HP 1000 Computer Systems

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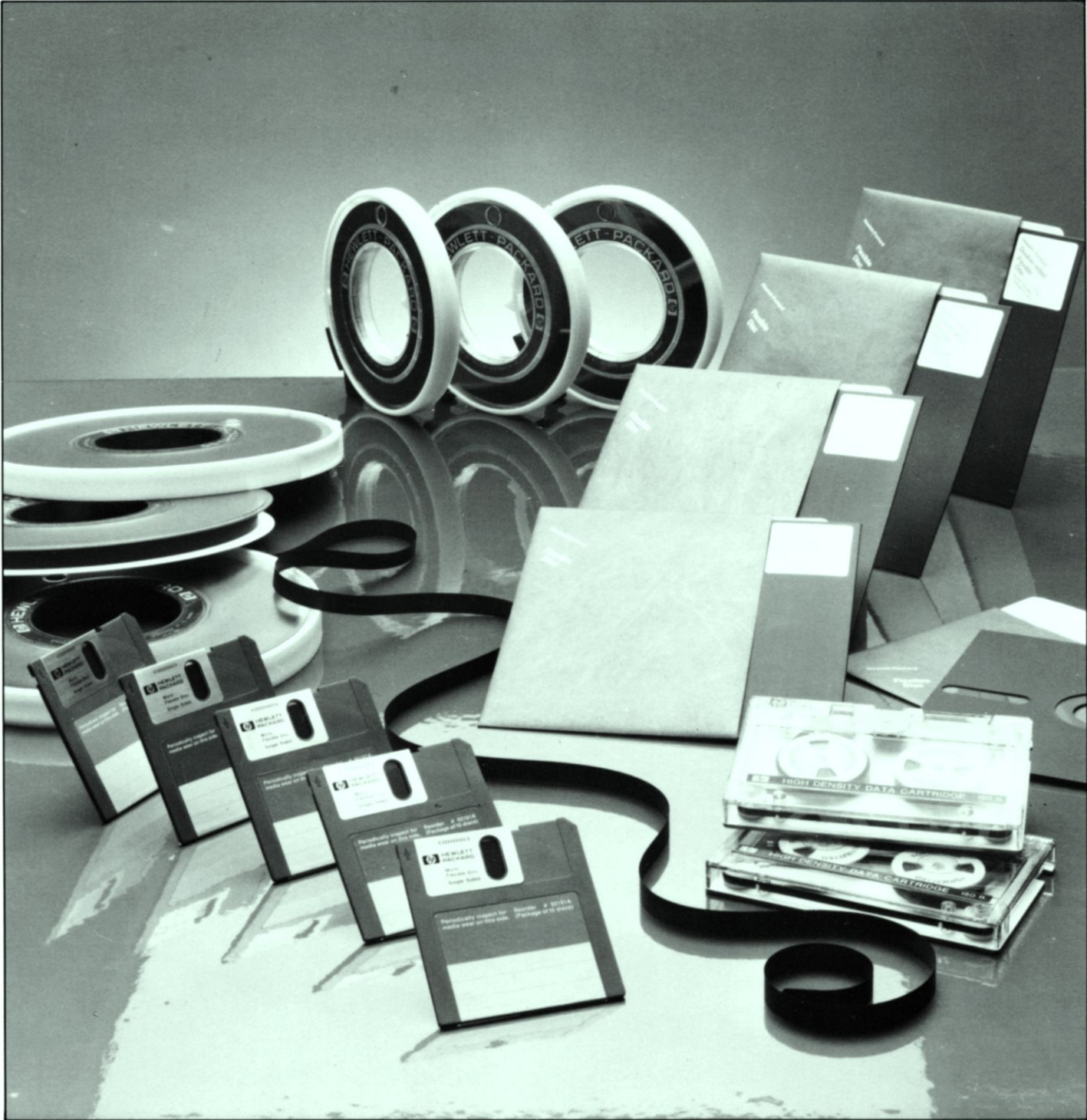
Software Technical Data, Volume I

Documentation Summary of HP 1000 Data Books

I/O ARCHITECTURE	Distributed Intelligence	Centralized Intelligence
COMPUTER SERIES	A	E/F
SYSTEMS AND COMPUTERS	HP 1000 A-Series Hardware Technical Data	HP 1000 E/F-Series Hardware Technical Data
INTERFACES	HP 1000 A-Series Interfaces Technical Data	HP 1000 E/F-Series Interfaces Technical Data
SOFTWARE	HP 1000 Software Technical Data, Volumes I and II	
COMMUNICATIONS	HP 1000 Computer Systems Communications Products Technical Data book	
PERIPHERALS	HP 1000 Peripherals Selection Guide	
MEASUREMENT AND CONTROL	Control/1000 Technical Information Package	
	HP 2250 Measurement and Control Systems Technical Data	

NOTE: Data book supplements containing new or revised information are sometimes printed between data book revisions. Ask your Hewlett-Packard representative for the current data book or supplement in your area of interest.

Update for 92077A RTE-A Real-Time Executive Operating System data sheet

NOTE: This update MUST ACCOMPANY the HP 1000 Software Technical Data book, Volume I, Literature Stock Number 5953-8710, dated 6/84

Introduction

This update clarifies the capabilities of the 92077A RTE-A Real-Time Executive operating system with respect to the size of system it can support.

The RTE-A system and system table space

As shown in the diagram at right, the RTE-A system and system tables occupy the lowest 64k bytes of system memory. The RTE-A system itself currently uses about 2/3 of that space, leaving about 1/3 for system tables associated with logical units (LUs) for I/O and program partitions.
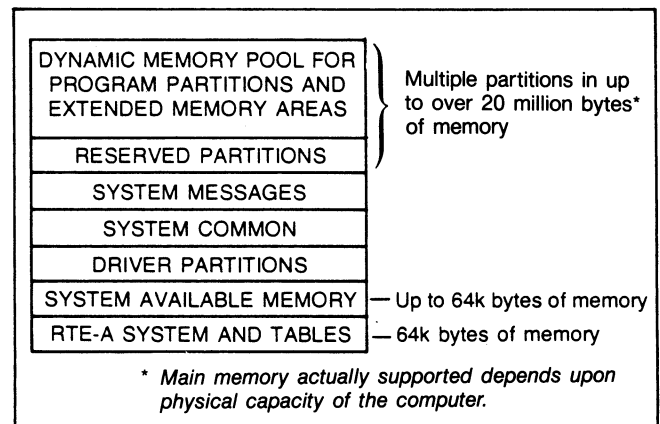
Logical and realizable I/O and program capacities of RTE-A

As specified in the RTE and RTE-A data sheets in the HP 1000 Software Technical Data book, Volume I (5953-8710, dated 6/84), a maximum of 255 logical units (LUs) and 255 fixed partitions are supported. However because of the relatively restricted space available for system tables in RTE-A, neither of these capacities is likely to be realized in an actual system.

All of RTE-A's system tables are allocated in the system table area. System tables include I/O tables, program ID segments, memory descriptors, and user ID segments. The desired I/O tables and the number of entries in fixed system tables are defined during system generation. The system manager who understands the configuration requirements of the particular installation can determine the table entries needed. System configurations which require more table space than is available cannot be supported.

The number of LUs and the number of program partitions that can actually be supported depends upon what the LUs are. The following general rules may apply to some configurations:

- A multiplexer with eight terminals (8 LUs) may use nearly 1/5 of the space available for system tables, depending upon the use of the terminals.

DYNAMIC MEMORY POOL FOR PROGRAM PARTITIONS AND EXTENDED MEMORY AREAS	Multiple partitions in up to over 20 million bytes* of memory
RESERVED PARTITIONS	
SYSTEM MESSAGES	
SYSTEM COMMON	
DRIVER PARTITIONS	
SYSTEM AVAILABLE MEMORY	— Up to 64k bytes of memory
RTE-A SYSTEM AND TABLES	— 64k bytes of memory

* *Main memory actually supported depends upon physical capacity of the computer.*

RTE-A System Memory Map

- A distributed systems interface (1 LU) requires about 1/10 of available table space.

- Four discs connected via an HP-IB interface and subdivided into 17 LUs use about 1/10 of available table space.

- Ten program partitions use about 1/16 of available table space.

Table space in RTE-A can start to become a limiting factor in systems with more than three fully- utilized 8-channel multiplexers (over 24 terminals) or more than 16 I/O interfaces. When considering a system of that size, consult your Hewlett-Packard Systems Engineer concerning the suitability of RTE-A for your application prior to ordering. This holds even when moving a large application from an HP 1000 E/F-Series system under RTE-6/VM to an A-Series system under RTE-A.

System performance

Although the absolute size of systems may be constrained by available table space, this is a capacity limit, not a performance limit.

Primary system requirement

The RTE-A primary system requires at least 256k bytes of memory.

HP 1000 Software Information Locator

NOTE: Data sheets for the Mature 92841A and 92842A Graphics/1000-II Version 1.0 Device-Independent Graphics Library and Advanced Graphics Package products are not included in this data book. If you will need information on those products, please retain the earlier HP 1000 Software Technical Data book Vol. I (5953-8710) dated 12/83.

Active Program Development Software

See Software Technical Data book, Volume II (5953-8711).

Communications and Manufacturing Software

All Communications Software is located in the HP 1000 Data Communications Products Technical Data book and Manufacturing Applications Software is located in individual PCIF/1000, and HP Process Monitoring and Control/1000 data sheets.

Software Data Book Indexes

NOTE: The software products below are indexed by a three-section code. The first number indicates Software Technical Data book Volume One (this book) or Volume Two (under separate cover). The second and third numbers, which follow a colon, identify the section and page number of the data sheet.

Product number index

Alphabetical index

Software Support

Introduction

Software is an indispensible part of your computer system, so it is important for you to know in advance the types and categories of Hewlett-Packard software and support that are available. This information is summarized in Table 1 (below).

The support products available for HP 1000 software products are listed in Table 2. For complete information on all aspects of HP Computer Systems support, ask your HP Sales Representative.

Special Software. Certain software items are available from the Special Software Development Group at the factory to accomplish special jobs or to achieve higher performance under specialized conditions. Support and training for special software are negotiated at time of purchase. For more information, ask your HP Sales Representative.

HP Plus software is available from software suppliers to complement and extend the capabilities of HP software. All HP Plus software and software suppliers are qualified by HP prior to their acceptance into the HP Plus program. Post-sale support of HP Plus software is provided by the software supplier and is not available from Hewlett-Packard. For more information, see the current HP Technical Computer Group HP Plus Catalog.

Contributed software can often provide you with many useful routines to help you further apply your HP 1000 Computer System. You can obtain the contributed software library by writing to:

> HP International Users Group
> 2570 El Camino Real West
> Crocker Bank Building, Fourth Floor
> Mountain View, CA 94040

HP Users Group Contributed Software is not supported by Hewlett-Packard in any way.

Table 1. Software Support by Supported HP Software Categories

SOFTWARE CATEGORY	ACTIVE	MATURE	INACTIVE	OBSOLETE
ENHANCEMENTS	May be made	Not usually considered	None	None
SOFTWARE MAINTENANCE	Regularly scheduled to correct known discrepancies (only serious discrepancies of inactive software will be corrected) and to maintain compatibility with other software products defined as compatible when the product was sold.			None
TERM	Indefinite		Five years	Indefinite
AVAILABLE FOR SALE	As first-time purchase or as license to copy product		As license to copy product only	As special purchase only
PRODUCT CONTENT FOR FIRST-TIME PURCHASE	Provides right to use software on one system and delivery of software and manuals (and firmware if part of the product)		Not applicable	Special; Ref manual & software on mag tape
LICENSE TO COPY PRODUCT CONTENT	Provides license to copy software to one additional system and delivery of manual(s) (and firmware if part of the product)			
CUSTOMER TRAINING	Regularly-scheduled for most products	Request-scheduled only	Request-scheduled only	Not available
SOFTWARE SUPPORT	Available for all active, mature, and inactive software products			Not available
Software Materials Subscription (SMS)	Via mail delivery, provides materials and information needed to keep software up to date.			Not available
Response Center Support (RCS)	In addition to SMS as defined above, provides assistance of a Systems Engineer or Customer Support Representative via telephone.			Not available
Account Management Support (AMS)	In addition to SMS and RCS as defined above, provides a close working relationship with a locally-assigned Systems Engineer or Customer Support Representative in coordination of system support and software update planning.			Not available
DOCUMENTATION SUPPORT	Available for all active, mature, and inactive software products			Not available
Software Notification Service	Via mail delivery, provides information on software updates, outstanding software problems and resolutions, and new programming techniques			Not available
Manual Update Service (MUS)	Via mail delivery, provides updates to manuals for operating system or category software for which it is ordered.			Not available

Table 2. *HP 1000 Software and Documentation Support Services Product Summary*

S/W CAT	SUPPORTED SOFTWARE PRODUCTS	SOFTWARE SUPPORT PRODUCT AVAILABILITY						
		ACCOUNT MGT SUPPORT	RESPONSE CENTER SUPPORT	ADD'L SYSTEM COVERAGE	ADD'L RESPONSE CENTER CALLER	SOFTWARE MATERIALS SUBSCRIP.	EXTENDED MATERIALS SUBSCRIP.	MANUAL UPDATE SERVICE
OPERATING SYSTEMS								
A	92077A RTE-A Real-Time Executive	+T00	+H00	+V00	+P00	+S00	+W00	na
A	92084A RTE-6/VM Real-Time Exec.	+T00	+H00	+V00	+P00	+S00	+W00	na
M	92068A RTE-IVB Real-Time Exec.	+T00	+H00	+V00	+P00	+S00	+W00	na
M	92070B RTE-L Real-Time Executive	+T00	+H00	+V00	+P00	+S00	+W00	na
M	92071A RTE-XL Real-Time Exec.	+T00	+H00	+V00	+P00	+S00	+W00	na
I	92001A RTE-II Real-Time Exec.	+T00	+H00	+V00	na	+S00	n/c	na
I	92060A RTE-III Real-Time Exec.	+T00	+H00	+V00	na	+S00	n/c	na
I	92064A RTE-M Real-Time Executive	+T00	+H00	+V00	+P00	+S00	n/c	+Q00
I	92067A RTE-IV Real-Time Exec.	+T00	+H00	+V00	na	+S00	+W00	na
PROGRAMMING LANGUAGES								
	99081D Programming Languages Category Support*	+C00	+C00	+V00	Note A	n/a	n/a	+Q00
A	92045A RTE Microprog for A700	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	92049A RTE Microprog for A900	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	92833A Pascal/1000 (used with RTE-A or RTE-6/VM)	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	92834A FORTRAN 4X (u/w RTE-IVB, RTE-XL, or RTE-6/VM)	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	92836A FORTRAN 77 (used with RTE-A or RTE-6/VM)	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	92857A BASIC/1000C (used with RTE-A or RTE-6/VM)	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
M	92061A RTE Microprog for M/E/F	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
M	92076A BASIC/1000L	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	n/c	Cat Sup
M	92101A BASIC/1000D	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	n/c	Cat Sup
M	92832A Pascal/1000 (u/w RTE-IVB)	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
M	92854A Pascal/1000 (u/w RTE-XL)	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
I	92065A BASIC/1000M	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	n/c	Cat Sup
PRODUCTIVITY TOOLS								
	99082D Productivity Tools Category Support*	+C00	+C00	+V00	Note A	n/a	n/a	+Q00
A	91823A Control/1000 M&C Software	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	92083A RTE Profile Monitor	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	92860A Symbolic Debug/1000	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	n/c	Cat Sup
I	92082A ACCEL/1000 Software	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
DATA MANAGEMENT SOFTWARE								
	99083D Data Management Software Category Support*	+C00	+C00	+V00	Note A	n/a	n/a	+Q00
A	91745A Datasafe/1000 Software	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	91747A Datashare/1000 Software	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	92069A Image/1000 Data Base Management Software	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	92078A RTE-A Virtual Code + S/W	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	92081A Image/1000-II Data Base Management Software	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	92843X Skeleton Device Handler Sources Product	na	na	na	na	na	na	na
A	92861A Graphics/1000-II Version 2.0 Device-Independent Graphics Library	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	92862A Graphics/1000-II Version 2.0 Advanced Graphics Pkg	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
M	92840A Graphics/1000 Graphics Plotting Software	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	n/c	Cat Sup
M	92841A Graphics/1000-II Version 1.0 Device-Independent Graphics Library	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
M	92842A Graphics/1000-II Version 1.0 Advanced Graphics Pkg	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
I	92063A Image/1000 Data Base Management Software	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	n/c	Cat Sup
I	92073A Image/1000 Data Base Mgt S/W without Query	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup

NOTE A: Additional Response Center Caller support purchased for operating system is extended to software supported under a 9208xA+C00/V00 category support product.

NOTE B: Software updates provided under Account Management Support, Response Center Support, or Software Materials Subscription are normally available on the same media as the parent software product. Available update media and software and support prices are listed in the current HP 1000 Ordering Guide.

* Category support of category software does not include software updates. Software Materials Subscription service to obtain updates is ordered individually for each software product.

na = Not Available   n/c = No Charge for copying Software Materials Subscription updates to additional system(s)

n/a = Not Applicable

Table 2. HP 1000 Software and Documentation Support Services Product Summary, Continued

S/W CAT	SUPPORTED SUPPORTED SOFTWARE PRODUCTS	SOFTWARE SUPPORT PRODUCT AVAILABILITY						
		ACCOUNT MGT SUPPORT	RESPONSE CENTER SUPPORT	ADD'L SYSTEM COVERAGE	ADD'L RESPONSE CENTER CALLER	SOFTWARE MATERIALS SUBSCRIP.	EXTENDED MATERIALS SUBSCRIP.	MANUAL UPDATE SERVICE

UTILITY SOFTWARE

S/W CAT	SUPPORTED SOFTWARE PRODUCTS	ACCOUNT MGT SUPPORT	RESPONSE CENTER SUPPORT	ADD'L SYSTEM COVERAGE	ADD'L RESPONSE CENTER CALLER	SOFTWARE MATERIALS SUBSCRIP.	EXTENDED MATERIALS SUBSCRIP.	MANUAL UPDATE SERVICE
	99084D Utility Software Category Support*	+C00	+C00	+V00	Note A	n/a	n/a	+Q00
A	12829A Vector Instruction Set used with RTE-6/VM	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	27203A Speech Output Library	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
M	12824A Vector Instruction Set used with RTE-IVB	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
M	92066A RTE Meas. & Control S/W	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	n/c	Cat Sup
M	92400A Sensor-Based DAS Utility Library	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	n/c	Cat Sup

DATA COMMUNICATIONS "A" SOFTWARE

S/W CAT	SUPPORTED SOFTWARE PRODUCTS	ACCOUNT MGT SUPPORT	RESPONSE CENTER SUPPORT	ADD'L SYSTEM COVERAGE	ADD'L RESPONSE CENTER CALLER	SOFTWARE MATERIALS SUBSCRIP.	EXTENDED MATERIALS SUBSCRIP.	MANUAL UPDATE SERVICE
	99085D Data Communications "A" Software Category Support*	+C00	+C00	+V00	Note A	n/a	n/a	+Q00
M	91731A Async Multiplexer S/W	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	n/c	Cat Sup
I	91741A DS/1000 Enhancement for HP 3000 Communications	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup

DATA COMMUNICATIONS "B" SOFTWARE

S/W CAT	SUPPORTED SOFTWARE PRODUCTS	ACCOUNT MGT SUPPORT	RESPONSE CENTER SUPPORT	ADD'L SYSTEM COVERAGE	ADD'L RESPONSE CENTER CALLER	SOFTWARE MATERIALS SUBSCRIP.	EXTENDED MATERIALS SUBSCRIP.	MANUAL UPDATE SERVICE
	99086D Data Communications "B" Software Category Support*	+C00	+C00	+V00	Note A	n/a	n/a	+Q00
A	91730A Multipoint Terminal/Multidrop Data Link Software for M/E/F-Series	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	n/c	Cat Sup
A	91732A Data Link Software for A-Series	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	91750A DS/1000-IV Network Software	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	91780A RJE/1000	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
I	91740A/B DS/1000 Software-Firmware	Cat Sup	Cat Sup	Cat Sup	C t Sup	+S00	+W00	Cat Sup

DATA COMMUNICATIONS "C" SOFTWARE

S/W CAT	SUPPORTED SOFTWARE PRODUCTS	ACCOUNT MGT SUPPORT	RESPONSE CENTER SUPPORT	ADD'L SYSTEM COVERAGE	ADD'L RESPONSE CENTER CALLER	SOFTWARE MATERIALS SUBSCRIP.	EXTENDED MATERIALS SUBSCRIP.	MANUAL UPDATE SERVICE
	99087D Data Communications "C" Software Category Support*	+C00	+C00	+V00	Note A	n/a	n/a	+Q00
A	91751A/X DSN/X.25 Comm. Software	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup
A	91782A DSN/MRJE Multileaving Remote Job Entry Software	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	Cat Sup

FACTORY AUTOMATION SOFTWARE

S/W CAT	SUPPORTED SOFTWARE PRODUCTS	ACCOUNT MGT SUPPORT	RESPONSE CENTER SUPPORT	ADD'L SYSTEM COVERAGE	ADD'L RESPONSE CENTER CALLER	SOFTWARE MATERIALS SUBSCRIP.	EXTENDED MATERIALS SUBSCRIP.	MANUAL UPDATE SERVICE
	99102D Factory Automation Software Category Support*	+T00	+H00	+V00	Note A	n/a	n/a	See s/w
A	92121A PMC/1000 Process Monitoring and Control Software	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	+Q00
A	92131A QDM/1000 Quality Decision Management Software	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	+Q00
A	94200A PCIF/1000 Programmable Controller Interface S/W	Cat Sup	Cat Sup	Cat Sup	Cat Sup	+S00	+W00	+Q00
A	94201A PCIF/1000 User-Definable Interface Documentation	n/a	n/a	n/a	n/a	n/a	n/a	+Q00

OTHER SOFTWARE   (Category Support Not Available)

S/W CAT	SUPPORTED SOFTWARE PRODUCTS	SOFTWARE MATERIALS SUBSCRIP.	EXTENDED MATERIALS SUBSCRIP.	MANUAL UPDATE SERVICE
A	24398B A-Series Peripherals Diagnostics Package	+S00	n/c	na
A	24612A A/L-Series System Diagnostics Package	+S00	n/c	na
A	91711B On-Line Diagnostics and Verification Package	+S00	n/c	na
A	92091A HPSPICE Circuit Simulation Program	+S00	+W00	na
M	24396A M/E/F-Series Diagnostics	+S00	n/c	na
M	24398A L-Series Peripherals Diagnostics Package	+S00	n/c	na
M	24601A L-Series Measurement and Control Interfaces Diagnostics	+S00	n/c	na
M	92835A Signal/1000 Digital Signal Processing Software	+S00	+W00	na
I	24600A L-Series Diagnostics Package for Intelligent Communications I/Fs	+S00	+W00	na

NOTE A: Additional Response Center Caller support purchased for operating system is extended to software supported under a 9208xA+C00/V00 or 99102D+T00/H00/V00 category support product.

NOTE B: Software updates provided under Account Management Support, Response Center Support, or Software Materials Subscription are normally available on the same media as the parent software product. Available update media and software and support prices are listed in the current HP 1000 Ordering Guide.

* Category support of category software does not include software updates. Software Materials Subscription service to obtain updates is ordered individually for each software product.

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n/a = Not Applicable

HEWLETT-PACKARD COMPANY
HP 1000 Software Rights and Privileges Statement

June 1, 1984

The following is a summary of the terms and conditions governing the acquisition and use of HP 1000 software and software updates. For further information, please contact your local Hewlett-Packard sales representative.

License to Use Software and Software Updates

The purchase of any HP 1000 software or software-firmware product (see Table 1), grants the buyer a license to use the software product originally delivered on **one** Computer with no time limit. No title to, or ownership of, the software is transferred to the buyer. The buyer's right to use is at all times subject to the copyright restrictions listed below.

The purchase of a software update product or a software support service that provides regular software updates grants the buyer a similar license to use those updates on **one** Computer with no time limit.

Copyrighted Software

Hewlett-Packard software (including software updates), the logical pattern implemented in firmware, and printed documentation are all copyrighted materials, protected under law. Unless HP specifically grants a customer the right to copy copyrighted materials, these may not be copied except for archive purposes, to replace a defective copy, or for program error verification purposes.

Specific grants of the right under copyright law to copy certain HP software products or software updates are described herein. While HP copyrighted firmware may be included in products with software or software updates, or the "Right to Copy" product, it is specifically excluded from any grant of rights to copy copyrighted material. The logical pattern contained in Hewlett-Packard firmware may not be copied under any circumstances.

Copyright Exemption

Hewlett-Packard defines two "Types" of HP 1000 software and software-firmware products in the **HP Software Terms** document. (HP Literature stock number 5953-2107) The "Type" of a software or software-firmware product governs how and when the software may be copied, as follows:

License to Copy Type I Software and Software-Firmware Products

Type I products are those products over which HP exercises complete copyright control via the HP Software Terms document.

A customer obtains the right to copy Type I software by purchasing the associated "Right to Copy" product (see Table 1). Each purchase of a "Right to Copy" product provides the buyer with an additional set of firmware (if any), manuals, and a license to make one copy of the Type I software for use on a single additional computer.

The "Right to Copy" product is sold subject to the following conditions:

1. The customer must have already purchased or be concurrently purchasing a license to use the Type I product at full list price less appropriate discounts. Reduced price software upgrade products or options and software bundled with HP 1000 computer systems do **not** satisfy this prerequisite.

2. The customer must agree to label each copy of the original software with the following notice: "© Copyright Hewlett-Packard Company, 19XX. Copy made by permission of Hewlett-Packard."

License to Use Execute-Only Portion of a Type I Software Product

For a limited number of Type I software products, a customer can obtain the right to use the execute-only portion of that software on an additional computer by purchasing the associated "Execute-Only" product (see Table 1). Each purchase of an "Execute-Only" product provides the buyer with an additional set of firmware (if any) and a license to use the *Execute-Only subset* of that product on a single additional computer. Definition of the subset of the modules which are included in the execute only license can be found in the data sheet for the appropriate software product.

The "Execute-Only" product also includes a license to use updated versions of the execute-only software modules (obtained via the appropriate software support service) on the additional system. This right is limited to use of updated versions of the specific modules included in the execute-only license as defined in the data sheet for the appropriate product.

The "Execute-Only" product is sold subject to the same conditions as the "Right to Copy" product described above.

License to Copy Type I Software Updates Provided by Support Services

A customer can obtain a license to copy the Type I software updates provided by a particular software support service by purchasing the additional system support extension product for the appropriate service *once* for each computer to which the updates will be copied. Each purchase of the support extension product provides the buyer with a set of firmware updates (if applicable) and a license to make one copy of the software updates for use on a single additional computer.

The additional system support extension product is sold subject to the following conditions:

1. The customer must have in force a valid HP support agreement that includes the appropriate Type I software support service.

Table 1. HP 1000 Type I and Type II Software and Software-Firmware Products

S/W CAT	SOFTWARE OR SOFTWARE-FIRMWARE PRODUCT	LICENSE TO COPY SOFTWARE TO ONE SYSTEM	LICENSE TO EXECUTE SOFTWARE ON ONE SYSTEM
ACTIVE TYPE I SOFTWARE			
A	91732A Data Link Software for A-Series computers	91732R	Not Available
A	91745A Datasafe/1000 Software	91745R	Not Available
A	91747A Datashare/1000 Software	91747R	Not Available
A	91750A DS/1000 Network Software	91750R	Not Available
A	91751A DSN/X.25 Communications Software	91751R	Not Available
A	91751X DSN/X.25 Communications Software Sources	91751Y*	Not Available
A	91782A DSN/MRJE 1000 Multileaving Remote Job Entry Software	91782R	Not Available
A	92045A RTE Microprogramming Package for A700 computers	92045R	Not Available
A	92049A RTE Microprogramming Package for A900 computers	92049R	Not Available
A	92069A Image/1000 Data Base Management System	92069R	Not Available
A	92077A RTE-A Real-Time Executive Operating System	92077R	92077E
A	92078A RTE-A Virtual Code+ Enhancement	92078R	92078E
A	92081A Image/1000-II Data Base Management System	92081R	Not Available
A	92083A RTE Profile Monitor	92083R	Not Available
A	92084A RTE-6/VM Real-Time Executive Operating System	92084R	Not Available
A	92091A HPSPICE Circuit Simulation Program	92091R	Not Available
A	92121A Process Monitoring & Control/1000 software for A-Ser	92121M/R	Not Available
A	92131A Quality Decision Management/1000 software for A-Ser	92131M/R	Not Available
A	92833A Pascal/1000 (used with RTE-A or RTE-6/VM)	92833R	Not Available
A	92834A FORTRAN 4X (used with RTE-A, RTE-IVB, or RTE-6/VM)	92834R	Not Available
A	92836A FORTRAN 77 (used with RTE-A or RTE-6/VM)	92836R	Not Available
A	92857A BASIC/1000C (used with RTE-A or RTE-6/VM)	92857R	Not Available
A	92860A Symbolic Debug/1000	92860R	Not Available
A	92861A Graphics/1000-II Version 2.0 Device-Independent Graphics Library	92861R	Not Available
A	92862A Graphics/1000-II Version 2.0 Advanced Graphics Pkg	92862R	Not Available
A	94200A Programmable Controller Interface/1000 software	94200R	Not Available
MATURE TYPE I SOFTWARE			
M	92068A RTE-IVB Real-Time Executive Operating System	92068R	92068E
M	92070B RTE-L Real-Time Executive Operating System	92070R	92070E
M	92071A RTE-XL Real-Time Executive Operating System	92071R	92071E
M	92832A Pascal/1000 (used with RTE-IVB)	92832R	Not Available
M	92835A Signal/1000 Software-Firmware	92835R	Not Available
M	92841A Graphics/1000-II Version 1.0 Device-Independent Graphics Library	92841R	Not Available
M	92842A Graphics/1000-II Version 1.0 Advanced Graphics Pkg	92842R	Not Available
M	92854A Pascal/1000 (used with RTE-XL)	92854R	Not Available
INACTIVE TYPE I SOFTWARE			
I	91740A DS/1000 Network Software-Firmware for M-Series	91740P	Not Available
I	91740B DS/1000 Network Software-Firmware for E/F-Series	91740R	Not Available
I	91741A DS/1000 Software Enhancement for HP 3000 Comm.	91741R	Not Available
I	92067A RTE-IV Real-Time Executive Operating System	92067R	Not Available
I	92073A Image/1000 Data Base Management System without Query	92073R	Not Available
I	92080A DATACAP/1000 Data Capture Software	92080R	Not Available

Table 1. *HP 1000 Type I and Type II Software and Software-Firmware Products, Continued*

S/W CAT	SOFTWARE OR SOFTWARE-FIRMWARE PRODUCT	LICENSE TO COPY SOFTWARE TO ONE SYSTEM	LICENSE TO EXECUTE SOFTWARE ON ONE SYSTEM
ACTIVE TYPE II SOFTWARE			
A	12829A Vector Instruction Set firmware & software equiv.	Not required	Not applicable
A	24398B A-Series Peripheral Diagnostics	Not required	Not applicable
A	24612A A/L-Series System Diagnostics	Not required	Not applicable
A	24612A A/L-Series System Diagnostics	Not required	Not applicable
A	91711B On-Line Diagnostics & Verification Package	Not required	Not applicable
A	91730A Multipoint Terminal/Multidrop Data Link Software	Not required	Not applicable
A	91780A RJE/1000 Communications Package	Not required	Not applicable
A	92843X Skeleton Device Driver Sources	Not required	Not applicable
MATURE TYPE II SOFTWARE			
M	12824A Vector Instruction Set firmware & software equiv.	Not required	Not applicable
M	24396C-F Diagnostics Library for M/E/F-Series	Not required	Not applicable
M	24398A L-Series Peripherals Diagnostics	Not required	Not applicable
M	24601A L-Series Meas. & Control Interfaces Diagnostics	Not required	Not applicable
M	91731A Asynchronous (12920B) Multiplexer Subsystem S/W	Not required	Not applicable
M	92061A RTE Microprogramming Package for M/E/F-Series Comp.	Not required	Not applicable
M	92066A RTE Measurement and Control Software Package	Not required	Not applicable
M	92076A BASIC/1000L Software	Not required	Not applicable
M	92101A BASIC/1000D Software	Not required	Not applicable
M	92400A Sensor-Based DAS Library	Not required	Not applicable
M	92840A Graphics/1000 Graphics Plotting Software	Not required	Not applicable
M	93824A HP-ATS Software	Not required	Not applicable
INACTIVE TYPE II SOFTWARE			
I	24600A L-Series Diagnostic Package	Not required	Not applicable
I	92001B RTE-II Real-Time Executive Operating System	Not required	Not applicable
I	92063A Image/1000 Data Base Management System	Not required	Not applicable
I	92064A RTE-M Real-Time Executive Operating System	Not required	Not applicable
I	92065A BASIC/1000M software	Not required	Not applicable

2. The customer must have previously purchased or be concurrently purchasing a license to use the original Type I software on each computer to which the updates are being copied. This license can be obtained either by purchasing an HP 1000 Computer System that includes the software, a separate copy of the Type I product, or a Type I "Right to Copy" product.
3. The customer must agree to label each copy of the updated software in accordance with the procedures outlined above.

License to Copy a Type I Software Update For Customers Without Support Services

Customers without support services on computers with copied software can obtain a license to copy a **single** Type I software update to such a computer by purchasing the associated "Right to Copy" product with option 001. Each purchase of a "Right to Copy" product with option 001 provides the buyer with a set of firmware (if any), manuals, and a license to make **one** copy of a Type I software update for use in updating the copied software previously installed on a single additional computer.

Option 001 of the "Right to Copy" product is sold subject to the following conditions:
1. The customer must have previously purchased the appropriate Type I software "Right to Copy" product without option 001 for the computer to which the update is being copied.
2. The customer must agree to label each copy of the updated software in accordance with the procedures outlined above

Type II Software Products and Updates

After a customer purchases a license to use a Type II product once at full list price, less appropriate discounts, HP grants that customer an additional license to copy and use that software on any other HP 1000 computers owned by the customer. The customer is required to label each copy of the Type II software in accordance with the procedures outlined above.

In addition, customers who have in force a valid HP support agreement that includes one of the Type II software support services are granted a license to copy and use those updates on any other HP 1000 computers owned by the customer. Each copy of the updated software must be labeled in accordance with the procedures outlined above.

Ordering/Acknowledgement Procedure

When a valid order for one or more of the license to copy Type I software or software updates products described above is received at an HP factory, one of the following acknowledgements will be sent:

"SPECIFIC RIGHTS TO REPRODUCE S/W GRANTED"

"SPECIFIC RIGHTS TO REPRODUCE
S/W UPDATES GRANTED"

At that point, Hewlett-Packard specifically grants the right to copy the Type I software or software updates in accordance with the prerequisites and conditions described above.

The right to copy Type II software is granted only after a customer meets all of the prerequisites described above. No formal acknowledgement of the right to copy is sent in this case.

Real-Time Executive (RTE) Operating Systems

HEWLETT PACKARD

product numbers
92077A, 92084A, 92068A,
92070B, and 92071A
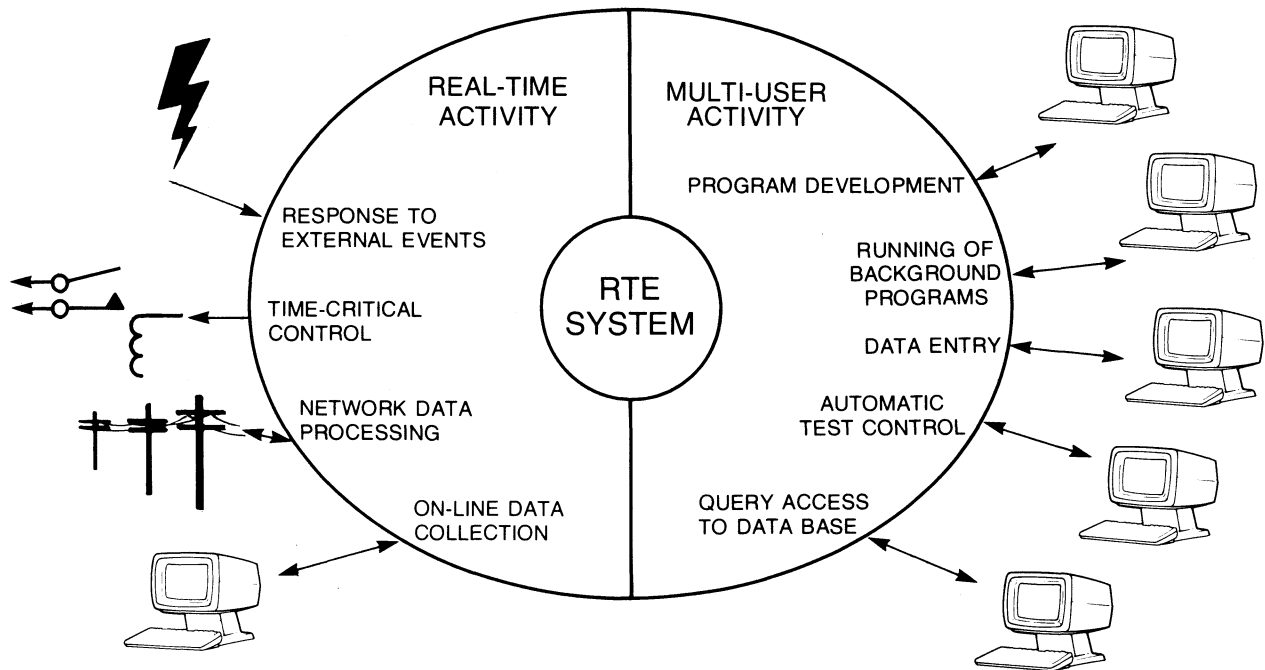
Real-Time Executive (RTE) is a disc or memory based software system used for management of operations and resources of HP 1000 computer systems. RTE systems provide true multiprogramming capability for monitoring and controlling concurrent events in real time. The configuration flexibilty of RTE systems makes it easy to accommodate a wide variety of application requirements.

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

RTE Common Features

- **True multiprogramming with concurrent program execution**
- **Time, event, program-to-program, and operator scheduling of program execution**
- **Time slicing within each priority level (except RTE-L)**
- **File management capabilities for creation, maintenance and manipulation of files by operators or programs**
- **Interactive debug and screen Editor to aid program development (except RTE-L)**

- **Reliability features such as power fail/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 HP 1000 software subsystems, including Graphics/1000-II, Image/1000 and DS/1000-IV**
- **Multi-lingual programming in Assembly language and, optionally, FORTRAN, Pascal and BASIC/1000 (except in RTE-L)**
- **Non-swappable memory-resident programs for fastest response to interrupts**

The RTE operating system family

RTE-A, RTE-L, and RTE-XL support the HP 1000 A and L-Series computers, which have a distributed intelligence I/O architecture. RTE-6/VM and RTE-IVB support the HP 1000 M, E, and F-Series computers that have a centralized intelligence I/O architecture. Each operating system is briefly discussed below within these categories. For a detailed comparison, see Table 1.

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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.)*

  Table 1. RTE Operating System Specifications Summary

OPERATING SYSTEMS	92077A RTE-A	92077A and 92078A RTE-A & VC+	92084A RTE-6/VM	92068A RTE-IVB	92071A RTE-XL	92070B RTE-L
HP 1000 COMPUTERS SUPPORTED	A-Series	A-Series	EF-Series	MEF-Series	L-Series	L-Series
STATUS	ACTIVE	ACTIVE	ACTIVE	Mature	Mature	Mature
STANDARD IN HP 1000 MODELS	S+ & 26 and Micro 26, 27 & 29	27 and 29	60 and 65	40 and 45	5	

MEMORY

	92077A RTE-A	92077A/92078A RTE-A & VC+	92084A RTE-6/VM	92068A RTE-IVB	92071A RTE-XL	92070B RTE-L
Minimum Memory Required	256 kb	256 kb	512 kb	256 kb	128 kb	64 kb
Maximum Memory Supported	32 Mb	32 Mb	2 Mb	2 Mb	512 kb	64 kb
Max. Physical Memory Available	24 Mb	24 Mb	2 Mb	2 Mb	512 kb	64 kb

PROGRAM CAPACITY AVAILABLE TO THE USER

	92077A RTE-A	92077A/92078A RTE-A & VC+	92084A RTE-6/VM	92068A RTE-IVB	92071A RTE-XL	92070B RTE-L
Maximum Overlay Program Code	(A)	7.75 Mb	(B)	(A)	(A)	(A)
Max. Length of Resident Program	64 kb	64 kb	1.8 Mb (C)	54 kb	64 kb	52 kb (D)
Maximum Path Length	62 kb	7.75 Mb	64 kb	62 kb	62 kb	64 kb-syst.
Number of program partitions	255 (E)	255 (E)	64	64	255	2 (F)

VIRTUAL MEMORY FOR DATA (VMA)

	92077A RTE-A	92077A/92078A RTE-A & VC+	92084A RTE-6/VM	92068A RTE-IVB	92071A RTE-XL	92070B RTE-L
Maximum VMA Space Accessible to Program	128 Mb	128 Mb	128 Mb	not appl.	not appl.	not appl.
Maximum Working Set Size	2 Mb	2 Mb	1.8 Mb (G)	not appl	not appl	not appl.

EXTENDED MEMORY AREAS (EMAs)

	92077A RTE-A	92077A/92078A RTE-A & VC+	92084A RTE-6/VM	92068A RTE-IVB	92071A RTE-XL	92070B RTE-L
Maximum EMA Data Space	1.99 Mb/pgm	1.99 Mb/pgm	1.8 Mb (G)	1.8 Mb (G)	(H)	(D)
Number of Sharable EMAs/System	15	15	8	not appl.	not appl.	not appl.
Number of Programs Sharing EMA	63	63	256	not appl.	not appl.	not appl.

OTHER SYSTEM CAPACITY SPECIFICATIONS

	92077A RTE-A	92077A/92078A RTE-A & VC+	92084A RTE-6/VM	92068A RTE-IVB	92071A RTE-XL	92070B RTE-L
Number of logical units	255	255	255	64	64	64
Number of I/O Select Codes that can use direct memory access simultaneously	24	24	2	2	29	29
System Available Memory	Up to 64 kb	Up to 64 kb	(I)	(I)	(I)	(I)

REAL-TIME PROGRAM SCHEDULING

	92077A RTE-A	92077A/92078A RTE-A & VC+	92084A RTE-6/VM	92068A RTE-IVB	92071A RTE-XL	92070B RTE-L
By Time	Yes	Yes	Yes	Yes	Yes	Optional
By Event	Yes	Yes	Yes	Yes	Yes	Optional
By Another Program	Yes	Yes	Yes	Yes	Yes	Optional
By Operator	Yes	Yes	Yes	Yes	Yes	Yes
Number of Priority Levels	32767	32767	32767	32767	32767	32767

MULTI-USER SUPPORT

	92077A RTE-A	92077A/92078A RTE-A & VC+	92084A RTE-6/VM	92068A RTE-IVB	92071A RTE-XL	92070B RTE-L
Log-on Access Control	No	Yes	Yes	Yes	No	No
Session Accounting	No	Yes	Yes	Yes	No	No
User Capability Discrimination	No	Yes	Yes	Yes	No	No
Protected Environment for Users	No	Yes	Yes	Yes	No	No
By Multi-Terminal Monitor	Yes	Yes	Yes	Yes	Yes	No
Time Slicing Among Users	Yes	Yes	Yes	Yes	Yes	No

(A) = RTE-A without VC+, RTE-IVB, RTE-XL, and RTE-L support segmentation of large programs by the user.
(B) = RTE-6/VM Multi-level segmentation, load-on-call capability supports simplified development or conversion, load-
      ing, 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 system.
(D) = Memory available for user's programs and data in RTE-L equals 64 kb less that used by the system.
(E) = Dynamic partition allocation; the number of fixed partitions is limited to 255.
(F) = Multiple programs can be loaded into the real-time partition of RTE-L.
(G) = Memory available for EMA data in RTE-6/VM and RTE-IVB equals total memory less that used by the system,
      resident libraries, programs, and software subsystems.
(H) = In RTE-XL, maximum data space equals 64 kb maximum partition size less space used by the program code.

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

Table 1. RTE Operating System Specifications Summary (Continued)

OPERATING SYSTEMS	92077A RTE-A	92077A and 92078A RTE-A & VC+	92084A RTE-6/VM	92068A RTE-IVB	92071A RTE-XL	92070B RTE-L
HP 1000 COMPUTERS SUPPORTED	A-Series	A-Series	EF-Series	MEF-Series	L-Series	L-Series
STATUS	ACTIVE	ACTIVE	ACTIVE	Mature	Mature	Mature

PROGRAM DEVELOPMENT SUPPORT

File Manager	Included	Included	Included	Included	Included	Included
Command Interpreter	Included	Included	No	No	No	No
Input Spooling	No	No	Yes	Yes	No	No
Output Spooling	To printer	Yes	Yes	Yes	No	No
Batch Processing	No	No	Yes	Yes	No	No
Interactive Screen Editor (EDIT)	Included	Included	Included	Included	Included	No
Symbolic Debug/1000	w/92860A	w/92860A	w/92860A	No	No	No
Interactive Debug Utility	No	No	Included	Included	Included	Included
Relocating Loader	Included	Included	Included	Included	Included	Included
Absolute Program Loader	No	No	Included	Included	Included	Included

PROGRAM LANGUAGE SOFTWARE

BASIC Compiler and Interpreter	w/92857A	w/92857A	w/92857A	not avail.	not avail.	(J)
BASIC Interpreter only	w/92076A	w/92076A	w/92101A	w/92101A	w/92076A	not supp.
FORTRAN 77 Compiler	w/92836A	w/92836A	w/92836A	(J)	(J)	(J)
FORTRAN 4X Compiler	(J)	(J)	w/92834A	w/92834A	w/92834A	(J)
Pascal Compiler	w/92833A	w/92833A	w/92833A	w/92832A	w/92854A	(J)
Assembler	Included	Included	Included	Included	Included	(J)

PERFORMANCE ENHANCEMENT

Program Activity Profiling	w/92860A	w/92860A	w/92083A or 92860A	w/92083A	not avail.	not avail.
Microprogram Development	w/92045A or 92049A	w/92045A or 92049A	w/92061A	w/92061A	not avail.	not avail.
Digital Signal Processing	not avail.	not avail.	w/92835A	w/92835A	not avail.	not avail.

GRAPHICS AND CIRCUIT SIMULATION

General Graphics Support	w/92861A	w/92861A	w/92861A	w/92841A	w/92841A	w/92841A
Interactive or 3-D Graphics Support	w/92862A and 92861A	w/92862A and 92861A	w/92862A and 92861A	w/92842A and 92841A	w/92842A and 92841A	not supp.
HPSPICE Circuit Simulation	not avail.	not avail.	w/92091A	not avail.	not avail.	not supp.
CEADS/CADD Drafting Software (See HP PLUS Catalog)	w/91753JA and 91755JA	w/91753JA and 91755JA	w/91753JA and 91755JA	not avail.	not avail.	not supp.

DATA BASE MANAGEMENT SYSTEMS (DBMS)

DBMS with on-line Query	w/92069A	w/92069A	w/92069A	w/92069A	w/92069A	w/92069A
DBMS with on-line Query and extensive recovery capabilities	w/92081A	w/92081A	w/92081A	not supp.	not supp.	not supp.

MANUFACTURING APPLICATIONS SOFTWARE

Programmable Controller Link	w/94200A	w/94200A	not avail.	not supp.	not supp.	not supp.
Process Monitoring and Control	w/92121A	w/92121A	not avail.	not supp.	not supp.	not supp.
Quality Decision Management	w/92131A	w/92131A	not avail.	not supp.	not supp.	not supp.

SYSTEM-TO-SYSTEM COMMUNICATION SOFTWARE

DS/1000-IV Network Software	w/91750A	w/91750A	w/91750A	w/91750A	w/91750A	w/91750A
DSN/X.25 Packet Switching Comm.	w/91751A	w/91751A	w/91751A	w/91751A	not supp.	not supp.
Remote Job Entry to IBM 360/370	w/91782A	w/91782A	w/91782A or 91780A	w/91780A	not avail.	not supp.

TERMINAL USER-TO-SYSTEM COMMUNICATION SOFTWARE

Data Link/Multipoint Comm.	w/91732A	w/91732A	w/91730A	w/91730A	w/91732A	not supp.
12040B/12792B 8-ch Multiplexer	Included	Included	Included	Included	Included	Included
12920B 16-channel Multiplexer	not supp.	not supp.	not supp.	w/91731A	not supp.	not supp.

(J) = Support for this programming language is limited to execution of compiled or assembled object code.

RTE Systems for Distributed Intelligence I/O

- **RTE-A** is HP's most powerful 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 6 megabytes). It supports Extended Memory Areas for data and the 92078A VC+ extension package for code and data separation and programs up to 7.75 megabytes, and also 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.

- **RTE-XL** is the advanced real-time executive operating system supporting L-Series microcomputer systems with multiprogramming capability. It may be configured as either memory-based or disc-based and manages up to 512k bytes of main memory with full DMA access. Up to 64k bytes of user partition space is available and edit, debug, load and system generation tools support program development.

- **RTE-L** is an operating system for small, dedicated applications with up to 64k bytes of main memory. It does not support program development. It is highly modular, making it applicable from small, operator-less memory-based environments to full, disc-based systems.

RTE Systems for Centralized Intelligence I/O

- **RTE-6/VM** is HP's most powerful disc-based 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-IVB** is a highly capable disc-based operating system for E/F-Series computers. It manages up to 2M bytes of memory, offers Extended Memory for data and provides 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 an operator, 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 placing them in the order of their program priorities in a list known as the scheduled list. RTE provides these methods of scheduling programs:

- External events recognized by the system as interrupts may cause their respective programs to be scheduled.
- A program can be scheduled by another program through an EXEC call.
- Programs can be scheduled to execute once or continuously at an absolute pre-specified time of day or at a specified time interval. Time count is derived from a system clock maintained as part of the operating system functions.
- A program may be scheduled to execute by an operator command at a terminal.

A calling program or an operator may either wait or not wait for the completion of execution of a scheduled program. Request choices allow either the program or the operator to schedule a program and then go on to other operations without waiting.

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

Time slicing. RTE controlled multiple programs of the same "background" priority can be made to run on a time sliced basis, except in RTE-L. In this scheme, each program is granted the same execution time "slice" as every other program running at the same priority, in a round robin scheduling arrangement. The length of a program's time slice is determined by the basic time slice interval quantum set during system generation. This can be used by the system manager to assure users an equitable allocation of program execution time commensurate with the relative urgency of their applications. Monopolization of the system by any individual compute-bound program can be avoided.

Real-time programs (with priority above the background priority boundary which distinguishes them from background programs) will not be time sliced even if more than one is assigned the same priority.

Memory utilization

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

RTE-L User Program Areas

Within its maximum capacity of 64k bytes of memory, RTE-L can accommodate two user program areas, the real-time area and the background area. Either one of these areas is optional in an RTE-L system.

The real-time program area may contain several programs whose run-times are critical to the performance of the system. For example, they may be programs that respond to external interrupts or programs that control data flow from other programs. Real-time programs are non-swappable, but may be replaced on-line by an operator. The last program in the real-time area may be segmented.

The number of programs in the real-time area is limited by the memory space allocated to that area during system generation.

The background area contains only one executing program at a time, which may be swapped to a disc when necessary to make room for another background program. Because of this swapping feature, only programs whose run-time is not critical to the performance of the system should be relocated as background programs.

RTE-A and RTE-XL User Program Areas

RTE-A and RTE-XL place all user program space (up to 496k bytes in RTE-XL and 5.9M bytes in RTE-A) above the system, subdivided into as many as 255 fixed partitions and/or a number of dynamically-allocated partitions that is essentially unlimited in RTE-A.

In the RTE-XL system, real-time and background programs are distinguished by program priority assignment. When the system is generated, a background priority boundary is defined. Any real-time program with priority above this boundary can be swapped only for a program with higher priority. Real-time programs thus tend to remain resident in memory partitions and ready to execute, though they may be swapped when necessary. This provides the quick response needed for real-time functions. Programs with priorities below the background priority boundary will be swapped in much the same way as RTE-L, but many more partitions and larger user areas (up to 64k bytes) are available.

In the RTE-A system, user memory spaces can be further divided into fixed partitions and dynamically allocated memory at system bootup. Critical programs can be assigned to fixed or reserved partitions to insure fastest possible response to requests for their execution. Memory space (partitions) is allocated to other programs from a dynamic memory pool as needed. If a large 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.)

If the VC+ package is not provided, a program too large to fit into available user program space can be divided according to the logic of the program 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 and RTE-XL.

RTE-IV and 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 1.8M bytes is available to the user in a 2.048M byte system). Partitions can be divided into real-time or background 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.

Data Areas in RTE-A, RTE-6/VM and RTE-IVB

Extended Memory Areas (EMAs) for data. The EMA is an area for arrays or other data that extends the logical address space up to the available physical memory, making it useful for large amounts of data storage, acquisition and processing. Disc access is avoided, making program execution very fast and useful for data acquisition from fast devices at real-time rates. A segmented program may use EMA, thus allowing many separate operations to be performed on the same EMA (one segment can read in the data, a second can process it, and a third can save the results). In RTE-A and RTE-6/VM, multiple sharable EMAs can be defined, each of which is sharable by up to 63 programs in RTE-A, 256 programs in RTE-6/VM.

Virtual Memory Areas (VMAs) for data in RTE-A and RTE-6/VM. RTE-A and RTE-6/VM offer VMA, (demand-paged Virtual Memory for data). This allows programs to access 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 transparent.

Interrupts

RTE uses the multi-priority level, vectored hardware interrupt system for detection of power failure, memory protect violation, parity error, unimplemented instructions and time base ticks, as well as all device I/O interrupts. When interrupts occur simultaneously, the interrupt with the highest hardware priority is recognized first, but the system also records the other interrupts, so no interrupt is forgotten or overlooked.

The M/E/F-Series centralized intelligence I/O architecture supported by RTE-IVB and RTE-6/VM can use two program-assignable DMA channels simultaneously. The A/L-Series distributed intelligence I/O architecture supported by RTE-A, L, and XL provides DMA capability simultaneously in all I/O interface cards, thereby minimizing the number of interrupts to be processed. Under RTE-A/L/XL, 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.

System Integrity

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

- Optional auto restart after power failure
- Operational system protected from accidental modification by user programs and user programs protected from accidental modification by each other
- Optionally "downing" an I/O device with a message to the operator when its failure is detected or programmatically returning the error status to the calling program
- Optionally allowing user programs to lock certain system resources for their exclusive use
- Optional protection of disc files from unauthorized access
- Memory parity error in user partition causes partition to be "downed". The affected program may be loaded into another partition, except under RTE-L. Programs in the remaining partitions continue to execute normally.
- In RTE-A, a memory error in a dynamically-allocated user partition causes the program running in that partition to be aborted and the bad page to be flagged and excluded from further use. The affected program can be reloaded into another partition for execution without stopping the system. Programs in partitions unaffected by memory errors continue to execute normally. A memory error in a reserved partition causes the program to be aborted and the entire partition (not just the bad page) to be "downed". Reboot and change of memory partitioning are required to recover the use of the good pages in a downed reserved partition.
- "Failsafe I/O" option returns control to program if it tries to make an I/O request to a down or locked device (RTE-A and RTE-6/VM)
- Optional program ownership of class numbers allows class number deallocation if program terminates abnormally (RTE-A, RTE-6/VM, and RTE-L)
- Session terminals require user to log-on with account name and password (RTE-A with VC+, RTE-6/VM, and RTE-IVB)
- Protection of disc cartridges and other resources allocated to Session users (RTE-A with VC+, RTE-6/VM, and RTE-IVB)
- Control of command capabilities available to Session users (RTE-A with VC+, RTE-6/VM, and RTE-IVB)
- Optional exclusive assignment protection of disc tracks (RTE-6/VM and RTE-IVB)
- Optional user and group file domains (RTE-6/VM and RTE-IVB)

Input/Output

How RTE-A and RTE-L/XL differ from RTE-6/VM and RTE-IVB

With A/L-Series distributed intelligence I/O architecture, all 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.

Driver support

See page 6-7.

RTE I/O features

See Table 2.

On-line program development tools

File Manager and File Management Package. The File Manager (FMGR) supports the creation, deletion, storing, copying, packing, and listing of disc files from operator command level. The file management package FMP consists of a set of subroutines to be called by user's programs to programmatically access disc files for such operations as creating files, opening files, writing to and reading from files, etc. All disc files are referenced by name. 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.

Command Interpreter. In RTE-A and RTE-6/VM, a Command Interpreter provides hierarchical directories; time stamping of the times of creation, last update, and last access; unpurge, and file names up to 16 characters long (vs 6 characters under FMGR). To take advantage of most of the improvements of the hierarchical file system, user directories must be reformatted and programs must be modified. Directory reformatting can be done with a utility included with RTE-A and RTE-6/VM, 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.

The Edit/1000 screen editor provides a variety of tools for editing to correct program bugs or to enter and correct 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 of a file. It also offers powerful line copy, move, break and join capabilities. Of course, these extra capabilities are in addition to the usual line or character display, insertion, replacement, and deletion capabilities normally expected in a program editor.

Table 2. RTE I/O Features

RTE-A	RTE-6/VM	RTE-IVB	RTE-L/XL	I/O Features
Y	Y	Y	Y	Timeout on I/O requests to prevent an inoperative I/O device from halting the entire system
Y	Y	Y	Y	I/O suspend with auto rescheduling at I/O completion to allow other non I/O bound programs to run
Y	Y	Y	Y	Buffering of output to slow devices so a program can continue execution without waiting for I/O
Y	Y	Y	Y	Mailbox I/O between multiple programs in a system frees programs from having to rely upon the integrity of a common data area shared and maintained by all interacting programs.
Y	Y	Y	Y	One interface driver serves multiple interfaces of the same kind, for efficient use of memory.
Y	Y	Y	Y	Input buffering through the use of class I/O.
Y	Y	Y	Y	Waiting list of backlogged I/O requests keeps each I/O device optimally utilized.
Y	Y	Y	Y	An I/O device on a controller is automatically downed in event of an equipment error without affecting other devices on the same controller.
Y	N	N	Y	Interleaving of requests to devices on a multi-device interface to increase system throughput.
Y	Y	Y	N	Spooling of output to printer to speed throughput with minimal use of main memory for buffering.
Y	N	N	Y	Write-read request on an interactive device allows two successive I/O operations to be initiated by only one system call, eliminating 50% of system call processing overhead for operations of that type. This is especially useful in an operator-prompting scheme where the prompting messages is first written out before waiting for a reply.
Y	N	N	Y	Fail-soft feature for standard or user-defined I/O error recovery.
Y	N	N	N	Class buffer rethreading allows the user to move class buffers from one completed class queue to another programmatically without the use of additional SAM or word moving overhead.
Y	Y	N	N	Up to 255 logical units (individual devices) and up to 255 equipment tables (device controllers), each with up to 64 subchannels.
Y	Y	N	N	No-suspend I/O option to make sure that critical programs are never suspended because of malfunctioning I/O devices (returns control to calling program that tries to make an I/O request to a down or locked device).
Y	Y	N	N	Optional program ownership of class numbers allows class number deallocation if program terminates abnormally.
Y	Y	Y	N	Exclusive assignment of I/O devices which, for example, can be used to assure that a low-priority program completes its use of a printer, without having that use preempted by another program.

On-line relocating loader. When a program has been compiled or assembled, RTE's loader relocates it on-line. The output is a memory image of the program fitted according to the snapshot of the particular generated system. The loader can be operated interactively, or by commands included in a file. The loader 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 also reload user programs into the latest version of the operating system. In RTE-A and RTE-6/VM, programs can run on different generations without reloading or relinking. In other RTE systems, programs are usually re-linked when the operating system is updated. This is a faster operation than a reload.

Interactive Program Debugger. The optional 92860A Symbolic Debug/1000 package (see page 1-19 in Volume II of the HP 1000 Software Data book) provides powerful program debug capabilities in RTE-A and RTE-6/VM systems. DBUGR, a less-powerful program-callable or loader-appendable utility subroutine, provides users of RTE-IVB, RTE-XL, and RTE-L systems with interactive debugging capability. To facilitate interpretation by the user, DBUGR translates machine codes in binary numbers back to assembly language mnemonics.

Utilities and Libraries
See Table 3.

Operator and Program Requests
See Table 4.

Optional software

See Table 1, page 2-3.

Basic specifications

See Table 1, page 2-2.

Operational requirements

See the individual RTE-A, RTE-6/VM, RTE-IVB, and RTE-L/XL data sheets on succeeding pages.

Ordering information

See the individual RTE-A, RTE-6/VM, RTE-IVB, and RTE-L/XL data sheets on succeeding pages.

Table 3. RTE Utilities and Libraries

RTE-A	RTE-6/VM	RTE-IVB	RTE-L/XL	Utilities and Libraries
Y	Y	Y	Y	Disc utilities for formatting, initialization and sparing of disc tracks; for saving and restoring files from disc or cartridge to magnetic tape, and vice versa; and for disc-to-disc copying in an efficient, packed format
Y	Y	Y	Y	System status reporting utilities that indicate active programs and describe all program states, indicate down or locked I/O devices, and show status of memory partitions
Y	Y	Y	Y	Logical Unit and I/O Table information utilities for display of current I/O configuration
Y	Y	Y	Y	Relocatable merge program for combining relocatable files together into a single file
Y	Y	Y	Y	Fast help utility for on-line explanation of error messages
Y	Y	Y	Y	Math/Utility Library with general-purpose mathematical routines and other utilities
Y	Y	Y	Y	HP-IB Library with routines to simplify programming of HP-IB instruments
Y	Y	Y	Y	System library with a variety of system-level subroutine calls, such as resource number requests, (RNRQ), LU lock requests (LURQ), parsing routine (PARSE), formatted time routine (FTIME), and programmatic execution of operator commands routine (MESS)
Y	Y	Y	Y	Decimal string arithmetic library with routines 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
Y	N	N	Y	Utility for installing the bootup file (BOOTEX) onto the beginning of a disc
Y	N	N	N	Utility for converting FMGR files to the hierarchical file system of the RTE-A command interpreter
Y	N	N	N	Utility for printing a file(s) on any HP 1000 supported system printer
Y	N	N	N	Utility for repacking hierarchical system files
Y	N	N	N	Utility for scanning hierarchical disc directories and reporting inconsistencies
Y	N	N	Y	Utility for conversion of an absolute binary program file into a memory image file, or vice versa
Y	N	N	N	Utility for reporting hierarchical disc space taken by a specific user or directory
Y	N	N	N	Utility for scanning the free space table of new file system discs and reporting the amount of free disc space and the largest individual space available
Y	N	N	N	Utility for file backup, including incremental backup capability
Y	N	N	N	Utility for tape formatting for TF and FC file backup utilities
Y	N	N	N	Routine for verification of CS/80 disc pushbutton backup and restore
Y	N	N	Y	Utility for combining memory image program files with system image to make a memory-based system
Y	N	N	Y	Managing files in HP's interdivisional file interchange (LIF) format
Y	Y	N	N	Library index routine for building an index to user libraries to increase program loading speed
N	Y	Y	N	On-line diagnostic and verification for monitoring the functional operation of system hardware
N	Y	Y	N	Soft-key utilities for creation of soft-key files and dumping of those files to terminals
A	Y	Y	N	Session accounts program (ACCTS) for configuration and control of the Session Monitor accounts
N	Y	Y	N	System track assignment utility (LGTAT) for display of the ownership of system disc tracks
Y	Y	Y	N	Class number program for display of status of system class numbers
N	Y	N	N	On-line driver loading and replacement for loading of drivers without system regeneration
N	Y	Y	N	Interface to compiler (COMPL) and interface to compiler and loader (CLOAD) for one-step compilation and loading of user programs with automatic outspooling
Y	Y	N	N	Fast command utility for on-line explanation of the syntax of all interactive RTE commands Also supports creation of user-defined message files for interactive user programs
N	Y	N	N	Large program segmenter to aid user in preparing Multi-Level Segmentation (MLS) Loader command files for segmentation of large programs (not needed for RTE-A)
N	Y	N	N	Cross-reference generator for identifying external routines that are called by a specified module and the routines in a specified module Also verifies the integrity of MLS Loader command files
N	Y	N	N	Source compare program for comparing two source files and identifying lines that differ and/or lines that are similar between the two files

A = RTE-A with VC+ provides a capability similar to ACCTS.

Table 4. RTE Operator and Program Requests

RTE-A	RTE-6/VM	RTE-IVB	RTE-L/XL	RTE REQUESTS
				Legend: O = Operator Request P = Program Request B = Both O and P requests N = Not available

PROGRAM SCHEDULING AND TIME OF DAY CLOCK REQUESTS

RTE-A	RTE-6/VM	RTE-IVB	RTE-L/XL	
B	B	B	B	Schedule programs to be run with or without wait for completion
B	B	B	B	Terminate or suspend execution of a program
B	B	B	B	Activate operator-suspended program
B	B	B	B	Change program priorities
O	O	O	O	List status of all programs or just currently executing programs
B	B	B	B	Request program execution at a specified time or specified interval
O	O	O	O	Set the real-time clock
B	B	B	B	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 operator)

INPUT/OUTPUT REQUESTS

RTE-A	RTE-6/VM	RTE-IVB	RTE-L/XL	
O	O	O	O	List I/O configuration in terms of table description and drivers
P	P	P	P	Read from/write to any I/O device with or without wait
P	P	P	P	Get status of queued read requests or the resulting input data
B	B	B	B	Control functions on mag tape or other peripheral device
B	B	B	B	Check I/O device/controller status
O	O	O	O	Alter I/O device timeout parameters
O	O	O	O	Alter device logical unit assignment
B	B	B	B	Control I/O device availability to programs
O	O	O	O	Alter device buffering assignments

RESOURCE CONTROL REQUESTS

RTE-A	RTE-6/VM	RTE-IVB	RTE-L/XL	
O	O	O	O	Display partition table (except in RTE-L)
P	P	P	P	Allocate/release own disc tracks or global disc tracks
B	P	P	B	Enable/disable swapping (except in RTE-L)
P	P	P	P	Request resource lock/unlock
P	P	P	P	Request device lock/unlock
N	P	P	N	Request partition status
O	O	O	O	Display or change program size
P	P	P	P	Determine size of own address space
O	O	N	N	Unlock sharable EMA partition
O	O	N	N	Establish working set size
P	N	N	P	Load program code segment from disc
P	N	N	P	Reserve buffer space outside the program space (except in RTE-L)
P	N	N	N	Get current status of memory

RTE-A	RTE-6/M	RTE-IVB	RTE-L/XL	RTE REQUESTS
				Legend: O = Operator Request P = Program Request B = Both O and P requests N = Not available

PROGRAM DEVELOPMENT REQUESTS

RTE-A	RTE-6/M	RTE-IVB	RTE-L/XL	
O	O	O	O	Compile or assemble programs (except in RTE-L)
O	O	O	O	Enter, test, debug, edit, and run BASIC programs (except in RTE-L)
O	O	O	O	Trace program execution, examine and modify memory and/or register contents, or perform other debugging operations
O	O	O	O	Edit program, data, and text files
O	O	O	O	Load relocatable programs and subroutines into a generated system

COMMAND INTERPRETER, FILE MANAGER, AND FILE MANAGEMENT PACKAGE REQUESTS

RTE-A	RTE-6/M	RTE-IVB	RTE-L/XL	
B	B	B	B	Create, locate, open, and close files
B	B	B	B	Rename and purge files
B	B	B	B	List or dump contents of a file to another file or to a peripheral device
B	B	B	B	Copy a file from one disc logical unit to another
B	B	O	O	List contents of a disc file directory
B	B	B	B	List contents of a cartridge directory of the disc logical units that are mounted on the system
B	B	N	N	Unpurge files prior to re-use of the affected file space
O	O	O	O	Pack a disc logical unit
P	P	P	P	Write in a random or sequential file
P	P	P	P	Read from a random or a sequential file relative record number
O	O	O	O	Mount and dismount cartridges

MISCELLANEOUS REQUESTS

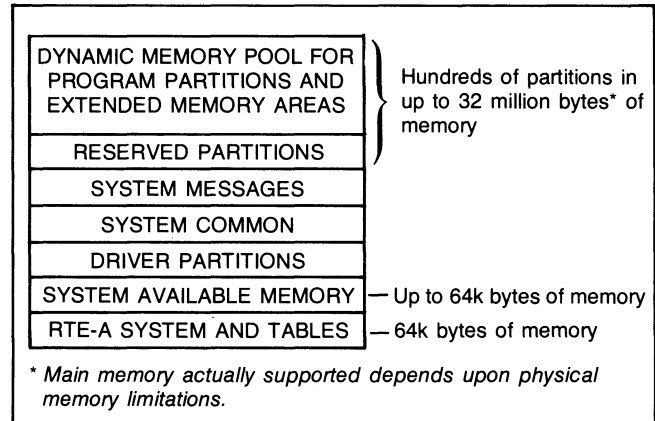| RTE-A	RTE-6/M	RTE-IVB	RTE-L/XL	
B	N	N	B	Determine the type of device (such as terminal, cartridge tape unit, disc, or printer) given the device number
P	N	N	P	Determine the device number of the terminal on which the command to run the program has been entered
P	P	P	P	Convert integers from ASCII to binary
P	P	P	P	Pass message or data buffers between programs
P	P	P	P	Get a parameter string entered by the operator who runs the program
P	P	P	P	Execute some system requests as if they had been entered by the operator who runs the program
P	P	P	P	Parse a command buffer into ASCII and integer fields
P	N	N	N	Control session status

RTE-A Real-Time Executive Operating System

The RTE-A Real-Time Executive operating system, product number 92077A, is a Real-Time Executive system for A-Series computers (HP 2136C/D, 2137A, 2139A, and 2156B) and A-Series Computer Systems (HP 1000 Micro 26, 27, and 29 and Models 6+, 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 128k bytes of main memory, but will support up to 32 megabytes*.

RTE-A is the "core" operating system for all current and future A-Series computers. New features, such as the 92078A Virtual Code+ (VC+) enhancement package, will 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	Hundreds of partitions in up to 32 million bytes* of memory
RESERVED PARTITIONS	
SYSTEM MESSAGES	
SYSTEM COMMON	
DRIVER PARTITIONS	
SYSTEM AVAILABLE MEMORY	— Up to 64k bytes of memory
RTE-A SYSTEM AND TABLES	— 64k bytes of memory

* Main memory actually supported depends upon physical memory limitations.

RTE-A System with 128 kilobytes to 32 megabytes* of memory

Features

- **All base capabilities of an RTE system as defined in the RTE operating systems data sheet on page 2-1, plus the following additional features**
- **Ample capacity for support of applications up to the very largest, with capabilities like:**
  - Management of 128k bytes up 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 1.998 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.
  - Up to 64 kilobytes of System Available Memory for buffered I/O and other uses.
  - 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**
- **New 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 24 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 128k 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 the 92078A data sheet 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

RTE-A incorporates a new file system that supports up to 20 gigabytes of disc memory. Practically usable disc space is limited mainly by card cage spaces available for disc interfaces and the capacity of available disc memories.

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 1.998 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, which more than quadruples the SAM available for buffering I/O requests as compared to other RTE systems. Larger SAM supports a much greater level 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 the relocating loader 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 without reloading.

A Hierarchical File System Incorporates Many User-Requested Enhancements

The new RTE-A 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 up to 404 megabytes long; and file unpurging. To take advantage of most of the file system improvements, user 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.

This is especially helpful in a system recovery situation. For example, after a system parity halt, a user can retrieve the interactive editor's work file by name and use it as the input source for continued editing, instead of losing edits that may have taken many hours to enter.

Single-Command Changeover to Another System

To boot an RTE-A system from a disc, the BOOTEX (Boot Extension) program is invoked from the computer's Virtual Control Panel (VCP) ROM. BOOTEX locates the operating system file on disc and 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

A new 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.

Operational requirements

A600 Hardware Revision Code

Model 6 and 16 Systems and 2106AK, 2136A/B, and 2156A Computers with serial prefix earlier than 2326 will be upgraded at no charge to work with RTE-A; contact your HP Customer Engineer or your nearest HP Sales Office for more information.

For User-Assembled Stand-Alone Systems

See Table 1.

For HP 1000 Systems

System Processor Units (SPUs) for HP 1000 Model 6*, 16*, 17, 19, 26, 27, and 29 systems and 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.

* See paragraph on A600 hardware revision code, above.

Table 1. Requirements for User-Assembled RTE-A Systems

Computer Product Number and Name	Interface(s) Required	Other Requirements
2106BK (A600+) Board Computer with 12030A Card Cage and Power Supply	12040B Eight-Chan Multiplexer or 12005A/B Async Serial Interface to system console and 12009A HP-IB (disc) Interface (optional)	Supported system console; system disc is optional
2107AK (A700) Board Computer with 12030A Card Cage and Power Supply	OR 12007B or 12044A DS/1000-IV pt-pt Interface OR 12072A Data Link Slave Interface OR 12008A PROM Module	OR Remote DS/1000-IV Network Node OR Fixed application program
2136C (A600+) Microsystem Component with Minifloppy discs	Terminal and disc interfaces included	Supported system console
2136D (A600+) Microsystem Component without Minifloppy discs	12009A HP-IB Interface (optional)	Supported system console & system disc (optional)
2156B (rack mtg A600+ box) Computer	12040B Eight-Chan Multiplexer* or 12005A/B Async Serial Interface to system console and 12009A HP-IB Disc Interface (optional)	Supported system console & system disc (optional)
2137A (rack mtg A700 box) Computer	OR 12007B or 12044A DS/1000-IV pt-pt Interface OR 12072A Data Link Interface	OR Remote DS/1000-IV Network Node
2139A* (rack mtg A900 box) Computer		
2436A (A600+) Micro 26 Component Package	OR 12008A PROM Module	OR Fixed application program
2437A (A700) Micro 27 Component Package		
2439A* (A900) Micro 29 Component Package		

* 12040B Eight-channel Asynchronous Multiplexer is not supported as a system console interface in the 2139A or 2439A because of excessive RFI.

Supported System Consoles

1. HP 2382A Office Display Terminal.
2. HP 262x Terminal (terminal Option 090 is required for integrated system console for Model 6+, or user-assembled system based on the HP 2136C/D Microsystem component).
3. HP 45610A HP 150 Multifunction Terminal.

Supported System Discs

Hard discs are required for program development, virtual memory, and/or system generation.

1. 14.5Mb Fixed (hard) Disc in 243xA +111 Micro/1000 package or 2486A +111 Micro 26, 2487A +111 Micro 27 or 2489A +111 Micro 29 system (270kb single microfloppy Disc is also included).
2. 7908R/P 16.5Mb Fixed (hard) Disc with built-in cartridge tape backup.
3. 7911R/P 28.1Mb Fixed (hard) Disc with built-in cartridge tape backup.
4. 7912R/P 65.6Mb Fixed (hard) Disc with built-in cartridge tape backup.
5. 7914R/P 132.1Mb Fixed (hard) Disc with built-in cartridge tape backup.
6. 7914TD 132.1Mb Fixed (hard) Disc and 1600 bpi mag tape in 56-in cabinet.
7. 7914ST 132.1Mb Fixed (hard) Disc and 1600 bpi mag tape in 56-in cabinet.
8. 7933H 404Mb Fixed (hard) Disc*.
9. 7935H 404Mb Removable Media (hard) Disc*.
10. 9121D 540kb Dual Microfloppy Disc.
11. 9133V/XV 4.8/14.5Mb Fixed (hard) Disc and 270kb single microfloppy disc.
12. 9134XV 14.5Mb Fixed (hard) Disc*.
13. 9895A 2.4Mb Dual Flexible Disc.

Model 6+ Minifloppy, 9121D Microfloppy Disc, 1600 bpi mag tape unit, or other software load device is also required with this disc.

Functional specifications

See page 2-2.

Optional software

See page 2-3.

Ordering information

92077A RTE-A Real-Time Executive Operating System (must order one of Use Options 600 through 891)

RTE-A consists of:

1. The following software on Media Option 022, 042, 044, 050, 051, or 061, one of which must be ordered:
   - A catalog file describing the set of software on the medium by part numbers and revision date codes
   - Primary RTE-A operating system, except with Option 051
   - On-line system generator
   - Macro/1000 Assembler, Edit/1000 interactive screen editor, and LINK relocating loader
   - HP-IB, relocatable, and decimal string arithmetic libraries
   - Command interpreter and file management package
   - System utilities
2. Manuals, as follows:
   a. 92077-90002 RTE-A User's Manual.
   b. 92077-90004 RTE-A Utilities Manual.
   c. 92077-90007 RTE-A Programmer's Reference Manual.
   d. 92077-90011 RTE-A Driver Reference Manual.
   e. 92077-90013 RTE-A System Design Manual.
   f. 92077-90019 RTE-A Driver Designer's Manual.
   g. 92077-90020 RTE-A Quick Reference Guide in 9282-0935 Binder.
   h. 92077-90034 RTE-A System Generation and Installation Manual.
   i. 92077-90035 RTE-A LINK User's Manual.
   j. 92077-90036 RTE-A Index and Glossary.
   k. 92077-90037 RTE-A Relocatable Libraries Manual.
   l. 92077-90038 RTE-A Primary System Installation Manual.
   m. 92077-90039 Getting Started with RTE-A.
   n. 92077-90048 FCO Utility Manual.
   o. 92074-90001 Edit/1000 User's Guide.
   p. 59310-90064 HP-IB User's Manual.
   q. 92059-90001 Macro/1000 Assembler Reference Manual.

92077A Options

022: Provides software or updates on CS/80 cartridge tape.

041: Provides software or updates on 1.2M byte flexible disc.

042: Provides software or updates on minifloppy disc for 2136A/C Microsystem component.

044: Provides software or updates on microfloppy disc for 243xA +111 Micro/1000 package or 9121D or 9133V/XV Disc.

050: Provides software or updates on 800 bpi, 9-track mag tape.

051: Provides software or updates on 1600 bpi, 9-track mag tape.

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

600: Use in 2106BK, 2136C/D, or 2156B Computer or 2436A Micro 26 Component Package.

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

700: Use in 2107AK or 2137A Computer or 2437A Micro 27 Component Package

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

890: Use in 2139A Computer or 2439A Micro 29 Component Package 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 600, 700, and/or 890 for use on a corresponding additional computer(s).

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

92077R Use of RTE-A for Program Development and Execution on One Additional Computer System (must order one of Use Options 600 through 891)

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. Manuals, as listed under 92077A, item 2, above.

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.

92077E Right to Execute RTE-A On One Additional Computer System (must order one of Use Options 600 through 891)

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.

RTE-A Software Support Products

See page 1-4.

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

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 and 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 FORTRAN, Pascal, or BASIC programs without any special conversion.

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 is also decreased because a code partition shared by many programs needs to be 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 can be recompiled to take advantage of shared code support. Programs that are not recompiled cannot be shared. Programs written in Macro/1000 Assembly language can be enhanced to include the instructions to implement separation of code and data.

A secure environment for multi-user operations

Log-on access control by the VC+ package verifies and identifies users who have legal access to the system. Each user must have a log-on name and (optionally) a password. These are associated with an individual directory of files that is integrated with the hierarchical file system of RTE-A and a program that will execute upon log-on to assist or inform the user.

Two simple categories of users are supported by the VC+ package. The most powerful are "superusers", 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, load, and run application programs. Standard users can also access some system commands to determine program and I/O status and program control, but are not allowed to issue 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 1.998 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 can 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: 2186A/B and 2196A/B, System Processor Units for Model 6 and 16 Systems with 256k bytes or more memory and 12107A (for 2186A/B and 2196A/B) and 2197A/B and 2199A/B System Processor Units for Model 17 and 19 Systems plus supported system console and system disc satisfy operational requirements of the RTE-A operating system with VC+. Customers on RTE-A.1 support will automatically receive RTE-A; customers not on support will have to purchase 92077A RTE-A with Use Option 601 (2186A/B or 2196A/B), 701 (2197A/B), or 891 (2199A/B).

For the latest HP 1000 A-Series Systems: 2186C/D, 2196C/D, 2197C/D, and 2199C/D System Processor Units (SPUs) for HP 1000 Model 6+, 26, 27, and 29 systems and 2486A, 2487A, and 2489A SPUs for HP 1000 Micro 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.)

For user-assembled stand-alone systems: Any of the following computers configured to support RTE-A. (See RTE-A operational requirements in the RTE-A data sheet).

1. 2106BK (A600+) Board Computer.
2. 2106AK (A600) Board Computer with 12107A Upgrade kit.
3. 2107AK (A700) Board Computer.
4. 2136C/D Model 6+ Component Package.
5. 2136A/B Model 6 Component Package with 12107A Upgrade Kit.
6. 2156B (rack mounting A600+) Computer.
7. 2156A (rack mounting A600) Computer with 12107A Upgrade Kit.
8. 2137A (rack mounting A700) Computer.
9. 2139A (rack mounting A900) Computer.
10. 2436A (A600+) Micro 26 Computer Package.
11. 2437A (A700) Micro 27 Component Package.
12. 2439A (A900) Micro 27 Component Package.

Ordering information

92078A RTE-A Virtual Code+ System Extension Package (must order one of Use Options 600 through 890)

The Virtual Code+ package consists of a 92078-90001 RTE-A Virtual Code+ (VC+) Information Sheet and the following software on Media Option 022, 041, 042, 044, 050, or 051, **one of which must be ordered:**

- A catalog file describing the set of software on the medium by part numbers and revision date codes
- Code and data separation and virtual code support software
- Enhanced multi-user environment software
- Extended outspooling software

92078A Media Options

022: Provides software or updates on 7908/11/12/14 compatible cartridge tape.

041: Provides software or updates on 1.2M byte flexible disc.

042: Provides software or updates on Minifloppy disc.

044: Provides software or updates on Microfloppy disc for 248xA+110 or 243xA+110 Micro/1000 Package or 9121D or 9133A/B Disc.

050: Provides software or updates on 800 bpi, 9-track mag tape.

051: Provides software or updates on 1600 bpi, 9-track mag tape.

92078A/R Use Options

600: Use in one 2106BK, 2136C/D, 2156B, 2186C/D, 2196C/D, 2436A, or 2486A.

700: Use in one 2107AK, 2137A, 2197C/D, 2437A, or 2487A.

890: Use in one 2139A, 2199A/B/C/D, 2439A, or 2489A or in any other A-Series computer capable of supporting VC+. With 92078A, includes the right to purchase one or more 92078R products with Use Option 600, 700 and/or 890 for use on a corresponding additional computer(s).

92078R Use of VC+ Package on One Additional Computer System (must order one of Use Options 600 through 890)

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.

VC+ Software Support Products

See page 1-4.

RTE-6/VM Real-Time Executive Operating System

HEWLETT PACKARD

The 92084A RTE-6/VM is a disc-based Real-Time Executive operating system used for management of the operations and resources of HP 1000 Model 60 and 65 Computer Systems and user-assembled systems based on Hewlett-Packard 2109, 2111, 2113, or 2117 Computers.

Features

- **All base capabilities of an RTE system as defined in the RTE operating systems data sheet on page 2-1.**
- **Large capacity for applications support, with:**
  - Management of 256 kb* to 2 Mb of main memory
  - File system support of up to 20 Gb of disc storage
  - Virtual memory for data arrays up to 128 Mb, divided between main memory and disc
  - Extended memory areas up to 1.8 Mb resident in main memory, up to 8 of which are sharable by up to 256 programs
  - Extended code space capability for development or conversion of very large programs to run in RTE-6/VM without source code modification
  - Up to 64 user partitions, any of which may be reserved for programs that require the fastest possible response to interrupt
  - Up to 255 equipment table entries (device controllers)
- **Firmware operating system accelerators to maintain high system throughput**
- **Session Monitor multi-user interface with:**
  - Access to system by password-protected accounts
  - Independence between multiple users
  - Protected file domains
  - Individually tailored environments
- **New 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

A large-capacity multi-user system

Firmware-Accelerated Responsiveness

Many time-critical operating system functions are implemented in microcode in RTE-6/VM. These functions include saving the state of the previously executing task upon interrupt, list searching, and time base generator handling. Implementation of these functions in microcode gives the system the speed it needs to carry the heavy workload of large applications. (Slower-executing software routines must be used in M-Series computers because of their much smaller control address space.)

Up to 255 Equipment Table Entries (EQTs)

RTE-6/VM supports up to 255 EQTs (an EQT is associated with one device controller). The actual number of I/O devices on a system may now be limited by the number of physical I/O slots in the computer (maximum of 46 slots on 2112M, 2113E, and 2117F with two 12979C I/O extenders), although some I/O cards, such as the 12792B Multiplexer or the 12790A Multipoint/Data Link interface can support many devices.

Large Main Memory Capacity

The RTE-6/VM system can operate in as little as 256k bytes* of memory, but can manage large-system applications in up to 2 megabytes.

Up to 64 Partitions for Programs

RTE-6/VM can manage up to 64 different multi-user partitions for programs and data. Partitions can be as small as 4 kilobytes or as large as 1.8 megabytes, of which 64 kilobytes is available for program code. Extensive capacity for data is provided by Virtual Memory and Extended Memory Area capabilities, as defined below. Critical programs can be made resident in fixed partitions to assure the fastest possible response to requests for their execution. Other programs scheduled for execution will be loaded into the smallest available partition in which they can execute. If none is available, the lowest priority program will be swapped out to free a partition.

Extended Code Space for Large Programs

A Multilevel Segmentation, Load-on-Call (MLS-LOC) facility simplifies the development or conversion, loading, and execution of programs with large code requirements. MLS-LOC is used when a program's memory requirements are larger than the 64 kilobyte logical address space of the computer. The MLS loader is used to segment programs. Segments can reside in physical memory, or on disc or in both. Segmenting is done at load time without any change to source code, which makes it relatively easy to transport large programs to RTE-6/VM. The run-time LOC facility, which maps segments into the logical address space, is fastest when segments are in main memory, but will also work for segments on disc.

A Gigabyte Capacity Disc File System

The RTE-6/VM primary system supports up to 3.2 gigabytes of disc memory based on up to eight 793xH 404 megabyte fixed or removable media CS/80 discs. Drivers for more interfaces can be generated into the system to support more disc capacity (up to about 20 gigabytes, limited mainly by card cage spaces available for disc interfaces and the capacity of available disc memories).

* RTE-6/VM Primary System requires at least 512 kb of memory.

Lots of Virtual Memory Space for Data

Up to 1.8 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 8 different sharable EMAs (SHEMAs) can be set up, within the limits of available memory. A SHEMA can accommodate up to 1.8 megabytes of data — data that is accessed quickly because it is all in main memory. Each SHEMA can be shared by up to 256 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 use of one program, within the limits of available main memory.

A Hierarchical File System

A new 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 up to 404 megabytes long, and file unpurging. To take advantage of most of the file system improvements, user file directories must be reformatted and programs must be modified. Directory reformatting can be done by a utility included with RTE-6/VM 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.

Operational requirements

For HP 1000 Computer Systems

HP 1000 Computer Systems, Models 60 and 65, include and satisfy operational requirements for the RTE-6/VM operating system.

For User-Assembled Systems

See Table 1.

Supported System Consoles

1. 262x Terminal* other than 2621B with 12966A +105 interface.
2. 2621B Interactive Terminal* or 2382A Office Display Terminal* or 45610A HP 150 Multifunction Terminal* with 12966A +106 interface.

With this console, an HP 7970B/E Mag Tape or an HP 85A/B Desktop Computer is also required by users who wish to have the ability to load and run diagnostics and/or use the off-line backup utility.

Table 1. Requirements for User-Assembled RTE-6/VM Systems

HP1000 Series	M	E	F
Computer	2108M* or 2112M*	2109E or 2113E	2111F or 2117F
Serial Prefixes	1833** and later	1812** and later	All
Firmware Mounting	Not Required	12791A or 13304A #	12791A Included
Power Fail Recovery System	12944B or 12991B	12944B or 12991B	12991B
Memory	256 kb or more; primary system requires 512 kb or more (see M/E/F-Series Data book for choices)		
Other Requirements	1. 12897B Dual-Chan Port Controller 2. 12539C Time Base Generator 3. Any supported system console with 12966A interface and appropriate cable 4. Any supported standard I/O unit 5. Any supported system disc with appropriate interface		

* Not recommended due to insufficient control store address capacity.

** For information on upgrading HP 1000 computers with earlier Serial Prefixes to use with RTE-6/VM, check with your Hewlett-Packard Sales Representative.

\# E-Series computers can use a 13304A Firmware Accessory Board, which does not use an I/O slot, or a 12791A Firmware Expansion Module, which does use an I/O slot. However, an E-Series with RTE-IVB EMA microcode as well as RTE-6/VM microcode will require the 12791A Module.

Supported Standard Input/Output Units

1. Mini cartridge I/O on 264x Terminal.
2. 7970B/E +226/236 800/1600 bpi Magnetic Tape Subsystem in own cabinet or for rack mounting. Either subsystem is expandable to a total of four drives.
3. 9895A +100 or 9895A +010,100 Master Dual/Single Flexible Disc Drive with 12821A Disc interface.
4. 12732A Flexible Disc Subsystem.

Supported System Discs

Any of the disc interfaces plus disc combinations listed under item 1, 2, or 3, below.

1. One of the following Command Set/80 (CS/80) discs connected to the system via a 12821A +001 interface (up to four discs per interface). The 12992J Loader ROM is required with CS/80 discs unless a 12992D Mag Tape Loader ROM is to be used for bootup from a 7970B/E +226/236 Mag Tape Subsystem.
   a. 7908P/R 16.5M byte fixed disc with cartridge tape backup.
   b. 7911P/R 28.1M byte fixed disc with cartridge tape backup.
   c. 7912P/R 65.6M byte fixed disc with cartridge tape backup.
   d. 7914P/R 132.1M byte fixed disc with cartridge tape backup.
   e. 7914TD+236 132.1M byte fixed disc with 1600 bpi mag tape unit in 56-inch cabinet (includes E/F-Series interface to MTU.

f. 7933A 404M byte fixed disc*.

g. 7935A 404M byte removable media disc*.

2. One of the following Multi-Access Controller (MAC) Master discs connected to the system via a 13175D interface (first computer connected) or 13178D interface (second through eighth computer connected). Up to seven 79xxS MAC Slave discs can be connected to the system via the MAC Master disc. The 12992B RPL Compatible MAC Disc Loader ROM is required with MAC discs.

   a. 7906M/MR +020/025 19.6M byte MAC Master Cartridge Disc Memory.

   b. 7920M 50M byte MAC Master removable pack Disc Memory.

   c. 7925M 120M byte MAC Master removable pack Disc Memory.

3. One of the following Integrated Controller Discs (ICDs) connected to the system via a Disc interface. A maximum of four ICDs can be connected to the system via two interfaces. (NOTE: The ICD products are listed here primarily to confirm their compatibility with the RTE-6/VM operating system. The ICD products are not supported in HP 1000 Model 60 or 65 Systems.) The 12992H Loader ROM, included with 12821A standard interface, is required with ICD products.

   a. 7906H/HR +020 19.6M byte Cartridge ICD memory.

   b. 7920H 50M byte ICD removable pack memory.

   c. 7925H 120M byte ICD removable pack memory.

* *Requires a 7970B/E +226/236 Magnetic Tape Subsystem and 12992D Mag Tape Loader ROM for system bootup, software loading, and system backup.*

Ordering information

92084A RTE-6/VM Operating System

RTE-6/VM consists of:

1. RTE-6/VM software as described in this data sheet on one of media options 022 through 061, which must be ordered.

2. Firmware ROMs containing RTE-6/VM microcode for HP 1000 E/F-Series Computers.

3. Manuals set, as follows:

   a. 92084-90001 RTE-6/VM Index to Operating System Manuals.

   b. 92084-90002 Getting Started with RTE-6/VM.

   c. 92084-90003 RTE-6/VM Quick Reference Guide with 9282-0935 binder.

   d. 92084-90004 RTE-6/VM Terminal User's Reference Manual.

   e. 92084-90005 RTE-6/VM Programmer's Reference Manual.

   f. 92084-90006 RTE-6/VM Batch and Spooling Reference Manual.

   g. 92084-90007 RTE-6/VM Utility Programs Reference Manual.

   h. 92084-90008 RTE-6/VM Loader Reference Manual.

   i. 92084-90009 RTE-6/VM System Manager's Reference Manual.

j. 92084-90010 RTE-6/VM On-Line Generator Reference Manual.

k. 92084-90011 RTE-6/VM Software Installation Manual.

l. 92084-90033 RTE-6/VM Command Interpreter User's Manual.

m. 92077-90037 RTE-A and RTE-6/VM Relocatable Libraries Reference Manual.

n. 92084-90014 RTE-6/VM Debug Subroutine Reference Manual.

o. 92084-90017 RTE-6/VM Interactive Line Editor Reference Manual.

p. 92059-90001 Macro/1000 Reference Manual.

q. 92068-90016 READR/SAVER Utility Reference Manual.

r. 92074-90001 Edit/1000 User's Guide.

s. 92200-93005 RTE Operating System Driver Writing Manual.

t. 09580-93027 DVM72 RTE Universal Interface Driver Manual.

u. 92084-90026 DVA37 for HP 59310B HP-IB Manual.

v. 12732-90001 DVR33 12732A/12733A Flexible Disc Driver Manual.

w. 92084-90025 DVM33/DVN33 CS/80 Disc Driver Manual.

x. 92068-90012 DVR32/DVA32 MAC/ICD Disc Driver Manual.

y. 92202-93001 DVR23 7970 Mag Tape Units Driver Manual.

z. 91200-90005 DVA13 91200B Driver Manual.

aa. 92001-90010 DVA12 Line Printer Driver Manual.

ab. 92062-90004 DVB12 2608A Line Printer Driver Manual.

ac. 92068-90022 DVC12 Line Printer Driver Manual.

ad. 92001-90015 DVR05/DVA05 264x Terminal Driver Manual.

ae. 29029-95001 DVR00 Multi-Device Driver Manual.

af. 59310-90064 HP-IB User's Guide.

ag. 92062-90003 2631B/2635B Printer Utility Subroutines Reference Manual.

ah. 5955-8867 12792B Multiplexer User's Manual.

ai. 5955-8868 12792B Multiplexer Configuration Guide.

aj. 92084-90038 RTE-6/VM Link User's Manual.

ak. 12791-90001 12791A Firmware Expansion Module Installation and Service Manual.

92084A Options

001: Provides a discount for upgrade from 92067A RTE-IV or 92068A RTE-IVB system for customer without 92068T/S

002: Provides a discount for upgrade from current version of 92068A RTE-IVB for customer currently on 92068T/S update service

022: Provides RTE-6/VM primary system on CS/80 cartridge tape

031: Provides RTE-6/VM primary system on 12940A (10M byte) disc cartridge for 7905A/7906M/MR Cartridge Disc Drive

032: Provides RTE-6/VM primary system on 13394A (50M byte) disc pack for 7920M Disc Drive

033: Provides RTE-6/VM primary system on 13356A (120M byte) disc pack for 7925M Disc Drive

036: Provides RTE-6/VM primary system on 12940A (10M byte) disc cartridge for 7906H/HR Cartridge ICD Drive

037: Provides RTE-6/VM primary system on 13394A (50M byte) disc pack for 7920H ICD Drive

038: Provides RTE-6/VM primary system on 13356A (120M byte) disc pack for 7925H ICD Drive

050: Provides RTE-6/VM relocatables on 800 bpi tape in WRITT format

051: Similar to 050, but on 1600 bpi mag tape

052: Provides RTE-6/VM primary system on 800 bpi mag tape in 7905A/7906M/7920M image format

053: Similar to 052, but on 1600 bpi mag tape

054: Provides RTE-6/VM primary system on 800 bpi mag tape in 7925M image format

055: Similar to 054, but on 1600 bpi mag tape

056: Provides RTE-6/VM primary system on 800 bpi mag tape in 7906H/7920H image format

057: Similar to 056, but on 1600 bpi mag tape

058: Provides RTE-6/VM primary system on 800 bpi mag tape in 7925H image format

059: Similar to 058, but on 1600 bpi mag tape

060: Provides RTE-6/VM primary system on 800 bpi mag tape in 7933H/7935H image format

061: Similar to 060, but on 1600 bpi mag tape

100: Deletes RTE-6/VM Manuals

RTE-6/VM Operating System in HP 1000 Computer Systems

The RTE-6/VM operating system with media option appropriate to the system disc ordered is included in HP 1000 Model 60 and 65 Computer Systems, which are based on 2178A/C and 2179A/C System Processor Units.

92084R Use of RTE-6/VM on One Additional Computer System

The 92084R product is available only to customers who have purchased a license to use 92084A. 92084R consists of:

1. Firmware ROMs containing RTE-6/VM microcode for HP 1000 E/F-Series Computers.
2. The license to make one copy of software purchased with the 92084A product for use on one additional system.
3. Manual set, as listed under 92084A, above.

92084R Options

001: Provides a discount for upgrade from 92067R or 92068R product for customer not supported under 92068V/W.

002: Provides a discount for upgrade from 92068R product for customer supported under 92068V/W.

100: Deletes manuals from the 92084R product.

RTE-6/VM Software Support Products

RTE-IVB Real-Time Executive Operating System

HP 1000 E/F-Series Mature Software   product number 92068A

The 92068A RTE-IVB is a disc-based Real-Time Executive operating system used for management of the operations and resources of HP 1000 Model 40 and 45 Computer Systems and user-assembled systems based on Hewlett-Packard 2108, 2109, 2111, 2112, 2113, or 2117 Computers.

RTE-IVB is also configurable as a memory-based, execute-only system (RTE-IVE) for user-assembled systems that need the power and versatility available with 2 megabytes of memory, but without the added cost and environmental vulnerablilty of a disc. It is important to understand, however, that system services which depend upon the system disc are not supportable in the RTE-IVE system. The services not supportable in RTE-IVE include the multi-user session monitor, program development, system generation, program swapping, file management, and batch processing.

Features

- All base capabilities of an RTE system as defined in the RTE operating systems data sheet on page 2-1, plus the following additional features
- Large capacity for applications support, with capabilities like:
  - Management of 128k bytes* up to 2M bytes of main memory
  - File system capable of supporting up to 1.9 gigabytes of disc storage
  - Extended memory area up to 1.8 megabytes resident in main memory
  - Up to 64 user partitions, any of which may be reserved for programs that require the fastest possible response to interrupt
- Human engineered Session Monitor multi-user interface provides features to increase system ease of use, including:
  - Access to system by password-protected accounts
  - Independence between multiple users
  - Protected file domains
  - Individually tailored environments

RTE-IVB: A capable, friendly multi-user system

Large Main Memory Capacity

The RTE-IVB system can operate in as little as 128k bytes of memory, but can manage large-system applications in up to 2 megabytes.

Up to 64 Partitions for Programs

RTE-IVB can manage up to 64 different multi-user partitions for programs and data. Partitions can be as small as 4 kilobytes or as large as 1.8 megabytes, of which 54 kilobytes is available for program code. Extensive capacity for data is provided by an Extended Memory Area (EMA), as defined below. Critical programs can be made resident in reserved partitions to assure the fastest possible response to requests for their execution. Other programs scheduled for execution will be loaded into the smallest available partition in which they can execute. If none is available, the lowest priority program will be swapped out to free a partition.

Extended Memory Area (EMA) for Data

Through the use of an Extended Memory Area (EMA) capability, data arrays over 33 times larger than the maximum user partition space can be processed by user's programs in systems with 2 megabytes of memory. The area available for data is equal to total physical memory less the memory allocated to the system, I/O drivers, resident programs, COMMON areas, and the user's disc resident program(s). An EMA up to 1.8 megabytes is possible.

Friendly Multi-User Environment

RTE-IVB includes a Session Monitor interface for on-line terminal users to control and coordinate their access to system resources and provide friendly assistance. The Session Monitor permits only users with valid identification to access the system. It sets up the same session logical units for each session so that session users are spared the inconvenience of learning a new set of logical unit numbers whenever the system configuration is changed or when changing from one terminal or set of similar peripherals to another. The system protects users from each other by mounting disc cartridges to specific users or groups of users and by locking peripherals while they are in use. Multiple users desiring to use the same program are each given a uniquely-identified copy. Optional time slicing can be used to help assure equitable sharing of program execution time among the various session users.

Operational requirements

For HP 1000 Computer Systems

HP 1000 Computer Systems, Models 40 and 45, include and satisfy operational requirements for the RTE-IVB operating system.

RTE-IVB Primary System requires at least 256 kb of memory.

For User-Assembled Systems

See Table 1.

Table 1. Requirements for User-Assembled RTE-IVB Systems

HP1000 Series	M	E	F
Computer	2108M or 2112M	2109E or 2113E	2111F or 2117F
Serial Prefixes	1810* and later	1812* and later	All
Firmware Mounting	Not Required	12791A or 13304A **	12791A Included
Power Fail Recovery System	12944B or 12991B	12944B or 12991B	12991B
Memory	128k bytes or more; primary system requires 256kb or more (see HP 1000 M/E/F-Series Data book for choices)		
Other Requirements	1. 12897B Dual-Chan Port Controller 2. 12539C Time Base Generator 3. Any supported system console with 12966A interface and appropriate cable 4. Any supported standard I/O unit 5. Any supported system disc with appropriate interface		

* For information on upgrading HP 1000 computers with earlier Serial Prefixes to work with RTE-IVB, check with your Hewlett-Packard Sales Representative.

** E-Series computers can use a 13304A Firmware Accessory Board, which does not use an I/O slot, or a 12791A Firmware Expansion Module, which does use an I/O slot. However, an E-Series with RTE-6/VM microcode as well as RTE-IVB EMA microcode will require the 12791A Module.

Supported System Consoles

1. 264x Terminal with Minicartridge I/O and 12966A +001 interface (after October 1, 1983 will be deliverable in the United States only for EMI-exempt applications).
2. 262x Terminal* other than 2621B with 12966A +105 interface.
3. 2621B Interactive Terminal or 2382A Office Display Terminal or 45610A HP 150 Multifunction Terminal with 12966A +106 interface.

* An HP 7970B/E Mag Tape or an HP 85A/B Desktop Computer is also required by users who wish to have the ability to load and run diagnostics and/or use the off-line backup utility.

Supported Standard Input/Output Units

1. Mini cartridge I/O on 264x Terminal.
2. 7970B/E +226/236 800/1600 bpi Magnetic Tape Subsystem in own cabinet or for rack mounting. Either subsystem is expandable to a total of four drives.
3. 9895A +100 or 9895A +010,100 Master Dual/Single Flexible Disc Drive with 12821A interface.
4. 12732A Flexible Disc Subsystem.

Supported System Discs

Any of the disc interfaces plus disc combinations listed under item 1. or 2., below.

1. One of the following Multi-Access Controller (MAC) Master discs connected to the system via a 13175D interface (first computer connected) or 13178D interface (second through eighth computer connected). Up to seven 79xxS MAC Slave discs can be connected to the system via the MAC Master disc. The 12992B Loader ROM is required with MAC discs.
   a. 7906M/MR +020/025 19.6M byte MAC Master Cartridge Disc Memory.
   b. 7920M 50M byte MAC Master removable pack Disc Memory.
   c. 7925M 120M byte MAC Master removable pack Disc Memory.
2. One of the following Integrated Controller Discs (ICDs) connected to the system via a 12821A interface. A maximum of four ICDs can be connected to the system via two interfaces. (NOTE: The ICD products are listed here primarily to confirm their compatibility with the RTE-IVB operating system. The ICD products are not supported in HP 1000 Model 40 or 45 Systems.) The 12992H Loader ROM, which is included with the 12821A interface, is required with ICD products.
   a. 7906H/HR +020 19.6M byte Cartridge ICD memory.
   b. 7920H 50M byte ICD removable pack memory.
   c. 7925H 120M byte ICD removable pack memory.

Ordering information

92068A RTE-IVB Operating System

RTE-IVB consists of:

1. RTE-IVB software as described in this data sheet on one of media options 031 through 059, which must be ordered.
2. Firmware ROMs containing EMA microcode for HP 1000 E/F-Series Computers.
3. Manuals set, as follows:
   a. 92068-90001 Getting Acquainted With RTE-IVB.
   b. 92068-90002 RTE-IVB Terminal User's Reference Manual.
   c. 92068-90004 RTE-IVB Programmer's Reference Manual.
   d. 92068-90005 Batch and Spooling Reference Manual.
   e. 92068-90006 RTE-IVB System Manager's Manual.
   f. 92068-90007 RTE-IVB On-Line Generator Reference Manual.
   g. 92068-90010 RTE-IVB Utility Programs Reference Manual.
   h. 92067-90005 RTE-IV Debug Subroutine Manual.
   i. 92067-90003 RTE-IV Assembler Reference Manual.
   j. 92200-93005 Driver Writing Manual.
   k. 12791-90001 HP 1000 M/E/F-Series Firmware Expansion Module Installation and Service Manual.
   l. 5955-8867 HP 12792B 8-Channel Asynchronous Multiplexer User's Manual.

m. 5955-8868 HP 12792B Configuration Guide.
n. 92067-90007 EMA Firmware Diagnostic Manual.
o. 02100-90140 Decimal String Arithmetic Manual.
p. 12992-90001 Loader ROM Installation Manual.
q. 09580-93027 DVM72 RTE Universal Interface Driver Manual.
r. 09600-93010 DVR11 Card Reader Driver Manual.
s. 12732-90001 DVR33 Flexible Disc Driver Manual.
t. 24998-90001 RTE-DOS Relocatable Library Manual.
u. 29029-95001 DVR00 Multi-Device Driver Manual.
v. 59310-90063 DVR37 59310B HP-IB Interface Programming Manual.
w. 91200-90005 DVA13 TV Monitor Driver Manual.
x. 92001-90010 DVR12 Line Printer Driver Manual.
y. 92068-90022 DVC12 (2608S) Line Printer Driver Manual.
z. 92001-90015 DVR05/DVA05 264x Console Driver Manual.
aa. 92202-93001 DVR23 7970 Mag Tape Units Driver Manual.
ab. 92062-90003 2631 Device Subroutine LP31 Manual.
ac. 92062-90004 DVB12 2608A Line Printer Driver Manual.
ad. 92068-90003 RTE-IVB Quick Reference Guide with 9282-0935 binder.
ae. 92068-90011 RTE-IVB Software Catalog.
af. 92068-90012 RTE-IVB Drivers DVR32/DVA32 Manual.
ag. 92068-90015 RTE-IVB Operating System Reference Manual.
ah. 92068-90016 READR/SAVER Utility Reference Manual.
ai. 92068-90023 Getting Started on Your RTE-IVB Primary System.
aj. 92068-90017 Index to 92068A RTE-IVB Operating System.
ak. 92074-90001 Edit/1000 User's Guide.
al. 59310-90064 HP-IB in the HP 1000 User's Manual.
am. 92060-90023 RTE FORTRAN IV Reference Manual.

92068A Options

001: Provides a discount for upgrade from 92064A RTE-M, 92001B RTE-II, or 92060A RTE-III system or for upgrade from a previous revision of 92068A RTE-IVB system to the latest revision, for customers without 92068T/S service.

031: Provides RTE-IVB software on 12940A (10M byte) disc cartridge for 7905A/7906M/MR Cartridge Disc Drive

032: Provides RTE-IVB software on 13394A (50M byte) disc pack for 7920M Disc Drive

033: Provides RTE-IVB software on 13356A (120M byte) disc pack for 7925M Disc Drive

036: Provides RTE-IVB software on 12940A (10M byte) disc cartridge for 7906H/HR Cartridge ICD Drive

037: Provides RTE-IVB software on 13394A (50M byte) disc pack for 7920H ICD Drive

038: Provides RTE-IVB software on 13356A (120M byte) disc pack for 7925H ICD Drive

92068R Use of RTE-IVB on One Additional Computer System

The 92068R product is available only to customers who have purchased a license to use 92068A. 92068R consists of:
1. Firmware ROMs containing EMA microcode for HP 1000 E/F-Series Computers.
2. The license to make one copy of software purchased with the 92068A product for use on one additional system.
3. Manuals set, as listed under 92068A RTE-IVB, above.

92068R Option 001

Provides a discount for right to copy the 92068A +001 product or a 92068T/S update for customer who has previously purchased the 92068R product.

92068E License to Generate and Execute One RTE-IVE Execute-Only, Memory-Based Operating System on One HP 1000 M/E/F-Series Computer

Includes EMA firmware. Prerequisite is the current RTE-IVB system. DS/1000-IV software must also be current if used with RTE-IVE.

92068E Options

001: Provides a discount for upgrade from 92064A RTE-M operating system for customer without 92064T/S support service.

002: Provides a discount for upgrade from 92064A RTE-M operating system for customer with 92064T/S support service.

RTE-IVB Support Products

RTE-L and RTE-XL Real-Time Executive Operating Systems

The 92070B RTE-L and 92071A RTE-XL are disc or memory-based Real-Time Executive operating systems used for management of the operations and resources of user-assembled systems based on Hewlett-Packard 2103L/LK Microcomputers. The 92071A RTE-XL system is also the operating system for the HP 1000 Model 5 Microsystem. These systems support the base capabilities of an RTE system as defined in the RTE operating systems data sheet on page 2-1.

Operational requirements

For HP 1000 Computer Systems

The HP 1000 Model 5 Microsystem includes and satisfies operational requirements for the RTE-XL operating system.

For User-Assembled Stand-Alone Systems

See Table 1.

Table 1. Requirements for User-Assembled RTE-L/XL Systems

Computer Product Number and Name	Interface(s) Required	Other Requirements
2103LK Board Computer with 1203xA Card Cage and power supply (RTE-XL support requires 2103LK Option 011 or 012)	12005A/B Async Serial (terminal) Interface 12009A HP-IB Interface (optional) OR 12007B or 12044A DS/1000-IV pt-pt Interface	Supported system console; system disc is optional OR Remote DS/1000-IV Network Node
2103L Computer (RTE-XL support requires 2103L Option 011 or 012)	OR 12072A Data Link Slave Interface OR 12008A PROM Module	OR Fixed application program
2122A Model 5 Microsystem Component with Minifloppy discs (RTE-XL support requires 2122A Option 011 or 012)	Terminal and disc interfaces included	Supported system console
2122B Model 5 Microsystem Component without Minifloppy discs (RTE-XL support requires 2122B Option 011 or 012)	12009A Disc Interface (optional) OR 12007B or 12044A DS/1000-IV pt-pt Interface OR 12072A Data Link Slave Interface OR 12008A PROM Module	Supported system console; system disc is optional OR Remote DS/1000-IV Network Node OR Fixed Application Program

Supported System Consoles

HP 262x Terminal (terminal Option 090 is required for Model 5 or user-assembled system based on 2122A/B Microsystem component).

Supported System Discs

Hard discs are required for program development and/or system generation in RTE-XL.

1. 7908P 16.5Mb Fixed (hard) Disc with built-in cartridge tape backup.
2. 7911P 28.1Mb Fixed (hard) Disc with built-in cartridge tape backup.
3. 7912P 65.6Mb Fixed (hard) Disc with built-in cartridge tape backup.
4. 7914P 132.1Mb Fixed (hard) Disc with built-in cartridge tape backup.
5. 9895A 2.4Mb Dual Flexible Disc.

Ordering information

92070B RTE-L Operating System

RTE-L consists of:

1. The following software on Media Option 041, 050 or 051, one of which must be ordered:
   - A catalog file describing the set of software on the medium by part numbers and revision date codes
   - RTE-L operating system
   - On-line system generator
   - Interactive debug utility, interactive editor, and relocating loader
   - HP-IB, relocatable, and decimal string arithmetic libraries
   - File manager and file management package
   - System and PROM programming utilities
2. The following manuals:
   a. 92070-90001 Getting Started With Your HP 1000 L-Series Computer.
   b. 92070-90002 RTE-L/XL Operator's Guide.
   c. 92070-90003 Interactive Editor Reference Manual.
   d. 92070-90004 RTE-L/XL Utilities Manual.
   e. 92070-90006 RTE-L/XL General Information Manual.
   f. 92070-90007 RTE-L/XL Programmer's Reference Manual.
   g. 92070-90008 File Management Reference Manual.
   h. 92070-90010 RTE-L/XL Debug Reference Manual.
   i. 92070-90011 RTE-L/XL Driver Reference Manual.
   j. 92070-90014 RTE-L/XL Generator Planning Guide.
   k. 92070-90016 RTE-L/XL Generator Reference Manual.
   l. 92070-90019 RTE-L/XL Driver Designer's Manual.
   m. 92070-90042 RTE-L/XL Generation Requirements for Drivers Manual.
   n. 92070-90030 RTE-L/XL PROM User's Guide.
   o. 02100-90140 Decimal String Arithmetic Routines Manual.
   p. 24998-90001 Relocatable Library Manual.
   q. 59310-90064 HP-IB User's Manual.
   r. 92070-90009 RTE-L Relocating Loader Reference Manual.

s. 92070-90013 RTE-L System Design Manual.
t. 92070-90018 RTE-L Software Installation Guide.
u. 92070-90020 RTE-L Quick Reference Guide.
v. 92067-90003 Assembler Reference Manual.

92071A RTE-XL Operating System

RTE-XL consists of:

1. The following software on Media Option 022, 041, 042, 050 or 051, one of which must be ordered:
   - A catalog file describing the set of software on the medium by part numbers and revision date codes
   - Primary RTE-XL operating system
   - On-line system generator
   - Macro/1000 Assembler, Edit/1000 interactive screen editor, interactive debug utility, and relocating loader
   - HP-IB, relocatable, and decimal string arithmetic libraries
   - File manager and file management package
   - System and PROM programming utilities
2. The following manuals:
   a   through q. Same as items a through q furnished with 92070B, above.
   r. 92071-90009 RTE-XL Relocating Loader Reference Manual.
   s. 92071-90013 RTE-XL System Design Manual.
   t. 92071-90018 RTE-L Software Installation Guide.
   u. 92059-90001 Macro/1000 Reference Manual.
   v. 92067-90003 RTE-IV Assembler Manual.
   w. 92074-90001 Edit/1000 User's Guide.

92070B/92071A Options

001: Provides a discount for upgrade from RTE-L to RTE-XL for purchaser of 12002A/B Extended memory controller who is not supported under 92070T/S.

002: Provides a discount for upgrade from RTE-L to RTE-XL for purchaser of 12002A/B Extended memory controller who is supported under 92070T/S.

022: Provides software or updates on CS/80 cartridge tape.

041: Provides software or updates on 1.2M byte flexible disc.

042: Provides software or updates on minifloppy disc for 2122A Microsystem component.

050: Provides software or updates on 800 bpi, 9-track mag tape.

051: Provides software or updates on 1600 bpi, 9-track mag tape.

100: Deletes manuals (from 92071A only).

92070R Use of RTE-L for System Generation and Execution on One Additional Computer System

The 92070R product is available only to customers who have purchased a license to use 92070B. 92070R consists of:

1. The right to make one copy of software purchased with the 92070B RTE-L system for use on an additional system.
2. The manuals provided with the 92070B product, listed above.

92070E Right to Execute RTE-L On One Additional Computer System

This is a low-cost load and execute only license for an OEM. No manual or software is supplied with this product.

92071R Use of RTE-XL for Program Development and Execution on One Additional Computer System

The 92071R product is available only to customers who have purchased a license to use 92071A. 92071R consists of:

1. The right to make one copy of software purchased with the 92071A RTE-XL system for use on an additional system.
2. The manuals provided with the 92071A product, listed above.

92071R Options

001: Discount for the right to copy the 92071A+001 product for customer who has previously purchased the 92070R product without software support and is concurrently purchasing a 12002A/B+001 XL Memory Controller for the system on which the copied 92071A software is to be used.

002: Discount for the right to copy the 92071A+001 product for customer who has previously purchased the 92070R product with software support and is concurrently purchasing a 12002A/B+001 XL Memory Controller for the system on which the copied 92071A software is to be used.

92071E Right to Execute RTE-XL on One Additional Computer System

This is a low-cost load and execute only license for an OEM. No manual or software is supplied with this product.

RTE-L/XL Software Support Products

Datasafe/1000

Reliability Enhancement Software for RTE-6/VM Systems   product number 91745A

Datasafe/1000 is a software package for RTE-6/VM systems which allows disc cartridges to be configured in mirrored pairs for data protection and high availability. These cartridge pairs can be configured on a single disc drive or on separate disc drives for a higher degree of data protection against disc failure. The Datasafe package contains a pseudo disc driver which functions as a user-transparent manager for the mirrored pairs and a utilities package to create, verify, and restore cartridge pairs.

Features

- **User-transparent data protection against disc failures**
- **Automatic real-time backup to assure high availability of data**
- **Support for up to 60 pairings of logical cartridges**
- **Down cartridge restore utility**
- **Paired cartridge verification utility**
- **Cartridge fault notification utility**
- **Uninterrupted read/write access even if one cartridge in a pair goes "down"**
- **Paired cartridge status log**
- **Support for one or two controller and one or two drive configurations and a variety of discs**
- **Compatibility with Datashare/1000**

Datasafe/1000 software

1. Pseudo driver DVI30, which initiates I/O requests to the disc drivers for each cartridge of the pair.
2. Utility DPAIR for definition of paired relationships between logical disc cartridges, controlling the state (Up, Down, or Standby) or obtaining status of each cartridge in a pair, and selecting the alarm program associated with paired cartridges.
3. Utility RPAIR for track-by-track restoration of a "Down" cartridge of a pair from the good cartridge.
4. Utility VPAIR for track-by-track verification of paired cartridges.
5. Utility LPAIR for maintaining log file <PAIR>, which catalogs each paired cartridge Logical Unit, its cartridges, and their status. In a multi-computer environment, LPAIR also lists all DS/1000-IV node numbers accessing each paired cartridge.

6. When either cartridge of a pair goes "down", an ALARM program scheduled by DVI30 prints a message and schedules ALRMX to update the log and issue a status-change message to each node in a multi-computer environment. The ALRMX program source code is supplied to facilitate application-specific customization by the user.

Functional description

After assignment of the pairing of logical cartridges using DPAIR, accesses to paired cartridges are made via pseudo driver DVI30, using the logical unit number assigned to the pair. DVI30 issues write access requests to both cartridges of the pair and reports status. Write accesses are sequential when both cartridges of a pair are accessed via the same disc controller (interface), but can gain the speed advantage of overlapped access when each cartridge of the pair is accessed via a different disc controller. Read accesses alternate between the cartridges to assure the earliest possible discovery of errors.

After setup, both write and read accesses are transparent to the user in that disc access calls are the same as would be used to access a single cartridge. However, with Datasafe the user gains the extra security of two identical copies of the data. For maximum security, the cartridges of a pair should be on different drives. The paired cartridge is accessible locally, and to remote DS network nodes via DS/1000-IV Distributed System links.

If either cartridge of a pair goes Down due to a disc failure, normal read and write accesses to the good cartridge continue as if nothing had happened. After the Down cartridge is repaired, the RPAIR (Restore PAIR) utility can be used to copy the good cartridge to restore it. Accesses via the RPAIRing computer are permitted during the RPAIR process, including accesses from remote DS/1000-IV network nodes. Other computers sharing the cartridge are temporarily locked out from accessing the logical cartridge pair.

Each paired cartridge is exclusive in the sense that each cartridge of the pair can only be paired with its mate. However, it is possible to use DPAIR to immediately substitute another logical cartridge to replace a Down cartridge, assuming that a spare cartridge of the correct size and number of sectors per track is available. RPAIR can then be used to restore the complete pair without waiting for completion of repairs on a failed drive or for the replacement of a damaged physical disc cartridge or disc pack.

Functional specifications

Operating requirements

Operating system: Datasafe/1000 operates under the RTE-6/VM Real-Time Executive system effective with software revision 2226.

Compatible disc memories and track format matching: Disc memories supported by Datasafe/1000 are listed below. Both logical cartridges of a pair must be on discs that have the same number of sectors per track and the same number of bytes per sector. All of the compatible discs have 256 bytes per sector, but differ with respect to sectors per track as follows:

Sectors per track:	35	48	64	92
Disc product nos.:	7908P/R	7906H/M	7911P/R	7933H
		7920H/M	7912P/R	7935H
		7905A	7914P/R	
			7925H/M	

Other Configuration requirements: One 46kb partition and Pascal/1000 library.

Maximum number of cartridge pairs: 60 per system.

Restrictions on pairings: None. Any cartridge may be paired, including cartridge Logical Units 2 and 3.

Write access overlapping

When each cartridge of a pair is accessed via a different controller (interface), write accesses can be overlapped, shortening the time required for automatic backup. If both cartridges of a pair are accessed via the same controller, write accesses are sequential.

Ordering information

91745A Datasafe/1000

Datasafe/1000 consists of:
1. The software summarized above, on one of media options 020, 022, 050, or 051, **which must be ordered,** and a license to use Datasafe/1000 on one system.
2. 91745-90001 Datasafe/1000 User's Reference Manual.
3. 91745-90002 Datasafe/1000 Software Numbering Catalog.
4. 91745-90003 RTE-6/VM Quick Reference Guide insert.

91745A Options

020: Provides software on 264x Mini cartridges.

022: Provides software on CS/80 cartridge tape.

050: Provides software on 800 bpi mag tape.

051: Provides software on 1600 bpi mag tape.

91745R Right to copy Datasafe/1000

The 91745R product is available only to customers who have purchased a license to use 91745A. 91745R consists of:
1. The right to make one copy of software purchased with the 91745A product.
2 through 4. Same as 2 through 4 of 91745A, above.

Software support products available

See page 1-4.

Datashare/1000

Reliability Enhancement Software for RTE-6/VM Systems   product number 91747A

Datashare/1000 is an extended RTE-6/VM file manager that allows up to four HP 1000 E/F-Series computers to share disc cartridges and files on one or more 79xxM/S Multi-Access Controller (MAC) Disc Memories.

All disc cartridges and files, except for the system and auxiliary (logical) discs, can be shared in a multi-computer environment, thereby forming one element of a high-availability system. Datashare's support of multi-computer use of discs can also be used to reduce overall system costs by sharing the storage capacity of one or more discs among up to four computers.

In a single-computer environment, the multi-computer features of Datashare/1000 are transparent and Datashare functions as the standard File Manager.

Features

- **Support for system-to-system data exchange via shared files on as many as 16 MAC discs**
- **Transparent sharing of disc files among as many as four computers — for redundant computer systems to enhance availability and/or to lower overall system costs**
- **Complete compatibility with user programs which use the standard RTE-6/VM or RTE-IVB file system**
- **Compatibility with Datasafe/1000**
- **Support for both one and two controller configurations**

Datashare/1000 software

1. Directory conversion utility DCONV converts cartridge specification entries to the format required for multi-computer use.
2. Utility DMALL updates the directory on each cartridge after boot-up of a switched system to dismount any cartridges that were mounted under the previous system. DMALL is also used after restoration of disc LU2. It places the cartridge list and cartridges in the same state (only LU2 and LU3 mounted).
3. A multi-CPU File Manager (FMGR), File Management Program (FMP), and Directory Manager (D.RTR).

Functional specifications

Compatible Disc Memories

Multi-Access Controller (MAC) Master Discs:
7906M/MR	19.6M byte MAC Master Cartridge Disc Memory*
7920M	50M byte MAC Master Disc Memory*
7925M	120M byte MAC Master Disc Memory*

With 13037C MAC Disc Controller; 13175D MAC Disc interface is required for first Computer, 13178D Multi-Unit CPU interface is required for second through fourth computers.

Multi-Access Controller (MAC) Slave Discs (up to seven per MAC Master Disc):
7906S/SR	19.6M byte MAC Slave Cartridge Disc Memory
7920S	50M byte MAC Slave Disc Memory
7925S	120M byte MAC Slave Disc Memory

Capacity

Number of computers: Datashare/1000 supports datasharing by up to four HP 1000 E/F-Series Computers, each operating under the RTE-6/VM Real-Time Executive system effective with software revision 2226.

Compatibility With Other System Reliability Enhancement Software

Datashare/1000 is compatible with the 91745A Datasafe/1000 package, which provides automatic, on-line backup of user-specified logical cartridges on one or more discs via one or two controllers for data protection and high availability.

Configuration Requirements

Datasharing computer identification: Each Datasharing computer must be uniquely identified by a number (0 through 7) during system generation.

Restriction on use of controller lock: When the multi-computer features of Datashare/1000 are enabled, the controller lock feature is used by directory manager D.RTR and cannot be used by other programs.

Identical user and account IDs: Correct operation in a session environment requires that all user and account IDs be the same in all of the Datasharing computers.

Logical system and auxiliary discs: Each datasharing computer must have its own logical system and auxiliary discs (Logical Unit numbers 2 and 3). The disc spaces assignable to these are accessible only to the particular computer that they support.

Datasharable Disc Space

Except for the logical system, auxiliary disc, and system scratch file spaces on the discs, all logical disc cartridges and files on all MAC discs can be shared among all of the Datasharing computers.

Ordering information

91747A Datashare/1000

Datashare/1000 consists of:

1. The software summarized above, on one of media options 020, 050, or 051, **which must be ordered,** and a license to use Datashare/1000 on one system.
2. 91747-90001 Datashare/1000 User's Reference Manual.
3. 91747-90002 Datashare/1000 Software Numbering Catalog
4. 91747-90003 RTE-6/VM Quick Reference Guide insert.

91747A Options

020: Provides software on 264x Mini cartridges.

050: Provides software on 800 bpi mag tape.

051: Provides software on 1600 bpi mag tape.

91747R Right to Copy Datashare/1000

The 91747R product is available only to customers who have purchased a license to use 91747A. 91747R consists of:

1. The right to make one copy of software purchased with the 91747A product.
2 through 4. Same as 2 through 4 of 91747A, above.

Software support products available

See page 1-4.

RTE Profile Monitor

**For Performance Enhancement
in RTE-6/VM or RTE-IVB**

product number 92083A

The RTE Profile Monitor (RPM) is a software package designed to help users improve program execution speed for more efficient utilization of HP 1000 Computer Systems. Because program execution speed is often critical, the RPM is an important tool for users who are faced with the need to reduce execution time of their programs. The RPM can be used on any program executing under 92084A RTE-6/VM, or 92068A RTE-IVB.

Programs spend 80% to 90% of their time in less than 5% of the code. Once identified, crucial areas of code can usually be optimized to significantly reduce overall program execution time. The RPM simplifies the location of crucial areas of code by providing a precise analysis of the activity distribution within the program.

Once the RPM has pinpointed the crucial code areas of a program, execution time can be shortened by:

- Source code modification.
- Reprogramming in assembly language.
- Reprogramming in microcode.

Execution time of a program written in a high-level language can be reduced by optimizing commonly used program loops, changing buffer sizes in system calls, and restructuring crucial program algorithms. Most frequently used program code can be rewritten in assembly language for a typical three to four times improvement over high level program code. Microcode provides even more impressive improvement, typically three to five times faster than the same code implemented in assembly language. Microcode runs faster than assembly language because program instruction fetch time is largely eliminated, microcoding can specify CPU and I/O operations more efficiently than assembly language, and microinstructions can accomplish more operations in parallel. The 92049A (A900), 92045A (A700), and 92061A (M/E/F-Series) RTE Microprogramming Packages support microcode development.

The RTE Profile Monitor User's Manual provides what-to-do instructions which are related to the various types of program code that may be taking too much execution time. This helps the user reduce program execution times with a minimum of effort.

Features

- **Interactive, conversational operation for program profiling**
- **Activity profiling of real-time, background, segmented, or unsegmented programs without program modification**
- **Ability to profile programs written in any language**
- **Wide choice of activity data collection options**
- **Frequency distribution and histogram profile plots**
- **Ability to track activity down to the individual instruction**
- **Linear and logarithmic plotting of activity profiles**

Sample RPM Program Activity Histogram

RTE Profile Monitor operation

The RTE Profile Monitor functions in two phases. In the first, or sample phase, the profiled program is executed while being monitored by a program called CTRAC. A second program, CPLOT, then plots the activity profile of the target program on a line printer.

Initially, CPLOT uses an instruction to instruction interval that displays an entire program, or program segment, on a single page. Both the integral of frequency distribution and a histogram are provided, showing percentage of execution time used plotted to the left of a listing of absolute and base addresses, which is easily correlated with a mixed listing of the program, as shown in Figure 1.

Areas of high activity on the initial plot can be further investigated by asking CPLOT to plot a narrower range of addresses. The new plot can have a resolution as small as one instruction, precisely pin-pointing those instructions on which the program is spending most of its time.

INITIAL ANALYSIS

```
DESCRIPTION : SEGMENT      SEG1
RANGE : 055466B-062064B              INSTRUCTIONS PER LINE: 000057
SAMPLE:    19847.    IN-RANGE :    18152.      REJECTS:        0.
     75.6   % 60.5   % 45.3   % 30.2   % 15.1   % 0.00   %
     +---------+---------+---------+---------+---------+
                              ************I   62006  (04320)
     ************************************************I   61727  (04241)
                                            I   61650  (04162)
     *       *       *       *       *       +  61571  (04103)
                                            I   61512  (04024)
                                            I   61433  (03745)
                                            I   61354  (03666)
     75.6% of activity                      I   61275  (03607)
     is spent in this     *       *       +  61216  (03530)
     small area of code                     I   61137  (03451)
                                            I   61060  (03372)
                                            I   61001  (03313)
                                            I   60722  (03234)
     *       *       *       *       *       +  60643  (03155)
                                            I   60564  (03076)
                                            I   60505  (03017)
                                            I   60426  (02740)
                                            I   60347  (02661)
     *       *       *       *       *       +  60270  (02602)
                                            I   60211  (02523)
                                            I   60132  (02444)
                                            I   60053  (02365)
                                            I   57774  (02306)
     *       *       *       *       *       +  57715  (02227)
                                            I   57636  (02150)
                                            I   57557  (02071)
                                            I   57500  (02012)
                                            I   57421  (01733)
     *       *       *       *       *       +  57342  (01654)
                                            I   57263  (01575)
                                            I   57204  (01516)
                                            I   57125  (01437)
                                            I   57046  (01360)
     *       *       *       *       *       +  56767  (01301)
                                            I   56710  (01222)
                                            I   56631  (01143)
                                            I   56552  (01064)
                                            I   56473  (01005)
     *       *       *       *       *       +  56414  (00726)
                                            I   56335  (00647)
                                            I   56256  (00570)
                                            I   56177  (00511)
                                            I   56120  (00432)
     *       *       *       *       *       +  56041  (00353)
                                            I   55762  (00274)
                                            I   55703  (00215)
                                            I   55624  (00136)
                                            I   55545  (00057)
                                            I   55466  (00000)
     +---------+---------+---------+---------+---------+
          *  HISTOGRAM OF P-REGISTER USAGE  *
                  (LINEAR SCALE)              PAGE    4
```

FULLY EXPANDED ANALYSIS

```
DESCRIPTION : ( SEG1   )  ZOOM IN EVEN FURTHER OF SEG1 NON-OPTIMIZED
RANGE : 061753B-062033B              INSTRUCTIONS PER LINE: 000001
SAMPLE:    19847.    IN-RANGE :    18152.      REJECTS:        0.
     18.0   % 14.4   % 10.8   % 7.19   % 3.59   % 0.00   %
     +---------+---------+---------+---------+---------+
                                            I   62033  (04263)
                                            I   62032  (04262)
                                           *I   62031  (04261)
     *       *       *       *       *       +  62030  (04260)
                                            I   62027  (04257)
                                            I   62026  (04256)
                                         ****I   62025  (04255)
                    ************************I   62024  (04254)
     *       *       *       *       *       +  62023  (04253)
                                            I   62022  (04252)
                                            I   62021  (04251)
                                            I   62020  (04250)
                                            I   62017  (04247)
     *       *       *       *       *       +  62016  (04246)
                                            I   62015  (04245)
                                            I   62014  (04244)
                                            I   62013  (04243)
                                            I   62012  (04242)
     *       *       *       *       *       +  62011  (04241)
                                            I   62010  (04240)
     Expansion shows                       *I   62007  (04237)
     two major areas                       *I   62006  (04236)
     of activity                           *I   62005  (04235)
                                          **+  62004  (04234)
                                           *I   62003  (04233)
                                           *I   62002  (04232)
                                           *I   62001  (04231)
                                      ******I   62000  (04230)
     *       *       *       *   ************* 61777  (04227)
                                  *********I   61776  (04226)
                                  *********I   61775  (04225)
                                  *********I   61774  (04224)
                                  *********I   61773  (04223)
     *       *       *       *   *********** 61772  (04222)
                                            I   61771  (04221)
     ***************************************I   61770  (04220)
                                  **********I   61767  (04217)
                                  **********I   61766  (04216)
                                  ***********+ 61765  (04215)
                                  *********I   61764  (04214)
                                  ***************I   61763  (04213)
                                  ***********I   61762  (04212)
                                  *********I   61761  (04211)
     *       *       *       *   ************** 61760  (04210)
                                          **I   61757  (04207)
                                        ****I   61756  (04206)
                                            I   61755  (04205)
                                            I   61754  (04204)
                                            I   61753  (04203)
     +---------+---------+---------+---------+---------+
          *  HISTOGRAM OF P-REGISTER USAGE  *
                  (LINEAR SCALE)              PAGE   12
```

MIXED LISTING

```
0107   PAGE 0006  CALC  12:19 AM  MON., 31  DEC., 1979
0108
0109
0110   0021      SUBROUTINE CALC
0111   0022      DIMENSION LU(2048),IBUF(128)
0112   0026      DO 50 J = 1,32767
0113                    LU        BSS 04200B
0114       04200  000000          NOP
0115       04201  000001X         JSB .ENTR
0116       04202  00420UR         DEF *-2
0117       04203  004277R         LDA 04277B
0118       04204  004276R         STA J
0119   0027         DO 100 I = 1,10
0120       04205  004277R         LDA 04277B
0121       04206  004301R         STA I
0122   0031         LU(I) = 1
0123       04207  004301R         LDA I
0124       04210  004303R         ADA 04303B
0125       04211  004304R         STA A.001
0126       04212  004277R         LDA 04277B
0127       04213  104304R         STA A.001,I
0128   0034         REAL1 = LU(I)
0129       04214  004301R         LDA I
0130       04215  004303R         ADA 04303B
0131       04216  160000          LDA 0,I
0132       04217  000002X         JSB FLOAT
0133       04220  000003X         JSB .DST
0134       04221  004305R         DEF REAL1
0135   0038  100     CONTINUE
0136       04222  004301R a100    LDA I
0137       04223  004277R         ADA 04277B
0138       04224  004301R         STA I
0139       04225  003004          CMA,INA
0140       04226  004302R         ADA 04302B
0141       04227  002021          SSA,RSS
0142       04230  004207R         JMP 04207B
0143   0039  50      CONTINUE
0144       04231  004276R a50     LDA J
0145       04232  004277R         ADA 04277B
0146       04233  004276R         STA J
0147       04234  003004          CMA,INA
0148       04235  004300R         ADA 04300B
0149       04236  002021          SSA,RSS
0150       04237  004205R         JMP 04205B
0151   0043         DO 300 K = 1,5
0152       04240  004277R         LDA 04277B
0153       04241  004307R         STA K
0154   0044         DO 200 I = 1,48
0155       04242  004277R         LDA 04277B
0156       04243  004301R         STA I
0157   0048         CALL EXEC(1,56,IBUF,128,K,I)
0158       04244  000004X         JSB EXEC
0159       04245  004254R         DEF 04200B+00054B
0160       04246  004277R         DEF 04277B
0161       04247  004312R         DEF 04312B
0162       04250  004000R         DEF 04000B
0163       04251  004275R         DEF 04275B
0164       04252  004307R         DEF K
0165
0166   PAGE 0007  CALC  12:19 AM  MON., 31  DEC., 1979
0167
0168
0169       04253  004301R         DEF I
0170   0052  200     CONTINUE
0171       04254  004301R a200    LDA I
0172       04255  004277R         ADA 04277B
0173       04256  004301R         STA I
0174       04257  003004          CMA,INA
0175       04260  004311R         ADA 04311B
0176       04261  002021          SSA,RSS
0177       04262  004244R         JMP 04244B
0178   0053  300     CONTINUE
0179       04263  004307R a300    LDA K
0180       04264  004277R         ADA 04277B
0181       04265  004307R         STA K
0182       04266  003004          CMA,INA
0183       04267  004310R         ADA 04310B
0184       04270  002021          SSA,RSS
0185       04271  004242R         JMP 04242B
0186   0055      RETURN
0187       04272  104200R         JMP 04200B,I
0188   0056      END
0189                    CALC      BSS 00002B
0190       04275  000200          OCT 000200
0191                    J         BSS 00001B
0192       04277  000001          OCT 000001
0193       04300  077777          OCT 077777
0194                    I         BSS 00001B
0195       04302  000012          OCT 000012
0196       04303  177777R         DEF 77777B
0197                    A.001     BSS 00004B
0198       04310  000005          OCT 000005
0199       04311  000060          OCT 000060
0200       04312  000070          OCT 000070
0201
0202
```

Area
of
Code
Profiled

By comparing the relative addresses on the plot with those on the mixed listing, the active areas of the program can be located precisely.
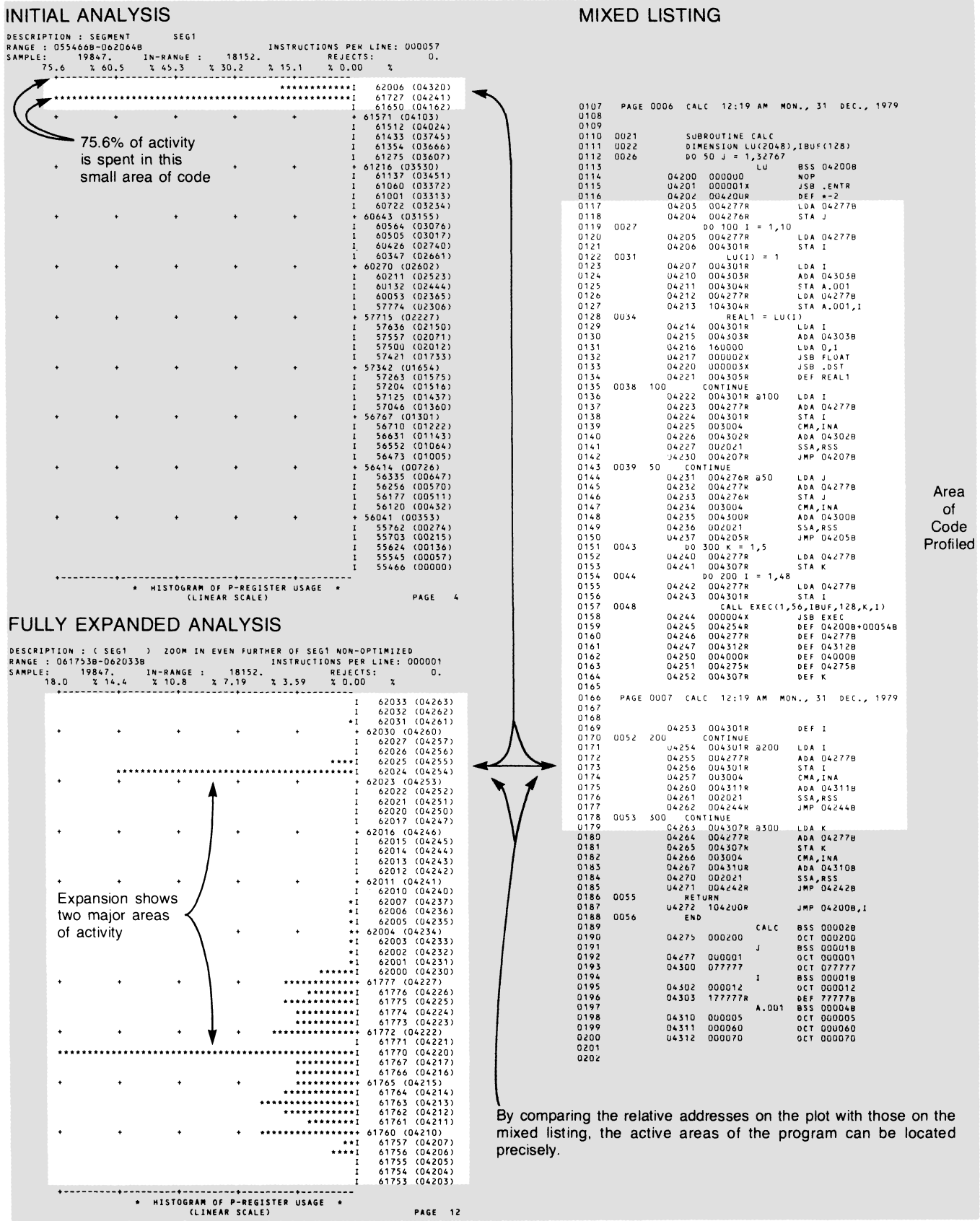
Figure 1. RTE Profile Monitor Activity Profile Histograms and Mapping to Mixed Listing of Target Program Segment

Functional specifications

RTE Profile Monitor Requirements

Operating environment. HP 1000 Computer System with disc memory and line printer operating under 92084A RTE-6/VM, or 92068A RTE-IVB.

Priority requirements. CTRAC and D.RTR must be the only active priority 1 programs. The target program must be the only program executing at the next highest priority. No other program can be active at any priority between CTRAC and the target program. It is desirable that CTRAC and the target program be the only active programs in the system.

Minimum target program duration. Because the activity profiler uses a sampling technique, the target program should have an elapsed execution time of at least several seconds.

CTRAC Memory requirement: 9 pages (18k bytes).

CPLOT Memory requirement: 15 pages (30k bytes).

RTE Profile Monitor CTRAC Options

Target program control: The target program can be run by CTRAC, or it can be scheduled by another process.

Data during I/O suspend: CTRAC can either take data while the target program is in I/O suspend if that would be useful or it can be told to ignore such data where it would not be significant. This distinction can be made individually for I/O suspend while the program is waiting for data from a terminal and for I/O suspend while the program is waiting for other peripheral devices. This feature is useful in determining whether a program spends a significant amount of time waiting for I/O devices to become available.

Data during general wait state: CTRAC can either take data while the target program is suspended for reasons other than I/O or it can be told not to take data during this time. This feature is useful in determining whether a program spends a significant amount of time waiting for system resources, such as Class I/O numbers.

Timing of the start of CTRAC action: CTRAC can take data right from the start of execution of the target program, or its data taking can be started later with a GO, CTRAC command. This facilitates selective profiling of only certain phases of a program.

RTE Profile Monitor CPLOT Options

Logarithmic plots and tabular data: CPLOT can provide logarithmic plots and tabular data in addition to the standard linear and integral histogram plots that are always output. The log plots will compress the data so that the activity of less active parts of the program does not seem to totally disappear.

Initial analysis: CPLOT can do an initial analysis which covers the entire address span of the target program on a single page (program segments are covered individually, each on its own page). Precision depends upon the address span of the program. If not desired, the initial analysis can be bypassed.

Range of interest: CPLOT provides for specifying the range of addresses whose activity data is to be displayed. With this capability, it is possible to determine the activity of each individual instruction.

Segment specification: CPLOT provides for requesting a particular segment to be plotted.

Base address: CPLOT provides for entering the base address for easier comparison of plotted activity data with the relative addreses given in Assembly listings or high level language mixed listings.

Graph naming: CPLOT provides for the entry of a graph label up to 40 characters long for the naming of graphs.

Ordering information

92083A RTE Profile Monitor

92083A RTE Profile Monitor includes:

1. RTE Profile Monitor software package on software Media Option 020, 022, 041, 042, 050, or 051, **one of which must be ordered.**
2. RTE Profile Monitor User's Manual (92082-90001).

92083A Options

001: Provides discount to user upgrading from previous version of 92083A or 92082A to latest version if not enrolled in the Customer Support Service or Software Subscription Service.

002: Provides discount to user who purchases the 92061A Microprogramming Package concurrently (for use on M/E/F-Series system only).

020: Provides 92083A software on 264x Mini cartridges.

022: Provides 92083A software on CS/80 cartridge tape.

041: Provides 92083A software on 1.2M byte flexible discs.

042: Provides 92083A software on 5-in. Minifloppy discs.

050: Provides 92083A software on 800 bpi magnetic tape.

051: Provides 92083A software on 1600 bpi magnetic tape.

92083R Right to Copy RTE Profile Monitor Software For Use on an Additional Computer System

The 92083R Right to copy product is available only to customers who have purchased a license to use 92083A. 92083R consists of:

1. The license to make one copy of software purchased with 92083A for use on an additional system.
2. RTE Profile Monitor Users Manual, (92082-90001).

92083R Option 001

Provides a discount for right to copy the 92083A+001 product or a 92083T/S update for a customer who has previously purchased the 92083R product.

Software support products available

See page 1-4.

RTE Microprogramming Packages

For HP 1000 Computer Systems

The 92049A, 92045A, and 92061A are RTE Microprogramming Packages for HP 1000 A900, A700, and M/E/F-Series computers respectively. Supported under their associated real-time operating systems, RTE-A (A900/A700), and RTE-6/VM or RTE-IVB (M/E/F-Series), these packages provide all the software tools needed for development by the user of customized microprogrammed instructions for HP 1000 Computers.

Features

- **On-line operation in RTE 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**

RTE Microprogramming Package comparison

Product Number	Supported Computer Type	Instr Word Length	Control Store Hardware	Microprogram Source Code to Object Code Translator
92049A	A900	48 bits	12205A Control Store Card	Easy-to-use Pascal-like Paraphraser
92045A	A700	32 bits	12153A Writable Control Store 12155A PROM Control Store	Easy-to-use Pascal-like Paraphraser
92061A	M/E/F	24 bits	13197A Writable Control Store 12791A Firmware Expansion Module	Microassembler

Microprogramming in the RTE environment

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 satis-

factorily supported using the basic instruction set of the computer. And, key routines from third party software houses can be microcoded to prevent copies from being made from machine to machine.

Microprogramming A900 and A700 Computers

The 92049A and 92045A packages provide 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 improve ease of maintenance.

The RTE Paraphraser (MPARA) converts a source microprogram into binary object code in 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 Edit/1000, the screen editor that is included with the RTE operating system.

The MPARA Paraphraser accepts free-format microprogram sentences and automatically interprets the phrases, directives, and labels, adds defaulted microcodes according to word types, sorts them into field/microorder format, and then translates the field/microorders into complete microinstructions. The MPARA output consists of microassembled binary object code, the source listing, optional label and floating field listings, and any error messages. The binary object code is accepted by WLOAD and can be written into a disc file.

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 a Writable Control Store (WCS) board.

RTE Drivers ID.42 (A900) and ID.41 (A700) provide software linking between MPARA, WLOAD, and the Control Store Board (12205A and 12153A respectively). 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 or ID.41 can load 4,096 microinstructions from main memory into WCS on a Control Store Board 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 92860A Symbolic Debug/1000 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. For RTE-6/VM and RTE-IVB systems, the 92083A RTE Profile Monitor provides a more extensive program profiling capability.

Microprogramming M/E/F-Series Computers

The 92061A uses a standard fixed field input. The user writes microprograms in symbolic form using a simple assembly language that is translated into HP 1000 Computer micro object code suitable for loading into Writable Control Store (WCS) using the Microdebug Editor or the WCS Load Utility. The Microdebug Editor is further used as an aid in programmatically testing and debugging the microprogrammed functions. From a terminal, the user can load or store micro object code to or from a WCS board and a disc file, set break points in the microprogram in symbolic form, and perform many other functions programmatically.

The 92061A package also links programs to new computer instructions by providing a pseudo instruction that defines new user instructions for HP Assembly language programs. FORTRAN and BASIC programs use the new user-implemented computer instructions via calls to simple, user-written assembly language subroutines that pass parameters to/from the higher level program and access the new instructions from the assembly language coding level.

PROM "burn" tapes can be generated for users who wish to permanently implement microprograms. The PROM Tape Generator creates mask tapes in the formats most commonly used by vendors that fuse PROM chips.

Functional specifications

Environment

92049A Package: Hard disc based 92077A RTE-A operating system in A900 Computer (2139A), Model 29 Computer System (2199C/D), or Micro/29 System (2439A or 2489A).

92045A Package: Hard disc based 92077A RTE-A operating system in A700 Computer (2137A) or Model 27 Computer System (2197C/D), or Micro/27 System (2437A or 2487A).

92061A Package: Hard disc based 92084A RTE-6/VM or 92068A RTE-IVB operating system in F-Series Computer (2117F), Model 45 (2177C/D/F), Model 65 (2179A/B/C) Systems and E-Series Computer (2113E), Model 40 (2176C/D/E) and Model 60 (2178A/B/C) Systems.

Memory Usage

92061A: The WCS driver requires 2160 bytes of resident memory. Other programs in the package require an 18k byte partition in RTE-6/VM or RTE-IVB, including the 2k bytes required for base page in each RTE-6/VM or RTE-IVB disc-resident partition.

92049A and 92045A: MPARA can operate in a 64k byte partition, which can be used for all 92049A or 92045A software modules.

Control Address Space (Instruction Words) Available to the User

	92049A A900 (48-bit)	92045A A700 (32-bit)	92061A	
			E-Series (24-bit)	F-Series (24-bit)
Total User Address Space	6k	8k	11.5k	5.5k
Writable Control Store Space/Card	4k*	4k (max of 2)	1k (max of 3)	1k (max of 3)
PROM Control Store Space/Card	2k*	8k (max of 1)	8k** (max of 1)	8k** (max of 1)

All on same 12205A Control Store Card.

Ordering information

92049A RTE Microprogramming Package

The 92049A RTE Microprogramming Package consists of:

1. The MPARA, WLOAD, and ID.42 software modules on Media Option 022, 041, 044, or 051, **one of which must be ordered.**
2. 92049-90001 RTE Microprogramming Package Reference Manual.
3. 92049-90002 RTE Driver ID.42 Programming and Operation Manual.

92049A Media Options

001: Provides discount to user upgrading from previous version of 92049A to latest version if not on 92049T/S software support service.

022: Provides 92049A software/updates on CS/80 cartridge tape.

041: Provides 92049A software/updates on 1.2 Mb flexible disc.

044: Provides 92049A software/updates on microfloppy disc.

051: Provides 92049A software/updates on 1600 bpi mag tape.

92049R Use of RTE Microprogramming Package on One Additional Computer System

The 92049R product is available only to customers who have purchased a license to use 92049A. 92049R consists of:

1. The license to make one copy of software purchased with 92049A for use on one additional system.
2. 92049-90001 RTE Microprogramming Package Reference Manual
3. 92049-90002 RTE Driver ID.42 Programming and Operation Manual

92049R Option 001

Provides a discount for the right to copy the 92049A+001 product or a 92049T/S update for a customer not supported under 92049V/W.

92045A RTE Microprogramming Package

The 92045A RTE Microprogramming Package consists of:

1. The MPARA, WLOAD, CSROM, and ID.41 software modules on Media Option 022, 041, or 051, **one of which must be ordered.**
2. 92045-90001 RTE Microprogramming Package Reference Manual.
3. 92045-90002 RTE Driver ID.41 Reference Manual.

92045 Media Options

Same media as Options 001, 022, 041 and 051 for 92049A, above.

92045R Use of RTE Microprogramming Package on One Additional Computer System

The 92045R product is available only to customers who have purchased a license to use 92045A. 92045R consists of:

1. The license to make one copy of software purchased with 92045A for use on an additional system.
2. 92045-90001 RTE Microprogramming Package Reference Manual.
3. 92045-90002 RTE Driver ID.41 Reference Manual.

92045R Option 001

Provides a discount for the right to copy the 92045A+001 product or a 92045T/S update for a customer not supported under 92045V/W.

92061A RTE Microprogramming Package, With Software on Punched Tape

The microprogramming package consists of:

1. RTE Microassembler, which translates symbolic microprograms into micro object code for the Microdebug Editor, PROM mask tape generator, and the WCS Loader Utility. Source input can be from disc or peripheral device; micro object code output code can be to disc file or tape punch.
2. RTE Micro Cross Reference Generator, for symbol table listing to aid debugging of microprograms.
3. RTE PROM Mask Tape Generator, to burn PROMs from the Microassembler object code.
4. RTE Microdebug Editor implemented as a main program for interactive loading, editing, testing, and debugging of microprograms in WCS.
5. RTE Microdebug Editor implemented as a user-callable subroutine for calling microprograms from user's programs.
6. RTE WCS Driver to read, write, write/verify, and setup base addresses of WCS cards, enable and disable WCS cards, and read the logical state of WCS cards.
7. RTE WCS Loader Utility, to load microprograms from a file or input peripheral into one or more WCS cards.
8. HP 1000 M-Series Microprogramming Manual (02108-90032) and pocket guide (02108-90034).
9. HP 1000 E/F-Series Microprogramming Manual (02109-90004) and pocket guide (02109-90008).
10. WCS Driver DVR36 and Loader Manual (13197-90001).

92061A Media Options

020: Provides 92061A software on 264x Minicartridges instead of paper tape.

022: Provides 92061A software on CS/80 cartridge tape tape instead of paper tape.

Additional Equipment Required For Operation

To be usable, microprogram instructions must be loaded into one or more (three max.) 13197A WCS boards installed in the computer.

Software support products available

See page 1-4.

Image/1000-II Data Base Management System

Image/1000-II is a general purpose data base management software system with Query, designed for use in HP 1000 computer systems managed by RTE-A and RTE-6/VM Real-Time Executive 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 fast 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 real, and ASCII character string data types supported
- Concurrent access for up to 100 users per data base
- Existing Image/1000 data bases can be 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
- Protection against unauthorized access at data base and data item level
- Data base capacity up to 3.2G bytes under RTE-6/VM and RTE-A
- 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
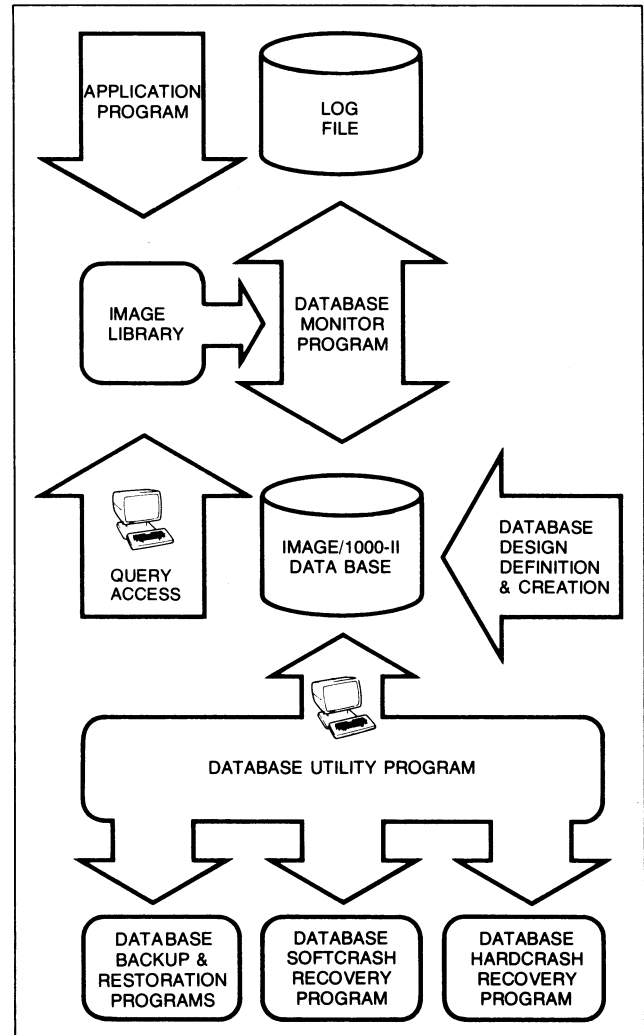
Functional description

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).

DATA BASE
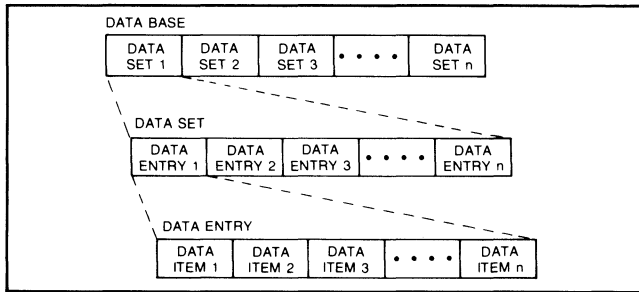
Image/1000-II supports master and detail data sets. A master data set is a collection of unique key values used for fast access to information stored either in the master data set or a related detail data set. Master data sets can be linked to more than one item in a detail data set. Access to a data 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.

IMAGE STRUCTURE
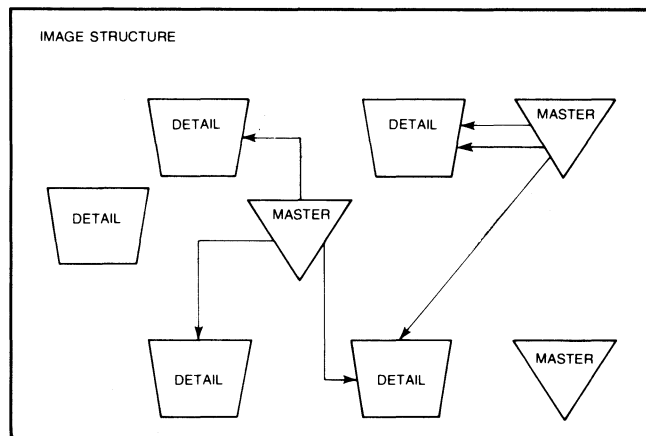
Reasons for using Image/1000-II

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 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 and privacy level. By specifying a different privacy level for read and write operations on each data item, users can be permitted to read but not to 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 on RTE-6/VM and RTE-A based systems.* Query can also be scheduled to run 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 affords 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 word.

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 ("AND"s and "OR"s).

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 great 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 of Query use in 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
TRANSBEGIN	Starts a transaction
TRANSEND	Ends a transaction
TRANSMEMO	Writes a comment to the transaction log
TRANSUNDO	Allows user to undo a pending transaction

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 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 using 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 to a data base.

DBDEL (Data Base Delete). Deletes existing information.

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

DBUNL (Data Base Unlock). Relinquishes exclusive user control and restores 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 that a log memo record be placed 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 only the data from a 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, presently a maximum of 3.2G bytes in RTE-A or RTE-6/VM (eight 7933H Disc Drives).

Data set: May contain up to 2(exp 31)−1 (>2 billion) data entries. However, a data set cannot span multiple disc sub-channels, limiting the data set size to a maximum of 404M bytes (1 HP 7933H or 7935H Disc Drive).

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: Single integer numbers with values −32768 to +32767, double integer numbers with values −2147483648 to +2147483647, two-word real numbers with values $\pm1.47 \times 10^{-39}$ to $\pm1.7 \times 10^{38}$, 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 descriptions of more that one data set.

Security code: Integer 1 to 32767 or two ASCII characters

Privacy level word: 1-6 characters

Configuration information

Remote data base access: An RTE-6/VM or RTE-A 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 Assembler language program using Image/1000-II subroutines. Software revision 2040 or later for DS/1000-IV (91750A or 91740A/B) is required.

Programming languages: FORTRAN IV, FORTRAN 77, Pascal, BASIC/1000C, HP RTE Assembly or 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 re-segmented, depending on the calls used.

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

Memory Usage:

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

Image Program		Program Size (Bytes)	Uses Data Base Buffers?
Schema Processor:	DBDS	44k	Yes
Query		40k*	Yes
Utilities:	DBBLD	52k	Yes
	DBSTR	54k	No
	DBRST	44k	No
	DBULD	38k	Yes
	DBLOD	38k	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 Systems: The Image/1000-II Data Base Management System software will be 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

92081A Image/1000-II Data Base Management System with Query For RTE-6/VM, or RTE-A Use

The 92081A Image/1000-II Data Base Management System, which must be ordered with one of Use Options 600, 601, 602, 700, 701, 702, 890, 891, and 892, includes:

1. One of software Media Options 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 92081A Software on CS/80 cartridge tape.

044: Provides 92081A Software on microfloppy discs.

050: Provides 92081A Software on 800 bpi mag tape.

051: Provides 92081A Software on 1600 bpi mag tape.

92081A/92081R Use Options

600: Use in A600 system with RTE-A

601: Upgrade from previous version of 92081A +600 for user not on 92081FT/FS

602: Upgrade from 92069A for user on 92069FT/FS. Must have been on services as of March 1, 1983

700: Use on A700 with RTE-A, or E/F-Series system with RTE-6/VM

701: Upgrade from 92069A or previous version of 92081A +700 for customer not on 92069GT/GS, or 92081GT/GS

702: Upgrade from 92069A for user on 92069GT/GS. Must have been on services as of March 1, 1983

890: General license to use in A900 or any other A/E/F-Series System, including right to purchase 92081R Opt 600/700/890 right to copy products for additional systems

891: Upgrade from previous version of 92081__ Opt 890 or 700 to latest version of 92081__ Opt 890 for customer NOT on support service

892: Upgrade from 92069A or 92063A for user on 92069HT/HS. Must have been on services as of March 1, 1983

92081R Right to Copy 92081A Image/1000-II Software For Use on an Additional Computer System

The 92081R Right to Copy product is available only to customers who have purchased a license to use 92081A at full list price (less any purchase agreement discount). 92081R which must be ordered with one of Use Options 600, 601, 602, 700, 701, 702, 890, 891, or 892, 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.
2-3. Same as items 2 and 3 of 92081A, above.

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 and logging/recovery.

Software support products available

See page 1-5.

Image/1000 Data Base Management System

Image/1000, product number 92069A, is a general-purpose data base management software system with Query* designed for use in HP 1000 Computer Systems managed by HP's RTE-A, RTE-6/VM, RTE-IVB, and RTE-L*/XL 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.

* *Query is not supported under RTE-L.*

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 3.2G bytes under RTE-6/VM, 960M bytes under RTE-IVB, 800M bytes under RTE-A, RTE-L, or RTE-XL
- 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 except under RTE-L
- Query facility that enables the non-programmer to easily retrieve, alter, and report information using English-like commands except under RTE-L
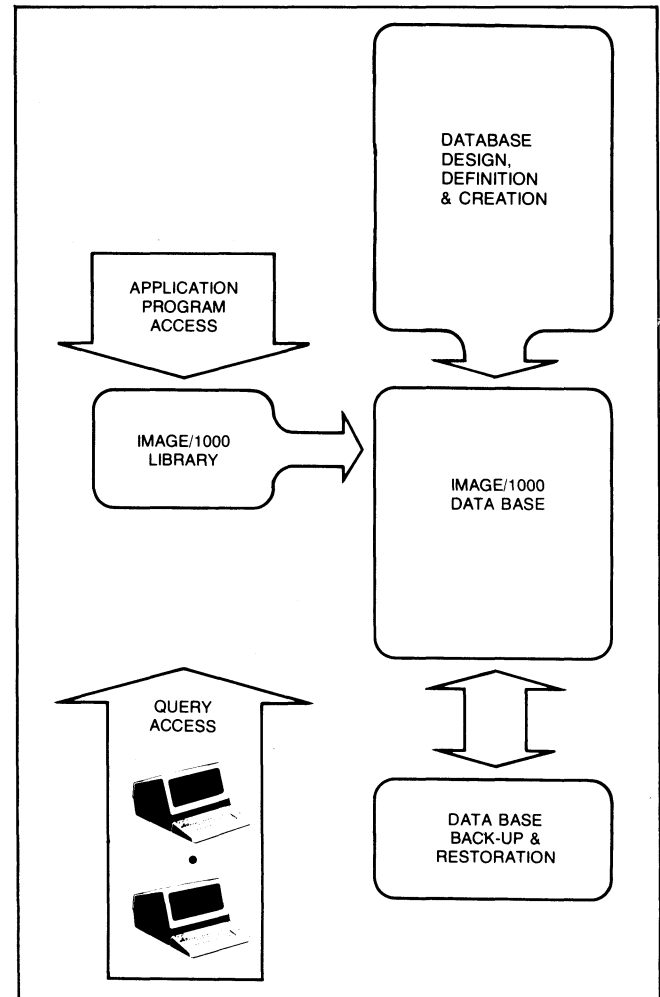
Reasons for using an Image/1000 data base

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. 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 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.

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 HP's 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, RTE-IVB, RTE-XL, and RTE-L, 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.

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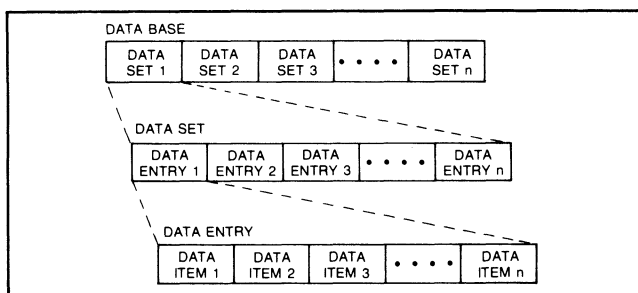
* NOTE: Image/1000 is required on the local system if programs to be used for accessing Remote Data Bases are to be developed on the local system.

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.
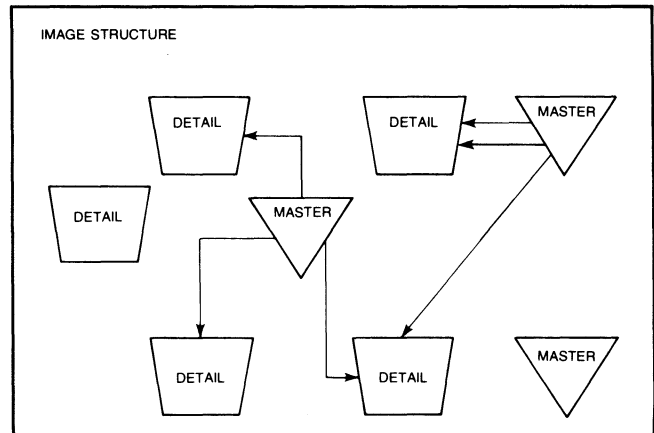
Image/1000 components

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 (not supported under RTE-L)
- 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 (not supported under RTE-L)

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 word.

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 ("and"s and "or"s).

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 predictable 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, RTE-IVB, or RTE-XL 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 using Query/3000.

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 RTE-A, RTE-6/VM, RTE-IVB, or RTE-XL based 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 information.

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. 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. 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 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 7933H Disc Drives), 960M bytes in RTE-IVB (8 HP 7925 Disc Drives). Total size under RTE-A/XL/L is a maximum of 200M bytes, which may contain up to 255 unique data items.

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/XL/L, 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 numbers 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

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 descriptions of more than one data set.

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

Privacy level word: 1-6 characters

Configuration Information

Remote data base access: An RTE-6/VM, RTE-IVB, or RTE-A/XL 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 (91750A or 91740A/B) 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 executing the 92069A schema processor should take place before reloading the data into the 92069A data base.

Minimum system requirements: Same as 92084A RTE-6/VM, 92068A RTE-IVB, 92077A RTE-A, 92071A RTE-XL or 92070A RTE-L system.

Memory Usage

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

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

92069A Image/1000 Data Base Management System With Query For RTE6/VM, RTE-IVB, RTE-A, RTE-XL*, or RTE-L Use

The 92069A Image/1000 Data Base Managemet System, which must be ordered with one of Use Options 300, 301, 600, 601, 700, 701, 890, or 891, includes:
1. One of software Media Options 020, 022, 040, 041, 042, 044, 050, or 051, **which must be ordered.**
2. 92069-90001 Image/1000 User's Manual.
3. 92069-90002 Image/1000 Software Numbering Catalog.

* *Usability of 92069A Image/1000 with RTE-XL effective with software revision 2101 and later revisions (higher revision numbers).*

92069A Media Options

020: Provides 92069A software on 264x Mini cartridges.

022: Provides 92069A software on CS/80 cartridge tape.

040: Provides 92069A software on 0.5M byte flexible discs.

041: Provides 92069A software on 1.2M byte flexible discs.

042: Provides 92069A software on 5-in. Minifloppy discs.

044: Provides 92069A software on 3.5-in. Microfloppy discs.

050: Provides 92069A software on 800 bpi mag tape.

051: Provides 92069A software on 1600 bpi mag tape.

92069A/92069R Use Options

300: Use in L-Series system.

301: Upgrade from previous version of 92069A/R option 300 to latest version of same for user not on software support service.

600: Use in A600 system.

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

700: Use in A700 or E/F-Series system.

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

890: General license to use in A900 or any other A/L/E/F-Series System, including right to purchase 92069R Opt 300/600/700/890 right to copy products for additional systems.

891: Upgrade from previous version of 92069__ Opt 890 or 700 to latest version of 92069__ Opt 890 for customer NOT on support service.

92069R Right to Copy 92069A Image/1000 Software For Use on an Additional Computer System

The 92069R Right to copy product is available only to customers who have purchased a license to use 92069A at full list price (less any purchase agreement discount). 92069R which must be ordered with one of Use Options 300, 301, 600, 601, 700, 701, 890, or 891, 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.

2-3. Same as items 2 and 3 of 92069A, above.

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

See page 1-5.

Device-Independent Graphics Library (DGL)

HEWLETT PACKARD

The 92861A Device-independent Graphics Library (DGL) is the basic building block for Graphics/1000-II Version 2.0 applications on HP 1000 Computer Systems. It provides a device-independent interface, which is designed to support Hewlett-Packard's 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 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 user 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 module 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.

On a growing list of graphics devices

DGL supports the graphics device configurations listed in Table 1 with the intent to extend support to additional graphics devices. Customers enrolled in support service for 92861A will automatically receive new device handlers and other enhancements as they are released.

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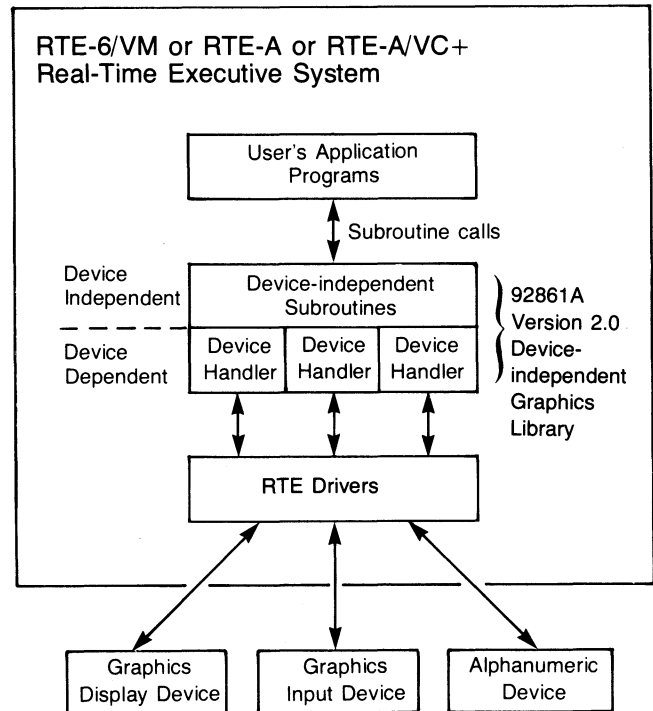
DGL Functional relationships

Functional specifications

Viewing Transformation Capability

The Device-independent Graphics Library (DGL) maps each point in two-dimensional user space to a point on the display surface without software clipping.

Graphics Work Station 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 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 1 for the logical device functions on the various physical graphics devices supported by DGL.

- Graphics display
- Alphanumeric display
- Button
- Keyboard
- Locator
- Valuator

Table 1. Supported Graphics Device Configurations

DEVICE PRODUCT NUMBERS	A-SERIES INTERFACE & CABLE	RTE-A DRIVER(S)	E/F-SERIES INTERFACE & CABLE	RTE-6/VM DRIVER(S)	LOGICAL DEVICE CODES
RASTER TERMINALS					
2623A 2627A	12040B * & 13222Y or 12005B+005	IDM00 & DD.00 or ID.00/ID.01 & DD.00	12792B & 13222Y or 12966A+105	PVM00, DVM00, & DDV05 or DVA05 or DVR05	A,B,D,K, L,V
2625A+523 2628A+523	12040B * & 13242Y or 12005B+006	IDM00 & DD.00 or ID.00/ID.01 & DD.00	12792B & 13242Y or 12966A+106	PVM00, DVM00, & DDV05 or DVA05 or DVR05	
2647F **	12040B * & 13242Y or 12005B+004	IDM00 & DD.00 or ID.00/ID.01 & DD.00	12792B & 13232Y or 12966A+001 #	PVM00, DVM00, & DDV05 or DVA05 or DVR05	
2647A @ 2648A 2649C/G @	Not supported in A-Series Systems		12792B & 13232Y or 12966A+001 #	PVM00, DVM00, & DDV05 or DVA05 or DVR05	
INPUT DEVICES					
9111A	12009A @@	ID.37	59310B @@	DVR37	B,L,V
9874A @	12009A @@	ID.37	59310B @@	DVR37	A,B,L,V
17263A	With 2623A or 2627A Terminal		With 2623A or 2627A Terminal		L
VECTOR DISPLAYS					
1350S @ 1351S ##	12009A @@	ID.37	59310B @@	DVR37	D
1350S @ or 1351S ## w/9111A	Not supported in A-Series systems		59310B @@	DVR37 with SRQ	
VECTOR PLOTTERS					
7220C/T @ 7221A/B @ 7221C/S/T @	Not supported in A-Series Systems		12966A+004 # used with 264x/2635B+ 051 Terminal	DVR37	D,L
7225B @ 7470A 7475A 7550A 758xB 9872x @	12009A @@	ID.37	59310B @@	DVR37	
RASTER PRINTERS					
2563A	2563A Opt 214 and 12009A @@	ID.37 and DDC12	2563A Opt 210 and 12821A+001	DVC12	D
2608A @	Not supported in A-Series Systems		2608A Opt 210 (Includes inter- face and cable)	DVB12	
2608S	2608S Opt 214 and 12009A @@	ID.37 and DDC12	2608S Opt 210 (Includes inter- face and cable)	DVC12	
293xA	12040B & 92219G	IDM00 and DD.00	Not supported in E/F-Series Systems		
	243xA Opt 046 and 12009A @@	ID.37 and DD.12	Not supported in E/F-Series Systems		

```
 * 12040B Eight-Channel Multiplexer is not supported in 2139A Computer, 2199C/D Model 29 SPU, 2439A Micro/1000
   Component, or 2489A Micro 29 SPU because of execessive RFI.
** Minifloppy disc of 2647F is not supported in HP 1000 systems.
 # Option 001 and 004 cables for 12966A do not comply with U.S. or German EMI regulations.
## This product does not comply with U.S. or German EMI regulations.
 @ Obsolete product listed here for reference only.
@@ 12009A and 59310B interfaces include cable to first device; use 10833x cables to additional devices.

Logical graphics device codes: A = Alphanumeric display, B = Button, D = graphics Display, K = Keyboard,
                               L = Locator, V = Valuator
```

Four Types of Graphics Input Devices

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

Keyboard: Returns alphanumeric data entered on an operator keyboard.

Locator: Returns X-Y coordinate information designated by operator using a terminal cursor or digitizer.

Valuator: Returns scalar real value entered by operator as the relative position of a terminal cursor or digitizer, or the setting of a knob.

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.

Compatibility

Operating system: RTE-6/VM with hierarchical file support, RTE-A, and RTE-A with VC+.

Program languages: FORTRAN 77, FORTRAN 4X, Pascal/1000, and Macro/1000 Assembly language.

Supported graphics devices: See Table 1.

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 provides a supported mechanism which allows the application program to access special features which are available with the graphics device. DGL-supported device features are described in the 92861A manuals.

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

Minimum System Requirements

Same as basic 92084A RTE-6/VM, 92077A RTE-A, or 92077A RTE-A with 92078A VC+ system, plus one graphics device, selected from those listed in Table 1.

Memory Required for Vector-to-Raster Conversion 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.

Required RTE Drivers

See Table 1.

Table 2. 92861A DGL Subroutine Capabilities

OUTPUT	
ZALPH	Sends test string to aphanumeric 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; uses device hardware for area fill
ZPGDI	Draws a polygon on the graphic display; area fill is software-generated unless device has compatible area fill capability
ZPOLY	Draws connected line sequence on 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 color table
ZDPST	Defines entry in polygon interior style table
ZHIGH	Sets highlight attribute
ZLSTL	Sets linestyle attribute
ZLWID	Sets linewidth attribute
ZPICL	Sets polygon interior color attribute
ZPILS	Sets polygon interior line style attribute
ZPSTL	Sets polygon interior style attribute

INPUT	
ZBUTN	Awaits button press, returns value to prog.
ZKYBD	Awaits keyboard-entered character string, returns string to program
ZLOCP	Defines locator echo position on 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 button device
ZBINT	Enables button device
ZBMOD	Sets batching mode (whether picture changes are immediate or buffered)
ZDEND	Disables the graphics display
ZDINT	Enables the graphics display
ZEND	Terminates the DGL system
ZKEND	Disables keyboard device
ZKINT	Enables keyboard device
ZLEND	Disables locator device
ZLINT	Enables locator device
ZMCUR	Makes the picture current
ZNEWF	Initiates a new frame action (clears graphics display or, on devices with chart advance, 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	Defines 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 coordinates to millimeters on the locator device
ZVIEW	Defines viewport boundaries
ZWIND	Defines window boundaries

Table 2. 92861A DGL Subroutine Capabilities (continued)

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

Ordering information

92861A Graphics/1000-II Version 2.0
Device-Independent Graphics Library (DGL)

The 92861A product, which must be ordered with one of Use Options 600 through 893, consists of:

1. The DGL software and a catalog file describing it on one of Media Options 020-051, **which must be specified when ordering.**
2. DGL Programmer's Reference Manual (97084-90000).
3. DGL Software Numbering Catalog (92861-18999).
4. Graphics/1000-II Device Handlers Reference Manual (92861-90003).
5. AGP/DGL Product Demonstration Instruction Sheet (24998-90010).

92861A Media Options

022: DGL software on CS/80 cartridge tape.

044: DGL software on 3.5-in. Microfloppy discs.

050: DGL software on 800 bpi mag tape.

051: DGL software on 1600 bpi, mag tape.

92861A/92861R Use Options

600: Use in A600+ system.

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

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

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

700: Use in A700 or E/F-Series system.

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

702: Upgrade from 92841A/R Option 700 to 92861A/R Option 700 F-Series system for user on support service for 92841A/R.

703: Upgrade from 92841A/R Option 700 to 92861A/R Option 700 for user NOT on support service.

890: General license to use in A900 or any other A/E/F-Series System, including right to purchase 92861R Opt 600/700/890 right to copy products for additional systems.

891: Upgrade from previous version of 92861A/R Opt 890 or 700 to latest version of 92861A/R Opt 890 for customer NOT on support service.

892: Upgrade from 92841A/R Option 890 to 92861A/R Option 890 for user on support service for 92841A/R.

893: Upgrade from 92841A/R Option 890 to 92861A/R Option 890 for user NOT on support service.

92861R Right to Copy 92861A Software For Use on an Additional Computer System

The 92861R Right to copy product is available only to customers who have purchased a license to use 92861A. 92861R, which must be ordered with one of Use Options 600 through 893, consists of:

1. The right to make one copy of software purchased with the 92861A package for use on an additional system.
2. All manuals supplied with 92861A.

Software support products available

See page 1-4.

Advanced Graphics Package (AGP)

HEWLETT PACKARD

The HP 92862A Advanced Graphics Package (AGP) is an interactive three-dimensional graphics package for use on HP 1000 Computer Systems with the 92861A Device-independent Graphics Library (DGL), both operating under the RTE-6/VM, RTE-A, or RTE-A with VC+.

Features

- Support under the hierarchical 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 operator interaction with picture segments to be displayed or changed
- Efficient design for fast execution and relatively small 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 8 workstations for simultaneous graphics input/output
- Six different fonts for graphics text
- Multilingual user programming 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. Objects defined in 3-D space can be viewed from any position.

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 segments by an operator.
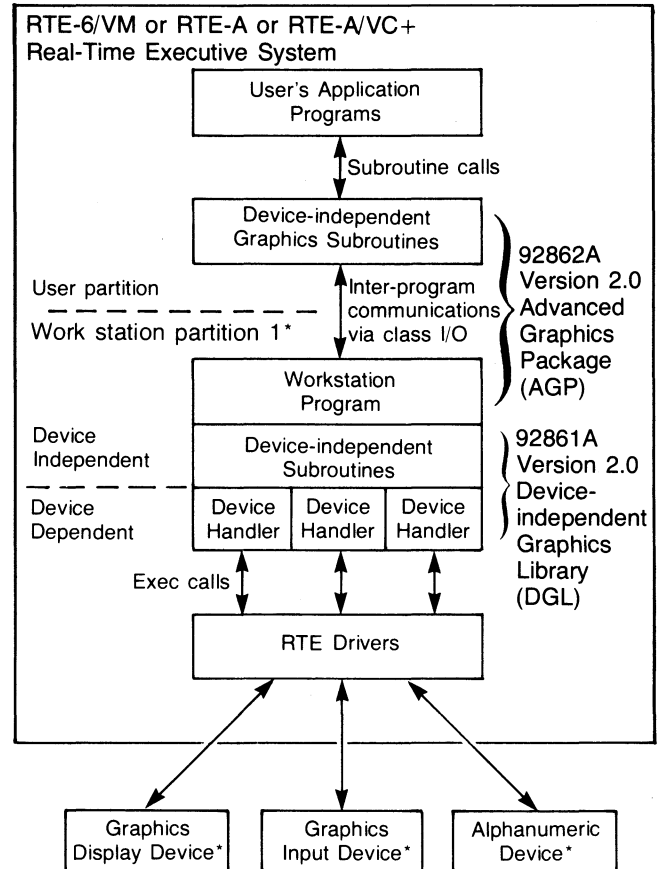
Each graphics work station may consist of one display device, one alphanumeric message device, and up to five different logical input devices; AGP supports up to eight concurrently active workstations.

Figure 1. AGP Functional relationships

Interactive Picking

A high-level input function, called "picking" is available for interactive applications. Using a "pick" input device, such as the stylus of an HP 9111A Graphics Tablet, the operator can point at the primitives of line, set of lines, or text on the display and have the segment name as well as the specific pick identifier for the specific primitives returned 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 operator is 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 both CDS* and non-CDS* graphics subroutines that become a part of user's application programs, a set of modules for configuring workstation programs, and a sample graphics monitor program. As shown in Figure 1, the application program with AGP graphics subroutines and the workstation program are separate. Thus, the application program's code and data space available is maximized. At the same time, this arrangement also makes very effective use of the overall system through concurrent processing in the multitasking RTE system environment.

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 92861A Device-independent Graphics Library (DGL).

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 in the world 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.

Picture Segmentation

The transformed images of the AGP output primitives specified by the user may 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. However, picking identification within segments provides a second level of picture element selectability.

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

Interactive 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). 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 text font storage: Graphics text fonts, including user-designed fonts, are stored in, and accessed from, font files on the disc.

Figure 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 by 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 1, some or all of which may be implemented on one physical device, such as an HP 2623A Graphics Terminal. Workstations may also consist of more than one physical device. See Table 1 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 an operator keyboard.

Locator: Returns X-Y coordinate information designated by operator using a terminal cursor or digitizer.

Valuator: Returns scalar real value entered by operator as the relative position of a terminal cursor or digitizer, or the setting of a knob.

Pick: Returns segment name and pick identifier of output primitive designated by operator using devices, such as a terminal cursor or digitizer.

Output Devices

Graphics display: Any graphics output device (such as a plotter or CRT display).

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

Graphics Subroutine Capabilities

See Table 2.

Compatibility

Operating system: RTE-6/VM, RTE-A, and RTE-A with VC+ systems with hierarchical file system support.

Program languages: FORTRAN 77, FORTRAN 4X, Pascal/1000, and Macro/1000 Assembly language.

Supported graphics devices: Graphics devices are operated through the 92861A Device-Independent Graphics Library (DGL) so AGP device support is the same as for DGL; see the 92861A DGL data sheet for supported graphics device configurations.

Extent of device support: Together, the 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 support those device features that are most important to the majority of HP 1000 application areas. AGP and DGL also provide a supported mechanism that allows the application program to access special features which are available on the graphics device. AGP supported device features are described in the 92861A and 92862A manuals.

Table 1. Supported Graphics Devices

DEVICE PRODUCT NUMBERS	USABLE IN		LOGICAL DEVICE CODES
	A-Ser	E/F-Ser	
RASTER TERMINALS			
2623A, 2627A, 2625A+523, 2628A+523, and 2647F **	YES	YES	A,B,D,K,L,P,V
2647A *, 2648A *, and 2649C/G *	NO	YES	
INPUT DEVICES			
9111A Graphics Tablet	YES	YES	B,L,P,V
9874A * Digitizer	YES	YES	A,B,L,P,V
17263A Graphics Tablet	YES	YES	L
VECTOR DISPLAYS			
1350S */1351S	YES	YES	D
1350S */1351S with 9111A	NO	YES	
VECTOR PLOTTERS			
7220C/T #, 7221A/B/C/S/T #	NO	YES	D,L
7225B *, 7470A, 7475A, 7550A, 7586B	YES	YES	
7580A */B, 7585A */B, 9872A/B/C/S/T *	YES	YES	D,L,P
RASTER PRINTERS			
2563A+214, 2608S+214, 2932A/33A/34A 2932A/33A/34A+046	YES	NO	D
2563A+210, 2608A */S+210	NO	YES	

```
 * Obsolete product listed here for reference only.

** Minifloppy disc of 2647F is not supported in
   HP 1000 systems.

 # A 264x or 2635B+051* Terminal used in an eaves-
   drop mode is required with 722x Plotters, which
   are obsolete products listed here for reference.

Logical graphics device codes:
  A = Alphanumeric display   B = Button
  D = Graphics display       K = Keyboard
  L = Locator                P = Pick
  V = Valuator
```

Table 2. 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 the current position using coordinates in a buffer
JRnDR*	Draws relative positioned line from the current position
JRnMK*	Draws relative positioned marker symbol
JRnMV*	Sets 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 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
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
JPLIM	Defines limits of pick device
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 view plane 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 prog.
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 operator response, returns locator value to program
JWVAL	Awaits operator response, returns valuator value to program

INQUIRY	
JICOL	Returns color parameters associated with an index in the color table
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
JITSZ	Returns size of a text string
JIWS	Returns information on op code specified workstation configuration and capabilities
JI1IN	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

Table 2. AGP Subroutine Capabilities, Continued

CONTROL/WORKSTATIONS	
JALPH	Sends a text string to the system alpha-numeric display device
JBATC	Initiates 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, on devices with chart advance, 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

Memory Requirements

Vector-to-Raster Conversion for Raster printers: At least 400 pages (800 kb) of EMA or 100 pages (200 kb) of working set for VMA.

Monitor program: 16 kb.

Each Workstation program: 20-64 kb non-CDS, 10-56 kb for code segment and 6-38 kb for data segment with CDS.

Installation: The 92862A AGP is a customer installed product, which is easily loaded from its relocatable libraries along with appropriate 92861A DGL subroutines and device handlers to satisfy the graphics requirements of the user's applications. It is not generated into the RTE operating system. An appropriate workstation program(s) must be configured and loaded before the application program(s) is run. A monitor program for communications between the application program(s) and the workstation program(s) must also be loaded.

Minimum System Requirements

Same as basic 92084A RTE-6/VM, 92077A RTE-A, or 92077A RTE-A with 92078A VC+ plus the 92861A DGL product and one graphics device, selected from those listed in Table 1.

Ordering information

92862A Graphics/1000-II Version 2.0 Advanced Graphics Package (AGP)

The 92862A package, which must be ordered with one of Use Options 600 through 893 consists of:

1. The AGP software and a catalog file describing it on one of Media Options 020-051, **which must be ordered.**
2. AGP User's Guide (97085-90000).
3. AGP Reference Manual (97085-90005).
4. AGP Reference Manual Supplement (92862-90001).

92862A Media Options

022: AGP software on CS/80 cartridge tape.

044: AGP software on 3.5-in. Microfloppy discs.

050: AGP software on 800 bpi mag tape.

051: AGP software on 1600 bpi mag tape.

92862A/92862R Use Options

600: Use in A600 system.

601: Upgrade from previous version of 92862A/R option 600 to latest version of same for user NOT on support service.

602: Upgrade from 92842A/R Option 600 to 92862A/R Option 600 for user on support service for 92842A/R.

603: Upgrade from 92842A/R Option 600 to 92862A/R Option 600 for user NOT on support service.

700: Use in A700 or E/F-Series system.

701: Upgrade from previous version of 92862A/R option 700 to latest version of same for user NOT on support service.

702: Upgrade from 92842A/R Option 700 to 92862A/R Option 700 for user on support service for 92842A/R.

703: Upgrade from 92842A/R Option 700 to 92862A/R Option 700 for user NOT on support service.

890: General license to use in A900 or any other A/E/F-Series System, including right to purchase 92862R Opt 600/700/890 right to copy products for additional systems.

891: Upgrade from previous version of 92862A/R Opt 890 or 700 to latest version of 92862A/R Opt 890 for customer NOT on support service.

892: Upgrade from 92842A/R Option 890 to 92862A/R Option 890 for user on support service for 92842A/R.

893: Upgrade from 92842A/R Option 890 to 92862A/R Option 890 for user NOT on support service.

92862R Right to Copy 92862A Software For Use on an Additional Computer System

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1. The right to make one copy of software purchased with the 92862A product for use on an additional system.
2. All manuals supplied with 92862A.

Software support products available

See page 1-4.

HPSPICE Circuit Simulation Program

For HP 1000 F-Series
Computer Systems

product number 92091A
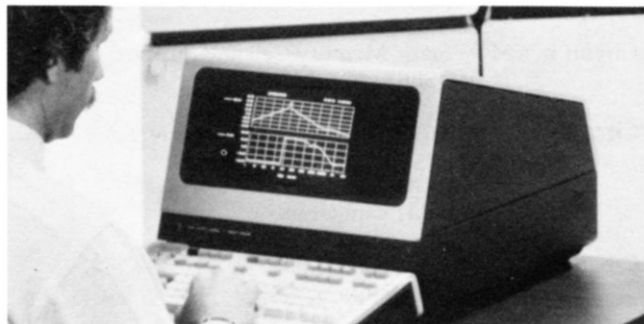
HPSPICE is a general purpose circuit simulation program that serves as a computer aid for use in the analysis and verification of electronic circuits. The simulation program is based upon the circuit simulator known as SPICE2 (version 2G.5), developed at the University of California at Berkeley. An interactive user interface with graphical output, defined by Hewlett-Packard, has been added to improve engineering productivity while designing and testing analog circuits, or analog and digital IC's.

With the use of HPSPICE in the Computer Aided Engineering environment, an engineering lab can realize an increase in productivity by reducing design cycle turnaround time. Greater effort may be extended in creative tasks, and less time in design evaluation and verification, where electrical engineers usually spend the largest amount of project time. The HPSPICE user may realize many benefits.

- The accuracy and precision with which design specifications are met is improved.
- The number of needed breadboard constructions is reduced.
- More finely engineered and reliable, quality endproducts are possible.
- Final high-quality analysis results exist for incorporation into engineering documentation.

Features

- **General purpose circuit simulation based upon renowned public domain software**
- **Active device models with parameters**
- **Multiple analysis types**
- **Large circuit capacity**
- **Interactive, easy-to-use interface**
- **High-quality graphical output**
- **Multiple user environment**
- **Interactive or batch mode operation**
- **Major vendor support (Software Subscription Services)**

Functional description

Circuit Elements

HPSPICE circuits may contain one or more of the following elements:

- Resistors
- Capacitors
- Inductors
- Mutual Inductors
- Voltage/Current Controlled Sources
- Transmission Lines
- Diodes
- Bipolar Junction Transistors (BJT's)
- Junction Field Effect Transistors (JFET's)
- MOS Field Effect Transistors (MOSFET's)

Types of Analysis

HPSPICE can perform

- **non-linear DC analysis** with the facility to generate transfer characteristics,

- **linear AC small-signal analysis** with noise and distortion simulation,

- and **non-linear transient analysis** with Fourier analysis options.

These analyses can be conducted at different temperatures as specified by the user.

Operating Modes

HPSPICE interacts with the user through the command set and EDIT/1000 commands. HPSPICE also provides for online interactive explanation of its commands to help the casual user who may have forgotten the available command set, or the usage of certain commands.

HPSPICE is designed to operate in two modes:

- **Batch mode,** in which circuits are queued for simulation in the background mode of the operating system. Other simulation tasks, such as graphical analysis of a previously simulated circuit, can be accomplished while circuits are being simulated in the background.

- **Interactive mode,** in which circuits are simulated while the engineer waits for the notification of simulation completion. Activity at the engineer's terminal may then resume.

Functional specifications

User Commands

The user interacts with HPSPICE by using the following commands:

COMMAND	PURPOSE
CIrcuit	specify the present circuit
CReate	create a circuit file
DEqueue	remove a simulation from the queue
DUmp	display the tabular results of a simulation
EDit	edit the circuit file
EXit	exit from HPSPICE
GRaph	plot the simulation results
HElp	display this table of commands
LISt	display the circuit file
NOdes	list the circuit nodes available for graphing
PUrge	purge the circuit's files
QUeue	add a simulation to the queue
SEt	set various graphics attributes
SHow	list the graphics attributes
SImulate	schedule a simulation
STatus	display HPSPICE status
SYntax	schedule a syntax check of the present circuit
/	toggle between alphanumeric and graphics displays

Note: The first two letters of each command are sufficient for interaction with the program.

Simulation Times

As an indication of the circuit simulation ability of HPSPICE, four typical circuits are identified, and the execution times for various types of analyses are exhibited in table 1. All HPSPICE analyses are performed using the hardware floating point features of the HP 1000 F-Series computer. All floating point calculations use 64-bit numbers to minimize round-off errors.

Circuit A = 7404 TTL Inverter:
  4 bipolar transistors
  2 diodes
  4 resistors

Circuit B = MOS Static Memory Cell and Support Circuitry
  16 MOSFET devices

Circuit C = 4 UA741 Operational Amplifiers
  88 (4 x 22) bipolar transistors
  56 (4 x 14) resistors
  4 (4 x 1) capacitors

Circuit D = Grey Code Counter
  264 transistors
  152 resistors
  6 voltage sources

Table 1. HPSPICE Circuit Simulation Times (seconds)

	A	B	C	D
DC Analysis	18	—	245	—
AC Analysis	—	—	426	—
Transient Analysis	21	54	351	4078

Notes:
1. *All simulations are run on a version of HPSPICE built upon Berkeley's SPICE2G.5 version.*
2. *All times are in seconds.*
3. *All analyses calculate 100 output points.*
4. *Times are for 2117F Computer running RTE-6/VM with 1.2M byte main memory.*

Graphical Output

The output from an HPSPICE simulation is generated using the Graphics/1000-II software, and has the following characteristics:

1. All graphs are labeled with a title, a timestamp, and a temperature appropriate to the circuit analysis results being displayed.

2. Axes are labeled in engineering units (millivolts, nanoseconds, etc.).

3. All graphs are automatically and uniformly scaled for any output device.

4. All curves on one graph either appear as different line types on softcopy devices, or different colors on multi-color hardcopy devices.

A typical simulation results in graphical output as follows:
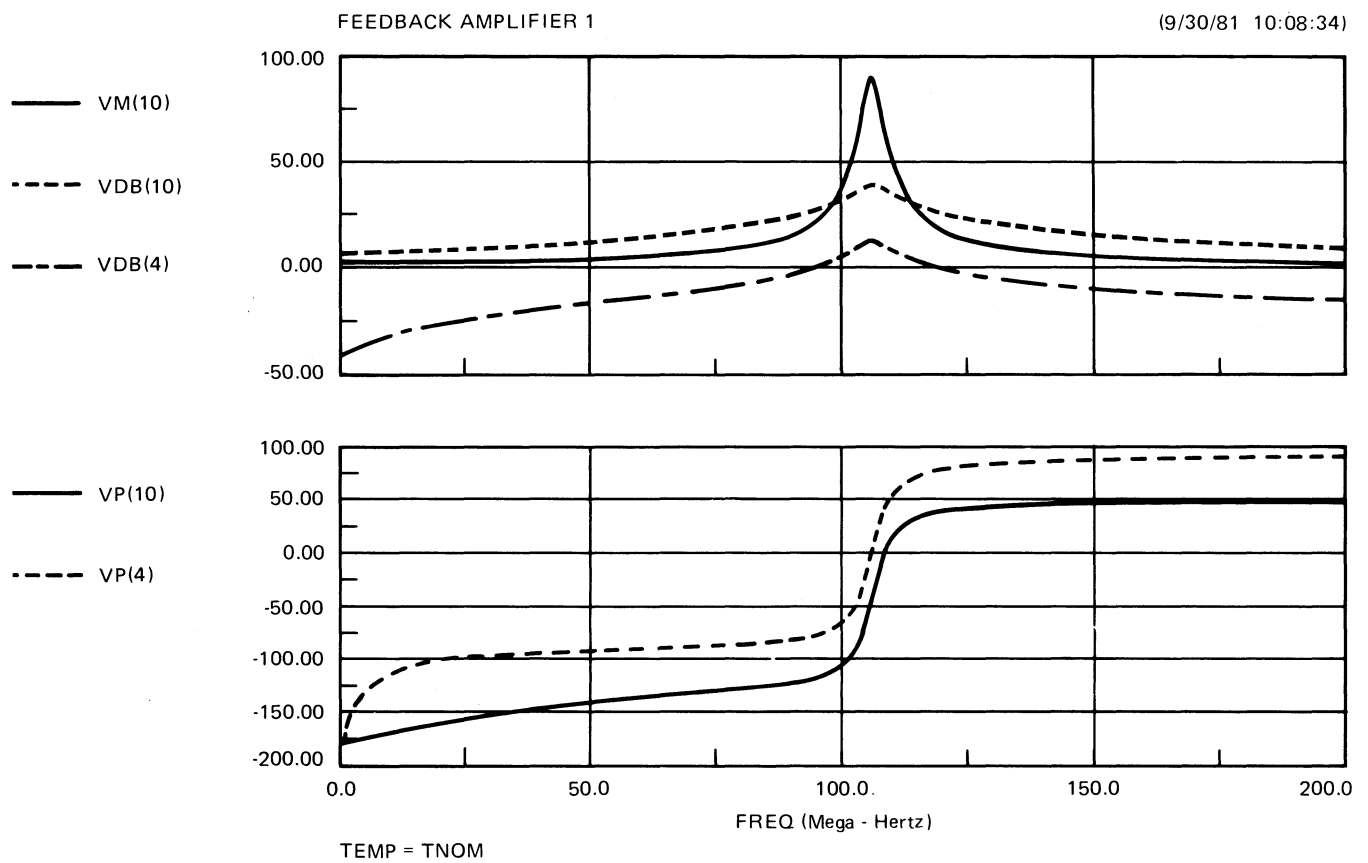
An Example of HPSPICE Graphic Output

Environment

Compatibility: The 92091A HPSPICE program is compatible with 2117F Computers and the HP 1000 Model 65 Computer System. HPSPICE requires 768k bytes of memory for minimum (1 HPSPICE user) operation. The HPSPICE compatible graphics peripherals include: HP 2647A, HP 2648A, HP 2623A, HP 2608A, HP 7580A, HP 9872A/B/C/S/T.

Software Required: 92084A RTE-6/VM operating system (with Session Monitor and batch spooling), 92074A EDIT/1000 text editor, and 92841A Graphics/1000-II Device-Independent Graphics Library (DGL).

Ordering information

92091A HPSPICE Circuit Simulation Program

92091A HPSPICE program includes:

1. HPSPICE relocatables (including simulator and user interface subsystems), loader command files, a verification circuit and its results, and tutorial circuits on software Media Option 020, 022, 050 or 051, **one of which must be ordered.**
2. HPSPICE Reference Guide (92091-90001).

92091A Options

020: Provides HPSPICE software on minicartridges.

022: Provides HPSPICE software on CS/80 cartridge tape.

050: Provides HPSPICE software on 800 bpi mag tape.

051: Provides HPSPICE software on 1600 bpi mag tape.

92091R Right to Reproduce HPSPICE for Use on an Additional Computer System With Right to Sub-License

The 92091R Right to reproduce product is available only to customers who have purchased the 92091A product. 92091R consists of:

1. The license to make one copy of software purchased with 92091A for use on an additional system.
2. The HPSPICE Reference Guide and Berkeley technical reports supplied with 92091A.

92091M Right to Reproduce HPSPICE for Use on an Additional Computer System Without Right to Sub-License

The 92091M Right to reproduce without sub-license product is available only to customers who have purchased the 92091A product. 92091M consists of

1. The license to make one copy of software purchased with 92091A for use on an additional system.
2. The HPSPICE Reference Guide and Berkeley technical reports supplied with 92091A.

Software support products available

A-Series Diagnostic Packages

HEWLETT PACKARD

The HP 24612A and 24398B Diagnostic Packages provide stand-alone testing of the A600, A700, and A900 CPUs, memory, interface cards, and CS/80 and H-Series discs and magnetic tape units. See table 1 on next page for summaries of the diagnostic packages. Diagnostic software can be loaded into memory from CS/80 cartridge tape; flexible, Minifloppy, or Microfloppy disc; or 264x Mini cartridge tapes.

Features

- **Choice of diagnostic packages, including:**
  - Basic package that checks out A600/A700/A900 CPU and memory, most interfaces, and control store and Floating Point Processor in A700
  - Package that checks out 1206xA Measurement and Control interfaces
  - Package that checks out CS/80 and H-Series discs and Mag tape unit
- **A "BASIC-like" Diagnostic Design Language interpreter for easier design by the user of diagnostics for user-developed interfaces based on the 12010A Breadboard Interface and for specialist-level diagnosis**
- **Test hoods for complete verification of interface cards**
- **All diagnostic software in each package on a single medium of user's choice**
- **Remote diagnosis via phone lines using Bell 103 or equivalent modem and the virtual control panel (VCP)**

Configuration Requirements

Processor: 2106AK/BK or 2107AK Board Computer, 2137A, 2139A, or 2156A/B Computer, 2136x or 2186x Microsystem, or 219xA-D Model 26, 27, or 29 Computer System, or 243xA or 248xA Micro 26, 27, or 29 Computer System.

Memory: 128k bytes, minimum.

Loading devices: Cartridge tape drive on 264x terminal (Media Option 020) or CS/80 fixed disc (Media Option 022); 9895A Flexible disc drive (Media Option 041); Minifloppy disc on 2136A/2186A Model 6/6+ Microsystems (Media Option 042); or Microfloppy disc on 9121D or 9133A/B Disc Memory (Media Option 044).

Console device (needed for running the Diagnostic Design Language interpreter or 24398B diagnostics — optional for running any of the interface diagnostics except that for the 12072A Data Link Slave Interface): Any HP 1000 A-Series compatible 238x or 26xxA terminal connected to the computer via a 12005A/B Asynchronous serial interface.

Ordering Information

24612A Diagnostic Package for A/L-Series Processor, Memory, and Most Interfaces

24398B Diagnostic Package for A600/A700/A900 Compatible Hard Discs, Except the 9134A Mini Winchester Disc, and Magnetic Tape Units

NOTE: For items supplied in the respective diagnostics packages, see Table 1 on next page; software will be supplied on one of Media Options 020, 022, 041, 042, or 044, which must be ordered. Manuals are furnished in a binder.

Diagnostics Package Media Options 24612A, 24613A, and 24398B

020: Diagnostic software on 264x Mini cartridges.

022: Diagnostic software on CS/80 cartridge tape.

041: Diagnostic software on 9895A flexible disc.

042: Diagnostic software on 5-in. Minifloppy discs.

044: Diagnostic software on 3.5-in. Microfloppy discs.

24612A and 24398B in HP 1000 A600/A700/A900 Systems

The 24612A and 24398B Diagnostic Packages are included in 2186A/B/C/D, 2196A/B/C/D, 2197A/B/C/D, and 2199A/B/C/D System Processor Units for Model 6/6+ Microsystems, 243xA or 248xA Micro/1000 Systems, and Model 26, 27, and 29 Computer Systems.

24612S and 24398BS Diagnostic Subscription Service

Provides all diagnostic routines, operating manuals, and test hoods included in the respective Diagnostic Package that have been added or updated in the last quarter as well as all manual updating supplements. The same Media Option used in ordering the Diagnostic Package must be specified when ordering the subscription service for it. Subscription service is priced in monthly units and is billable quarterly.

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Table 1. A-Series Diagnostics Packages Summary

Supported Function or Product	Software Item	Manual Part Number	Test Hood Part Numbers(s)
24612A DIAGNOSTICS PACKAGE FOR A/L-SERIES PROCESSOR AND MOST INTERFACES			
Diagnostic operation and troubleshooting	Diagnostic control system with Basic Control Module	24612-90001	
Preparation of diagnostics for user-designed interfaces or specialist-level diagnosis	Diagnostic Design Language Interpreter	24612-90002	
Checking of all 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	
Checking of the following A/L-Series Computer Interfaces — 12005A/B Asynchronous Serial Interface — 12006A Parallel Interface — 12008A PROM Storage Module — 12009A HP-IB Interface	Individual diagnostics are provided for each interface	24612-90004	24397-60003 24397-60004
12007/12044/12073/12082 DS/1000-IV Interfaces based on the Programmable Serial Interface Card	Diagnostic	24600-90001	5061-3453 and 5061-3460
12040A/B 8-Channel Asynchronous Multiplexer Interface	Diagnostic	12040-90003	5061-4901
12072A DS/1000-IV Data Link Slave Interface	Diagnostic	24600-90002	5061-4909
12153A Writable Control Store Card (A700 only)	Diagnostic	24612-90003	
12060A High-Level Analog Input Card and 12061A Extension Multiplexer Card	Diagnostic	24601-90001	12060-60003 and 12061-60002
12062A Analog Output Card	Diagnostic	24601-90002	12062-60002
12063A 16-In/16-Out Digital I/O Card	Diagnostic	24601-90003	12063-60002
24398B DIAGNOSTICS PACKAGE FOR DISCS AND MAG TAPE UNITS			
7908R/P, 7911R/P, 7912R/P, and 7914R/P CS/80 Fixed Disc with built-in tape cartridge backup	Diagnostic	5955-3462	
7906H and 7910H Integrated Controller Discs	Diagnostic	5955-4355	
7971A+140/144 or 7970E+636 Magnetic Tape Subsystem	Diagnostic	7970-90980	

L-Series Diagnostic Packages

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The HP 24612A and 24398A Diagnostic Packages provide stand-alone testing of the L-Series CPU, memory, interface cards, and CS/80 and H-Series discs and magnetic tape units. See Table 1 on next page for summaries of the diagnostic packages. Diagnostic software can be loaded into memory from CS/80 cartridge tape, flexible or Mini-floppy disc, or 264x Mini cartridge tapes.

Features

- **Choice of diagnostic packages, including:**
  — Basic package that checks out CPU, memory, and most interfaces
  — Package that checks out CS/80 and H-Series discs and Mag tape unit
- **A "BASIC-like" Diagnostic Design Language intepreter for easier design by the user of diagnostics for user-developed interfaces based on the 12010A Breadboard Interface and for specialist-level diagnosis**
- **Test hoods for complete verification of interface cards**
- **All diagnostic software in each package on a single medium of user's choice**
- **Remote diagnosis via phone lines using Bell 103 modem and the Virtual Control Panel (VCP)**

Configuration Requirements

Processor: 2103LK Board Computer, 2103L Computer, or 2122A/B or 2142A/B Microsystem.

Memory: 64k bytes, minimum; 128k bytes for checkout of CS/80 discs.

Loading devices: Cartridge tape drive on 264x terminal (Media Option 020) or CS/80 fixed disc (Media Option 022); 9895A Flexible disc drive (Media Option 041); or Mini-floppy disc on 2122A/2142A Model 5 Microsystem (Media Option 042).

Console device (needed for running the Diagnostic Design Language interpreter or 24398A diagnostics — optional for running any of the interface diagnostics except that for the 12072A Data Link Slave Interface): Any HP 1000 L-Series compatible 238x or 26xxA terminal connected to the computer via a 12005A Asynchronous serial interface.

Ordering Information

24612A Diagnostic Package for A/L-Series Processor, Memory, and Most Interfaces

24398A Diagnostic Package for L-Series Compatible Hard Discs, Except the 9134A Mini Winchester Disc, and Magnetic Tape Units

NOTE: For items supplied in the respective diagnostics packages, see Table 1, next page; software will be on one of Media Options 020, 022, 041, or 042, which must be ordered. Manuals are furnished in a binder.

Diagnostics Package Media Options

020: Diagnostic software on 264x Mini cartridges.

022: Diagnostic software on CS/80 cartridge tape.

041: Diagnostic software on 9895A flexible disc.

042: Diagnostic software on Minifloppy disc for 2122A or 2142A Model 5 Microsystem.

24612A and 24398A in HP 1000 Model 5 Microsystems

The 24612A Diagnostic Package is included in the 2142A and 2142B Model 5 Microsystems. The 24398A Diagnostic Package is also included in the 2142B Model 5 Microsystem.

24612S and 24398S Diagnostic Subscription Service

Provides all diagnostic routines, operating manuals, and test hoods included in the respective Diagnostic Package that have been added or updated in the last quarter as well as all manual updating supplements. The same media option used in ordering the Diagnostic Package must be specified when ordering the subscription service for it. Subscription service is priced in monthly units and is billable quarterly.

Table 1. L-Series Diagnostics Packages Summary

Supported Function or Product	Software Item	Manual Part Number	Test Hood Part Numbers(s)
24612A DIAGNOSTICS PACKAGE FOR A/L-SERIES PROCESSOR AND MOST INTERFACES			
Diagnostic operation and troubleshooting	Diagnostic control system with Basic Control Module	24612-90001	
Preparation of diagnostics for user-designed interfaces or specialist-level diagnosis	Diagnostic Design Language Interpreter	24612-90002	
Checking of all 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	
Checking of the following A/L-Series Computer Interfaces — 12005A/B Asynchronous Serial Interface — 12006A Parallel Interface — 12008A PROM Storage Module — 12009A HP-IB Interface	Individual diagnostics are provided for each interface	24612-90004	24397-60003 24397-60004
12007/12044/12073/12082 DS/1000-IV Interfaces based on the Programmable Serial Interface Card	Diagnostic	24600-90001	5061-3453 and 5061-3460
12040A/B 8-Channel Asynchronous Multiplexer Interface	Diagnostic	12040-90003	5061-4901
12072A DS/1000-IV Data Link Slave Interface	Diagnostic	24600-90002	5061-4909
12060A High-Level Analog Input Card and 12061A Extension Multiplexer Card	Diagnostic	24601-90001	12060-60003 and 12061-60002
12062A Analog Output Card	Diagnostic	24601-90002	12062-60002
12063A 16-In/16-Out Digital I/O Card	Diagnostic	24601-90003	12063-60002
24398A DIAGNOSTICS PACKAGE FOR DISCS AND MAG TAPE UNITS			
7908R/P, 7911R/P, 7912R/P, and 7914R/P CS/80 Fixed Disc with built-in tape cartridge backup	Diagnostic	5955-3462	
7906H and 7910H Integrated Controller Discs	Diagnostic	5955-4355	
7971A+140/144 or 7970E+636 Magnetic Tape Subsystem	Diagnostic	7970-90980	

On-Line Diagnostic and Verification Package

For HP 1000 E/F-Series Computer Systems   product number 91711B

The On-line diagnostic and verification package is a group of diagnostic and verification programs that run in the RTE-6/VM, RTE-IVB, or RTE-IVE, operating environment. They offer the user the important advantage of being able to be used while other programs are executing on the system (except those that may be affected by a malfunction). These on-line programs can be used to:

1. Diagnose faults of:
   a. Hardware Floating Point Processor (in F-Series Computer).
   b. Scientific Instruction Set firmware (in F-Series Computer).
   c. Extended Memory Area firmware (in E/F-Series Computer).
   d. Vector Instruction Set firmware (in F-Series Computer).
   e. Integrated Controller Disc (ICD) Memories.
   f. CS/80 Disc Memories.
   g. Virtual Memory Area (in E/F-Series Computer).
2. Verify functional operation of:
   a. The HP 21xx computer cpu, memory, and firmware.
   b. HP 79xxH Integrated Controller Disc (ICD) memories, HP 79xxM/S Multi-Access (MAC) controller disc memories, and the RTE file manager.
   c. 91740x DS/1000 Distributed systems communication.
   d. 91750A DS/1000-IV Distributed Systems Communication.
   e. HP 59310B HP-IB interface.
   f. HP 26xx Operator terminal operation under DVR05, DVA05, multipoint, and DVR00.
   g. HP 7970B/E Mag tape unit operation.
   h. Line printer operation.
   i. HP 3075A/76A/77A Data Capture/Time Reporting Terminal operation under multipoint.

Features

- **On-line verification and diagnosis while executing other system activity.**
- **5 different on-line diagnostic programs**
- **13 different on-line verification programs**
- **2 different off-line diagnostic programs**

Functional specifications and usability

The 91711B diagnostic and verification programs, their memory requirements, and their usability by operating system and HP 1000 Computer series are summarized in Table 1.

Ordering information

91711B On-Line Diagnostic and Verification Package

The 91711B On-line diagnostic and verification package includes:

1. On-line diagnostic and verification package software on software Media Option 020, 050, or 051, **one of which must be ordered.**
2. On-Line Diagnostic and Verification Package Reference Manual (91711-90006).
3. Integrated Controller Disc Utilities Reference Manual (5955-4355).
4. CS/80 External Exerciser Reference Manual (5955-3462).

91711B Options

001: Provides discount to user upgrading 91711B if not enrolled in the Customer Support Service or Software Subscription Service.

020: Provides 91711B software on 264x Mini cartridges.

050: Provides 91711B software on 800 bpi magnetic tape.

051: Provides 91711B software on 1600 bpi magnetic tape.

Software support products available

See page 1-5.

Table 1. 91711B On-Line Diagnostic and Verification Usability Summary

91711B ROUTINES	MEMORY REQUIRED		USABLE IN RTE-			USABLE IN HP 1000 SERIES		
	Pages	Bytes	6/VM	IVB	IVE	F	E	M
ON-LINE DIAGNOSTIC PROGRAMS								
Hardware Floating Point Processor Diagnostic	5	10k	Yes	Yes	Yes	Yes	No	No
Scientific Instruction Set Diagnostic	5	10k	Yes	Yes	Yes	Yes	No	No
Extended Memory Area Firmware Diagnostic	7	14k	Yes	Yes	Yes	Yes	Yes	No
Virtual Memory Area Firmware Diagnostic	17	34k	Yes	No	No	Yes	Yes	No
Vector Instruction Set Firmware Diagnostic	12	24k	Yes	Yes	Yes	Yes	No	No
CS/80 Discs Diagnostic	25	50k	Yes	No	No	Yes	Yes	No
Integrated Controller Discs Diagnostic	20	40k	Yes	Yes	No	Yes	Yes	No
ON-LINE VERIFICATION PROGRAMS								
Main Central Processor Unit Verification	6	12k	Yes	Yes	Yes	Yes	Yes	Yes
Memory Verification	3	6k	Yes	Yes	No	Yes	Yes	Yes
Supported E/F-Series Firmware Verification	9	18k	Yes	Yes	Yes	Yes	Yes	No
Disc plus RTE File Manager Verification	10	20k	Yes	Yes	Yes	Yes	Yes	Yes
DS/1000 Distributed Systems Communications Verification	6	12k	Yes	Yes	Yes	Yes	Yes	Yes
DS/1000-IV Distributed Systems Communications Verification	10	20k	Yes	Yes	Yes	Yes	Yes	Yes
HP-IB Interface Verification	6	12k	Yes	Yes	Yes	Yes	Yes	Yes
Magnetic Tape Unit Verification	9	18k	Yes	Yes	Yes	Yes	Yes	Yes
Line Printer Verification	8	16k	Yes	Yes	Yes	Yes	Yes	Yes
264x Terminal plus DVR05/DVA05 Verification	9	18k	Yes	Yes	Yes	Yes	Yes	Yes
264x Multipoint Terminal Verification	7	14k	Yes	Yes	Yes	Yes	Yes	Yes
RS-232 Terminal plus DVR00 Verification	7	14k	Yes	Yes	Yes	Yes	Yes	Yes
3075A, 3076A, and 3077A plus Multipoint Verification	17	34k	Yes	Yes	No	Yes	Yes	Yes
MAC/ICD Disc Verification	14	28k	Yes	Yes	No	Yes	Yes	Yes

Device Drivers Provided with RTE Operating Systems

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HP 1000 Software

All RTE operating systems include relocatable driver routines for supported peripheral devices. The drivers supplied with the RTE-L/XL/A operating systems, which support the distributed intelligence architecture of A/L-Series Computer Systems are listed in Table 1. Drivers supplied with RTE-IVB and RTE-6/VM operating systems, which support the centralized intelligence architecture of E/F-Series Computer Systems are listed in Table 2 on the next page.

Table 1. Device Drivers Supplied with RTE-L/XL/A for A/L-Series Computer Systems

PROVIDED WITH RTE-			INTER-FACE DRIVER	SUPPORTED INTERFACE	DEVICE DRIVER	SUPPORTED DEVICES OR CAPABILITIES
L	XL	A				
Y	Y	Y	ID.00 ID.01*	12005A#/B Async Serial Interface	DD.00 DD.20	2382A, 262x, 264x, & 45610A Terminals Cartridge Tape Units in 264x Terminals
Y	Y	Y	IDM00	12040A#/B Eight-channel Asynchronous Multiplexer	DD.00 DD.20	2382A, 2563A+049, 2601A, 262x, 263x#, 264x, 2687A+214, 293xA, and 45610A Terminals and Printers Cartridge Tape Units in 264x Terminals
Y	Y	Y	ID.37	12009A HP-IB Interface	DDC12 DD.12 DD.30	2563A+214 or 2608S+214 Line Printer 2631B+214# or 293xA+046 Printers 7910H#, 7906H, 7920H, 7925H, 9121D/S, 9133V/XV, 9134XV, or 9895A Disc
N	Y	Y	ID.37	12009A HP-IB Interface	DD.23 DD.33	7970E+626/636, 7971A+140/141, or 7974A Mag Tape Unit 79xxP/R and 7933H/35H CS/80 discs and 9144A Tape Cartridge Subsystem
N	N	Y	ID.37	12009A HP-IB Interface	DDM30	79xxM/MR MAC Master Disc and up to seven 79xxS Slave Discs with 12745D HP-IB Adapter Kit, supported as peripheral discs only (not as system disc)
Y	Y	Y	ID.37	12009A HP-IB Interface	Note A Note B	2671A, 2671G, 2673A Thermal Printers 7470A, 7475A, 7550A, 758xA#/B, and 9872x* Plotters, and 9111A Graphics Tablet
Y	Y	Y	ID.50	12006A Parallel I/F 12060B A-to-D Converter 12062A DAC Interface 12063A Iso. Digital I/O Interface		Interfacing of various parallel I/O devices Digitizing of analog input signals Analog output Interfacing of digital inputs and outputs
Y	Y	Y	ID.36	12008A PROM Storage Module	DD.36	Disc emulation for read-in of programs from PROM storage
Y	Y	Y	ID.43	12013A, 12154A, or 12157A Battery Backup Card		Power fail/auto restart support
Y	Y	Y	ID.52	12006A Parallel I/F		CPU-to-CPU communication

* 12005A/B driver ID.01 supports both modem and direct connect communication with terminals. ID.00 supports only direct connect communication.

\# Obsolete product listed here for reference only.

NOTE A: 2671A, 2671G, and 2673A Thermal 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 or 92841A Version 1.0 Graphics/1000-II Device-Independent Graphics Library.

Table 2. Device Drivers Supplied with RTE-IVB or RTE-6/VM for E/F-Series Computer Systems

PROVIDED WITH RTE-		DRIVER	SUPPORTED INTERFACE(S)	SUPPORTED DEVICES OR CAPABILITIES
IVB	6/VM			
Yes	Yes	DVR00	12531C/D Terminal Interface 12597A 8-Bit Duplex Register	2382A and 26xx Terminals 2748A/B# Punched Tape Reader and 2895B# Tape Punch
Yes	Yes	DVR05	12966A Buffered Async Interface	Direct-connected 2382A, 26xx, or 45610A Terminal
Yes	Yes	DVA05	12966A Buffered Async Interface	Modem-connected or direct-connected 2382A, 26xx, or 45610A terminal
Yes	Yes	PVM00 DVM00 DDV05 DDV12	12792A*/B Eight Channel Async Multiplexer	Pre-driver required for all applications Basic interface driver for character mode communication Screen mode support of 2382A, 262x, and 264x Terminals Support of 2563A+049, 263x*, and 293x Printers
Yes	Yes	DVA12 LP31	12845A*/B Printer Interface	2607A*/10A*/13A*/17A*/19A* Line Printer 2631B+210* Printer (also uses DVA12)
Yes	Yes	DVB12	26099A Line Printer Interface	2608A* Line Printer
Yes	Yes	DVC12	12821A+001 Interface	2563A+210 or 2608S Line Printer
Yes	Yes	DVR12	12653A* Printer Interface 12566B*/C Microcircuit Interface	2767A* Line Printer 9866A* Printer
Yes	Yes	DVA13#	91200B TV Monitor Interface	B&W display w/1 interface, color w/3 interfaces
Yes	Yes	DVR15	17200-60001* OMR Interface	7261A* Optical Mark Reader
Yes	Yes	DVR23	13181B MTU Interface 13183B MTU Interface	7970B+236 800 bpi MTU or comparable 7971A MTU 7970E+236 1600 bpi MTU or comparable 7971A MTU
Yes	Yes	DVR31	13210A* Disc Interface	7900A* Moving-Head Cartridge Disc Drive
Yes	Yes	DVA32	12821A Disc Interface	7906H/HR, 7920H, and 7925H Integrated Controller Discs
Yes	Yes	DVR32	13175A*/B*/D MAC Master Disc I/F 13178B*/C*/D Multi-CPU Interface	79xxM MAC Master Disc and up to seven 79xxS Slave Discs
No	Yes	DVM33	12821A+001 Interface	79xxP/R and 7933H/35H CS/80 Discs, including built-in cartridge tape on 79xxP/R Discs
Yes	Yes	DVR33	Two 12566B*/C Microcircuit I/Fs	9885M* Flexible Disc Memory (12732A* Flexible Disc Subsystem includes 9885M and both 12566B/C interfaces)
Yes	Yes	DVR37#	59310B HP-IB Interface	Up to 14 HP-IB devices connected via Hewlett-Packard (IEEE Std 488-1978 Digital) Interface Bus, including 1350S* or 1351S@ Graphics Display System, 7225B/17601A*, 7470A, 7475A, 7550A, 758xA*/B, or 9872x Plotter, 9111A Graphics Tablet, or 9874A* Digitizer (NOTE A).
Yes	Yes	DVA47	40280A* Serial Link Controller Interface	3070* Data Capture Terminals
Yes	Yes	DVM72	12556B 40-Bit Register Interface 12566B*/C Microcircuit Interface 12604B Data Source Interface	General-purpose input/output

* Identifies discontinued product listed here for reference only.

Supporting subroutine library is also included with DVA13 and DVR37.

@ This product does not comply with U.S. or German EMI regulations.

NOTE A: Device handlers provided in the 92861A Version 2.0 or 92841A Version 1.0 Graphics/1000-II Device-Independent Graphics Library are also required for support of the graphics products listed here.

Diagnostics Library

**Mature Software for
HP 1000 E/F-Series Computer Systems**

product numbers 24396A, B, C, D, E, F

HP 24396 diagnostic library products enable HP 1000 E/F-Series computer users to load a diagnostic or control program into memory from any one of nine different input devices. These include the 2748A Punched Tape Reader; HP 7900, 7905, or 7906 disc drive; HP 7970B or 7970E Magnetic Tape Unit; or 264x Terminal with Mini cartridge I/O.

Features

- A broad range of diagnostic software support media
- Increased service efficiency by reducing test time
- CPU and peripheral diagnostics in a compact form
- Disc cartridges, magnetic tapes, and cartridge tape versions provide a wide range of peripheral subsystem diagnostics

Configuration information

CPU Required

HP 1000 E/F-Series Computer.

CPU Options Required

As specified by the diagnostic to be executed.

Memory Required

See the "Diagnostics library summary".

Prerequisites

24396A: 2748A/B, 2758A, or 2737A/B paper tape readers; 2752A or 2754A teleprinter, and HP 1000 or 2100A/S computers.

24396B: 7900A or 7901A cartridge disc drive, 12992A disc loader ROM, DCPC, and HP 1000 computer.

24396C: 7905A/7906A cartridge disc drive, 12992B disc loader ROM, DCPC, and HP 1000 computer.

24396D: 7970B magnetic tape unit, 12992D tape loader ROM, DCPC, and HP 1000 computer.

24396E: 7970E magnetic tape unit, 12992D tape loader ROM, DCPC, and HP 1000 computer.

24396F: 264x Terminal with Mini cartridge I/O, HP 1000 computer, and 12992C cartridge loader ROM.

NOTE: 2100A/S computers are supported only by single file or 24396A diagnostic products. 24396B/C/D/E/F diagnostic libraries require HP 1000 loader ROMs for proper operation.

Ordering information

24396A Diagnostics on paper tape

24396B Diagnostics on 2.5M byte disc cartridge

24396C Diagnostics on 10M byte disc cartridge

**24396D Diagnostics on 7970B magnetic tape
(800 BPI; NRZI)**

**24396E Diagnostics on 7970E magnetic tape
(1600 BPI;PE)**

24396F Diagnostics on 264x Mini cartridge tapes

Individual Cartridges and Single File Diagnostics

Any of the individual 264x Mini cartridges or single file diagnostics and related manuals may be ordered using the part numbers shown in the diagnostics library summary of this data sheet. Each Mini cartridge includes the diagnostic configurator as the first file. Single file diagnostics require the 24296-60001 diagnostic configurator for proper operation.

24396S HP 1000 Diagnostic Subscription Service

The 24396S HP 1000 Diagnostic Subscription Service provides quarterly distribution of update information and revised diagnostic routines necessary to keep the diagnostics supplied with your 24396A/B/C/D/E/F Diagnostics library or the diagnostics supplied with your HP 1000 Computer System up to date with respect to changes by the factory. The 24396S service provides updates for a year, renewal annually. Updates are available on paper tape, Mini cartridge, or 800 or 1600 bpi magnetic tape, selectable by specifying one of the following Media Options **which must be ordered** along with 24396S to receive the Diagnostic Subscription Service.

24396S Media Options

010: Paper tape updates of Diagnostics library.

020: Mini cartridge updates of 24396F Diagnostics library.

025: Mini cartridge updates of Diagnostics library supplied with HP 1000 Computer Systems.

050: 800 bpi Magnetic tape updates of Diagnostics library.

051: 1600 bpi Magnetic tape updates of Diagnostics library.

Diagnostics Supplied in HP 1000 E/F-Series Computer Systems

HP 1000 E/F-Series Computer Systems include a subset of the diagnostics supplied in the 24396F Diagnostics library, which is provided on Mini cartridges. This subset provides diagnostic support of all computer and peripheral capabilities that can be provided in HP 1000 E/F-Series Computer Systems.

TESTED CAPABILITY/PRODUCT	REQ. MEM. SIZE (bytes)	SINGLE FILE BINARY TAPE	MANUAL	24396A PAPER TAPE	DISCS & MAG TAPES	24396F 2644/45/48 CARTRIDGE TAPE	MANUAL VOLUME
Diagnostic configurator	8k	24296-60001	02100-90157	24296-60001	↑	24396-13301	24396-14001
Memory ref. instr. group	8k	24315-16001	02100-90218	24396-12001			
Alter-skip instr. group	8k	24316-16001	02100-90211				
Shift-rotate instr. group	8k	24317-16001	02100-90212				
Core memory (2100 16 15 14)	8k	24323-16001	02100-90219				
Semiconductor memory (HP 1000)	8k	24395-16001	24395-90001	24396-12001			
EAU instr. group	8k	24319-16001	02100-90214	24396-12002			
Floating point instr. group	8k	24320-16001	24320-90001	24396-12002			
Memory prot parity error (2100 HP 1000)	8k	12892-16001	12892-90005	24396-12002			
Power fail auto restart	8k	24321-16001	02100-90216	24396-12003			
I O instruction group	8k	24318-16001	02100-90213				
General-purpose register	8k	24391-16001	24391-90001				
Direct memory access (2100 HP 1000)	8k	24322-16002	24322-90002	24396-12003		24396-13301	24396-14001
Ext. instr. group (index instr.)	8k	12943-16002	12943-90004	12943-16002	**24396B 2.5Mb DISC** 24396-13001	24396-13302	24396-14002
Ext. instr. group (word. bit. byte)	8k	12943-16001	12943-90004	12943-16001			
2100 Fast Fortran package	8k	12907-16003	12907-90003	12907-16003			
HP 1000 Fast Fortran package 1	8k	12977-16004	12977-90002	12977-16004			
HP 1000 Fast Fortran package 2	8k	12977-16005	12977-90002	12977-16005			
FPP-SIS-FFP-F-Series	16k	12740-16001	12740-90004	12740-16001	**24396C 10Mb DISC** 24396-13101	24396-13302	
Memory expansion unit	32k	12929-16001	12929-90003	12929-16001		24396-13101	
Microcoded semicond. memory	8k	24395-16002	24395-90003	24395-16002			
Time base generator	8k	12539-16001	12539-90011	12539-16001			
12936 Priv. interrupt fence	8k	12936-16001	12936-90003	12936-16001	**24396D 800 BPI Mag Tape** 24396-13501		
12908 12978 256 word WCS	8k	12908-16001	12908-90013	12908-16001			
13197 1k WCS	8k	13197-16002	13197-90002	13197-16002			
12889 Hardwired serial interface	8k	24335-16001	02100-90169	24335-16001			
59310 HP-IB interface	8k	59310-16001	59310-90061	59310-16001		24396-13303	24396-14002
12587 Async data set interface	16k	12587-16001	12587-90013	12587-16001	**24396E 1600 BPI Mag Tape** 24396-13601	24396-13304	24396-14003
12920 Async multiplexer (data)	8k	12920-16001	12920-90009	12920-16001			
12920 Async multiplexer (control)	8k	12920-16002	12920-90009	12920-16002			
12621 Sync data set interface (rec)	8k	12621-16001	12621-90008	12621-16001			
12622 Sync data set interface (send)	8k	12622-16001	12622-90008	12622-16001			
12967 Sync data set interface	8k	12967-16001	12967-90001	12967-16001			
12966 Async data set interface	16k	12966-16001	12966-90004	12966-16001			
12968 Async comm interface	8k	12968-16001	12968-90003	12968-16001			
12821A ICD Disc interface	16k	12821-16001	12821-90002	12821-16001		24396-13304	
2607 Line printer	8k	24340-16001	12987-90004	24340-16001		24396-13305	
2613 17 18 Line printer	8k	02618-16001	02618-90006	02618-16001			
2631 Printer	16k	02631-16001	02631-90906	02631-16001			
2635 Printing terminal	16k	02635-16001	02635-90906	02635-16001			
2608 Line Printer	8k	02608-16001	02608-90906	02608-16001			
9866 Line printer	8k	12996-16001	12996-90001	12996-16001		24396-13305	24396-14003
12732A Flexible disc subsystem	16k	12732-16003	12732-90003	12732-16003		24396-13306	24396-14004
7900 01 Cartridge disc	16k	12960-16001	12960-90003	12960-16001			
7905 06 20 Cartridge disc	32k	12962-16001	12962-90001	12962-16001			
92900A Terminal s s (3070. 40280)	8k	92900-16001	92900-90003	92900-16001		24396-13306	
9-track Mag tape (7970. 13181 3)	16k	13181-16001	13181-90095	13181-16001		24396-13307	
7 9-track Mag tape (13184 I F)	16k	13184-16001	13184-90008	13184-16001			
Diagnostic cross-link	8k	24296-16003	02100-90157	24296-16003			
7900 7905 7906 7920 Disc initialization	8k	24296-16002	02100-90157	24296-16002			
Paper tape reader-punch	8k	12597-16001	12597-90031	12597-16001			
Dig. plotter I F (CalComp)	8k	12560-16001	12560-90029	12560-16001			
2892 Card reader	8k	12924-16001	12924-90006	12924-16001			
2894 Card reader-punch	16k	12989-16001	12989-90001	12989-16001			
Teleprinter	8k	12531-16001	12531-90042	12531-16001			
2615 Video terminal	8k	24351-16001	02615-90002	24351-16001			
12909B PROM writer	4k	24360-16001	24360-90001	24360-16001	↓	24396-13307	

Signal/1000 Digital Signal Processing Package

HEWLETT PACKARD

Mature Software for HP 1000 F-Series Computer Systems

product number 92835A

The Signal/1000 Digital Signal Processing Package consists of a comprehensive FORTRAN library that forms the foundation for all digital signal processing applications. This package also includes a set of microcoded firmware instructions that provide extremely fast processing for increased computational power. Verification programs included for testing subroutine functions also serve as simple examples for program development.

Features

- **Microcoded signal processing firmware that speeds calculations**
- **Comprehensive documentation**
- **Verification programs with documented input data and output results**
- **Support of large (512 x 512) memory resident data arrays for image processing**
- **On-line firmware diagnostics**

Applications

- Signal Analysis
- Speech Processing
- Seismology
- Digital Filter Design
- Image Processing

Functional description

The Signal/1000 library is divided into eight major areas:
1. Discrete (Fast) Fourier Transforms
2. Power Spectrum Analysis and Correlation
3. Convolution
4. Linear Prediction Analysis
5. Finite Impulse Response (FIR) Filter Design and Analysis
6. Infinite Impulse Response (IIR) Filter Design and Analysis
7. Cepstral Analysis
8. Interpolation and Decimation

These routines utilize microcoded instructions that perform the following operations:
- Complex array bit reversal
- Complex FFT butterfly
- Real FFT phasor multiplication
- Complex add, subtract, multiply and divide
- Complex conjugate, complement, AIMAG and CMPLX operations

Functional specifications

Execution Times:
See Table 1.

Table 1. Signal/1000 FFT Execution Times (sec)

Sample Size	Real FFT		Complex FFT	
	Forward	Reverse	Forward	Reverse
256	0.06	0.07	0.10	0.11
512	0.13	0.14	0.21	0.23
1024	0.27	0.29	0.46	0.48
2048	0.58	0.60	0.97	1.03
4096	1.21	1.27	2.07	2.18
8192	2.55	2.67	—	—

NOTES:
1. All times are in seconds.
2. "Forward" means Time to Frequency, "Reverse" means Frequency to Time.
3. Reverse times are slightly larger due to scaling, which is performed with VIS instructions.
4. Timings are for 2117F Computer with 1 megabyte of memory without fault control.

Configuration Information

Compatibility: The 92835A Signal/1000 package is compatible with 2117F Computers and HP 1000 Model 65 and 45 Computer Systems.

Required accessory: 12829A or 12824A Vector Instruction Set (VIS) and associated 12791A Firmware Expansion Module (FEM). 12791A FEM is now included in all F-Series computers and systems. VIS is included in the Model 65 and 45 F-Series systems.

Control store location requirement: Four 256 word modules (56 through 59) in 2117F Computer.

Current required from +5V computer power supply: 3.32A, including 1.2A base requirement for the 12791A Firmware Expansion Module, 1.06A for the 1k words of ROM storage required by the 12824A Vector Instruction Set, and 1.06A for the 1k words of ROM storage required by the Signal/1000 firmware.

Software required: 92084A RTE-6/VM or 92068A RTE-IVB operating system and 92836A FORTRAN 77 Compiler in RTE-6/VM system or 92834A FORTRAN 4X compiler in RTE-IVB system. The Signal/1000 subroutines are also callable from Pascal/1000 and BASIC/1000D.

Ordering information

92835A Signal/1000 Digital Signal Processing Package

The 92835A Signal/1000 package includes:

1. Signal processing sources, relocatables, verification programs, and test data on software Media Option 022, 050 or 051, **one of which must be ordered.**
2. Signal Processing Instruction Set ROMs (92835-80001 through 80003).
3. IEEE Programs for Digital Signal Processing Manual (User instruction and subroutine description) (92835-90001).
4. HP Signal/1000 User Reference and Installation Manual (92835-90002).

92835A Media Options

022: Provides 92835A software on CS/80 cartridge tape.

050: Provides 92835A software on 800 bpi magnetic tape.

051: Provides 92835A software on 1600 bpi magnetic tape.

92835R Right to Copy Signal/1000 For Use on an Additional Computer System

The 92835R Right to copy product is available only to customers who have purchased the 92835A product. 92835R consists of

1. The license to make one copy of software purchased with 92835A for use on an additional system.
2. All firmware supplied with 92835A.
3. All manuals supplied with 92835A.

Software support products available

See page 1-5.

With 5953-8711, Supersedes 5953-8720 and 5953-8726