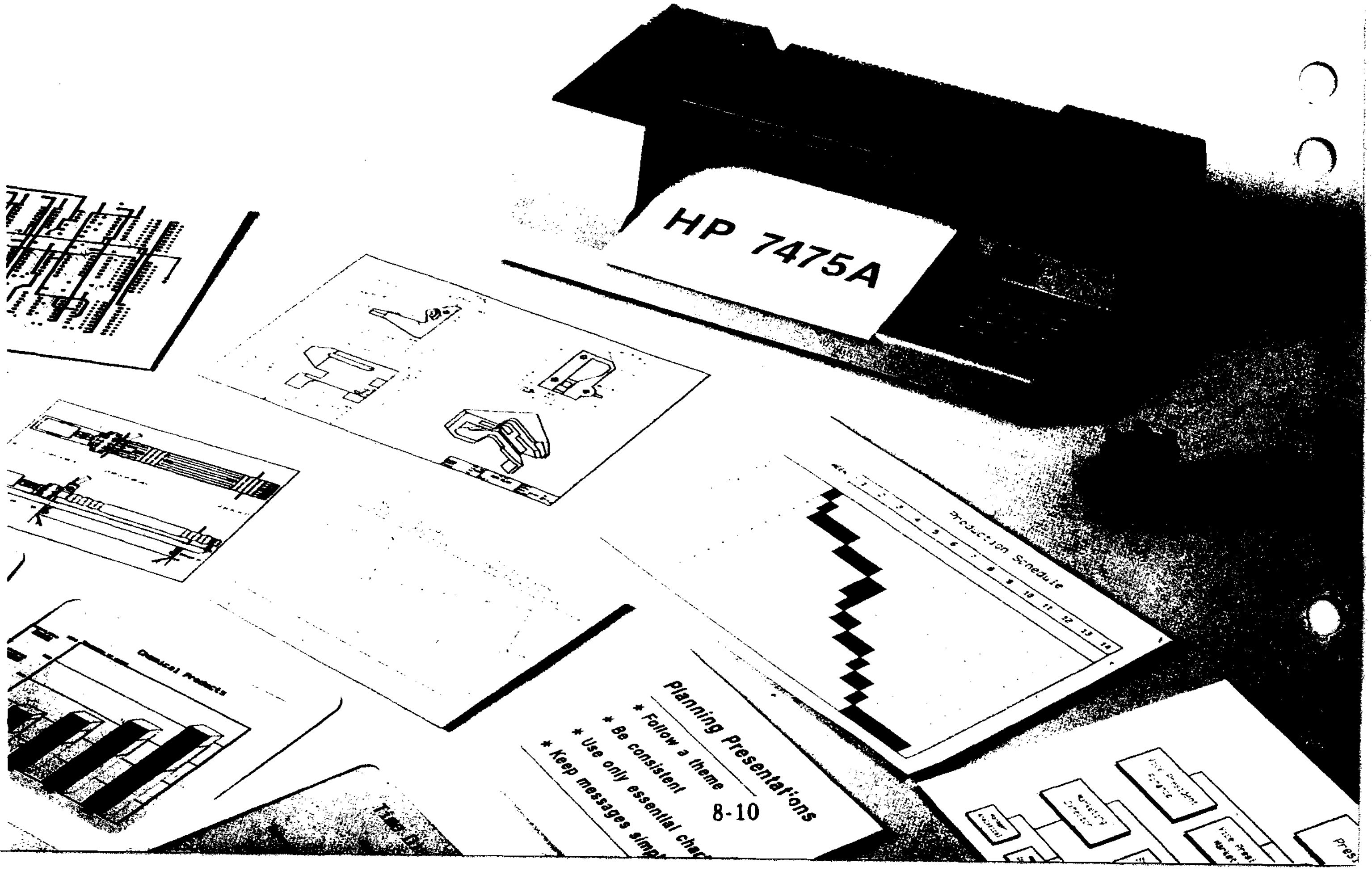
*A4 size is 210 × 297 mm; A size is 8½ × 11 in.
A3 size is 297 × 420 mm; B size is 11 × 17 in.



Special programming features

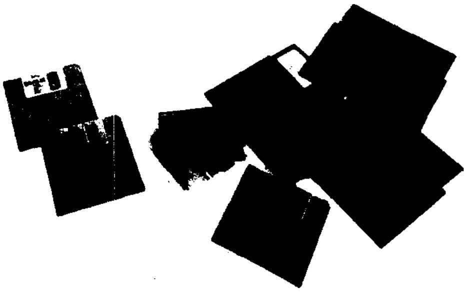
If you create your own custom programs, you'll be glad to learn that the HP 7475A contains over 50 HP-GL (Hewlett-Packard Graphics Language) instructions to control such functions as arc and circle generation, and area fill in bar and pie charts. Plus, the HP 7475A has 19 internal character sets, including ANSI ASCII, ISO European sets, and Katakana.

Plenty of software

If you prefer to use existing software packages, you'll have lots to choose from. The HP 7475A is supported on packages for a broad spectrum of technical and business applications for personal, technical desktop, mini, and mainframe computers. As a matter of fact, the HP 7475A is one of the world's most widely supported plotters.

In short . . .

With the HP 7475A you get presentation graphics, drafting capability, and two media sizes — *plus* HP quality and reliability.



For peak performance, choose the HP 7550A

The high-performance HP 7550A handles heavy graphics workloads with ease, either for work groups sharing a plotter or for high-volume individual users. The HP 7550A provides fast, top-quality A4/A- and A3/B-size* color graphics *in quantity* for both business and technical applications.

Advanced features make *quantity* graphics easy

The HP 7550A — HP's fastest plotter — has a pen velocity of 80 cm/s (31.5 in./s) and an acceleration of 6 g's. Automatic sheet feed of paper or transparency film allows unattended operation, making the HP 7550A ideal for high-volume users or as a shared resource in multiuser environments. In addition to multiuser application software support from ISSCO, SAS, and others, the HP 7550A is supported on local area network systems such as EtherSeries by 3Com Corp. and Netware/S-Net by Novell, Inc.

The HP 7550A's advanced microprocessor automatically senses carousel type and adjusts pen speed and force accordingly. The HP 7550A automatically senses media size to set plot boundaries, and automatically caps pens after each use for long pen life.

Dual interfaces — an HP-IB (IEEE 488-1978) port and two RS-232-C/CCITT V.24 ports — let you adapt the HP 7550A to a variety of system environments. Connect the HP 7550A either directly to your computer, or in series (eavesdrop) between your computer and terminal, thus saving a computer port.

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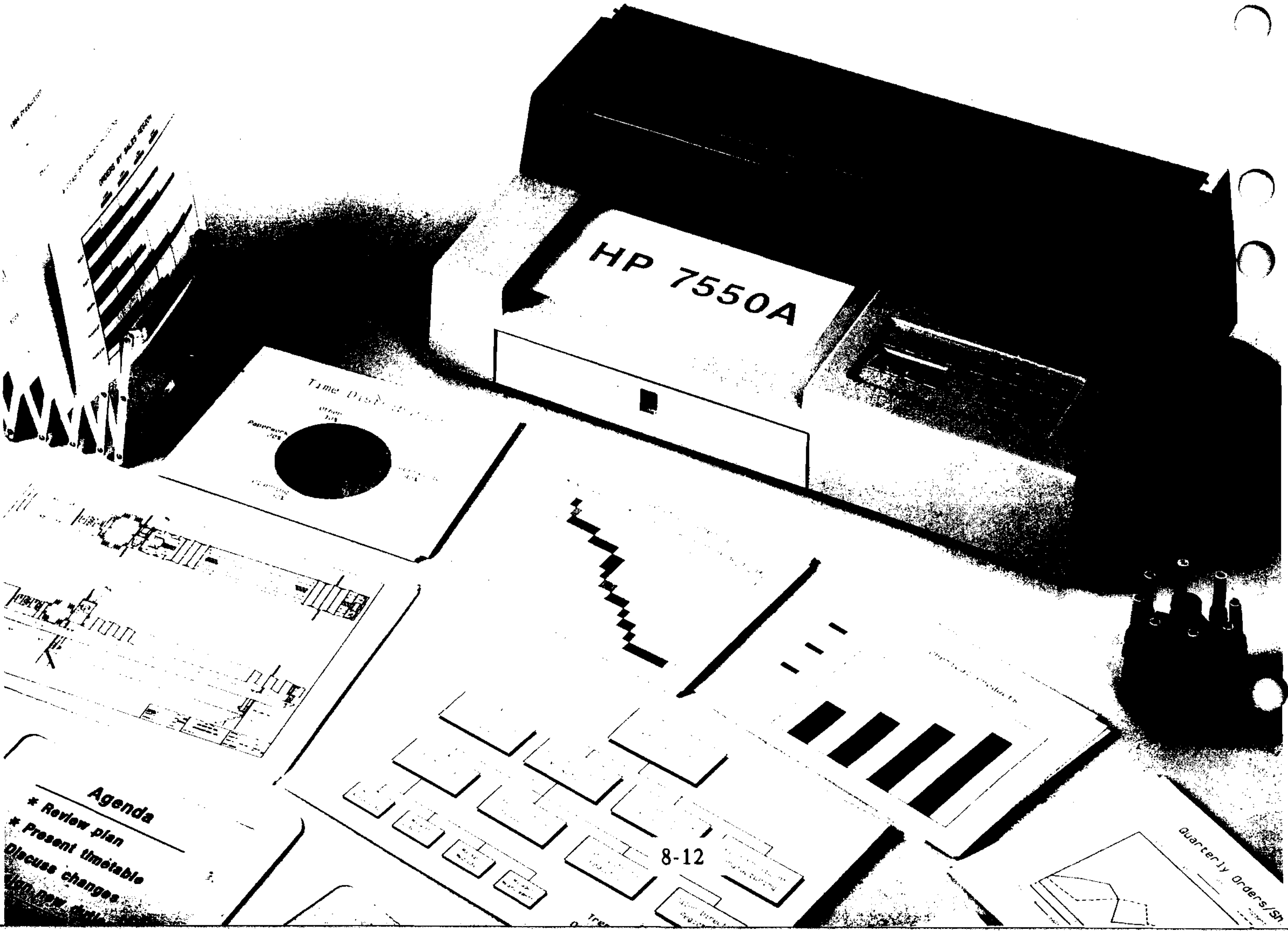
*A4 size is 210 × 297 mm; A size is 8½ × 11 in. A3 size is 297 × 420 mm; B size is 11 × 17 in.



The liquid crystal display on the front panel shows plotter status; use the front panel keys to change various parameters, such as size of plotting area or plot orientation.

Designed for optimum quality output

With line quality comparable to HP's large-format drafting plotters, the HP 7550A is ideal for both working and final drawings in small-format CAD applications. Addressable resolution of 0.025 mm (0.001 in.) and mechanical resolution of 0.006 mm (0.00025 in.) ensure that the HP 7550A produces smooth, clean circles and arcs and straight, uniform lines. Its precise repeatability means that beginning and end points of a figure will match to within 0.1 mm (0.004 in.), so edges align, filled areas are even, and characters are precise.

A full array of media choices

HP 7550A users can select from A4/A- and A3/B-size paper, vellum, and polyester film, plus A4/A-size overhead transparency film. For the 8-pen carousel, choose fiber-tip paper or transparency pens, roller-ball pens, or liquid-ink drafting pens (disposable or refillable).

Productivity tools for programmers

The powerful HP-GL (Hewlett-Packard Graphics Language) instruction set includes more than 80 instructions, such as polygon fill. Define and store your own character set for future use. Or access any of the 20 character sets (in either of two fonts).

To sum up . . .

Automatic sheet feed, high acceleration and speed, premium line quality, a full range of media choices — when you need top-quality graphics in quantity, get the HP 7550A.

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	
Pen down	[illegible]
Pen up	[illegible] cm/s [illegible]
Acceleration	
Maximum	Approx. 6 g's
Programmable	Approx. 1 to [illegible]
Character Sets	20 sets, each [illegible] Set, Roman [illegible] [illegible] Reference [illegible] (ISO), Norwegian [illegible] for Names (DIN), [illegible]
Maximum Plotting Area	
Pen axis	272 mm (10.7 in.) for [illegible] mm ([illegible] in.) for [illegible]
Paper axis	399 mm (15.7 in.) for [illegible] mm ([illegible] in.) for [illegible] 190 mm (7.5 in.) for A4 [illegible] mm (7.7 in.) for A
Interfaces	
HP-IB (IEEE 488-1978)	Parallel interface which follows the IEEE 488-1978 [illegible]
RS-232-C/CCITT V.24	Asynchronous serial [illegible] 300, 600, [illegible] [illegible]
Power Requirements	
Source*	100, 120, 220, 240 V ac −10%, +5%
Frequency	48 — 66 Hz
Consumption	100 W maximum
*Source voltage depends on plotter destination	
Environmental Range	
Operating	0°C to 55°C
Nonoperating	−40°C to 75°C
Size	
Height	215 mm (8.5 in.)
Width	670 mm (26.4 in.)
Depth	With A4/A loading tray/no catcher [illegible] With A4/A loading tray/A4/A catcher [illegible] With A3/B loading tray/no catcher [illegible] With A3/B loading tray/[illegible] catcher [illegible]
Weight	
Net	Approx. 17.3 kg [illegible]
Shipping	Approx. 25.0 kg [illegible]
Certifications	FCC certified [illegible] with a Class B [illegible] Meets or exceeds [illegible]
Buffer Size (user partitionable)	Default [illegible] From [illegible]
Automatic Sheet Feeder [illegible]	
Media sizes	210 mm × 297 mm (ISO A4) [illegible] (A3/B-size automatic sheet feeder is available [illegible])
Environmental Range	
Operating	Paper: [illegible] Transparency [illegible]
Nonoperating	[illegible] [illegible]

Ordering Information

HP ColorPro Plotter	HP 7475A	HP 7550A
8	6	8
A4/A	A4/A, A3/B	A4/A, A3/B
Paper, transparency film	Paper, transparency film, polyester film	Paper*, transparency film*, vellum, polyester film *Can be fed automatically.*
40.0 cm/s	38.1 cm/s	80 cm/s
1.2 g's	2 g's	6 g's
RS-232-C/CCITT V.24 or HP-IB (IEEE 488-1978)	RS-232-C/CCITT V.24 or HP-IB (IEEE 488-1978)	RS-232-C/CCITT V.24 and HP-IB (IEEE 488-1978)

Accessories Supplied

- Operating Manual
- Plotter paper sampler, A4/A size*
- Transparency film sampler, A4/A size*
- An assortment of fiber-tip pens for paper and transparency, in various colors
- 8-pen carousel for fiber-tip pens (paper or transparency)
- Power supply (based on plotter destination)

**Plotter destination determines whether metric size (A4) or English size (A) will be sent.*

Accessories Available

(Items listed below must be ordered separately)

Description	HP Part No.
Programming Manual (includes information on Graphics Enhancement Cartridge; available in English only)	HP 07440-90001
Graphics Enhancement Cartridge	HP 17440A

Interface Options

(Computer interface cable not included)

Description	HP Part No.
ColorPro plotter with RS-232-C/CCITT V.24 interface	HP 7440A, Option 001
ColorPro plotter with HP-IB (IEEE 488-1978) interface	HP 7440A, Option 002

Cables Available

(Must be ordered separately)

Description	Length	Application	HP Part No.
Ⓜ—Ⓜ RS-232-C/CCITT V.24, straight-through cable	3 meters	Apple IIe, Apple *III**, and other DCE devices	HP 17355M
Ⓜ—Ⓕ RS-232-C/CCITT V.24, straight-through cable	3 meters	Selected RS-232-C/CCITT V.24 configurations	HP 17355D
Ⓜ—Ⓕ RS-232-C/CCITT V.24 cable, modem eliminator type	1.5 meters	IBM PC, PC/XT, AT*, and other DTE devices	HP 17255D
Ⓜ—Ⓜ RS-232-C/CCITT V.24 cable, modem eliminator type	5 meters	HP Touchscreen computer and other DTE devices	HP 13242G
HP-IB (IEEE 488-1978) cable, RFI shielded. Cables HP 31389 and HP 45529 are equivalent to HP 10833.	A is 1 meter, B is 2 meters, C is 4 meters	HP-IB (IEEE 488-1978) configurations	HP 10833A/B/C

**Additional cable required from computer manufacturer.*

Accessories Supplied

Operation and Interconnection Manual

Interfacing and Programming Manual

Reference card

Blank plotter paper
- 50 sheets, A4/A regular plotter paper*
- 50 sheets, A3/B regular plotter paper*

An assortment of fiber-tip paper pens in 2 line widths and various colors

6-pen carousel for fiber-tip pens (paper or transparency)

Power cord (appropriate cord supplied based on destination)

[illegible]

Cables Available (Must be ordered separately)

Description	Length	Application	HP Part No.
M—M RS-232-C/CCITT V.24, straight-through cable	3 meters	Apple IIe, Apple ///*, and other DCE devices	HP 17355M
M—F RS-232-C/CCITT V.24, straight-through cable	3 meters	Selected RS-232-C/CCITT V.24 configurations	HP 17355D
M—F RS-232-C/CCITT V.24 cable, modem eliminator type	1.5 meters	IBM PC, PC/XT, AT*, and other DTE devices	HP 17255D
M—M RS-232-C/CCITT V.24 cable, modem eliminator type	5 meters	HP Touchscreen computer and other DTE devices	HP 13242G
Eavesdrop Y-cable, RS-232-C/CCITT V.24		Eavesdrop configurations	HP 17455A
HP-IB (IEEE 488-1978) cable, RFI shielded. Cables HP 31389 and HP 45529 are equivalent to HP 10833.	A is 1 meter, B is 2 meters, C is 4 meters	HP-IB (IEEE 488-1978) configurations	HP 10833A/B/C

*Additional cable required from computer manufacturer.

Accessories Supplied

Operating and Interconnection Manual

Interfacing and Programming Manual

[illegible]

[illegible]
- [illegible]
- [illegible]

Blank plotter paper
- 50 sheets, A4/A size**

Overhead transparency film
- 5 sheets, A4/A size**

An assortment of fiber-tip pens for paper and transparency, in various colors

8-pen carousel for fiber-tip paper pens

8-pen carousel for fiber-tip transparency pens

Power cord (appropriate cord supplied based on destination)

*Plotter destination determines whether A4-size (HP 07550-60158) or A-size (HP 07550-60152) media loading tray will be supplied. The A3/B-size automatic load/catch is an optional accessory (A3 size, HP 17598A; B size, HP 17525A).

**Plotter destination determines whether metric size (A4) or English size (A) will be sent.

Interfaces

One HP-IB connector and two RS-232-C/CCITT V.24 connectors are built into every HP 7550A plotter.

Cables Available (Must be ordered separately)

Description	Length	Application	HP Part No.
M—F RS-232-C/CCITT V.24, straight-through cable	3 meters	Apple IIe, Apple ///*, and other DCE devices, and remote modem environments	HP 17355D
F—F RS-232-C/CCITT V.24, straight-through cable	3 meters	Selected RS-232-C/CCITT V.24 configurations	HP 17355F
F—F RS-232-C/CCITT V.24 cable, modem eliminator type	1.5 meters	IBM PC, PC/XT, AT*, and other DTE devices	HP 17255F
M—F RS-232-C/CCITT V.24 cable, modem eliminator type	1.5 meters	HP Touchscreen computer and other DTE devices	HP 17255D
M—F RS-422-A adapter cable; 5-pin (RS-422-A) male to 25-pin (RS-232-C/CCITT V.24) female	5 meters	Mainframe computers	HP 17855A
HP-IB (IEEE 488-1978) cable, RFI shielded. Cables HP 31389 and HP 45529 are equivalent to HP 10833.	A is 1 meter, B is 2 meters, C is 4 meters	HP-IB (IEEE 488-1978) configurations	HP 10833A/B/C

*Additional cable required from computer manufacturer.

Guide to Pens and Media

The chart directly below indicates the pens that can be used with different media, and on which plotters. The bottom chart shows the media sizes that are available for different plotters.

Pens and Media

	Plotter Paper	Glossy Paper*	Transparency Film	Vellum	Polyester Film
	●	●			
		●	●		
	●				
				●	●
				●	

Media Sizes

	Plotter Paper	Glossy Paper*	Transparency Film	Vellum	Polyester Film
				●	
					●
	●	●	●		
				●	
					●
	●	●			

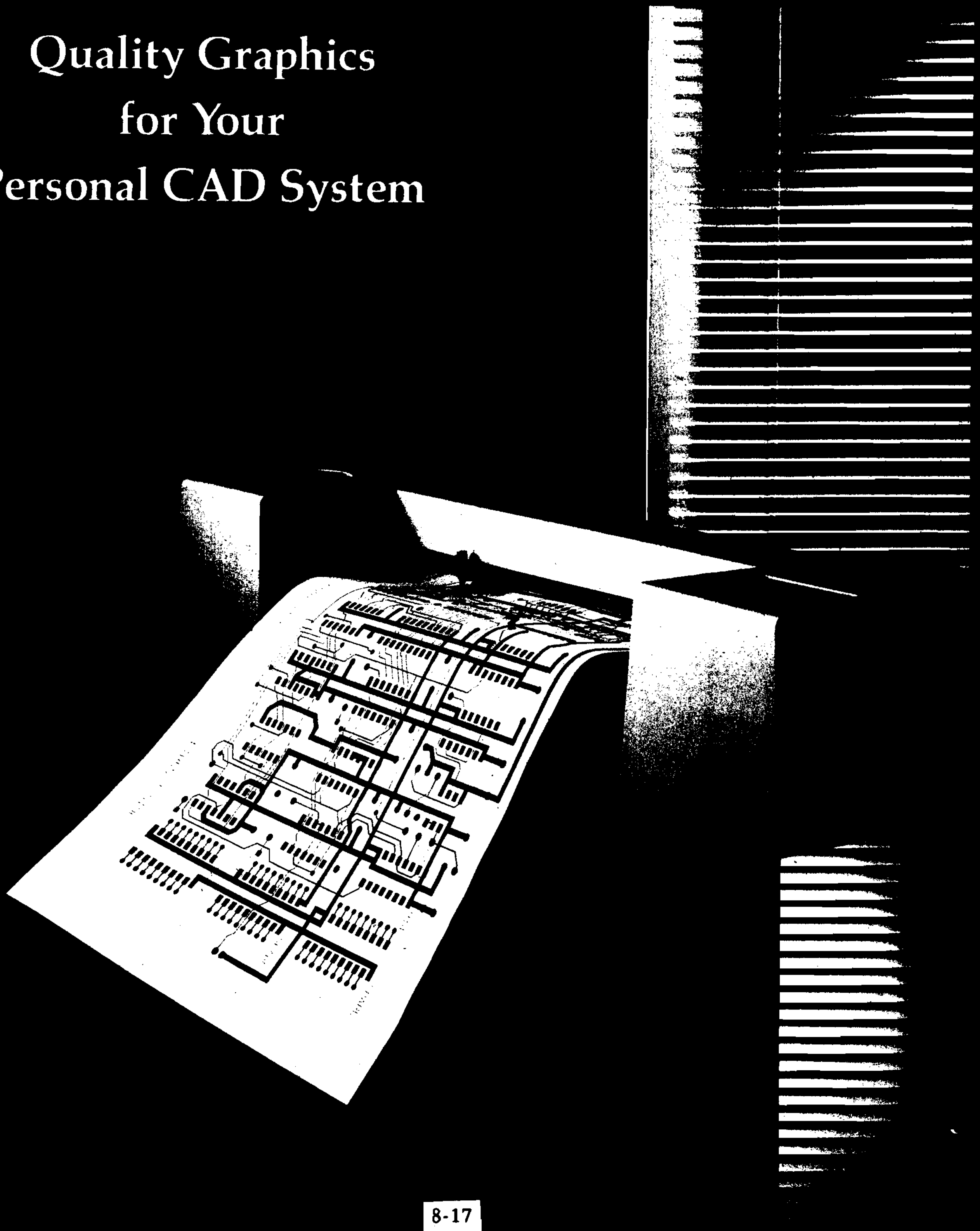
[illegible] telephone directory white pages. Or write to Hewlett-Packard: **U.S.A.** — P.O. Box 10301, Palo Alto, CA [illegible] **Europe** — [illegible] The Netherlands. **Canada** — 6877 Goreway Drive, Mississauga, L4V 1M8, Ontario. **Japan** — Yokogawa-[illegible] **Elsewhere** in the world, write to Hewlett-Packard Intercontinental, 3495 Deer Creek Road [illegible]

HEWLETT-PACKARD

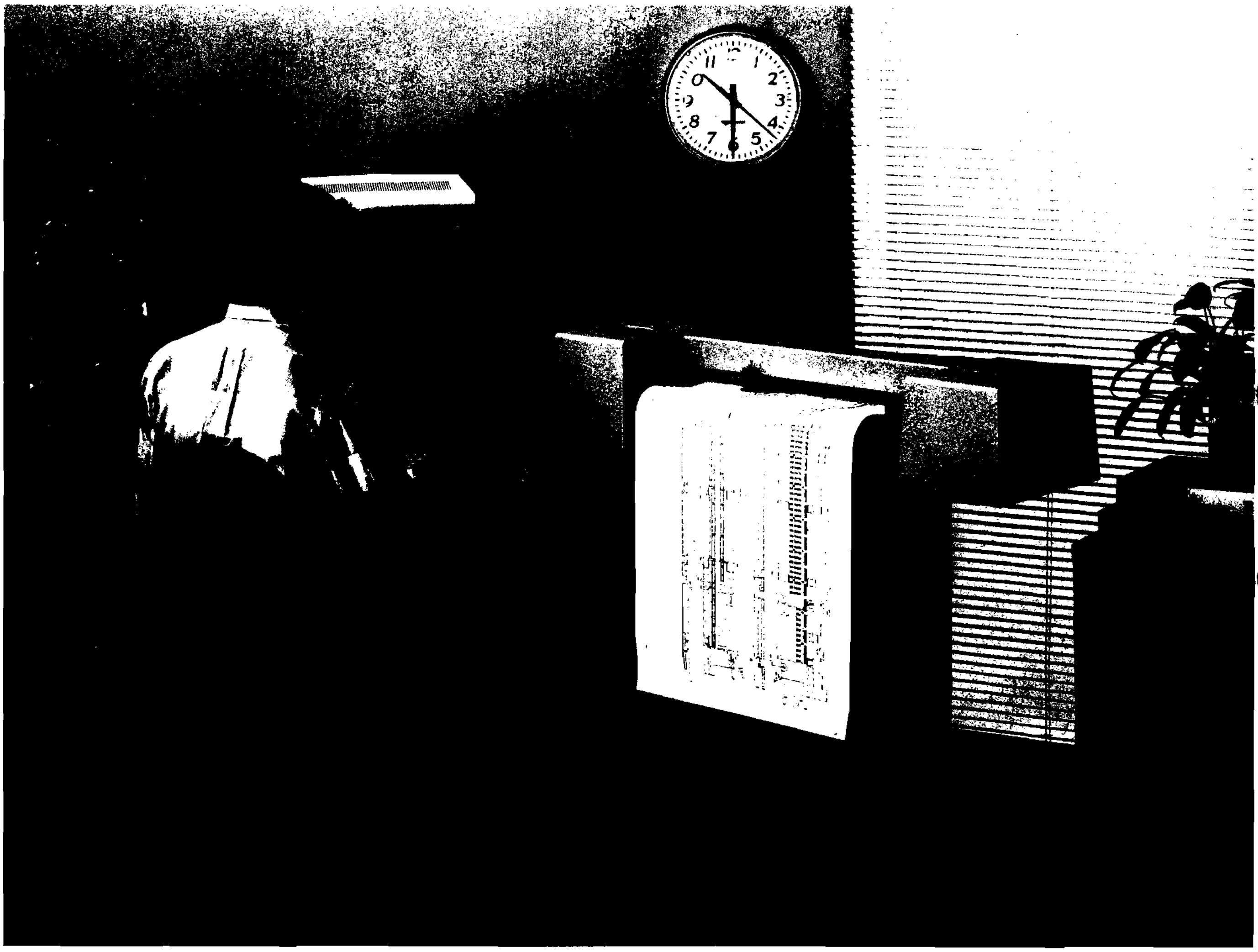
The HP DraftPro Plotter

Quality Graphics
for Your
Personal CAD System

TECHNICAL DATA, JUNE 1986



An Introduction



What is the HP DraftPro Plotter?

The HP DraftPro is an 8-pen drafting plotter that's been designed especially for you and your personal CAD system.

Our goal was simple: make a reliable machine that produces quality output, avoid non-essential frills without cutting corners.

What Can It Do?

The HP DraftPro plotter handles all your full-size drafting demands.

So whether you need an electrical schematic for this morning's meeting, a mechanical drawing to send to a vendor, or an architectural design for a client presentation, your new HP DraftPro will get the job done quickly, easily, and professionally.

How Will the HP DraftPro Plotter Fit into My System?

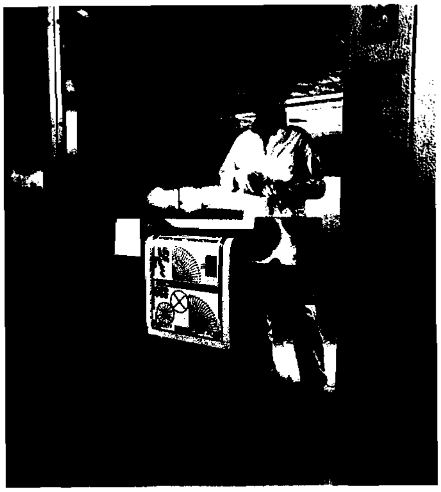
Perfectly. Because you already *have* the pieces you need.

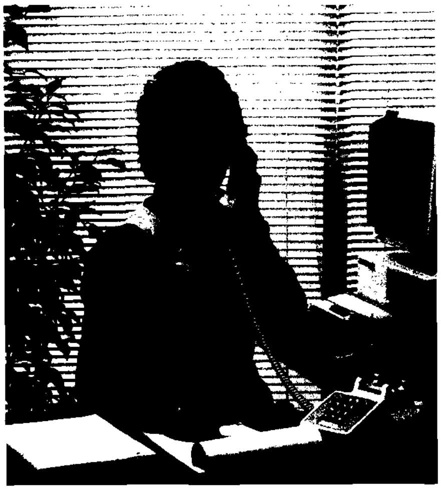
The HP DraftPro connects easily to your personal computer or workstation, and it's most likely supported by the design software you use in your daily professional routine.

What Makes this Plotter Stand Apart from the Rest?

Our new drafting plotter outshines its competitors by offering you *traditional Hewlett-Packard quality, reliability, and service at an untraditional low price* — a combination we think you'll find hard to beat.

The Premium Product in Its Class





Designed for Quality

When designing any new product, there are always choices to be made — choices like "should we save a few cents here and there?" or "should we insure that our customers get the quality they deserve?"

The HP DraftPro was designed with the latter philosophy in mind. For example, our grit drive system optimizes contact with the plotting media. This firm grasp means your paper remains aligned and your drawing remains accurate.

Built for Reliability

The HP DraftPro plotter was designed to operate in freezing cold temperatures and extreme heat and humidity.

Once in manufacturing, life doesn't get much easier. There are more than 200 checks of the building process to insure that the HP DraftPro meets its original design specifications.

All this guarantees the very best of performances under your routine operating conditions.

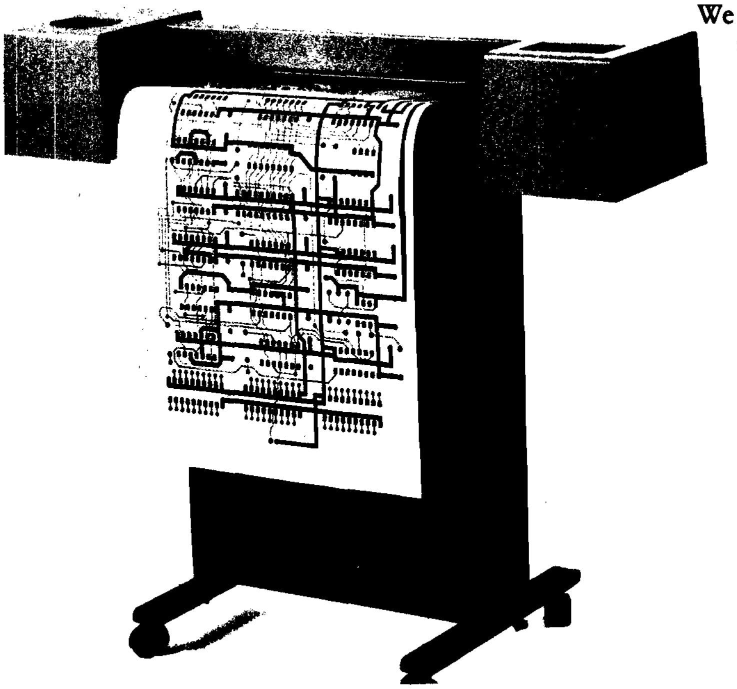
Backed by HP Service and Support

Hewlett-Packard has been building plotters for more than sixteen years, so we've had lots of time to perfect our craft and to learn the meaning of customer satisfaction.

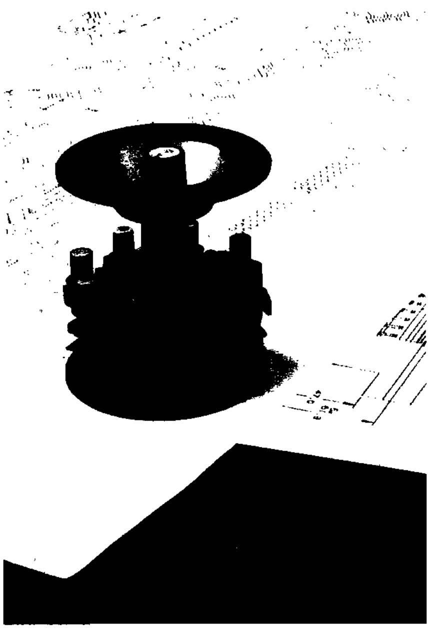
Each HP DraftPro plotter comes with a 90-day on-site parts and labor warranty. Support may be extended beyond this period by purchasing a monthly service contract (at a very reasonable rate).

We also guarantee the availability of service, support, and parts for at least 10 years after purchase. That's comforting in a world of high-technology turnover.

Finally, if you have questions or problems, HP has more than 330 sales and service offices worldwide, ready and able to help.



A Closer Look at Features



Quality Output

When the design session is complete, the only thing you have to show for your effort is the drawing you hold in your hand — and that drawing must reflect the quality of your work.

With the HP DraftPro plotter, you'll get smooth circles, consistent line widths, and crisp characters — output quality that will impress even the most trained professional eye.

Hardware Compatibility

Chances are excellent that whatever your computer — from the HP Vectra to the Apple Macintosh, the DEC VAX to the IBM AT — the HP DraftPro will fit neatly with your CAD workstation.

An RS-232-C/CCITT V.24 interface comes standard; HP-IB (IEEE 488-1978) can be ordered as an accessory.

The IBM AT is a product of International Business Machines Corp.

The Apple Macintosh is a product of Apple Computer, Inc.

The DEC VAX is a product of Digital Equipment Corp.

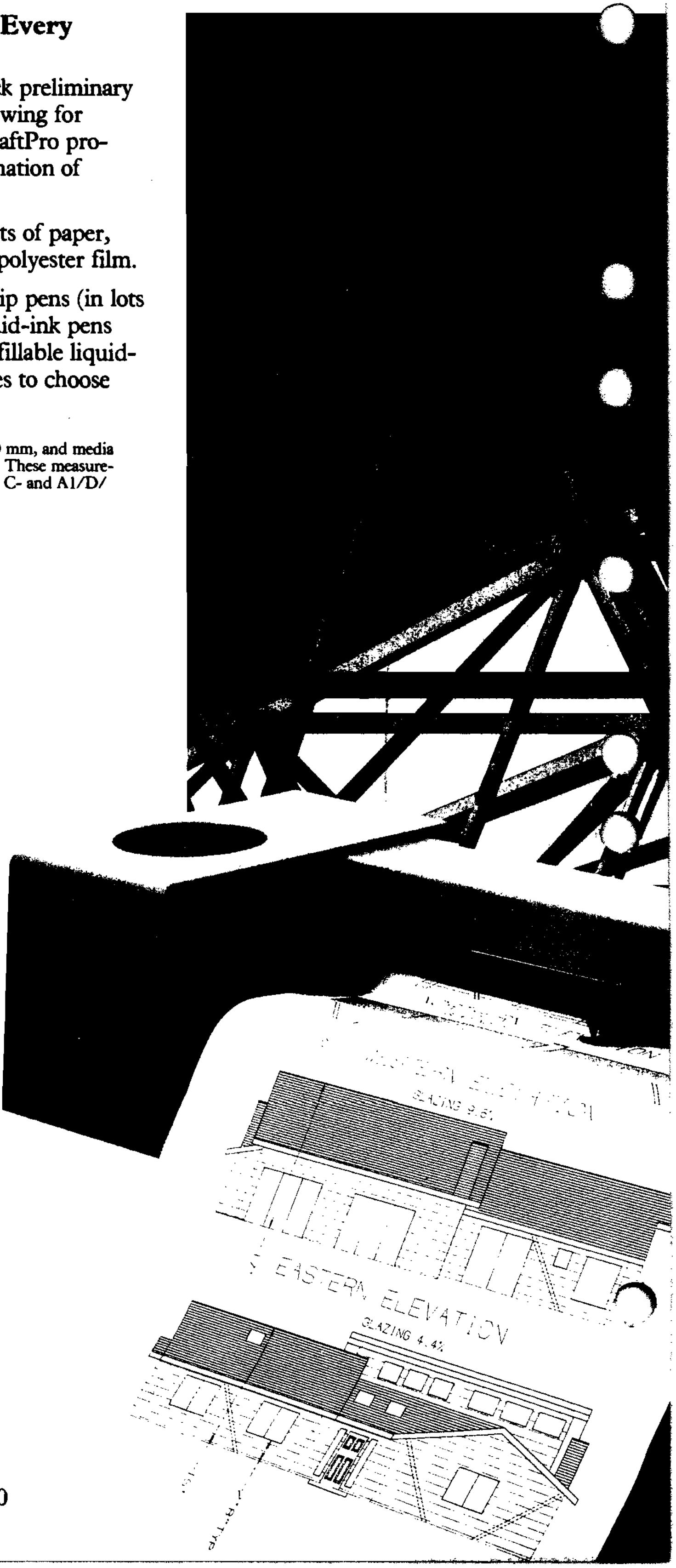
Media and Pens for Every Application

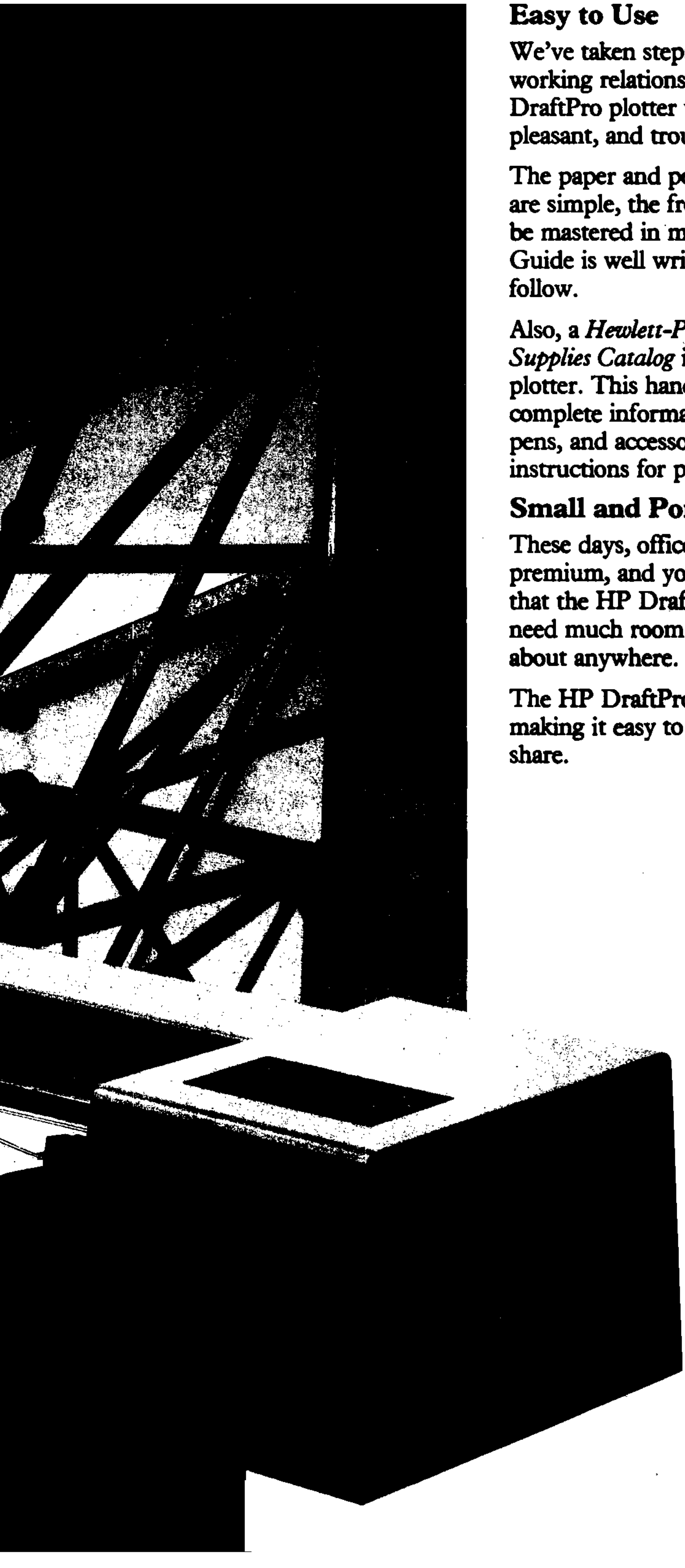
Whether you need a quick preliminary plot or a final-quality drawing for reproduction, the HP DraftPro provides the winning combination of media and pens.

It plots on full-size* sheets of paper, vellum, or double-matte polyester film.

And it draws with fiber-tip pens (in lots of colors), disposable liquid-ink pens (very convenient), and refillable liquid-ink pens (many point sizes to choose from).

*Media widths from 550 mm to 640 mm, and media lengths from 400 mm to 1000 mm. These measurements include A2/C/Architectural C- and A1/D/Architectural D-size media.





Easy to Use

We've taken steps to insure that your working relationship with the HP DraftPro plotter will be productive, pleasant, and trouble free.

The paper and pen loading procedures are simple, the front-panel controls can be mastered in minutes, and the User's Guide is well written and easy to follow.

Also, a *Hewlett-Packard Drafting Supplies Catalog* is shipped with every plotter. This handy guide provides complete information about HP media, pens, and accessories as well as simple instructions for placing phone orders.

Small and Portable

These days, office space is a real premium, and you'll be happy to know that the HP DraftPro plotter doesn't need much room to work. It fits just about anywhere.

The HP DraftPro also has wheels, making it easy to move and easy to share.

Lots of Software

The HP DraftPro offers the same wide variety of software support as our other HP drafting plotters, which includes popular packages such as AutoCAD and VersaCAD. For the most up-to-date software information, be sure to contact your local HP Sales Representative.

If you write your own code, the HP DraftPro supports more than 80 HP-GL (Hewlett-Packard Graphics Language) instructions to simplify graphics programming. With just a few commands, you can label; draw lines, arcs, and circles; or select one of 20 international character sets.

Technical Specifications:

What They Are and What They Mean to You

What will the HP DraftPro Draw On?

Different types of media are appropriate for different applications. Paper, for example, is perfect for everyday use. Polyester film, however, is best for final drawings.

- **Types of media:** paper, vellum, and double-matte polyester film.
- **Media size:** single sheets; widths from 550 mm to 640 mm, lengths from 400 mm to 1000 mm. These measurements include A2/C/Architectural C- and A1/D/Architectural D-size media.

What About Margins?

The HP DraftPro offers two margin settings: normal mode and expanded mode. Normal mode is appropriate for most all your applications. Expanded mode allows you to draw closer to the media's edge. (It may not be suitable, however, when using liquid-ink pens on polyester film or vellum).

- **Expanded mode:** three margins of approximately 5 mm (0.2 in.), fourth margin is approximately 31 mm (1.2 in.).
- **Normal mode:** three margins of approximately 15 mm (0.59 in.), fourth margin is approximately 39 mm (1.5 in.).

What Will the HP DraftPro Draw With?

For the best results, it's important to choose pens that are compatible with your media. For example, fiber-tip pens are appropriate for paper; refillable liquid-ink pens make a great combination with vellum or polyester film; and disposable liquid-ink pens work best with vellum.

- **Types of pens:** fiber-tip, disposable liquid-ink, and refillable liquid-ink drafting pens.
- **Number:** 8-pen carousel, automatic pen changing and pen capping.

What About Line Quality?

How good the lines look is a function of three things: addressable resolution, mechanical resolution, and repeatability.

Addressable resolution is the smallest distance *you* can program the pen to move. Left to its own devices, the *machine's* mechanical resolution is even more precise, equivalent to about 1/6th the width of a human hair. The smaller the resolution specifications, the better the line quality. For example, the HP DraftPro makes smooth curves, not stair-step approximations.

Repeatability refers to the plotter's ability to return a pen to a precise point. Excellent repeatability assures that new lines join smoothly with previously plotted lines and that circles close properly.

- **Addressable resolution:** 0.025 mm (0.001 in.)
- **Mechanical resolution:** 0.013 mm (0.0005 in.)
- **Repeatability:** for the same pen, 0.10 mm (0.004 in.); pen to pen, 0.20 mm (0.008 in.)

Note: the repeatability specification is for 0.08 mm (0.003 in.) polyester film.

What Does Accuracy Really Mean?

Accuracy refers to the difference in length between the distance the plotter is *instructed* to draw and the distance it *actually* draws. This specification is especially important for applications that require precision plotting.

- **Accuracy:** 0.5 mm (0.02 in.) or 0.2% of the specified line length, whichever is greater.

Note: this specification is for 0.08 mm (0.003 in.) polyester film.

How Fast Will It Plot?

The answer to this question depends on several things. Plotting time is commonly measured by pen acceleration and velocity. But these specifications don't tell the whole story.

The HP DraftPro has strong communication abilities that enhance plotting speed. It raises and lowers pens quickly. And it minimizes the number of pen picks by grouping lines of the same color together and drawing them at the same time. This is called "pen sorting."

The bottom line? You get your drawing faster.

- **Acceleration:** 2 g
- **Velocity:** pen down equals 40 cm/s (15.7 in./s); pen up equals 50 cm/s (19.7 in./s).
- **Pen cycle time:** 100 ms
- **Pen sorting capability**
- **Buffer size:** 7448 bytes (to be shared between user-definable I/O, polygon, and pen sort buffers)

How Much Energy Does It Take to Run the HP DraftPro?

Less energy than it takes to power an average household light bulb.

- **Source:** 100, 120, 220, 240 V ~ ±10%
- **Frequency:** 47.5–66 Hz
- **Consumption:** less than 80 W maximum

What About Environment?

No air conditioning? No heat? No cause to worry. The HP DraftPro plotter will work comfortably even when you can't.

- **Operating temperature:** 0°C to 55°C
- **Nonoperating temperature:** −40°C to 75°C
- **Relative humidity:** 5% to 95% (in 0°C to 40°C)

Note: media size may vary with temperature and humidity.

How Does It Measure Up?

As you've seen, good things come in this relatively small package.

- **Height:** 1030 mm (40.6 in.)
- **Width:** 1140 mm (44.9 in.)
- **Depth:** 520 mm (20.5 in.)
- **Weight:** 30 kg (66 lb)

What Interfaces are Available?

To insure compatibility with most popular CAD systems, RS-232-C comes standard on the HP DraftPro. An easy-to-install, plug-in HP-IB interface may be ordered as an accessory (and you can use RS-232-C even with the HP-IB cartridge plugged in).

- **Standard:** RS-232-C/CCITT V.24
- **Option:** HP-IB (IEEE 488-1978)

What Comes in the Box?

Here are all the accessories and supplies you'll find when you unpack your new HP DraftPro plotter.

- User's Guide
- Power Cord
- Media Sampler Kit
  5 sheets of architectural
  D-size paper
- Fiber-tip pens (0.3 mm)
  Pkg of 5 (black, blue, green, red, and yellow)
- Carousels
  Fiber-tip pen carousel
  Liquid-ink drafting pen carousel
- Grit Wheel Brush
- Hewlett-Packard Drafting Supplies Catalog

And Finally, the Price?

One of our objectives for this brochure was to prove to you what we've believed all along . . . that when you buy the HP DraftPro, you're getting *the most value for your money.*

- **U.S.A. suggested list price:** $5400

Specifications at a Glance

Media

Paper, vellum, and double-matte polyester film.

Widths from 550 mm to 640 mm, lengths from 400 mm to 1000 mm. These measurements include A2/C/Architectural C- and A1/D/Architectural D-size media.

Margins

Expanded mode: 5 mm (0.2 in.) on three edges, 31 mm (1.2 in.) on the fourth.
Normal mode: 15 mm (0.59 in.) on three edges, 39 mm (1.5 in.) on the fourth.

Pens

Fiber-tip, disposable liquid-ink, and refillable liquid-ink drafting pens.
8-pen carousel, automatic pen changing and pen capping.

Resolution

Addressable: 0.025 mm (0.001 in.) Mechanical: 0.013 mm (0.0005 in.)

Repeatability*

For the same pen: 0.10 mm (0.004 in.) Pen to pen: 0.20 mm (0.008 in.)

Accuracy*

0.5 mm (0.02 in.) or 0.2% of the specified line length, whichever is greater.

Acceleration

2 g

Velocity

Pen down: 40 cm/s (15.7 in./s) Pen up: 50 cm/s (19.7 in./s)

Pen Cycle Time

100 ms

Buffer Size

7448 bytes (to be shared between user-definable I/O, polygon, and pen sort buffers)

Power Requirements

Source: 100, 120, 220, 240 V ~ ±10%
Frequency: 47.5–66 Hz
Consumption: less than 80 W maximum

Environmental Range (limited by media)

Operating temperature: 0°C to 55°C
Nonoperating temperature: −40°C to 75°C
Relative humidity: 5% to 95% (in 0°C to 40°C)

Size

Height: 1030 mm (40.6 in.) Depth: 520 mm (20.5 in.)
Width: 1140 mm (44.9 in.) Weight: 30 kg (66 lb)

Interfaces

RS-232-C/CCITT V.24; HP-IB (IEEE 488-1978) available as an accessory

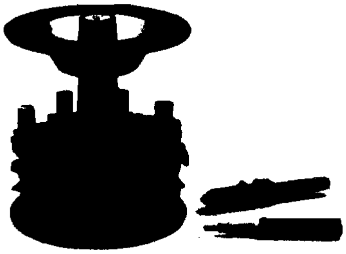
U.S.A. Suggested List Price

$5400

*These specifications are for 0.08 mm (0.003 in.) polyester film.

Ordering Information

From our design team to yours!



DraftPro Plotter

Description	Part Number
RS-232-C/CCITT V.24 interface	HP 7570A

Accessories

Description	Part Number
HP-IB Cartridge	HP 17570A
HP-IB Installation Instructions	07570-90014
Programmer's Reference (available in English only)	07570-90001
Programmer's Pocket Guide (available in English only)	07570-90003
Hardware Support Manual	07570-90000

Cables (must be ordered separately)

Description	Part Number
Male-to-male, RS-232-C/CCITT V.24, straight-through cable (3 metres). For use with Apple IIe, Apple III*, and other DCE devices.	HP 17355M
Male-to-female, RS-232-C/CCITT V.24, straight-through cable (3 metres). For use with DCE devices requiring a female connector.	HP 17355D
Male-to-female, RS-232-C/CCITT V.24, modem eliminator type (1.5 metres). For use with IBM PC, PC-XT, plug compatibles, and other DTE devices.	HP 17255D
Male-to-male, RS-232-C/CCITT V.24, modem eliminator type (HP 17255M is 1.5 metres, HP 13242G is 5 metres). For use with HP Touchscreen computers and other DTE devices.	HP 17255M or HP 13242G
Male-to-female (25-pin to 9-pin), RS-232-C/CCITT V.24, modem eliminator type (3 metres). For use with IBM AT, HP Vectra, plug compatibles, and other DTE devices.	HP 24542G
Male-to-male (25-pin to 9-pin), RS-232-C/CCITT V.24 (1.5 metres). For use with Apple Macintosh computers.	HP 92219M**
RS-232-C/CCITT V.24, Eavesdrop Y-cable	HP 17455A
HP-IB (IEEE 488-1978) cable, RFI shielded. Cables HP 31389 and HP 45529 are equivalent to HP 10833. A is 1 metre, B is 2 metres, C is 4 metres.	HP 10833A/B/C

*Additional cable required from computer manufacturer.

**Similar to Imagewriter cable. Please verify with software supplier before purchase.

HEWLETT PACKARD

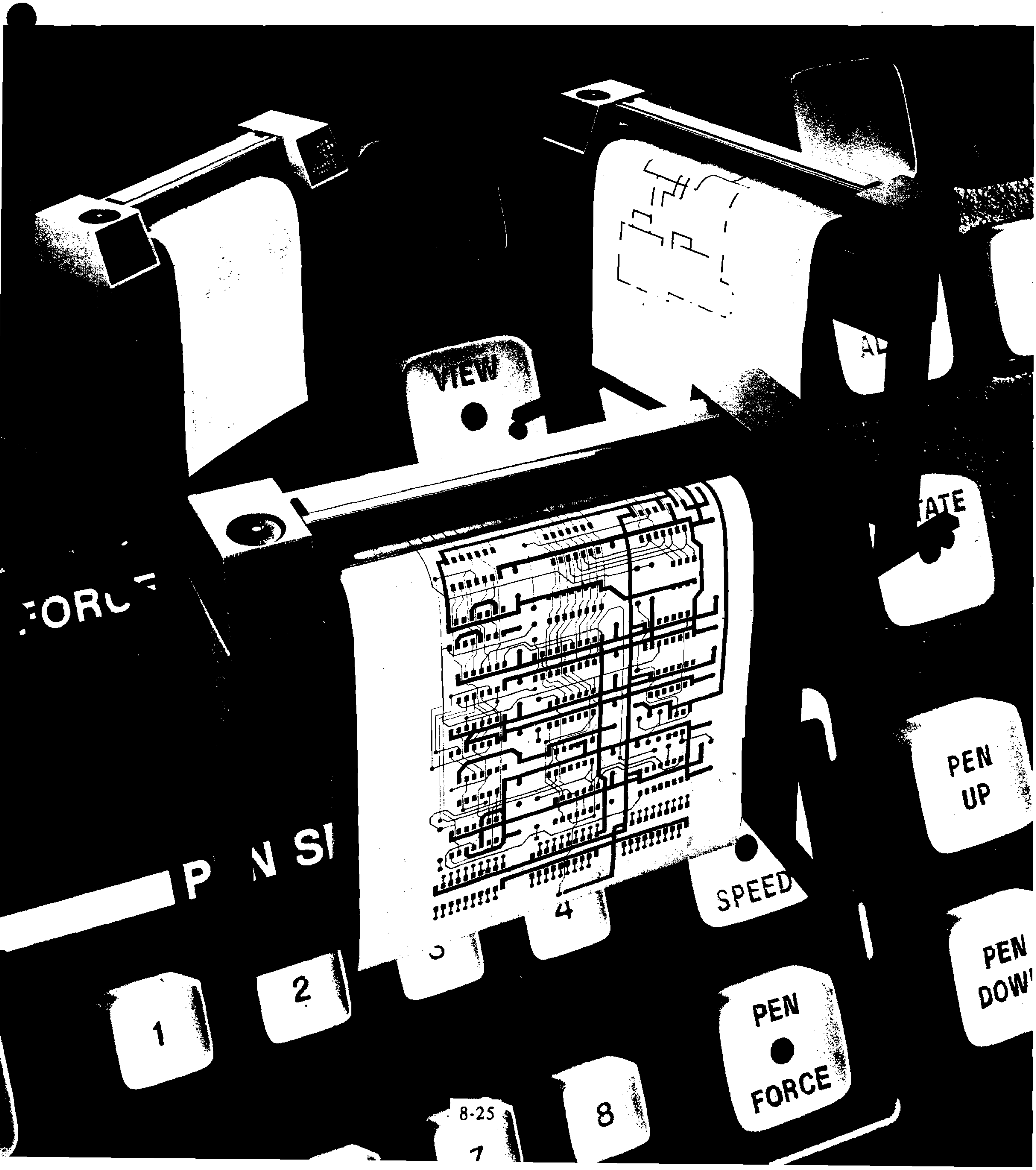
For more information, call your local HP sales office listed in the telephone directory white pages. Or write to Hewlett-Packard: **U.S.A.** — P.O. Box 10301, Palo Alto, CA 94303-0890. **Europe** — P.O. Box 9[illegible] Z Amstelveen, The Netherlands. **Canada** — 6877 Goreway Drive, Mississauga, L4V 1M8, Ontario. **Japan** — Yokogawa-Hewl[illegible]d Ltd., 3-29-21, Takaido-Higashi, Suginami-ku, Tokyo 168. **Elsewhere** in the world, write to Hewlett-Packard Intercontinental, [illegible] Creek Road, Palo Alto, CA 94304.

A Complete Family of HP Drafting Plotters

HEWLETT PACKARD

TECHNICAL DATA, AUGUST 1985

HP 7580B A1/D-size model for sheet media
HP 7585B A0/E-size model for sheet media
HP 7586B A0/E-size model for sheet and roll media


VIEW
FORCE
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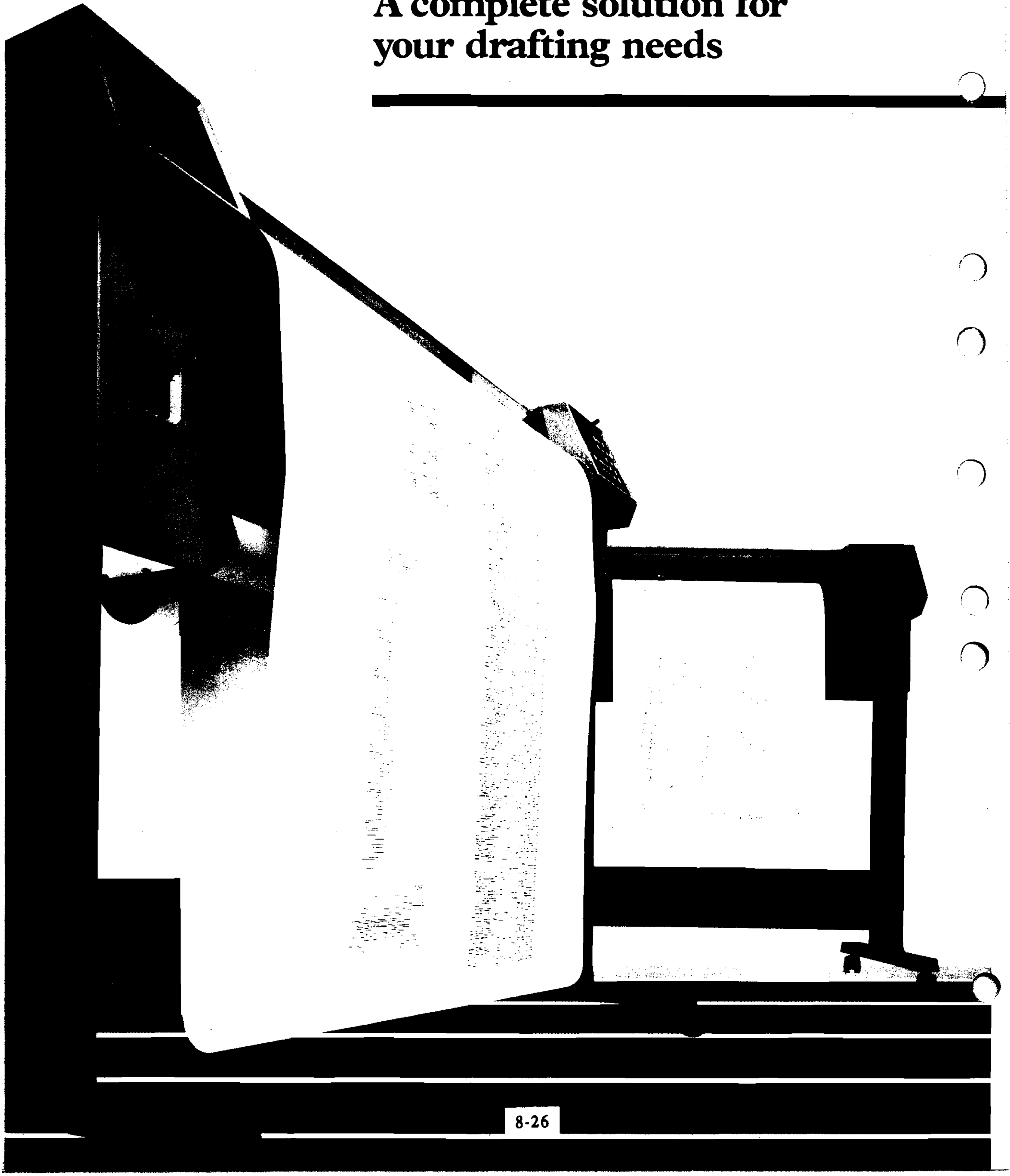
STATE

A complete solution for your drafting needs

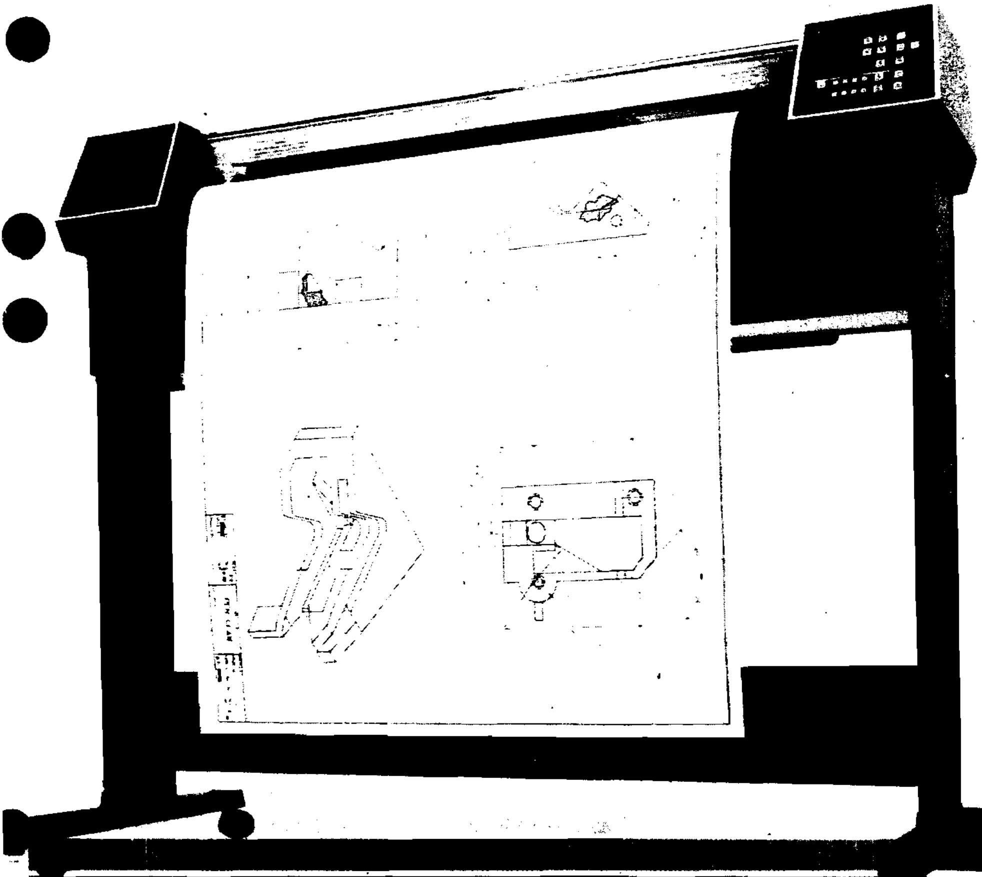


Computer Museum

Plotters you can buy with confidence

Just four years ago, Hewlett-Packard revolutionized the drafting plotter market with the HP 7580A. The plotter's innovative paper-moving technology, superior performance, and low price established HP as a leader in large plotter design.

Today, HP drafting plotters are industry standards for two simple reasons: unmatched quality and reliability, and prices you can afford. That's a combination that builds confidence!



A plotter made to fit your needs

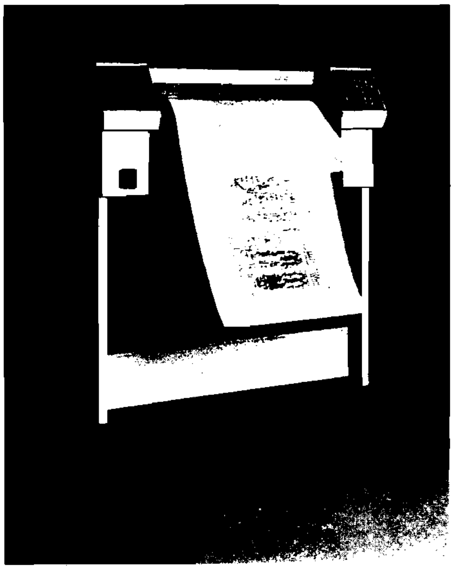
Whenever you need large, visually perfect drawings, you'll find an HP drafting plotter suited to your application. Hewlett-Packard offers you a choice of three models.

The HP 7580B is a cost-effective solution for single sheet plots in sizes up to A1/D. When you need larger A0/E-size plots, add the HP 7585B to your system.

Completing our selection, is the HP 7586B A0/E-size plotter for both single sheet and roll media plotting. Designed for high volume, continuous feed, and long axis plotting, the HP 7586B is a truly versatile solution for all your drafting plotter requirements.

Take a look at the features described on the following pages — you'll see how all the details work together to ensure fast, high-quality output, user convenience, flexibility and power, and reliability. You'll also find a feature listing to help you choose between the three models.

Quick, precise plotters for high-quality output



Each drawing from an HP drafting plotter speaks for itself. Plotting is quick and precise, lines and curves are consistently smooth, and characters are sharply defined. To achieve output quality and speed, every detail counts — high resolution and repeatability, intelligent pen control, and mechanical accuracy.

High resolution and repeatability give you superior line quality

A plotter's addressable resolution is the smallest move that you can specify programmatically. On HP plotters this is 0.025 mm (0.000984 in.). An even finer mechanical resolution of 0.003 mm (0.00012 in.) makes pen movements still more precise.

High repeatability enables the plotter to join new lines smoothly to previously plotted ones. With HP drafting plotters this repeatability is 0.10 mm (0.004 in.) on paper, vellum, and 0.075 mm (0.003 in.) double-matte polyester film.

Pen control means line consistency

In HP drafting plotters, pen motion is damped as pens descend toward the plotting surface. Damping minimizes pen bounce and protects pen tips. As a result, lines are uniform and pens last longer.

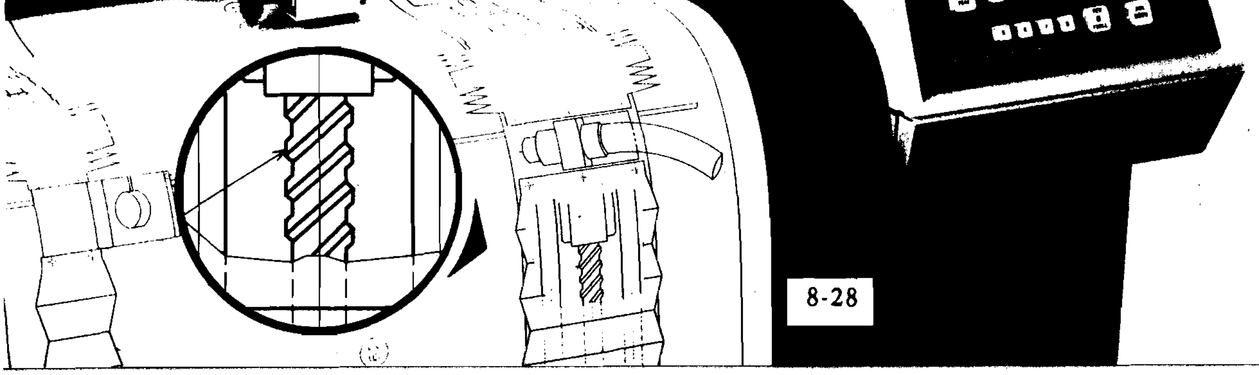
To keep line width consistent, the same pen velocity and acceleration are maintained in any given direction. And to assure the highest line quality for each pen type, the plotter sets optimum pen speed and force automatically.

Speed and acceleration are keys to high throughput

At 60 cm/s (24 in./s) maximum speed and 4 g's acceleration, HP pen plotters are among the fastest in their price range. But HP has done even more to optimize throughput. The plotter executes all pen-up moves at maximum speed, even when your drawing medium requires slower pen-down speeds. The pen is lifted to maximum height only for long moves. And for quick working drawings, you can program the plotter to write in a character font that plots faster.

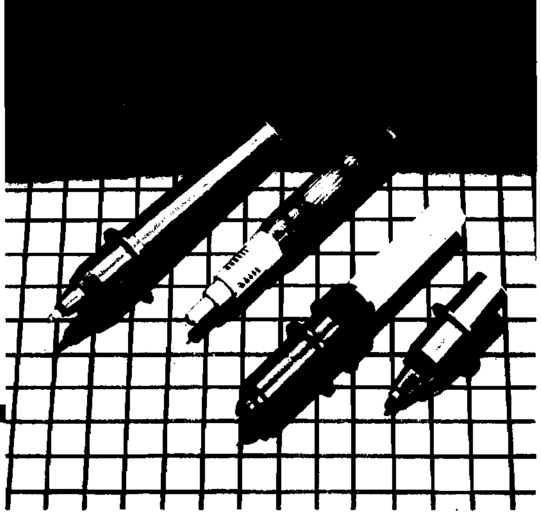
High accuracy for critical applications

Algorithms are stored in plotter memory to compensate for mechanical tolerances. This enables the plotter to position one endpoint with a high degree of accuracy in relation to other endpoints. Endpoint accuracy in HP drafting plotters is 0.1% of the specified move length or 0.25 mm (0.01 in.), whichever is greater. This exactness exceeds the needs for most drawing applications.



This unretouched close-up shows the excellent line quality achieved by HP drafting plotters. It is a section of a plot drawn on paper with a fiber-tip pen.

Friendly, versatile plotters that save you time

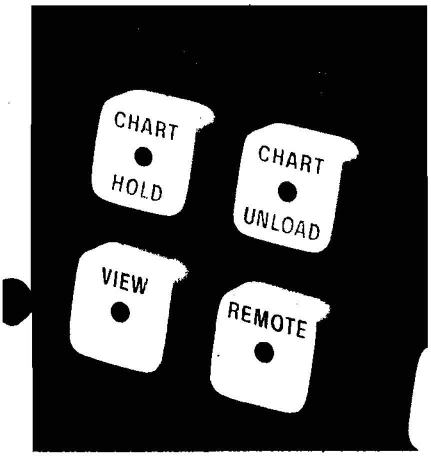


HP's attention to detail is apparent in features which make plotter operation easy. Whether you are loading paper and pens or using front-panel controls, you will appreciate HP features that save you time and add to your drawing flexibility.

Quick media loading

For single sheets, loading is very easy. Use the paper guide and slip the paper under the pinch wheels; move the right pinch wheel to the media edge; lower the wheels with the push of a button — the plotter does the rest. Electronic sensors identify paper size and set the margins automatically.

Roll media loading on the HP 7586B is also easy. Snap the supply roll into place and thread the paper under the pinch wheels. If you want the plotter to store your drawings as they are finished, tape the paper to each end of the take-up core. Then push CHART HOLD and all adjustments will be made automatically. The HP 7586B will sense electronically whether you are using single sheets or rolls.



Just four front-panel buttons control normal plotter operation.

A carousel of colors: eight pens capped automatically

HP drafting plotters hold eight pens. You can use four pen types — fiber tip, roller ball, refillable drafting, and disposable drafting pens — and each type has its own carousel.

You can mix a variety of pen widths and colors in one carousel, and if you need to, you can even mix different pen types in the same carousel.

When not in use, pens remain tightly capped in the carousel to prevent premature ink drying.

Easy front-panel control

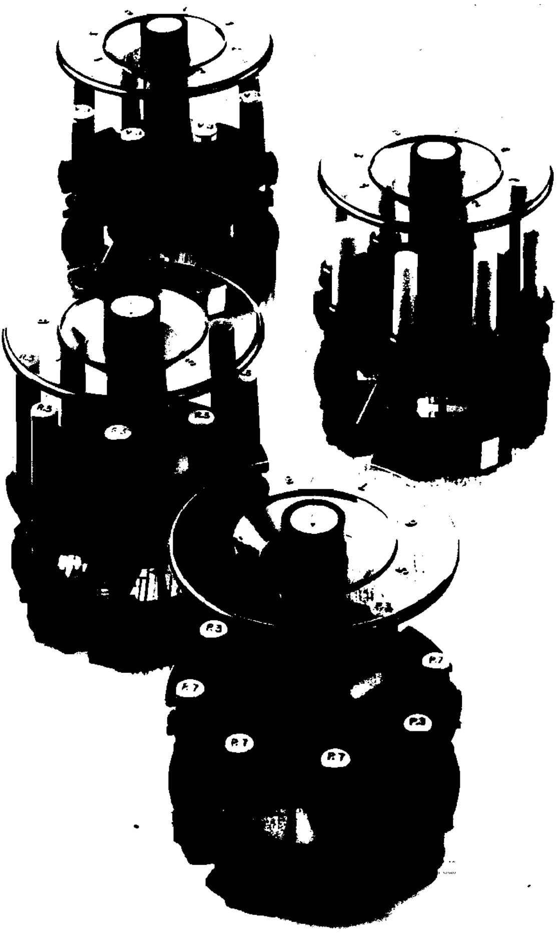
Just four buttons control normal plotter operation: CHART HOLD, CHART UNLOAD, VIEW, and REMOTE. These buttons lower and raise the pinch wheels for media loading, tell the plotter to begin accepting program instructions from the computer, and let you interrupt plotting to view your drawing.

The front panel also gives you local control of many plotter functions. For example, you can override default or programmed values for pen speed and force, reset plotting limits, change P1 and P2 positions for scaling, rotate your drawing 90 degrees, and align the axes with those on preprinted forms.

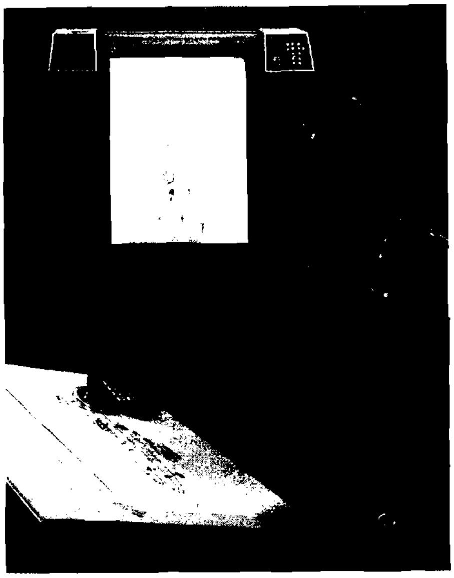
For point digitizing, you can install a digitizing sight in the pen holder and move the joystick in any direction to locate coordinates quickly.

Lightweight and easy to move

HP drafting plotters are compact and lightweight so they roll easily from one work area to another. They require less space than most tables.



Each pen type has its own eight-pen carousel. Pen type is represented pictorially on the carousel's safety cap.



Reliable plotters that place flexibility and power at your fingertips

HP drafting plotters give you the flexibility and power that every user should have. Look at the intelligence and interfacing features below — and see what you can expect from a superior drafting plotter.

Powerful graphics instruction set

The Hewlett-Packard Graphics Language (HP-GL) is a set of two-letter codes, usually first letter abbreviations of plotting functions. These internal instructions simplify graphics programming. With just one or two instructions you can, for example, draw arcs, lines and circles; label; color wedges, rectangles and polygons; or select a character set.

Since HP-GL is used in almost all HP plotters, most programs already running on smaller plotters can be used on the drafting plotters.

HP-GL area fill instructions

Area fill instructions make it easy to use patterns or solid coloring in wedges, rectangles, and polygons. To color a wedge, just specify its angle; to fill a rectangle, define just two points, the current pen position and its opposite corner. Or you can fill polygons, even with multiple islands, by defining the polygon boundaries. These instructions will save programming time and host computer overhead.

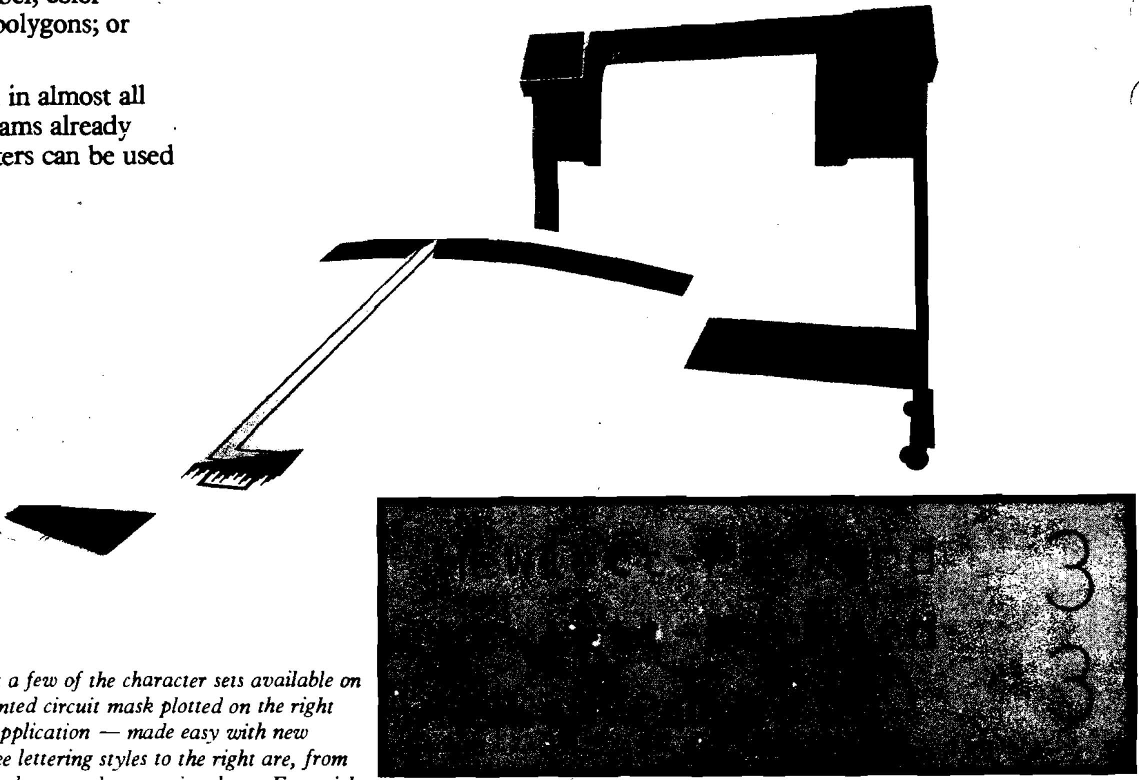
Select a character set . . . or define your own

With HP drafting plotters you have access to 21 international character sets including ten ISO European sets, Katakana, ASCII, Roman Extensions, and special symbol sets.

A "downloadable" set for creating user-defined characters is also available whenever you need a special alphabet, font, or symbol. For example, you can download your terminal's character set so the plotted output will look just like your display. Or create a set of symbols used frequently in your specific application.

Choose from three lettering styles

Each character set can be plotted in three styles. Fixed vector lettering produces equally spaced block characters. High-resolution arc-generated characters can be plotted with proportional spacing for maximum aesthetic appeal or with fixed spacing so columns and tables line up evenly.



The plot on the left shows just a few of the character sets available on HP drafting plotters. The printed circuit mask plotted on the right illustrates a typical area fill application — made easy with new HP-GL instructions. The three lettering styles to the right are, from top to bottom, fixed block, fixed arc, and proportional arc. For quick lettering you can plot arc characters with fewer vectors as shown by the second number three in the sample.

18K-byte buffer

A large, 18K-byte partitionable buffer adds more power to your HP drafting plotter. This increased size allows you to pass more data to the plotter with minimal system overhead.

Error recovery with block mode data transfer

Data can be transferred in block mode with both the RS-232-C and HP-IB interfaces. Block mode data transfer provides a reliable method of detecting transmission errors, permits error recovery, and prevents loss of your valuable plotting time.

Interfacing flexibility

Two switch-selectable standard interfaces are built into each plotter: the HP-IB (IEEE 488-1978) interface and the RS-232-C/CCITT V.24 serial interface.

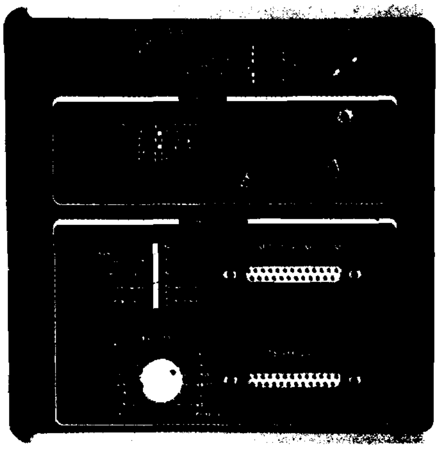
Four handshaking modes allow interfacing to a broad range of computer systems: XON/XOFF and HARDWIRE, two plotter-controlled handshakes; SOFTWARE CHECK, a handshake controlled from an application program; and ENQ/ACK, a computer-controlled handshake.

To make remote modem operation easy, two RS-232-C connectors are provided so that one computer port can support both the plotter and a terminal.

Multilevel graphics software

HP drafting plotters are supported on HP computer systems, desktop and personal computers, and intelligent terminals at two levels: application software and software for programmer support. Application software gives you packaged solutions to specific graphics needs. Programmer software simplifies programming tasks with high-level, device independent tools such as graphics ROM commands and extensions to HPL, BASIC and Pascal.

For users of industry standard FORTRAN subroutines, Hewlett-Packard's Industry Standard Plotting Package (HP-ISPP) provides 15 user-callable FORTRAN subroutines which make the programs you are already using compatible with HP plotters.

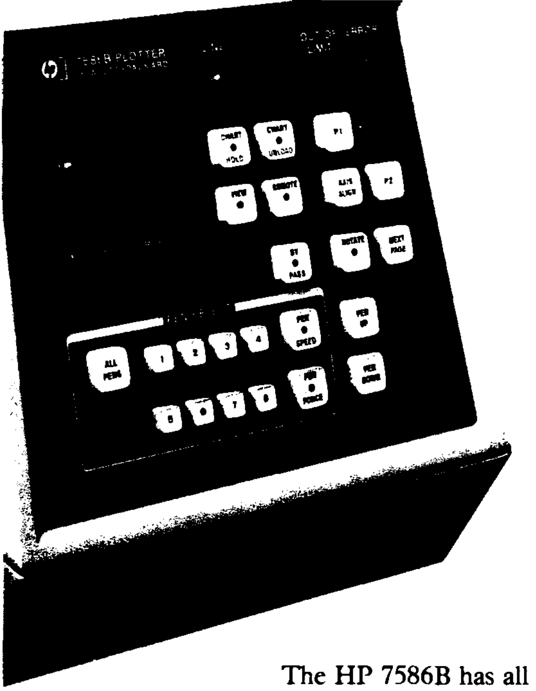


Reliability and support are part of the product

When we build quality, convenience, flexibility, and power into our plotters, we build in reliability as well. Extensive testing assures you low maintenance costs and products that are guaranteed to perform as specified.

When you buy HP products, you can expect prompt and thorough service and support. Because HP maintains sales and service facilities throughout the world, we can supply information or repair service when and where you need it. In addition to a standard product warranty, HP offers a variety of on-site service plans. And all HP drafting plotters have built-in self-tests to help service personnel isolate problems quickly. With this kind of support your HP plotter is ready when you are — its power is at your fingertips.

Take a closer look at HP's selection of drafting plotters on the following pages. Then decide which plotter fits your particular needs.



A closer look at the HP 7586B roll feed plotter

The HP 7586B has all the advantages of the HP 7580B and HP 7585B — and more. Look what else you can do with the HP 7586B.

Increase media flexibility

The HP 7586B can be operated in three different modes. It works as a sheet plotter, so you can use preprinted forms or do single plots; as a roll feed plotter with take-up, so you can run large numbers of plots which are rolled up for neat storage; and as a roll feed plotter without take-up, so you can remove each plot as it is finished.

With roll feed, you can plot without reloading media for each drawing, an advantage when many users share one plotter. The HP 7586B accommodates paper, vellum, or double-matte polyester film on rolls in standard widths from 267 mm (10.5 in.) to 919 mm (36.2 in.) and lengths up to 46 m (150 ft).

Draw long axis plots

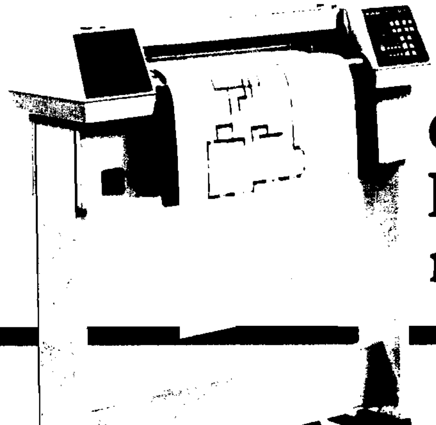
The HP 7586B's frame-to-frame long axis technique allows you to draw plots up to 46 metres (150 ft) long.

Long plots are divided into sections and drawn one frame at a time. The plotter draws registration marks in the margins to align the sections. As the plotter finishes each section, it digitizes these marks and adjusts the next frame to assure that the plot continues exactly where it left off.

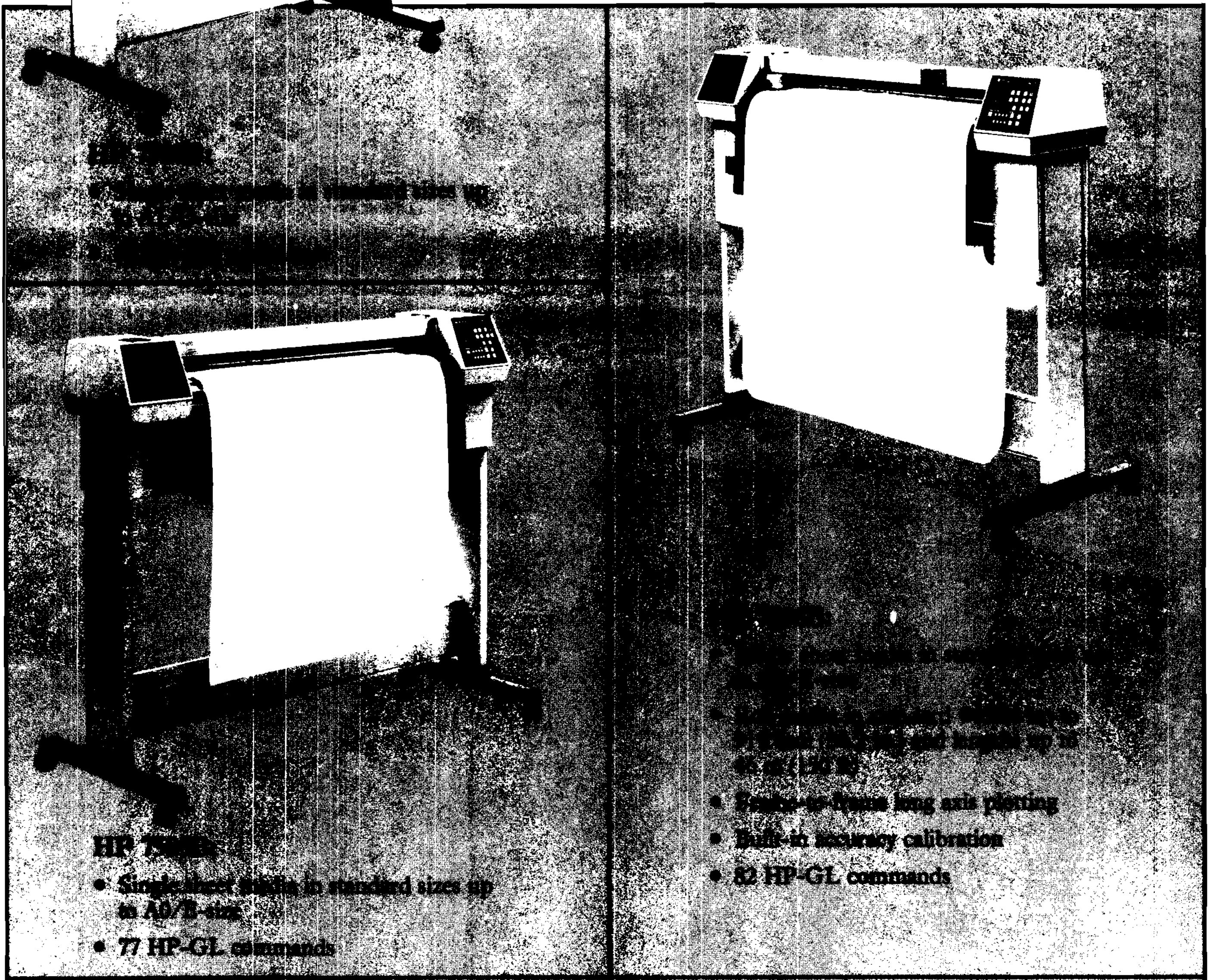
Calibrate your own plotter

The HP 7586B has a built-in accuracy calibration routine which allows you to calibrate your own plotter. The procedure is easy and it can be done using the plotter alone, so you can check plotter accuracy as often as required. And you can recalibrate for different media types when accuracy is critical to your application.

This feature puts more plotter control in your hands, saves you service calls, and gives you confidence that your plots will always be drawn with optimum accuracy.



Choose the HP drafting plotter that makes sense for you



[illegible]

HP [illegible]

- [illegible]
- [illegible]
- Scale-to-frame long axis plotting
- Built-in accuracy calibration
- 82 HP-GL commands

HP [illegible]

- Single-sheet media in standard sizes up to A0/E-size
- 77 HP-GL commands

With all three models you'll have the following advantages:

- high addressable resolution of 0.025 mm (0.000984 in.)
- 60 cm/s maximum speed and 4 g's acceleration
- 8-pen carousels with automatic pen capping
- choice of media including paper, vellum, tracing bond, and double-matte polyester film
- four pen types — fiber tip, roller ball, refillable drafting, and disposable drafting pens — in a variety of colors and widths
- intelligence features including 21 character sets, a downloadable character set, HP-GL, area fill commands, and an 18K-byte buffer
- switch-selectable dual interface with four handshaking modes and eavesdrop

Specifications

Resolution

Smallest addressable move	0.025 mm (0.000984 in.)
Mechanical resolution	0.003 mm (0.00012 in.)

Repeatability (for a given pen)

On paper, vellum or 0.075 mm (0.003 in.) double-matte polyester film at 10–30°C	0.10 mm (0.004 in.)

Backlash Accuracy

On 0.075 mm (0.003 in.) double-matte polyester film at 10–30°C, level floor	0.1% of the move or 0.25 mm (0.0098 in.), whichever is greater

NOTE: Specifications apply only when plotting single frames and using HP supplies.

Supplemental Characteristics

Maximum Plotting Area

Single sheet plotting	Drawing sheet less margins
Roll media plotting	Roll width times frame length less margins
Long axis plotting	Roll width less 30 mm (1.2 in.) margin, length variable up to 45 metres (150 ft).

Frame Lengths for Roll Media

Roll widths less than 298.5 mm (11.75 in.): 431.8 mm (17 in.)
Roll widths greater than 721.4 mm (28.4 in.): 1219.2 mm (48 in.)
Roll widths between 298.5 and 721.4 mm: 914.4 mm (36 in.)

Margins

Single sheet:	Normal mode	Three margins approximately 15 mm (.59 in.) each, fourth margin approximately 39 mm (1.5 in.)
	Expand mode	Three margins approximately 5 mm (.2 in.) each, fourth margin approximately 29 mm (1.1 in.)
Roll media:	Normal mode	15 mm (.59 in.) each side
	Expand mode	Not recommended for use

Speed

Pen down	
Maximum	60 cm/s (24 in./s) independent of vector direction
From the program	1 to 60 cm/s (0.4 to 24 in./s) in increments of 1 cm/s
From the front panel	10 to 60 cm/s (4 to 24 in./s) in increments of 10 cm/s

Supplemental Characteristics (Cont.)

Speed (Cont.)

Pen up	60 cm/s (24 in./s) regardless of pen-down speed

Acceleration

Maximum	4 g's (39 m/s^2, 128 ft/s^2)
From the program	1 to 4 g's (9.8 to 39 m/s^2, 32 to 128 ft/s^2) in increments of 1 g

Pen Force

From the program or front panel	10 to 66 grams in increments of 8 grams

Power Requirements

Source	100, 120, 220, 240 V ~ −10%, +5%
Frequency	48–66 Hz
Consumption	[illegible] W maximum

Environmental Range (limited by media)

Operating	
Temperature	0°C to 55°C
Relative humidity: Sheets	5% to 95% [illegible]
Rolls	[illegible]
Nonoperating	
Temperature	−40°C to 75°C

Interfaces (selectable from front panel)

HP-IB (IEEE 488-1978)	[illegible] or less
RS-232-C/CCITT V.24	[illegible] 9600

Buffer

Size	[illegible] bytes

Pens

Number	8, automatic pen changing from carousel
Type	Fiber tip, refillable drafting, disposable drafting, roller ball

Media Types

Most standard paper, vellum, and tracing bond; double-matte polyester films from 0.05 mm (0.002 in.) to 0.1 mm (0.004 in.) thick

[illegible]

[illegible]	
HP 7580B	
Width	[illegible] mm (16.5 in.) to 622 mm (24.5 in.), which includes standard sizes A4/A, A3/B, A2/C, A1/D, and architectural size D
Length	203 mm (8 in.) to 1231.9 mm (48.5 in.)
HP 7585B and HP 7586B (sheets)	
Width	267 mm (10.5 in.) to 298 mm (11.75 in.), which includes standard sizes A4/A and A3/B; and 546 mm (21.5 in.) to 927 mm (36.5 in.), which includes standard sizes A2/C, A1/D, A0/E, and architectural size E
Length	203 mm (8 in.) to 1231.9 mm (48.5 in.)
HP 7586B (rolls)	
Width	267 mm (10.5 in.) to 298 mm (11.75 in.) and 546 mm (21.5 in.) to 919 mm (36.2 in.)
Length	46 metres (150 ft)
Roll core, inner diameter	51 mm ±1.6 mm (2.0 in.)
Plotter Size	
HP 7580B	
Height	1188 mm (46.8 in.)
Width	1087 mm (42.8 in.)
Depth	557 mm (21.9 in.)
HP 7585B and HP 7586B	
Height	1188 mm (46.8 in.)
Width	1392 mm (54.8 in.)
Depth	557 mm (21.9 in.)
Plotter Weight	
HP 7580B	
Net weight	59.1 kg (130 lb)
Shipping weight	Approximately 114 kg (250 lb)
HP 7585B	
Net weight	70.4 kg (155 lb)
Shipping weight	Approximately 131 kg (290 lb)
HP 7586B	
Net weight	86.4 kg (190 lb)
Shipping weight	Approximately 147.8 kg (325 lb)

Accessories Supplied with Plotters

[illegible] and Programming Manual	[illegible]
Operator's Manual	07580-[illegible]
Reference Card	07580-90035
Preferred Media Guide	07580-90036
Pen Carousels	
Fiber tip	07580-60035
Disposable Drafting	07580-60240
Roller ball	07580-60062
Fiber-tip Pens with 0.7 mm Tips	
Package of 4 (assorted colors)	5060-6858
Package of 6 (assorted colors)	5060-6895
Disposable Drafting Pens	
Package of 4 (black, blue, red, green)	5061-7566
Disposable Drafting Pen Adapters and Caps	5061-7578
Roller-ball Pens	
Package of 4 (assorted colors)	5061-5037
Media Sampler* (each sampler — 50 sheets of chart paper and 5 sheets of vellum)	
HP 7580B	
A1-size media or D-size media	[illegible]
HP 7585B	
A0-size media or E-size media	[illegible]
HP 7586B	
A0-size media or E-size media	[illegible]
914.4 mm [illegible]	[illegible]
914.4 mm [illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Power Cord (cord appropriate to destination of plotter)	
Male-to-male Interface Cable	[illegible]
Drafting Supplies Catalog	
U.S.A. only	[illegible]
International	[illegible]

* [illegible]

Ordering Information

Accessories Available	**HP Part No.**
Service Manual	
HP 7580B	07580-90022
HP 7585B	07585-90002
HP 7586B	07586-90000
Chart paper	
D-size, 200 sheet package	9280-0527
E-size, 150 sheet package	9280-0587
A1-size, 200 sheet package	9280-0528
A0-size, 150 sheet package	9280-0590
609.6 mm (24 in.) roll	9280-0638
914.4 mm (36 in.) roll	9280-0637
Vellum	
D-size, 150 sheet package	9280-0529
E-size, 150 sheet package	9280-0593
A1-size, 150 sheet package	9280-0530
A0-size, 150 sheet package	9280-0594
609.6 mm (24 in.) roll	9280-0635
914.4 mm (36 in.) roll	9280-0636
Tracing bond	
D-size, 150 sheet package	9280-0600
E-size, 150 sheet package	9280-0598
A1-size, 150 sheet package	9280-0599
A0-size, 150 sheet package	9280-0597
Double-matte polyester film, 0.075 mm (0.003 in.)	
D-size, 50 sheet package	9280-0526
E-size, 50 sheet package	9280-0591
A1-size, 50 sheet package	9280-0525
A0-size, 50 sheet package	9280-0592
609.6 mm (24 in.) roll	9280-0634
914.4 mm (36 in.) roll	9280-0633
Paper spool	
609.6 mm (24 in.) spool	9300-1068
914.4 mm (36 in.) spool	9300-1069

***NOTE:** All rolls are 46 metres (150 ft) long. D-size is 22 × 34 in.; A1-size is 594 × 841 mm; E-size is 34 × 44 in.; A0-size is 841 × 1189 mm.*

Refillable Drafting Pen Carousel	07580-60081
Refillable Drafting Pen Bodies	07580-60025
Refillable Drafting Pen Tips	
0.18 mm tip	9260-0742
0.25 mm tip	9260-0741
0.35 mm tip	9260-0588
0.50 mm tip	9260-0744
0.7 mm tip	9260-0579
1.0 mm tip	9260-0743

Accessories Available (Cont.)	**HP Part No.**
Refillable Drafting Pen Cleaning Syringe	9282-0905
Refillable Drafting Pen Ink — Black (0.75 oz. container)	9260-0596
Refillable Drafting Pen Cleaning Solution	9282-0908
Writing accessories chest, hardwood	07580-60163
Plotter Pen Organizers	
Four-pen Holder	07225-40054
Thirty-pen Holder	
For Short-body Pens	92177T
For Long-body Pens	92177U
Digitizing sight, angled view	07585-60191
Digitizing sight, straight view	09872-60066
Pen caps for carousels	
For fiber-tip or roller-ball pens, package of 8	07580-60182
For drafting pens, package of 8	07580-60181

Refillable drafting pen tips are also available in the following sizes: 0.18, 0.25, 0.35, 0.50, 0.70, and 1.00 mm. See the HP Computer Users Catalog (P/N 5953-2450) for a complete list of HP supplies. Media and drafting pen tips can also be purchased from HP computer dealers and engineering supply stores. The operator's manual lists recommended media and pen tips.

Ordering Options

Manual Options*

051	for use with HP 9000, Series 200 computers
052	for use with HP Series 100 personal computers
053	for use with HP 3000 computers
058	for use with HP Series 80 personal computers
059	for use with HP 9000, Series 500 computers
060	for use with HP 1000 computers
065	for use with Non-HP computers

*Use the manual option numbers to indicate the computer you will use with your plotter. If a graphics programming guide is available for that computer, it will be shipped with your plotter.

Price

HP 7580B	$ 9,900
HP 7585B	$12,900
HP 7586B	$16,900

U.S.A. List Prices Only.
Prices include delivery to any destination in the 50 United States.
Prices do not include insurance or sales tax.

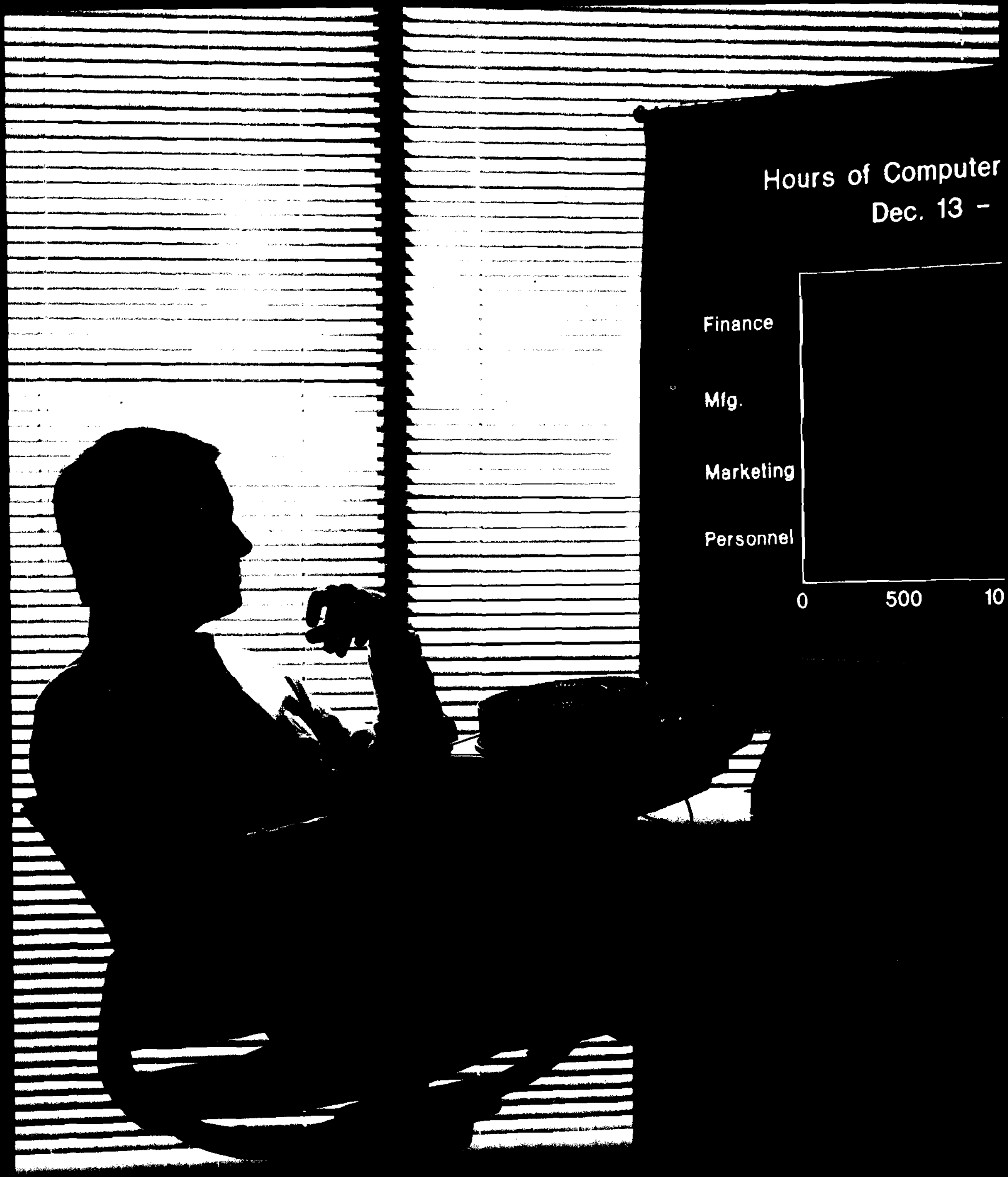
For more information, call your local HP Sales Office or nearest Regional Office: Eastern (301) [illegible] Midwestern (312) 255-9800; Southern (404) 955-1500; [illegible] Or write Hewlett-Packard, [illegible] Palo Alto, CA [illegible] In Europe, Hewlett-Packard S.A., [illegible] Switzerland. In Japan, Yokogawa-Hewlett-Packard Ltd., [illegible]

HEWLETT-PACKARD

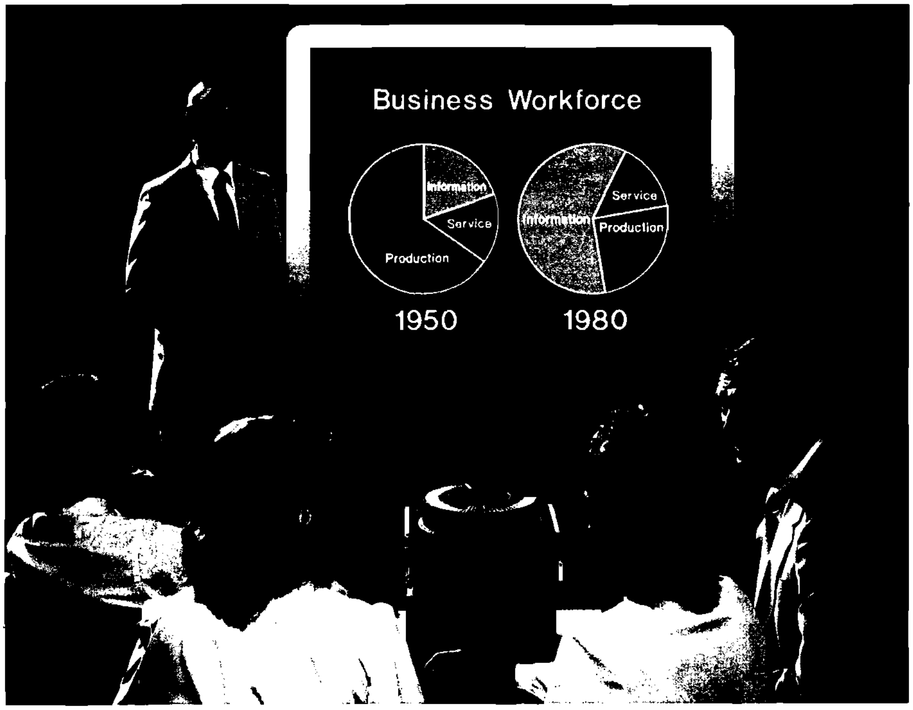
HP 7510 Color Film Recorder

For high-quality 35-mm slides

TECHNICAL DATA, JULY 1985


Hours of Computer
Dec. 13 -
Finance
Mfg.
Marketing
Personnel
0
500
10

HP 7510 color film recorder


Business Workforce
Information
Service
Production
1950
Information
Service
Production
1980

Slides make presentations shine!

Recognized as the premier visual aid, 35-mm slides add color and vitality to those important presentations. Nothing attracts and holds attention like the brightness and image quality of a high-resolution 35-mm slide.

Now with the Hewlett-Packard 7510 color film recorder, you can create slides and instant prints with your mainframe, mini, or personal computer. The HP 7510 is the perfect complement to your in-house graphics capabilities.

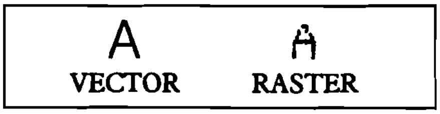
Enhance your professionalism

Bright, colorful slides really bring your presentation to life. And a polished presentation is a sparkling reflection of your professionalism.

With the HP 7510 you're assured of the highest-quality slides — slides you'd only expect from a system costing much, much more.

Most slide systems use raster technology or rely on screen resolution. This often produces slides with "jaggies" — an annoying zigzag effect that makes straight lines look like flights of stairs.

Vector technology and high resolution enable the HP 7510 to draw arrow-straight lines and smooth curves.


A
VECTOR
A
RASTER

Vector technology produces straight lines and smooth curves. Raster devices can only approximate curves and diagonals by selecting dots from a matrix.

Worldwide CAE/CAD/CAM Market
1984-88 by Application

Easy to use

Coupled with software, the HP 7510 requires no technical or artistic expertise to use. Just turn the HP 7510 on, create a chart or graph on your computer, load the film, and remove the results — everything else is automatic!

Similar to a plotter

Think of the HP 7510 as a pen plotter, but instead of drawing on paper with ink, you will be drawing on film with light. This light automatically passes through internal color filters, allowing you to create over 16 million colors!

The HP 7510 is supported by many of the same software packages that support plotters. Your HP representative can provide you with specifics or you can contact the vendor of your current graphics software package for more information about their HP 7510 support plans.

Just plug it in

The HP 7510 has both an RS-232-C/CCITT V.24 and an IEEE-488 (HP-IB) connector for easy interfacing with your mainframe, mini, or personal computer. This dual interface provides flexibility and adapts to your changing systems requirements.

Because the HP 7510 uses vector technology, it accepts the vector output produced by most graphics software directly — increasing speed and eliminating the need for special vector-to-raster conversion cards.

Time's on your side

If you're currently using a slide service bureau, you know it often takes several days to get results. With the HP 7510 you can get same-day or even immediate results.

Most slides can be recorded on film by the HP 7510 in just a few minutes. After that, 35-mm film can be sent to a one-hour or overnight developer.

For those rush jobs, use Polaroid® instant slide film. You can develop this film yourself in less than five minutes.

Revisions to your slide presentation no longer put you past your deadline. With the HP 7510, last minute fine-tuning and periodic updates are a snap. A real lifesaver when there are only a few hours before the big meeting!

Keeps your secrets

Information about your future plans, new products, and sales figures can be confidential. Keep it that way by using the HP 7510 — confidential information never leaves your office.

Pays for itself

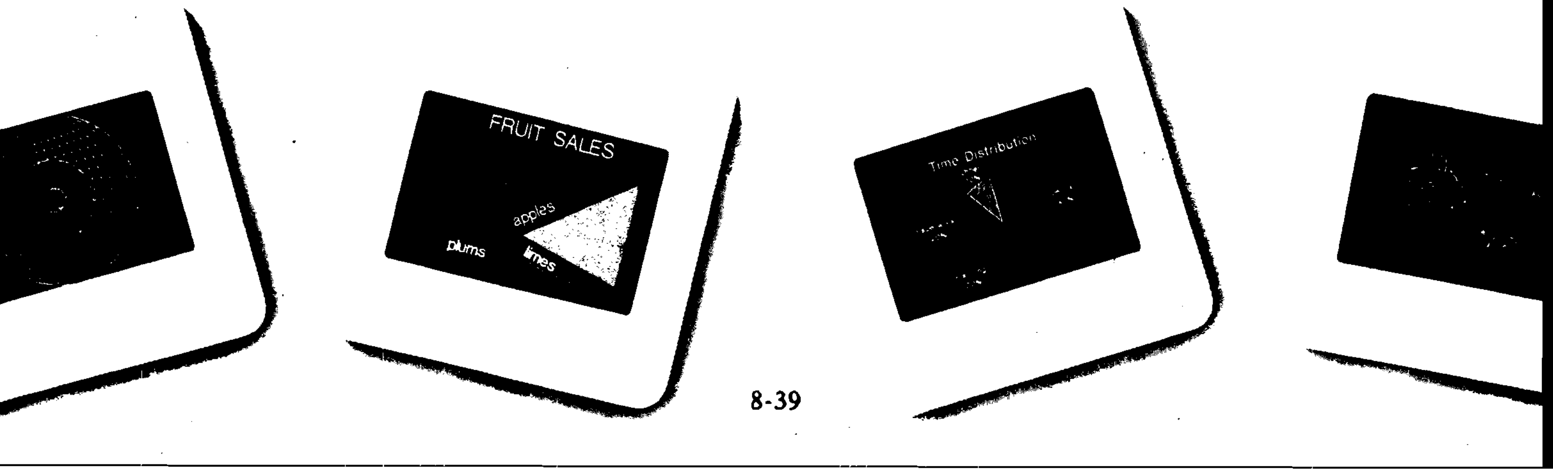
Often, many professionals in a company can benefit from the use of slides. When you share the HP 7510 between several users or departments, it becomes even more economical.

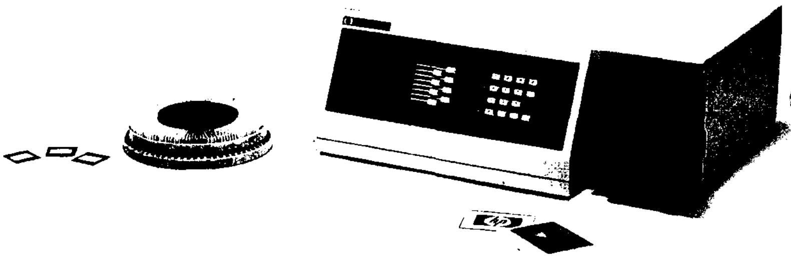
Designed to be a shared peripheral, a central HP 7510 can receive information from many users. Because everything is automatic, there's no need for constant operator supervision.

An intelligent peripheral

If you plan to do your own programming, you'll appreciate the HP 7510's internal intelligence. Built in is a simple, yet powerful, graphics instruction set called Hewlett-Packard Graphics Language that lets you perform complex drawing tasks with minimal effort.

Other firmware features include two lettering styles, labeling in 20 character sets, film compensation curves, and color-coordinated palettes. Speeding system communication is a powerful 16-bit microprocessor, like the ones used in advanced personal computers.





Choose your format

A 35-mm camera module is standard with every HP 7510 color film recorder. This module accepts both standard 35-mm film (just send it out for one-hour or overnight processing) and Polaroid instant slide film (which you can process immediately).

An optional Polaroid instant print camera module is also available. This module uses instant print film that develops in minutes. Use these for previewing slides, proofreading slides, or as hardcopy visuals to help you practice your presentation.

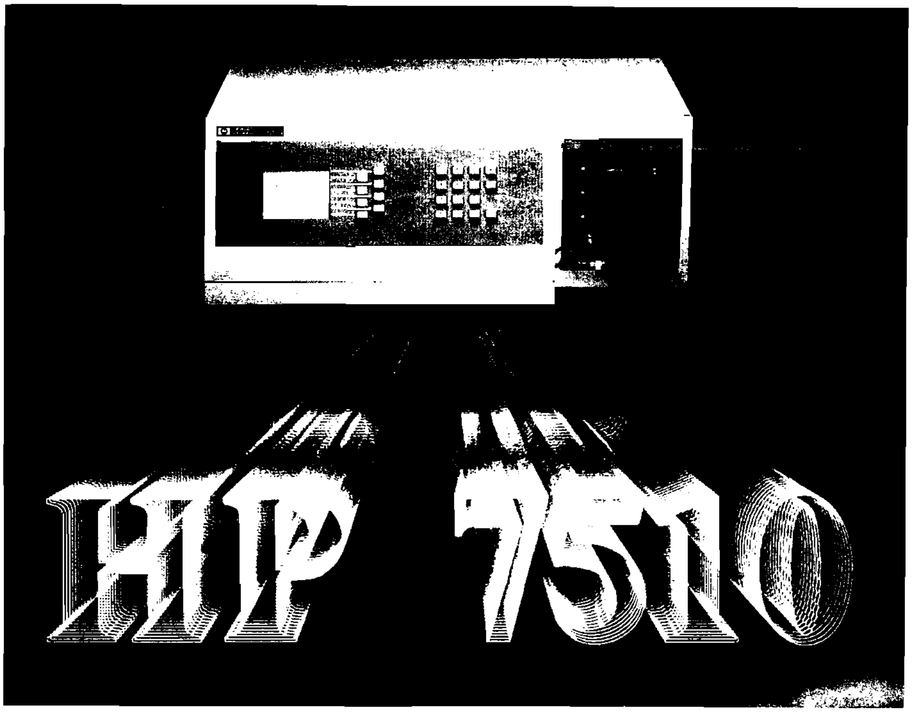
Dedication to excellence

For almost five decades, Hewlett-Packard has been making exceptional products. Our reputation for quality and reliability have made us an industry leader.

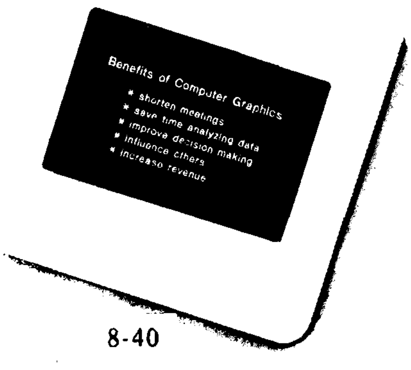
With the HP 7510 you are assured of low maintenance costs and a film recorder that will meet high performance standards throughout its lifetime. Should you ever need service for your HP 7510, we have over 180 service facilities in 31 countries. In fact, more than 75 percent of our customers are within 25 miles of an HP service office.

Like all HP products, the HP 7510 is backed by comprehensive documentation. An operating manual describes the film recorder thoroughly, leads you through operating procedures, and provides information to ensure your success with the HP 7510.

HP is committed to customer satisfaction: we show our commitment before the sale by building products that last and we continue to show it after the sale with worldwide service and support.

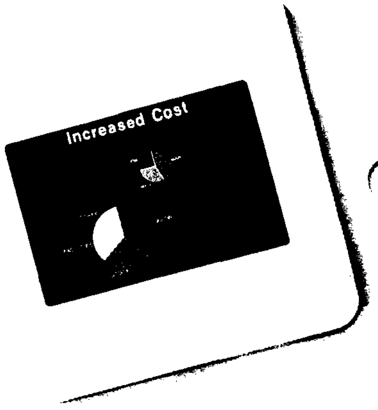


Business Workforce
Service
Production
1950
1980



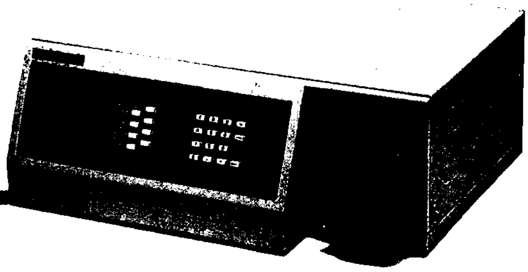
Benefits of Computer Graphics

- shorten meetings
- save time analyzing data
- improve decision making
- influence others
- increase revenue



Ordering information

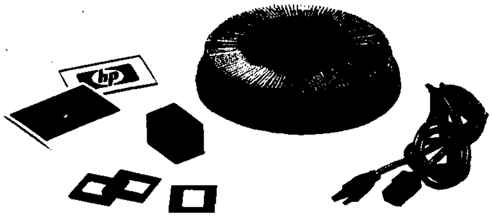
HP 7510 color film recorder $13,900*
Prices effective August 1, 1985



Accessories supplied

Description	Part number
35-mm camera module	17510A
Operating manual	07510-90901
Power cord	

An appropriate power cord and a manual in the appropriate language are supplied based on the destination of the film recorder.

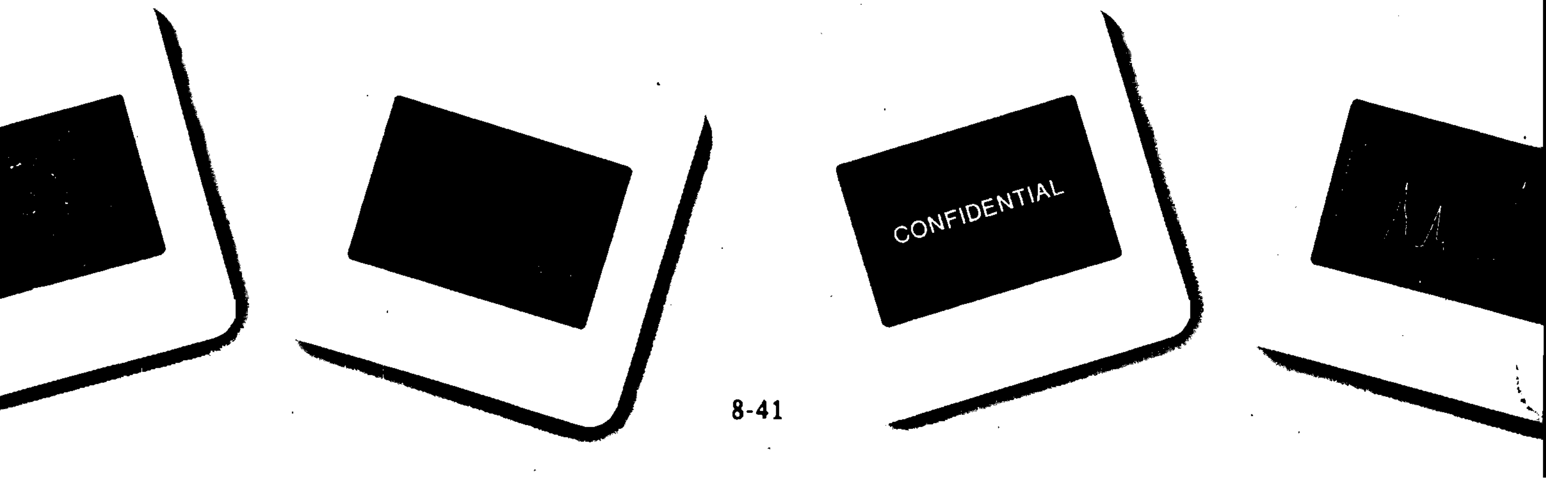


Accessories available

The HP 7510 has one HP-IB and two RS-232-C/CCITT V.24 connectors built in, so no interface option number is necessary when ordering. The male connector is usually for connection to a computer or modem; the female connector is usually for connection to a terminal.

Description	Part number	Price*
Cables available		
Male-to-female RS-232-C/CCITT V.24 25-pin cable, wired straight through.	HP 17355D	$ 60.00 ea
Female-to-female RS-232-C/CCITT V.24 25-pin cable, wired straight through.	HP 17355F	60.00 ea
Female-to-female RS-232-C/CCITT V.24 cable; wired pins 1-1, 2-3, 3-2, 7-7, 5&6-20, 20-5&6.	HP 17255F	40.00 ea
Male-to-female RS-232-C/CCITT V.24 cable; wired pins 1-1, 2-3, 3-2, 7-7, 5&6-20, 20-5&6.	HP 17255D	40.00 ea
RS-422-A adapter cable to connect RS-422-A devices to the HP 7510; 5-m long; 5-pin male (RS-422-A) to 23-pin female (RS-232-C).	HP 17855A	200.00 ea
HP-IB cable, 1-m long, RFI shielded.	HP 10833A	80.00 ea
HP-IB cable, 2-m long, RFI shielded.	HP 10833B	90.00 ea
Additional camera modules		
Polaroid instant print camera module	17515A	1600.00 ea
35-mm camera module (in addition to supplied module)	17510A	2500.00 ea
Additional manuals		
Service manual (available 1/86)	07510-90900	
Programming manual	07510-90902	95.00 ea
Pocket guide for HP-GL	07510-90903	5.00 ea

*U.S.A. list prices only



Technical information

Film supported

Using supplied 35-mm camera module

35-mm slide films:
- Kodachrome 25 and 64, Ektachrome 100 and 200, Polachrome® 40, Fujichrome 100 and 200, Agfachrome 100 and 200

35-mm print films:
- Kodacolor 100, Fujicolor 100, Agfacolor 100

Using optional Polaroid instant print camera module
- Polacolor® 331 and 339

Interfaces

HP-IB (IEEE-488)

Implements the following HP-IB functions as defined in IEEE-488: SH1, AH1, T6, L3, SR1, RL0, DC1, DT0, C0, PP2 for address of 7 or less, PP1 for address greater than 7, and PP0 for listen only. Device address is front-panel selectable.

RS-232-C/CCITT V.24

Asynchronous serial ASCII with front-panel selectable baud rates of 75, 110, 150, 200, 300, 600, 1200, 2400, 4800, 9600, and external.

Input buffer size

Default	1024 bytes

From the program, expandable to approx. 8000 bytes

Addressable resolution

16 344 × 10 896 addressable points per frame.

Power requirements

Source	100, 120, 220, 240 V, −10%, +5%
Frequency	48 − 66 Hz
Consumption	150 W maximum

Environmental range

Operating	0°C to 55°C
Nonoperating	−40°C to 75°C

Size

Height	215 mm (8.5 in.)
Width	609 mm (24 in.)
Depth	457 mm (18 in.)

Weight

Net	Approximately 20.8 kg (46 lbs)
Shipping	Approximately 25 kg (55 lbs)

Internal intelligence

Over 16 million colors available. Firmware features include: color-coordinated palettes, film compensation curves, polygon fill, automatic film advance, exposure counter, camera module sensing, and 20 character sets in two fonts.

"Polaroid", "Polachrome", and "Polacolor" ® by Polaroid Corporation.

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Business Graphics.
For Leaders
in Business.
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(11) 5953-9858(D) Prices and Data Subject to Change Printed in U.S.A. 7/85

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Printers Selection and Interfacing

For HP 1000 A-Series Computer Systems

Introduction

This section contains information on the selection and connection of printers for HP 1000 A-Series Computer Systems.

Types of Printers

Four types of printers are supported on HP 1000 Computer Systems, making it easy to get the right type of printer for your application. These printer types are compared in Table 9-1 with respect to relative cost, print speed, noise level, relative paper cost, and estimated print quality.

Inkjet Printers

Inkjet (Thinkjet and Quietjet) printers offer low price, reasonably fast print speed, and the quietest operation of all printers. The principal disadvantage of inkjet printers is the 50% higher cost of paper designed specifically for inkjet printing and the fact that only one copy is made at a time. This type of printer is useful mainly as a low-cost, light-workload, workstation printer. It should never be considered for use as the only printer in a system.

Dot-Matrix Serial Impact Printers

Dot-matrix serial impact printers combine versatility at reasonable cost with good print speed. Versatility can include graphics image and bar code printing and the ability to trade print speed for better print quality. Good print speed means that a dot-matrix serial impact printer can be used as the only printer on a system with modest-to-average printing requirements.

Dot-Matrix Impact Line Printers

Dot-matrix impact line printers offer versatility similar to dot-matrix serial impact printers at faster print speeds and higher prices. A dot-matrix impact line printer should be selected for uses with large printing requirements.

Laser Printers

Laser printers combine excellent print quality with print speed a bit faster than the fastest dot-matrix serial printers at higher cost. Laser printers are almost as quiet as Inkjet printers. They are recommended for systems with average printing workload in which high print quality is important and the lack of multipart forms print capability is irrelevant.

Table 9-1. Types of Printers Supported by HP 1000 Systems

Printer Type	Relative Cost; Thinkjet has a base of 1.	Print Speed (char/sec or equiv.)	Noise Level (dBA)	Relative Paper Cost	Print Quality
Thinkjet	1.0	150	50	1.5	C
Quietjet	1.2 to 1.6	160	50	1.5	B
Dot-Matrix Serial Impact	5.2 to 6.05	40 to 200	63	1.0 to 1.3	C, B
Laser	6.05 to 8.07	165 to 250	53	1.0	A
Dot-Matrix Impact Line	11.9 to 44.6	660 to 1920	65	1.0 to 1.3	B

Printer Selection

All of the printers currently supported on HP 1000 Computer Systems are compared in Table 9-2 with respect to major differences in features. The data sheets in this section provide details specifying the capabilities and requirements for printers.

Table 9-2. A-Series Printers

Printer	Maximum Print Rate	Paper Type	Text Quality	Graphics	Bar Codes
INKJET PRINTERS					
2225D Think jet	150 cps	Std. fanfold, single sheets	Draft	Raster	Yes
2227A Quiet jet	160 cps	Wide fanfold, single sheets	Draft, NLQ	Raster	Yes
2228A Quiet jet	160 cps	Std. fanfold, single sheets	Draft, NLQ	Raster	Yes
DOT-MATRIX IMPACT PRINTERS					
2932A Dot-Matrix	200 cps	Std. fanfold, 6-part forms	Draft	Vector to raster†	No
2934A Dot-Matrix Impact	200 cps	Std. fanfold, 6-part forms	Draft, NLQ	Vector to raster†	Yes
82906A* Dot-Matrix	160 cps	Std. fanfold, 3-part forms	Draft	Raster	No
DOT-MATRIX LINE PRINTERS					
2563B Dot-Matrix	300 lpm	Wide fanfold, 6-part forms	Draft	Vector to raster†	Yes
2564B Dot-Matrix	600 lpm	Wide fanfold, 6-part forms	Draft	Vector to raster†	Yes
2566B Dot-Matrix	900 lpm	Wide fanfold, 6-part forms	Draft	Vector to raster†	Yes
LASER PRINTERS					
2686A Laserjet	To 8 ppm	Single sheets	LQ	Raster †	No
2686A-300 Laserjet Plus	To 8 ppm	Single sheets	LQ	Raster †	Yes
DOT-MATRIX THERMAL PRINTERS*					
2671G Graphics*	120 cps	Std. fanfold, roll, thermal	Draft	Raster	No
2673A Intell. Graphics*	120 cps	Std. fanfold, roll, thermal	Draft	Raster	No

** Discontinued product, listed here for reference only.*

† When supported by HP 92861A Device-Independent Graphics Library.

Printer Interfacing

Printer connections for various printers in A-Series Computer Systems are described in Table 9-3.

Table 9-3. Printer Interfacing

	Computers Based on A400	**Computers Based on A600+, A700, A900**
Multiplexer-Connected Printers	The first three multiplexer-connected devices in addition to system console require a cable. With more devices, 12040C/D multiplexer(s) are required.	Each printer requires one channel of 12040C/D 8-channel multiplexer and the appropriate cable.
2225D 2227A 2228A 2686A 2686A + Opt 300	Connect using a 13242N cable.	
2563B w/Opt 049 2565B w/Opt 049 2566B w/Opt 049 2932A 2934A	Connect using a 92219G cable.	
HP-IB Connected Printers	Requires one 12009A HP-IB interface.	
2563B w/Opt 214 2564B w/Opt 214 2566B w/Opt 214 2608SR*	Connect using a 10833B/C cable. Each printer uses 1/2 of the capacity of the 12009A interface; no other devices may be connected via a 12009A interface used to connect 256xA/B+214 or 2608SR line printers.	
2932A 2934A 2671G* 2673A* 82906A*	Connect using a 10833B/C cable. Each printer uses 1/8 of the capacity of the 12009A interface; other types of HP-IB devices may be connected via the 12009A interface used to connect these printers.	

* *Discontinued product, listed here for reference only.*

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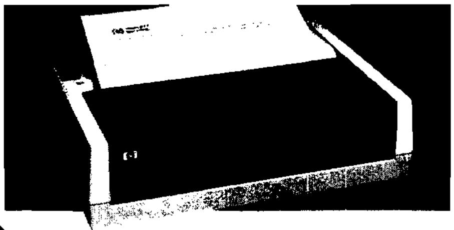
ThinkJet Printer Series



The ThinkJet Printer delivers quick, quiet printing for office, home, or on-the-go. So small and quiet, you'll hardly know it's there. Yet it's capable and efficient, delivering crisp, easy-to-read text and graphics for your letters, reports, even spreadsheets. There are convenient desktop and portable battery-powered versions, compatible with most popular PCs and portables.

User Convenience

Easy to set up, easy to use, you'll lose no time putting this quiet, compact printer to work. A convenient disposable ink print cartridge lifts out or drops in—for clean, quick ink cartridge changes.

Portable Printing

Two battery-powered versions allow you to match it with the smallest of computers. Its long battery life allows you to take it just about anywhere. It's rugged and light weight for carrying through airports, hotel lobbies, wherever you go.

Features	**Benefits**
•Quiet printing	You can talk on the telephone; you can print what you need without disturbing anyone.
•Very small size	It fits easily in the smallest of work areas, allowing you the convenience of personal printing when and where you need it.
•Portable -less than six pounds -200-page battery life (between battery recharges)	Gives you the freedom to take your work with you through airports, hotel lobbies, wherever you go.
•Excellent compatibility	It hooks up with a variety of PCs and portables–HP, IBM or Apple. And it's supported on most popular industry-standard software.
•Comprehensive print features -four print pitches -underline and bold	You can highlight and vary your output. And you can print spreadsheets in compressed print on 8½" paper.
•Pin or friction feed	Use continuous fanfold paper or single sheets.
•Disposable print cartridge	Ink replacement is quick, clean, easy.

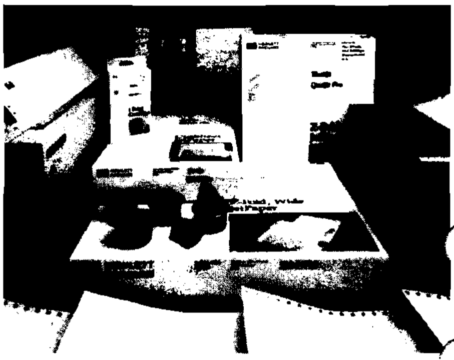
Print Sample

Print quality is enhanced over common dot matrix printers by an 11×12 character cell which provides high resolution characters in boldface or underline modes and four print pitches as shown here.

```
This is compressed print.
This is normal print.
This is Expanded-Compressed print.
T h i s   i s   E x p a n d e d   p r i n t .
```

Supplies and Accessories

Supplies: Meeting Everyday Needs



The HP JetSeries Printer is actually a system, composed of the printer, an innovative disposable ink print cartridge, and HP JetPaper. Together they provide **quiet** operation and **quality** printing, a winning combination.

A wide range of JetSeries supplies support quality printing on ThinkJet and QuietJet Printers. HP's JetSeries supplies and accessories now include address labels, even single-color print cartridges in black, red, blue or green.

To order, simply see your local dealer. Or, order direct from Hewlett-Packard Direct Marketing for 24-hour delivery by calling the toll-free number (800-538-8787).

Description	Order No.
ThinkJet accessory kit To get you started: two ink print cartridges, one space-saving acrylic printer stand, one custom-fit dust cover, 500 sheets of Z-fold paper, 500 sheets of cut-sheet paper.	**92261D**
Black ink print cartridge. Fits ThinkJet and QuietJet printers.	**92261A**
Red ink print cartridge. Fits ThinkJet and QuietJet printers.	**51605R**
Blue ink print cartridge. Fits ThinkJet and QuietJet printers.	**51605B**
Green ink print cartridge. Fits ThinkJet and QuietJet printers.	**51605G**
Z-fold JetPaper. 8½"×11" finished size, 500 sheet box. 20 lb, microperforated.	**51630A**
CutSheet JetPaper. 8½"×11" 500 sheet box. 20 lb, single sheets.	**51630J**
Z-fold JetPaper. 8½"×11" finished size. 2500 sheet carton. 20 lb, microperforated.	**92261N**
JetLabels. 2000 address labels (3.5"×15/16" labels–two across), 9.5" form width. Pressure sensitive.	**51630L**
ThinkJet printer stand (for use with Touchscreen II or the HP 2392 Terminal.	**92171X**
Smoked acrylic mini-printer stand.	**92261S**
ThinkJet dust cover.	**92250V**
ThinkJet carrying case.	**13269TT**
ThinkJet battery pack (for HP 2225B and HP2225P)	**82199A**
ThinkJet recharger (for HP2225B and HP2225P)	**82059D**
Jetstart software program. Modifies standard Macintosh application discs to run with the HP2225D ThinkJet Printer.	**35177M**

Specifications

Print Speed	150 cps, draft mode (bidirectional, optimized path), 12 cpi
Character Cell Structure	11 (h) × 12 (v)
Character Sets	HP Roman 8 128 US ASCII (upper and lower case and control codes) Supports Danish, Dutch, English, Finnish, French, German, Norwegian, Portuguese, Spanish, and Swedish ISO 7-bit languages (HP 2225C and HP 2225D only) Supports French, German, Spanish, Swedish/Finnish, United Kingdom, and US ASCII IBM PC character set (alphanumeric only)
Graphics	96 × 96 dots per inch dot-addressable graphics 192 × 96 dots per inch, double density mode
Print Modes	Normal, 12 cpi, 80 characters per line Expanded, 6 cpi, 40 characters per line Compressed, 21.3 cpi, 142 characters per line Expanded-Compressed, 10.7 cpi, 71 characters per line
Operational Modes	Switch selectable HP/alternate (Epson) modes
Command Language and Emulation	HP Printer Command Language PCL level 1+; Epson MX80 emulation
Software Support	The ThinkJet Printer is fully supported on major software packages. Additional support is being provided on a regular basis.
Paper Handling	Friction feed for single sheets Pin feed for continuous fan-fold paper Paper widths: 8.5″ × 11″ (U.S. standard) 21.0 cm × 29.7 cm (metric A-4) Note: Use only HP JetPaper. We are interested in quality and cannot guarantee optimal print quality or printer reliability on non-HP paper.

Key Panel	Power-on and Paper-out indicators. Top-of-form, Line feed, and Form feed buttons.
Interfaces and Power Sources	HP-IB parallel, AC line power (HP2225A) HP-IL serial, DC battery power (HP2225B) Centronics parallel, AC line power (HP2225C) Centronics parallel, DC battery power (HP2225P) RS-232C-type serial, AC line power (HP2225D)
Power Requirements	Input voltage: 120 VAC (+5%, −10%) at 47.5–63 Hz Power consumption: 10 W non-printing (maximum) 18 W printing (maximum)
Environmental	Temperature: 10° to 40°C (50° to 104°F), operating; −20° to 60°C (−4° to 140°F), non-operating Humidity: 10 to 90% RH, non-condensing Acoustics: (per ISO DP7779 standard) Sound pressure level – Lpa: <50dBA @ 1 meter bystander position
Dimensions/ Weight	292 mm (11.5″) W × 89 mm (3.5″) H × 206 mm (8.1″) D Weight: 3.36 kg (7.4 lbs.) HP2225A 2.5 kg (5.5 lbs.) HP2225B 3.1 kg (6.8 lbs.) HP2225C and HP2225D
Buffer Size	1K bytes
Estimated Usage	Less than 40 pages per day (maximum)
Product Certifications	UL, CSA, FEI, NEMKO, TUV, VDE/FTZ, IEC compliance, FCC Class B Certified per FCC Rules, Part 15, Subpart J, when used with a Class B computing device. Any questions concerning regulatory compliance should be directed to your local HP sales office.

Interface and Cable Requirements

Interface and Cable Requirements

HP SYSTEM SERIES MODEL	PRINTER MODEL	HOST INTERFACE	CABLE
HP 41C, CV, CX	2225B	82160A	82167A, B, or D
HP 71B	2225B	82401A	82167A, B, or D
HP 75C and D	2225B	Built-in	82167A, B, or D
HP 85*	2225A	82937A	10833A, B, C or D
	2225B	82938A	82167A, B or D
	2225C	82949A	—
HP 86A	2225C	Built-in	92957A
HP 86B and 87	2225A	Built-in	10833A, B, C or D
Series 100	2225A	Built-in	10833A, B, C or D
Touchscreen PCs	2225D	Built-in	13242G
Series 200	2225A	Built-in	10833A, B, C or D

NON-HP SYSTEM SERIES MODEL	PRINTER MODEL	HOST INTERFACE	HP CABLE #	NON-HP CABLE #
Apple II, II+, IIe	2225C	Apple II Parallel Interface Card or Grappler+	Not Available	Apple #590-0042
	2225D	Apple Super-serial Card	17355M	Apple #590-0037
Apple IIc	2225D	Built-in	92219N	Apple # 590-0191-A
Macintosh**	2225D	Built-in	92219M	Standard Macintosh Printer Cable
IBM PC, PC / XT	2225C	IBM Parallel Printer Adaptor	92219K	IBM Parallel Printer Cable
	2225D	IBM Asyn. Com. Adaptor	17255D or 13242H	Not available
IBM PCjr.	2225C	IBM Parallel Printer Attachment	92219K	IBM Parallel Printer Cable
	2225D	Built-in	92219P	Not available
IBM AT	2225C	IBM Serial/Parallel Adaptor	24542D	IBM Parallel Printer Cable
IBM AT	2225D	IBM Serial/Parallel Adaptor	24542G	
IBM Convertible	2225P	IBM Serial/Parallel Adaptor	92219Z	Parallel Interconnect Cable

*The HP 85 also requires an HP 99985-1599 Plotter/Printer ROM. The HP 85 does not require the 10833 cable if there are no other peripherals attached.

**Requires software driver (PN35177M, available from CSO)

Ordering Information

HP 2225A (HP-IB version)
HP 2225B (HP-IL battery-power version)
HP 2225C (Centronics parallel version)
HP 2225D (RS-232C serial version)
HP 2225P (Centronics/battery-power version)

Standard unit includes:

Print head cartridge, packet of fanfold ink-jet paper, owner's manual, and warranty card. The HP 2225A, 2225C, and 2225D include a power cord. The 2225B includes a 1-meter-HP-IL cable, battery pack, and a recharger. The HP 2225P includes a battery pack and recharger.

HP-IB, Centronics-type, and RS-232C-type cable **must be ordered separately**. Non-HP interface boards and cards must be ordered through the personal computer supplier. The HP 2225P requires a 92219Z cable.

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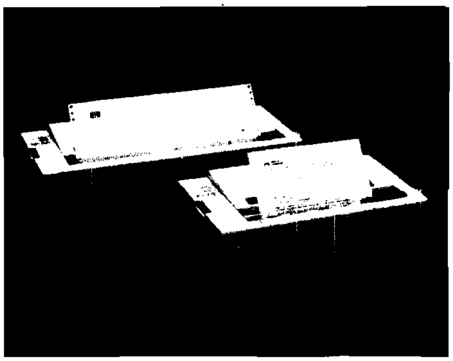
QuietJet Printer Series



The flexible QuietJet Printers offer the best features of personal printing ...without the noise.

You get exceptionally **quiet**, **quality** printing for word processing, data base management, and computer graphics. For spreadsheets, letters, or labels as you need.

QuietJet Printers work with most major personal computers. And it's supported on a host of popular industry-standard software packages.

Quality Printing

You get high-quality printing: near letter-quality (NLQ) for important letters and reports and graphics in three densities for impressive charts and illustrations. Even when printing quick drafts, you get sharp characters for easy reading and a professional look.

User Convenience

The disposable, drop-in ink print cartridge combines innovation with true user convenience. The friendly key panel allows you to select NLQ, draft, and compressed printing at the touch of a button.

Features	**Benefits**
• Quiet printing	You can talk on the telephone; you can print what you need without disturbing anyone.
• Quality text and graphics -NLQ at 40/48 cps -160/192-cps draft printing -High-quality graphics	Turns out professional-looking letters and reports and fast, easy-to-read spreadsheets and charts.
• Excellent compatibility	It hooks up with a variety of PCs and portables–HP, IBM or Apple. And it's supported on most popular industry-standard software.
• Comprehensive print features -six print pitches -near letter-quality (NLQ) -superscripts and subscripts	Your customer can change the print size and use print enhancements to highlight, clarify, or simply get more information on a page.
• Convenient keypanel	Select NLQ, draft and compressed print with just one keystroke.
• Paper-handling convenience -last-form tearoff -paper advance knob -Adjustable tractors	Inserting, adjusting, even tearing off of paper is quick and easy to manage. And there is no paper waste.
• Expandable, tailorable	As application needs grow, your customer can get dealer-installable RAM for special applications.

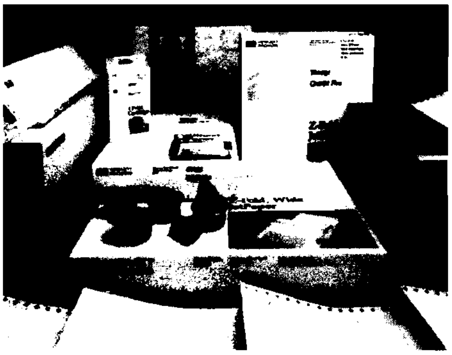
Print Sample

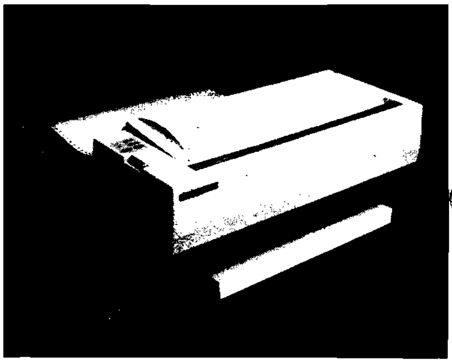
Print quality is enhanced over common dot matrix printers by 19×16 (draft) and 19×32 (NLQ) character cells which provides high resolution characters in bold face or underlining and six print pitches as shown here.

This is compressed print.
This is normal print.
This is Expanded-Compressed print.
This is Expanded print.
This is NLQ print.
This is draft print

Supplies and Accessories

Supplies: Meeting Everyday Needs





The HP JetSeries Printer is actually a system, composed of the printer, an innovative disposable ink print cartridge, and HP JetPaper. Together they provide **quiet** operation and **quality** printing, a winning combination.

A wide range of JetSeries supplies support quality printing on ThinkJet and QuietJet Printers. HP's JetSeries supplies and accessories now include wide paper for QuietJet Plus spreadsheet printing, address labels, even single-color print cartridges in black, red, blue or green.

To order, simply see your local dealer. Or, for 24-hour delivery, order direct from Hewlett-Packard Direct Marketing by calling the toll-free number (800-538-8787).

Description	Order No.
Black ink print cartridge. Fits ThinkJet and QuietJet printers.	**92261A**
Red ink print cartridge. Fits ThinkJet and QuietJet printers.	**51605R**
Blue ink print cartridge. Fits ThinkJet and QuietJet printers.	**51605B**
Green ink print cartridge. Fits ThinkJet and QuietJet printers.	**51605G**
Z-fold JetPaper. 8½"×11" finished size. 500 sheet box, 20 lb., microperforated.	**51630A**
Wide Z-fold JetPaper. 14⅞"×11". 500 sheet box, 20 lb.	**51630B**
Wide Z-fold JetPaper. 14⅞"×11". 2500 sheet carton, 20 lb.	**51630D**
CutSheet JetPaper. 8½"×11". 500 sheet box, 20 lb., single sheets.	**51630J**
Z-fold JetPaper. 8½"×11" finished size. 2500 sheet carton, 20 lb., microperforated.	**92261N**
JetLabels. 2000 address labels (3.5"×15/16" labels–two across), 9.5" form width. Pressure sensitive.	**51630L**
QuietJet Plus Printer dust cover.	**92250W**
QuietJet Printer dust cover.	**92250X**
QuietJet Plus Printer stand.	**92261T**
QuietJet Printer stand.	**92261U**
QuietJet Series wire paper catcher. (requires printer stand).	**92261G**
Jetstart software program. Modifies standard Macintosh application discs to run with the QuietJet Printer series.	**35177M**

Specifications

Print Speed	160 cps, draft mode (bidirectional, optimized path), 10 cpi 40 cps, NLQ mode (unidirectional, optimized path), 10 cpi 192 cps, draft mode (bidirectional, optimized path), 12 cpi 48 cps, NLQ mode (unidirectional, optimized path), 12 cpi
Character Cell Structure	19 (h)×16 (v), draft mode 19 (h)×32 (v), NLQ mode
Character Sets	HP Roman 8 128 US ASCII (upper and lower case and control codes) Supports Danish, Dutch, English, Finnish, French, German, Norwegian, Portuguese, Spanish and Swedish ISO 7-bit languages Supports French, German, Italian, Portuguese, Spanish, Swedish/Finnish, Norwegian, United Kingdom, and US ASCII IBM PC character set (US and Europe).
Graphics	96×96 dots per inch dot-addressable graphics 192×96 dots per inch, double density mode 192×192 dots per inch, quadruple density mode
Print Modes	
Normal—10 cpi	QuietJet: 80 characters/line QuietJet Plus: 132 characters/line
Normal—12 cpi	QuietJet: 96 characters/line QuietJet Plus: 158 characters/line
Expanded—5 cpi	QuietJet: 40 characters/line QuietJet Plus: 66 characters/line
Expanded—6 cpi	QuietJet: 48 characters/line QuietJet Plus: 79 characters/line
Compressed—21.3 cpi	QuietJet: 170 characters/line QuietJet Plus: 281 characters/line
Expanded-Compressed —10.7 cpi	QuietJet: 85 characters/line QuietJet Plus: 141 characters/line Draft print; a variation of Letter Gothic font NLQ print; a variation of Courier font
Operational Modes	Switch selectable HP/ alternate (Epson-type) modes
Command Language and Emulation	HP Printer Command Language PCL level 1+; Epson MX80 emulation
Software Support	The QuietJet Printers are fully supported on major software packages. Additional support is being provided on a regular basis.
Paper Handling	Friction feed for single sheets Tractor feed for continuous fan-fold paper Paper widths: 10.2 cm (4″) minimum 38.1 cm (15″) QuietJet Plus maximum; 24.8 cm (9¾″) QuietJet maximum. Note: We are interested in quality and cannot guarantee optimal print quality or printer reliability on non-HP paper.
Key Panel	Buttons: On-line, Form Feed, Line Feed LED indicators: NLQ mode, Draft mode, Compressed mode
Dual I/O Interface	Centronics parallel and RS-232C serial, standard
Power Requirements	Power modules 100 volts AC (+10%, −10%) 47.5–63 Hz 120 volts AC (+10%, −10%) 47.5–63 Hz 220 volts AC (+10%, −10%) 47.5–63 Hz 240 volts AC (+10%, −10%) 47.5–63 Hz Power consumption at 20 VAC 10 W maximum non-printting 18 W maximum printing Maximum heat output 61.5 BTU/hour
Environmental	Temperature: 10° to 40°C (50° to 104°F), operating; −20° to 60°C (−4° to 140°F), storage Humidity: 10 to 90% RH, non-condensing Acoustics: (per ISO DP7779 standard) Sound pressure level − L_{pa}: <48.5 dB(A)@1 meter bystander position
Dimensions	QuietJet: 395 mm (15.5″) W×118 mm (4.65″) H×214 mm (8.43″) D QuietJet Plus: 527 mm (20.75″) W×121 mm (4.76″) H×221 mm (8.7″) D
Weight	QuietJet: 3.9 kg (8 lb., 9 oz) QuietJet Plus 4.7 kg (10 lb., 7 oz.)
Buffer Size	2K bytes, expandable up to 18K
Estimated Usage	Less than 40 pages per day
Product Certifications	UL, CSA, FEI, NEMKO, TUV, VDE/FTZ, IEC compliance, FCC Class B Certified per FCC Rules, Part 15, Subpart J, when used with a Class B computing device. Any questions concerning regulatory compliance should be directed to your local HP sales office.

Interface and Cable Requirements

Interface and Cable Requirements

HP SYSTEM SERIES MODEL	PRINTER I/O	HOST INTERFACE	CABLE
Vectra PC	Parallel	HP 24540A Serial/Parallel Interface Card	24542D
	Serial	HP 24540A Serial/Parallel Interface Card	24542G
		HP 24541A Dual Serial Interface Card	24542G (using 9 pin connector) 13242G (using 25 pin connector)
Touchscreen PC	Serial	Built-in	13242G
Portable PC	Serial	Built-in	92221P
HP Terminals (2392A, 2393A, 2394A, 2397A)	Parallel	Opt 093 or HP 40210P*	40242D
	Serial	Opt 092 or HP 40210R*	40242G

NON-HP SYSTEM SERIES MODEL	PRINTER I/O	HOST INTERFACE	HP CABLE #	NON-HP CABLE #
Apple II, II+, IIe	Parallel	Apple II Parallel Interface Card or Grappler+	Not Available	Apple #590-0042
	Serial	Apple Super-serial Card	17355M	Apple #590-0037
Apple IIc	Serial	Built-in	92219N	Apple # 590-0191-A
Macintosh**	Serial	Built-in	92219M	Standard Macintosh Printer Cable
IBM PC, PC / XT	Parallel	IBM Parallel Printer Adaptor	92219K	IBM Parallel Printer Cable
	Serial	IBM Asyn. Com. Adaptor	17255D or 13242H	Not available
IBM AT	Parallel	IBM Serial/Parallel Adaptor	24542D	IBM Parallel Printer Cable
IBM AT	Serial	IBM Serial/Parallel Adaptor	24542G	

*Host interface to order when adding QuietJet Printer to standard terminal.
**Requires software driver (PN35177M, available from DMK)

Ordering Information

HP 2227A QuietJet Plus Personal Printer
HP 2228A QuietJet Personal Printer
Standard unit includes: Print head cartridge, packet of fanfold ink-jet paper, power module/cord, owner's manual, and warranty card.

Centronics-type and RS-232C-type cables must be ordered separately. Non-HP interface boards and cards must be ordered through the personal computer supplier.

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Printed in U.S.A 9/86 (54)
5954-6985

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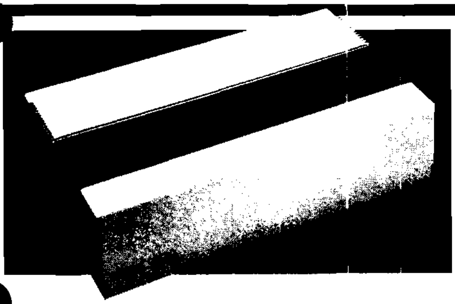
HP 2932A
General Purpose Printer



The HP 2932A 136-column impact printer offers fast, high-quality printing. Simplicity of operation, graphics capability, and a strong set of transaction and technical printing features allow the 2932A to meet single-user and distributed printing needs.

Paper Handling

The paper-saving last-form tearoff feature and practical front forms loading assure paper handling convenience and efficiency for all your printing applications.

You can produce labels, spreadsheets and multipart forms. Adjustable tractors add the convenience of continuous forms of widths up to 400 mm (15.75"). The straight paper path assures smooth movement of multipart forms of up to six parts.

Printing Flexibility

A comprehensive selection of print features and character sets, including ten resident languages, assure output as you require. Produce charts, graphs, illustrations, and tables. Use underlining and three different character pitches to highlight output. In any event, you'll get excellent print quality on all your printed material.

Features	**Benefits**
• 200 cps impact printing	Provides fast, high-quality printing for forms, reports and memos.
• Last-form tearoff	Saves paper–no need to waste a blank sheet to remove your printout.
• Front paper loading	Allows you to load or change paper quickly and conveniently.
• Adjustable tractor-feed	Accommodates a variety of paper sizes.
• Straight paper path	Paper and multipart forms advance reliably.
• Uncomplicated feature selection via friendly control panel –Ten resident languages –Line drawing and math symbols –COURIER (serif) and CUBIC (sans serif) fonts –Selectable print pitches, line spacings, and margins	You'll quickly learn how to operate and format the printer to suit a variety of tasks.
• High-quality graphics (via supported host software)	Allows you to add illustrations and graphs to reports and memos.
• Low maintenance	Reduces cost of ownership with long-life ribbon cartridges and user-replaceable print head.

Applications

- General Purpose Printer

  The 2932A provides the print speed and forms handling required for general purpose printing.

- Remote System Printer

  For users who wish to share a printer for output from the computer system, the 2932A can be interfaced directly to a central computer or via a modem. This offloads the busy system line printer and provides quick, easy access to hard copy.

Specifications

PRINT SPEED
200 characters per second
Bidirectional, optimized path

CHARACTER STRUCTURE
9x12 character cell

CHARACTER SETS
HP Roman8 character set includes
  128 USASCII
    (upper/lower case and control codes)
  96 Roman Extension
    (French, Spanish, German, Italian, United Kingdom, Norwegian/Danish, Swedish/Finnish, JASCII)
ISO 7-bit languages
Kana8 character set
  128 JASCII
  96 Katakana
64 Line Drawing character set
64 Math Symbols character set

GRAPHICS
90 x 90 dots per inch dot addressable raster graphics

PRINTING FORMAT
Print pitch (characters per inch)
  16.36–Compressed
  10.0–Normal
  5.0–Expanded
Line length (characters per line)
  223–Compressed
  136–Normal
  68–Expanded
Variable line spacing (lines per inch)
  1, 2, 3, 4, 6, 8, or 12

FORMS HANDLING
Forms tractors
Last-form tearoff
  (requires one inch top margin)
16 Channel vertical forms control
Programmable page and text length, margins, and tabs
Automatic perforation skip

FORMS REQUIREMENTS
Paper widths (edge to edge)
  Maximum width: 400mm (15.75")
  Minimum width: 57mm (2.25")
Paper weights
  Single part: 15 to 100 pound (56-380 gm./sq. meter)
  Multipart: 12 pound (46 gm./sq. meter), up to six total copies; 8 pound carbons (30 gm./sq. meter); .51 mm (.020") maximum pack thickness. All forms and card stock should be tested for satisfactory feeding, registration and print quality.

CONTROLS AND INDICATORS
Power on indicator
Paper out indicator
On line indicator/key
Modem indicator
Line and page advance keys

POWER REQUIREMENTS
Input voltage
  100, 120, 220, 240 volts AC (+5%, −10%) selectable from rear panel; 47.5-66 Hz
Power consumption
  120 VA maximum non-printing
  300 VA maximum printing

INTERFACES
RS-232C V.24 Full Duplex (standard; see ordering information for additional options)
Serial Protocol
  ENQ/ACK, X-on/X-off and printer busy
  2K character buffer
  Bell 103 and 212 type modem support
  Receive rates selectable up to 9600 baud
  Parity
  25 Pin EIA RS-232C connector

ENVIRONMENTAL CONDITIONS
Temperature, free space ambient
  0° to 55°C (32° to 131°F) operating
  −40° to 75°C (−40° to 167°F) non-operating
Acoustics (per ISO DP7779 standard)
  Sound power level–L_{WA}: 73dB(A)
  Sound pressure level–L_{PA}: 63dB(A) ((@ 1 meter bystander position)
Humidity
  Top paper exit: 10% to 90% RH (non-condensing)
  Rear paper exit: 10% to 70% RH (non-condensing)

PHYSICAL SPECIFICATIONS
365mm (14.37") D x 600mm (23.85") W x
  185mm (7.28") H
20.4 kg (45 lbs.) net weight

PRODUCT CERTIFICATIONS
UL, CSA, IEC Compliance. FCC Class B certified per FCC Rules, Part 15, subpart J, when used with a Class B computing device.

PRINTING DUTY CYCLE
No duty cycle limitations.

Ordering Information

HP 2932A PRINTER

Standard unit includes:
RS-232C V.24 Interface, ribbon, all supported character sets, power cord, owners manual. Power supply voltage is user-configurable to 100, 120, 220, or 240 V. Interface options replace the standard interface. Only one option can be ordered. No cable is provided; it must be ordered separately.

Option Number	Interface
#035	RS-422
#042	Centronics-type Parallel
#046	HP-IB

Supplies and Accessories

92171G	Paper catcher for table top
92214P	Printer stand (includes cabinet, paper catcher and casters)
92154B	Print head (customer-installable)
92155L	Three ribbon pack

Fast phones for price and availability by location:
Austria: (0222) 25 00 or 615/616 • Belgium/Luxembourg: (02) 7 62 32 00 • Denmark: (02) 8166 40, Ext. 258 • Finland: (90) 4 55 0211 • France: (6) 9 28 32 64 • Greece: (01) 6473360-1 • Italy: (02) 92 36 91 or (06) 5 48 31 • Middle East: Athens–(01) 808-0359 • Norway: (02) 17 1180 • South Africa: Johannesburg–(011) 802 5111; Cape Town–(021) 53 7954; Durban–(031) 28 4178 • Spain: (01) 6 38 4013 • Sweden: (08) 750 20 28 • The Netherlands: (020) 47 0639 • Switzerland: (057) 312254/59 • United Kingdom: (0734) 69 72 01 • United States: 800-538-8787; California–408-738-4133 • West Germany: 0130 33 22.

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Interface and Cable Requirements

SYSTEM SERIES MODEL	PRINTER INTERFACE	CABLE
Series 80	HP-IB	Included with 82937A HP-IB interface on host
Series 100	HP-IB (recommended)	10833A, B, C, or D†
	RS-232C	13242G
Vectra PC	RS-232C	24542G
	Centronics	24542D
	HP-IB	10833A, B, C, or D†
Series 200		
Models 16, 26, 36	HP-IB	10833A, B, C, or D†
HP 250/260*	RS-232C	8120-3258
HP 1000		
A Series	HP-IB (recommended)	Included with 12009A HP-IB interface with host
	RS-232C	92219G
E, & F Series	RS-232C	92219G
HP 3000	RS-232C	92219G
	RS-422	13242P
HP 9000	HP-IB	10833A, B, C, or D†
HP 239X Terminals	RS-232C	40242G
	Centronics	40242D
HP 262X Terminals		
All Models	RS-232C (recommended)	13242G
2625A & 2628A	HP-IB (optional)	10833A, B, C, or D†
HP 264X Terminals		
2645A	RS-232C	13232G
2647F/A, 2648A	HP-IB	10833A, B, C, or D†

*Supported on B.06.00 release of HP250 operating system.
† B, C, or D cables vary by length.

For more information, call your local HP Sales Office. Or write to Hewlett-Packard: 1820 Embarcadero Road, Palo Alto, CA 94303.

Printed in U.S.A. 9/85
Data Subject to Change
5953-6298 (54)

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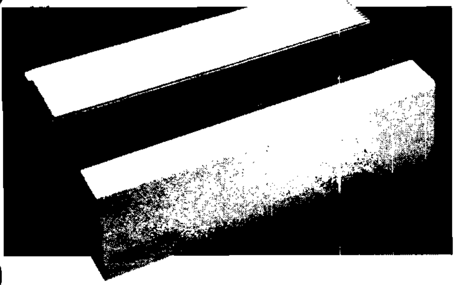
HP 2934A Business Printer



The HP 2934A Business Printer combines letter-quality printing with fast data processing and multipart-forms capability. You can produce letter-quality documents at 67 or 40 characters per second (cps), or produce draft-quality work at 200 cps. The HP 2934A Printer supports many word-processing features for the office, plus bar codes and large character generation for business and manufacturing. Long-distance interface options accommodate remote and distributed printing applications.

Word Processing

When used with HP word processing software, the HP 2934A creates high-quality documents. A wide variety of typestyles are available via handy plug-in cartridges.

Bar-Code Generation

The printer simplifies the generation of bar codes for routing sheets, part labels, and inventory lists in any of several common code types, or you may generate your own codes.

Paper Handling

The paper-saving last-form tearoff feature, straight paperpath, and practical front forms loading assure paper handling convenience and efficiency for all your printing applications.

You can produce labels, spreadsheets, and multipart forms up to 400 mm (15.75 in.). An optional sheet feeder accessory allows for efficient printing of cut-sheet paper.

Features	**Benefits**
• Two printing modes: letter-quality at 67 and 40 cps; draft-quality at 200 cps	You get more value and flexibility in one printer.
• Prints bar codes and alphanumeric equivalents automatically	Simplifies bar code generation and lessens likelihood of errors when you attach the preprinted labels to parts or documents.
• Last-form tearoff	Saves paper–no need to waste a blank sheet to remove your printout.
• Adjustable tractor-feed	Handles a variety of printing tasks–from labels to spreadsheets.
• Single-bin sheet feeder accessory	Accurate, efficient printing on cut-sheet paper.
• Simple feature selection, friendly control panel	You'll quickly learn to operate the printer and format it for a variety of tasks.
• High-quality graphics (via supported host software)	Allows you to add illustrations and graphs to your reports and records.

Applications

- For Small Business Systems
  Broad range of printing features and paper handling capabilities.
- For Personal Computers
  Letter-quality plus time-saving draft-quality; wide carriage for spreadsheets.
- For Factory Data Systems
  Automatic bar code and large characters; long-distance interfaces.

Print Sample

```
At 40 cps, your HP2934A Business Printer
produces  letter-quality  print as shown
here.  For true versatility  and  high-
quality  printing,  the  HP2934A  is  an
excellent choice.
```

Specifications

PRINT SPEED
200, 67, 40 characters per second
Bidirectional, optimized path

CHARACTER STRUCTURE
36 x 24 character cell (67 cps)
9 x 12 character cell (200 cps)

CHARACTER SETS
- HP Roman8 character set includes
  - 128 USASCII
    - (upper/lower case and control codes)
  - 96 Roman Extension
    - (French, Spanish, German, Italian, United Kingdom, Norwegian/Danish, Swedish/Finnish, JASCII)
- ISO 7-bit languages
- Kana8 character set
  - 128 JASCII
  - 96 Katakana
- 64 Line Drawing
- 64 Math Symbols
- Large Characters (up to 28 times)

GRAPHICS
90 x 90 dots per inch dot addressable raster graphics

PRINTING FORMAT
- Print pitch (characters per inch)
  - 16.36–Compressed
  - 10.0, 12.0–Normal
  - 5.0–Expanded
  - Proportional (with typestyle cartridge)
- Line length (characters per line)
  - 223–Compressed
  - 136–Normal (at 10 characters per inch)
  - 68–Expanded
- Variable line spacing (lines per inch)
  - 1, 2, 3, 4, 6, 8, or 12

BAR CODE PRINTING
- Code types
  - InterMec Code 39™, Industrial 2 of 5, Matrix 2 of 5, Interleaved 2 of 5, internally-generated. User-definable codes may be generated by user program. Bar code printing is designed to be compatible with HP readers. For compatibility with other readers check with your sales representative.
- Throughput
  - 650 labels per hour maximum for a 10-character Code 39™ alphanumeric bar code label 0.6 inches high, printed with the default density of 3.4 characters per inch.
- Paper type
  - OCR quality single part fanfold paper with uniform thickness, opacity, and reflectivity. Paper should have a smooth, non-gloss surface finish. Recommended 20# minimum, white, matte finish computer stock.*

WORD PROCESSING
- Right justification
- Auto centering
- Proportional spacing
- Underlining
- Optional character cartridges

FORMS HANDLING
- Forms tractors
- Last-form tearoff (requires one inch top margin)

FORMS REQUIREMENTS
- Paper widths (edge to edge)
  - 57 mm (2.25") to 400 mm (15.75")
- Paper weights
  - Single part: 15 to 100 pound (56-380 gm./sq. meter)
  - Multipart: 12 pound (46 gm./sq. meter), up to six total copies; 8 pound carbons (30 gm./sq. meter); .51 mm (.020") maximum pack thickness.

POWER REQUIREMENTS
- Input voltage
  - 100, 120, 220, 240 volts AC (+5%, −10%) selectable from rear panel; 47.5-66 Hz
- Power consumption
  - 120 VA maximum non-printing
  - 300 VA maximum printing

BUFFER SIZE
2K character buffer

INTERFACES
- RS-232C V.24 Full Duplex (standard; see ordering information for additional options)
- Serial Protocol
  - ENQ/ACK, X-on/X-off and printer busy
  - Bell 103 and 212 type modem support
  - Receive rates selectable up to 19200 baud
  - Parity
  - 25 Pin EIA RS-232C connector

ENVIRONMENTAL CONDITIONS
- Temperature, free space ambient
  - 0° to 55°C (32° to 131°F) operating
  - −40° to 75°C (−40° to 167°F) non-operating
- Humidity
  - Top paper exit: 10% to 90% RH (non-condensing)
  - Rear paper exit: 10% to 70% RH (non-condensing)
- Acoustics (per ISO DP 7779 standard)
  - Sound power level–L_{WA}:73dB(A)
  - Sound pressure level–L_{PA}:63dB(A) (@ 1 meter bystander position)

PHYSICAL SPECIFICATIONS
365mm (14.37") D x 600mm (23.85") W x 185mm (7.28") H
20.4 kg (45 lbs.) net weight

PRODUCT CERTIFICATIONS
UL, CSA, IEC Compliance. FCC Class B certified per FCC Rules, Part 15, subpart J, when used with a Class B computing device.

PRINTING DUTY CYCLE
No duty cycle limitations.

*All forms and card stock should be tested for satisfactory feeding, registration, print quality, and readability.

Code 39 is a trademark of Interface Mechanisms, Inc.

Ordering Information

Standard HP 2934A PRINTER Includes

RS-232C V.24 Interface, Courier character style cartridge, ribbon, all supported character sets, power cord, owners manual. Power supply voltage is user-configurable to 100, 120, 220, or 240 V. Interface options replace the standard interface. Only one option can be ordered. Cable must be ordered separately, except for Option #034 or 039.

Option Number	Interface
#034	Multipoint Synchronous (Nth terminal)
#035	RS-422
#042	Centronics-type Parallel
#039	DSN/Data Link
#046	HP-IB

Supplies and Accessories

92171G	Paper catcher for table top
92214P	Printer stand (includes cabinet, paper catcher and casters)
92154B	Print head (Customer-installable)
92155L	Three Ribbon Pack
92155M	Three-Pack of OCR/Bar code ribbon cartridges

Character Style Cartridges

92188A	Courier	92188M	Prestige Pica	92188W	Turkish
92188B	Courier 12	92188N	Prestige Elite 12	92188X	Hebrew-7
92188E	Helv.	92188R	Letter Gothic 12	92188Y	Hebrew-8
92188H	Italic 10	92188U	Arabic	92188G	OCR A
92188J	Italic 12	92188V	Greek	92188T	OCR B
92188K	Orator				

Fast phones for price and availability by location:

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Interface and Cable Requirements

SYSTEM SERIES/MODEL	PRINTER INTERFACE	CABLE
Series 80	HP-IB	Included with host interface
Series 100	HP-IB (recommended) RS-232C	10833A, B, C or D† 13242G
Vectra PC	RS-232C Centronics HP-IB	24542G 24542D 10833A, B, C or D†
Series 200		
Models 16, 26, 36	HP-IB	10833A, B, C, or D†
HP 250/260*	HP-IB RS-232C	10833A, B, C, or D† 8120-3258
HP 1000		
A Series	HP-IB (recommended) RS-232C	Included with host interface 92219G
E & F Series	RS-232C	92219G
HP 3000	RS-232C RS-422	92219G 13242P
HP 9000	HP-IB	10833A, B, C, or D†
HP 239X Terminals	RS-232C Centronics	40242G 40242D
HP 262X Terminals		
All Models	RS-232C (recommended)	13242G
2625A & 2628A	HP-IB (optional)	10833A, B, C, or D†
HP 264X Terminals		
2645A	RS-232C	13232G
2647F/A, 2648A	HP-IB	10833A, B, C, or D†

*Supported on B.06.00 release of HP250 operating system.
† B, C, or D cables vary by length.

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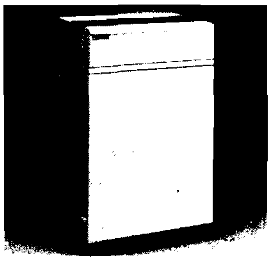
For more information, call your local HP Sales Office. Or write to Hewlett-Packard: 1820 Embarcadero Road, Palo Alto, CA 94303.

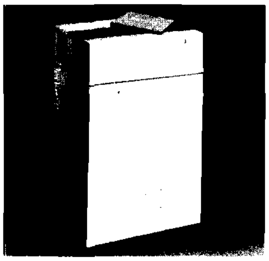
Printed in U.S.A. 9/85
Data Subject to Change
5953-6299 (54)

The Dot Matrix Impact Printer Family

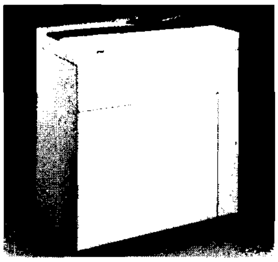
HEWLETT PACKARD



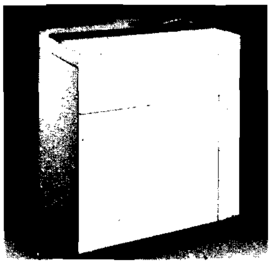
HP 2563B



HP 2564B



HP 2566B



HP 2567B

Technical Data

THE HP 256XB FAMILY OF PRINTERS

The HP 256XB family of dot matrix line printers is designed for a wide variety of printing applications and offers many special printing capabilities such as raster graphics, compressed print, double-size and block characters, OCR characters, bar code printing, math and multi-national character sets. Other convenience features include paper out and paper jam detection, a 16-channel downloadable VFC, and easy forms alignment. In addition, this family features:

- **High Reliability**
- **Excellent Print Quality**
- **Many Optional Character Sets**
- **Interfacing Flexibility**
- **Common Printer Command Language**

STANDARD PRINTING FEATURES

The HP 256XB printers include as standard:

- Low-density Roman-8 character set in 5, 10 and 16.7 pitch. Roman-8 combines USASCII and Roman Extension characters. HP Roman-8 supports Danish, Dutch, English, Finnish, French, German, Spanish and Swedish. It is also possible to select British, French, German, Spanish, Danish/Norwegian or Swedish/Finnish 7-bit character sets from either the front panel or through your program.
- **Compressed print (16.7 pitch).**
- **Double-high, double-wide print.**
- **Raster graphics (software dependent).**

Standard Character Set Print Speed (Lines/Min.)

	2563B lpm	2564B lpm	2566B lpm	2567B lpm
NORMAL 10 characters/in.	300	600	900	1200
COMPRESSED 16.7 characters/in.	300	525	480	600
DOUBLE HIGH/WIDE 66 characters/line	150	145	240	320

	Characters per Line			
Line Length	12 cpi	13.3 cpi	15 cpi	16.7 cpi
8.5 Inches	102	113	127	141
11.0 Inches	132	146	165	183
13.2 Inches	158	176	198	220

OPTIONAL CHARACTER SETS

- **Option #001** Low-density Line Draw, Math Symbols and Large Block character sets. The large block characters are built by an application program to sizes that are 4, 6, 8, 12, or 16 times the standard size. A sample program listing for creating block characters is supplied with this option.
- **Option #002** Low-density Katakana-8 character set which includes Japanese, JASCII, and Katakana.
- **Option #003** High-density character set which prints OCR characters. The OCR fonts are designed as OCR-A and OCR-B.
- **Option #004** High-density version of the standard Roman-8 character set.
- **Option #005** High-density italics version of the Roman-8 character set.
- **Option #006** High-density version of the Katakana-8 character set.
- **Option #008** High-density UPC Version A and E, and EAN Version 8 and 13 bar codes, and in addition, these bar codes: Interleaved 2 of 5, Industrial 2 of 5, and Code 3 of 9. All bar codes are low to medium resolution. Bar codes and the labeling information used with them can easily be selected using escape sequences.
- **Option #009** Low-density compressed characters at 12 and 13.3 cpi using the standard Roman-8 symbol set.

- **Option #011** Low-density, for HP 2567B printer only, adds a high-speed Draft Quality 7-bit USASCII character set and also includes Line Draw, Math Symbols and Large Block (5 x 7) characters (uppercase only) allows printing at 1600 lpm. For a print sample of draft-quality character set, contact your HP Sales Representative.
- **Option #012** Low-density compressed characters at 12 and 15 cpi using the standard Roman-8 symbol set.
- **Option #013** Low-density compressed characters at 13.3 and 15 cpi using the standard Roman-8 symbol set.
- **Option #014** Low-density, for HP 2567B printer only, adds a high-speed Draft Quality Roman-8 character set (upper case only) which allows printing at 1600 lpm.
- **Option #030** Low-density Line Draw and Arabic-8 character sets.
- **Option #031** High density Arabic-8 character set.
- **Option #032** Low-density USASCII, Line Draw, and Turkish-8 character sets.
- **Option #033** High-density USASCII and Turkish-8 character sets.
- **Option #034** Low-density USASCII, Line Draw, and Greek-8 character sets.
- **Option #035** High-density USASCII and Greek-8 character sets.
- **Option #036** Low-density USASCII, Line Draw and Hebrew-8 character sets.
- **Option #037** High-density USASCII and Hebrew-8 character sets.
- **Option #038** Low-density Line Draw and Hebrew-7 character sets.
- **Option #039** High-density Hebrew-7 character set.

Note: Due to the variations among industry readers, test the HP 256XB bar code and OCR print samples with your reader(s) prior to purchase.

Note: Only one additional low-density and four high-density character set options can be installed in the printer at one time.

Character Set Upgrade Kits

26761B Character Set Upgrade Kit. Specify part number 26761B and one of the option numbers (001 through 013) from above.

Printer Specs Of Optional Character Sets*

	2563B		2564B		2566B		2567B	
OPTION	lpm	ipm	lpm	ipm	lpm	ipm	lpm	ipm
#001	300		600		900		1200	
#002	300		600		900		1200	
#003	150		300		248		320	
#004	150		300		248		320	
#005	150		300		248		320	
#006	150		300		248		320	
#008		14.5		29		50		66.7
#009	300		525		480		600	
#011	N/A		N/A		N/A		1600	
#012	300		525		480		600	
#013	300		525		480		600	
#014	N/A		N/A		N/A		1600	
#030	300		600		900		1200	
#031	150		300		248		320	
#032	300		600		900		1200	
#033	150		300		248		320	
#034	300		600		900		1200	
#035	150		300		248		320	
#036	300		600		900		1200	
#037	150		300		248		320	
#038	300		600		900		1200	
#039	150		300		248		320	

*These speeds may vary depending upon customer application.

GRAPHICS CAPABILITIES

Standard HP 256XB Line Printers include raster graphics capability (software dependent). For HP 3000 Printer Graphics Support Software which allows output capability from HPDRAW, DSG/3000, and HPEASY CHART order part number 36583A from the Software Distribution Center (SDC).

Extended Graphics Options

- **Option #021** Enables printer to attain higher compressed, double size, and graphics (up to 100 inches/min.) speeds. For HP 2566B only.
- **Option #022** provides a vector graphics board, allowing faster and more efficient raster conversion since graphics data can be "offloaded" from the CPU to the printer. This board converts up to 500 vectors per second and provides ANSI/VDM compatibility. Option #022 has a 128 Kb memory and prints a maximum page size of 13.2 x 15.6 inches at 70 x 72 dots per inch (dpi), or 7.3 x 7.1 inches at 140 x 144 dpi. Cannot be installed in the printer at the same time as the HP Label Card.
- **Option #023** provides the same capability as option #022 but includes 512 Kb of memory and will print page sizes of 13.2 x 62.7 inches at 70 x 72 dpi, or 13.2 x 15.6 inches at 140 x 144 dpi. Cannot be installed in the printer at the same time as the HP Label Card.

- **Option #024** adds the HP Label Card graphics which enables the printer to print varying sizes of characters, graphics, bar codes, and lines using QMS®* Magnum®* language. (See the HP Label Card data sheet part number 5954-7327, for more detail.)

*QMS and MAGNUM are registered trademarks of QMS, Inc..

Extended Graphics Upgrade Kits

26061A Vector Graphics Upgrade Kit (specify one option). (Cannot be installed in printer at the same time as the HP Label Card.)

- **Option #022** 128Kb vector graphics board
- **Option #023** 512Kb vector graphics board

26062A Label Card Upgrade Kit (see the HP Label Card data sheet part number 5954-7327 for more detail). [Specify one option only.]

- **Option #001** for HP 2563A Printer
- **Option #002** for HP 2563B Printer
- **Option #004** for HP 2564B Printer
- **Option #006** for HP 2566A Printer
- **Option #007** for HP 2566B Printer
- **Option #008** for HP 2567B Printer

INTERFACES AND COMPATIBILITY

Interface Subsystem Options

INTERFACE SUBSYSTEMS (an interface subsystem must be specified)		2563B	2564B	2566B	2567B
#049*	RS-232C Interface Subsystem	o	o	o	o
#050*	RS-422A Interface Subsystem	o	o	o	o
#052*	Dataproducts short line	o	o	o	o
#053*	Centronics Interface Subsystem	o	o	o	o
#054*	Dataproducts long line	o	o	o	o
#055*	HP 3000 Multipoint Interface Subsystem	o			
#100*	HP 1000 M/E/F parallel Interface Subsystem (2608A compatible)	o			
#200	Series 200 Basic/Pascal HP-IB Interface Subsystem	o	o	o	
#210	HP 1000 M/E/F HP-IB Interface Subsystem	o	o	o	
#214	HP 1000 A-Series HP-IB Interface Subsystem	o	o	o	
#230*	HP 3065 HP-IB Interface Subsystem	o			
#250	HP 250/260 HP-IB Interface Subsystem	o			
#264*	HP 64000 HP-IB Interface Subsystem	o			
#290	Series 300/500 HP-IB Interface Subsystem	o	o	o	
#337	HP 3000 37 HP-IB Interface Subsystem	o	o	o	o
#340	HP 3000 39, 40, 42, 52 HP-IB Interface Subsystem	o	o	o	o
#344	HP 3000 44, 48, 58 HP-IB Interface Subsystem	o	o	o	o
#364	HP 3000 64, 68, 70 HP-IB Interface Subsystem	o	o	o	o
#850	HP Shared Resource Manager HP-IB Interface Subsystem	o	o	o	
#390	HP 3000 Series 930 HP-IB Interface Subsystem	**	**	o	**

*No cables included.
**Supported on second release (MPE XL).

Note: Only one printer subsystem may be ordered.

Interface Subsystem Upgrade Kits

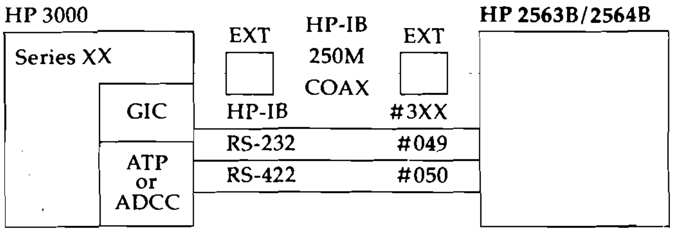
26099A Parallel printer interface for HP 1000M/E/F-Series, HP 2563B ONLY.

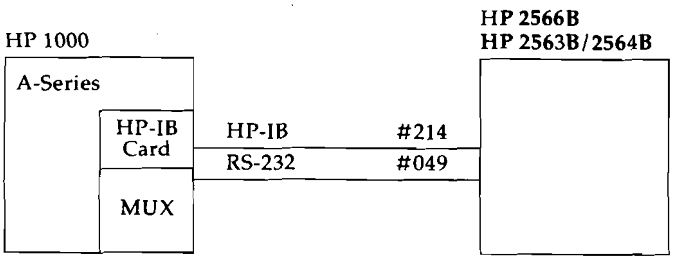
26067B System interface Upgrade Kits (specify one option identified below).

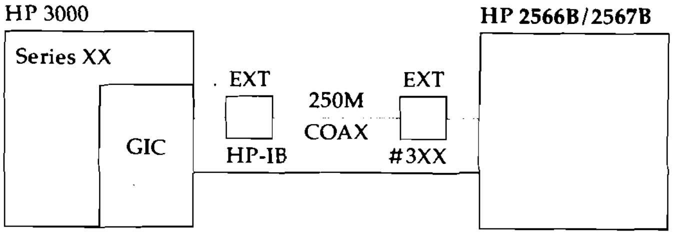
Option #001	HP-IB Interface
Option #002*	Multipoint Interface
Option #003	RS-232C Interface
Option #004	RS-422A Interface
Option #005*	2608A Compatible Parallel Interface (HP 1000) (M/E/F only)
Option #006	Centronics Interface
Option #007	Dataproducts Short-Line Interface
Option #008	Dataproducts Long-Line Interface

*2563B ONLY.

Typical Configurations







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DISTRIBUTED PRINTING

2916 HP 256XB Line Printers are supported with the 37204B (coax only) or 37203A Option #010 (coax and fiber optics) HP-IB Extenders on the HP 3000 Series 4X, 5X, 6X, and 7X computers. A set of extenders (i.e., two extenders or more connected by coaxial or fiber optics cable) allows you to increase the distance between the printer and the HP 3000 processor (up to 1000 metres for fiber optics and 250 metres for coax), making printed output easily accessible in an office environment. For more information on HP-IB Extenders contact your HP Sales or Service Representative.

37204B HP-IB Extender
37203A HP-IB Extender
- **Option #010 HP-IB Extender**

POWER SUPPLY OPTIONS (all models)

The standard power configuration for the printers is 110 VAC, 50/60 Hz. For alternate power configurations, identify one of the following options:

- **Option #015** 220 VAC, 50/60 Hz
- **Option #016** 100 VAC, 50/60 Hz
- **Option #017** 240 VAC, 50/60 Hz

65 dBA OPTION

Standard HP 2563B and HP 2564B models are quietized units with 55 dBA ratings (average sound pressure at 1 metre). They come complete with quiet printer stands, sound shroud, and passive paper stacker. The quietized features can be deleted by ordering option #114 (see below for further detail). (THERE ARE NO 55 dBA Upgrade Kits.) The quietized feature is not available for HP 2566B or HP 2567B.

CONVENIENCE OPTIONS

- **Option #068** Three pack of the standard ribbons for HP 2563B/2564B.
- **Option #114** provides a 65 dBA **desktop** model for the HP 2563B or a 65 dBA **cabinetized** HP 2564B. This option applies to the HP 2563B and HP 2564B only.
- **Option #115** Passive Paper Stacker (for additional stacking capabilities see Application Note 416) for HP 2566B and HP 2567B only.
- **Option #500** Extended Capabilities Package (includes Opt. #004, #005, #115) for the HP 2566B and HP 2567B only.
- **Option #510** Extended Capabilities Package (includes Opt. #004, #005, #008, #068) for the HP 2563B and HP 2564B only.
- **Option #715** Service Documentation.

Convenience Option Upgrade Kits

26763A	Passive Paper Stacker for HP 2563B (use with 92214P stand from DMK).
26763B	Passive Paper Stacker for HP 2566B and HP 2567B.
26763C	Passive Paper Stacker for HP 2564B (for use with 26764C only).
26764A	Sound Reduction Attachment for HP 2563B.
26764C	Sound Shroud Attachment for the HP 2564B.

FROM HEWLETT-PACKARD'S COMPUTER SUPPLIES CATALOG

92158A Box of 3 Ribbon Cartridges for the HP 2563B/2564B only (Average life 30 mil. characters per ribbon).
92158M Box of 3 Ribbon Cartridges - Carbon-black for the HP 2563B/2564B only, recommended for OCR, bar code, and archival applications (Average life 3 mil. characters per ribbon).
92214P Printer Stand for the HP 2563B only (Order from DMK).
9282-0545 Towel Ribbon (15" x 20 yards) for the HP 2566B/2567B only.

SPECIFICATIONS

Safety Compliance

The HP 256XB printers are listed by Underwriter's Laboratories, Incorporated, in the following categories with their respective guide designations: Electronic Data Processing Equipment (EMRT) and Office Appliance and Business Equipment (QAOT). In addition, the HP 256XB printers are certified to Canadian Standard Association (CSA) requirements for data processing equipment.

The HP 256XB printers have been tested and found to comply with the limits for a Class A computing device, pursuant to Subpart J, of Part 15 of the FCC rules.

These products were designed and tested to comply with IEC 380 and IEC 435. Additionally, these printers are designed to meet European Safety and RFI/EMC standards for Electronic Data Processing Equipment. This includes Germany's VDE 08711 Level B. Any questions concerning regulatory agency compliance should be directed to your local Hewlett-Packard Sales Office.

Environmental Specifications

	Degrees	
Temperature	C	F
Operating (printer & ribbon)	10 to 50	50 to 122
Storage (printer)	-40 to 75	-40 to 167
Survival (power-on)	-20 to 65	-4 to 149
Storage (ribbon)	10 to 50	50 to 122
Relative Humidity*	Non-Condensing	Advised
Non-Operating	5% to 95%	
Operating		30% to 80%

*Forms should be tried at high humidity for satisfactory feeding and handling and at low humidity to determine if static buildup must be eliminated for proper stacking.

PERFORMANCE	LPM	PITCH cpi	MATRIX dpi	[illegible]	[illegible]	MATRIX dpi	LPM STD/ OPT 021	PITCH cpi	MATRIX dpi	[illegible]	[illegible]	[illegible]
Normal (Upper Case)	300	10	5of13X7	600	10	5of13X7	900/900	10	5of13X7	1200	10	5of13X7
Normal (Lower Case)	233	10	5of13X9	467	10	5of13X9	720/720	10	5of13X9	960	10	5of13X9
High Density (Upper Case)	150	10	7of19X14	300	10	7of19X14	248/480	10	7of19X14	320	10	7of19X14
High Density (Lower Case)	117	10	7of19X18	233	10	7of19X18	195/379	10	7of19X18	253	10	7of19X18
Compressed (Upper Case)	300	12	5of13X7	525	12	5of13X7	480/900	12	5of13X7	600	12	5of13X7
	300	13.3	5of13X7	525	13.3	5of13X7	480/900	13.3	5of13X7	600	12	5of13X7
	300	15	4of10X7	525	15	4of10X7	480/900	15	4of10X7	600	15	4of10X7
	300	16.7	4of10X7	525	16.7	4of10X7	480/900	16.7	4of10X7	600	16.7	4of10X7
Compressed (Lower Case)	233	12	5of13X9	420	12	5of13X9	379/720	12	5of13X9	480	12	5of13X9
	233	13.3	5of13X9	420	13.3	5of13X9	379/720	13.3	5of13X9	480	13.3	5of13X9
	233	15	4of10X9	420	15	4of10X9	379/720	15	4of10X9	600	15	4of10X9
	233	16.7	4of10X9	420	16.7	4of10X9	379/720	16.7	4of10X9	480	16.7	4of10X9
Double Size (Upper Case)	150	5	10of26X14	135	5	10of26X14	240/450	5	14of38X14	320	5	14of38X14
Double Size (Lower Case)	117	5	10of26X18	110	5	10of26X18	189/360	5	14of38X18	253	5	14of38X18
Draft Quality (Upper Only)	N/A			N/A			N/A			1600		4X5
	INCHES/ MIN.		MATRIX dpi	INCHES/ MIN.		MATRIX dpi	INCHES/ MIN.		MATRIX dpi	INCHES/ MIN.		MATRIX dpi
Bar Codes	14.5		N/A	29		N/A	50		N/A	66.7		N/A
Raster Graphics (Low)	14.5 - 29		70X72	29 - 58		70X72	50/100		70X72	66.7		70X72
Raster Graphics (High Density)	7.2 - 14.5		140X144	9.7 - 14.3		140X144	16.7/25		140X144	22.2		140X144

	2563B	2564B	2566B	2567B
FORM FEED RATE 6 or 8 lpi (slew speed)	ips 14	ips 15	ips 25	ips 25

	2563B inch/cm	2563B lbs/Kg	2564B inch/cm	2564B lbs/Kg	2566B inch/cm	2566B lbs/Kg	2567B inch/cm	2567B lbs/Kg
PHYSICAL								
Standard Model (Cabinetized)								
Width	23.4/59.5	-	23.4/59.5	-	38.7/98.3	-	38.7/98.3	-
Depth	29.95/76.1	-	29.95/76.1	-	25.0/63.5	-	25.0/63.5	-
Height	39.4/100	-	39.4/100	-	43.3/110	-	43.32/110	-
Weight		160		178		465/211		465/211
65 dBA Model (Opt. #114)								
Width	23.3/60	-	23.4/59.5		-	-	-	-
Depth	17.75/45	-	29.9/76.1		-	-	-	-
Height	10.75/27	-	39.4/100		-	-	-	-
Weight	-	75	-	171	-	-	-	-

POWER CONSUMPTION	2563B		2564B		2566B		2567B	
	Non-Print 80W	Print (typ) 230W	Non-Print 110W	Print (typ) 240W	Non-Print 115W	Print (typ) 575W	Non-Print 150W	Print (typ) 780W

FORMS/PAPER	2563B		2564B		2566B		2567B	
	CM	INCH	CM	INCH	CM	INCH	CM	INCH
Width Maximum	42.4	16.7*	42.4	16.7	45.7	18.0	45.7	18.0
Maximum Print	-	-	-	-	33.5	13.2	33.5	13.2
Minimum	7.6	3.0*	7.6	3.0	7.62	3.0	7.62	3.0
Margin Left Maximum	0-4.0	0-1.6	0-4.0	0-1.6	5.08	2.0	5.08	2.0
Right Maximum	5+	2 or more	5+	2 or more	7.11	2.8	7.11	2.8
Form Length Maximum	40.6	16.0	40.6	16.0	40.6	16.0	40.64	16.0
Length Minimum	5.0	2.0	5.0	2.0	5.08	2.0	5.08	2.0

*Only one print pitch can be used on each line.

Note: Print speed may vary with application and configuration.
Also, the printer monitors the number of dots printed over a unit of time and is able to slow down when the internal temperature is excessive to protect the electronics. (This could affect throughput in warmer operating environments.)

PAPER SPECIFICATIONS

Single Part: 15 pound up to 100 lb. (57 to 380 gm/sq metre) 12 pound first carbon and 7 lb. second to sixth part (0.61 mm max. or 0.024 inches maximum thickness).

Note: Due to variations in manufacturing processes, quality and composition of forms, HP cannot guarantee satisfactory performance with all paper and forms. Therefore, all special paper, including multipart forms, carbonless forms, card stock, and labels, should be tested for satisfactory feeding, registration, and print quality prior to purchase. Please refer to the HP 2566B/2567B Paper Specifications Guide (part number 5954-2290) for additional information.

SERVICE AND SUPPORT

Hewlett-Packard Service is available for the HP 256XB printers. Maintenance Agreement prices are based on the level of usage and level of service. Consult your local Hewlett-Packard sales or service office for additional information.

For the U.S. Sales Office or authorized dealer nearest you, call (800) FOR-HPPC (367-4772); in Canada, call (800) 387-3867. Or write to your Hewlett-Packard regional office: U.S.A. (East) Choke Cherry Road, Rockville, MD 20850; (Midwest) 5201 Tollview Drive, Rolling Meadows, IL. 60008; (West) 5161 Lankershim Boulevard, North Hollywood, CA 91601; (South) 2000 South Park Place, Atlanta, GA 30339.
CANADA -6877 Goreway Drive, Mississauga, Ontario, Canada, L4V 1M8. EUROPE - 150 Route du Nant-d'Avril, P.O. Box CH-1217 MEYRIN 2, Geneva, Switzerland. JAPAN - Yokogawa-Hewlett-Packard Ltd., 29-21, Takaido-Higashi 3-chome, Suginami-ku, Tokyo 168. Elsewhere in the world - Hewlett-Packard Intercontinental, 3495 Deer Creek Road, Palo Alto, CA 94304 U.S.A.

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5954-7326 10/86

HEWLETT-PACKARD

LaserJet Printer Family

The Professional Printers

Technical Data

The Hewlett-Packard LaserJet, LaserJet PLUS, and LaserJet 500 PLUS are true letter-quality printers. They are fast, printing up to 8 pages per minute, and whisper quiet. The ability to mix different fonts (typestyles) on a single page as well as advanced graphics features gives the LaserJet family of printers unmatched flexibility in both personal computer and office workstation settings. In addition to the standard LaserJet features, the LaserJet PLUS and LaserJet 500 PLUS printers offer electronic forms capabilities, more graphics per page, font downloading and macro abilities, and increased memory to meet additional personal or office printing needs. Where printing requirements typically range from 500-4000 pages per month, you'll find that the LaserJet and LaserJet PLUS printers meet all of your printing needs. The HP LaserJet 500 PLUS printer further enhances the HP LaserJet Printer family by adding additional paper handling features with two increased-capacity input bins, job offsetting, correct-order output, and a typical printing range of up to 6000 pages per month. Additionally, Hewlett-Packard offers service contracts which support higher printing ranges for the LaserJet family of printers.

Feature Comparison

	LaserJet Printer		
Pages per Minute	Up to 8	Up to 8	Up to 8
Text Resolution	300 X 300 dpi	300 X 300 dpi	300 X 300 dpi
Number of Sheets Per Input Tray	100	100	250
Number of Input Trays	1	1	2
Number of Sheets Per Output Tray	20	20	250
Correct Order Output	No	No	Yes
Job Offsetting	No	No	Yes
Character Height	Up to 18 pt. Size	Up to 30 pt. size	Up to 30 pt. size
Graphics Resolution (8 X 10 inch page) 75 dpi 100 dpi 150 dpi 300 dpi	 Full page Half page Quarter page Sixteenth page	 Full Page Full page Full page Half page	 Full Page Full Page Full Page Half Page
Internal Fonts	Courier (10 CPI/12 point portrait and landscape)	Courier (10 CPI/12 point portrait and landscape) Compressed Line Printer (16.66 CPI/8.5 point portrait)	Courier (10 CPI/12 point portrait and landscape) Compressed Line Printer (16.66 CPI/8.5 point portrait)
Cartridge	Yes	Yes	Yes
Downloadable Fonts	No	Yes	Yes
Number of Fonts Printed Per Page	Up to 8	Up to 16	Up to 16
Macros (User defined commands)	No	Yes	Yes
Software Forms Utilities	Cartridge-based character sets	Cartridge-based character sets; built-in rules, shading, and patterns with automatic forms overlay	Cartridge-based character sets; built-in rules, shading, and patterns with automatic forms overlay
Downloadable Forms	No	Yes	Yes
Forms Overlay	No	Yes	Yes
User Memory	59K	395K	395K
Total Memory	128K	512K	512K
Hardware Interface	RS-232C/422	Parallel and RS-232C/422	Parallel and RS-232C/422
One-Year Warranty	Yes	Yes	Yes

LaserJet Printer Features

Excellent Print Quality

- True letter-quality print
- Print resolution up to 300 x 300 dots-per-inch

Raster Graphics Capability

- Up to 59K Bytes of memory can be used to print raster graphics on a single page. This can be used to print single or multiple images on a page at four different resolutions (300, 150, 100, 75 dots per inch). Many current personal computer software packages take advantage of this capability.
- IBM PC screen raster graphics capability with software
- Apple Macintosh screen raster graphics capability with software
- HP 150 screen raster graphics capability

Ideal for Office Information Systems

- Very quiet operation (<55 dBA)
- Compact desktop size
- Letter and legal size single-sheet paper or envelopes
- Multiple fonts per page
- Workstation on-demand printing
- Duplex (two-sided) printing with manual feed
- Prints up to 8 pages per minute

Easy to Maintain and Operate

- Disposable EP cartridge containing the main electrophotographic components makes the printer easy to service and very reliable
- Simple preventative maintenance procedures
- A variety of Hewlett-Packard maintenance support packages and services are available

Font Flexibility

- Standard: Courier 10 CPI/12 point (Portrait & Landscape)
- Prints characters up to 18 point size
- A large variety of character fonts in plug-in cartridges are available from your HP Dealer or from HP's Direct Marketing Division
- Prints up to 8 fonts per page

Interface

- Standard RS-232C/422 Interface (300-19.2K baud)

LaserJet PLUS Printer Features

In addition to all of the features listed for the standard LaserJet printer, the LaserJet PLUS printer offers the advanced capabilities outlined here. Where applicable, these features replace those of the standard LaserJet. The standard LaserJet printer may easily be upgraded to a LaserJet PLUS.

Raster Graphics Capability

- Up to 395K Bytes of memory can be used to print raster graphics on a single page. This can be used to print single or multiple images on a page at four different resolutions (300, 150, 100, 75 dots per inch). Many current personal computer software packages take advantage of this capability.

Forms Design

- Rules, gray shading and patterns
- Forms overlay to enable automatic forms printing
- Up to 32 forms can be stored in memory
- Downloadable macros (user defined commands for forms applications)
- Ideal for such things as tax forms, letterheads, page borders and logos

Font Flexibility

- Standard: Courier 10 CPI/12 point (Portrait & Landscape) and Compressed Line Printer 16.66 CPI/8.5 point (Portrait)
- Prints characters up to 30 point size
- Downloadable soft font capability available from host CPU for flexibility in printing multiple fonts per page
- Prints up to 16 fonts per page
- Up to 32 soft fonts can be stored in memory for increased printer sharing ability (dependent on memory used)
- Increased selection of soft fonts, including support for kerning

Interface

- Standard Parallel and RS232C/422 Interface (300-19.2K baud)

LaserJet 500 PLUS Printer Features

In addition to all of the features listed for the standard LaserJet and LaserJet PLUS printers, the LaserJet 500 PLUS printer offers the additional paper handling features listed here.

Paper Handling Capabilities

- Dual-bin paper feed with automatic feed feature
- Two, 250-sheet input bins and a 250-sheet output bin for increased printing flexibility
- Front panel or programmatic control of input bin paper feeding capabilities.
- Correct order output
- Job Offsetting for easy separation between jobs

Specifications

(LaserJet Family of Printers)

Safety and Environment Compliance

- UL 478 listed
- CSA 22.2 154 Certified
- Complies with IEC 380 & IEC 435
- FCC level B
- VDE 0836, VDE 0871B, IEC-TC76 and VBG 93 (level B)
- BRH Certified Class I Laser Product (safe for office/EDP use)

Print Capacity

- Print Speed: First page less than 18 seconds after receipt of data (22 seconds using manual feed). Subsequent pages at 8 pages per minute - print speed is application and system dependent.
- Warm-Up Time: Less than two minutes from cold turn on
- Paper Tray Capacity: 100 sheets per input tray and 20 sheets per output tray
- LaserJet 500 PLUS Paper Tray Capacity: 250 sheets per input tray and 250 sheets per output tray
- Paper Feed: Single sheet, automatic. Two sided printing capability with manual feed for second pass. Paper stacking is done in reverse order for LaserJet and LaserJet PLUS printers. Paper stacking is done in either correct or reverse order for the LaserJet 500 PLUS printer.

Printing Process

- Dry type electrophotography

Paper*

- Paper: Single sheet copier paper
- Weights: 16 to 21 lbs. (60-79 g/m^2)
- Size: Letter (8.5 x 11 inch)
  Legal (8.5 x 14 inch)
  European A4 (210mm x 297mm)
  European B5 (182mm x 257mm)
- Type: The printers were designed for use with high quality photocopier bond paper. The LaserJet printers can also accommodate a wide variety of special application paper, such as labels, colored and preprinted paper, as well as overhead transparency film designed for photocopiers. It is strongly recommended that all paper be tested before purchasing.
- Storage and use: Best results will be obtained if paper is kept within the listed ranges.

  Temperature: 17-23 degrees C (63-73 degrees F)

  Relative Humidity: 40-50%

*Note: For additional information concerning LaserJet Printer Family paper specifications, refer to the LaserJet Paper Specifications Guide available from your HP Dealer or Sales and Service Representative (part number 5954-2268).

Printing

- Print Resolution: Up to 300 x 300 dots-per-inch
- Print Orientation: Portrait (printing across the width of the page) and Landscape (printing across the length of the page)
- LaserJet Resident Fonts: Courier 10 CPI/12 point portrait and landscape orientation
- LaserJet PLUS and LaserJet 500 PLUS: Additional Line Printer 16.66 CPI/8.5 point resident font - portrait orientation
- Optional Fonts: Additional fonts can be used by inserting a plug-in font cartridge.
- LaserJet PLUS and LaserJet 500 PLUS: Fonts may be downloaded from host CPU for flexibility in printing multiple fonts per page and printer sharing.

- LaserJet 500 PLUS: Job offsetting can be used between jobs to allow for easy job separation.

Printable Characters-Per-Line (Fixed Pitch)

Print	Portrait/Landscape			
Pitch	Std.	Legal	A4	B5
10	80/106	80/136	77/112	66/97
12	96/127	96/163	93/135	80/116
16.66	132/176	132/226	129/188	111/167

Printable Lines-Per-Page

Lines/	Portrait/Landscape			
Inch	Std.	Legal	A4	B5
6	62/48	80/48	66/46	56/39
8	84/63	108/63	89/61	76/52

Printable Surface

		Std.	Legal	A4	B5
Width:	Inches	8.0	8.0	7.8	6.7
	MM	203	203	198	170
Length:	Inches	10.6	13.6	11.3	9.7
	MM	269	345	287	247

Power

- Voltage/Frequencies:
  115V+/-10% 60Hz
- Optional:
  220V+/-10% 50Hz
  240V+/-10% 50Hz
- Power Consumption at 115 VAC:
  850 Watts Printing Maximum (2900 BTU/Hr)
  170 Watts Standby (580 BTU/Hr)

Environmental

Temperature (Printer & Cartridge)

Operating	10 to 32.5 degrees C. (50 to 91 degrees F.)
Storage	0 to 35 degrees C. (32 to 95 degrees F.)

Altitude

Operating	0 to 2,500 metres (0-8,200 feet)
Non-operating	0 to 15,000 metres (0-49,200 feet)

Humidity

Operating	20 to 80% RH
Non-Operating	10 to 80% RH

Audible Noise

Printing < 55 dB(A)   Standby < 45 dB(A)

Note: Measured one meter from source according to ISO/DIS 7779

Physical (LaserJet and LaserJet PLUS)

Width	47.5 cm. (18.5 inches)
Depth (body only)	41.5 cm. (16.2 inches)
Depth (with trays)	72.3 cm. (28.2 inches)
Height	29.3 cm. (11.4 inches)
Weight	32 kg. (71 pounds)

Physical (LaserJet 500 PLUS)

Width	47.5 cm. (18.5 inches)
Depth (body only)	49.5 cm. (19.5 inches)
Depth (with trays)	87.5 cm. (34.4 inches)
Height	46.0 cm. (18.1 inches)
Weight	43 kg. (94 pounds)

LaserJet Printer Font Product Summary

Soft Fonts

Ask your HP Dealer or Sales Representative for the latest information on soft fonts. Disc-based soft fonts can be used with the LaserJet PLUS and LaserJet 500 PLUS printers only.

Font Cartridges (Currently Available)

92286A	Courier 1
92286B	Tms Proportional 1
92286C	International 1
92286D	Prestige Elite
92286E	Letter Gothic
92286F	Tms Proportional 2
92286G	Legal Elite
92286H	Legal Courier
92286J	Math Elite
92286K	Math Tms
92286L	Courier Portrait and Landscape
92286M	Prestige Elite Portrait and Landscape
92286N	Letter Gothic Portrait and Landscape
92286P	Tms Rmn Portrait and Landscape
92286Q	Memo 1
92286R	Presentations 1
92286T	Tax 1
92286U	Forms Portrait
92286V	Forms Landscape
92286W	Bar Code 3-of-9/OCR-A
92286X	Bar Code EAN/UPC and OCR-B
92286Y	PC Courier 1

For font print samples and other font information, ask your HP Dealer or Sales Representative for the LaserJet Printer Font Cartridge Selection Guide, part number 5954-2270 (or ask to see the LaserJet Printer Family Font Catalog, part no. 5954-2277).

Font cartridges and discs are available through your HP Dealer or through Hewlett-Packard's Direct Marketing Division. Call toll free: 800-538-8787 (in California call 408-738-4133 collect).

Ordering Information

LaserJet Printer	2686A	Professional PC Printer Includes: ● Operator's Manual ● Technical Reference Manual ● 128K RAM Memory (Up to 59K user memory) ● Standard RS-232C/422 Interface ● EP Toner Cartridge ● Letter-size input and output trays ● Courier 10 CPI/12 point font (Portrait and Landscape)	
LaserJet PLUS Printer	2686A Option 300	Includes everything in standard LaserJet package plus: ● 512K RAM Memory (Up to 395K user memory) ● Dual Parallel and RS-232C/422 Interface ● Line Printer 16.66 CPI/8.5 point font (Portrait)	
LaserJet 500 PLUS Printer	2688D	Includes everything in LaserJet PLUS package and: ● Dual input bin paper feed ● Two, 250-Sheet letter-size input trays and a 250-sheet output tray ● Paper Select key on Operator Control Panel ● Correct Order Output ● Job Offsetting	
Supplies and Accessories	92285A	Black Toner Cartridge	
	92285G	Brown Toner Cartridge	
	92285B	Letter-Size Input Paper Tray (8 1/2 X 11)	**LaserJet and LaserJet PLUS Printers**
	92285C	Legal-Size Input Paper Tray (8 1/2 X 14)	
	92285D	A4-Size Input Paper Tray (210mm X 297mm)	
	92285E	B5-Size Input Paper Tray (182mm X 257mm)	
	92287B	LaserJet 500 PLUS Letter-Size Input Paper Tray (8 1/2 X 11)	
	92287C	LaserJet 500 PLUS Legal-Size Input Paper Tray (8 1/2 X 14) .	
	92287D	LaserJet 500 PLUS A4-Size Input Paper Tray (210mm X 297mm)	
	92287E	LaserJet 500 PLUS B5-Size Input Paper Tray (182mm X 257mm)	
	26053A	LaserJet PLUS Upgrade Kit (to convert a standard LaserJet to a LaserJet PLUS)	
RS-232C Cables	17255D	3.3-foot (1 meter) Male-to-Female IBM PC\XT Cable	
	92221P	5-foot (1.5 meter) Male-to-Male HP 110 Portable Cable	
	17355M	9-foot (2.3 meter) Male-to-Male Apple IIe and ///, DEC Rainbow Cable	
	24542G	10-foot (3 meter) Male-to-Female HP Vectra IBM PC\AT Cable	
	92219H	16-foot (5 meter) Male-to-Male HP 150 Cable	
	92219J	16-foot (5 meter) Male-to-Female IBM PC\XT Cable	
	13242-60010	16.7-foot (5 meter) Male-to-Male HP 150 Cable	
Parallel Cables	13242D	6.6-foot (2 meter) Male-to-Female HP 150 Cable	
	24542D	6.6-foot (2 meter) Male-to-Male HP Vectra or IBM PC\XT and PC\AT Cable	
	92219K	9-foot (2.7 meter) Male-to-Male HP Vectra or IBM PC\XT and PC\AT Cable	
Serial Extension Cables	92215F	50-foot (15 meter) Female-to-Male Cable	
	92215T	100-foot (30 meter) Female-to-Male Cable	

Supplies and accessories are available through Hewlett-Packard's Direct Marketing Division. Call toll free: 800-538-8787 (in California call 408-738-4133 collect).

Apple Macintosh is a product of Apple Computer, Inc.
IBM PC is a product of International Business Machines Corporation.

Call your local HP Sales Office or nearest Region Office for more information: Eastern (301) 258-2000; Midwestern (312) 255-9800; Southern (404) 955-1500; Western (213) 877-1282; Canadian (416) 678-9430. Ask the operator for Hewlett-Packard computer sales, or write: Hewlett-Packard 1820 Embarcadero Road, Palo Alto, CA 94303. In Europe write: Hewlett-Packard GmbH, Computer Products, Herrenberger Strasse 110, D-703 Boeblingen, Postfach 1430 West Germany. In Canada write: Hewlett-Packard (Canada) Ltd., 6877 Goreway Drive, Mississauga, Ontario Canada L4V 1M8. Elsewhere write: Hewlett-Packard Intercontinental, 3495 Deer Creek Road, Palo Alto, California 94304.

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Discs and Tape Units Selection and Interfacing

HEWLETT PACKARD

For HP 1000 A-Series Computer Systems

Introduction

This section contains information on the selection and connection of mass storage devices (discs, flexible discs, and cartridge and reel-to-reel magnetic tape units) for HP 1000 A-Series Computer Systems.

System Functions of Mass Storage Devices

Mass storage devices provide for the installation, storage, and backup of the operating system, programs, and data for HP 1000 Computer Systems.

System Bootup

Each system must include a mass storage device that supports bootup to initiate operation of a particular generation or configuration of the operating system. Each system that cannot bootup from another system via a communications link requires a boot-up device. The system boot-up function is supported by all HP 1000-compatible magnetic tape units and by most, but not all, HP 1000-compatible discs. If the boot-up device is a disc, it is called a system disc.

Hard Discs for Fast Access Storage

Hard discs with moving read/write heads are used to provide fast-access storage of programs and data for these reasons:

1. The hard disc media has a dimensional stability which makes possible writing and reading of magnetic patterns of very high density.

2. The hard disc can be made with enough strength and balance to be rotated at high speeds, which:
    a. Minimizes the rotational delay in accessing data in any particular disc sector.
    b. Maximizes the rate at which data passes beneath the read/write heads, which determines the maximum data transfer rate.

Hard discs with removable media can also be used for input and backup of programs and data. However, the relatively high cost of disc cartridges and disc packs precludes the distribution of most software via removable disc media. Software is usually provided on magnetic tape or flexible disc media.

Magnetic Tape Units for Software/Data Input and Backup

Magnetic Tape Units are used for software/data input and backup for these reasons:

1. Magnetic tape is the lowest-cost, high-density recording medium available and is easily mounted, dismounted, and stored.

2. A cartridge or reel of magnetic tape has high capacity (10-40 times the capacity of a flexible disc), which is essential for backing up large volumes of disc storage.

3. Magnetic tape drives have high sequential read/write access rates (equaling or exceeding those of flexible disc drives), which are also necessary for backing up large volumes of disc storage.

Flexible Discs for Software Input and Limited-Volume Backup

Flexible discs are an excellent medium for input and backup of individual programs. However, the limited storage capacity of each disc makes it impractical to use flexible discs for input or backup of any but small systems or data bases. This same capacity limitation makes flexible discs cumbersome for the installation of large software products from Hewlett-Packard or other vendors.

Disc Selection

Types of Discs

The principal types of discs supported on HP 1000 A-Series Computer Systems are discussed below and compared with respect to capacity and performance in Table 10-1.

Table 10-1. Disc Selection

Product Number	**Description**	**Capacity (MB/Disc)**	**Access Time (ms)**	**Burst Transfer Rate (kb/s)**
CS/80 DISCS				
7907A	Fixed/Removable	41	44.3	600
7911P/R	Fixed Disc	28	38.4	1170
7912P/R	Fixed Disc	65	38.4	1170
7914P/R/CT*	Fixed Disc	132	40.4	1170
7914ST*	Disc/Tape Subsystem	132	40.4	1170
7914TD**	Disc/Tape Subsystem	132	40.4	1170
7933H	Fixed Disc	404	35.1	1200
7935H	Removable Media Disc	404	35.1	1200
7936A	Fixed Disc	307	30.8	2350
7937H	Fixed Disc	571	30.8	2350
7941A*	Fixed Disc	23	48.4	625
7945A	Fixed Disc	55	48.4	625
7942A*	Disc-Tape Drive	23	48.4	625
7946A	Disc-Tape Drive	55	48.4	625
7957A	Fixed Disc	81	41.5	1250
7958A	Fixed Disc	130	41.5	1250
MULTI-ACCESS CONTROLLER (MAC) DISCS †				
7920M*, 7920S*	Master Disc, Slave Disc	50	33.3	740
7925M*, 7925S*	Master Disc, Slave Disc	120	36.1	740

* *Discontinued product, listed here for reference only.*

** *Does not support bootup of RTE-A system.*

† *Because MAC discs do not support bootup of RTE-A system, they are useful only as peripheral discs in A-Series systems operating under RTE-A. All MAC discs incorporate removable media.*

Table 10-1. Disc Selection, continued

Product Number	Description	Capacity (MB/Disc)	Access Time (ms)	Burst Transfer Rate (kb/s)
OTHER DISCS				
9122D	Dual Microfloppy	0.6	478	63
9133H*	Fixed and Microfloppy	19.9 0.631	93 478	630 63
9133L	Fixed and Microfloppy	39.9 0.631	55 478	630 63
9134H*	Fixed	19.9	93	630
9134L	Fixed	39.9	55	630
9153B	Fixed and Microfloppy	19.9 0.631	75 478	500 63
9154B	Fixed	19.9	75	500
* *Discontinued product, listed here for reference only.*				

CS/80 Discs. CS/80 discs with capacity to 571 MB use Winchester technology wherein the disc is sealed off from environmental contamination. This protection makes possible very high data density, with high capacity in a small space, at very low cost per data byte. However, the sealed disc cannot be removed from its drive to lock it up for security or to move it to another system.

CS/80 discs with 404 MB capacity are available with media that can be removed for security or use on another system.

Built-in intelligence and the command set in these discs simplifies interfacing of discs of various capacities. This facilitates upgrading of disc capacity to satisfy changing system requirements.

All CS/80 discs are supported under RTE-A and RTE-6/VM. For connections, see Figure 10-1.

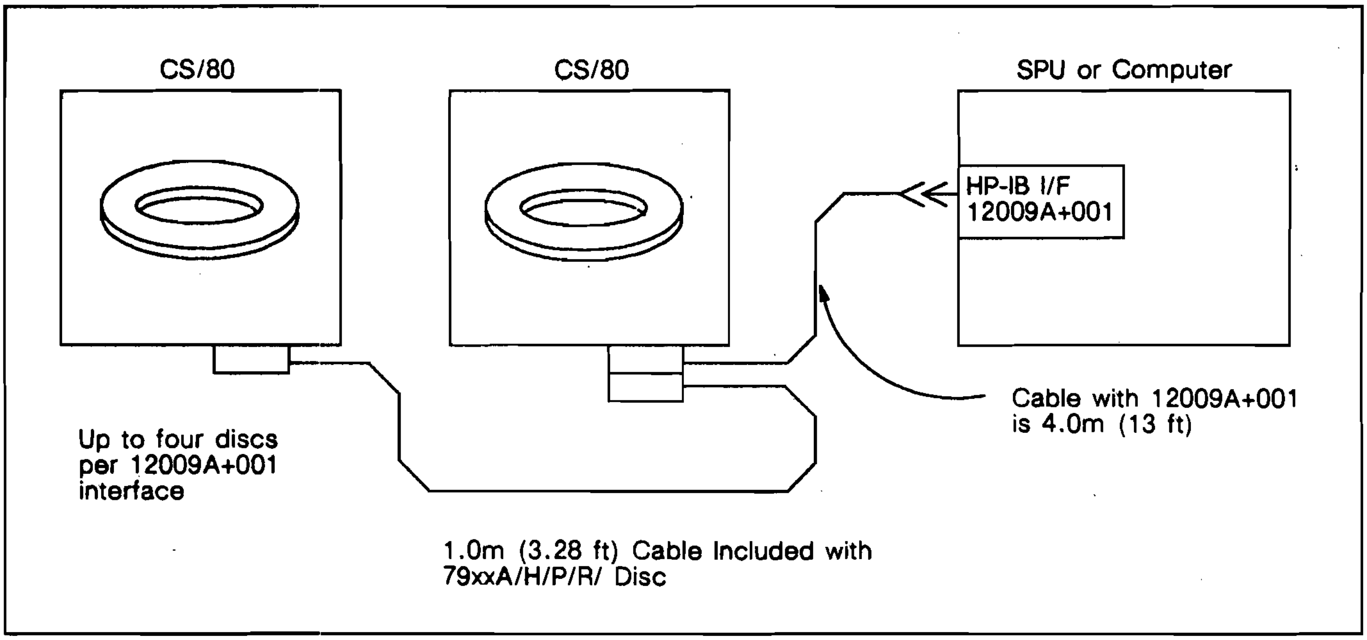

CS/80
CS/80
SPU or Computer
HP-IB I/F
12009A+001
Cable with 12009A+001 is 4.0m (13 ft)
Up to four discs per 12009A+001 interface
1.0m (3.28 ft) Cable Included with 79xxA/H/P/R/ Disc

Figure 10-1. CS/80 Disc Connections to HP 1000 A-Series Computers

Multi-Access Controller (MAC) Discs. MAC discs accommodate multi-system access to a common storage facility. Up to three A-Series computers can be connected to one MAC master disc.

Multi-computer compatibility is supported by the RTE-A and RTE-6/VM operating systems and file managers for computers that access their own exclusive disc spaces on one or more MAC disc drives.

Because MAC discs do not support bootup of RTE-A systems, they are useful only as peripheral discs in systems operating under RTE-A.

All of the MAC discs also incorporate removable media for applications which require that capability.

For MAC disc connections to HP 1000 A-Series see Figures 10-2 and 10-3.

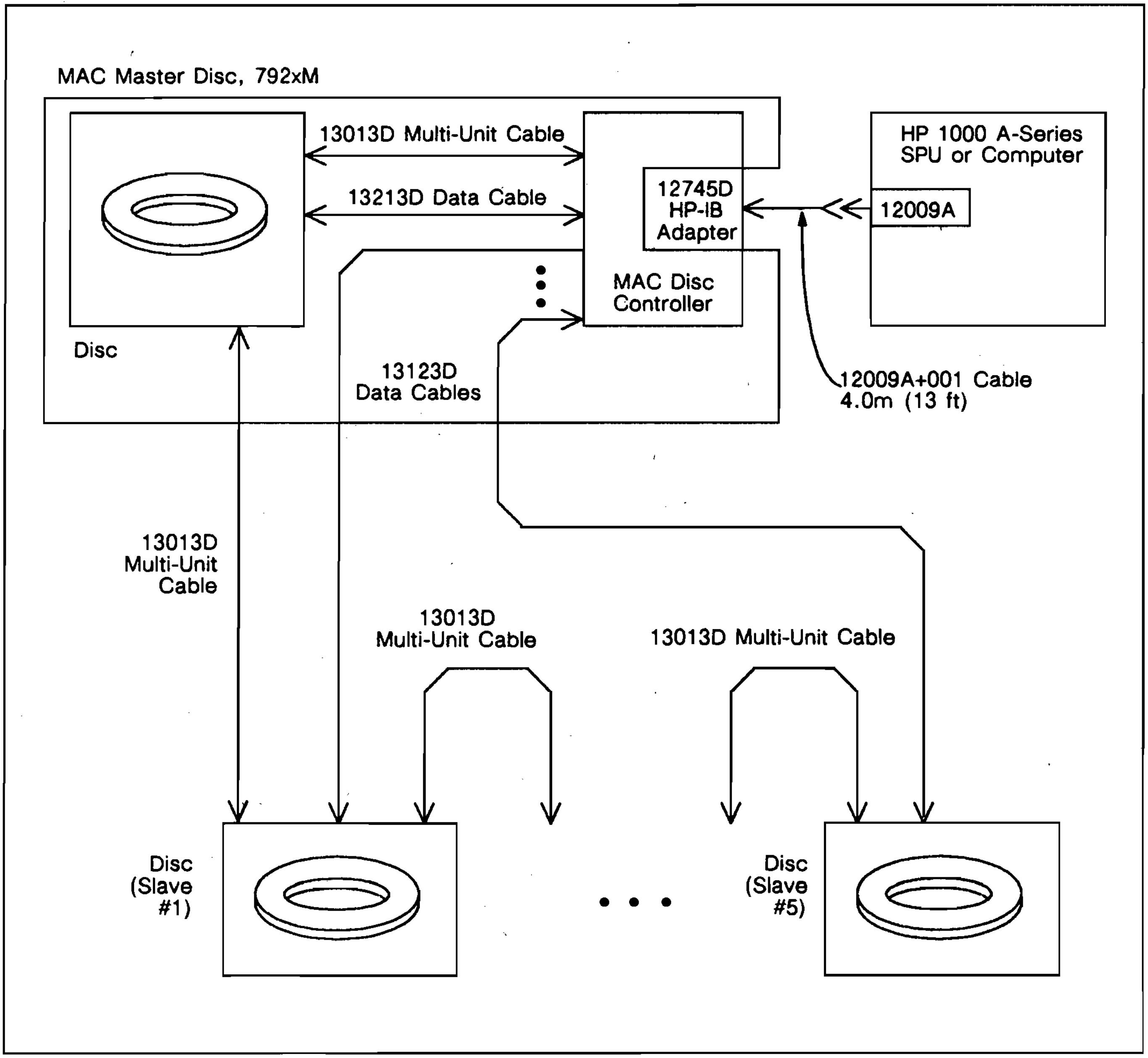

MAC Master Disc, 792xM
13013D Multi-Unit Cable
13213D Data Cable
12745D
HP-IB
Adapter
MAC Disc
Controller
HP 1000 A-Series
SPU or Computer
12009A
Disc
13123D
Data Cables
12009A+001 Cable
4.0m (13 ft)
13013D
Multi-Unit
Cable
13013D
Multi-Unit Cable
13013D Multi-Unit Cable
Disc
(Slave
#1)
Disc
(Slave
#5)

Figure 10-2. MAC Disc Connection to HP 1000 A-Series Computers

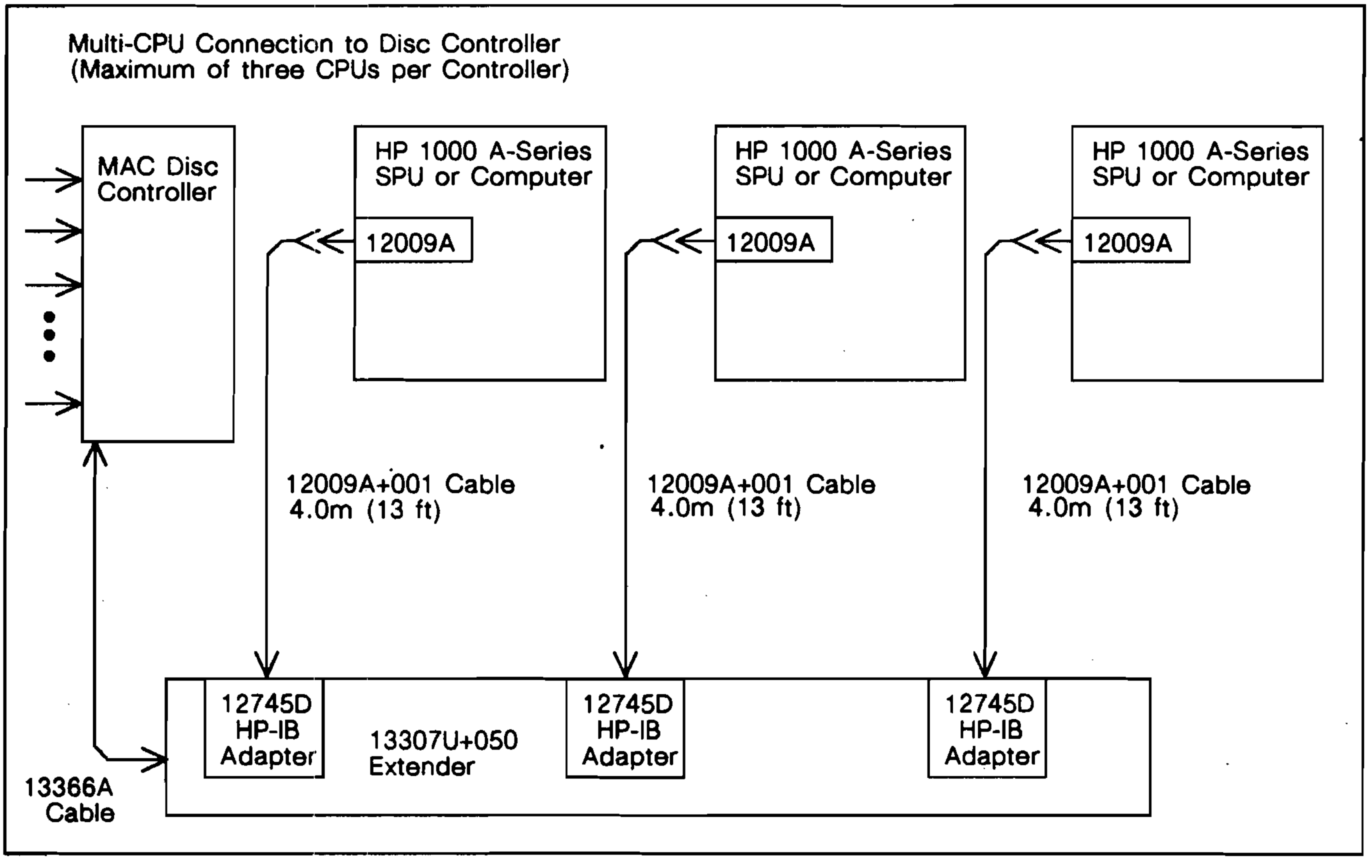

Multi-CPU Connection to Disc Controller
(Maximum of three CPUs per Controller)
MAC Disc Controller
HP 1000 A-Series SPU or Computer
12009A
HP 1000 A-Series SPU or Computer
12009A
HP 1000 A-Series SPU or Computer
12009A
12009A+001 Cable 4.0m (13 ft)
12009A+001 Cable 4.0m (13 ft)
12009A+001 Cable 4.0m (13 ft)
12745D HP-IB Adapter
13307U+050 Extender
12745D HP-IB Adapter
12745D HP-IB Adapter
13366A Cable

Figure 10-3. Multi-CPU Connection to MAC Disc, HP 1000 A-Series Computers

Other Discs. Other discs supported under HP 1000 Computer Systems include small hard disc drives, hard disc/3.5-inch flexible disc drive combinations, and 3.5-inch flexible disc drives. The small hard disc and flexible disc packages are intended for use in small systems in which small size and low cost are overriding considerations. The flexible discs offer a convenient means of loading software into the system and providing copies of software for transportation to other HP 1000 Systems. For connection of these discs to HP 1000 Computer Systems, see Figure 10-4.

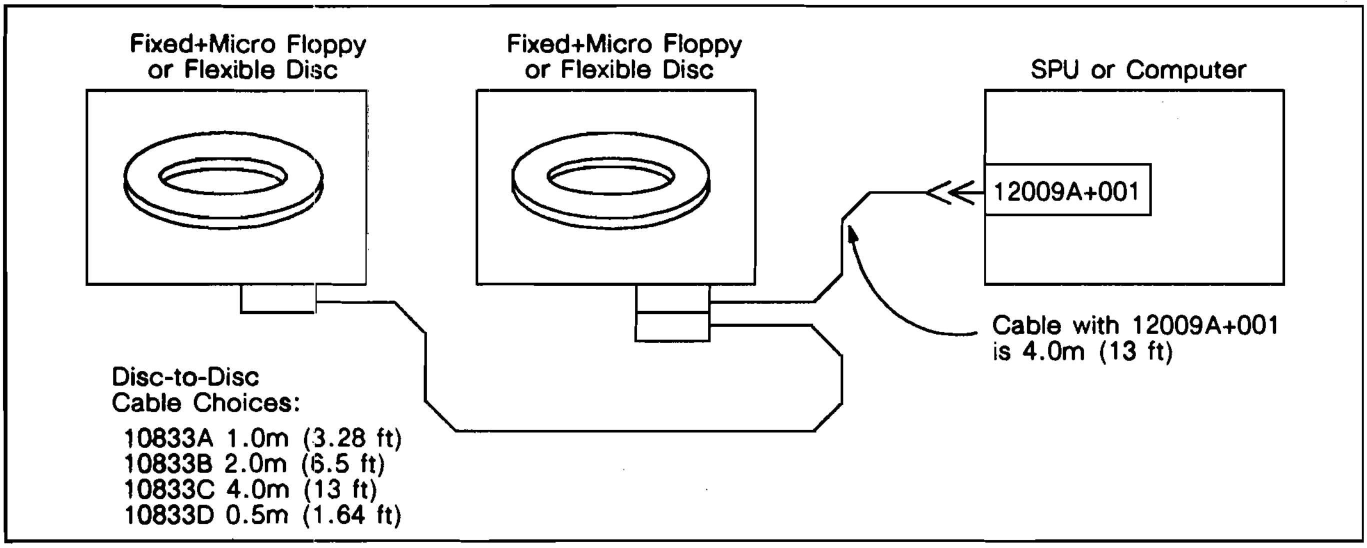

Fixed+Micro Floppy or Flexible Disc
Fixed+Micro Floppy or Flexible Disc
SPU or Computer
12009A+001
Cable with 12009A+001 is 4.0m (13 ft)
Disc-to-Disc Cable Choices:
10833A 1.0m (3.28 ft)
10833B 2.0m (6.5 ft)
10833C 4.0m (13 ft)
10833D 0.5m (1.64 ft)

Figure 10-4. Connecting Other Discs to HP 1000 A-Series Computers Using HP-IB Interface

Performance Considerations

Capacity, access time, and transfer rates of the discs that are supported on HP 1000 A-Series Computer Systems are compared in Table 10-1. The significance of these performance factors is discussed in the following paragraphs.

Capacity. The disc(s) selected must provide enough storage capacity to accommodate the operating system, storage and working space for program development software; space for data bases, and space for other software and data. For help in determining disc storage capacity requirements, see the Software section in this handbook.

In systems with very large disc storage needs, it may be necessary to connect multiple disc drives to one or more interfaces. The RTE primary systems support up to two disc interfaces, up to 4.5 gigabytes of disc storage using eight 7937H 571-megabyte discs, four per interface. However, it is possible to generate an RTE system that supports more interfaces to increase disc capacity. The capacity can be to greater than 20 gigabytes, limited mainly by card cage spaces available for disc interfaces and the capacity of supported disc memories.

Access Time. Access time is the time required for the moving read/write head to reach the area on the disc that is to be accessed. This includes the average time (including controller overhead) that is required for the head to reach the desired track plus the time required for the desired disc sector to come under the read/write head (this time is half that required for one revolution of the disc).

Minimizing access time is most important in real-time applications that are heavily dependent upon disc accesses, such as processing of Virtual Memory Area data arrays for simulation or interactive graphics. Frequent access to data base information is another situation in which it is particularly desirable to minimize disc access time.

Transfer Rate. Transfer rate is a function of recording density and speed of disc rotation. Fast transfers are most important in applications that involve transfers of large files between systems or frequent overlaying of program segments.

Disc Interfacing

Connection of discs to HP 1000 Computer Systems is illustrated in Figures 10-1 through 10-4.

Multi-interface access to discs may be necessary because the required disc capacity cannot be connected to the system via a single interface. However, multi-interface access may also be used to provide parallel paths that permit multiple disc accesses to take place concurrently, thereby speeding up overall throughput.

Although multi-interface access can be used to speed up overall throughput, the extent to which it is usable for that purpose is limited by the I/O bandwidth of the computer. The aggregate data rate of all concurrent disc transfers and other concurrent transfers cannot exceed the I/O bandwidth of the computer and may not quite reach it. Attempts to exceed the computer's I/O bandwidth can even result in loss of data. With MAC discs, which are less intelligent than the CS/80 discs, attempts at simultaneous disc access via two interfaces have exceeded I/O bandwidth and actually resulted in loss of data. See Table 10-2.

One CS/80 disc can be connected to the same 12009A interface as one MAC master disc. A maximum of five 79xxS slave discs can be connected to a MAC master disc in A-Series systems. Performance may be degraded because of contention between the two different types of discs on the same HP-IB bus.

Table 10-2. I/O Bandwidth of A-Series Computers

Processor	I/O Bandwidth (MBytes/sec)
A400	4.4
A600+	4.27
A700	4.0
A900	2.5 (output) 3.7 (input)

Magnetic Tape Unit Selection

Performance Considerations

A magnetic tape unit must provide a transfer rate and capacity adequate to the job it has to perform. These, in turn, depend upon recording density, operating mode, and tape speed, as summarized for the various HP 1000-supported magnetic tape units in Table 10-3.

Transfer rate becomes increasingly important as the size of the system or data base to be backed up increases. Backup of a very large system or data base can easily require multiple tapes and one to several hours to complete. A tape unit with a fast transfer rate will get the job done in proportionately less time than a slower tape unit.

Capacity per reel of tape is another performance factor whose importance increases with the volume of data to be backed up or stored. With a multi-tape backup of a system or a data base, tapes will have to be changed less often on a tape unit recording at a high density that maximizes the data packed on each reel of tape. Tape storage space is also less with higher capacity because fewer reels of tape are needed to store a given volume of data.

Compatibility Considerations

Where a library of tapes already exists, the ability of the magnetic tape unit to read those tapes can be very important. A magnetic tape recorded at 800 cpi can only be read on a tape unit at that density. If only one tape unit can be provided for the system, the need for compatibility with existing tapes may conflict to some extent with the need for high performance.

Operational Modes

Start-stop is the traditional mode of magnetic tape unit operation. The magnetic tape unit starts the tape and reads or writes a record of *n* bytes, stops, starts and reads or writes a record, etc., until an end-of-file mark is reached. The starting and stopping of the tape necessarily slows down the data transfer process. This inefficiency is particularly disadvantageous for system or data base backup, where very large volumes of data must be saved on tape.

Streaming mode tape motion is continuous, which typically increases the data transfer rate as compared to start-stop mode. Streaming mode magnetic tape units are supported in A-Series systems, effective with RTE-A revision code 2440.

Appearance Considerations

The 7974A and 7978A Magnetic Tape Units are housed in cabinets that differ from HP 1000 System Processor Unit cabinets and from each other with respect to cabinet height, color of finish, and means of unlatching the front door of the cabinet. Customers who regard uniformity of appearance of their computer system installation as highly important should compare the 7974A/7978A and the HP 1000 System Processor Unit side by side before deciding on a tape unit.

Table 10-3. Tape Unit Selection

MAGNETIC TAPE UNIT		**Recording Density (char/inch)**	**Operating Mode**	**Transfer Rate (kB/sec)**	**Reel Capacity (MB/2400ft)**
Product	**Name**				
7914ST*	Disc Tape Subsystem	1600/800	Start-Stop Streaming	80/40 160/80	40/20
7970ER	Magnetic Tape Unit	1600	Start-Stop	72	40
7971AR	Magnetic Tape Unit	1600	Start-Stop	72	40
7974A	Magnetic Tape Unit	1600/800	Start-Stop Streaming	80/40 160/80	40/20
7978B	Magnetic Tape Unit	6250/1600	Streaming	468/120	140/40

CARTRIDGE TAPE SUBSYSTEMS		**Recording Density (bits/inch)**	**Operating Mode**	**Transfer Rate (kb/sec)**	**Reel Capacity (MB)**
Product	**Name**				
9144A	Tape Cartridge Subsystem	10,000	Streaming	34	16.7/67.1
35401A	Cartridge Auto-Changer Tape Subsystem	10,000	Streaming	34	16.7/67.1

* *Discontinued product, listed here for reference only.*

Tape Drive Unit Interfacing in HP 1000 A-Series Systems

Connection of magnetic tape units to HP 1000 A-Series Computer Systems is illustrated in Figure 10-5.

Magnetic tape units are connected to A-Series systems via the 12009A HP-IB interface. One 12009A interface can support two HP 797xA Magnetic Tape Units, which can be different units, such as one 7974A and one 7978A.

The cartridge tape subsystems are connected in the same manner as the CS/80 disc drives, that is, up to four drives per 12009A interface.

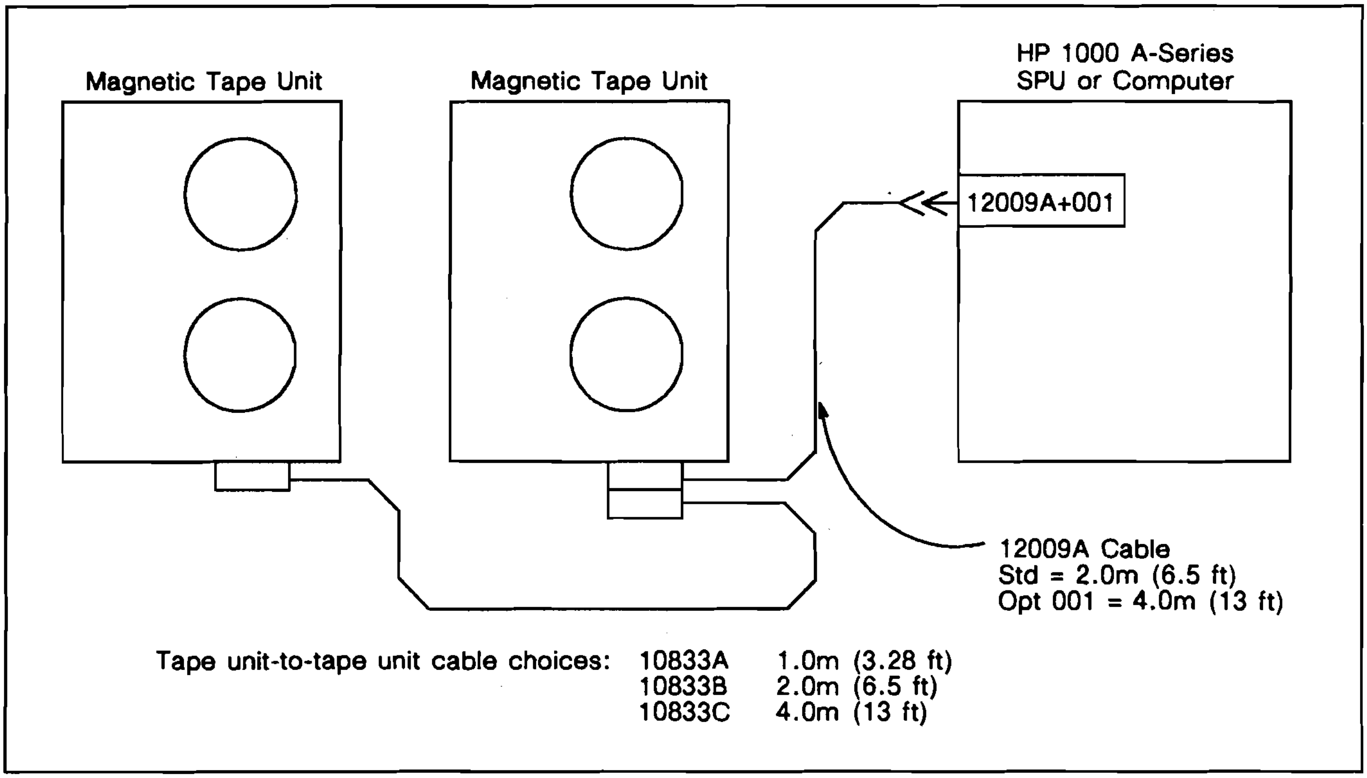
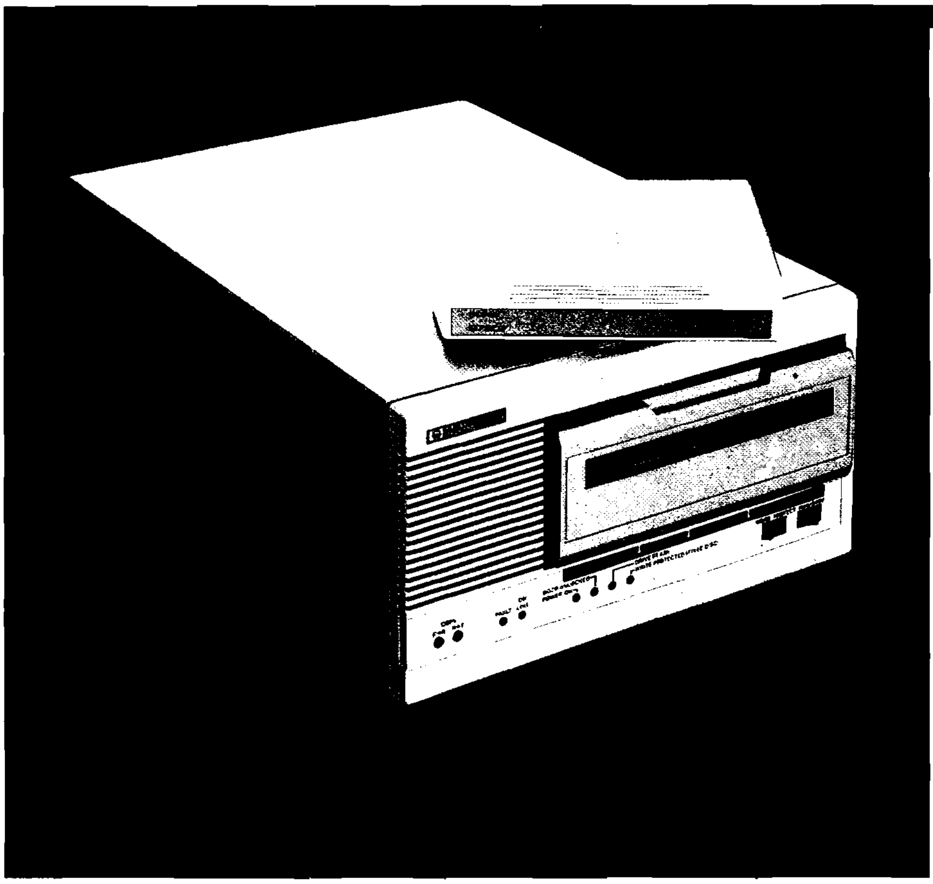

Magnetic Tape Unit
Magnetic Tape Unit
HP 1000 A-Series
SPU or Computer
12009A+001
12009A Cable
Std = 2.0m (6.5 ft)
Opt 001 = 4.0m (13 ft)
Tape unit-to-tape unit cable choices: 10833A 1.0m (3.28 ft)
10833B 2.0m (6.5 ft)
10833C 4.0m (13 ft)

Figure 10-5. Connecting Magnetic Tape Units to HP 1000 A-Series Computers

HEWLETT-PACKARD

HP 7907A Fixed/Removable Mass Storage Subsystem



A revolutionary new mid-range disc drive for

- Data Logging
- Data Security
- CAD/CAM
- Automated Testing

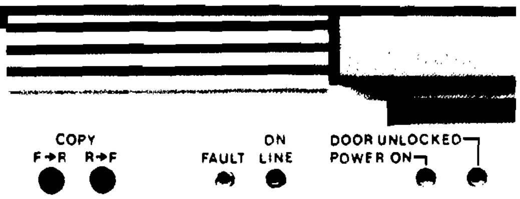
Technical Data July 1985

Introducing the HP 7907A

Now the CS/80 product family includes a fixed/removable disc drive in the mid-range!

- 20.5 megabytes of fixed *and* 20.5 megabytes of removable formatted capacity in an easy to use front-loading configuration.
- 8-inch removable disc cartridge with an intelligent controller using the CS/80/HP-IB protocol.
- CS/80 and HP-IB compatibility means support on HP 1000 and HP 9000 processors.

Pushbutton back-up is just one of the special features built into this drive.

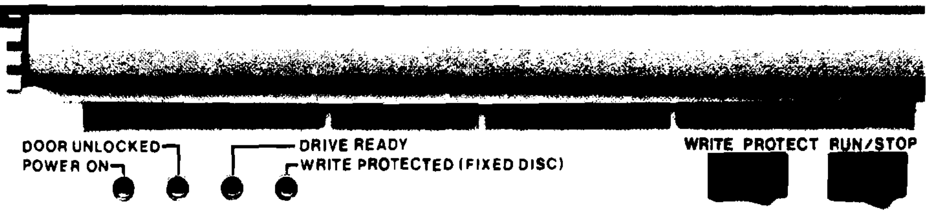


Designed for high performance, like fast back-up three different ways!

In addition to back-up done through the CPU, the HP 7907A offers a pushbutton back-up feature that copies data from the fixed to the removable disc and vice-versa *in less than three minutes.* Since the CPU is only locked out for the time it takes to do the back-up, system downtime is minimized. That means you don't have to wait longer than three minutes to get back on the computer!

If you prefer, you can tell the CPU to initiate the back-up, which simply means you don't push the copy button; the CPU, in effect, does it for you. It's still done directly from disc to disc, and it's done in less than three minutes. Of course, back-up can always be done via the CPU, but the system may be locked out for the back-up. This is an option that's good to use for partial back-ups, and when you'd like the CPU to reorganize the files as it copies them.

The "write protect" feature safeguards sensitive data.



There's even a built-in data protection device.

Because of the "write-protect" toggle switch on the front panel, valuable or sensitive data can be protected at the touch of a button. Turn it on and data on the fixed disc cannot be written over or erased. Turn it off when the data no longer needs to be protected.

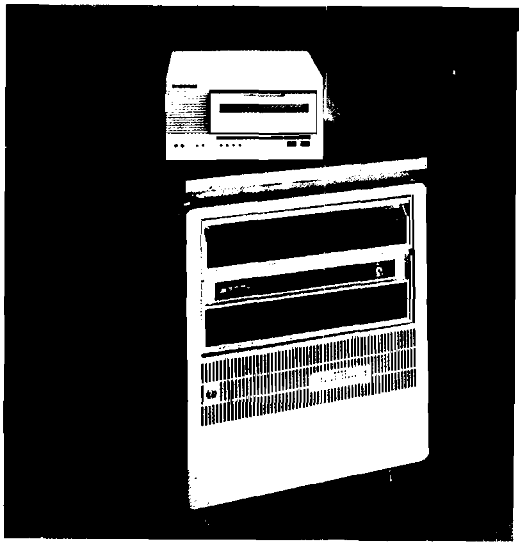
The removability of the disc cartridge means the HP 7907A is ideal for a variety of applications.

Users in the CAD/CAM industry will find this disc drive extremely useful, since large volumes of data are common and need to be interchanged quickly and easily. It will be equally desirable in automated testing environments, where quick system reconfiguration is required. In security and intelligence applications data security is critical, so the ability to remove the disc cartridge and lock it away is essential. And, when large amounts of data are recorded or taken off-line quickly, as in data logging, an easy to handle removable disc cartridge is invaluable.

The HP 7907A offers mid-range system users high performance and a variety of special features in a compact, lightweight package.

And it's all in a compact package!

The HP 7907A is less than 7 inches high and 13 inches wide, so it can be used as a desktop model, or can be easily put into the Hewlett-Packard mobile mini-rack, or standard 19-inch EIA rackmount.



The HP 7907A offers HP 7906 customers a removable-media disc that is smaller, less expensive, and supported on both HP 1000 and HP 9000 systems.

Compare the HP 7907A to its predecessor, the HP 7906.

With twice the storage capacity and one-tenth the physical size, the HP 7907A is truly in a class ahead of the HP 7906. But that's not the best part . . . the HP 7907A is only one-third the cost per megabyte!

Technical Data:

Operating Specifications

Disc performance

Average controller throughput time:	4.0 ms
Average seek time:	30.0 ms
Average rotational delay:	8.5 ms
Average time to transfer 1 kbyte:	1.8 ms
Total average transaction time (excluding system overhead):	44.3 ms
Maximum disc transactions per second, for 1 kbyte transfers, less system overhead:	22.6 ms*

**Refers to fundamental disc performance; true I/O rates must include the individual system configuration specifications and are application dependent.*

Operating Characteristics

Data capacity (formatted)

Item	Data Bits Per	Data Bytes Per	Data Words Per	Sectors Per	Tracks Per
Byte	8	—	—	—	—
Words	16	2	—	—	—
Sector	2,048	256	128	—	—
Track	131,072	16,384	8,192	64	—
Fixed Disc	164,364,288	20,545,536	10,272,768	80,256	1,254
Cartridge	164,364,288	20,545,536	10,272,768	80,256	1,254
Drive	328,728,576	41,091,072	20,545,536	160,512	2,508

Overall Characteristics

Heat dissipation (typical operating)

7907A Disc Drive: 145 watts (495 Btu/hr, 125 Kcals/hr)

Electromagnetic emissions

Radiated and conducted interference:

- HP 7907A — For U.S.A., designed to meet FCC Docket 20780 for Class A computing devices.
- HP 7907A — For Europe, designed to meet applicable VDE requirements for computing devices.

Safety

The HP 7907A meets all applicable safety standards of the following:

- IEC 380 and 435
- UL 114 and 478
- CSA C22.2 No. 154

Physical Characteristics

Dimensions

HP 7907A in stand-alone cabinet:

Height: 180.3 mm (7.1 in.)
Width: 325.1 mm (12.8 in.)
Depth: 467.4 mm (18.4 in.)

Weight

HP 7907A

Shipping: 29.1 kg (64.1 lb)
Net: 25 kg (55 lb)

Environmental requirements

Note: Before installing the HP 7907A, refer to the *Site Environmental Requirements for Disc/Tape Drives Manual,* part number 5955-3456. Available at your local Hewlett-Packard Sales Office.

Ordering Information

HP 7907A

41 Mbyte disc drive, integral CS/80 controller, disc cartridge, and 1-metre HP-IB cable.

Available options

015 — 240V/50 Hz
550 — Deletes HP-IB cable

Accessories supplied with each HP 7907A

Disc Drive Owner's Manual (07907-90901)
Site Environmental Requirements for Disc/Tape Drives (5955-3456)
One 20.5 Mbyte Removable Disc Cartridge (97907A)

Accessories NOT supplied with each HP 7907A

HP 19507A Rackmount Kit for 19-inch EIA equipment racks.
HP 92211R/L Desk-height stand-alone cabinets for stackable peripherals and systems.

Hewlett-Packard, in a continuing effort to offer excellent products at a fair value, reserves the right to change specifications, designs, and models without notice.

For assistance call the HP regional office nearest you: Eastern 301/258-2000, Midwest 312/255-9800, Southern 404/955-1500, Western 801/50o-3700, Canadian 800/387-3867. Or write to: Hewlett-Packard, 1820 Embarcadero Road, Palo Alto, California 94303; in Europe: Hewlett-Packard S.A., 7 rue du Bois-du-Lan, P.O. Box 364, 1217 MEYRIN 1, Geneva, Switzerland; elsewhere in the world: Hewlett-Packard Intercontinental, 3495 Deer Creek Road, Palo Alto, California 94304.

HEWLETT
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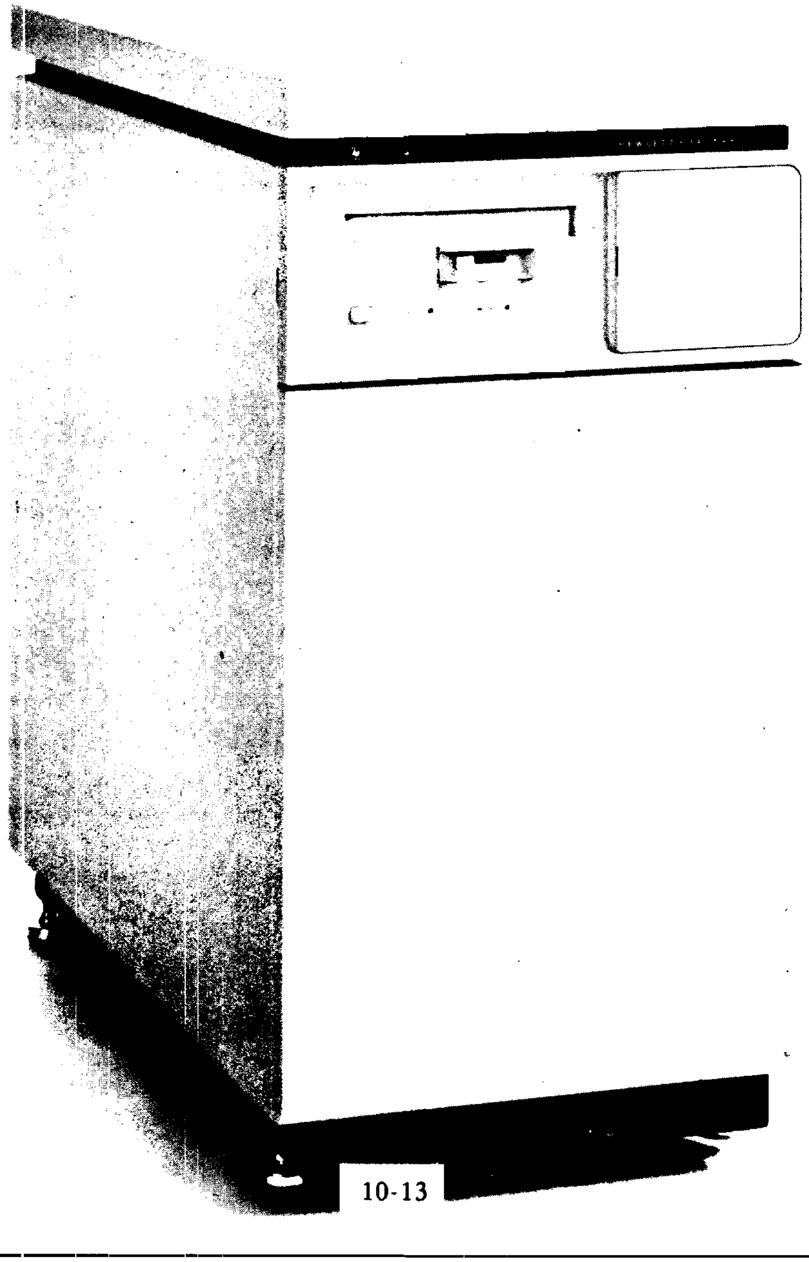
Printed in U.S.A. 7/85
5953-3665

HP 7911, 7912 and 7914 Disc/Tape Drive

Technical Data **February 1984**



The HP 7911, 7912 and 7914 are complete peripheral storage products providing user I/O, mass storage, and backup capabilities. The HP 7911, 7912 and 7914 combine an advanced Winchester-type disc drive for reliable mass storage and a built-in cartridge tape drive supplying cost-effective backup, software distribution capability or an easy path for data interchange between systems. A sophisticated microprocessor-based controller manages both storage components, integrated into a single compact package.

Features

Disc drive

- 28.1/65.6/132.1 megabytes of formatted data storage capacity
- Advanced Winchester head/media technology
- Fixed disc reliability

Built-in cartridge tape drive

- Easy-to-handle, reliable 1/4-inch cartridge tape media
- Automatic error correction
- Automatic tape tensioning and head alignment

Integral microprocessor-based controller

- Track and sector sparing
- Automatic seek and read retry
- Programmable sector interleaving and 4-kbyte buffer to allow matching of data transfer rate to a wide variety of systems
- Extensive internal diagnostic capabilities
- Automatic error logging
- Real time error correction
- CS/80 instruction set for communication with host systems
- HP-IB* interface

Description

The HP 7911P, 7912P and 7914P are peripheral storage systems combining either a 28.1-, 65.6- or 132.1-megabyte fixed disc drive, built-in cartridge tape drive with a 67.0-megabyte tape cartridge, intelligent controller, and power supply in a convenient stand-alone cabinet. The 7911R, 7912R and 7914R include identical equipment packaged in a rackmount enclosure.

Each HP 7911, 7912 and 7914 controller communicates with the host system over an HP-IB interface utilizing HP's efficient CS/80 instruction set. This interface and instruction set have been adopted to provide flexibility in system configuration as well as an easy upgrade path for users with expanding mass storage requirements.

Serviceability of the 7911, 7912 and 7914 is enhanced by an extensive self-diagnostic capability resident in the controller. Troubleshooting of intermittent failures is facilitated by an error-logging capability which allows trained service personnel to detect failure patterns over time. In addition, a proprietary error correction integrated circuit corrects data errors in real time, without any degradation to data transfer rates.

Operating specifications

Disc performance

	7911/12	7914
Average controller overhead time:	4.0 ms	4.0 ms
Average seek time:	27.1 ms	28.1 ms
Average rotational delay:	8.3 ms	8.3 ms
Average time to transfer 1 kbyte:	1.2 ms	1.2 ms
Total average transaction time (excluding system overhead):	40.6 ms	41.6 ms

	7911/12	7914
Maximum disc transactions per second, for 1 kbyte transfers, less system overhead:	24.6*	24.0*

**Refers to fundamental disc performance; true I/O rates must include the individual system configuration specifications and are application dependent.*

Tape drive

Tape speed
Read/Write: 60 ips
Seek: 90 ips

Data transfer rate
System dependent (35 kbytes/s maximum)

Operating characteristics

Disc drive

Data Capacity	Data Bits Per	Data Bytes Per	Sectors Per	Tracks Per
Byte	8	1		
Word	16	2		
Sector	2,048	256	1	
Track	131,072	16,384	64*	1
7911/12 Head	74,973,184	9,376,148	36,608	572*
7914 Head	150,994,944	18,874,368	73,728	1,152*
7911**	224,919,552	28,114,944	109,824	1,716
7912**	524,812,228	65,601,536	256,256	4,004
7914**	1,056,964,608	132,120,576	516,096	8,064

*Total number of tracks per head is 582 (7911/7912) and 1,164 (7914); eight are used as spares for defective track allocation and two are used for maintenance tracks. Two additional tracks are reserved for future use. Total number of sectors per track is 65, with one used as a spare.

**The 7911, 7912 and 7914 utilize two heads per surface.

HP-IB: Not just IEEE-488, but the hardware, documentation and support that delivers the shortest path to a computation system.

Tape drive

Data Capacity	Bits Per	Bytes Per	Words Per	Blocks Per	Tracks Per
Byte	8				
Word	16	2			
Block	8,192	1,024	512		
Track*	8,372,224	1,046,578	523,264	1,022	
Cartridge*	133,955,584	16,744,448	8,372,224	16,352†	16
Track§	33,488,896	4,186,112	2,093,056	4,088	
Cartridge§	535,822,336	66,977,792	33,488,896	65,408‡	16

*150 foot cartridge

†Total number of blocks per 150 foot cartridge is 16,624; 32 are used as spares and 240 are used as maintenance blocks.

§600 foot cartridge

‡Total number of blocks per 600 foot cartridge is 65,776; 128 are used as spares and 240 are used as maintenance blocks.

Overall characteristics

Heat dissipation

700 Watts (2,389 Btu/hr) maximum

Electromagnetic emissions

Radiated and conducted interference:

- HP 7911/12/14P — For U.S.A., designed to meet FCC Docket 20780 for Class A computing devices.
- HP 7911/12/14P — For Europe, designed to meet VDE 0871 for Level A computing devices. FTZ licensed on some HP systems. Refer to your local HP sales representative for more information.
- HP 7911/12/14R — The rackmount versions of disc drives are sold as component products and are incomplete in nature. These products have not been tested to comply with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules which are designed to provide reasonable protection against such interference when operated in a commercial environment. When installed in a complete computing device product, these units require testing to the Class A limits.

Safety

- HP 7911/12/14 P/R — CSA certified to CSA 22.2 No. 154
- HP 7911/12/14 P/R — Meet all applicable safety standards of IEC 380 and IEC 435
- HP 7911/12/14 P — UL listed to UL 114 and UL 478
- HP 7911/12/14 R — UL recognized to UL 114 and UL 478

Physical characteristics

Dimensions

	HP 7911/12/14R	HP 7911/12/14P
Height:	310 mm (12.2 in.)	720 mm (28.3 in.)
Front Panel Width:	482 mm (19.9 in.)	N/A
Width (between mounting holes):	464 mm (18.3 in.)	354 mm (14.0 in.)
Depth (behind front panel):	696 mm (27.4 in.)	711 mm (28.0 in.)
Depth (overall):	744 mm (29.3 in.)	N/A

Weight

	HP 7911/12/14R	HP 7911/12/14P
Net:	67.2 kg (148 lb)	85.4 kg (188 lb)
Shipping:	89.9 kg (198 lb)	117.1 kg (258 lb)

Environmental requirements

Note: Before installing the HP 7911, 7912 or 7914, refer to the *Site Environmental Requirements Manual*, part no. 5955-3456, available from your local Hewlett-Packard Sales and Support Office.

Power requirements

Voltage Range*	Current 47.5 - 55 Hz	Current 57 - 66 Hz
100 volts	8.8 Amps	8.0 Amps
120 volts	7.4 Amps	7.0 Amps
220 volts	4.0 Amps	—
240 volts	3.7 Amps	—

Power ~ 700 Watts
* All voltages +5%, -10%

System configurations*

- Total cable length is limited to 1 m per equivalent HP-IB load.
- Each HP 7911, 7912 and 7914 places one equivalent load on each of the HP-IB lines.
- In addition to the external HP-IB cable provided, each HP 7911, 7912 and 7914 has an internal 1-metre HP-IB cable that must be considered when configuring the drive with a system.

**Consult the appropriate system configuration guide for specific configuration.*

Ordering information

HP 7911/7912P: 28.1/65.6-megabyte disc drive, integral cartridge tape drive, 67-megabyte tape cartridge, controller, power supply, stand-alone cabinet, and 1-metre HP-IB cable.

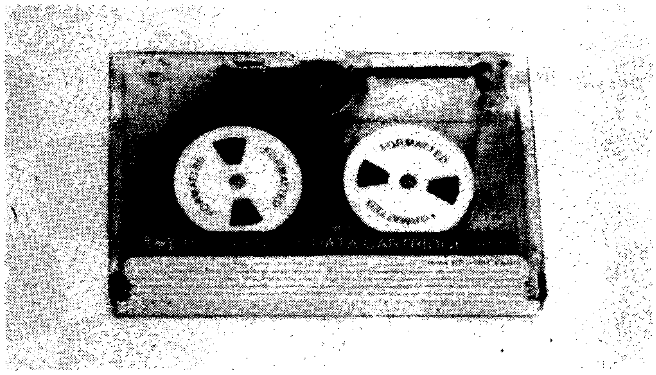
HP 7914P: 132.1-megabyte disc drive, integral cartridge tape drive, two 67-megabyte tape cartridges, controller, power supply, stand-alone cabinet, and 1-metre HP-IB cable.

HP 7911/7912R: Same as 7911/7912P except rackmount enclosure replaces stand-alone cabinet and 2-metre HP-IB cable is included.

HP 7914R: Same as 7914P except rackmount enclosure replaces stand-alone cabinet and 2-metre HP-IB cable is included.

Available options:

015 — 220V/50 Hz operation
140 — Delete cartridge tape drive
001 — Dedicated tape controller (for HP 3000 systems) includes extra 1 m HP-IB cable
D01 — Disc media retention (for security-conscious customers who cannot exchange disc mechanisms)



Accessories supplied

Operator instructions: 07912-90901
Operating and Installation Manual: 07912-90902
Site Environmental Requirements Manual: 5955-3456
Tape Head Cleaner Solution (1 fl oz container)
Lint-free Swabs (box of 10)
7911/12 — one 67.0-Mb 600-ft tape cartridge
7914 — two 67.0-Mb 600-ft tape cartridges

Accessories available through an HP supply organization

Table: 92170G
Service Manual: 07912-90903
Tape Cartridges:
  16.7 Mb, 150 ft (package of 5): 88140S/SC*
  67.0 Mb, 600 ft (package of 5): 88140L/LC*
Tape Head Cleaner (4 fl oz container): 8500-1251
Lint-free Swabs (box of 50): 9300-0767

*"C" *denotes factory certified tapes.*

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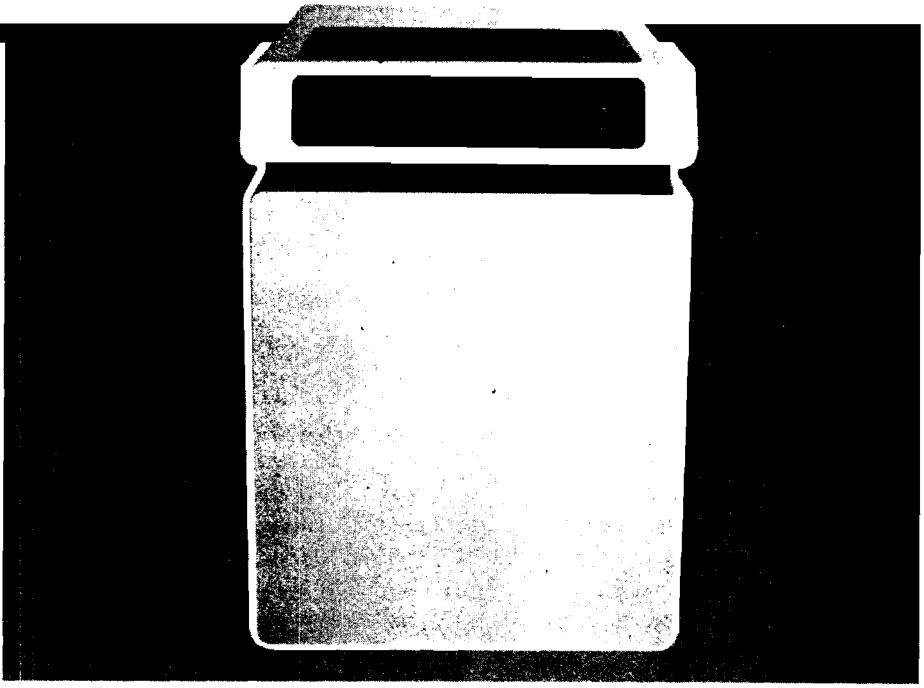
Printed in U.S.A. 2/84
5953-3651

HP 793X Family Disc Drives



The HP 7933/7935 family of 404 Mbyte disc drives provides a high level of performance, reliability, and serviceability. The performance of these drives promotes overall greater system efficiency. The advanced reliability and serviceability are reflected in the exceptionally low maintenance costs of these products.

The HP 7933XP and HP 7935XP Disc Drives are enhanced versions of the disc family, offering extra performance on supported systems* through implementation of cache in the disc drive's controller. Since active data is kept in the controller cache, it can be retrieved directly from the cache rather than requiring a disc access. The reduced number of physical I/O's results in both faster effective access times and improved reliability of the disc drive.

The HP 7935H and HP 7935XP are high-capacity, high-performance removable media disc drives (the 7933 versions are fixed media drives). The 404 Mbyte removable media module can be used for private volume configurations and disc-to-disc backup/restore operations, providing increased system flexibility and greater system uptime.

*See your HP sales representative for supported configurations.

Features

- 404 Mbytes of formatted storage
- 1.0 Mbyte/second transfer rate
- Front panel diagnostic access and readout
- Integral microprocessor controller
- Automatic head alignment
- Sector and track sparing
- Automatic error correction
- HP-IB compatible
- 1.0 Mbyte cache ("XP" models)

Description

Performance

The 404 Mbyte family of disc drives contributes significantly to the overall high performance of HP systems. Through implementation of controller cache, the enhanced "XP"versions of the family offer significant performance improvements over the "H" versions. Each drive also has its own integrated controller, allowing for sector and track sparing and automatic error detection and correction.

Reliability

Major contributions to reliability result from an automatic head alignment capability which reduces maintenance requirements and a real-time error correction process which ensures high data integrity. The "XP" drives provide even higher reliability by reducing the number of mechanical movements of the disc drive. The 7935 versions come with an enclosed, removable media module which provides a protected environment for prolonged off-line data storage.

Serviceability

System uptime is increased through ease of service. The foam-molded cabinetry allows quick access to all replaceable assemblies without the need for special tools. In the 7935 versions, the enclosed media module is removable to provide easy access for data back-up and private volumes. Other major contributions are the keypad and alphanumeric display on the front panel, providing a human interface to diagnostics. These diagnostics monitor drive operations and troubleshoot problems to the assembly level.

Technical Data

Operating specifications

The following chart gives a raw comparison of the "XP" and "H" versions of the drive. Please read the footnotes carefully. Consult with your HP Systems Engineer to understand the impact of the "XP" on your system's performance.

	"XP"	"H"
Average controller overhead time:	4.5 ms	3.5 ms
Average seek time:	24.0 ms	24.0 ms
Average rotational delay:	11.1 ms	11.1 ms
Average time to transfer 1 kbyte:	1.0 ms	1.0 ms
Controller cache impact:	- 16.6 ms*	0.0 ms*
Total average transaction time (excluding system overhead):	24.0 ms	39.6 ms
Disc performance index:	41.7**	25.3**

*The reduction in time is due to the reduced number of seeks required for a drive with controller cache. The actual performance improvement on a drive will vary, depending on the read hit rate and the read percentage; the listed values are based on a read hit rate of 70 percent and a read percentage of 70 percent.

**Average disc transactions per second. Refers to fundamental disc performance; actual I/O rates are application dependent and must take into account system overhead, the system configuration, and the locality of data on the disc. The read hit rate and the read percentage will also have a significant impact on performance of the "XP" drives.

Operating characteristics

Data capacity (formatted)

Item	Data Bits Per	Data Bytes Per	Sectors Per	Tracks Per
Sector	2048	256		
Track	[illegible]	23,552	92	
Surface	[illegible]	31,112,192	121,532	1,321
[illegible]	[illegible]	404,458,496	1,579,916	17,173

Overall characteristics

Heat Dissipation

1300 Watts (4437 Btu/hr) maximum

Electromagnetic emissions

Radiated and conducted interference:

- For U.S.A., designed to meet FCC Docket 20780 for Class A computing devices.
- For Europe, designed to meet VDE 0871 for Level A computing devices. FTZ licensed on some systems. Refer to your local sales representative for more information.

Magnetic operating: < 10 gauss at any surface

Magnetic nonoperating: < 2 milligauss at 2 m (7 ft) on all surfaces

Safety

The HP 793X disc drives meet all applicable safety standards of the following:

- IEC 380 and 435
- UL 114 and 478
- CSA no. 154

System configurations*

- Total cable length is limited to one metre per equivalent HP-IB load.
- One disc drive places one equivalent load on each of the HP-IB lines.

*Consult the appropriate system configuration guide for specific constraints in conjunction with the host CPU.

Power requirements

AC Voltage (± 10%): 120, 208,220, 240
Frequency: 47.5 to 63 Hz
Phase: Single
Power: 1300 Watts maximum
Current: 7.6A maximum at 208V

Physical characteristics

Dimensions

Height : 82.5 cm (32.5 in.)
Width: 55.2 cm (21.7 in.)
Depth: 83.4 cm (32.8 in.)

Weight

Net: 154 kg (340 lb)
Shipping: 192 kg (423 lb)

Environmental requirements

Note: Before installing a disc drive, refer to the Site Environmental Requirements Manual, Part No. 5955-3456, available from your local Hewlett-Packard Sales Office.

Ordering information

All disc drives include a 404-megabyte disc drive with a fixed or removable media module, integral controller, power supply, stand-alone cabinet, and 1-metre HP-IB cable.

Standard 208-volt operation.

Note: All power cords are hard-wired.

Available options

120 — For 120-volt operation
210 — For 208-volt operation in Canada
220 — For 220-volt operation Canada
221 — For 220-volt operation in Continental Europe
222 — For 220-volt operation in Switzerland
223 — For 220-volt operation in Denmark
241 — For 240-volt operation in United Kingdom
242 — For 240-volt operation in Australia and New Zealand

HP 97930XP upgrade kit

Decreasing the average effective access time of 7933H and 7935H disc drives on supported systems* is easy. This can be accomplished in the field in less than one hour by installing the 97930XP Upgrade Kit. The price of the kit includes installation by a Hewlett-Packard Customer Engineer.

The 97930XP Upgrade Kit includes a replacement DMA PCA, a cache PCA, MR6 firmware IC's, a replacement card cage cover, and a 97930XP Upgrade Kit Installation Manual (07930-90911).

Accessories supplied with each drive

Operator Instructions Manual: 07930-90901 or 07935-90901
Operating and Installation Manual: 07930-90902 or 07935-90902
Site Environmental Requirements Manual: 5955-3456

Accessories available through the HP supply organization

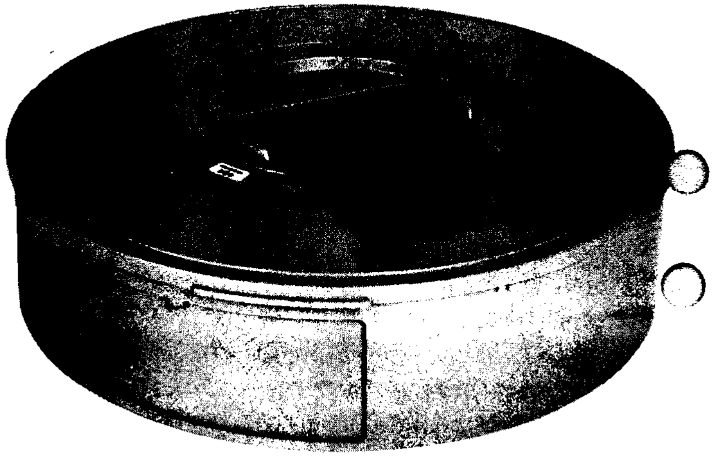
Media Module: 97935A (for 7935's only)
Service Manual: 07930-90903

For information concerning alternate HP-IB cable lengths, contact your nearest HP Sales Office.

**See your HP sales representative for supported configurations.*

HP 97935A Media Module

The HP 97935A Media module is a fully formatted and removable seven-platter disc pack which is designed for exclusive use on the HP 7935 404-megabyte disc drive. The enclosed design protects the media from contamination while being handled or stored. Data interchangeability, disc-to-disc back-up, archival storage, and use of private volumes are all possible with this uniquely designed compact module.



Media statement

Any damage sustained to the heads, spindle, or media, or any consequential damage resulting from the use of non-HP media or CLEANED media is excluded from warranty or service contract coverage, but will be repaired subject to HP's then current standard time and material charges. Use of non-HP media or CLEANED media, however, does not affect warranty or service contract coverage on other components of the drive not associated with the head-media-spindle interface.

Features

- 404 megabytes of formatted storage
- Removable and interchangeable
- Fully enclosed design
- Pre-recorded head alignment tracks
- Spare sectors and tracks
- Optional maintenance contract

Media module physical characteristics

Dimensions

Height: 110 mm (4.33 in.)
Diameter: 388 mm (15.28 in.)

Weight

Net: 5.4 kg (12.0 lb)
Shipping: 9.1 kg (20.0 lb)

Available spares

Tracks: 50 per module
Sectors: 16,000 per module

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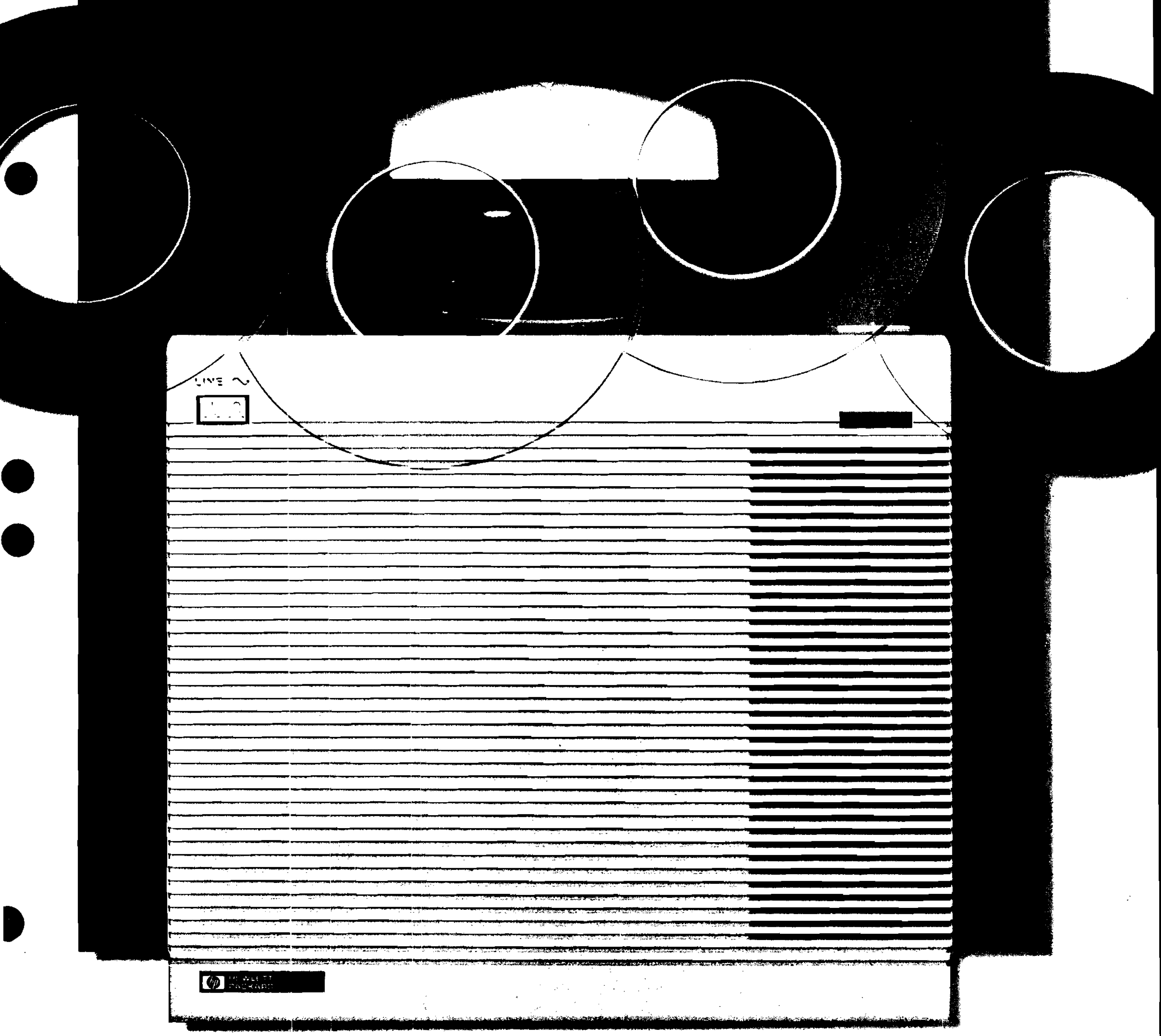
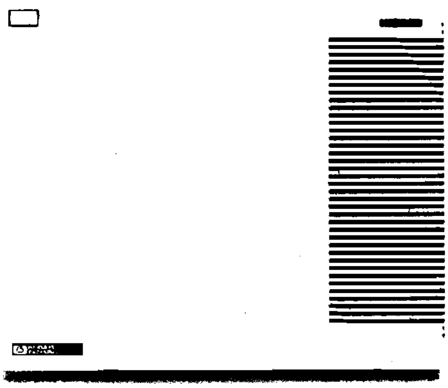
For assistance call the HP regional office nearest you: Eastern 301/258-2000, Midwest 312/255-9800, Southern 404/955-1500, Western 818/506-3700, Canadian 416/678-9430. Or write to: Hewlett-Packard, 1820 Embarcadero Road, Palo Alto, California 94303; in Europe: Hewlett-Packard S.A., 7, Rue du Bois-du-Lan, P.O. Box CH-1217 MEYRIN 2, Geneva, Switzerland; elsewhere in the world: Hewlett-Packard Intercontinental, 3495 Deer Creek Road, Palo Alto, California 94304.

Printed in U.S.A. 3/86
5953-3671

HP 7936 and HP 7937

Thin Film Technology Disc Drives





1.

Compact size coupled with high density data format make the HP 7936 and the HP 7937 Disc Drives ideal data storage for a wide range of multi-user computer systems. The HP 7936 and HP 7937 are easily matched to HP 3000, HP 1000, and the HP 9000 computers. High data density storage is provided by state-of-the-art thin film magnetic media. Seven eight-inch platters in the HP 7937 provide 571 megabytes of formatted data storage, while four platters provide 307 megabytes in the HP 7936. These data capacities provide the lowest per-megabyte storage cost in the HP line-up of disc drives.

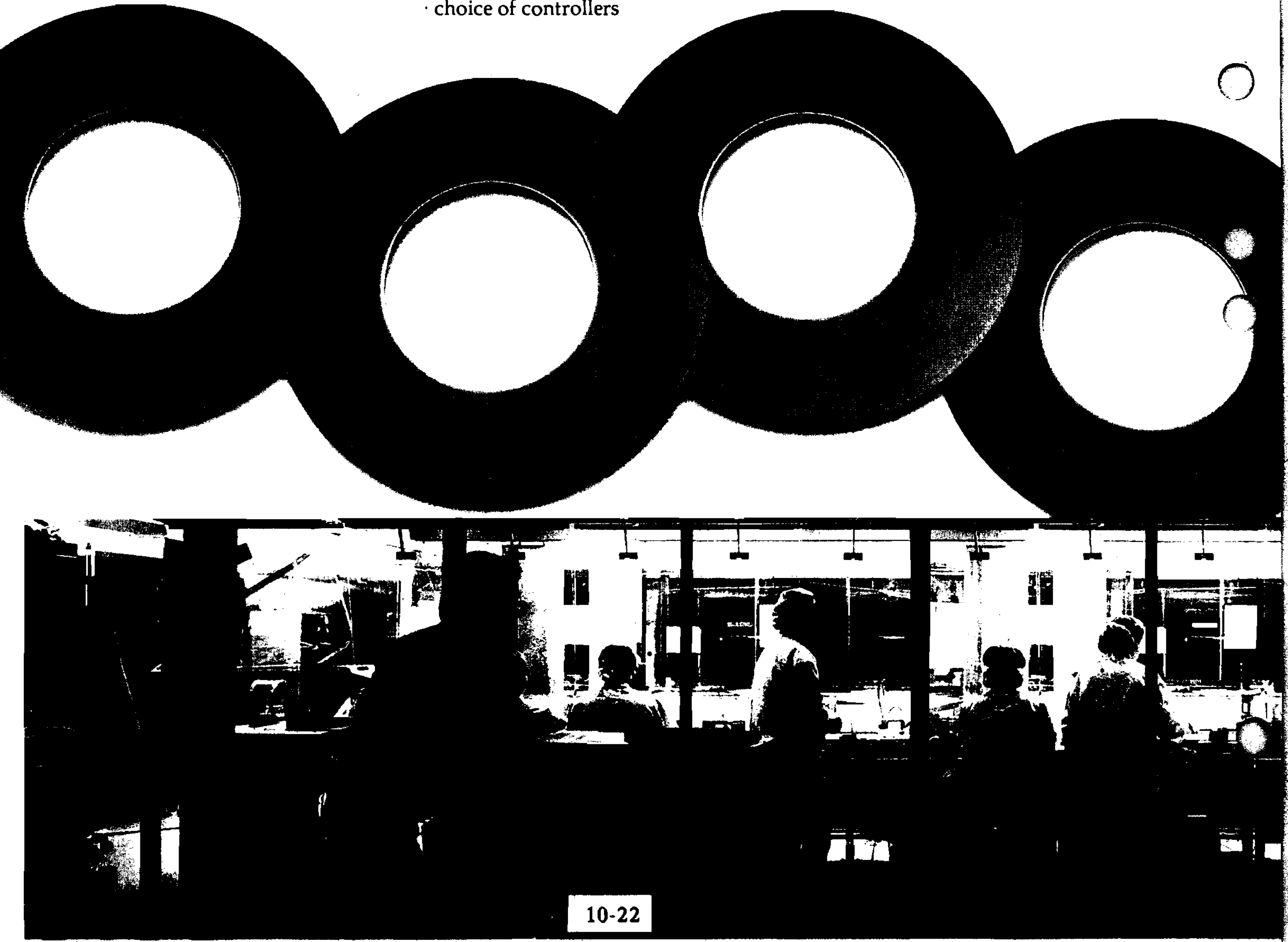
Features:

- 571 megabytes (formatted); HP 7937
- 307 megabytes (formatted); HP 7936
- 2.35 megabytes/second internal burst data transfer rate
- 20.5 ms average seek time
- high reliability
- compact size
- low power consumption
- wide environmental tolerance
- choice of controllers

Compact Size

The physical size of the HP 7936 and HP 7937 disc drives allows two drives to be vertically stacked in a cabinet. This optimizes floor space utilization, allowing the addition of more equipment to the data center. The modular design offers increased flexibility in rack mount and cabinet configuration.

Since power consumption is low, the installation of multiple units has minimal impact on data center air conditioning requirements. Low power consumption and a wide tolerance for ambient conditions make the disc drives suitable for installation in a variety of environments, including the factory floor, the data center, and the typical business environment.



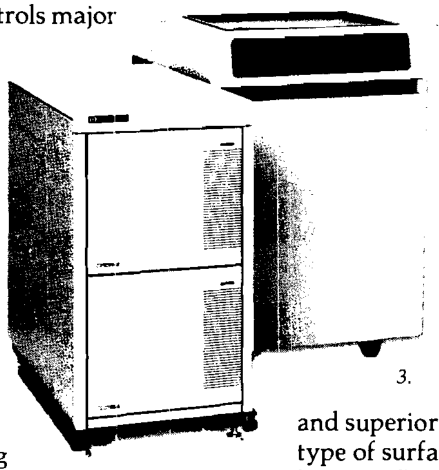
Performance

A sophisticated dual servo system in each drive provides fast head positioning with the precise accuracy required by high track densities. One servo system controls major arm movement across the disc surface while the second positions the head precisely on track center. This type of mechanical control system not only provides a high degree of data integrity, but also improves reliability by making the drive less susceptible to the effects of environmental stress.

To take full advantage of the high bit density available through the use of thin film storage media, VLFM (variable length frequency modulation) coding is used. Precise mechanical control and high bit densities allow the HP 7936 and HP 7937 to seek at an average access time of 20.5 ms, and transfer data at burst rates of up to 2.35 megabytes per second while maintaining complete data integrity.

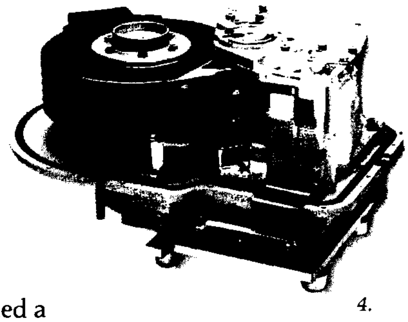
Thin Film Media

Sputtered thin film media from Hewlett-Packard was first introduced in 1984 in the 10 megabyte 97501 "Nighthawk" disc drive. This introduction was followed in 1985 with a 20 megabyte version. Over 40,000 of these drives are in use and have proven superior reliability and ruggedness.


3.

The HP 7936 and HP 7937 have been expertly developed using these prior product successes as their foundation.

Tightly controlled semi-conductor sputtering technology is used to manufacture the thin film media used in the HP 7936 and HP 7937. This manufacturing method provides an extremely smooth surface and superior magnetic qualities. This type of surface allows the read/write heads to fly extremely low. High track density is achieved with a smaller head size and precise head position control. The overall result is high capacity with increased performance and low cost.


4.

To produce the thin film media used in the HP 7936 and HP 7937, Hewlett-Packard custom designed a computer controlled sputter deposition system. The system, the largest ever employed by Hewlett-Packard, maintains the discs in a precisely controlled, high vacuum environment throughout the thin film process. The high level of cleanliness and process control achieved during this process ensures that each disc provides the highest in data integrity, and operates reliably for the life of the unit.

Controllers

Each disc drive includes a controller that best fits system requirements. HP-IB forms the foundation for current controllers. Utilizing the intelligent protocols of the CS/80 instruction set and standard cabling, these controllers meet the demands of most system applications.

The cache controller contains two megabytes of RAM for read cache, plus a single transaction, non-volatile write cache. Read and write cache provide high speed response without the overhead of mechanical movements. Read cache maintains a copy of frequently requested data in RAM to reduce average read access time. Write cache gives an immediate response to the CPU after a write operation, then writes data to the disc during mechanism idle times.

1. Close-up of modular design; 2. Extremely smooth surface of thin-film media; 3. New smaller unit maximizes floor space utilization; 4. Internal view of head assembly; 5. Hewlett-Packard clean production line assures quality and reliability.

2.

5.

Operating specifications

Access time

Average controller overhead time: < 1.0 ms
Average seek time: 20.5 ms
Average rotational delay: 8.33 ms
Average time to transfer 1 kbyte (at 1 megabyte per second over HP-IB): 1.0 ms
Total average transaction time (excluding system overhead): 30.8 ms
Rotation speed: 3600 rpm

Data transfer rate

Instantaneous: 2.35 megabytes per second

Recording density

Bits per inch (maximum): 18.8K
Tracks per inch: 1121

Operating characteristics

Capacity (formatted)

Per sector: 256 bytes
Per track: 31.5 kbytes
Total: 571 megabytes (HP 7937)
307 megabytes (HP 7936)
Sectors per track: 123
Tracks per data surface: 1396
Number of data heads: 13 (HP 7937)
7 (HP 7936)
Number of discs: 7 (HP 7937)
4 (HP 7936)

Reliability

Mean time to repair: 30 minutes
Service life: 10 years

Overall characteristics

Heat dissipation (typical): 320 watts (1092 Btu/hr)

Electromagnetic emissions

Radiated and conducted interference:

- HP 7936 and HP 7937 — For U.S.A., designed to meet FCC docket 20780 for Class A computing peripheral devices.
- HP 7936 and HP 7937 — For Europe, designed to meet EMI level FTZ 1046/84 and provide a Manufacturer's Declaration. Refer to your local Hewlett-Packard sales representative for more information.

Safety

The HP 7936 and HP 7937 disc drives meet all applicable safety standards of the following:

- IEC 380 and 435
- UL 114 and 478
- CSA C22.2 No. 154 and 143

Power requirements

Voltage range*

	Current	
	48 Hz - 52 Hz	58 Hz - 62 Hz
100V	4.4A	4.0A
120V	3.7A	3.5A
200V	2.1A	2.1A
208V	2.1A	2.1A
220V	2.0A	2.0A
240V	1.9A	2.0A

* All voltages ±10%

Physical characteristics

Dimensions

Height: 272 mm (10.69 inches)
Width: 324.2 mm (12.76 inches)
Depth: 741 mm (29.16 inches)
Weight: 56.7 kg (125 lb)

Environmental requirements

Refer to *Site Environmental Requirements for Disc/Tape Drives Manual*, HP part no. 5955-3456, for more environmental requirements.

Ordering information

Disc drive products

HP 7937H - 571 megabyte fixed disc drive with HP-IB controller
HP 7937XP - 571 megabyte fixed disc drive with HP-IB controller cache
HP 7936H - 307 megabyte fixed disc drive with HP-IB controller
HP 7936XP - 307 megabyte fixed disc drive with HP-IB controller cache
(Cabinets must be ordered separately from disc drives.)

Available options

015 - 50 Hz operation
017 - 200, 208, 220, 240 VAC operation
Std - 60 Hz, 100-120 VAC operation

Cabinets/Accessories

HP 19511A - Two-drive cabinet for HP 7936/37 disc drives. Includes rack slides and filler panels.
Available options:
208 - Convenience receptacle/power tap for 60 Hz, 208V operation.
HP 19512A - Adapter kit for mounting HP 7936/37 disc drives in 19-inch EIA cabinet.

Upgrade kits

HP 97520XP - Controller cache field upgrade kit for HP 7936 and HP 7937 disc drives.

For assistance call the HP regional office nearest you: (Eastern) Hewlett-Packard, 4 Choke Cherry Road, Rockville, MD 20850, 301/258-2000; (Midwest) Hewlett-Packard, 5201 Tollview Drive, Rolling Meadows, IL, 60008, 312/255-9800; (Western) Hewlett-Packard, 5161 Lankershim Boulevard, North Hollywood, CA, 91601, 818/505-5600; (Southern) Hewlett-Packard, 2000 South Park Place, Atlanta, GA, 30339, 404/955-1500; (Canada) Hewlett-Packard Canada Ltd., 6877 Goreway Drive, Mississauga, Ontario, L4V 1M8, 416/678-9430; (Europe) Hewlett-Packard S.A., 150 Route du Nant-d'Avril, P.O.Box CH-1217 MEYRIN 2, Geneva, Switzerland, 011/41 22 838-111; (Japan), Yokogawa-Hewlett-Packard Ltd., 29-21 Takaido-Higashi 3-chome, Suginami-ku, Tokyo, 168, 03/331-6111; (Far East) Hewlett-Packard Asia Headquarters, 47F China Resources Building, 26 Harbour Road, Wanchai, Hong Kong, 5/833-0833; elsewhere in the world: Hewlett-Packard Intercontinental, 3495 Deer Creek Road, Palo Alto, CA, 94304, U.S.A. 415/857-1501.

Hewlett-Packard, in a continuing effort to offer excellent products at a fair value, reserves the right to change specifications, designs, and models without notice.

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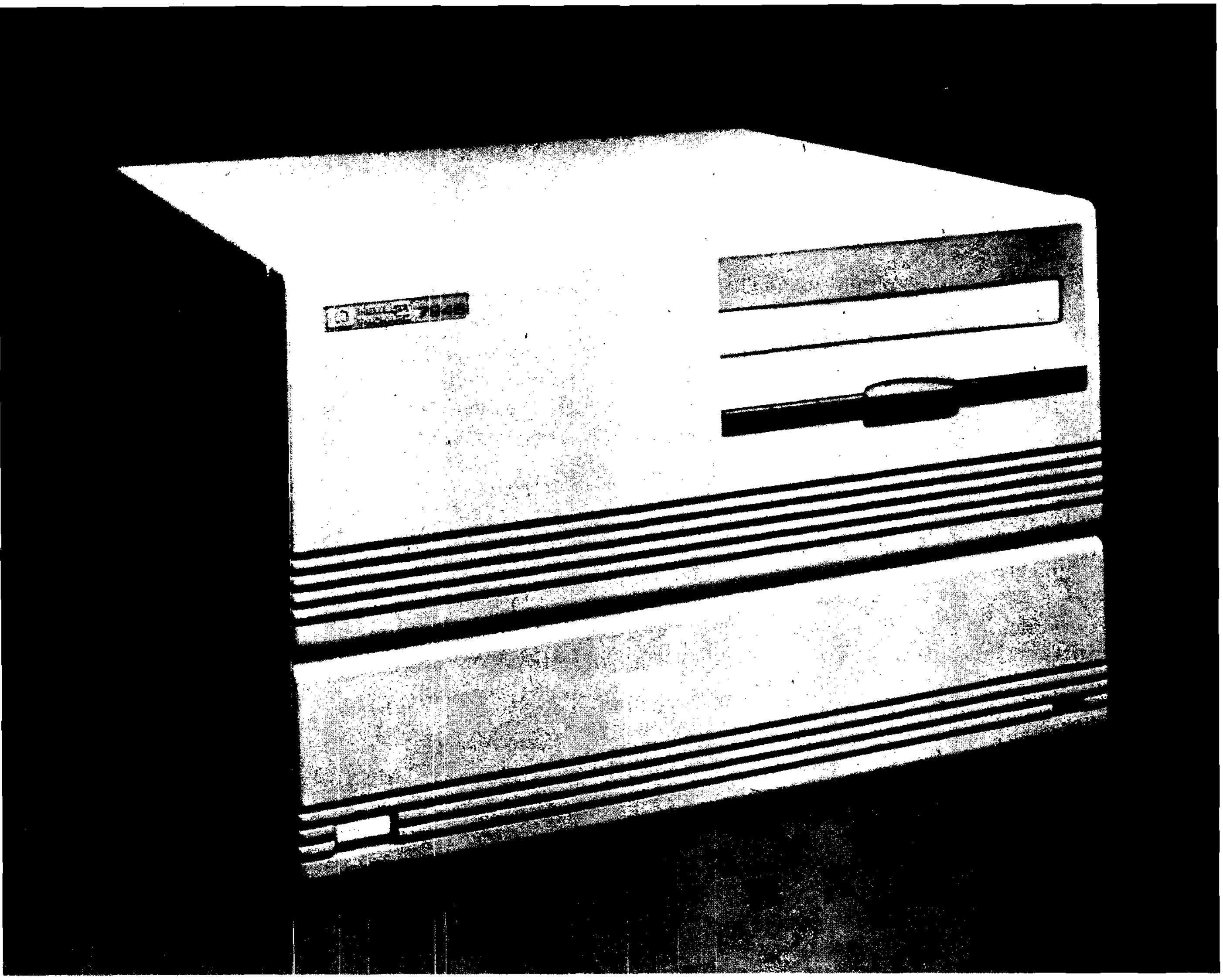
Printed in U.S.A. 12/86
5953-3675

HEWLETT PACKARD

HP 7942A and HP 7946A Disc/Tape Drives

TECHNICAL DATA DECEMBER 1984



The HP 7942A and HP 7946A are complete peripheral storage products designed to meet the capacity and performance needs of entry-level multi-user systems. They combine a high-performance 5¼-inch disc drive for mass storage with a cartridge tape drive that provides a cost-effective method of back-up, software distribution, and data interchange between systems. Each product also includes a microprocessor-based controller that manages both disc and tape drives and ensures the accuracy of all recorded data. All these features are packaged in a compact, desktop unit.

Computer Museum

Features

Disc drive

- 24 megabytes (formatted) — HP 7942A
- 55 megabytes (formatted) — HP 7946A
- Rugged, sealed head-media design
- 5¼-inch plated media
- 30 ms average seek time

Tape drive

- Low-cost, easy-to-handle, ¼-inch cartridge tape media
- Tape cartridges available in 67-megabyte and 16-megabyte capacities
- Transfer rates of up to two megabytes per minute (host dependent)
- Read-after-write capability provides immediate error detection during write operations
- Full compatibility with existing HP cartridge tape drives ensures data interchange

Integral microprocessor-based controller

- Automatic error correction
- Extensive internal diagnostic capabilities
- Off-line disc-to-tape and tape-to-disc data transfer
- Automatic data error logging
- Real-time error correction
- CS/80 instruction set for communication with host systems
- HP-IB compatible*

Description

The HP 7942A and HP 7946A are peripheral storage systems combining either a 24- or 55-megabyte fixed disc drive, cartridge tape drive, intelligent controller, and power supply in a compact desktop cabinet. Both products are fully configured and ready to operate after being simply "plugged in" to an AC power source and the HP-IB channel of any supporting system.

Although compact in size, each product is designed to meet the capacity and performance needs of entry-level multi-user systems, and to deliver the ruggedness, quality, and reliability typical of HP products.

Each product contains a fixed disc drive mechanism utilizing 5¼-inch plated disc media for high data storage densities. The disc mechanism also features a sophisticated "closed-loop" servo system and rotary actuator, providing fast data storage and retrieval. The result of these features is a medium capacity, high performance disc mechanism in a compact space.

The cartridge tape drive included in each product uses a convenient DC600-type, preformatted data cartridge. Tape drive features include read-after-write, automatic error correction, and a built-in media monitor, which indicates a tape cartridge is nearing the end of its useful life — features which ensure the protection of valuable user data. Increased reliability of both the tape media and the drive motor is achieved through the use of an electromechanical servo control that gently accelerates and decelerates the motor when moving the tape.

The controller in each product is designed to complement the performance of both the disc and tape, and to ensure accuracy of data storage and retrieval. The controller communicates with a host system through an HP-IB interface using HP's efficient CS/80 Instruction Set. This interface and instruction set permits additional storage devices to be installed quickly, offering an easy upgrade path for users with growing mass storage requirements.

Product serviceability is enhanced by extensive self-test capabilities resident in the controller. Troubleshooting of intermittent failures is also facilitated by an error logging capability, which allows trained service personnel to detect failure patterns over time.

Operating specifications∮

Disc performance

Average controller overhead time: 10 ms

Average seek time: 30 ms

Average rotational delay: 8 ms

Average time to transfer 1 kbyte (at 625 kb/s): 2 ms

Total average transaction time (excluding system overhead): 50 ms

Disc performance index: 20†

†Maximum disc transactions per second, for 1 kbyte transfers, less system overhead. The index refers to fundamental disc performance; true I/O rates are application-dependent and must take into account system overhead, including the individual system configuration specifications.

I/O comparison:

HP 9134XV	HP 7908	HP 7942 and HP 7946	HP 7912
9	16	20	25

Tape performance

Tape speed:

Read/Write: 60 IPS

Search/Rewind: 90 IPS

Maximum sustained transfer rate: 34 kb/s‡

‡Maximum sustained transfer rate does not necessarily reflect system throughput, which varies depending upon application, file structures, and driver implementations.

Operating characteristics

Disc drive formatted capacity

Item	Data Bits Per	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Byte	8				
Sector	2,048	256			
Track	65,536	8,129	32		
Head	63,438,848	7,929,856	30,976	968	
7942A	190,316,544	23,789,568	92,928	2,904	3
7946A	444,071,936	55,508,992	216,832	6,776	7

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* HP-IB: Not just IEEE-488, but the hardware, documentation and support that delivers the shortest path to a computation system.

∮ Hewlett-Packard, in a continuing effort to offer excellent products at a fair value, reserves the right to change specifications and models without notice.

Tape drive formatted capacity

Data Capacity	Bits Per	Bytes Per	Words Per	Blocks Per	Tracks Per
Byte	8				
Word	16	2			
Block	8,192	1,024	512		
Track*	8,372,224	1,046,578	523,264	1,022	
Cartridge*	133,955,584	16,744,448	8,372,224	16,352	16
Track**	33,488,896	4,186,112	2,093,056	4,088	
Cartridge**	535,822,336	66,977,792	33,488,896	65,408	16

*150 foot cartridge
**600 foot cartridge

Overall characteristics

Power

Voltage (true RMS):
115V setting: 100V, 115V, 120V, single phase (inclusive tolerance range is 90V to 132V)
230V setting: 220V, 240V, single phase (inclusive tolerance range is 180V to 264V)

Frequency: 47.5 to 66 Hz

Typical current:
115V setting: 1.5A
230V setting: 0.80A

Typical power:
115V setting: 120W
230V setting: 120W

Heat dissipation

120 Watts (410 Btu/hr) typical

Electromagnetic emissions

Radiated and conducted interference:

- For U.S.A., designed to meet FCC Docket 20780 for Class B computing devices.
- For Europe, designed to meet VDE 0871 for Level B computing devices. FTZ licensed on some HP systems. Refer to your local sales representative for more information.

Safety

Meets all applicable safety standards of the following:

- IEC 380 and 435
- UL 114 and 478
- CSA C22.2 no. 154

Physical characteristics

Dimensions

Height: 208 mm (8.2 in.)
Width: 325 mm (12.8 in.)
Depth: 285 mm (11.2 in.)

Weight

Net: 15.8 kg (34.8 lb)
Shipping: 19.6 kg (43.3 lb)

Environmental requirements

Note: Before installing the disc drive, refer to the *Site Environmental Requirements Manual*, part no. 5955-3456, supplied with the disc/tape drive.

System configurations*

- Total cable length is limited to one metre per equivalent HP-IB load.
- One HP 7942A or HP 7946A places one equivalent load on each of the HP-IB lines.
- For information concerning the use of HP-IB cable lengths other than the standard 1-metre cable, contact your nearest HP Sales Office.

Ordering information

HP 7942A or HP 7946A

Includes a 24- or 55-megabyte disc drive, cartridge tape drive, integral controller, power supply, stand-alone cabinet, power cable, and 1-metre HP-IB cable.

Available options

015 — For non-U.S. shipments. Voltage Selector switch set for 230V operation

550 — Delete 1-metre HP-IB cable

Accessories supplied with each disc/tape drive

Owner's Manual: 07942-90901

Site Environmental Requirements Manual: 5955-3456

67-megabyte tape cartridge (formatted and certified)

Tape head cleaner: 8500-1251

Cleaning swabs: 9300-0767

Two fuses (5-ampere, 250V, no time delay): 2110-0010

Accessories available through an HP supply organization

Service Manual: 07942-90903

CS/80 Instruction Set Programming Manual: 5955-3442

CS/80 External Exerciser Reference Manual: 5955-3462

92211A Cabinet — a desk-height stand-alone cabinet for the disc drive and other desktop stackable peripherals.

19501A Rack Mount — provides for mounting the disc/tape drive in a standard 19-inch EIA equipment rack.

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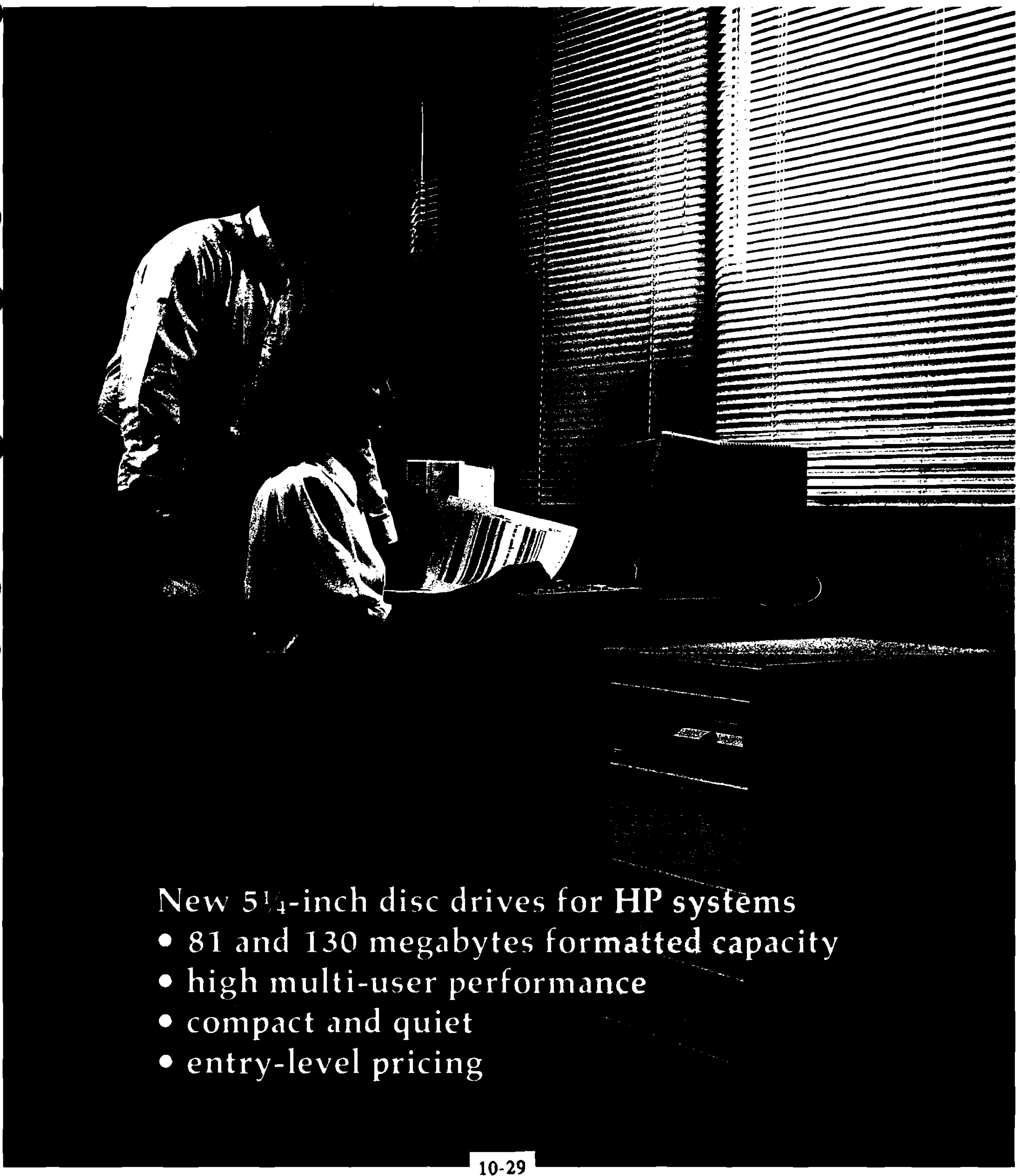
*Consult the appropriate system configuration guide for specific constraints in conjunction with the host CPU.

For assistance call the HP regional office nearest you: Eastern 301/258-2000, Midwest 312/255-9800, Southern 404/955-1500, Western 801/506-3700, Canadian 800/387-3867. Or write to: Hewlett-Packard, 1820 Embarcadero Road, Palo Alto, California 94303; in Europe: Hewlett-Packard S.A., 7 rue du Bois-du-Lan, P.O. Box 364, 1217 MEYRIN 1, Geneva, Switzerland; elsewhere in the world: Hewlett-Packard Intercontinental, 3495 Deer Creek Road, Palo Alto, California 94304.

Printed in U.S.A. 12/84
5953-3659

HEWLETT-PACKARD

HP 7957A and HP 7958A Midrange Disc Drives



New 5¼-inch disc drives for HP systems
- 81 and 130 megabytes formatted capacity
- high multi-user performance
- compact and quiet
- entry-level pricing

Technical Data

November 1986

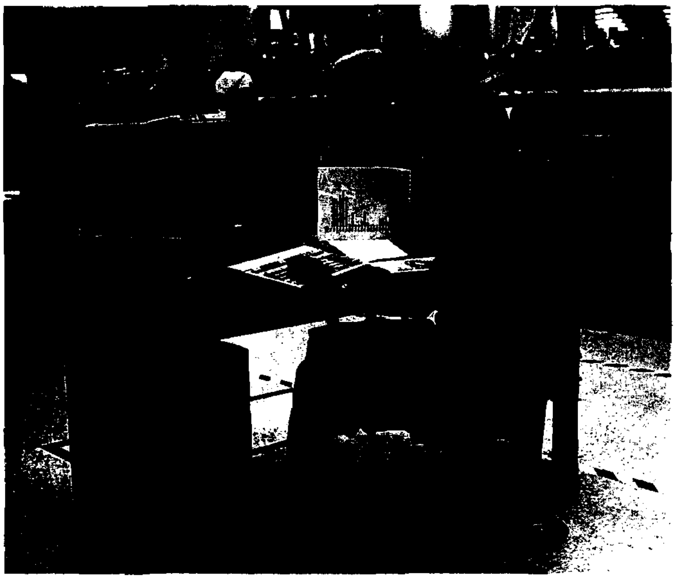
The HP 7957A and 7958A disc drives usher in a new era in Hewlett-Packard mass storage technology . . . now 5¼-inch disc drives offer the high capacity and high performance previously found only in our 14-inch disc products.

High capacity, attractive low price

With 81 megabytes and 130 megabytes of formatted capacity, respectively, the new HP 7957A and 7958A are the highest capacity 5¼-inch disc products offered by Hewlett-Packard. Their attractive entry-level pricing results in a substantial reduction in cost per megabyte over previous HP midrange disc drives.

Performance for multi-user applications

Both the HP 7957A and 7958A provide the performance demanded by today's commercial and technical multi-user systems and engineering workstations. These new products feature a 29 millisecond average seek time and a burst data transfer rate of 1.25 megabytes per second. Combined with a new low-overhead controller that accurately and swiftly processes each transaction, the HP 7957A and 7958A offer performance levels previously found only in more expensive 8-inch and 14-inch disc drives.



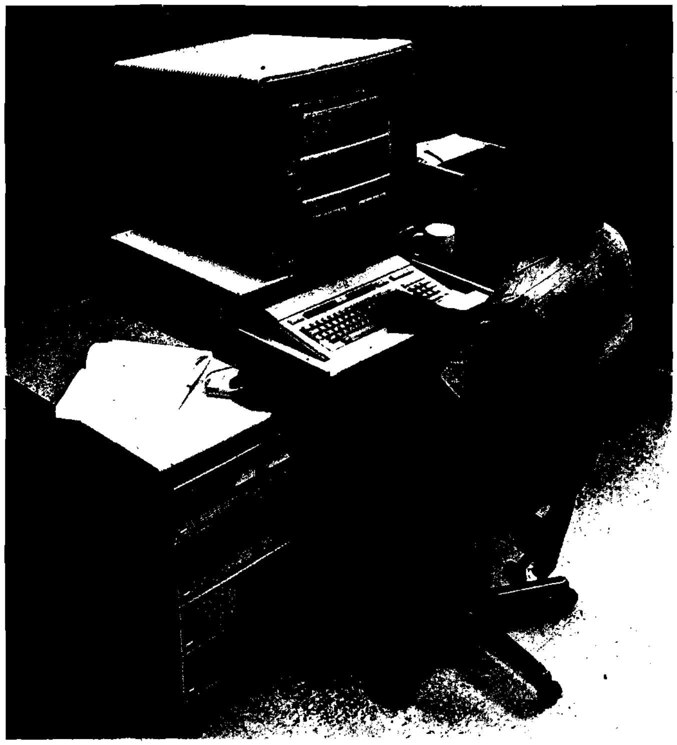
Shown here in a desktop configuration, the HP 7958A has the capacity and performance to complement this HP 1000 A900 real-time computer.

Quiet and compact

The compact packaging of the HP 7957A and 7958A allows them to be tucked away in HP's attractive mini-rack cabinetry, or placed unobtrusively in desktop applications. With a sound power level of 52 dB(A), both drives are barely audible in an office environment.

Reliability and ease of support

The HP 7957A and 7958A boast new, low monthly support costs that are a direct result of continuing improvements in reliability. Should a disc-related problem occur, self-test and error-logging capabilities allow service personnel to quickly troubleshoot failure modes. Repair time is minimized by a package design that allows quick access to the field replaceable assemblies.



The 81 megabyte HP 7957A is an excellent entry-level disc drive for HP 9000 Series 300 workstations running HP-UX.

Features

High capacity/low price
- 81 megabytes — HP 7957A
- 130 megabytes — HP 7958A
- low, entry-level pricing

High performance
- 29 ms average seek time
- 1.25 megabytes/sec burst data transfer rate
- low overhead controller
- 16 kbyte data buffer

Compact packaging
- desktop use
- HP Design Plus cabinets available
- 19-inch rackmount adapter kit

Performance specifications

Seek time

Track-to-track	7 ms
Average	29 ms
Maximum	63 ms

Rotational Speed	3600 rpm

Data transfer rate

Burst	1.25 megabytes/s
Average	853 kbytes/s

Average transaction time

Average controller overhead	3.0 ms
Average seek time	29.0 ms
Average rotational delay	8.3 ms
Average time to transfer 1 kbyte (at 853 kbytes/s)	1.2 ms
Total average transaction time (excludes system overhead)	41.5 ms
Disc performance index (I/O's per second)	24.1*

Disc I/O comparisons

Random seeks, 1 kbyte transfers:

Product	I/O's per second*
7957/7958	24.1
7945/7946	20.0
7914	24.0
7911/7912	24.6
7933/7935	25.7
7936/7937	32.5

**Maximum disc transactions per second, for 1 kbyte transfers, less system overhead. Refers to fundamental disc performance; true I/O rates are application dependent and must take into account system overhead, including the individual system configuration specifications.*

Ideal for office use
- quiet operation
- low power requirements
- office environment specifications

Reliable design
- 5¼-inch thin film media
- extensive factory testing
- automatic error correction
- automatic error logging
- new, low monthly support rates

Compatible design
- CS/80 instruction set
- HP-IB interface

Capacity specifications

Data capacity (formatted) — HP 7957A and HP 7958A

Item	Data Bits Per	Data Bytes Per	Sectors Per	Tracks Per	Heads Per
Byte	8				
Sector	2,048	256			
Track	129,024	16,128	63*		
Head	130,701,312	16,337,664	63,819	1,013*	
HP 7957A	653,506,560	81,688,320	319,095	5,065	5
HP 7958A	1,045,610,496	130,701,312	510,552	8,104	8

**There is one spare sector per track and six spare tracks per head.*

Overall specifications

Heat dissipation

Maximum:	85 Watts (290 Btu/hr, 73 kcals/hr)
Typical:	65 Watts (222 Btu/hr, 56 kcals/hr)

Electromagnetic emissions

- HP 7957A/7958A — For U.S.A., designed to meet FCC docket 20780 for Class B computing peripheral devices. These products comply with the limits for a Class B computing device pursuant to Subpart J of part 15 of the FCC Rules. See instructions if interference to radio reception is suspected.
- HP 7957A/7958A — For Europe, designed to meet EMI level FTZ 1046/84 and provides a Manufacturer's Declaration. Refer to your local sales representative for more information.

Radiated and magnetic interference

Magnetic nonoperating:	< 2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating:	< 5 gauss on all surfaces

Safety

- CSA certified to CSA 22.2 No. 154.
- Meets all applicable safety standards of IEC 380 and IEC 435.
- UL listed to UL 114 and UL 478.

Power requirements

Voltages (true RMS):	
115V setting:	100V, 115V, 120V, single phase (inclusive tolerance range is 90V to 132V)
230V setting:	220V, 240V, single phase (inclusive tolerance range is 180V to 264V)
Frequency:	47.5 - 66 Hz
Typical Current:	
115V setting:	0.80A (true RMS at 115V, 60 Hz)
230V setting:	0.50A (true RMS at 230V, 50 Hz)
Typical Power:	
115V setting:	84 V-A (115V, 60 Hz)
230V setting:	97 V-A (230V, 50 Hz)

Acoustic Emissions

Average sound pressure level (L_{pA}):	41 dB(A)
Sound power level (L_{WA}):	52 dB(A)

Overall characteristics

Physical characteristics

Dimensions	
Height:	132 mm (5.2 in.)
Width:	325 mm (12.8 in.)
Depth:	285 mm (11.2 in.)
Weight	
Net:	10.9 kg (24.0 lb)
Shipping:	14.0 kg (31.0 lb)

System configurations*

- Total cable length is limited to one metre per equivalent HP-IB load.
- One HP 7957A or 7958A places one equivalent load on each of the HP-IB lines.

**Consult the appropriate system configuration guide for specific constraints in conjunction with the host CPU.*

Environmental requirements

Note: Before installing a disc drive, refer to the Site Environmental Requirements Manual, part no. 5955-3456, available at your local Hewlett-Packard Sales Office.

Ordering information

HP 7957A and HP 7958A include:

- a disc drive (81 or 130 megabytes, respectively)
- integral controller and power supply
- stand-alone cabinet
- power cable
- 1-metre HP-IB cable
- 90-day on-site warranty (parts and labor)

Available options

015 — For non-U.S. shipments: Voltage selection switch for 230V operation.

550 — Delete 1-metre HP-IB cable.

Accessories supplied with each drive

Disc Drive Owner's Manual:	07957-90901
Site Environmental Requirements Manual:	5955-3456

Accessories available through an HP supply organization

Service Manual:	07957-90903
CS/80 Instruction Set Programming Manual:	5955-3442
CS/80 External Exerciser Reference Manual:	5955-3462

HP 19500B Rack Mount Kit for mounting in a standard 19-inch EIA cabinet.

HP 92211-Series cabinets.

For assistance call the HP regional office nearest you: (Eastern) Hewlett-Parkard, 4 Choke Cherry Road, Rockville, MD 20850, 301/258-2000; (Midwest) Hewlett-Packard, 5201 Tollview Drive, Rolling Meadows, IL, 60008, 312/255-9800; (Western) Hewlett-Packard, 5161 Lankershim Boulevard, North Hollywood, CA, 91601, 818/505-5600; (Southern) Hewlett-Packard, 2000 South Park Place, Atlanta, GA, 30339, 404/955-1500; (Canada) Hewlett-Packard Canada Ltd., 6877 Goreway Drive, Mississauga, Ontario, L4V 1M8, 416/678-9430; (Europe) Hewlett-Packard S.A., 150 Route du Nant-d'Avril, P.O. Box CH-1217 MEYRIN 2, Geneva, Switzerland, 011/41 22 838-111; (Japan), Yokogawa-Hewlett-Packard Ltd., 29-21 Takaido-Higashi 3-chome, Suginami-ku, Tokyo, 168, 03/331-6111; (Far East) Hewlett-Packard Asia Headquarters, 47F China Resources Building, 26 Harbour Road, Wanchai, Hong Kong, 5/833-0833; elsewhere in the world: Hewlett-Packard Intercontinental, 3495 Deer Creek Road, Palo Alto, CA, 94304, U.S.A. 415/857-1501.

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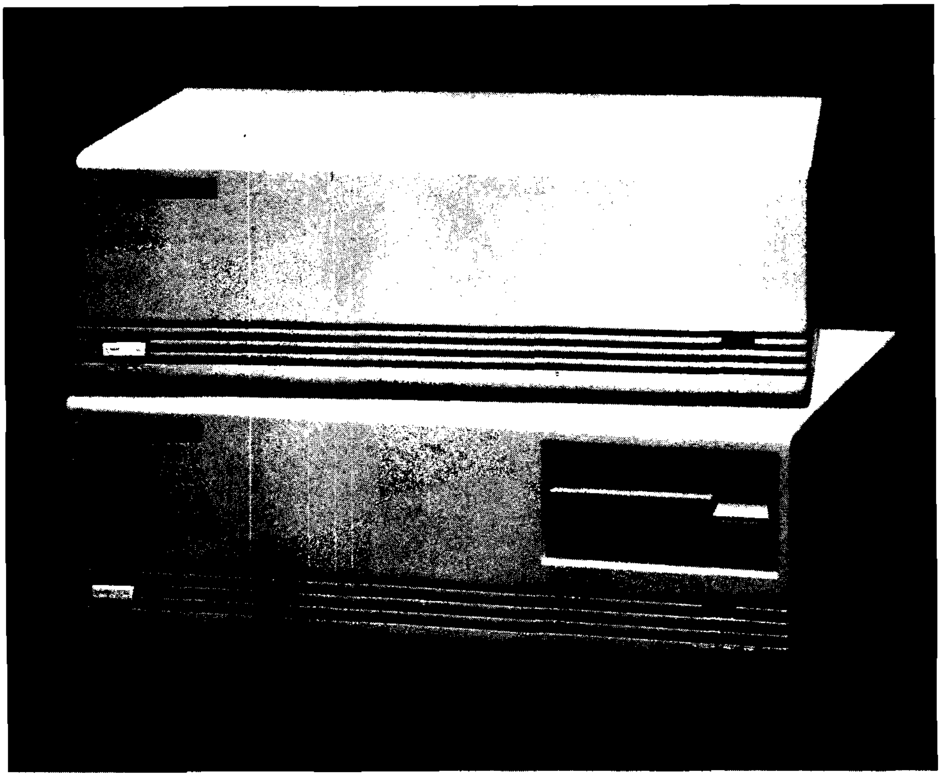
5953-3677

20 Megabyte Hard Discs

Technical Data Nov. '86



Now Hewlett-Packard is offering the office environment the same built-in ruggedness and reliability that is required by our industrial customer.

HP's 9153B and 9154B, our 20 megabyte drives, have been optimized for the single-user environment. They are well-suited for the automated test and measurement market as well as for everyday applications such as word processing, business graphics, and spreadsheets.

FEATURES and BENEFITS

- **Reliability and Ruggedness**
  HP's Rugged Disc Drive has been designed and manufactured with HP-developed technology from top to bottom!

  Now you can transport your disc drive with confidence ... Its shock and vibration capabilities allow you to move it as needed without the extreme caution required with other drives.

- **Work Station Capacity**
  20 Megabyte Capacity allows you to store up to 20,000 typewritten pages of data – the perfect size for the single-user environment.

- **Write Protection**
  Supported on the HP 9000 Series 200 and 300, the new write protect feature allows the user to prevent unauthorized modification of a chosen section of the hard disc.

  Now, you can distribute programs outside your direct span of control, confident that the integrity of those programs is assured.

- **Data Protection**
  HP's Initialize* Protection Feature helps insure your data integrity and prevent data loss. Just flip a switch and be assured that you won't reinitialize (reformat) your hard disc accidently! – Now you can experience the same protection that you're accustomed to with your floppy-based system.

- **Increased Data Throughput**
  HP's Advanced Disc Controller Design utilizes HP's VLSI** technology in conjunction with a full track buffer to maximize your system performance. Our controller automatically adjusts the data rate to the **best** rate your specific application can attain.

- **IBM Compatibility**
  Support for the 9154B is provided by the Touchscreen II as well as the HP Vectra PC and IBM PC/XT/AT. Operation with the HP Vectra PC, IBM, Compaq, AT&T 6300, and Olivetti M-24 computer, requires our 88500A Disc/Tape Interface.

* Initialize = format

** Very large scale integration

Performance Characteristics

■ **CAPACITY HARD DISC**	
Unformatted	28.1MB
Formatted	
256 Bytes/Sector	20MB
Sectors per Track	
256 Bytes/Sector	28
■ **TRANSFER RATE** (mechanism)	4 Mbit/sec[1]
■ **AVERAGE ACCESS TIME** (defined as average seek time + 1/2 rotational time)	75 ms

[1] The transfer rate listed is a disc mechanism transfer rate. The system rate obtained is dependent upon the computer and the application used.
Maximum sustained rate is 150 KB/sec. on writes, 195 KB/sec on reads.

Functional Characteristics

■ **ROTATIONAL SPEED**	3000 rpm
■ **RECORDING TECHNIQUE**	MFM
■ **INTERFACE**	HP-IB
■ **TOTAL TRACKS PER SURFACE** (includes spares and system tracks)	1408
■ **TRACKS PER INCH**	1800
■ **RECORDING SURFACES**	2

Environmental Ranges

■ **TEMPERATURE**[2]	
Operating	10°C to 40°C (0°C to 40°C 9154B)
Non-Operating	-40° to 60°C (9153B & 9154B)
■ **HUMIDITY**	
Operating	5% to 95% (9154B) RH (non-condensing) 20% to 80% (9153B) RH (non-condensing)
29°C max. wetbulb temperature	
Non-Operating (without flexible media)	5% to 95% RH (non-condensing)
■ **ALTITUDE**	
Operating	0 to 4572 m (0 to 15,000 ft)
Non-Operating	-304 to 15,240 m (-1000 ft to 50,000 ft)
■ **SHOCK**[3]	
End Use Handling	50 ips half-sine < 3 ms
Transportation	30 G's trap.; Δ V = 292 in/sec
■**VIBRATION** (3 major axes)	
Operating (Random)	~ 0.30 G rms
Non-Operating (Random)	~ 2.41 G rms
■**ACOUSTIC NOISE**	(0-20 kHz A-weighted scale)
Average sound power (Nominal)	46dB

[2] The HP 9154B (and HP 9153B with no media inserted) have been operated at 50 degree C and ambient humidity (approximately 7%) with no errors or performance degradation.

[3] Shock information is derived from specific tests, designed and administered by HP. These tests apply shock to each of six faces for one occurrence only.

Power Requirements

■ **VOLTAGE** (switch selectable)	
Range	86-127V~ (115V setting) 195-253V~ (230V setting)
■ **FREQUENCY**	
Nominal	60 Hz
Range	48-66 Hz
■ **MAXIMUM POWER CONSUMPTION**	50 W

Physical Characteristics

■ **DIMENSIONS**	
Height	106 mm (4.2 in)
Width	325 mm (12.8 in)
Depth	285 mm (11.2 in)
■ **WEIGHT**	
Net	
9153B	7.7 kg (16.2 lbs)
9154B	6.8 kg (14.9 lbs)
Shipping	
9153B	9.4 kg (20.8 lbs)
9154B	8.9 kg (19.5 lbs)

System Support

HP 9000 Series 200 & 300, Touchscreen II, HP Vectra PC, IBM PC/XT/AT, COMPAQ Portable, AT&T 6300, Olivetti-M24, HP Portable PLUS

Ordering Information

20 Mbyte formatted capacity Winchester with 720 KB 3 1/2" Microfloppy Drive	9153B
20 Mbyte formatted capacity Winchester	9154B
Disc/Tape Interface Card for HP Vectra PC, IBM PC/XT/AT, COMPAQ Portable, AT&T 6300, and Olivetti-M24	88500A

Accessories Supplied

9153B

Operator's manual, power cord, two fuses, one 3 1/2" Microfloppy.

9154B

Operator's manual, power cord, two fuses.

Accessories Available

HP-IB Cables

0.3 meter (Right angle)	92220R
0.5 meter	10833D
1.0 meter	10833A
2.0 meter	10833B

Safety and EMI Compliance

Underwriters Laboratories, Inc.: Recognized component for electronic data processing equipment and office appliance

Canadian Standards Association: Certified as component for use in data processing equipment.

International Electrotechnical Commission: Certified by Hewlett-Packard as component for use in equipment designed to m IEC 380 and IEC 435.

EMI (Electro-Magnetic Interference): Designed for use in equipment that must meet FCC Class B and VDE Level B.

Questions concerning regulatory agency compliance should be directed to the local Hewlett-Packard Sales and Service Office.

Warranty and Service

The Hewlett-Packard data storage peripheral described in this data sheet is warranted against defects in materials and workmanship for a period of one year from date of purchase. For warranty service or repair, return this product with proof of purchase to a Hewlett-Packard Field Repair Center or an authorized dealer. Contact your local Hewlett-Packard sales office for the address of the Hewlett-Packard Repair Center or authorized dealer nearest you. A copy of the complete warranty statement is available upon request.

HP offers complete service and maintenance worldwide. Maintenance agreements are available for all HP data storage products. Advantages of these agreements to the customer include a fixed annual cost, individualized cost-effective contracts, a choice of response time, and the option of either on-site or service center repair. Current U.S. rates can be determined by contacting your local HP Sales Office.

The selection and use of media, supplies and consumables is the customer's responsibility. Hewlett-Packard reserves the right to exclude from this agreement any repairs for damage to HP products which HP reasonably determines or believes was caused by use of non-HP media. Hewlett-Packard will, upon request, repair such damage on a time and material basis.

The information and specifications presented in this data sheet are subject to change without notice.

For assistance call the HP regional office nearest you: Eastern 301/258-2000, Midwest 312/255-9800, Southern 404/955-1500, Western 213/506-3700, Canadian 416/678-9430. Or write to Hewlett-Packard, 700 71st Ave., Greeley, Colorado 80634; in Europe, Hewlett-Packard, S.A., P.O. Box, 150, Route Du Nant D'Avril, CH-1217, MEYRIN 2 (Geneva) Switzerland; elsewhere in the world, Hewlett-Packard Intercontinental, 3495 Deer Creek Road, Palo Alto, California 94304.

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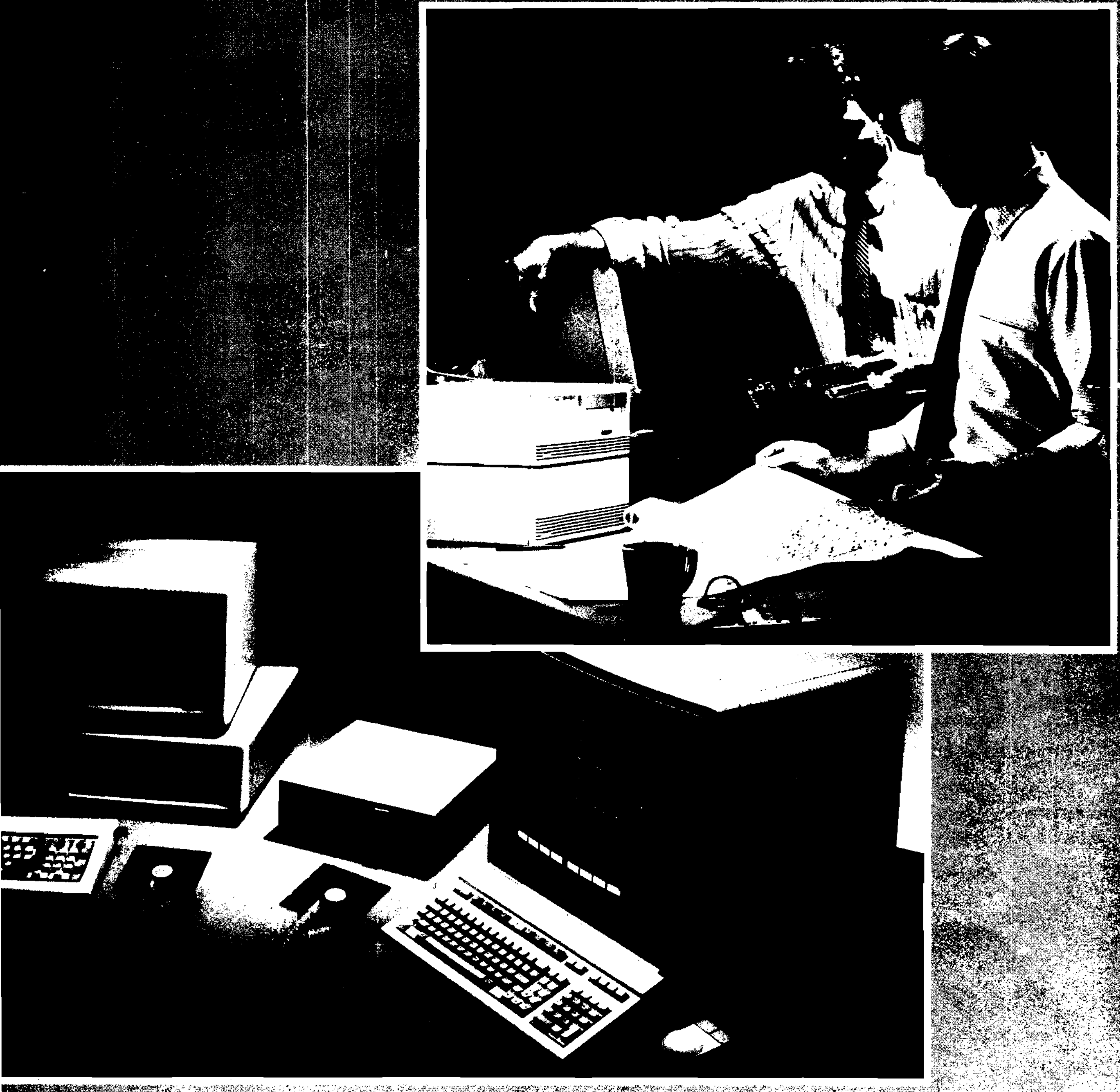
HEWLETT-PACKARD

Data Storage for Personal and Portable Computers

Technical Data



November 1986

Hewlett-Packard offers you a full line of data storage and backup solutions to fit your personal or technical computer needs. Our products include our 10, 20, and 40 Megabyte Winchester hard disc systems as well as a low cost 1/4" tape backup solution. We also offer you 3 1/2" microfloppies and 5 1/4" flexible disc drives.

The following information will guide you in the proper selection of a data storage solution to complete or expand your computing system. Enclosed you'll find product descriptions, system configurations, technical specifications, and ordering information to help you define your personal data storage needs and help you make the ideal choice based on those needs.

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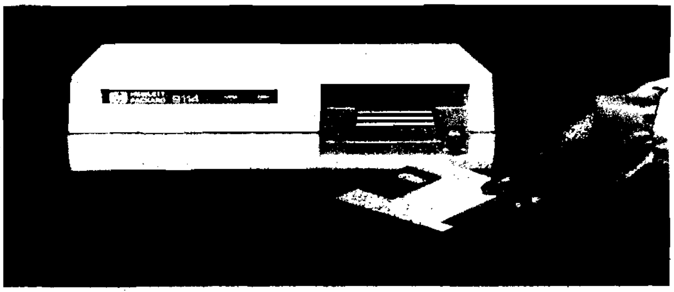
3 1/2" MICROFLOPPY DATA STORAGE SYSTEMS

The 3 1/2" microfloppy family of disc drives combines reliability and removable media into low-cost compact packages. These features are ideal for portable applications, entry level business and professional applications such as spreadsheets, graphics presentations, word processing, and data exchange. The double-sided, double-density 3 1/2" media stores up to 788 kilobytes of user data. (Specific capacity is dependent upon both the computer system and the programming language.)

Portable Microfloppy

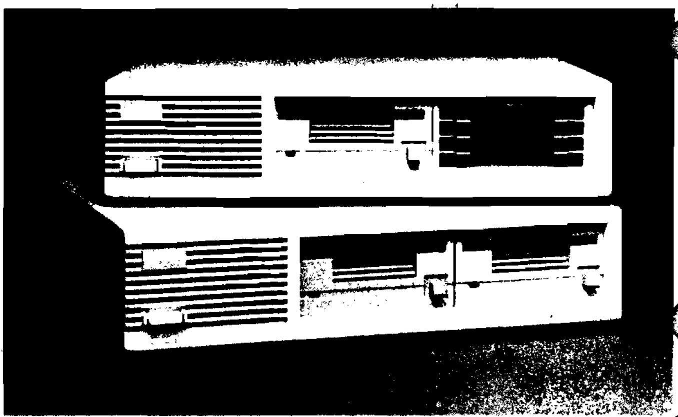


HP 9114B Portable 3 1/2" Disc Drive, Battery-operated

Designed for HP's Portable computer family as well as Series 40 and Series 70, the HP 9114B provides up to 710 Kbytes of formatted capacity in a lightweight, battery-operated package. The 3 1/2" disc drive can read, write, and initialize media in both single-sided and double-sided formats. This feature allows data exchange with single-sided drives currently in use. In addition data may be exchanged between the Portable and the Touchscreen systems. The space-saving size and lightweight features allow the HP 9114B Portable to be stacked on your desk with your ThinkJet printer.

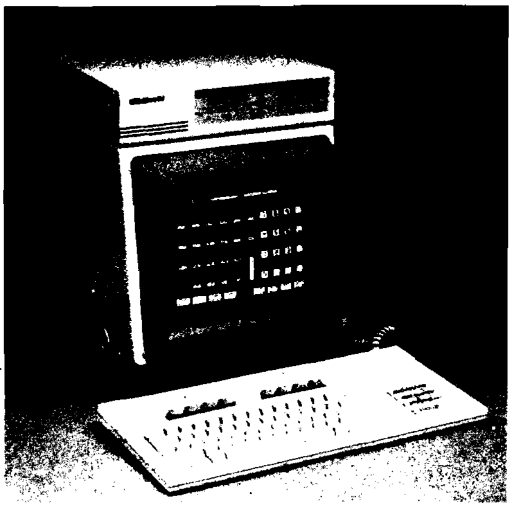
The LED "Fuel Gauge" on the front panel indicates the state of battery charge. This feature allows you to easily track battery charge.

Personal Workstation Microfloppies



HP 9122D Double-sided 3 1/2" Dual Drive
HP 9122S Double-sided 3 1/2" Single Drive

The HP 9122D is a highly reliable, double-sided 3 1/2" microfloppy designed for use with HP's desktops and personal computers. Available in both dual and single configurations, the HP 9122D and HP 9122S provide up to 788 Kbytes per drive of formatted capacity. The 3 1/2" disc drive can read, write and initialize media in both single-sided and double-sided formats. This disc drive is supported on the Portable and Portable PLUS, the Touchscreen, Touchscreen II, Series 80, HP 9000–Series 200, Series 300 and Series 500.



HP 9123D Double-sided 3 1/2" Dual Drive

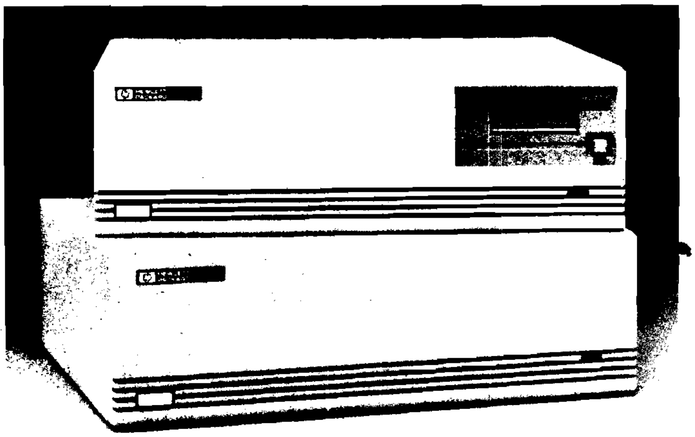
Hewlett-Packard has designed the 9123D exclusively for the HP Touchscreen II. This 3 1/2" drive provides the same formatted capacity as the 9122D but relies on the Touchscreen II for its power supply. The HP 9123D media is compatible with both the 9122D/S and the 9114B.

WINCHESTER HARD DISCS

HP's hard disc systems provide up to 40 Mbytes of formatted capacity for HP computer systems and offer two to seven times the speed of our floppy-based system. Sustained transfer rates of up to 5 Mbit per second save you valuable time. HP hard disc storage solutions add the benefit of convenient data manipulation not provided by floppy-based storage.

In addition to business applications, the HP hard disc satisfies the data storage needs of engineering and industrial applications. As the price difference between the Winchester hard disc and floppy-based systems narrows, more HP users are choosing one of the following hard disc personal data storage solutions:

10 Megabyte Hard Discs

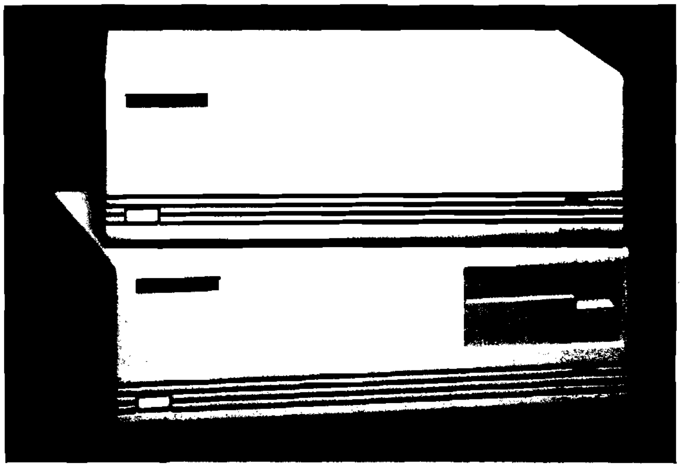


HP 9153A–10 MB Hard Disc and Microfloppy
HP 9154A–10 MB Hard Disc

The HP 9153A combines the storage and performance capabilities of HP's 10 Mbyte hard disc with the backup and interchange capabilities of the 3 1/2" microfloppy in one compact package. The removable media is fully compatible with the HP 9122D/S, 9123D, and HP 9114B data storage units. The 9154A, hard disc only model, adds Winchester performance and convenience to floppy-based computer systems.

The 9153A and 9154A are supported on the Touchscreen II, Series 80, HP Integral, and HP 9000–Series 200, 300, and 500 computers. The 9154A is also supported on the IBM PC/XT/AT and the COMPAQ Portable with the 88500A Disc/Tape Interface. Please refer to the Configuration Guide for additional information.

20 Megabyte Hard Discs



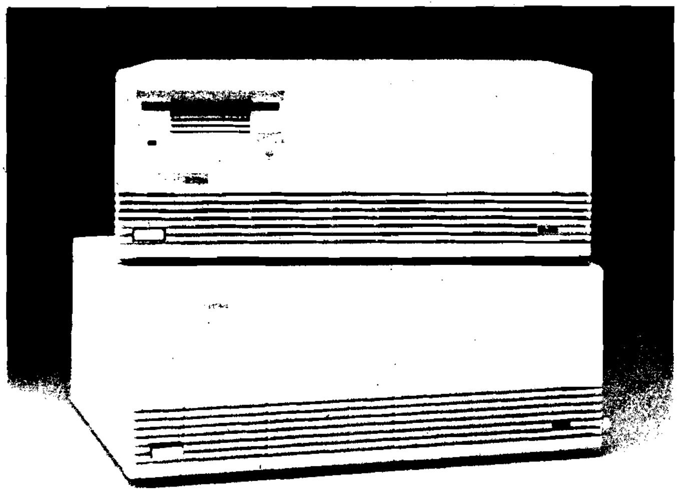
HP 9153B-20MB Hard Disc and Microfloppy
HP 9154B-20MB Hard Disc

The storage capabilities of HP's 20 Mbyte hard disc and the backup and interchange capabilities of HP's 3 1/2" microfloppy are combined in the 9153B. The removable media is fully compatible with the HP 9122D/S, the HP 9123D and the HP 9114B data storage units.

The high performance HP 9153B and 9154B are well suited for the rugged automated test and measurement market as well as for everyday application such as word processing, business graphics, and spreadsheets. Two new features have been integrated into the HP 20 Mbyte hard disc drives: write protection and initialize protection. The write protect feature allows you to prevent unauthorized modification of a chosen section of the hard disc. The initialize protect feature insures your data integrity and prevents data loss.

The HP 9153B and 9154B are supported on the Touchscreen II, HP 9000–Series 200 and 300. The 9154B is also supported on the HP Vectra PC, Touchscreen II, AT&T 6300, Olivetti-M24, IBM PC/XT/AT, and COMPAQ Portable with the 88500A Disc/Tape Interface. Please refer to the Configuration Guide for additional information.

40 Megabyte Hard Discs



HP 9133L-40MB Hard Disc and Microfloppy
HP 9134L-40MB Hard Disc

The Hewlett-Packard 40 Megabyte hard discs further the evolution of HP's reliable Winchester hard disc family. These systems are designed for users who require higher performance and greater capacity.

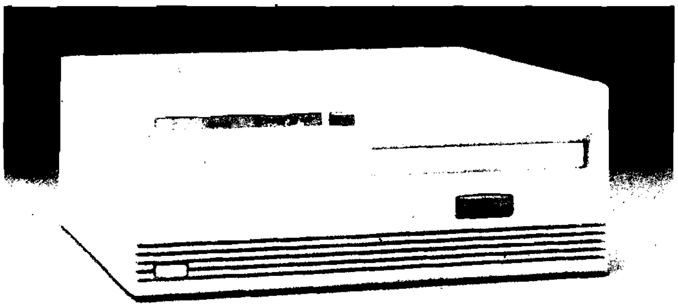
The 40 MByte capacity is ideal for both business and technical applications such as CAD/CAM, data base management, and accounting. In addition, it provides the perfect solution for popular networks such as 3COM®, PC Net®, and Hewlett-Packard's Office Share®.

Support for the 9133L and 9134L includes the Touchscreen II and HP 9000 Series 200 and 300. Support via HP 88500A Disc/Tape Interface card includes the HP Vectra, IBM PC/XT/AT, COMPAQ Portable, AT&T 6300, and Olivetti-M24.

1/4" TAPE BACKUP

The Hewlett-Packard Tape Backup Subsystems provide a range of solutions to meet your format, capacity, and performance needs. Our tape system provides backup protection against equipment failure and operator error. Archival storage for economical, long term data preservation as well as online data storage are additional benefits of our tape subsystems.

Low-Cost 1/4" Tape Backup



HP 9142A Low-Cost 1/4" Tape Backup

The HP 9142A is a low-cost, reliable 1/4" streaming tape backup solution designed for personal computers where low cost and high reliability are the key criteria. It stores approximately up to 52 Mbytes of information when used with the HP Touchscreen and Touchscreen II PCs and up to 60 Mbytes when used with the IBM PC/XT/AT on a single cartridge. (Capacity is dependent on cartridge length and system type.)

The 9142A uses a soft key driven utility for fast and simple backup. This backup utility saves the time and frustration of using DOS commands. Extensive help screens provide valuable user assistance.

Unlike many competitive drives, the 9142A subsystem allows both file AND image store and restore operations. In addition it offers not only error detection but an error correction feature. This feature utilizes 50% data redundancy for increased reliability. Data redundancy uses the redundant data to recreate the original data should the tape become flawed.

The HP 9142A transfers data at a rate of up to 2 Mbytes/minute without verification and up to 1 Mbyte/minute with verification. Off-line formatting saves valuable computer time by allowing the user to format, initialize and certify the tape cartridge without tying up the system.

Support for the HP 9142A is provided by the Touchscreen, and Touchscreen II as well as the IBM PC/XT/AT and COMPAQ Portable. Operation with an IBM computer requires our 88500A Disc/Tape Interface. (Cartridges formatted on the 9144A are not compatible with those formatted on the 9142A).

DATA INTERCHANGE

Hewlett-Packard computer systems can share data with IBM computer systems in both the 3 1/2" and 5 1/4" format.

IBM–PC 3 1/2" Data Interchange

Our personal and portable computers can read IBM 3 1/2" discs for easy data exchange. Also by using the HP 82973A Portable Desktop Link Card for the IBM-PC with the HP 9114B portable disc, 3 1/2" discs can be formatted by the IBM-PC in HP format. This allows MS®-DOS data files to be moved between the HP Portable, HP Touchscreen, Touchscreen II, and IBM-PC.

IBM-PC 5 1/4" Data Interchange

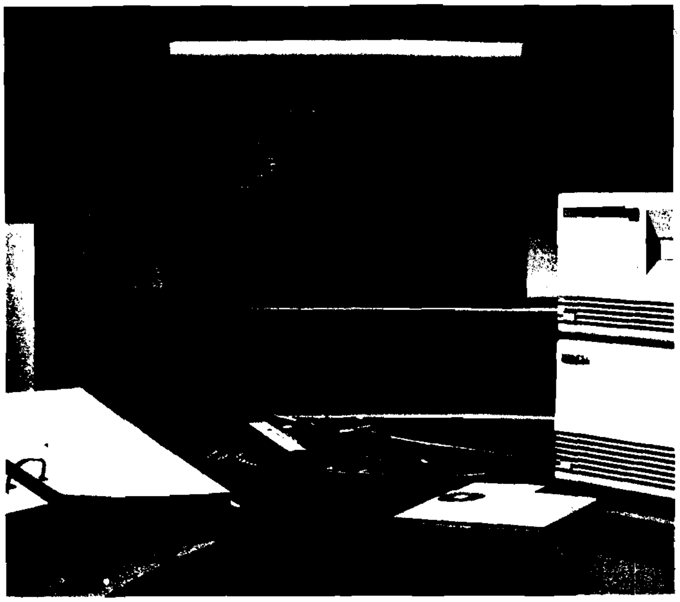
HP 9127A IBM-PC 5 1/4" Data Interchange

The HP 9127A, single 5 1/4" disc drive, can format discs in IBM-PC formats (PC-DOS 1.0, 1.1, 2.0 and 2.1) as well as the HP format.

The disc can be moved between IBM and HP computer systems for easy data interchange. The HP 9127A also allows the user to run off-the-shelf IBM software on the HP 9000 Series 300 systems with the new HP Series 300-DOS coprocessor card, opening up office automation to the technical workstation.

In addition the HP 9127A gives the HP Touchscreen and Touchscreen II data compatibility with the IBM-PC via 5 1/4" discs. Connected by the HP-IB to the Touchscreen computers, the drive can read and write in the 1.0, 1.1, 2.0 and 2.1 IBM-PC formats.

INTERFACE SOLUTIONS



HP 88500A/B IBM Disc/Tape Interface

Hewlett-Packard provides an interface solution to connect your HP tape or disc to your IBM PC/XT/AT and COMPAQ Portable. This easy-to-install system includes the powerful Data Manager and Tape Backup software. The Tape Backup software allows fast image backups and restores. Data Manager simplifies DOS commands, organizes your tapes or discs and provides selective file backup onto floppies or tapes. The diagnostic software ensures drive integrity and pinpoints service problems. One short slot interface card allows you to connect up to 7 discs and 1 tape.

Designed for customers who already have an HP-IB solution for their personal computer, the HP 88500B is a software only product. The HP 88500B, in conjunction with the 82990A card and appropriate software, allows you to run HP-IB instruments on the HP Vectra PC as well as disc drives and tape drives.

The HP 88500A/B supports both the 9154A, 9154B, 9134L discs as well as the 9142A tape.

SYSTEM/DISC CONFIGURATION GUIDE

COMBINATIONS		DISC DRIVE			HOST		
Host	**Disc Drive**	**Maximum No. of Data Storage Systems**	**Type of Interface**	**Cables Sent with Disc**	**Interface and/or Cable Required**	**ROM, Driver or System Required**	**Notes**
Series 80, 9915	9121D/S 9122D/S 9153A/B 9154A/B	**9121D/S:** **2/HP-IB Interface** **All others:** **8/HP-IB Interface**	HP-IB	None	HP83/85/86A – 82937A HP-IB Interface HP86B/87 – 45529 HP-IB cable (or 10833) (86B & 87 ship w/cable)	Mass storage ROM #1. 00085-15001 Extended mass storage ROMs #2. 00085-15013 #3. 00087-15013 (See Notes for Required ROMs)	**REQUIRED ROMs:** 9121D/S; 9122D/S 9153/54A/B HP83A: #1; Not supported HP85A/9915A: #1; Not supported HP85B/9915B: Supported; #2 HP86A/HP87A/XM: Supported; #3 HP86B: Supported; #3 CP/M: Supported; Not supported *Only 16.7 MB are supported on the 9153/9154B.
The Portable (HP 110) **The Portable PLUS**	9114B 9121D/S 9122D/S 9153A/B 9154A/B	**8/HP-IL Loop**	9114B: HP-IL All others: HP-IB	9114B: One HP-IL cable All others: None	All systems require 82167A/B/D HP-IL cables. All HP-IB drives require 10833 HP-IB cable & the HP 82169A HP-IB to HP-IL converter (S/N 2406 and higher)	The required operating system for all drives is built in.	Reference application note 5954-1143 for the use of the HP-IB drives. The Portable cannot init. in IBM format w/9127A. Read/Write HP format and PC-DOS 2.0/2.1 discs. Can only format 16MB of the 20MB hard discs. (9153/54B)
HP Touchscreen PC (150B) **HP Touchscreen Max (150B)**	9121D/S 9122D/S 9127A 9142A	**8/HP-IB Interface**	HP-IB	None	10833 HP-IB cable Note: Series 100 shipped with one HP-IB cable.	9142A: Order Option 150	The 9127A is to be used as an add-on only since software is distributed on 3 1/2" media.
HP Touchscreen II (150C) **HP Touchscreen II Max (150C)**	9121D/S 9122D/S 9123D/S 9127A 9133L 9134L 9142A 9153A/B 9154A/B	**8/HP-IB Interface**	HP-IB	None	10833 HP-IB cable Note: Series 100 shipped with one HP-IB cable.	9142A: Order Option 150	The 9127A is to be used as an add-on only since software is distributed on 3 1/2 inch media. Option 001 (1k sectors) is recommended but not required for the 9133L and the 9134L.
HP 41 **HP 71** **HP 75**	9114B	**8/HP-IL Loop**	HP-IL	One HP-IL cable	HP41: 82160A HP-IL Module HP71: 82401A HP-IL Module 82167A/B/D HP-IL cables	The required operating system is built into all hosts.	HP 41: limited to 128KB capacity. User's group utility, P/N 41-09114, extends data files to 630KB.
1000 E,F Series	9121D 9122D	**4/HP-IB Interface**	HP-IB	None	12821A (HP-IB cable included)	Disc driver: DVA 37 (included with RTE 6/VM)	Boot up is not supported from any of these devices.
1000 A Series	9121D/S 9122D/S 9133L 9134L 9153B 9154B	**4/HP-IB Interface**	HP-IB	None	12009A (HP-IB cable included)	9121D/S,9895A: Interface driver ID.37 – Device driver DD.30 included with RTE-A All others: ID.37 DD.33 and A.85 software release.	9121D/S is supported only with RTE-A. Software is distributed on single-sided 3.5 inch media.
HP Integral PC (HP 9807)	9121D/S 9122D/S 9133L 9134L 9153A/B 9154A/B	**8/HP-IB Interface**	HP-IB	None	82977A/B HP-IB cable or 10833 HP-IB cable	The required operating system for all drives is built in.	Release 1.0.0 of the integral operating system requires work around procedure when formatting the 20MB and 40MB (9153/54B & 9133/34L) hard discs.
HP 250, HP 260	9133L 9134L 9153B 9154B	**4 maximum**	HP-IB	None	10833 HP-IB cable	All require operating system. B.07.00	Up to 3 stand-alone disc drives may be added to a disc/backup device.
9000 Series 200, 300	9121D/S 9122D/S 9127A 9133L 9134L 9153A/B 9154A/B	**2/HP-IB Interface**	HP-IB	None	10833 HP-IB cable Note: Series 200, 300 shipped with one HP-IB cable.	For information regarding the HP 9000 Series 200, order the following configuration information and order guides: Series 200 – 09800-90020 Series 300 – 98561-90020	
9000 Series 500	9122D/S 9127A 9133L 9134L 9153A/B 9154A/B	**2/HP-IB Interface**	HP-IB	None	27110A One shipped with each host computer.	For information regarding the HP 9000 Series 200 and 500, order the following configuration information and order guides: Series 500 – 09050-90050	
IBM-PC **IBM-XT** **IBM-AT**	9134L 9142A 9154A 9154B	**9154A/B & 9134L:** **8/HP-IB Interface** **9142A: 1/HP-IB Interface**	HP-IB	None	88500A Disc & Tape Interface card. (One HP-IB cable is sent with the card.) Additional drives can use the same card but require an additional 10833 (HP-IB) cable.	PC-DOS 2.0, 3.1, and 3.2 Software drivers are sent with 88500A card.	The 88500A card only works with these discs and tape drives.
COMPAQ Portable	9134L 9142A 9154A 9154B	**9154A/B & 9134L:** **8/HP-IB Interface** **9142A: 1/HP-IB Interface**	HP-IB	None	88500A Disc & Tape Interface card. (One HP-IB cable is sent with the card.) Additional drives can use the same card but require an additional 10833 (HP-IB) cable.	MS-DOS 2.0 & 2.11 Software drivers are sent with 88500A card.	The 88500A card only works with these discs and tape.
AT&T 6300 **Olivetti-M24**	9134L 9142A 9154A 9154B	**9134L & 9154A/B:** **8/HP-IB Interface** **9142A:** **1/HP-IB Interface**	HP-IB	None	88500A Disc & Tape Interface card. (One HP-IB cable is sent with the card). Additional drives can use the same card but require an additional 10833 (HP-IB) cable.	MS-DOS 2.11 must have version 2.0 or greater software.	The 88500A card only works with these discs and tapes.
HP Vectra	45816A/M 9122D/S 9134L 9142A 9154A 9154B	**Internal: two 20MB discs and two floppies.** **External: 7 discs and 1 tape drive.**	**Internal: Plug-in card through Vectra 1 backplane.** **External: HP-IB**	**Internal: cables included.** **External: None**	Internal: None – External: 88500A Disc & Tape Interface card. (One HP-IB cable is sent with the card). Additional drives can use the same card but require an additional 10833 (HP-IB) cable.	MS-DOS 3.1 software drivers for the external drives are sent with the 88500A card. Version 2.0 or greater is required.	

Please refer to the Peripheral Configuration Guide (#5953-9470) for additional host support information.

PERFORMANCE CHARACTERISTICS

	3-1/2" Flexible Discs		5-1/4" Flexible Discs 9127A	Winchester Hard Discs			1/4" Tape Backup 9142A	
	Double-Sided 9114B,9122D/S 9133L,9153A/B	Single-Sided 9121D/S		10 Mbyte 9153A/9154A	20 Mbyte 9153B/9154B	40 Mbyte 9133L/9134L		
CAPACITY						50.9MB	600 ft	150 ft
Unformatted	1.0 MB	437.5KB	500KB	14.09MB	28.1MB	39.9MB	138MB	35MB
Formatted †						44.8MB	up to 60MB	up to 15 MB
Single-Drive								
256 Bytes/Sector	631KB	270KB		10.0MB	20.0MB			
512 Bytes/Sector	710KB	-	-	-	-	-		
1024 Bytes/Sector	788KB	-	-	-	-	-		
Dual Drive								
256 Bytes/Sector	1.26MB	540KB	-	-	-			
512 Bytes/Sector	1.42MB	-	-	-	-			
1024 Bytes/Sector	1.58MB	-	-	-	-			
Sectors per Track								
256 Bytes/Sector	16	16		28	28	32		
512 Bytes/Sector	9	-		-	-			
1024 Bytes/Sector	5	-		-	-			
Tracks/Tape							16	16
User Blocks/Track (max)							915	228
Frames/Block							6 (4 data, 2ECC)	6 (4 data, 2ECC)
Bytes/Frame							up to 1024	up to 1024
TRANSFER RATE* (mechanism)	500 Kbit/Sec	500 Kbit/Sec	250 Kbit/Sec	4 Mbit/Sec	4 Mbit/Sec	5 Mbit/Sec	600 Kbits/Sec	600 Kbits/Sec
AVERAGE SEEK TIME (includes settling time)	175 msec (on) ‡	370 msec (on)	93 msec (on)	75 msec	75 msec	40 msec		

† Actual formatted capacity is system dependent.

* The transfer rates listed above are disc and tape mechanism transfer rates.
The transfer rate that the user will actually see is dependent upon the computer system and application used.

‡ The 9133L microfloppy has average seek time of 428 msec.

Computer Museum

FUNCTIONAL CHARACTERISTICS

	3-1/2" Flexible Discs		5-1/4" Flexible Discs 9127A	Winchester Hard Discs			1/4" Tape Backup 9142A
	Double-Sided 9114B,9122D/S 9123D/33L/53A/B	Single-Sided 9121D/S		10 Mbyte 9153A/9154A	20 Mbyte 9153B/9154B	40 Mbyte 9133L/9134L	
ROTATIONAL SPEED	600 rpm	600 rpm	300 rpm	3000 rpm	3000 rpm	3600 rpm	62.5 inches/sec (read/write) 90.0 inches/sec (search/rewind)
RECORDING TECHNIQUE	Double Density	Double Density	Double Density	MFM	MFM	MFM	Encoding - GCR Bit density - 9600 bits/inch
INTERFACE	9114B - HP-IL All others - HP-IB	HP-IB	HP-IB	HP-IB	HP-IB	HP-IB	HP-IB
TOTAL TRACKS PER SURFACE (includes spares and system tracks)	80	70	40	703	1408	977	16
TRACKS PER INCH	135	135	48	1100	1850	960	64
RECORDING SURFACES	2	1	2	2	2	2	1

ENVIRONMENTAL RANGES

	3-1/2" Flexible Discs		5-1/4" Flexible Discs 9127A	Winchester Hard Discs			1/4" Tape Backup 9142A
	Double-Sided 9114B,9122D/S 9123D/33L/53A/B	Single-Sided 9121D/S		10 Mbyte 9153A/9154A	20 Mbyte 9153B/9154B	40 Mbyte 9133L/9134L	
TEMPERATURE							
Operating	10° to 40°C (50° to 104°F)	5° to 45°C (41° to 113°F)	10° to 40°C (50° to 104°F)	10° to 40°C (50° to 104°F)	10° to 40°C * (50° to 104°F)	10° to 40°C (50° to 104°F)	5° to 40°C (41° to 104°F)
Non-Operating	-40° to 60°C (-40° to 140°F)	-40° to 60°C (-40° to 140°F)	-40° to 60°C (-40° to 140°F)	-40° to 60°C (-40° to 140°F)	-40° to 60°C (-40° to 140°F)	-40° to 60°C (-40° to 140°F)	-40° to 75°C (-40° to 167°F)
HUMIDITY							
Operating (non-condensing) 26°C max wet bulb temperature	20% to 80%	20% to 80%	20% to 80%	20% to 80% (9153A) 5% to 95% (9154A)	20% to 80% (9153B) 5% to 95% (9154B)	20% to 80% (9133L) 8% to 80% (9134L)	20% to 80%
Non-Operating (non-condensing)	8% to 80% (media) 5% to 95% (drive)	8% to 80% (media) 5% to 95% (drive)	8% to 80% (media) 5% to 95% (drive)	5% to 95%	5% to 95% (without media)	5% to 95% 5% to 95% (drive)	20% to 80% (media)
ALTITUDE							
Operating	0 to 4,572m (0 to 15,000 ft)	0 to 4,572m (0 to 15,000 ft)	0 to 4,572m (0 to 15,000 ft)	0 to 4,572m (0 to 15,000 ft)	0 to 4,572m (0 to 15,000 ft)	0 to 4,572m (0 to 15,000 ft)	0 to 4,572m (0 to 15,000 ft)
Non-Operating	-304 to 15,240m (-1000 to 50,000ft)	-304 to 15,240m (-1000 to 50,000 ft)	-304 to 15,240m (-1000 to 50,000 ft)	-304 to 15,240m (-1000 to 50,000 ft)	-304 to 15,240m (-1000 to 50,000 ft)	-304 to 15,240m (-1000 to 50,000 ft)	-304 to 15,240m (-1000 to 50,000 ft)

* The 9154B (and 9153B with no media inserted) have been operated at 50°C and ambient humidity with no errors or performance degradation.

POWER REQUIREMENTS

	3-1/2" Flexible Discs		5-1/4" Flexible Discs 9127A	Winchester Hard Discs			1/4" Tape Backup 9142A
	Double-Sided 9114B,9122D/S 9123D/33L/53A/B	Single-Sided 9121D/S		10 Mbyte 9153A/9154A	20 Mbyte 9153B/9154B	40 Mbyte 9133L/9134L	
VOLTAGE (switch selectable)							
Nominal	100-120V~ (115V setting) 200-240V~ (230V setting)	100-120V~ (115V setting) 200-240V~ (230V setting)	100-120V~ (115V setting) 200-240V~ (230V setting)	100-120V~ (115V setting) 200-240V~ (230V setting)	100-120V~ (115V setting) 200-240V~ (230V setting)	100-120V~ (115V setting) 200-240V~ (230V setting)	100-120V~ (115V setting) 200-240V~ (230V setting)
Range	86-127V~ (115V setting) 180-253V~ (230V setting)	86-127V~ (115V setting) 180-253V~ (230V setting)	86-127V~ (115V setting) 180-253V~ (230V setting)	86-127V~ (115V setting) 180-253V~ (230V setting)	86-127V~ (115V setting) 180-253V~ (230V setting)	86-127V~ (115V setting) 180-253V~ (230V setting)	86-127V~ (115V setting) 180-253V~ (230V setting)
FREQUENCY							
Nominal	50-60 Hz	50-60 Hz	50-60 Hz	50-60 Hz	50-60 Hz	50-60 Hz	50-60 Hz
Range	48-66 Hz	48-66 Hz	48-66 Hz	48-66 Hz	48-66 Hz	48-66 Hz	48-66 Hz
POWER CONSUPTION (max)	9114B - 6 Watts 9122D/S 67 Watts	67W	100W	100W	50W	100W	100W

* The 9114B is battery-operated and has the following characteristics:

Voltage, selected by recharger .... 90~120V

Battery life, continuous use: 100% duty cycle .... 1 hour without recharger plugged in

Typical usage, 5% duty cycle........ No limit with recharger plugged in

* The 9114B uses a 6-volt lead-acid dry cell battery

Sleep State (stand by): unit is powered on but not accessed .... 24 hours

Service life: total life of battery .... 3-5 years

* * The 9123D's power is supplied by the Touchscreen II.

PHYSICAL CHARACTERISTICS

	9114B	9121D/S	9122D/S	9123D	9127A
DIMENSIONS					
Height	78mm (3.1 in)	81mm (3.2 in)	81mm (3.2 in)	81mm (3.2 in)	106mm (4.2 in)
Width	292mm (11.5 in)	325mm (12.8 in)	325mm (12.8 in)	325mm (12.8 in)	325mm (12.8 in)
Depth	203mm (8.0 in)	285mm (11.2 in)	285mm (11.2 in)	285mm (11.2 in)	285mm (11.2 in)
WEIGHT					
NET					
Dual	---	4.5kg (10 lbs)	4.5kg (10 lbs)	3.6kg (8 lbs)	---
Single	2.45kb (5.4 lbs)	3.8kg (8.4 lbs)	3.8kg (8.4 lbs)	---	6.82kg (15 lbs)
Shipping					
Dual	---	7.7kg (17 lbs)	7.7kg (17 lbs)	6.8kg (15 lbs)	---
Single	5.64kg (12.4)	6.9kg (15.4 lbs)	6.9kg (15.4 lbs)	---	8.75kg (19.25 lbs)

PHYSICAL CHARACTERISTICS (Continued)

	9153A/9154A	9153B/9154B	9133L/9134L	9142A
DIMENSIONS				
Height	107mm (4.2 in)	107mm (4.2 in)	132mm (5.2 in)	132mm (5.2 in)
Width	325mm (12.8 in)	325mm (12.8 in)	325mm (12.8 in)	325mm (12.8 in)
Depth	285mm (11.2 in)	285mm (11.2 in)	285mm (11.2 in)	285mm (11.2 in)
WEIGHT				
NET				
Dual	8.98kg (19.75 lbs) (9153A)	7.7kb (16.2 lbs) (9133H)	10.5kb (23 lbs) (9133L)	8.64kg (19 lbs)
Single	8.18kg (18.00 lbs) (9154A)	6.8kb (14.9 lbs) (9134H)	9.5kg (21 lbs) (9134L)	---
Shipping				
Dual	11.79kg (26 lbs) (9153A)	9.4kb (20.8 lbs) (9133H)	14.5kg (32 lbs) (9133L)	12.27kg (27 lbs)
Single	11.34kg (25 lbs) (9154A)	8.9kg (19.5 lbs) (9134H)	13.5kg (30 lbs) (9134L)	---

ORDERING INFORMATION

3 1/2" MICROFLOPPY DATA STORAGE SYSTEMS

Double-sided 3 1/2" Disc Drives

Single Drive, battery-operated, 710 Kbytes formatted	9114B
Dual Drive, 1420 Kbytes formatted (710 KB/drive)	9122D
Single Drive, 710 Kbytes formatted	9122S
Dual Drive, 1420 Kbytes formatted (710 KB/drive) Touchscreen II (150C) only	9123D

Single-sided 3 1/2" Disc Drives

Dual Drive, 540 Kbytes formatted (270 KB/drive)	9121D
Single Drive, 270 Kbytes formatted	9121S

Media

HP Double-sided (9114B, 9122D/S, 9123D, 9153A, 9153B) Box of 10 discs	92192A
HP Single-sided (9121D/S) Box of 10 discs	92191A

Accessories Supplied

9114B
Operator's manual, one meter HP-IL cable, battery pack, battery recharger, one flexible disc.

9121D, 9121S, 9122D, 9122S
Operator's manual, power cord, two fuses, one flexible disc per drive.

9123D
Two flexible discs.

Accessories Available

9114B Replacement Battery Pack	88014B
HP-IL Cable	82167A
HP-IB Cables – See below	
19" Rack Mount Kit	19500B

WINCHESTER HARD DISC SYSTEMS

3 1/2" Winchester Hard Discs

10 Mbyte formatted capacity Winchester with 3 1/2" Microfloppy	9153A
10 Mbyte formatted capacity Winchester	9154A
20 Mbyte formatted capacity Winchester with 3 1/2" Microfloppy (710 Kbytes formatted)	9153B
20 Mbyte formatted capacity Winchester	9134B
40 Mbyte formatted capacity Winchester with 3 1/2" Microfloppy (710 Kbytes formatted)	9133L
with 1 Kbyte sectors (44.8 Mbytes formatted)	9133L Opt. 001
40 Mbyte formatted capacity Winchester	9134L
with 1 Kbyte sectors (44.8 Mbytes formatted)	9134L Opt. 001

Accessories Supplied

9153A/9154A, 9153B/9154B, 9133L/9134L
Operator's manual, power cord, two fuses, one flexible disc (9153A/B only).

Accessories Available

HP-IB Cables – See below	
19" Rack Mount Kit	19500B

1/4" TAPE BACKUP SYSTEMS

1/4" Tape Drives

1/4" Low-Cost Cartridge Tape Drive	9142A
For use with Touchscreen PC's (HP 150)	9142A Opt. 150

Media

9142A Cartridge, user formatted	
up to 15 Mbytes formatted, Box of 5 Cartridges	92242S
up to 60 Mbytes formatted, Box of 5 Cartridges	92242L

Accessories Supplied

Operator's manual, power cord, one fuse, 600-ft. tape cartridge, head cleaner*, swabs.

Accessories Available

HP-IB Cables – See below	
19" Rack Mount Kit	19500B
Cleaning Supplies	
Magnetic Head Cleaning Kit	92193H
Individual Cleaning Supplies	
Tape Head Cleaner (Six 4oz. bottles)	92193X
Foam Swabs (50 per package)	
Wooden Shaft	9300-0468
Plastic Shaft	9300-0767
Lint-free Wipes (100 per bag)	92193W

* Periodic cleaning required to ensure proper operation (after a new cartridge is inserted, if read/write errors occur or at least once a week).

DATA INTERCHANGE and INTERFACE SOLUTIONS FOR NON-HP SYSTEMS

DATA INTERCHANGE SOLUTIONS

5 1/4" Flexible Discs

Single Drive IBM data compatible on HP Series 200/300, Touchscreen PC's (HP 150)	9127A

Media

HP double-sided, (9127A) Box of 10 discs	92190A

Accessories Supplied

5 1/4" and 3 1/2"
Operator's manual, power cord, two fuses, one flexible disc, software for use with Touchscreen II PC's (HP 150).

Accessories Available

Padded Carrying Case	1540-0685
HP-IB Cables – See below	
19" Rack Mount Kit	19500B

INTERFACE SOLUTION

Disc/Tape Interface Card for IBM PC/XT/AT and COMPAQ Portable (for use with 9154A/B, 9134L, 9142A discs and tape drives)	88500A
Software-only product to run HP-IB instruments on HP Vectra PC when used in conjunction with the HP 82990A card	88500B

HP-IB CABLES

Right angle .03 meter	92220R
0.5 meter	10833D
1.0 meter	10833A
2.0 meter	10833B
4.0 meter	10833C*

*Not recommended with 1/4" tape backup systems.

SAFETY and EMI COMPLIANCE

Underwriters Laboratories, Inc.
  UL 478: Electronic Data Processing Equipment (EMRT)

  UL 114: Office Appliances and Business Equipment (QAOT)

Canadian Standards Association
  CSA C22.2 #154: Data Processing Equipment

International Electrotechnical Commission
  IEC 380 and 435

FCC
  Class B Part 15 for computing equipment

VDE
  Level B with a Level B SPU

Questions concerning regulatory agency compliance should be directed to the local Hewlett-Packard Sales and Service Office.

FOR MORE INFORMATION CONTACT YOUR HEWLETT-PACKARD SALES REPRESENTATIVE OR FOR THE DEALER NEAREST YOU, CALL 1-800-FOR-HPPC

WARRANTY and SERVICE

Most of the Hewlett-Packard data storage peripherals described in this data sheet are warranted against defects in materials and workmanship for a period of one year* from date of purchase. For warranty service or repair, return this product with proof of purchase to a Hewlett-Packard field Repair Center or an authorized dealer. Contact your local Hewlett-Packard sales office for the address of the Hewlett-Packard Repair Center or authorized dealer nearest you. A copy of the complete warranty statement is available upon request.

HP offers complete service and maintenance worldwide. Maintenance agreements are available for all HP data storage products. Advantages of these agreements to the customer include a fixed annual cost, individualized cost-effective contracts, a choice of response time, and the option of either on-site or service center repair. Current U.S. rates can be determined by contacting your local HP Sales Office.

The selection and use of media, supplies and consumables is the customer's responsibility. Hewlett-Packard reserves the right to exclude from this agreement any repairs for damage to HP products which HP reasonably determines or believes was caused by use of non-HP media. Hewlett-Packard will, upon request, repair such damage on a time and material basis.

*The following products are covered by the one year HP Warranty: 9123D, 9122D/S, 9133L, 9134L, 9153A/B, 9154A/B, 9142A, and the 88500A/B. The other products listed in this brochure receive a 90 day return-to-HP warranty. If your peripheral was received as part of coordinated delivery with a Hewlett-Packard computer which received 90 day on-site warranty, your peripheral will receive a 90 day on-site warranty.

The information and specifications presented in this data sheet are subject to change without notice.

For assistance call the HP regional office nearest you: Eastern 301/258-2000, Midwest 312/255-9800, Southern 404/955-1500, Western 213/506-3700, Canadian 416/678-9430. Or write to Hewlett-Packard, 700 71st Ave., Greeley, Colorado 80634; in Europe, Hewlett-Packard, S.A., P.O. Box, 150, Route Du Nant D'Avril, CH-1217, MEYRIN 2 (Geneva) Switzerland; elsewhere in the world, Hewlett-Packard Intercontinental, 3495 Deer Creek Road, Palo Alto, California 94304.

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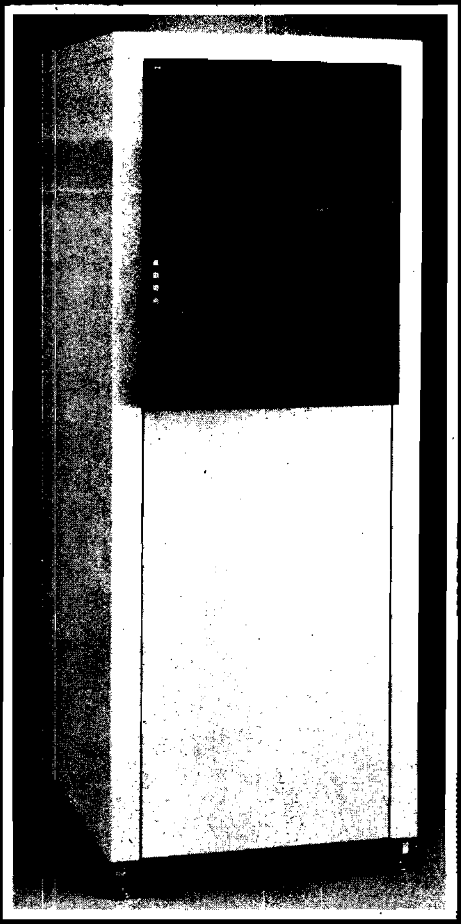
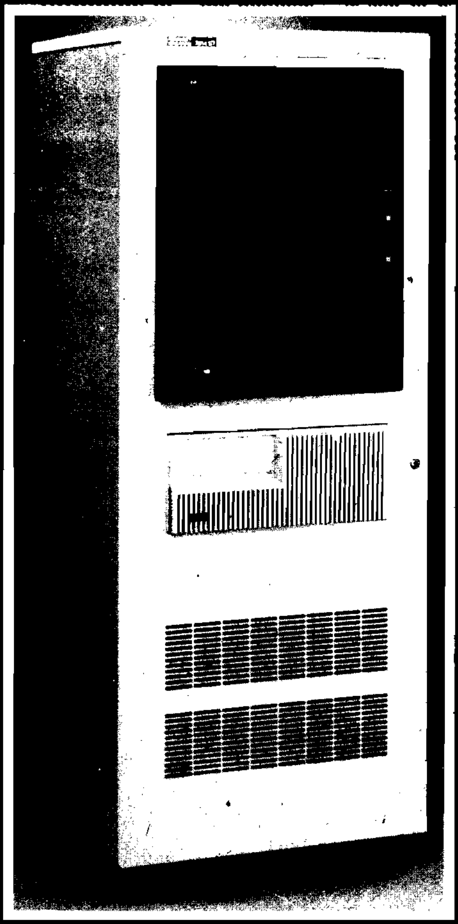
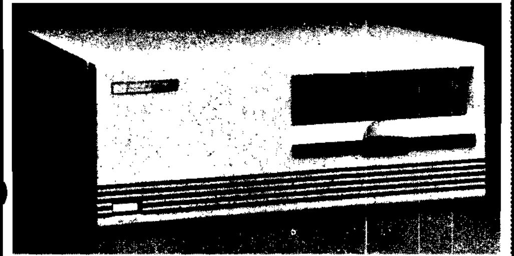
5953-6880

The HP Family of 1/2-inch and 1/4-inch Tape Drives

*Technical Data April, 1986





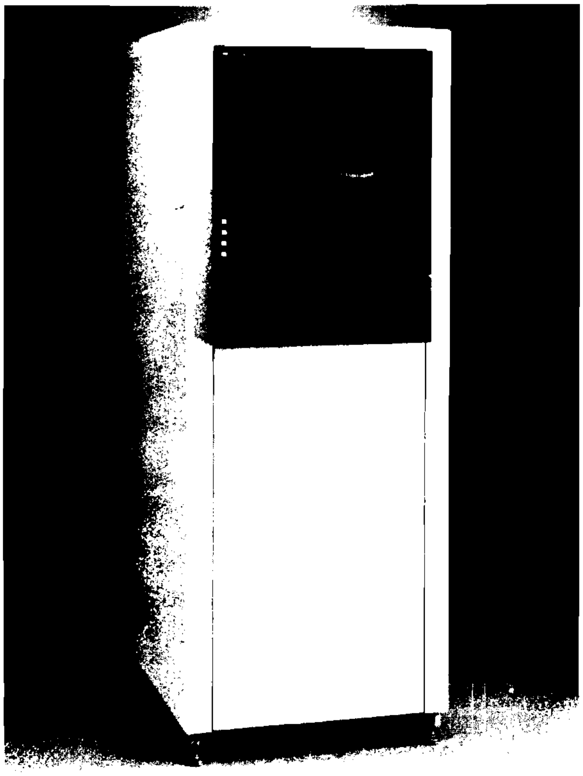


TAPE DRIVES AT A GLANCE

FEATURES	**1/2-inch Tape Drives**			**1/4-inch Tape Drives**	
	HP 7978B	**HP 7974A** **HP 7914ST†**	**HP 7970E**	**HP 35401A** **HP 9144A** **HP 7914CT†** **HP 7942/46†** **HP 7911/12/14†**	**HP 9142A**
Density (characters per inch)	6250/1600 cpi	1600/800 cpi	1600 cpi	10,000 cpi	9,600 cpi
Format	GCR/PE	PE/NRZI	PE	DC 600 H.C.	PC/T
Capacity per reel or cartridge (megabytes)	140/40 Mb	40/20 Mb	40 Mb	67/16 Mb	60/15 Mb
Optimum megabytes of disc storage to backup	>400 Mb	100-500 Mb	100-400 Mb	100-536 Mb (35401A) 20-134 Mb (others)	10-60 Mb
Speed (inches per second)					
Read/write	75 ips	100 ips (streaming) 50 ips (start-stop)	45 ips	60 ips	62.5 ips
Rewind	250 ips	200 ips	160 ips	90 ips	90 ips
Maximum data transfer rate*	22 Mb/min	8 Mb/min	3.5 Mb/min	2 Mb/min	2 Mb/min
Interface	HP-IB	HP-IB	Parallel	HP-IB	HP-IB (IBM PC interface card available)
Cabinet styles	Upright, Rackmount	Upright	Lo-boy, Rackmount	Desktop, Design Plus cabinet, Rackmount	Desktop

† Disc/Tape combination

* Includes writing data, gaps, file marks, etc. but not rewind time, reel changes, or verify passes. System throughput varies depending upon application, file structures and host/tape driver implementation.



In 1985, the HP 7978 tape drive was awarded the Designer's Choice award from Industrial Design magazine for its styling and ergonomics.

HP 7978B
High performance 1/2-inch tape drive

The HP 7978B, like its predecessor the HP 7978A, is a high performance 1/2-inch streaming tape drive designed for systems with over 400 megabytes of disc storage. With a 22 megabytes per minute transfer rate, the drive is ideally suited for fast transfer of large volumes of data. Key features include dual density 6250 GCR and 1600 PE cpi formats with 75 ips tape speed. The formatted capacity per 2400 foot tape reel is approximately 140 megabytes when written at 6250 cpi density and 40 megabytes when written at 1600 cpi density.

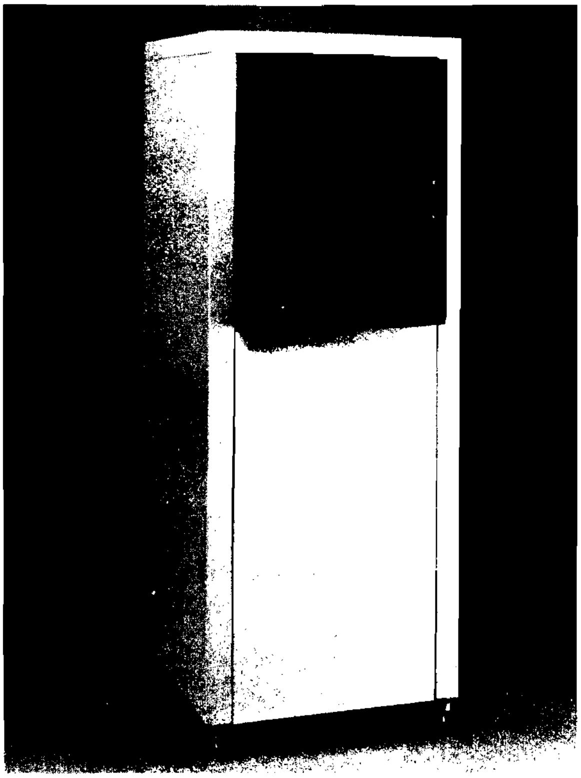
The drive also offers premium performance during system restores, continuous data logging, batch tape processing and other applications which previously required a start-stop drive. Even when sharing an interface channel with another device, the tape drive still offers high performance.

To achieve this performance, the HP 7978B's internal data buffer has been expanded to 256 Kbytes, eight times the capacity of the HP 7978A buffer. The larger buffer, together with the advanced streaming software features of Immediate Response and Read-ahead, allow stacking of up to 70 data blocks in the buffer. This makes the drive less sensitive to variations in the timing of data transfer requests to and from the host system and minimizes repositions, providing consistently high performance during all applications.

Two factors contribute to the HP 7978B's favorable cost of ownership-- reliability and serviceability. HP-designed VLSI circuitry and a simple mechanical design decrease component count, reduce power consumption, and lower the failure rate. Extensive internal selftest and diagnostic routines allow quick isolation and repair of problems. Because of the drive's excellent reliability, monthly maintenance costs are exceptionally low.

For use with HP computers:

HP 3000 Series 37,39,40/42,44/48,58,64/68,70,930
HP 1000 A Series
HP 9000 Series 300,500



HP 7974A
Midrange streaming/start-stop 1/2-inch tape drive

The HP 7974A is used as a general system tape drive for midrange systems with 100 to 500 megabytes of disc storage. The standard drive offers 1600 cpi PE format, with the option to add 800 cpi NRZI format if required for data interchange. The formatted capacity per 2400 foot reel is approximately 40 megabytes when written at 1600 cpi density and 20 megabytes when written at 800 cpi density.

The drive operates in both streaming and start-stop modes to provide versatility in matching various application requirements. The 100 ips streaming mode

(continued)

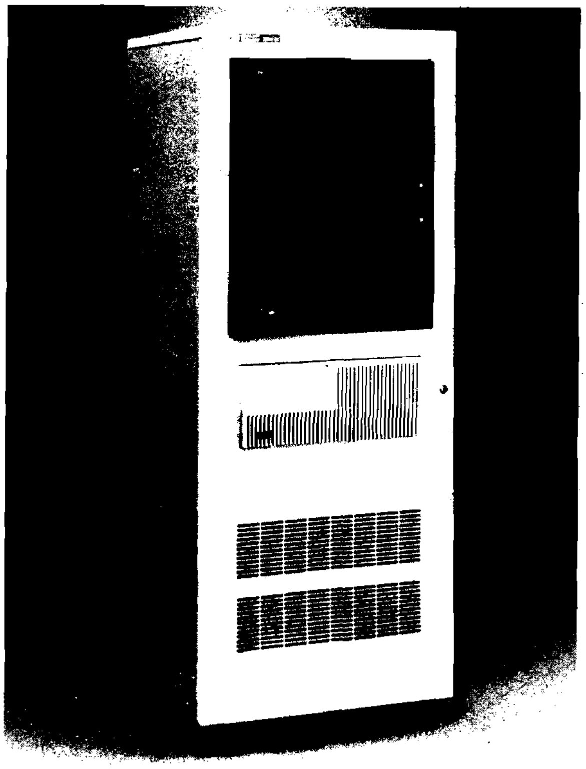
HP 7974A *(continued)*

operation, with a data transfer rate of approximately 8 megabytes per minute, optimizes backup. With a smaller electronic buffer than the HP 7978B, the HP 7974A uses tension arm buffers and a 50 ips start-stop operation to improve data logging and tape processing efficiency. To maximize overall job performance, an automatic speed algorithm can change the speed of the drive from 100 ips in streaming mode to the 50 ips start-stop operation (or vice versa) based on the host data transfer rate.

Reliability and ease of repair are designed into the HP 7974A, resulting in fewer equipment failures and low monthly maintenance costs.

For use with HP computers:

HP 3000 Series 37,39,40/42,44/48,58,64/68,70,930
HP 1000 A Series, E/F Series (requires RTE-VI 4.0 or special driver)
HP 9000 Series 300,500

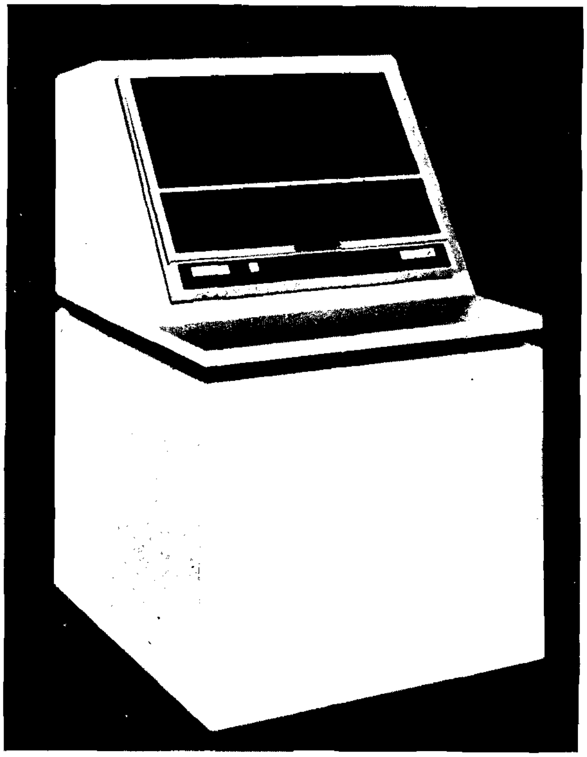


HP 7914ST
132 Mb disc plus 1/2-inch tape combination

The HP 7914ST mass storage subsystem, combining the HP 7914 132 megabyte Winchester disc and the HP 7974A 1/2-inch tape drive in one cabinet, is ideal for situations where space is critical. The cabinet also contains room to add another 132 megabyte disc or HP supported computer. An optional 1/4-inch cartridge tape drive is available for data interchange and software distribution.

For use with HP computers:

HP 3000 Series 37,39,40/42,44/48,58,64/68,70
HP 1000 A Series, E/F Series (requires RTE 6/VM 4.0 or special driver)
HP 9000 Series 300,500

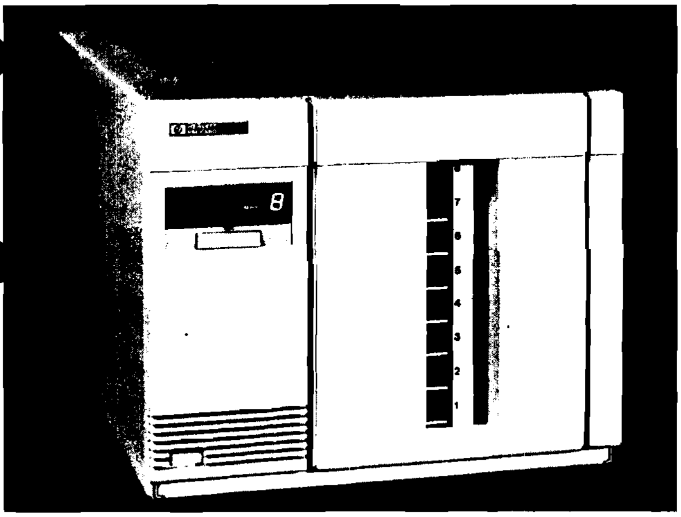


HP 7970E
OEM start-stop 1/2-inch tape drive

The HP 7970E start-stop tape drive is used primarily in OEM configurations requiring a parallel interface or 48 volt DC operation. It provides 1600 cpi PE density with a formatted capacity of approximately 40 megabytes per 2400 ft. tape reel. Operating at 45 inches per second, it has a transfer rate of 3.5 megabytes per minute. The HP 7970E systems are available either in a lo-boy cabinet or without a cabinet for rack mounting.

For use with HP computers:

HP 1000 E/F Series



HP 35401A
1/4-inch cartridge autochanger tape drive

The HP 35401A provides an unattended backup solution for computer systems with up to 536 Mbytes of disc storage. By combining the major components of the HP 9144A tape drive with an autochanger mechanism, the HP 35401A automates cartridge loading and unloading and allows the tape drive to access up to eight cartridges from a removable magazine.

With a 2 megabyte per minute transfer rate, the 1/4" cartridge drive is slower than a 1/2-inch tape drive, but has the advantage that it does not require a trained operator or a special EDP environment. Because cartridge changing no longer requires an operator, the drive is well suited to applications such as unattended backup and software duplication. System backup may be scheduled at night, thereby avoiding costly overtime or the need to shut down the system for backup during normal working hours.

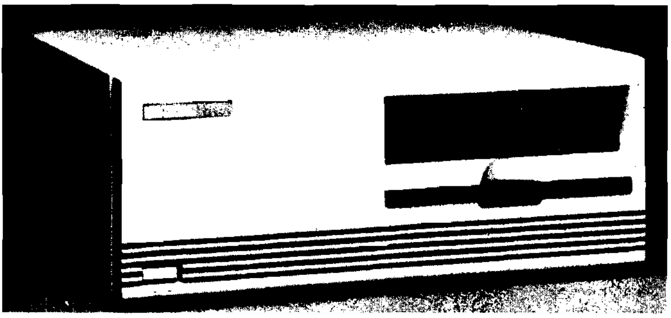
The magazine of eight cartridges offers backup flexibility. Data can be structured to suit the users, perhaps designating cartridge for different users or by each day of the week. The 536 megabyte capacity also means that the HP 35401A is suited for on-line data storage in applications where access times are not critical.

The HP 35401A uses the same popular cartridge and data format that is used in the HP 9144A and HP's range of integrated cartridge tape/disc drives (e.g. 7911/12/14/42/46). This means that you can exchange data between any of these drives.

The drive may be integrated with a computer system into HP's Design Plus cabinet or used as a standalone unit. A 19" rackmount unit will also be available.

For use with HP computers:

HP 3000 Series 37,39,40/42,44/48,58,64/68,70
HP 9000 Series 200,300,500 (Multiple cartridge use with some operating systems requires some operator intervention)
Further support planned.



HP 9144A
1/4-inch cartridge tape drive

The HP 9144A provides a 1/4-inch tape solution for HP's high performance workstations and multi-user systems. Priced well below the cost of larger tape drives, it is suited for systems with 15 to 220 megabytes of disc storage. With a data transfer rate of up to 2 megabytes per minute and a cartridge capacity of 67 megabytes, it is a cost effective and convenient backup alternative to multiple floppy discs, without the expense of a 1/2-inch tape drive.

The drive has a read-after-write head for automatic data verification during the write process, plus extensive error detection and correction capabilities to ensure reading the data correctly. These features, coupled with its gentle tape handling and media monitor, provide excellent data and drive reliability.

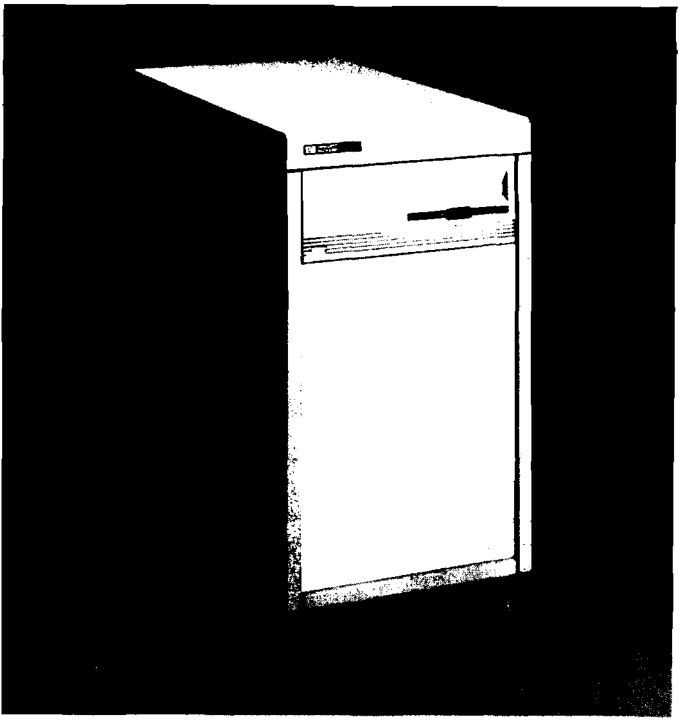
The HP 9144A can, depending on the system, perform both selective file and image backup. In addition to backup, the drive is used for software distribution and data exchange, and is also suitable for limited transaction logging. It is format compatible with the HP 35401A and the HP 7911/12/14/42/46 integrated cartridge subsystems. (HP 9144A cartridges are not compatible with HP 9142A cartridges).

As a desktop unit, it occupies an area of desk space only slightly larger than an in-tray. Alternatively, it can be mounted in an HP Design Plus cabinet along with other system components, or mounted in a standard 19-inch rack.

For use with HP computers:

HP 3000 Series 37,39,40/42,44/48,58,64/68,70
HP 1000 A Series
HP 9000 Series 200,300,500
HP Touchscreen PC (HP 150B), Touchscreen II (HP 150C)

1/4-INCH TAPE DRIVES

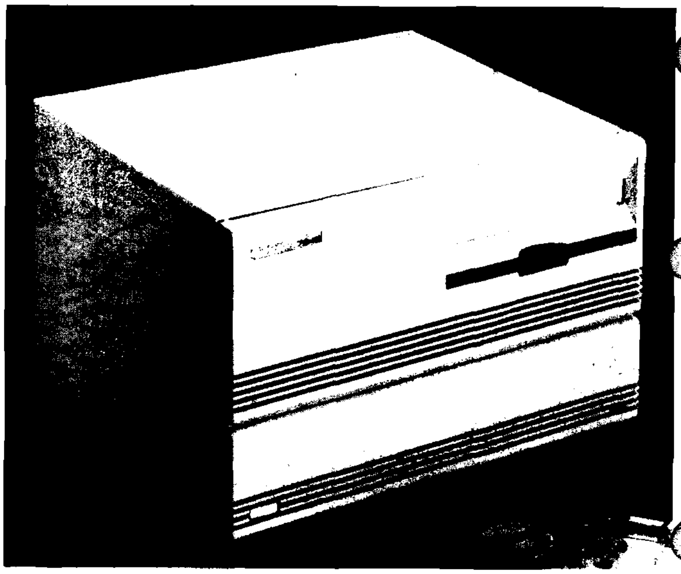


HP 7914CT
132 Mb disc plus 1/4-inch tape combination

The HP 7914CT mass storage subsystem combines the HP 7914 132 megabyte Winchester disc and a built-in HP 9144A 1/4-inch cartridge tape drive, each with its own controller and power supply. This complete subsytem provides user I/O, mass storage and backup capabilities in the Design Plus cabinet.

For use with HP computers:

HP 3000 Series 37,39,40/42,44/48,58,64/68,70
HP 1000 A Series
HP 9000 Series 200,300,500
HP 260

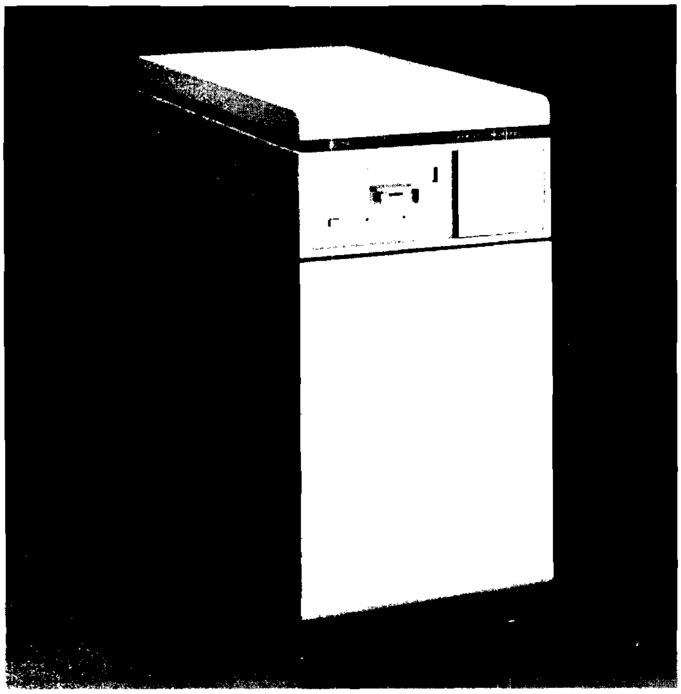


HP 7942A/46A
24/55 Mb disc plus 1/4-inch tape combination

The HP 7942A and HP 7946A are desktop mass storage subsystems combining either a 24 or 55 megabyte fixed disc drive with the HP 9144A cartridge tape drive, a single intelligent controller, and power supply. They perform off-line disc-to-tape and tape-to-disc transfers at rates of up to 2 megabytes per minute. Offering space saving convenience, they can be mounted in the Design Plus cabinet or stand on the desktop.

For use with HP computers:

HP 1000 A Series
HP 9000 Series 200,300,500
HP 260



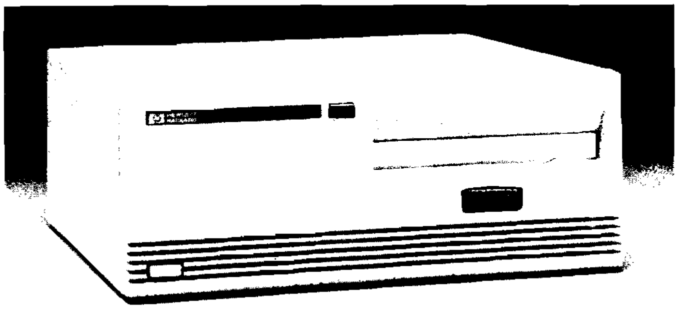
HP 7911/12/14
28/65/132 Mb discs with integrated cartridge tape drive

These mass storage subsystems combine a 28, 65 or 132 megabyte Winchester hard disc with HP's earlier 1/4-inch integrated cartridge tape drive on the single controller. They are available in either a pod cabinet (P) or as a rackmount unit (R).

The cartridge tape drive can perform off-line disc-to-tape and tape-to-disc data transfers at approximately 2 megabytes per minute. It is used for backup, software distribution, and data interchange, particularly for technical computers. It is format compatible with all HP 1/4-inch tape drives except the HP 9142A.

For use with HP computers:

HP 3000 Series 30/33,37,39,40/42,44/48,58,68,70
HP 1000 A Series, E/F Series
HP 9000 Series 200,300,500
HP 260



HP 9142A
1/4-inch cartridge tape drive for Personal Computers

The HP 9142A is an entry-level 1/4-inch streaming tape backup solution designed for Personal Computers. It stores up to 52 megabytes of information on one cartridge (or 13 megabytes with a short cartridge) when used with the HP Touchscreen and Touchscreen II PCs. It stores up to 60 megabytes (or 15 megabytes with a short cartridge) when used with the HP Vectra, IBM PC/XT/AT and supported compatibles. (Capacity is dependent on cartridge length and system requirements).

A short slot interface card (HP 88500A) is required when using the tape drive with the HP Vectra and other supported computers.

The interface kit includes a softkey driven utility for fast and simple backup, saving novice users the time and frustration of using DOS commands. Extensive help screens provide valuable user assistance.

The HP 9142A transfers data at a rate of up to 2 megabytes per minute without verification and up to 1 megabye per minute with verification. Off-line cartridge formatting saves computer time by allowing the user to format, initialize and certify the tape cartridge without tying up the system. 1/4-inch cartridges formatted on the HP 9142A are not compatible with preformatted 1/4-inch cartridges used with any other HP 1/4-inch tape drive.

Supported on HP computers:

HP Touchscreen (HP 150B) and Touchscreen II (HP 150C)
HP Vectra

Supported on other computers:

IBM PC/XT/AT
Compaq Portable
AT&T 6300
Olivetti M24

HOW TO SELECT A TAPE DRIVE

There are five key types of tape drive applications:

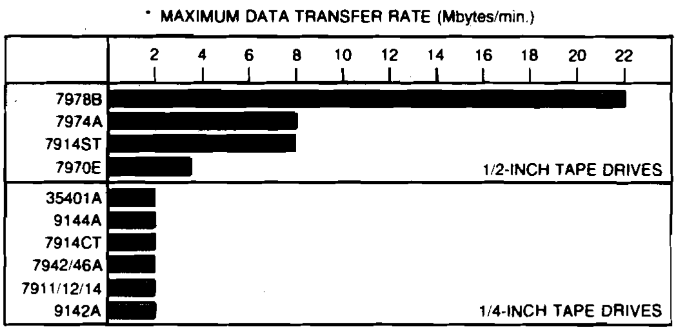
- **Backup for protection against operator error and equipment failure**
- **Archival storage for economical, long term data preservation**
- **Data exchange with other computers**
- **Software distribution**
- **Online Mass Storage for data logging and tape processing**

The key areas to consider when buying a tape drive are total megabytes of disc storage, tape drive performance, interchange standard (format/density), and budget.

PERFORMANCE AND CAPACITY

The speed of a tape drive and capacity of the media should be well matched to the user's computer system. In general, as the disc storage on a system increases, there is a corresponding need for a higher performance tape drive with higher capacity per reel to minimize backup times and improve data storage efficiency.

TAPE DRIVE PERFORMANCE



* Includes writing data, gaps, file marks, etc. but not rewind time, reel changes, or verify passes on HP, 7911/12/14 or HP 9142A.

Workstations and small multi-user systems

Desktop 1/4-inch cartridge tape drives are designed to backup personal computers, desktop and small commercial and technical computers. Priced at a fraction of the cost of a larger 1/2-inch tape drive, they are ideally suited for up to 134 megabytes of on-line disc storage with the performance and speed required by a small system. For instance, a 1/4-inch cartridge tape drive takes about 30 minutes to backup a 55 megabyte disc.

Midrange systems

A midrange system with up to 500 megabytes of disc storage requires a tape drive with a higher capacity to handle the data efficiently. A system of this size could be a multi-user office computer or a technical computer running a large application such as CAD/CAE.

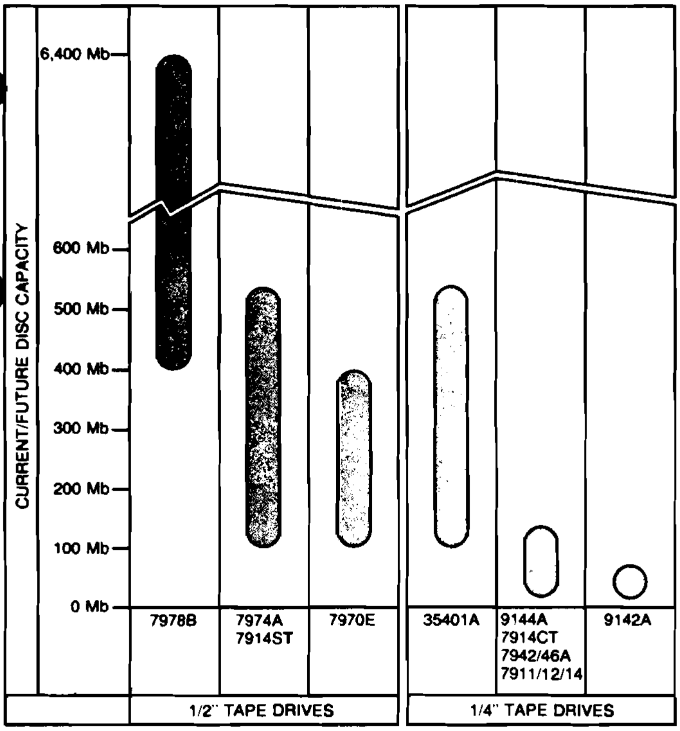
In the past, this usually meant purchasing a large 1/2-inch tape drive. HP's new 1/4-inch cartridge autochanger tape drive offers an alternative. Stacking up to eight cartridges in the cartridge magazine increases 1/4-inch cartridge backup capacity to 536 megabytes. While slower than a 1/2-inch reel to reel drive, this autochanger cartridge tape drive permits unattended backup, does not require a skilled operator and is suited for a quiet office environment.

On the other hand, a 1600 cpi 1/2-inch tape drive stores about 40 megabytes of data on each tape reel (similar to data cartridge capacity), but has a transfer rate that is about four times faster than a 1/4-inch drive. The 1/2-inch drive requires operator attention for changing reels, but performs faster backups. For example, a 1600 cpi tape drive can backup 100 megabytes in about to 20 minutes (including 2 reel changes). To back up the same 100 megabytes using the autochanger tape drive would take about 60 minutes (includes tape tensioning time).

High performance systems

For the large computer system with more than 400 megabytes of disc storage, a high density (6250 cpi), high speed drive is desirable. With a 6250 cpi drive, data can be transferred to the tape almost three times faster than it can be transferred to a 1600 cpi tape drive. A high density drive can store more than three times as much data per reel as a midrange tape drive, minimizing media expense and the number of times an operator needs to change tape reels to back up the system. For example it takes about 30 minutes for 400 megabytes with 2 reel changes.

RECOMMENDED TAPE DRIVE BASED ON DISC STORAGE



INTERCHANGE STANDARDS

If the user needs to share data between systems or distribute software to other systems, then a tape drive with the same density and format as the other drives must be purchased. It may also be important to have a tape drive that reads and writes in an industry standard format for data interchange between HP and non-HP systems. For instance, a 1600 cpi PE tape drive can only transfer data to another tape drive with 1600 cpi PE capability. However, a drive capable of multiple densities (6250/1600 or 1600/800 cpi) may be appropriate in those applications which require both high performance backup and data interchange. A user should plan for both current and future data interchange needs when selecting a tape drive.

INTERCHANGE STANDARDS

DENSITY/FORMAT	6,250 GCR	1,600 PE	800 NRZI	10,000 D.C. 600 H.C. PRE-FORMATTED CARTRIDGE	9,600 HP PC/T
PRODUCTS SUPPORTING FORMAT	7978B	7978B 7974A 7914ST 7970E	7974A 7914ST	9144A 7914CT 7942A/46A 7911/12/14 35401A	9142A
	1/2" TAPE DRIVES **INDUSTRY STANDARD FORMATS**			1/4" TAPE DRIVES **HP FORMATS**	

BUDGET

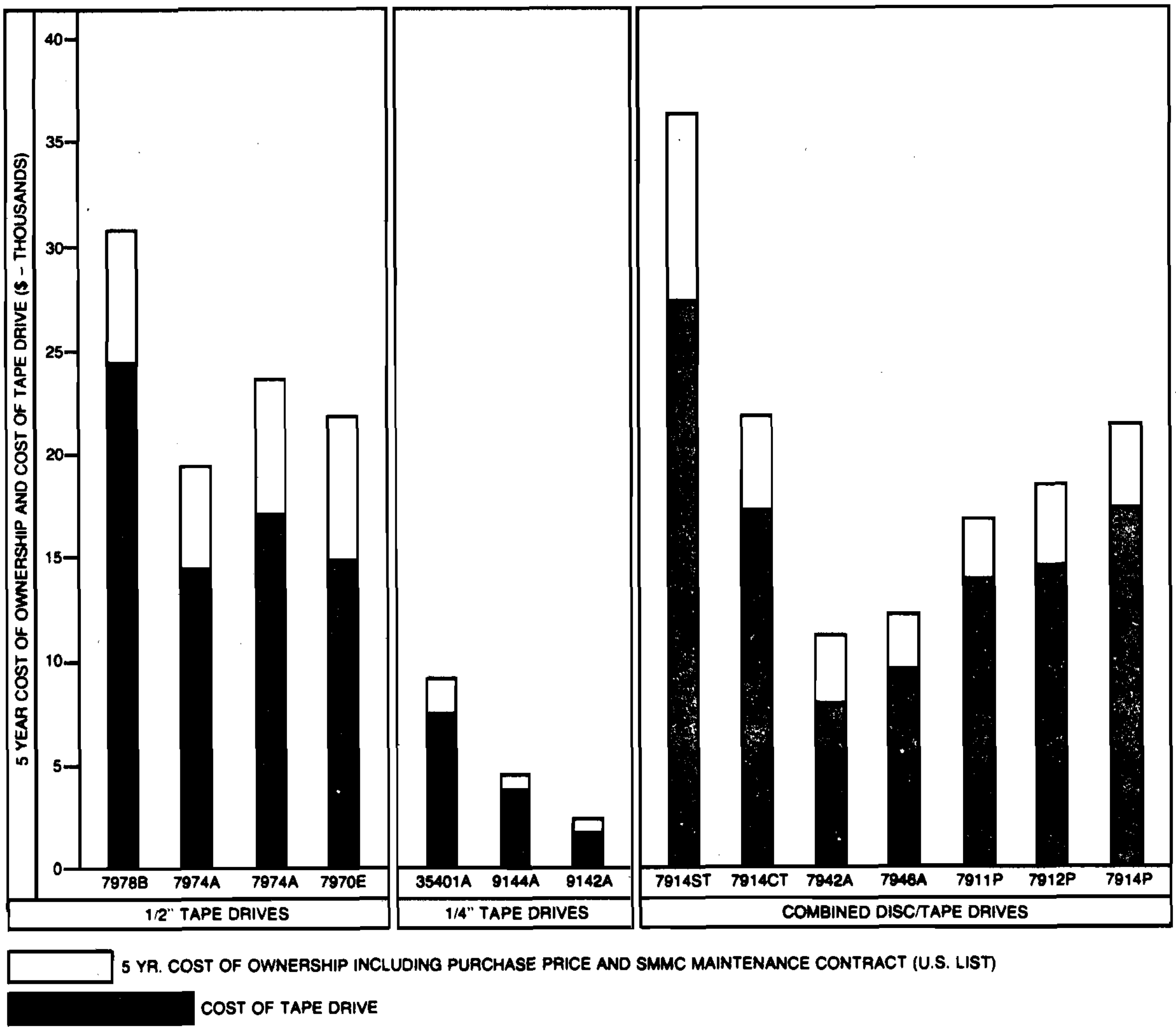
When buying a tape drive, one naturally looks at initial cost. Sometimes price alone can determine the level of backup performance one can buy. A second important factor is the cost of ownership--how much does the monthly maintenance contract contribute to the five year cost of owning the drive under consideration?

The chart shows only cash costs for purchase of products and maintenance contract costs. Other costs, such as operator's time, media, and media storage costs may need to be considered as well.

FUTURE GROWTH NEEDS

It is often the case that system enhancements and additions are planned to allow for increased business levels in the future. If disc capacity is expected to grow, it might be wise to purchase a faster or higher capacity backup device with the initial system. HP also provides attractive upgrade programs to allow smooth migration to higher performance products.

BUDGET



TECHNICAL SPECIFICATIONS

1/2-INCH TAPE DRIVES	HP 7978B	HP 7974A	HP 7914ST	HP 7970E
PERFORMANCE CHARACTERISTICS				
Burst Transfer Rate Half-inch tape drives				
6250 GCR	468 Kbytes/second	N/A	N/A	N/A
1600 PE	120 Kbytes/second	160 Kbytes/sec (streaming)	160 Kbytes/sec (streaming)	72 Kbytes/sec
800 NRZI	N/A	40 Kbytes/sec (streaming)	40 Kbytes/sec (streaming)	N/A
Data Capacity (2400 ft tape)				
6250 GCR	140 Mbytes, typical	N/A	N/A	N/A
1600 PE	40 Mbytes, typical	40 Mbytes, typical	40 Mbytes, typical	40 Mbytes, typical
800 NRZI	N/A	20 Mbytes, typical	20 Mbytes, typical	N/A
Data Capacity (Disc)	N/A	N/A	132 Mbytes	N/A
Maximum Block Size on tape (Block size may be limited by host operating system)	60 Kbytes (6250 cpi) 32 Kbytes (1600 cpi)	16 Kbytes (1600/800 cpi)	16 Kbytes (1600/800 cpi)	Not specified
FUNCTIONAL CHARACTERISTICS				
Density/Format	6250 cpi GCR 1600 cpi PE	1600 cpi PE 800 cpi NRZI (opt. 800)	1600 cpi PE 800 cpi NZI (opt. 800)	1600 cpi PE
Speed				
Read/Write/Speed	75 ips	100 ips (streaming) 50 ips (start-stop)	100 ips (streaming) 50 ips (start-stop)	45 ips
Rewind Search Speed	250 ips	200 ips	200 ips	160 ips
Internal Buffer Size	256 Kbytes	32 Kbytes	32 Kbytes	64 bytes
Operating Mode	Streaming	Streaming/start-stop	Streaming/start-stop	Start-stop
Interface	HP-IB (IEEE-488)	HP-IB (IEEE-488)	HP-IB (IEEE-488)	Parallel
ENVIRONMENTAL RANGES				
Temperature				
Operating Temperature (Range is media limited)	15° to 32°C (59° to 90°F)	15° to 32°C (59° to 90°F)	15° to 32°C (59° to 90°F)	15° to 32°C (59° to 90°F)
Storage Temperature	-40° to 75°C (-40° to 167°F)	-40° to 75°C (-40° to 167°F)	-10° to 65°C (14° to 149°F)	-40°to 75°C (-40° to 167°F)
Shipment Temperature	-40° to 75°C (-40° to 167°F)	-40° to 75°C (-40° to 167°F)	-40° to 60°C (-40° to 140°F)	-40° to 75°C (-40° to 167°F)
Rate of Change	20°C (36°F)/hour	20°C (36°F)/hour	10°C (18°F)/hour	20°C (36°F)/hour
Relative Humidity (Non-Condensing)				
Operating	Media limited to 20% to 80% at <29°C (84°F) maximum wetbulb temperature	Media limited to 20% to 80% at 25°C (78°F) maximum wetbulb temperature	Media limited to 20% to 80% at 25°C (78°F) maximum wetbulb temperature	Media limited to 20% to 80% at <29°C (84°F) maximum wetbulb temperature
Storage or Shipment	90% at 40°C (104°F) maximum	90% at 40°C (104°F) maximum	90% at 40°C (104°F) max.	90% at 40°C (104°F) max.
Altitude (Above Sea Level)				
Operating	3000 m (10,000 ft)	3000 m (10,000 ft)	3000 m (10,000 ft)	3000 m (10,000 ft)
Non-operating	15,000 m (50,000 ft)	15,000 m (50,000 ft)	15,000 m (50,000 ft)	15,000 m (50,000 ft)
Shock & Vibration (Non-operating)				
Shock	30 G, 11 ms duration half sine	20 G, 11 ms duration half sine	2 G, 11 ms duration half sine	30 G, 11 ms duration half sine
Vibration	Random: 5-500 Hz @ ~ 2.09G RMS Swept sine: 5-500 Hz @ constant acceleration of .5G max.	Swept sine 5-55-5 Hz @ constant acceleration of .75G max.	.002 G^2/Hz, 1 to 500 Hz	Swept sine 5-55-5 Hz @ constant displacement of .015 inches
Audible Noise (Sound Power)	58 dBA Sound Power	60 dBA Sound Power	68 dBA Sound Power (with one 7914 in cabinet)	52 dBA Sound Power
POWER REQUIREMENTS				
Line Voltage	Factory configured to 90 – 125 vac or 198 – 250 vac Cannot be field adjusted	Factory configured to 90 – 105 vac 110 – 125 vac 210 – 225 vac 230 – 245 vac Field adjustable	Factory configured to 90 – 105 vac 110 – 125 vac 210 – 225 vac 230 – 245 vac Field adjustable	115 vac (± 10%) std 230 vac (± 10%) opt. 015
Line Frequency	48 to 66 Hz Single phase	48 to 66 Hz Single phase	48 to 66 Hz Single phase	48 to 66 Hz Single phase
Power Consumption (Watts)	At 90 – 125 vac At 198 – 250 vac	451W maximum	520W maximum	800W maximum
Operating (any motion)	377W 397W	295W	262W	
Heat Dissipation	932 Btu/hr, max	734 Btu/hr, max	4266 Btu/hr, max Opt. 114 – 6485 Btu/hr	1364 Btu/hr, max
Line Current (Amperes-max. average)	At 90 - 125 vac At 198 - 250 vac	At 120 vac	At 117 vac	At 115 vac
Standby	3.5 A RMS max. 1.3 A RMS max.		12.3 RMS max	Not specified
Operating (any motion)	7.1 3.7	3.4 A RMS nominal	15 A RMS nominal	7 A RMS
Tolerated Line Dropout	20 ms dropout in 10 cycles	10 ms dropout in 10 cycles	10 ms dropout in 10 cycles	Not specified
PHYSICAL CHARACTERISTICS				
	With cabinet. OEM rackmount version available.			Rackmount version
Height	160 cm (63 inches)	160 cm (63 inches)	160 cm (63 inches)	60.9 cm (24 inches)
Width	60 cm (24 inches)	60 cm (24 inches)	60 cm (24 inches)	48.2 cm (19 inches)
Depth	78 cm (31 inches)	78 cm (31 inches)	81.3 cm (32.0 inches)	40.0 cm (15.75 inches)
Weight	190 kg (419 bls)	180 kg (400 pounds)	261 kg (574 pounds)	63.6 kg (140 pounds)

MAGNETIC TAPE

Width . . . . 12.7 mm (0.5 inch)
Thickness . . . . .038 mm (1.5 mils)
Use of 1 mil tape not recommended or supported.

Tape media should meet or exceed the following ANSI standards:
ANSI X3.40 – 1976
Media quality has a direct impact on drive performance.

Environmental and Power Requirement specifications were tested on sample units. Specific units may vary.

TECHNICAL SPECIFICATIONS

1/4-INCH TAPE DRIVES	HP 35401A		HP 9144A		HP 7914CT	
PERFORMANCE CHARACTERISTICS						
Data Capacity (Tape)						
Tapes per magazine	8 (maximum)		N/A		N/A	
Bytes per magazine	536.8 Mbytes (maximum)		N/A		N/A	
Cartridge capacity	600 ft cartridge 67.1 Mbytes	150 ft cartridge 16.7 Mbytes	600 ft cartridge 67.1 Mbytes	150 ft cartridge 16.7 Mbytes	600 ft cartridge 67.1 Mbytes	150 ft cartridge 16.7 Mbytes
Tracks per tape	16	16	16	16	16	16
User blocks per track	4096	1024	4096	1024	4096	1024
Frames per block	6 (4 data, 2 ECC)	6 (4 data, 2 ECC)	6 (4 data, 2 ECC)	6 (4 data, 2 ECC)	6 (4 data, 2 ECC)	6 (4 data, 2 ECC)
Bytes per frame	256		256		256	
Data Capacity (Disc)	N/A		N/A		132 Mbytes	
Transfer Rate (including data redundancy)	35 Kbytes/sec		35 Kbytes/sec		35 Kbytes/sec	
FUNCTIONAL CHARACTERISTICS						
Density	10,000 bits/inch		10,000 bits/inch		10,000 bits/inch	
Format	DC 600 HC Pre-recorded format		DC 600 HC Pre-recorded format		DC 600 HC Pre-recorded format	
Speed						
Read/Write/Speed	60 ips		60 ips		60 ips	
Rewind/Search Speed	90 ips		90 ips		90 ips	
Operating Mode	Streaming		Streaming		Streaming	
Interface	HP-IB (IEEE-488)		HP-IB (IEEE-488)		HP-IB (IEEE-488)	
ENVIRONMENTAL RANGES						
Temperature						
Operating Temperature (range is media limited)	5° to 40°C (41° to 104°F)		5° to 40°C (41° to 104°F)		10° to 40°C (50° to 104°F)	
Non-operating Temperature	-40° to 75°C (-40° to 167°F)		-40° to 75°C (-40° to 167°F)		-40° to 60°C (-40° to 140°F)	
Relative Humidity (Non-condensing) (media limited)	20% to 80% at <26°C (79°F) maximum wet bulb		20% to 80% at <26°C (79°F) maximum wet bulb		20% to 80% at <24°C (75°F) maximum wet bulb	
Altitude (Above Sea Level)						
Operating	0 to 4572m (0 to 15,000 ft)		0 to 4572m (0 to 15,000 ft)		Not specified	
Shock and Vibration (Non-operating)						
Shock	30 G, 11 ms duration half sine		30 G, 11 ms duration half sine		30 G, 11 ms duration half sine	
Vibration	Swept sine 5-55-5 Hz at constant displacement of .015 inches		Swept sine 5-55-5 Hz at constant displacement of .015 inches		5 to 350 Hz 0.008 G /HZ	
Audible Noise (Sound Power)	58 dBA		58 dBA		63 dBA	
POWER REQUIREMENTS						
Line voltage (nominal)	90 – 125V or 180 – 250V switch selectable		100 – 120V (115V setting) 200 – 240V (230V setting)		100 – 120V (115V setting) 200 – 240V (230V setting)	
Line Frequency (range)	48 – 66 Hz		48 – 66 Hz		48 – 66 Hz	
Power Consumption (Watts)	725 Watts		725 Watts		700 Watts (maximum)	
Heat Dissipation	247 Btu/hr		247 Btu/hr		2389 Btu/hr	
PHYSICAL CHARACTERISTICS						
Height	260 mm (10.2 in)		132 mm (5.2 in)		720 mm (28.4 in)	
Width	325 mm (12.8 in)		325 mm (12.8 in)		375 mm (14.8 in)	
Depth	575 mm (22.6 in)		285 mm (11.2 in)		777 mm (30.5 in)	
Weight	22.5 kg (50.5 lbs)		8.64 kg (19 lbs)		109 kg (239 lbs)	

Environmental and Power Requirement specifications were tested on sample units.

TECHNICAL SPECIFICATIONS

1/4-INCH TAPE DRIVES	HP 7942/46A		HP 7911/12/14		HP 9142A	
PERFORMANCE CHARACTERISTICS						
Data Capacity (Tape)						
Tapes per magazine	N/A		N/A		N/A	
Bytes per magazine	N/A		N/A		N/A	
Cartridge capacity	600 ft cartridge 67.1 Mbytes	150 ft cartridge 16.7 Mbytes	600 ft cartridge 66.9 Mbytes	150 ft cartridge 16.7 Mbytes	600 ft cartridge up to 60 Mbytes	150 ft cartridge up to 15 Mbytes
Tracks per tape	16	16	16	16	16	16
User blocks per track	4096	1024	4096	1024	915	288
Frames per block	6 (4 data, 2 ECC)	6 (4 data, 2 ECC)			6 (4 data, 2 ECC)	6 (4 data, 2 ECC)
Bytes per frame	256		256		up to 1024	up to 1024
Data Capacity (Disc)	24 Mb (7942A), 55 Mb (7946A)		28 MB (7911), 65 MB (7912) 132 MB (7914)		N/A	
Transfer Rate (including data redundancy)	35 Kbytes/sec		35 Kbytes/sec		35 Kybtes/sec	
FUNCTIONAL CHARACTERISTICS						
Density	10,000 bits/inch		10,000 bits/inch		9600 bits/inch	
Format	DC 600 HC Pre-recorded Format		DC 600 HC Pre-recorded Format		PC/T	
Speed						
Read/Write/Speed	60 ips		60 ips		62.5 ips	
Rewind/Search Speed	90 ips		90 ips		90 ips	
Operating Mode	Streaming		Streaming		Streaming	
Interface	HP-IB (IEEE-486)		HP-IB (IEEE-488)		HP-IB (IEEE-488) (Interface available for IBM and supported compatibles)	
ENVIRONMENTAL RANGES						
Temperature						
Operating Temperature (range is media limited)	5° to 40°C (40° to 104°F)		10° to 40°C (50° to 104°F)		5° to 40°C (41° to 104°F)	
Non-operating Temperature	-40° to 60°C (-40° to 140°F)		-40° to 60°C (-40 to 104°F)		-40° to 75°C (-40° to 167°F)	
Relative Humidity (Non-condensing) (media limited)	20% to 80% at <26°C (79°F) maximum wet bulb		20% to 80% at <29°C (79°F) maximum wet bulb		20% to 80% at <26°C (79°F) maximum wet bulb	
Altitude (Above Sea Level)						
Operating	0 to 3000m (0 to 10,000 ft)		0 to 4572m (0 to 15,000 ft)		0 to 4572m (0 to 15,000 ft)	
Shock and Vibration (Non-operating)						
Shock	20 G, 11 ms duration half sine		20 G, 11 ms duration half sine		159 G, 2.3 ms duration half sine 30 G, 23 ms duration trapezoidal	
Vibration	5 x 10^{-4} G^2/Hz, 10-2000 Hz		5 x 10^{-4} G^2/Hz, 10-2000 Hz		Random 5-500 Hz @ ~2.42 G RMS Swept sine 5-500 Hz at constant acceleration of .75 G	
Audible Noise	52 dBA Sound Power		88 dBA Sound Power (791XP) Not specified (791XR)			
POWER REQUIREMENTS						
Line voltage (nominal)	100 – 120V (115V setting) 200 – 240V (230V setting)		100 – 120V (+5%, -10%) 220 – 240V (+5%, -10%)		100 – 120V~ (115V setting) 200 – 240V~ (230V setting)	
Line Frequency (range)	47.5 – 66 Hz		47.5 – 66 Hz		48 – 66 Hz	
Power Consumption (Watts)	120 Watts, typical		700 Watts, maximum		39.7 Watts	
Heat Dissipation	410 Btu/hr		2389 Btu/hr		136 Btu/hr	
PHYSICAL CHARACTERISTICS						
			7911/12/14R	**7911/12/14P**		
Height	208 mm (8.2 in)		310 mm (12.2 in)	720 mm (28.3 in)	132 mm (5.2 in)	
Width	325 mm (12.8 in)		482 mm (19.9 in)	482 mm (19.9 in)	325 mm (12.8 in)	
Depth	285 mm (11.2 in)		744 mm (29.3 in)	744 mm (29.3 in)	285 mm (11.2 in)	
Weight	15.8 kg (34.8 lbs)		87.2 kg (148 lbs)	85.4 kg (188 lbs)	8.64 kg (19 lbs)	

Environmental and Power Requirement specifications were tested on sample units. Specific units may vary.

1/2-INCH TAPE DRIVES

HP 7978B and HP 7974A
Tape Head Cleaner
Foam Swabs (1 Package)
2400 ft. Reel of Magnetic Tape
2 Meter Shielded HP-IB Cable
Power Cable
Operator Manual

HP 7914ST
Same as HP 7974A Plus:
Operator Manual (Disc Drive)
Installation Manual
Site Environmental Requirements Manual
Installation and Service Manual

HP 7970E
Tape Head Cleaner
Empty 2400 ft. Take-up Reel
2400 ft. Reel of Magnetic Tape
Operator Manual

1/4-INCH CARTRIDGE TAPE DRIVES

HP 35401A
Cleaning Cartridge Kit
1 Meter HP-IB Cable
Power Cord
Cartridge Magazine
Tape Cartridge (600 ft.)
Quick Reference Guide
User Manual

HP 9144A
Head Cleaner
Swabs
Power Cable
Fuse, 3.0 Amp
Tape Cartridge (600 ft.)
User Manual

HP 7914CT
Same as HP 9144A Plus:
HP 7914CT Installation, Operating and Service Manual
HP Operator Instructions (Disc)
Operating and Installation Manual (Disc)
Two HP-IB Cables (1 Meter Long)
Two Power Cords

HP 7942A/HP 7946A
Head Cleaner
Swabs
Two Fuses, 5-Amp, 250V, No Time Delay
Tape Cartridge (600 ft.)
User Manual (Tape)
Owner's Manual (Disc)
Site Environmental Requirements Manual

HP 7911/12/14 P&R
Tape Head Cleaner Solution
Lint Free Swabs
7911/12 - One 67 Mbyte 600 ft. Tape Cartridge
7914 - Two 67 Mbyte 600 ft. Tape Cartridges
1 Meter HP-IB Cable (R Version Has 2 Meter Cable)
Operator Instructions
Operating and Installation Manual
Site Environmental Requirements Manual

HP 9142A
Head Cleaner
Swabs
Fuse
Power Cable
Tape Cartridge (600 ft.)
User Manual

ORDERING INFORMATION

Since there may be specific cabling, I/O board and operating system requirements as well as software support issues, please consult an HP sales representative for configuration information before selecting a tape drive.

1/2-INCH TAPE DRIVES

■ 6250 GCR/1600 PE streaming tape drive

6250 GCR/1600 PE streaming tape drive	**HP 7978B**
OEM delete cabinet option	**HP 7978B,Opt.135**
HP 7978A to HP 7978B upgrade kit	**88702A**

■ 1600 PE half-inch tape drives

1600 start-stop/streaming drive	**HP 7974A**
HP 7974A tape drive with 132 Mb disc drive	**HP 7914ST**
Start-stop tape drive with parallel interface	**HP 7970E**
Master drive: Lo-boy cabinet	**HP 7970E, Opt.226**
No cabinet	**HP 7970E, Opt.236**
Add-on master drive with multi-unit cable	**HP 7970E, Opt.230**
Component OEM drive without cabinet or interface	**HP 7970E, Opt.151**

■ 800 NRZI half-inch tape drive

800 NRZI/1600 PE start-stop/streaming drive	**HP 7974A, Opt.800**
HP 7974A tape drive with 800 NRZI plus 132 Mb disc drive	**HP 7914ST,Opt.800**
HP 7974A 1600 cpi to HP 7974A 1600/800 cpi upgrade kit	**HP 88700A**

1/4-INCH CARTRIDGE TAPE DRIVES

■ DC 600 format 1/4-inch tape drives for workstation & small multi-user systems

1/4-inch cartridge autochanger tape drive	**HP 35401A**
For use with HP 9000 Series 500	**HP 35401A, Opt. 500**
1/4-inch cartridge tape drive	**HP 9144A**
For use with Touchscreen PC's (HP 150)	**HP 9144A, Opt.150**
HP 9144A with 132 Mb disc drive	**HP 7914CT**
For 220V/50Hz operation	**HP 7914CT,Opt.015**
HP 9144A with 24 Mb disc drive	**HP 7942A**
For 230V operation	**HP 7942A, Opt.015**
HP 9144A with 55 Mb disc drive	**HP 7946A**
For 230V operation	**HP 7946A, Opt.015**
28/65 Mbyte disc drive, integral cartridge tape drive	**HP 7911/12/14P**
28/65/132 Mb disc drive with integral cartridge tape drive (rackmount)	**HP 7911/12R**
220V/50Hz operation	**HP 7911/12/14, Opt. 015**
Dedicated tape controller (for HP 3000 systems) includes extra 1m HP-IB cable	**HP 7911/12/14, Opt. 001**

■ PC/T format 1/4-inch tape drive for Personal Computers

1/4-inch tape drive for Personal Computers	**HP 9142A**
For use with Touchscreen PC's (HP 150)	**HP 9142A, Opt.150**

SAFETY AND EMI COMPLIANCE

Safety Requirements/Standards

All products listed in this data sheet meet the following:

Underwriters Laboratories, Inc.
UL 478: Information-Processing and Business Equipment
UL 114: Office Appliances and Business Equipment

Canadian Standards Association
CSA C22.2 #154–M1983: Data Processing Equipment

International Electrotechnical Commision
IEC Publication 435: Satety of Data Processing Equipment
IEC Publication 380: Satety of Electrically Energized Office Machines

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	1/2-Inch Tape Drives		**1/4-Inch Tape Drives**	
EMI Requirements/Standards	HP 7978B[1] HP 7974A	HP 7914ST HP 7970E	HP 9144A HP 7914CT HP 7942/46 HP 9142A	HP 35401A HP 7911/12/14[2]
FCC				
Class A Part 15 for Computing Equipment	X	X		X
Class B Part 15 for Computing Equipment			X	
FTZ				
Level A (1046/84)(Capable of Level B with a Level B SPU)	X	X	X	X

[1] The HP 7978B, Opt. 135 requires final packaging to meet stability standards of UL, CSA and IEC for end user products.

[2] The rackmount versions of the disc drives (HP 7911/12/14R) are sold as component products and are incomplete in nature. These products have not been tested to comply with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules which are designed to provide reasonable protection against such interference when operated in a commercial environment. When installed in a complete computing device product, these units require testing to the Class A limits.

Questions concerning regulatory agency compliance should be directed to the local Hewlett-Packard Sales and Service Office.

WARRANTY & SERVICE

Most HP tape products are warranted against defects in material and workmanship for 90 days following date of installation. (The HP 9142A is covered by a one year warranty.) HP will repair or replace products which prove to be defective during the warranty period. A copy of the complete warranty statement is available upon request.

HP offers complete service and maintenance worldwide. Maintenance agreements are available for all HP peripheral products. Advantages of these agreements to the customer include a fixed annual cost, individualized cost-effective contracts and a choice of response time. Current rates can be determined by contacting your local HP Sales Office.

The selection and use of media, supplies and consumables is the customer's responsibility. Hewlett-Packard reserves the right to exclude from the warranty or service agreement any repairs for damage to HP products which HP reasonably determines or believes were caused by the use of non-HP media or cleaning supplies. Hewlett-Packard will, upon request, repair such damage on a time and material basis.

* The information and specifications presented in this data sheet are subject to change without notice.

For assistance call the HP regional office nearest you: Eastern 301/670-4300, Midwest 312/255-9800, Southern 404/955-1500, Western 818/509-2300, Canadian 416/678-9430. Or write to Hewlett-Packard 700 71st Ave. Greeley, CO 80634; in Europe, Hewlett-Packard, S.A, 150 Route du Nant-D'Avril, CH-1217 MEYRIN 2 (Geneva) Switzerland; elsewhere in the world, Hewlett-Packard Intercontinental, 3495 Deer Creek Road, Palo Alto, California 94304.

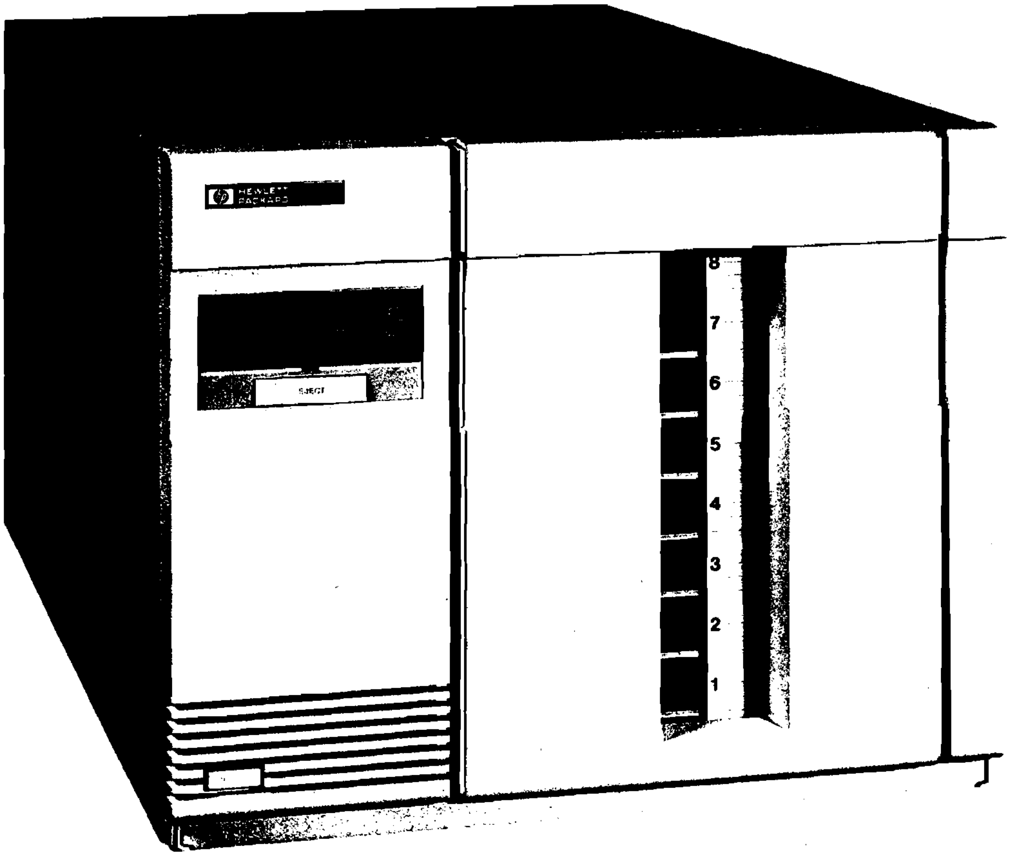
Printed in U.S.A. 4/1/86
5953-6868

HEWLETT PACKARD

HP 35401A
¼-inch Cartridge Autochanger Tape Subsystem

Technical Data March 1986

Simplify your operations with ...



HEWLETT PACKARD
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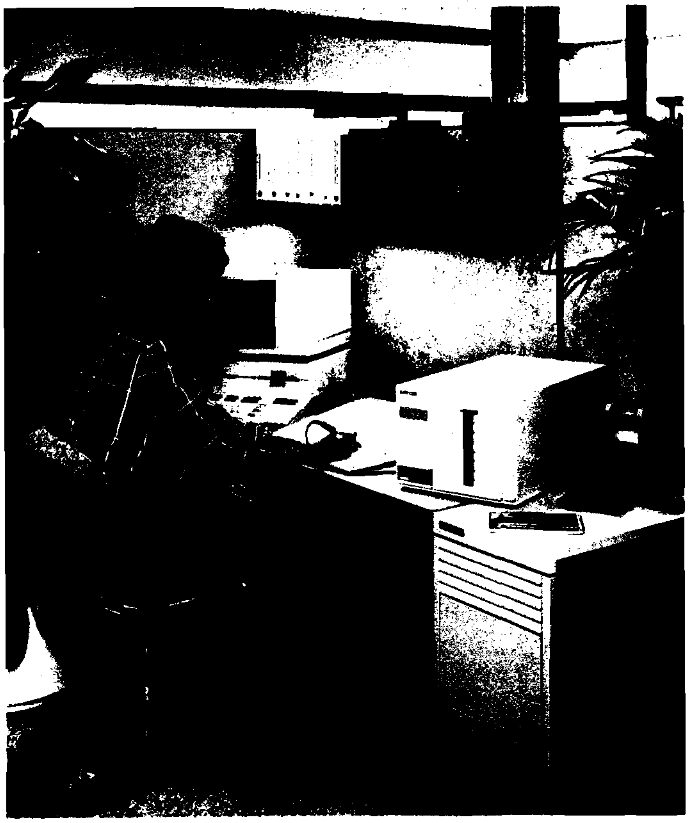
...536 Mbytes of cartridge tape storage

Solving Your Problems...

- Cost-effective system backup for up to 536 Mbytes of disc storage
- Allows unattended system backup to 536 Mbytes
- Media compatible with HP 9144A and HP's integrated cartridge tape/disc drives
- Transfer rate to 2 Mbytes per minute
- Suitable for use in the Design Plus cabinet or as a stand-alone unit
- Read-while-write and error correction to ensure data integrity
- Two modes of operation for application flexibility
- Removable cartridge magazine for easy cartridge loading and storage



Offering 536 Mbytes of storage, the HP 35401A ¼-inch Cartridge Autochanger Tape Subsystem (tape drive) is a versatile solution to your backup needs.

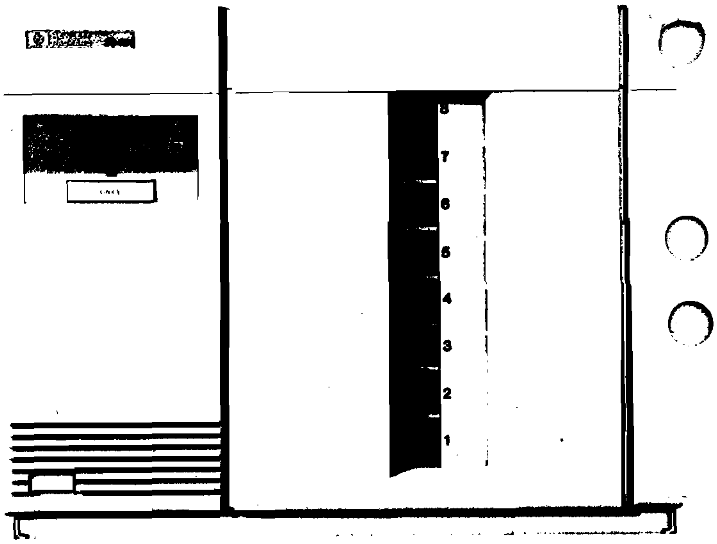
The Importance of Backup

System backup is important. In the rare event that a file is accidentally lost or a system develops a fault, it's reassuring to know that your data is safe -indeed, many businesses can depend upon it.

However, if backup is difficult to do it won't get done as often as necessary. The HP 35401A, a really simple backup solution, will help.

Planning for Future Growth

As your computer system grows backup times will increase. Consequently, the tape drive that you originally purchased may no longer be well matched to your disc storage. In addition, you will probably see your backup becoming more labor intensive.



The HP 35401A offers you a solution which will satisfy your present needs and allow for future growth up to 536 Mbytes.

Reduce Operating Costs with Unattended Backup

You often pay more to operate a tape drive than just its purchase price and media cost. In fact, the largest single expense could well be hidden operator cost.

With the HP 35401A you can avoid costly overtime or the need to shut down your system for backup during normal working hours.

The HP 35401A...

The HP 35401A combines the major components of the HP 9144A tape drive with an autochanger mechanism. This reliable combination automates cartridge loading and unloading, and allows the drive to use up to eight cartridges from a removable magazine.

Application Flexibility

Because cartridge changing no longer requires an operator, the HP 35401A is well suited to unattended backup and software duplication.

Cartridges can be accessed in either a sequential or a selective manner. In the sequential mode each cartridge is accessed in turn, one through eight. Alternatively, on some systems, cartridges may be accessed in any order by using the selective mode.

These two modes of operation offer you many ways to structure your data. For example, a single magazine could be used for a week's backup, perhaps allocating cartridges by day of the week.

With its capacity of 536 Mbytes, you can also use the HP 35401A for on-line data storage in applications where access times are not critical. An example would be the sharing of reference data and libraries in a network.

Simple to Use

You don't have to be a computer expert to benefit from the HP 35401A. After just a few minutes use you will find that it is very easy to operate.

CERTIFIED DATA CARTRIDGE 600 ft.

The chances of operator error are minimised with a comprehensive display and the convenient cartridge magazine. You will also find that the magazine doubles as an excellent storage container.

For straightforward use, just place your cartridges into the magazine and load it into the drive. From then on the HP 35401A takes care of everything.

Uses Compatible Media

The HP 35401A uses the same popular cartridge and data format that is used in the HP 9144A and HP's range of integrated cartridge tape/disc drives (e.g. 7908/11/12/14). This means that you can exchange data between any of these drives and the HP 35401A.

Pays for Itself

Through its capability for unattended system backup you will find that the HP 35401A can quickly pay for itself. Savings will soon become apparent through reduced overtime payments and increased system availability during the working day.

Designed for the Office

Whether used as a stand-alone unit, or integrated with a computer system in a system package, you'll find that the HP 35401A fits well into your office. It occupies about one tenth the space of a reel-to-reel tape drive and both its noise and heat output levels are unobtrusive.

OPERATING SPECIFICATIONS

Performance

TRANSFER RATE: 2 Mbytes per minute (system dependent).

TAPE SPEED (maximum sustained):

Read/Write: 60 inches per second
Search/Rewind: 90 inches per second

Capacity

TAPES PER MAGAZINE: 8 (maximum)
BYTES PER MAGAZINE: 536.8 Mbytes (maximum)
TRACKS PER TAPE: 16
USER BLOCKS PER TRACK

16.7 Mbytes, 150 foot Cartridge: 1024
67.1 Mbytes, 600 foot Cartridge: 4096

FRAMES PER BLOCK: 6 (4 for data and 2 for error correction).

BYTES PER FRAME: 256

Format and Density

ENCODING TECHNIQUES: MFM
BIT DENSITY: 10,000 bits per inch

Operating Modes

SEQUENTIAL
SELECTIVE

OVERALL CHARACTERISTICS

Interface

HP-IB (IEEE-488 1978) using CS/80 protocol

Electromagnetic Emissions

RADIATED AND CONDUCTED INTERFERENCE:

USA; meets FCC Rules Part 15 Class A computing devices requirements.
Europe; meets FTZ 1046/84 computing devices.

Sound Power

NOISE POWER EMISSION: < 5 Bels Averaged over a typical operation cycle.

Environmental Specifications

Operating Limits (media limited)

TEMPERATURE: 5°C to 40°C (40°F to 104°F)
HUMIDITY: 20% to 80% with maximum wet bulb temperature not to exceed 26°C (79°F)
ALTITUDE: 0 to 4572 metres (0 to 15,000 feet)
SHOCK: 2 G maximum 11 milliseconds duration
VIBRATION: 5 to 350 Hz 0.0001 G^2/Hz

Non-operating Limits

Storage and Transit of Drive

TEMPERATURE: −40°C to 75°C (−40°F to 167°F)
SHOCK: 30G maximum 11 milliseconds duration
VIBRATION: 5 to 350 Hz 0.008 G^2/Hz

Storage and Transit of Media

TEMPERATURE: −40°C to 45°C (−40°F to 113°F)

Power

LINE VOLTAGE: 90 to 125 V or 180 to 250 V at 125 W rms; switch selectable
LINE FREQUENCY: 48 to 66 Hz

Physical

NET WEIGHT: 22.5 kg (50.5 lb)
SHIPPING WEIGHT: 27 kg (60.5 lb)
HEIGHT: 260 mm (10.2 inch)
DEPTH: 575 mm (22.6 inch)
WIDTH: 325mm (12.8 inch)

SAFETY

- CSA certified to CSA 22.2 No. 154
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

ORDERING INFORMATION

The HP 35401A is customer installable and has no options available.

HP 35401A: includes the Tape Drive along with the standard accessories supplied.

Accessories Supplied

HP 35401A User's Manual: 35401-90902
HP 35401A Quick Reference Guide: 35401-90903
Cartridge Magazine: HP 92192C
67.1 Mbytes, 600 foot Cartridge
HP-IB Cable 1.0 metre: HP 10833A
Power Cable: *Suitable for country of destination*
Cleaning Cartridge Kit*: HP 92193E

Accessories Available

HP 35401A Hardware Support Manual: 35401-90904
Cartridge Magazine: HP 92192C
Cleaning Cartridge Kit*: HP 92193E
Replenishment Kit for HP 92193E*: HP 92193P
Pack of five 16.7 Mbytes tape cartridges: HP 88140SC
Pack of five 67.1 Mbytes tape cartridges: HP 88140LC
Design Plus Mobile Minirack System Cabinet: HP 92211R
Rail Kit for HP 92211R: HP 92211S
Filler Panel Kit for HP 92211R: HP 92211T
19-inch EIA Rackmount Kit: HP 35490A

**Periodic cleaning of the HP 35401A read/write head is recommended to ensure correct operation (after a magazine of new cartridges has been used, when read/write errors occur or on a weekly basis).*

Hewlett-Packard, in a continuing effort to offer excellent products at a fair value, reserves the right to change specifications, designs and models without notice.

For assistance call the HP regional office nearest you: Eastern 301/258-2000, Midwest 312/255-9800, Southern 404/955-1500, Western 213/877-1282, Canadian 416/678-9430. Or write to: Hewlett-Packard, 1820 Embarcadero Road, Palo Alto, California 94303; in Europe; Hewlett-Packard S.A., 7 rue de Bois-du-Lan, P.O. Box CH-1217 MEYRIN 2, Geneva, Switzerland; elsewhere in the world; Hewlett-Packard Intercontinental, 3495 Deer Creek Road, Palo Alto, California 94303.

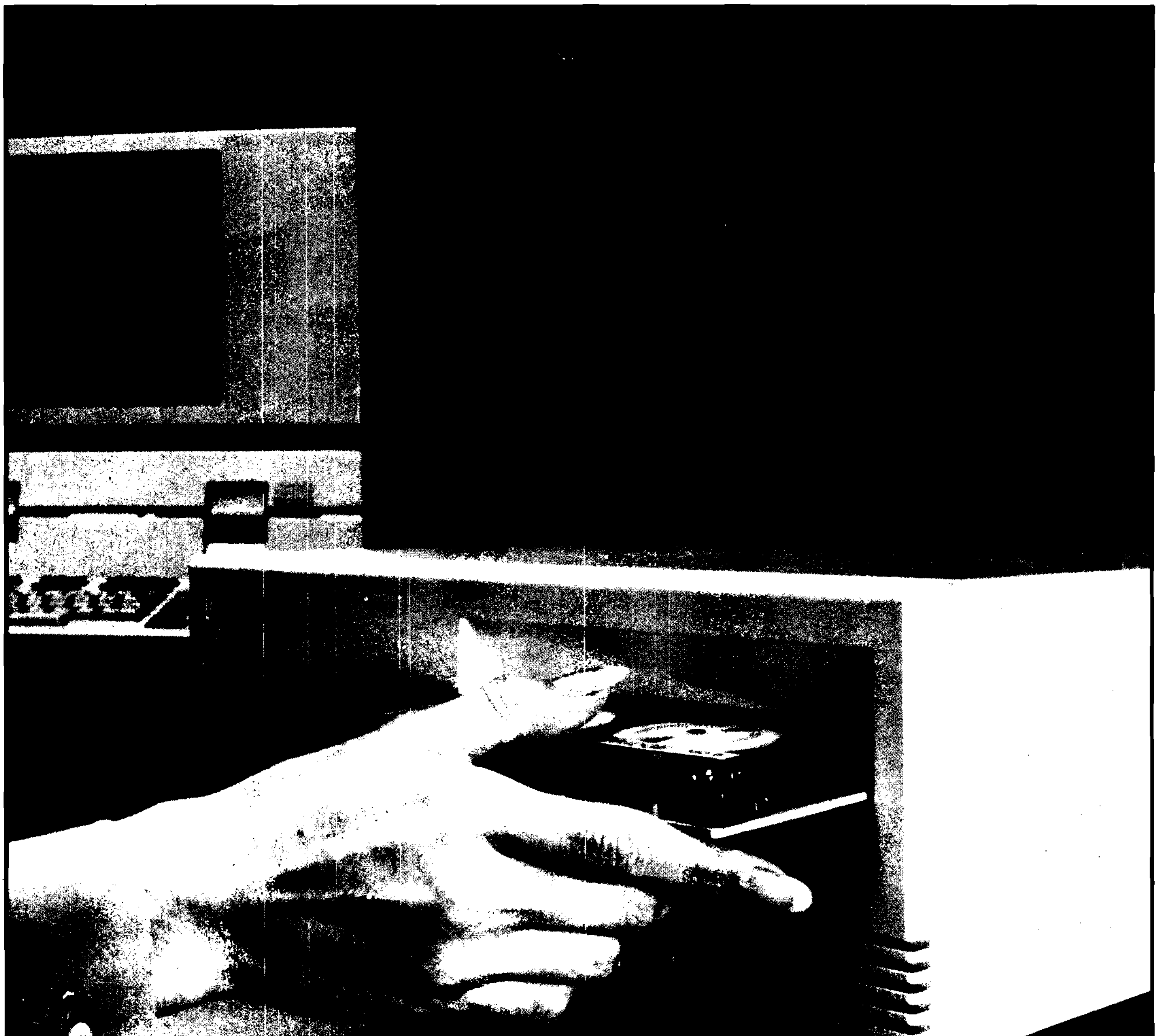
HEWLETT PACKARD

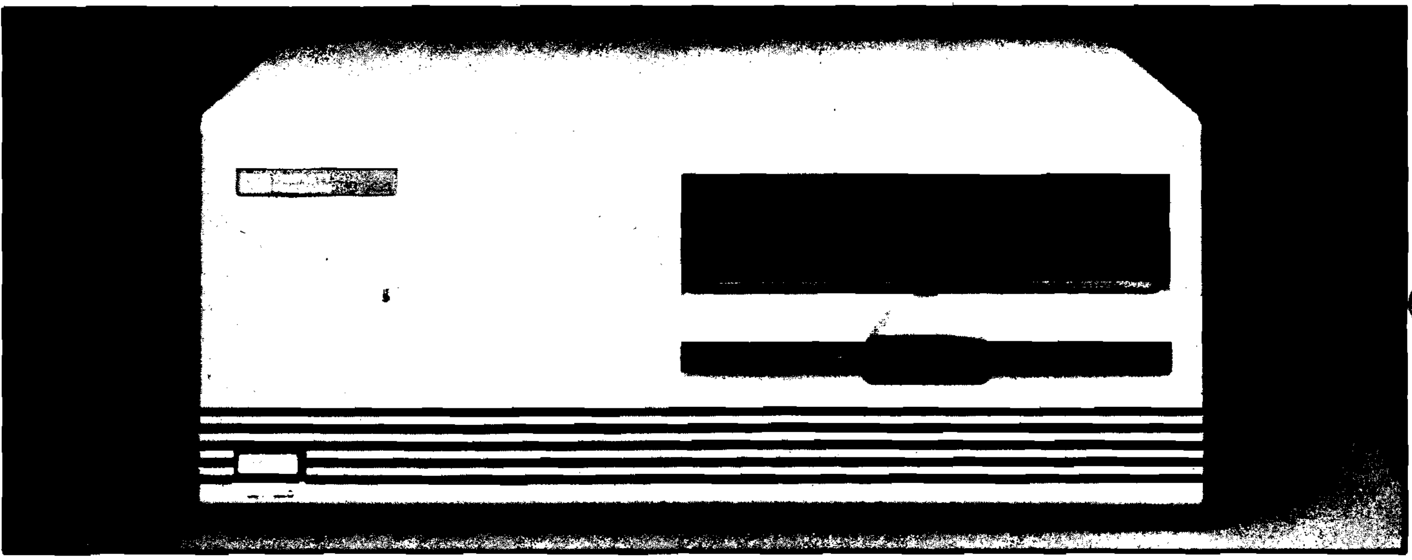
Printed in U.K. 02/86
5954-1954

HP 9144A
1/4" Tape Cartridge Subsystem

The right backup choice for your small to midrange system

* Technical Data Sept., 1984





HP 9144A: Combining HP quality and technology for backup confidence

- Low cost backup of fixed discs with capacities of up to 132 Mbytes using convenient 16 or 67 Mbyte cartridges
- Compact in-basket size cartridge tape drive saves valuable desk-top space
- Read-after-write and error correction capabilities assure you that valuable data is not lost
- Extensive built-in diagnostics confirm the drive is operational and mean faster repairs should a failure occur
- Compatibility with existing cartridge subsystems built into HP discs offers data interchange

Easy to use, low cost data protection

The HP 9144A is a compact, in-basket size 1/4 inch cartridge tape subsystem designed for easy to use, low cost backup of HP fixed discs with capacities of up to 132 Mbytes. It can sit on the desktop, be packaged in a pod configuration or mounted in a standard 19" rack.

Backup matched to your desktop or personal workstation

With performance up to 2 Mbytes/min (depending on host software), the cartridge tape drive offers small to midrange system users a cost effective and convenient alternative to multiple floppies at about one third the cost of the faster half inch tape drives.

Multiple applications offer system versatility

Utilizing a 12 Kbyte buffer in the drive and optimized system software which minimizes waiting for data transfers and commands from the host, the HP 9144A operates in streaming mode providing fast, efficient backup. It has the capability, depending on the system, for both selective file and image backup and is also used for software distribution and for data interchange between HP systems. Additionally, it is suitable for limited transaction logging operations.

Choose the right cartridge for your disc and application

Cartridges are available in two sizes, 16 and 67 Mbytes. Both are fully interchangeable in the tape drive and require no system reconfiguring or operator adjustments. Choose the cartridge capacity to match the size of your disc or application. The 16 Mbyte version with 75% less tape than the 67 Mbyte cartridge is more appropriate for applications requiring frequent cartridge loading or unloading such as personal I/O, software distribution or specific file searching. The 67 Mbyte version is an excellent match for the larger discs. 132 Mbytes can be backed up using only two cartridges. Compatible with existing cartridge subsystems built into HP discs (HP 7908/11/12/14), one drive can read media written on another drive just by inserting a cartridge.

Automatically protects your valuable data three ways

Read-after-write capability provides automatic data verification during the write process. Any media problems are detected immediately during writing, not later when an attempt is made to read the data back.

Data reliability is ensured during the read process by exclusive-or error correction which uses data redundancy for automatic error detection and correction. This means that if data becomes defective and you attempt to read it back, the drive has the capability, under most circumstances, of reconstructing the corrupt data.

Another contribution to data integrity is the built-in Media Monitor. Before the media usage begins to affect data reliability, a light flashes indicating that it is time to replace the tape. You don't replace the media too soon, and you don't risk losing data on worn media.

HP reliability designed into the drive

An electro-mechanical servo control feature provides gentle acceleration and deceleration as the drive starts and stops which increases both tape and drive motor life for better media and drive reliability.

Extensive internal diagnostics have been designed into the HP 9144A. The power-on self test indicates that the drive is operational. If a problem does occur, the operator is alerted by a light on the front panel. Rear panel diagnostics indicate the actual field replaceable unit that failed. Quick isolation of failure and ease of repair means minimum downtime for servicing plus lower maintenance costs.

Technical Specifications

Storage Capacity	16.7 and 67.1 Mbyte cartridges
Tracks/Tape	16
User Blocks/Track	
16 Mbyte (150′)	1024 maximum
67 Mbyte (600′)	4096 maximum
Frames/Block	6 (4 frames for user data plus 2 frames for data recovery)
Bytes/Frame	256
Transfer Rate	
Maximum Sustained	
Transfer Rate†	2 Mbytes/minute
Tape Speed	60 inches/second (read/write) 90 inches/second (search/rewind)

† Maximum sustained transfer rate does not necessarily reflect system throughput which varies depending upon application, file structures and host/tape driver implementation.

Interface	HP-IB (using CS80 protocol)

HP Supported Configurations
HP 9000, Series 200
HP 1000, A Series
For further support information and future supported configurations, see support chart on back.

Format	
Encoding	MFM
Bit Density	10,000 bits/inch (bpi)
Physical Specifications	
Net Weight	8.67 kg (19 lbs)
Height	125 mm (4.9 in)
Depth	285 mm (11.2 in)
Width	325 mm (12.8 in)
Power Requirements	
Line Voltage	90-125 volts or 180-250 volts @ 125 watts RMS (switch selectable)
Line Frequency	48-66 Hertz
Environmental Specs	
Operating Limits	
Temperature	5°C to 40°C (41°F to 104°F) (media limited)
Humidity	20% to 80% with maximum wet bulb temperature (non-condensing) not to exceed 26°C (79°F) (media limited)
Altitude	0 to 4572 m (0 to 15,000 ft)
Non-operating Limits	
Storage and transit of drive	
Temperature	-40°C to 75°C (-40°F to 167°F)
Altitude	-304 to 15240 m (-1000 to 50,000 ft)
Storage and transit of media	
Temperature	-40°C to 45°C (-40°F to 113°F)
Noise Level (db)	<60 dbA

Accessories

Supplied	HP Part Number
Power Cable	*
Operator's Manual	09144-90000
Fuse 3.0 Amp	2110-0003
Tape Cartridge (600′)	88140LC
Head Cleaner**	8500-1251
Swabs	9300-0767

* Power cable supplied dependent on shipping destination.

** Periodic cleaning required to ensure proper operation (after a new cartridge is inserted, when read/write errors occur or at least once a week).

Available	HP Part Number
HP-IB Interface Cable	
.5 meter	10833D
1 meter	10833A
2 meter	10833B
4 meter	not recommended
19″ Rack Mount Kit	19500A
Cartridges	
16.7 M byte formatted/certified	
Box of 5	88140SC
67 M byte formatted/certified	
Box of 5	88140LC
Cleaning Supplies	
Magnetic Head Cleaning Kit	92193H
Individual Cleaning Supplies	
Tape Head Cleaner, 6 4 oz bottles	92193X
Foam Swabs (50 per package)	
wooden shaft	9300-0468
plastic shaft	9300-0767
Lint-free Wipes (100 per bag)	92193W

HP Supported Configurations
HP 9144A

Mainframe	Op. System	Supported	Interface	Cable	Notes
HP 9000					
Series 200	Basic Pascal HP-UX	Yes Yes Yes	98624A or internal 98625A	HP-IB Must order cable separately.	
Series 500	HP-UX Basic	Yes Planned	27110A 27110A	Optional cable lengths available. (All)	Represents 1 HP-IB load. (All)
HP 1000					
MEF Series		No support planned			
A Series	RTE A.84	Yes	12009A		Performance improvements planned for future O/S
HP 3000	MPE	Yes	30079A		Does not require dedicated GIC
Touchscreen	MS-DOS	Yes			Order Opt. 150

Safety and EMI Compliance

HP 9144A meets the following requirements/standards

Electronic Data Processing Requirements

Underwriters Laboratories, Inc.
UL 478: Electronic Data Processing Equipment (EMRT)

UL 114: Office Appliances and Business Equipment (QAOT)

Canadian Standards Association
CSA C22.2 #154: Data Processing Equipment

International Electrotechnical Commission
IEC 380 and 435

FCC
Class B Part 15 for computing equipment

VDE
Level B with a Level B SPU

Questions concerning regulatory agency compliance should be directed to the local Hewlett-Packard Sales and Service Office.

Warranty & Service

HP tape products are warranted against defects in material and workmanship for 90 days following date of installation. HP will repair or replace products which prove to be defective during the warranty period. A copy of the complete warranty statement is available upon request.

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Printed in U.S.A. 9/1/84
5953-6834

Integrated Discs

HEWLETT PACKARD

For Micro/1000-based A-Series Systems

product number 12122A

HP 12122A is a separately-ordered product that provides Integrated Discs for A-Series computer systems housed in 243xA Micro/1000 Computers or 248xA Micro/1000 System Processor Units. HP 12122A includes a 19.4 MB fixed, hard disc, a microfloppy drive that supports microfloppy discs in both 630 kB double-sided and 270 kB single-sided formats, an HP-IB controller that supports both discs, and an HP 12009A HP-IB interface card.

Functional Specifications

Capacity

Fixed Disc: 19.4 megabytes.

Microfloppy Disc: 630 kilobytes on double-sided discs; this microfloppy disc also supports read/write access to 270 kilobyte single-sided discs.

Additional Use of 12009A Interface: Because of physical limitations, the 12009A interface included in the 12122A product does not support connection of any HP-IB devices other than the integrated discs.

Performance

Fixed Disc: 75 millisecond average access time, 150 kB/sec average transfer rate (based on the minimum time required to transfer one track without overrun).

Microfloppy Disc: 225 millisecond average access time,17 kB/sec average transfer rate.

System Bootup

Micro/1000 systems can be restored from microfloppy discs in 270 kB single-sided format* to the 19.4 MB fixed disc. HP software for HP 1000 systems is not available on microfloppy discs in 630 kB double-sided format.

* *Double-sided microfloppy discs, which are enclosed in a gray housing, can be formatted and used as single-sided media.*

Ordering Information

12122A Integrated Disc Product*

The 12122A Integrated Disc Product includes:

1. 19.4 MB fixed, hard disc.
2. Single microfloppy drive with both 630 kB double-sided and 270 kB single-sided capability.
3. Single HP-IB disc controller for both the 19.4 MB hard disc and the microfloppy disc drive.
4. 12009A HP-IB Disc Interface and cables.
5. 24998-13465 FCO software on microfloppy disc for upgrade of RTE-A system with revision prior to Rev. 5000 to support the 12122A discs.
6. Installation in Micro/1000 computer or SPU at the factory.

* *HP 243xA option 151 or 248xA option 150 must also be ordered to support the installation of the HP 12122A product.*

12122A Option 001 Upgrade Kit

HP 12122A Option 001 adds the following items for in-the-field upgrading from earlier integrated discs in Micro/1000-packaged systems to HP 12122A Integrated Discs:

1. 02430-90010 HP Micro 24/26/27/29 Installation and Service Manual.
2. 12122-90001 Micro/1000 Upgrade Kit Installation Manual.

243xA/E Option Required for 12122A Integrated Disc Product

151: Installation preparation Kit for the 12122A Integrated Disc Product.

248xA Option Required for 12122A Integrated Disc Product

150: Installation preparation Kit for the 12122A Integrated Disc Product and deletion of the standard 12009A HP-IB interface from the 248xA SPU.

Manual Part No. 5954-8571
Printed in U.S.A. June 1987
E 687

HEWLETT
PACKARD