HP 1000 Computer Systems

Software technical data
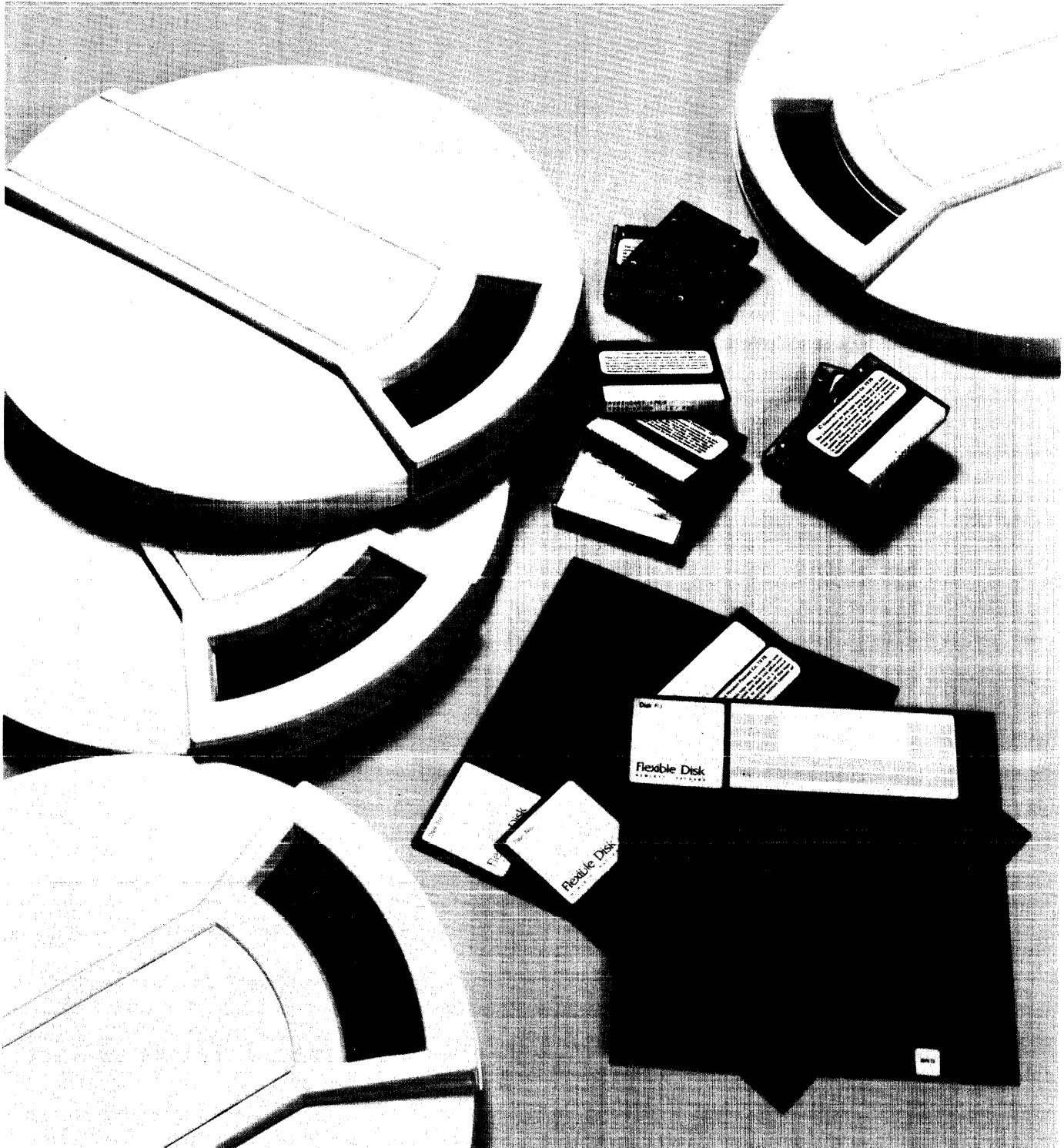
Alphabetical index

Product number index

HP 1000 Software Information Locator

Support

Active Operating Systems

Active Program Development and Performance Optimization Software

Active Data Base Management and Data Capture Software

Other Active Software or Software-Firmware

Mature Software and Diagnostics

Standard Software Provided with Operating Systems

Software Source and Listing Products

Communications Software

All Communications Software is located in the HP 1000 Communications Products Technical Data book.

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 for the HP Computer Systems Support Services Data Book.

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.

Contributed software

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 1000 International Users Group
P.O. Box 54895
Oklahoma City, OK 73154

HP 1000 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 software discrepancies and to maintain compatibility with other software products defined as compatible when the product was sold	Regularly scheduled to correct known software discrepancies and to maintain compatibility with other software products defined as compatible when the product was sold	As needed to correct serious software discrepancies and to maintain compatibility with other software products defined as compatible when the product was sold	None
Term	Indefinite	Indefinite	5 years	Indefinite
Available for sale	As 1st time purchase or as license to copy product	As 1st time purchase or as license to copy product	As license to copy product only	As special purchase only
Product Content for 1st time purchase	Provides the right to use software on one computer and delivery of software and manuals (and firmware if part of product)		Not applicable	Special: Ref manual & S/W on mag tape
Product Content for license to copy product	Provides the license to copy software onto one additional computer system and delivery of manual (and firmware if part of product)			
Customer Training Availability	Regularly scheduled courses are available for most active software products	Request scheduled only	Request scheduled only	Not available
Software support services	Available for all active, mature, and inactive software products			Not available
Customer Support Service (CSS) content	Right to use software updates and applicable firmware updates, delivery of software, firmware, and reference manual updates, Account Responsible Systems Engineer, Phone-in Consulting Service, On-site systems engineering assistance, Software Status Bulletin, Software problem reporting, and HP 1000 Communicator			Not available
Software Subscription Service (SSS)	Right to use software updates and applicable firmware updates, delivery of software, firmware, and manual updates, Software Status Bulletin, Software problem reporting through the mail, and HP 1000 Communicator			Not available
Documentation Distribution Services	Available for all active, mature, and inactive software products			Not available
Software Notification Service content	Provides information on software updates, outstanding software problems and resolutions, and new programming techniques			Not available
Manual Update Service content	Provides periodic manual updates to keep additional manual sets for HP 1000 software products up to date			Not available

Table 2. HP 1000 Software and documentation services product summary

Supported software, software-firmware, or firmware-only product	S/W CAT	Customer Support Service Products			Software Subscription Service Products		9xxxxT and 9xxxxS Media Choices				Manual Update Service Product
		For First System	For Central Support of Add'l System	For Add'l Phone-In Consulting Caller	For First System	For Copy of Updates to Add'l System	Pun Tape	Mini Cart	Flex disc	Mag Tape	
Operating systems											
92068A RTE-IVB software-firmware	A	92068T	92068V	92068P	92068S	92068W		•		•	92068Q
91068X RTE-IVB software sources	A				92068Z					•	
92070A RTE-L software	A	·92070T	92070V	92070P	92070S	92070W			•	•	92070Q
92071A RTE-XL software	A	92071T	92071V	92071P	92071S	92071W			•	•	92071Q
92070X RTE-L software sources	A				92070Z				•	•	
92071X RTE-XL software sources	A				92071Z				•	•	
92001B RTE-II software	M	92001T	92001V		92001S		•	•			
92064A RTE-M software	M	92064T	92064V	92064P	92064S			•	•		92064Q
92060A RTE-III software	I	92060T	92060V		92060S			•			
92067A RTE-IV software-firmware	I	92067T	92067V		92067S			•		•	
Programming languages											
92076A BASIC/1000L software	A	92076T	92076V		92076S			•	•	•	92076Q
92101A BASIC/1000D software	A	92101T	92101V		92101S		•	•		•	92101Q
92832A Pascal/1000 software	A	92832T	92832V		92832S	92832W		•		•	92832Q
92834A RTE FORTRAN 4X software	A	92834T	92834V		92834S	92834W		•	•	•	92834Q
92854A Pascal/1000 software	A	92854T	92854V		92854S	92854W		•	•	•	92854Q
92065A BASIC/1000M software	M	92065T	92065V		92065S			•	•		92065Q
System-system communications											
91750A DS/1000-IV software	A	91750T	91750V		91750S	91750W		•	•	•	91750Q
91780A RJE/1000 software	A	91780T	91780V		91780S		•	•			91780Q
91740A/B DS/1000 software	I	91740T	91740V		91740S	92740W	•	•			91740Q
91741A DS/1000 software enhancement	I	91741T	91741V		91741S	91741W	•	•			91741Q
Operator-system communications											
91730A Multipoint Software	A	91730T	91730V		91730S			•			91730Q
91731A Async Mpxer Software	A	91731T	91731V		91731S			•			91731Q
Data base mgt & data capture											
92069A IMAGE/1000 Software	A	92069T	92069V		92069S	92069W		•			92069Q
92073A IMAGE/1000 software	A	92073T	92073V		92073S	92073W		•	•	•	92073Q
92080A DATACAP/1000-II Software	A	92080T	92080V		92080S	92080W		•		•	92080Q
92063A IMAGE/1000 Software	I	92063T	92063V		92063S		•	•			
92903A DATACAP/1000 Software	I	92903T	92903V		92903S	92903W		•			
Other software products											
92083A RTE Profile Monitor	A	92083T	92083V		92083S	92083W		•		•	92083Q
92061A RTE Microprogramming Package	A	92061T	92061V		92061S		•	•			92061Q
92835A Signal/1000 software	A				92835A	92835W		•		•	
92400A Sensor-Based DAS Utility Library	A	92400T	92400V		92400S		•	•			920400Q
92066A RTE Measurement & Control software package	A	92066T	92066V		92066S		•	•			92066Q
24397A L-Series Diagnostics	A				24397S			•	•		
24600A L-Series Diagnostics	A				24600S			•	•		
91711A On-line diagnostics and verification package	A				91711S			•		•	91711Q
92840A Graphics/1000 Graphics Plotting Software	A	92840T	92840V		92840S			•			92840Q
24396A-F (M/E/F-Series) Diagnostics Library	M				24396S		•	•		•	
Firmware-only products											
12790A Multipt interface firmware	A				12790S						
12823F F-Series (2111F/2117F) firmware upgrade product	A				12823S						
12824A Vector Instruction Set	A	12824T	12824V		12824S	12824W		*			
13306A Fast FORTRAN Processor	A				13306S						
13307A Dynamic Mapping Instr.	A				13307S						

92830A Software Notification Service: Covers all Active, Mature, and Inactive HP 1000 Software Products

* Applies to updates for 12824A software equivalents used in HP 1000 M/E-Series Computers.

S/W (Software) Category column definitions:

A = Active software, M = Mature software, I = Inactive software

HEWLETT-PACKARD COMPANY
HP 1000 Software Rights and Privileges Statement

February 1, 1981

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 I), 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 I). 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 I). 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.

SOFTWARE OR SOFTWARE-FIRMWARE PRODUCT	CAT	LICENSE TO COPY PRODUCT	EXECUTE-ONLY PRODUCT
TYPE I SOFTWARE			
91740A DS/1000 Network Software-firmware for HP 1000 M-Series Computers	I	91740P DS/1000 Firmware for HP 1000 M-Series Computers & "License to Copy" 91740A/B software once	Not available
91740B DS/1000 Network Software-firmware for HP 1000 E/F-Series Computers	I	91740R DS/1000 Firmware for HP 1000 E/F-Series Computers & "License to Copy" 91740A/B software once	Not available
91741A DS/1000 Software Enhancement for HP 1000 - HP 3000 Communication	I	91741R "License to Copy" 91741A Software once	Not available
91750A DS/1000-IV Network Software for HP 1000 L/M/E/F-Series Computers	A	91750R "License to Copy" 91750A Software once	Not available
92067A RTE-IV Operating Sys Software and Firmware	I	92067R RTE-IV firmware & "License to Copy" 92067A Software once	Not available
92067X RTE-IV Software Sources	I	92067Y RTE-IV firmware & "License to Copy" binary object code derived from the 92067X product once	Not available
92068A RTE-IVB Operating Sys Software and Firmware	A	92068R RTE-IVB Firmware & "License to Copy" 92068A Software once	92068E Firmware & Right to execute RTE-IVE on one additional computer
92068X RTE-IVB Software Sources	A	92068Y RTE-IVB Firmware & "License to Copy" binary object code derived from the 92068X product once	Not available
92069A IMAGE/1000 Software with QUERY	A	92069R "License to Copy" 92069A Software once	Not available
92070A RTE-L Operating System Software	A	92070R "License to Copy" 92070A Software once	92070E Right to execute RTE-L software on one additional computer
92070X RTE-L Software Sources	A	92070Y "License to Copy" binary object code derived from the 92070X product once	Not available
92071A RTE-XL Operating System Software	A	92071R "License to Copy" 92071A Software once	92071E Right to execute RTE-XL software on one additional computer
92071X RTE-XL Software Sources	A	92071Y "License to Copy" binary object code derived from the 92071X product once	Not available
92073A IMAGE/1000 Software without QUERY	A	92073R "License to Copy" 92073A Software once	Not available
92080A DATACAP/1000-II Software	A	92080R "License to Copy" 92080A software once	Not available
92083A RTE Profile Monitor Software	A	92083R "License to Copy" 92083A software once	Not available
92832A Pascal/1000 Software	A	92832R "License to Copy" 92832A software once	Not available
92834A FORTRAN 4X Software	A	92834R "License to Copy" 92834A Software once	Not available
92835A Signal/1000 Software Firmware	A	92835R "License to Copy" 92835A Software once	Not available
92854A Pascal/1000 Software	A	92854R "License to Copy" 92854A Software once	Not available
92903A DATACAP/1000 Software	I	92903R "License to Copy" 92903A software once	Not available
TYPE II SOFTWARE			
29396A-F Diagnostics Library	M	Not required	Not applicable
24397A L-Series Diagnostic Package Software	A	Not required	Not applicable
24600A L-Series Diagnostic Package Software	A	Not required	Not applicable
91700A-05A Network Communications Software	I	Not required	Not applicable
91711A On-Line Diag & Verif Package	A	Not required	Not applicable
91730A Multipoint Terminal Subsystem Software	A	Not required	Not applicable
91731A Async Multiplexer Subsystem Software	A	Not required	Not applicable
91780A RJE/1000 Communications Package	A	Not required	Not applicable
92001B RTE-II Operating System	M	Not required	Not applicable
92060A RTE-III Operating System	I	Not required	Not applicable
92061A RTE Microprogramming Package	M	Not required	Not applicable
92062X RTE Driver Sources	M	Not required	Not applicable
92063A IMAGE/1000 Software	I	Not required	Not applicable
92064A RTE-M Operating System Software	M	Not required	Not applicable
92065A BASIC/1000M Software	M	Not required	Not applicable
92066A RTE Meas. and Control Software Package	A	Not required	Not applicable
92076A BASIC/1000L Software	A	Not required	Not applicable
92101A BASIC/1000D Software	A	Not required	Not applicable
92400A Sensor-Based DAS Utility Library	A	Not required	Not applicable
92840A Graphics/1000 Graphics Plotting Software	A	Not required	Not applicable
93284A HP-ATS Software	M	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.

Setting up a training program

We encourage you to discuss your training requirements with your local Hewlett-Packard representative. This person is trained to assist you in setting up an optimum training plan for your needs. However, the following comments about the HP 1000 training program are intended to help you prepare in advance for that discussion.

In general, courses should be taken in the sequence indicated in the training program diagrams, below and on page 1-7, starting from the left and proceeding toward the right. Completion of each course in sequence will ensure that all needed prerequisites are satisfied.

HP 1000 M/E/F-Series training courses

22951C Introduction to HP 1000 Computers

This 5-day course provides an entry point into HP computer training for those customers who have had no previous ex-perience with small computer systems. Upon completion of class and lab sessions, the student will be familiar with the concepts of:

1. HP 1000 computer architecture.
2. Operating systems.
3. High level languages.

22992A HP 1000 Memory-Based RTE System Course

This 10-day course covers the use of the RTE-M operating system in an HP 1000 system environment. This includes class and lab training in program preparation using the standard flexible disc-based FORTRAN IV compiler, as-sembler, editor, relocating and absolute loaders; system software generation; and use of the file manager.

CUSTOMER TRAINING PROGRAM FOR HP 1000 M/E/F-SERIES COMPUTER SYSTEMS

COURSE SEQUENCE

| 22993A IMAGE/1000 |
| 22968B DS/1000-IV USER'S |
| 22960B PASCAL/1000 |
| 22970B ATS/1000 USER TEST PROG |
| 22963B INSTRUMENT INTERFACE WITH HP-IB |
| 22995B RTE-IVB SYSTEM MGR'S COURSE |
| 22952B ASSEMBLER PROG COURSE |

| 22957B DATACAP/1000 |
| 22969B DS/1000-IV INTERNALS |
| 22970B DS/1000-IV TO HP 3000 |
| 22973B ATS/1000 ADVANCED TEST PROG |
| 22996A ADV RTE WORKSHOP |
| 22990B DRIVER WRITING |
| 22983B E/F-SERIES MICROPROG |

| 22951C INTRODUCTION TO HP 1000 COMPUTERS |
| 22958A/C or 22959B FORTRAN IV SELF-STUDY OR USER'S COURSE |
| 22954A RTE-IVB SESSION MONITOR USER'S COURSE |
| 22992A HP 1000 MEMORY-BASED RTE COURSE |

* Or FORTRAN Programming Experience

22994A HP 1000 RTE-IVB/Session Monitor User's Course

This 10-day course covers the use of an RTE-IVB/Session Monitor operating system in an HP 1000 System environment. Class and lab sessions cover program development using standard editor, compiler, assembler, and loader, and interactive and programmatic use of the RTE-IVB operating system, the file management system, and the spooling system. Course emphasis is on how to use the capabilities of RTE-IVB. Generating and updating the RTE-IVB/Session Monitor system is covered in the 22995A RTE-IVB System Manager's Course.

22995A HP 1000 RTE-IVB System Manager's Course

In class and lab sessions, this 5-day course covers how to generate and update an RTE-IVB/Session Monitor operating system in an HP 1000 System environment. This includes system generation, reconfiguration, initialization, and back-up; Session Monitor account setup and updating; use of the primary and grandfather systems; and HP support services. This course is intended for the RTE-IVB System Manager who is responsible for system generation, updating, and integrity, and for communication with the HP Customer and System Engineers for his account.

22960B Pascal/1000 Programming Course

This 5-day course instructs the student in Pascal/1000 programming in the RTE-IVB and RTE-XL system environments. In addition to teaching the basic techniques of structured programming in Pascal, course class and labs will cover the use of Hewlett-Packard's extensions.

22968B DS/1000-IV User's Course

In classes and labs, this 3-day course discusses the characteristics of DS/1000-IV including network initialization, remote I/O, remote file access, remote EXEC calls, program-to-program calls, store-and-forward communications, utility calls, and generation.

22969B DS/1000-IV Internals

This 5-day class and lab course describes the internal operation of DS/1000-IV software for the network manager and programmer/analyst, who need to know the internal functioning of the HP 1000-to-HP 1000 link. Included are hands-on programming of the system, exercising system utilities, diagnostics, and troubleshooting tools. System generation and network reconfiguration are covered in detail.

22970B DS/1000-IV to DS/3000

This 2-day course describes the user-level and internal operation of DS/1000-IV for HP 1000-to-HP 3000 link. Intended for network managers and programmer/analysts, the course discusses listings, tables, and flow charts while covering the monitors, utilities, network configuration, 1000 driver, line protocol, troubleshooting, and HP 1000 as Master/Slave to the HP 3000.

22993A IMAGE/1000 Data Base Management System Course

This 5-day class and lab course covers the creation, building, back-up, and modification of data bases using the 92069A IMAGE/1000 Data Base Management System. It also includes the writing of programs to access a data base and the use of QUERY to access a data base.

22957B DATACAP/1000 Customer Course

This 5-day class and lab course provides training in the use, configuration, and installation of DATACAP/1000 in an RTE-IVB operating system environment.

22990B HP 1000 Driver Writing Course

This 5-day class and lab course covers the techniques and requirements for developing RTE device drivers for use in an HP 1000 system. Topics covered include: HP 1000 Computer family hardware and software I/O structure, interrupt-driven drivers, RTE driver structure and operation, use of DCPC by drivers, and privileged RTE drivers.

22983B HP 1000 E-/F-Series Computers Microprogramming Course

This 5-day class and lab course covers the theory and use of HP microprogramming hardware and software to prepare, alter, and install microprograms for HP 1000 E-Series and F-Series computers.

22996A Advanced RTE Workshop

This 5-day course for the system analyst/programmer covers internal design and operation of the RTE operating system. Topics include RTE modules and functions, lists and tables, use of DMS, programming dispatching/partition assignment, RTE utilities, and performance measurements.

22972B ATS/1000 User Test Programming Course

This 5-day class and lab course is intended for test engineers who write programs for the ATS/1000 Automatic Test System. The course begins with an overview of system architecture, then covers MTIS software and its usage, interrupt processing in ATS, setting up and controlling ATS switches, test programming techniques and examples, and BASIC in ATS.

22973B ATS/1000 Advanced Test Programming Course

This 5-day course is intended for customer's engineers with system manager responsibilities for an ATS/1000 system, senior test programmers, and system-level ATS/1000 programmers. It covers MTIS internals, trap processing internals, generation considerations, troubleshooting, and the DTU in ATS/1000. A generation and troubleshooting workshop are also included.
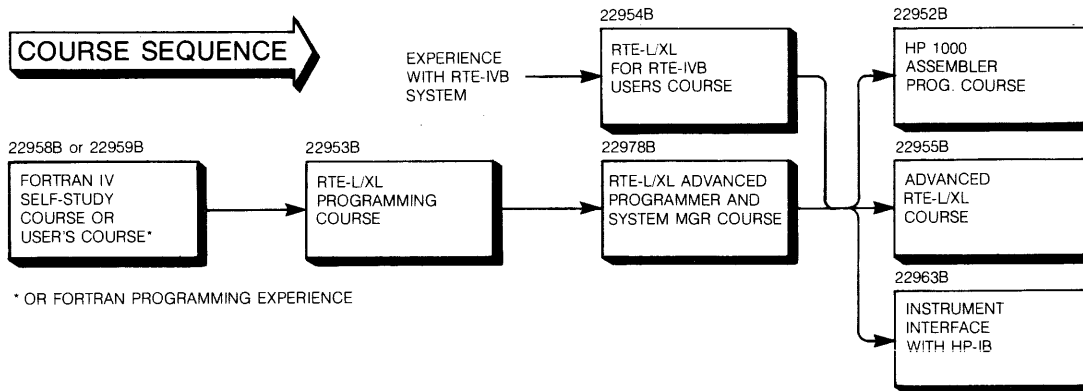
HP 1000 L-Series training courses

22953B RTE-L/XL Programming Course

This 5-day class and lab course covers all aspects of RTE-L/XL operating system functioning that support program development on L-Series systems. This includes use of exec calls, the file manager, procedure files, and saving and restoring of disc cartridges as well as user development of simple programs using FORTRAN IV and the Assembler.

22978B RTE-L/XL Advanced Programmer and System Manager's Course

This 5-day class and lab course combines coverage of program scheduling, class I/O, and other system topics useful to the advanced programmer with system familiarization, and training in system generation, initialization, backup, and software maintenance for the system manager.

22954B RTE-L/XL for RTE users

This 4-day class and lab course is intended to provide current RTE-IVB users with a working understanding of RTE-L/XL. Because of the student's previous training and experience, this shorter course can substitute for the 22953B and 22978B courses listed above. After a first-day introduction to the L-Series hardware, the student will be using the RTE-L/XL system for program development during the second day and will be generating RTE-L/XL systems during the third and fourth days.

22955B Advanced RTE-L/XL Course

This 5-day class and lab course explores the RTE-L/XL system in sufficient depth to give a basis for making intelligent decisions about system performance and to provide instruction in the preparation of input/output drivers for use in the RTE-L/XL operating system.

Training courses of interest to all HP 1000 Users

22958B RTE FORTRAN IV Self Study Course

The course consists of ten self-paced training sessions in the structure, syntax, and use of FORTRAN IV. It includes six video tapes and accompanying workbook containing supplemental information and practice problem sets. Special emphasis is placed on the interactive use of FORTRAN IV in the RTE-IVB operating system environment.

22958C RTE FORTRAN IV + 4X Self Study Course

This course is similar to 22958B, above, but includes eight video tapes, adding coverage for FORTRAN 4X to the coverage of 22958B.

22959B RTE FORTRAN IV User's Course

A 3-day first course in the FORTRAN IV programming language as implemented in HP 1000 RTE operating systems. The student workbook and video tapes used in the 22958B FORTRAN IV Self Study Course are supplemented by classroom discussions, lab exercises, and more in-depth coverage of the topic of FORTRAN IV programming aimed at the particular student background of the class.

22952B HP 1000 Assembler Programming Course

This 5-day class and lab course covers the operation of the RTE assembler in an HP 1000 computer system environment. Major emphasis is placed on the development of assembly language programs for use in an RTE operating system.

22963B Instrument Interface with HP-IB

This 4-day class and lab course provides an introduction to HP-IB concepts, theory, and use in HP 1000 Computer Systems, with special emphasis on use in M/E/F-Series Computers. Information on HP-IB message subroutines and device subroutine writing techniques is also presented.

Maintenance training courses

Maintenance training is also available. See the current HP Computer Systems Group Course Schedule for the list of available courses.

Ordering, registration, and scheduling information

Information on tuition for scheduled courses is provided in the HP 1000 Systems Ordering Information booklet and course scheduling information is provided in the current HP Computer Systems Group Course Schedule. Both of these documents are available from your Hewlett-Packard representative.

Operating systems hardware and software support matrix

LEGEND:

Y   = Yes, is supported by the operating system in whose column the Y appears

Yx = Yes, is supported when option 011/012 is ordered

Y3 = Supported by RTE-MIII configuration of RTE-M

N   = No, is not supported in that compatibility has not been tested by Hewlett-Packard or driver is not supplied. No HP effort will be made to support an N item under this system

A   = Alternate computer choices supported by the operating system. Older computer may require updating to latest serial prefix status to achieve compatibility

P   = Operating System with P in its column is provided in the respective computer system; P is equivalent to Y

R   = Item Required by the operating system; only items associated with the selected computer and only one item of a type (such as a memory package or memory option) is required

L   = RTE-M supports only the WCS Load Utility and WCS Driver DVR36

Mt = Item supported when system is equipped with 91730A Multipoint Software

Ax = Item supported when system is equipped with 91731A Async Multiplexer Software

D4 = Item supported when system is equipped with 91750A DS/1000-IV Network software

Ds = Item supported when system is equipped with 91740A/B DS/1000 software-firmware

Dp = Item supported when system is equipped with 91730A Multipoint Software and 92080A (RTE-IVB) or 92903A (RTE-IV) DATACAP/1000 software

D   = Alternate system Disc choices supported by the operating system

M   = Item supported when system is equipped w/92066A RTE Measurement and Control Software Package

G   = Item for which 92840A Graphics Plotting Software is recommended to aid graphics programming

E   = Execute-only support of Pascal/1000 programs under RTE-L

F   = Program language supplied only with 92064A RTE-M media option 040

I   = Program language support Included with the operating system

*   = Discontinued product that is listed here for reference

I/F = Abbreviation for Interface

INACTIVE RTE-		MATURE RTE-		ACTIVE RTE-			SUPPORTED HARDWARE AND SOFTWARE PRODUCTS
III	IV	II	M	IVB	L	XL	
							HP 1000 L-Series Computers, Systems, accessories, and interfaces
N	N	N	N	N	A	A	2103L Computer (8 available I/O channels)
N	N	N	N	N	N	R	-011 Substitutes 128kb expandable memory for 64kb
N	N	N	N	N	N	R	-012 Substitutes 512kb memory for 64kb
N	N	N	N	N	A	A	2103LK Board Computer w/1203x Card Cage and 12035A Power Module
N	N	N	N	N	N	R	-011 Substitutes 128kb expandable memory for 64kb
N	N	N	N	N	N	R	-012 Substitutes 512kb memory for 64kb
N	N	N	N	N	P	Yx	2145A/B System Processing Unit (11 available I/O channels)
N	N	N	N	N	N	P	-011 Substitutes 128kb expandable memory for 64kb, RTE-XL for RTE-L
N	N	N	N	N	N	P	-012 Substitutes 512kb memory for 64kb, RTE-XL for RTE-L
N	N	N	N	N	P	Yx	2146A/B System Processing Unit (11 available I/O channels)
N	N	N	N	N	N	P	-011 Substitutes 128kb expandable memory for 64kb, RTE-XL for RTE-L
N	N	N	N	N	N	P	-012 Substitutes 512kb memory for 64kb, RTE-XL for RTE-L
N	N	N	N	N	Y	Y	12008A PROM Module (64k byte capacity)
N	N	N	N	N	Y	Y	12013A Battery Backup Card
N	N	N	N	N	Y	Y	12005A Asynchronous Serial Interface (for terminals)
N	N	N	N	N	Y	Y	12006A Parallel Interface
N	N	N	N	N	D4	N	12007A DS/1000-IV HDLC Modem Interface
N	N	N	N	N	Y	Y	12009A HP-IB Interface
N	N	N	N	N	Y	Y	12010A Breadboard Interface
N	N	N	N	N	Y	Y	12040A 8 Channel Async Multiplexer
N	N	N	N	N	D4	N	12044A DS/1000-IV HDLC Direct Connect Interface
N	N	N	N	N	Y	Y	12063A Isolated Digital I/O Card with 16 inputs and 16 outputs
							HP 1000 M-Series Computers and accessories
N	N	N	A	N	N	N	2105A Computer (2 memory slots, 4 I/O channels)*
A	A	A	A	A	N	N	2108 Computer (5 memory slots, 9 I/O channels)
N	N	N	A	N	N	N	2108K/MK (325 ns) Board Computer w/12728E base instr set & 12728B/J Card Cage (capacity equiv to 2105A Computer)
A	A	A	A	A	N	N	2108K/MK (325 ns) Board Computer w/12728E base instr set & 12728B Card Cage (capacity equiv to 2108 Computer)
R	R	N	Y	R	N	N	12784A-D/12785A-D 128-1024 kb Memory Packages (12784A Package is incl in 2112M Computer)
R	R	R	Y	R	N	N	12897B Dual Channel Port Controller
R	R	N	Y	Y	N	N	12976B Dynamic Mapping System (incl in 2112M Computer and 12784A-D & 12785A-D Memory Packages)
R	R	N	Y	R	N	N	12731A Memory Expansion Module (incl in 12976B)

INACTIVE RTE-		MATURE RTE-		ACTIVE RTE-			
III	IV	II	M	IVB	L	XL	SUPPORTED HARDWARE AND SOFTWARE PRODUCTS
							HP 1000 M-Series Computers and accessories continued
R	R	N	Y	R	N	N	12778B Dynamic Mapping Instructions (included in 12976B)
R	R	R	Y	R	N	N	12892A/B Memory Protect (included in 12976B)
R	R	R	Y	R	N	N	12539C Time Base Generator
Y	Y	Y	Y	Y	N	N	12977B (or 12976B Opt 003) Fast FORTRAN Processor
N	Y	N	N	Y	N	N	12824A Vector Instruction Set software equivalent routines
Y	Y	Y	Y	Y	· N	N	12620A Breadboard Interface used as RTE Privileged Interrupt fence
Y	Y	Y	L	Y	N	N	13197A Writable Control Store (when system is equipped with 92061A RTE Microprogramming Package)
Y	Y	N	Y	Y	N	N	12791A Firmware Expansion Module
							HP 1000 E-Series Computers and Systems
A	A	A	A	A	N	N	2109 Computer (5 memory slots, 9 I/O channels)
A	A	A	A	A	N	N	2109K/EK (175/280 ns) Board Computer w/12728H Base Set Instr ROMs & 12728J Card Cage (capacity equiv to 2109 Computer)
A	A	A	A	A	N	N	2113 Computer (10 memory slots, 14 I/O channels)
N	N	N	P	N	N	N	2174A/B Computer System (12 available I/O channels)
N	N	N	N	P	N	N	2176C/D Computer System (11 available I/O channels)
							HP 1000 F-Series Computers and Systems
N	A	N	A	A	N	N	2111F Computer (5 memory slots, 9 I/O channels)
N	A	N	A	A	N	N	2117F Computer (10 memory slots, 14 I/O channels)
N	N	N	P	N	N	N	2175A/B Computer System (12 available I/O channels)
N	N	N	N	P	N	N	2177C/D Computer System (10 available I/O channels)
							HP 1000 E-Series and F-Series Computer Accessories
N	Y	N	N	Y	N	N	12824A Vector Instruction Set (firmware supported in F-Series, software equivalent supported in E-Series)
R	R	R	Y	R	N	N	12897B Dual Channel Port Controller
R	R	R	Y	R	N	N	13304A Firmware Accessory Board for 2109K/EK
R	R	R	Y	R	N	N	12786A-D/12787A-D 128-1042 kb Memory Packages (E-Series only — 12786A Package is incl in 2113E Computer & 2176C/D System)
R	R	R	Y	R	N	N	12788A/D/12789A-D 128-1042 kb Memory Packages (12788A Package is incl in 2117F Computer and 2177C/D System)
R	R	R	Y	R	N	N	13305A Dynamic Mapping System (incl in 2113E/17F Computers, 2176-7C/D Systems & 12786-9A-D Memory Packages)
R	R	R	Y	R	N	N	12731A Memory Expansion Module (included in 13305A)
R	R	R	Y	R	N	N	12892B Memory Protect (included in 13305A)
R	R	R	Y	R	N	N	13307A Dynamic Mapping Instructions (included in 13305A)
R	R	R	Y	R	N	N	12539C Time Base Generator
Y	Y	Y	Y	Y	N	N	13306A Fast FORTRAN Processor
Y	Y	Y	Y	Y	N	N	12620A Breadboard Interface used as RTE Privileged Interrupt fence
Y	Y	Y	L	Y	N	N	13197A Writable Control Store (when system is equipped with 92082A ACCEL/1000 or 92061A RTE Microprogramming Package)
Y	Y	N	Y	Y	N	XL	12791A Firmware Expansion Module
							HP 1000 M/E/F-Series Recommended Terminal Interfaces
Y	Y	Y	Y	Y	N	N	12966A Buffered Async (block or char mode) Communications Interface
N	Mt	N	Mt	Mt	N	N	12790A Multipoint Terminal Interface
N	N	N	Y3	Y	N	N	12792A 8-Channel Asynchronous Multiplexer
N	Ax	N	Ax	Ax	N	N	12920B 16-Channel Asynchronous Multiplexer
							HP 1000 M/E/F-Series DS/1000 Interfaces
N	Ds	N	Ds	Ds	N	N	12771A Computer Serial (hardwire) Interface for HP 1000-HP 1000 comm
N	Ds	N	Ds	Ds	N	N	12773A Computer Modem Interface for HP 1000-HP 1000 comm
N	N	N	D4	D4	N	N	12793A DS/1000-IV Bisync Modem Interface to HP 3000
N	N	N	D4	D4	N	N	12794A DS/1000-IV HDLC Modem Interface to HP 1000
N	N	N	D4	D4	N	N	12825A DS/1000-IV HDLC Direct Connect Interface to HP 1000
N	N	N	D4	D4	N	N	12834A DS/1000-IV Bisync Direct Connect Interface to HP 3000
N	Ds	N	Ds	Ds	N	N	12889A Hardwired Serial I/F for HP 1000-HP 3000 comm (when system is equipped with 91740A/B DS/1000 Software-firmware and 91741A DS/1000 Software Enhancement)
							Other HP 1000 M/E/F-Series Data Communications Interfaces
Y	Y	Y	Y	Y	N	N	12531C Teleprinter char mode, current loop Interface
Y	Y	Y	Y	Y	N	N	12531D Terminal char mode, current loop Interface
N	N	N	N	N	N	N	12587B Async Data Set Interface (M-Series only)
N	N	N	N	N	N	N	12589A Auo Calling Unit Interface (M-Series only)
Y	Y	Y	N	Y	N	N	12618A Synchronous Comm Interface (included in 91780A RJE/1000)
Y	Y	Y	Y	Y	N	N	12880A Character Mode CRT Terminal Interface*
N	N	N	N	N	N	N	12967A Synchronous Communications Interface
N	N	N	N	N	N	N	12968A Asynchronous Communications Interface

INACTIVE RTE-		MATURE RTE-		ACTIVE RTE-			SUPPORTED HARDWARE AND SOFTWARE PRODUCTS
III	IV	II	M	IVB	L	XL	
							HP 1000 M/E/F-Series Printer Interfaces
Y	Y	Y	Y	Y	N	N	12845B Printer Interface for 2613A/17A/31A/B
N	Y	N	Y	Y	N	N	26099A Printer Interface for 2608
							HP 1000 M/E/F-Series Measurement & Control Interfaces
N	Y	N	Y	Y	N	N	12604B Data Source Interface (M-Series only)
M	M	M	M	M	N	N	91000A Plug-in A-to-D Interface Subsystem
							HP 1000 M/E/F-Series General-Purpose Interfaces
N	N	N	N	N	N	N	12551B Relay Output Register
N	N	N	N	N	N	N	12554A 16-Bit Duplex Register
N	N	N	N	N	N	N	12555B Dual 8-Bit D-A Converter (M-Series only)
N	Y	N	Y	Y	N	N	12556B 40-Bit Output Register
N	Y	N	Y	Y	N	N	12566B Microcircuit (duplex) Interface
N	N	N	N	N	N	N	12597A 8-Bit Duplex Register
N	N	N	N	N	N	N	12620 Breadboard Interface not used for RTE Privileged Interrupt
N	N	N	N	N	N	N	12930A Universal Interface
Y	Y	Y	Y	Y	N	N	59310B HP-IB Interface
Y	Y	Y	Y	Y	N	N	91200B TV Interface
							HP 1000 M/E/F-Series Disc Interfaces
N	N	N	N	Y	N	N	12821A ICD (79xxH) Disc Interface
Y	Y	Y	N	Y	N	M	13175B MAC (79xxM) Disc Interface
Y	Y	Y	N	Y	N	N	13178C Multi-Unit CPU Interface to 79xxM MAC Disc
							Display terminals (80 char/line, 24 lines/display) and accessories
N	N	N	N	N	Y	Y	2621A/P (or 2629A/B OEM) Interactive Terminal w/12005A +001 I/F (to 960 cps) or with 12005A +003 I/F, 13222M/N cable, modems, & phone ckt (to 120 cps)
N	N	N	N	N	Y	Y	2621A/P (or 2629A/B OEM) Interactive Terminal w/13222N cable using one chan of 12040A 8-chan Multiplexer via 12828A Multiplexer Panel, hardwired or via modems, 30062B cable, and phone ckt
N	Y	N	Y	Y	N	N	2621A/P (or 2629A/B OEM) Interactive Terminal w/12966A +005 I/F (to 960 cps) or with 12966A +002 I/F, modems, 13232M/N cable, & phone ckt (to 120 cps)
N	N	N	Y3	Y	N	N	2621A/P (or 2629A/B OEM) Interactive Terminal w/13222N cable using one chan of 12792A 8-chan Multiplexer via 12828A Multiplexer Panel, hardwired or via modems, 30062B cable, and phone ckt
N	Ax	N	Ax	Ax	N	N	2621A/P (or 2629A/B OEM) Interactive Terminal w/13222N cable using one chan of 12920B Async mpxer, hardwired or via modems, phone ckt, & 30062A cable (to 240 cps)
N	N	N	N	N	Y	Y	2624A (or 2629C OEM) Display Terminal w/12005A +001 I/F (to 960 cps) or w/12005A +003 I/F, 13222M/N cable, modems, and phone ckt (to 120 cps)
N	N	N	N	N	Y	Y	2624A (or 2629C OEM) Display Terminal w/13222N cable using one chan of 12040A 8-chan Multiplexer via 12828A Multiplexer Panel, hardwired or via modems, 30062B cable, and phone ckt
N	Y	N	Y	Y	N	N	2624A (or 2629C OEM) Display Terminal w/12966A +005 I/F (to 960 cps) or w/12966A +002 I/F, 13222M/N cable, modems, and phone ckt (to 120 cps)
N	N	N	Y3	Y	N	N	2624A (or 2629C OEM) Display Terminal w/13222N cable using one chan of 12792A 8-chan Multiplexer via 12828A Multiplexer Panel, hardwired or via modems, 30062B cable, and phone ckt
N	N	N	N	N	Y	Y	2626A (or 2629D OEM) Display Station w/12005A +001 I/F (to 960 cps) or w/12005A +003 I/F, 13222M/N cable, modems, and phone ckt (to 120 cps)
N	N	N	N	N	Y	Y	2626A (or 2629D OEM) Display Station w/13222N cable using one chan of 12040A 8-chan Multiplexer via 12828A Multiplexer Panel, hardwired or via modems, 30062B cable, and phone ckt
N	Y	N	Y	Y	N	N	2626A (or 2629D OEM) Display Station w/12966A +005 I/F (to 960 cps) or w/12966A +002 I/F, 13222M/N cable, modems, and phone ckt (to 120 cps)
N	N	N	Y3	Y	N	N	2626A (or 2629D OEM) Display Station w/13222N cable using one chan of 12792A 8-chan Multiplexer via 12828A Multiplexer Panel, hardwired or via modems, 30062B cable, and phone ckt
N	Mt	N	Mt	Mt	N	N	2626A (or 2629D OEM) Display Station w/12790A I/F and 13267A term I/F to first terminal, 13268A term I/F to add'l terminal (to 960 cps)
N	Mt	N	Mt	Mt	N	N	2626A (or 2629D OEM) Display Station w/12790A +001 interface, modems, phone ckt, and 13267A std/Opt 001 term I/F to first terminal, 13268A std/Opt 001 term I/F to add'l terminal (to 960 cps)
Y	Y	Y	Y	Y	N	N	2640A/B Display Terminal w/12966A +001 I/F (to 240 cps) or w/12966A +002 I/F, modems, 13232M/N cable, & phone ckt (to 120 cps)
N	Ax	N	Ax	Ax	N	N	2640A/B Display Terminal w/13232A cable using one chan of 12920B Async mpxer, hardwired or via modems, phone ckt, & 30062A cable (to 240 cps)

Operating systems hardware and software support matrix, continued

INACTIVE RTE-		MATURE RTE-		ACTIVE RTE-			SUPPORTED HARDWARE AND SOFTWARE PRODUCTS
III	IV	II	M	IVB	L	XL	
							Display terminals (80 char/line, 24 lines/display) and accessories, continued
Y	Y	Y	Y	Y	N	N	2644A +020 Mini Data Station* w/12966A +001 I/F (to 240 cps) or with 12966A +002 I/F, modems, 13232M/N cable, & phone ckt (to 120 cps)
N	N	N	N	N	Y	Y	2642A Enhanced Display Station w/12005A +001 I/F (to 960 cps) or with 12005A +003 I/F, 13232M/N cable, modems, and phone ckt (to 120 cps)
N	N	N	N	N	Y	Y	2642A Enhanced Display Station w/13232N cable using one chan of 12040A 8-chan Multiplexer via 12828A Multiplexer Panel, hardwired or via modems, 30062B cable, and phone ckt
N	Y	N	Y	Y	N	N	2642A Enhanced Display Station w/12966A +001 I/F (to 960 cps) or with 12966A +002 I/F, 13232M/N cable, modems, and phone ckt (to 120 cps)
N	N	N	Y3	Y	N	N	2642A Enhanced Display Station w/13232N cable using one chan of 12792A 8-chan Multiplexer via 12828A Multiplexer Panel, hardwired or via modems, 30062B cable, and phone ckt
N	N	N	N	N	Y	Y	2645A +032 Display Station or 2649B +032 OEM Block or Char Mode Terminal or 2648A +032 (or 2649C +032 OEM) Graphics Terminal w/12005A +002 I/F & 13232C cable (to 960 cps) or w/12005A +003 I/F, modems, 13232M/N cable, & phone ckt (to 120 cps)
N	N	N	N	N	Y	Y	2645A Display Station or 2649B OEM Block or Char Mode Terminal or 2648A (or 2649C OEM) Graphics Terminal w/13232A cable using one chan of 12040A 8-chan mpxer, hardwired or via 12828A Multiplexer Panel, modems, phone ckt, & 30062A cable (to 960 cps)
Y	Y	Y	Y	Y	N	N	2645A +032 Display Station or 2649B +032 OEM Block or Char Mode Terminal or 2648A +032 (or 2649C +032 OEM) Graphics Terminal w/12966A +001 I/F (to 960 cps) or w/12966A +002 I/F, modems, 13232M/N cable, & phone ckt
N	Mt	N	Mt	Mt	N	N	2645A +033 Display Station or 2649B +033 OEM Block or Char Mode Terminal or 2648A +033 (or 2649C +033 OEM) Graphics Terminal w/12790A I/F & 13232P cable to 1st terminal, 13232Q/T cable to add'l terminal (to 960 cps)
N	Mt	N	Mt	Mt	N	N	2645A +033/034 Display Station or 2649B +033/034 OEM Block or Char Mode Terminal or 2648A +033/034 (or 2649C +033/034 OEM) Graphics Terminalw/12790A +001 I/F, modems, phone ckt, & 13232P cable to 1st terminal, 13232Q/T cable to add'l terminal (to 960 cps)
N	Y	N	Y	Y	N	N	2645A Display Station or 2649B OEM Block or Char Mode Terminal or 2648A (or 2649C OEM) Graphics Terminal w/13232A cable using one chan of 12792A 8-chan mpxer, hardwired or via 12828A Multiplexer Panel, modems, phone ckt, & 30062A cable (to 240 cps)
N	Ax	N	Ax	Ax	N	N	2645A Display Station or 2649B OEM Block or Char Mode Terminal or 2648A (or 2649C OEM) Graphics Terminal w/13232A cable using one chan of 12920B Async mpxer, hardwired or via modems, phone ckt, & 30062A cable (to 240 cps)
Y	Y	Y	Y	Y	Y	Y	2645A/49B/48A/49C Opt 007: Adds 120 cps Mini cartridge I/O (not supported with 8-chan mpxer)
N	N	N	N	N	Y	Y	2647A +032 (or 2649G +032 OEM) Intelligent Graphics Terminal w/12005A +002 I/F & 13232C cable (to 960 cps)
Y	Y	Y	Y	Y	N	N	2647A +032 (or 2649G +032 OEM) Intelligent Graphics Terminal w/12966A +001 I/F (to 960 cps)
Y	Y	Y	Y	Y	Y	Y	13246A/B auxiliary (thermal) Printer Subsystem* for use with 264x Terminals with Mini cartridge I/O or 13261A Device Support Firmware
Y	Y	Y	Y	Y	Y	Y	13349A auxiliary (impact) Printer Subsystem* for use with 264x Terminals with Mini cartridge I/O or 13261A Device Support Firmware
Y	Y	Y	Y	Y	Y	Y	2631A/B +240 auxiliary (dot-matrix impact) Printer Subsystem (180 cps, 136 char/line) for use with 264x Terminals with Mini cartridge I/O or 13261A Device Support Firmware
Y	Y	Y	Y	Y	Y	Y	7310A +240 auxiliary (thermal) Graphics Printer (200-500 LPM) for 264x Terminals w/Mini cartridge I/O or 13261A Device Support Firmware
Y	Y	Y	Y	Y	Y	Y	9876A +240 auxiliary Thermal Graphics Printer (90-480 LPM) for 264x Terminals w/Mini cartridge I/O or 13261A Device Support Firmware
							Printing terminals
N	N	N	N	N	Y	Y	2635A/B Printing Terminal w/12005A +002 I/F (to 180 cps), 136 char/line) or w/12005A +003 I/F, modems, & phone ckt (to 120 cps)
N	Y	N	Y	Y	N	N	2635A/B +051 Printing Terminal w/12966A +001 I/F (to 180 cps, 136 char/line or w/12966A +002 I/F, modems, & phone ckt (to 120 cps)
N	Ax	N	Ax	Ax	N	N	2635A/B Printing Terminal using one chan of 12920B Async mpxer, hardwired or via modems, phone ckt, & 30062A cable (to 180 cps)
N	N	N	N	N	Y	Y	2675A Thermal Printing Terminal w/12005A +001 I/F (to 120 cps) or with 12005A +003 I/F, 13222M/N cable, modems, and phone ckt (to 120 cps). SIF-format Mini cartridge I/O is not supported.
N	N	N	N	N	Y	Y	2675A Thermal Printing Terminal w/13222N cable using one chan of 12040A 8-chan Multiplexer via 12828A Multiplexer Panel, hardwired or via modems, 30062B cable, & phone ckt. SIF-format Mini cartridge I/O is not supported.
N	Y	N	Y	Y	N	N	2675A Thermal Printing Terminal w/12966A +005 I/F (to 120 cps) or with 12966A +002 I/F, 13222M/N cable, modems, and phone ckt (to 120 cps). SIF-format Mini cartridge I/O is not supported.
N	N	N	Y3	Y	N	N	2675A Thermal Printing Terminal w/13222N cable using one chan of 12792A 8-chan Multiplexer via 12828A Multiplexer Panel, hardwired or via modems, 30062B cable, & phone ckt. SIF-format Mini cartridge I/O is not supported.
Y	Y	Y	Y	Y	N	N	2752A/2754A/B Teleprinter* with 12531C local only I/F
Y	Y	Y	Y	Y	N	N	2762A/B Terminal Printer* with 12531D +001/002 local/modem I/F

INACTIVE RTE-		MATURE RTE-		ACTIVE RTE-			SUPPORTED HARDWARE AND SOFTWARE PRODUCTS
III	IV	II	M	IVB	L	XL	
							Data capture terminals
N	N	N	N	Dp	N	N	3075A/3076A Desktop/wall mounting Data Capture Terminals w/12790A +001 Interface, with or without 3074A Data Link Adapter for factory data link connection
N	N	N	N	Dp	N	N	3077A Time Reporting Terminal w/12790A +001 Interface, with or without 3074A Data Link Adapter for factory data link connection
N	Y	N	N	Y	N	N	92900B Data Capture Terminal Subsystem* and 3070B Data Capture Terminals* (when system is equipped with 92903A (RTE-IV) or 92080A (RTE-IVB) DATACAP/1000 software)
							Disc memories
D	D	D	N	D	N	N	12960A (4.9M byte) Cartridge Disc Subsystem* (up to 19.6M bytes with three add-on 12960A +010 Disc Drives)
D	D	D	N	D	N	N	12962A/B/C/D (14.7M byte) Cartridge Disc Subsystem* (up to 117.9M bytes with seven add-on 13180A/B Disc Drives; up to 365.2M bytes with seven add-on 7920S Disc Drives)
N	N	N	N	D	N	N	7906H/HR (19.6M byte) ICD drive with 12821A (M/E/F-Series) or 12009A (L-Series) Interface, max of 2 ICD drives per interface
D	D	D	N	D	N	N	7906M/MR (19.6M byte) MAC Master cartridge disc drive with 13175 Interface; up to seven 7906S/SR, 7920S, or 7925S** MAC slave discs can be added
N	N	N	N	N	D	D	7910HR (12M byte) Fixed ICD drive with 12009A L-Series Interface, max of two ICD drives per interface
N	N	N	N	D	N	N	7920H (50M byte) ICD drive with 12821A M/E/F-Series Interface, max of two ICD drives per interface
D	D	D	D	D	N	N	7920M (50M byte) MAC Master Disc drive with 13175 Interface; up to seven 7906S/SR, 7920S or 7925S** MAC slave discs can be added
N	N	N	N	D	N	N	7925H (120M byte) ICD Drive with 12821A M/E/F-Series Interface, max of two ICD drives per interface
N	N	N	N	D	N	N	7925M (120M byte) MAC Master Disc Drive with 13175 Interface; up to seven 7906S/SR, 7920S, or 7925S MAC slave discs can be added
Y	Y	Y	Y	Y	N	N	12732A (500k byte) Flexible disc Subsystem (up to 2M bytes with three add-on 12733A Drives)
							**Only RTE-IVB file manager makes full use of 7925S disc capacity.*
							Punched tape and tab card subsystems
Y	Y	Y	Y	Y	N	N	12925A Punched Tape Reader Subsystem (500 bytes/sec)
Y	Y	Y	Y	Y	N	N	12926A Tape Punch Subsystem (75 bytes/sec)
Y	Y	Y	Y	Y	N	N	12985A Card Reader Subsystem (600 punched cards/min)
Y	Y	Y	Y	Y	N	N	12986A Optical Mark Reader Subsystem*
							Printers
N	Y	N	Y	Y	N	N	2608A Printer with opt 210 or 26099A Interface (400 LPM x 132 col)
Y	Y	Y	Y	Y	N	N	2613A Printer with opt 100 or 12845B Interface (300 LPM x 136 col)
Y	Y	Y	Y	Y	N	N	2617A Printer with opt 100 or 12845B Interface (600 LPM x 136 col)
Y	Y	Y	Y	Y	N	N	2618A Printer* with opt 100 or 12845B Interface
N	N	N	N	Y	N	N	2619A Printer with opt 100 or 12845B Interface (1000 LPM x 132 col)
Y	Y	Y	Y	Y	N	N	2631A/B +210 Printer (180 cps x 136 col)
N	N	N	N	N	Y	Y	2631A/B +046/214 Printer with 12009A (L-Series) I/F † (180 cps x 136 col)
N	N	N	Y	Y	N	N	7310A Graphics Printer w/59310B I/F † (200-500 LPM, 80 col)
N	N	N	Y	Y	N	N	9876A Thermal Graphics Printer w/59310B I/F † (90-480 LPM, 80 col)
Y	Y	Y	Y	Y	N	N	12975A Line Printer Subsystem*
Y	Y	Y	Y	Y	N	N	12983A Line Printer Subsystem*
Y	Y	Y	Y	Y	N	N	12987A Line Printer Subsystem*
Y	Y	Y	Y	Y	N	N	12966A Page Printer Subsystem*
Y	Y	Y	Y	Y	N	N	13053A Line Printer Subsystem*
							†Customer programming is required to provide line printer functions with this printer.
							Graphics Devices
N	G	N	G	G	N	N	1350S/1351S Graphics Display System w/14-inch display & 59310B I/F
N	G	N	G	G	N	N	2647A, 2648A, 2649C, or 2649G Graphics Terminal w/12966A or 12790A I/F or using 12920B Async mpxer channel
Y	Y	Y	Y	Y	N	N	91200B TV Interface
N	G	N	N	G	N	N	2608A Line Printer with option 210 or 26099A I/F (when system is equipped w/92840A GRAPHICS/1000 Graphics Plotting Software)
N	G	N	G	G	N	N	7221A/B/S Graphics Plotter w/12966A +004 I/F & 2635 +051 or 264x Terminal
N	G	N	G	G	N	N	7225A Graphics Plotter w/17601 Personality Module & 59310B I/F
N	G	N	G	G	N	N	7245A/B Plotter/Printer with 59310B I/F
N	G	N	G	G	Y	Y	9872A/B/S Graphics Plotter w/12009A (L-Series) or 59310B (M/E/F-Series) I/F
N	G	N	G	G	Y	Y	9874A Digitizer w/12009A (L-Series) or 59310B (M/E/F-Series I/F
Y	Y	Y	N	Y	N	N	12935A Graphic Plotter Subsystem*

INACTIVE RTE-		MATURE RTE-		ACTIVE RTE-			SUPPORTED HARDWARE AND SOFTWARE PRODUCTS
III	IV	II	M	IVB	L	XL	
							Magnetic tape subsystems
Y	Y	Y	Y	Y	N	N	7970B +226/236 800 bpi, 9-track NRZI Magnetic Tape Subsystem
Y	Y	Y	Y	Y	N	N	7970E +226/236 1600 bpi, 9-track Phase-Encoded Mag Tape Subsystem
Y	Y	Y	Y	Y	N	N	12970A 800 bpi, 9-track NRZI Magnetic Tape Subsystem*
Y	Y	Y	Y	Y	N	N	12971A 200/556/800 bpi, 7-track Magnetic Tape Subsystem*
Y	Y	Y	Y	Y	N	N	12972A 1600 bpi, 9-track Phase-Encoded Magnetic Tape Subsystem*
							Measurement and control products
Y	Y	Y	Y	Y	Y	Y	2240A Measurement & Control Processor w/12009A (L-Series) or 59310B (M/E/F-Series) I/F (supports function cards for up to 128 analog and/or digital I/O points, exp to 256 w/2241A Extender; hardware rates to 20,000 points/sec)
M	M	M	M	M	N	N	2313B Analog I/O Subsystem (supports function cards for up to 144 analog inputs; up to 528 w/two extenders; hardware rates to 45,000 channels/sec)
M	M	M	M	M	N	N	91000A Plug-in A-to-D Interface Subsystem (16 single-ended/8 diff. inputs, hardware rates to 20,000 channels/sec)
Y	Y	Y	Y	Y	N	N	91226A/B Remote Measurement and Control Station Interface*
M	M	M	M	M	N	N	9611R Remote Industrial Measurement and Control Station*
							System-to-system communications software
N	N	N	Y3	Y	Y	N	91750A DS/1000-IV Network software (works with 12007A/12044A/12794A/12825A I/F in each system for HP 1000-HP 1000 comm, 12793A/12834A/12889A I/F in HP 1000 for comm with HP 3000
Y	Y	N	Y	Y	N	N	91740A/B DS/1000 Network software-firmware (works with 12771A/12773A Interfaces in each system)*
Y	Y	N	Y	Y	N	N	91741A DS/1000 Software enhancement for HP 1000-to-HP 3000 Comm (works with 12889A Interface in HP 1000 System and 30360A Interface and 32190A DS/3000 software in HP 3000 System)*
Y	Y	Y	N	Y	N	N	91780A RJE/1000 communications package (including HP 1000 interfaces) for Remote Job Entry to IBM 360/370 System
N	N	Y	N	N	N	N	91700A Network Central Comm Package (supports program-to-program comm with 91700A Package in another system or full distributed systems communication with 91703A/04A/05A Satellite Comm packages in memory based satellite systems operating under BCS/RTE-B/RTE-C, 91700A includes one hardwired interface (modem interface optional)*
							Operator-to-system communications software
N	Y	N	Y	Y	N	N	91730A Multipoint Terminal Subsystem Software (works w/12790A I/F)
N	Y	N	Y	Y	N	N	91731A Async Multiplexer Subsystem Software (works with 12920B Async Multiplexer)
							Program language support
N	N	N	N	Y	E	N	92832A Pascal/1000
N	N	N	N	N	E	Y	92854A Pascal/1000
N	N	N	N	Y	Y	Y	92834A FORTRAN 4X
Y	Y	Y	N	Y	N	N	92101A BASIC/1000D
N	N	N	Y	N	N	N	92065A BASIC/1000M
N	N	N	N	N	Y	Y	92076A BASIC/1000L
Y	Y	Y	F	Y	Y	Y	RTE FORTRAN IV
Y	Y	Y	F	Y	Y	Y	RTE Assembler
							Data base management and data capture software
N	N	N	N	Y	N	Y	92069A IMAGE/1000 Data Base Management System with QUERY
N	N	N	N	Y	Y	Y	92073A IMAGE/1000 without QUERY
Y	Y	Y	N	Y	N	N	92063A IMAGE/1000 Data Base Management System*
N	N	N	N	Y	N	N	92080A DATACAP/1000-II Data Capture Software
N	Y	N	N	N	N	N	92903A DATACAP/1000 Data Capture Software*
							Other software
N	Y	N	N	Y	N	N	92083A RTE Profile Monitor
N	Y	N	Y	Y	N	N	92840A GRAPHICS/1000 Graphics Plotting Software
N	N	N	N	Y	N	N	92835A Signal/1000 Digital Signal Processing Package (requires 12824A Vector Instruction Set)
Y	Y	Y	Y	Y	N	N	92400A Sensor-Based DAS Utility Library
N	N	N	Y	Y	N	N	91711A On-line Diagnostic and Verification Package
Y	Y	Y	N	Y	N	N	92061A RTE Microprogramming Package

RTE-L and RTE-XL real-time executive operating systems

product numbers 92070A and 92071A

RTE-L and RTE-XL (product numbers 92070A and 92071A) are real-time operating systems for management of the operations and resources of HP1000 Model 9 and 10 Computer Systems and user-assembled systems based on HP 1000 L-Series (2103L/LK) Microcomputers. These systems provide true multiprogramming capability and may be configured as memory-based or disc based systems. RTE-L and RTE-XL differ with respect to memory capacity. RTE-L manages 64k bytes of main memory based on the standard 64k byte L-Series memory card while RTE-XL can manage up to 512k bytes of main memory based on the 12002A L-Series 128k byte XL Memory Controller Card or 12002B L-Series 512k byte High Density XL Memory Controller Card. With the 12002A controller card, memory managed under RTE-XL can be expanded from 128k bytes to 512k bytes in 128k byte increments by adding 12003A L-Series XL Memory Array Cards.
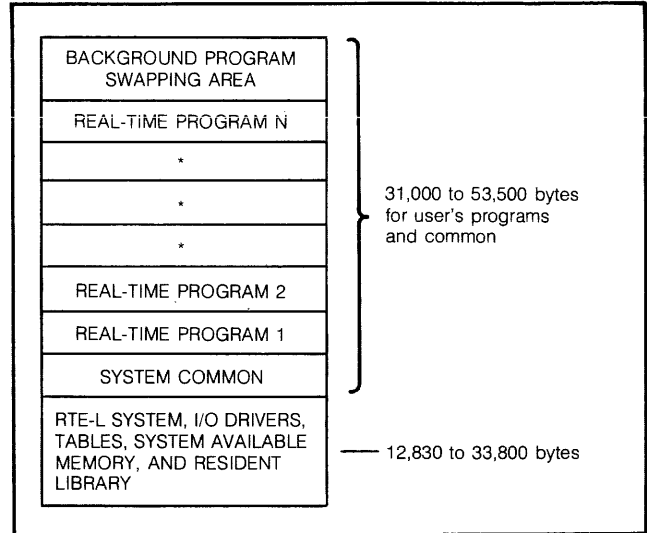
64k byte RTE-L System

Features

- Modular design that supports a range of configurations from small, operator-less, execute-only stations to full disc-based systems with program preparation capability
- True multiprogramming with concurrent program execution
- Time, event, program-to-program, and operator scheduling of program execution
- Time slicing within each priority level (RTE-XL only)
- Complete file management capabilities for creation, maintenance, and manipulation of files on peripheral discs
- Support of up to 255 user partitions (RTE-XL only)
- Management of up to 512k bytes of memory with DMA access to any section of memory (RTE-XL only)
- Up to 64k byte user partition space (RTE-XL only)
- Multi-lingual programming in HP 1000 Assembler and (optionally) Pascal/1000*, FORTRAN 4X, and BASIC/1000L
- High degree of program request and operator command compatibility with the HP 1000 RTE family of operating systems.
- Program development tools that include an interactive source editor (EDITR), program debugger (DBUGR), relocating loader (LOADR) and system generator (RTLGN). (EDITR, LOADR and RTLGN can be executed on RTE-IVB systems as well as RTE-L and RTE-XL systems.)
- Transportability that can be designed into user programs for the HP 1000 family of RTE operating systems
- Simplified on-line system generation and update procedure for fast, easy system generation and changeover
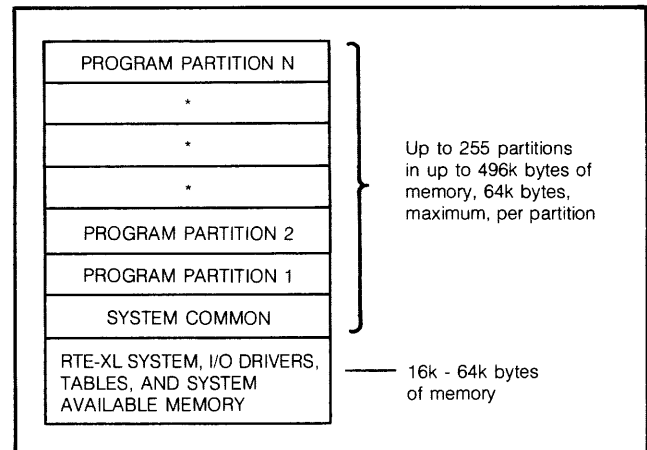
RTE-XL System with 128k bytes to 512k bytes of memory

- Drivers that take advantage of the advanced L-Series I/O architecture, minimizing I/O processing overhead
- Modular device and interface drivers that work together to provide efficient I/O with minimal use of memory
- Support for HP-IB instruments or peripheral subsystems is included
- Optional DS/1000-IV Distributed Systems Networking (RTE-L only)
- Optional IMAGE/1000 Data Base Management

* *Pascal/1000 programs can be executed, but not compiled, in RTE-L. Both compilation and execution of Pascal/1000 programs are supported in RTE-XL.*

RTE-L: Modularity for efficient use of 64k bytes of memory

The RTE-L operating system is highly modular for use in small, operator-less, memory-based configurations or in more versatile disc-based configurations which support file management and program development concurrent with real-time operations, or for configurations between these extremes.

In small memory-based configurations, RTE-L can operate in less than 12k bytes of memory, leaving over 52k bytes for users' dedicated applications. From this base, capabilities can be added modularly. Potential additions include time and program-to-program scheduling, mailbox I/O, interactive operator communication with the system, program segmentation, program swapping, etc., but the user includes only needed system capabilities, maximizing space available for user applications.

RTE-XL: A multi-user system for microcomputer hardware

For those HP 1000 L-Series applications that require more than the 64k bytes supported by the RTE-L operating system, Hewlett-Packard offers the new RTE-XL real-time executive system. The RTE-XL system can manage up to 512k bytes of main memory. The first 16 to 64k bytes are used by the RTE-XL operating system and system available memory. All remaining memory, up to 496k bytes in a 512k byte system, is available for user's applications. The user program area can be subdivided into as many as 255 partitions. Maximum partition size is 64k bytes, all of which is available for the user's application program, appended subroutines, and data buffering. Minimum partition size is 2k bytes.

Human engineered for easy use

At Hewlett-Packard, an important part of any design effort is directed toward maximizing the usability of our products. This is particularly true of the RTE-L and RTE-XL operating systems. The top-down structural design of these systems and their documentation set make them not only easy to use, but easy to understand.

Simplified system generation and loading

RTE-L/XL systems are generated by the RTLGN utility program. RTLGN can be executed on RTE-L/XL systems with a flexible or hard disc while other programs are running. RTLGN can also be executed on RTE-IVB host systems to generate RTE-L/XL systems for dedicated applications. Systems are generated in a semi-automatic mode from a file which the user prepares in advance to provide commands to RTLGN. Default options and command file examples in the RTE-L/XL Generation Planning simplify command file preparation. I/O configuration, often the most complex part of system generation, is made easier by built-in equipment identifiers in the software drivers.

With the command file, system generation is typically accomplished in less than 15 minutes. The generator provides a list file of all messages and descriptions during the generation process, a 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. With RTE-XL it is usually not necessary to relocate user and system programs after a new generation of the system. Instead, a quick linking process requires just a few seconds per program.

Disc access by name

RTE-L/XL has a unified file structure for all disc space allocations in the system. This includes files for the swapped-out images of background programs; scratch files for temporary working storage by the interactive editor, assembler, and compiler; files occupied by the memory image of an RTE-L/XL operating system; and user files for source, relocatable, or executable programs and data. Regardless of how it is used, every disc space can be identified and accessed by a file name because its location is registered in a file directory. This is especially helpful in system recovery. For example, suppose a user has been interactively editing a source file and before the new edits are saved, the system halts with a memory parity error. Instead of losing edited information which may have taken hours to enter, the editor's work file containing most of the new edits can be retrieved by name and used as the input source for continued editing.

Single-command changeover to another system

In RTE-L/XL, a disc initialized by the file manager (FMGR) contains a BOOTEX program which, when loaded into memory by the disc loader ROM, locates the operating system file on disc by searching through the file directory for its name. BOOTEX then loads the new system into memory and starts it executing to complete the boot-up process. With the aid of the Virtual Control Panel (VCP) built into the L-Series central processor and BOOTEX, a user may boot-up an RTE-L/XL operating system by name from anywhere on a disc instead of some fixed and reserved physical disc location. This is accomplished via a terminal that temporarily serves as the system VCP communication port.

Single-command switchover facilitates switching to an updated RTE-L/XL system with the latest revision of software modules generated into it. This same capability also makes it easy to generate and use multiple RTE-L/XL operating systems, each optimized for a specific application. As the time or need arises to use one of these operating systems for a specific application, it can be easily booted up in less than a minute without requiring extensive preparatory work, such as backing up a disc, prior to the switchover.

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

User-designable terminal control

Up to three levels of prompting response can be specified for an unexpected keystroke to prompt the interrupting operator with a message. The highest two prompt response levels are optionally assignable during system generation and can be changed on-line after system generation. The lowest level, when neither of the first two levels is available, is the response of the RTE-L/XL system itself.

Provision of optional response levels helps an OEM to develop a controlled sequence of operator input. An unexpected terminal keystroke can cause either of two (primary and secondary) user programs to be scheduled and executed to screen, control, and guide an operator's use of the system. This is very useful for designing applications to be used by operators with little or no computer experience.

Easily accessed modular documentation

System documention matches the exceptionally modular organization of RTE-L/XL so the user can access needed information easily. Over 20 different manuals are provided, from tutorial step-by-step guides to programming reference guides, and individual reference manuals on system generation, program development software, the software drivers included with the system, and the supporting libraries. The software manuals are divided into three main sets according to usage: operator's guide set, program development set, and system designer set.

Family compatibility

RTE-L and RTE-XL are members of HP's compatible family of RTE operating systems. RTE-L/XL program requests and operator commands are functionally compatible with the RTE-IVB system. Differences in certain programming calls to the RTE-L/XL executive vs RTE-IVB are documented in the RTE-L/XL General Information Manual.

Real time multiprogramming

RTE-L/XL supervises the execution of multiple programs which can be used to perform several different functions concurrently. For example, under RTE-L/XL, 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 can run concurrently and independently.

Program Scheduling

RTE-L/XL schedules programs by placing them in the order of program priorities in a list known as the scheduled list. RTE-L/XL provides these methods of scheduling programs:

- External events recognized by the system as interrupts may cause certain programs to be scheduled.
- A program can be scheduled by another program through an EXEC call when program-to-program scheduling is configured into the system.

- Programs can be scheduled to execute once or repeatedly at a pre-specified time of day or at a specified time interval. Time count is derived from the internal CPU time base which updates a system clock maintained as part of the operating system functions when the time scheduling function is configured into the system.
- A program may be scheduled to execute by an operator command at a terminal when the required modules for interactive access are configured into the system.

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 a program or an operator to schedule a program and then go on to other operations without waiting.

Priority Management

RTE-L/XL has 32767 levels of priority, for close control over the priority execution of tasks. When a higher priority program is added to the scheduled list, a currently-executing lower priority program will be suspended, and the higher priority program will begin execution.

Time Slicing (RTE-XL only)

In RTE-XL, multiple "background" programs of the same priority run on a time sliced basis. 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 by the system manager. By appropriate assignment of program priorities, the system manager can 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. Programs with priority above the time slice boundary will run to completion without time slicing even if more than one is assigned the same priority.
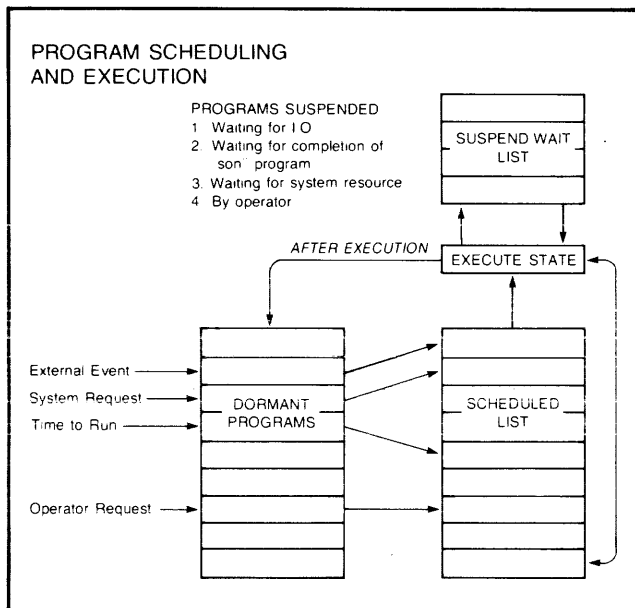
Memory utilization

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. For example, the interactive editor, the FORTRAN 4X compiler, and other program development tools may be placed in this area. A segmented program can also be relocated for the background area.

PROGRAM SCHEDULING AND EXECUTION

PROGRAMS SUSPENDED
1. Waiting for I O
2. Waiting for completion of son program
3. Waiting for system resource
4. By operator

SUSPEND WAIT LIST

AFTER EXECUTION

EXECUTE STATE

External Event
System Request
Time to Run

DORMANT PROGRAMS

SCHEDULED LIST

Operator Request

RTE-XL User program areas

RTE-XL places all of its user program space (up to 496k bytes) above the lowest 16 to 64k bytes of memory, subdivided into as many as 255 partitions. 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 in RTE-L, but many more partitions and larger user areas (up to 64k bytes) are available.

Program segmentation

A program too long 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. The main segment also controls the program execution flow from segment to segment by invoking the appropriate segment load and execute service provided by RTE-L/XL.

Interrupts

RTE-L/XL uses the multi-priority level, vectored hardware interrupt system of the HP 1000 L-Series computer for detection of power failure, memory protect violation, parity error, illegal instructions, and time base ticks, as well as all device I/O interrupts. Interrupts are handled by priority according to the rules of the I/O backplane of the computer.

Direct Memory Access (DMA) capability per I/O interface card minimizes the number of interrupts to be processed. Even for the slowest input device connected to an interface, DMA can be used to load data into memory, minimizing CPU overhead. Only after a full block of data has been transferred will an interrupt be generated.

System Integrity

The integrity of the RTE-L/XL system is protected by the following features:

- Optional auto restart after power failure
- The operating system is protected from accidental modification by user programs and user programs are protected from accidental modification by each other.
- Illegal instructions are trapped as interrupts to the operating system
- 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 security code protection of disc files from unauthorized access
- In RTE-XL only, a memory parity error in a user partition causes the partition to be "downed". The affected program may be loaded into another partition. Programs in the remaining partitions continue to execute normally.

Input/Output

Input/output efficiency

The RTE-L/XL system fully exploits the built-in input/output efficiency of HP 1000 L-Series hardware. Direct memory access per I/O channel involves the system only at the beginning and end of an input/output operation, maximizing the CPU time available for other processing.

Driver Support

The following RTE-L/XL drivers are included for the support of interfaces and peripherals:

Interface Driver	Supported L-Series Cards	Device Driver	Supported Devices or Capabilities
ID.00	12005A Asynchronous Serial Interface	DD.00	26xx Terminals*
		DD.20	Cartridge tape units in 26xx Terminals
ID.37	12009A HP-IB Interface	DD.12	2631A +046 Printer or 2631B +214 Printer
		DD.23	7970E Magnetic Tape Unit
		DD.30	Double density, two-sided flexible disc or 7910H/7906H/7920H/ 7925H hard disc
ID.50	12006A General-Purpose Interface		Interfacing of various parallel I/O devices
	12060A 55kHz Analog-to-Digital Converter		Measurement of analog input signals
	12063A Isolated Digital I/O		Interfacing of digital inputs and outputs
ID.36	12008A PROM Storage Module	DD.36	Disc emulation for read-in of programs from PROM storage
ID.43	12013A Battery Backup Module		Power fail/auto restart support

The 26xx terminals are supported in point-to-point mode only.

Driver Structure

RTE-L/XL uses both interface drivers and device drivers. The interface drivers, whose naming convention is ID.xx, are programmed according to the specifications of the interface card as far as flag signals and command/status controls are concerned to perform actual I/O instructions. The device drivers, whose naming convention is DD.xx, are programmed according to the characteristics of the devices they address, such as device address data sequence which may precede every data transfer to a device (e.g. CTU unit number), or formatting of data (e.g. line spacing control in column 1 for line printers). Many simple devices, such as HP-IB instruments, do not require device drivers.

RTE-L/XL drivers are designed to optimize I/O processing for multiple device interfaces, which can support several types of intelligent peripheral devices or instruments connected to a single interface card plugged into a computer. The following features are provided:

- High flexibility, ease and low development cost in adding another device to a system because only a device driver needs to be designed.
- Efficient use of memory because one interface driver can serve multiple interface cards of the same kind.
- Interleaving of requests to devices on a multi-device interface may increase the system's aggregate throughput.

For example, under RTE-L/XL adding a printer to a configured HP-IB requires only the addition of a new printer device driver; the multi-device HP-IB interface driver remains unchanged.

Other I/O Features

- Timeout on I/O requests to prevent an inoperative I/O device from halting the entire system.
- I/O suspend of a program, with automatic rescheduling at I/O completion, in order to allow other non-I/O bound programs to execute.
- Buffering of output to slow devices so a program can continue execution without waiting for I/O completion.
- Input buffering through the use of mailbox I/O.
- Mailbox I/O between multiple programs in a system to free the programs from reliance upon the integrity of a common data area shared and maintained by all interacting programs. Mailbox I/O helps to reduce the complexity and development costs of user programs.
- Write/read request on an interactive device to allow two successive I/O operations initiated by only one system call, eliminating 50% of the system call processing overhead. This is especially useful in an operator-prompting scheme where the prompting message is first written out before waiting for a reply.
- Fail-soft feature for either standard or user defined I/O error recovery.

On-line Program Development

When RTE-L/XL is configured with a disc, programs can be developed concurrently with real-time processes.

Language Support

- HP 1000 Assembler and cross reference generator
- Optional HP 92834A FORTRAN 4X
- Optional HP 92854A Pascal/1000 (RTE-XL only). Both RTE-L and RTE-XL can execute Pascal/1000 programs compiled on an RTE-IVB or RTE-XL system, if the HEAPII option is not used
- Optional HP 92076A BASIC/1000L

Development Tools

- Interactive file manager program, FMGR, and file management package FMP.
- Interactive editor of source files.
- On-line relocating loader.
- On-line debug utility to aid user program development.

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 create, open, write to and read from files, close files to inhibit further access, delete files, etc. All disc files are referenced by name. Except for fixed-length record random access files, disc files can be automatically extended to additional storage space when an attempt is made to write beyond the current end of file. The maximum number of times a file can be extended is 255. The maximum number of records is 32,767.

The Interactive Editor has the capabilities of searching for and correcting character strings in a file, in addition to the line-by-line editing features of inserting, deleting, copying, and replacing lines or characters.

On-line relocating loader. When a program has been compiled or assembled and is ready to be installed into the system for execution, RTE-L/XL's loader can relocate it on-line into the appropriate program area according to the program type or to the operator's command. The output is a memory image of the program fitted according to the snapshot of the particular operating system. This loader can be executed on an RTE-IVB system as well as on RTE-L/XL, supporting L-Series user program development on the service-oriented high end system.

The loader can be operated interactively, or by commands included in a file, by which a large number of programs can be relocated in one "full sweep" operation. This is especially helpful to a user who has updated RTE-L/XL under Customer Support Service or Software Subscription Service and must also reload user programs into the latest version of the operating system. In RTE-XL, programs are usually just re-linked when the operating system is updated.

Interactive Program Debugger. DBUGR, a program-callable or loader-appendable utility subroutine, provides users with the interactive capability of examining and modifying memory and registers when the program is in execution, setting of a breakpoint within the program, and tracing program execution. To facilitate visual interpretation by a user, DBUGR translates machine codes in binary numbers back to assembly language mnemonics and octal numbers.

PROM Formatting Utility

A PFORM utility program is provided for programming PROMs to be installed on the 12008A PROM Storage Module. PFORM formats software object code and/or data files into disc images of PROMs and records these images on flexible disc or hard disc. These images must then be output via a user-provided routine to a PROM burner for burning program patterns into PROMs.

The PFORM utility can also be executed on an RTE-IVB system as well as RTE-L/XL, allowing OEMs to program PROMs for use in HP 1000 L-Series Computer Systems on the same system they use for program development.

HP-IB Library

In addition to relocatable libraries of commonly-used mathematical and utility subroutines, RTE-L/XL includes HP-IB Library routines that provide a consistent access method for all HP-IB instruments. With these routines a user can read, write, clear, and exercise other HP-IB control functions via high-level program calls without concern for the details of HP-IB bus protocol with an instrument.

System Utilities

RTE-L/XL also includes a set of utility programs for the following purposes:

- Disc backup from one flexible disc to another or from one hard disc to another.
- Installing the boot-up file, BOOTEX, onto the beginning of a disc.
- Converting an absolute binary program file into a memory image file.

- Converting a memory image file into an absolute binary file.
- Concatenating relocatable subroutines into one relocatable file for use as a library file during system generation or on-line program relocation.
- Formatting, initialization, and sparing of disc packs.
- Concatenating memory image program files with the system image to produce a memory-based operating system (RTE-XL only).

Optional software

- HP 92854A Pascal/1000 (RTE-XL only, effective with software revision 2126)
- HP 92076A BASIC/1000L
- HP 92834A FORTRAN 4X
- HP 92069A IMAGE/1000 Data Base Management System with QUERY (RTE-XL only, effective with software revision 2101)
- HP 92073A IMAGE/1000 Data Base Management System without QUERY
- HP 91750A DS/1000-IV Distributed Systems Network Software-Firmware (RTE-L only)

RTE-L/XL FUNCTIONAL RELATIONSHIPS

REAL-TIME EXECUTIVE
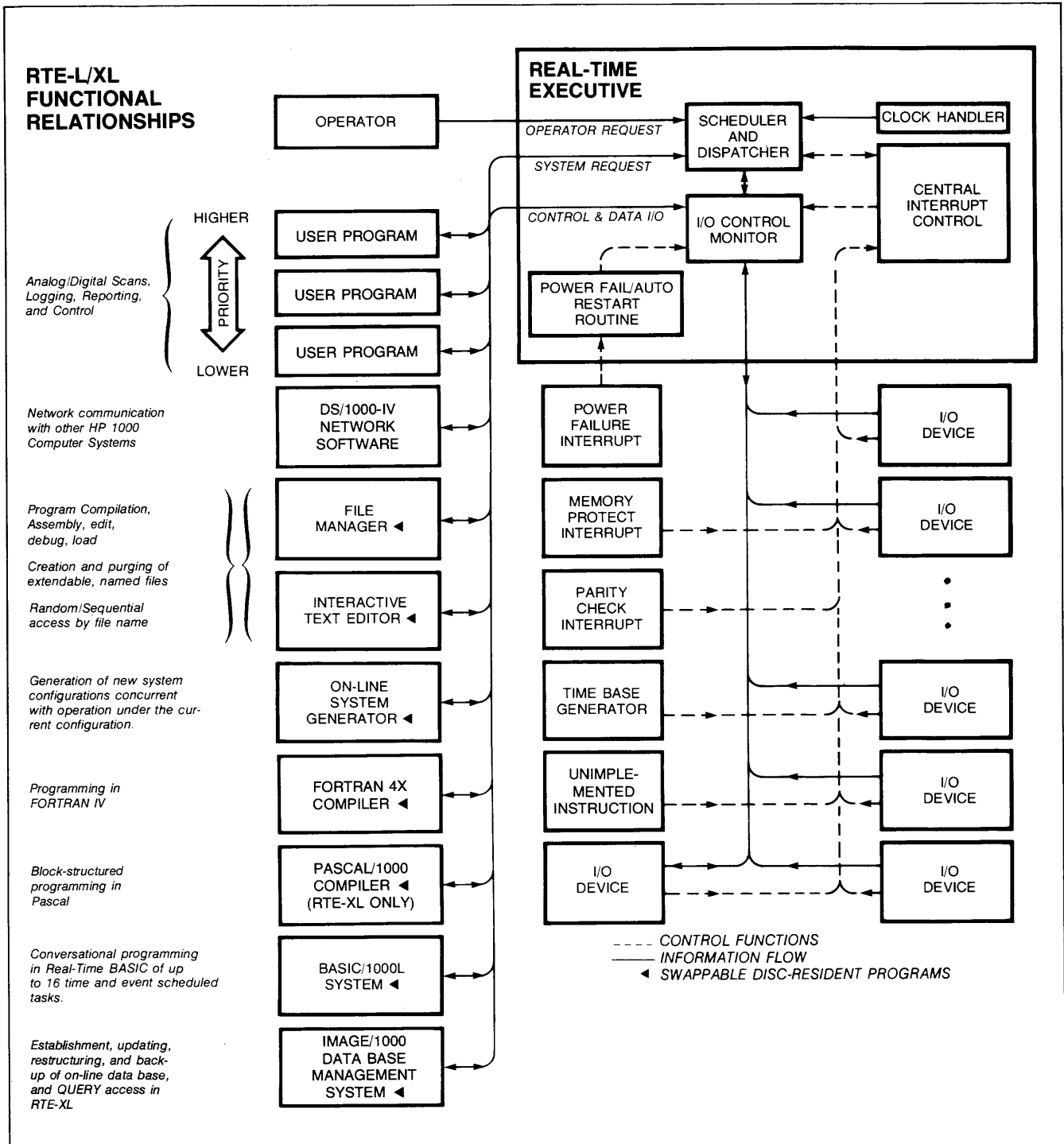
Functional Specifications

Operating system basic specifications

Type: Disc or memory based real-time multiprogramming.

Basis of program scheduling for execution: By operator, time, event, or another program in the order of program priority. The caller (either the operator or another program) has the option of waiting or not waiting for the completion of execution of the requested program.

Program priority levels: 1 through 32767, the lowest number designating the highest priority.

RTE-L user program areas: A real-time program area for multiple user programs and/or a background area for one swappable background program.

Maximum program space available to the RTE-L user: The difference between 64k bytes and the size of the operating system, including optional modules, I/O device and interface drivers, and table space. To predetermine approximate space that will be available for your application, use Table 1 for information on memory space used by the various modules available in RTE-L.

RTE-XL user program areas: Up to 255 program partitions, whose use for real-time and/or background programs may be distinguished by a background priority boundary specified during system generation.

Maximum program space available to the RTE-XL user: 496k bytes in a 512k byte system, divided into partitions with a maximum of 64k bytes each. Minimum parition size is 2k bytes.

Number of logical units supported: 63.

System requirements

Memory supported: 64k bytes in RTE-L, 128k bytes to 512k bytes in RTE-XL.

RTE-L Configuration requirements: See Table 1.

RTE-XL Configuration requirements: The RTE-XL operating system requires a 2103L Computer or 2103LK Board Computer with at least 128k bytes of extended memory. Additional hardware requirements for interfacing terminals, power fail/auto restart, disc storage, HP-IB interface, etc., are the same as those listed as items 6, 7, 8, 10, 11, 12, 19, 20, 21, 22, and 23 in Table 1.

On-line operator requests

1. Turn program on and wait for completion
2. Turn program on without wait for completion
3. Terminate the execution of a program
4. Suspend user program, either executing or scheduled
5. Activate user program from operator suspension
6. List programs currently executing in the system
7. List status of all programs
8. List I/O configuration in terms of table description and drivers
9. Change priority of programs
10. Examine I/O device or I/O controller status
11. Alter I/O device timeout parameters
12. Alter device logical unit assignments
13. Control I/O device availability to programs
14. Set the real time clock
15. Display time (time-of-day, day, month, year, and day of the week)
16. Request program execution at a specified time or at a specified time interval
17. Alter device buffering assignments
18. Display partition table (RTE-XL only)
19. Enable debugging of user programs via an HP 1610 Logic State Analyzer (RTE-XL only)

Program development requests

1. Compile FORTRAN IV* programs or Pascal/1000 programs (optional in RTE-XL only) or assemble ASMB programs
2. Enter, test, debug, edit and run real-time BASIC programs (with optional BASIC/1000L subsystem)
3. Trace program execution, examine and modify memory and/or register contents with the DBUGR utility
4. Edit program and data files
5. Load relocatable programs and subroutines into a generated system

FORTRAN IV programming in RTE-XL requires the optional 92834A FORTRAN 4X compiler.

File Manager and File Management Package

1. Create files
2. Dump contents of a file to another file, or to a peripheral device
3. Copy files from one disc logical unit to another
4. List contents of a disc file directory
5. List contents of a cartridge directory of the disc logical units that have been mounted on the system
6. Purge disc files
7. Pack a disc logical unit
8. Rename disc files
9. Open files for access with mode options
10. Write on a random or a sequential file
11. Read from a random or a sequential file
12. Position a file according to an absolute or a relative record number
13. Close a file from further access
14. Mount and dismount cartridges (RTE-XL only)

Table 1. Configuration capabilities and requirements summary

Configuration capability	Req'd. Module	Approximate Memory Req'd. (bytes)		Hardware and/or additional software requirements
		Main Memory	Disc-Res.*	

1. Minimum system (includes):
  a. Base page
  b. System executive
  c. Input/output control
  d. Table space for each active program
	EXEC
	RTIOL
		2,048
		1,800
		3,620
				1. 2103L/LK Computer or HP 1000 Model 10 Computer System with any of the following supported boot-up sources:
				  a. 12008A PROM Storage Module † (requires user-supplied PROM burner and user-written driver)
				  b. Any supported disc (see items 11 and 13, below) †
				  c. Any supported terminal (see items 6 through 8, below)
				  d. DS/1000-IV network link (see item 22, below)

2. Time scheduling	TIME	640		

3. System available memory management
  a. Allocation module
  b. System available memory
  c. String passing to programs (requires items a and b, above)
  d. Class I/O (requires items a and b)
	SAM
	
	STRNG
	
	CLASS
		260
		1k-4k Δ
		270
		
		1,140		

4. Program-to-program scheduling	SCHED	270		
5. LU and Resource Locking	LOCK	170		

6. Interface to terminal
  a. Async serial interface driver
  b. Table space for each interface
	ID.00	690
		50
				6. 12005A Asynchronous serial interface per terminal

7. Terminal(s) providing keyboard and display or printout (requires item 6, above)
  a. Terminal driver
  b. Table space for each terminal
	DD.00	1,500
		100
				7. Item 6, above, and any of the following terminals:
				  a. 262x terminals or 2675A terminals with 12005A interface cable option 001
				  b. 2635A/B Printing terminal with 12005A interface cable option 002
				  c. 264x terminals with 12005A interface cable option 005

8. Terminal(s) providing Mini cartridge I/O as well as keyboard and display or printout (requires item 6, above)
  a. Terminal driver
  b. Mini cartridge driver
  c. Base table space per terminal
  d. Additional table space for each Mini cartridge tape unit used
	DD.00
	DD.20
		1,500
		1,100
		100
				8. Item 6, above, and any of the following terminals:
				  a. 2645A +007, 032 Display station or 2649B +007, 032 OEM Block or Character Mode Terminal with 12005A interface cable option 005
				  b. 2647A +032 (or 2649G +032 OEM) Intelligent Graphics Terminal with 12005A interface cable option 005.
				  c. 2648A +007, 032 (or 2649C +007, 032 OEM) Graphics Terminal with 12005A interface cable option 005.

9. Interactive use and error logging (requires items 6 and 7, above; item 8 is optional instead of item 7)
  a. Operator commands module
  b. Error logging module
  c. Operator error messages
  d. Status commands
  e. System commands
	SYCOM
	ERLOG
	OPMSG
	STAT
	XCMND
		900
		400
		130
		650
		120
				9. Items 6 and 7, above; item 8 is optional instead of 7

10. Power fail/auto restart	ID.43	450		10. 12013A Battery backup module

11. HP-IB interface (used as disc, printer, and/or instrumentation interface)
  a. HP-IB interface driver
  b. Table space for each interface
	ID.37	2,410
		260
				11. 12009A HP-IB interface

12. Disc storage (required for program development, storage, swapping, and on-line sys. generation) (Requires item 11, above)
  a. Disc driver
  b. Base table space per disc drive
  c. Table space per logical unit (LU)
	DD.30	1,000
		50
		60
				12. Item 11, above, and any of the following discs (up to two per 12009A interface)
				  a. Double sided double density Flexible disc drive with 1.2 Megabytes of storage ■
				  b. 7910HR Fixed disc with 12 Megabytes of storage on a single non-removable disc platter

13. Program and segment loading (requires items 11 and 12, above)	LOAD	380		13. Items 11 and 12, above
14. Program swapping (requires items 11, 12, and 13, above)	SWAP	410		14. Items 11 and 12, above
15. File directory handler (requires items 11 and 12, above)	D.RTR	2,320		15. Items 11 and 12, above
16. Interactive file manager programs (requires items 2-6, 7 or 8, 9-13, and 15, above)	FMGR		18k	16. Items 6, 7 or 8, 11, and 12, above

Table 1. Configuration capabilities and requirements summary

Configuration capability	Req'd. Module	Approximate Memory Req'd. (bytes)		Hardware and/or additional software requirements
		Main Memory	Disc-Res.*	
17. Program development software (requires items 2-6, 7 or 8, 9-13, 15, and 16, above)				17. Items 6, 7 or 8, 11, and 12, above
a. FORTRAN IV Compiler	FTN4		18k	
b. Assembler and Cross-Reference Symbol Table	ASMB		20k	
c. Debug routine	DBUGR		4k	
d. Interactive Editor	EDITR		14k	
e. Relocating Loader	LOADR		24k ◀	
18. On-line System Generator (requires items 2-6, 7 or 8, 9-13, and 15, above)	RTLGN		24k ◀	18. Items 6, 7 or 8, 11, and 12, above
19. Printer support (requires item 11, above)				19. 2631A Printer with option 046 or 2631B Printer with option 214 and item 11, above
a. Printer driver	DD.12	1,360		
b. Table space for each printer		60		
20. General-purpose parallel interface				20. 12006A Parallel interface and/or 12060A 55kHz Analog-to-Digital Converter and/or 12063A Isolated Digital Input/Output Card
a. Parallel interface driver	ID.50	450		
b. Table space for each interface		10		
21. Access to software in PROM storage				21. 12008A PROM Storage Module
a. PROM Storage Module Driver	ID.36	220		
b. Table space per PROM Storage Module		88		
c. Driver for disc emulation	DD.36	0		
d. Table space per module w/DD.36		120		
22. DS/1000-IV network link				22. 12007A (modem) or 12044A (direct connect) HDLC interface and 91750A DS/1000-IV Network software
a. Interface driver ◆	ID.66	2,700		
b. Table space for each interface		60 ◆◆		

* Since disc-resident programs are swappable, this area must be allocated enough memory at system generation to hold the largest disc-resident program to be used.

† Bootup sources a and b may be used for automatic boot-up at power on. Virtual Control Panel (VCP) command can be used to boot-up from a, b, or c. Use of VCP command for boot-up will also require items 6 and 7 or 8, listed in the hardware column, above.

Δ System available memory requirements are application-dependent and, for some uses may even exceed the sample 4k byte upper limit listed here.

■ The system flexible disc is a single disc drive that is integrated into HP 1000 Model 10 Computer Systems.

◀ Relocating Loader and On-Line Generator memory requirements include approximately 8k bytes used for symbol table space.

◆ Driver ID.66 is included in the 91750A DS/1000-IV Network software product.

◆◆ Additional memory requirements for useful communication are too complex to cover here. Consult your Hewlett-Packard System Engineer for more information.

System requests from programs

For Input/Output functions:
1. Read from or write to any non-disc input/output device with or without wait
2. Write to and then read from the same interactive device in the same call
3. Get status of queued read requests, or the resulting input data
4. Check I/O device or controller status
5. Control functions on CTU or other peripheral devices
6. Determine the type of a device (such as a terminal, a cartridge tape unit, a disc, or a printer, etc.) given the device number
7. Determine the device number of the terminal on which the command to run the program has been entered
8. Allocate/release I/O devices or other system resources for own exclusive use
9. Request device lock/unlock

For program scheduling functions:
10. Schedule programs for execution with or without wait for completion
11. Terminate own execution
12. Suspend self into a wait state
13. Load a program code segment from a disc (applicable to a segmented program only)
15. Lock/unlock program (disallow/allow swapping) in a partition (RTE-XL only)

For other functions:
16. Obtain current year, date and time of day
17. Request resource lock/unlock
18. Reserve buffer space outside the program space
19. Convert integers from binary to ASCII
20. Pass message or data buffers between programs
21. Get a parameter string entered by the operator who runs the program
22. Execute some system requests as if they had been entered by an operator
23. Parse a command buffer into ASCII and integer fields

Ordering information

Products for the first-time single user

NOTE: The RTE-L system on 1.2M byte flexible discs is included in the standard HP 214xA/B L-Series System Processing Unit. RTE-XL on 1.2M byte flexible discs is included in the HP 214xA/B option 011/012 System Processing Unit. The HP 92070A RTE-L and HP 92071A RTE-XL operating systems are for user assembled L-Series systems.

92070A RTE-L Real-Time Executive Operating System

RTE-L consists of:

1. The following software on one of media options 041, 050, or 051, 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
   - RTE FORTRAN IV compiler, HP1000 Assembler, Cross Reference generator, interactive DBUGR utility, interactive editor, and relocating loader
   - HP-IB, relocatable, and decimal string arithmetic libraries
   - File manager and file management package
   - PROM formatting utility
   - System utilities
2. Getting started with your HP 1000 L-Series Computer (92070-90001).
3. RTE-L/XL General Information Manual (92070-90006).
4. RTE-L/XL Operator's Guide (92070-90002).
5. RTE-L/XL Interactive Editor Reference Manual (92070-90003).
6. RTE-L/XL Utilities Manual (92070-90004).
7. RTE-L/XL Programmer's Reference Manual (92070-90007).
8. RTE-L/XL File Management Reference Manual (92070-90008).
9. RTE-L Relocating Loader Reference Manual (92070-90009).
10. RTE-L/XL DEBUG Reference Manual (92070-90010).
11. RTE-L/XL Driver Reference Manual (92070-90011).
12. RTE-L System Design Manual (92070-90013).
13. RTE-L/XL Generation Planning Guide (92070-90014).
14. RTE-L/XL Generator Reference Manual (92070-90016).
15. RTE-L Software Installation Guide (92070-90018).
16. RTE-L/XL Driver Designer's Manual (92070-90019).
17. RTE-L/XL Quick Reference Guide (92070-90020).
18. RTE-L/XL Generation Requirements for Drivers Manual (92070-90042).
19. RTE-L/XL PROM Card User's Guide (92070-90030).
20. Decimal String Arithmetic Routines Manual (02100-90140).
21. Relocatable Library Manual (24998-90001).
22. HP-IB User's Manual (59310-90064).
23. RTE-IV Assembler Reference Manual (92067-90003).
24. RTE-FORTRAN IV Reference Manual (92060-90023).

92071A RTE-XL Real-Time Executive Operating System

RTE-XL consists of:

1. The following software on one of media options 041, 050, or 051, which must be ordered:
   - A catalog file describing the set of software on the medium by part numbers and revision date codes
   - RTE-XL operating system
   - On-line system generator
   - HP1000 Assembler, Cross Reference generator, interactive DBUGR utility, interactive editor, and relocating loader
   - HP-IB, relocatable, and decimal string arithmetic libraries
   - File manager and file management package
   - PROM programming utility
   - System utilities
2 through 8. Same as items 2 through 8 furnished with 92070A RTE-L system, above.
9. RTE-XL Relocating Loader Reference Manual (92071-90009).
10. and 11. Same as items 10 and 11 furnished with 92070A RTE-L system, above.
12. RTE-XL System Design Manual (92071-90013).
13 and 14. Same as items 13 and 14 furnished with 92070A RTE-L system, above.
15. RTE-XL Software Installation Guide (92071-90018).
16 through 23. Same as items 16 through 23 of 92070A RTE-L system, above.

92070A/92071A RTE-L/XL options

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

002: Provides a discount for upgrade to RTE-XL from 92070A RTE-L for purchaser of 12002A/B +001 L-Series XL Memory Controller who is supported under 92070T/S.

041: Provides all RTE-L/XL system software on 1.2M byte flexible disc.

050: Provides all RTE-L/XL system software on an 800 bpi, 9-track mag tape.

051: Similar to 050, above, but with RTE-L/XL system software on a 1600 bpi, 9-track mag tape.

Products for additional use on multiple systems

92070R Right to copy RTE-L for program development and execution on an additional computer system

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

1. The right to make one copy of software purchased with the 92070A RTE-L system for use on an additional system.
2. All manuals supplied with 92070A, items 2 through 24, listed previously.

NOTE: To assure proper support, a user who intends to use copies ("R" products) of other HP software products, such as BASIC/1000L with copies of RTE-L, should purchase the 92070R product (above) rather than the 92070E execute-only product (below).

92070E Right to execute RTE-L on one additional L-Series computer system

This is a low-cost license for an OEM to use the RTE-L software as part of its product. (Excludes capabilities 17 and 18 of Table 1.) No manual or software is supplied and no program preparation is allowed on this product. This product is simply a license to execute RTE-L and user programs developed to run under RTE-L on a dedicated L-Series application system. 92070E includes the right to copy 92070S/T updates.

92071R Right to copy RTE-XL for program development and execution on an additional computer system

The 92071R Right to copy 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. All manuals supplied with 92071A, items 2 through 23, listed previously.

NOTE: To assure proper support, a user who intends to use copies ("R" products) of other HP software products, such as BASIC/1000L with copies of RTE-XL, should purchase the 92071R product (above) rather than the 92071E execute-only product (below).

92071R Options

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

002: Provides a discount for right to copy the 92071A +002 product for customer who has previously purchased the 92070R product and 92070T/S support and is concurrently purchasing a 12002A/B +001 L-Series 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 L-Series computer system

This is a low-cost license for an OEM to use the RTE-XL software as part of its product. (Excludes program development and on-line system generation use on the system for which 92071E is purchased.) No manual or software is supplied with this product. This product is simply a license to execute RTE-XL and user programs developed to run under RTE-XL on a dedicated L-Series application system. 92071E includes the right to copy 92071S/T updates.

92071M RTE-XL Manuals Package

The 92071M RTE-XL Manuals package includes manual items 2 through 24 supplied with 92071A, listed previously. This is intended for an RTE-XL user wanting an additional set of manuals.
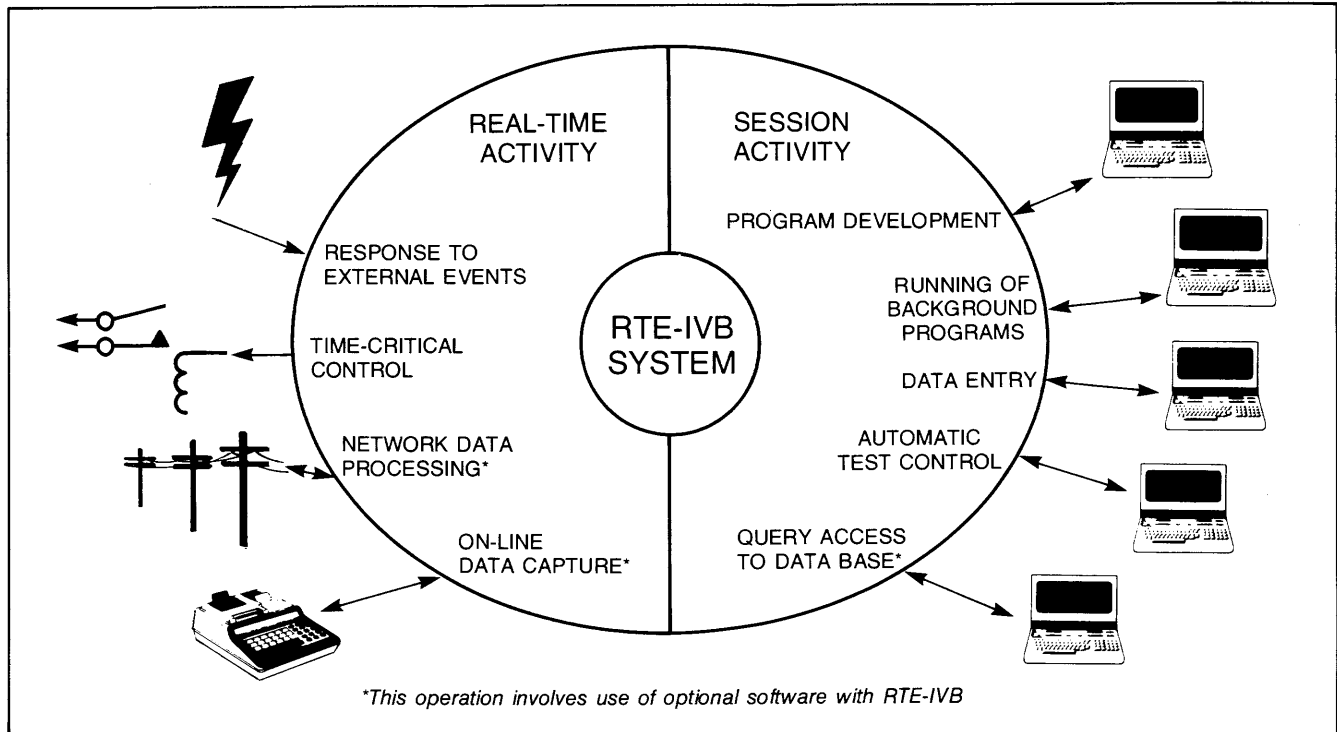
Software support products available

See page 1-1.

RTE-IVB Real-Time Executive operating system with Session Monitor and RTE-IVE Execute-only system

product numbers 92068A and 92068E

This operation involves use of optional software with RTE-IVB

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.

The 92068E RTE-IVE is an execute-only, memory-based subset of the 92068A disc-based RTE-IVB system. It is intended for user-assembled systems which require the power and versatility available with up to 2 Megabyte memory capacity, but without the added cost and environmental vulnerability of a disc.

Features

- Event-driven, time slice, and batch programs in same system
- Human-engineered session interface for multiple users
- Log-on/Log-off session
- Protected file domains
- Session independence
- Interactive help facility
- User-tailorable session capabilities
- Session accounting of cpu and connect time
- Management of up to 64 disc-resident multi-user program partitions in up to 2.048 Megabytes of memory
- Non-swappable memory resident programs

- Up to 54k bytes per partition for user's program code, independent of physical memory used by the operating system and drivers
- User addressing of extended memory area for data limited only by available memory (nearly 2 Megabytes in a 2.048 Megabyte system)
- Support for 32-bit integer and 64-bit floating point, and powerful new F-Series Vector Instruction set.
- Support for choice of 4.9, 14.7, 19.6, 50, or 120M byte system disc, the latter expandable to 960M byte capacity with additional 120M byte disc drives
- Batch-Spool Monitor for single-stream, multi-job batch processing.
- Concurrent execution and development of FORTRAN IV, Assembly language, and Pascal and BASIC (optional) programs.
- FORTRAN IV support of program access to large data arrays.
- Interactive debug package and interactive screen editor to aid program development
- Optional RTE microprogramming package for on-line development and debugging of user-microprogrammed sub-routines for faster data processing by the computer
- Memory partition and I/O reconfigurability at boot-up
- Input/output spooling for slow peripherals.
- RTE drivers and device subroutines for supported peripherals included with the system

- Support of optional IMAGE/1000 Data Base Management System for more efficient use of data files, easier access to data
- Optional GRAPHICS/1000 Graphics Plotting Software
- Support of optional multipoint and multiplexer multi-terminal interface software
- Support of optional DATACAP/1000 data capture software
- Support of multiple instrument clusters connected via the Hewlett-Packard Interface Bus (HP-IB)*
- Support of optional DS/1000 software-firmware for communication with other HP 1000 Computer Systems and/or with HP 3000 Series II/III systems
- Low-cost support of powerful, disc-less distributed system nodes using RTE-IVE
- Remote system boot-up of E/F-Series Computers via DS/1000-IV link

*The Hewlett-Packard Interface Bus (HP-IB) is Hewlett-Packard's implementation of IEEE Standard 488-1978, "Digital Interface for programmable instrumentation", identical ANSI Standard MC1.1.

RTE-IVB — More convenience, flexibility, and power for multiple on-line users

The Session Monitor — systematic resource allocation and friendly interface for on-line users

The Session Monitor is an interface for on-line multi-terminal users that can be configured into the RTE-IVB operating system to control and coordinate access to system resources and to provide friendly assistance to a wide variety of on-line users. The Session Monitor provides:

Orderly, accountable access to system. Under the Session Monitor, users can access the system only with valid user.group/password identification assigned by the system manager. At log-on, the Session Monitor configures the I/O devices allocated to the Session, using information in the system's Device Reference Table and in the Group and User Account File Entries. At log-off, the Session Monitor records the Session CPU and connect time in the system account file for allocation of charges for system use.

Friendly interface. User activity on the system is defined in terms of "sessions". When the user begins the Session by logging on, a copy of the file manager is scheduled for the Session user and an optional, user "welcome" procedure file prepared by the system manager may be used to provide guidance appropriate to the user. During the Session, a HElp command can be used to expand on mnemonic error messages, to minimize the need to refer to separate manuals, or, to call on a tailorable help file.

Terminal-independent operation. At log-on, the system builds a Session Control Block (SCB) for the user. The SCB contains all pertinent Session information; what system resources (logical units) the user may access, the user's command capability level, and other Session-related application information. Within the SCB, a Session Switch Table (SST) maps Session logical unit numbers to actual system logical unit device numbers so for all Sessions on the system can use the same logical unit numbers for peripherals of the same type (mini cartridge tape unit, printer, plotter, mag tape unit, digital voltmeter, etc.) at any terminal in the sys-

tem. Session users are thus 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.

Protected user environment. While a user is in a Session, the system blocks adverse interaction from other Sessions by mounting disc cartridges to specific users or groups of users, with exclusive access to the designated user or users, and by locking of peripherals while they are in use.

Session Monitor command capability levels provide users with the commands needed to do their jobs while minimizing the possibility of interference with system operations caused by the misuse of unnecessary commands by unsophisticated users.

Program duplication and sharing of execution time. When a user requests the running of a program, the Session Monitor automatically provides the Session with its own individually-identified copy of a multiply-used program. In this way, several Sessions may have several copies of the same program concurrently active in the system. The optional time-slicing capability of the RTE-IVB system can be used to help assure equitable sharing of program execution time among the various Session users.

Access to sharable group resources. The user base may be subdivided into groups of users who may share common functions, applications, discs and/or other resources.

Extensive usability. Session users can access virtually all of the resources managed by the RTE-IVB system, including all program development software and the 92069A IMAGE/1000 Data Base Management System.

Large partition space for users

In RTE-IVB, maximum user partition space is 54k bytes, a capacity that is not diminished by the physical memory allocated to the operating system, I/O drivers, or resident memory, but may be diminished by 2k bytes by table space requirements in very large systems.

Megabyte-sized data space in main memory

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 2.048 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, and COMMON areas, and the user's disc-resident program. This EMA capability makes it possible for HP 1000 computers and systems to tackle problems that formerly could be handled only by far more expensive machines with processing faster than in many systems that use a disc-virtual memory addressing scheme.

Exceptional flexibility

One or more disc resident programs using their own Extended Memory Areas (EMAs) for data being processed can be executed concurrently. A disc-resident program using a large EMA may occupy all of the space of a large partition, called a "mother" partition. When that use is completed, other multiple EMA or non-EMA programs with smaller memory space requirements can run in sub-partitions of the "mother" partition. Thus, large-scale computational needs and extensive multi-user operations can be handled easily in the same system without regeneration or reconfiguration.

Family compatibility

RTE-IVB is a member of Hewlett-Packard's compatible family of real-time executive operating systems, which also includes the RTE-L and RTE-XL systems. It thus shares and expands upon the capabilities of the entire RTE family, as described below.
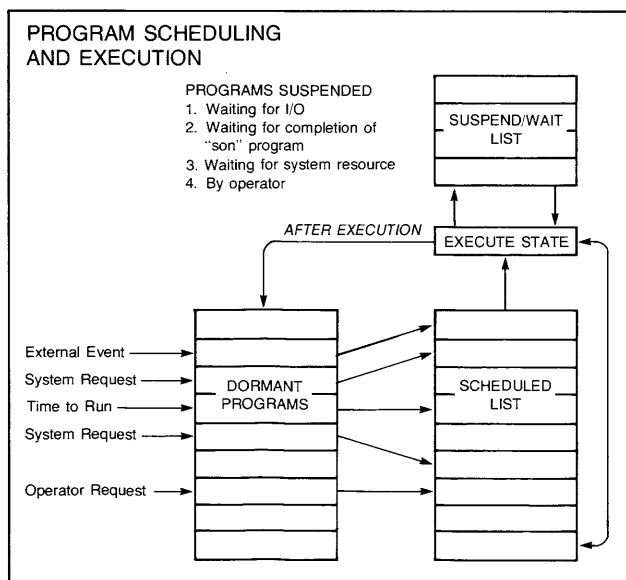
Three modes of operation

The RTE-IVB system offers the user three modes of operation, which can all be active concurrently, or which can be individually active during a given period of operation, depending upon user needs. The basic mode is priority-scheduled real-time multiprogramming. Within the lower priority levels of the priority structure, time slicing may be used to share execution time among programs running at the same priority level. Also, at lower levels of priority, RTE-IVB can be used for batch processing.

Real-time multiprogramming

RTE supervises the execution of multiple programs, effectively converting a single disc-based system to several systems, each serving one of several different users. The system can receive and respond to data inputs, retrieve data, run computations, print out reports, or perform other jobs for various users at the same time. In this way, multiprogramming also makes it easy to match the diverse needs of real-time measurement and control or automatic testing applications in manufacturing and research.

Scheduling. Multiple programs running under RTE are executed on a scheduled basis, as shown in the diagram, below. RTE lists all programs in order of priority that are ready for execution. Programs are put in this list when requested by the operator, when it is time for them to run on a regularly-scheduled basis, when an external event interrupt calls for program execution, or when requested by another program.

PROGRAM SCHEDULING AND EXECUTION

PROGRAMS SUSPENDED
1. Waiting for I/O
2. Waiting for completion of "son" program
3. Waiting for system resource
4. By operator

SUSPEND/WAIT LIST

AFTER EXECUTION

EXECUTE STATE

External Event
System Request
Time to Run
System Request
Operator Request

DORMANT PROGRAMS

SCHEDULED LIST

Priorities and execution. RTE-IVB has 32767 priority levels. Execution is started immediately for the highest priority scheduled program. Programs may be scheduled on time resolutions as small as tens of milliseconds. If a higher priority program program becomes scheduled, that program starts execution and the current program is temporarily suspended.

Dynamic memory mapping. RTE-IVB provides fast multiprogram access to as much as 2.048 Megabytes of physical memory by a logical-to-physical address translation using memory maps and the Dynamic Mapping System (DMS) in the system computer. When it's time for a program to run, RTE-IVB sets up a map for that program in the DMS. Thereafter, memory addressing through the map is automatic and completely independent of RTE-IVB, although RTE-IVB may modify the map during program execution as discussed in the section on Memory Management.

Disc-resident program swapping. In addition to memory-resident program space, RTE-IVB manages up to 64 disc-resident partitions in memory. When a disc-resident program moves to the top of the scheduled list, the system dispatches it in an appropriate partition (after swapping out any program that may be in that partition). Swapping greatly extends system program capacity while providing fast response for higher priority programs. Higher priority programs do not have to wait for completion of lower priority programs before being granted execution space and time.

Time slicing

Below a system manager-specified priority level in RTE-IVB, multiple programs with the same priority can run on a time-sliced basis, as shown in the illustration on the next page. Thus, by appropriate assignment of program priorities, the various Session users and other users can be fairly allocated execution time for programs, and monopolization of the system by any individual compute-bound program can be avoided. This gives the system manager a powerful means of load-balancing the system without affecting fast response real-time process interrupts.

Batch processing

At a priority that is normally lower than that for most time-slicing user's programs, RTE-IVB provides for batch operations. These use RTE-IVB's Batch-Spool Monitor (BSM), usually operating alone at its own priority level, calling on other system resources for job-controlled program development and other data processing tasks.

Job I/O is device independent and job priority and time limits are controlled by an easily-used job command language. This makes possible unattended batch processing. All system level operator commands may be used in batch job stream files. BSM input/output spooling facilitates batch operations because it increases the number of jobs that can be backlogged for processing and moves large-capacity output buffering from main memory to the disc.

PRIORITY LEVELS — TIME SLICING IN RTE-IVB

HIGHEST

REAL-TIME PROGRAMS

Time-slicing limit is selected by the system manager

MEDIUM

TIME-SLICING AT PRIORITY LEVEL A

PROG A1, PROG A2, PROG A3, PROG A4, PROG A(N)

TIME-SLICING AT PRIORITY LEVEL B

PROG B1, PROG B2, PROG B3, PROG B(N)

TIME-SLICING AT OTHER PRIORITY LEVELS

LOWEST

Memory management

Program partitions

Memory partitions are defined during system generation and can be redefined at system boot-up. Partitions in RTE-IVB can be as large as available physical memory. They can be all of the same type or can be divided into real-time and background categories. Disc-resident programs scheduled for execution will be loaded into the smallest available partition or if none is available, will force the swapping of the lowest priority program in a partition of suitable size. To further increase throughput, programs can be assigned to a particular disc-resident partition and will thus only be loaded into that partition. The maximum executable user code in a partition is 54k bytes, as shown below.

Mother partition

A partition in RTE-IVB that can be larger than the maximum code address space is called a "mother partition". This partition allows for sub-partitions. RTE-IVB uses mother partitions to dispatch programs that use an Extended Memory Area (EMA). Subpartitions of a mother partition have the same characteristics (real-time or background) as the mother partition, and they give the user the capability of using the large amount of memory assigned to the mother partition to run many smaller programs when the mother partition is not in use by a program using large data arrays.

RTE-IVB LOGICAL-TO-PHYSICAL MEMORY MAPPING FOR DISC-RESIDENT PARTITIONS, I/O DRIVERS, AND EXTENDED MEMORY AREA DATA SEGMENTS

2-15
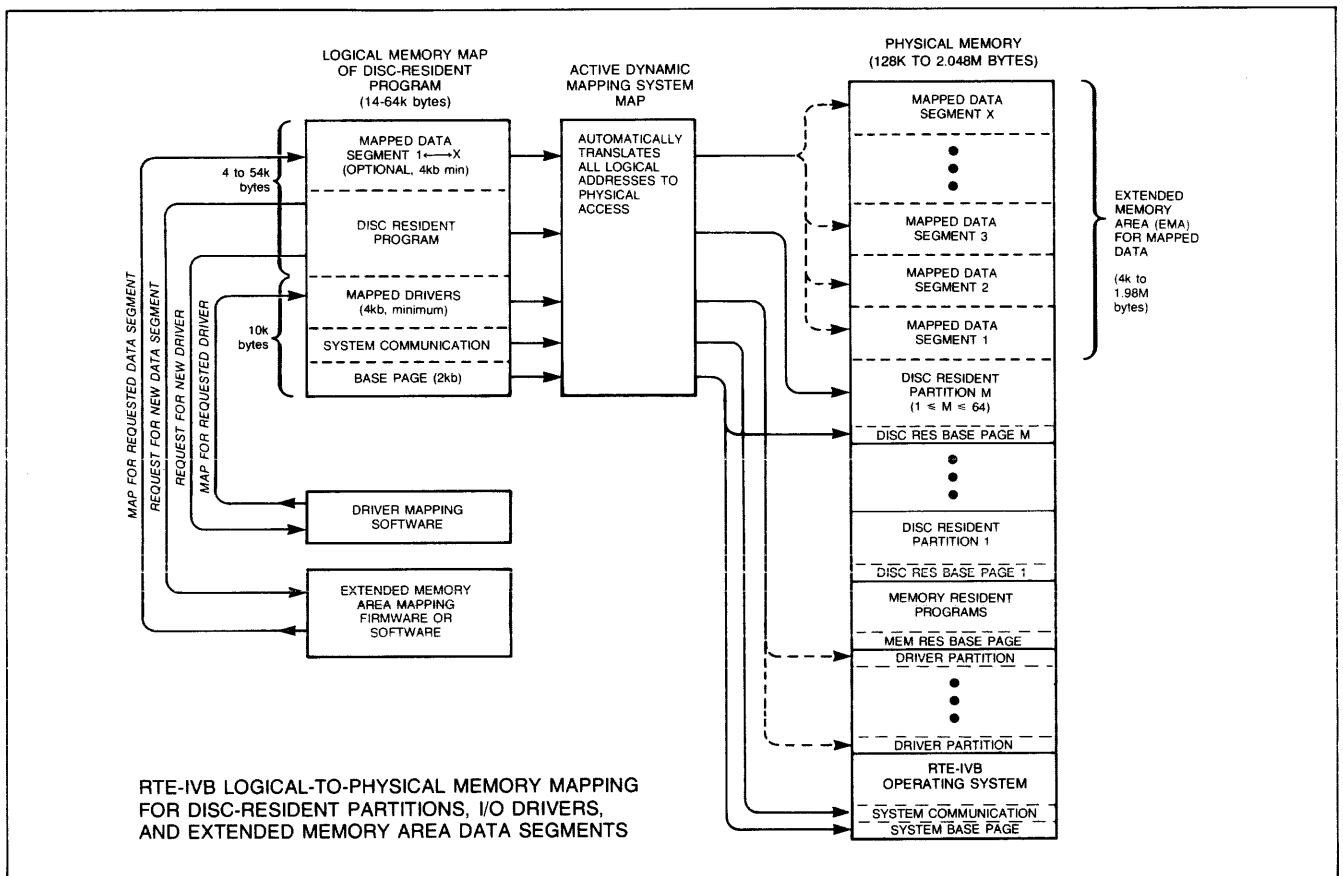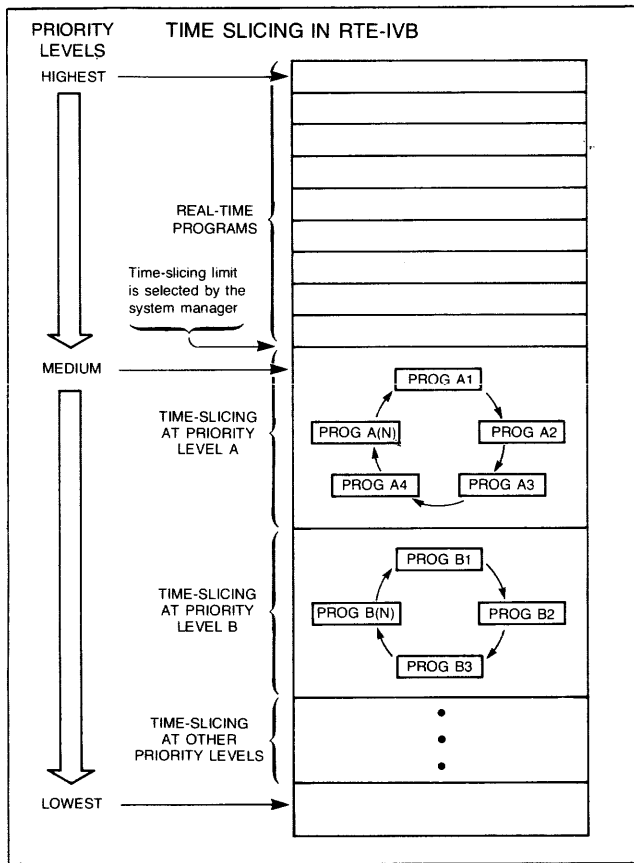
Extended Memory Area (EMA) for data

The EMA is an area for arrays or other data that extends the logical address space up to the available physical memory. One or more small or very large arrays may reside in the EMA. An EMA can extend well beyond the maximum program-addressable space by occupying the available memory in the program's partition that extends beyond the logical address space. At least two pages are reserved in the program's logical address space for the mapping of a window segment (MSEG) of the EMA. When an EMA element needs to be accessed, the segment of the EMA containing the required element is mapped into the program's logical address space. This mapping requires no disc swaps; therefore it is very fast. EMA mapping is quickest in HP 1000 E and F-Series computers, which use fast-executing firmware subroutines; in HP 1000 M-Series computers, software subroutines are used for EMA mapping.

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).

EMAs are used for large amounts of data storage, acquisition, and processing. Because EMA data accessing does not involve disc access, it is useful for data acquisition from fast devices at real-time rates. EMAs are also useful for data processing that requires a lot of data accessing from random locations, such as sorting. Scientific applications using large matrices, including matrix inversion, can be performed with ease and speed This latter type of processing can now be done faster than ever before, using the 12824A Vector Instruction Set in HP 1000 F-Series Computers.

EMA programming

Standard FORTRAN I/O and array accesses to arrays residing in EMA, using subscripts, are handled without any special action by the user. User's FORTRAN IV programs access the EMA as a named COMMON. This COMMON may have any of the usual entries in it, except that the total address space of any array may exceed 64k bytes and may be as large as nearly 2 Megabytes. The user designates that a particular COMMON is an EMA COMMON with the following statement.

$EMA (COMMON name, MSEG size in pages of memory)

The use of EMA is illustrated in the following program example:

```
$EMA(COMNM,3)
    PROGRAM EXAMPLE
    COMMON/COMNM/A(100,2000),C(3000,80)
    .
    .
    EQUIVALENCE(A(99,1000),B)
    .
    .
    B=SIN(A(J,K))
    S=UFUN((A(J,K)))
    .
    .
```

From the EMA statement and the contents of the program, **the RTE FORTRAN IV or FORTRAN 4X compiler generates all needed EMA map requests.** The ability to declare EMA access is also provided in the RTE Assembler, so the assembly language programmer may generate the required mapping subroutine calls.

Interrupts

Normal interrupt processing

RTE-IVB uses the multi-priority level, vectored hardware interrupt system of the HP 1000 computer for power fail detection, memory protect violation, parity error, and time base interrupts, as well as for peripheral I/O and user-interfaced equipment. When one or more interrupts occur simultaneously, the interrupt with the highest hardware priority is recognized first, but the system also remembers the other interrupts, so no interrupt is forgotten or overlooked.

Privileged interrupt

The system also offers a privileged interrupt capability that can be used to bypass normal RTE-IVB interrupt processing for fastest response to interrupts having the greatest urgency or highest frequency.

System integrity

The integrity of the RTE-IVB system is protected by the following provisions:
- Auto restart after power failure.
- "Fence" register protection of the system table areas, driver partitions, COMMON, and base page from program alteration
- Dynamic Mapping System protection between the system, memory-resident programs, and disc-resident programs.
- Write protection of the drivers, system, table areas, and base page
- Continued execution on parity error encountered in a user program (hard parity error aborts only program encountering it; system notifies operator and automatically downs affected partition until next boot-up).
- Automatic "downing" (with a message to the operator) of I/O device that failed to respond within a predetermined time (I/O device timeout)
- Protection of disc cartridges and other resources allocated to Session users.
- Control of command capabilities available to Session users.
- Optional exclusive assignment protection of disc tracks
- Optional user and group file domains.
- Optional security code protection of disc files from unauthorized access
- Hardware protection of system memory image tracks on the disc

Input/output

An I/O control module manages I/O operations, which proceed concurrently with program execution, using only one I/O driver for each group of similar devices. It performs memory mapping for I/O drivers and also provides:
- A waiting list of backlogged I/O work for keeping each I/O device optimally utilized.
- I/O timeout capability for detecting I/O conditions that could stall the system

- I/O suspension with automatic rescheduling of programs waiting for I/O service to make processing time available to other programs that can perform useful work.
- Buffering of output to slow devices so a program can continue execution without waiting for I/O completion
- Mailbox data exchange (class I/O) that lets the user set up specific "mailbox" buffers for device-to-program or program-to-program communication instead of using COMMON
- Re-entrant I/O that allows swap-out of a program with an active I/O request in progress in favor of a higher-priority program, speeding system response
- 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 pre-empted by another program.
- Automatic downing of I/O devices on a controller when they encounter an equipment error, without affecting other devices on the same controller.

On-line multi-user program development and optimization

The disc-based real-time multiprogramming design of RTE-IVB makes possible on-line program processing concurrent with real-time operations. All program development and loading is done from disc files, so there is no restriction on multiple use of any program development facility. New commands provide for easier compile (or assemble) and compile and load operations. Program development in RTE-IVB is supported by the following standard and optional disc-based software:

- RTE FORTRAN IV Compiler or optional 92834A FORTRAN 4X Compiler, which provides automatic generation of map requests for EMA programs
- RTE Assembler, which includes ability to facilitate preparation of mapping subroutine calls by the programmer for EMA programs
- Cross-reference generator
- Optional 92832A Pascal/1000 compiler and cross reference generator
- Optional 92101A multi-user Real-Time BASIC/1000D
- Optional 92083A RTE Profile Monitor
- Optional 92061A RTE Microprogramming Package
- Relocating loader
- Batch-Spool Monitor
- Interactive debug package
- Interactive screen editor
- Real-time I/O drivers for peripheral subsystems

File management

In addition to batch processing, the Batch-Spool Monitor (BSM) provides file management that includes creating, opening, writing, reading, listing, closing, and purging of automatically-extendable, named program and data files, as well as repacking, moving, and duplicating files.

Interactive symbolic debugging

DBUGR, a program-callable or loader-appendable utility subroutine, provides user requests for examination and modification of the contents of memory locations and registers, insertion of a breakpoint, and the tracing of program execution. To facilitate interpretation, DBUGR translates machine language code back to assembly language mnemonics and octal numbers, which are more easily checked against assembly language listings generated by the Assembler or the FORTRAN IV compiler.

Interactive screen editing

Editing to correct program bugs or to enter and correct program, data, or text files on the disc are greatly facilitated the powerful Edit/1000 interactive screen editor. In addition to its convenient screen mode, this editor provides character string search and correction capabilities that let the user locate and change all occurrences of a particular string of characters throughout a file, or only in specific lines or columns of a file. It also offers powerful line copy, move, break, and join capabilities. Of course, these extra capabilities are in addition to the usual line or character display, insertion, replacement, and deletion capabilities normally expected in a program editor.

Decimal arithmetic library

RTE-IVB includes a decimal arithmetic library containing routines for addition, subtraction, multiplication, and division of decimal character string numbers that exceed the integer, floating point, and extended precision capabilities of the standard libraries.

Multi-Terminal Monitor

A Multi-Terminal Monitor (MTM) is provided for use instead of the Session Monitor when the powerful multi-user management capabilities of the Session Monitor are not desired.

System configuration flexibility

On-line system generation

The RTE-IVB system is generated in an on-line mode, concurrent with other system activities, such as program development or interactive access to a data base. As needed, several different system configurations can be generated and stored in disc files for future use. Modular software makes it easy to configure an RTE-IVB system tailored to particular application requirements for input/output peripherals, instrumentation, and optional software. This may be accomplished interactively through a systematic dialog between the system manager and the on-line generator in which the parameters of the configuration are specified and appropriate software modules are retrieved from the disc and loaded into the system file. With the On-line Generator, the configuration can also be generated from a previously-entered response file on the disc, so that generation can proceed with minimal operator intervention.

Easy system switchover

A special utility program is provided for switchover to operation under previously-generated configuration stored in a disc file.

RTE-IVB FUNCTIONAL RELATIONSHIPS

EMA DATA SEGMENT MAPPER

MEMORY MAPPING FOR DATA SEGMENTS

DYNAMIC MAPPING SYSTEM

OPERATOR REQUESTS

SYSTEM EXEC REQUEST HANDLER

SCHEDULER AND DISPATCHER

MEMORY MAPPING FOR PROGRAMS

PROGRAM SCHEDULING

SESSION MONITOR

SPOOL MONITOR

MEMORY MAPPING FOR I/O DRIVERS

HIGHER

PRIORITY

LOWER

Analog digital scans, Quick-look data logging, and Control

REAL-TIME USER PROGRAM

REAL-TIME USER PROGRAM

CONTROL & DATA INPUT/OUTPUT

I/O CONTROL MODULE

POWER FAIL INTERRUPT

MEM PROTECT INTERRUPT

PARITY ERROR INTERRUPT

TIME BASE GENERATOR

Computation, array scans and sorts, logging, plotting, and reporting

BACKGROUND USER PROGRAMS

I/O DRIVERS

POWER FAIL — AUTO RESTART ROUTINE

REAL-TIME OR BACKGROUND USER PROGRAM

RTE-IVB REAL-TIME EXECUTIVE

Interactive user debugging of programs under development

DEBUG SUBROUTINE

Interactive editing of program or text files with powerful character string search and replacement capabilities

INTERACTIVE EDITOR

On-line or batch development of user's application programs

FORTRAN IV COMPILER RTE ASSEMBLER & RELOCATING LOADER

DISCS

Entry of program development and other batch processing jobs

BATCH MONITOR

Creation, reading, writing, and or purging of extendable named files

FILE MANAGER

Generation of new system concurrently with operation under the present system

ON-LINE SYSTEM GENERATOR

Switchover from the current system to other system in disc file

GENERATION SWITCH

CRT DISPLAY TERMINALS

Development of user's application programs in Pascal

92832A Pascal/1000

Multi-user conversational programming in real-time BASIC of up to 16 time-and-event-scheduled tasks

92101A BASIC/1000D SYSTEM

Establishment, updating, restructuring, and back-up of on-line data base. English-like QUERY access by non-programmers

92069A IMAGE/1000 DATA BASE MANAGEMENT SYSTEM

PRINTING TERMINALS

Program activity profile analysis

92083A RTE PROFILE MONITOR

Network communications with other HP 1000 Systems with nodal addressing and store-and-forward message handling and/or communication with HP 3000 Systems

91750A DS/1000-IV NETWORK SOFTWARE

Adds RJE communication with IBM 360/370 Computer

91780A RJE/1000

Support for user development of data capture transactions and on-line operation of multiple HP 307xA/B Data Capture Terminals

92080A DATACAP/1000-II PACKAGE

MAG TAPE UNITS
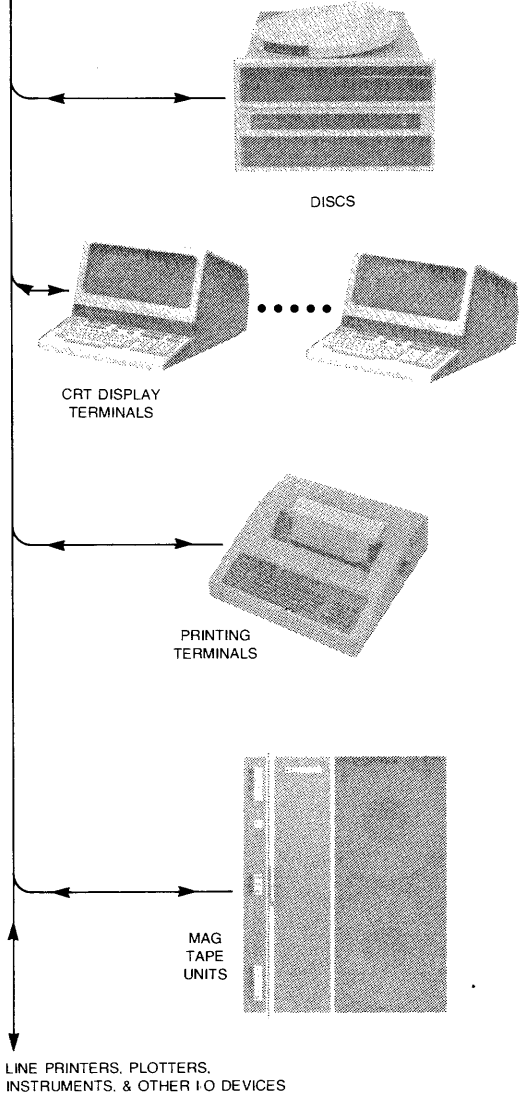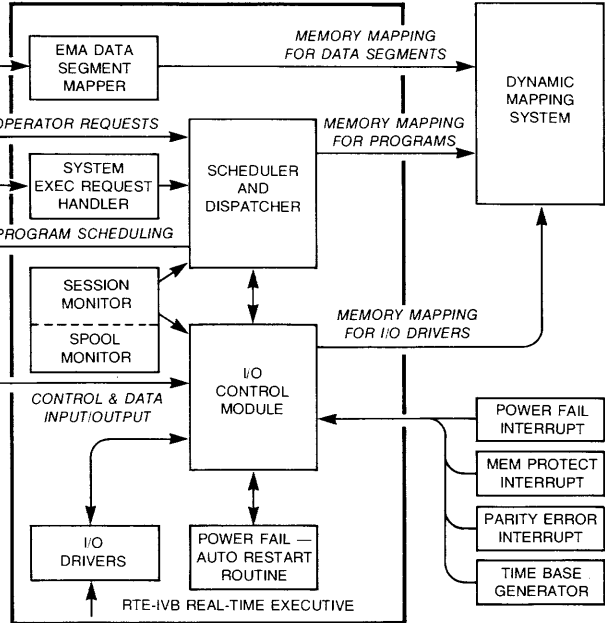
LINE PRINTERS, PLOTTERS, INSTRUMENTS, & OTHER I/O DEVICES

Reconfiguration at boot-up

At every boot-up, the user can elect to enter a reconfiguration dialog during which any or all of the following can be accomplished:

- Change of I/O select code assignments
- Identification of pages of memory that contain parity errors
- Change the total number of memory pages
- Change the size of system available memory
- Change the number and size of disc-resident partitions
- Change program assignments to specific partitions
- Change the size requirements of individual programs

The changes in I/O and memory configuration can be made temporarily, for only the current boot-up, or can be permanently incorporated into the system during the reconfiguration dialog. The ability to substantially reconfigure the system without regenerating it provides exceptional flexibility and saves considerable time and effort when the system configuration must be modified.

Utilities

Soft key utilities

Soft key utilities included with RTE-IVB facilitate the establishment of single-keystroke commands using the programmable "soft" keys on the 2645A/47A/48A/49B/49C/49G CRT display terminal that serves as system console, or an auxiliary 264x or 2624A/26A/29C/29D terminal that also uses driver DVR05 or DVA05. The KEYS utility provides for creation, change, or listing of soft key command sets (up to eight single keystroke commands per set) and the transfer of the current soft key command set to the CRT Terminal that is to use it, or to a disc or Mini cartridge file or CRT cartridge tape LU to save it. Each keystroke command can be used to issue a system or software subsystem command up to 80 characters long. A KYDMP utility is provided for transfer of previously-developed soft key command sets from an LU or file to the terminal where such transfer is the only capability that is required.

Master software update utility

A utility program is provided to facilitate updating of the grandfather disc, so that enhancements distributed on Mini cartridges as part of the 92068S Software Subscription Service or 92068T Customer Support Service can be incorporated easily.

Disc backup utilities

Other utility programs provide for saving and restoring information from the disc to magnetic tape and vice versa. These same utilities also facilitate disc-to-disc copying.

Optional software

- HP 92832A Pascal/1000
- HP 92834A FORTRAN 4X
- HP 92101A BASIC/1000D
- HP 92083A RTE Profile Monitor
- HP 92061A RTE Microprogramming Package
- HP 92069A IMAGE/1000 with QUERY
- HP 92080A DATACAP/1000-II Data Capture System

- HP 92073A IMAGE/1000 without Query
- HP 92835A Signal/1000 Digital Signal Processing Package
- HP 92840A Graphics/1000 Graphics Plotting Software
- HP 91750A DS/1000-IV Distributed Systems Network Software*
- HP 91780A RJE/1000 Remote Job Entry Package*
- HP 91730A Multipoint Software*
- HP 91731A Async Multiplexer Software*

Data on these products is in the HP 1000 Communications Products Technical Data book

How RTE-IVE differs from RTE-IVB

Code identity RTE-IVE runs the identical operating system code of RTE-IVB, with certain disc-related features shut down, as listed below. Because RTE-IVE and RTE-IVB code is identical, program transportability between systems operating under RTE-IVB and those operating under RTE-IVE is guaranteed.

System generation is not supported, so RTE-IVE must be generated on a host RTE-IVB system and down-loaded via DS network link or transported via magnetic tape or Mini cartridge media.

Program development using compilers, editor, etc. is not supported, so programs to run under RTE-IVE must be developed on a host RTE-IVB system and down-loaded via DS network link or transported via magnetic tape, flexible disc, or Mini cartridge media. However, loading of absolute programs and run-time debugging of programs with DBUGR are supported in RTE-IVE.

Session monitor management is not supported, but interactive multi-user access is supported in RTE-IVE via the Multi-Terminal Monitor terminal handling software package.

The RTE-IVB file manager program FMGR is replaced by a modified version for RTE-IVE systems with a peripheral flexible disc.

Spooling is not supported in RTE-IVE.

Program swapping is not supported in RTE-IVE.

EXEC calls pertaining to disc track allocation and release are not supported in RTE-IVE.

Segment loading is supported in RTE-IVE by the utility SEGLD, but not by the EXEC8 program call. Segments may be loaded from remote files via a DS/1000-IV network link or from local files on a peripheral flexible disc.

Functional specifications

Operating system basic specifications

RTE-IVB Type: Disc-based real-time multiprogramming with time-slicing and batch capabilities.

RTE-IVE Type: Execute-only, memory-based real-time multiprogramming with time-slicing capabilities.

Basis of program scheduling for execution: By operator, time, event, or another program, in order of program priority.

Program priority levels: 1 through 32767, the lowest number designating highest priority.

Number of program partitions: Up to 64, including mother partitions and subpartitions, depending upon physical memory provided and partition sizes used.

Program time slicing

Time slice limit: Round-robin scheduling of multiple programs assigned to the same priority level is performed on all priority levels below the time-slice limit. The default time slice limit level is 50, permitting time-slicing on priority levels 50 through 32767. This limit can be moved to another level by an on-line command.

Time slice quantum: A program's time slice quantum (PTSQ) is determined by the system slice quantum (SSQ) and a priority multiplier (PM), as follows:

$$PTSQ = SSQ \times PM + SSQ$$

The SSQ may be set at any value between 10 and 32760 milliseconds; the default value is 1500 milliseconds. The priority multiplier is 0 for the highest time slice priority level, incrementing by 1 for each range of 256 below the highest level.

How time-slicing works: Within the scheduled list, all programs at a given priority level in the time-slicing range form a circular queue. While no higher priority programs are scheduled, each program within any one queue executes in turn until it exceeds its time slice quantum or is suspended or interrupted. When a higher priority program interrupts a time-slice program that is still scheduled, the remaining portion of its execution time slice is saved. When the interrupted time slice program is re-entered, it completes its time-slice before the next program in the queue is granted execution time.

Session monitor (RTE-IVB only)

Number of concurrently-active sessions: Depends on job mix and can range from 8 heavy compute-bound sessions to 16 or more simple data entry/retrieval sessions.

Terminal and device independence: A Session Switch Table (SST) maps session logical unit numbers to system logical unit numbers. The I/O address space seen by the user can thus be completely independent of the actual system configuration. For example, all terminals can seem to have identical I/O addressing spaces.

Memory specifications

Main memory capacity: RTE-IVB/RTE-IVE can address up to 2.048M bytes (1024 pages) of memory.

Extended memory area for data: The Extended Memory Area (EMA) for data can be equal to the total physical memory less the physical memory used by the system, System Available Memory, driver partitions, resident library, system COMMON area, and memory-resident programs.

Maximum program space per partition: Up to 54k bytes for large background partitions. This may be reduced to 52k bytes if system tables are very large or if the driver partition is greater than 2 pages.

Approximate RTE-IVB memory requirements (bytes): The following memory requirements are approximate and do not reflect a maximum system. Requirements are additive for resident memory. The requirements for disc-resident partitions include 2k bytes for base page, which is part of each disc-resident partition:

Software item	Resident Memory	R-T Disc Resident	B-G Disc Resident
RTE-IVB System	50-52k		
Session Monitor	1k	4-8k	20-32k†
RTE FORTRAN IV Compiler			22-28k†
RTE Assembler			18-24k†
Cross-ref symbol table generator			16-28k†
On-line System Generator			26-40k†
Relocating Loader			24-28k†
Batch-Spool Monitor		20k	20k
Interactive DBUGR routine			5k
Interactive Editor			12-14k†
SAVE Utility			14-22k†
RESTORE Utility			16-24k†
COPY Utility			14-22k†
VERIFY Utility			14-30k†
KEYS Utility			11k
KYDMP Utility			4k

*The System memory requirement as listed here includes the resident system, typical table areas, common, subsystem global area, and base page, disc, system console, power fail, and spool drivers, and 6k bytes of System Available Memory.

†The size of background partition required depends partly on size or complexity of program being compiled or assembled, or buffer size used; short or simple programs or short buffers will be processable in the smallest partition size given; larger programs or buffers may take up to the maximum partition size given.

RTE-IVE memory requirements: Similar to RTE-IVB memory requirements, listed above, to the extent items listed above are pertinent in the RTE-IVE environment, but differing in that all programs used must be resident and all memory requirements are resident requirements.

Operational requirements

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

For user-assembled systems:
1. 2108, 2109, 2111, 2112, 2113, or 2117 Computer with at least 128k bytes of memory †, 12897B Dual Channel Port Controller, 13304A Firmware Accessory Board (except in 2108 or 2112 Computer), 12976B or 13305A Dynamic Mapping System, 12944B or 12991B Power Fail Recovery System, and 12539C Time Base Generator.
2. Any supported system console.
3. Any supported standard input/output unit.
4. Any supported system disc.

†256k bytes of memory is strongly recommended for use with DS/1000-IV.

Supported system consoles:
1. 2645A/48A/49B/49C +007, 032 Terminal or 2647A/49G +032 Terminal or 2642A +032, 070 Terminal with 12966A +001 interface is preferred because it combines the functions of system console and Mini cartridge standard input/output unit.
2. 2621A/P (or 2629A/B OEM) Interactive Terminal with 12966A +005 interface provides a low-priced system console for new installations.
3. 2624A (or 2629C OEM) Display Terminal with 12966A +005 interface.
4. 2626A (or 2629D OEM) Display Station with 12966A +005 interface.
5. 2635B +051 Printing Terminal with 12966A +001 interface.
6. 2675A Thermal Printing Terminal with 12966A +005 interface.
7. 2644A +020* Mini Data Station with 12966A +001 interface (combines the functions as system console and Mini cartridge standard input/output unit at 1/4 the speed of item 1 terminals).

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

Supported system discs (RTE-IVB requirement only):
1. 7906H/HR 19.6M byte Cartridge ICD Drive with 12821A interface (max. of two drives/interface).
2. 7920H 50M byte ICD Drive with 12821A interface (max. of two drives/interface).
3. 7925H 120M byte ICD Drive with 12821A interface (max. of two drives/interface).
4. 7906M/MR 19.6M byte MAC Master Cartridge Disc Drive with 13175B interface (max. of seven add-on 79xxS slave drives per MAC Master).
5. 7920M 50M byte MAC Master Disc Drive with 13175B interface (max. of seven add-on 79xxS slave drives per MAC Master).
6. 7925M 120M byte MAC Master Disc Drive with 13175B interface (max. of seven add-on 79xxS slave drives per MAC Master).
7. 12962A/B/C/D* 14.7M byte Cartridge Disc Subsystem.

Identifies discontinued product that is listed here for reference only.

Compatibility

Computer serial prefix compatibility: RTE-IVB/IVE is compatible with HP 2108 and 2112 Computers serial prefix 1810 and later, 2109 and 2113 Computers serial prefix 1812 and later, and all 2111 and 2117 Computers. Compatibility-affecting plug-ins (Dual-Channel Port Controller, Dynamic Mapping System, etc.) shipped with computers that meet the basic serial prefix requirement are also compatible.

For information on upgrading computers with earlier serial prefixes to work with RTE-IVB, contact your Hewlett-Packard Sales Representative.

Compatibility with software subsystems: DATACAP/1000-IV requires the RTE-IVB system for correct operation. DS/1000 software-firmware must be date code 1913 or later. Other software subsystems may require updating to be compatible with RTE-IVB. Disc-based RTE subsystems that have been kept up to date with the aid of HP's Software Subscription Service (SSS) or Customer Support Service (CSS) will be compatible as a result of such updating. If you have software subsystems that have not been kept up to date under SSS or CSS, ask your Hewlett-Packard Sales Representative to determine if any action will be needed to achieve compatibility with RTE-IVB.

Program compatibility: Most programs written for other Hewlett-Packard memory-based or disc-based RTE systems will run in RTE-IVB/IVE with little or no change.

RTE-IVB Operator requests

Session monitor command capability control: RTE-IVB establishes command capability levels, which can be changed if desired by regenerating the system. A user can only use commands that do not exceed the capability level assigned to the user's ID code. The initial command capability levels are:

1 User may only transfer to command files or log-off.

10 Users can list files, obtain system status, obtain system table definitions, send and receive messages, mount and dismount cartridges and up downed devices.

20 Users may create and manipulate files and pack disc cartridges.

30 Users may run and abort programs and create type 6 files (intended for the general application programmer).

40 Users can manipulate file manager globals and add entries to their Session Switch Table, potentially providing access to any system device.

50 Users can place programs in the time list, schedule programs, assign programs to partitions, and adjust priority levels. Programs subject to control can be any in the system, so this level should be reserved for system programmers and support people.

60 This is the system manager level, so access to all commands is permitted.

These numbers are used in the following list of session requests to identify the commands that are available to users at each capability level under the initial capability level tables. Users at higher capability levels may use all commands that are available to users at lower capability levels.

Session modes and requests: Each session operates in either of two modes. Normally, a session will operate under a copy of the system's file manager. This is the primary mode. However, there are instances in which other system resources must be accessible. For those situations, the session can also operate in a secondary mode, called break mode. The session requests summary below subdivides all session requests by capability level and mode. The higher request capability levels include all lower capability levels. Thus, a capability level 60 user can use all system commands.

SESSION REQUESTS SUMMARY

Capability level 1 — Primary mode

TR (or :) Transfers control to a named procedure file.
EX Exits session (or terminates file manager).

Capability level 10 — Primary mode

AC Allocates a disc cartridge to the session and mounts (logically installs) it (usable in session only).
CL Lists cartridges. DC Dismounts (logically removes) a disc cartridge.
DL Lists file directory.
HE Displays an extended explanation of error message or other help file guidance to the session user (usable in session only).
LI Lists a file.
MC Mounts (logically installs) a disc cartridge.
ME Reports and clears messages.
SL Displays session logical unit entry (translation between session logical units and system logical units) in Session Switch Table.

SESSION REQUESTS SUMMARY, continued

SM Sends message to a message file for user or group or to a non-disc peripheral device.
TE Sends message to the system console or log device.
WH Schedules WHZAT to display current status of scheduled and suspended programs or status of all partitions for the session.
?? Displays expanded error message.
** Provides for entry of comments in a command entry list.

Capability level 10 — Break mode

BL Examines current buffer limits of a program.
BR Sets attention flag in session-assigned program's ID segment to provide for break point interruptibility.
EQ Displays description and status of I/O controller as recorded in its equipment table (EQT) entry.
FL Eliminates buffered output to a terminal.
HE Same as HE in primary mode.

RS Aborts and restarts this session's copy of FMGR.
SL Examines an existing Session Switch Table entry.
ST Requests status of a named program.
TE Same as TE in primary mode.
TI Displays current year, day, and time of day from system's real-time clock.
TO Displays timeout value of an I/O controller.
UP Declares an I/O controller and associated devices available for use by the RTE system.
WH Same as WH in primary mode.
QU Displays time slice parameters.

Capability level 20 — Primary mode

AN Sends message to list device for annotation of jobs.
CN Controls a non-disc peripheral device.
CO Copies one cartridge to another.
CR Creates a file.
CT Controls terminal.
DP Displays values of global parameters used in the Batch-Spool Monitor.
DU Transfers data from a file or logical unit to another file or logical unit.
LL Designates list device.
PK Packs cartridge to recover tracks assigned to purged files.
PU Purges a file.
RN Renames a file.
ST Creates and stores into a disc file or logical unit.
SV Changes conditions of error logging on log device.

Capability level 30 — Primary mode

AB Aborts job (batch only).
CS Changes outspool setup, including logical unit.
EO Terminates job.
JO Identifies job.
OF Aborts session-assigned program.
RP Restores program previously saved by SP request.
RT Releases disc tracks assigned to a program.
RU Runs a program.
SP Creates a disc file and saves a program.
TL Sets job time limit.

Capability level 30 — Break mode

GO Reschedules previously-suspended, session-assigned program.
OF Same as OF in primary mode.
RT Same as RT in primary mode.
RU Same as RU in primary mode.
SS Suspends session-assigned program.
SZ Displays or changes partition space allocated to a program.

Capability level 40 — Primary mode

CA Calculates global parameter values.
IF Provides for conditional skipping within a job.
LO Changes log device.
PA Pauses and sends message to log device or other device.
SE Assigns values to global parameters.
SL Changes session logical unit entries in Session Switch Table (translation between Session LUs and system LUs - Usable only in Session).

Capability level 50 — Break mode

AS Assigns program to a partition.
IT Sets time schedule parameter for a program.
ON Schedules program for immediate execution.
PR Changes program priority.
UR Releases previously reserved program partition.

Capability level 60 — Primary mode

IN Initializes disc cartridge.

Capability level 60 — Break mode

BL Examines or modifies current system buffer limits.
BR Sets attention flag in the ID segment of any program in the system to provide for break point interruptibility.
DN Makes an I/O controller or device unavailable.
EQ Examines or modifies a system logical unit.

GO Reschedules any previously-suspended program in the system.
LU Displays or changes an LU number assignment.
OF Aborts or removes any program in the system.
QU Displays or changes time slice quantum.
SS Suspends any non-dormant program.
TM Sets real-time clock.
TO Examines or changes timeout value of an I/O controller.

Program development requests: Operator's requests running under Session or non-Session conditions can be used to:

1. Compile FORTRAN IV programs or Assemble programs.
2. Enter, test, debug, edit, and run real-time BASIC programs (with optional BASIC/1000D subsystem).
3. Trace program execution and examine and modify memory and register contents with the DBUGR utility.
4. Edit program and data files.
5. Load relocatable programs and subroutines into disc-resident partitions.

Other requests: The following other requests provide for:

1. Setting logical source pointers.
2. Allocation of load-and-go tracks.
3. Setup of logical source area.
4. Setup of load-and-go tracks.
5. Saving of logical source or load-and-go-areas.
6. Changing of batch logical units.
7. Displaying job status.
8. Backing up the disc on magnetic tape.
9. Updating the master software (grandfather) disc.
10. Generation of new operating system.
11. Switching from the current system to another system taken from a disc file.
12. Enable Session mode operation on system console.

RTE-IVE On-line operator requests

1. Turn programs on or off.
2. Suspend user program, either executing or scheduled.
3. Activate user program.
4. List programs currently executing in the system.
5. List status of all programs.
6. List status of all partitions.
7. Change priority and timing of programs.
8. Examine I/O device or I/O controller status; dynamically alter device buffering assignments.
9. Set buffer limits.
10. Examine or change memory requirements for partition-resident programs with job-dependent space requirements.
11. Dynamically alter I/O device timeout requirements.
12. Dynamically alter device logical unit assignments.
13. Control I/O device availability.
14. Set the real-time clock.
15. Display time (year, day of the year, and time of day).
16. Request execution of programs.

RTE-IVB/IVE Program requests

System requests from programs:

1. Read from/write to any non-disc input/output device with or without wait.
2. Read from/write to disc with wait (RTE-IVB only).
3. Get status of queued read requests, or the resulting input data.
4. Check I/O device of I/O controller status.
5. Control functions on magnetic tape unit or other peripheral device.
6. Schedule programs to be run, with or without wait on completion of the called program.

7. Make dormant or suspend self or other program.
8. Obtain current year, day, and time of day.
9. Change time scheduling of self or other program.
10. Allocate/release own disc tracks or global disc tracks available to all programs (RTE-IVB only).
11. Allocate/release I/O devices or other system resources for own exclusive use.
12. Enable/disable swapping of self (RTE-IVB only).
13. Request resource lock/unlock.
14. Request device lock/unlock.
15. Request partition status.
16. Determine size of own address space.

File manager program requests: In RTE-IVE, these requests apply only to standard input/output flexible disc devices 3 and 4, listed above.
1. Create files.
2. Rename files.
3. Purge files.
4. Open files.
5. Write on a random or sequential file.
6. Read from a random or sequential file.
7. Locate a file.
8. Close a file.

Ordering information

Products for the first-time single user

92068A RTE-IVB operating system for user-assembled systems

RTE-IVB consists of:
1. The following software on one of media options 030 through 033 or 050 through 059, which must be ordered:
   - RTE-IVB operating system
   - On-line system generator, system switch, and boot-up reconfigurator
   - Session Monitor
   - Multi-Terminal Monitor
   - RTE FORTRAN IV compiler, RTE-IV Assembler, Cross-Reference Table Generator, Interactive DBUGR utility, Interactive RTE Editor, Relocating Loader, Relocatable Library, and Decimal Arithmetic Library
   - EMA software routines
   - Batch-Spool Monitor
   - Device Drivers (see list in the Device Drivers data sheet)
   - Update and backup utilities
2. EMA Firmware ROMs for use on 2109, 2111, 2113, or 2117 Computer.
3. Getting acquainted with RTE-IVB manual (92068-90001).
4. RTE-IVB Terminal User's Ref. Manual (92068-90002).
5. RTE-IVB Programmer's Ref. Manual (92068-90004).
6. RTE-IVB Batch and Spooling Ref. Manual (92068-90005).
7. RTE-IVB System Manager's Manual (92068-90006).
8. RTE-IVB On-line Generator Ref. Manual (92068-90007).
9. RTE-IVB Utility Programs Ref. Manual (92068-90010).
10. RTE-IV Debug Subroutine Manual (92067-90005).
11. RTE FORTRAN IV Reference Manual (92060-90023).
12. RTE-IV Assembler Reference Manual (92067-90003).
13. Driver Writing Manual (92200-93005).
14. RTE-IV EMA Firmware Installation Manual (92067-90006).

15. RTE-IV EMA Firmware Diagnostic Manual (92067-90007).
16. Decimal String Arithmetic Manual (02100-90140).
17. ROM Loader Manual (12992-90001).
18. 7261 Card Reader Driver Manual (07261-90010).
19. DVR11 Card Reader Driver Manual (09600-93010).
20. DVR33 Flexible Disc Driver Manual (12732-90001).
21. RTE-DOS Relocatable Library Manual (24998-90001).
22. DVR00 Multi-device Driver Manual (29029-95001).
23. DVR37 HP-IB Interface Programming Manual (59310-90063).
24. DVA13 TV Monitor Driver Manual (91200-90005).
25. DVR12 Line Printer Driver Manual (92001-90010).
26. DVR05/DVA05 264x Console Driver Manual (92001-90015).
27. DVA12 Line Printer Driver Manual (92200-93001).
28. DVR23 Mag Tape Driver Manual (92202-93001).
29. 3070 Driver Manual (92900-90005).
30. 2631A Device subroutine LP31 manual (92062-90003).
31. 2608A Line printer driver DVB12 manual (92062-90004).
32. 59310B User's Manual (59310-90064).

92068A RTE-IVB 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 92068S/T.

031: Provides all RTE-IVB software on a 12940A (10M byte) disc cartridge for 12962A/B/C/D (14.7M byte) or 7906M/MR (19.6M byte) Cartridge Disc Drive.

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

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

036: Provides all RTE-IVB software on a 12940A (10M byte) disc cartridge for 7906H/R (19.6M byte) Cartridge Disc Drive.

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

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

052: Provides all RTE-IVB software on 800 bpi, 9-track magnetic tape for 7906M/MR or 7920M Disc Drive or 12962 Disc Subsystem, plus copying utilities.

053: Similar to 052, but on 1600 bpi, 9-track mag tape.

054: Provides all RTE-IVB software on 800 bpi, 9-track magnetic tape for 7925M Disc Drive, plus copying utilities.

055: Similar to 054, but on 1600 bpi, 9-track mag tape.

056: Provides all RTE-IVB software on 800 bpi, 9-track magnetic tape for 7906H/HR or 7920H Disc Drive, plus copying utilities.

057: Similar to 056, but on 1600 bpi, 9-track mag tape.

058: Provides all RTE-IVB software on 800 bpi, 9-track magnetic tape for 7925H Disc Drive, plus copying utilities

059: Similar to 058, but on 1600 bpi, 9-track mag tape.

RTE-IVB operating system in HP 1000 Computer Systems

The 92068A RTE-IVB system with media option appropriate to the disc ordered is included in HP 1000 Model 40 and 45 (2176C/D and 2177C/D) Computer Systems.

92068M RTE-IVB Manuals Package

The 92068M RTE-IVB Manuals package includes manual items 3 through 32 supplied with 92068A, listed previously.

Products for additional use on multiple systems

92068R Right to copy 92068A RTE-IVB for use on an additional computer system

The 92068R Right to copy product is available only to customers who have purchased a license to use 92068A. 92068R consists of:

1. The license to make one copy of software purchased with the 92068A RTE-IVB system for use on an additional system.

2. EMA Firmware ROMs for use on 2109, 2111, 2113, or 2117 Computer.

3. All manuals furnished with 92068A, items 3 through 32, listed previously.

92068R Option 001

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

92068E License to generate and execute one RTE-IVE execute-only, memory-based operating system on 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.

NOTE: Until revision code 2126 RTE-IVB updates are distributed to the field, one of media options 020, 050, or 051 must be ordered with 92068E.

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 software support service.

020: Software for RTE-IVE on 264x Mini cartridges

050: Software for RTE-IVE on 800 bpi, 9-track mag tape

051: Software for RTE-IVE on 1600 bpi, 9-track mag tape

Software support products available

See page 1-1 and special 92068V and 92068W products, below.

92068V +001 Central System Support for one copy of 92068E; includes the right to generate RTE-IVB updates into one RTE-IVE system, extends phone-in consulting service through the central RTE-IVB system manager, and, when applicable, also includes one set of firmware updates.

92068W +001 Right to generate RTE-IVB updates into one RTE-IVE system and, when applicable, also includes one set of firmware updates.

product numbers 92832A and 92854A

The Pascal/1000 compiler implements the Pascal high-level, block-structured programming language that can be used for program development in HP 1000 Computer Systems operating under Hewlett-Packard's RTE-IVB or RTE-XL real-time executive operating system. Pascal/1000 fully implements the "standard" language defined by Niklaus Wirth as well as important extensions that take full advantage of the extra HP 1000 Computer System capabilities that are available to users in the RTE-IVB system environment. The Pascal/1000 compiler translates Pascal source code to RTE Assembly language source code, which is then automatically assembled to produce object code. Pascal/1000 object programs can be executed in HP 1000 Computer Systems operating under HP's RTE-L/XL real time executive system as well as the RTE-IVB system.

Pascal combines good control structures and powerful data structuring with simplicity of use. It is easy to learn, programs written in it are easy to read, and a great deal of compile-time and run-time checking can be done to ensure program correctness.

Features

- Easily-understood programming
- Powerful, compact syntax
- Modern block-structured language
- Logical organization that facilitates documentation, modification, and maintenance of programs
- Early detection of errors at compile and run time
- Fast debugging
- Improved program reliability
- Clearly defined data structures complemented by flexible user-declared data types
- FORTRAN and Assembly language subroutines
- Fast execution
- 16- and 32-bit integer, single and double precision real, Boolean, character, text file, and user-defined data types using arrays, records, sets, files, and pointers
- Compatibility with HP 1000 software subsystems, such as IMAGE/1000, GRAPHICS/1000, and DS/1000-IV

Extensions to standard Pascal

Pascal/1000 is a superset of "standard" Pascal as defined by Jensen and Wirth in PASCAL User Manual and Report (second edition), published by Springer and Verlag, 1976. To avoid unintentional inclusion of Pascal/1000 extensions in a program that must be transportable to a system that executes only "standard" Pascal, the Pascal/1000 compiler includes an option for error-flagging any feature in a Pascal/
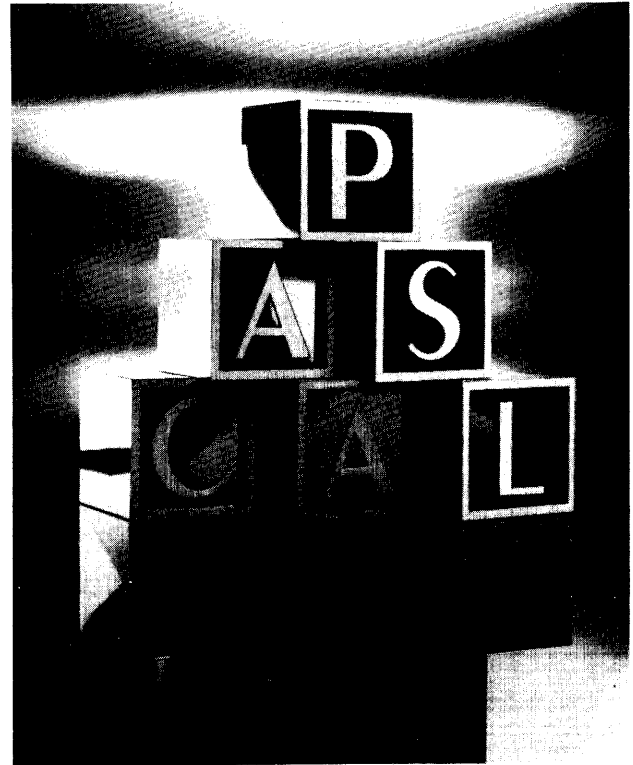
1000 program that is not part of "standard" Pascal. Pascal/1000 extensions include:

1. 32-bit integer and double-precision floating point data types.
2. Predefined procedures for directed access I/O.
3. Separate compilation with load-time linking of modules (In "standard" Pascal, the entire program must be compiled at the same time.) Segmentation can be accomplished in a straightforward manner.
4. The CASE statement can have subrange labels and an OTHERWISE clause.
5. Constant-valued expressions are allowed in most places that a constant is allowed in "standard" Pascal.
6. Structured constants allow arrays, records, and sets to be easily initialized.
7. Declarations may be in any order, except that LABEL must be first if it is used at all. More than one of each declaration section is allowed (such as two or more sections of TYPE, CONST, and/or VAR declarations).
8. Identifiers may be up to a source line in length with all characters significant, vs only the first eight characters in "standard" Pascal.

9. A function may return any type of data including arrays, records, or sets, but excluding files or data types containing files.

10. MARK and RELEASE procedures supplement the "standard" Pascal facilities for dynamic memory management.

11. EXEC, FMP, Pascal, FORTRAN, or Assembly language routines external to the Pascal program may be called by it.

12. The Heap can reside in logical address space, or in the Extended Memory Area (EMA) for Pascal programs running under RTE-IVB.

Functional specifications

Environment

Program development in RTE-IVB system: The 93832A Pascal/1000 compiler runs in a mother partition using the Extended Memory Area (EMA) managed by the RTE-IVB operating system. The EMA partition size must be at least 41 pages (84k bytes) resulting in compilation speed of around 50 lines per minute. Additional pages increase compilation speed. Exact memory requirements depend upon the customer's needs. To achieve approximately 500 compiled lines per minute, a 170 page (340k byte) EMA partition is needed. A separate 17 page (34k byte) partition is required for running the Pascal Monitor.

Program development in RTE-XL system: The 92854A Pascal/1000 compiler requires a minimum of two partitions, requiring a total of 128k bytes of memory, which provides a compile speed of approximately 50 lines per minute. Faster compile speed, up to about 150 lines per minute, can be achieved by providing partitions using a total of 512k bytes of memory.

Pascal program execution: Generated code runs under RTE-IVB, RTE-IVE, RTE-L, or RTE-XL.

Character set

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

Numeric characters: The ten digits 0 through 9.

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

Data types

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

Real: A 32-bit quantity with sign, exponent, and mantissa that ranges from $\pm2^{-128}$ to $\pm2^{+127}$, providing 6 to 7 decimal digit accuracy.

Longreal: A 64-bit quantity with sign, exponent, and mantissa that ranges from $\pm2^{-128}$ to $\pm2^{+127}$, providing 16 to 17 decimal digit accuracy.

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

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

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

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

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

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

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

Compiler options

NOTE: All compiler options may be used for compiling programs under either the RTE-IVB or RTE-XL operating system, but object programs compiled using the EMA or HEAP option may be executed only under RTE-IVB or RTE-IVE.

ANSI: ON causes an error message to be issued for any feature of Pascal/1000 which is not part of "standard" Pascal. Default is OFF.

PARTIAL __EVAL: ON suppresses evaluation of the right operand of the AND operator when the left operand is false or of the right operand of the OR operator when the left operand is true. OFF causes all operands of Boolean operators to be evaluated. Default is ON.

LIST: ON causes the source to be listed. OFF suppresses the listing except for lines that contain errors. Default is ON.

PAGE: Causes the listing to resume on top of the next page if LIST is ON.

INCLUDE: The string parameter names a file which contains text to be included at the current position in the program. Included code may not contain additional INCLUDE options.

WIDTH: Number of significant characters in source lines. Additional characters in the line are ignored. Default is 80.

ASMB: Specifies the option string to be passed to the Assembler for control of the nature of assembler OUTPUT, such as whether a listing of the assembled code is provided. Default is R (no listing).

AUTOPAGE: ON specifies that each procedure or function is to be listed on a new page. Page eject is performed after each routine has been compiled, so that a nested routine and the the body of its enclosing routine are listed on separate pages. Default is OFF.

EMA: Specifies parameters of the EMA instruction emitted for HEAP 2 programs. The string is of the form 'emasize,msegsize' (such as '65,2') where emasize and msegsize are integer literals. Default is '0,0'.

HEAP: 0 specifies that no heap is used. 1 specifies that the heap/stack area resides in the area between the end of the program and the end of the partition in which the program is currently executing. Pointers are one-word addresses. 2 specifies that the heap/stack resides in EMA. Pointers are two-word double integer offsets from the start of EMA. Default is 1.

LIST __CODE: ON specifies that the program listing is to contain emitted code in symbolic (assembly language) form. Default is OFF.

CODE: ON specifies that executable code is to be emitted. Default is ON.

RANGE: ON specifies that run-time checks of array indexing, subrange assignments, and pointer values are to be emitted. Default is ON.

RECURSIVE: OFF specifies that subsequent procedures cannot be called recursively. Default is ON.

TITLE: The first 25 characters of the string parameter will be printed on the top of the next and subsequent pages of the source listing.

PASCAL: The string parameter follows the name on the NAM record of the program, subprogram, or segment, and can be used to specify program type, priority, etc., and a comment. In addition, the system utilities COMPL and CLOAD look for '$PASCAL' as the first characters of a source file in order to schedule the Pascal compiler.

SEGMENT: Specifies that the current compilation unit is a segment, rather than a subprogram or main program. A segment is similar to a subprogram, except that it can be loaded dynamically.

SUBPROGRAM: Specifies that the current compilation unit is a subprogram. A subprogram is similar to a main program, except that there is no body. Each outer level routine in a subprogram unit is an entry point.

SUBTITLE: The first 25 characters of the string parameter will be printed under the title string, if any, at the top of the next and subsequent pages of the listing.

TABLES: ON specifies that symbol table information is to be dumped following each procedure and the main program. Default is OFF.

TRACE n: Specifies that calls are to be placed in the emitted code that invoke runtime trace procedures to keep a history of procedure entry and exit on LU n. Default is 0 (no trace).

ALIAS: Followed by a character string provides alternate identification of a procedure or function.

DIRECT: If used, bypasses normal .ENTR parameter handling to speed up program execution in non-recursive routines. Default is use of .ENTR convention.

ERROREXIT: Specifies that an external routine's calling sequence includes an error return.

HEAPPARMS: OFF changes Heap 2 parameter handling to be the same as Heap 1 parameter handling, to realize savings in memory and execution time, when actual VAR parameters are not in the Heap. Default is ON.

XREF: If used, generates Pascal cross-reference.

IDSIZE n: Specifies the number of significant characters in identifiers (1 to 150). Default is 150.

IMAGE n: Specifies the amount of space to be reserved for the IMAGE subsystem (range 0 to 32767). This space is always reserved from the logical address space following the program, even for HEAP 2 programs.

KEEPASMB: Specifies that the file containing the generated Assembly language is to be saved after it is assembled. Default is that the Assembly language file is purged.

LINESIZE n: Specifies the number of characters per line that text files can handle (range 1 to 255). Default is 128.

MIX: ON specifies that the generated Assembly source is to contain Pascal source lines as comments. Default is OFF.

STATS: Specifies that the state of the compiler options and certain compiler configuration information is to be displayed at the end of the compilation.

VISIBLE: ON specifies that subsequent level 1 routines are entry points (accessible to other compilation units); OFF specifies they are not entry points (and therefore not accessible). Default is ON.

BUFFERS n: Specifies number of buffers (1 to 255) to be used for files. Default is 'BUFFERS 1'.

LINES n: Specifies the number of source lines to print per page of source listing. Default is 56, which includes three lines of heading.

RESULTS: Names a file to which the results of the compilation are to be appended.

WORK n: Specifies the number of pages of EMA workspace that the compiler should use (applies to 92832A Pascal/1000 compiler only).

Ordering information

Products for the first-time single user

92832A Pascal/1000 for RTE-IVB

92832A Pascal/1000 includes:

1. Pascal/1000 compiler, library, error message file, and cross reference generator on software media option 020, 050, or 051, one of which must be ordered.
2. Pascal programmer's reference manual (92832-90001).
3. Programming in Pascal (tutorial manual) (92832-90002).
4. Pascal/1000 Configuration Guide (92832-90003).
5. Pascal/1000 Software Numbering Catalog (92832-90004).

92832A Options

001: Provides discount to a user upgrading from previous version of 92832A to latest version if not enrolled in the Customer Support Service or Software Subscription Service.

002: Provides discount for customer who has purchased 92854A Pascal/1000.

020: Provides Pascal/1000 software on 264x Mini cartridges.

050: Provides Pascal/1000 software on 800 bpi magnetic tape.

051: Provides Pascal/1000 software on 1600 bpi magnetic tape.

92854A Pascal/1000 for RTE-XL (usability on RTE-XL is effective with software revision code 2126)

92854A Pascal/1000 includes:

1. Pascal/1000 compiler, library, error message file, and cross reference generator on software media option 041, 050, or 051, one of which must be ordered.
2. Pascal programmer's reference manual (92832-90001).
3. Programming in Pascal (tutorial manual) (92832-90002).
4. Pascal/1000 Configuration Guide (92854-90003).
5. Pascal/1000 Software Numbering Catalog (92854-90004).

92854A Options

001: Provides discount to a user upgrading from previous version of 92854A to latest version if not enrolled in the Customer Support Service or Software Subscription Service.

002: Provides discount for customer who has purchased 92832A Pascal/1000.

041: Provides Pascal/1000 software on 1.2M byte flexible disc.

050: Provides Pascal/1000 software on 800 bpi magnetic tape.

051: Provides Pascal/1000 software on 1600 bpi magnetic tape.

Products for additional use on multiple systems

92832R/92854R Right to copy Pascal/1000 compiler for use on an additional computer system

The 92832R/92854R Right to copy product is available only to customers who have purchased a license to use 92832A/92854A without discount option. 92832R/92854R consists of:

1. The license to make one copy of software purchased with 92832A/92854A for use on an additional system.

2. All manuals furnished with 92832A/92854A.

92832R/92854R option 001

Provides a discount for right to copy the 92832A +001/ 92854A + product or a 92832T/S or 92854T/S update for a customer who has previously purchased the 92832R/ 92854R product.

Support service products available

See page 1-1.

The FORTRAN 4X compiler is an extensively-enhanced version of the RTE FORTRAN IV compiler and runs in the RTE-IVB, RTE-L, and RTE-XL operating systems. FORTRAN 4X provides 32-bit integer, file I/O, and IF-THEN-ELSE capabilities, improved code generation, and other improvements which offer increased computational power and easier programming to the FORTRAN user.

Features

- Fast compilation
- Local optimization
- Direct access I/O (both IBM and FORTRAN 77 Style)
- Many features of the ANSI 77 Standard, such as IF-THEN-ELSE
- 16- and 32-bit integer; 16- and 32-bit logical; single, extended, and double precision real; and single and double complex data types
- Full I/O capability to/from remote nodes of a distributed system
- Compatibility with HP 1000 software subsystems, such as IMAGE/1000, GRAPHICS/1000, DATACAP/1000, and DS/1000

Extensions to standard ANSI FORTRAN 66

HP FORTRAN 4X is a superset of ANSI FORTRAN X3.9-1966, with the following enhancements:

Declarations

Byte length type declarations: All type declarations can be followed by *n where n is an integer constant; the following declarations are possible:

INTEGER*2 .... integer
INTEGER*4 .... double integer
LOGICAL*2 .... logical
LOGICAL*4 .... double logical
REAL*4 .... real
REAL*6 or DOUBLE PRECISION*6 .. extended precision
REAL*8 or DOUBLE PRECISION*8 ..... double precision
COMPLEX*8 .... complex
COMPLEX*16 .... double complex

Double integer constants and variables are allowed wherever a single integer is legal.

IMPLICIT and IMPLICIT NONE declarations: The IMPLICIT declaration redefines the implied data type of symbolic names. The IMPLICIT NONE declaration requires that all variables be declared (typed).

Array dimensions: Arrays can have up to seven dimensions.

Array declarators: Lower and upper bounds of array dimensions can be specified in array declarators. The value of the lower bound dimension declarator can be negative, zero, or positive.

HP FORTRAN 4X

HP FORTRAN IV

ANSI 66 FORTRAN
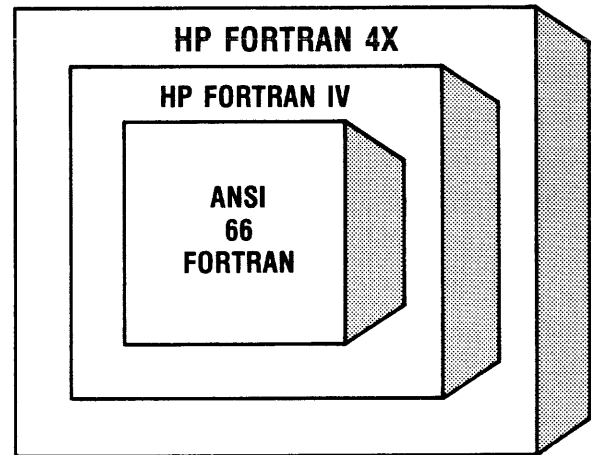
Alphanumeric literals in DATA statement: Strings of characters bounded by apostrophes can be used in place of Hollerith constants in DATA statements.

Long Hollerith in DATA statements: A single Hollerith constant may initialize more than one element of an array.

Executable statements

General expressions are permitted for the initial value, increment, and limit parameters in the DO statement; as control parameter in the computed GOTO statement; in I/O lists of WRITE and PRINT statements; as array subscripts; as logical unit numbers.

IF-THEN-ELSE construct: The IF(...) THEN, ELSE, ELSEIF(...) THEN, and ENDIF statements are included in HP FORTRAN 4X.

Alternate returns mechanism: Allows program flow to return to a statement other than the one following the subroutine call statement.

DO increment parameter: Value of the DO statement increment parameter can be either positive or negative. (DO indices must be single or double word integers).

Logical operations on integer data: The logical operators .AND., .OR., .NOT., .XOR., .EQV., and .NEQV. may be applied to 16-bit or 32-bit integer data to perform bit masking and manipulation.

Additional instrinsic functions include bit shifting, ISHFT, number of actual parameters, PCOUNT, and a number of transcendental functions such as arcsine.

Generic function selection: A single name may be used for all versions of an intrinsic (e.g. SIN vs DSIN) for most FORTRAN library functions.

Direct access READ and WRITE statements are compatible with ANSI FORTRAN 77 and IBM style and may be formatted or unformatted.

ENCODE and DECODE statements provide memory to memory formatting.

List directed READ and WRITE are allowed.

ANSI FORTRAN 77 style I/O statements including OPEN and INQUIRE.

Error and End of File Control are provided by the END =, ERR =, and IOSTAT keywords.

HP-IB device control is provided by passing secondary addressing or control buffers within READ and WRITE statements.

Program form

Lower case: Lower case keywords and names are accepted and mapped into upper case, thereby improving readability.

Compiler command: A compiler command line specification allows all integer and logical declarations without explicit length specifications to be considered as INTEGER*2 and LOGICAL*2, or INTEGER*4 or LOGICAL*4 respectively.

Debugging statements: Statements included in a program to aid debugging can be designated by the letter "D" in column 1 and compiled only when the associated command string option switch is set. Otherwise they are treated as comments.

Comment lines: An asterisk is accepted as the start of a comment line. Also, any FORTRAN statement can be followed in the same line by a comment that begins with an exclamation point.

Error directory provides brief explanation of each error detected.

Parameter (p1 = k1, p2 = k2, ... kn) defines names for constants, which may then be used in DIMENSION statements and anywhere else a constant may be used, including constant folding and conditional compilation.

Conditional compilation provides for different compilations of one source file to accommodate different requirements on different systems or for different applications.

Functional specifications

Applicable standard

HP FORTRAN 4X is a superset of ANSI FORTRAN X3.9-1966.

Environment

Operating system: HP 1000 Computer System operating under RTE-IVB, RTE-L, or RTE-XL, plus a list device.

Memory requirements:

Program size	Memory required
Up to 2000 lines	38 kilobytes
Up to 5000 lines	56 kilobytes

Compilation Speed (cpu time only)

In M/E/F-Series operating under RTE-IVB: 2000-3000 lines/minute.

In L-Series operating under RTE-L, or RTE-XL: 500-1000 lines/minute.

Local optimizations by compiler

Constant expression folding: Folding of operations that involve only constant values is done for all arithmetic and relational operators which do not also involve exponentiation or complex data.

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

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

Computed GOTO: In-line code is generated for three or fewer statement numbers.

DO statements: The compiler takes advantage of constant final values.

Character set

Alphabetic characters: All upper and lower case letters (A through Z and a through z in which a = A, b = B, etc.).

Numeric characters: The ten digits 0 through 9.

Special characters: Blank; equals, plus, and minus signs; asterisk; slash; left and right parentheses; comma; decimal and exclamation points; currency symbol, quotation marks, and apostrophe.

Hollerith data: All characters are legal within Hollerith data, except null and carriage return.

Data types

Integer: A 16-bit quantity, including sign, that ranges from −32768 to +32767.

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

Real: A 32-bit quantity with sign, exponent, and mantissa that ranges from $\pm 2^{-129}$ to $\pm 2^{+127}$ (about 1.47×10^{-39} to 1.70×10^{38}), providing 6.6 to 6.9 decimal digit accuracy.

Extended precision: A 48-bit quantity with sign, exponent, and mantissa that ranges from $\pm 2^{-129}$ to $\pm 2^{127}$ (about 1.47×10^{-39} to 1.70×10^{38}), providing 11.4 to 11.7 decimal digit accuracy.

Double precision: A 64-bit quantity with sign, exponent, and mantissa that ranges from $\pm 2^{-129}$ to $\pm 2^{127}$ (about 1.47×10^{-39} to 1.70×10^{38}), providing 16.3 to 16.6 decimal digit accuracy.

Complex: A 64-bit quantity consisting of two real data quantities, one for the real part of a complex quantity, the other for the imaginary part.

Logical: A 16-bit variable in which only the sign bit is used to determine the Boolean value, true or false.

Double logical: A 32-bit variable in which only the sign bit is used to determine the Boolean value, true or false. This data type is made available to help transport programs which EQUIVALENCE logical variables or which store Hollerith data in logical variables.

Hollerith: ASCII data which may be used as numeric values or actual parameters to subprograms.

Program vocabulary extensions with respect to ANSI FORTRAN X3.9-1966

Specification statements

$EMA (CMDAT,3) In RTE-IVB only, sets up Extended Memory Area (EMA) common to provide for quick referencing and manipulation of large data arrays. When used, this statement must be the first non-comment statement of the program.

$INCLUDE (file name) (directive or statement) Compiles the statements in the named file as if they were in the source at this point.

$TITLE Specifies a new title for the program listing.

$PAGE Causes a page eject in the program listing.

$LIST ON or $LIST OFF Controls the listing on a line-by-line basis. Also controls the mixed listing, if any.

PROGRAM CALST(4,90) Identifies program by name and sets program specification, such as priority, for the system.

IMPLICIT REAL*8 (A-T) Redefines implied data type of symbolic names; in this example, variable names with first letter A through T are implicitly defined as being double precision (REAL*8) variables.

IMPLICIT NONE Disables implicit data type designation, so the types of all variables must be declared.

Control statements

```
IF (SALARY .LT. 1) THEN
    TAX  = 0                      Executes one of two or more
ELSE IF (SALARY .LT. 10) THEN    blocks of statements depending
    TAX  = SALARY/2               upon the value of a logical
ELSE                              expression (may be nested to
    TAX  = SALARY                 any level).
ENDIF
```

CALL SUBR (I,J,A,B,*10,*30,*25) Calls a subroutine and passes it actual arguments to replace the dummy arguments in the subroutine. Actual arguments may include statement numbers used as alternate returns.

RETURN (J +2) Returns control from a subprogram to the calling program unit. This statement may select an alternate return from those supplied in a CALL statement.

Input/output statements

OPEN (6,FILE ='OUTPUT',STATUS ='NEW',NODE =2001) Associates an existing file with a logical unit, or creates a new file and associates it with a logical unit. The file to be opened can be either local or can be located at a remote node of a DS/1000 Distributed Systems network. In addition, the OPEN statement can contain specifications for file creation or subsequent processing, including file name, direct or sequential access, form (formatted or unformatted), record size, interpretation of blanks, and whether the file can be shared.

CLOSE (6, ERR =99) Disassociates a file from a logical unit. A status keyword provides for saving or deleting the file.

READ (U,F) R or READ (U,*,END =22) R Reads one logical record R from logical unit U, in format designated by statement F, or as free-field input designated by *, and assigns the input values to the elements in a list (formatted READ).

READ (U,REC =RECNUM) A,B,C or READ (U'R) A,B,C Reads specified logical record from logical unit U; may be either formatted or unformatted (direct access READ).

WRITE (U,ZBUF =CNBUFF,ZLEN =100) BUFFER Writes one logical record BUFFER to device U on the HP-IB bus, using control buffer CNBUFF of length 100 words.

PRINT 10, I, X, Y List-directed write to the default output device (normally a printer).

INQUIRE (U, ACCESS =ATYPE, NEXTREC =RECNUM) Sets specified variables to values of file attributes, including all information supplied in the OPEN statement, plus file position, whether it is open, and whether it exists if not open.

ENCODE (9,'("(T)",I3.3,",I5)")',PFORM) COLUMN Writes the elements of the I/O list into a memory buffer, translating the data into ASCII format.

DECODE (5,100,ASCII) (CHARS(i),i =1,5) Reads the elements in the I/O list from a memory buffer, translating the data from ASCII format into internal binary format.

Logical operators (operate on logical or integer constants, variables, and expressions. NOTE: .AND., .OR., and .NOT. have standard meaning.)

A .EQV. B Logical EQUIVALENT (true if A and B are both true or if A and B are both false)

A .NEQV. B Logical NOT EQUIVALENT (true if A is true and B is false, or vice versa)

A .EOR. B or A .XOR. B Logical EXCLUSIVE OR (true if A is true and B is false, or vice versa)

FORTRAN library functions

IFIX	AMIN0	*COS	*ACOS
FLOAT	AMIN1	DCOS	DACOS
SNGL	DMIN1	CCOS	*ATAN
*DBLE	*MAX	*TAN	DATAN
*REAL	MAX0	DTAN	*ATAN2
*INT	MAX1	CTAN	DATAN2
AINT	AMAX0	*EXP	*ASINH
DINT	AMAX1	DEXP	DASINH
DDINT	DMAX1	CEXP	*ACOSH
IDINT	*MOD	*LOG10	DACOSH
*NINT	AMOD	ALOG10	*ATANH
IDNINT	DMOD	DLOG10	DATANH
ANINT	*SIGN	*LOG	IAND
DNINT	ISIGN	ALOG	IOR
AIMAG	DSIGN	DLOG	NOT
CMPLX	*DIM	CLOG	IXOR
CONJG	IDIM	*SINH	IEOR
*ABS	DDIM	DSINH	ISHFT
IABS	*SQRT	*COSH	PCOUNT
DABS	DSQRT	DCOSH	ISSW
CABS	CSQRT	*TANH	
*MIN	*SIN	DTANH	
MIN0	DSIN	*ASIN	
MIN1	CSIN	DASIN	

* generic form.

Compiler options

L: Produces Listing.

M: Produces Mixed listing.

A: Produces Assembly listing.

T: Produces table of symbols (type, address, etc.)

C: Produces cross-reference of symbols.

D: Compiles debug lines.

F: Formats listing for Teleprinter.

Q: Adds relative addresses of statements to listing.

X and Y: The X option declares all double precision variables and constants to default to 48 bits; variables may be explicitly typed to 64-bit double precision, but constants may not. The Y option declares all double precision variables and constants to default to 64 bits; variables may be explicitly typed to 48-bit extended precision, but constants may not.

I and J: The I option declares that all integer variables and constants default to 16 bits; either may be explicitly typed to 32 bits. The I option declares that all integer variables and constants default to 32 bits; either may be explicitly typed to 16 bits.

Ordering information

92834A RTE FORTRAN 4X

92834A FORTRAN 4X includes:
1. FORTRAN 4X compiler and library on software media option 020, 041, 050, or 051, one of which must be ordered.
2. RTE FORTRAN 4X Reference Manual (92834-90001).

92834A options

001: Provides discount to a user upgrading from previous version of 92834A to latest version if not enrolled in the Customer Support Service or Software Subscription Service.

020: Provides FORTRAN 4X software on 264x Mini cartridges.

041: Provides FORTRAN 4X software on 1.2M byte flexible disc.

050: Provides FORTRAN 4X software on 800 bpi magnetic tape.

051: Provides FORTRAN 4X software on 1600 bpi magnetic tape.

92834R Right to copy FORTRAN 4X compiler for use on an additional computer system

The 92834R Right to copy product is available only to customers who have purchased a license to use 92834A without an upgrade discount option. 92834R consists of:
1. The license to make one copy of software purchased with 92834A for use on an additional system.
2. RTE FORTRAN 4X Reference Manual (92834-90001).

92834R Option 001

Provides a discount for right to copy the 92834A +001 product or a 92834T/S update for a customer who has previously purchased the 92834R product.

Software support products available

See page 1-1.

HEWLETT PACKARD

BASIC/1000L
and BASIC/1000D

Hewlett-Packard's BASIC/1000L and BASIC/1000D are subsystems for conversational development, testing, and execution of Real-Time BASIC programs in computer systems managed by disc-based RTE-L/XL/II/IV/IVB real-time executive operating systems.

Features

● Concurrent multi-user development and execution of Real-Time BASIC programs in RTE-XL/IV/IVB
● Conversational programming
● Time and event scheduled operation for single user
● High-level subroutine calls for instrumentation, including multi-instrument clusters bus-connected via HP-IB*
● Easy access to disc file storage for programs and data or to IMAGE/1000 data base in RTE-IV/IVB/XL only
● Character string manipulation with string variables
● Support of bit manipulation
● Usability of subroutines or functions in FORTRAN or Assembly language
● Print with format control
● Ability to run BASIC or non-BASIC program as a subprogram

Functional description

Basic/1000L is a program-compatible subset of the disc-based BASIC/1000D. These BASIC language subsystems support the following capabilities.

Single-user and multi-user operation. The RTE host systems all support single-user operation. In systems with enough memory, multi-user operation can be provided by individually-identified copies of BASIC/1000L or D, each serving a different user. All active copies run concurrently with each other and with other programs in the RTE system, but only one copy can use time and event scheduling.

On-line program development. BASIC/1000L and D operate in either conversational (program development) or run (program execution) mode. In RTE, several copies of BASIC/1000L or D can be used for program development while another is running a program, so BASIC-programmed operations can be extended on-line.

Conversational program development. Real-Time BASIC programs are entered into the system via the system console or another terminal. BASIC checks each statement entered. If a statement contains an error, BASIC returns a message to help the user re-enter that statement correctly, in a conversational process. Program execution errors are flagged and corrected with similar ease.

Character string manipulation. Strings up to 255 characters long can be represented by variables. This provides a shorthand representation of frequently-used strings that can save programming time and effort. It also makes possible the extraction of string segments using subscripts and character-by-character comparison of two strings.

Real-time multi-tasking. The host RTE system provides a multi-program, multi-partition environment in which BASIC/1000L or D operates. This environment provides for multi-user operation via multiple copies of the BASIC. User's program code in each of these copies or in single-user BASIC/1000L or D is not just a single task, but can be subdivided into as many as 16 tasks that are BASIC subroutines. This subdivision helps the user to match the frequency, timing, and basis for execution of programmed task actions to the diverse needs of real-time applications. For one of the copies of BASIC in the system, task executions may be scheduled as a function of time or event interrupt (such as contact closure). (This requires the provision of time scheduling, which is optional in RTE-L). BASIC/1000L and D recognize priority levels from 1 through 99.

Print with formatting. A useful BASIC/1000L and D capability is the PRINT USING statement for specifying the format in which the variables specified in the statement are to be printed. This format can be in a literal string, a string variable, or in a special statement called the IMAGE statement. With PRINT USING:

● Numbers can be printed in integer, fixed point, and floating point representations.
● The exact position of plus and minus sign can be specified.
● String values can be printed in specified fields and literal strings and blanks can be inserted wherever needed.
● Full control of carriage returns and line feeds is possible.
● Arbitrary long lines can be printed without the carriage returns and line feeds normally provided by the PRINT statement.

Program testing. User requests are provided for tracing program execution, inserting up to four breakpoints, and for simulating execution of subroutine calls. These capabilities are helpful for testing programs on a system different from the target system in which they will be used.

Program statement renumbering. In BASIC/1000L and D, the user can systematically change program statement numbering with a simple command, without retyping statements, a capability that greatly facilitates insertion of additional program statements where needed.

*HP-IB (Hewlett-Packard Interface Bus) is Hewlett-Packard's implementation of IEEE Standard 488-1978, "Digital Interface for programmable instrumentation."

Disc storage of programs and data. BASIC programs are easily saved in named disc files, in either source or semi-compiled (faster-executing) form. The user can also create files on the disc for data storage and retrieval access with simple PRINT and READ program statements. Files are easily renamed or purged to meet changing needs.

Program linking. BASIC/1000L and D include CHAIN and INVOKE statements for automatically linking programs together so they run as one long program. The CHAIN statement in the current program retrieves a named program from the disc and starts it running from the first statement or any later statement number that is specified in the CHAIN statement. The INVOKE statement is more capable than the CHAIN statement. It can call BASIC or non-BASIC programs. INVOKEd programs can access previously-opened BASIC data files and use previously-enabled TRAPs. An INVOKEd program may INVOKE another program. When the current executing INVOKEd program terminates, control is returned to the program that called it.

Program editing. Using the interactive editor of BASIC, the user can edit characters within a statement line, leaving some characters unchanged, inserting characters, and replacing or deleting characters as desired.

Data base access. BASIC/1000L&D include an interface to the IMAGE/1000 Data Base Management System. This interface connects BASIC program calls to subroutines of IMAGE/1000, including the routines that open or close the data base, locate, read, update, add, or delete data, and lock or unlock the data base. *It is not usable in RTE-II or RTE-L.*

Functional specifications

Environment

BASIC/1000L: Disc based RTE-L/XL system with 64/128k bytes of memory.

BASIC/1000D: Disc based RTE-II system with at least 48k bytes of memory, or RTE-IV/IVB system with at least 128k bytes of memory.

Basis of BASIC task scheduling for execution

By operator, another task, time, or event (only one copy of BASIC can use time and/or event scheduling) in order of task priority.

BASIC task priority levels

1 through 99, the lowest number designating highest priority.

Program data types

- REAL data — a 32-bit quantity with sign, exponent, and mantissa, ranging from $\pm 2^{-127}$ to $\pm 2^{+127}$, with 6 to 7 decimal digit accuracy.
- STRING data — ASCII strings up to 255 characters long represented and manipulated by variables.
- OCTAL data — a 16-bit quantity including sign that can be entered into programs, manipulated, and output using the bit manipulation statements provided in HP Real-Time BASIC.

Program character set

- The 26 upper case letters A through Z.
- The ten digits 0 through 9.

- Special characters: blank; equals, greater than, less than, plus, minus, up arrow, and # signs; asterisk; slash; left and right parentheses and left and right brackets; quotation, apostrophe, and question marks; comma; colon; semi-colon; decimal and exclamation points; ampersand; and currency symbol.

Operator requests

BASIC/1000L	BASIC/1000D	Operator requests
X	X	Load program into memory.
X	X	Merge additional tasks or statements into program already in memory.
X	X	Run program that is in memory or stored on an off-line media.
X	X	List program that is in memory.
X	X	Save program that is in memory on flexible disc, cartridge disc, disc pack or mag tape in source format.
X	X	Save program that is in memory on flexible disc, cartridge disc, or disc pack in semi-compiled (faster executing) format.
X	X	Delete current program from memory.
X	X	Enter individual program statements, operator requests, or data inputs into system.
X	X	Delete a line(s) of program.
X	X	Interrupt or abort a running program.
X	X	Create a data file on disc or other device.
X	X	Purge program or data file from disc.
X	X	Rename program or data file on disc.
X	X	Request or release exclusive use of peripheral device.
X	X	Trace program execution for correcting program faults.
X	X	Set up program breakpoints for correcting program faults.
X	X	Display and/or set subroutine call variables for simulation of subsystems not in the host computer system.
X	X	Renumber program statements.

System requests from programs

BASIC/1000L	BASIC/1000D	System requests
X	X	Read from any non-disc input device.
X	X	Print on any non-disc output device.
X	X	Access disc via file manager.
X	X	Schedule task to be run at specified time, at specified intervals, and/or in response to specific event, including terminal keystroke.
X	X	Enable or disable self or other task.
X	X	Open or close files on disc or flexible disc.
X	X	Read from or write on disc.
X	X	Access data base via IMAGE/1000 interface.
X	X	Link from current program to another named program or program segment on disc.

Supported capabilities

BASIC/1000L	BASIC/1000D	Supported capabilities
X	X	Real-time operation program statements are provided for specifying task priority and time scheduling, and for linking event interrupts to tasks. (Time and event scheduling are usable by only one copy of BASIC/1000L or D during any particular execution period.)
X	X	Disc file access.
X	X	Access to IMAGE/1000 data base.
X	X	High-level calls to instrumentation and peripheral subsystems, including analog I/O, digital I/O, instruments on the Hewlett-Packard Interface Bus (HP-IB), mag tape I/O, and punched or mark-sense tab card input, in addition to CRT and hard copy terminals, line printers, and punched tape I/O subsystems.
X	X	Bit manipulation program statements are provided for examination, logical addition and multiplication, shifting and selective setting and clearing of digital word bit patterns.
X	X	Character string definition and manipulation: ASCII strings up to 255 characters long may be represented and manipulated through the use of string variables.
X	X	Chaining or linking together of program segments so they run as one long program.
X	X	Computation: real-time BASIC can call on 23 different standard functions and operators, including square root, exponentiation, logarithmic, logical, and trigonometric functions, as well as the base capabilities of addition, subtraction, multiplication, and division.
X	X	Decimal string arithmetic.
X	X	Formatted printing of numbers and character strings.

Software not supported

BASIC/1000L and D do not support the 92400A Sensor-Based DAS Utility Library or the 92413A ISA Fortran Extension Package. The 92840A GRAPHICS/1000 Graphics Plotting Software is not supported in BASIC/1000L and is not usable at the same time with BASIC/1000D in the RTE-II operating system.

Limitation in RTE-II or RTE-L

IMAGE/1000 calls cannot be made from BASIC programs in an RTE-II or RTE-L system.

Ordering information

92076A BASIC/1000L System (for use in RTE-L/XL System)

BASIC/1000L consists of:

1. BASIC/1000L resident library, subroutine library, including table generator, task scheduler, decimal string arithmetic interface, BASIC interpreter, and software numbering file on one of options 041 through 051, which must be ordered.
2. BASIC/1000L Real-Time BASIC Reference Manual (92076-90001).
3. RTE-L BASIC/1000L Software Installation Manual (92076-90002).

92076A BASIC/1000L options

041: Provides BASIC/1000L software on 1.2M byte flexible disc.

The following options are valid only for current RTE-IVB users with the 7970B/E mag tape subsystem who have 92070A/92071A (RTE-L/XL relocatables) on the RTE-IVB system and intend to also configure the BASIC/1000L subsystem for an L-Series operating system.

050: Provides BASIC/1000L software on an 800 bpi, 9-track mag tape in exact disc image format of a FMGR disc space.

051: Similar to option 050, above, but with BASIC/1000L on 1600 bpi, 9-track mag tape.

92101A BASIC/1000D (for use in RTE-II/IV/IVB system—Software on punched tape)

The 92101A BASIC/1000D System consists of the following items:

1. Multi-user real-time BASIC resident library, subroutine library including mag tape subroutines, table generator, task scheduler, IMAGE/1000 and decimal string arithmetic interfaces, 6940 and 2313 device subroutines, and relocatable alarm program.
2. BASIC Interpreter.
3. Multi-User Real-Time BASIC Programming and Operating Manual (92060-90016).
4. 92101A Software Numbering Catalog (92101-90001).

92101A BASIC/1000D Options

001: Provides discount to user upgrading from previous version of 92101A to latest version if not enrolled in the Software Subscription Service or Comprehensive Software Support service.

020: Replaces software items 1 and 2 in the standard 92101A listing above, with the same software modules on two 264x Mini cartridges.

Software support products available

See page 1-1.

The RTE Profile Monitor (RPM) is a software package designed to help users to speed 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 92068A RTE-IVB or 92067A RTE-IV.

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 often 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. Hewlett-Packard provides a full set of tools for microcode development in the 92061A RTE Microprogramming Package.

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
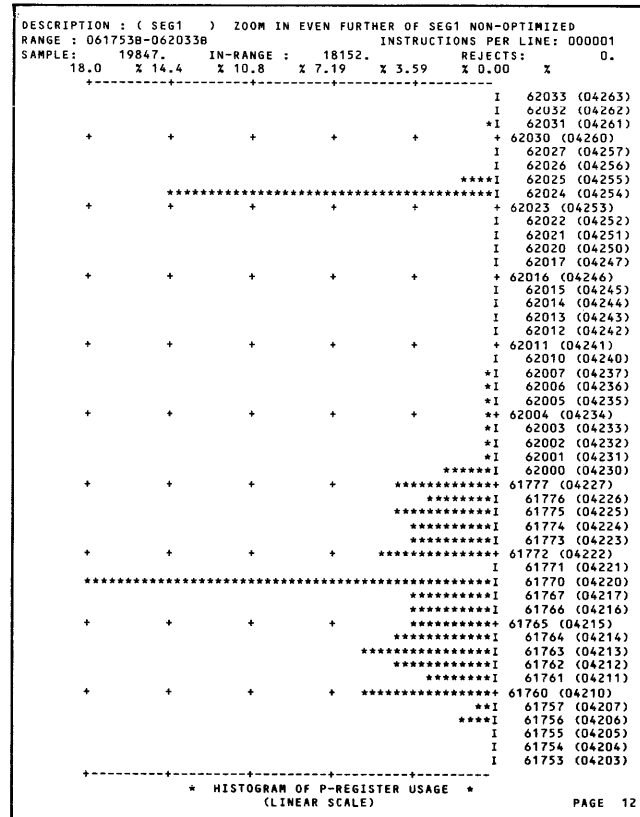
Sample RPM Program Activity Histogram

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)
                                               I  61275 (03607)
         .         .         .         .     + 61216 (03550)
                                               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
```

75.6% of activity is spent in this small area of code

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)
                                            *I  62007 (04237)
                                            *I  62006 (04236)
                                            *I  62005 (04235)
                                           **+ 62004 (04234)
                                            *I  62003 (04233)
                                            *I  62002 (04232)
                                            *I  62001 (04231)
                                        ******I  62000 (04230)
      +         +         +    *************I  61777 (04227)
                                  ********I  61776 (04226)
                                  ********I  61775 (04225)
                                  ********I  61774 (04224)
                                  ********I  61773 (04223)
      +         +         +    ***************I  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
```
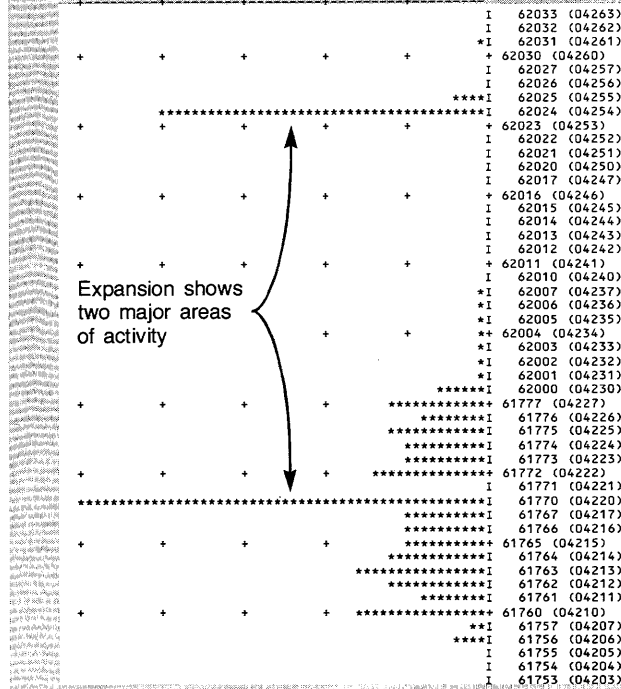
Expansion shows two major areas of activity

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  004200R      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 000028
0190          04275  000200       OCT 000200
0191                      J      BSS 000018
0192          04277  000001       OCT 000001
0193          04300  077777       OCT 077777
0194                      I      BSS 000018
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 92068A RTE-IVB or 92067A RTE-IV.

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

Products for the first-time single user

92083A RTE Profile Monitor

92083A RTE Profile Monitor includes:

1. RTE Profile Monitor software package on software media option 020, 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.

020: Provides RTE Profile Monitor software on 264x Mini cartridges.

050: Provides RTE Profile Monitor software on 800 bpi magnetic tape.

051: Provides RTE Profile Monitor software on 1600 bpi magnetic tape.

Products for additional use on multiple systems

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 1-1.

RTE microprogramming package

The 92061A is a support package for on-line development by the user of special microprogrammed instructions for HP 1000 Computers and Systems operating under the RTE-II or RTE-IV/IVB system.

Functional specifications

Environment

92001A RTE-II system with 92002A Batch-Spool Monitor or 92001B RTE-II system or 92067A RTE-IV system, or 92068A RTE-IVB system .

Memory usage

The WCS driver requires 2160 bytes of resident memory. Other programs in the RTE Microprogramming Package require an 16k byte background partition in RTE-II or an 18k byte partition in RTE-IV/IVB, including the 2k bytes required for base page in each RTE-IV/IVB disc-resident partition.

Microprogram capacity

The WCS Load Utility and Driver programs work with up to three 13197A WCS boards (3072 user instructions) in the Computer.

System requirements

Same as 92001B RTE-II system, 92067A RTE-IV system or 92068A RTE-IVB system.

PROM burn tape requirement

To output PROM burn tapes, a 12926A Tape Punch Subsystem will be required.

Ordering information

92061A RTE microprogramming package, with software on punched tape

The microprogramming package consists of:

1. RTE Microassembler, which translates symbolic HP 1000 Computer microprograms into micro object code, in standard format recognized by the Microdebug Editor, PROM mask tape generator, and the WCS Loader Utility. The source can be input from disc or a peripheral device; the micro object code can be output to a disc file or a tape punch.
2. RTE Micro Cross Reference Generator, which generates a cross-reference symbol table listing to aid debugging of microprograms.
3. RTE PROM Mask Tape Generator, which generates mask tapes to be used for burning PROMs from the object code produced by the Microassembler. The generator output can be specified to support a variety of mask tape formats.

4. RTE Microdebug Editor implemented as a main program provides for interactive loading, editing, testing, and debugging of microprograms in WCS.
5. RTE Microdebug Editor implemented as a user-callable subroutine provides for calling microprograms from user's programs.
6. RTE WCS Driver, which provides for read, write, write/ verify, and setup of base addresses of WCS cards, enabling and disabling of WCS cards, and reading the logical state of WCS cards.
7. RTE WCS Loader Utility, which loads 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 Mini cartridge option 020

Replaces the punched tape software modules listed under items 1 through 7, above, with software on one HP Mini cartridge for read-in by 264x Display Terminal.

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 1-1.

HEWLETT PACKARD

IMAGE/1000
Data Base
Management Systems

IMAGE/1000 is a general-purpose data base management software system designed for use in HP 1000 Computer Systems managed by HP's RTE-IVB/L/XL operating systems. Two different versions are offered. HP 92069A IMAGE/1000 with QUERY can be used under the RTE-IVB or RTE-XL system. The 92073A IMAGE/1000 without QUERY is usable under RTE-L as well as RTE-XL and RTE-IVB. Both versions of IMAGE/1000 provide a complete software package for consolidating large quantities of data into a single, interrelated data base that can be shared by many different people for a wide variety of purposes. In combination with Distributed Systems/1000 software, IMAGE/1000 services remote data base access requests.

Features

- IMAGE/1000 data bases can be restructured without needing to change your application programs
- Host language subroutines callable from Pascal, FORTRAN, BASIC, and Assembly language
- Minimum data redundancy through file consolidation
- Protection against unauthorized access at data base and data item level
- Data base capacity up to 960M bytes under RTE-IVB, 200M bytes under 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
- RTE-IVB IMAGE/1000 data base can be accessed remotely with DS/1000 or DS/1000-IV
- QUERY facility that enables the non-programmer to easily retrieve, alter, and report information using English-like commands

Reasons for using an IMAGE/1000 data base

Data independence

The description of the data is independent of the programs that access the data base. IMAGE/1000 maintains all the pointers necessary to logically relate the data. Programmers can access the data base without concern of 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 groups that use the data base. Use of the same data by different
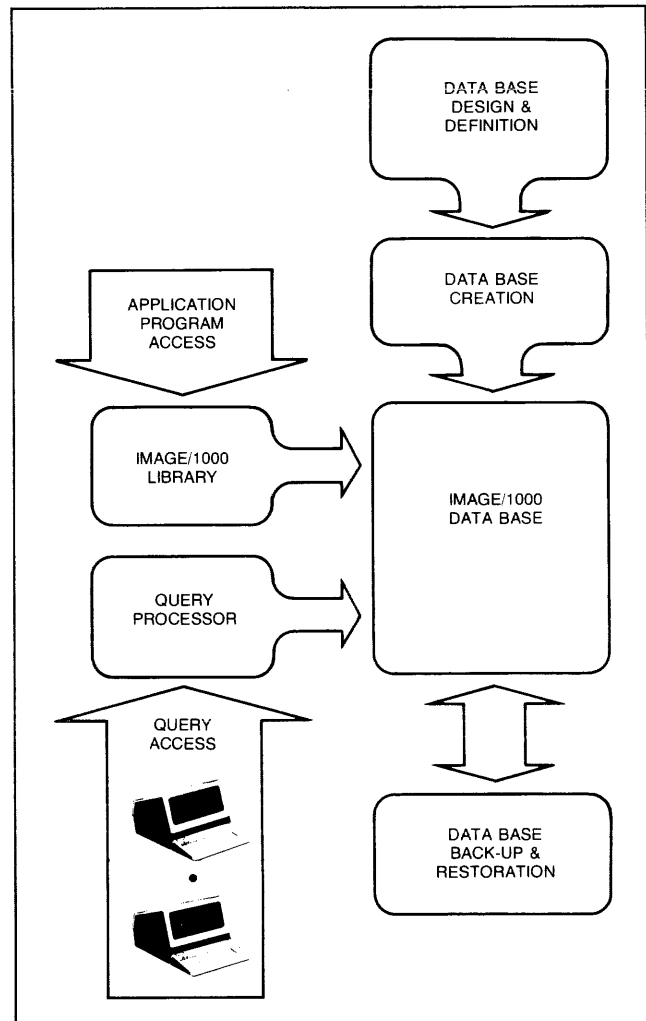
programs reduces data redundancy, since its not necessary to create and maintain data files for each application program. Physical storage requirements are reduced and only one set of data needs to be maintained. The problem of how to simultaneously update independent data files that contain redundant 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.

4-0

Data access

The data base can be accessed by either a user written application program or by the QUERY language facility included with 92069A IMAGE/1000. Application programs can be written in Pascal, FORTRAN, or Assembly language. The 92069A 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-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 System 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-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).
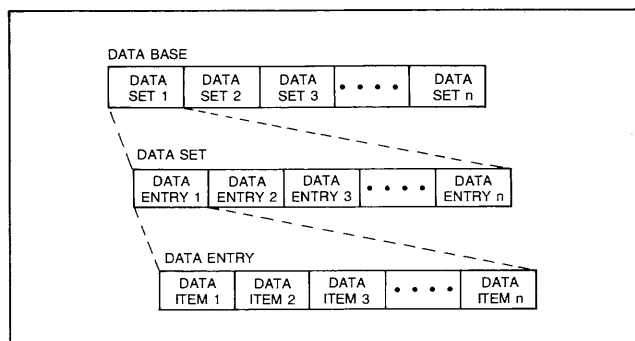
IMAGE/1000 supports master and detail data sets. Master data sets are a collection of key values used for fast access to information stored either in the master data set or a related detail data set. Master data sets can be linked to more than one item in a detail data set. Access to a data entry in a master data set may be calculated (hashed), based on the key value of the data entry. Access to data entries in a detail data set is usually via a key value that is chained from a related master data set. Data entries can also be accessed serially or directly. Master and detail data sets can be chained together as shown below.
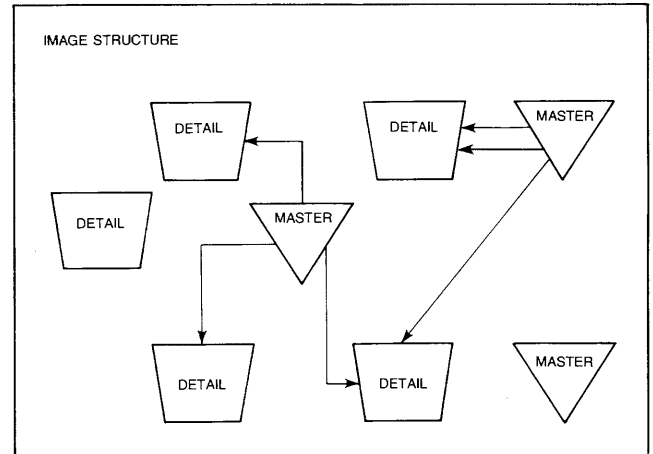
IMAGE/1000 components

To handle your information needs, IMAGE/1000 provides easy-to-use software for the following data base tasks:
- Creating the Data Base
- Querying the Data Base
- Host Language Access
- Maintaining the Data Base

Creating the data base

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

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

Querying the data base

A 92069A 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.

*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.

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 or DS/1000-IV allows an HP 1000 Computer System to execute QUERY at a remote DS/1000 node that has an RTE-IVB based 92069A 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 REMAT program. With both DS/3000 and DS/1000, 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, or Assembly language. HP 92069A IMAGE/1000 also supports access from Real-Time BASIC programs.

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-IVB 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-IVB is limited only by the total available storage, presently a maximum of 960M bytes in RTE-IVB (8 HP 7925 Disc Drives). Total size under RTE-L or RTE-XL 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-IVB. However, a data set cannot span multiple disc sub-channels, limiting the data set size to a maximum of 120M bytes (1 HP 7925 Disc Drive). Under RTE-L/XL, 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-IVB based IMAGE/1000 data base can be accessed from a remote DS/1000 node by QUERY and with a Pascal, FORTRAN, or Assembly language program using IMAGE/1000 subroutines. Software revision 2040 or later for DS/1000 (91750A or 91740A/B) is required.

Programming languages: FORTRAN IV, Pascal, and HP RTE Assembly language (and Real-time BASIC with 92069A).

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 and 92073A IMAGE/1000 are 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 92068A RTE-IVB or 92071A RTE-XL System for 92069A or 92073A used in RTE-IVB or RTE-XL, same as 92070A RTE-L system with 64k bytes of memory for 92073A used in RTE-L.

Approximate memory usage (bytes): IMAGE/1000 programs usually reside in large background partitions. In addition to the memory used by the various IMAGE/1000 programs listed overleaf, space may be required in the partition for the data base buffers and data control blocks. The data base buffers (0.3k bytes to 18k bytes depending on size and complexity of the user's data base) include a memory copy of the root file and the storage areas necessary for data set manipulation. The data control blocks (total of 0.6k to 9k bytes) are buffers used to communicate between the file buffers and the disc.

IMAGE Program		Program Size (Bytes)	Uses Data Base Buffers?	Uses Data Control Blocks?
Schema Processor:	DBDS	20k	Yes	No
QUERY		32k*	Yes	Yes
Utilities:	DBBLD	26k	Yes	Yes
	DBSTR	26k	No	No
	DBRST	26k	No	No
	DBULD	26k	Yes	Yes
	DBLOD	28k	Yes	Yes
	DBSPA	22k	Yes	Yes
	RECOV	12k*	No	No
	DBUP	28k	Yes	Yes
Access Control Program:	DBCOP	6k	No	No

*Add 2k bytes for support of execution from a remote DS/1000 node.

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 RTE-IVB or RTE-XL* use

The 92069A IMAGE/1000 Data Base Management System includes:
1. One of software media options 020, 041, 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 is effective with software revision 2101 and later revisions (higher revision numbers).

92069A Option 001

Provides discount for upgrade from 92063A or from previous version of 92069A for customer without 92069T/S.

92073A IMAGE/1000 Data Base Management System without QUERY for RTE-L/XL or RTE-IVB

The 92073A IMAGE/1000 Data Base Management System includes:
1. One of software media options 020, 041, 050, or 051, which must be ordered.
2. 92069-90001 IMAGE/1000 User's Manual.
3. 92073-90002 IMAGE/1000 Software Numbering Catalog.

92073A Options

001: Provides discount for upgrade from previous version of 92073A for customer without 92073T/S.

002: Provides discount to purchaser of 92069A for purchase of 92073A to be used on an additional computer. The purchase of 92069A must be at full list price (less any purchase agreement discount).

92069A and 92073A Media Options

020: Provides IMAGE/1000 software on 264x Mini cartridges.

041: Provides IMAGE/1000 software on 1.2M byte flexible disc.

050: Provides IMAGE/1000 software on 800 bpi, 9-track magnetic tape.

051: Provides IMAGE/1000 software on 1600 bpi, 9-track magnetic tape.

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 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.

92073R Right to Copy 92073A IMAGE/1000 software for use on an additional Computer System

The 92073R Right to copy product is available only to customers who have purchased a license to use 92073A at full list price (less any purchase agreement discount). 92073R consists of:
1. The right to make one copy of software purchased with the 92073A IMAGE/1000 Data Base Management System for use on an additional system.
2-3. Same as items 2 and 3 of 92073A, above.

92069R and 92073R Option 001

Discount for right to copy 92069A +001 or 92073A +001 product or 92069T/S or 92073T/S updates for customer who has previously purchased the 92069R or 92073R product.

Recommended additional equipment

In addition to the basic hardware required to support the host 92068A RTE-IVB or RTE-XL 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 1-1.

HP 92080A DATACAP/1000-II is a real-time data capture support package used with HP 3075A and 3076A Data Capture Terminals and the HP 3077A Time Reporting Terminal in HP 1000 Computer Systems managed by HP's disc-based RTE-IVB real-time executive operating system. Typical configurations are shown on the next page. DATACAP/1000-II functions include creation of transaction specifications, set-up of a data capture subsystem, on-line management of multiple HP data capture terminals, data entry validation checking, and serial recording of transactions and/or entry of data into an IMAGE/1000 data base.

Features

* Simple configuration and management of multiple data capture transactions running on multiple HP data capture terminals

* Easy creation and modification of transaction specifications, using menu form guidance on 264x CRT display terminal

* Direct recording of data onto mag tape or disc files

* Data entry direct to data sets in data base with optional IMAGE/1000 Data Base Management System as well as retrieval and updating from data capture terminals

* Automatic transaction logging and IMAGE data base recovery from a transaction file of data base modifications

* Support of user subroutines for special display, input validation, data entry, or storage procedures

* Security code can be used to protect data integrity and prevent unauthorized system access through the data capture terminals

* Automatic detection and recovery from data transmission error or power failure at any of the data capture terminals

* HP-IB and RS-232 devices can be dropped off of the data capture terminals and accessed directly by the HP 1000 via user-written subroutines

* Time schedulable start-up and shut-down

Purpose of DATACAP/1000-II

DATACAP/1000-II provides software support for entry of information (e.g., employee numbers, clock-in time, part numbers, work orders, test results, etc.) from multiple HP data capture and/or time reporting terminals directly into computer-readable storage media or an IMAGE/1000 data base.

A completely operational DATACAP/1000-II system tailored to the user's application can be established with a minimum of programming. DATACAP/1000-II is a complete package that manages multiple HP data capture terminals in accordance with user-defined transaction specifications. The transaction specifications are defined with the aid of a Transaction Generator Program that provides a guided, fill-in-the-blanks transaction specification process designed for
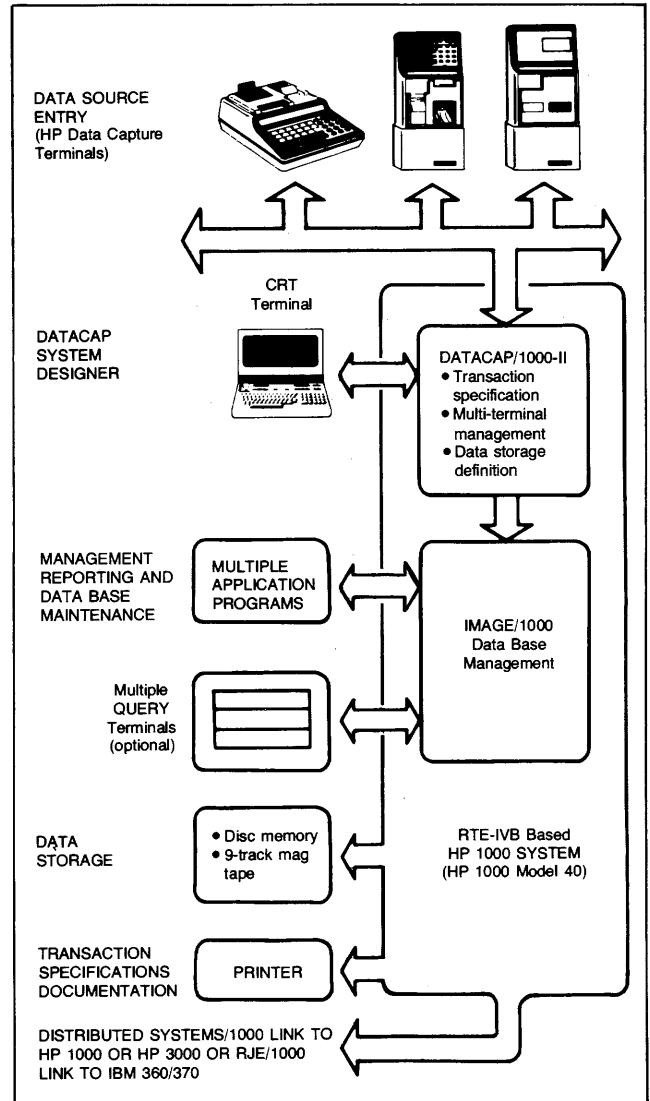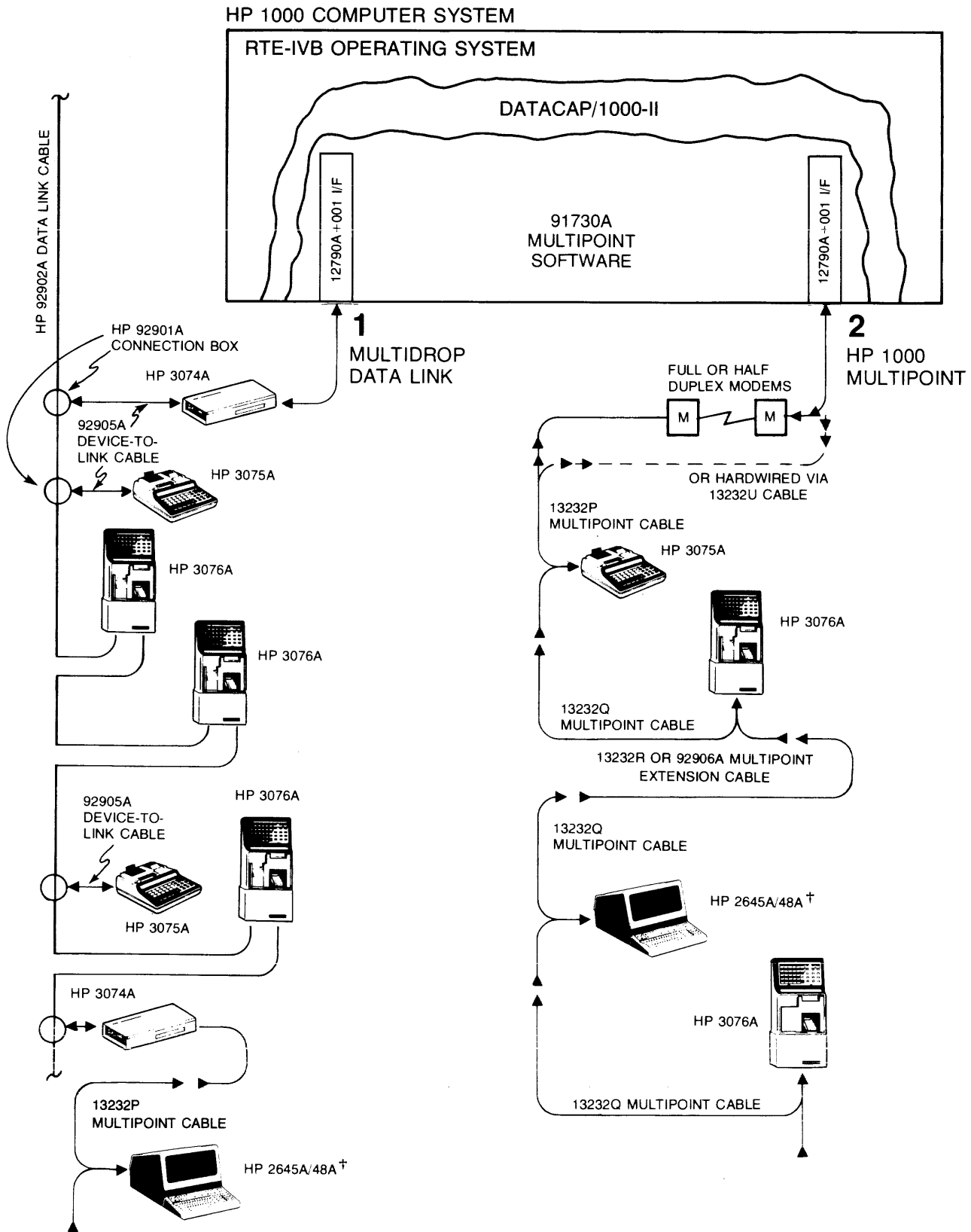

use by people who know what information must be captured by each transaction.

DATACAP/1000-II provides all of the basic tools needed for specifying and executing transactions at multiple HP data capture terminals. This includes checking and validation of entered data. For users with special display, input validation, data entry, and/or data recording requirements, DATACAP/1000-II provides linkage to user-written subroutines.

Use of a DATACAP/1000-II system bypasses the slow, costly, error-prone process of filling out handwritten forms, keypunching, and reading cards into the computer. The result is lower overall information processing costs and improved timeliness and accuracy.

Data capture terminal connection configurations

HP 1000 COMPUTER SYSTEM

RTE-IVB OPERATING SYSTEM

DATACAP/1000-II

12790A+001 I/F

91730A
MULTIPOINT
SOFTWARE

12790A+001 I/F

1

MULTIDROP
DATA LINK

2

HP 1000
MULTIPOINT

HP 92902A DATA LINK CABLE

HP 92901A
CONNECTION BOX

HP 3074A

92905A
DEVICE-TO-
LINK CABLE

HP 3075A

HP 3076A

HP 3076A

92905A
DEVICE-TO-
LINK CABLE

HP 3076A

HP 3075A

HP 3074A

13232P
MULTIPOINT CABLE

HP 2645A/48A †

FULL OR HALF
DUPLEX MODEMS

M   M

OR HARDWIRED VIA
13232U CABLE

13232P
MULTIPOINT CABLE

HP 3075A

HP 3076A

13232Q
MULTIPOINT CABLE

13232R OR 92906A MULTIPOINT
EXTENSION CABLE

13232Q
MULTIPOINT CABLE

HP 2645A/48A †

HP 3076A

13232Q MULTIPOINT CABLE

† The 2645A/48A CRT Display Terminals
are not under DATACAP control

Functional description

Terminal capabilities used by DATACAP/1000-II

DATACAP/1000-II can use all data capture capabilities available on the data capture terminals (see Figure 1). These include:

1. Numeric (std) or alphanumeric (optional) keyboard for data entry.

2. Numeric (std), alphanumeric (optional), or CRT (optional) display for echoing of operator's data entries or system-to-operator communication.

3. Special function keys for sending predetermined signals from the terminal to DATACAP.

4. Multifunction badge/card reader, optional on 3075A, 3076A, and 3077A, for data entry from Type III badges and/or standard punched or mark sense tab cards.

5. Type V badge reader, std on 3077A, optional on 3075A and 3076A for data entry from Type V industrial badges.

6. Alphanumeric printer, optional on 3075A and 3076A for selective printing of hard-copy of communications exchanged between the terminal and DATACAP/1000-II.

7. Magnetic strip reader (optional) for reading documents and embossed plastic badges encoded on track number 2 of the ISO Standard 3554.

8. Low cost bar code reader (optional) for data entry from bar code labels. The wand reads these codes:
   a. Industrial 2 out of 5.
   b. Matrix 2 out of 5.
   c. Code 39 (a registered trademark of Interface Mechanisms, Inc).

9. HP-IB and RS-232 ports (optional). User-written subroutines can access HP-IB or RS-232 devices interfaced to the data capture terminals so machine-collected data can be entered directly into the HP 1000.

For more information, see the 3075A, 3076A, and 3077A Data Capture Peripherals data sheet which is available from your Hewlett-Packard Sales Representative.
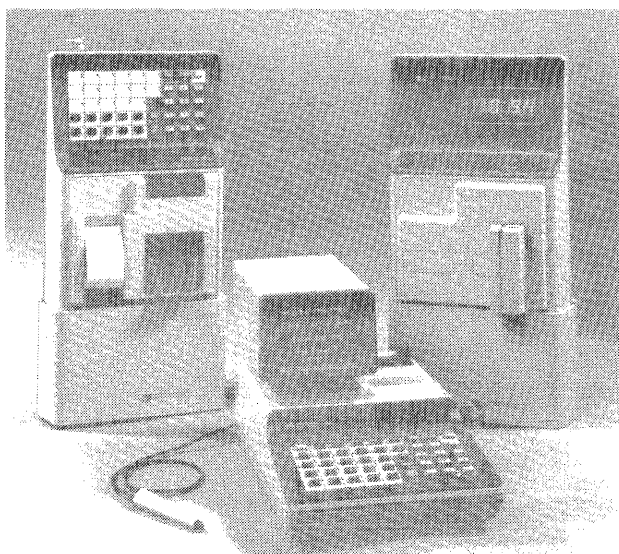

Figure 1. Wall-mounting and desktop data capture Terminals

The data entry Transaction

The Transaction is a process in which a set of related data items is entered into an HP data capture terminal. After data items have been accepted by DATACAP with respect to user specifications, they are recorded along with desired system-provided information (such as time of day) onto a user-specified medium (magnetic tape or disc file) or entered into an IMAGE/1000 data base on disc. Each item of the Transaction is requested by a prompting light that may ask a unique question (answerable only once) or a multiple question (which can be asked and answered repeatedly). Figure 2 compares the use of a printed form and a Transaction for entry of production data. Up to 20 questions can be specified in each transaction.

Paper form

PRODUCTION REPORT		Date: _____
(Employee's name)		
Work Order No.	Qty Compl.	Prod. Code

DATACAP/1000-II Transaction

EMPL#?	*(a unique question)*
W.O.#?	*(a multiple question)*
Qty Compl.?	*(a multiple question)*
Prod. Code?	*(a multiple question)*

The unique question is asked and answered once; the multiple questions are asked and answered repeatedly until the HP data capture terminal user presses one of the special function keys to signal "TRANSACTION COMPLETE". Date does not have to be entered by the terminal user because the system can furnish date and time.

Figure 2. Comparison of printed form and DATACAP/1000-II Transaction

As part of the transaction, a value retrieved from an IMAGE/1000 data base or provided by a user-written subroutine can be shown on the terminal display, or on the printer. The terminal user can then either enter a corrected value or return the original value without change, a capability that facilitates both the use and updating of data base information.

Data validation

Values entered into the HP data capture terminal may be submitted to validation checks selected from the following:

Data Type	Data Checks against
Integer numbers (no decimal point)	Maximum and minimum value limits
Real (decimal) numbers	Maximum and minimum value limits
Character strings	Permissible pattern of characters and numbers
Functions	Allowable answers for the question
Any of the above	IMAGE/1000 data base item

Any input that is an item in an IMAGE/1000 data base can be validated with a "check for existence" command which takes the entered data and attempts to match it up with an identical item in the data base. The next question will not be prompted to the operator until the match is made. This feature can be used to ensure data inputs fit a specific range of values that have previously been entered into the data base.

Data recording

Each accepted data item is stored temporarily by DATACAP until TRANSACTION COMPLETE is issued by the HP data capture terminal user. DATACAP then records the data (along with the transaction number, terminal identification, date, and/or the time of day, if requested) on one or more of the following:
- ADD, DELETE, or UPDATE of an IMAGE/1000 data base
- Magnetic tape
- Cartridge disc file
- Storage provided by the user via a user-written subroutine

Optionally, the data may also be directly logged to a disc file or a dedicated magnetic tape to ensure that the data has been saved and is not in a crash-vulnerable buffer and also to provide an audit trail. With this option, the data capture terminal user is not able to continue until the data is successfully stored on the log device, and is notified that data has been logged by a "beep" from the terminal. In the event of a mishap, the operator can use this log file to recover the data base from a known state.

Transaction selection

Each Transaction specification is assigned its own identification name and number and may also be assigned a security code. The user initiates Transaction selection by supplying the appropriate Transaction number, and security code if required, via the numeric keypad on the terminal or by a function key.

DATACAP/1000-II

DATACAP/1000-II consists of the following programs whose relationships are illustrated in Figure 3. These are:

1. The Data Capture Monitor program (DCMON) which is a convenient operator interface for accessing the other DATACAP programs. This monitor provides access to any DATACAP program by single "soft" key-stroke request from the data capture system designer's CRT terminal. However, all DATACAP programs can also be requested through the RTE system executive, so the use of the Data Capture Monitor is optional.

2. The Transaction Generator Program (TGP) is used by the data capture system designer for defining Transaction specifications to be run on the HP data capture terminals. Transaction specifications are saved in a Transaction Specification Library.

3. The Transaction Monitor Program Generator (TMPGN) is used by the data capture system designer to define the Transaction Monitor Program (TMP), which monitors a specific set of HP data capture terminals, user-written subroutines, and IMAGE/1000 data bases.
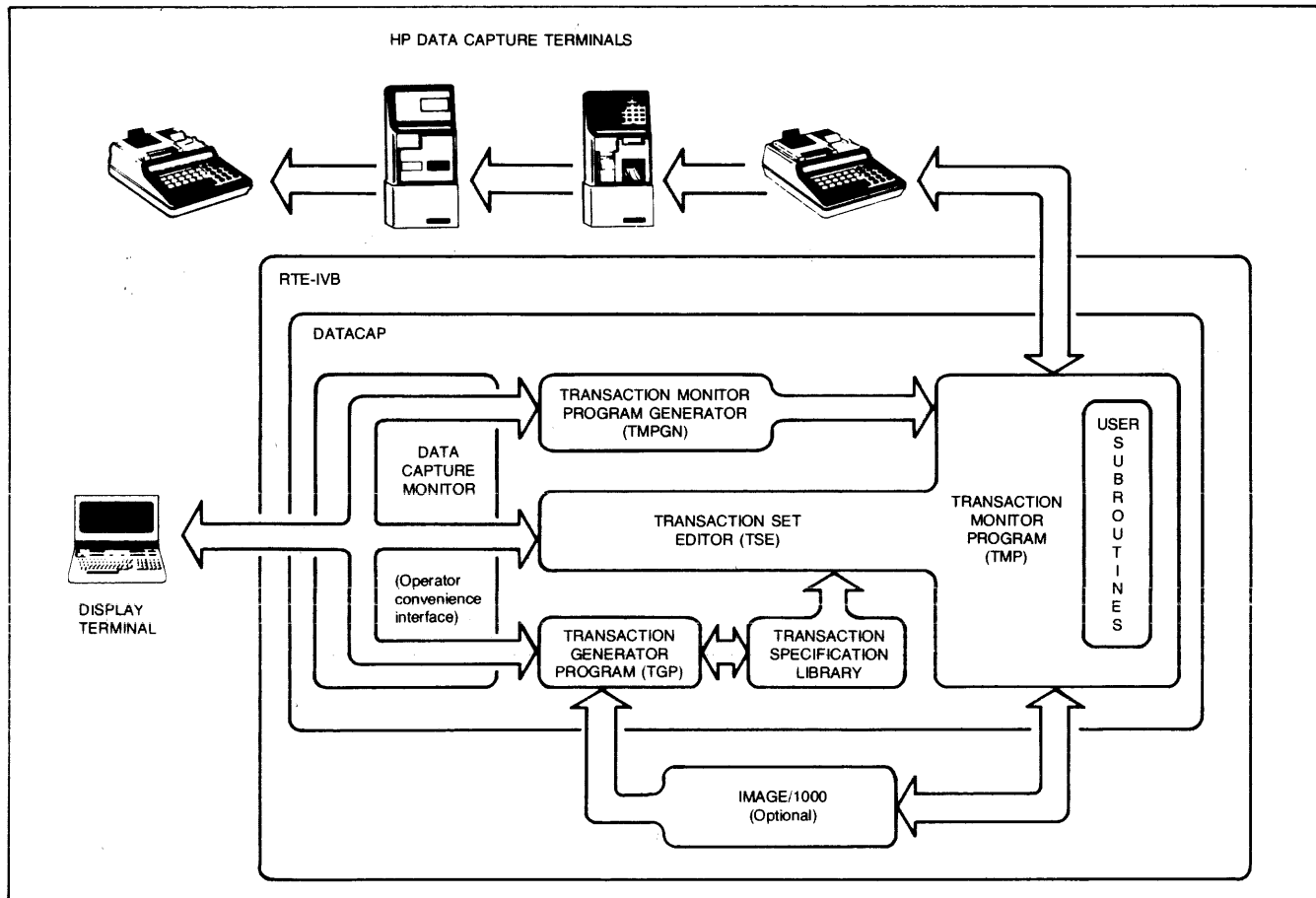

Figure 3. DATACAP/1000-II operational relationships

4-8

4. The Transaction Set Editor (TSE), part of the Transaction Monitor Program (TMP), is used by the data capture system operator to designate the set of Transaction Specifications that the controlling TMP program, defined in TMPGN, can access.

5. The Transaction Monitor Program (TMP) is the execution module of DATACAP. It responds to multiple terminal user's requests for data entry Transactions and receives, validates, and records the entries, or directs them to an IMAGE/1000 data base. (A single TMP can communicate with up to four IMAGE data bases.)

People involved in a Data Capture System

The following different types of people are involved in a data capture system.

1. The factory worker who enters data on a data capture terminal.

2. The DATACAP administrator/designer who creates and modifies the system, and its interface to other system functions, using the system console.

3. The managers and supervisors who access the timely and accurately collected data using the system console or other 2645A/2648A CRT display terminal and the QUERY capability of the IMAGE/1000 Data Base Management System to get information about where jobs are, how many parts have been made, etc.

4. The computer operator responsible for daily startup of DATACAP operations and maintenance of journal files, data bases, and/or user programs using the system console.

Implementing DATACAP

DATACAP/1000-II has been designed to be simple to use. Basically, implementation consists of the following five-step process:

1. Generate DATACAP into the RTE system. This can be done by your own in-house system manager, or it can be done for you by an HP Systems Engineer under HP's Software Consulting Service. Either way, the person performing this step must be familiar with DATACAP, RTE-IVB, and IMAGE, if used.

2. Via the Data Capture Monitor, access the Transaction Generator program (TGP) to generate Transaction Specifications. TGP steps through a series of CRT displays or "screens" providing tutorial guidance and spaces for "fill-in-the-blanks" entry of Transaction Specification details (questions, validation check criteria, media on which data is to be recorded, etc.).

3. Via the Data Capture Monitor, turn on the Transaction Monitor Program Generator (TMPGN) to configure the Transaction Monitor Program (TMP), defining which terminals the TMP is to control and which user-written routines, if any, may be accessed via the TMP. Although the TMP can communicate with up to four IMAGE/1000 data bases, no transaction specification can access more than one data base. A "fill-in-the-blanks" procedure simplifies configuration of the TMP.

4. Via the Data Capture Monitor, turn on the TMP and use the Transaction Set Editor (TSE) to define which Transaction Specifications are usable with it. This is also an easy-to-use, "fill-in-the-blanks" procedure.

5. Capture data.

Functional specifications

Maximum number of terminals

An HP 1000 Computer or System can support up to 56 HP data capture terminals. The number of terminals supportable by DATACAP/1000-II depends upon the following factors:

● Number of transactions per hour to be processed, i.e., response time required.

● Transaction complexity, such as IMAGE/1000 data base activity, user subroutines, etc.

● System main memory size.

Pre-purchase consultation with an HP System Engineer is strongly recommended to help you determine the number of terminals that should be supportable and the probable system performance in your application.

Communication with IMAGE/1000 data base

Transaction Monitor Program (TMP) can retrieve data from, and record data in up to four IMAGE/1000 data bases. No transaction specification can access more than one IMAGE/1000 data base. Any user program has read/write access to a data base that is under DATACAP control.

Computer compatibility

DATACAP/1000 is compatible with HP 2108, 2109, 2111, 2112, 2113, and 2117 Computers.

Compatibility with Session Monitor

DATACAP/1000-II does not use or require the Session Monitor in RTE-IVB and in certain respects may not be compatible with the Session Monitor. The DATACAP Configuration Guide (92080-90003) documents the particulars regarding DATACAP/1000-II compatibility with Session Monitor.

Data capture system requirements

HP 92080A DATACAP/1000-II is supported only on the 92068A RTE-IVB operating system, and therefore has the same minimum system requirements as the 92068A, plus the following additional requirements:

Data base software: If communication with an IMAGE/1000 data base is desired, 92069A IMAGE/1000 is required.

Data capture terminals: At least one (and up to 56) of any of the HP 3075A, 3076A, or 3077A, terminals.

Magnetic tape: A magnetic tape unit is strongly recommended if IMAGE/1000 is used.

System console: HP 2645A, 2647A, 2648A, 2649B, 2649C, or 2649G system console on which DATACAP/1000-II is readied for use must connect to the system via the 12966A +001 interface and must have the following options and accessories:

● Option 007: Mini cartridge I/O (not required on 2647A/49G)

● Option 032: Substitutes Extended Async Comm. Card for standard comm. card

● 13231A Display enhancements with line drawing character set

Memory: High performance memory is mandatory for performance critical applications. All published performance data assumes high performance memory.

Fast FORTRAN Processor firmware: 12977B for 2108 or 2112 Computer, 13306A for 2109 or 2113 Computer.

RTE-IVB system memory requirements: The RTE-IVB system configured to support DATACAP/1000-II has the following memory requirements:
System code and tables: 56k bytes.
System available memory: 12k bytes.
System common for DATACAP use: 4k bytes.

DATACAP/1000-II memory partition requirements: The following partitions are required for DATACAP/1000-II:
DATACAP/1000-II application code: 122k bytes.
Buffering for data capture terminals: 54k-404k bytes (see Table 1), using RTE-IVB mother partition.

Optional memory partitions: The following partitions are required for optional DATACAP/1000-II capabilities:
Each IMAGE/1000 data base accessed: 56k bytes.
For interfacing with user subroutines: 10k bytes, variable, for the user subroutines.
Transaction generator program: 40k bytes, to avoid swapping if creating transactions concurrently with real-time data capture operations.
DS/1000 network communications: 6-25k bytes, depending upon remote access capabilities supported.

Table 1. Memory buffering requirements by number of Data Capture Terminals

No. of Terminals	Buffer Size	No. of Terminals	Buffer Size	No. of Terminals	Buffer Size
1 - 5	54 kb	21 - 25	194 kb	41 - 45	334 kb
6 - 10	89 kb	26 - 30	229 kb	46 - 50	369 kb
11 - 15	124 kb	31 - 35	264 kb	51 - 56	404 kb
16 - 20	159 kb	36 - 40	299 kb		

Ordering information

92080A DATACAP/1000-II Data capture software package, including:

1. DATACAP/1000-II software on one of software media options 020, 050, or 051, which must be ordered.
2. DATACAP/1000 Programming and operating manual (92080-90001).
3. DATACAP/1000-II Software Numbering Catalog (92080-90002).
4. DATACAP/1000-II Configuration Guide (92080-90003).

92080A options

001: Provides a discount for upgrade from previous revision to latest revision for customers without 92080S/T.

020: Provides DATACAP/1000 software on Mini cartridges.

050: Provides DATACAP/1000 software on 800 bpi, 9-track mag tape.

051: Provides DATACAP/1000 software on 1600 bpi, 9-track mag tape.

92080R Right to copy DATACAP/1000-II for use on an additional computer system

The 92080R Right to copy product is available only to customers who have purchased a license to use 92080A without an upgrade discount option. (92080R +001, listed below, is available to customers who have previously purchased one or more 92080R products and wish to upgrade those products from 92080A +001 software.) 92080R consists of:

1. The license to make **one** copy of software purchased with the 92080A DATACAP/1000-II for use on an additional system.
2. All manuals (items 2-4) furnished with 92080A.

92080R +001 Right to copy 92080A +001 DATACAP/1000-II to update one existing 92080R product

The 92080R +001 Right to copy product is available to customers who have previously purchased a 92080R product and who now wish to upgrade their "R" product from 92080A +001 software (or a 92080S/T update).
92080R +001 consists of:

1. The license to make **one** copy of a DATACAP/1000 software upgrade purchased as 92080A +001 (or obtained as a 92080S/T update) for use on an additional system.
2. All manuals (items 2-4) furnished with 92080A.

Software support products available

See page 1-1.

HEWLETT PACKARD

Signal/1000 Digital Signal Processing Package for HP 1000 F-Series Computers and 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 2111F and 2117F Computers and HP 1000 Model 45 Computer Systems.

Required accessory: 12824A Vector Instruction Set and associated 12791A Firmware Expansion Module.

Control store location requirement: Four 256 word modules (56 through 59) in 2111F/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: 92068A RTE-IVB operating system and 92834A FORTRAN 4X compiler. The Signal/1000 subroutines are also callable from Pascal/1000 and BASIC/1000D.

Ordering information

Products for the first-time single user

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 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 Options

050: Provides Signal/1000 software on 800 bpi magnetic tape.

051: Provides Signal/1000 software on 1600 bpi magnetic tape.

Products for additional use on multiple systems

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 1-1.

The HP 24397A and 24600A Diagnostic Packages provide stand alone testing of the L-Series CPU, memory, and its set of interface cards. Diagnostic software can be loaded into memory from flexible disc or a 264x Terminal with Mini cartridge tape unit.

Features

- Verification by the kernel diagnostic of all CPU instructions, memory, I/O logic and processor functions such as interrupt handling, timebase generator, memory protect, parity checking and direct memory access (DMA)
- An interface diagnostic written in Diagnostic Design Language for each of the following L-Series interface cards:

  12005A — Asynchronous Serial Interface
  12006A — Parallel Interface
  12007A — HDLC Modem Interface
  12008A — PROM Card
  12009A — HP-IB Interface
  12044A — HDLC Direct Connect Interface

- Test hoods for complete verification of interface cards
- "BASIC-like" Diagnostic Design Language interpreter for easier user diagnostic design for user-designed interfaces and specialist level diagnosis
- All diagnostic software on a single medium of user's choice
- Remote diagnosis capability via phone lines using Bell 103 modem and the virtual control panel (VCP)

Configuration requirements

L-Series processor: 2103L/LK Computer or HP 1000 L-Series System.

Memory: 32k bytes, minimum.

Loading devices: Cartridge tape unit on a 264x Terminal, or a double density double sided flexible disc drive.

Console device (needed only for running the Diagnostic Design Language and optional for running any of the interface diagnostics): Any HP 1000 L-Series compatible 26xxA terminal connected to the computer via a 12005A Asynchronous Serial Interface.

Ordering information

24397A Diagnostic Package, consisting of:

1. The following modules on one of media options 020 or 041, which must be ordered:
   a. Kernel Diagnostic for CPU functions
   b. Diagnostic Design Language
   c. 24397A Software numbering file
   d. 12005A Async Serial Interface Diagnostic
   e. 12006A Parallel Interface Diagnostic
   f. 12008A PROM Storage Module Diagnostic

   g. 12009A HP-IB Interface Diagnostic
   h. 12002A/B XL Memory Diagnostic
2. A binder containing the following manuals:
   a. Hardware Troubleshooting for HP 1000 L-Series Computers Manual (24397-90001).
   b. Kernel Diagnostic Operating Manual (24397-90002).
   c. Diagnostic Design Language (DDL) Operating and Programming Manual (24397-90003).
   d. HP 12005A Async Serial Interface Diagnostic Operating Manual (24397-90005).
   e. HP 12006A Parallel Interface Diagnostic Operating Manual (24397-90006).
   f. HP 12008A PROM Storage Module Diagnostic Operating Manual (24397-90008).
   g. HP 12009A HP-IB Interface Diagnostic Operating Manual (24397-90009).
   h. 12002A/B XL Memory Diagnostic Manual (24397-90010).
3. Test hoods 24397-60003 for verification of 12005A Asynchronous Serial Interface and 24397-60004 for verification of 12006A Parallel Interface.

24600A Diagnostic Package, consisting of:

1. The following modules on one of media options 020 or 041, which must be ordered:
   a. PSI Diagnostic
   b. 24600A Software numbering file
2. A binder containing the PSI Diagnostic Reference Manual (24600-90001).
3. Test hoods 5061-3453 for verification of 12007A HDLC Modem Interface and 5061-3460 for verification of 12044A HDLC Direct Connect Interface.

24397A and 24600A options

020: Diagnostic software on phase-encoded Mini cartridges for 264x Terminal with Mini cartridge I/O.

041: Diagnostic software on double sided, double density flexible disc.

24397A and 24600A in HP 1000 L-Series Systems

The 24397A and 24600A L-Series Diagnostic Packages are included in HP 1000 L-Series Systems.

24397S and 24600S Diagnostic Subscription Service

Provides all diagnostic routines, operating manuals, and test hoods included in the 24397A or 24600A 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 24397A or 24600A Diagnostic Package must be specified when ordering 24397S or 24600S. The 24397S or 24600S service is priced in monthly units and is billable quarterly.

HEWLETT PACKARD

On-line diagnostic and verification package for HP 1000 Computer Systems

product number 91711A

The On-line diagnostic and verification package is a group of diagnostic and verification programs that run in the RTE-IVB, RTE-IVE, or RTE-M 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.

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 HP 92068A RTE file manager.
   c. 91740x DS/1000 Distributed systems communication.
   d. HP 59310B HP-IB interface.
   e. HP 26xx Operator terminal operation under DVR05, DVA05, multipoint, and DVR00.
   f. HP 7970B/E Mag tape unit operation.
   g. Line printer operation.
   h. HP 3070 Data Capture Terminal operation under DVA47.
   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
- 21 different on-line verification programs

Functional specifications and usability

The 91711A 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

91711A On-line diagnostic and verification package

The 91711A 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 (91711-90001).

91711A Options

001: Provides discount to user upgrading from previous version of 91711A to latest version if not enrolled in the Customer Support Service or Software Subscription Service.

020: Provides On-line diagnostic and verification package software on 2645A/47A/48A Mini cartridges.

050: Provides On-line diagnostic and verification package software on 800 bpi magnetic tape.

051: Provides On-line diagnostic and verification package software on 1600 bpi magnetic tape.

Software support products available

91711S Software Subscription Service for 91711A software (same media option as 91711A)

91711Q Manual Update Service for 91711A software manual

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Table 1. 91711A On-line diagnostic and verification usability summary

91711A Routines	Memory Required Pages &	(bytes)	Op Sys Usability RTE-M	RTE-IVB/E	Computer Usability F-Series	E-Series	M-Series
ON-LINE DIAGNOSTIC PROGRAMS							
Hardware Floating Point Processor diagnostic	5	(10k)	Yes	Yes	Yes	No	No
Scientific Instruction Set diagnostic	5	(10k)	Yes	Yes	Yes	No	No
Extended Memory Area firmware diagnostic	7	(14k)	No	Yes	Yes	Yes	No
Vector Instruction Set diagnostic	12	(24k)	No	Yes	Yes	No	No
ON-LINE VERIFICATION PROGRAMS							
Main central processing unit verification	6	(12k)	Yes	Yes	Yes	Yes	Yes
Memory verification	3	(6k)	No	Yes*	Yes	Yes	Yes
Supported F/E-Series firmware verification	9	(18k)	Yes	Yes	Yes	Yes	No
Disc plus RTE file manager verification	10	(20k)	No	Yes	Yes	Yes	Yes
Distributed systems verification (91740x only)	6	(12k)	Yes	Yes	Yes	Yes	Yes
HP-IB interface verification	6	(12k)	Yes	Yes	Yes	Yes	Yes
Mag tape verification	9	(18k)	Yes	Yes	Yes	Yes	Yes
Line printer verification	8	(16k)	Yes	Yes	Yes	Yes	Yes
2645A/47A/48A Terminal plus DVR05/DVA05 verification	9	(18k)	Yes	Yes	Yes	Yes	Yes
2645A/48A Multipoint Terminal verification	7	(14k)	Yes	Yes	Yes	Yes	Yes
RS-232C Terminal plus DVR00 verification	7	(14k)	Yes	Yes	Yes	Yes	Yes
HP 3070A/B plus DVA47 verification	6	(12k)	No	Yes	Yes	Yes	Yes
HP 3075A/76A/77A plus multipoint verification	17	(34k)	No	Yes*	Yes	Yes	Yes
ICD memory/MAC disc verification	14	(28k)	No	Yes*	Yes	Yes	Yes

* Not usable in RTE-IVE.

RTE measurement and control software package

product number 92066A

The 92066A Package contains drivers, device subroutines, and on-line and off-line verifications and diagnostics that support the measurement and control subsystems which are compatible with HP 2108, 2109, 2111, 2112, 2113 and 2117 Computers. It also includes the ISA FORTRAN Extension Package. The software and manuals provided are summarized in the table below.

Software Items	Approx. Memory Required	Software Part No.	Manual Part No.	Instruments and Functions Supported
Driver DVR62 for RTE-II, RTE-MI, RTE-MII	1,100 bytes	29009-60001	29009-93001	2313B Analog I/O Subsystem and 12764A and 12765A Extenders (including operation in 9603R or 9611R-100 Remote Measurement and Control Station) and 91000A Plug-in Analog-to-Digital Interface card. Note: Class I/O calls with the 2313B or 91000A are not supported in RTE-IV/IVB.
Driver DVR62 for RTE-III, RTE-MIII	1,330 bytes	02313-16001		
Driver DVR62 for RTE-IV/IVB	1,170 bytes	02313-16004		
Device subroutine R2313	750 bytes	29011-60001		DVR62 and R2313 support single-channel, sequential, or random-scan measurement of specified analog input channels in 2313B or 91000A, pacer control optional in 2313B. These routines also support setting and reading the gain of 2313B low-level multiplexer channels.
Device subroutine P2313	150 bytes	29011-60002		P2313 supports setting of pace rate and starting and stopping of programmable pacer.
Device subroutine D2313	370 bytes	29011-60004		D2313 supports output of one or more digital values in analog form from one or more DAC output channels, pacer control optional.
Remote microcircuit diagnostic		09610-16001	09610-93014	09610-60044 Remote Microcircuit Card for 9603R and 9611R Remote Measurement and Control Stations.
On-line verification	15,200 bytes	02313-16002		2313B Analog I/O Subsystem and 12764 and 12765A Extenders only, including operation in 9603R or 9611R-100 Remote Measurement and Control Stations.
Off-line verification		09611-16014		2313B Analog I/O Subsystem, including operation in 9603R or 9611R-100 Remote Measurement and Control Station, and 91000A Plug-in Analog-Digital Interface Card.
Driver DVA72 On-line verification	1,770 bytes 8,000 bytes	09611-16005 09611-16006	29100-93003 09611-90010	91063A (6940B) Digital I/O Subsystem and 91140A (6941B) Extenders (including operation in 9603R-T19 or 9611R Remote Measurement and Control Station).
Device subroutine for verification	840 bytes	09611-16015		DVA72 supports exec calls to read a specified number of digital input words from one or more specified digital input card channels and exec calls to write a specified number of digital output words to one or more specified digital or DAC card output channels.
Sense routine for verification	750 bytes	09611-16007		
92413A ISA FORTRAN Extension Package:			9610-93003	2313B and 91000A Analog I/O Subsystems and 91063A Digital I/O Subsystem, including use of the 2313B and 91063A in 9603R and 9611R Remote Measurement and Control Stations and including 12764A, 12765A, and 91140A Extenders.
On-line Table Generator	10,200 bytes	92413-12001		Generates linkage table connecting user's ISA FORTRAN format program calls to appropriate driver and/or executive subroutines.
Off-line Table Generator	13,400 bytes	92413-16011		
TRPNT Routine	110 bytes	92413-16006		Dummy routine required if BASIC is not in system.
Event Sense Interrupt Program	1,050 bytes	92413-16007		Determines which event sense/interrupt card in the 91063A Digital I/O Subsystem has issued an interrupt.
Event Sense Routine	1,100 bytes	92413-16008		Sets up or disconnects a linkage between a given event and a program.
Stall Program	250 bytes	92413-16009		Repeatedly resets timer card in 91063A Digital I/O Subsystem before it times out; failure of the system, but not the digital I/O subsystem, triggers a stall alarm connected to the timer card when it times out because it has not been reset.
ISA FORTRAN Library	6,000 bytes	92413-16010		Provides the additional routines and program calls to driver that are summarized in table on next page.

PASCAL	FTN	BASIC	ASMB	SUBROUTINES AND FUNCTIONS
				Executive interface routines
X	X	B	X	START Starts named program after parameter-specified delay.
X	X	B	X	TRNON Starts named program at parameter-specified time of day.
X	X	B	X	WAIT Suspends execution of requesting program for parameter-specified delay.
				Analog input w/2313B Analog I/O Subsystem
X	X		X	AISQ Requests sequential analog input with integer data.
X	X		X	AISQW Is AISQ with wait for completion.
X	X		X	AIRD Requests analog input from channels sampled in random order, using channel numbers from an array, with integer data.
X	X		X	AIRDW Is AIRD with wait for completion.
X	X	B	X	AISQF Requests sequential analog input with real data.
X	X	B	X	AIRDF Requests analog input from channels sampled in random order, using channel numbers from an array, with real data.
				Analog output w/2313B Analog I/O Subsystem
X	X		X	AO Requests analog output of integer data from array via analog output channels listed in another array.
X	X		X	AOW Is AO with wait for completion.
X	X	B	X	AOF Requests analog output of real data from array via analog output channels listed in another array.
				Digital input/output w/6940B Digital I/O Subsystem
X	X	B	X	DI Requests input of digital words to an integer array via digital input channel numbers listed in another array.
X	X	B	X	DIW Is DI with wait for completion.
X	X	B	X	DOM Requests momentary digital output of digital words in an integer array via digital output channel numbers listed in another array. A parameter specifies length of time that each output is to remain set.
X	X	B	X	DOMW Is DOM with wait for completion.
X	X	B	X	DOL Requests latching digital output of digital output words in an integer array via digital output channel numbers listed in another array, with the further possibility of modifying the output with masking bit patterns stored in a third array.
X	X	B	X	DOLW Is DOL with wait for completion.
				Bit manipulation
X	X	B	X	IEOR Requests exclusive OR of integers i and j.
X	X	B	X	ISHFT Requests shift of m by n digits right (−) or left (+).
				Event sense
X	X		X	EVSNS Sets up or removes a linkage between a specified event sense channel and a specified program.
				Auxiliary Analog I/O Subsystem Routines
X	X	B	X	NORM Initializes 2313B Analog I/O Subsystems.
X	X	B	X	SGAIN Sets gain of specified low-level multiplexer channel.
X	X	B	X	RGAIN Reads gain previously entered for a specific channel.
X	X	B	X	PACER Sets subsystem pace rate of the programmable pacer.
				Special Digital I/O Subsystem Functions
X	X		X	FREQ Measures frequency using pulse counters addressed by digital I/O channel number.
X	X		X	PSET Presets pulse counters which are addressed by digital I/O channel number. Completion of a preset count can be used to interrupt the system and schedule a program via the EVSNS routine.
X	X		X	STEP Steps a stepping motor 'N' pulses clockwise or counter-clockwise.
X	X		X	STEPW Is STEP with wait for completion.
				Stall alarm program
X	X		X	STALL Prevents issuance of an alarm contact closure while the system continues to reschedule the STALL program, resetting a programmable timer card in the digital I/O subsystem. The digital I/O subsystem must also continue to function.

B = *Routine in Real-Time BASIC library similar to the routine listed here as part of ISA FORTRAN Extension Package.*

The 92066A Package contains drivers, device subroutines, and on-line and off-line verifications and diagnostics that support the measurement and control subsystems which are compatible with HP 2108, 2109, 2111, 2112, 2113 and 2117 Computers. It also includes the ISA FORTRAN Extension Package. The software and manuals provided are summarized in the table below.

Ordering information

92066A RTE measurement and control software package (Software on punched tape)

The 92066A package consists of the software modules (on punched tape) and manuals that are listed in the facing table, plus the 92066-90001 Software Numbering Catalog.

92066A Mini cartridge option 020

Replaces software on punched tape with the software on 264x Mini cartridges.

Software support products available

See page 1-1.

product number 92400A

The 92400A Sensor-Based DAS Utility Library is a collection of routines and functions usable in FORTRAN and Assembly programs providing ready-to-use calculation capabilities that have proven helpful to Hewlett-Packard computer system users. The standard libraries satisfy all of the externals required by the DAS Library.

Ordering information

92400A Sensor-Based DAS Utility Library

The 92400A consists of the following items (software is on punched tape).
1. DAS Utility Library Manual (92400-93001).
2. Thermocouple Linearization Package, relocatable and source programs.
3. Humidity Package, relocatable and source programs.
4. Statistical Analysis Package, relocatable and source programs.
5. Code Conversion Package, relocatable and source programs.
6. Curve Fit Package, relocatable and source programs.
7. Interpolation Package, relocatable and source programs.
8. Integration Package, relocatable and source programs.
9. HP 2240 High Speed Read package, relocatable and source programs.
10. Bit Manipulation and Executive Interface Package, relocatable and source programs.
11. 92400A Software Numbering Catalog (92400-93003).

92400A Mini cartridge option 020

Replaces software on punched tape with software on 264x Mini cartridges.

Software support products available

See page 1-1.

92400A Sensor-Based DAS Utility Library
Subroutines and Functions

Thermocouple Linearization
FECON Converts Iron-Constantan thermocouple output voltage to °C/°F with correction of non-linearity.
CRALM Converts Chrome-Alumel thermocouple output voltage to °C/°F with correction of non-linearity.
CUCON Converts Copper-Constantan thermocouple output voltage to °C/°F with correction of non-linearity.

Humidity Calculations
PPDWR Calculates vapor pressure from dew point temperature.
PPRH Calculates vapor pressure from relative humidity.
PPBLB Calculates vapor pressure from wet and dry bulb temperatures.
RHDWP Calculates relative humidity from dew point temperature.
RHBLB Calculates relative humidity from wet and dry bulb temperatures.

Data Interpolation
FRSTU Performs first-order interpolation of uniformly-spaced data.
SCNDU Performs second-order interpolation of uniformlyspaced data.
FRSTR Performs first-order interpolation of randomly-spaced data.
SCNDR Performs second-order interpolation of randomlyspaced data.

Statistical Analysis
STATF Calculates mean and standard deviation of fixed array of real data.
STATI Calculates mean and standard deviation of fixed array of integer data.
HISTF/HISTB Generates histogram of fixed array of real data.
HISTI Generates histogram of fixed array of integer data.
INTLF/INTLB Initializes for recording of running real data.
INTLI Initializes for recording of running integer data.
RCRDF/RCRDB Records running real data.
RCRDI Records running integer data.
REPRT Reports mean and standard deviation and number of data points after recording of running data.

Code Conversion
ASCEB Converts ASCII to EBCDIC.
EBCAS Converts EBCDIC to ASCII.
ASCBC Converts ASCII to BCD.
BCDAS Converts BCD to ASCII.

Curve Fitting
CRVFT Fits user's data to any of six different standard functions.

Data Integration
FAREA Performs numerical integration of a fixed array of data.
STRTA Initializes for integration of running data.
AREA Computes latest value of running integral.

HP 2240A High Speed Read Package
R2240 Reads ASCII record from 2240A.
C2240 Converts ASCII characters from 2240A to integer data.

Executive Interface Routines
START Starts a program immediately, or after a specified time delay.
TRNON Starts a program at a specific time.
WAIT Suspends execution of a program for a specified interval.

Bit Manipulation
IEOR Requests Exclusive OR of two integers.
ISHFT Shifts a digital word a specified number of bit positions left or right.

HEWLETT PACKARD

GRAPHICS/1000
Graphics plotting software

The 92840A Graphics Plotting Software is the basic GRAPHICS/1000 software product for use in HP 1000 Computers and Systems operating under the RTE-M, RTE-IV, or RTE-IVB real time executive system. This package offers a powerful set of application-independent subroutines for the FORTRAN, Pascal, BASIC, or Assembly language programmer. Its device independence also makes possible the support of a wide variety of Hewlett-Packard graphics output devices, currently including the HP 1350S* Graphics Display System, 2608A Line Printer, 2647A/48A/49C/49G Graphics Terminal, the 7221A/B/S, 7225A+17601A, and 9872A/B/S Graphics Plotters, the 7245A/B Plotter/Printer, and the 9874A Digitizer.

Features

- 53 device-independent plotting subroutines
- User-defined world coordinate system for data plotting
- Automatic axis and grid drawing and labeling
- Easy development of application programs for interactive graphics, picture handling, and creation of graphical data structures
- Software text with choice of six different completely controllable fonts for varied annotation of graphs, preparation of vue graphs using various type styles
- Usability with FORTRAN IV, Pascal, real-time BASIC, and HP's RTE Assembly language
- Compatibility with RTE-M and RTE-IV/IVB operating systems and 1350S Graphics Display System, 2608A Line Printer, 2647A/48A/49C/49G Graphics terminals, 7221A/B/S, 7225A+17601A, and 9872A/B/S Graphics Plotters, 7245A Plotter/Printer, and 9874A Digitizer
- Program control of paper advance on 7221S and 9872S Plotters

*1350S consists of the 1350A Graphics Translator and an associated CRT Display Unit.

Functional description

The modular organization of the 92840A Graphics Plotting Software provides device-independent operation, as shown in the diagram at right. Any or all of the supported devices can be in the system. Programmer's plotting requests simply identify the destination device by logical unit and device subroutine I.D. number. In that way, the flexibility and power of the plotting subroutines can be applied to any or all of a variety of graphics devices.

Applications

The 92840A Graphics Plotting Software provides two levels of programming support for plotting. For the novice user, the 92480A software includes easily-used plotting subroutines which facilitate the creation of engineering or business graphs. These fundamental subroutines are listed in Table 1.
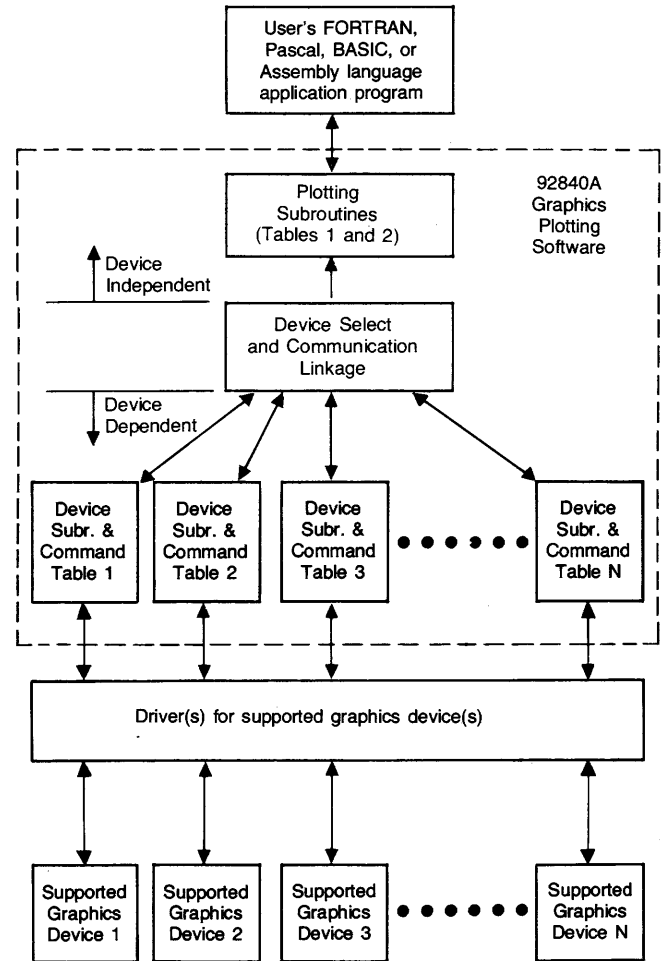
Additional subroutines, listed in Table 2, help to simplify the programming of more sophisticated graphics applications by the experienced user. Overall, the 92840A provides powerful plotting support capabilities important to a wide range of users in the following computer-aided application areas:

- Research and engineering data plotting
- Electrical and mechanical design
- Graphic presentation of management data
- Display monitoring of plant status and utilization in process control
- Drafting
- Education
- Display of Quality Control data
- Design of printed circuit and integrated circuit layouts

Functional specifications

Plotting subroutines

See Tables 1 and 2.

Table 1. 92840A Fundamental Subroutines

OUTPUT PRIMITIVES	
MOVE	Moves pen to absolute position
MOVEI	Moves pen to incremental position
DRAW	Draws line to absolute position
DRAWI	Draws line to incremental position
CPLOT	Draws line or moves pen in increments of character blocks
GTEXT	Outputs text string in mode selected by GFONT (see Output Primitive Attributes, below)
LABEL	Used to turn on and off the graphics text mode

OUTPUT PRIMITIVE ATTRIBUTES	
PEN	Selects a pen
LINE	Selects one of a predefined set of line styles (solid, dashed, etc.)
CSIZE	Specifies character height, width/height, and slant for graphics text
GFONT	Selects one of the character fonts shown in Figure 1 or standard hardware text font (which is default if no software font is selected)
LDIR	Establishes direction of a group of graphics text characters
LORG	Designates origin of a group of graphics text characters relative to the current pen position

VIEWING TRANSFORMATIONS	
SETAR	Defines width/height ratio of the logical view surface boundary. This is used to guarantee transportability of plots from one device to another.
VIEWP	Defines mapping area (viewport) on logical view surface in normalized device coordinates.
WINDW	Defines the area in world coordinate space to be mapped onto the viewport. The boundaries of this region are the clip limits. Only the portion of the picture within the clip limits will appear on the graphics display.

INPUT PRIMITIVES	
CURSR	Reads cursor (locator) position
POINT	Moves cursor to absolute position
DIGTZ	Reads cursor position with a prompt and wait

CONTROL	
PLOTR	Select and initialize graphics device
GPON	"Power on" reset of a graphics device
GCLR	Clears the display area or advances plot paper
GLEN	Returns the output length of the text string in the current coordinate system
LIMIT	Allows user to set device plotting limits within default physical device limits
CLPOF	Turns off clipping
CLPON	Turns on clipping

Compatibility

Operating system: 92064A RTE-M* operating sytem (RTE-MII or MIII configuration) (BASIC/1000M is not supported) and 92067A RTE-IV or 92068A RTE-IVB system with or without 92101A BASIC/1000D. The 92840A Graphics Plotting Software is not supported in any other HP 1000 operating environment and spooling is not possible for graphics output.

Program languages: FORTRAN IV, Pascal, Real-Time BASIC, and HP RTE Assembly language.

Table 2. 92840A Additional Subroutines

DATA DISPLAY FUNCTIONS	
AXES	Draws a pair of axes with optional tic marks
LAXES	Performs AXES with labelling of tic marks
GRID	Draws a full grid within the limits of the data display area
LGRID	Performs GRID with labelling
FXD	Selects LAXES and LGRID labelling format
FRAME	Draws a rectangle around the limits of the data display area

OUTPUT PRIMITIVES	
PENUP	Logically raises the pen
PENDN	Logically lowers the pen
LABON	Turns on graphics text mode
LABOF	Turns off graphics text mode
PLOT	Absolute position plotting with pen control
IPLOT	Incremental plotting with pen control
MOVER	Moves pen to relative position
DRAWR	Draws line to relative position
RPLOT	Relative plotting with pen control
PORG	Defines origin for relative plotting

VIEWING TRANSFORMATIONS	
MSCAL	Input units are in millimeters. Forces mapping so that picture is in true 1:1 scale
SETGU	Selects normalized device coordinate units as the input units for plotting and control
SETUU	Selects world coordinate system units as the input units for plotting and control
SHOW	Defines a window surrounding a region of interest in world coordinate space that gives isotropic scaling
CLIP	Redefines clip limits set by WINDW. The mapping remains unchanged
MARGN	Specifies the placement of the viewport within the physical limits of the plotting or display area

CONTROL	
XMIT	Transmits data in I/O buffer to graphic device
LGERR	Sets the logical unit number of the error logging device
IGERR	Returns the most recent "soft" error, which is an error that does not prevent continued operation of the graphics software
HDERR	Causes all errors to be reported and may also stop processing by the graphics software because of an error that would not normally result in termination
WHERE	Returns the logical pen location and state (up or down)
GPMM	Converts millimeters to normalized device coordinates
GSTAT	Returns Graphics Plotting Software package status
GDSTT	Returns graphics device status

Graphics devices: HP 1350S Graphics Display System, 2608A Line Printer*, 2647A/49G Intelligent Graphics Terminal (can also be used as system console), 2648A/49C Graphics Terminal (2648A/49C +007 can also be used as system console), 7221A/B/S, 7225A +17601A, and 9872A/B/S Graphics Plotters, 7245A/B Plotter/Printer, and 9874A Digitizer.

The 2608A Line Printer is not supported by RTE-M or BASIC for graphics applications.

Extent of device support: The 92840A software 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 92840A graphics package supports those device features that are most important to the majority of HP 1000 application areas. If necessary, the user can also use program statements that transmit device-dependent commands directly to a particular graphics device to access a device feature not sup-

ported by the 92840A software. Device features that are directly supported by the 92840A software are described in the 92840A manual.

Figure 1. Graphics Text Character Fonts

Installation

The 92840A is a customer installed product, which is easily loaded from the relocatable library to satisfy the graphics communication requirements of user's application, It is *not* generated into the RTE operating system.

Minimum system requirements

In RTE-IV/IVB: Same as 92067A RTE-IV or 92068A RTE-IVB system with 2645A/48A/49B/49C +007 or 2647A/49G CRT terminal, plus one or more compatible graphics devices, selected from those listed on the previous page.

In RTE-M. Same as 92064A RTE-MII or MIII (multi-terminal) configuration of RTE-M system with 2645A/48A/49B/49C +007 or 2647A/49G plus one or more compatible graphics devices, selected from those listed on the previous page.

Required RTE drivers

For 2608A: DVB12, included in 92067A RTE-IV, and 92068A RTE-IVB operating systems and "graphics" driver DVZ12, included with the 92840A Graphics Plotting Software.

For 2647A: DVR05 or DVA05, included in 92064A RTE-M, 92067A RTE-IV, and 92068A RTE-IVB operating systems.

For 2648A: DVR05 or DVA05, included in 92064A RTE-M, 92067A RTE-IV, and 92068A RTE-IVB operating systems, or DVA07 included in 91730A Multipoint Terminal Subsystem Software Package.

For 7221A/B/S: DVR05/DVA05, included in 92064A RTE-M, 92067A RTE-IV, and 92068A RTE-IVB operating systems.

For 1350S, 7225A+17601A, 7245A/B, 9872A/B/S, and 9874A: DVR37 included in 92064B RTE-M, 92067A RTE-IV, and 92068A RTE-IVB operating systems.

Approximate memory requirements

Plotting subroutines: 5-20k bytes; 10k bytes typical.

Device select and communications linkage: 6k bytes

Device subroutine and command tables:

1350S: 2.0k bytes.

2608A: 7.1k bytes.

2647A/48A/49C/49G: 2.0k bytes.

7221A/B/S: 3.0k bytes.

7225A+17601A: 2.2k bytes.

7245A/B: 2.2k bytes.

9872A/B/S: 2.2k bytes.

9874A: 1.6k bytes.

NOTE: The 7225A+17601A, 7245A/B, and 9872A/B/S share a common device subroutine, included in all of their device subroutine memory requirements, that uses 0.7k bytes.

Ordering information

92840A +020 Graphics Plotting Software

The Graphics Plotting Software consists of:

1. Graphics Plotting Software on 264x Mini cartridges.
2. User's manual (92840-90001).
3. Software numbering catalog (92840-90005).

Software support products available

See page 1-1.

The 92064A RTE-M is a memory-based operating system for management of the operations and resources of HP 1000 Model 20 and 25 Computer Systems, and user assembled systems based on Hewlett-Packard 2105†, 2108, 2109, 2111, 2112, 2113 or 2117 Computers.

Functional specifications

Type of operating system

Memory-based real-time multiprogramming.

Basis of program scheduling for execution

By operator or optionally by time, event, or another program, in order of program priority.

Program priority levels

1 through 32,767, the lowest number designating highest priority.

Main memory capacity

RTE-MI/MII configuration. 65,536 bytes (32 pages).
RTE-MIII configuration: 2,097,152 bytes (1024 pages).

Operational requirements for user-assembled systems

The operational requirements for user-assembled RTE-M systems differ according to the functions that the system is expected to perform, as follows:

Minimum, single-program execute only system
An RTE-M system to run single FORTRAN or HP Assembly language programs developed on another system requires:
1. HP 2105*, 2108, 2109, 2111, 2112, 2113 or 2117 Computer with at least 32k byte memory.
2. Any supported system console and any supported standard input unit.

2105 is compatible only with RTE-MI, not with RTE-MII or MIII.

Multiprogram execute only system
For an RTE-M system to run multiple FORTRAN or HP Assembly language programs developed on another system, add 12892 Memory Protect to the minimum system.

Real-time BASIC program development and execution
Addition of single-user BASIC program development and execution to the system requires:
1. 64kb memory.
2. 92065A BASIC/1000M system.

FORTRAN and Assembly programming
Development of FORTRAN and HP Assembly language programs requires:
1. 64kb memory.
2. 12897A/B Dual-Channel Port Controller.
3. 12732A Flexible Disc Subsystem.

System generation
System generation requires:
1. 64kb memory.
2. Either a 264x system console with Mini cartridge I/O or 12732A Flexible Disc Subsystem and 12897 Dual-Channel Port Controller.

Multi-user program development and on-line system generation
Multi-user development of FORTRAN or HP Assembly language programs (also BASIC programs with 92065A) requires the following additions to the minimum system (also supports on-line system generation):
1. 128kb memory.
2. 12976 Dynamic Mapping System for 2108 or 2112 Computer or 13304A Firmware Accessory Board and 13305A Dynamic Mapping System for 2109, 2111, 2113 or 2117 Computer.
3. 12897 Dual-Channel Port Controller.
4. 12732A Flexible Disc Subsystem (also requires 12897 Dual-Channel Port Controller).

Real-time clock, I/O timeout, and time scheduling of programs
Real-time clock, I/O timeout, and time scheduling of programs requires the addition of the 12539C Time Base Generator to the system (can be execute-only system).

Supported system consoles
- 2645A/48A/49B/49C+007, 032 Terminal or 2647A/49G+032 Terminal with 12966A+001 interface (preferred because it combines the functions of system console and Mini cartridge standard I/O unit)
- 2621A/P Display Terminal with 12966A+005 interface
- 2635A+051 Printing Terminal with 12966A+001 interface
- 2644A+020* Mini Data Station with 12966A+001 interface

Supported standard I/O units
- Mini cartridge I/O on 264x Terminal.
- 12732A Flexible Disc Subsystem.
- 12925A Tape Reader Subsystem for punched tape input and 12926A Tape Punch for punched tape output.

Identifies discontinued product that is listed here for reference only.

Memory requirements (bytes)
The following requirements are additive for resident memory. With respect to programs added after system generation, the user memory area must be large enough to accommodate the largest single program that will be run in it. Mapped RTE-MIII partitions must be large enough to accommodate the largest program that will be run in them, plus 2048 bytes for base page, which is part of each mapped partition in RTE-MIII.

Software Items	Resident Memory	User Program Area
RTE-MI base system	11,800*	
RTE-MII base system	13,400*	
RTE-MIII base system	14,800*	
Flexible disc driver DVR33 for 12732A	1,150*	
Program-to-program scheduler module†	640*	
I/O buffering module†	340*	
Real-time clock and I/O timeout module	220*	
Time scheduling of programs module	980*	
Additional on-line operator commands module	1,220*	
Resource management module	200*	
Mailbox data exchange module	800*	
Auto restart after power failure module	520*	
File directory access modules		
(RTE-MI)	2,160*	
(RTE-MII/MIII)	2,050*	
Absolute program loader (Mini cartridge)	3,400*	
Absolute program loader (Flexible disc)	5,060*	
Multi-terminal monitor	800*	
KEYS Utility		11k
KYDMP Utility		4k
FORTRAN IV compiler and symbol table		28-32k[1]
FORTRAN II compiler and symbol table		24-32k[1]
RTE Assembler and symbol table		24-32k[1]
Cross-Ref Table Generator		14-20k[1]
File Manager		20k
Interactive Editor		20-24k[1]
Relocating Loader		20-24k[1]
System generator		30k

* These module sizes are approximate and are subject to growth of no more than 10% if current page linking is used.

† These modules are optional only in RTE-MI; they are included in RTE-MII and RTE-MIII.

[1] The size of User Program Area (plus system available memory) required depends partly on program or buffer size used; short programs or small buffers will be processable in the smallest size given; larger programs or buffers may take more space, up to the maximum size given.

On-line operator requests

1. Turn programs on or off.
2. Suspend user program, either executing or scheduled.
3. Activate user program.
4. List programs currently executing in the system.
5. List status of any program.
6. List status of any partition (RTE-MIII only).
7. Change priority and timing of programs [1].
8. Examine I/O device status; dynamically alter device buffering assignments[2].
9. Dynamically alter device logical unit assignments[2].
10. Control I/O device availability.
11. Dynamically alter device I/O timeout parameters[3].
12. Set the real-time clock[3].
13. Print time (time-of-day, day, and year)[3].
14. Display or establish limits on use of system available memory for output buffering[2].
15. Indicate change of left or right Mini cartridge in CRT system console.
16. Compile FORTRAN IV programs or assemble programs with flexible disc.
17. Enter, test, change, and run Real-Time BASIC programs with BASIC/1000M system.
18. Edit program or data files.
19. Convert relocatable programs and subroutines to absolute form for loading into memory.
20. On-line program installation and removal.
21. Generate a new system configuration.

22. Create files on flexible disc.
23. Copy files from Mini cartridge to flexible disc, or vice versa.
24. List contents of file directory.
25. Purge files.

System requests from programs

1. Read from any non-disc input device with or without wait.
2. Write to any non-disc output device with or without wait.
3. Access flexible disc file via file management subroutines.
4. Get status of queued read requests, or the resulting input data.
5. Check I/O device status.
6. Control functions on magnetic tape unit or other peripheral device.
7. Schedule programs to be run, with or without wait for completion of the called program.
8. Make dormant or suspend self or other program.
9. Obtain current year, day, and time of day[3].
10. Change time scheduling of self or other program[1].
11. Allocate/release I/O devices or other system resources for own exclusive use[4].
12. Request resource lock/unlock[4].
13. Request device lock/unlock[4].
14. Request partition status (RTE-MIII only).
15. Create files.
16. Rename files.
17. Purge files.
18. Open files.
19. Write on a random or sequential file.
20. Read from a random or sequential file.
21. Locate file.
22. Close a file.

[1] Timing control of programs requires time-of-day clock and time scheduling modules.

[2] These commands are provided in the additional on-line commands module.

[3] Time-of-day and timeout control requires the real-time clock and I/O timeout module.

[4] These commands require the resource management module (optional in RTE-MII/MIII).

Ordering information

92064A RTE-M operating system
(for user-assembled systems)

RTE-M consists of:

1. One of software media choice options 020 or 040, which must be specified on the order.
2. RTE-M Programming and Operating Manual (92064-90002).
3. RTE-M System Generation Manual (92064-90003).
4. RTE-M Editor Manual (92064-90004).
5. 92064A Software Numbering Catalog (92064-90001).
6. FORTRAN Manual (02116-9015).
7. FORTRAN IV manual (92060-90023).
8. RTE/DOS Program Libraries Manual (24998-90001).
9. Assembler Manual (92060-90005).
10. Multi-device driver DVR00 manual (29029-95001).
11. 264x CRT Terminal driver DVR05/DVA05 manual (92001-90015).
12. 7210A Graphic Plotter driver DVR10 manual (17210-90004).
13. CalComp Plotter driver DVR10 manual (12560-90023).
14. 3070A data entry Terminal driver DVA47 manual (92900-90005).

15. 2892A Card Reader driver DVR11 manual (09600-93010).
16. 2607A Line Printer driver DVA12 manual (92200-93001).
17. 2767A Printer driver DVR12 manual (92001-90010).
18. 91200B TV interface driver DVA13 manual (91200-90005).
19. 7261A Optical Mark Reader driver DVR15 manual (07261-90010).
20. 7970 9-track Mag Tape driver DVR23 manual (92202-93003).
21. 59310B HP-IB Interface User's Guide (59310-90064).
22. 12732A Flexible Disc driver DVR33 manual (12732-90001).
23. RTE Operating System Drivers and Device Subroutines Programming and Operating manual (92200-93005).
24. RTE Utilities manual (92060-90017).
25. RTE-M Pocket Guide (92064-90007).
26. 2631A/5A Printer Utility Subroutine manual (92062-90003).
27. 2608A DVB12 Driver manual (92062-90004).
28. 59310B User's Guide (59310-90064).

92064A RTE-M options

001 Discount for upgrade from 20885A BCS, 2300B RTE-B or 2300C RTE-C system or from previous version of RTE-M for customer not on 92064T/S. RTE-B upgrade should also include purchase of 92065A+001 BASIC/1000M.

020 Provides software on the following Mini cartridges for read-in by 264x Display Terminal:
1. RTE-MI operating system, including optional modules for output buffering, program-to-program scheduling, real-time clock, time scheduling, additional on-line commands, and dummy library.
2. RTE-MII operating system, including optional modules for real-time clock, time scheduling, additional on-line commands, resource management, mailbox data exchange, and dummy library.
3. RTE-MIII operating system, including optional modules for real-time clock, time scheduling, additional on-line commands, resource management, class I/O, and dummy library.
4. Soft key utilities, and power fail/auto restart modules.
5. Relocating loader, absolute program loader, system generator, file manager, and multi-terminal monitor modules.
6. System libraries.
7. Off-line generator.
8. RTE/DOS relocatable library.
9. RTE/DOS FORTRAN formatters.
10. Device drivers (see list in the Device Drivers data sheet).

040 Provides software on the following flexible discs for read-in by the 12732A Flexible Disc Subsystem:
1. Generation disc, including all software items provided in option 020 plus flexible disc versions of the file management program, file manager, and file directory access modules.
2. Program preparation disc, including the FORTRAN IV compiler, Assembler, Cross-Reference Symbol Table Generator, Flexible Disc File Manager modules, Relocating Loader and supporting subroutines, Editor, RTE and RTE-M system libraries, soft key utilities, and Multi-terminal monitor modules.

RTE-M operating system in HP 1000 Computer Systems

The 92064A RTE-M operating system with Mini cartridge option 020 is included in HP 1000 Model 20 (2174A/B) and 25 (2175A/B) Computer Systems. Flexible disc option 032 to 2174A/B or 2175A/B substitutes 92064A flexible disc option 040 for Mini cartridge option 020.

92827A RTE-M Manuals package

Provides all of the manuals supplied with the 92064A RTE-M system (items 2 through 28 listed under 92064A, above).

Software support products available

See page 1-1.

RTE-II real-time executive operating system

Mature Software

The 92001B RTE-II is a disc-based Real-Time Executive operating system used for management of the operations and resources of user-assembled systems based on Hewlett-Packard 2108, 2109, 2112, or 2113 Computers.

Functional specifications

Type of operating system

Disc-based real-time multiprogramming.

Basis of program scheduling for execution

By operator, time, event, or another program, in order of program priority.

Program priority levels

1 through 32767, the lowest number designating highest priority.

Number of disc swapping partitions

Two, Real-Time and Background.

Main memory capacity

65,536 (64k) bytes

Disc Memory capacity

With 12960A Subsystem: 4.9 to 19.6M bytes.

With 12962A/B/C/D Subsystem: 14.7 to 365.2M bytes with seven 7920S add-on drives.

With 7906M + 13175 Subsystem: 20 to 370M bytes with seven 7920S add-on drives.

Operational requirements for user-assembled systems

1. 2108, 2109, 2112, or 2113 Computer with 64k bytes of memory, Direct Memory Access or Dual-Channel Port Controller, 12944B/12991B Power Fail Recovery, 12892B Memory Protect, and 12539C Time base generator.
2. 12960A (4.9M byte), 12962A/B/C/D (14.7M byte), or 7906M/MR (19.6M byte) Cartridge Disc Subsystem.
3. Any supported system console.
4. Any supported standard input unit.

Supported system consoles

- 2645A/48A/49B/49C+007, 032 Terminal or 2647A/49G+032 Terminal with 12966A+001 interface (preferred because it combines the functions of system console and Mini cartridge standard I/O unit).
- 2621A/P Interactive Terminal with 12966A+005 interface.
- 2365A+051 Printing Terminal with 12966A+001 interface.

Supported standard I/O units

- Mini cartridge I/O on 264x Terminal.
- 12925A Tape Reader Subsystem for punched tape input.
- 12926A Tape Punch for punched tape output.

Approximate memory requirements (bytes)

The following memory requirements are additive for resident memory. With respect to real-time or background disc-resident memory, the respective partition must be large enough to accommodate the largest single program/segment that will be run in it, then all others will also fit.

Software Item	Resident Memory	R-T Disc Resident	B-G Disc Resident
RTE-II System	26,806[1]		
RTE FORTRAN IV Compiler			20-24k[2]
FORTRAN II Compiler			10-14k[2]
HP ALGOL Compiler			16-24k[2]
RTE Assembler			12-18k[2]
Cross-Ref. Table Generator			10-18k[2]
Interactive Editor			10-12k[2]
Relocating Loader			14-18k[2]
RTE Microprogramming Package	2,160		16k
On-Line System Generator			20k
Batch-Spool Monitor		2.4k	10k
Multi-User Real-Time BASIC	1,000	4k	24k
IMAGE/1000	80		24k
SAVE Utility			14-22k[2]
RESTORE Utility			16-22k[2]
COPY Utility			14-22k[2]
VERIFY Utility			14-30k[2]

[1]System memory requirement as listed includes resident system, base page, typical group of drivers, including spool driver, system tables, and resident library, as summarized in the memory map table on page 2-5.

[2]The size of background partition required depends partly on program or buffer size used; short programs or buffers will be processable in the smallest partition size given, larger programs or buffers may take more space, up to the maximum partition size given.

On-line operator requests

1. Turn programs on or off.
2. Suspend user program, either executing or scheduled.
3. Activate user program.
4. List programs currently executing in the system.
5. List status of all programs.
6. Change priority and timing of programs.
7. Examine I/O device or I/O controller status; dynamically aler device buffering assignments.
8. Dynamically alter device logical unit assignments.
9. Control I/O device availability.
10. Dynamically alter device I/O timeout parameters.

11. Set the real-time clock.
12. Print time (time-or-day, day, and year).
13. Compile FORTRAN IV/II or ALGOL programs, or assemble programs.
14. Enter, test, debug, edit, and run Real-Time BASIC programs.
15. Edit program or data files.
16. Load relocatable programs and subroutines into real-time or "background" disc-resident area of memory.
17. Request load-and go execution of programs.
18. Allocate/release program tracks.
19. Back up the disc on mag tape.
20. Update the master software disc cartridge.
21. Generate a new system configuration.
22. Switch from the current system configuration to another system configuration taken from a disc file.
23. Enter batch job commands.
24. Link spool files to peripherals.
25. Create files.
26. Dump contents of a file to another file, or a peripheral device.
27. Copy files from one disc top another.
28. List contents of file directory.
29. Purge files.
30. Repack the disc.
31. Display status of spool jobs.
32. Change spool job priorities.

System requests from programs

1. Read from any non-disc input device with or without wait.
2. Write to any non-disc output device with or without wait.
3. Access disc file area via file management subroutines.
4. Get status of queued read requests, or the resulting input data.
5. Check I/O device or I/O controller status.
6. Control functions on magnetic tape unit or other peripheral device.
7. Schedule programs to be run, with or without wait for completion of the called program.
8. Make dormant or suspend self or other program.
9. Obtain current year, day, and time of day.
10. Change time scheduling of self or other program.
11. Allocate/release own disc tracks, or global disc tracks available to all programs.
12. Allocate/release I/O devices or other system resources for own exclusive use.
13. Enable/disable swapping of self.
14. Request resource lock/unlock.
15. Request device lock/unlock.
16. Create files.
17. Rename files.
18. Purge files.
19. Open files.
20. Write on a random or sequential file.
21. Read from a random or sequential file.
22. Locate a file.
23. Close a file.

Ordering information

92001B RTE-II operating system

RTE-II consists of:

1. The following software on one of media options 010, 020, 030, or 031, which must be ordered:
   - RTE-II operating system
   - Off-line and on-line system generators and system switch
   - Multi-terminal monitor
   - RTE FORTRAN IV and ALGOL compilers, Assembler, Cross-Reference Table Generator, Interactive Editor, Relocating Loader, Relocatable Library, and Decimal Arithmetic Library
   - Batch-Spool Monitor
   - Device Drivers (see list in the Device Drivers data sheet)
   - Soft key, update, and backup utilities
2. RTE-II Programming and operating manual (92001-93001).
3. 92001B Software Numbering Catalog (92001-93003).
4. RTE and Batch-Spool Monitor Pocket Guide (92060-90010).
5. RTE: A Guide for New Users (92060-90012).
6. RTE Utilities manual (92060-90017).
7. FORTRAN Manual (02116-9015).
8. FORTRAN IV Manual (92060-90023).
9. HP ALGOL Manual (02116-9072).
10. Assembler Manual (92060-90005).
11. Decimal String Arithmetic Manual (02100-90140).
12. RTE/DOS Program Libraries Manual (24998-90001).
13. Software Input/Output System Manuals Kit (09600-14005).
14. Batch-Spool Monitor Reference Manual (92060-90013).
15. 7261A Optical Mark Reader Driver DVR15 Manual (07261-90010).
16. Multi-Device Driver DVR00 Manual (29029-95001).
17. 59310B HP-IB Interface Driver DVR37 Manual (59310-90063).
18. 59310B User's Manual (59310-90064).
19. 2892A Card Reader Driver DVR11 Manual (09600-93010).
20. 91200B TV Interface Driver DVA13 Manual (91200-90005).
21. DVA12 Line Printer Driver Manual (92200-93001).
22. DVR05/DVA05 264x Console Driver Manual (92001-90015).
23. DVR12 Line Printer Driver Manual (92001-90010).
24. DVR23 Mag Tape Driver Manual (92202-93001).
25. 3070 Driver DVA47 Manual (92900-90005).
26. 12732A Flexible Disc Driver DVR33 Manual (12732-90001).
27. 2631A Device Subroutine LP31 Manual (92062-90003).
28. 2608A Line Printer Driver DVB12 Manual (92062-90004).
29. Driver Writing Manual (92200-93005).

92001B RTE-II options

010: Provides all RTE-II system software on paper tapes.

030: Provides all RTE-II system software on a 12869A 2.5M byte disc cartridge for 12960A 4.9M byte Cartridge Disc Subsystem.

031: Provides all RTE-II system software on a 12940A 10M byte disc cartridge for 12962A/B/C/D (14.7M byte) or 7906M/MR (19.6M byte) Cartridge Disc Drive.

Software support products available

See page 1-1.

product number 92065A

BASIC/1000M is a subsystem for conversational development, testing, and execution of Real-Time BASIC programs in computer systems operating under the RTE-M real-time executive system.

Functional specifications

Environment

Mini cartridge or flexible disc based RTE-M system with at least 48k bytes of memory.

Basis of BASIC task scheduling for execution

By operator, another task, time, or event (only one copy of BASIC can use time and/or event scheduling) in order of task priority.

BASIC task priority levels

1 through 99, the lowest number designating highest priority.

Program data types

- REAL data — a 32-bit quantity with sign, exponent, and mantissa, ranging from $\pm 2^{-127}$ to $\pm 2^{+127}$, with 6 to 7 decimal digit accuracy.
- STRING data — ASCII strings up to 255 characters long represented and manipulated by variables.
- OCTAL data — a 16-bit quantity with sign that can be entered into programs, manipulated, and output with bit manipulation statements.

Operator requests

1. Load program into memory.
2. Merge additional tasks or statements into program already in memory.
3. Run program that is in memory or stored on an off-line media.
4. List program that is in memory.
5. Save program that is in memory on Mini cartridge, magnetic tape, or punched tape.
6. Delete current program from memory.
7. Enter individual program statements, operator requests, or data inputs into system.
8. Delete a line(s) of program.
9. Interrupt or abort a running program.

System requests from programs

1. Read from any non-disc input device.
3. Print on any non-disc output device.
3. Schedule task to be run at specified time, at specified intervals, and/or in response to specific event.
4. Enable or disable self or other task.

Supported capabilities

1. Real-time program statements can specify task priority, time scheduling, and event interrupts linkage to tasks.

2. High-level calls to devices on the Hewlett-Packard Interface Bus (HP-IB).
3. Bit manipulation program statements for examination, logical addition and multiplication, shifting and selective setting and clearing of digital word bit patterns.
4. ASCII strings up to 225 characters long may be represented and manipulated using string variables.
5. 23 different functions and operators, including square root, exponentiation, logarithmic, logical, and trigonometric functions, and the base capabilities of addition, subtraction, multiplication, and division.

Program character set

- The 26 upper case letters A through Z.
- The ten digits 0 through 9.
- Special characters: blank; equals, greater than, less than, plus, minus, up arrow, and # signs; asterisk; slash; left and right parentheses and left and right brackets; quotation, apostrophe, and question marks; comma; colon; semi-colon; decimal and exclamation points; ampersand; and currency symbol.

Software not supported

BASIC/1000M does not support the 92400A Sensor-Based DAS Utility Library, 92413A ISA Fortran Extension Package, or the 92840A GRAPHICS/1000 Graphics Plotting Software Package.

Ordering information

92065A BASIC/1000M (for use in RTE-M System)

The 92065A BASIC/1000M System consists of:

1. One of software media choice options 020 (mini cartridge) or 040 (flexible disc), which must be ordered.
2. BASIC/1000M Programming and Operating Manual, (92065-90001).
3. 92065A Software Numbering Catalog (92065-90002).

92065A BASIC/1000M options

020: Provides BASIC/1000M software on Mini cartridges for read-in by 264x Display Terminal:

    1. Table generator, BASIC interpreter, error message and error codes modules, and dummy trap module.
    2. Libraries, task scheduler, 6940 BASIC subroutines, BASIC device subroutines, Alarm module, and BASIC table generator.

040: Provides the BASIC/1000M software listed under option 020, above, on a flexible disc for read-in by the 12732A Flexible Disc Subsystem.

Software support products available

See page 1-1.

HP 24396 diagnostic library products enable HP 1000 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 or 2100A/S Computer.

CPU options required
As specified by the diagnostic to be executed.

Memory required
8k bytes minimum; certain diagnostics may require more, 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
Any of the individual 264x cartridges may be ordered using the part numbers shown in the diagnostics library summary of this data sheet. Manuals for these may be ordered using part numbers listed in the same summary. When ordering, specify both part numbers; one for the cartridge tape and one for its appropriate manual. Each cartridge includes the diagnostic configurator as the first file.

Single file diagnostics
These may be ordered using the binary tape part numbers shown in the diagnostics library summary of this data sheet. Manuals for these may be ordered using the manual part numbers shown in the same summary. When ordering, specify both part numbers; one for the diagnostic on paper tape and one for the appropriate manual. 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 Computer Systems
HP 1000 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 Computer Systems.

Diagnostics library summary

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**	24396-13302	24396-14002
Ext. instr. group (word, bit, byte)	8k	12943-16001	12943-90004	12943-16001	**2.5Mb**		
2100 Fast Fortran package	8k	12907-16003	12907-90003	12907-16003	**DISC**		
HP 1000 Fast Fortran package 1	8k	12977-16004	12977-90002	12977-16004	24396-13001		
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**	24396-13302	
Memory expansion unit	32k	12929-16001	12929-90003	12929-16001	**DISC**	24396-13101	
Microcoded semicond. memory	8k	24395-16002	24395-90003	24395-16002	24396-13101		
Time base generator	8k	12539-16001	12539-90011	12539-16001			
12936 Priv. interrupt fence	8k	12936-16001	12936-90003	12936-16001	**24396D**		
12908/12978 256 word WCS	8k	12908-16001	12908-90013	12908-16001	**800 BPI**		
13197 1k WCS	8k	13197-16002	13197-90002	13197-16002	**Mag Tape**		
12889 Hardwired serial interface	8k	24335-16001	02100-90169	24335-16001	24396-13501		
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**	24396-13304	24396-14003
12920 Async multiplexer (data)	8k	12920-16001	12920-90009	12920-16001	**1600 BPI**		
12920 Async multiplexer (control)	8k	12920-16002	12920-90009	12920-16002	**Mag Tape**		
12621 Sync data set interface (rec)	8k	12621-16001	12621-90008	12621-16001	24396-13601		
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	12962-90013	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	

The standard program languages included in RTE operating systems are RTE FORTRAN IV, and RTE Assembly language. These are described individually in the following paragraphs.

RTE FORTRAN IV compiler

RTE FORTRAN IV programs are translated by a two-pass compiler producing relocatable obdect code. It is based on ANSI Standard FORTRAN IV (X3.9-1966), except that intrinsic functions are treated as external functions.

Extensions of standard FORTRAN IV

The following extensions expand the capabilities and increase the power of HP FORTRAN IV, as compared with ANSI Standard FORTRAN IV:

- A subscript expression may be any expression allowed in HP FORTRAN IV.*

- Initial, terminal, and step-size parameters of a DO statement may be any arithmetic expressions.*

- The step-size parameter of a DO statement may be either positive or negative, which provides for incrementing or decrementing to the terminal value.

- The integer variable reference in a computed GO TO can be replaced by any arithmetic expression.*

- Any two arithmetic types may be mixed in any relational or arithmetic operation except exponentiation.

- An unsubscripted array name is an admissible list element in a DATA statement.

- Automatic EMA map request generation for FORTRAN IV programs to be used in RTE-IV/IVB operating systems.

- DOUBLE REAL data types can have either 48-bit or 64-bit precision (compiler option).

- Library routines for single (32-bit), extended (48-bit), and double-precision (64-bits) REAL data types and transcendental functions. Double precision is implemented in hardware in F-Series computers.

- Subroutine access to the Vector Instruction Set is available.

Expressions other than integer are converted to integer after evaluation.

Functional specifications

See the program language specifications table, next page.

Ordering information

The RTE FORTRAN IV compiler is included in the 92064A+040 RTE-M, 92001B RTE-II, 92068A RTE-IVB, and 92070A RTE-L operating systems.

RTE assembly language

HP Assembly language symbolic source language instructions are translated by the RTE Assembler into absolute or relocatable object code in a two-pass operation. The source language provides mnemonic machine operation codes, assembler-directing pseudo instructions, and symbolic addressing.

Functional specifications

The specifications of the RTE Assembler are shown in the program language specifications table, next page.

Ordering information

The RTE Assembler is included in the 92064A-040 RTE-M, 92001B RTE-II, 92068A RTE-IVB, and 92070A RTE-L operating systems.

FORTRAN IV	Assembler	Specifications
		Data Types
X	X	Integer data (a 16-bit quantity including sign, ranging from +32767 to −32768)
X	X	Real data (a 32-bit quantity with sign, exponent, and mantissa, ranging from $\pm2^{-127}$ to $\pm2^{+127}$, providing 6 to 7 decimal digit accuracy)
X	X	Extended precision data (a 48-bit quantity with sign exponent, and mantissa having range identical to real data, but providing 11 to 12 decimal digit accuracy)
X	X	Double precision data (a 64-bit quantity with sign, exponent, and mantissa having range identical to real data, but providing 16 to 17 decimal digit accuracy
X		Complex data (a 64-bit quantity consisting of two real data quantities, one for the real, the other for the imaginary part of a complex quantity)
X		Logical data (a 16th-bit variable in which only the integer sign bit is used to determine the Boolean value, true or false)
		Character Set
X	X	The 26 letters A through Z (capitals only)
X	X	The 10 digits 0 through 9
X	X	Special characters: blank; equals, plus, and minus signs; asterisk; slash; left and right parentheses; comma; decimal point; currency symbol, quotation marks, and apostrophe
	X	Special characters: greater than; less than; up arrow and # signs; left and right brackets; question mark; colon and semi-colon; exclamation point; and ampersand.
	X	Special characters: back arrow, percent and @ signs, and back-slash.
		Environment
X	X	Provides on-line program development in disc-based RTE-IVB system in interactive mode
X	X	Provides on-line program development in disc-based RTE-IVB system in batch mode, using the Batch-Spool Monitor

FORTRAN IV	Assembler	Specifications
		Supported Capabilities
	X	Double integer (a 32-bit quantity including sign, ranging from +2,147,483,647 to −2,147,483,648).
X	X	Real-time operation, by providing for the passing of program priority, type, and time-scheduling information from the source language program I.D. statement to the relocatable object program
X	X	System-to-system program statements addressed to the 91740A/B and/or 91741A DS/1000 Network software-firmware for communication with other HP 1000/21MX Computer systems and/or HP 3000 Systems
X	X	Disc file access program statements addressed to the Batch-Spool Monitor in RTE-IVB systems
X		High-level calls to instrumentation and control and peripheral subsystems
	X	Word, byte, and bit processing
	X	Index register instructions
X	X	Data base access and manipulation program statements addressed to IMAGE/1000 in RTE-IVB systems
X	X	Decimal string arithmetic program calls for adding, subtracting, multiplying, or dividing decimal strings (in integer form) whose length exceeds the capacity of the standard integer, floating point, or standard program libraries.
X	X	Extended Memory Area mapping in RTE-IVB system.

The HP 1000 standard libraries provide subroutines and functions for the common arithmetic and transcendental functions, including complex and double precision functions usable in Pascal, FORTRAN, and Assembly language programs. The library also includes a Formatter, debug package, and other utility subroutines and functions. The most important of the mathematical and utility subroutines and functions and their program language usability are summarized in the table, below. The table also includes the comparable mathematical and utility routines callable from real-time BASIC.

Mathematical subroutines and functions

PASCAL	FTN4	BASIC	ASMB	SINGLE (Int)	DOUBLE (Int)	SINGLE (Real)	EXTEND (Real)	DOUBLE (Real)	COMPLEX	SUBROUTINES AND FUNCTIONS
										Transcendental calculations on real numbers
X	X	B	X			S	X	S		Natural log of a real X.
X	X	B	X			S	X	S		Log to base 10 of a real X.
X	X	B	X			S	X	S		Arc tangent of a real X.
X	X		X			S	X	S		Arc tangent of a real Y/X.
X	X	B	X			S	X	S		Cosine of X.
X	X	B	X			S	X	S		Sine of X.
X	X	B	X			S	X	S		e^x.
X	X	B	X			S	X	S		Square Root of real X.
X	X		X			S	X	S		Hyperbolic tangent of real X.
X	X	B	X			S	X	S		Tangent of real X.
										Transcendental calculations on complex numbers
X	X		X						S	Complex natural log of a complex X.
X	X		X						S	Complex cosine of complex X.
X	X		X						S	Complex sine of complex X.
X	X		X						S	Complex e of complex X.
X	X		X						S	Complex square root of complex X.
										Other integer and real arithmetic functions
X	X	B	X	X		H	X	H		Absolute value of integer or real X.
X	X	B	X	X		X	X	X		Truncates a real X to a real Y.
X	s	B	X	X		X	F	H		Truncates a real X to an integer J.
X	X		X	X		H	H	H		Calculates a remainder of X/Y.
X	s	B	X	X	X	H	H	H	H	Addition, subtraction, multiplication, and division of two numbers.
X	X		X	X		X	X	X		Calculates maximum and minimum of a series of real or single integer values.
X	X		X			S	X	S		Raises a real or integer number to integer power.
X	X		X			S	X	S		Raises a real number to a real power.
X	s		X	X		X	F	X		Calculates greatest integer not exceeding a real X.
X	s		X	X	X	H	H	H		Converts single or double integer to single, extended, or double real.

Mathematical subroutines and functions (continued)

PASCAL	FTN4	BASIC	ASMB	SINGLE (Int)	DOUBLE (Int)	SINGLE (Real)	EXTEND (Real)	DOUBLE (Real)	COMPLEX	SUBROUTINES AND FUNCTIONS
										Other integer and real arithmetic functions, continued
X	X		X	X		X	X	X		Transfers sign of a number to another number.
X			X				X			Evaluates extended real polynominal.
X			X					H		Evaluates Chebyshev series.
X	X		X	X		X				Calculates positive difference between real X and Y or integer I and J (value is zero for negative difference).
X	X		X	X						Logical AND of bits of integers I and J.
		B					X			Logical product of real X and Y.
X	X		X	X						Inclusive OR or bits of integers I and J.
		B					X			Logical inclusive OR of real X and Y.
			X		X					Increment or decrement double integers.
			X		H					Negate double integers.
			X		H					Increment or decrement double integers and skip if zero.
			X		H					Compare two double integers.
			X			X				Extracts mantissa of real X.
X	X		X			X	X	X		Calculates real remainder of M/N.
X	X		X	X		X				Calculates integer remainder of I/J.
X			X	X	X					Logical NOT of integers I and J.
		B	X							Logical not of real X.
		B					X			Calculates sign of real X.
X			X	X		F				Calculates X times 2^n for real X and integer n.
										Other complex functions
X	X		X						X	Extracts imaginary part of a complex X.
X	X		X						X	Calculates real absolute value of complex X.
			X						H	Addition, subtraction, multiplication, and division of two complex numbers.
X	X		X						X	Forms conjugate Y of a complex X.
X	X		X	X					X	Raises complex X to integer power I.
X	X		X			X	X	X	X	Converts extended real X to a complex Y.
X	X		X			X			X	Extracts real part of a complex X.

X = Supported in software.

B = Support in real-time BASIC is limited to single-precision real numbers.

S = Scientific Instruction Set (SIS) firmware speeds execution of this function in HP F-Series Computers. In other HP 1000 Computers, this function is calculated in software.

F = Function performed by the Fast FORTRAN Processor in HP 1000 M-Series or E-Series Computers, by the Hardware Floating Point Processor in HP 1000 F-Series Computers, and by software in HP 1000 L-Series.

H = Standard floating point firmware instructions support these calculations in HP 1000 M/E-Series Computers, augmented in the HP 1000 F-Series by the extra power of the hardware Floating Point Processor. These calculations are supported by software in HP 1000 L-Series.

s = FORTRAN IV supports only single-precision integer numbers.

Usable From				SUBROUTINES AND FUNCTIONS
P A S C A L	F T N 4	B A S I C	A S M B	
	X		X	Clears system to make all I/O devices available for new operation.
	X		X	FORMATTER structures input/output and converts between ASCII and binary.
		M		Determines length (no. of characters) of character string.
		B		Provides for printing of octal values.
		X		Generates random numbers (0 through 1).
		X		Returns state of specified computer switch register bit.
		X		Controls column spacing in PRINT statements.
		D		Determines type (number, character string, or end-of-file) of next item in disc file.

M = Available in BASIC/1000M, BASIC/1000D or BASIC/1000L.
D = Available in BASIC/1000D or BASIC/1000L.

Ordering information

Relocatable libraries appropriate to the program languages supported are included in the 92064A RTE-M, 92068A RTE-IVB, and 92070A RTE-L systems. Comparable libraries appropriate to the BASIC interpreter and the operating environment are included in the 92065A, 92076A, and 92101A BASIC/1000 subsystems.

Device drivers provided with M/E/F-Series operating systems

Device drivers summary

DRIVER NAME	DEVICES SUPPORTED	MANUAL PART NOS.	APPROX. MEMORY REQUIRED (BYTES)		
			RTE-M	RTE-II	RTE-IVB
Character mode multi-device driver DVR00	2621A/P, 2635A, 2752A*, 2762A/B*, 2640A*, 2640B, with 12531C/D or 12880A interface, and 2748A Tape Reader and 2895B Tape Reader and 2895B Tape Punch with 12597A interfaces	29029-95001	1,120	1,120	1,120
Local page mode terminal driver DVR05 Modem or local page mode driver DVA05	2621A/P, 2635A, 2640A*/2640B, 2644A+020*, 2645A, 2647A, 2648A, 2649B, 2649C, or 2649G with or without options 007 and 032 and 7221A, all using 12966A+001/002/004/005 interface; also supports 13246A/B*, 13349A*, 2631A+240 7310A+240, and 9876A+240 auxiliary printers for 2644A and 2645A/48A/49B/49C+ 007, 032, and 2647A/49G+032.	92001-90015	1,800† 2,900† 3,200	1,800† 2,900† 3,200	1,800† 2,900† 3,200
Card reader driver DVR11	2892B Card Reader with 12924A interface	09600-93010	1,100	1,100	1,100
Line printer driver DVA12 2631A Device subroutine LP31	2607A*, 2610A*, 2613A, 2617A, 2618A*, and 2631A Printers with 12845A/B interface	92200-93001 92062-90003	700 1,600	700 1,600	700 1,600
Line printer driver DVB12	2608A Line printer with 26099A interface	92062-90004	1,420	1,420	1,420
Line printer driver DVR12	2767A* Line Printer with 12653A interface and 9866A* Printer with 12566B interface	92001-90010	960	960	960
TV Interface driver DVA13, library, and verification	91200B TV Monitor interface (one card for B&W, three cards for color)	91200-90005	500 2,700	500 2,700	500 2,700
OMR driver DVR15	7261A Optical Mark Reader* with 17200-60001 interface*	07261-90010	1,200	1,200	1,200
9-track MTU driver DVR23	Up to four 7970B/E+226/236 9-track Mag Tape Units (w/13181A/ 13183A interface)	92202-93001	900	900	900
M-H Disc driver DVR31	Up to four 7900A Disc drives with 13210A interface		N/A	1,300	1,300
ICD Driver DVA32 interface	Up to two 7906H/HR, 7920H, and/or 7925H ICD Drives with 12821A	92068-90012	N/A	N/A	2,700
MAC Disc Driver DVR32	Up to eight 7905A*, 7906A, 7920A, and/or 7925A Disc Drives with 13037A/B/C Disc Controller and 13175A/B interface		N/A	1,800	1,800
Flexible disc driver DVR33	12732A Flexible Disc Subsystem with up to three 12733A additional disc drives	12732-90001	1,150	1,150	1,150
HP-IB interface driver DVR37 and library	59310B Hewlett-Packard Interface Bus (HP-IB) interface (IEEE Standard 488-1978 Digital Interface)	59310-90063	2,100 2,600 500 200	2,100 2,600 500 200	2,100 2,600 500 200
Data capture terminal driver DVA47	Up to 55 HP 3070 Data capture terminals connected to the system via 40280A interface	92900-90005	2,800	2,800	2,800
Universal interface driver	12556B, 12566B, and 12604B interface cards	09580-93027	960	960	960

*Identifies discontinued device that is listed here for reference only.

†Small DVR05 supports keyboard-display only; larger DVR05 also supports Mini cartridge I/O and auxiliary printer subsystems for 264x Terminals.

Smaller DVR37 does not provide SRQ; larger DVR37 provides SRQ.

Functional specifications

Multi-device driver DVR00

Supported capabilities

1. Character mode keyboard input (ASCII).
2. Punched tape input (ASCII or binary), on punched tape reader or teleprinter.
3. Printer/CRT display output (ASCII).
4. Punched tape output (ASCII or binary), on tape punch or teleprinter.
5. Enabling/disabling of program scheduling by keystroke on terminal.
6. Keyboard terminal operation with Bell 103 or equivalent modem.

Capabilities not supported. Auto answer, horizontal tabs, vertical tabs, and form options of keyboard printer terminals.

Character set. The driver passes the entire ASCII character set, but only upper-case characters can be used in system, file manager, or program statement names and labels. Other characters, such as lower case, result in an error message. However, this does not exclude the entry/retrieval of other characters in data files, their use in program documentation comments, or the editing of strings containing lower case characters using the interactive editor.

Page mode terminal drivers DVR05 and DVA05

Supported capabilities

1. Keyboard input in character or block mode.
2. Write to/read from display.
3. Enabling/disabling of program scheduling by keystroke on terminal.
4. Write EOF, forward/backspace one record or file, locate specific file, or write to/read on Mini cartridge transport 1 or 2 (264x terminal w/Mini cartridges).
5. Print output on Auxiliary Printer Subsystem (requires 264x terminal with Mini cartridges or with 13261A Device Support Firmware).
6. Bidirectional control of printwheel on 13349A Printer.
7. Modem communication via Bell Type 103A2 or 103A3, VADIC VA3400, or equivalent modems to supported peripheral **(DVA05 only).**

Capabilities not supported. Plotting or reverse linefeed on 13349A Printer or remote system console operation over modem links.

Character set. Same as described for DVR00.

Card reader driver DVR11

Supported capabilities. Reading of punched cards in Hollerith, packed binary, or column image binary format.

Line printer driver DVA12

Supported capabilities. Printing, 64 or 96 character set and automatic page eject with controllable line skipping.

Line printer driver DVB12

Supported Capabilities

1. Printing with multiple character sets; primary and/or secondary character set can be printed on the same line.
2. Standard or double-size printing.
3. Printing in non-character graphics mode.
4. Vertical form control.
5. Selection of printing or control action of control characters.
6. Self test.

Line printer driver DVR12

Supported capabilities. Printing, 64-character set.

TV interface driver DVA13 and library

Supported capabilities. Display of points, vectors, or characters with selective writing or erasure of any screen area.

OMR driver DVR15

Supported capabilities

1. Reading of mark-sense or punched cards in Hollerith, packed binary, or column-image binary format.
2. Sorting of cards into select and output hoppers.
3. Ringing of operator-signalling bell.

9-track mag tape unit driver DVR23

Supported capabilities (up to four units)

1. Read/write records on magnetic tape.
2. Write End-of-File (EOF).
3. Forward/backspace one record or file.
4. Rewind.
5. Erase four inches of tape.

Moving-head disc driver DVR31

Supported capabilities (up to four drives). Write/read access to specific tracks and sectors in specific disc drives.

ICD interface driver DVA32

Supported capabilities (up to two drives). Write/read access to specific tracks and sectors in specific disc drives.

MAC disc driver DVR32

Supported capabilities (up to eight drives). Write/read access to specific tracks and sectors in specific disc drives.

Flexible disc driver DVR33

Supported capabilities (up to four drives). Write/read access to specific tracks and sectors in specific disc drives.

HP-IB* interface driver DVR37

Supported capabilities

1. Reads from/writes to automatically-addressed instruments/devices on the Hewlett-Packard Interface bus (HP-IB).
2. Commanding of instruments/devices on the HP-IB.
3. Alarm scheduling of programs in response to service requests from devices on the HP-IB.
4. Read/write control of the HP-IB protocol itself.

Data entry terminal driver DVA47

Supported capabilities.

1. Numeric or special function keyboard input from any of up to 56 HP 3070 Data Capture Terminals.
2. Display output to any of 15 prompt signal lights on any of up to 56 HP 3070 Data Capture Terminals.

Universal interface driver DVM72

Supported capabilities: I/O via the compatible interface cards using RTE EXEC calls.

Ordering information

The Device Drivers listed in the summary on the previous page are furnished with the 92064A RTE-M, 92001B RTE-II, and 92068A RTE-IVB operating systems except where N/A is specified in the memory required column for RTE-M or RTE-II.

HEWLETT PACKARD

M/E/F-Series RTE Drivers Sources Product

product number 92062X

The 92062X RTE Drivers Sources Product is a set of computer source code used for RTE real-time drivers (comparable relocatable binary code is included with M/E/F-Series RTE operating systems). The drivers sources product is provided for customers who have a current HP Purchase Agreement that wish to modify or directly support portions of the RTE drivers software. Purchasing the 92062X product gives the customer the right to use RTE drivers sources on one HP 1000 computer.

Description

The RTE Drivers Sources Product consists of:

1. The source language code for the software listed in Table 1, on 800 bpi or 1600 bpi magnetic tape.

2. A directory of the source code, which is the first file on the magnetic tape.

3. An RTE driver writing manual (92200-93005).

4. Driver source programs user's guide (92062-90005).

Table 1. 92062X Drivers Sources Summary

Source Name/Description

&DVR00	Character mode multi-device driver
&DVA05	Modem or local page mode terminal driver
&DVR05	Local-only page mode terminal driver
&DVA47	HP 3070A/B Data capture terminal driver
&DVR11	HP 2892B Punched card reader driver
&DVA12	HP 26xxA Line printer driver
&DVR12	HP 2767A/9866A Printer driver
&DVA13	TV interface driver
&CHARS	TV interface character plot utility
&TVERF	TV interface verify utility
&DVR15	HP 7261A Optical Mark Reader driver
&DVR23	9-track Magnetic Tape subsystems driver
&DVR37	HP 59310B HP-IB interface driver
&HP-IB	HP-IB library utility
&SRQ.P	HP-IB SRQ utility
&MESS	HP-IB Meta-messages utility
&DVR33	HP 12732A Flexible Disc Subsystem driver
&DVR31	HP 7900A Disc driver
&DVR32	HP 7905A/6/M/7920/M Disc driver
&DVB12	HP 2608A Line Printer driver
&LP31	HP 2631A Device subroutine
&DVR10	CalComp. Plotter interface driver
&PLOT	CalComp Plotter library
&1DV10	HP 7210A Graphic Plotter driver w/library
&2DV10	HP 7210A Graphic Plotter driver w/o library
&DVM72	Universal interface driver
&DSCHD	Universal interface program scheduler

Ordering information

Prerequisites

The 92062X product is available to customers who have a current HP Purchase Agreement and who have previously acquired the M/E/F-Series RTE drivers separately or in an HP 1000 system. Purchase of the 92062X product requires the signing of a Software License Agreement and payment of the license fee listed in the Hewlett-Packard Corporate Price List. The License Agreement defines the appropriate use of the Software Sources and any derived object code.

92062X RTE Drivers Sources Product

The 92062X product is supplied to customers meeting the given prerequisites. A media option must be selected from one of those listed below.

92062X Media options

050 Source code directory and source code on 9-track, 800 bpi magnetic tape.

051 Source code directory and source code on 9-track, 1600 bpi magnetic tape.

Support

Hewlett-Packard will not support any binary object code derived from RTE drivers source code modified by the user.

Warranty

Hewlett-Packard will warrant only the media upon which the source code is delivered.

HEWLETT PACKARD	# RTE-IVB Software Sources Product

The 92068X Software Sources Product (Table 1) is a set of computer source code used to construct an RTE-IVB (92068A) real-time executive operating system and supporting subsystems, such as the file manager, loader, assembler, FORTRAN compiler, RTE drivers, and libraries. Purchasing the 92068X product gives the customer the right to use the RTE-IVB sources on one HP 1000 M/E/F-Series Computer. Minimum hardware requirements are defined in the 92068A data sheet.

Table 1. 96068X Software Sources Summary

Source Name/Description	Source Name/Description
RTE-IVB Operating System	Spool System*
RTE-IVB System Library	File Manager*/Session Monitor
Relocating Loader	Directory Manager
RTE-IVB System Generator	Batch Monitor Library
Switch Program	Editor
WHZAT Program	Utilities-RTE FORTRAN IV Compiler
Log Track Table	Compiler Library
RTE Assembler	Flexible Disc Backup
Cross-Reference Program	Formatter Library
Multi-Terminal Monitor	RTE/DOS Library
Power Fail and Auto-Restart Routine	Decimal String Package
	RTE Drivers
Configuration Extension	
EMA Diagnostic	

NOTE: Parts of the file manager and spool system have been written in SPL/2100. The SPL/2100 Compiler is available from the Program Library of User-contributed Software (PLUS/1000). The library can be obtained from the:

International HP 1000 Users Group
P.O. Box 54895
Oklahoma City, OK 73154

Note, however, that the SPL/2100 Compiler has not been tested by Hewlett-Packard in the RTE-IVB operating system and, like other HP 1000 Users Group contributed software, is not warranted or supported by Hewlett-Packard in any way.

Ordering information

Prerequisites

The 92068X product is available to customers who have a current HP Purchase Agreement and who have previously acquired the 92068A product separately or in an HP 1000 system. Purchase of the 92068X product requires the signing of a Software License Agreement and payment of the license fee listed in the Hewlett-Packard CorporatePrice List. The License Agreement defines the appropriate use of the Software Sources and any derived object code.

92068X RTE-IVB Software Sources Product

92068X RTE-IVB Software Sources Product consists of:
1. A directory and the source language code for the software listed in Table 1 on one of media options 050 or 051, which must be selected.
2. The right to use the 92068X product and the binary object code derived from it on one HP 1000 Computer System.
3. The Source Programs User's Guide (5955-4321).
4. The RTE-IVB Technical Specifications Manual (92068-90013).

92068X Media options

050: Provides source code directory and RTE-IVB source software on 800 bpi, 9-track magnetic tape.

051: Provides source code directory and RTE-IVB source software on 1600 bpi, 9-track magnetic tape.

92068Y Right to copy binary object code derived from the 92068X RTE-IVB Software Sources Product

92068Y, which is available only to purchasers of the 92068X product, consists of:
1. The right to make one copy of object code derived from the 92068X RTE-IVB Software Sources Product.
2. All manuals furnished with the 92068A RTE-IVB Real-Time Executive Operating System
3. EMA Firmware for use on HP 1000 E-Series or F-Series Computers.

92068Z Software Subscription Service for 92068X

The 92068Z Software Subscription Service, which is available only to purchasers of the 92068X product, provides updates as required to keep your RTE-IVB source code current with respect to design changes as they are released by Hewlett-Packard. Media option 050 or 051, the same as selected for 92068X, must be specified when ordering 92068Z.

Support of object code

Support of object code derived from the 92068X product is the customer's responsibility. Hewlett-Packard will not support any binary object code derived from source code modified by the user.

Warranty

Hewlett-Packard will warrant only the media upon which the source code is delivered.

HEWLETT PACKARD

RTE-L and RTE-XL Software Sources

The 92070X or 92071X Software Sources Product is a set of computer source code used to construct an RTE-L (92070A) or RTE-XL (92071A) real-time executive operating system and supporting subsystems, such as the driver software, file manager, loader, and generator. Purchasing the respective source product gives the customer the right to use the object code derived from it sources on **one** HP 1000 L-Series Computer. RTE-L/XL hardware requirements are defined in the 92070A/92071A data sheet.

Ordering information

Prerequisites

The 92070X or 92071X product is available to customers who have a current HP Purchase Agreement and who have previously acquired the 92070A or 92071A product separately or in an HP 1000 Computer System. Purchase of the source product requires the signing of a Software License Agreement and payment of the license fee listed in the Hewlett-Packard Corporate Price List. The License Agreement defines the appropriate use of the Software Sources and any derived object code.

92070X RTE-L Software Sources Product

The 92070X product consists of:

1. Source language program code on one of media options 041, 050, or 051, which must be selected, for the following software:
   a. All modules in the operating system, including RTE-L System Libraries.
   b. All standard RTE-L interface and device drivers.
   c. FMGR and FMP*.
   d. RTE-L Relocating Loader.
   e. RTE-L Generator.
2. The following manuals:
   a. RTE-L Executive Control Technical Specifications Manual (92070-90021).
   b. RTE-L I/O Control Technical Specifications Manual (92070-90022).
   c. RTE-L File Management Technical Specifications Manual (92070-90023).
   d. RTE-L/XL Drivers Technical Specifications Manual (92070-90024).
   e. RTE-L Loader/Generator Technical Specifications Manual (92070-90025).

92071X RTE-XL Software Sources Product

The 92071X product consists of:

1. Source language program code on one of media options 041, 050, or 051, which must be selected, for the following software:
   a. All modules in the operating system, including RTE-XL System Libraries.
   b. All standard RTE-XL interface and device drivers.
   c. FMGR and FMP*.
   d. RTE-XL Relocating Loader.
   e. RTE-XL Generator.
2. The following manuals:
   a. RTE-XL Executive Control Technical Specifications Manual (92071-90021).
   b. RTE-XL I/O Control Technical Specifications Manual (92071-90022).
   c. RTE-XL File Management Technical Specifications Manual (92071-90024).
   d. RTE-L/XL Drivers Technical Specifications Manual (92070-90024).
   e. RTE-XL Loader/Generator Technical Specifications Manual (92071-90023).
   f. RTE-XL Bootex/Build Technical Specifications Manual (92071-90025).

92070X/92071X Options

041: Provides all Source Software on 1.2M byte flexible discs.

The following options are valid only for current RTE-IVB users with the 7970 mag tape subsystem who intend to develop RTE-L/XL systems on an RTE-IVB operating system with revision code 2001 or later.

050: Provides all Source Software on 800 bpi, 9-track mag tapes.

051: Similar to 050, above, but with Source Software on 1600 bpi, 9-track mag tapes.

92070Y/92071Y Right to copy binary object code derived from the 92070X/92071X RTE-L/RTE-XL Software Sources Product

92070Y/92071Y which is available only to purchasers of the 92070X/92071X product, consists of:

1. The right to make **one** copy of object code derived from the Software Sources Product.
2. All manuals furnished with the 92070A/92071A RTE-L/RTE-XL Real-Time Executive Operating System.

Software support products available

See page 1-1.

Support

Hewlett-Packard will not support any binary object code derived from the RTE-L/RTE-XL source code modified by the user.

Warranty

Hewlett-Packard will warrant only the media on which the source code is delivered.

NOTE: Portions of the file manager have been written in SPL/2100 for which a compiler is available from the International HP 1000 Users Group Contributed Library. You can obtain the library by writing to:

International HP 1000 Users Group
P.O. Box 54895
Oklahoma City, OK 73154

NOTE, however, that this compiler has not been tested by Hewlett-Packard in RTE-L, RTE-XL, or RTE-IVB and, like other HP 1000 Users Group contributed software, is not warranted or supported by Hewlett-Packard in any way.