



Data General Desktop Generation

Model 10, Model 10/SP, Model 20 & Model 30

■ PROFILE

Operating Systems • Data General's AOS/WS multiuser operating system, RDOS real-time operating system, and MP/AOS-SU single-user, real-time operating system • Microsoft's MS-DOS; Digital Research's CP/M-86.

Data Management • Data General's AOS/WS DBMS, AOS/WS INFOS II file management system, AOS/WS present query facility, AOS/WS Dataprep data entry facility.

Communications/Networks • Data General's DG/Gate terminal emulator, HASP emulator, MP/3270 BSC emulator, RJE80 emulator, X.25 protocol, Xodiac Network Manager.

Languages • Data General's Extended BASIC, Business BASIC, MP/BASIC, AOS/COBOL, Interactive COBOL, FORTRAN IV, FORTRAN 77, FORTRAN V, MP/Pascal, PL/1, RPG II, DG/L (resembles ALGOL) • Microsoft's GW-BASIC.

Models • Model 10, Model 10/SP, Model 20, and Model 30.

CPU • Data General 16-bit microECLIPSE—all models; 16-bit Intel 8086—Model 10, Model 10/SP.

Memory • Model 10—128K to 768K bytes; Model 10/SP—256K to 768K bytes; Model 20—256K to 2M bytes; Model 30—512K to 1.5M bytes.

Chassis Slots • 5 card slots—all models; 3 slots open—Models 10, 10/SP, 20; 2 slots open—Model 30.



Ports • RS-232C printer port with Models 10 and 10/SP.

Mass Storage • 368K bytes to 736K bytes of formatted diskette storage—all models • 15M-byte to 30M-byte hard disk storage—all models • 15M-byte cartridge tape—all models.

Terminals/Workstations • up to 4—all models.

Printers • 150- to 160-cps dot-matrix printers; 35-cps letter-quality printers.

First Delivery • October 1983.

Systems Delivered • information not available.

Comparable Systems • Models 10 and 10/SP are comparable with 16-bit integrated desktop systems supported MS-DOS or CP/M-86; also comparable with Honeywell microSystem 6/10, DEC Professional 300, and IBM XT/370 for vendor-specific mini and mainframe software compatibility • Models 20 and 30 are comparable with Honeywell microSystem 6/20 and Burroughs B 20.

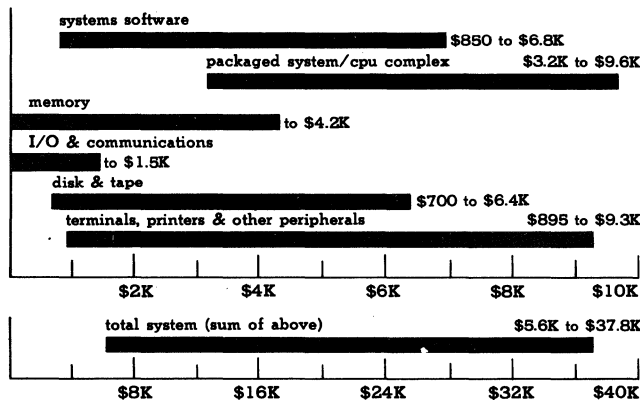
Vendor • Data General Corporation; 4400 Corporate Drive, Westboro, MA 01581 • 617-366-8911.

Canada • Data General Corporation; 180 Duncan Mills Road, Suite 606, Don Mills, ON M3B 3K3 • 416-445-8026.

Distribution • Model 10, Model 10/SP through computer retailers, office machine dealers, service bureaus, OEMs, and direct sales force • Model 20, Model 30 through OEMs, system houses, value-added resellers, and direct sales force.

PURCHASE PRICE RANGE

hardware & software



DATA GENERAL DESKTOP GENERATION PURCHASE PRICING bar graphs illustrate price ranges for small to large systems, with solid bars reflecting software/hardware purchase pricing • **SMALL SYSTEM** is based on Model 10 packaged system (includes dual CPUs, 128K-byte memory, CRT and keyboard, serial printer port, single 368K-byte diskette drive, power supply) and the following options: AOS/WS (Pregen), MS-DOS operating system, INFOS DBMS software, additional 368K-byte diskette drive, 40- to 160-cps multifunction dot-matrix printer • **LARGE SYSTEM** is based on Model 30 packaged system (includes single CPU, 512K-byte memory, hardware floating-point accelerator card, 15M-byte Winchester, 368K-byte diskette drive, 2 power supplies) and the following options: AOS/WS (Sysgen) and RDOS (Sysgen) operating systems, Xodiac network, X.25 protocol, 2780/3780 emulation, file transfer utility, asynchronous terminal emulation, Extended BASIC, Business BASIC, Interactive COBOL, INFOS DBMS, word processing, speller, and spreadsheet software; additional 1M-byte memory; 5-slot expansion module for I/O; USAM-4 communications interface; additional 15M-byte Winchester disk drive; cartridge tape subsystem; 3 Dasher 211, 1 Dasher 460 terminals; 40- to 160-cps multifunction dot-matrix printer, 35-cps letter-quality printer.

■ ANALYSIS

Data General designed and marketed its first computer—the Nova minicomputer system—in 1968. Since then, the company has grown to become a Fortune 500 company with more than 125,000 computer systems installed worldwide. Until recently, DG computers included the 16-bit Nova, ECLIPSE, and microNova families plus the 32-bit ECLIPSE MV/family. Then, in July 1983, Data General unveiled its Desktop Generation, a series of professional microcomputers. Even though DGs entry into the already crowded micro marketplace was late, the company still found a niche because it was only the third major manufacturer to offer a micro system that is compatible with its other major product lines. The first was DEC with its Professional 300 and the latest, IBM with its XT/370.

The Desktop Generation Series can be used as a



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TABLE 1: DESKTOP GENERATION MODEL DIFFERENCES

| | MODEL 10 | MODEL 10/SP | MODEL 20 | MODEL 30 |
|-----------------------------------|----------------------------------|--|------------------------|--|
| CPU | microECLIPSE Intel 8086 | microECLIPSE Intel 8086 | microECLIPSE | microECLIPSE |
| Floating-Point Instruction Set | none | firmware | firmware | hardware with commercial instruction set |
| Minimum Memory | 128K bytes | 256K bytes | 256K bytes | 512K bytes |
| Maximum Memory | 768K bytes | 768K bytes | 2M bytes | 1.5M bytes |
| System console | monochrome monitor & keyboard | monochrome monitor & keyboard | any Dasher terminal | any Dasher terminal |
| Open expansion slots | 3 | 3 | 3 | 2 |
| Printer ports | 1 | 1 | 0 | 0 |
| Operating Systems | RDOS, MS-DOS, CP/M-86 | RDOS, MS-DOS, CP/M-86, AOS, MP/AOS-SU | RDOS, AOS, MD/AOS-SU | RDOS, AOS, MP/AOS-SU |

standalone professional workstation for individual use and also as an extension of DG's distributed data processing, factory automation, and CEO office automation systems. The Series consists of 4 models, all of which can support up to 4 users concurrently. All models are reported to have full system compatibility with DG's 16-bit and 32-bit minis and run under scaled-down version of the MP/AOS, RDOS, and AOS minicomputer operating systems. The 2 low-end models also support MS-DOS and CP/M-86.

The Model 10 and Model 10/SP, entry-level systems, are marketed through a network of computer retailers, office machine dealers, and service bureaus. They are dual processor systems that feature the Intel 8086 CPU as well as a DG microECLIPSE processor. One of the unique system features of these 2 models is the ability of the CPUs to run in a concurrent mode, a task that is accomplished via high-speed logic. The logic design, for which DG is awaiting a patent, couples the processors together through a shared high-speed memory. In a multiuser environment, a user can employ the Intel 8086 while up to 3 others utilize the microECLIPSE. As standalone units, the Model 10 and Model 10/SP are comparable to most other 16-bit Intel 8086/8088 integrated desktop units. Where they have the edge against their competitors is in their ability to run proven mini software in addition to the industry-standard micro software. Also, they are multiuser systems, while most of their desktop competitors are not.

As far as compatibility across the product line, the DG low-end models are similar in capability to the Honeywell microsystem 6/10, the DEC Professional, and the IBM XT/370. All units, except the DEC Professional, are dual processor systems incorporating an industry-standard, 16-bit Intel CPU and a proprietary CPU that has an instruction set similar to their larger family members. All are software compatible with their family members and all have networking capabilities.

The Desktop Generation's other systems, the Model 20 and Model 30, are focused on more specialized business

solutions and are marketed through DG OEMs, system integrators, and DG's direct sales force. These 2 models are more closely related to the Honeywell microSystem 6/20. All support the same number of users, employ a single CPU (their own proprietary processor), and are software compatible up the product line.

The DG models are less expensive than both their Honeywell and IBM counterparts, but are outranked by them in the area of communications, most specifically regarding SNA facilities which are presently not available on the DG systems.

Data General plans to keep a tight control on the prices of its low-end systems by shipping to dealers on a consignment basis. The company is emphasizing its support programs (16 different options) and the systems' flexibility in running both micro and minicomputer software that is already proven and user-available.

Strengths

If any one word could describe the Desktop Generation it would have to be flexibility. These systems offer a multiuser capability, generous memory expandability, and on some models, dual processor capabilities, all at prices comparable to, or, in most cases, lower than the competition. Flexibility is also prominent in DG's range of support options.

A user has a variety of software from which to choose with 2 micro industry-standard and 3 DG operating systems available. The graphics capabilities are some of the most extensive for a micro, consisting of graphics displays and output devices as well as a large amount of graphics development software.

Limitations

DG's statement that the Desktop Generation is compatible with the IBM PC needs clarification. In many cases, users could not take software running on the IBM PC and load it into the DG micros without going through a conversion



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process. Also, the Desktop Generation does not use IBM PC peripheral cards nor the same user interface. However, these facts are not system limitations unless a user is looking at the DG systems as being IBM PC compatible.

■ SOFTWARE

□ Terms & Support

Terms • available for a one-time fee.

Support • includes 2 options for application programs and 4 for technically oriented people doing some or all of their own programming • application program options provide an On-Line Information Service for 24-hour access, via modem, to frequently updated listings of current software revisions and fixes, and product tips and techniques; and an Application Helpline for "how-to" questions • options for technical people include a Software Subscription Service which provides updated software on diskettes, updated software manuals, and a monthly newsletter, for an annual subscription fee; a Full Service contract, which offers telephone assistance by software engineers, and includes Software Subscription Service and On-Line Information Service, at a fixed, yearly price; Full Service Plus contract includes everything in Full Service plus on-site assistance when needed; and a Time and Materials option, which provides on-site assistance on a pay-as-you-go basis.

□ Software Overview

The Desktop Generation runs under scaled-down versions of Data General's RDOS, AOS, and MP/AOS minicomputer operating systems. Additionally, the Model 10 and Model 10/SP support Microsoft's MS-DOS and Digital Research's CP/M-86. Because the Desktop Generation uses the same instruction set and the same DG operating systems as the larger DG systems, software running on the mini systems should also run on the Desktop Generation. Of course, this is subject to memory limitations on the micros.

Data General offers a variety of languages, communication, and graphic software for the Desktop Generation. Several third-party products are supported as well. Some of these are Digital Research's C, DR LOGO, and Pascal II; Microsoft's Multiplan and GW BASIC; MicroPro's WordStar family; Information Unlimited's Easywriter and accounting series; Condor's DBMS; SSI's Word Perfect; and Peachtree's accounting packages.

□ Packaged Software

30522 AOS/WS Present & Trendview • used for business graphics • Present is a query facility described under Data Management; Trendview is a graphics package listed under Development Aids:

\$500 lcms

30517 CEO Environment (Sysgen) • includes AOS/WS (Sysgen), X.25, CEO Word Processing, CEO Information Management, Netop Subset (async Xodiac), and RMA:

1,150

30516 CEO Environment (Pregen) • same as 30517 except with AOS/WS (Pregen):

1,400

□ Operating Systems

30505 AOS/WS (Sysgen) • version of the standard AOS multiprogramming, multiuser operating system minus those files not applicable to Desktop Generation processors • supports up to 2M bytes of main memory with simultaneous control of timesharing, multiple batch, online, and communications operations concurrently • data access methods include direct, sequential, indexed-sequential, and chained (via DG/DBMS and INFOS) • processes (collection of programs tasks) can be up to 64K bytes (up to 32 2K-byte pages) and are handled through stack-oriented procedures; pages can be sharable or unsharable; shared areas are protected by access privileges (read, write, execute); a process can be permanently resident (real-time applications), pre-emptible (event driven), or swappable (timesharing and batch); CPU time is allocated based on priority

and eligibility; a LRU (least recently used) algorithm is used to ensure optimum use of shared pages and reduce disk I/O • diagnostics can be run concurrently exercising central processor, memory, options, and peripheral devices • CLI (Command Line Interpreter) is basic communication between system and users, supporting file creation, maintenance, spooling, and invoking execution of programs; a HELP capability supports CLI command information • additional utilities supported include software development aids, interactive debugger for program development assistance, log-on system, accounting facility, system administration facilities, and data management and backup aids • includes all files necessary to generate 30506 AOS/WS (Pregen) systems: INFOS, MP/BASIC, and Sort/Merge subsets plus CLI macros contained in AOS/WS Pregen • supports a single-user environment only on the Model 10/SP and a multiuser environment on the Models 20 and 30; requires 512K bytes of memory, diskette drive, 15M bytes of hard disk storage:

\$1,000 lcms

30506 AOS/WS (Pregen) • same characteristics as 30505 AOS/WS (Sysgen) except provides full runtime support without system generation or a development capability • includes INFOS, Sort/Merge, and MP/BASIC plus CLI macros; does not include SED or files necessary to perform a SYSGEN:

750

30568 RDOS (Sysgen) • capable of executing 2 programs at once in a foreground/background environment; supports real-time process control, program development, and most standard applications; manages 64K to 512K bytes of memory • supports 256-level priority interrupt structure for real-time events; multitasking permits multiple execution paths to perform functions asynchronously; tasks are scheduled based on processor, memory, and peripheral use through a tasking queue • data access methods include sequential, random, and contiguous file organizations; supports INFOS database-oriented file management system • tasks are swapped in and out of memory from disk; programs are chained if larger than available memory; chaining is division of programs into small, serially executing segments (overlays); overlays are disk resident in memory image format; overlays from multiple applications can execute simultaneously; maximum of 128 overlays per program • CLI (Command Line Interpreter) is basic user/system interface; utilities include Relocatable Loader, Extended Assembler, Symbolic Debugger, Task Monitor, Overlay Loader, and single and multiterminal text, Library File, Octal, and disk editors • runs on all systems; requires 2-line communication card for multiuser environment:

750

30566 RDOS (Pregen) • same characteristics as 30568 RDOS (Sysgen) except provides full runtime support without system generation or development capabilities • does not include files necessary to perform a SYSGEN:

250

30500 MP/AOS-SU • single-user, real-time technical operating system; derivative of MP/OS • features task-switching, priority-driven scheduling, interprocess communication, and memory management • main interface with system is through Command Line Interpreter (CLI) • supports various utilities including system management facilities, program development aids, file management facilities, text editor, file tracking, process monitoring and reporting, and file transfer • compatible with AOS; programs generated under AOS using cross-development utilities will run under MP/AOS-SU • requires firmware floating-point instruction set, 15M-byte Winchester disk:

350

30538 CP/M-86 • a 16-bit enhanced version of the 8-bit CP/M operating system designed to support the Intel 8086 or 8088 microprocessors; incorporates all the basic elements of the CP/M system but adapts these functions to the larger and faster operating environment • consists of 4 elemental structures: Basic Input/Output System (BIOS), Basic Disk Operating System

LCNS: license fee—right to use. NA: information not available.



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(BDOS), Command Console Processor (CCP), and a Transient Program Area (TPA) • BIOS is the modifiable portion of the operating system enabling users to tailor CP/M systems to meet specific configurations; allows users to define all hardware-independent elements of the system by defining low-level interface and the peripheral I/O for the system • BDOS provides all the disk management control; supports up to 16 logical drives containing up to 8M bytes each, for a maximum of 128M bytes of online storage; any one file can reach the full drive size • CCP provides the interface between the user's console and the rest of the CP/M system; it reads, interprets, and executes commands entered from the console; commands are both built-in commands and transient commands; transient commands are loaded into the TPA and executed • TPA is the area designated to hold programs that are loaded from disk and then executed • standard utilities provided include; DDT-86 interactive debugger; PIP file transfer utility; SUBMIT batch control utility; ED command-oriented text editor; ASM-86 assembler; STAT system status utility; and GENCMD that processes Intel "H86" format files • memory requirements depend on number and types of options implemented • supports up to 1M bytes of memory; requires 56K bytes of memory and an ASCII terminal • runs standalone or in conjunction with RDOS or AOS/WS:

100

MS-DOS 1.25 • single-user, interactive and batch processing disk operating system developed by Microsoft; has its equivalent in IBM PC-DOS 1.2 • supports maximum diskette storage of 160K bytes in up to 64 different files in double-sided format; handles records from 1 to 65,546 bytes long in file transfers; executes external (disk based) commands, giving the user ability to expand the DOS vocabulary to the limits of disk space • includes batch processing capabilities with automatic execution on power up; user commands include DATA, TIME, DISKCOPY, FORMAT, RENAME, ERASE, COMP (compare), CHKDSK (check disk) • innovations include a double File Allocation Table (disk map) with third-memory resident copy for efficient disk access, a disk mapping technique which conceptualizes conventional tracks and sectors as a single dimensioned array of logical sectors, and allocation units which subdivide data section into 1, 2, 4, 8, 16, 32, 64, or 128 logical sector groups, eliminating disk external fragmentation typical of conventional track-sector mapping • MS-DOS is divided into four parts: a device independent I/O handler, an I/O command processor, reference and jump vectors in low memory, and a command processor; the device independent I/O handler on hidden file MSDOS.SYS is the core of MS-DOS through which I/O must be directed; the I/O processor physically moves data and instructions by means of hidden file IO.SYS as commanded by MSDOS.SYS; the command processor, using the COMMAND.COM program is responsible for interface between user and MS-DOS, error trapping, batch file processing, interpreting user commands, and executing file names • runs standalone or in conjunction with RDOS or AOS/WS:

100

□ Utilities

Sort/Merge • consists of independent sort, merge, and copy programs • can be executed by entering a single line execute command from a terminal, from a command file that can reside on disk, or through calls in COBOL programs; supports any record format, AOS fixed length, variable length, data sensitive text files • any number of keys can be specified in ascending or descending order for each key; selective copy facilities extract certain record types, sample data, or copy portions of files • runs under RDOS or AOS/WS:

NA lens

□ Transaction Management

30623 AOS/WS TPMS (Transaction Processing Management System) • functionally equivalent to AOS TPMS which runs on the Eclipse systems • provides support for design, development, testing, execution, and maintenance of transaction processing applications • TPMS includes 4 integrated runtime modules, including TCP (Transaction Control Program), CCP (Console Control Program), SSP (Shared Page Process), and LM (Local Monitor); these modules provide for execution

management of transaction application programs and the interface to INFOS II file management software • provides a set of software utilities for creating and editing screen formats; for linking screen formats and application packages; for printing screen formats; for setting security limits • supports a library file utility as well as AOS COBOL and PL/1 languages, INFOS II file management, and COBOL and PL/1 debugging tools; provides automatic restart and recovery capabilities; multiple user interactive development, and multiple local or remote (Xodiac supported) runtime applications • for AOS-based Model 30 only:

\$750 lens

□ Data Management

30622 AOS/WS DBMS • functionally equivalent to AOS DBMS which runs on the Eclipse systems • based on 1978 Codasyl recommendations; supports network and hierarchical data structures; database has 1 schema and multiple subschemas; schema is the complete description of all data items (fields), record types, and set types included in the database; subschema logical views may differ from the actual schema description for omitting or renaming record sets or data items; Data Description Language (DDL) is used to describe schemas and subschemas; top down organizational maximums are 16 databases in use concurrently • Data Definition Facility (DDF) is an interactive, screen-oriented utility that helps create and maintain the database design description; Data Manipulation Language (DML) are the commands within the application program to read or write database records; COBOL Compiler has been extended to directly interpret DML commands • interfaces to COBOL and FORTRAN host programming languages as well as XODIAC networking software for access to remote databases • DG/DBMS IQ (interactive query utility) is a nonprocedural, end-user, read-only query program; retrieval commands permit data selection by multiple criteria; users can then accumulate, display, or print the information gathered • DBMON (Database Monitor) and DBCON (Database Controller) monitor and control the status of all open databases within the DG/DBMS as well as all processes that use the databases; applications programs interface reading and writing through DBCON; DBCON maintains the internal database structure; 1 DBCON process for each open database • DG/DBMS saves a copy of database information prior to updating, on a before image file; should a problem occur, this file is used to backup all incomplete transactions and restore the database; provides automatic rollbacks when concurrent update conflicts are encountered; an afterimage can also be maintained for restoring databases in case of software or hardware failure; REBUILD is then used to merge afterimages onto a backup copy of the database • requires Model 30 with 768K bytes of memory, 20M bytes of disk, and any magnetic tape:

\$1,100 lens

AOS/WS INFOS II • database-oriented file management system based on 2 data access methods • ISAM (index-sequential access method) permits keyed, sequential, and relative position processing; database and keys are maintained in separate files; duplicate key option allows access to multiple database records from 1 key; generic and approximate key access allows record retrieval without full key; device independence allows files to span multiple physical disks; variable length keys and records optimize space • DBAM is an extension of ISAM allowing greater database accessing and manipulation; database inversion allows multiple index files for the same database records; multilevel indices provide the ability to define hierarchical data structures and complete data cross-reference as well as allowing restriction of records to particular users • requires C series with 512K bytes of memory, terminal, 10M bytes of hard disk, real-time clock, interval timer, and mag tape • bundled with AOS/WS (Pregen).

30520 AOS/WS PRESENT • interactive, nonprocedural, read-only query facility supporting access to DG/DBMS databases using English keywords and phrases • supports hard-copy report generation including page headings, page numbering, and report formatting • includes a HELP facility • uses 2 data manipulation methods: arithmetic computation and special display formatting using COBOL-like picture clauses • presents pie charts, bar charts, and line plots when used in conjunction with the Trendview graphics package • not supported on the Model 10:

400



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AOS/WS DATAPREP • interactive, multiterminal, key-to-disk data entry facility • supports all standard data entry functions such as record entry, verification, deletion, and movement • features provided include function key-oriented operator commands, global supervisor control of jobs in progress, menu-driven supervisor interface, automatic restart/recovery, and automatic operator activity log • screen formats for data entry can be created or modified in an interactive environment:

NA

□ Communications/Networks

Desktop Generation systems can connect with other Desktop Generation Computers, with a DG host, with a DG host through another Desktop Generation computer, with an IBM host or IBM-compatible host, and with public information databases.

Xodiac Network Management • based on CCITT Recommendation X.25 packet-switching protocol; provides the ability for multiple systems to exchange data and share resources, connecting directly via communications lines and intercomputer links or indirectly via public data networks • composed of an AOS X.25 module for basic interface; common XODIAC VTA/RMA/FTA module for Virtual Terminal, Resource Management, and File Transfer support; and 2 separately priced AOS RIA (Remote INFOS II Agent) and RDA (Remote Database Agent) software packages for database file accessing • does not run on Model 10.

30524 AOS/WS Zodiac Pregon • includes X.25 protocol and VTA (Virtual Terminal Agent) facility • requires AOS/WS Pregon and USAM-1 or -4 communications card:

\$1,000 lcms

30525 AOS/WS Zodiac • prerequisite: X.25 protocol and VTA/RMA/FTA facilities • functional layer of network which performs user-oriented remote resource access functions • VTA (Virtual Terminal Agent) allows a terminal on a local system to appear as if connected to a remote process; terminal user executes using VTA which establishes the connection with the remote system; remote process can be a user application, CLI (Command Line Interpreter) command, or any utility program • RMA (Resource Management Agent) allows users to access remote files, devices, or processes; runs as a single process on each host on behalf of all local and remote users • FTA (File Transfer Agent) allows a user to transfer files across a XODIAC network using the operating system's user name/password name, and file access controls across the entire network:

1,250

30523 AOS/WS X.25 • provides CCITT X.25 protocol capabilities for AOS • supports multiple switched or permanent virtual circuits between an AOS process and an X.25-based process; connections can be via private, leased, or switched communication facilities with X.21 bis/RS-232C interface, Multiprocessor Communication Adapter (MCA), or public packet-switched network; user-specified window limits help eliminate transmitter flooding and buffer overloading; tracing packets globally or selectively isolates virtual circuit related problems • character-oriented and bit-oriented HDLC protocols are both supported • does not run on Model 10; requires AOS system with 256K bytes of memory:

300

30526 AOS/WS Remote INFOS II Agent (RIA) • functional level process which allows users to access remote INFOS II files using the same commands and language interfaces that support local files • runs as a single process on each host; INFOS II must be running on system where INFOS II files are residing • requires Zodiac or X.25, AOS/WS INFOS II, and USAM-1 or -4 communication card:

250

30527 AOS/WS Remote DBMS Agent (RDS) • functional level process that allows users to access remote DG/DBMS databases using the same DG/DBML DML commands which are used in programs in a non-networking environment on local databases • runs as a single process on each host; DG/DBMS must be running on the system where the DG/DBMS databases reside • requires Zodiac or X.25, AOS/WS DBMS, and USAM-1 or -4 communication card:

250

RJE80 • Remote Job Entry control program • emulates IBM 2780 or 3780 terminals and communicates with an IBM 360/370 or another Data General computer • supports point-to-point and multipoint communications to and from IBM 360/370 or another Data General computer; supports space compression, horizontal format control, vertical format control, and cyclic redundancy check polynomial with automatic retransmission; line speed is a function of the line multiplexer or control unit on the system.

30528 AOS/WS RJE80 • does not run on Model 10; requires AOS/WS, 256K bytes of memory, 10M-byte hard disk, real-time clock, programmable interval timer, diskette drive, and USAM-1 or -4 communication card:

700

30573 RDOS RJE80 • requires RDOS, 32K bytes of memory, 10M-byte hard disk, real-time clock, and USAM-1 or -4 communication card:

700

30585 MP/RJE80 • does not run on Model 10; requires MP/AOS-SU, 10M-byte hard disk, and USAM-1 or -4 communication card:

400

30529-84 HASP • workstation emulator • supports communications from DG system to IBM 360/370 or other Data General computers by emulating an IBM HASP workstation (IBM 360/20) • supports HASP, ASP, JES command format; multileaves up to 7 input and 7 output data streams using IBM bisync line protocol; supports full data compression, full use of DG I/O devices, vertical forms control simulation for printer operation, and CRC polynomial; spooler feature provides temporary storing on disk until printer is available; line speed is a function of multiplexer or control unit on the system • requires system with 256K-byte memory, terminal, 10M-byte hard disk, real-time clock, interval timer, mag tape, or diskette drive, and USAM-1 or USAM-4 • runs under AOS/WS or RDOS:

400

30583 MP/3270 • emulates IBM 3271 Cluster Controller and 3277 Display using IBM bisynchronous protocol • up to 4800 bps • dedicated multidrop • standard communications hardware and RS-232C interface • requires MP/AOS-SU:

600

30556/57 DG/BLAST • asynchronous file transfer utility • requires AOS/WS or DG/RDOS; uses 1 line of either USAM-1 or USAM-4 communication card:

200

30560/61 DG/GATE • General Asynchronous Terminal Emulator • menu-driven with an online HELP facility • operates in 2 modes: emulating a terminal in a DG ECLIPSE host environment or emulating a terminal in a non-DG host environment • runs under AOS/WS or RDOS:

200

□ Program Development/Languages

Extended BASIC • extensions include string variables and literals, string concatenation, string subsetting, and matrix manipulation • supports floating-point arithmetic with or without optional hardware; assembly language subroutines can be called from basic program, supports use of CLI (Command Line Interpreter) • runtime options include output formatting, program chaining, timed user response, and error handling.

30594 AOS/WS Extended BASIC • requires AOS system with floating-point instruction set:

\$300 lcms

30569 RDOS Extended BASIC • requires RDOS system:

200

Business BASIC • interpreter designed for commercial data processing • allows multiple users to create, test, debug, or execute programs concurrently; packaged with a library of subroutines and utilities • includes text editor with command repertoire; terminal function keys, justification, and output formatting; special arithmetic, data management, and screen



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formatting facilities oriented for business • requires floating-point instruction set.

30545 AOS/WS Business BASIC: 750

30544 RDOS Business BASIC: 750

30577/78 MP/BASIC • extension of ANSI X3.60-1978 BASIC interpreter • features real data type, string manipulation, integer data type, string dimensioning and concatenation, substrings, letter-digit array names, extensive built-in string and mathematical functions, fixed- and variable-length file manipulations, program swapping and chaining, and exception handling • compatible subset of VS/BASIC which runs on DGs ECLIPSE MV/Systems • runs under AOS/WS and MP/AOS-SU with floating-point instruction set: 200

GW-BASIC • implementation of Microsoft BASIC-86 • provides dual-mode graphics capabilities (medium and high resolution) and drawing statements for creating lines and circles or painting the screen • screen editor implements special function keys and multistatement lines • allows calling of machine language subroutines, merging of multiple programs, and transferring of control to specific program lines during certain events • IF THEN/ELSE constructs are supported as well as trace/no trace for easier debugging • runs under MS-DOS on Model 10 and 10/SP • developed by Microsoft: NA

30508 AOS COBOL • implements ANSI 74 COBOL specifications • significant extensions include support of variable length binary, packed decimal, and floating-point data formats, extensive sort/merge facilities, and capability to use assembly language routines, and an interactive debugging program which allows users to set traps or breakpoints, modify data items, and then resume program execution; allows multilevel indexing and the capability to dynamically define and create indices and subindices through additional verbs; allows free format terminal input of source programs • runs on Model 30 under AOS/WS with 256K bytes of memory, 10M-byte hard disk; real-time clock, interval timer, mag tape or diskette: 750

30542/43 Interactive COBOL • includes utilities for writing source code and documentation; designing, coding, and documenting display screen formats, and compiling and debugging programs • features a sort/merge facility, extra data types, structured program support, and the ability to call assembly language routines within a COBOL program • runs under RDOS and AOS/WS: 750

FORTRAN IV • implements ANSI FORTRAN standard (X3.9-1966) with several user-oriented language extensions, including multitasking and reentrant code (allowing operation in a real-time environment), assembly language instruction interfacing within statements, handling of random record and direct block I/O, and bit string manipulation (testing/setting/shifting) for support of industrial applications.

30592 AOS/WS FORTRAN IV • requires AOS/WS system, floating-point instruction set: 500

30570/71 RDOS FORTRAN IV HFP/SFP • supports hardware/software floating point • requires RDOS system: 350

30580/81 MP FORTRAN IV HFP/SFT • supports hardware/software floating point • requires MP/AOS-SU system: 300

30591 AOS/WS FORTRAN 77 • globally/locally optimizing compiler • meets ANSI X3.9-1978 standards with ISA S61.1 standard extensions • requires AOS system with floating-point instruction set: 700

30593/72 FORTRAN V • implements ANSI FORTRAN standard (X3.9-1966) with user-oriented language extensions, including multitasking and sharable code (allowing operation in a real-time environment), full mixed mode arithmetic, simplified I/O, generic library functions, generalized array subscripting, segmentation into disk-resident overlays, interfacing with assembly language routines, random record and direct block I/O, and bit string manipulation • runs under AOS/WS or RDOS; requires floating-point instruction set: 500

30581 MP/Pascal • extended structured programming language • extensions to Pascal include separate compilation modules; assembly language interface, dedicated application programmability, dynamic string data types, multitasking, and AOS compatibility for cross-development: 300

30582 SP/Pascal • superset of MP/Pascal for system development • additional features include exception handling and routine signaling support; floating-point instructions for single- and double-precision real arithmetic operations; structured constants for use as constants or literals; and scalar expressions in most constant contexts: 700

30590 AOS/WS PL/1 • fully implements ANSI PL/1 standard (X3.53-1976) with user-oriented extensions which include % REPLACE statement for symbolic parameter definition, size function for determining data item storage requirement, DO CASE statement for inline coding of alternate processing paths • supports INFOS, single- and multikey ISAM as well as database access; supports 3 optimization levels at compilation time; allows dynamic allocation of storage for variables, structures, and arrays; adjustable array extents and string lengths; assembly routine interfacing is supported utilizing the CALL statement; assembly language programs can call PL/1 routines; runtime errors can be intercepted using ON conditions; in the absence of program-specified error handling, the runtime system provides English-language description of the error • requires AOS/WS system with floating-point instruction set: 750

30510 AOS/WS RPG II • standard RPG compatible with IBM System/3 and DOS RPG II • supports INFOS database-oriented file management system; reads and writes sequential, random, indexed sequential, and database access methods; interactive symbolic debugger allows programmers to set breakpoints at compiled program line numbers so that variables and indicators can be examined and/or modified; during debugging, programmers can reference both original source and a tutorial (HELP) file describing the debugger operation; uses dynamic paging scheme to accommodate large programs at execution time • screen generator unit (SGU) allows users to design screen formats interactively for RPG II and TPMS • requires Model 30 with AOS/WS, 256K-byte memory, 10M-byte hard disk, real-time clock, interval timer, mag tape: 750

DG/L • structured language for system development; resembles ALGOL • provides for nested expressions and statements; blocks recursively • runs under AOS/WS systems: NA

30507 AOS/WS GLDP (General Language Development Package) • contains editors, object code linkers, program patcher, debugging tools including SWAT, and the full INFOS DBMS product • runs under AOS/WS (Pregen and Sysgen): 400

30567 RDOS Development Kit: 250

BusiGEN • Business BASIC program generator • designs, codes, and documents programs for data entry, file maintenance, data inquiry, and report writing; creates pie, line, or bar charts • runs under AOS/WS or RDOS • will be available during the second quarter 1984: NA



Data General Desktop Generation

Model 10, Model 10/SP, Model 20 & Model 30

30624 PROXI • COBOL program generator • creates code for file manipulation, inquiry handling, transaction entry, screen handling, and report generation • runs on Model 30 under AOS/WS:

450

30511/89 Text Control System (TCS) • tracks changes made to text files at various stages of development; recreates previous revisions and generates final, executable program files • runs under AOS/WS or MP/AOS-SU but not on Model 10:

750

SWAT • interactive source-level debugging of PL/1, COBOL, and FORTRAN 77 programs • sets/clears break points; recognizes most recent procedure • displays/alters variables • displays and has calculator mode for expressions • generic file name control • lists procedure source code • has HELP facility for user aid • does not run on Model 10; requires AOS/WS:

NA

MASM/MAC • macroassemblers for AOS (MASM) and RDOS (MAC) • supports macro nesting and locally defined symbols:

NA

Cross-Development Utilities • from AOS/VS to AOS/WS and from MP/AOS-SU to AOS/WS • does not run on Model 10:

NA

30228 GKS (Graphics Kernel Software) • interactive graphics program that utilizes device-independent application code, allowing application packages to be used on a wide variety of peripheral devices • supports drawing primitives such as line, arc and sector, and display lists; supports all of Data General's graphics displays:

300

GSS-Kernel • graphics subroutine library; level 0 adaptation of the Graphics Kernel System standard for 2-dimensional graphics • incorporates graphics into existing applications without a major software conversion; provides customized graphics to specific hardware requirements • runs under AOS/WS:

NA

GSX-86 • extension of GKS for CP/M-86:

NA

CLRE • common language runtime environment graphics subroutines • runs under RDOS and AOS for FORTRAN 5 and DG/L and under AOS for FORTRAN 77, PL/1, and COBOL:

NA

30521 Trendview • for creating pie, bar, line, or more complex graphs • handles automatic smooth curve fitting and linear regression trend line plotting • supports 3 modes of operation which include: interactive, where chart descriptions are entered at the keyboard (includes an online HELP feature which explains chart description commands); stored file retrieval, where the same or different files can contain descriptions and data; and through application program control where communication with Trendview is through an Inter-Process Communications (IPC) port • chart features include pie chart segments which can be offset or omitted for emphasis; 3 different bar chart formats (stacked, side by side, hidden) can be drawn either vertically or horizontally; and graphs that can be plotted with or without lines interconnecting data points; lines can be straight or a smooth curve • includes tilting and labeling facilities with titles in normal, bold, or italic format • runs under AOS/WS:

200

□ Applications Packages

Comprehensive Electronic Office (CEO) • integrated system contains individual packages on word processing, spelling, electronic mail, information management (electronic filing cabinet), and text files in various languages • runs only under AOS/WS; requires minimum of 512K bytes.

30512 CEO Word Processing • menu-driven • text move/copy/delete • FIND/REPLACE facility • placemarking and annotation of documents • output can be viewed in printout format • index

creation and printing • mailing list merges • hyphenation support • user HELP facility:

\$480 lcms

30513 CEO Information Management • supports electronic filing, electronic mail, administrative support • menu-driven • document search by keywords, sender, date, subject, or other parameters • private and public filing • "wastebasket" allows retrieval for a set period • private mail in-box for each user • return-to-sender of undeliverable mail • general, certified, confidential, and urgent mail categories • users can have up to 3 "aliases" • calendar management • mailing list and telephone directory storage • user HELP facility:

800

30518 CEO Spelling • module can be combined with AOS CEO Word Processing • 75,000 words • entries can be added:

100

30530-34 CEO Text File • available in English, Spanish, Italian, French, and German:

100

30564-65 CompuCalc • electronic spreadsheet; runs under RDOS or AOS/WS:

250

□ Other Facilities

30575 RDOS SAM (Sensor Access Manager) • a library of device handlers and subroutines that control I/O between user programs and analog and digital sensor devices • includes calls specified by ISA Standard S61.1 with expanded features that include the capability to suspend single or multiple tasks waiting for single or multiple events, and for mixing analog and digital I/O in the same request; dual processor configurations allow automatic backup in critical process applications • interfaces with FORTRAN IV or V • runs on RDOS-based systems:

\$450 lcms

30595 User Diagnostics • menu-driven programs for identifying failing modules:

50

■ HARDWARE

□ Terms, Support & Documentation

Terms • 90-day warranty; start-up telephone service for first 90 days.

Support • includes 5 on-site options, 2 mail-in options, and 2 self-maintenance options • on-site maintenance provides On-Call contracts for 4-hour response, 24-hour response, pre-scheduled service, and per-call fixed rate for 8-hour response or firm price in advance • mail-in maintenance provides for Time-and-Materials repairs or firm quotes in advance of repairs; parts of the whole computer are shipped to a DG Product Repair Center and repaired in less than 10 days • self-maintenance options include an extended warranty which provides overnight shipment of replacement parts for a flat, annual fee, and modular mail, which provides parts shipments on a pay-as-you-go basis within 72 hours; DG also provides telephone support and diagnostic diskettes for isolating failing system elements; on power-up each system executes an automatic self-test for verifying the first 64K bytes of memory, testing the virtual console memory, testing the byte parity checking function, and testing the I/O system.

Documentation • 2 levels available: easy-to-read description of system and its components; and a more technically oriented set of manuals.

□ Physical Specifications (H x W x D); Weight

CPU • 9 x 4.5 x 12 inches; 39.5 pounds.

Display • 13.1 x 12.8 x 12.8 inches; 16.1 pounds (for Dasher D210).

Keyboard • 2.4 x 20 x 7.5 inches; 5.8 pounds (for Dasher D210 Terminal).



Data General Desktop Generation

Model 10, Model 10/SP, Model 20 & Model 30

□ Systems Overview & Configurability

The Desktop Generation is comprised of 4 models, all of which can be used in a single-user environment or in a multiuser environment supporting up to 4 users concurrently. Each system configuration consists of a computer unit, a system console, and optional plug-in components such as terminals, printers, and sensor devices. The computer unit is modular in design and encompasses at least a CPU card module, diskette module, and power supply module. The modules attach to one another with DIN connectors which carry signals between the modules; other optional modules can be easily connected.

Models 10 and 10/SP are entry-level systems of the Desktop Generation. They utilize two processors, a 16-bit microECLIPSE, and a 16-bit Intel 8086, which operate in a concurrent mode via high-speed logic. Packaged into the CPU card module along with the 2 processor boards are a memory management and protection system (MAPS), a diskette controller, CRT controller, keyboard interface, either 128K bytes or 256K bytes of RAM with parity, and a 9600-bps asynchronous serial printer port. Model 10/SP also contains a floating-point instruction set in firmware.

Another standard feature of Models 10 and 10/SP configurations is the system console unit which consists of a 12-inch monochrome monitor and a detached keyboard. Other configurations are available which offer a color monitor and graphics, and memory to 786K bytes. While these 2 systems can support up to 4 users concurrently, only 1 can be running under the Intel 8086.

Models 20 and 30 are single processor systems. They contain just the 16-bit microECLIPSE CPU, either 256K or 512K bytes of memory with parity, the memory management and protection system, and an asynchronous console interface packaged in the CPU card module. The Model 20 provides a floating-point instruction set in firmware while the Model 30 includes a commercial instruction set and floating-point hardware card. The system console unit with these 2 models is priced separately for all configurations and can be any Data General Dasher terminal.

Users have a choice of disk storage capacity for all models. Available are single- and dual-diskette drives and a 15M-byte Winchester drive. Magnetic cartridge tape is available for system backup.

Since the Desktop Generation is I/O bus compatible with the microNova and ECLIPSE S/20, it should run all their peripherals. Dasher terminals can be employed as user-terminals with all models in a multiuser environment. A 5-slot card expansion module is also available as are communication multiplexer boards for adding additional serial ports.

Maximum configurability is stated below; minimum configurations are discussed under Packaged Systems.

Model 10 & Model 10/SP System Maximums • dual CPUs, 768K-byte RAM, monochrome monitor and keyboard plus 3 Dasher terminals, 30M-byte hard disk storage with additional power supply, 368K-byte diskette drive, 15.4M-byte cartridge tape subsystem, parallel printer port, 5-slot expansion unit with 1 slot utilizing USAM-4 board for the terminals, 4 slots open.

Model 20 System Maximums • single CPU, 2M-byte RAM, 4 Dasher terminals, 30M-byte hard disk storage with additional power supply; 368K-byte diskette drive, 15.4M-byte cartridge tape subsystem, 5-slot expansion unit with 1 slot utilizing the USAM-4 board for the terminals, 1 slot occupied with the tape cartridge, 3 slots open.

Model 30 System Maximums • same as Model 20 except only 1.5M-byte RAM.

□ Packaged Systems

Configured Systems

Data General offers various configurations of its Desktop Generation.

Model 10 & Model 10/SP Basic System • includes microECLIPSE processor, Intel 8086 microprocessor, memory, monochrome monitor and keyboard, serial printer port, disk storage, and power supply.

E91001 • Model 10 with 128K-byte memory, single 368K-byte diskette drive:

 \$3,165 prch \$43/\$33/\$24 maint

E91001C • Model 10 with same features as E91001 except uses color graphics controller card and 13-inch color graphics monitor and keyboard:

 5,315 67/54/38

E91002 • Model 10 with 256K-byte memory, dual 368K-byte diskette drive:

 4,065 56/41/31

E91002C • Model 10 with same features as E91002 except uses color graphics controller card and color graphics monitor and keyboard:

 6,215 80/62/45

E91003 • Model 10 with 256K-byte memory, single 368K-byte diskette drive, 15M-byte Winchester disk, additional power supply:

 6,560 79/59/47

E91003C • Model 10 with same features as E91003 except uses color graphics controller card and color graphics monitor and keyboard:

 8,710 103/80/61

E91006 • Model 10/SP with floating-point instruction set, 256K-byte memory, dual 368K-byte diskette drive, 15M-byte Winchester drive, additional power supply:

 4,465 56/41/31

E91006C • Model 10/SP with same features as E91006 except uses color graphics controller card and color graphics monitor and keyboard:

 6,615 NA/NA/NA

E91007 • Model 10/SP with floating-point instruction set, 256K-byte memory, single 368K-byte diskette drive, 15M-byte Winchester drive, additional power supply:

 6,960 79/59/47

E91007C • Model 10/SP with same features as E91007 except uses color graphics controller card and color graphics monitor and keyboard:

 9,110 103/80/61

Model 20 & Model 30 Basic System • microECLIPSE processor, memory, single 368K-byte diskette drive, 15M-byte Winchester drive, 2 power supplies.

E91020 • Model 20 with 256K-byte memory, firmware floating-point instruction set:

 6,570 79/59/47

E91021 • Model 20 with 512K-byte memory, firmware floating-point instruction set:

 7,620 89/66/50

E91030 • Model 30 with 512K-byte memory, hardware floating-point accelerator card:

 9,620 101/77/57

Base Modules

Base modules elements are available for users who wish to configure their own systems.

Base Model 10 & Model 10/SP • CPU logic module with 5 slots, microECLIPSE processor and Intel 8086 processor cards, memory, and cables to connect to power module • requires power supply.

E8711-K • Base Model 10 with 128K-byte memory:

 \$1,240 prch \$17/\$14/\$11 maint

PRCH: purchase price. MAINT: monthly maintenance charge for on-site 4-hour response/on-site 24-hour response/extended warranty; single maint price denotes on-call service charge.



Data General Desktop Generation

Model 10, Model 10/SP, Model 20 & Model 30

E8711-N • Base Model 10 with 256K-byte memory:
1,640 23/17/15

E8712-N • Base Model 10/SP with 256K-byte memory and firmware floating-point instruction set:
2,040 23/17/15

Base Model 20 & Model 30 • CPU logic module with 5 I/O slots, microECLIPSE processor, memory, and cables to connect to power module • requires power supply.

E8717-N • Base Model 20 with 256K-byte memory and firmware floating-point instruction set:
2,500 34/24/20

E8717-R • Base Model 20 with 512K-byte memory and firmware floating-point instruction set:
3,550 44/31/23

E8719-R • Base Model 30 with 512K-byte memory and hardware floating-point accelerator card:
5,550 58/42/32

□ CPU

The central processor of the Desktop Generation is the microECLIPSE which is used in Data General's S/20 systems. Additionally, the Models 10 and 10/SP also employ an Intel 8086 microprocessor. The 2 processors operate in a concurrent mode via high-speed logic with the microECLIPSE handling all I/O.

For scientific operations, a floating-point instruction set is included in firmware for Models 10/SP and 20. Model 30 employs a separate hardware floating-point accelerator card and 16-bit ECLIPSE commercial instruction set as standard features. The CPU card for all systems contains the interface for the system console plus a real-time clock, a programmable interval timer, and memory allocation and protection (MAP) unit for allotting and securing the programming address space for each user.

microECLIPSE Processor • implements 16-bit ECLIPSE character instruction set and floating-point instruction set • I/O bus compatible with microNova and ECLIPSE S/20 • standard CPU on all models; occupies 1 card slot.

Intel 8086 Processor • 16-bit data bus interface, 16-bit internal architecture, direct addressing to 1M bytes of memory, 16-bit register set with symmetrical operations, approximately 70 basic instructions with up to 30 addressing modes, 8-bit and 16-bit signed and unsigned arithmetic with binary and decimal operands, extensive string and block move facilities • powerful segmentation facilities allow memory partitioning for multitasking, concurrent, or multiuser capabilities • a pseudo-superset of the Intel 8080 instruction set where translation of 8086 is straight-forward • instruction set compatible with 8088 • for Models 10 and 10/SP only • occupies one I/O slot • included in system price.

Floating-Point Instruction Set • supports single- and double-precision floating-point number manipulation • located in firmware on the CPU card of Models 10/SP and 20.

Hardware Floating-Point Accelerator Card • for implementing the 16-bit ECLIPSE commercial instruction set; accelerates floating-point computations • standard on Model 30; occupies 1 card slot.

E8694-A Power Supply Module • includes single power supply • for base module non-configured systems:
\$375 prch \$5/\$4/\$3 maint

E8694-B Power Supply Module • includes dual power supplies • for base module non-configured systems:
625 10/8/6

8695 Expansion Power Supply • for adding a second power supply to a system containing a single power supply:
250 5/4/3

8862 Real-Time Clock • to provide system real-time clock synchronized to AC line frequency:
50 1/1/1

□ Memory

All memory boards have a read/write/refresh cycle time of 500 nanoseconds, a maximum memory bandwidth of 4M bytes per second, and parity checking. Each board has an independent controller for generating its timing and refresh operations.

Model 10 Memory • minimum of 128K or 256K bytes depending on configuration, expandable to 768K bytes.

Model 10/SP Memory • minimum of 256K bytes expandable to 768K bytes.

8713-N Model 10 & 10/SP • 256K-byte add-on memory • occupies 1 card slot:
\$1,050 prch \$14/\$12/\$8 maint

8713-R Model 10 & 10/SP • 512K-byte add-on memory • occupies 1 card slot:
1,850 18/15/10

Model 20 Memory • minimum of 256K or 512K bytes depending on configuration, expandable to 2M bytes.

Model 30 Memory • minimum of 512K bytes expandable to 1.5M bytes.

8736-NT Model 20 & 30 256K-Byte Add-On Memory • occupies 1 card slot:
1,200 29/23/15

8736-RT Model 20 & 30 512K-Byte Add-On Memory • occupies 1 card slot:
2,100 56/45/29

□ I/O & Communications

All Desktop Generation models contain 5 card slots; 2 are reserved for specific cards—the CPU card and a memory card; the remaining 3 slots are available for options. The exception is Model 30, which uses 1 of the free slots for its floating-point hardware card. All systems are expandable with a 5-card expansion module. Sensor I/O cards are also available from Data General for interfacing with data acquisition and control equipment.

Printer Port • RS-232C printer port • included with Models 10 and 10/SP only.

E8697 Logic Expansion Module • provides 5 slots for I/O cards • requires 8694-B or 8695 power supply:
\$400 prch NA/NA/NA maint

1325 Power Cord • different power cords available depending on the country:
20 NA/NA/NA

4516 IEEE-488 Interface • for bidirectional asynchronous transmission between digital instruments and peripherals:
1,150 9/NA/NA

4222 Digital I/O Card • interfaces directly with data acquisition and control instruments:
480 9/NA/NA

4223 Analog to Digital Card • converts analog input signals to digital signals; + or -10V:
1,390 15/NA/NA

4224 Digital to Analog Card • converts digital signals to analog signals • controls external analog devices using 2 analog output channels; + or -10V:
970 13/NA/NA

USAM Communications Interface • universal synchronous/asynchronous multiplexer card with switch-selectable RS-232C, RS-422, and 20-mA current-loop electrical interfaces.

4463-W USAM • single-line card providing a synchronous or asynchronous line:
300 4/3/2

4463-Z USAM • 4-line card providing 2 lines of synchronous or asynchronous communication and 2 lines of asynchronous only:
1,050 5/4/2



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4463-ZT USAM-4 • same as 4463-Z except also provides full model control; supports AT&T 103, 202, 212, or equivalent; also supports AT&T 2121A modem but for a fixed data rate only:

1,080 8/4/2

4463-WT USAM-1 • same as 4463-W except also provides full modem control; supports AT&T 103, 202, 212, or equivalent; also supports AT&T 212A modem but for a fixed data rate only:

300 4/3/2

Mass Storage

Desktop Generation systems can accommodate a maximum of 2 diskette drives and 2 Winchester disk drives. The diskette drives can be programmed to read/write and format in either DG standard formats or IBM PC formats. On Models 10 and 10/SP, the diskette controller is located on the CPU card, leaving an open slot in the diskette module for an optional I/O card. Models 20 and 30, however, incorporate the diskette controller in the diskette module. For disk backup, Data General offers a 0.25-inch cartridge tape subsystem.

Disk Storage

Diskette Module • 5.25-inch double-density diskette drive; 368.6K bytes (DG format); 250K-bps transfer rate; 9 sectors per track; 40 tracks per recording head • configured systems include the price of either a single- or dual-drive system; prices listed are for use with base module units.

E6267-A Models 10 & 10/SP Diskette Module • single-drive system:

\$700 prch \$7/\$5/\$3 maint

E6267-B Models 10 & 10/SP Diskette Module • dual-drive system:

1,200 14/10/6

E6268-A Models 20 & 30 Diskette Module • single-drive system; includes controller in diskette module:

700 10/8/5

E6268-B Models 20 & 30 Diskette Module • dual-drive system; includes controller in diskette module:

1,200 15/13/8

E6269 Add-On Diskette Drive • to expand a single diskette module into a dual-diskette module:

500 7/5/3

E6271 Winchester Disk Drive Module • 5.25-inch 15M-byte drive with controller and cables:

2,745 28/19/16

E6271-A Add-On Winchester Drive • for adding a second drive to a system • includes power supply module with one power supply; requires 1325 power cord:

2,995 28/22/19

Tape Storage

E6270 Cartridge Tape Subsystem • quarter-inch tape stores up to 15.4M bytes; operates at 6400 bpi • media and format compatible with Data General 6230 and 6231 cartridge tapes • includes power supply, controllers, and all required cabling:

\$3,395 prch \$40/\$40/\$26 maint

Terminals/Workstations

Model 10 and 10/SP systems contain a detached keyboard and either a monochrome monitor or a color monitor. In a multiuser context, up to 4 DG Dasher terminals can be attached to the systems, each to one asynchronous line of a communication multiplexer. Models 20 and 30 also support the DG Dasher terminals, but use them as the system console as well as add-on terminals. Terminals connect to these 2 models through an integral asynchronous port or a communication multiplexer.

E6261 Monochrome Monitor • 12-inch graphics monitor; green phosphor; raster scan (similar to a television monitor) • tilt bases; no-glare screen; brightness control; underscore, blink, dim, and reverse video attributes • 24 lines x 80 columns; graphics

resolution is 640x240 pixels; 5x8 character size; 8x10 character cell; bit-mapped • for Models 10 and 10/SP only; included with configured systems; price is for attachment to base module unit:

\$600 prch \$11/\$8/\$6 maint

E6262 Color Monitor • 13-inch screen; contains same features as monochrome monitor • requires graphics controller card • for Models 10 and 10/SP only; included with certain configured systems; price is for attachment to base module unit:

1,750 25/24/16

E6265 Graphics Controller Card • provides 16 levels of color at a time for a palette of 4096 colors • required for color monitor on Models 10 and 10/SP:

1,000 6/5/4

E6245-T Keyboard • low-profile detached keyboard • contains 107 sculptured keys including alphanumerics; 12-key cluster for cursor control and special editing functions; 14-key numeric keypad; 20 function keys across top row; n-key rollover • 6-foot coiled cord plugs into display monitor • included with Models 10 and 10/SP configured systems; price is for attachment to base module unit:

250 3/2/1

Dasher Terminals • 12-inch green phosphor no-glare screen; blink, dim, underscore, reverse video • multilingual capabilities available; tilt base • detached standard typewriter-style keyboards.

6168 Dasher D210 • 24 lines x 80 columns; 7x9 character size; 10x12 character cell; 810x288 pixels; character-mapped • supports both DG D200 and ANSI 3.64 character/command codes; 7-bit/96-character capability • RS-232C interface • packaged with 25-foot interface cable and detached keyboard:

1,060 13/NA/NA

6169 Dasher D211 • same features as D210 plus provides for RS-422 and 20-mA current-loop interfaces; serial printer port; both 7-bit/96-character and 8-bit/192-character capability:

1,260 15/NA/NA

6166 Dasher D410 • 24 lines x 80 or 135 columns; 7x11 character size; 10x12 character cell; up to 24 independent windows; 810x288 pixels; character mapped graphics • vertical/horizontal scrolling • 256-character capability; extended ROM-resident set of characters including all eleven languages, line drawing set, math notation, word processing symbols, subset of Greek alphabet • supports DG 7-bit and ANSI 3.41/3.64 standard • selectable RS-232C, 20-mA current-loop, RS-422 interfaces; includes printer interface • packaged with 25-foot interface cable and keyboard:

1,700 17/NA/NA

6167 Dasher D460 • similar to D410 plus provides memory to store up to 3572 downline loadable, user-defined symbols to create special character sets, symbols, graphs, and diagrams:

1,850 19/NA/NA

Printers/Graphics

4434 Multifunction Dot-Matrix Printer • speeds of 160 cps in data mode, 40 cps in semi-correspondence mode, 80 cps in graphics mode; 136-233 columns; 10, 12, 16.7, or 20 cpi • uses sheet, continuous roll, or fanfold paper in widths from 4 to 9 inches • RS-232C interface; data rate is 150 to 9600 bps:

\$895 prch \$36/\$30/\$19 maint

4433 Remote Dot-Matrix Printer • speed of 150 cps; 80-160 columns; 5, 8.5, 10, 17.1 cpi • 4 print fonts; 8 language fonts • uses continuous roll, fanfold paper, or 6-part forms in widths from 1.5 to 15 inches • RS-232C or 20-mA current-loop interface; data rate is 110 to 19,200 bps:

2,500 45/NA/NA

4518 Letter-Quality Printer • speed of 35 cps; 136-203 columns; 10, 12, or 15 cpi • uses sheet, continuous roll, or fanfold paper in widths of 16 inches • RS-232C interface; data rate is 300 to 1200 bps:

2,800 39/NA/NA



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4522 Bidirectional Forms Tractor • for continuous forms paper on 4518 LQP:

300 2/NA/NA

4523 Single-Sheet Feeder • for automatic feeding of single sheets on 4518 LQP:

1,400 10/NA/NA

4526 Cut-Sheet Guide • for sheet feeding by hand on 4518 LQP:

165 5/NA/NA

4435 Desktop Color Plotter • 2-pen color plotting • IEEE 488 or RS-232C interface • baud rate of 9600 bps:

1,515 23/19/12

Data Tablet Digitizer • 12-inch x 12-inch graphics tablet • provides a maximum of 6096x6096 pixels; user can select

resolution of up to 500 lines per inch and/or up to 20 lines per millimeter; tablet can automatically scale output to match any monitor's resolution • interfaces to RS-232C port; fully supported by GKS software packages.

4437-AA Tablet with Stylus:

1,995 23/19/10

4437-AB Tablet with Puck:

1,945 23/19/10

4436-A Mouse • 3-button mouse for digitizing graphics data and directing the cursor on the screen • connects to RS-232C port:

350 6/5/3

• END



Digital Equipment Professional 300 Series

Professional 325 & Professional 350

PROFILE

Operating Systems • Professional Operating System (P/OS), a multitasking proprietary system; PRO/V7M, a UNIX system; and PRO/RT-11, a single-user, real-time operating system from Digital Equipment • UCSD p-System Version IV.1 from Softech Microsystems • CP/M-80 on a softcard.

Data Management • NPL Information System; RS/1 data management system; PRO/Datatrieve data management system.

Communication/Networks • PRO/Communications terminal emulator and file transfer system; PRISM 3276 BSC emulator; PRO 2780/3780 emulator • Digital Network Architecture (DNA) with DECnet software scheduled to be available by year end 1984.

Languages • PRO/BASIC, UCSD Pascal, UCSD FORTRAN, R/M COBOL.

Models • Professional 325, Professional 350.

CPU • 16-bit F11 (PDP-11/23) microprocessor.

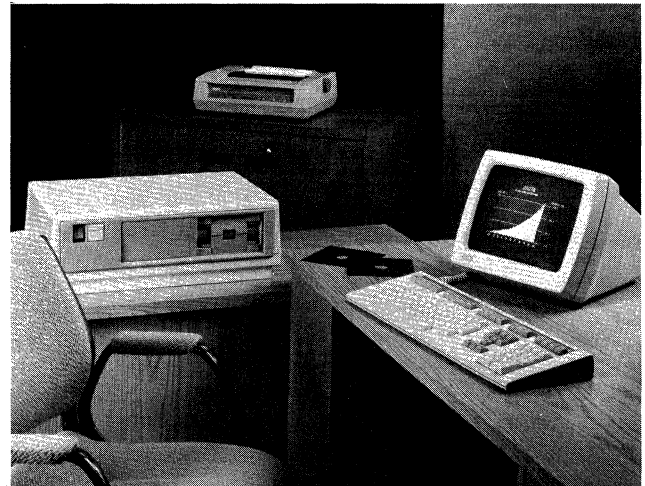
Memory • 512K bytes of RAM expandable to 768K bytes on the 325 and 1M bytes on the 350.

Chassis slots • 1 expansion slot on the 325; 3 expansion slots on the 350.

Ports • RS-232C/423 communication port, 1 RS-232C/423 printer port on each model.

Mass Storage • 1.6M bytes of diskette storage on the 325; 800K bytes of diskette storage and 10M bytes of hard disk storage on the 350.

Terminals/Workstations • single-user systems.



Printers • dot-matrix and letter-quality printers available from Digital.

First Delivery • January 1983.

Systems Delivered • approximately 50,000.

Comparable Systems • Data General Desktop Generation, Honeywell microSystem 6/10, 6/20, IBM XT/370.

Vendor • Digital Equipment Corporation; 146 Main Street, Maynard, MA 01754 • 617-897-5111.

Canada • Digital Equipment of Canada Ltd; P.O. Box 13000, 100 Herzberg Road, Kanata, ON K2K 2A6 • 613-592-5111.

Distribution • direct sales through Digital; also available through retailers.

ANALYSIS

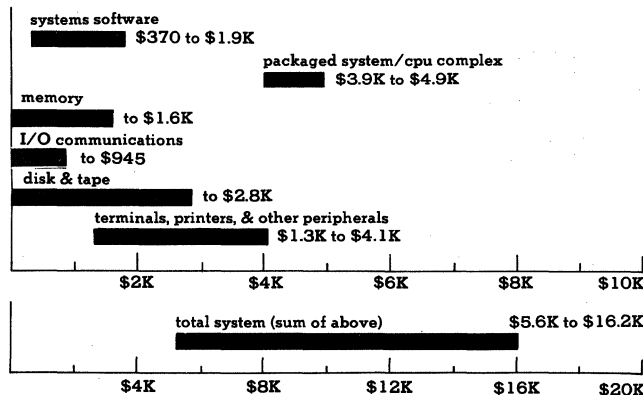
Digital Equipment Corporation is the number-one supplier of minicomputer systems worldwide. It is the manufacturer of the first mass-produced minicomputer—the PDP-8—as well as the manufacturer of the PDP-11 and VAX machines. Its Professional Series, which is built around a PDP-11 microprocessor, was introduced in 1982 along with 2 other personal computers, the Rainbow 100 and the DECmate II.

Outwardly the Professional resembles its 2 sister products, since all 3 utilize the same monitor, keyboard, and disk drives. However, that is where the resemblance ends. The Professional is a more powerful machine that is compatible with Digital systems running RSX-11M, RSX-11M PLUS, and VAX/VMX software.

Digital's initial marketing efforts of its Professional line were not very successful. Product delivery was later than promised to dealers, software availability was extremely limited, and system performance was criticized. Also,

PURCHASE PRICE RANGE

hardware & software



PROFESSIONAL 300 PURCHASE PRICING • bar graphs illustrate price ranges for small to large systems, with solid bars reflecting software/hardware purchase pricing • **SMALL SYSTEM** is based on **PROFESSIONAL 325 packaged system** (includes CAU, 512K-byte RAM, dual 400K-byte diskette drive, 2 serial ports, floating point processor, 1 expansion slot) and the following options: P/OS 1.7 operating system, PRO/BASIC software; monitor, keyboard, and dot matrix printer. • **LARGE SYSTEM** is based on **PROFESSIONAL 350 packaged system** (includes CPU, 512K-byte RAM, dual 400K-byte diskette drive, 2 serial ports, floating-point processor) and the following options: P/OS 1.7 operating system, PRO/BASIC, PRD/Communications, PRISM, SuperComp-Twenty spreadsheet, Prose Plus word processor software; additional 512K-byte memory; autocal modem; 10M-byte hard disk; color monitor with extended graphics module, keyboard, letter-quality/dot matrix printer.



Digital Equipment Professional 300 Series Professional 325 & Professional 350

Digital initially introduced the Professional as a high-end personal computer and did not emphasize its role as a workstation to its PDP-11 base.

The Professional has undergone a major overhaul since its introduction and now boasts a larger software base, enhanced standard features, and greater storage capacity. Software additions include an enhanced P/OS operating system, plus the availability of UNIX System 7, RT-11 and CP/M-80 operating systems, the Professional Tool Kit, and various applications packages. The system's base configuration now includes 512K bytes of memory and floating point hardware while the disk storage capacity has been increased to 10M bytes.

In order to position the system in more environments, Digital is offering a real-time interface module which enables the Professional to serve as a frontend controller in a laboratory environment. No-charge licensing of the Professional's Computing Terminal Interconnect (CTI) bus to third-party hardware vendors was also announced. This will pave the way for third-party developers to design options for the systems.

In addition to the system enhancements and the open architecture policy, Digital is also making other moves to bolster sales. They have initiated a new service and warranty package called the "Investment Protection Plan", which provides retail buyers with a 1-year, on-site service warranty and corporate buyers with a 90-day, on-site service warranty, extendable to one year for a fee. Additionally, Digital salespeople have been assigned to focus exclusively on marketing the personal computer.

Strengths

The Professional will serve as the ideal PC in a DEC-based user shop since software files from both the PDP-11 and VAX machines can be downloaded to the system. The system's support of UNIX and CP/M-80 also adds strength to its software repertoire.

Digital's new policy of an open architecture environment ensures that more expansion features will appear in the marketplace from third-party vendors. Also, the company's new protection plan is one of the best in the micro industry. Digital's commitment to the Professional is obvious considering all the major enhancements made to the product line. This should give users a feeling of security that the system will not be abandoned despite its initial slow start.

Limitations

The Professional 325 is, in itself, a limitation since its level of expandability is practically nil. And at \$4,000 a system, that's something to consider. Users would be better off purchasing the Professional 350 from the start. Not that the 350 is without shortcomings—it could use additional expansion slots to take advantage of some of the more interesting options. For example, if a user wished to utilize the full 1M bytes of memory, the extended graphics option, and the Telephone Management System, he/she would be a slot short. And what about future growth? The system's inability to run MS-DOS applications is also a limiting factor.

SOFTWARE

Terms & Support

Terms • available for a one-time license fee • 1-year warranty covers software in addition to hardware.

Support • Applications Advisory Support Services available for a fee after initial warranty.

Software Overview

The Professional Series employs a proprietary operating system that was developed from Digital's RSX-11M-PLUS minicomputer operating system. Called the Professional Operating System (P/OS), it provides multitasking capabilities, file, disk, and print services, a memo editor, and a Computer Based Instruction (CBI) course. Because of its compatibility with the PDP-11 minicomputer line, the Professional will support the existing PDP-11 software base. The latest release is Version 1.7.

Other operating systems include PRO/V7M, a UNIX system offered by Digital under license from AT&T; the RT-11 V5.1 single-user, real-time operating system which is a modification of the RT-11 operating system running on the PDP-11 minicomputers; and the UCSD p-System.

To run 8-bit, industry-standard micro software, Digital is offering a CP/M softcard. This includes the operating system, a Z80 microprocessor, and 64K bytes of RAM on one card.

With the optional PRO/Communication package, users can transfer files between a Professional system and a VAX/VMS, RSX-11M, or RSX-11M PLUS host as well as emulate VT52, VT102, and VT125 terminals. Digital also provides 3270 and 2780/3780 emulation packages and a Tool Kit for applications development.

Packaged Software

QBA25/26-A3 Applications Starter Kit • for novice Professional users; an integrated, day-to-day, personal package of easy-to-learn applications • consists of the PRO/spreadsheet, PRO/Graph, PRO/DataManager, PROSE word processor, and DEClender—a game designed to help user's get acquainted with the system • available in hard disk and diskette version:

\$399 *lcns*

QA111-C3 UCSD p-System & Pascal • operating system and language processor for hard disk-based systems only:

975

Operating Systems

The Professional Operating System is available in 2 versions—a diskette version and a hard disk version. Both versions include file, disk, and print services. Only the hard disk version includes the PROSE text editor and accommodates the Developer's ToolKit. The operating system is included with the diskette/disk drives.

PRO/V7M includes all standard features of UNIX version 7 and is highly compatible with Digital's V7M operating system for the PDP-11. Communications between PRO/V7M on the Professional and V7M-11 on PDP-11s include the ability to transfer text and program files. Programs are also easily adaptable between these systems.

RT-11 is a popular operating system on the PDP-11. The new version for the Professional includes a communications option which is helpful to users who require I/O intensive applications.

With the CP/M card installed, users can run Rainbow and DECmate II CP/M-80 applications without modification as long as they do not access hardware devices directly. Users can also transfer ASCII files between P/OS and CP/M software environments as well as format an area of the hard disk to function as a CP/M diskette for storing and accessing CP/M files.

P/OS Version 1.7 • multitasking system • provides menus for selecting services and applications; a Help service; file services for manipulating, organizing, and providing up-to-date file

LCNS: one-time license fee. Prices effective as of December 1983.



Digital Equipment Professional 300 Series

Professional 325 & Professional 350

information; disk and diskette services for copying, naming, and erasing diskettes; PROSE editor; print service; and a message/status board • includes a runtime environment for applications development • PROSE memo editor has baseline word processing capabilities; provides for document editing with cut and paste capabilities; search and replace; and word, line, paragraph, and page advance and backup • Version 1.7 takes advantage of the increased memory and floating-point processing capabilities of the systems; places parts of menu-handling in main memory, making menu selections for certain applications faster; provides an optional, native P/OS development tool kit that handles local development capabilities in PDP-11-compatible languages; accesses TMS, IVIS, IBM 3276 BSC and IBM 2780/3780 BSC, and diskette-copying services.

QBA23-A3 PRO/V7M • includes all standard features of UNIX Version 7 such as kernel routines; a tree-structured directory system; C compiler; the Shell (Bourne) command language; pipes, background, and more than 100 utility programs • compatible with Digital's V7M for the PDP-11 • additional features include complete error language and user diagnostics; VI full screen editor from the University of California at Berkeley (UCB 2.8 UNIX System) for program development and document preparation; user overlay kernel scheme for large programs; and communications with other PRO/V7M and V7M-11 systems including the ability to transfer text and program files:

_____ **\$695 lcms**

QBA39-H3 PRO/RT-11 Version 5.1 • single user, real-time system operating in native mode • contains the full set of functions found in previous versions plus the following: Virtual Terminal Communications Package (VTCOM) which enables the Professional to emulate a local terminal and to transfer ASCII files between the host and the RT-11 system; also allows binary files to be transferred with the optional TRANSF utility; Transparent Spooling Package (SPOOL) for simultaneous output to RT-11 serial devices concurrent with other system actions; SET-UP for setting video characteristics and manipulating them during program execution:

_____ **700**

QA112-C3 UCSD p-System Version 4.12 • provides a portable environment for developing and executing applications software; programs can be written in UCSD Pascal and FORTRAN-77 • consists of 3 modules: operating system, the p-machine emulator, and the basic I/O system • the operating system contains 5 components: interactive operating system; screen-oriented printer; file handler; library of program modules; and dynamic runtime binding facility • Version IV.1 supports event-driven multitasking; 2-level filing and utilities; and improved error handling • hard disk-based system:

_____ **600**

QA579-C3 UCSD p-System • for diskette-based systems:

_____ **600**

CP/M (2.2) • single-user, single tasking, general-purpose operating system designed to support the Intel and Zilog families of 8-bit processors; features and facilities of this basic system are all upward compatible and are present in all other versions of CP/M; consists of 4 elemental structures: Basic I/O System (BIOS), Basic Disk Operating System (BDOS), Console Command Processor (CCP), and a Transient Program Area (TPA) • BIOS is the modified portion of the operating system enabling users to tailor CPM systems to meet specific configurations; allows users to define all hardware-independent elements of the system by defining low-level interface and the peripheral I/O for the system • BDOS provides all the disk management control; supports up to 16 logical devices, containing up to 65,536 records, with up to an 8M-byte capacity • CCP provides the interface between the user's console and the rest of the CP/M system; it reads, interprets, and executes commands entered from the console; commands are both built-in commands and transient commands; transient commands are loaded into TPA and executed • TPA is the area designated to hold programs that are loaded from disk and then executed • standard utilities provided include: DDT interactive debugger; PIP file transfer utility; DUMP utility; SUBMIT/XSUB batch control utilities; ED command-oriented text

editor; ASM assembler; and STAT system status utility • memory requirements depend on number and types of options implemented; basic system requires 20K bytes of memory and an ASCII terminal • included with CP/M Option Module.

Utilities

Standard utilities are incorporated in the operating systems.

Data Management

QBA43-A3 PRO/Datatrieve • full implementation of the Datatrieve-11 interactive data management system available on the VAX and PDP-11 • used to create customized database applications, perform queries, and generate reports for the database using the Datatrieve command language • requires a hard disk:

_____ **\$495 lcms**

QBA20-A3 PRO/Datatrieve Layered Application Facility (LAF) • designed for DEMs and users who want to build specialized applications that can be installed and invoked directly from a menu by the application name:

_____ **495**

QA117-C3 NPL Information System • data management system for nonprogrammers • provides an ad-hoc query facility; a report writer; a database manager; a data entry system; and a direct access data editor • compatible with such information management systems as FOCUS, RAMIS, and NOMAD • formats the screen layout and automatically checks the validity of data as it is entered; interfaces with other program data; stores multiple NPL requests in a file and reformats or rebuilds a program; offers a choice of being menu- or command-driven • requires a hard disk:

_____ **800**

QA497-C3 RS/1 Data Management System Version 11.7

• designed for use by scientists, engineers, and technicians • inserts data into tables; produces 2- and 3-dimensional graphs and bar charts; performs mathematical and statistical calculations, curve fitting and modeling • uses simple English commands without the need to program • statistical routines include analysis of variance, linear or non-linear regression, multivariate analysis, nonparametric statistics, and contingency table analysis • Research Programming Language (RPL) allows the user to construct new analysis procedures, prepare formatted output, and automate programs, resources, and data files such as ASCII of binary data produced by other packages • requires a hard disk:

_____ **1,900**

Communications/Networks

QBA05-A3 PRO/Communications Version 1.5 • enables a Professional system to emulate a terminal to a host system and to transfer files between 2 Professionals or a Professional and a host • emulates VT52/VT102 video terminal or VT125 graphics terminal • files can be transferred between a Professional and a VAX/VMS, RSX-11M, or RSX-11M-PLUS host by invoking a file transfer task on the host • also maintains a directory of names, phone numbers, and line characteristics:

_____ **\$195 lcms**

QA176-C3 PRISM (Professional Inter-System Management)

• for communicating directly with an IBM system • offers 2 main facilities: Virtual Terminal Emulator (VTE) and Inter-task Communication Facility • VTE allows emulation of an IBM 3276/3278 Model 2 terminal using the 3270 subset of BSC; also provides 3287 printer emulation • Inter-task Communications Facility is used with the Professional Developer's Toolkit for writing programs that share data with an IBM system across 3270 links • features local and remote data communications at up to 9600 bps; menus which set up connections to and from the IBM host; full on-screen Help; and computer-based instruction course, TUTOR, for learning how to set up and use PRISM • several Professionals may share a single hard-wired communications line to the IBM system through the multidrop or multipoint capability of the 3270 • requires hard disk:

_____ **595**



Digital Equipment Professional 300 Series Professional 325 & Professional 350

QBA47-A3 PRO-2780/3780 Emulator • emulates an IBM 2780/3780 workstation; sends and receives information between the Professional and remote systems as batch mode of file transfer; can also run as a background job • requires hard disk:

595

Programming/Development Languages

Languages presently available from Digital include PRO/BASIC, UCSD Pascal and FORTRAN, and R/M COBOL. To design customized applications, the PRO/Tool kit is available.

The Tool Kit's development environment requires 2 computer systems—a host computer and a personal computer. The host can be a Digital RSX-11M, RSX-11M-PLUS, or a VAX/VMS system. The programmer's computer must be a Professional 350 with a hard disk. The host system uses its own PRO-Host Tool Kit software which is available separately.

QBA04-A3 PRO/BASIC • provides online Help; performs immediate syntax checking; identifies errors; and provides immediate feedback • includes instructions to move the cursor to any pixel position; draws lines and curves; uses alternate character fonts; controls character size, angle, and spacing; and controls the color map • contains a single-line editor that uses the arrow keys of the editing pad and the insert and delete keys • supports virtual arrays, dynamic dimensioning of arrays, advanced error handling, extended mathematical capabilities, string functions and variable names of up to 31 characters • debugging tools include Trace mode, Step mode, and Show, which allows, the program size, the number of lines, and the amount of free memory:

\$195 lenc

QA113-C3 UCSD Pascal • hybrid compiler supports subset implementation of International Standards Organization (ISO) Working Draft #6 for Pascal language; generates pseudo-code which is interpreted at runtime • features include: overlays; optional separate compilation of functions and procedures; EXTERNAL routines; 36-digit integer operands; 32-bit floating-point operands; access to graphics/sound facilities through systems through system library routines; checking for syntax, type, and range errors; compiler directives:

375

QA114-C3 UCSD FORTRAN-77 Compiler • hybrid compiler supports implementation of ANSI-1977 FORTRAN; generates pseudo-code which is interpreted at runtime • features include extensions for development and commercial programming:

250

QA466-C3 RM/COBOL • a high-level implementation of the ANSI-74 COBOL, (X3.23-1974) standard • features include Level 2 sequential, relative, and indexed file access methods; full arithmetic capability; standard DISPLAY and COMPUTATIONAL data type support, extended to include binary as well as packed decimals; extended ACCEPT DISPLAY operations for CRT control; interactive debug at the source statement level; undermarked errors with self-explanatory messages; cross-reference listing; single-pass compilation; segmentation at the source language level; and built-in security features for source language library control • developed by Ryan/McFarland:

950

QBA14-A3 Pro/Tool Kit • includes an interactive forms-based utility for creating menus, online help, and message frames; RMS record and file management service to enable keyed access data files to be defined, populated, updated, and maintained; uses the Indexed Sequential Access Method (ISAM); FMS forms-oriented video I/O management system for designing forms directly and interactively on the screen; and a Sort utility • CORE graphics Library is callable from the Tool Kit's development languages and enables developers to build detailed control of the picture-generating process into their software • all phases of development can be performed at the Professional 350 using it alternately in local mode and in terminal emulation mode to communicate with the host system • utilizes a MACRO Assembler:

295

QBA15-A3 PRO/Tool Kit FORTRAN-77 • requires standard Tool Kit:

495

QBA16-A3 PRO/Tool Kit DIBOL • requires standard Tool Kit:

495

QBA17-A3 PRO/Tool Kit BASIC-PLUS-2 • requires standard Tool Kit:

495

QBA18-A3 PRO/Tool Kit Pascal • requires standard Tool Kit:

495

QBA19-A3 PRO/Tool Kit COBOL-81 • requires standard Tool Kit:

495

QBA21-A3 PRO/Tool Kit FORTRAN-77 Debug • requires standard and FORTRAN-77 Tool Kits:

200

Application Packages

PRO/Spreadsheet • provides all the basic capabilities found in most spreadsheets • helps perform numerical calculations and financial analysis, including balancing budgets, completing expense reports or generating expense reports • included with the Applications Starter Kit.

PRO/Graph • for creating bar, line, or pie charts • data is entered through the system's keyboard or compiled through PRO/Spreadsheet or PRO/DataManager • included with Applications Starter Kit.

PRO/DataManager • for storing, finding, and sorting information such as telephone directories, and mailing and inventory lists, and creating detailed reports from these lists • included with Applications Starter Kit.

PROSE • word processor for creating, revising, editing, and printing memos, reports, and BASIC programs • included with Applications Starter Kit.

QBA11-A3 Prose Plus • superset of PROSE • provides 4-way cursor movement; global search and replace; word wrapping; text manipulation and layout features such as cut and paste, inserting text from another document, moving selected text, and recovery and deletion; formatting features including right, left, and centering justification; and specialized function keys for previous screen, next screen, nonbreaking hyphen, cancel, resume, and next or previous page:

\$295 lenc

QA476-C3 Supercomp-Twenty • electronic spreadsheet • provides for columns up to 126 characters in length; creates text labels up to 200 characters in length as long as the adjacent cells are blank • specifies relative or absolute references directly in a formula; noncontiguous cells can be chosen and copied into another area or a whole new worksheet • automates series of often-used procedures and stores them in a file; built-in logic includes IF-THEN-ELSE, SELECT, and LOOK UP functions; provides auto backup facilities; worksheet and individual cells may be locked or unlocked to data entry • reads and writes ASCII text files containing text and numbers with user-specified delimiters:

400

QA431-C3 MAPS/PRO Financial Modeling • includes an interactive command language and editor, a financial database subsystem, a procedural modeling language, a tabular report generator, and a financial function library • provides a model definition menu; a help facility; and a consolidation facility • can exchange models and data with a VAX machine running compatible MAPS/Host software:

1,250

QA432-C3 MAPS/PRO Graphics • fully functional business graphics system • generates custom multishared or multicolored



Digital Equipment Professional 300 Series

Professional 325 & Professional 350

line, stacked bar, and clustered bar charts on the monitor; supports various colors, fill patterns, and line patterns for generating X-Y axes graphics • requires extended bit-mapped option and hard disk:

200

QA434-C3 FINGRAPH Graphics System • decision support graphics system for converting databases in visual displays; as data changes over time, FINGRAPH regenerates the new information in the same standard style and scale for direct, one-to-one comparison • produces 5 chart formats: component charts, item charts, variance charts, ratio charts, and time series charts • features built in Help; full menu driver interface; initial, one-time set up of chart formats stored for future access; automatic scaling and labeling of charts; addition, subtraction, and totaling of elements; multicolor options for chart identification; slide show capabilities:

595

QA180-C3 TK!Solver • tool kit and multiple equation solver for modeling programs requiring real number solutions to sets of algebraic equations • models are created using English-like statements and solved by entering values for certain parameters • accepts data in the DIF file format from VisiCalc, VisiFile, VisiTrend/Plot, and some database programs • requires a hard disk:

299

QA434-C3 Financial Management TK!SolverPack • requires TK!Solver equation package:

100

QA442-C3 Mechanical Engineering TK!SolverPack • requires TK!Solver equation package:

100

■ HARDWARE

Terms, Support & Documentation

Terms • available on a purchase-only basis; 90-day warranty on parts and labor.

Support • warranty service includes telephone help line; mailings of updated software releases and documentation; and a newsletter • extended warranty for on-site repair is available at the time of system purchase • 3 post-warranty agreements are available for on-site service, carry-in service, and mail-in service; carry-in service is to one of the 145 Digital Servicenters; mail-in service is for more technically-oriented users, and means the customer isolates the faulty component using system diagnostics, removes the component and mails it to a Customer Return Center for replacement • educational courses are available on how to use the system, fundamentals of P/OS operating system, hands-on knowledge of CP/M, and how to use the Developer's Tool Kit.

Documentation • Owner's Manual, installation instructions, Diskette System User's Guide packaged with the system.

Physical Specifications (H x W x D); Weight

System Unit • 6.5 x 14.3 x 22 inches; 35 pounds maximum.

Display • monochrome monitor, 11.5 x 13.8 x 12.3 inches; 14 pounds • color monitor, 12.8 x 14.5 x 15.5 inches; 35 pounds.

Keyboard • 2 x 21 x 6.8 inches; 4.5 pounds.

Systems Overview & Configurability

The Professional Series 300 consists of 2 models, the 325 and the 350. Both models include a system unit that contains a 16-bit PDP-11 microprocessor with 22-bit addressing, a system clock, 512K bytes of RAM, 16K bytes of ROM, and a floating-point processor. Two serial ports and a dual 5.25-inch diskette drive round out standard system features.

The differences in the 2 models are as follows: the 325 system unit has 1 expansion slot to accommodate options while the 350 has 3. The 350 also has a larger power supply for adding a 5M-

or 10M-byte hard disk and can accommodate the CP/M Option Module and the Realtime Interface Module as well as the Telephone Management System. The memory on the 325 is expandable to 784K bytes while the 350's memory is expandable to 1M-byte.

Users have a choice of 3 monochrome monitors or a color monitor. The Professional's built-in, bit-mapped graphics capability which supports one plane of 960 x 240 pixels can be extended on the 350 model to include 2 additional planes. Keyboards can be ordered in one of 16 national country kits.

Interesting system options include a Telephone Management System (TMS) which consist of a telephone management module, a voice unit, and PRO/Communications software. The TMS provides for conference calling, automatic dialing, a personal phone directory, a modem for VT100 and VT125 emulation, plus other communications features. The Realtime Interface Module (RTI) option turns the Professional 350 into a personal workstation for a laboratory.

Another option, the Interactive Video Information System (IVIS), combines the graphics of the system with color video segments from a 2-channel audio videodisk system. Using the color monitor, users working with complex procedures can call-up video segments while receiving voice-over narration. System graphics can be overlaid on any video image enabling graphs, arrows, and charts to be used to highlight the visual portion of various procedures.

The 325 can be upgraded to a 350 by replacing the system board. This provides expanded capabilities including increased room for system options and the ability to add the hard disk. The Professional 325 board can be returned to Digital for credit.

Maximum configurability is stated below; minimum configurations are discussed under Packaged Systems.

Professional 325 System Maximums • 16-bit CPU, 784K bytes of RAM, CRT, keyboard, 2800K-byte dual diskette drives, 2 serial ports.

Professional 350 System Maximums • 16-bit CPU, 1M bytes of RAM, CRT, keyboard, one 800K-byte dual diskette drive, 10M byte hard disk, 2 serial ports, one remaining expansion slot.

Packaged Systems

PC325-D2 Professional 325 System Unit • 16-bit CPU, 512K bytes of RAM, 16K bytes of ROM, one dual diskette drive with a total of 800K bytes, system clock, RS-232C/423 printer port, RS-232C/423 communications port, floating point processor, 1 expansion slot:

\$3,975 prch

PC350-D2 Professional 350 System Unit • same as 325 except with larger power supply, 3 expansion slots:

4,975

PC325-UG Upgrade Kit • to upgrade a Professional 325 system unit to a 350 system unit:

2,300

PC3XS-AA CP/M Option Module • includes Z80 microprocessor, 64K-byte RAM, and CP/M operating system • requires hard disk, 1 expansion slot:

695

CPU

The Professional systems employ a 16-bit DEC PDP-11/23 minicomputer microprocessor as the CPU. They also include a floating-point processor for high-speed calculation of large numbers. An optional CP/M softcard with an 8-bit Z80 microprocessor is available for the Professional 350 to run industry-standard CP/M software.

F11 PDP 11/23 Processor • 16-bit NMOS microprocessor provides 22-bit addressing • includes 4-level vectored interrupt handling, 9 general-purpose registers, last-in/first-out (LIFO)

PRCH: purchase only. Prices effective as of December 1983.



Digital Equipment Professional 300 Series Professional 325 & Professional 350

register stack, power fail/auto-restart capability, memory battery backup (MOS static RAM only), and memory management • through the use of memory management, 16-bit virtual addresses are translated to 22-bit physical addresses; programs are mapped in pages consisting of 1 to 128 64-byte blocks; a program may contain up to 8 pages • the instruction set can operate on bits, bytes, words, and multiple words • 32-bit single and 64-bit double floating-point instructions (46 total) provide respectively 8- and 17-digit precision via the floating-point processor.

Zilog Z80 Processor • 8-bit internal architecture, 8-bit data bus interface; direct addressing to 64K bytes of memory; fourteen registers include 16-bit program and stack pointers, two index registers, and a duplicate set of an 8-bit accumulator and a 7-bit flag register; upwardly compatible with the Intel 8080, it provides binary coded decimal (BCD) arithmetic, double-precision operations, multiple indexing with address registers, multiple interrupt, increment, decrement and move capabilities • in addition to being able to execute all 78 Intel 8080 instructions, 50 enhancements to the instruction set include advanced block move and search macros, relative jump, and three types of selectable response interrupts, for a total of 128 operations.

Memory

The systems come equipped with 512K bytes of memory, which is expandable in 256K byte increments. The Professional 325 maximum memory is 768K bytes and the Professional 350 maximum memory is 1M bytes.

MSC11-CK 256K-byte Memory Option • occupies one expansion slot; maximum of 1 on 325, 2 on 340: \$795 prch

I/O & Communications

In addition to the Professional's 2 serial ports, the 325 contains one expansion slot and the 350, 3 expansion slots. Available options include a Telephone Management Module, voice unit, Real-time Interface Module, Modem, Mini-Exchange Computer linker, and a floor stand for the system unit.

Printer Port • general-purpose RS-423 printer port • supports 75- to 9600-baud programmable bit rates; software programmable character formats • included in packaged system.

Communications Port • RS-423 asynchronous/byte synchronous port full- or half-duplex; up to 19,200 baud • supports communication to a host, direct or through a modem • included in packaged system.

DTC11-A Telephone Management Module • consists of a telephone line interface and a controller board • telephone interface provides 4 jacks: 2 for telephone lines (one for data, one for voice communications); one for a local telephone handset; and one for the optional voice unit; connects to the computer via a special mounting slot located on the back panel of the system unit; does not utilize any expansion slots • controller board contains a modem, voice digitizing circuitry, and a transceiver to send and receive pushbutton telephone signals; integral modem transmits at 300/1200 bps with AT&T 103J- and 212A-compatible modems; voice digitizing circuitry converts analog voice signals from either one of the 2 telephone lines of the voice unit into digital signals for storage on the hard disk; it can reverse this process to send the recorded voice over the telephone lines of voice unit; occupies one expansion slot • requires PRO/Communications software and a hard disk: \$895 prch

DTC11-B Voice Unit • contains a pushbutton telephone keypad, voice dictation function keys, and a built-in microphone and speaker • plugs into a jack on the telephone interface module: 295

PC3XX-AA Realtime Interface Module (RTI) • for monitoring and controlling intelligent instruments, collecting and analyzing data, and outputting text and graphics reports • combines 3 interfaces: IEEE-488 bus, 2 RS-232C/423 ports, and 24-line bidirectional parallel port • interfaces can be used singly, in combinations or all concurrently • internal cabling and a 62-

pin connector for attaching to the system unit's back panel are included; optional external cables also available • occupies 1 expansion slot: 595

IEEE-488 General Purpose Instrument Bus • allows the system to act as a master or slave and to control up to 14 compatible external devices • has 2 complete bus ports, one for interfacing and one for verifying correct operation and handshaking in maintenance mode.

RS-232C/423 Asynchronous Ports • 50 to 9600 bps rate, 5- to 8-bit word length with 0 to 2 stop bits, and odd, even, or no parity flags under software control.

Parallel Port • 24-line bidirectional port 8-, 16-, and 24-bit data transfers to TTL compatible devices; handshaking in 8- and 16-bit modes can be suppressed through software; 24-bit mode has no handshaking.

PC3XX-AB Connector Pad • connector box for RTI; required when multiple functions are being run concurrently: 295

BCC10/11/12-03 RTI Cables • for connecting various devices to the 62-pin connector on the RTI Module • cables available for each of the 3 interfaces; price is per cable: 50

Mini-Exchange • for linking personal computers with each other; for transferring information in document or file format and for sharing I/O devices such as printers, modems, or multiplexers • supported by standard asynchronous Professional communications package • links up to 8 of any combination of personal computers and I/O devices through RS-232/423 ports; connects up to 200 feet from the unit; speeds range from 300 to 19,200 bps; operates on point-to-point circuit switching; includes 128K-byte read/write data memory, power-up and self-test diagnostics, and external loop-back test: 895

DF03-AA Modem • provides synchronous transmission at 1200 bps or asynchronous transmission at 300/1200 bps: 745

DF03-AC Modem • same as DF03-AA except with auto-call: 945

PCXXF-AA System Unit Floor Stand • for standing the system unit vertically on the floor: 99

Mass Storage

Diskettes

Both Professional systems come equipped with a dual diskette subsystem. This subsystem consists of a microprocessor-based diskette controller card and a dual diskette drive which accommodates 2 diskettes on a single spindle. Each diskette stores 400K bytes of information. The diskette subsystem contains self-diagnostics that test and verify that all system components are working during power up. The diagnostics also provide continuous error checking during normal operation and maintain a dialog with the system to report error status.

Integrated Diskette Subsystem • single-sided, double-density, dual 5.25-inch diskette drive and controller • 819K-byte total formatted storage; 164-microsecond average seek time; 96 tracks per inch; 250K-bps transfer rate; 290-millisecond access time; 300-rpm rotation speed • included with packaged system.

RX50-XA Add-on Dual Diskette Unit • for adding a second drive to the unit; for use with model 325: \$995 prch

Hard Disk

The Professional 350, because of its larger power supply and system unit, can accommodate an internal 5M- or 10M-byte hard disk drive. A user merely has to slide the disk drive into its



Digital Equipment Professional 300 Series

Professional 325 & Professional 350

designated bracket until it snaps into place. The controller card is then placed in an option slot and the power cable is connected from the power supply to drive unit. No tools are needed. Like the diskette drive, the hard disk also contains diagnostics to test and verify system components.

RCD50-AA Winchester Storage Option • 5.25-inch, 5M-byte hard disk drive • 1.25M bytes per surface; 8192 bytes per track; 512 bytes per sector; 16 sectors per track; 5M-bps transfer rate; 170-millisecond average access time; 3600-rpm rotational speed; 254 tracks per inch:

\$1,570 prch

RCD51-AA Winchester Storage Option • internal 5.25-inch, 10M-byte hard disk drive • same specs as 5M-byte drive except 2.5M bytes per surface; 85-millisecond average access time; 345 tracks per inch:

2,820

Terminals/Workstations

Digital offers both monochrome and color monitors as well as extended graphics capabilities for the Professional series. Additionally, users can choose from 16 international keyboard country kits which consists of a power cord and documentation as well as the keyboard.

The system's graphics capability is made possible through the integral bit-mapped video controller. Graphics are implemented through an interface between the application program and graphics support software that conforms to the CORE conventions. CORE is a proposal supported by the ACM Special Interest Group of Graphics (ACM-SIGGRAPH). Extensions have been added to the Professional's graphics capability that include rectangles, circles, arcs, and interpolated curves. The end user can program graphics using the Professional BASIC programming language.

Digital also offers the optional Interactive Video Information System (IVIS) for users who need assistance in learning complex procedures. IVIS combines the graphics capabilities of the computer with color video segments from a 2-channel videodisc system by providing graphics overlays on any video image.

Display • detached monochrome monitor; 12-inch, 24-line x 80-/132-column display • features include 4K-byte character RAM; 4K-byte video attribute RAM; 7x10 dot matrix includes 2-dot descenders • bit-mapped graphics capability of 960x240 pixels • full and split scrolling; double height line; double width characters; memory mapped video; bold, blink, and underline; reverse video; variable intensity • 60-image-per-second refresh rate • 5- to 15-degree adjustable tilt.

VR201-A White Phosphor Monitor:

\$325 prch

VR201-B Green Phosphor Monitor:

325

VR201-C Amber Phosphor Monitor:

375

VR241-A RGB Color Monitor • 13 inch screen with same characteristics as monochrome monitor • displays 8 colors from a palette of 256 • requires extended bit-map graphics module:

1,325

VC241-A Extended Bit-Map Graphics Module • provides 2 additional bit-mapped planes of 960 x 240 pixels each for a total of 3 planes on the system • uses 1 option slot:

895

Keyboard • detached, 105-key, low-profile keyboard; complies with European 30mm home row requirement • contains its own 8-bit microprocessor; 36 function keys of which 16 are programmable; separate cursor control pad; 18-key data entry keypad; 6-foot cord; audio feedback speaker.

PC3K1-AA U.S./Canadian Country Kit • includes keyboard, power cord, documentation:

295

All Other Kits:

295

PC3VS-A Interactive Video Information System • for combining graphics capabilities with segments from a 2-channel audio videodisc system • occupies 2 expansion slots:

2,995

Printer/Graphics

Digital offers 3 printers for its personal computers. Each contains internal self-diagnostics tests which are executed automatically on power-up and are composed of modular subassemblies for easy maintenance. In addition to the 3 printers, Digital also offers an assortment of character fonts, printwheels, and other printer supplies for the units.

LA50-RA Personal Printer • dot-matrix impact printer • features 3 print modes; text (100 cps); enhanced (50 cps); and full bit-mapped graphics (144 x 72 dots per inch) • 80/132 print columns; 2/3/4/6/8/12 lpi; 10/12/16.5 cpi; 255-character buffer; up to 10-inch fanfold/single-sheet paper; 110 to 4,800 bps • international character set stored in ROM enables printing in 11 major languages • self-test and power -up diagnostics • attaches to printer port:

\$695 prch

LA 100 Letterprinter 100 • 30-/240-cps letter-quality/fast drafting dot matrix printer; 80 cps memo mode optional • 2/3/4/6/8/12/lpi; 5/6/6.6/8.25/10/12/13.2/16.5 cpi; 50 to 9,600 bps; 9-wire printhead; graphics mode of 132 x 72 dots per inch; 66 to 217 print columns; 3- to 14.9-inch fanfold, single-sheet, or rolled paper; 4K character buffer optional • multinational character set, Courier 10 typeface, and VT-100 line drawing characters standard • attaches to printer port:

1,595

LQPO2-AA Letter-Quality Printer • full-character, bidirectional, daisywheel printer • 32 cps; 10/12 cpi; 132/158 print columns; 2/3/4/6/8 lpi; 110 to 9,600 bps; up to 15-inch fanfold or single sheet paper • attaches to printer port:

2,800

LQPXX-AA • bidirectional forms tractor:

270

LQPX2-SF • dual-tray cut-sheet feeder:

1,800

• END



Digital Equipment Rainbow Computers

Rainbow 100 & Rainbow+

■ PROFILE

Operating Systems • Digital Research CP/M-86/80 or Microsoft MS-DOS single-user diskette operating systems; concurrent CP/M and UCSD p-System also available.

Data Management • dBase II relational database management system.

Communications/Networks • DEC VT-102 terminal emulation • BSC 3270, 2780/3780 emulation.

Languages • Microsoft MBASIC interpreter; Mark William's Company C Compiler; Phoenix Systems's COBOL Program Generator, Ryan McFarland COBOL.

Models • Rainbow 100, Rainbow 100+, hard disk system.

CPU • Intel 8088 4.77-MHz 16-/8-bit processor; Zilog Z80A 2.03-MHz 8-bit processor.

Memory • 64K to 256K bytes on 100; 128K to 896K bytes on 100+.

Chassis Slots • 3 DEC proprietary slots.

Ports • 20 RS-423 serial ports.

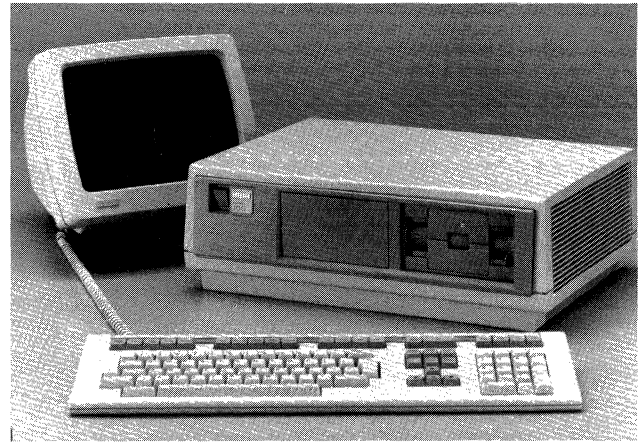
Mass Storage • 6.6M bytes maximum • up to 4 5.25-inch diskettes plus single 5M-byte 5.25-inch Winchester disk.

Terminals/Workstations • single-terminal system.

Printers • dot-matrix and letter-quality printers.

Systems Delivered • not available from vendor.

First Delivery • 100 in fourth quarter 1982; 100+ in fourth quarter 1983.



Comparable Systems • all 16-bit desktop workstations such as Eagle 1600; Fortune 32:16; IBM PC 1 and PC/XT; NEC APC; Olivetti M20; Radio Shack Model 16; Texas Instruments PC; Vector 4; Victor 9000; Wang PC; Zenith Z110.

Vendor • Digital Equipment Corporation (DEC); 146 Main Street, Maynard, MA 01745 • 617-897-5111.

Canada • Digital Equipment of Canada, Ltd; P.O. Box 13000, 100 Herzberg Road, Kanata ONT K2K 2A6 • 613-592-5111.

Distribution • worldwide through DEC sales/service offices • nationally through Computerland, Inc and other retail dealers; also through Digital Business Centers • wholesale sales through Hamilton Avnet.

■ ANALYSIS

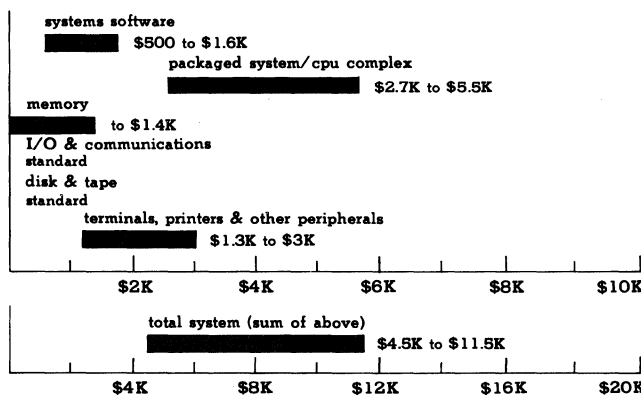
In May 1982 Digital Equipment held an elaborate press conference to announce that the company was taking the plunge into the micro marketplace. What the company unveiled were 3 micro products, all targeted at different segments of the business world. The 3 systems—the Rainbow 100, the DECmate II, and the Professional 300 Series—are similar looking machines, all using the same monitor, keyboard, and dual diskette drive. However, their processors, memory, storage capacity, and software all differ.

The Rainbow 100 is billed as Digital's entry-level system in the micro marketplace and, so far, is its most successful. It was designed to take advantage of industry-standard software, thereby providing users with a variety of immediate solutions to their work load problems. The Rainbow uses a dual microprocessor configuration, each with its own operating system (loosely coupled) to run both 8- and 16-bit application software. The system can function either as a standalone unit or as an intelligent terminal connected locally to a host system.

Where does the Rainbow fit in as far as its competition

PURCHASE PRICE RANGE

hardware & software



RAINBOW MICROCOMPUTERS PURCHASE PRICING bar graphs illustrate price ranges for small to large systems, with solid bars reflecting software/hardware purchase pricing • **SMALL SYSTEM** is based on Rainbow 100 packaged system (includes dual CPUs, 64K-byte main memory, 819K-byte diskette storage, serial printer port, and communications port) and the following options: CP/M-86/80 operating system and MBASIC interpreter system software; B/W monitor; low-profile keyboard; dot-matrix personal printer • **LARGE SYSTEM** is based on Rainbow 100+ packaged system (includes dual CPUs, 128K-byte main memory, 819K-byte diskette storage, 10M-byte hard disk storage, serial printer port, and communications port) and the following options: CP/M-86/80, MS-DOS, MBASIC, Select word processor, Multiplan spreadsheet systems software; 768K additional RAM; color monitor; low-profile keyboard; graphics option, 30-/240-cps dot-matrix printer.



Digital Equipment Rainbow Computers Rainbow 100 & Rainbow+

goes? Presently, only 6 professional desktop units are marketed with a loosely coupled dual processor configuration as a standard system feature. Of these, the Rainbow comes in with one of the lowest prices. However, several other 16-bit workstations are available which can be expanded to run 8-bit software by inserting an optional CP/M softcard. So the number of dual processor systems is really greater than 6, but the Rainbow still comes in on the low end of the price scale.

One area where the Rainbow really outshines its competition is in its CP/M-86/80 operating system. Digital's CP/M-86/80 is formed by the combination of CP/M-80 and CP/M-86, the 8-bit and 16-bit versions of the popular CP/M operating system.

The unique feature of this hybrid operating system is that it automatically differentiates 8-bit and 16-bit instructions, invokes the appropriate subset of CP/M-80 or CP/M-86, and executes the software on the appropriate processor. None of the Rainbow's competitors have such a feature in their systems.

Digital's announcement of the Rainbow 100+ is viewed by many analysts as a response to IBM's PC/XT. The 100+ is an integrated 10M-byte hard disk version of its sister computer. Memory capacity has been enhanced to a maximum of 896K bytes, compared with 256K bytes on the 100. The 100+ runs all Rainbow 100 software and can also run software requiring more than 256K. All Rainbow 100 peripherals except for the extended communication card and auxiliary diskette drives are compatible with the 100+. DEC has 5M-byte and 10M-byte hard disk upgrades available for Rainbow 100 users.

Much of the software for MS-DOS falls short of taking full advantage of the Rainbow graphics capabilities and full function keyboard. This same limitation applies to plain vanilla CP/M-80 and -86 programs as well.

Both the Rainbow and its peripherals have been built using modular components. This allows for quick and easy component assembly and maintenance. Upon start-up and during normal operation, the system conducts a self-test of all assemblies and components. If the test reveals a malfunction, the video screen displays an error message. The system box also includes 7 LEDs which also indicate the system errors. Components have been designed with snap-in, snap-out features for easy customer installability, upgradability, and maintenance. If a repair is necessary, the malfunctioning component can be removed and brought to any one of the 160 carry-in service centers established at Digital branch offices throughout the U.S.

Strengths

DEC's decision to offer 2 of the most popular microcomputer operating systems (CP/M and MS-DOS) for the Rainbow provides the user with access to a wide range of software. DEC's CP/M-86/80 operating system allows the user to purchase either 8-bit software (which is plentiful), or more powerful 16-bit software as it becomes available. As mentioned previously, one particularly attractive feature of the operating system is that it automatically differentiates between 8-bit and 16-bit

instructions, freeing the user of the burden of having to instruct the system about the type of program being loaded.

The Rainbow has been designed with current ergonomic principles in mind. The CRT screen is coated with an antiglare coating, and swivels and tilts through a 30-degree range. The detached keyboard can be moved to the most comfortable position for the typist. The shape, feel, and typing angle of the keyboard is comfortable and logical.

With enhanced disk storage and MS-DOS 2.01 the Rainbow+ is quite competitive with the IBM PC/XT. It possesses the same ergonomic features as the 100 with added storage power and memory capacity. Digital is increasing its lists of approved software at a rapid pace. Currently, most major MS-DOS packages have been successfully implemented; this includes roughly half of all IBM-PC compatible software.

The modular design of the Rainbow and the self-test features allows for quick and easy component assembly and easy maintenance. Upon startup, the system conducts a self-test of all components and assemblies. Components and interior have been designed with snap-in, snap-out, and slide-out features for easy customer installation and maintenance.

Limitations

Unfortunately, despite the excellent design of the Rainbow line of microcomputers, Digital's initial marketing strategy has imposed the most severe limitation. The machine was prematurely announced, over-priced, and did not allow enough of a profit margin for retailers. This resulted in weak sales and poor representation in retail outlets. In response to poor sales, Digital has since revamped its microcomputer marketing strategy. This poor early showing, however, disillusioned many third-party software and hardware developers and vendors resulting in a shortage of software that takes advantage of DEC Rainbow's unique abilities. Though it is too early to tell, the effects of Digital's marketing reorganization are directed at correcting this limitation.

SOFTWARE

Terms & Support

Terms • available for a one-time license fee; 30-day guarantee.

Support • software warranty, Investment Protection Plan, includes toll-free Help Line telephone support • Classified Software includes Digital-Tested, Digital-Serviced, and Digital-Developed Packages • Digital-Tested Packages run as specified in the documentation, have no known bugs, and meet Digital's criteria for installation, ease of use, and performance consistency; support for this classification is not provided • Digital-Serviced Packages (produced by outside vendors) and Digital-Developed Packages (produced by Digital) pass Digital-Tested Packages requirements plus meeting serviceability criteria; service contracts are available for Digital-Tested and Digital-Developed Packages, Investment Protection Plan provides limited 30-day return policy.

Software Overview

The Digital Rainbow 100 and 100+ both have identical software environments. Both run a unique version of CP/M-86/80 dual-operating system, and MS-DOS 2.01.



Digital Equipment Rainbow Computers

Rainbow 100 & Rainbow+

As with any MS-DOS microcomputer, the Rainbow 100 line is compatible with about half of the IBM PC software. There are a number of third-party MS-DOS and CP/M programming and development packages available. These include languages such as: BASIC, Pascal, FORTRAN, COBOL, "C," and Logo. It is recommended that compatibility with the Rainbow 100 be verified by either Digital or the software vendor prior to purchase. The unique dual-disk format, as well, may cause some difficulties in the installation of non-DEC software.

Digital provides a list of approved software to users. This list includes such titles as TK! Solver-86, dBase II-86, RIM COBOL, WordStar, Lotus 1-2-3, and MBSI accounting packages. There are currently over 400 titles that have been approved for use by Digital on the Rainbows.

Packaged Software

There is no packaged software supplied with Digital Equipment's microcomputers. Digital does distribute third-party software that is has fully tested and approved.

Operating Systems

QV012-A3 CP/M-86/80 Operating System • general-purpose disk/diskette operating system supports single-user, single-task interactive and batch processing • hybrid operating system formed by the combination of 2 related operating systems: CP/M-86 supports 16-bit instructions running on 8088 processor, CP/M-80 supports 8-bit instructions running on Z80 processor; CP/M-86/80 automatically differentiates between 8-bit and 16-bit instructions, invokes the appropriate subset of CP/M-86/80, and executes software on the appropriate processor; almost all CP/M commands are included plus a few additions and enhancements: COPY command for a complete disk backup from one drive to another drive; screen-oriented editor instead of CP/M's line-oriented editor • developed by Digital Research, Inc.

\$250 lcms

QA069-C3 MS-DOS 2.00 • single-user, interactive and batch processing operating system with UNIX-like hierarchical directories, piping functions, filters and hard disk support; equivalent to IBM PC-DOS 2.0 • supports up to 180K bytes in up to 64 different files in single-sided format and up to 360K bytes in up to 112 files double-sided, and 5M or 10M bytes with thousands of filenames on hard disk; handles records from 1 to 65,535 bytes long in file transfer, executes external (disk-based) commands giving the user ability to expand the DOS vocabulary to limits of disk space • batch processing capabilities with automatic execution on power-up, user commands include: DATE, TIME, COPY, ECHO, PATH, MKDIR, RMDIR, CHDIR, TREE, RECOVER, GRAPHICS, BREAK, and CTTY • additions over DOS 1.25 in performance include hierarchical directories to facilitate hard disk use, numerous performance enhancements, redirection of input/output (I/O), piping of functions (sequentially rather than concurrently as in UNIX), higher sector density per track (9 sectors per track vs 8 in DOS 1.25), and installable device drivers • MS-DOS is divided into four parts: a device independent I/O handler, an I/O processor, reference and jump vectors in low memory, and a command processor; the device independent I/O handler on hidden file MS-DOS.SYS is the core of MS-DOS through which I/O must be directed; the I/O processor physically moves data and instructions by means of hidden file IO.SYS as commanded by MS-DOS.SYS; the command processor, using the COMMAND.COM program, is responsible for interface between user and MS-DOS, error trapping, batch file processing, interpreting user commands and executing file names • MS-DOS 2.00 will read earlier MS-DOS diskettes; there are several unique system interrupt calls and file descriptors that make programs utilizing these features non-transportable between MS-DOS 2.00 and earlier versions • an editor, debugger, and other utilities are provided:

250

UCSD p-System Operating System • general-purpose disk/diskette system by Softech Microsystems supports single-user interactive and batch processing; provides for software transportability from one hardware environment to another; provides software framework for UCSD Pascal and

BASIC program development/execution; manages UCSD Pascal and BASIC compilers; macro assembler, linker file handler, and text editor • features include: program chaining; input/output redirection; block I/O service routines; dynamic overlays; dynamic memory allocation; runtime support routines; support for asynchronous processes concurrently primitives in Pascal:

250

Concurrent CP/M-86 • a single-user, multitasking operating system compatible with CP/M-86 and MP/M-86 operating systems; provides a virtual console environment where each virtual console can perform its own task; one virtual console is always mapped to the physical console and is the foreground console, with all other virtual consoles being background consoles; switching a virtual console to the physical console is accomplished through the use of function keys (typical installations use from 4 to 10 function keys for this process) • supports up to 1M bytes of memory, multiple list devices, and up to 16 logical disk drives, each containing up to 512M bytes of storage for a maximum of 8G bytes of online storage • features include: Real-Time Monitor providing process control and dispatching, as well as queue, flag, and clock management; allows processes to share reentrant code; file management with date and time stamping; and protection of user files and directories through the use of optionally assigned passwords • requires an Intel 8086/8088 microprocessor, 256K bytes of memory (recommended), a console device, disk storage, and a real-time clock • developed by Digital Research, Inc;

NA

Utilities

Only utilities that come with the operating system are included with the Rainbow microcomputers. There are various utilities under MS-DOS available from third-party vendors at additional cost.

Data Management

QA281-C3 dBase II • relational database management system • uses interactive prompts to name files and define fields as well as entering data once file is designed • uses English-like commands to interactively (con conversationally) access and manipulate the database; program access is supported as well • system supports up to 65,535 records per database file, up to 1,000 characters per record, 32 fields per record, and 254 characters per field • requires at least 48K bytes of memory; CP/M • developed by Ashton-Tate:

\$695 lcms

Communications/Networks

VT100 Terminal Emulation • for emulating a DEC VT-102 terminal • included in ROM.

Poly-BSC/RJE • for communicating with remote systems using a subset of IBM's BSC protocol • used to submit jobs to an IBM host as a 2780/3780 RJE system, to retrieve output after the job is completed, and to transmit files to and receive files from an IBM host or another Rainbow 100 running Poly-BSC/RJE • runs under CP/M:

\$500 lcms

Poly-BSC/3270 • for emulating an IBM 3271 Model 2 control unit with attached 3277 Model 2 display or 3286 Model 2 unbuffered printer; for emulating an IBM 3275 Model 2 integrated control unit/display station with attached 3284 Model 3 unbuffered printer • runs under CP/M:

575

QA193-C3 Poly-XFR • for allowing DEC's CP/M-based personal computers to communicate with other DEC systems and other manufacturer's CP/M-based personal computers • supports ASCII and binary file transfers and spooling of files • run at 9600 bps in a local environment and uses full-duplex modems

LCNS: one-time license fee. NA: price not available. Prices effective as of August 1983.



Digital Equipment Rainbow Computers

Rainbow 100 & Rainbow+

for remote data transfer:

300

□ Program Development/Languages

QA066-C3 MBASIC Language Interpreter • implementation of ANSI subset standard BASIC • features include: variable names of up to 40 characters; password protection; dynamic-string space allocation; WHILE/END, IF/THEN/ELSE and nested IF/THEN/ELSE, CHAIN, COMMON statements; automatic line-number generation and renumbering • developed by Microsoft, Inc • requires CP/M-86/80 Operating System:

\$250 lens

QA068-C3 C Compiler • structured programming language; generates 16-bit programs as either binary files or as assembly language files • requires CP/M-86/80 Operating System • developed by Mark Williams' Company:

500

COBOL Program Generator • for generating ANSI 74 COBOL code • combines a dictionary containing file, field, and program definitions with COBOL source code generators to produce programs; interacts with the user in English to define and store file definitions and field parameters for new or existing files and to select program types for generation • runs under CP/M • developed by Phoenix Systems, Inc:

1,495

□ Applications Packages

QA061-C3 Select Word Processing • menu-driven word processor with self-teaching program • features disk-overflow protection and automatic back-up file maintenance; global search and replace; merging for mailing lists; text formatting and margin control; edit capability of spreadsheet reports • runs under CP/M:

\$595 lens

QA277-C3 List Manager • menu-driven list processing system; uses a 3-key indexing system to access records in lists containing up to 30,000 records • can be used standalone or in conjunction with Select to create form letter from a database • runs under CP/M:

250

EasyWriter • word processing system • features page-oriented editing and display; automatic word-wrap; automatic line numbering; global search and replace • developed by Information Unlimited Software • tailored to run under CP/M-86:

NA

QA063-C3 Multiplan Spreadsheet • electronic spreadsheet and planning package • up to 63 columns wide, 255 rows deep • requires CP/M-86/80 Operating System • developed by Microsoft, Inc:

275

QA283-C3 TK! Solver • rule-oriented problem solving system • user enters a set of calculation rules and variable relationships; may also enter tables; system compares all compatible results:

300

QA280-C3 Graphwriters • for producing presentation-quality charts and graphs (bar, pie, line) on the printer • uses 1 million pixels:

595

QA282-C3 Microplan • for financial planning and budget/variance analysis • runs under CP/M-86:

790

RealWorld • financial accounting system • consists of 7 COBOL applications: accounts receivable; accounts payable; general ledger; payroll; sales analysis; order entry; billing; inventory control • runs under CP/M-86 • \$650 per application.

□ Other Facilities

Computer-Based Instruction • included with system.

Rainbow Screen-Oriented Editor • included with system.

Self-Test Diagnostics • internal test which is implemented when system is turned on • other test software comes on a floppy diskette • included with system.

■ HARDWARE

□ Terms, Support & Documentation

Terms • available for purchase; 90-day warranty • installation available.

Support • Investment Protection Plan warranty service includes toll-free Help Line telephone support • Basic Service Agreement provides 8-hour/5-day service; Carry-In Service Agreement supported by 160 centers worldwide • DECmailer Service handles faulty modules or boards; repaired or replaced components returned using Express Mail.

Documentation • bound manuals are provided for 100 and 100+ system installation, use and maintenance; user installable expansions come with step-by-step directions.

□ Physical Specifications (H X W X D); Weight

CPU • 6.5 x 19 x 14.3 inches for 100 and 100+; 30 pounds for Rainbow 100, 35 pounds for Rainbow 100+.

Display • 11.5 x 13.75 x 12.25 inches; 14 pounds.

Keyboard • 2 x 21 x 6.75 inches; 4.5 pounds.

□ Systems Overview & Configurability

The Rainbow 100 and 100+ are dual-processor microcomputers utilizing an 8-bit Zilog Z80A and a 16-bit Intel 8088 microprocessor. The basic packaged systems consists of a system unit which houses the dual processors, 64K bytes of main memory, dual diskette drives on the 100, 128K bytes, diskette and hard disk drives on the 100+, power supply, and 3 slots for adding hardware options. The system unit can be positioned horizontally on a desktop, or vertically on the floor. The power supply is switch-selectable either 115V or 230V.

The 2 processors are interconnected using a dual bus structure. Specific system functions are delegated to each processor. For example, reading or writing to disk is controlled by the Z80, while the video display, keyboard, input/output port, and hardware options are controlled by the 8088. Both processors share main memory.

Two I/O ports are included in the basic system package. The Communications Port is an RS-423C port that supports communications to a host computer direct or through a modem. The Printer Port is also an RS-423 port through which a printer may be attached to the system. A second communications port and an RS-422 port may be added to the system through the addition of an Extended Capabilities Option. The RS-423 interfaces are electrically compatible with RS-232C. This means that either an RS-423 or RS-232C device can be attached to the port. However, the pin configuration on the 2 interfaces are different, so the user must make sure he/she has the right cable connector.

An integral dual diskette drive is standard on both the 100 and 100+, providing 819K bytes of auxiliary storage on 2 5.25-inch diskettes. A second dual diskette drive and a 5.25-inch Winchester drive may be added to the 100 system bringing total online storage to 1.6M bytes of diskette storage, and 5M bytes of Winchester disk storage. The 100+ comes with a 10M-byte hard disk and no further expansion options.

To round out the system configuration, Digital offers separate monochrome and color monitors plus several country-specific keyboards. The monochrome monitor tilts and swivels, weighs only 14 pounds, and has a retractable handle for portability. The low-profile keyboard comes with a "country kit" which includes those elements that are unique to a given country (country-specific keyboard, power cord, and documentation in the appropriate language).

The system unit has 3 dedicated option slots which can support 3 option boards. These are for additional main memory, the Extended Capabilities Option, and the Graphics Option which provides bit-mapped monochrome and color graphics capability.



Digital Equipment Rainbow Computers Rainbow 100 & Rainbow+

Maximum configurability is stated below; minimum configurations are discussed under Packaged Systems.

System Maximums • 256K-byte main memory for 100, 896K for 100+ • 1.6M-byte diskette storage and 5M-byte Winchester storage for 100, 819K-byte floppy and 10M-byte hard disk for 100+ • 2 communications ports, a single printer port, and a single RS-422 port.

☐ Packaged Systems

PC100 Packaged System • dual processor system • 64K-byte main memory; 24K-byte read-only memory (ROM) • communications port; printer port • diskette controller; dual 5.25-inch diskette drive • power supply and 3 option slots:

\$2,675 prch \$28 maint

PC 100+ Packaged System • dual-processor system • 128K-byte main memory; 24K-byte ROM • communication and printer ports • diskette controller with single dual 5.25-inch diskette drive, hard disk controller with 10M-byte hard disk drive • power supply and 3 option slots:

5,475 NA

☐ CPUs

The Rainbow 100's incorporate both an 8-bit Z80A and an 8-/16-bit 8088 microprocessor. The 2 processors are linked together through an interrupt scheme. They divide system functions between themselves: reading and writing to disk is controlled by the Z80A, while the video display, keyboard, input/output port, and hardware options are controlled by the 8088. A dual 8-bit data bus structure is utilized, with 1 bus linked to each processor, and both buses connected to the 64K bytes of main memory that comes standard with the Rainbow.

Zilog Z80A Processor • 8-bit LSI microprocessor; 200-nanosecond cycle time; 2.03-MHz clock speed • provides control for 2K-byte dedicated RAM, diskette interfacing.

Intel 8088 Processor • 8-/16-bit LSI microprocessor; 208-nanosecond cycle time, 4.77-MHz clock speed • provides control for optional main memory, 24K-byte ROM, 4K-byte attribute RAM, 4K-byte screen RAM, keyboard, video display, communications and printer ports, color/graphics option, extended capabilities option.

☐ Memory

Standard Memory • 64K-byte main memory expandable to 256K bytes on 100; 128K bytes to 896K bytes on the 100+ • lower 2K bytes of RAM reserved for the 8088 processor interrupt vector area; 2K-byte dedicated Z80A RAM • 24K-byte ROM containing self-test diagnostics, power-up initialization routines, VT102 emulation firmware, disk boot loader, and memory mapped video service routines • 4K-byte attribute RAM; 4K-byte dedicated screen RAM • 100 memory expandable in 64K-byte or 192K-byte increments; 100+ memory expandable in 192K-byte, 256K-byte, 512K-byte, or 768K-byte increments.

PC1XX-AA 64K-Byte RAM Option • expands Rainbow 100 memory to 128K bytes • attaches to dedicated option slot on system unit

\$495 prch \$3 maint

PC1XX-AB 192K-Byte RAM Option • expands Rainbow 100 or 100+ memory to 256K bytes • attaches to dedicated option slot on system unit:

650 10

☐ I/O & Communications

In addition to the Rainbow's 2 serial ports, the system also contains 3 option slots; 422/423 option for 100 only.

Printer Port • general-purpose RS-423 printer port • supports 75- to 9600-baud programmable bit rates; software programmable character formats • included in packaged system.

Communications Port • RS-423 asynchronous/byte synchronous port full- or half-duplex; up to 19,200 baud • supports communication to a host, direct or through a modem • included in packaged system.

PC1XX-BB Rainbow 100 Extended Capabilities Option • includes an RS-423 asynchronous/byte synchronous port and 880K-bps RS-422 port • supports DMA asynchronous, byte synchronous, and bit synchronous protocols • RS-422 port supports attachment of Winchester drive • attaches to dedicated option slot on system unit:

\$500 prch \$3 maint

☐ Mass Storage

All 100 packaged systems come equipped with a dual diskette drive, a controller, and an interface to support an additional dual diskette drive. The Rainbow 100 can also support a single 5M-byte, 5.25-inch Winchester disk drive. 100+ systems come with one integrated diskette system and one 10M-byte hard disk.

Integrated Diskette Subsystem • single-sided, double-density, dual 5.25-inch diskette drive and controller • 819K-byte total formatted storage; 164-microsecond average seek time; 96 tracks per inch; 5120 bytes per track; 512 bytes per sector; 10 sectors per track; 250K-byte-per-second transfer rate; 290-millisecond access time; 300-rpm rotation speed • included with packaged system.

RX50-XA Add-On Dual Floppy Option • freestanding dual 5.25-inch diskette drive and controller • expands total formatted storage to 1.6M bytes • specifications same as Integrated Diskette Subsystem • includes user installation and diagnostic procedures:

\$700 prch \$8 maint

RCD50-BA Winchester Storage Option • freestanding 5.25-inch, 5M-byte hard diskette drive • 1.25M bytes per surface; 170-millisecond average seek time; 8192 bytes per track; 512 bytes per sector; 16 sectors per track; 5M-byte-per-second transfer rate; 95-millisecond average access time; 3600-rpm rotational speed; 254 tracks per inch • firmware diagnostics provide continuous error checking during startup and normal operation • attaches to RS-423 port of Extended Communications Option:

2,675 10

☐ Terminals/Workstations

Users of the Rainbow 100 can choose from various international country kits which consist of a keyboard, power cord, and documentation. Both monochrome and color monitors are available as is a graphics capability.

Keyboard • detached 103-key low profile keyboard; complies with European 30-mm home row requirement • contains its own 8-bit microprocessor; 36 function keys of which 16 are programmable; separate cursor control pad; 18-key data entry keypad; 6-foot cord; audio feedback speaker.

PC1K1-AA U.S./Canadian Country Kit • includes keyboard, power cord, documentation:

\$245 prch \$3 maint

All Other Country Kits:

245 3

VR201-A Monochrome Monitor • detached B/W monitor; 12-inch, 24-line x 80-/132-column display • features include 4K-byte character RAM; 4K-byte video attribute RAM; 7x9 dot-matrix; full and split screen scrolling; double-height line; double-width characters; memory mapped video; bold, blink, and underline; reverse video; variable intensity; 5 to 15 degree adjustable tilt

325 NA

VR241-A Color Monitor • requires bit-mapped graphics option:

1,325 NA

PC1XX-BA Graphics Option • provides bit-mapped

PRCH: purchase price. MAINT: monthly maintenance charge for Basic Service Agreement. NC: no charge. NA: not available. Prices effective as of August 1983.



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monochrome and color graphics capability; requires color monitor for color graphics • 800x240 picture elements, 2 planes, 4 colors from 8-color palette (high resolution mode); 320 x 240 picture elements, 4 planes, 16 colors (low resolution mode) • executes Digital's Remote Graphics Instruction Set (ReGis); attaches to dedicated option slot on system unit:

695 3

□ Printers/Graphics

LA50-RA Personal Printer • dot-matrix impact printer • features 3 print modes: text (100 cps); enhanced (50 cps); and full bit-map graphics (144x72 or 180x72 dots-inch) • 80/96/132 print columns; 2/3/4/6/8/12 lpi; 10/12/16.6 cpi; 255-character buffer; up to 10-inch fanfold/single-sheet paper; self-test and power-up diagnostics • international character set stored in ROM enables printing in 11 major languages • attaches to printer port:

\$695 prch \$14 maint

Letterprinter 100 • 30-/240-cps (letter-quality/fast-drafting) dot-matrix printer • 2/3/4/6/8/12 lpi; 5/6/6.6/8.25/10/12/13.2/16.5 cpi; 50 to 9600 bps; 9-wire printing head; 132 x 72 dots per inch; 66 to 217 print columns; 3 to 14.9-inch paper; 400-character buffer • attaches to printer port.

LA100-RA Letterprinter 100 • includes Courier-10 and Orator-10 dot-matrix fonts; friction feed mechanism:

2,215 25

LA100-YA Letterprinter 100 • includes LA100-RA Letterprinter items plus tractor-feed, ribbon cartridge, and paper:

2,475 25

LA100-ZA Letterprinter 100 • includes LA100-YA Letterprinter items plus multiple font option:

2,690 25

LQPO2-AA(AD) Letter-Quality Printer • full-character, bidirectional, daisywheel, 32-cps impact printer • 10/12 cpi; 2/3/4/6/8 lpi; 110 to 9600 baud; up to 15-inch paper • attaches to printer port:

2,800 29

LQPX2-AA • bidirectional forms tractor:

250 NC

LQPXX-AC • dual-tray cut sheet feeder:

1,800 17

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