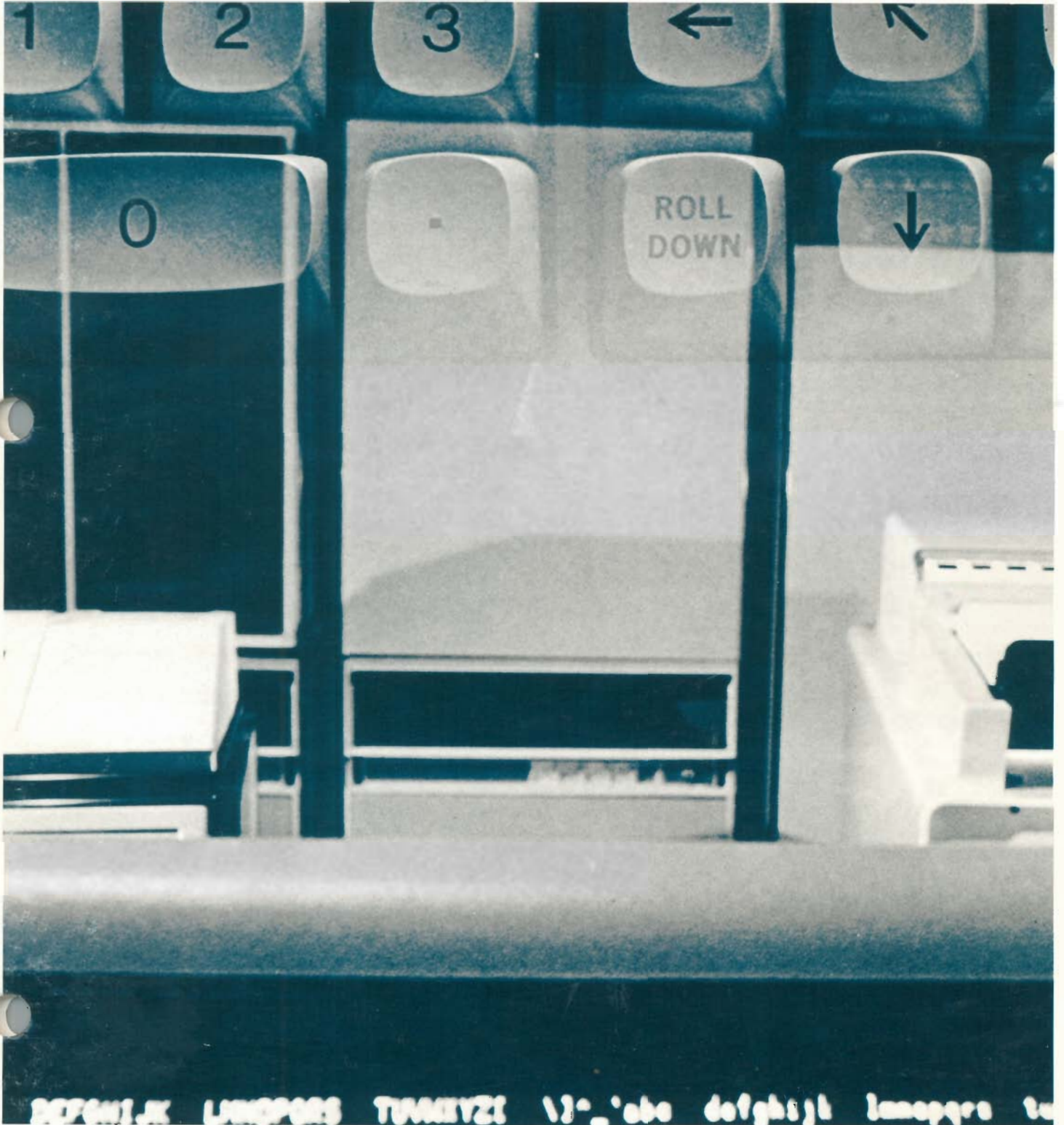# HP 3000CX Mini DataCenters and Subsystems Data

Preface

HP 3000 computers form the basis for the most powerful minicomputer systems available anywhere. A continuing development program incorporates the state-of-the-art in computer architecture, software and peripherals, into products that are highly cost-effective and easy-to-use solutions for existing user needs, and for future requirements.

The products described can be employed in any Hewlett-Packard 3000 or 3000CX Mini DataCenter. Additional systems enchancements can be anticipated on a continuing basis.

The subject matter in this publication is indexed to first present whole system configurations, then software and hardware subsystems in that order.

Index

HEWLETT hp PACKARD

3000CX Series Mini DataCenters

Introduction

The HP 3000CX Series Mini DataCenters are designed to meet the needs of distributed computer network users as well as those with single-unit dedicated computer requirements. Any Mini DataCenter within the HP 3000CX Series can be selected to fit individual hardware and software needs without altering the CPU operating system.

An HP 3000CX Mini DataCenter may be easily integrated into networks of interconnected Mini DataCenters and large central computing systems.

SYSTEM FEATURES
Designated 50CX, 100CX, 200CX and 300CX, these interactive Mini DataCenters have a common multiprogrammed operating system (MPE/C) that features spooling, virtual memory and a communications subsystem to link CX Series systems to each other and to larger computers as well. The operating system also offers data base management software and supports access to multiple interactive terminals and batch devices concurrently.

Other features of 3000CX Mini DataCenters are the ability to expand the CPU microprocessor to include decimal arithmetic instruction for business applications and extended precision floating point instructions for scientific use. Software includes six language subsystems, COBOL, Report Program Generator (RPG), FORTRAN, System Programming Language (SPL), BASIC Interpreter, and the first full BASIC language compiler. Also available is a complete line of peripheral equipment.

ARCHITECTURE
- Hardware implementation of stack provides efficient memory utilization and a highly effective multiprogramming environment
- Separation of code and data for multi-user code sharing
- Concurrent CPU and I/O processing for maximum systems utilization
- Modular organization built around a high speed (175-ns) data bus for high system throughput

- CPU utilizes 32-bit LSI bipolar ROM-based microprocessor to form the basis of 182 instructions. The comprehensive instruction set reflects compiler, execution and operating systems requirements
- 16-port terminal controller with autospeed detect and type 103 modem capability for effective communications with terminals
- 16-channel SIO multiplexer with 880,000 byte/second transfer rate for rapid data transfers

MULTIPROGRAMMED EXECUTIVE OPERATING SYSTEM
- Virtual memory in the form of code segmentation provides cost-effective use of main memory and the capability to handle large programs
- Dynamic memory manager for maximum memory utilization
- Advanced file system for extensive data handling
- Automatic input and output spooling for efficient peripheral usage
- Accounting and logging to aid system management
- Comprehensive file security for protection of sensitive data
- Simple file and program backup on magnetic tape for data integrity
- Power-fail with auto-restart for continuous system operation
- On-line peripheral access and resource sharing for flexible I/O use

MINI DATACENTER CONFIGURATION
The four different hardware configurations use a common multi-user operating system built on a full hardware implementation of stack architecture. These Mini DataCenters with their specific hardware, sets of peripherals and selected software, represent the various levels of throughput and capability to handle a specific number of functions.

HEWLETT **hp** *PACKARD*

50CX
Mini DataCenter
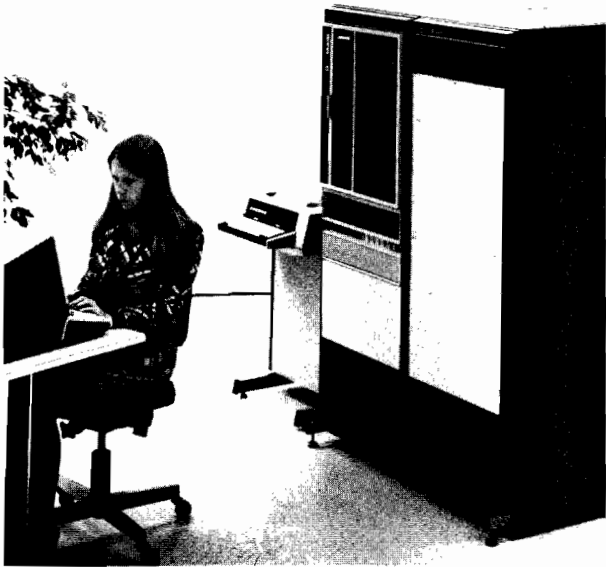
The 50CX Mini DataCenter is the smallest of the
HP 3000CX Series. It consists of a 96 K-byte processor,
5-megabyte disc, 800-bpi magnetic tape unit, system
console and a 16-port asynchronous terminal controller.
It is a starter system—the basic building block from
which larger, more powerful systems may be formed.

HARDWARE SUPPLIED

HP 3000CX fundamental hardware, including:
- central processing unit (CPU)
- 96 K-bytes of core memory
- memory controller
- system clock
- 16-port asynchronous terminal controller
- 16-channel SIO multiplexer
- Hard copy system console
- cabinet bays, card cages and power supplies

30110A: 4.9-million-byte moving-head cartridge-disc unit

30115A: 800-bpi magnetic tape unit

FUNDAMENTAL OPERATING SOFTWARE

- multiprogramming executive operating system (MPE/C)
- systems programming language (SPL)
- text editor (EDIT)
- program debugging aids (DEBUG and TRACE)
- file-copying utilities (FCOPY)
- sort and merge subsystems (SORT)

HP Computer Museum
www.hpmuseum.net

For research and education purposes only.

100CX
Mini DataCenter
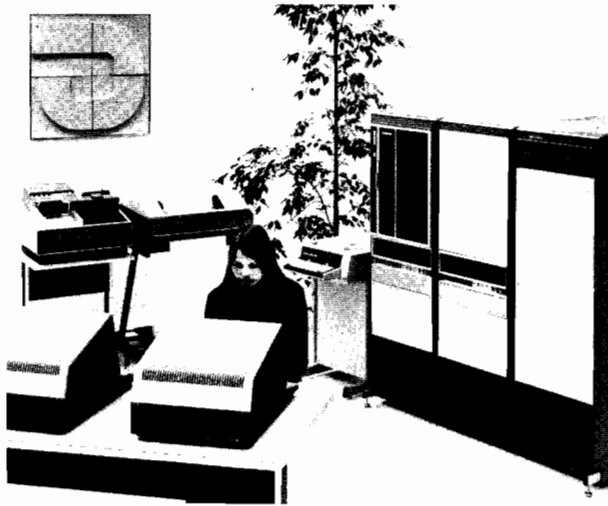
The 100CX Mini DataCenter provides increased inter-active terminal and batch processing capabilities. A wide range of software makes the 100CX ideal for scientific, commercial and timesharing applications requiring terminal oriented processing. Depending on the specific application, the system can support four to eight terminals. With optional core expansion it can support as many as 16 terminals.

TIMESHARING OPTION
A timesharing option, including a full BASIC compiler, and a BASIC interpreter is available. The interpreter provides an effective program development medium, while the full compiler provides efficient execution of frequently run programs.

SCIENTIFIC AND BUSINESS OPTIONS
A versatile on-line interactive editor, ANSI standard FORTRAN compiler, scientific library and statistical analysis software package, provide a powerful scientific processing capability. For business oriented applications, the 100CX offers RPG II with hardware decimal instruction.

MINI DATACENTER FEATURES
On-line disc storage of 9.8 million bytes is provided by two fast-access moving-head discs operating from a single controller. The discs, with 7-ms maximum track-to-track positioning (average access time less than 35 ms), are the basis of the system's terminal responsiveness. An 800-bpi, 9-track (NRZI), IBM-compatible tape unit provides an efficient data-file backup mechanism.

HARDWARE SUPPLIED
HP 3000CX fundamental hardware, including:
- central processing unit (CPU)
- 96 K-bytes of core memory
- memory controller
- system clock
- 16-port asynchronous terminal controller
- 16-channel SIO multiplexer
- hard-copy system console
- cabinet bays, card cages and power supplies

30106A 600-cpm card reader

Two 30110A 4.9-million-byte cartridge disc units (9.8 M-byte total)

30115A 800-bpi magnetic tape unit

30118A 200-lpm line printer

FUNDAMENTAL OPERATING SOFTWARE
- multiprogramming executive operating system (MPE/C)
- systems programming language (SPL)
- text editor (EDIT)
- program debugging aids (DEBUG and TRACE)
- file-copying utilities (FCOPY)
- sort and merge package (SORT)

SOFTWARE OPTIONS
Timesharing Option
- BASIC interpreter (32101A)
- BASIC compiler (32103A)

Scientific Option
- FORTRAN compiler (32102A)
- scientific library (32205A)
- statistical analysis package (32204A)
- expanded instruction set — extended precision floating point (30011A)

Business Option
- RPG II compiler (32104A)
- expanded instruction set -- decimal (30011A-001)

3

200CX
Mini DataCenter

The 200CX Mini DataCenter is ideal for the terminal-oriented user. Enhancing the operating system are 128 K-bytes of core memory and a fixed-head swapping disc. This combination extends the number of terminal users allowing an additional 16-port terminal controller.

TIMESHARING OPTION
A BASIC interpreter and BASIC compiler comprise the timesharing option. File independence and virtual memory are features that allow the user to broaden the scope of an application and maintain the benefits of on-line processing.

SCIENTIFIC OPTION
An ANSI FORTRAN IV compiler, scientific library, statistical analysis package and floating-point hardware are available through the scientific option. The performance enhancements of the system bring more resources to a greater number of engineering users.

BUSINESS OPTION
A full capability terminal, the HP 3000 system's technological contribution to the commercial user, is augmented by the 200CX, which adds another dimension allowing even more terminal users. This capability is complemented by 47 million bytes of mass storage, a 600-cpm card reader and a 200-lpm line printer. The

commercial hardware and software options include an ANSI COBOL compiler, RPG II compiler and decimal arithmetic hardware.

HARDWARE SUPPLIED
HP 3000CX fundamental hardware, including:
- central processing unit (CPU)
- 128 K-bytes of core memory
- memory controller
- system clock
- 16-port asynchronous terminal controller
- 16-channel SIO multiplexer
- hard-copy system console
- cabinet bays, card cages and power supplies

30102A 47-million-byte moving-head disc

30103A 2-million-byte fixed-head disc

30106A 600-cpm card reader

30115A 800-bpi magnetic tape unit

30118A 200-lpm line printer

FUNDAMENTAL OPERATING SOFTWARE
- multiprogramming executive operating system (MPE/C)
- systems programming language (SPL)
- text editor (EDIT)
- program debugging aids (DEBUG and TRACE)
- file-copying utilities (FCOPY)
- sort and merge package (SORT)

SOFTWARE OPTIONS
Timesharing Option
- BASIC Interpreter (32101A)
- BASIC compiler (32103A)

Scientific Option
- FORTRAN compiler (32102A)
- scientific library (32205A)
- statistical analysis package (32204A)
- expanded instruction set — extended precision floating point (30011A)

Business Option
- ANSI COBOL compiler (32213B)
- RPG II compiler (32104A)
- expanded instruction set — decimal (30011A-001)

300CX
Mini DataCenter

The 300CX Mini DataCenter is designed for the maximum processing needs of today's computer user. The 300CX Mini DataCenter can handle six to 32 users in both batch and terminal-oriented environments. It features a hardware-implemented stack, code sharing, microcoded instruction set and virtual memory. These features enable users to implement applications with minimal impact on overall system resources.

TIMESHARING OPTION
Timesharing users are provided an option which includes a BASIC interpreter and a full BASIC compiler. Efficient software, a fixed-head disc and a powerful CPU offer concurrent terminal users more capability than any other minicomputer.

SCIENTIFIC OPTION
A FORTRAN compiler, scientific library, statistical analysis package and floating-point instruction hardware are featured in the scientific option. Versatile on-line capabilities and powerful batch features give users the needed tools and performance.

BUSINESS HARDWARE
This option provides a Data Base Management package (IMAGE/3000) and a Data Base Inquiry facility (QUERY/3000). Also included are RPG II, ANSI COBOL, and decimal arithmetic hardware. These features added to HP's MPE/C operating system, text editor, sort and merge package, file copier, program debug intrinsics, a card reader/punch, 47-M-byte storage device and 1250-lpm line printer, give the production-oriented user full system capabilities in a multi-user environment.

HARDWARE SUPPLIED
HP 3000CX fundamental hardware, including:
- central processing unit
- 128 K-bytes of core memory
- memory controller
- system clock
- 16-port asynchronous terminal controller
- 16-channel SIO multiplexer
- hard-copy system console
- cabinet bays, card cages and power supplies

30102A 47 M-byte moving-head disc

30103A 2 M-byte fixed-head swapping disc

30115A 800-bpi magnetic tape unit

30119A card reader punch, includes:
   200-cpm card reader
   up to 75-cpm card punch

30128A 1250-lpm line printer

FUNDAMENTAL OPERATING SOFTWARE
- multiprogramming executive operating system (MPE/C)
- systems programming language (SPL)
- text editor (EDIT)
- program debugging aids (DEBUG and TRACE)
- file-copying utilities (FCOPY)
- sort and merge package (SORT)

SOFTWARE OPTIONS

Timesharing Option
- BASIC interpreter (32101A)
- BASIC compiler (32103A)

Scientific Option
- FORTRAN compiler (32102A)
- scientific library (32205A)
- statistical analysis package (32204A)

- expanded instruction set — extended precision floating point (30011A)

Business Option
- ANSI COBOL compiler (32213B)
- RPG II compiler (32104A)
- IMAGE/3000 data base management package (32215A)
- QUERY/3000 data base inquiry facility
- expanded instruction set — decimal (30011A-001)

HEWLETT **hp** *PACKARD*

3000CX Series Fundamental Operating Software

MPE/3000

Features

- Concurrent multi-lingual capability, FORTRAN, COBOL, RPG, BASIC, and SPL
- Multiprogramming
- Virtual memory
- Stack architecture
- Simple command language
- Complete accounting of resources
- File backup and security
- Relocatable program modules
- ANSI standard languages
- Recursivity/reentrancy
- Dynamic resource allocation
- Remote processing via terminals
- Spooling – input and output
- Power fail/automatic restart

MPE/3000 is a general purpose, disc-based software operating system that makes possible concurrent execution of many programs in a multi-lingual environment. When a user program enters execution, the commands within it are executed on a multiprogramming basis. Should one job be temporarily suspended, perhaps to await the completion of an I/O operation, another can immediately employ the central processor. Thus, when many users are active in the system, uninterrupted processing and high user throughput can be maintained.

User programs are independent of the mode through which they are input; the user can run the same code from either traditional batch input devices or interactive terminals. In fact, the same system code is used to accomplish particular functions in either mode, resulting in storage economy and reduced overhead.

STACK ARCHITECTURE AND VIRTUAL MEMORY

The employment of stack architecture by MPE/3000 automatically provides the separation of code from a user's data. This separation of data from code provides for both recursivity and reentrancy of user programs. That is, one copy of a program can be shared by many users while each still operates in his own environment free from interference by the other users.

Storage for local data is allocated only as needed and is automatically freed when no longer required, allowing reuse of that area of memory by other parts of the program. Consequently, programs require less average storage than conventional systems.

MPE/3000 virtual memory provides a total memory space that far exceeds the maximum main memory size of 128K bytes. Virtual memory consists of both main memory and disc storage. The concept of virtual memory is achieved by code segmentation.

STORAGE ECONOMY

MPE/3000 provides economized use of main memory and secondary mass storage, freeing the maximum storage possible for user programs and data. Priorities are used to control main-memory resources, eliminating the need for fixed or variable memory partitions to support MPE's unified multi-lingual, multiprogramming environment. Main memory is allocated for temporary and local variables only when needed, and is de-allocated upon exit. Disc storage is automatically allocated as needed, and files on disc can be accessed simultaneously by many users.

COMMAND LANGUAGE

The simplicity of the command language greatly enhances the MPE System's usability. The user interfaces with MPE/3000 through commands (for general functions external to his programs) and intrinsic calls (for specific functions invoked during program execution). Common system commands are used to initiate and terminate jobs and sessions, re-specify file characteristics, compile and execute programs, and call various utility subsystems. (As a matter of fact, each language processor and subsystem is accessed by a unique MPE/3000 command. The programmer need learn only one set of conventions for using these programs, because they all use the same command formats, special characters, and error-diagnostic methods). Intrinsic calls

HEWLETT **hp** *PACKARD*

MPE/3000 (Cont'd)

implement such functions as reading, writing on, and updating files, skipping forward or backward on a file, or returning system table information to the user's program. These intrinsic calls are available not only to the SPL (Systems Programming Language) but also to the higher level languages FORTRAN and COBOL.

For example, the required command input for FORTRAN compile, program preparation (link edit), and program execution, is detailed for a worst case situation, as follows:

```
:FORTRAN
                 | SOURCE
                 | PROGRAM
:EOD
:PREP $OLDPASS,PROGF
:SAVE PROGF
:RUN PROGF
                 | PROGRAM
                 | OUTPUT
```

These steps can be simplified with a single command, FORTGO, detailed below:

```
:FORTGO
                 | SOURCE
                 | PROGRAM
:EOD
                            | PROGRAM
                            | OUTPUT
:SAVE $OLDPASS,PROGF
```

FILE MANAGEMENT CAPABILITIES
MPE file system provides user program interaction with I/O devices in a manner that is device independent (the system furnishes default device specifications). Thus, for example, any program can read data from either a card reader, tape, or disc using an identical procedure.

File commands allow programs to reference files without specific knowledge of their actual names or characteristics, and allow file specifications to be altered at run-time.

The file system simplifies I/O programming and provides a straightforward method to access data.

The security file system and account/group/user structure provides many classes of security for user files. Access to files may be controlled at several levels which range from un-restricted access by anyone to controlled access available only to the creator of the file. For example, a user could make his data file available to any other user in a 'ready-only' mode, while only mambers of his immediate account can append data to the file. The file and account/group/user structure provides the user with security and integrity.

SPOOLING
Jobs and job input/output are automatically buffered, if desired, thus removing the contention that would normally be encountered with non-shareable devices.

This spooling capability requires no modification to programs or data to implement, thus it is "transparent" to the HP 3000 user. For example, a simple STREAM command is used to initiate a spooled job. After a spooled job is started a SHOWJOB Command will interactively display the progress of the job.

ACCOUNTING
Accounting capability enables the HP 3000 system manager to set CPU time, connect time and disc space limits on individual accounts, and to obtain reports of the usage of these resources broken down by individual group. It also enables an account manager to set limits and obtain reports on groups within his account. Job/session data is also provided to individual users to enable the placement of limits on jobs.

Through logging capability, the system supervisor can collect a record of system activity at the user level on a disc file. The collected data enables the writing of a billing program which takes into account use of all significant system resources, or to analyze the manner in which the system is used. Examples of statistics collected are amounts of virtual memory used by a process, number of I/O transactions to a file, number of processes created, use of files by name, etc.

POWER FAIL/AUTOMATIC RESTART
In case of a power failure the HP 3000 preserves system and user permanent information, so that continuity of processing is maintained when the system automatically restarts.

DEBUGGING FACILITIES
Extensive system tools are provided for indepth debugging of System Programming Language (SPL) programs. These capabilities are especially useful when machine dependent and privileged routines are being developed.

SYSTEM GENERATION AND MAINTENANCE
MPE/3000 consists of a single operating system which can be specifically tailored to the installation needs within minutes. Through the system generation facilities, file directories and files modified as of a specified date can be dumped to tape. This capability, along with the standard system reload procedure, provides for complete file backup.

SUPPORTING SOFTWARE
ANSI standard programming languages and software subsystems greatly enhance and complement the capabilities of MPE/3000. These systems include the languages FORTRAN, COBOL, BASIC, and SPL, plus a text editor, sort/merge package, scientific library, statistical analysis package, utility functions, and system diagnostic software.

Diagnostics

Diagnostic software helps the computer operator to identify, diagnose and correct hardware problems in the HP 3000 system. Three levels of diagnostic software are provided:

- SDM/3000, System Diagnostic Monitor, performs on-line diagnostics under control of MPE/3000, and is a subset of MPE/3000, the computer's operating system. On-line diagnostics run concurrently with other programs under control of MPE/3000, and permit uninterrupted computer operation while diagnostic and routine maintenance checks are performed on the running system. Through the System Diagnostic Monitor, the user of the system console, invokes, executes, and modifies diagnostic programs, thus interacting on-line through sets of commands and messages. A diagnostic program exists for the central processor and for every standard peripheral device offered for the HP 3000 computer system.

- Stand-Alone Diagnostics
  If the minimum hardware configuration required by the operating system is not operable, Stand-Alone Diagnostics must be used in place of on-line diagnostics. Stand-Alone Diagnostics perform functions complementary to those of on-line diagnostic (SDM/3000); several independently operated programs run directly on the central processor while the operating system (MPE/3000) is shut-down.

- Microdiagnostics
  If a problem prevents the use of both on-line and stand-alone diagnostics, the HP 3000 Microdiagnostics must be used. These are microprograms that replace the instruction set microprograms in the central processor and in certain controllers. They identify and diagnose problems by checking the functions of the hardware at the most basic level.

Compiler Library

The HP 3000 Compiler Library is a set of subroutines that provides many operations commonly needed by users programming in COBOL/3000, FORTRAN/3000, SPL/3000, and BASIC/3000. These operations include:

- Extended-precision floating-point arithmetic
- Matrix operations
- Complex arithmetic
- Trigonometric functions
- Mathematical functions
- Numeric conversions
- Utility functions

In addition, the Compiler Library includes a formatter program that simplifies input/output operations for the FORTRAN/3000 programmer. This program makes it unnecessary to specify precise machine operations; the user only specifies the format of the data, a list of variables, and a device or file.

TRACE/3000

TRACE/3000 is a programmatic debugging subsystem that aids the user in finding program logic errors in SPL/3000 and FORTRAN/3000 programs. TRACE/3000 helps the user follow the path of execution, computation of values, and manipulation of data in his programs by printing information about program identifiers (such as labels, variables, arrays, and subroutines), and structure points (critical points of passage into and out of program units) during program execution. TRACE/3000 allows the user to specify selective conditions for reporting information, for example: Print data only when a variable exceeds a certain value, or when it is changed a specified number of times. The user communicates with TRACE/3000 by entering special paragraphs and sentences through his job or session input stream. TRACE/3000 offers these features:

- Operation in batch job or time-sharing session mode.
- Input of TRACE/3000 paragraphs and sentences in three ways:
  Through a Batch File (on cards, disc, or tape) in a job.
  Through the terminal in a session.
  Through a Batch File (on cards, disc, or tape) in a session. (This method is ideal when the user plans to issue the same directives during several successive runs of his program in session mode).
- Option to either print a report, or print a report and halt the user's program, upon satisfaction of specified conditions.

Utility Functions

The utility, FCOPY, is a program used for general file copying operations. In addition to this basic capability, it has features for character code translation, set up of line printer dump formats, verification of a copy operation, selection of a subset of the file, and the capability of ignoring a specified number of read errors from the source file.

The capability to translate character codes allows the user to convert EBCDIC and BCD source files to ASCII and vice versa.

Dump formatting allows for the formatting of hexadecimal, octal and character dumps. The user specifies the dump formats and title if desired, and the utility automatically establishes the dump format according to the output device class.

Verification capability allows the user to compare two source files. When a compare error is found, the user is given both the record and the word or byte number where it occurred.

Utility Functions (Cont'd)

Through the subset option, the user can select a portion of a file based on field content, number of records starting with a given record, or all records contained between two record numbers.

These functions can be performed as a single operation or as multiple operations within a single access to FCOPY.

EDIT/3000

Features

- All occurrences of a character string can be changed with one command
- A command to call user-written procedures for modifying or processing text
- USE mode for execution of pre-stored EDIT/3000 commands
- Nested, interative loop facility for repetitive editing
- Multiple-line delete, insert, move and replace capability
- Metacommands to provide Boolean logic for conditional editing
- Many options for display before editing, display after editing, do not display, etc.
- Columns may be selected for restricted searches and edits.
- HOLD file for storing data to be duplicated into other text files
- Selective concatenation of portions of files
- Line by line template display for easy modifications to complex text

The EDIT/3000 Text Editor permits the user to create and manipulate files of upper and lower case ASCII characters with great ease. Lines, strings and characters can be inserted, deleted, replaced, searched for, etc. The files to be edited can be source language programs, such as FORTRAN, SPL, COBOL, etc., or text material, such as reports.

EDIT/3000 interacts with the user through edit commands. The command language is so designed that a non-experienced user will find those commands that normally exist in all editors (e.g., DELETE, REPLACE, INSERT); the experienced users will find that EDIT/3000 contains all the commands necessary to write complex edit command sequences, where editing is based on conditions found within the text itself.

ENVIRONMENT
The EDIT/3000 Text Editor is designed to operate in the following three modes:

- Session Mode
  Edit commands and text are entered interactively at the terminal.
- Batch Mode
  The editor locates the commands and text in the job input stream.
- USE Mode
  The editor reads the commands from a file, but sends messages to the standard output device. Text records are read from the standard input device. This text mode facilitates complex and repetitive editing where it's desirable to make the required commands transparent to the user.

FILE HANDLING
Five files are maintained by EDIT/3000:

- Standard input file. Generally a terminal in Session mode or a batch input device in Batch mode. EDIT/3000 normally reads the edit commands and text records from this file.
- Standard output file. Generally a terminal in Session mode or a batch output device in Batch mode. EDIT/3000 normally outputs messages to this file.
- TEXT file. A temporary file that contains the information to be modified. EDIT/3000 never operates directly on a user file in order to minimize the possibility of an operator causing accidental destruction of an only copy.
- HOLD file. Serves as a temporary file for the editor. Used mainly for holding interim information (e.g., copying parts of the TEXT file to the HOLD file and to add or insert the HOLD file in the TEXT file, through the application of various commands).
- USE file. Specified by the USE command. Causes EDIT/3000 to read all commands from the file, but any messages and requests for text records are sent to the user terminal (if so desired). It is also possible to specify that all information (including text records) are to be found in the USE file.

In addition to these files, the user may add or insert other specified files to the TEXT file.

COMMAND LANGUAGE SUMMARY

ADD	Enter lines of text into the TEXT file from the standard input device or the HOLD file.
CHANGE	Replace one string by another over a specified part of the text.
DELETE	Delete characters and lines from the TEXT file.
END	Terminate execution of EDIT/3000.
FIND	Locate a string in the TEXT file.
GATHER	Move and renumber portions of text from one location to another in the TEXT file.

EDIT/3000 (Cont'd)

HOLD	Copy text from the TEXT file into the HOLD file.
INSERT	Insert text into the TEXT file from the standard input device or the HOLD file.
JOIN	Add all or portion of a file to the TEXT file.
KEEP	Save all or part of the TEXT file in a USER file.
LIST	Print out any portion or all of the TEXT file. Two options of this command are of special interest:

OFFLINE – Directs the listing to a specified file. If in session mode, it can be used for instance to direct listings to the line printer.

TRANSLATE – Converts all lowercase alphabetic characters to uppercase. This feature allows the use of output devices incapable of producing lowercase characters.

MODIFY	Modify lines in the TEXT file using three operations: delete (D), insert (I), and replace (R).
REPLACE	Replace lines in the TEXT file.
SET	Alter options that are normally set by the subsystem and govern editing operations.
TEXT	Copy all or part of a user file onto the TEXT file.
VERIFY	Obtain the setting of options (see SET).
XPLAIN	Print an explanation of selected commands or all commands.

COMMAND—FILES RELATIONSHIP

Files required to be on disc are illustrated as discs.

ADVANCED FEATURES

EDIT/3000 has several commands designed primarily for complex editing. While these commands require programming-like knowledge on the part of the user, they provide superlative editing power. Some of these commands are:

- PROCEDURE
  This command allows EDIT/3000 to call and use logical procedures written in FORTRAN, SPL, or COBOL. The called procedure may then act on the text records passed by EDIT. This very potent feature allows the user to implement his own editing functions.

- USE
  Permits editing operations to be carried out in a combined interactive/batch mode. The user initially stores EDIT commands in an MPE file. Subsequently, while editing at an interactive terminal the USE command is entered to transfer temporary EDIT control to the file. When EDIT exhausts the file, control returns to the terminal.

- WHILE
  Causes repetitive execution of blocks of EDIT commands until a "false" condition occurs. When used in conjunction with other EDIT metacommands, Boolean logic can be invoked on nested blocks of EDIT commands. The result is conditional execution of EDIT commands where execution is contingent on both the text and the EDIT commands.

SORT/3000

Features

- Sorts any file
- Merges any sorted files
- Ascending or descending sort by keys
- Keys can be contiguous, separated, or overlapping
- Keys may be of multiple data types
- Record size is unrestricted and may be fixed or variable length
- Input and output media may be of various types (e.g. disc files, magnetic tapes, cards printer output, etc.)
- The sorted output can be chosen from sequenced records, key fields, record numbers or record numbers plus key fields
- No extra disc space required except for the sort file
- User specified routines may be used for key compare, pre-processing, and post processing

11
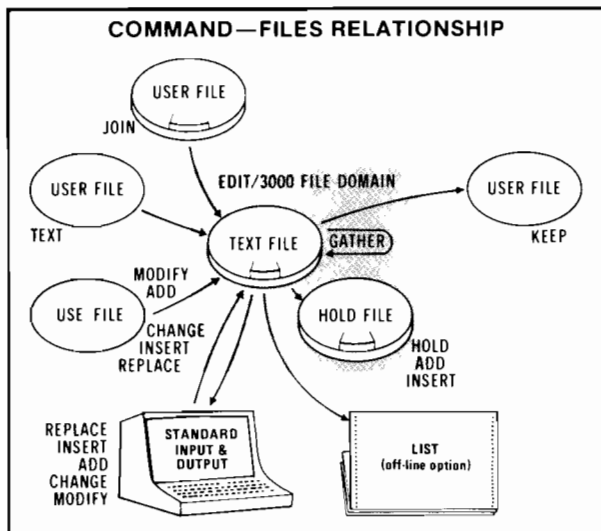
SORT/3000 (Cont'd)

SORT/3000 Subsystem provides the capability to **sort and/or merge** multiple files of sequential records into a sequential record. This permits users of the HP 3000 Computer System to arrange large quantities of records (a file) into a prescribed order. Each record consists of a series of data fields which describe one "item" of information. Sorting is based on keys (values of one or more data fields). Merging forms one sorted sequence of records by combining one or more previously sorted sequences of records.

ENVIRONMENT

SORT/3000 is capable of operating in the minimum HP 3000 configuration. The program may be employed in a variety of applications:

- As a free standing subsystem, it can be activated through commands in Batch or Session mode.
- As a number of procedures, the subsystem provides a set of procedures callable by user programs written in SPL, FORTRAN, and also via the SORT verb in COBOL.

KEYS

The basis for determining the sequence of records in a file is a group of items that constitute the control word for a record. The data in the control words of all records are compared against each other to determine the sequence of the records.

The control word is made up of keys specified by the user. Most significant is the major key and is compared first. Other keys are minor and compared according to their relative position following the major key in the parameter description. Minor keys are compared only if the more significant keys result in an equal condition.

The SORT/3000 Subsystem is two programs capable of sorting or merging records on keys specified by the user. Individual keys may be contiguous, separated or overlapping and may appear anywhere in the record. Different Different key fields have their own sequences, thus indicating that different keys can be sorted in different order (ascending/descending) in the same run.

Length, type, relative position, number and priority of keys and type of sort, input and output files, are specified as parameters by the user.

The key data may be the following types:

ASCII ⎤
EBCDIC ⎦ sorted as 8-bit positive integers
Signed Integer with any precision
Positive Integer with any precision
Real Number with any precision
Packed Decimal
Numeric Display

FILES

Three files are required for sorting: Input, Output and Sort. The Sort file is built by the sort program and is always stored on a disc. The Input and Output files can generally be any type of medium such as cards, magnetic tape or disc files. Sorting requires disc space for only the sort file.

The output can be chosen from:
- Sequenced records
- Key fields or record numbers, or both

SPL/3000 Compiler

Features

- A unique Systems Programming Language (SPL). Modern successor to assembly language programming
- High-level yet machine dependent. ALGOL-like high level statements are combined with special machine dependent statements for full capability
- Efficient coding. The high level nature of SPL/3000 reduces coding errors and increases program production
- Self-documenting for ease of readability
- Permits access to all hardware features and data types
- One-dimensional arrays supported
- All object-code is re-entrant. Permits maximum utilization of HP 3000 CPU
- Dynamic allocation of local storage for working space and local variables in procedures. Memory de-allocated on exit from procedures
- Three program levels: Main program, procedures, subroutines
- Program segmentation feature
- Simple interface to other languages, and to the Multi-programming Executive operating and file systems (MPE/3000)
- Assemble statement permits machine level coding

SPL/3000 is the Systems Programming Language for the HP 3000 Computer System. It serves as both a high-level language and a machine-dependent language. With SPL/3000 the programmer can express himself clearly and concisely while producing efficient object programs.

SPL/3000 Compiler (Cont'd)

BACKGROUND
The choice of programming languages on most computers lies in selecting one of two mutually exclusive groups: a high-level machine-independent language such as FORTRAN, on the one hand, and a completely machine dependent assembly language on the other.

In assembly language, the syntax usually matches the structure of the machine language very closely. Assembly language can be used to attain a high degree of efficiency and control, but usually at the expense of lengthy develop-ment. To fully utilize assembly language capabilities, the programmer must have a thorough knowledge of the machine's structure and intricacies.

High-level languages, on the other hand, insulate the programmer from the details of the machine: They enable the overall program to be written clearly and concisely because they follow the structure of normal human discourse. Unfortunately, most high-level languages cannot generate code as efficiently as an assembly language. They do not offer the scope required for interrupt handling, bit and register manipulations, or precise control of peripherals such as graphic displays. For these reasons, systems software (operating systems, monitors, compilers, etc.) is usually written in assembly language.

THE STATE OF THE ART
To simplify systems programming, SPL/3000 combines the best features of both types of languages. It offers the programmer a high-level language similar to (but not equivalent to) ALGOL, to produce the more usual coding sequences. Moreover, it has added features which enable the programmer to easily exert control over machine-dependent functions of the computer system. SPL/3000 also provides excellent commenting facility, and the language structure aids documentation.
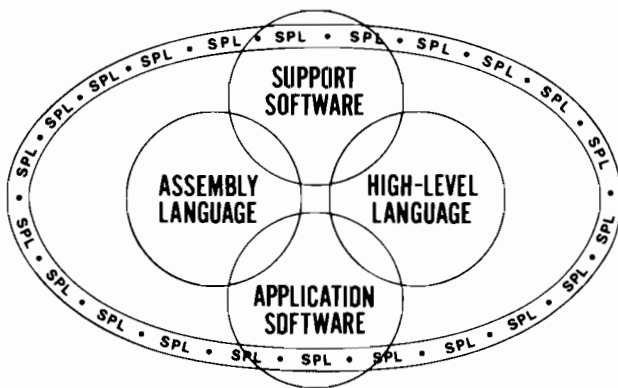
HIGH EFFICIENCY
SPL/3000 permits the programmer to include assembly code.

This facility allows the programmer (in the midst of high level constructs) to operate directly on hardware registers, perform branches based on hardware status, extract/deposit/shift bit fields, or generate any sequence of hardware machine instructions.

SPL/3000 has been made as structured as possible to ease the work of the programmer. Constructs have been included only where economical code generation is not sacrificed. The language provides many features normally found only in applications languages such as ALGOL and PL/1, and includes:

- Free-form structure
- Arithmetic and logical expressions
- High level statements with unlimited nesting (IF, FOR, SWITCH, CASE, DO-UNTIL, WHILE-DO, MOVE, SCAN, assignment and compound statements)
- Recursive procedures and subroutines
- Variables and arrays of many different data types

ENVIRONMENT
Programs may be compiled in batch mode or via a time-share "session". In batch mode, input is taken from the standard input device (card reader), and list output is directed to the standard list device (line printer). In time-share mode, all input and output occurs at the user's terminal.

The operating system automatically allocates these devices to the compiler; however, the user may override these decisions and allocate other suitable devices. Thus a time-share user can, for example, perform a compilation with the source code in a disc file and list the output to the line printer (subject to the user having the necessary authority).

LANGUAGE USE AND STRUCTURE
An ALGOL programmer can begin using SPL/3000 almost immediately, while other users will find it much easier to learn than a conventional language.

SPL/3000 is procedure oriented. A program written in SPL normally comprises a main program, and a set of procedures which may be called either from the main program or from within one of the procedures. The language not only generates re-entrant code, but easily lends itself to generation of recursive routines.

VARIABLES
Variables may be either "global" or "local". Global vari-ables are those declared in the main program and are accessible from any part of the program including pro-cedures. Local variables however, are declared within a procedure and are only accessible from within that procedure.

SPL/3000 Compiler (Cont'd)

DATA TYPES SUPPORTED*

- *Logical:* 16-bit TRUE/FALSE or $\emptyset$ to 65535
- *Byte:* 8-bit character data or arithmetic values $\emptyset$ to 255
- *Integer:* 16-bit arithmetic variables (-32768 to +32767)
- *Double Integer:* 32-bit arithmetic variables (+2,147,483,648 to -2,147,483,647)
- *Real:* 32-bit floating point variables (6.9 digit accuracy) $\pm 10^{77}$
- *Long Real:* 48-bit floating point variables (11.7 digit accuracy) $\pm 10^{77}$

    *Single dimensional arrays may be any of these data types.

SYNTAX FEATURES

Each SPL/3000 statement is either a high-level or machine-dependent feature.

High-Level Features

In all programming efforts, a need frequently arises for standard program constructs, such as loops, and evaluation of arithmetic expressions. Rather than hand-coding these often-used structures each time, SPL/3000 allows the programmer to write them at a high level. The compiler then provides an efficient, error-free code sequence in each case. Examples of such constructs include:

- RESULT: = (4*(J) + M − KJ MOD 1$\emptyset$) / 31;
- IF J=1 THEN GO TO JP1$\emptyset$ ELSE J:=J+5;
- WHILE VAR < $\emptyset$ DO ARRY (VAR:=VAR+3):=$\emptyset$;
- DO (X:=X+7) UNTIL X = 1000;
- FOR P:=7 STEP 2 UNTIL 1000 DO BEGIN

  $\qquad\qquad\qquad\qquad$ X(P):=1;
  $\qquad\qquad\qquad\qquad$ Y(P):=3;
  $\qquad\qquad\qquad\qquad$ END;

The high level features increase program production and contribute to documentation.

Machine-Dependent Features

SPL/3000 allows the use of machine-level constructs to insure complete control of the HP 3000 Computer System. These constructs permit the following:

- Direct register references
- Branching based on actual hardware conditions
- Bit extraction, deposit, and shift
- Generation of any sequence of hardware machine instructions (in the midst of high level constructs)

Examples Of Machine-Dependent Statements

- IF A=6 THEN ASSEMBLE (LDI 3; RI$\emptyset\emptyset$; STOR TIME)

  <<reads time from I/O channel 3 if A=6>>
- SCAN INPUTDATA WHILE AN ;

  <<scans the byte array "inputdata" until a character is found which is not alphanumeric (AN) i.e. $\emptyset$-9, A-Z>>

- IF OVERFLOW THEN RETURN;

  << Tests the overflow condition in the arithmetic unit>>
- MOVE ARY :=SOURCE WHILE N;

  << moves bytes from array source to ARY as long as they are numeric >>
- N$\emptyset$2:=NUMBER. (13:3);

  << extract 3 bits from 'number' starting at bit 13 and assign the resulting 3-bit field to N$\emptyset$2 at its right-hand end. Rest of N$\emptyset$2 set to zeros >>

Example Of An SPL/3000 Procedure

The following SPL/3000 procedure is part of the SPL compiler with minor modifications made for clarity. It is used to sort the symbol table when the MAP option is chosen. Each entry in the symbol table has the identifier name preceded by the ASCII character corresponding to the number of characters in the symbol. If the number is greater than nine, the character is not numeric.

Name of procedure: SHELLSORT

Parameters:

INFO	array of symbol table entries
INDICES	array of indices each of which corresponds to an entry in the symbol table
SIZE	number of entries

Subroutine is almost assembly language.
Procedure body is almost ALGOL.

For readers familiar with ALGOL, the following explanations should make the method of the procedure understandable.

<< >>	A pair of broken brackets is used to enclose comments.
;	Statements are terminated by semicolons.
:=	This symbol means "is assigned the value".
TOS	Refers to the value of the top of stack.
@	This means either 1) operate with the contents of a pointer, not the item pointed at, or 2) operate on the address of a variable, not the contents of the variable.
POINTER	A pointer is a quantity that is used to point at another item (i.e., provides one-level indirect addressing).
LSL	Logical Shift Left.
DDEL	Delete the top two items on the stack.
*	In a 'compare' this means that the parameter is in the stack.

SPL/3000 Compiler (Cont'd)

```
PROCEDURE  SHELLSORT(INFO, INDICES, SIZE)!
    VALUE SIZE!                     << SPECIFICATIONS            >>
    INTEGER SIZE! ARRAY INFO, INDICES!
BEGIN
    INTEGER X1, X2, TEMP,           << LOCAL DECLARATIONS         >>
              D, I, J!
    BYTE POINTER  SM0=S-0, SM1=S-1!  << INDIRECT POINTERS         >>

    SUBROUTINE  COMPARE!
    BEGIN COMMENT COMPARE THE TWO ASCII STRINGS INDEXED BY X1 AND X2. !
        TOS:=@INFO(X1)&LSL(1)!
        X1:=SM0!                     << ASCII CHARACTER COUNT      >>
        @SM0:=@SM0+1!                << NOW POINTS TO SYMBOL X1    >>
        TOS:=@INFO(X2)&LSL(1)!       << MAKE BYTE POINTER TO ENTRY>>
        X2:=SM0!                     << ASCII CHARACTER COUNT      >>
        @SM0:=@SM0+1!                << NOW POINTS TO SYMBOL X2    >>
        IF SM1=SM0 THEN              << 1ST POINTER NOW AT S-1     >>
          BEGIN
            TOS:=IF  X1<X2 THEN X1   << MINIMUM OF LENGTHS         >>
                 ELSE X2!
            TOS:=TOS-"0"!            << CONVERT ASCII TO BINARY    >>
            IF *=*,(TOS) THEN        << COMPARE BYTE STRINGS       >>
              ASSEMBLE(LOAD X1!      << IF = THEN COMPARE SIZES    >>
                     CMPM X2)!
          END
        ELSE  DDEL!                  << POINTERS WERE NOT USED     >>
    END!  << COMPARE >>

COMMENT START MAIN BODY OF SHELLSORT PROCEDURE.  !

    IF SIZE <= 1 THEN GO TO EXIT!    << ONE OR NO ENTRIES          >>
    D:=1!  WHILE (D:=D+D)<SIZE DO !  << DOUBLE D WHILE < SIZE       >>
L1:IF (D:=D/2)<=0 THEN GO TO EXIT
    ELSE I:=1!
L2:TEMP:=INDICES((J:=I)+D)!          << INTERMEDIATE LOOP           >>
L3:X1:=TEMP!                         << TWO STRINGS TO COMPARE      >>
    X2:=INDICES(J)!
    COMPARE!                         << SUBROUTINE CALL             >>
    IF < THEN                        << TEST CONDITION CODE         >>
      BEGIN
        INDICES(J+D):=INDICES(J)!    << REPLACE TEST VALUE          >>
        IF (J:=J-D)>0 THEN GO TO L3!  << INNER LOOP WHILE J > ZERO  >>
      END!
    INDICES(J+D):=TEMP!              << STORE VALUE BACK IN TABLE  >>
    IF (I:=I+1)+D<=SIZE THEN         << CHECK FOR END OF TABLE      >>
      GO TO L2
    ELSE  GO TO L1!
EXIT: END!  << SHELLSORT >>
```

HEWLETT *hp* PACKARD

32213B
COBOL/3000
Compiler

Features

- 1968 ANSI standard COBOL
- Highest level federal COBOL
- Direct communication with SORT/3000 via SORT verb
- Communications with COBOL or non-COBOL subroutines
- Table handling up to 3 dimensions
- Sequential and random files
- Object code segmentation controlled by programmer
- Data segmentation through dynamic-type subroutines
- Packed decimal, binary, and display (zoned) data types
- Compile time editing
- Selective compilation
- Optimizing compiler provides for faster execution times.
- Concurrent batch and terminal capability
- Optimal bounds checking for tables at program execution time.

COBOL/3000 provides the user with language resembling English as a programming tool. It is self-documenting, easy to learn, and permits fast program development. The language has efficient statements to simplify file descriptions, I/O, table handling, sorting, mass storage manipulation and report generation. The compiler is integrated into the HP 3000 Multiprogramming Executive (MPE/3000) to allow great flexibility in every environment.

IMPLEMENTATION LEVEL

Two major standards describe COBOL compilers: ANSI standard COBOL and U.S. Federal Standard COBOL, as defined by the National Bureau of Standards. Hewlett-Packard COBOL/3000 has fully implemented* the ANSI standard while conforming to the high-level Federal Standard in all categories. The following table shows the COBOL/3000 rating in each standard.

Every module except report writer.

MODULE	ANSI* RATING	FEDERAL RATING
Nucleus	High	High
Table Handling	High	High
Sequential Access	High	High
Random Access	High	High
SORT	High	High
Report Writer	Null	N/A
Segmentation	High	High
Library	High	High

NOTE: ECMA** COBOL conforms with ANSI COBOL.

ANSI: American National Standards Institute
**ECMA: European Computer Manufacturers Association*

COBOL MODULES

COBOL/3000 is a set of functional processing modules that have the following capabilities:

Nucleus: Provides a basic language capability for the internal processing of data within the basic structure of the four divisions of a COBOL program.

Table Handling: For defining tables of contiguous data items and accessing an item relative to its position in the table. Tables may be variable length and may have up to three dimensions.

Sequential Access: To access records of a file in an established sequence. Sharing memory area among files is also provided.

Random Access: To access records of a mass storage file according to a programmer-supplied key. Sharing memory area among files is also provided.

Sort: To order a file of records according to a set of user-specified keys within each record. Special processing of addition, deletion, creation, altering, editing, etc. is provided.

Segmentation: To specify object program segmentation requirements.

Library: For specifying text that is to be copied from a library. Library text is available to a source program at compile time and need not be actually written as part of the source program.

HEWLETT **hp** *PACKARD*

Interprogram Communication: Provides the capability to call (or be called by) a program written in COBOL/3000 or other HP 3000 Languages.

Language Extensions: In addition to the ANSI Standard, Hewlett Packard has implemented a number of extensions which include:

Interprogram Communication
Packed Decimal (COMPUTATIONAL-3)
Note Lines [defined by * (an asterisk) in column 7]
Current-Date (MM/DD/YY)
Time-of-day (HHMMSS)
THEN optional
Multiple REDEFINEs of a given location
Unary +
Go to MORE-LABELS EXIT
Synchronized for index data items
Forms message for special forms

OPTIMIZER

COBOL/3000 consists of two compilers, one of which is an optimizer. The optimizer, while a somewhat slower compiler, generates optimal code. This generated code when used in conjunction with the decimal firmware, can increase execution speeds by at least a factor of three.

Thus, the optimizing compiler would not be used when compile times are more important than execution times (e.g. during the checkout phase of program development).

DATA TYPES

COBOL/3000 allows Binary (Computational), Packed Decimal (Computational-3), and Display (Zoned) data types.

ENVIRONMENT

COBOL/3000 is fully integrated into the Multi-programming Executive (MPE/3000), providing flexibility in compiling, linking, segmenting and executing in batch and session mode.

32104A
RPG/3000
Compiler

Features

- Automatic program segmentation
- Edit codes
- Calculation control of I/O
- Closed subroutines
- Single dimension arrays
- Automatic EBCDIC/ASCII file translation and alternate collating sequence
- Cross reference
- Formatted dump
- Run time error options can be preselected or dynamic
- DEBUG allows source level debugging
- Spread cards
- File error option

RPG/3000 is a machine-independent, problem-oriented language that is easy to learn, use, and code. It allows the user to specify many important operations with a minimum of effort, by making simple entries on specially-formatted coding sheets. Because RPG is a standard language available on many different machines, programs can be submitted coded in another manufacturer's RPG or RPG II, directly to the RPG/3000 compiler with little or no re-coding for conversion. In addition, the RPG/3000 Compiler helps the user detect errors at the source language level with extensive diagnostic messages.

RPG/3000 EXTENSIONS TO RPG II
Parameters for external subroutine calls:
Parameters may be specified after an EXIT (external subroutine call) operation, simplifying interfacing with COBOL, SPL, BASIC or FORTRAN subroutines.

Run-time error options:
Three methods are provided for handling run-time errors:

Specifying on the Control Record at compile time, whether the run-time error should be ignored or the program terminated.

Allowing the operator to determine the mode of operation at run time.

Testing an error code in RPG calculations and determining the mode of operation programmatically.

Cross reference option:
A cross reference may be requested showing all references to file names, indicators and field names.

Automatic program segmentation:
RPG/3000 will automatically segment code generated for an RPG program in 1K, 2K, 3K, or 4K-word segments resulting in a virtually unlimited size RPG program.

EBCDIC/ASCII automatic translation:
The user can request RPG/3000 to automatically generate file translation tables for EBCDIC to ASCII or ASCII to EBCDIC conversions, or to use an EBCDIC alternate collating sequence.

Combined terminal file:
The user may define an Input/Output terminal file.

Calculation indicator repetition:
Duplicate conditioning indicators need not be repeated line-to-line in calculation.

HEWLETT **hp** *PACKARD*

DATA TYPES
RPG/3000 allows data to be input or output in the following formats:
- binary – one or two word binary data
- packed decimal
- alphanumeric
- unpacked decimal
- unpacked decimal with leading or trailing sign

ENVIRONMENT
RPG/3000 runs under the Multiprogramming Executive Operating System (MPE/3000), providing the user with flexibility such as:
- compile/execute in batch or timesharing mode
- device independence
- call any program compiled in any other language
- an interactive debugging facility

MPE FILE SUPPORT
All file types supported by the Multiprogramming Executive Operating System are available to the user through RPG/3000. This includes input, output and update files accessed sequentially, or randomly by relative record number.

SPECIFICATION TYPES
The statements that describe the input, processing, and output to the compiler must be written according to the rules of RPG/3000. These statements are written on specifications sheets which can be ordered from Hewlett-Packard. There are seven types of specifications accommodated on five different specification sheets. The seven specification types are:

Control Record[1]
File Description[1]
File Extension[2]
Line Counter[2]
Input
Calculation
Output

[1] Same specification sheet
[2] Same specification sheet

HEWLETT **hp** *PACKARD*

32102A
FORTRAN/3000
Compiler

Features

- Six data types: Integer, logical, real, double precision, complex and character
- Character variables and character arrays
- Bit extract and deposit capability with PARTIAL-WORD DESIGNATORS
- Arrays may have up to 255 dimensions
- Named common blocks may be initialized by block data sub-programs
- Symbolic names may contain up to 15 characters
- Dynamic array declaration and allocation in sub-programs
- A label can be used as an argument in sub-program call statements to allow alternate return points
- FUNCTIONS and SUBROUTINES may be called recursively
- Parameters to non-FORTRAN subprograms may be passed by value rather than reference
- ACCEPT and DISPLAY statements for free field input/output
- Up to 99 files may be used during execution of a FORTRAN program
- Action labels may be specified in READ/WRITE statement to indicate point of transfer in case of end-of-file or I/O error
- Mixed mode arithmetic supported
- The dependent statement of a logical IF can be another logical IF
- Compilation time editing

HP FORTRAN/3000 is based on ANSI STANDARD FORTRAN (X3.9-1966). In addition, FORTRAN/3000 has many extensions which expand the capabilities and increase the power of the language.

ENVIRONMENT

The HP 3000 Multiprogramming Executive (MPE/3000) provides great flexibility for the FORTRAN user in the following areas:

- Compile in batch or timesharing mode, or call the compiler programmatically
- Compile subroutines written in other languages (e.g., COBOL) as part of the main FORTRAN object program
- Execute in either batch or timesharing mode
- File equate for device independent I/O
- Segment programs without re-compiling
- Call any program or subprogram compiled in any other language, limited only by security
- A debugging facility provided by the use of TRACE/3000

DATA TYPES

FORTRAN/3000 provides six types of data.

- INTEGER type: A 16-bit quantity including sign. The range is +32767 to −32768.
- LOGICAL type: A 16-bit mask. The least significant bit is used to determine the Boolean value (True and False).
- REAL type: A 32-bit quantity with sign, exponent and mantissa. The range is $\pm(2^{-256}, 2^{+256})$ with 6 to 7 decimal digit accuracy.
- DOUBLE PRECISION type: A 48-bit quantity with sign, exponent and mantissa. The range is identical to REAL but with 11 to 12 decimal digit accuracy.
- COMPLEX type: A 64-bit quantity consisting of two type reals, one for the real part and one for the imaginary part.
- CHARACTER type: Character values are represented by strings of 8-bit USASCII code.

SOURCE PROGRAM FORMAT

FORTRAN/3000 was designed with several powerful convenience features for time-sharing users. The nature of terminal devices makes the historical position-dependent

HEWLETT **hp** *PACKARD*

fixed-format program representation extremely inconvenient; however, HP FORTRAN/3000 surmounts these drawbacks by offering both fixed format and free format representation for source language input.

CHARACTER MANIPULATION

FORTRAN/3000 supports exceptional capabilities in the areas of character string manipulation. A new data type, "CHARACTER", allows FORTRAN/3000 users to directly manipulate strings up to 255 characters in length. Subscript-like notation may be used to access substrings within a string, as small as one character. String operations include comparison and replacement.

Conversion of character expressions to numeric values (integer, real or double precision) and vice versa is provided by INTRINSIC FUNCTIONS.

Example:
The following problem solved by FORTRAN/3000 demonstrates the utility value of character manipulation.

Given: An 80 column input card
Problem: Find the last non-blank character
Solution:

```
        CHARACTER INPUT*80
        READ (5,10) INPUT
10   FORMAT (S)
        DO 20 I=80, 1, -1
        IF (INPUT[I:1] .NE. " ") GO TO 25
20   CONTINUE
25   DISPLAY I
```

BIT MANIPULATION

PARTIAL WORD DESIGNATORS act as unary operators which extract or replace a specified bit string to form a new value of the same type. This operator applies to INTEGER type or LOGICAL type data.

COMPOSITE NUMBERS provide a convenient method of representing specific bit patterns for any type of data except CHARACTER or COMPLEX.

FILE FACILITY

Uniform access to disc files and standard input/output devices is accomplished through the MPE/3000 file system. Users access their files using normal READ/WRITE statements. The structure of a file and method of access can be defined via a file statement by the programmer or left to default values. This provides device independence and easy access to all types of files.

Device type can be defined at execution time; consequently, the devices used by a program can be readily changed.

Sequential and random access of disc files is supported by FORTRAN/3000.

Users with highly specialized requirements may communicate directly with the MPE/3000 file system. Data file privacy is achieved through the normal MPE/3000 protection mechanisms.

DEBUG FACILITY

The HP 3000 TRACE program and FORTRAN/3000 are designed to work together, providing a convenient and powerful capability for the user in monitoring program execution. A traceable item is a symbolic name of a simple variable, array, statement-function, or external procedure or is a statement label of an executable statement. Monitoring can be conditional, thereby eliminating massive amounts of output.

HEWLETT **hp** *PACKARD*

32101A
BASIC/3000
Interpreter

Features

- A powerful language that's easy to learn
- Programs and data files can be accessed from either time-share or batch mode
- Conversational program generation with extensive messages
- Four numeric data types: real, integer, real extended precision, and complex
- Mixed mode arithmetic
- All standard functions (SIN, COS, LOG, etc.) plus matrices, strings and files
- Program segmentation with common storage
- User definable file security including password
- Can be used alone or in conjunction with HP/3000 BASIC Compiler

BASIC/3000 is an easy to learn language designed especially for interactive terminal use. The HP BASIC/3000 language contains extensions that make it the most powerful implementation of BASIC currently available.

ENVIRONMENT
Timesharing Mode
Implementation of BASIC in the HP 3000 operating system results in a very powerful language which encourages the user to take advantage of extensive conversational capabilities.

Batch Mode
HP BASIC itself is such a flexible language that the BASIC/3000 Interpreter may be used in Batch Mode as well. In Batch Mode, all input (i.e. program statements, commands and data) is read from the batch input device; all output is directed to the batch output device.

User Tailored Modes
BASIC/3000 permits full use of HP 3000 device independence. Users can link each type of input (e.g. program statements, commands and data) and output (e.g. program output, messages and listings) with any available peripheral device. This flexibility within BASIC can be employed to construct end-user packages such that BASIC is invisible to the user. The resultant simplicity of execution is especially important to instructional/ educational applications.

DATA TYPES
BASIC/3000 permits four types of numeric representation:

- INTEGER Type: A 16-bit quantity. The range is -32767 to +32767.
- REAL Type: A 32-bit quantity with sign, exponent and mantissa. The range is $\pm(10^{-78}, 10^{+77})$ with 6 to 7 decimal digit accuracy.
- LONG Type: A 48-bit quantity with sign, exponent and mantissa. The range is identical to REAL but with 11 to 12 decimal digit accuracy.
- COMPLEX Type: 64-bit quantity consisting of two real numbers, the real part and the imaginary part.

Mixing of data types within an arithmetic expression is allowed.

CHARACTER STRING MANIPULATION
The user may define and manipulate ASCII character strings and string arrays. All digits, upper and lower case alphabetic characters, and all other printing and non-printing ASCII characters can be stored in string variables. They can be input and output at the terminal and stored and retrieved from data files. Substrings as small as zero characters and as large as 255 characters in length can be printed, concatenated and compared to other strings. These may be used for branching or sorting.

A CONVERT statement is available for conversion of numeric strings to numeric values and vice versa. Several built-in functions are available for manipulation (e.g. to obtain the numerical value of a character's ASCII code and remove leading and trailing blanks, etc.). Easy intermixing of string and numeric data is provided for program and file input and output.

DATA FILES
BASIC/3000 maintains three distinct file types:

- FORMATTED files: Provide advanced, easy-to-use capabilities that are intended for (but not restricted to) BASIC language use. These enable run-time checking of file data type.
- ASCII and BINARY files: These are available for communicating data to and from programs written in languages other than BASIC.

HEWLETT **hp** *PACKARD*

BASIC FORMATTED files may have a record size between 4 and 319 words. Data can be accessed either serially or on a record basis with random access to any record in the file. The ADVANCE and UPDATE statements provide the capability to access individual items within a record. Files may be created and purged either by commands or under program control.

Through the operating system, data file security among different levels of users is achieved by a set of restrictions (e.g. read-only, read-only with dynamic locking, etc.) which may be placed on the access of the files. A data scrambler may also be used. This security feature can be used in conjunction with the name and password security provided by the operating system.

PROGRAM SEGMENTATION AND SUBROUTINES
BASIC/3000 provides four types of subroutines:

- Built-in functions include SIN, TAN, TNH (hyperbolic tangent). Approximately 40 such functions are provided.
- User defined functions are established in the user's program and can be called from within the program. They may consist of multiple statements and local variables and arrays whose scope extends only within the declared function.
- A simple subroutine consists of a set of BASIC statements followed by a return statement. There is no explicit indication in a program as to which statements comprise a subroutine.
- External subroutines are not controlled by BASIC and may be written in another language, i.e. FORTRAN, SPL. BASIC programs may call external subroutines from one of the libraries accessible to the user.

Because program size is necessarily limited by machine memory, the BASIC system provides a means of segmenting programs. Two statements are provided for communication between programs:

- The CHAIN statement terminates the current program and automatically initiates the "CHAINED" program.
- The INVOKE statement is similar to CHAIN, but the current program is suspended rather than terminated. The called program may then transfer control back to the calling program (this is one method for calling general subroutines written in BASIC).

Programs "CHAINED to" or "INVOKED" may communicate with the "chaining" or "invoking" program through common blocks. Up to 10 different blocks may be used in a program. Files opened in an invoking program may be accessed by the invoked program.

TRACE-DEBUG FACILITY
This mode serves in an interactive debugging capacity. Several commands are available for:
- Tracing the path of execution through a program and the change in value of variables.
- Setting breakpoints, displaying and changing values of variables and resuming operation.
- Displaying names of files currently open to a program.
- Displaying a list of functions and programs which represent the path through which nested calls will return.

MATRIX OPERATION
One or two dimensional arrays are handled as easily as single valued variables. Addition, subtraction, multiplication, inversion, and transposition require only one program statement. A single statement creates an identity matrix or loads a matrix with all ones or zeroes. Matrix input and output statements are also available.

ADDITIONAL FEATURES
- Multiline statements allowed
- IF-THEN-ELSE statements and compound statement blocks
- Program access to system clock
- Embedded FOR loops in input/output statements
- Formatting (PRINT USING) with dynamically definable output images
- Extra input items optionally saved in a buffer for optional subsequent input
- String arrays with complete substring accessibility
- Substring search functions
- File management under program control
- Move forward or backward any number of elements through a file without knowing what data types are being skipped
- User definable file security
- Program profile showing number of executions and amount of CPU time for each statement executed
- Specification of many operating system commands under program control

PROGRAM COMPATIBILITY
Programs written for the HP 2000 Series Timeshared BASIC Systems can be run using BASIC/3000.

HEWLETT PACKARD

32103A BASIC/3000 Compiler

Features

- Supports all BASIC/3000 interpreter language extensions
- Average execution speed 10-30 times faster than interpreter
- Shareable machine code
- Can be combined with SPL procedures and FORTRAN subroutines in the same program file
- Load-and-go capability

The BASIC/3000 compiler provides the means for converting BASIC/3000 programs (having been written, debugged and saved via the BASIC/3000 Interpreter), into machine code. Compiled BASIC/3000 programs exist in the system as actual code segments and can be run directly, rather than through line-by-line interpreting. This method is 10 to 30 times faster.

ENVIRONMENT

There are three general phases in the development of a BASIC/3000 compiled program.

Program Development

In the first phase, a BASIC/3000 program is written and debugged interactively using the BASIC/3000 Interpreter commands and statements. The interpreter constructs the interpretive version of a program. When the user is satisfied that the BASIC/3000 program runs properly in its interpretive form, the program is saved (SAVE,FAST) in a file. This fast save file is the "source" input to the BASIC/3000 Compiler.

Compile and Prepare

The BASIC/3000 compiler is used to compile the fast save file. The program is then prepared in a form that results in an efficient machine code version of the original program.

Execution

The third phase is to execute the program directly under the operating system using the RUN command.

BASIC/3000 programs may be compiled in batch or timesharing mode, and programs may be run in either mode.

DATA TYPES

BASIC/3000 permits four types of numeric representation:

- INTEGER Type: A 16-bit quantity. The range is −32767 to +32767.
- REAL Type: A 32-bit quantity with sign, exponent and mantissa. The range is $\pm(10^{-78}, 10^{+77})$ with 6 to 7 decimal digit accuracy.
- LONG Type: A 48-bit quantity with sign, exponent and mantissa. The range is identical to REAL but with 11 to 12 decimal digit accuracy.
- COMPLEX Type: 64-bit quantity consisting of two real numbers, the real part and the imaginary part.

Mixing of data types within an arithmetic expression is allowed.

CHARACTER STRING MANIPULATION

The user may define and manipulate ASCII character strings and string arrays. All digits, upper and lower case alphabetic characters, and all other printing and non-printing ASCII characters can be stored in string variables. They can be input and output at the terminal and stored and retrieved from data files. Substrings as small as zero characters and as large as 255 characters in length can be printed, concatenated and compared to other strings. These may be used for branching or sorting.

A CONVERT statement is available for conversion of numeric strings to numeric values and vice versa. Several built-in functions are available for manipulation (e.g. to obtain the numerical value of a character's ASCII code and remove leading and trailing blanks, etc.). Easy intermixing of string and numeric data is provided for program and file input and output.

HEWLETT **hp** *PACKARD*

DATA FILES

BASIC/3000 maintains three distinct file types:

- FORMATTED files: Provide advanced, easy-to-use capabilities that are intended for (but not restricted to) BASIC language use. These enable run-time checking of file data type.

- ASCII and BINARY files: These are available for communicating data to and from programs written in languages other than BASIC.

BASIC FORMATTED files may have a record size between 4 and 319 words. Data can be accessed either serially or on a record basis with random access to any record in the file. The ADVANCE and UPDATE statements provide the capability to access individual items within a record. Files may be created and purged either by commands or under program control.

Through the operating system, data file security among different levels of users is achieved by a set of restrictions (e.g. read-only, read-only with dynamic locking, etc.) which may be placed on the access of the files. A data scrambler may also be used. This security feature can be used in conjunction with the name and password security provided by the operating system.

PROGRAM SEGMENTATION AND SUBROUTINES

BASIC/3000 provides four types of subroutines:

- Built-in functions include SIN, TAN, TNH (hyperbolic tangent). Approximately 40 such functions are provided.

- User-defined functions are established in the user's program and can be called from within the program. They may consist of multiple statements and local variables and arrays whose scope extends only within the declared function.

- A simple subroutine consists of a set of BASIC statements followed by a return statement. There is no explicit indication in a program as to which statements comprise a subroutine.

- External subroutines are not controlled by BASIC and may be written in another language, i.e. FORTRAN, SPL. BASIC programs may call external subroutines from one of the libraries accessible to the user.

Because program size is necessarily limited by machine memory, the BASIC system provides a means of segmenting programs. Two statements are provided for communication between programs:

- The CHAIN statement terminates the current program and automatically initiates the "CHAINED" program.

- The INVOKE statement is similar to CHAIN, but the current program is suspended rather than terminated. The called program may then transfer control back to the calling program (this is one method for calling general subroutines written in BASIC).

Programs "CHAINED" to or "INVOKED" may communicate with the "chaining" or "invoking" program through common blocks. Up to 10 different blocks may be used in a program. Files opened in an invoking program may be accessed in the invoked program.

MATRIX OPERATION

One or two-dimensional arrays are handled as easily as single valued variables. Addition, subtraction, multiplication, inversion, and transposition require only one program statement. A single statement creates an identity matrix or loads a matrix with all ones or zeroes. Matrix input and output statements are also available.

ADDITIONAL FEATURES

- Multiline statements allowed

- IF-THEN-ELSE statements and compound statement blocks

- Program access to system clock

- Embedded FOR loops in input/output statements

- Formatting (PRINT USING) with dynamically-definable output images

- Extra input items optionally saved in a buffer for optional subsequent input

- String arrays with complete substring accessibility

- Substring search functions

- File management under program control

- Move forward or backward any number of elements through a file without knowing what data types are being skipped

- User definable file security

- Specification of many operating system commands under program control

PROGRAM COMPATIBILITY

Programs written for the HP 2000 Series Timeshared BASIC Systems can be run using BASIC/3000.

HEWLETT **hp** *PACKARD*

32215A IMAGE/3000 Data Base Management System

Features

- Security at the data base, data set, and data item levels
- Multiple master-detail data set relationships
- Logically related files can be accessed and maintained as a single entity (a data base)
- Network structuring allows for complex relationships among data items
- Access methods are serial, directed, calculated, and chained
- Data types include packed decimal, ASCII character strings, real numbers, etc.
- Shared or exclusive data base access
- Deleted record space automatically reusable
- Data base restructuring without reprogramming
- Dump and load backup capability
- Storage and retrieval of related entries in sorted sequence
- Ten library routines callable from COBOL, FORTRAN or SPL
- Automatic linkage management when data is added, modified or deleted
- Access to multiple data bases
- Efficient disc utilization (no index or overflow areas)

IMAGE/3000 is a general purpose data base management system for use with the HP/3000 computer. It provides the basis for developing information systems tailored to today's industrial, educational, and corporate needs. IMAGE/3000 operates in both terminal and batch environments. Hence, input sources may be paper tape, punched cards, magnetic tape or disc, or interactive terminals. Application programs which interface with IMAGE may be written in COBOL, FORTRAN, or SPL (Hewlett-Packard's powerful Systems Programming Language). The host language issues its requests to IMAGE via simple CALL statements. These serve as a manipulation language that permits the user to interface

with the data base. Thus, a programmer can concentrate on the data processing power of his host language and leave the complex accessing activity to IMAGE.

MANAGING THE DATA BASE
IMAGE/3000 provides the capabilities to implement a data base through the following procedures:

Describing Data Base Structures
The data base designer describes the items (length, data type, symbolic name), security, data sets, data set relationships, and storage needed using the *schema* language (data base description statements). The *schema* statements are then processed by the *schema* processor, to create the stored data structure called the Data Base Root File. The location and relationships of information are known to IMAGE through this root file.

Creating Data Bases
Disc space for each data set of a referenced data base is allocated and initialized to an empty condition by an IMAGE utility. The data base is then ready for initial loading.

Accessing And Maintaining Data
To access or maintain data, a set of IMAGE Library Routines callable from user written programs is provided. These routines perform such functions as opening the data base, reading and writing at the data item and/or entry level, obtaining structure information, deleting entries, and locking and unlocking the data base. IMAGE makes possible the retrieval of entries with a specific search item value in sorted sequence.

Backup
Utility programs are included to enable dumping of data bases to magnetic tape for backup purposes, and for restoring data bases from magnetic tape. These utilities handle a data base in its entirety, and ascertain that all the data sets and the root file are successfully transferred.
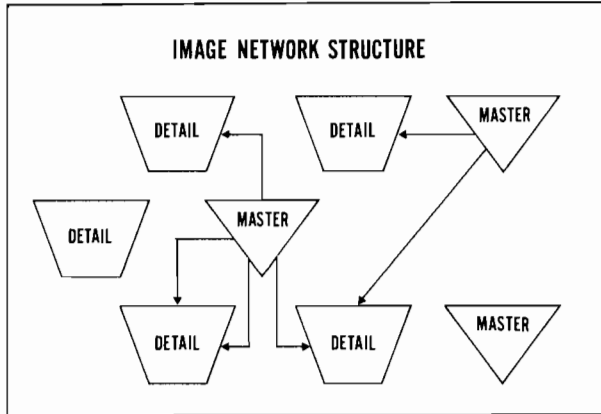
Restructuring
Utilities are provided for restructuring data bases in

HEWLETT **hp** *PACKARD*

the following ways:

- Change a data item name or data set name
- Change security provisions
- Increase data set capacities
- Add or remove data items at the end of a data entry
- Change data set relationships

IMAGE NETWORK STRUCTURE

Data Set Types

IMAGE/3000 allows two types of data sets, master and detail. Access to data entries in a master data set is direct, and is based on the key value of the data entry. Access to a data entry in a detail data set is usually via a particular master entry and a particular relationship between the master and detail data sets. An example is diagrammed below:
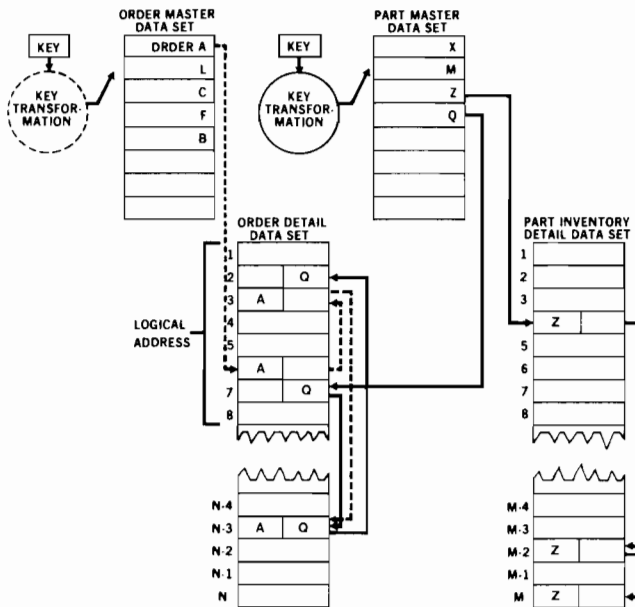
MASTER-DETAIL CHAIN PATHS:

Order Master entry A links to Order Detail entries 6, 3, and N-3.
Parts Master entry Q links to Order Detail entries 7, N-3 and 2.
Parts Master Z links to part inventory entries 4, M-2 and M.

This data structure allows a master entry to be related to many detail entries, and a detail entry related to many master entries.

Specifications

Data item names per data base: 255
Data sets[1] per data base: 99
Characters per item name: 16
Characters per data set name: 16
Data items per entry: 127
Maximum entry size: 4094 bytes[1]
Keys per detail data set: 16
Detail data sets per master data set: 16
Entries per chain: 65,000

Note:
[1] The space occupied by any single data set cannot exceed the capacity of any one disc drive; however, the total data base is limited only by the total available storage.

SERVICE
Hewlett-Packard installs and validates the software and provides a complete service contract for ninety days at no charge. An extended term service contract is optionally available.

TRAINING
Data Base Management courses are offered at a nominal cost, and presented on a regular schedule. Courses involve both classroom and "hands-on" workshop sessions.

ORDERING INFORMATION
32215A IMAGE/3000 Data Base Management System. Includes 800 bpi magnetic tape and manual[1].

32215A-100 Same as 32215A, but on 1600 bpi magnetic tape.

Note:
[1] Additional user manuals are optionally available; order as part number 32215-90001.

HEWLETT **hp** *PACKARD*

Sales and service from 172 offices in 65 countries.
1501 Page Mill Road, Palo Alto, California 94304

32216A QUERY/3000 Data Base Inquiry Facility

Features

- Interactive or batch data base interrogation
- Boolean-logic selection of data
- 9 data types converted, error checked and displayed
- Extensive editing of output items
- Multiple level sort for grouped items
- Formatted reporting of retrieved data including page titles, column headings, group subtotals, totals and averages
- Command files to store complex or frequently-used commands for repeated execution
- Data base updating through addition, deletion and modification of data records
- English-like commands for simplified use by non-programmers
- Display of the data base structure accessible to an individual user

QUERY/3000 is designed to easily locate, report and update data values within an IMAGE/3000 data base. QUERY may be executed from either a terminal or batch device; reported output may be directed to either a terminal or a line printer. The user communicates with QUERY through 17 unique commands.

SECURITY CONSIDERATIONS

QUERY adheres to all the security provisions that a data base designer includes in the IMAGE data base. After QUERY is invoked, the user must enter a data-base name and a security-level word. The security-level word, obtained from the data base designer, determines which data elements (i.e., data items and data sets) the user is allowed to access. QUERY will return an error whenever a user's security level does not match the security level within an IMAGE element.

The user may determine which data elements are accessible to him by entering the FORM command. QUERY responds by listing all the data elements available to the user, based upon the level word that he entered.

LOCATING DATA

QUERY is capable of retrieving all occurrences of data within a data set which meet user-specified conditions. To accomplish this, the user enters a FIND command which includes logical terms that are similar to phrases spoken in English. For example, suppose a production control manager wishes to know which part numbers are in short supply or over supply when compared with outstanding customer orders. Assuming the data base contains a part-number data set, the manager could locate all such parts with one FIND command as follows (note – ILT means "is less than" and IGT means "is greater than"):

FIND QUANTY ILT "100" AND CUST-ORD IGT "50" OR QUANTY IGT "10000" AND CUST-ORD ILT "1000" END

QUERY responds to the FIND command by locating all the data records which contain the requested data item values.

REPORTING DATA

After the data records have been located through the FIND command, the user may enter a REPORT command to specify which items within those records QUERY is to display. The REPORT command may also specify:

- top-of-page titles including date and time
- addition, counting and averaging of selected data items
- column headings, group subtotals and totals
- line spacing
- up to 5 levels of sorting to produce grouped items
- edit masks to suppress leading zeroes, insert punctuation characters, etc.
- page skipping

For quick information, the REPORT command can simply specify that all data item names and their values are to be displayed without formatting.

HEWLETT **hp** *PACKARD*

UPDATING A DATA BASE

Maintenance of the data base can also be performed using QUERY/3000. The UPDATE command, designed for this purpose, allows insertion and deletion of data records and replacement of data item values. When UPDATE ADD is entered, QUERY will prompt a terminal user for data item values. The user is not required to enter values for all items.

FREQUENTLY USED PROCEDURES

Repetitive or complex operations are easily performed through QUERY's ability to execute FIND, REPORT and UPDATE commands from a command file stored on disc. A command stored within a file is referred to as a procedure; a procedure may consist of one or more lines. QUERY provides commands for creating, deleting and listing procedures within a command file. Also, the lines within a procedure may be added, deleted or replaced.

DATA TYPES

The following data types are converted and error-checked during QUERY I/O operations:

- one word integer numbers
- two word integer numbers
- two word real numbers
- three word extended precision numbers
- one word logical values as absolute numbers
- ASCII character strings containing no lower-case alphabetics
- general ASCII character strings
- zoned decimal numbers
- packed decimal numbers

SERVICE

Hewlett-Packard installs and validates the software and provides a complete service contract for ninety days at no charge. An extended term service contract is optionally available.

TRAINING

Data Base Management courses are offered at a nominal cost and presented on a regular schedule. Courses involve both classroom and "hands-on" workshop sessions.

ORDERING INFORMATION

32216A QUERY/3000 Data Base Inquiry Facility. Includes 800 bpi magnetic tape and manual[1].

32216A-100 same as 32216A, but with 1600 bpi magnetic tape.

Note:
[1] Additional user manuals are optionally available; order as part number 32216-90001.

HEWLETT [hp] PACKARD

Sales and service from 172 offices in 65 countries.
1501 Page Mill Road, Palo Alto, California 94304

30

32205A
Scientific
Library

Features

- Error and gamma functions
- Exponential, sine-cosine, and Fresnel integrals
- Elliptic functions and integrals
- Bessel functions
- Elemenatary statistics
- One-way frequency distribution
- Correlation
- Multiple linear regression

The Scientific Library is a collection of procedures that perform the scientific functions required most often in scientific applications. These procedures can be called by user programs written in FORTRAN/3000, COBOL/3000, SPL/3000, or BASIC/3000.

32204A
STAR/3000
Statistical Analysis
Routines

Features

- Simplifies the use of statistical functions
- Generates easy-to-read analyses from on-line input or stored data
- Eliminates the need to program statistical operations
- Provides powerful computational capabilities through HP's Scientific Library
- Ensures correct values through extensive editing functions
- Provides a quickly-learned and easily-used operating procedure
- Provides versatility in applications through keyboard and batch operations
- Allows user to focus on research rather than programming requirements and numerical techniques
- Reduces analysis time through use of on-line terminals
- Provides a useful tool for instructional applications

SIMPLIFIED STATISTICAL ANALYSIS

Statistical Analysis Routines consists of a sophisticated software package which provides simplified access to statistical functions of the HP Scientific Library through an interactive terminal or batch operation. Designed to run on the HP 3000 computer system, STAR is a subsystem of the Multiprogramming Executive (MPE) Operating System. As such, STAR/3000 enables the user to input data, manipulate file space, perform statistical operations and output the results in easy-to-read form.

Since STAR provides statistical functions in professionally programmed form, the user no longer has to create these functions himself. Nor does the user need to learn a programming language to use STAR, as all communication is done via commands (in batch mode) or questions and answers (in on-line terminal mode).

HEWLETT **hp** *PACKARD*

STAR/3000 (Cont'd)

EXTENSIVE CAPABILITIES

STAR can perform many types of statistical analyses. Up to 32,767 observations of each of 63 variables can be analyzed, and this data can be edited to ensure correct values. These observations are represented internally as single precision (32-bit) floating point numbers; all calculations are done with single precision arithmetic.

Computational Routines

All STAR analyses are performed by modularized routines. These are as follows:

- Elementary Statistics Module
  Calculates mean, standard deviation, standard error and mean, variance, kurtosis, skewness, minimum, maximum and range
- One-Way Frequency Distribution Module
  Calculates one-way frequency distribution
- Correlation Module
  Calculates product-moment correlation
- Regression Module
  Calculates multiple linear regression
- Transformation Module
  Transforms the observation values of one or more variables in the following ways: reciprocal, Naperian base e to the x power, natural logarithm, base 10 logarithm, square root, nearest integer, calculation of $10^n * x$ where n is a scale factor
- Scatter Diagram Module
  Plots an x-y graph of the relationship between two variables
- Histogram Module
  Constructs a distribution bar graph of the observations for a specified variable

Editing Facilities

STAR includes an Editor Module for changing erroneous observations or sets of observations (variables). Entire observation sets may be added, deleted or printed in order to ensure that their values are correct.

SIMPLE, EASILY-LEARNED PROCEDURE

Commands to STAR use familiar statistical terminology and a simple format. For example, commands such as FREQUENCY, TRANSFORM and CORRELATE are used to call the routines which perform these functions. When used from a terminal, STAR provides easily understood request messages, error messages and explanatory "help" messages. These assist the user in specifying exactly what he wants in the correct format. The sample print-out (adjacent) illustrates an interactive dialogue with STAR.

Keyboard or Batch

The data upon which STAR operates can be entered directly from a keyboard terminal or through a batch input device. STAR may also, at the user's direction, get its data from a previously constructed MPE data file. The reports which are generated may be directed to a user terminal or another output device such as a line printer.

A VALUABLE RESEARCH AID

STAR is particularly useful to researchers who need to do mathematical analyses on empirically gathered data. The fact that these analyses may be done interactively from a terminal can significantly reduce the amount of time necessary to discover important relationships among the variables.

All the necessary routines have been professionally programmed and are actively supported by Hewlett-Packard. This means that the researcher can focus on the problems involved in his research and experiments and need not concern himself with problems which result from inappropriate implementations of numerical techniques.

A USEFUL INSTRUCTIONAL TOOL

The ability of STAR to generate many easily readable reports from a previously prepared set of data makes STAR useful in instructional applications.

The student may choose or be required to generate several different reports from one or several data bases. In this way he discovers for himself the real meaning and relationships of various statistical methods. He may also be required to gather the data himself, thereby making STAR an important tool in any instructional laboratory in the sciences.

SAMPLE STAR RUN USING "PRINT" AND "PLOT" COMMANDS

The user is given the opportunity to declare himself an experienced STAR user, in which case the program would shorten all questions, assuming their context to be understood. In this example, questions are printed in full, since the user is inexperienced. For clarity, user responses have been underlined.

The Scatter Diagram Module plots two variables, one as a function of the other. One variable corresponds to the X-axis and the other to the Y-axis. Each axis is scaled independently according to the range of the corresponding variable. The plot symbol is designated by the user and can be any keyboard symbol. In this case, an asterisk is selected.

STAR/3000 (Cont'd)

Program Size
Approximately 40K bytes (includes all Scientific
Library routines needed). Largest single code segment
is 8K bytes.


```
:HELLO ...
:STAR ...

ARE YOU AN EXPERIENCED STAR USER?
>NO
WHAT IS YOUR DATA FILE?
>*
ENTER NUMBER OF VARIABLES AND OBSERVATIONS
>4,6
ENTER DATA
?1,6,1,1;
?2,5,3,2;
?3,4,5,4;
?4,3,7,8;
?5,4,11,16;
?6,5,13,32;
WHICH PROCEDURE DO YOU WISH TO USE?
#PRINT

ROW      1          2          3          4

1     1.00000    6.00000    1.00000    1.00000
2     2.00000    5.00000    3.00000    2.00000
3     3.00000    4.00000    5.00000    4.00000
4     4.00000    3.00000    7.00000    8.00000
5     5.00000    4.00000    11.0000    16.0000
6     6.00000    5.00000    13.0000    32.0000
WHICH PROCEDURE DO YOU WISH TO USE?
#PLOT
ENTER X (HORIZONTAL) AND Y (VERTICAL) VARIABLES
>1,4
SPECIFY A PLOT SYMBOL
>*
```
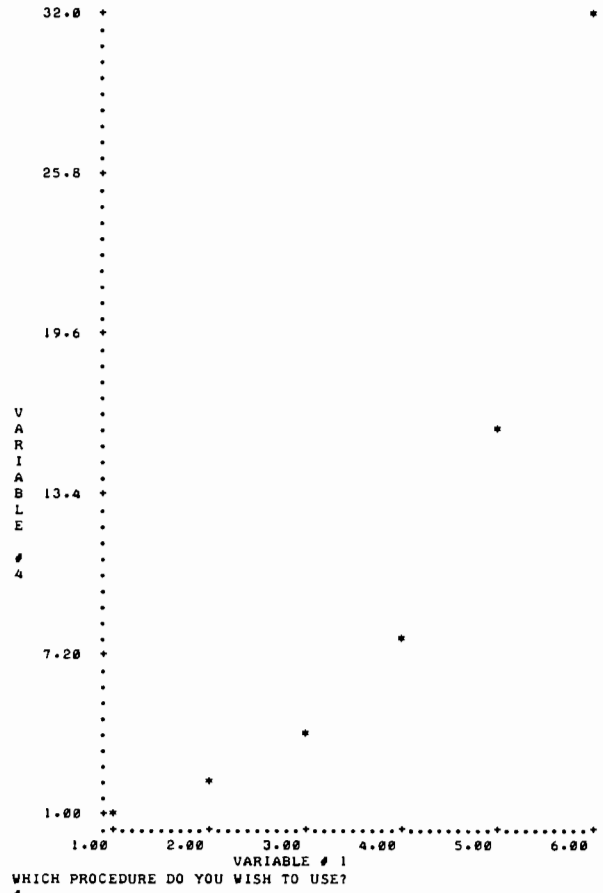
HEWLETT **hp** *PACKARD*

HEWLETT *hp* PACKARD

34

30011A
Expanded
Instruction Set
Extended Precision
Floating Point

Features

- Microcode in bipolar memory for
  Long floating point addition, subtraction,
  multiplication, division
  Long floating point negation
  Long floating point comparison
- Provides 7 to 15 fold increase in instruction performance
- Requires no software changes

The 30011A Expanded Instruction Set consists of a single plug-in circuit board, containing a set of long (48 bits) extended precision floating point routines stored in bipolar read-only memory. It provides six additional arithmetic instructions that are executed by the microprocessor, greatly increasing the performance of all software executing long floating point operations.

MICROCODED ROUTINES

EADD   adds two long floating point numbers

ESUB   subtracts two long floating point numbers

EMPY   multiplies a long floating point number by another

EDV   divides a long floating point number by another

ENEG   negates a long floating point number

ECMP   compares two long floating point numbers.
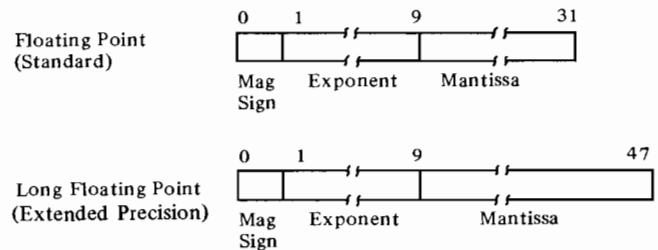
Specifications

PHYSICAL CHARACTERISTICS
The 30011A is mounted on a single upper ROM board.

ENVIRONMENT
The 30011A meets all HP 3000 Computer System environmental specifications.

DATA FORMAT

Floating Point
(Standard)

| 0 | 1 | | 9 | | 31 |

Mag Sign   Exponent   Mantissa

Long Floating Point
(Extended Precision)

| 0 | 1 | | 9 | | 47 |

Mag Sign   Exponent   Mantissa

INSTRUCTION SPEEDS

	Time in μsec	
Name	Minimum	Maximum
EADD	26.5	44.3
ESUB	27.0	44.8
EMPY	59.3	64.2
EDIV	74.6	82.6
ENEG	6.7	13.0
ECMP	6.1	16.6

INSTALLATION
When ordered for existing computer installations, an HP representative will install the 30011A at the customer location, without charge. When requested with the initial order for an HP 3000 System, the product is installed at the factory.

ORDERING INFORMATION
HP 30011A Expanded Instruction Set, Extended Precision Floating Point includes upper ROM board, diagnostic software and manuals.

HP 30011A-001 Expanded Instruction Set, Decimal is also available (see data sheet). Both capabilities are also provided combined as HP 30011A-002.

HEWLETT [hp] PACKARD

HEWLETT *hp* PACKARD

30011A-001 Expanded Instruction Set Decimal

Features

- Microcode in bipolar memory for

   Conversions between packed decimal numbers and external decimal (ASCII) numbers

   Conversions between packed decimal numbers and multi-word binary numbers

   Packed decimal add, subtract, compare

   Packed decimal right shift, left shift, and normalizing left shift

- Provides a 6 to 40-fold increase in instruction performance over simulations

- Requires no software changes

The 30011A-001 Expanded Instruction Set, Decimal, consists of a single plug-in circuit board, containing a set of routines in bipolar read-only memory; these perform conversions between several data types, packed decimal arithmetic, and packed decimal shifts.

MICROCODED ROUTINES

CVAD   converts a 1 to 28-digit number in external decimal (ASCII) format to packed decimal format

CVDA   converts a 1 to 28-digit number in packed decimal format to external decimal (ASCII) format

CVBD   converts a 1 to 6-word two's complement number to a packed decimal number of 1 to 28 digits

CVDB   converts a 1 to 28-digit packed decimal number to a two's complement binary number of 1 to 6 words in length

ADDD   adds two packed decimal numbers, each 1 to 28 digits in length

SUBD   subtracts two packed decimal numbers, each 1 to 28 digits in length

CMPD   compares two packed decimal numbers, each 1 to 28 digits in length

SRD   takes a packed decimal number of 1 to 28 digits in length, shifts it by the specified number of positions to the right, and copies it to another field in memory

SLD   takes a packed decimal number of 1 to 28 digits in length, shifts it by the specified number of positions to the left, and copies it to another field in memory

NSLD   takes a packed decimal number of 1 to 28 digits in length, shifts it by the specified number of positions to the left (or by a lesser shift amount, such that no significant digits are lost), and copies it to another field in memory

Specifications
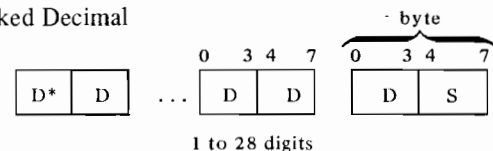
PHYSICAL CHARACTERISTIC
The 30011A-001 is mounted on a single upper ROM board.

ENVIRONMENT
The 30011A-001 meets all HP 3000 Computer System environmental specifications.
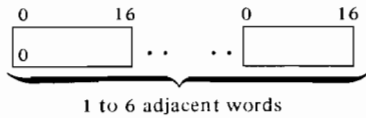
DATA FORMATS
Packed Decimal

1 to 28 digits

- S   Sign (binary 0000 to 1111 are legal, but 1100 is +, 1101 is –, 1111 is absolute
- D   Digit (binary 0000 to 1001)
- D*   most significant digit position is ignored (but preserved) if an even number of digits is specified in the field
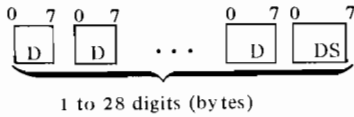
HEWLETT **hp** *PACKARD*

Multi-Word Binary

1 to 6 adjacent words

treated as a 16, 32, 48, 64, 80, or 96 bit
two's complement binary number

External Decimal

1 to 28 digits (bytes)

DS the least significant digit carries the sign of the
field according to COBOL external decimal
conventions (ASCII characters $\emptyset$ to 9 imply an
unsigned number); [is a positive $\emptyset$, A to I are
positive 1 to 9;] is a negative $\emptyset$, J to R are
negative 1 to 9)

D ASCII $\emptyset$-9 (octal 60 to 71) or a leading blank
(octal 40). No embedded blanks are permitted.

INSTRUCTION SPEEDS

	Time in μsec	
	Minimum	Maximum
CVAD	31	173
CVDA	33	146
CVBD	42	400
CVDB	35	216
ADDD	59	180
SUBD	59	180
CMPD	59	138
SRD	51	125
SLD	59	139
NSLD	59	139

INSTALLATION

When ordered for existing computer installations, an HP
representative will install the 30011A-001 at the
customer location, without charge. When requested with
the initial order for an HP 3000 System, the product is
installed at the factory.

ORDERING INFORMATION

HP 30011A-001 Extended Instruction Set, Decimal
includes upper ROM board, diagnostic software and
manuals.

HP 30011A Expanded Instruction Set, Extended Pre-
cision Floating Point is also available (see data sheet).
Both capabilities are available combined as HP 30011A-
002.

HEWLETT hp PACKARD

30130A
2780/3780 Emulation Subsystem

Features

- Communicates with any station that supports an IBM 2780 or 3780 capability
- Runs in full multiprogramming environment
- Accessible from both interactive terminals and traditional batch devices.
- Unrestricted peripheral and file access for input and output
- Provides for multiple users to queue jobs to be transmitted
- Supports all significant 2780/3780 standard and optional capabilities on point-to-point lines
- Automatic blank compression and trailing blank truncation
- Unlimited record blocking

The 2780/3780 Emulation Subsystem allows the user to transfer data between an HP 3000 Computer System and a variety of remote processors, in a full multiprogramming environment. It communicates over public telephone- or private leased-lines at speeds up to 4800 bits-per-second. The emulator causes the HP 3000 to appear (to a remote processor) as either an IBM 2780 or 3780 Data Communication Terminal; however, the Emulation Subsystem is more flexible than the IBM terminals in that it allows the user to employ a greater variety of input/output devices.

The package provides the user with all standard 2780 and 3780 capabilities plus 22 additionally optional capabilities. The most significant of these follow:

- Blank compression
- Short record truncation
- EBCDIC and ASCII transparency
- Horizontal tabulation
- All 2780/3780 vertical format control
- Multi-record transmission (can optionally transmit more than seven records per block under user control)
- Print/punch component select

The user interfaces with the emulator through seven commands which control the sequence of input/output processing. Additionally, the file system and service utilities (i.e., EDIT/3000) make job control language, program and data files easier to maintain and transfer.

ORDERING INFORMATION
HP 30130A 2780/3780 Emulation Subsystem includes HP 30055A Synchronous Single Line Controller, emulation software, diagnostics, 7.62m (25 feet) cable (for modem connection), and manual.
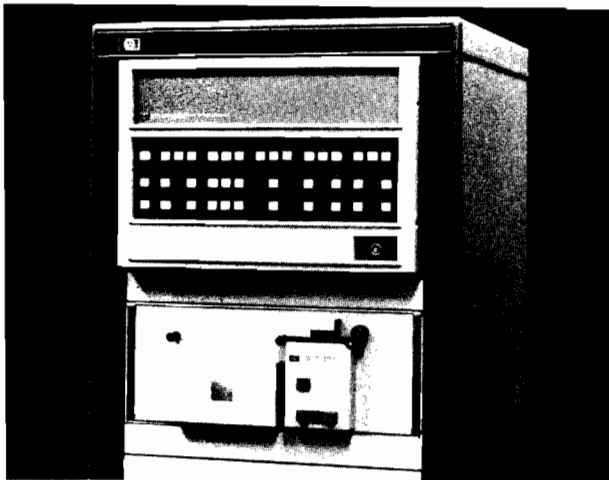
HEWLETT *hp* PACKARD

40

Computer Museum

30300A Programmable Controller Subsystem

faces, drivers, and I/O software it is specifically designed for attachment of foreign devices and on-line instrumentation applications. It adds to the HP 3000, a self-contained, multilevel priority interrupt structure, and the ability to have core resident programs responsive to critical on-line tasks.

Like any other device on the HP 3000 system, the Programmable Controller is accessed through the file system of the HP 3000 Multiprogramming Executive (MPE), and may be remotely located up to 250 feet away.

The standard Programmable Controller System (HP 30300A) provides an HP2100S computer which includes 8192 words of core memory, dual-channel direct memory access (DMA), hardware extended arithmetic and floating point instructions, programmable time-base generator, and self-contained power supply. Also supplied is an interconnecting kit to the HP 3000, paper tape reader, cross loader and cross assembler, and necessary cabinetry.

Eleven input/output channels remain available to the user for the connection of device interfaces. The HP 2155A I/O Extender may be added to provide 31 additional input/output channels. Memory sizes up to 32K words are also optionally available.

The HP 30300A automatically inherits a comprehensive range of input/output drivers, the result of HEWLETT-PACKARD's long proven experience with the BCS operating system. The availability of a complete line of I/O interface kits permits complete monitoring systems to be tailored around the HP 30300A.

Software provided with the sub-system allows user written programs executing in the HP 3000, to monitor and control the application program executing in the Controller. Data transfer between the Controller and

Features

- Independent, core resident I/O processor, for immediate response to external events
- Hardwired, 16-bit parallel, transfer up to 200K words/sec.
- Self-contained, multilevel priority interrupt structure, for efficient I/O handling
- Access through HP 3000 file system
- Connects via hardwired link to HP 2100 I/O system, interfaces, drivers, and I/O software
- Capability to communicate with other computer systems
- Program development and down-load facility from HP 3000
- Convenient access to HP instrumentation or foreign devices
- Control and access from HP 3000 terminals and batch devices

The Programmable Controller brings to the HP 3000 the additional power of the HP 2100S, operating under the Basic Control System (BCS). With its I/O system, inter-

HEWLETT **hp** *PACKARD*

the HP 3000 file system as well as direct control of Programmable Controller operation, are performed through application programs in the HP 3000 and HP 2100. HP 3000 terminals can access an application program, provide terminal control of Programmable Controller functions and control of input and output.

Programs that execute in the Programmable Controller, and their associated configured BCS systems, can be stored as HP 3000 files in absolute binary format. The configured program for the Programmable Controller can be down-loaded from the HP 3000 to the Programmable Controller, under HP 3000 program control. The absolute binary code is automatically loaded in the HP 2100 Computer, and executed. The link between the HP 3000 application program and the Controller program is immediately established, and ready for data transfer or command information flow.

2100 CROSS ASSEMBLER

- Access from HP 3000 Computer terminals and batch devices
- Source code input and object code output treated as HP 3000 files
- Source code input using EDIT/3000 or input device external to HP 3000
- On-line source code modification using EDIT/3000
- Merge/edit of source file and edit file
- Selective assembly
- Source code assembled into relocatable or absolute object code
- Generation of programs that run on any HP 2100 Series Computer
- Extended Arithmetic Unit (EAU) and Floating Point instructions supported

The Cross Assembler allows a user of an HP 3000 Computer System to develop Assembly Language programs for the HP 30300A Programmable Controller or other HP 2100 Series Computer. The Cross Assembler accepts HP 2100 Assembly Language source as input, and outputs relocatable object code that can be loaded and executed.

Environment
The Cross Assembler is fully integrated into the Multi-programming Executive (MPE/3000). Consequently, the Cross Assembler can be run in batch or terminal (session) mode, and all input and output files are normal files found in the MPE/3000 file system.

Implementation Level
Source programs for the Cross Assembler are input to the HP 3000 from any HP 3000 input device, or may be created at a terminal through the use of EDIT/3000. The output generated by the Cross Assembler consists of relocatable object code or absolute code, optional program listings, optional symbol table listings, and

optional symbol cross reference table listings. These may be output to an I/O device, passed to the HP 2100 Cross Loader, or stored in the system.

The Cross Assembler augments the HP 2100 Extended Assembler, by providing assembler subsystem commands that allow a merge/edit capability between an HP 2100 Assembler source file and an edit file. IFN and IFZ pseudo-operations are provided with an IFa statement, to allow selective assembly of HP 2100 Assembler source. The ORB pseudo-operation is provided to define portions of relocatable code that must be assigned a base page origin. The Cross Assembler is compatible with all other HP 2100 assembler, and most closely resembles the HP 2100 DOS/DOS-M/DOS III Assembler. As with all HP 2100 Assemblers, extended arithmetic instructions and floating point instructions can be produced instead of subroutine calls.

EXAMPLE: Assembling A Source Program
The following MPE command sequence can be employed in assembling a source program residing on the disc file SRC. It is assumed the user wishes to list this program on the line printer, and transmit the assembled object code to a Magnetic Tape Unit. The entire job could appear as this simple sequence of commands:

Input	Function Performed
:JOB JONES.ACT2	Invokes MPE/3000, starts job.
:FILE XAOBJ; DEV=TAPE;REC=,,U :FILE XATEXT=SRC,OLD	Specifies input/output files.
:RUN XA2100	Invokes Cross Assembler
:EOJ	Terminates Job.

2100 CROSS LOADER

- Access from HP 3000 Computer terminals and batch devices
- Input and output code treated as HP 3000 files
- Accepts relocatable input from the HP 2100 Cross Assembler or any HP 2100 Series Computer assembler or compiler
- Supports BCS, TODS, TOPTS, RTE-C, RTE-E, and DOS III operating system environments
- Provides system generation for BCS, TODS, TOPTS, RTE-C, RTE-E, and DOS III
- Command files to generate operating systems can be stored as HP 3000 files

The Cross Loader runs on an HP 3000 computer to provide program relocation and linking for programs already assembled or compiled. The Cross Loader accepts as input, the relocatable output of HP 2100 Computer assemblers or compilers, and the 2100 Cross Assembler. The Cross Loader converts the object code

to absolute binary form, using a file of Cross Loader commands to create the operating system environment. The Cross Loader stores the output in absolute format in an HP 3000 file. This file can then be transferred to an output device, or down-loaded to the HP 30300A Programmable controller.

Environment
The Cross Loader is fully integrated into the Multi-programming Executive (MPE/3000). Consequently, the Cross Loader can be run in batch or terminal (session) mode, and all input and output files are normal files found in the MPE/3000 file system.

Command Language
Cross Loader operation is controlled by ten load-directive commands and nine keyword pointers. The load-directive commands are: RELOCATE, SAVE, OUTPUT, SEARCH, DISPLAY, SET, XEQ, LINK, END and EXIT. Their purpose is to:
- Establish system configuration parameters for the desired HP 2100 system
- Load relocatable program modules
- Create the EQT and SQT equipment tables
- Establish links to desired modules
- List the existing configuration by address
- Save configuration data in a "command" file that can be edited using EDIT/3000
- Establish entry point names and core locations to any desired value.

Operating System Generation
Operating system generation is performed to create an operating environment to which an HP 2100 relocatable object program can link.

For example, operating system generation with the Cross Loader for a BCS environment, is functionally equivalent to running Prepare Control System (PCS), during a BCS system generation on an HP 2100 computer. By simply building system tables, setting entry points, and relocating the necessary I/O drivers, the Cross Loader can generate an executable absolute file of the operating system for a given memory, I/O configuration, and set of application programs. Operating Systems that can be generated this way are Basic Control System (BCS), Test Oriented Disc System (TODS), Test Oriented Paper Tape System (TOPTS), and Real Time Executive C (RTE-C). The Real Time Executive E (RTE-E) and Disc Operating System (DOS, DOS/M, DOS III) can be generated by converting the absolute file generated from the Cross Loader, to core-image absolute.

Operating systems configuration for various memory and I/O configurations of the Programmable Controller Subsystem or other HP 2100 computers, can be stored as HP 3000 ASCII command files. These "Command" files are then available to the Cross Loader, for any

given HP 2100 application program which requires a specific operating system or HP 2100 I/O configuration.

EXAMPLE: Loading a User Program
The following series of inputs to the Cross Loader show a complete, authentic HP 3000 job for generating executable absolute binary code, consisting of application programs and a BCS system. The HP 3000 file ACOMR will contain the absolute binary output of the Cross Loader. HP 3000 file RTM contains HP 2100 application programs CONST and LIST in HP 2100 relocatable object code form. HP 3000 file EAU contains BCS Extended Arithmetic library routines. HP 3000 file BCSCMD is the BCS system "command" file generated in an operating system generation step.

Input	Function Performed
:JOB JONES.ACT1	Initialize Job
:RUN XL2100	Invoke Cross Loader
OUTPUT ACOMR	Specifies Output file
XEQ BCSCMD	Specifies the particular HP 2100 I/O configuration to be modeled.
RELOCATE TRM (CONST, LIST) SEARCH EAU DISPLAY ALL	Load Programs Resolve Undefineds Display Result
END EXIT	Terminate Cross loader
:EOD :EOJ	Terminate Job

Specifications

MEMORY
Word size: 16 bits
Page size: 1024 words
Memory size: 8, 16, 24, 32K words configuration
Cycle time: 980 nsec

INPUT/OUTPUT
Multilevel automatic priority interrupt: determined by interface location.
I/O channels: 14, 11 of which are available for attaching I/O devices to the controller.
Additional channels: 31 I/O available with HP 2155A extender
Total possible available I/O channels: 42 (11 + 31)

DIRECT MEMORY ACCESS
Number of channels: 2, 1 channel is available for user tasks
Word size: 16 bits
Maximum size: 32768 words
Assignable: To any I/O channel

CRYSTAL-CONTROLLED TIME-BASE GENERATOR

Base Intervals

0.1 ms	1 second
1 ms	10 seconds
10 ms	100 seconds
0.1 second	1000 seconds

Stability: 2 parts in 10^6 per week

PAPER TAPE READER

Speed: 500 characters per second (415 characters per second at 50 Hz)
Technique: Photoelectric, character-by-character
Code: 8 level
Width: 1 inch

INTERCONNECTION

Speed: 200,000 words at 50 ft.
Components: HP 2100 and HP 3000 parallel interface cards and cable

POWER REQUIREMENTS

115V/230V ± 10%,
60 Hz ± 10%, 50 Hz ± 5%
Power consumption: 1040 watts, maximum

CURRENT AVAILABLE TO I/O

Supply Voltage	Current Available, Amperes (Depending on memory size)			
	8K	16K	24K	32K
+12	2.9	2.9	2.9	2.9
+5	22.8	21.9	20.8	20.0
−2	10.7	9.9	9.1	8.3
−12	3	3	3	3

ENVIRONMENTAL CONDITIONS

Operating Temperature: 0° to 55°C (32° to 131°F)
Non-operating Temperature: −40° to 73°C (−40° to 165°F)
Relative humidity: 95% at 40°C (104°F)

SOFTWARE SUPPLIED

HP 3000 Computer
• A procedure for transferring programs from the HP 3000 to the Controller
• A driver to execute file system intrinsics to open, close, read, write, and obtain information about transfers
• Cross Loader for HP 2100
• Cross Assembler for HP 2100

Programmable Controller
• BCS System with input/output control (IOC), paper-tape-reader driver, extended-arithmetic-unit library
• A loader to accept the transfer of programs from the HP 3000 and initiate them
• A driver to execute I/O control subroutine requests to read, write, clear, and obtain status information (uses 1 DMA channel)

ORDERING INFORMATION

HP 30300A Programmable Controller. Includes HP 2100s Computer with 8K memory, DMA, programmable time-base generator, hardware extended arithmetic and floating point instructions; HP 12925A Paper Tape Reader Subsystem; interconnection interfaces for HP 2100 and HP 3000; signal cable,* 15,24m (50 ft.); necessary cabinetry (1); supporting HP 3000 and HP 2100 software.

HP 30300A-001 Programmable Controller. Same as standard HP 30300A, but mounted in separate, stand-alone cabinet for remote location.

HP 30300A-016 Programmable Controller. Same as standard HP 30300A, but with 16K memory.

HP 30300A-024 Programmable Controller. Same as standard HP 30300A, but with 24K memory.
30300A-032 Programmable Controller. Same as standard HP 30300A but with 32K memory.

HP 30361A Programmable Controller Interface Kit[2]. Includes interfaces for HP 2100 and HP 3000, signal cable,* 14.24m (50 ft.); supporting HP 3000 and HP 2100 software. Assumes existence of an HP 2100-based computer with DMA and a paper tape reader.

Notes:
[1] Provided as an additional bay contiguous with the HP 3000 Computer, or as a separate, stand-alone rack for a remote location.
[2] For existing HP 2100 installations, an HP 2100 computer may become a "programmable controller" by interconnecting with the HP 3000 Computer through the HP 30361A Interface Kit. Requires a 2100A or 2100S Computer, 8K memory, HP 12925A Paper Tape Reader Subsystem, and HP 12985A DMA for HP 2100 Series Computer.
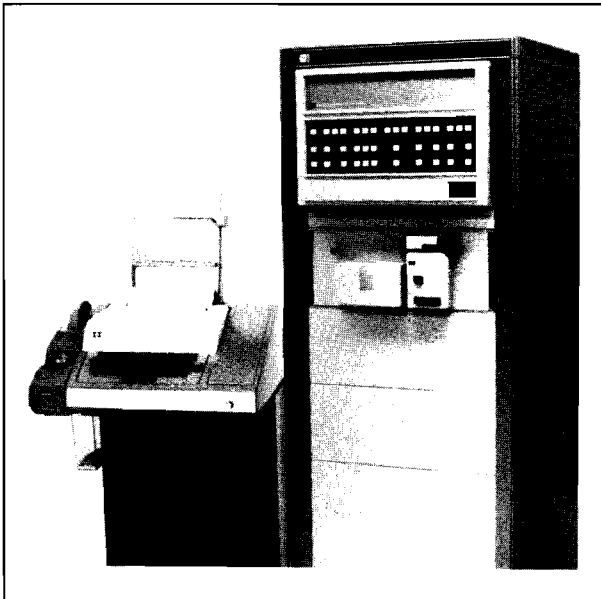*76.2m (250 ft.) maximum cable length can be specified.

HEWLETT **hp** *PACKARD*

30301A
Real-Time
Programmable
Controller Subsystem

- Extensive library of measurement and control programs available
- Either HP 3000 or HP 2100 can be configured as master as master or slave

The Real-Time Programmable Controller with proven RTE-C capability provides the HP 3000 with dedicated, real-time access to measurement and control devices simultaneously with general data processing. As instrumentation data is acquired by the controller it can be transferred to the HP 3000 for concurrent analysis, using high-level languages such as ANSI COBOL and FORTRAN, RPG, BASIC or SPL.

This combination is also a cost-effective alternative to expensive peripherals which are only occasionally needed, such as printers on a real-time computer. By connecting all peripherals to the HP 3000, they can be continuously shared by many different multi-programmed applications. Further, the HP 3000 supports terminal users over telephone lines, thus allowing technicians to control instrumentation devices from remote locations.

COMPONENTS
The HP 30301A includes the following:
- HP 2100S Computer with
  8K-words of core memory
  dual-channel direct memory access (DMA)
  extended precision floating point hardware instructions
  programmable time base generator

- HP 2752 Teleprinter Terminal
- HP 12925A Paper Tape Reader
- HP 30361 Programmable Controller interface with
  interface boards for both the HP 2100 and HP 3000
  signal cable linking the HP 2100 to HP 3000
  RTE-C/3000 software

Features

- Simultaneous real-time instrumentation, data analysis and software development
- Full use of RTE-C on the HP 2100 Minicomputer with MPE multiterminal access
- Bi-directional data transfer between HP 3000 and HP 2100
- Hardwired, 16-bit parallel transfer rate up to 200K-words/sec
- Allows high-level scientific and business languages for data analysis and report writing
- Easier, lower-cost development of real-time software
- Time-scheduled execution of instrumentation programs
- RTE-C system generation and program development on the HP 3000 with download capability

HEWLETT **hp** *PACKARD*

RTE-C/3000 SOFTWARE

HP 3000 Resident Software:
- HP 32223A Cross Assembler program XA2100
- HP 32226A Cross Loader program XL2100
- Cross RTE-C Generation program XRTCGEN
- Download-Program library routine DNLDUSER
- Download-System library routine DNLDSYS
- Diagnostic program LINETEST

HP 2100 Resident Software:
- Basic Binary Link Loader (BBLL)
- RTE-C Operating System (HP 3000 version)
- Diagnostic Program LTEST

RTE-C CAPABILITY

RTE-C is a core-resident, real-time executive operating system capable of running multiple instrumentation programs concurrently. It maintains a list of programs to be run and can initiate the programs on either a time schedule or in response to a special interrupt.

The RTE-C scheduler orders program execution according to 99 user-supplied priority levels. Interrupt-driven programs are initiated according to the hardware priority of an interrupt, with all other interrupts remembered.

I/O operations are performed concurrently with CPU execution. Programmable timeout notification for non-responding I/O devices permits operator intervention from the Teleprinter terminal.

APPLICATIONS

RTE-C is typically used for:
- Data acquisition
- Stimulus-response and sensor-based industrial testing
- Process monitoring and automation
- Experiment control and analysis
- High-resolution analog-to-digital conversion

SOFTWARE DEVELOPMENT

Application programs on the HP 3000 access the Real-Time Programmable Controller through the MPE file system, in the same fashion as any peripheral on the HP 3000. From SPL, for example, a program would call the standard file intrinsics FOPEN, FCONTROL, FREAD, FWRITE, FGETINFO and FCLOSE.

Programs for the Controller may be written in either HP 2100 Assembler or FORTRAN languages. I/O devices are accessed using standard RTE-C EXEC calls. Assembler programs may be assembled on the HP 3000 using the Cross Assembler. FORTRAN programs must be compiled on the HP 2100. The output may be transferred to the HP 3000. All relocatable Controller programs must be converted to absolute form on the HP 3000 using the Cross Loader. Absolute programs for the Controller may be stored in HP 3000 disc files, and downloaded to the HP 2100 by HP 3000 program calls to the routine DNLDUSER.

The RTE-C operating system is generated on the HP 3000 by running the Cross RTE-C Generation program. An operating system may be stored on HP 3000 disc and downloaded to the Controller by calling the routine DNLDSYS.

Software development for the Controller is much easier, faster and more economical through the use of terminals and the powerful Editor (EDIT/3000) on the HP 3000. Paper tape operations are eliminated except for loading existing programs, FORTRAN compiles and hardware failure recovery.

Specifications

MEMORY
Word size: 16 bits
Page size: 1024 words
Memory size: 8, 16, 24, 32K-words configuration
Cycle time: 980 nsec

INPUT/OUTPUT
Multilevel automatic priority interrupt: determined by interface location
I/O channels: 14, 11 of which are available for attaching I/O devices to the controller
Additional channels: 31 I/O available with HP 2155A extender
Total possible available I/O channels: 42 (11 + 31)

DIRECT MEMORY ACCESS
Number of channels: 2, 1 channel is available for user tasks
Word size: 16 bits
Maximum size: 32768 words
Assignable: To any I/O channel

CRYSTAL-CONTROLLED TIME-BASE GENERATOR
Base Intervals

0.1 ms	1 second
1 ms	10 seconds
10 ms	100 seconds
0.1 second	1000 seconds

Stability: 2 parts in 10^6 per week

INTERCONNECTION
Speed: 200,000 words at 15.24m (50 ft.)
Components: HP 2100 and HP 3000 parallel interface cards and cable

POWER REQUIREMENTS
115V/230V ± 10%, 60 Hz ± 10%, 50 Hz ± 5%
Power consumption: 1040 watts, maximum

CURRENT AVAILABLE TO I/O

Supply Voltage	Current Available, Amperes (Depending on memory size)			
	8K	16K	24K	32K
+12	2.9	2.9	2.9	2.9
+5	22.8	21.9	20.8	20.0
−2	10.7	9.9	9.1	8.3
−12	3	3	3	3

ENVIRONMENTAL CONDITIONS

Operating Temperature: 0° to 55°C (32° to 131°F)
Non-operating Temperature: −40° to 73°C (−40° to 165°F)
Relative humidity: 95% at 40°C (104°F)

[1] For specifications on the HP 12925A Paper Tape Reader and the HP 2752A Teleprinter, see HP literature 5952-4616(22) and 5952-4334(22) respectively.

ORDERING INFORMATION

HP 30301A Real-Time Programmable Controller includes HP 2100S Computer with 8K memory, DMA, programmable time-base generator, hardware extended arithmetic and floating point instructions; HP 12925A Paper Tape Reader Subsystem; HP 2752A Teleprinter; interconnection interfaces for HP 2100 and HP 3000; signal cable,* 15.24m (50 ft.); necessary cabinetry[1]; supporting HP 3000 and HP 2100 software.

HP 30301A-001 Real-Time Programmable Controller. Same as standard HP 30301A, but mounted in separate, stand-alone cabinet for remote location.

HP 30301A-016 Real-Time Programmable Controller. Same as standard HP 30301A, but with 16K memory.

HP 30301A-024 Real-Time Programmable Controller. Same as standard HP 30301A, but with 24K memory.

HP 30301A-032 Real-Time Programmable Controller. Same as standard HP 30301A, but with 32K memory.

HP 30361A-001 Programmable Controller Interface Kit for RTE-C[2]. Includes interfaces for HP 2100 and HP 3000, signal cable,* 15.24m (50 ft.); supporting HP 3000 and HP 2100 software. Assumes existence of an HP 2100-based computer with 8K memory, DMA, time base generator, paper tape reader and a teleprinter console.

Notes:

[1] Provided as an additional bay contiguous with the HP 3000 Computer, or as a separate, stand-alone rack for a remote location.

[2] For existing HP 2100 installations, an HP 2100 computer may become a "programmable controller" by interconnecting with the HP 3000 Computer through the HP 30361A Interface Kit.
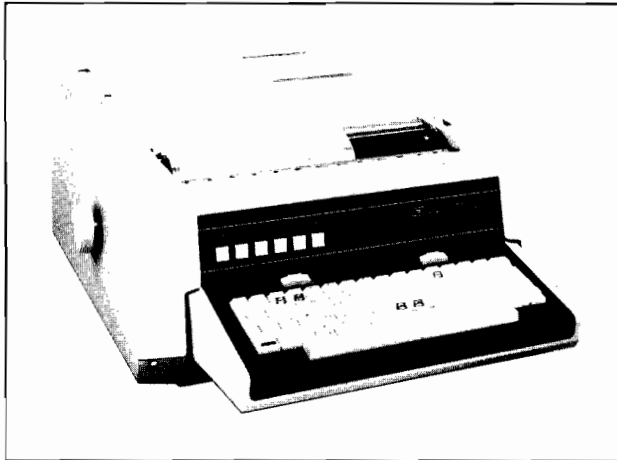
*76.2m (250 ft.) maximum cable length can be specified.

47

HEWLETT *hp* PACKARD

30120A
Printer Terminal

nous terminal controller and employed as a terminal. Input to the HP 30120A is RS-232C compatible, allowing connection through modems and making possible remote use as a terminal. All necessary software for printer terminal operation with HP 3000 Computer Systems is supplied.

Many additional quality features provide operator and performance enhancements, including: Print position indicator (a digital display that indicates next column to be printed); Print position scale; End-of-line alarm; Internal illumination; Low paper alarm; Vertical tabulation (provides local or remote control tabulation, form feed, and programmable forms); Horizontal tabulation (allows local or remote setting or total clearing of tabs at any character print position across print line).

A 30120A is supplied with the HP 3000 Computer System as a console.

Features

- 75 or 118 column format
- 30 character per second print rate
- Heavy duty mechanism for continuous duty
- Quiet operation in a compact unit
- Completely integrated for use with the HP 3000

The HP Printer Terminal is a medium speed computer terminal for direct or remote communication. It serves as a system console or terminal for HP 3000 computer systems.

With an output printing speed of 30 characters per second, the HP 30120A enhances your system by making far more effective use of computer time than would be possible with conventional, slower terminals.

The HP 30120A is a modern self-contained, heavy duty unit that permits reliable, continuous duty. Acoustical design insures welcome quiet operation.

A Printer Terminal can be directly connected to the HP 3000 Computer System and employed as a system console*, or it can be interfaced through the asynchro-

Specifications

CONTROL UNIT
Transmission: Full duplex, serial asynchronous; 8 bits, 7-level ASCII plus parity (even)

Interface: EIA Standard RS232C (CCITT V-24), external modem (Compatible with Bell 103A or equivalent; direct distance dialing (300 baud), Bell 103A2 or equivalent; private line (300 baud), Bell 103F or equivalent)

PRINTING SYSTEM
Revolving print font belt, ink ribbon
Ink standard color: black
Character set: 96-character USASCII (CCITT no. 5)
Print positions (line length): 75 and 118 (characters)
Horizontal tabbing spacing: 10 characters per inch (2.54 cm)
Vertical tabbing spacing: 6 or 3 lines per inch (determined by line space switch)
Printed character size (typical)
  Height: 2.5 mm nominal (0.1 inch)
  Width: 1.5 to 2.2 mm (0.060 to 0.085 inch)

HEWLETT **hp** *PACKARD*

Forms: provides crisp, clean, hard copy on six-part carbon or three-part carbonless, sprocketted forms (for pin-feed units) up to 12-27/32 inches (32.7 cm) wide

Single copy only on friction feed units
Maximum recommended pack thickness: 0.025 inch (0.64 mm)
Home paper rate: 6.66 inches (16.9 cm) per second
Indicators: local, standby, on-line, ready, interrupt, alarm, print pointers

KEYBOARD
Magnetically coupled key contacts ensure reduced wear, longer operating life, and high reliability. The full 128-character ASCII set (94 printable) can be generated.

Switches: All Caps, Auto Line Feed

PRINTING SPEED
10/15/30 characters/second

DATA TRANSFER
Bit serial 10-bit code (11-bit at 10 cps)

NUMBER OF COLUMNS
75 or 118 columns

POWER REQUIREMENTS
2.0A at 117V ± 10%, 60 Hz −1.5 Hz +1 Hz
1.0A at 220 or 240V ± 8%, 50 Hz ± 0.5 Hz
Phases and Lines: Single phase, 3 wire
Power Consumption
    Standby: 40 watts
    Motor on: 85 watts
    Printing: 110 watts
The Printer Terminal conforms to the following codes and standards:
    Underwriters' Laboratory Standard 478 (60 Hz only)
    Canadian Standards Association (60 Hz only)
    Federal Communications Commission Rule 15
    Electronic Industries Association Standard RS-232C
    American National Standard USAS X3.4-1968
    International Electrotechnical Commission 335-1
      (50 Hz only)

ENVIRONMENTAL CONDITIONS
Operating Temperature: 0° to 43°C (+32° to +110°F)
Storage: −20° to +71°C (−4° to +160°F)
Relative Humidity
    Operating and Non-Operating: 10 to 95%
      (non-condensing)
Altitude
    Operating: 0-12,000 ft.
    Non-Operating: 0-50,000 ft.
Heat Dissipation: (Device) 207 kilocalories/hr
    (820 BTU/hr)

PHYSICAL CHARACTERISTICS
Width: 52 cm (20-3/8 inches)
Height: 19 cm (7½ inches); with pedestal: 100.3 cm (39½ inches) high
Depth: 67.3 cm (26½ inches)
Weight: 36.3 kg (80 lbs)
Shipping Weight: 47.6 kg (105 lbs)

ORDERING INFORMATION
30120A: Printer Terminal with keyboard, 75 column, fixed width 21.6 cm (8½ inches) pinfeed, 30 cps, without pedestal.

30120A-001: Printer Terminal with keyboard, 118 column, variable width forms feed tractors with external paper guide, vertical tab/form feed (including programmable vertical tabulation), horizontal tab, 30 cps. Includes pedestal.

30120A-003: Printer Terminal with keyboard, 75 column, friction feed, 30 cps; with pedestal.

All ordering numbers include HP 2762A printer terminal; power cable − 2.44 m (8 ft); signal cable* − 1.57 m (5 ft 2 in.); necessary software for integration with the HP 3000; diagnostic software.

OPERATING SUPPLIES AVAILABLE

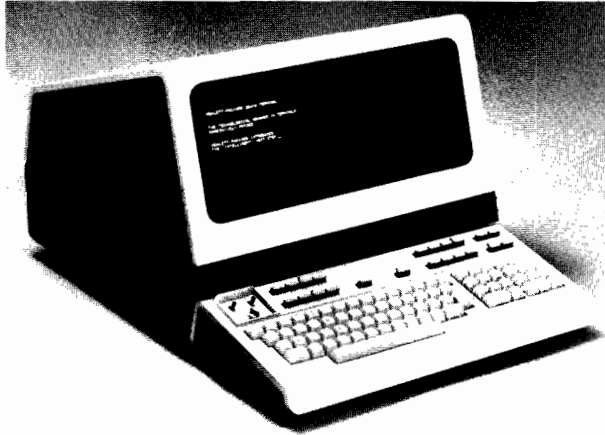|	
Paper, Roll (75 column)	HP Part No. 9280-0046
Paper, Stack (75 column fanfold)	HP Part No. 9280-0705
Paper, Stack (118 column fanfold)	HP Part No. 9320-0551
Ribbon, Black ink	HP Part No. 9282-0524
Programmable Vertical Format Discs	HP Part No. 0950-0590

*Special length signal cables may be ordered.

HEWLETT **hp** *PACKARD*

2640A CRT Terminal for HP 3000 Systems

Features

- Completely supported for use with the HP 3000, in Character Mode.
- Enhanced high-resolution display
- Plug-in character sets
- Self-test
- Multi-task keyboard
- Off-screen storage with scrolling capability
- Programmable protected fields
- Inverse video for highlighting; optional blinking, underline, half-bright
- Cursor addressability and positioning control (tabulation)

The HP 2640A CRT Terminal provides reliable computer communications and a smooth flow of visual information. The high data transmission rates and operational flexibility of the HP 2640A reduces on-line time and simplifies computer communications.

ENHANCED HIGH-RESOLUTION DISPLAY
The CRT has a 5 inch by 10 inch rectangular display providing a 1,920 character capacity in 24 lines of 80 characters per line. The characters are formed by a 7 x 9 dot matrix generated in a 9 x 15 dot character cell. The high resolution of the 7 x 9 dot matrix is enhanced for precise character definition.

PLUG-IN CHARACTER SETS
The HP 2640A has the capacity to include up to four 128-character sets resident concurrently in the terminal. Adjacent characters on the display may be from any of the four character sets. A Math Character Set and Line Drawing Set are available with the optional Underline, Blinking and Half-Bright features.
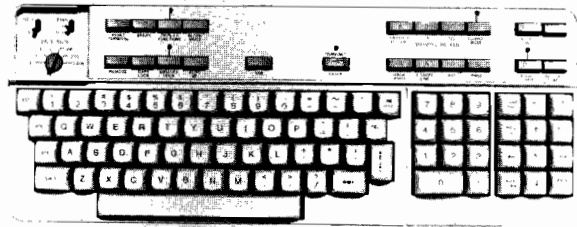
Standard Multi-Task Keyboard
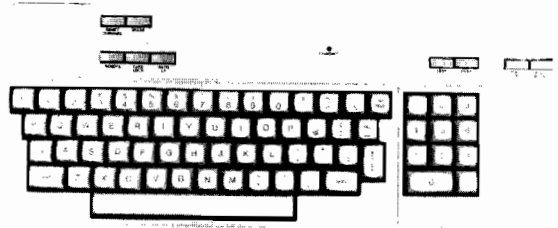
Optional Simplified Keyboard

SELF-TEST
The HP 2640A has been engineered for high reliability, ease of maintenance, testing, and rapid repair when needed. By depressing the TEST button on the keyboard the user receives a go/no-go indication from results of a memory test, firmware test, and display verification.

OPERATING MODE
The HP 3000 supports the HP 2640A only in character mode. It is supported when terminal type 10 (;TERM = 10) is designated during log on.

HEWLETT hp *PACKARD*

Specifications

GENERAL
Screen Size: 127 mm (5 inches) x 254 mm (10 inches)
Screen Capacity: 24 lines x 80 columns (1,920 characters)
Character Size: 2.46 mm (.097 inches) x 3.175 mm
(.125 inches)

Character Set: 64 upper-case Roman
Cursor: blinking underline
Display Modes: white on black; black on white
(inverse video)

Refresh Rate: 60 Hz (50 Hz optional)
Memory: MOS; ROM: 8Kbytes (program); RAM: std.
1024 bytes; 8192 bytes max

Keyboard: Full ASCII Keyboard, 8 special function
keys, and 12 additional control and editing keys;
ten-key numeric pad; cursor pad; multi-speed auto-
repeat: N-key roll-over; stand-alone, 4-foot cable.
(keys related to block mode are not supported on
HP 3000 Systems)

DATA COMMUNICATIONS
Data Rate: 110, 150, 300, 1200, 2400 baud, and
external – switch selectable (110 selects two stop bits)

Communications Interface: EIA standard RS232C; type
103 and 202 modem compatible

Transmission Modes: Full or half duplex, asynchronous
Operating Modes: On-line; Off-line; Character

POWER REQUIREMENTS
Input Voltage: 110 (+15%, –20%) at 60 Hz
             220 (+15%, –20%) at 60 Hz
Power Consumption: 75W to 125W max.

ENVIRONMENTAL CONDITIONS
Operating Temperature: 0 to +55°C (+32 to +131°F)
Relative Humidity: 5 to 95% (non-condensing)
Heat Dissipation: 107 kilocalories/hr (426 BTU/hour)

PHYSICAL SPECIFICATIONS
Display Monitor Weight: 16.8 kg (37 lbs)
Keyboard Weight: 3.2 kg (7 lbs)
Display Monitor Dimensions: 444.5 mmW x 457.2 mmD
x 342.9 mmH (17.5"W x 18"D x 13.5"H) (647.7 mmD
(25.5"D) including keyboard)

Keyboard Dimensions: 444.5 mmW x 215.9 mmD x
88.9 mmH (17.5"W x 8.5"D x 3.5"H)

ORDERING INFORMATION

PRODUCT NO.	DESCRIPTION/NOTES
2640A	Interactive Display Terminal Character mode; 64 character upper case Roman set; 1024 bytes of storage, expandable to 8192 bytes maximum; inverse video; 110-2400 Baud; RS232; includes 2 option slots. (Option 005 required).
opt. 001	128 Character Set – Roman Add lower case and displayable control codes.
opt. 005	103/202 Modem Cable – for connection to 103/202 modem or HP 3000 asynchronous terminal controller (male RS232 connector)
opt. 010	Simplified Keyboard Replace standard multi-task keyboard with typewriter compatible keyboard (including numeric pad).
opt. 015	230V/50 Hz
13231A	Display Enhancements Adds blinking, half-bright & underline, and provides for addition of three 128 character sets (occupies one option slot)
opt. 201	64-character mathematic symbol set Adds display of integral signs, Greek letters, etc.
opt. 202	64-character line drawing set Adds display of continuous horizontal and vertical line segments for forms, histograms, etc.
13233A	Terminal Memory Module (+2K) 2048 bytes of additional storage for 2640A (occupies one option slot).
13234A	Terminal Memory Module (+4K) 4096 bytes of additional storage for 2640A (occupies one option slot).
13238A	Terminal Duplex Register For use with 2640A Interactive Display Terminal (occupies one option slot).
opt. 001	HP 9866 Cable Adds cable for connection to 9866 Line Printer. (Firmware currently supports 9866 printer only.)
13240A	2640A Option Slot Extender Adds five option slots in 2640A (includes fan).

HEWLETT [hp] *PACKARD*

30122A
CRT Terminal
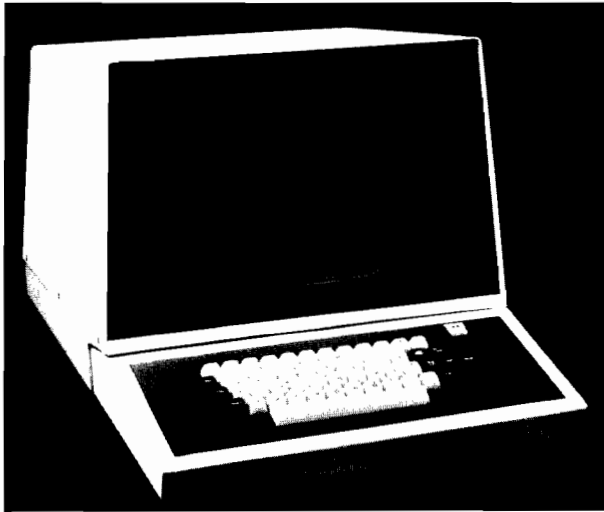
Features

- Displays 25 lines, 80 characters per line
- Non-destructive, blinking underline cursor
- Brightness control on keyboard
- Easily read 5 x 7 dot matrix characters
- Flicker-free 60 times-per-second screen refresh rate
- RS-232C data communications interface to 2400 baud
- ASCII character set
- Simplified keyboard – detachable
- Extensive cursor and clear/erase controls operable from application programs

The HP 30122A CRT Terminal provides reliable computer communications and a smooth flow of visual information. The high data transmission rates and operational flexibility reduces on-line time and simplifies computer communications.

DISPLAY
The HP 30122A CRT Terminal can display 2000 characters using a 5 x 7 dot matrix for each character. Clarity is maintained by two-dot separation between characters and a three-dot separation between lines. Line feed entered on bottom line scrolls entire display upward, leaving bottom line blank.

KEYBOARD
The 52-key, teleprinter style keyboard is easy to use and requires little operator training. The keyboard is a separately enclosed unit connected to the display via a 76.4 cm (30-inch) cable. Thus, the user can arrange the terminal for high visibility and maximum operator convenience.

HIGH RELIABILITY
Digital electronics are contained on a single printed circuit board resulting in high reliability and lower maintenance costs.

Specifications

CONTROLS
Power: ON/OFF
Mode: ON-LINE/LOCAL
Transmission: FULL duplex
Screen: BRIGHTNESS – control on keyboard
         CONTRAST – control on rear panel
Clear: ESC E
Curson home: ESC,H
        up: ESC,A
        down: ESC,B
        right: ESC,C
        left: ESC,D
Erase line: ESC,K
Erase to end of screen: ESC,J

DISPLAY
30.5 cm (12-inch) rectangular tube (measured diagonally)
Character type: 5 x 7 dot matrix
Character size (nominal): 2 mm by 4.5 mm
Characters displayed: 2000
Characters per line: 80
Lines per display: 25
Refresh rate 60 Hz (crystal clock-controlled)
Character set: 64 upper case* ASCII characters displayed, plus control set
Memory: 2000 character MOS semiconductor
Cursor: blinking underline

*Lower case characters received from the HP 3000 computer, will be displayed in upper case.

HEWLETT **hp** *PACKARD*

DATA COMMUNICATIONS
EIA RS-232C serial asynchronous
ANSI USAS x 3.4-1968 code compatible with HP 3000
Data Rate: 110, 150, 300, 600, 1200, 2400 — switch selectable
Modern Support: full duplex, type 103

PHYSICAL CHARACTERISTICS
Weight
    Display Unit: 25 kg (55 lbs)
    Keyboard: 3.63 kg (8 lbs)
Dimensions
    Keyboard: 42 cm wide, (16.55 inches)
             24.8 cm deep, (9.7 inches)
             7.6 cm high, (3 inches)
    Display Unit: 42 cm wide, (16.55 inches)
             38.8 cm deep, (15 inches)
             34 cm high, (13.5 inches)

ENVIRONMENTAL CONDITIONS
Operating Temperature: 5° to 40°C (40° to 104°F)
Storage: -20° to +60°C (-4° to 140°F)
Relative Humidity: 5% to 80% (non-condensing)
Heat Dissipation: 140 kilocalories/hr (555 BTU/hr)
Shock: 12" drop in shipping container
Altitude: Sea level to 10,000 ft.

POWER REQUIREMENTS
1.3A at 117V ± 10%, 0.65 A at 220V ± 10%
50 or 60 Hz ± 5%, 100W
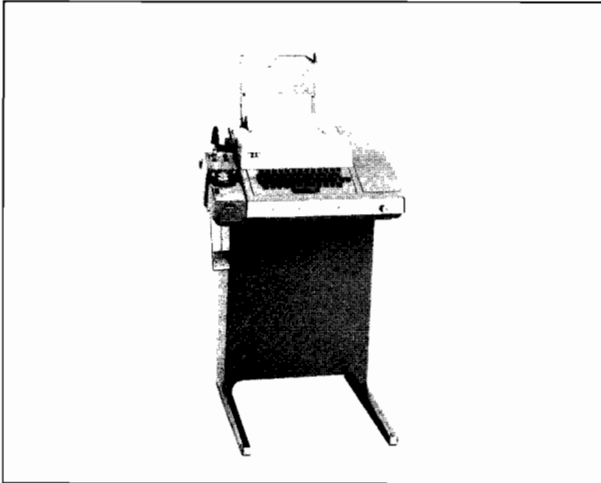
ORDERING INFORMATION
30122A CRT Terminal. Includes HP 2615A CRT
Terminal; power cable — 2.28 m (7.5 ft) signal cable*
— 1.52 m (5 ft); necessary software for integration
with the HP 3000; diagnostic software.

*Special length signal cable may be ordered.

HEWLETT hp PACKARD

30124A Teleprinter Terminal

Computer data output can be received at the terminal as printed copy with or without punched tape. An answer-back feature permits a called station to automatically identify itself.

Specifications

DATA TRANSFER
Full duplex, 10 cps, 110 baud, serial asynchronous, even parity over 8 bits, 11 unit code (1 start bit, 8 character bits, 2 stop bits)
EIA standard RS-232C interface, includes coupler for data set connections

PRINTING SYSTEM
Impact printer using a cylindrical typewheel; standard typewriter ink ribbon
Character set: 63 printable characters. ME typewheel and DSL keytop (ASR 33 keyboard) with key interlock. Lower case ASCII code causes upper case to be printed

Print positions (line length): 72 characters. Signal bell at approximately 61st and 71st column
Horizontal spacing: 10 characters per inch (2.54 cm)
Vertical spacing: 6 or 3 lines per inch
Platten: Friction feed
Forms: Original and 1 carbon copy possible (roll paper, 400 ft. length), approximately 8.5 inches (21.6 cm) wide
Typing speed: 100 words/minute (maximum)
Tape punching and printing speed: 10 cps

TAPE PUNCH AND READER
Manual or automatic operation

TAPE CODE
8-channel on 1-inch tape (2.54 cm)

TAPE TYPE
Oil-base stock, 0.004 inch (0.10 mm)

Features

- EIA Standard RS-232 C coupling for data set operation
- Full duplex, 110 baud
- Time meter
- Pedestal mount
- ASCII code, even parity over 8 bits
- Alpha "0" and numeric "Ø"
- X-ON/ X-OFF-activated paper tape reader
- Automatic paper tape punch
- Automatic answer back
- Completely integrated for use with the HP 3000

The HP 30124A satisfies the basic needs for communication with the HP 3000 computer. The teleprinter combines a keyboard (similar to a typewriter), tape reader and tape punch in a single unit, and is suitable for standard duty (intermittent operation).

Data input to the computer can be made by means of a keyboard or punched tape. Tape sending and receiving can be manually or automatically (computer) controlled with simultaneous printing of local copy for visual reference. Tape can also be punched off-line with local printed copy. A coupling unit provides necessary voltage levels for connection to a data set.

HEWLETT **hp** *PACKARD*

POWER REQUIREMENTS
15A (start-up surge — maximum), 3A (running) at
115V ± 10%, 50 or 60 Hz ± 3/4%, single phase.
1.5A at 230 ± 10%, 50 Hz ± 3/4%, single phase.
Power consumption 250 watts, nominal. Conforms to
UL and CSA requirements.

ENVIRONMENTAL CONDITIONS
Operating Temperature: -40° to +65°C
(-40° to 150°F)
Relative Humidity: 90% maximum at 38°C (100°F)
Heat Dissipation: 195 kilocalories/hr (775 BTU/hr)

PHYSICAL CHARACTERISTICS
Width: 55.9 cm (22 inches)
Height: 21.6 cm (8½ inches); with pedestal: 83.8 cm
(33 inches)
Depth: 47 cm (18½ inches)
Weight: 34.7 kg (77 lbs) includes pedestal
Shipping Weight: 41.8 kg (92 lbs) includes pedestal

ORDERING INFORMATION
30124A Teleprinter Terminal, 72 column, friction feed.
Includes HP 2749B Teleprinter with pedestal, running-
time meter, chad box, copy holder, paper shaft and
tape spools; power cable — 1.91 m (7½ ft); signal cable*
— 1.52 m (6 ft); necessary software for integration with
with the HP 3000; device diagnostic software. Also
included are the following operating supplies: one roll
printer paper, one roll paper tape, lubrication kit.

Other signal cable lengths may be specified.
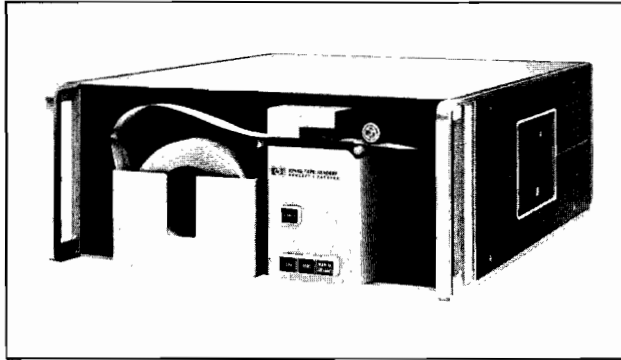
OPERATING SUPPLIES AVAILABLE
Paper, Roll 21.6 cm (8.5 inches wide), 94 m (370 ft long)
HP Part No. 9280-0046

Paper, Tape 2.54 cm (1 inch wide),
304.8 m (1000 ft long)   HP Part No. 9280-0063
Lubrication Kit   HP Part No. 5080-6610
Paper Tape Winder, 115V/230V/Battery, includes re-
chargeable battery   HP Part No. 12575C

30104A
Punched Tape
Reader Subsystem

Features

- Reading speed to 500 characters-per-second
- Error-free reading of both dry and oil-base tape without adjustment
- Simple operation and rugged construction for long life
- Completely integrated for use with the HP 3000

The high speed of the reader permits rapid read in while offering the economy and versatility of punched tape input. A significant advantage in reading accuracy is also provided by using a new compensating sensing technique. Data reliability is enhanced as each character is read only once with no overshooting of characters. Positive feedhole control and a reliable clutch/brake mechanism ensure that the tape will stop on the character that initiates the stop. Simple operation, rugged construction and electrically-conservative design ensures long life at top performance.

Specifications

READING SPEED
500 characters per second (415 characters per second when operated from 50 Hz power)

READING TECHNIQUE
Photoelectric, character-by-character

TAPE
Code: 8 level code
Width: 1 inch (2.54 cm)
Material: Any material with less than 60% transmissivity

START/STOP TIMES
Start time: Less than 6 milliseconds
Stop time: Less than 500 microseconds (stops on character)

CONTROLS
Load: Releases pinch roller and stops capstan for tape threading
Read: Enables all circuits for external control
Manual Advance: Advances tape when pressed
Power: Turns on reader

POWER REQUIREMENTS
2.5A at 115V ± 10%;
1.25A at 230V ± 10%, 50 or 60 Hz ± 5%

ENVIRONMENTAL CONDITIONS
Operating Temperature: 0° to 55°C (32° to 131°F)
Non-operating Temperature: -40° to 75°C (-40° to 167°F)
Relative Humidity: 95% at 25° to 40°C
Heat Dissipation: (Device) 172 kilocalories/hr (683 BTU/hr)

PHYSICAL CHARACTERISTICS
Height: 17.8 cm (7 inches)
Width: 43.2 cm (17 inches)
Depth: 40.6 cm (16 inches), not including panel controls and connectors
Device Weight: 19.1 kg (42 lb.)
Shipping Weight: 24.5 kg (54 lb.)
Mounting: Desk-top or HP 3000 Cabinet

ORDERING INFORMATION
30104A Punched Tape Reader Subsystem, 500 cps at 60 Hz or 420 cps at 50 Hz. Includes HP 2748B Punched Tape Reader; rack mounting kit; controller/interface; signal cable* – 5.48 m (18 ft); power cable – 2.28 m (7½ ft); necessary software for integration with the HP 3000; device diagnostic software.

OPERATING ACCESSORY AVAILABLE
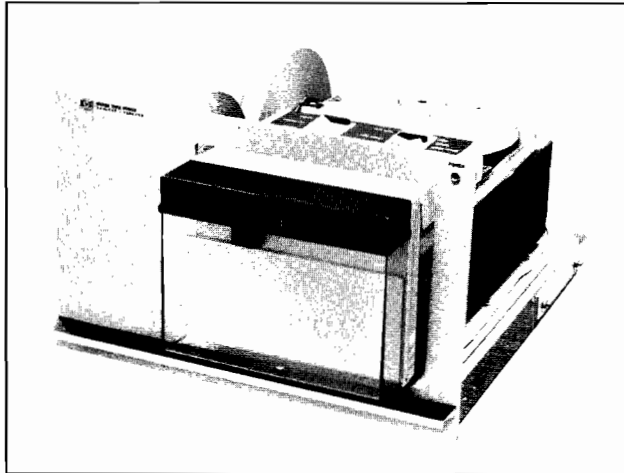12575C Paper Tape Winder, 115/230V/Battery. Includes rechargeable software.

*maximum permissible signal cable length: 15.24 m (50 ft)

HEWLETT hp PACKARD

HEWLETT *hp* PACKARD

30105A
Tape Punch
Subsystem

Features

- **Compact and quiet-running**
- **Punches tape at 75 Characters-per-second**
- **Punches both paper tape and mylar tape**
- **Completely integrated for use with the HP 3000**

The HP 30105A combines reliability and compactness in a self-contained unit. At 75 characters-per-second, the punch provides significantly faster tape punching speed when compared with ASR 33/35 punch rate. Intermediate assembly and compilation tapes can be punched and loaded much faster, permitting greatly improved system throughput rates.

Specifications

PUNCH SPEED
75 characters-per-second, asynchronous

TAPE TYPE
Paper, Mylar or plastic

TAPE WIDTH
Standard 5 level 17.5 mm (11/16 inch) and 8 level 25.4 mm (1 inch)

TAPE THICKNESS
Paper: 0.08 to 0.13 mm (0.003 inch to 0.005 inch) oil-base or dry
Mylar: 0.08 to 0.10 mm (0.003 inch to 0.004 inch)
Plastic: 0.08 to 0.11 mm (0.003 inch to 0.0045 inch)

POWER REQUIREMENTS
2A at 115V ± 10%; 1A at 230V ± 10%; 47.5 to 66 Hz

OPERATING CONTROLS
POWER ON: applies primary ac power
DC ON: applies dc power to internal circuits
TAPE FEED: feeds blank tape through unit
EXT: manually signals computer to request data
FEED HOLES: punches only feed holes as tape passes through unit
CODE HOLES: feeds tape (punches 8-level code and feed hole)
Tape Winding Direction switch: position 1 winds counter-clockwise, position 2 winds clockwise
Tape Winding Motor switch: position 1 is "On," position 2 is "Off"

ENVIRONMENTAL CONDITIONS
Operating Temperature: 10° to 40°C (50° to 104°F)
Relative Humidity: up to 80% at 40°C (104°F) with no condensation
Heat Dissipation: (Device) 172 kilocalories/hr (683 BTU/hr)

PHYSICAL CHARACTERISTICS
Height: 26.7 cm (10½ inches)
Width: 42.5 cm (16¾ inches)
Depth: 53.8 cm (21-3/16 inches)
Mounting: Fits in HP 3000 cabinet
Device Weight: 15.9 kg (35 lb) including drawer
Shipping Weight: 21.3 kg (47 lb)

ORDERING INFORMATION
30105A Tape Punch Subsystem, 75 cps. Includes HP 2895B Tape Punch; controller/interface; power cable – 2.28 m (7.5 ft); signal cable – 4.57 m (15 ft); necessary software for integration with the HP 3000; device diagnostic software.

OPERATING SUPPLIES AVAILABLE
Extra Tape (Order by Part No.; appropriate discount for large quantities)
Paper Tape, 2.54 cm (1-inch wide) 304.8 m (1000 ft. roll) HP Part No. 9280-0063
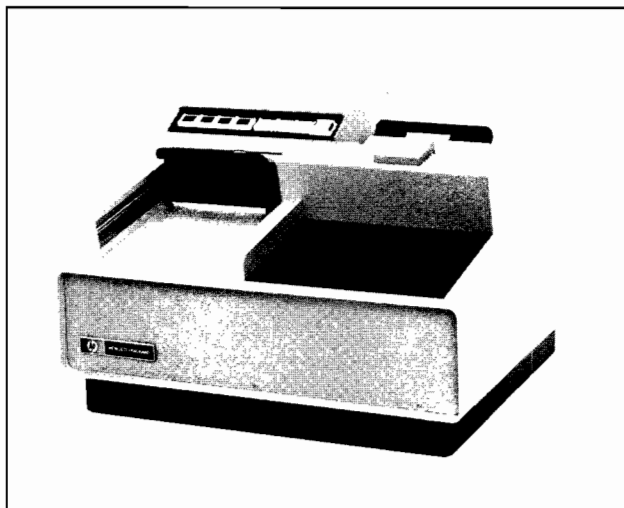Mylar Tape, 1-inch wide, 152.4 m (500 ft.) roll, HP Part No. 0460-0747

HEWLETT **hp** *PACKARD*

30106A
Card Reader
Subsystem

Specifications

CARD RATE
600 cards/minute

CARD TYPE
Standard 80-column EIA card

HOPPER/STACKER
1000 card capacity

CARD LIFE
Excess of 1000 passes

LIGHT SOURCE
Infrared light emitting diodes

READ STATION
Photo transistor, 12 bits simultaneously

INTERNAL CLOCK
Crystal Oscillator

CONTROLS
Stop Switch
Reset Switch
End of File Switch
Power Switch

INDICATORS
Read Check Indicator
Motion Check Indicator
Pick Check Indicator
Hopper/Stacker Indicator

DATA FORMATTING
The HP 3000 interface controller provides Hollerith to ASCII conversion with packing; packed binary formatting (packs four columns into six bytes), and column binary conversion (each column plus four leading zeros packed into two bytes).

POWER REQUIREMENTS
12.4A (starting), 4.0A (running) at 115V ± 15%;
6.2A (starting), 2A (running) at 230V ± 15%;
50 or 60 Hz ± 2%

Features

- Reads 600 punched cards per minute
- Vacuum card picking
- Slant-top design for smooth card flow
- Straight-through card-track for long card life
- Automatic feed
- 1000 card hopper/stacker
- Completely integrated for use with the HP 3000

The HP 30106A Subsystem provides dependable medium speed, card reading capability. A vacuum pick mechanism is used in conjunction with riffle air for ease of card picking and minimum card wear. This technique also permits extremely high tolerance to damaged or worn cards. The card track is very short so that at no time is more than one card in motion. Card life is in excess of 1000 passes.

The many checking features of the reader insure safe, dependable operation. These include light/dark check, motion check, pick check for stapled cards, and hopper checks.

HEWLETT **hp** *PACKARD*

ENVIRONMENTAL CONDITIONS

Operating Temperature: 10° to 40°C (+50° to +104°F)
Non-operating Temperature: – 31° to +57°C
(– 25° to +135°F)

Relative Humidity: 80% maximum
Heat Dissipation: (Device) 310 kilocalories/hr
(1230 BTU/hr)

PHYSICAL CHARACTERISTICS

Height: 39.4 cm (15.5 inches)
Width: 58.6 cm (23-1/16 inches)
Depth: 45.7 cm (18 inches)

Net Weight: 34 kg (75 lbs)
Shipping Weight: 45.4 kg (100 lbs)
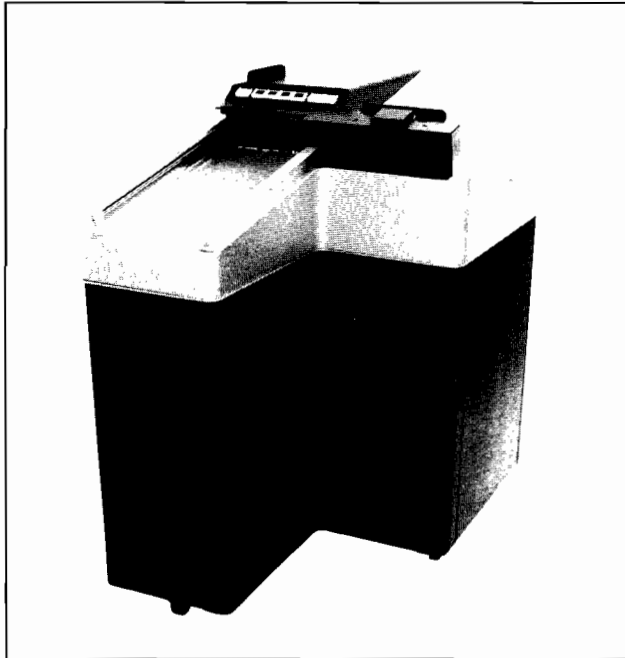
ORDERING INFORMATION

The 30106A Card Reader Subsystem includes HP 2893A
Card Reader; controller/interface; power cable – 1.83 m
(6 ft); signal cable* – 15.24 m (50 ft); necessary software
for integration with the HP 3000; device diagnostic
software

*152.4 m (500 ft) maximum signal cable can be specified

30107A
Card Reader
Subsystem

A photo-transistor array reads standard 12-row, 80-column punched cards in serial, column by column fashion. The data detected is compared for discrepancies providing maximum card reading accuracy. Standard checking features include light/dark check, motion check, pick check, and hopper checks.
A dual read station is available as an option.

Specifications

CARD RATE
1200 cards/minute

CARD TYPE
Standard 80-column EIA card

HOPPER/STACKER
18-inch capacity or approximately 2250 cards

CARD LIFE
Excess of 1000 passes

LIGHT SOURCE
Infrared light emitting diodes (LED's).

READ STATION
Photo transistor sensors, 12-bits parallel. Optional dual read station subsystem contains two sets of photo transistors spaced one card column apart.

CONTROLS
Stop Switch
Reset Switch
End-of-File Switch
Power Switch

INDICATORS
Read Check Indicator
Motion Check Indicator
Pick Check Indicator
Hopper/Stacker Indicator

DATA FORMATTING
Interface controller provides program control for Hollerith to ASCII conversion with packing; packed binary formatting (packs four columns into six bytes), and column binary conversion (each column plus four leading zeros packed into two bytes).

Features

- 1200-card per minute reading speed
- Vacuum card picking
- Optional dual read station
- Straight-through card-track for long card life
- Automatic feed
- 2250-card hopper and stacker capacity
- Completely integrated for use with the HP 3000

The HP 30107A Subsystem provides a high-speed, large-capacity and economical punched card reader. It features a reading speed of 1200 cpm, a hopper and stacker capacity of 2250 cards plus the most reliable card mechanism available.

The sophisticated vacuum picker mechanism has a high tolerance to mutilated, warped and edge-damaged cards. Stapled cards are rejected without damage to the cards. By using a straight-through card track, almost unlimited card life is assured. This also makes the reader virtually jam proof since only one card is in the card track at any time.

HEWLETT **hp** *PACKARD*

POWER REQUIREMENTS
35A (starting), 5.8A (running) at 115V ± 10%;
17.5A (starting), 4.9A (running) at 230V ± 10%;
50 or 60 Hz ± 1%

ENVIRONMENTAL CONDITIONS
Operating Temperature: 10° to 40°C (50° to 104°F)
Nonoperating Temperature: -30° to +57°C
(-22° to +135°F)

Relative Humidity: 90% (non-condensing)
Heat Dissipation: (Device) 576 kilocalories/hr
(2276 BTU/hr)

PHYSICAL CHARACTERISTICS
Height: 105.4 cm (41½ inches)
Width: 59.7 cm (23½ inches)
Depth: 99 cm (39 inches)
Net Weight: 90.7 kg (200 lbs)
Shipping Weight: 113.4 kg (250 lbs)

ORDERING INFORMATION
30107A Card Reader Subsystem. Includes HP 2950A
Card Reader with single read-station; power cable —
1.83 m (6 ft); controller/interface; signal cable* —
15.24 m (50 ft); necessary software for integration with
the HP 3000; device diagnostic software.

30107A-001 Card Reader Subsystem. Same as stated
above but with dual read station.

*152.4 m (500 ft) maximum signal can be specified.

HEWLETT **hp** *PACKARD*

30119A
Card Reader Punch
Subsystem

Primary and secondary input hoppers are provided with capacities of 600 and 400 cards respectively. Under program control, cards may be selected from either input hopper and directed to either 400-card output stacker following reading, punching, or printing. This feature eliminates the need for interfiling of blank cards in decks to be duplicated, provides for automatic separation of original and duplicate cards, and allows for sort/merge operations under control of users' programs.

Input and output punched code formats include column binary card image and packed binary as well as Hollerith.

The printer employs a modified ASCII 64-character set as standard. A 64-character Swedish/Finnish character set is optional.

Features

- On-line 80-column card reading, card punching and card printing
- Rapid throughput
- Read, punch and print functions independently controlled by the computer system
- Individual data storage buffers for each function
- Dual input hoppers and output stackers selectable under program control
- Multiple code formats
- Provides MPE-C software driver plus hardware interface for use with HP 3000 Series computers
- U/L listed and CSA certified

The HP 30119A provides complete punched card I/O capability in a single peripheral device, fully buffered, on-line 80-column card reading, punching, and printing capabilities for use with HP 3000 Series computers. Off-line data recorder (keypunch) capability is optionally available. Reading rate is 200 cards per minute. Punch/print rate is 45 to 75 cards per minute, depending on the number of columns involved. A fast slew rate allows rapid skipping of columns and fields not requiring punching or printing.

Separately buffered and independently controlled read, punch, and print functions may be utilized in any combination. This feature allows operations such as verification of previously punched cards, printing of information different from that punched, or duplication of existing cards.

OFF-LINE FEATURES (Optional Configurations 002, 017 and 022 only)

- Off-line data recorder capability
- Expanded operator control panel
- Moveable, light touch keyboard
- Memory buffering of keyed data
- Card format program storage
- Automatic card remake cycle during verification

Selection of Optional Configurations 002, 017, or 022 provides the user with the following powerful off-line capabilities:

Complete off-line card preparation and on-line input/output operations in a single unit, increasing the cost effectiveness of the subsystem.

A comprehensive control panel allows the operator to select ON-LINE (computer controlled) operation or OFF-LINE (operator controlled) functions. OFF-LINE functions include card format program preparation, program loading, punching, verifying, reproducing, or printing. Included are illuminated machine status, error, and column number indicators.

HEWLETT **hp** *PACKARD*

The 64 character keyboard is connected by a cable to the operator panel. This allows the operator to adjust its position for convenience and comfort. An audible feedback is provided for each successful keystroke. Color coding is used to differentiate data keys from function keys.

Keyed data is stored in an 80-character buffer memory prior to punching or printing. Backspace and Erase keys may be used to edit this data by character, field, or record.

Control programs may be prepared by the operator. These programs define the format for various card operations by designating field boundaries, data type for each field (alpha or numeric) and columns to be skipped. Memory is provided in the unit for storage of up to 4 programs, each of which is keyboard selectable. Reversion to a designated program is automatic following temporary selection of any other program.

When an error has been corrected during verification, the errored card is automatically placed in the unused stacker and a blank card fed and punched with the corrected data.

CONTROLS AND INDICATORS
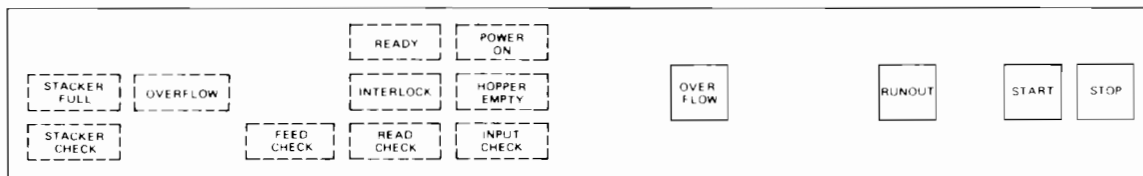
Operator's Panel (included on Standard Unit and Optional Configurations 015 and 020)
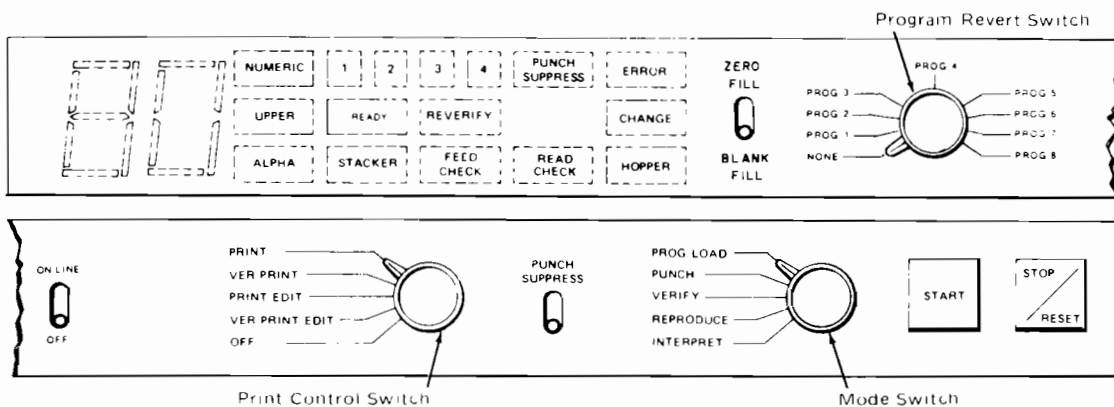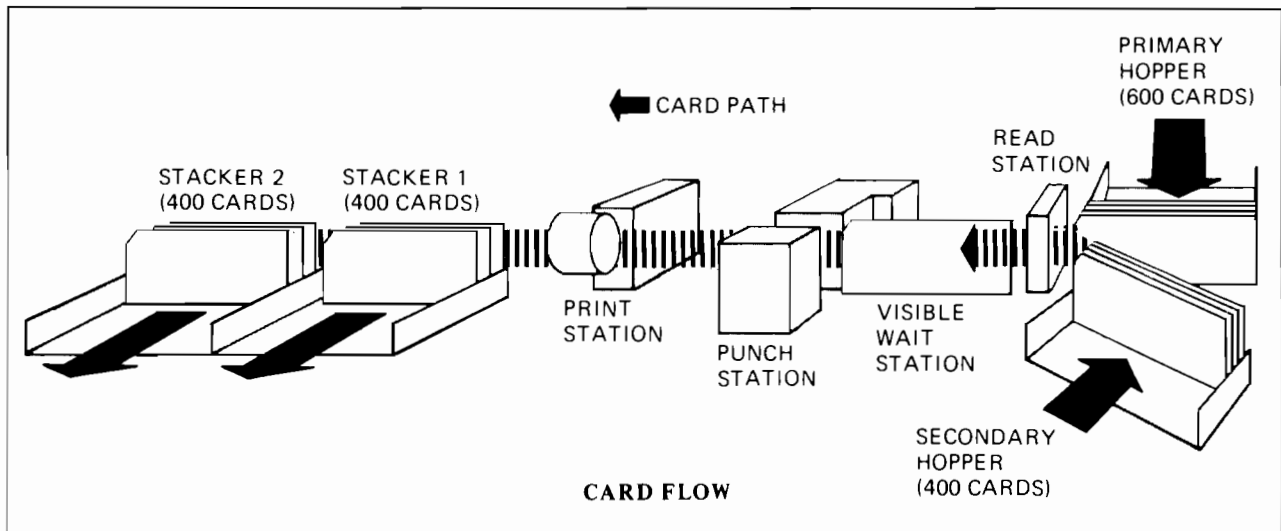

Operator's Panel (included on Optional Configurations 002, 017 and 022)
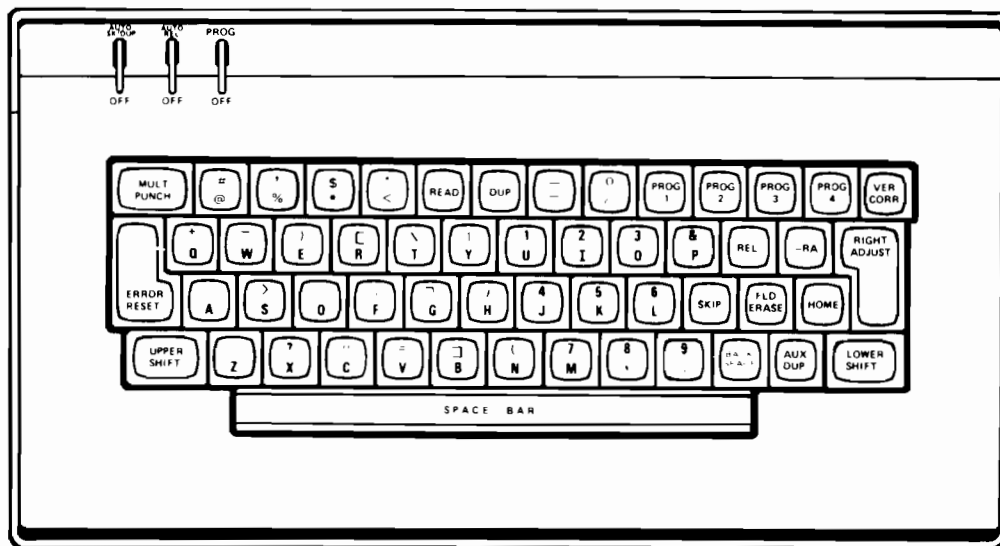
Keyboard (included on Optional Configurations 002 and 017)

Keyboard for Optional Configurations 002 and 017 shown above. Optional Configuration 022 (Swedish/Finnish) has characters Å, Ä, and Ö in position of ASCII comma, period, and backspace, respectively. Backspace key is relocated.

CARD PATH

PRIMARY
HOPPER
(600 CARDS)

READ
STATION

STACKER 2
(400 CARDS)

STACKER 1
(400 CARDS)

PRINT
STATION

PUNCH
STATION

VISIBLE
WAIT
STATION

SECONDARY
HOPPER
(400 CARDS)

CARD FLOW

Specifications

SYSTEMS COMPATIBILITY
Operating System: MPE-C
Computers: HP 3000 Series

CODE COMPATIBILITY
Hollerith (ANSI X3.26-1970)
Column Binary Card Image
Packed Binary

CHARACTER SET (Printer)
Upper case modified ASCII standard
Upper case Swedish/Finnish optional

PERFORMANCE
Card Type: 80 column
Reading Rate: 200 cards per minute
Punching and/or Printing Rate: 45-75 cards per minute depending on number of columns

Input Hopper Capacity, Primary: 600 cards
Secondary: 400 cards

Output Stacker Capacities, both: 400 cards

POWER REQUIREMENTS
2894A

60 Hz models:	115 VAC ± 10% single phase
	60 Hz ± 1 Hz line frequency
50 Hz models:	220 VAC ± 10% single phase
	50 Hz ± 1 Hz line frequency
Power consumption:	425 watts

ENVIRONMENTAL CONDITIONS
Temperature, Operating: $+5°C$ to $+43°C$
$(+41°F$ to $+110°F)$
Non-operating: $-40°C$ to $+60°C$ $(-40°F$ to $+140°F)$
Relative Humidity,* Operating: 8% to 90% with maximum wet bulb of $+29°C$ $(+84°F)$
Non-operating: 5% to 95% (may include condensation)
Heat Dissipation: 365 kilocalories/hr (1450 BTU/hour)

*This is a device specification. Card specifications must also be considered.

PHYSICAL CHARACTERISTICS

Height: 102 cm (40 inches)
Width: 107 cm (42 inches)
Depth: 69 cm (27 inches)
Weight: net: 113.5 kg (250 lb)
　　　　shipping: (approximate) 158.9 kg (350 lb.)

30119A OPTIONAL CONFIGURATIONS

FEATURES

	2894A Card Reader Punch Option Supplied	Provides On-Line Capabilities	Keyboard, Expanded Control & Off-Line Features	ASCII 64 Character Set	Swedish/ Finnish 64 Charac- ter Set	115 VAC 60 Hz Operation	220 VAC 50 Hz Operation
Standard	Standard	X		X		X	
002	002	X	X	X		X	
015	015	X		X			X
017	017	X	X	X			X
020	020	X			X		X
022	022	X	X		X		X

ORDERING INFORMATION

30119A Card Reader Punch Subsystem.
Includes HP 2894A Card Reader Punch; 30219A
universal interface package, consisting of interface
card and cable* – 15.24m (50 ft.); power cable –
2.44m (8 ft); necessary software for integration with
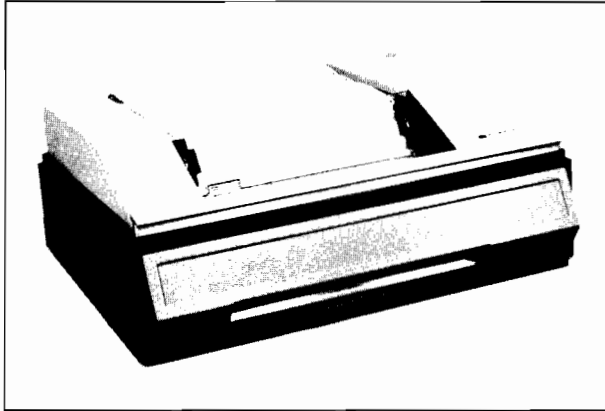the HP 3000; device diagnostic software.

*maximum length

OPERATING SUPPLIES PROVIDED

9320-1430: Box of 2000 80-column cards, 2 boxes
supplied
9260-0373: Ink Cartridge, 2 supplied
1535-3089 Card Removal Tool (supplied with HP 2894A)

HEWLETT **hp** *PACKARD*

30118A
Line Printer
Subsystem

An optional 128-character set includes lower case letters and 32 control codes. The full character set is completely transparent, printing a unique symbol for each ASCII code. The lower-case characters provide full text processing capabilities, thus making possible the generation of reports and specifications. The 32 control characters are printed with standard ANSI symbols, providing an excellent capability for analyzing terminal and data communication programs.

The HP 30118A is a flexible initial printer, ideal for applications that require moderate volumes of list output. As applications grow and require more throughput, an additional HP 30118A can be added. And as an auxiliary printer, it is especially valuable for text processing or program development.

Features

- Prints 132 columns at 200 lines per minute
- Clear dot pattern characters on one original and five carbon copies
- 64-character ASCII set, standard
- Full 128-character set
- High-reliability comb printing mechanism
- Eight-channel vertical format unit
- Convenient paper loading
- Completely integrated with HP 3000 Computer Systems

The HP 30118A is a low cost line printer with comprehensive features that make it an excellent initial or expansion capability for the HP 3000 Computer System.

The standard device is a 64-character, dot pattern impact printer, producing an original and five clearly legible carbon copies. A unique comb printing mechanism with few moving parts produces a full 132-column line, one line at a time, at a rate of 200 lines-per-minute with high reliability. The printing rate is constant regardless of line length.

Also featured is an eight-level vertical format unit. The user may employ a standard format control tape supplied, or produce special format control tapes through the use of a tape format kit and the printer's built-in punch. The control tape is read by an eight-channel optical reader. The vertical format unit increases printing throughput of invoices, statements, reports and other forms.

Specifications

PRINTING SPEED
200 lines per minute (64 character set with a special symbol for control characters)
165 lines per minute (128 character set when printing lines containing lower case characters or control codes)

CHARACTERS PER LINE
132

CHARACTER STYLE
5 x 7 dot pattern
5 x 9 for lower case and control codes

CHARACTER SIZE
5 x 7: 1.6 mm x 2.5 mm (0.062 inches x 0.097 inches)
5 x 9: 1.6 mm x 3.2 mm (0.062 inches x 0.125 inches)

CHARACTER PITCH
Vertical: 6 or 8 lines per inch, switch selectable
Horizontal: 10 characters per inch, no overprint

VERTICAL FORMAT UNIT
8-channel optical tape reader
Integral punch and die for tape preparation

HEWLETT **hp** *PACKARD*

CHARACTER SETS
Standard: 64 characters (conforms to ASCII). Lower case characters are printed in upper case.

@ – at, each	(– left parenthesis
A-Z – alphabet	) – right parenthesis
[– left bracket	* – asterisk
\ – left slash	+ – plus sign
] – right bracket	' – apostrophe
∧ – caret	– – minus sign
_ – lowest row of dots	. – period
– one space	/ – right slash
! – exclamation mark	0-9 – decimal digits
" – double quote	: – colon
# – number	; – semicolon
$ – dollar sign	< – less than
% – percentage	= – equal sign
& – ampersand	> – greater than
, – comma	? – question mark

Plus: (| |) – a unique symbol whenever a control code is represented.

OPTIONAL
Full 128 characters (ASCII)
All the above characters plus:
a-z – alphabet (lower case)
| – vertical line
~ – tilde
{ – opening left brace
} – closing right brace
32 control codes (different ANSI symbols represent each control code, such as line feed, carriage return, bell, etc.)

POWER REQUIREMENTS
105-140V; 60 Hz ± 3 Hz
187-264V; 50 Hz ± 3 Hz
Standby: 10 VA
Non-printing: 500 VA
Printing: 800 VA

ENVIRONMENTAL CONDITIONS
Operating Temperature: +10° to +40°C (+50° to +105°F)
Storage Temperature: –17° to +62°C (0° to +145°F)
Relative Humidity: 50 to 90%, non-condensing
Heat Dissipation: 630 kilocalories/hr (2500 BTU/hr)

PAPER ADVANCE
8 cm/second (3.2 inches/second)

CONTROLS AND INDICATORS
ON – applies operating power
PRINT – places printer on-line
FORM FEED – advances paper to top of form
LINE FEED – advances paper one line
8LPI – selects either 6 or 8 line-per-inch spacing
PAPER OUT DETECTION – sounds audio alarm. Form is automatically completed before printer is halted.

PHYSICAL CHARACTERISTICS
Cabinet Dimensions (including stand)
Height: 102 cm (40 inches)
Width: 71 cm (28 inches)
Depth: 58 cm (23 inches)
Weight: 118 kg (260 pounds)
Mounting: Printer may be removed from stand for table-top use

FORMS SPECIFICATIONS
Type: Continuous, fanfold, sprocket feed
Width: 10 to 37.7 cm (4 to 14-7/8 inches), including sprocket margins

Single Part: 15 to 25-pound paper stock
Multiple Part: 15-pound 1st part, 12-pound for each of 5 copies

Maximum Pack Thickness: 0.61 mm (0.024 inches)
Form Length:
   Standard format tape, 6 lines per inch: 27.9 cm (11 inches)
   Custom format tape, 6 lines per inch: to 40.2 cm (15-5/6 inches) in 4.2 mm (1/6 inch) increments
   Custom format tape, 8 lines per inch: to 39.4 cm (15-1/2 inches) in 12.7 mm (1/2 inch) increments

ORDERING INFORMATION
30118A Line Printer Subsystem. Includes HP 2607A Line Printer, 200 lpm (64 character set, 132 columns)

30118A-001 Line Printer Subsystem. Includes HP 2607A Line Printer, 165-200 lpm (128 character set, 132 columns)

Subsystems include stand and form shelf, power cable – 2.3 m (7.5 ft.); controller/interface; signal cable* – specify either 15.2 or 30.5 m (50 or 100 ft.); necessary software for integration with the HP 3000; device diagnostic software; operating supplies including ribbon, HP standard format tape and vertical format tape kit; Operating and Reference manual.

OPERATING SUPPLIES AVAILABLE
- [1] Vertical Format Unit Tape Kit. Permits user to punch format tape, 8LPI, 88 line page. Includes 25 self-adhesive splices, laminated tape – 6.1 m (20 ft.), alignment fixture. HP Part No. 1150-0897
- [1] Pre-punched HP Standard Format Tape (66-line page, 6 lpi). HP Part No. 1535-2655
- [1] Ribbon, black ink. HP Part No. 0282-0531
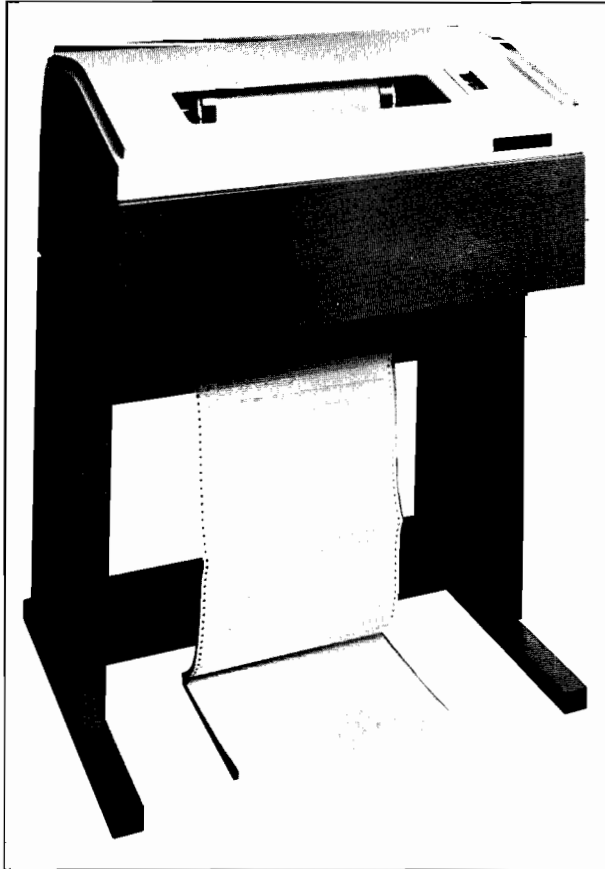- Paper, fanfold, 15 lb. bond, green bar. HP Part No. 9320-1659

[1] Supplied with initial order

*152m (500 ft.) maximum signal cable can be specified

HEWLETT hp PACKARD

30127A
Line Printer
Subsystem

The HP 30127A Line Printer Subsystem represents an optimized combination of high print quality, moderate speed and low price in a drum printer subsystem. This subsystem is ideally suited to applications requiring a medium duty printer.

The unit attains a print rate of 300 lines per minute when printing a full 64-character set in a 136-column format. Print rate is 240 lines per minute for 96-character set configurations.

A 12-channel Vertical Format Unit allows convenient and efficient printing in predetermined formats such as business forms. The VFU uses industry standard control tapes. Under program control the VFU may be commanded to slew to the next hole in a given channel of the tape or to slew an absolute number of lines from 0 to 15.

A switch allows the operator to choose 6 or 8 lines per inch (60 or 80 lines/page respectively). A matching VFU tape will synchronize the forms to the VFU.

An ASCII 64-character set is standard with 96-character ASCII optional.

Six part forms are easily handled by the HP 30127A. Forms alignment is simplified by horizontal and vertical paper alignment guides. Fine vertical paper alignment adjustments can be made while printing. A paper receptacle is provided.

Differential line drivers allow the printer to be located up to 500 feet from the computer for flexibility of installation design.

Paper and ribbon loading are facilitated by a swing hinge which allows the drum-gate to be opened 90 degrees.

All EDP category safety requirements are met for equipment listing by Underwriters Laboratories.

Features

- Prints 136 columns of 64 characters at 300 lines per minute
- 12-channel vertical forms control
- Printer may be located up to 500 feet from CPU
- Clear, crisp printout
- Multiple copies – prints up to 6-part forms
- Both 64-character or 96-character ASCII available
- 6 or 8 lines per inch – operator selectable
- U/L listed

HEWLETT **hp** *PACKARD*

Specifications

CHARACTER DRUM
Characters per Line: 136
Character Type: Open Gothic
Symbol Size (Typical): 2.4 mm (0.095 inch) high
1.65 mm (0.064 inch) wide

Character Code: ASCII
Standard 64 Character Set:

@ - at, each	# - number	– - minus sign
A-Z - alphabet	$ - dollar sign	. - period
[- left bracket	% - percentage	/ - right slash
\ - left slash	& - ampersand	0-9 - decimal digits
] - right bracket	, - comma	: - colon
^ - caret	(- left parenthesis	; - semi-colon
_ - underscore	) - right parenthesis	< - less than
(BLANK) - one space	* - asterisk	= - equal sign
! - exclamation mark	+ - plus sign	> - greater than
" - double quote	' - apostrophe	? - question mark

Optional 96 Character Set Adds the Following:

` - grave accent	| - vertical line
a-z - alphabet	~ - tilde
{ - left brace	- space (delete)
} - right brace	

PAPER FEED
One set of pin tractors above drum, friction paper
tensioner below drum

Line Advance: 50 milliseconds
Slew Rate: 50.8 cm (20 inches) per second

PAPER DIMENSIONS
Standard fanfold, edge punched paper 12.4 cm (4.875
inches) to 42.6 cm (16.75 inches) wide

PAPER TYPE
Single copy, 15 lb. bond minimum weight
Multi-copy up to 6 parts, 12 lb. bond with single shot
carbon

VERTICAL FORMAT UNIT
Number of Channels: 12
Addressing: Slew to next hole in channel "n" or slew
0 to 15 lines

POWER REQUIREMENTS
2613A Printer
60 Hz Models: 115V AC ± 10% Single Phase
60 Hz ± 2% Line Frequency
50 Hz Models: 220 or 240V AC (jumper selectable)
± 10% Single Phase
50 Hz ± 2% Line Frequency

ENVIRONMENTAL CONDITIONS
Temperature
Operating: +10°C to +37°C (+50°F to 99°F)
Storage: −18°C to +66°C (0°F to 151°F)
Relative Humidity
Operating: 30% to 90% (non-condensing)
Storage: 5% to 95% (non-condensing)
Heat Dissipation: 454 kilocalories/hr (1800 BTU/hr)
nominal

PHYSICAL CHARACTERISTICS
Height: 114.5 cm (45 inches)
Width: 83.8 cm (33 inches)
Depth: 55.9 cm (22 inches)
Weight
Net: 154.2 kg (340 lb.)
Shipping: 165.6 kg (365 lb.)

PRINTING SPEEDS

Char. Set	Drum Speed	136 Char. Line Per Minute
64	1200	300
96	800	240

30127A CONFIGURATIONS
Standard − 64 character, 300 lpm, 115VAC/60 Hz
001 − 96 character, 240 lpm, 115VAC/60 Hz

ORDERING INFORMATION
30127A Line Printer Subsystem. Includes HP 2613A
Line Printer, 300 lpm (64 characters, 136 columns)

30127A-001 Line Printer Subsystem. Includes HP
2613A Line Printer, 240 lpm (96 characters, 136
columns)

Subsystems include power cable − 3.66 m (12 ft.);
controller/interface; signal cable* − 7.62 m (25 ft);
necessary software for integration with the HP 3000;
VFU tapes (6 and 8 lines/inch); VFU diagnostics
software (6 and 8 lines/inch); printer ribbon;
operating and service manual.

* 152.4 m (500 ft.) maximum signal cable can be specified.

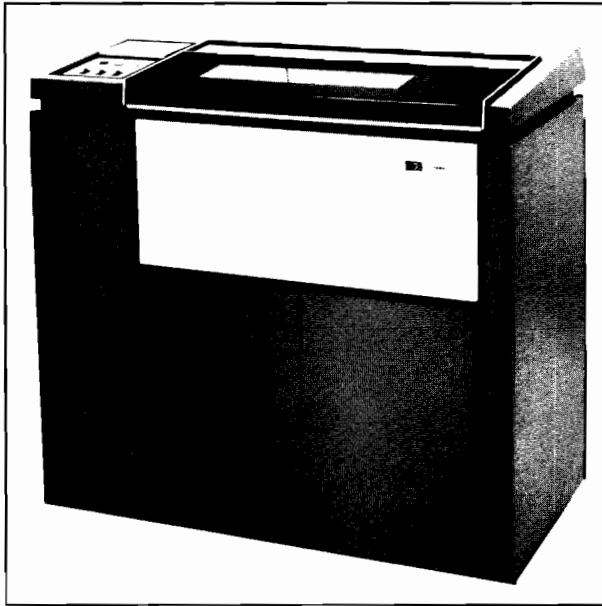## OPERATING SUPPLIES AVAILABLE
9282-0545 Printer Ribbon
9320-1659 Paper stock, single part 37.8 x 27.9 cm
(14.87 x 11 inches) green bar, 3000 pages per box.

Contact your HP Sales Office for other available
stock. Sufficient paper is supplied with the printer
for installation testing. User should order operating
quantities in advance of installation.

HEWLETT [hp] PACKARD

30128A
High Speed
Line Printer Subsystem

The subsystem with a 64-character set prints at 1250 lines per minute. When printing a subset of 36 consecutive characters, 1800 lines per minute is achieved. Printing rate is independent of line length.

Two operator selectable drum speeds are incorporated. The higher rpm provides maximum printing speeds while the lower rpm provides enhanced print quality. Data is stored in a full line buffer prior to printing.

A 12-channel Vertical Format Unit uses industry standard control tapes. Under program control, the VFU may be commanded to slew to the next hole in a given channel of the tape or to slew an absolute number of lines from 1 to 15.

A single adjustment allows the operator to choose 6 or 8 lines per inch. A matching VFU tape will synchronize the forms to the VFU.

An ASCII 64-character set is standard and an ASCII 96-character set is optional.

Six-part forms are easily handled by the printer. Forms alignment is simplified by horizontal and vertical paper alignment guides. Fine vertical paper alignment adjustments can be made while printing.

Printer controls have been minimized and are easy to read. A swing hinge allows the drum-gate to be opened 90 degrees to facilitate both paper and ribbon loading.

An electronic static eliminator is provided to counteract charge build-up on forms.

Features

- Prints 132 columns at rates to 1800 lines per minute
- Dual speed drum for high quality printout
- 12-channel vertical forms control
- Simplified control panel and front paper loading for operator convenience
- 6 or 8 lines per inch – operator selectable
- Both 64-character and 96-character ASCII available
- Multiple copies – prints up to 6-part forms
- Electronic static eliminator for improved forms stacking

The HP 30128A provides high speed, high quality printed output, and quiet operation for HP 3000 series systems. This printer is ideally suited for applications requiring high duty cycle or continuous operation.

Specifications

CHARACTER DRUM
Characters per Line: 132
Character Type: Open Gothic
Symbol Size (Typical): 2.4 mm (0.095 inch) high
                       1.65 mm (0.065 inch) wide

HEWLETT **hp** *PACKARD*

Character Code: ASCII
Standard 64 Character Set:

@ - at, each	# - number	– - minus sign
A-Z - alphabet	S - dollar sign	. - period
[- left bracket	% - percentage	/ - right slash
\ - left slash	& - ampersand	0-9 - decimal digits
] - right bracket	, - comma	: - colon
^ - caret	(- left parenthesis	; - semi-colon
_ - underscore	) - right parenthesis	< - less than
(BLANK) - one space	* - asterisk	= - equal sign
! - exclamation mark	+ - plus sign	> - greater than
" - double quote	' - apostrophe	? - question mark

Optional 96 Character Set Adds the Following:

` - grave accent	| - vertical line
a-z - alphabet	~ - tilde
{ - left brace	- space (delete)
} - right brace	

PAPER FEED
Two sets of pin tractors
Line Advance: 14 milliseconds (maximum)
Slew Speed: 89 cm (35 inches) per second

PAPER DIMENSIONS
Standard fanfold, edge punched paper 10.2 cm to
48.3 cm (4 to 19 inches wide)

PAPER TYPE
Single copy, 15 lb. bond minimum weight.
Multi-copy up to 6 parts, 12 lb. bond with single-shot
carbon.

VERTICAL FORMAT UNIT
Number of Channels: 12
Addressing: Slew to next hole in channel "n" or slew
0 to 15 lines

POWER REQUIREMENTS
2618A Printer

60 Hz Models:	115VAC ± 10% single phase
	60 Hz ± 2% line frequency
50 Hz Models:	230 VAC ± 10% single phase
	50 Hz ± 2% line frequency
Power Consumption:	1.95 kW maximum

ENVIRONMENTAL CONDITIONS
Temperature
Operating: +10°C to +40°C (+50°F to 104°F)
Storage: −17°C to +65°C (0°F to 149°F)
Relative Humidity
Operating: 50% to 90% (non-condensing)
Storage: 5% to 95% (condensing)

Heat Dissipation
Printing: 1663 kilocalories/hr (6600 BTU/hour)
Standby: 756 kilocalories/hr (3000 BTU/hour)

PHYSICAL CHARACTERISTICS
Height: 116.8 cm (46 inches)
Width: 123.2 cm (48.5 inches)
Depth: 92.7 cm (36.5 inches)
Weight: Net: 362.9 kg (800 lb)
Shipping: 409 kg (900 lb)

PRINTING SPEEDS

Characters On Drum	Drum Speed Switch Position	#Consecutive Characters Printed	Printer Speed Lines/Minute 132 Columns
64	1800	1-36/37-64	1800/1250
64	1200	1-46/47-64	1200/925
96	1200	1-67/68-96	1200/925
96	800	1-76/77-96	800/675

30128A CONFIGURATIONS
Standard — 64 char., 1250 lpm, 115VAC/60 Hz
001 — 96 char., 925 lpm, 115VAC/60 Hz

ORDERING INFORMATION
30128A Line Printer Subsystem. Includes HP 2618A
Line Printer 1250 lpm (64 characters, 132 columns).

30128A-001 Line Printer Subsystem. Includes
HP 2618A Line Printer 925 lpm (96 characters, 132
columns).

Subsystems include power cable – 3.66 m (12 ft);
controller/interface; signal cable* – 7.62 m (25 ft.);
necessary software for integration with the HP 3000;
device diagnostic software; printer ribbon; VFU tape
(6 lines/inch, 60 lines/page); operating and reference
manual.

*152.4 m (500 ft) maximum signal cable can be specified.
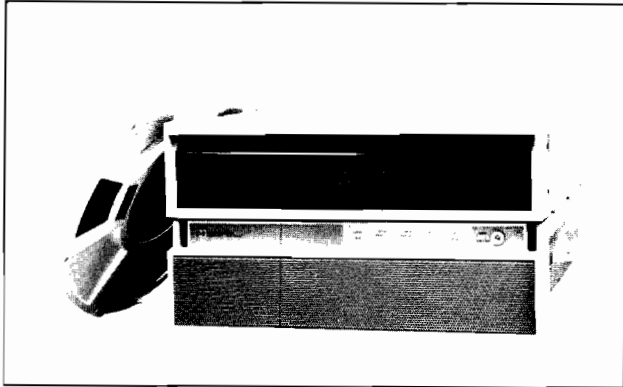
OPERATING SUPPLIES AVAILABLE
9282-0543: Printer Ribbon
9320-1659: Paper Stack, single part, 37.78 x 27.94 cm
(14.87 x 11 inches) green bar, 3000 pages per box.

Contact your HP Sales Office for other available stock.
Sufficient paper is supplied with the printer for instal-
lation testing. User should order operating quantities in
advance of installation.

HEWLETT hp PACKARD

30110A
Cartridge
Disc Subsystem

Specifications

CAPACITY

Drive: 4,915,200 bytes; 200 cylinders; 800 tracks; 19,200 sectors
Track: 24 sectors; 6,144 bytes
Cylinder: 4 tracks; 96 sectors; 24,576 bytes
Sector: 256 bytes
Recording Surfaces: 4
Discs: 2

RECORDING

2200 bits/inch on inner track, 100 tracks/inch, 203 tracks/surface

ACTUATOR

Voice coil actuator with position and velocity feedback

CARRIAGE

Stainless steel rails life tested in excess of two hundred million seeks

AIR FILTRATION AND CIRCULATION

65 CFM squirrel cage blower distributes air to both discs. All air passing over the discs goes through an absolute filter located at outlet side of blower. Positive air pressure is maintained during cartridge change.

DATA ACCESS

Rotation Speed: 2400 RPM
Head Positioning (including settling time)
    Track-to-Track (Maximum): 7 ms
    67 Tracks (Maximum): 30 ms
    203 Tracks (Maximum): 55 ms
Rotational Delay (latency)
    Average (½ revolution): 12.5 ms
    Maximum (1 revolution): 25 ms
Total Average Response Time
    (position and rotation): 47.5 ms
Data Transfer
    8 Bit Bytes/second: 245,760 average
    Bits/Second: 1.96 million average
Cartridge Change at 60 Hz Power
    Stop Time: 25 sec, maximum
    Start Time: 30 sec, maximum

Features

- Compact on-line storage
- Dual storage media for maximum convenience
- 4.9 million bytes
- Expandable to 19.6 million bytes (4 discs can be connected to one controller)
- Average access time less than 35 milliseconds
- Photo-optical head positioning for guaranteed interchangeability
- Reliability through simple and rugged design
- Completely integrated for use with the HP 3000

The HP 30110A Cartridge Disc Subsystem uses an efficient and dependable Moving-head Disc Drive. It serves as a low-cost mass storage device for use in HP 3000 computer systems.

Each drive has a removable cartridge disc in combination with a fixed disc. Together they store 4.9 million bytes of information. Both discs are served by the same moving-head mechanism. The removable disc is permanently enclosed in a cartridge for protection against contamination and damage.

HEWLETT **hp** *PACKARD*

POWER REQUIREMENTS
110/120V ± 10%, 60 Hz ± 2%, 3.4A, 1∅
220/240V ± 10%, 50 Hz ± 2%, 2.0A, 1∅

INTERCHANGEABILITY
The unit's unique photo-optical head positioning system allows any disc written on any HP 30110A within its operating temperature (10° to 40°C) to be read on any other HP 30110A unit operating within that temperature range.

ENVIRONMENTAL CONDITIONS
Operating Temperature: +10° to +40°C (+50° to +104°F)
Relative Humidity: 8 to 80%, non-condensing
Vibration: 10 to 50 Hz at 0.25 mm (0.01 inch) peak-to-peak excursion
Attitude (pitch and roll): Accuracy of position is not affected by attitude of the drive.
Heat Dissipation: (Device) 351 kilocalories/hr (1393 BTU/hr)

PHYSICAL CHARACTERISTICS
Disc Drive
    Height: 26.7 cm (10½ inches)
    Width: 48.3 cm (19 inches), 42.5 cm (16¾ inches) behind rack mounting ears)
    Depth: 65.1 cm (25-5/8 inches), (58.3 cm (22-15/16 inches) behind rack mounting ears)

Weight: 53.1 kg (117 lbs.)
Shipping Weight: 63.5 kg (140 lbs.)
Mounting: Fits in HP 3000 cabinet
Power Supply
    Height: 17.8 cm (7 inches)
    Width: 42.5 cm (16¾ inches)
    Depth: 50.2 cm (19¾ inches)
    Weight: 25 kg (55 lbs.)
    Shipping Weight: 29.5 kg (65 lbs.)
    Mounting: Fits in HP 3000 cabinet

ORDERING INFORMATION

30110A: Cartridge Disc Subsystem, 4.9 kbytes. includes the HP 7900A cartridge disc drive; power supply; power cable—4.57 m(15 ft); signal cable 15 ft; controller/interface; disc cartridge.

30110A-010: Additional drive on same controller, 4.9 M bytes. This option includes the HP 7900A disc drive; power supply; power cable — 4.57 m (15 ft.); signal cable—4.57 m; disc cartridge. Up to 4 drives may be included on one interface controller. Subsystems include necessary software for integration with the HP 3000; device diagnostic software.

OPERATING SUPPLIES AVAILABLE
30334A — Disc Cartridge

HEWLETT **hp** *PACKARD*

30103A
Fixed Head
Disc Subsystem

Features

- Fixed-head design for efficient, high-speed operation
- Fits easily into cabinet bays
- 2 and 4 million byte storage capacities
- 8.5 millisecond average access time
- Helium atmosphere system for maximum life and reliability
- Completely integrated for use with the HP 3000

The HP 30103A Disc Subsystem assures maximum performance and throughput. The unit incorporates the latest advances in fixed-head disc design and modern integrated-circuit technology. Units are available with 2 or 4 million byte storage capacities. A modular system of plug-in circuits and heads allows capacity to be tailored to individual requirements.

High-density storage coupled with a disc rotational speed of 3520 rpm provide an average data transfer rate of 485 Kilobytes per second.* When the magnetic heads are lowered to their operating position, the heads fly at a nominal spacing of 120 microinches from the recording surface. All surface wear is eliminated. In addition, the rotating assembly is sealed in an inert helium atmosphere. This technique provides maximum protection against oxidation and contaminant damage to vital disc and head components.

*At 60 Hz operation

Specifications

CAPACITIES
30103A-001: 2,097,152 bytes (expandable)
30103A-002: 4,194,304 bytes (non-expandable)

ORGANIZATION
30103A-001: 256 tracks
30103A-002: 512 tracks
Track: 32 sectors; 8192 bytes
Discs: 4
Tracks/Surface: 64
Surfaces/Disc: 2
Head Configuration: One fixed-head per hardware track

DATA ACCESS
Disc Speed (nominal)
   3520 RPM (60 Hz)
   2940 RPM (50 Hz)
Access Time (average)
   8.5 ms (60 Hz)
   10.2 ms (50 Hz)
Data Transfer Rate (average): 485,000 bytes/sec, 60 Hz; 405,000 bytes/sec, 50 Hz
Bits/Second: 3.97 million (nominal)
Start Time: 6 minutes (nominal)

DISC CONTROL PANEL
Pressure Gauge
Motor Reset Switch
Motor Power On Indicator
Bottle Pressure Low Indicator
Speed Low Indicator
Pump On Indicator
Temperature High Indicator

POWER REQUIREMENTS
The Disc Unit derives power from power supply. Power Supply Requirements: 2.5A (when loaded with disc), at 208V ± 10%, 50 or 60 Hz ± 3%. (Employs two-phase from three-phase connection.) Field-strapping permits 200 to 240V, 50 or 60 Hz in 10V increments. Load is determined by memory unit.

Disc Unit Power Requirements: 0.6A at 115V (drawn from Power Supply) ± 10%, 50 or 60 Hz ± 3%, single-phase. Also, 2.2A at +25Vdc, or 5.5A at +5Vdc, or 2.0A at -12Vdc. An initial (turn-on) current surge of 2.5A can be expected.

POWER FAILURE
No recorded data is affected by ac or dc power loss in any sequence other than the write mode. In the write mode, only the sector being written may be affected.

HEWLETT hp PACKARD

ENVIRONMENTAL CONDITIONS

Temperature: 0° to +40°C (+32° to 104°F)

Relative Humidity: 5% to 95% (non-condensing)

Heat Dissipation: (Device) 151 kilocalories/hr
(600 BTU/hr)
(Power Supply) 277 kilocalories/hr (1100 BTU/hr)

PHYSICAL CHARACTERISTICS

Disc Memory
Front Panel Height: 53.3 cm (21 inches)
Rack Mount Width: 48.3 cm (19 inches)
Unit Depth: 58.7 cm (23-1/8 inches)
Device Weight: 81.7 kg (180 lbs)
Shipping Weight: 96.7 kg (213 lbs)
Mounting: Fits in HP 3000 cabinet

Power Supply
Height: 17.8 cm (7 inches)
Width: 48.3 cm (19 inches)
Depth: 50.2 cm (19-3/4 inches)
Weight: 28.1 kg (62 lbs)
Shipping Weight: 43.1 kg (95 lbs)
Mounting: Fits in HP 3000 cabinet

ORDERING INFORMATION

30103A-001 Disc Subsystem. Includes HP 2660A-001
Disc (2.0 Mbytes); power supply; power cable —
1.83 m (6 ft); signal cable — 3.04 m (10 ft); disc
controller/interface; necessary software for integration
with the HP 3000; device diagnostic software.

30103A-002 Disc Subsystem. Same as above except uses
HP 2660A-022 Disc (4.0 Mbytes).

HEWLETT **hp** *PACKARD*

30102A
Moving Head
Disc Subsystem

pack. Removal and interchangeability of packs is assured. Contamination is eliminated through the use of absolute air filtration and disc pack brushes.

Up to eight disc subsystems can be handled from a single interface controller.

Specifications

CAPACITY
47,104,000 bytes

ORGANIZATION
Discs: 11
Number of Heads: 20
Number of Cylinders: 406 (including 6 spares)
Track: 23 sectors; 256 bytes/sector; 5888 bytes/track

DATA ACCESS
Minimum: 7 ms
Average: 29 ms
Maximum: 55 ms
Rotational Delay (Latency)
    Average (½ revolution): 12.5 ms
    Maximum (1 revolution): 25 ms
Total Average Response Time
    Position and Rotation: 41.5 ms
    Maximum Response: 80 ms

OPERATION
Start Up: 20 sec (nominal)
Stop Time: 25 sec maximum (nominal)
Disc Rotational Speed: 2400 RPM
Data Transfer Rate: 312,000 bytes/sec (maximum)
    236,000 bytes/sec burst rate (average)

ACTUATOR
Electro-magnetic actuator with closed-loop optical servo positioning

DISC PACK – HP 30333A
No physical sectoring required
20 surfaces
400 tracks/surface plus 6 spare tracks/surface

Features

- 47 million byte storage capacity
- Uses conventional disc packs
- 29 milliseconds average access time
- Electronic servoing and continuous temperature compensation for guaranteed interchangeability
- Completely integrated for use with the HP 3000

The Hewlett-Packard 30102A Moving Head Disc supplies 47 million bytes of on-line storage. Its fast average access time of 29 milliseconds coupled with high density storage permits rapid handling of large amounts of data. The Disc Subsystem uses a standard 11-high disc pack to supply twice the storage of comparable units.

This results in a significant cost per byte saving as well as less equipment to operate and maintain.

Electronic servoing and continuous temperature compensation enables 406 cylinders to be written on a single

HEWLETT **hp** *PACKARD*

POWER REQUIREMENTS

The disc derives power from the Power Control Unit. Power Control Unit requirements: 230V ± 10%, 50 or 60 Hz ± 3%, three-phase. PCU uses a negligible amount of power. Load is determined by the number of disc files. Each disc requires 5A at 208/230V ± 10%, three-phase, 60 Hz ± ½ Hz. Turn-on surge 30A

ENVIRONMENTAL CONDITIONS

Temperature: 15° to 32°C (59° to 89°F)
Relative Humidity: to 80%
Heat Dissipation: (Device) 882 kilocalories/hr (3500 BTU/hr)

PHYSICAL CHARACTERISTICS

Height: 101.6 cm (40 inches)
Width: 76.2 cm (30 inches)
Depth: 61 cm (24 inches)
Device Weight: 187 kg (410 lbs)
Shipping Weight: 231 kg (510 lbs)
Mounting: Casters and Levelers
Required Clearance: 45 cm (18 inches) front and rear

ORDERING INFORMATION

30102A Disc Subsystem. Includes HP 2888A Disc Sub-system with controller/interface; power control unit; signal cable* – 7.62 m (25 ft); junction panel for 8 drives; disc pack.
30102A-010: Additional Disc Subsystem (disc on same controller); signal cable – 7.62 m (25 ft.), disc pack.

OPERATING SUPPLIES AVAILABLE
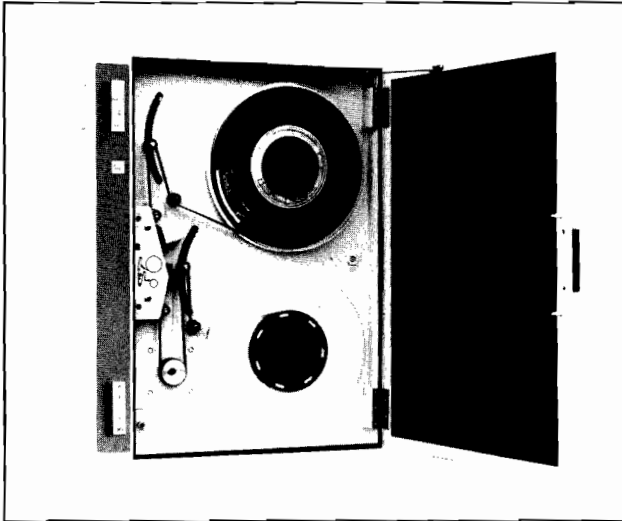
30333A: Additional Disc Pack

Note: Power supply cable is not provided. Local codes determine requirement.

*Distance to first drive 15.24 m (50 ft) maximum. Total accumulated distance 30.48 m (100 ft) maximum. Distance from drive to drive depends on total number of drives connected to a single controller.

HEWLETT *hp* *PACKARD*

30115A
30115A-100
Digital Magnetic
Tape Subsystems

Reel motors provide direct drive, eliminating trouble-some belts and pulleys. Tape tensioning is performed by photo-resistive controlled tension arms, eliminating the need for vacuum system components. Head assemblies consist of read stack, write stack and full width erase head. The Tape Units are recognized under the component program of Underwriters Laboratories.

Specifications

NUMBER OF TRACKS
Nine

READ/WRITE SPEED
114 cm/s (45 ips)

DENSITY
315 bits/cm (800 cpi), NRZI electronics
630 bits/cm (1600 cpi), phase encoded electronics

DATA TRANSFER RATE
36,000 characters per second maximum, NRZI electronics
72,000 characters per second maximum, phase encoded electronics

WRITE ENABLE
Supply reel write enable ring and switch
Ring removal precludes writing

REEL DIAMETER
Up to 26.7 cm (10½ inches)

TAPE (Computer Grade)
Width: 12.7 mm (0.5 inches)
Thickness: 0.038 mm (1.5 mils)

REWIND SPEED
406 cm/s (160 ips)

START/STOP TIMES
8.33 ms (read-after-write) at 114 cm/s (45 ips)

EOT and BOT REFLECTIVE STRIP DETECTION
Photoelectric, IBM Compatible

Features

- Fast data transfer – up to 36Kbytes/sec (NRZI) – up to 72Kbytes/sec (phase encoded)
- 9-track configuration
- 315 bits/cm (800 cpi), NRZI electronics
- 630 bits/cm (1600 cpi), phase encoded data electronics
- 114 cm/s (45 ips) read/write, 406 cm/s (160 ips) rewind/fast forward
- Dynamic braking
- Up to 26.7 cm (10½ inch) reels
- IBM/ANSI compatible
- Completely integrated for use with the HP 3000

Hewlett-Packard Digital Magnetic Tape Units are high performance, reliable magnetic tape drives for use in HP 3000 computer systems. IBM compatible NRZI recording mode is used at a density of 800 cpi. High packing density and data transfer rates are achieved by using ANSI-compatible 1600 cpi phase encoded data electronics. Data written on any IBM or ANSI-compatible equipment can be read on the HP 3000. An interface controller is provided with each subsystem. Four tape drives can be operated from a single controller.

HEWLETT **hp** *PACKARD*

OPERATOR CONTROL PANEL

Reset Switch: Stops tape travel in any mode and returns unit to local control

Rewind Switch: Rewinds tape at 160 ips (114 cm/s)

On-Line Switch: Places unit under remote control

Load Switch: Initiates loadpoint (BOT) search

Write Enable Indicator: Illuminated when write enable ring is installed on the supply reel

POWER REQUIREMENTS

3.4A (maximum) at 115V ± 10%, 50 or 60 Hz ± 0.5%;
1.7A (maximum) at 230V ± 10%, 50 or 60 Hz ± 0.5%

ENVIRONMENTAL CONDITIONS (Hardware)

Ambient Temperature: $0°$ to $55°C$ ($32°$ to $131°F$)

Relative Humidity: 20 to 80% (non-condensing)

Heat Dissipation: (Device) 350 kilocalories/hr
1400 BTU/hr

PHYSICAL CHARACTERISTICS

Height: 61 cm (24 inches)

Width: 48.3 cm (19 inches)

Depth: 30.5 cm (12 inches) from mounting surface

Overall Depth: 40.7 cm (16 inches)

Mounting: Fits in HP 3000 cabinet

Device Weight: 63.5 kg (140 lbs) maximum

Shipping Weight: 86.2 kg (190 lbs)

ORDERING INFORMATION

NRZI Electronics

30115A: Digital Magnetic Tape Subsystem. Includes HP 7970B Digital Magnetic Tape Drive (9-Track, 800 cpi, 45 ips, NRZI electronics); interface controller; 731 m (2400 ft) reel of tape; and necessary connecting cables* (4 drives can be operated from one interface controller).

30115A-200: Additional 800 cpi drive, without controller

Phase Encoded Electronics

30115A-100: Digital Magnetic Tape Subsystem Includes the HP 7970E Magnetic Tape Drive (9-track 1600 cpi, 45 ips PE electronics); interface controller; 731 m (2400 ft) reel of tape; and necessary connecting cables* (4 drives can be operated from one interface controller). This controller can control a mixture of 1600 cpi and 800 cpi tape drives.

30115A-300: Additional Drive (master) (9-track, 45 ips, 1600 cpi, PE electronics) on same controller; 731 m (2400 ft) reel of tape

30115A-400: Additional Drive (slave) (9-track, 1600 cpi, 45 ips, PE electronics) on same controller; 731 m (2400 ft) reel of tape

Note: One drive must be a master

OPERATING SUPPLIES AVAILABLE

Certified Magnetic Tape for Above Drives

9162-0025: 731 m (2400 foot) roll of 0.5 inch, 800 cpi, 3200 frpi (PE), certified blank tape.

9162-0026: 365 m (1200 foot) roll of 0.5 inch, 800 cpi, 3200 frpi (PE), certified blank tape.
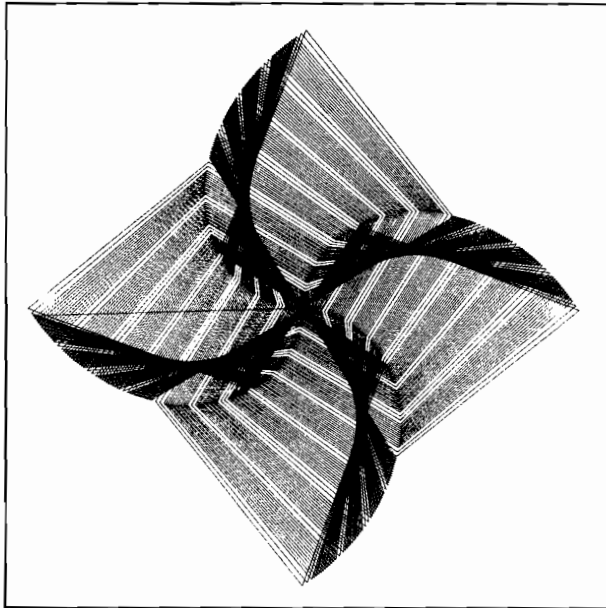
*Interconnecting cables:
  Power cable 2.28 m (7.5 ft)
  Signal cable: 6.1 m (20 ft) to first drive and 6.1 m between drives

30126A CalComp Plotter Interface Subsystem

Features

- **For CalComp Series 500 Plotters**
- **Permits the translation of computer information into graphic form**
- **Simple subroutines callable from FORTRAN, COBOL, SPL and BASIC**

HP 30126A interfaces the HP 3000 computer with a CalComp 500 Series Plotter. The complete interface consists of a single printed circuit board, software driver, basic plotting software and a signal cable for interconnecting the plotter and interface.

The user initiated procedures are programmed to translate computed data into distinct plotter commands necessary to direct an on-line plotter. The resulting graphic form can include graphs, three-dimensional drawings, contour maps, charts, etc., and plot annotation (ASCII alphanumeric characters and special graphic symbols). The subsystem is also responsible for file maintenance operations related to the plotter file, and input/output error-handling.

EASY TO PROGRAM

The basic plotting software consists of five FORTRAN callable procedures; their functions are described below:

1. PLOTS   Initialize plotter variables, initialize a user-defined plotter commands buffer, and open the plotter file.
2. PLOT   Convert X-axis and Y-axis parameters into plotter commands, manage buffering of plotter commands, and close the plotter file when the plotting sequence is completed.
3. FACTOR   Change the plot factor (the ratio of the plot physical size to the plot command size).
4. WHERE   Return the X-axis and Y-axis coordinates of the present pen position (with respect to the current origin) and return the current plot factor.
5. SYMBOL   Write plot annotation in the form of ASCII characters and special symbols.

In addition, through the courtesy of CalComp Corporation the following four additional routines are provided.

1. NUMBER   Convert a floating-point number to the appropriate decimal equivalent in order that the number may be plotted in the FORTRAN F-Type format.
2. SCALE   Examine the data values in an array, also determine a starting value and a scaling factor.
3. AXIS   Indicate the orientation and values of the plotted data points. When both the X and Y axes are needed, AXIS is called separately for each one.
4. LINE   Produce a line plot of the paired data points contained in arrays X and Y. Also compute the page coordinates and scaling factor of these points.

HEWLETT **hp** *PACKARD*

HP 3000
Software Courses

Training is conducted in the U.S.A. at facilities in Cupertino, California and Rockville, Maryland.

Each Training Center is staffed with professional instructors. Students receive both classroom instruction and practical, hands-on experience. By attending the courses in the recommended sequence for your particular HP system, the student will gain the most beneficial training available to meet the needs of your specific application.

HP 3000 SYSTEMS UTILIZATION

This course is designed primarily for the system manager and operator. It is the minimum training required for a user to operate and manage an HP 3000 computer installation. The goal of this course is to develop an understanding of the operation and capabilities of the HP 3000 Computer System. Attendance prior to system installation is recommended.
Length: 10 days   Lab time: approximately 30-40%
Pre-requisites: Prior programming experience.

SYSTEMS PROGRAMMING LANGUAGE

Designed for experienced programmers, this one week course introduces the user to the HP 3000 Systems Programming Language (SPL). This ALGOL-like compiler language was used by Hewlett-Packard to write the HP 3000 Multiprogramming Executive (MPE) and all HP 3000 subsystems. The course also includes training in the use of MPE.
Length: 5 days   Lab time: approximately 30-40%
Pre-requisites: Prior programming experience and completion of the HP 3000 Systems Utilization or equivalent HP 3000 experience.

HP IMAGE/3000

This course is designed to provide the student with a working knowledge of QUERY/3000 – the data base inquiry facility, and IMAGE/3000 – the data base management system. The student will use QUERY to produce reports, updates, and listings from an IMAGE Data Base. Additionally, the student will use the Data Base Definition Language and IMAGE utilities to create and perform maintenance on an IMAGE Data Base. The student will modify an existing host program (COBOL, FORTRAN, or SPL) to exercise the capabilities of the Data Base Procedures Library.
Length: 5 days   Lab time: approximately 25-40%
Pre-requisites: Programming experience in COBOL, FORTRAN, or SPL. HP 3000 System user experience.

LOCATION AND SCHEDULE

The current schedule and course locations are contained in a separate document, available from your local HP Sales Office.

REGISTRATION

Requests for enrollment in an HP Training course should be made through your local HP representative, who will supply the Training Registrar at the appropriate location with the course number, dates, and requested motel reservations. Enrollments are acknowledged by a written confirmation indicating the Training Course, time of class, location and accommodations reserved.

HEWLETT **hp** *PACKARD*

ACCOMMODATIONS
Students provide their own transportation, meals, and lodging. The Training Registrar will be pleased to assist in securing motel reservations at the time of registration.

CANCELLATIONS
In the event a registrant cannot attend a particular class your prompt notification is appreciated.

SELF STUDY COURSES
HP 3000 COBOL and HP 3000 BASIC courses are available as self study packages utilizing modularized audio cassettes, student workbooks, and language reference manuals. Each course is designed to acquaint the student with the essentials of the language. By completing lab problems in each module the student gains practical "hands-on" experience.

HP 3000 COBOL
This course, designed for the beginning and intermediate programmer, consists of the following modules:
1. Overview of COBOL
2. Language elements
3. Identification, environment and data divisions
4. Procedure division
5. Sorting and I/O procedure options
6. Interprogram communication
7. Library features
8. Table handling
9. Random access
10. Segmentation

Pre-requisites
The student should be familiar with basic data processing concepts and terminology, including an understanding of program logic.

Lab Work
This course requires access to an HP 3000 system with a card reader, line printer, and an HP 3000 COBOL compiler.

Course Time
Average 30 hours.

Ordering Information
HP 3000 COBOL SELF STUDY COURSE
Consists of: 10 cassette tapes, 2 card decks, student workbook, HP 3000 COBOL reference manual, coding pad, and complete Advisors Guide.

HP 3000 COBOL STUDENT MATERIALS (1 per additional student)
Consists of: Student workbook, destructible card deck, coding pad.
HP 3000 COBOL ADVISORS GUIDE (additional set)
Consists of: Advisors guide, tests, answer sheets, and answer key.

HP 3000 BASIC
Designed as an in-depth study of BASIC, the modules are as follows:
0 Introduction and Library Commands
1 Essentials of BASIC
2 Strings – data structure
3 Files – structure and direct access
4 Segmentation

Pre-requisites
The student should be familiar with HP 3000 log on procedures and know how to use the MPE Command Interpreter and File System.

Lab Work
The course requires student access to an HP 3000 system, terminal, and HP 3000/BASIC Interpreter.

Course Time
25-30 hours

Ordering Information
HP 3000 BASIC SELF STUDY COURSE
Consists of: 5 cassette tapes, student workbook, HP 3000 Basic Reference manual and MPE manual.

WESTERN TRAINING CENTER
Hewlett-Packard Company
11000 Wolfe Road
Cupertino, California 95014
(408) 257-7000

EASTERN TRAINING CENTER
Hewlett-Packard Company
4 Choke Cherry Road
Rockville, Maryland 20850
(301) 948-6370

For locations outside the U.S.A., please contact your local Hewlett-Packard Representative.

HEWLETT hp PACKARD

The Mini DataCenter Idea

Whatever your preconceptions about minicomputer systems, think again. Hewlett-Packard did. And developed a simple, new architecture and operating system that eliminates the redundancy and wasted memory inherent in traditional minis that echo big-computer design philosophy.

NO OTHER MINI CAN OFFER THE PERFORMANCE OF A MINI DATACENTER

Code and data are handled in separate modules. By dividing program elements into those that will change and those that do not, programs can be shared among all users while each maintains his own unique data space. As a result, no memory is wasted in pointless repetition of common code.

Virtual memory is provided by a user-determined form of code segmentation. This approach permits a program to be larger than the main memory while avoiding waste-ful thrashing between disc and memory that often results when segmentation is totally machine determined. As a further aid to efficiency, our 3000CX Mini DataCenters monitor the frequency of use of code segments, auto-matically eliminating swap out of segments that are in frequent use.

A hardware-implemented variable stack design sharply reduces the amount of memory required to execute the 3000CX Mini DataCenter programs. Since the data stack expands and contracts to meet the need of the program in use, no data area is wasted by unused subroutines. The data stack also provides variable-sized arrays, re-entrant code, recursive programming, and an extremely efficient method of parameter passing to subroutines.

PERFORMANCE IS ENHANCED BY A STRONG RELATION BETWEEN ARCHITECTURE AND OTHER SYSTEM FEATURES

A 32 bit LSI ROM forms the basis of the microprocessor at the heart of our 3000CX Mini DataCenters. This microprocessor implements 182 instructions, has a cycle time of 176 nanoseconds, utilizing overlapped microinstructions to provide both extreme speed and power – as many as 5.27 million operations per second.

Add to this interleaved memory modules for faster access, CPU and I/O processor designed for greater throughput and bus-oriented architecture for modularity, and the potential of 3000CX Mini DataCenters for your application begins to be evident.

Additionally, program size is kept small because of the very efficient code generation resulting from the system's strong instruction set, specifically designed to implement high-level languages. The subroutine call process is unusually fast because the microcode – not the user – shoulders the burden of determining whether code segments are in disc or memory. Program design is simplified because many features of the instruction set are reflected in the syntax of the programming languages.

A 3000CX MINI DATACENTER THAT PROVIDES A RANGE OF OPERATING FEATURES ON A PAR WITH LARGE-SCALE DATA SYSTEMS

At a fraction of the cost, it extends the capabilities of a major data system outward to users who want the features and convenience of a large system, but whose problems don't require the full brute force capabilities of a costly major system. In the corporate environ-ment, it permits EDP management to shift time-consuming, lower-priority management demands out of the central system's work flow with measurable savings in time and cost. Able to communicate with all other HP computers and with major IBM systems, while performing other batch and interactive tasks, a 3000CX Mini DataCenter can form the basis of powerful dis-tributed systems that enhance the reach, versatility and value of the corporate-level effort.

HEWLETT **hp** *PACKARD*

Find Out More
...Call Us

UNITED STATES

ALABAMA
8290 Whitesburg Dr , S E
P O Box 4207
Huntsville 35802
Tel (205) 881-4591
TWX 810-726-2204

ARIZONA
2336 E Magnolia St
Phoenix 85034
Tel (602) 244-1361
TWX 910-951-1331

2424 East Aragon Rd
Tucson 85706
Tel (602) 889-4661

CALIFORNIA
1430 East Orangethorpe Ave
Fullerton 92631
Tel (714) 870-1000
TWX 910-592-1288

3939 Lankershim Boulevard
North Hollywood 91604
Tel (213) 877-1282
TWX 910-499-2170

6515 Arizona Place
Los Angeles 90045
Tel (213) 776-7500
TWX 910-328-6148

3003 Scott Boulevard
Santa Clara 95050
Tel (408) 249-7000
TWX 910-338-0518

*Ridgecrest
Tel (714) 446-6165

2220 Watt Ave
Sacramento 95825
Tel (916) 482-1463
TWX 910-367-2092

9606 Aero Drive
P O Box 23333
San Diego 92123
Tel (714) 279-3200
TWX 910-335-2000

COLORADO
5600 South Ulster Parkway
Englewood 80110
Tel (303) 771-3455
TWX 910-935-0705

CONNECTICUT
12 Lunar Drive
New Haven 06525
Tel (203) 389-6551
TWX 710-465-2029

FLORIDA
P O Box 24210
2806 W Oakland Park Blvd
Ft. Lauderdale 33307
Tel (305) 731-2020
TWX 510-955-4099

P O Box 13910
6177 Lake Ellenor Dr
Orlando 32809
Tel. (305) 859-2900
TWX 810-850-0113

GEORGIA
P O Box 28234
450 Interstate North
Atlanta 30328
Tel (404) 434 4000
TWX 810-766-4890

HAWAII
2875 So King Street
Honolulu 96814
Tel (808) 955-4455

ILLINOIS
5500 Howard Street
Skokie 60076
Tel (312) 677-0400
TWX 910-223-3613

INDIANA
3839 Meadows Drive
Indianapolis 46205
Tel (317) 546-4891
TWX 810-341-3263

IOWA
1902 Broadway
Iowa City 52240
Tel (319) 338-9466
Night (319) 338-9467

LOUISIANA
P O Box 840
3239 Williams Boulevard
Kenner 70062
Tel (504) 721-6201
TWX 810-955-5524

MARYLAND
6707 Whitestone Road
Baltimore 21207
Tel. (301) 944-5400
TWX 710-862-9157

4 Choke Cherry Road
Rockville 20850
Tel (301) 948-6370
TWX 710-828-9685
710-828-0487

P O Box 1648
2 Choke Cherry Road
Rockville 20850
Tel (301) 948-6370
TWX 710-828-9684

MASSACHUSETTS
32 Hartwell Ave
Lexington 02173
Tel. (617) 861-8960
TWX 710-326-6904

MICHIGAN
23855 Research Drive
Farmington 48024
Tel (313) 476-6400
TWX 810-242-2900

MINNESOTA
2459 University Avenue
St. Paul 55114
Tel (612) 645-9461
TWX 910-563-3734

MISSOURI
11131 Colorado Ave
Kansas City 64137
Tel (816) 763-8000
TWX 910-771-2087

148 Weldon Parkway
Maryland Heights 63043
Tel (314) 567-1455
TWX 910-764-0830

*NEVADA
Las Vegas
Tel (702) 382-5777

NEW JERSEY
W 120 Century Rd
Paramus 07652
Tel (201) 265-5000
TWX 710-990-4951

NEW MEXICO
P O Box 8366
Station C
6501 Lomas Boulevard N E
Albuquerque 87108
Tel (505) 265-3713
TWX 910-989-1665

156 Wyatt Drive
Las Cruces 88001
Tel (505) 526-2485
TWX 910-983-0550

NEW YORK
6 Automation Lane
Computer Park
Albany 12205
Tel (518) 458-1550
TWX 710-441-8270

1219 Campville Road
Endicott 13760
Tel (607) 754-0050
TWX 510-252-0890

New York City
Manhattan, Bronx
Contact Paramus, NJ Office
Tel (201) 265-5000
Brooklyn, Queens, Richmond
Contact Woodbury, NY Office
Tel (516) 921-0300

82 Washington Street
Poughkeepsie 12601
Tel (914) 454-7330
TWX 510 248 0012

39 Saginaw Drive
Rochester 14623
Tel (716) 473-9500
TWX 510-253-5981

5858 East Molloy Road
Syracuse 13211
Tel (315) 455-2486
TWX 710-541-0482

1 Crossways Park West
Woodbury 11797
Tel (516) 921-0300
TWX 510-221-2168

NORTH CAROLINA
P O Box 5188
1923 North Main Street
High Point 27262
Tel (919) 885-8101
TWX 510-926-1516

OHIO
16500 Sprague Road
Cleveland 44130
Tel (216) 243-7300
Night 243-7305
TWX 810-423-9431

330 Progress Rd
Dayton 45449
Tel (513) 859-8202
TWX 810-459 1925

1041 Kingsmill Parkway
Columbus 43229
Tel (614) 436-1041

OKLAHOMA
P O Box 32008
Oklahoma City 73132
Tel (405) 721-0200
TWX 910-830-6862

OREGON
17890 SW Boones Ferry Road
Tualatin 97062
Tel (503) 620-3350
TWX 910-467-8714

PENNSYLVANIA
111 Zeta Drive
Pittsburgh 15238
Tel (412) 782-0400
Night 782 0401
TWX 710-795-3124

1021 8th Avenue
King of Prussia Industrial Park
King of Prussia 19406
Tel (215) 265-7000
TWX 510-660-2670

SOUTH CAROLINA
6941-0 N Trenholm Road
Columbia 29260
Tel (803) 782-6493

*TENNESSEE
Memphis
Tel (901) 274-7472

TEXAS
P O Box 1270
201 E Arapaho Rd
Richardson 75080
Tel (214) 231-6101
TWX 910-867-4723

P O Box 27409
6300 Westpark Drive
Suite 100
Houston 77027
Tel (713) 781-6000
TWX 910-881-2645

205 Billy Mitchell Road
San Antonio 78226
Tel (512) 434-8241
TWX 910-871-1170

UTAH
2890 South Main Street
Salt Lake City 84115
Tel (801) 487-0715
TWX 910-925-5681

VIRGINIA
P O Box 9854
2914 Hungary Springs Road
Richmond 23228
Tel (804) 285-3431
TWX 710-956-0157

WASHINGTON
Bellefield Office Pk
1203-114th SE
Bellevue 98004
Tel (206) 454-3971
TWX 910 443-2446

*WEST VIRGINIA
Charleston
Tel (304) 345 1640

WISCONSIN
9431 W Beloit Road
Suite 117
Milwaukee 53227
Tel (414) 541 0550

FOR U.S. AREAS NOT LISTED:
Contact the regional office
nearest you Atlanta, Georgia
North Hollywood, California
Rockville, (4 Choke Cherry Rd)
New Jersey   Skokie, Illinois
Their complete addresses
are listed above

*Service Only

CANADA

ALBERTA
Hewlett-Packard (Canada) Ltd
11748 Kingsway Ave.
Edmonton T5G 0X5
Tel (403) 452-3670
TWX 610-831-2431

Hewlett-Packard (Canada) Ltd
915-42 Avenue S E. Suite 102
Calgary T2G 1Z1
Tel (403) 287-1672

BRITISH COLUMBIA
Hewlett-Packard (Canada) Ltd
837 E Cordova Street
Vancouver V6A 3R2
Tel (604) 254-0531
TWX 610-922-5059

MANITOBA
Hewlett-Packard (Canada) Ltd
513 Century St
St James
Winnipeg R3H 0L8
Tel: (204) 786-7581
TWX: 610-671-3531

NOVA SCOTIA
Hewlett-Packard (Canada) Ltd
800 Windmill Road
Dartmouth B3C 1L1
Tel (902) 469-7820

ONTARIO
Hewlett-Packard (Canada) Ltd
1785 Woodward Dr
Ottawa K2C OP9
Tel (613) 225-6530
TWX 610-562-8968

Hewlett-Packard (Canada) Ltd
6877 Goreway Drive
Mississauga L4V 1L9
Tel (416) 678-9430
TWX 610-492-4246

QUEBEC
Hewlett-Packard (Canada) Ltd
275 Hymus Blvd
Pointe Claire H9R 1G7
Tel (514) 697-4232
TWX 610-422-3022
TLX 05-821521 HPCL

Hewlett-Packard (Canada) Ltd
2376 Galvani Street
Ste-Foy G1N 4G4
Tel (418) 688-8710

FOR CANADIAN AREAS NOT LISTED:
Contact Hewlett Packard (Canada)
Ltd in Mississauga

CENTRAL AND SOUTH AMERICA

ARGENTINA
Hewlett-Packard Argentina
S A C e I
Lavalle 1171-3° Piso
Buenos Aires
Tel 35-0436, 35-0627, 35-0341
Telex 012-1009
Cable HEWPACK ARG

BOLIVIA
Stambuk & Mark (Bolivia) Ltda
Av Mariscal, Santa Cruz 1342
La Paz
Tel 40626, 53163, 52421
Telex 3560014
Cable BUKMAR

BRAZIL
Hewlett-Packard Do Brasil
I E C Ltda
Rua Frei Caneca,1 152-Bela Vista
01307-**São Paulo**-SP
Tel 288-71-11, 287-81-20,
287-61-93
Telex 309151/2/3
Cable HEWPACK São Paulo

Hewlett-Packard Do Brasil
I E C Ltda
Praca Dom Feliciano, 78-8°
andar (Sala 806/8)
9000-**Pôrto Alegre**-RS
Tel 25-84-70-DDD (0512)
Cable HEWPACK Pôrto Alegre

Hewlett-Packard Do Brasil
I E C Ltda
Rua Siqueira Campos, 53, 4°
andar Copacabana
2000-**Rio de Janeiro**-GB
Tel 257-80-94-DDD (021)
Telex 2100 79 HEWPACK
Cable HEWPACK
Rio de Janeiro

CHILE
Calcagni y Metcalfe Ltda
Calle Lira 81, Oficina 5
Casilla 9418
Santiago
Tel 398613
Cable CALMET

COLOMBIA
Instrumentación
Henrik A. Langebaek & Kier S A
Carrera 7 No 48-59
Apartado Aéreo 6287
Bogota, 1 D E
Tel: 45-78-06, 45-55-46
Cable: AARIS Bogota
Telex: 44400INSTCO

COSTA RICA
Lic. Alfredo Gallegos Gurdián
Apartado 10159
San José
Tel. 21-86-13
Cable: GALGUR San José

GUATEMALA
IPESA
Avenida La Reforma 3-48,
Zona 9
Guatemala
Tel 63627, 64736
Telex 4192 TELTRO GU

MEXICO
Hewlett-Packard Mexicana,
S A de C V.
Torres Adalid No 21, 11 Piso
Col del Valle
Mexico 12, D F.
Tel (905) 543-42-32
Telex 017-74-507

Hewlett-Packard Mexicana,
S A de C V
Ave. Constitución No. 2184
Monterrey, N L.
Tel 48-71-32, 48-71-84

NICARAGUA
Roberto Terán G.
Apartado Postal 689
Edificio Terán
Managua
Tel 3451, 3452
Cable ROTERAN Managua

PANAMA
Electrónico Balboa, S A
P O Box 4929
Ciudad de Panama
Tel 64-2700
Telex 3431103 Curunda,
Canal Zone
Cable ELECTRON Panama

PARAGUAY
Z J Melamed S R L
Division Aparatos y Equipos
Medicos
Division Aparatos y Equipos
Scientificos y de
Investigación
P O Box 676
Asunción
Tel 4-5069, 4-6272
Cable RAMEL

PERU
Compañia Electro Médica S A
Ave Enrique Canaual 312
San isidro
Casilla 1030
Lima
Tel. 22-3900
Cable ELMED Lima

PUERTO RICO
San Juan Electronics, Inc
P O Box 5167
Ponce de León 154
Pda 3 PTA de Tierra
San Juan 00906
Tel. (809) 725-3342, 722-3342
Cable: SATRONICS San Juan
Telex SATRON 3450 332

URUGUAY
Pablo Ferrando S A
Comercial e Industrial
Avenida Italia 2877
Casilla de Correo 370
Montevideo
Tel 40-3102
Cable RADIUM Montevideo

VENEZUELA
Hewlett-Packard de Venezuela
C A
Apartado 50933
Edificio Segre
Tercera Transversal
Los Ruices Norte
Caracas 107
Tel 35-00-11
Telex 21146 HEWPACK
Cable HEWPACK Caracas

FOR AREAS NOT LISTED, CONTACT:
Hewlett-Packard
Inter-Americas
3200 Hillview Ave
Palo Alto, California 94304
Tel (415) 493-1501
TWX 910-373-1260
Cable: HEWPACK Palo Alto
Telex 034-8300, 034-8493

EUROPE

AUSTRIA
Hewlett-Packard Ges m b H
Handelskai 52/3
P O Box 7
A-1205 **Vienna**
Tel (0222) 33 66 06 to 09
Cable HEWPAK Vienna
Telex 75923 hewpak a

BELGIUM
Hewlett-Packard Benelux
S A /N V
Avenue de Col-Vert, 1.
(Groenkraaglaan)
B-1170 **Brussels**
Tel (02) 672 22 40
Cable PALOBEN Brussels
Telex 23 494 paloben bru

DENMARK
Hewlett-Packard A/S
Datavej 52
DK-3460 **Birkerod**
Tel: (01) 81 66 40
Cable HEWPACK AS
Telex 166 40 hp as

Hewlett-Packard A/S
Torvet 9
DK-8600 **Silkeborg**
Tel (06) 82-71-66
Telex 166 40 hp as
Cable HEWPACK AS

FINLAND
Hewlett-Packard Oy
Bulevardi 26
P O Box 185
SF-00120 **Helsinki** 12
Tel (90) 13730
Cable HEWPACKOY Helsinki
Telex 12 15363 hel

FRANCE
Hewlett-Packard France
Quartier de Courtaboeuf
Boite Postale No 6
F-91401 **Orsay**
Tel (1) 907 78 25
Cable HEWPACK Orsay
Telex 60048

Hewlett-Packard France
Agenee Regional
Chemin des Mouilles
Boite Postale No 12
F-69130 **Ecully**
Tel (78) 83 65 25
Telex 31 617

HP 3000CX Mini DataCenters
. . . There Are No Equals

You'll find few systems that offer a single operating system for concurrent execution of batch, real-time and time-share with a common file system for all. And in the price range of an HP 3000CX Mini DataCenter, there is only Hewlett-Packard.

The only minicomputer system that lets you work simultaneously in any mode from multiple interactive terminals concurrently. Or lets you do it in RPG, COBOL, FORTRAN, BASIC and SPL at the same time; even mixing languages in the same program. Or permits terminal accessed input-output spooling.

The only minicomputer system that implements virtual memory and code-sharing programming in hardware to free you from the memory consuming inefficiencies of afterthought software implementation.

The only minicomputer system that offers decimal arithmetic and extended precision floating point as time saving microprocessor features. Or come with a built-in debug and trace to cut program check-out time in half.

The only minicomputer system that offers you as extensive an array of batch and terminal access capabilities.

The only minicomputer system that offers a BASIC interpreter plus a full BASIC compiler with execution as much as 10 times faster than those attainable with incremental compilers.

And, of course, Hewlett-Packard offers you the world-wide delivery and maintenance network, the HP guarantee and HP's tradition of quality.

Write or phone your nearby HP sales engineer.

HEWLETT **hp** *PACKARD*