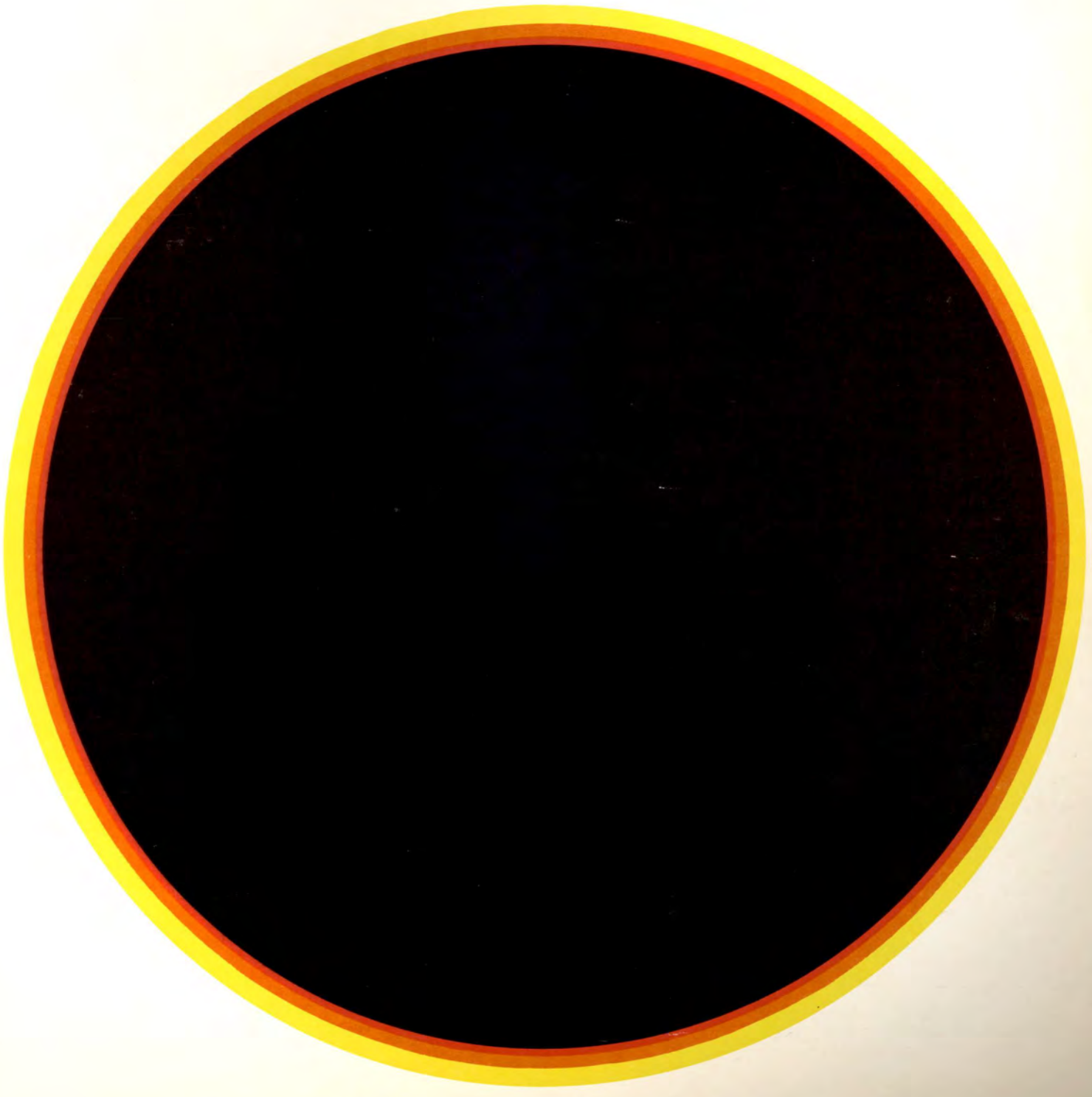
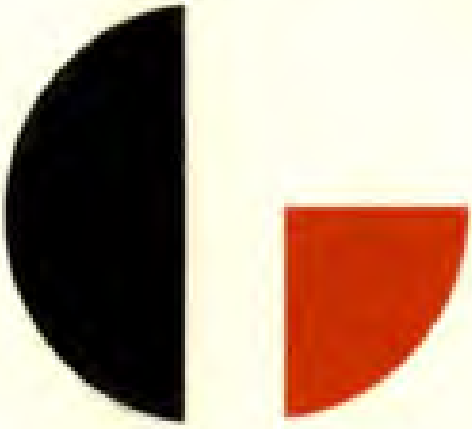
Data General Corporation

DataGeneral

ECLIPSE COMPUTER SYSTEMS





DATA GENERAL CORPORATION

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ECLIPSE

ECLIPSE™ is a new generation of compact, general-purpose computer systems.

ECLIPSE microprogrammed architecture optimizes operating systems and high-level language performance.

ECLIPSE cache memories yield cycle times as low as 200 nanoseconds.

ECLIPSE error management *corrects* errors in main memory.

ECLIPSE Writable Control Store tailors the computer to applications.

No other compact, general-purpose computer combines ECLIPSE's broad features and power. None makes that power so accessible through powerful operating systems and high-level languages. And none goes so far beyond simple hardware reliability to the central issue of data integrity and system availability.

ECLIPSE. No other small computer in the world can match it.

PERFORMANCE IS THROUGHPUT

ECLIPSE's high performance starts with a fast microprogrammed architecture. A random-access stack and versatile interrupt system replace software routines with high-speed hardware. A Floating Point Processor performs single- and double-precision arithmetic at large computer speeds. A fast bipolar cache memory front-ends economical semiconductor memory for high speed. Interleaving reduces core and semiconductor memory cycle time. Effective memory speeds range from 640 to 200+ nanoseconds.

These ECLIPSE computer features mean performance that translates into high throughput. Throughput that lets ECLIPSE handle demanding real-time applications like large timeshared computations, on-line process control, and heavy-load message switching.

ACCESSIBILITY MEANS ECONOMY

ECLIPSE performance is highly accessible through sophisticated operating systems and high-level languages like Fortran 5. Both are ideal for on-line, file-based operations. Both let users concentrate on application software while system software manages computer resources. Both use the ECLIPSE computer's comprehensive instruction set to provide accessibility without compromising performance. ECLIPSE accessibility means economy. Economy to implement and to operate systems.

SYSTEM INTEGRITY MEANS AVAILABILITY

ECLIPSE's speed and accessibility come with extremely high system integrity. Error Checking and Correction detects and corrects main memory errors. Memory Allocation and Protection provides program and system integrity. Dual processor ECLIPSE systems provide system availability and integrity through redundancy. These features deliver the kind of total system reliability critical applications demand. Applications like communications processing, real-time process control, and on-line data base management.

ADAPTABLE DESIGN MEANS SUITABILITY

ECLIPSE's design adapts to changing requirements. Writable Control Store lets users access ECLIPSE's microprogrammed processor for fast execution of custom instructions. Core and semiconductor memories can be mixed in one system for computational speed or economy. And ECLIPSE can be configured into single-processor, dual-processor, multiprocessor, and distributed computing systems.

ECLIPSE IS THE COMPLETE COMPUTER SYSTEM

Throughput.

Economy.

Availability.

Suitability.

All these features make ECLIPSE ideal for computation, communications, data processing, and instrumentation and control applications.

ECLIPSE. The one compact, general-purpose computer in the world that gives you every important computing capability you need.

FEATURES

ARCHITECTURE DESIGNED TO OPTIMIZE SYSTEM THROUGHPUT

- Comprehensive instruction set customized for operating systems and high-level language compilers. The set includes word, byte, and bit manipulation; extensive shift and logical operations; signed and unsigned integer multiply/divide; and block data movement.
- Extensive hardware stack mechanisms for fast subroutine linkage and context switching in real-time, reentrant environments
- Flexible 16-level interrupt system optimized for operating system use
- Memory Allocation and Protection with dynamic address translation, expansion to 256K bytes main memory, write and address protection, and individual I/O device protection
- High-speed, multi-accumulator Floating Point Processor featuring 32-bit and 64-bit formats, parallel processing, and 56 instructions
- Dynamic user access to the 56-bit, 200-nanosecond microprogrammed processor via Writable Control Store
- Upward compatibility with Data General NOVA® computer peripherals and software

HIGH PERFORMANCE "INTELLIGENT" MEMORY SYSTEM

- Economical core and fast semiconductor memory mixed in a single system for configuration flexibility
- High-speed bipolar cache that front-ends MOS semiconductor memory to dramatically improve performance
- Automatic error checking and correction of main memory errors
- Memory interleaving and overlapping that significantly reduce instruction execution times

COMPLETE RANGE OF SOPHISTICATED SYSTEM SOFTWARE

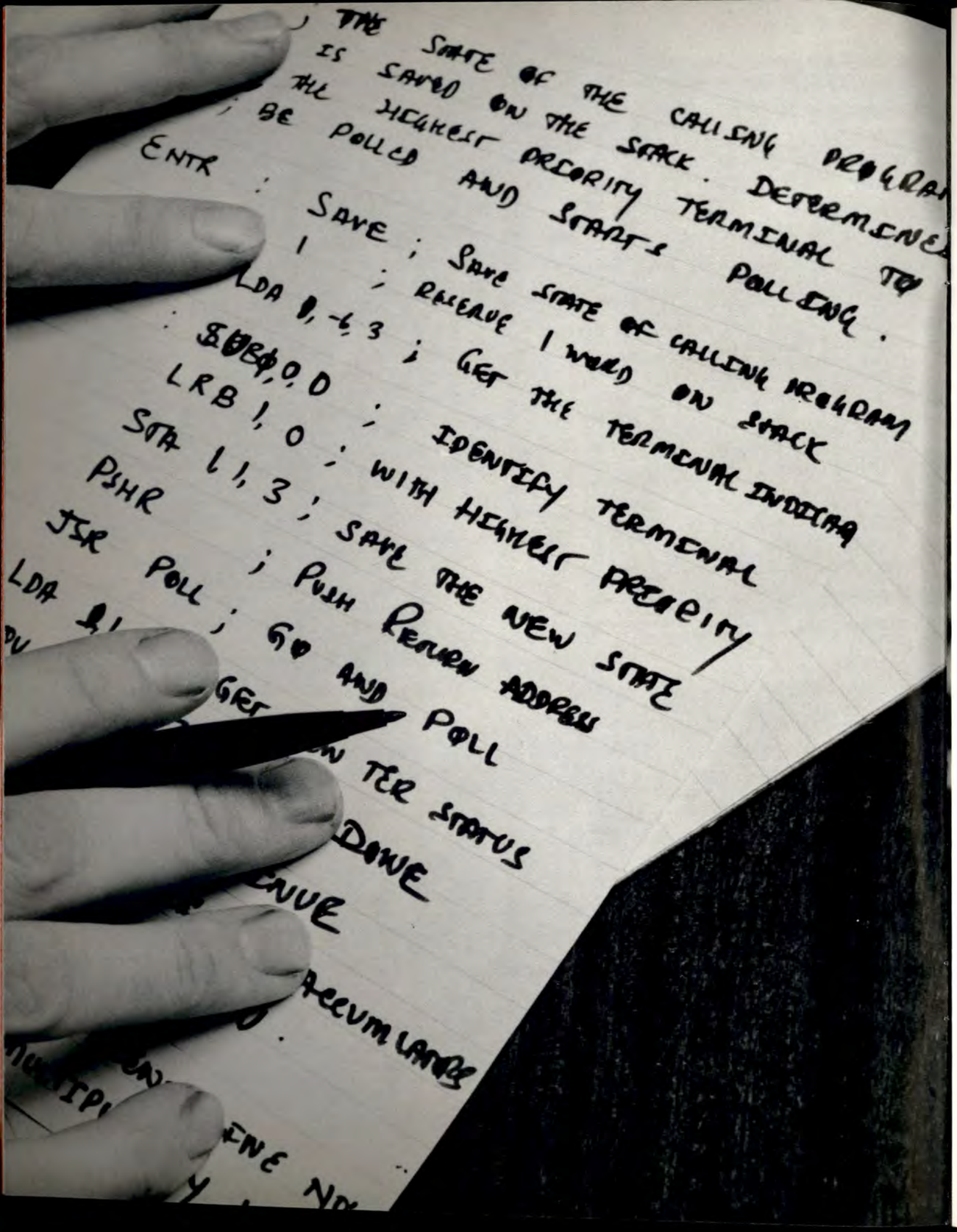
- Family of compatible operating systems
- High-level languages like Fortran 5, Fortran IV, Algol, and Extended BASIC

COMPLETE LINE OF PERIPHERALS AND INPUT/OUTPUT DEVICES

SINGLE-PROCESSOR, DUAL PROCESSOR, MULTIPROCESSOR, AND DISTRIBUTED COMPUTING SYSTEMS

WORLDWIDE CUSTOMER SUPPORT ORGANIZATION THAT INCLUDES SERVICE, SOFTWARE SUPPORT, TRAINING, AND USER'S GROUP

ECLIPSE combines features ideal for demanding real-time applications.



Single ECLIPSE instructions replace subroutines.

ARCHITECTURE

COMPREHENSIVE INSTRUCTION SET

All ECLIPSE computers have a microprogrammed architecture that incorporates a comprehensive instruction set. Instructions include:

- 16-bit and 32-bit instructions
- Block, word, byte, and bit manipulation
- Fixed point signed and unsigned multiply/divide arithmetic
- Direct, indirect, indexed, immediate and extended addressing
- Decimal arithmetic
- Extensive logical operations
- Single-word and double-word shifts, including hexadecimal shifts
- Single-precision and double-precision floating point instructions
- Simplified input/output instructions for easy, efficient peripheral handling
- Extended operation (XOP) for subroutines and Writable Control Store
- Upward compatibility with NOVA computer instruction set

Single instructions do work normally done by subroutines in operating systems and high-level language compilers. For example, the ECLIPSE computer DISPATCH ABSOLUTE instruction does most of the processing typically done by a Fortran-computed GO TO statement. The LOCATE AND RESET LEAD BIT instruction lets ECLIPSE operating systems quickly identify and allocate an available disc block. A BLOCK MOVE instruction moves data blocks between memory buffers. A complete set of logical operations and bit manipulation instructions is provided for data communications and process control applications.

Instructions come in both 16-bit single-word and 32-bit double-word formats so users can choose between memory economy and addressing range.

EXTENDED HARDWARE STACK FACILITY

All ECLIPSE computers use an extended last-in, first-out hardware stack facility to do operations complicated software algorithms normally do, but faster and more flexibly. An ECLIPSE stack is a series of variable-length temporary storage areas called frames, each easily assigned and randomly addressed. A single SAVE instruction allocates the frame, saves the entire machine state, and sets a pointer to the frame area. A single RETURN instruction reverses the entire procedure. This ECLIPSE random access stack is far more efficient than traditional serial access stacks. It results in fast subroutine linkages, rapid context switching, and high system throughput in reentrant high-level language and operating system environments.

Stack manipulation instructions give users complete flexibility to specify arguments saved on or restored from the stack. A single instruction pushes or pops multiple registers. Stack limits are dynamically assigned, with or without automatic overflow and underflow protection.

INTERRUPT PROCESSING

The ECLIPSE computer's fast interrupt facility handles even the most time-critical events. Real-time operating system interrupt servicing is in hardware, rather than slower software routines. The servicing can be tailored to individual peripheral devices and applications, with the powerful VECTOR instruction.

For simple interrupt processing, VECTOR combines fast service with minimum system overhead. The instruction identifies the interrupting device, then directly transfers control to the device handler, all in about 2.7 microseconds (4-way interleaved core). For the most complete interrupt processing, VECTOR identifies the interrupting device, switches from user stack to interrupt stack, saves the machine state, establishes a new priority, reenables interrupts, then transfers control to the device handler. VECTOR typically performs even this most complex function in only 18 microseconds (4-way interleaved core).

This vector/stack facility produces extremely fast interrupt servicing, and high system throughput. At the same time, it allows the computer's 16-level priority structure and interrupt servicing to be easily altered for specific devices and applications.

MEMORY ALLOCATION AND PROTECTION

The ECLIPSE Memory Allocation and Protection (MAP) provides program and data integrity in multi-user environments. It provides hardware protection between user programs, and between a program and the operating system.

MAP manages up to 256K bytes of main memory resource. It allocates memory to each user in 2K byte blocks, up to 32 blocks at a time. The blocks are small enough to make efficient memory use, yet large enough to keep system overhead to a minimum. The same block of physical memory can be allocated to more than one user, allowing procedure and data sharing among users.

MAP simultaneously holds three dynamic address translation maps—two user maps and a data channel map. The two user maps speed context switching. The separate data channel map lets I/O activity of one user overlap with another's program execution.

In addition to address translation, MAP provides several kinds of protection. Blocks can be write-protected so users cannot alter them, important when physical memory is shared. Individual input/output devices can be made accessible or inaccessible to a user. Each MAP protection function is enabled separately and easily, letting the operating system handle users with widely differing requirements.

ARCHITECTURE

FLOATING POINT PROCESSOR

The ECLIPSE multi-accumulator Floating Point Processor performs extremely fast single-precision and double-precision floating point arithmetic. High-level languages like Data General's Fortran 5 and Extended BASIC make extensive use of the Processor, producing high system throughput in computational applications.

The Processor has four separate 64-bit floating point accumulators for floating point arithmetic. Operands stored in these accumulators are quickly available for floating point manipulation, especially in iterative processes like sine and cosine calculations.

The Floating Point Processor operates in parallel with the computer's central processor. High-speed floating point arithmetic can therefore be performed simultaneously with other instruction processing.

In addition to four floating point accumulators, the Processor contains a 32-bit status register that controls and monitors the status of the Floating Point Processor. The register signals faults including exponent overflow and underflow, zero divisor, and mantissa overflow. This fault detection gives Fortran 5 users extensive diagnostic messages.

There are 56 comprehensive floating point instructions that perform single- or double-precision floating point arithmetic.

Instructions PUSH or POP the entire Floating Point Processor state on or off the user stack, an extremely useful feature for rapid context switching. FIX and FLOAT instructions allow convenient double-precision integer arithmetic with the Floating Point Processor.

The performance of ECLIPSE's Floating Point Processor is comparable to large computers'. For example, a double-precision floating point ADD takes only 2.4 microseconds.

WRITABLE CONTROL STORE

Writable Control Store gives users access to ECLIPSE's 200-nanosecond microprogrammed processor, where user-defined instructions execute at high speed. Writable Control Store can significantly increase throughput in high-speed applications. Users access this part of the microprogrammed processor through a single XOP instruction. Writable Control Store is dynamically loaded under program control. This easy-load facility lets users rapidly reprogram Writable Control Store to reflect changing requirements of specific applications.

CONSOLE FEATURES

The ECLIPSE programmer's console has an Address Compare facility to simplify debugging of real-time assembly programs. In MONITOR mode, the console displays contents of any memory location addressed by data switches, while the program is running. This lets users monitor program action on any memory location.

In STOP/ADDRESS mode, the facility implements a hardware breakpoint that lets users track program flow. It monitors the central processor and stops it if it tries to read or write the addressed locations. Console lights show the instruction and the instruction address attempting the access.

In STOP/STORE mode, the facility monitors the central processor and stops it if it tries to alter the addressed memory location. Console address lights show the address of the instruction attempting to alter the location. Data lights show the actual instruction.

High-performance Floating Point Processor works in parallel with the central processor.

MEMORY SYSTEMS

ASYNCHRONOUS BUS

All ECLIPSE central processor units have a common clocked asynchronous memory interface for all memories. This allows mixing different memory technologies and speeds in any proportion.

If speed is important, ECLIPSE computers use semiconductor memories. For economy, they use core memories. If both speed and economy are important, ECLIPSE computers mix memory types. The effective instruction execution time of the computer then depends on which memory module is being accessed. All memory modules have a 16K byte capacity.

CACHE MEMORIES FOR HIGH SYSTEM THROUGHPUT

Cache memories make fast memories run faster. Each ECLIPSE semiconductor memory module has a bipolar cache with an extremely fast, 200-nanosecond cycle time. Each cache is sixteen 16-bit words, arranged into 4-word blocks. When the processor addresses semiconductor memory, it checks both cache and MOS memory. If the addressed word is in cache, it goes to the central processor in 200 nanoseconds. If the addressed word is not in cache, it is transferred from MOS memory to the central processor in 700 nanoseconds. At the same time, the cache is loaded from MOS with four sequential words including the addressed word.

Cache locations accept data through a Least-Recently-Used (LRU) algorithm. LRU clears out least-needed data to ensure that cache, not MOS memory, is addressed most often.

Interleaving semiconductor memories increases the number of sequential memory locations in cache. In four-way interleaving, for example, sixty-four sequentially addressed cache words can be addressed with a 200-nanosecond cycle time.

Cache memories yield cycle times as low as 200 nanoseconds.

MEMORY SYSTEMS

DATA INTEGRITY

ECLIPSE's Error Checking and Correction (ERCC) provides users maximum data integrity and system use for critical applications. It detects and corrects all single-bit main memory errors and detects the majority of multiple-bit errors.

Error Checking and Correction is available on core and semiconductor memories. It adds a 5-bit check field to each 16-bit memory word. Check field contents are constructed each time the memory location is written. When the memory location is read, check field contents are again constructed. If the two fields match, the data is immediately transmitted to the central processor.

When check field contents do not match, an error has occurred. ERCC corrects all single-bit errors in 200-800 nanoseconds, depending on the memory type, then sends corrected data to the central processor. This lets users continue their full system operation, even though a memory module may be failing.

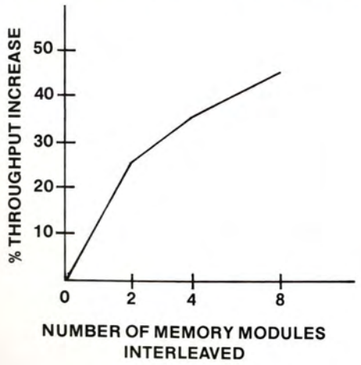
Error Checking and Correction gives users an easy way to automatically log errors. It also simplifies trouble-shooting by isolating memory errors to a single module, word, and bit. These features let users schedule maintenance around operations rather than operations around maintenance.

HIGH SPEED INTERLEAVING/OVERLAPPING

ECLIPSE computers interleave and overlap memories to increase speed and system throughput. Interleaving puts sequential memory locations on different modules. Both core and semiconductor ECLIPSE memories can be interleaved two and four ways. Core memories can be interleaved eight ways. In four-way core interleaving, for example, each of four consecutive memory locations is on a separate memory module.

Since successive locations are on separate memory modules, and since ECLIPSE computer microinstructions are overlapped, ECLIPSE accesses the next sequential location before it completely finishes processing the previous location.

The effect on instruction execution time is dramatic. A four-way core-interleaved system reduces a 1400 nanosecond LOAD ACCUMULATOR instruction to 800 nanoseconds. The more modules interleaved, the faster the memory cycle time. Users get higher performance when they need it most, in large memory configurations.



Interleaving increases core and semiconductor memory speed most in large memory configurations.

SOFTWARE

ECLIPSE is the first time a new generation of computers has been introduced with such extensive system software. Software based on highly successful concepts, field-proven in over 12,000 NOVA computer installations.

The nucleus of this powerful software is Data General's real-time, disc-based operating system. It supports language compilers like Fortran 5 and Algol, subsystems like Timesharing BASIC and Batch, and application programs like the 2780 emulator. The resulting file and data compatibility greatly simplify programming and system implementation.

REAL-TIME DISC OPERATING SYSTEM/MAPPED REAL-TIME DISC OPERATING SYSTEM

- Dual operations
- Multitasking monitor
- Total system integrity
- Powerful file management structure
- Common input/output interface
- Background checkpointing
- User program segmentation by swaps, chains, and overlays
- Easy operator communications
- Intertask communication/ synchronization
- Multiprocessor/shared disc support
- High-level language support
- Extensive utility software
- Easy system customization
- RTOS, SOS compatibility

ECLIPSE computers operate with two real-time, disc-based operating systems. Both the Real-time Disc Operating System (RDOS) and the Mapped Real-time Disc Operating System (MRDOS) are fully integrated disc systems. They support a wide variety of real-time, multi-user and batch processing applications, using the complete range of ECLIPSE hardware and software. MRDOS also supports dual operations that allow two independent environments to operate concurrently.

REAL-TIME OPERATING SYSTEM

The Real-Time Operating System (RTOS) is a compatible subset of RDOS/MRDOS. Application programs written under RDOS/MRDOS can execute under RTOS. RTOS provides a modular interface to user programs, for task and I/O management in real-time, multitasking environments. Application programs can be written in Fortran IV, Fortran 5, and assembly language.

STAND-ALONE OPERATING SYSTEM

For program development in non-disc environments, the Stand-alone Operating System (SOS) is a compatible subset of RDOS/MRDOS. SOS lets users edit, assemble, compile, or execute programs stored on paper, magnetic, or cassette tape.

ECLIPSE's real-time disc operating systems manage system resources in real-time, multi-programming environments.

SOFTWARE

EXTENDED FORTRAN 5

- Global code optimization
- Comprehensive error checking and diagnostics
- Reentrant code
- Full mixed-mode numeric conversion
- Acceptance of any expression as a control variable or parameter in a DO statement or DO-implied list
- Generic library functions
- Multiple entry points to subprograms

Data General's Extended Fortran 5 is the most powerful Fortran ever available on a small computer. It is a superset of Data General's Fortran IV, ANSI Fortran, IBM Fortran IV (H extended), and Univac Fortran V. Its superset nature makes conversion from other machines easy. Fortran 5 has the real-time features of Data General's Fortran IV. Other extensions include static and dynamic storage allocation, PARAMETER declaration, and statement functions expanded as in-line code. Fortran 5 globally optimizes user source programs to produce object code that minimizes execution time. The compiler features nearly 250 easily interpreted error messages at compile time for fast program development.

REAL-TIME FORTRAN IV

Data General's real-time Fortran IV gives ECLIPSE computer users the processing facilities of large-scale computers. It is ANSI Fortran IV with important features for real-time and multi-terminal applications: ISA real-time extensions, reentrant code, multitasking, easy interfacing to assembly language subroutines and tasks, and operation under SOS, RTOS, RDOS or MRDOS. It is also extended Fortran IV, allowing lower as well as upper bounds for array dimensions, mixed mode expressions, strings within quotes, conditional subroutine returns, and recursive subroutines. Extensions have been provided so communication systems can be implemented using real-time Fortran.

EXTENDED BASIC

- Complete resource management and program development support for 32 users
- Extensive data base access
- Private subdirectory/subpartition allocation to each user
- Sharing of user files
- System accounting
- Keyboard operation mode
- Interactive syntax checking at program entry
- Matrix and string variable operations
- Fortran- and Algol-compatible format for floating point number storage
- Expanded output formatting including picture specifications
- Non-LET assignment statements
- Generalized IF statement

BASIC is the most widely used interactive language available. It comes in both multi-user and single-user versions, both widely enhanced implementations of the BASIC language developed at Dartmouth College. Data General's BASIC includes string and matrix extensions, and even allows complete matrices to be read or written in a single I/O call. In addition, Extended BASIC allows accessing of multiple peripheral devices under control of RDOS, in a formatted ASCII, unformatted ASCII, or binary I/O mode.

EXTENDED ALGOL

Extended Algol has the features of Algol 60. Extensions allow the use of character strings, pointer and based variables, and subscripted labels. This version of Algol also provides virtually unlimited precision arithmetic, with up to 60 digits of precision. Extended Algol is so powerful that Data General has used it as a systems programming language to write compilers.

2780 EMULATOR

The Remote Synchronous Terminal Control Program (RSTCP) turns ECLIPSE computers into remote intelligent data terminals, by allowing point-to-point communication with an IBM 360/370 or any Data General computer. RSTCP runs in small core-memory systems under RTOS. Under RDOS/MRDOS, RSTCP implementation becomes very powerful, allowing transmission to and from disc and tape files, in addition to card readers and line printers.

COMMUNICATIONS SOFTWARE

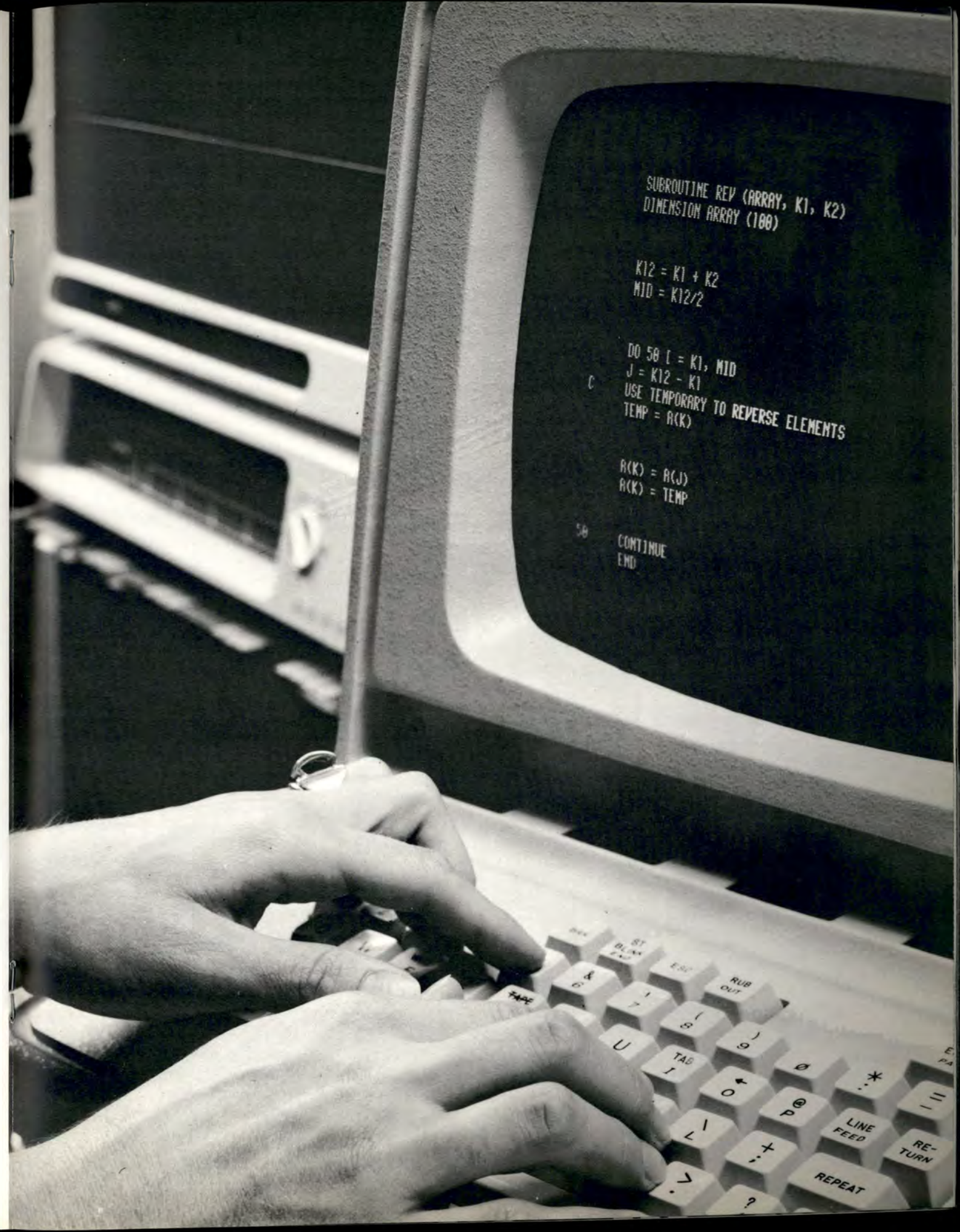
A library of communications software is available for operation under RDOS, MRDOS, or RTOS.

- Device-independent drivers for single- and multi-line synchronous and asynchronous adapters, with full modem control
- Device-independent drivers for computer-to-computer communications including:
  - IBM 360/370 channel interface for direct connection to IBM 360/370
  - Multiprocessor Communications Adapter for networks of up to 15 Data General computers
  - High-speed DMA-controlled synchronous adapters
- Fortran-callable IBM Binary Synchronous Communication support package

UTILITY LIBRARY

A variety of utility software is available with ECLIPSE computers.

- A Batch command interpreter/job supervisor executes stacked jobs, with system direction through job control commands.
- Dataplot is a series of Fortran-callable routines for character generation, line drawing, axis rotation, and other functions using digital incremental plotters.
- The Commercial Subroutine Package is a superset of the IBM 1130 Commercial Subroutine Package, callable from Fortran for data and format conversions, and extended precision integer arithmetic.
- The Real-Time Input/Output System is a Fortran-callable library to support analog-to-digital, digital-to-analog, and digital input/output interfaces.
- RDOS Sort/Merge program is a utility that allows sorting and merging disc or tape files by user-specified keys.
- A MACRO assembler includes an extensive macro library.
- Text editors allow source program creation and modification for 1 to 20 users.
- A symbolic debugger lets users employ symbolic names rather than absolute addresses, and greatly speeds program debugging.



High-level language processors give users easy access to ECLIPSE's high-performance.

PERIPHERALS · INPUT/OUTPUT · COMMUNICATIONS

PERIPHERALS

FIXED HEAD DISCS
- Fast, 8.4 millisecond average access time
- 256K to 1536K byte capacity per drive
- Up to 8 million bytes total storage
- Can be shared between two Data General computers

MOVING HEAD DISC CARTRIDGE DRIVES
- Convenient mass storage
- Removable cartridge and 2.494 million byte capacity
- Fixed, removable cartridges and 4.988 million byte capacity
- Up to 20 million bytes total storage
- Can be shared between two Data General computers

MOVING HEAD DISC PACK DRIVES
- High storage capacity
- 6.236, 24.498 or 89.498 million byte capacity per drive
- 30 to 35 millisecond average access time
- Up to 715 million bytes total storage
- Can be shared between two Data General computers

MAGNETIC TAPE SUBSYSTEMS
- 7-track and 9-track
- 800 and 1600 bpi
- 12.5 to 75 inches per second
- Up to 16 transports per computer

TAPE CASSETTES
- 1600 byte/second average transfer rate
- 134K byte storage capacity
- Full-width, single-track recording
- Read-after-write head configuration
- Up to 16 drives per computer

LINE PRINTERS
- 80 and 136 column formats
- 64- and 96-character ASCII sets
- 300 to 1100 lines per minute
- 165 characters/second, 132 character/line matrix printer

CARD READERS
- Punched and mark sense
- 150 to 1000 cards per minute

PERFORATED TAPE UNITS
- 8-channel
- 400 characters/second, reader
- 63 characters/second, punch

PLOTTERS
- Drum, flatbed, Z-fold models
- 200 or 300 increments/second

VIDEO DISPLAY TERMINAL
- Variable code structure
- Full-duplex or half-duplex operation
- 110 to 4800 baud
- 1920 flicker-free characters
- 24 80-character lines
- Operates in roll, page, or page-buffered mode
- Hardware-protected background formatting

TELETYPEWRITERS
- 10 and 15 characters/second

INPUT/OUTPUT

ANALOG INPUT SYSTEMS
- Single-ended and differential inputs
- 1 to 256 channels
- 8 to 15 bits
- 75KHz maximum system conversion rate

WIDE-RANGE ANALOG INPUT SUBSYSTEMS
- Up to 512 channels
- Several programmable input voltages from ±2.5mV to 10.24V
- Integrating analog-to-digital converters

DIGITAL-TO-ANALOG DEVICES
- Up to 24 channels
- 8 to 14 bits
- Plotter and scope control interfaces available

DIGITAL INPUT/OUTPUT
- 16 to 1024 total points
- Variety of signal levels and types, including DC, AC, TTL, pulse, common alarm, and relay contact operations
- Modular construction

GENERAL-PURPOSE INTERFACE AND WIRING BOARDS

COMMUNICATIONS ADAPTERS

A complete range of communications adapters turns ECLIPSE computers into front-end processors, remote concentrators, message switching systems, and multi-function remote intelligent terminal systems.

SINGLE-LINE ASYNCHRONOUS ADAPTERS
- Current loop or EIA modem control interface
- Up to 9600 baud

MULTI-LINE ASYNCHRONOUS ADAPTERS
- Up to 9600 baud
- 4 to 64 lines
- 4-line increments

LARGE MULTI-LINE ASYNCHRONOUS ADAPTERS
- Up to 2400 baud
- Current loop interface or EIA-232C with full modem control
- Up to 128 lines/system
- 2-line and 4-line increments
- Program-controlled single-line switching between dual computers

SINGLE-LINE SYNCHRONOUS ADAPTERS
- Full modem control
- Up to 9600 baud (programmed input/output) with standard IBM BISYNCH protocol supported
- Up to 50K baud (data channel input/output)

MULTI-LINE SNYCHRONOUS ADAPTERS
- Up to 9600 baud
- 4-line increments
- 4 to 64 lines
- Standard IBM BISYNCH protocol supported

INTER-COMPUTER ADAPTERS
- IBM 360/370 channel adapter
- Multiprocessor Communications Adapter for networks of up to 15 Data General computers
- Interprocessor Bus for dual computer/shared disc systems

ECLIPSE comes with a complete line of peripherals, input/output devices, and communications adapters.

CONFIGURATIONS

ECLIPSE computers are available in single-processor, dual-processor, multi-processor, and distributed computing systems. All are fully supported by Data General's real-time disc operating systems and high-level languages.

HIGH-SPEED COMPUTATION

SINGLE-PROCESSOR/DUAL OPERATIONS ECLIPSE COMPUTER SYSTEM

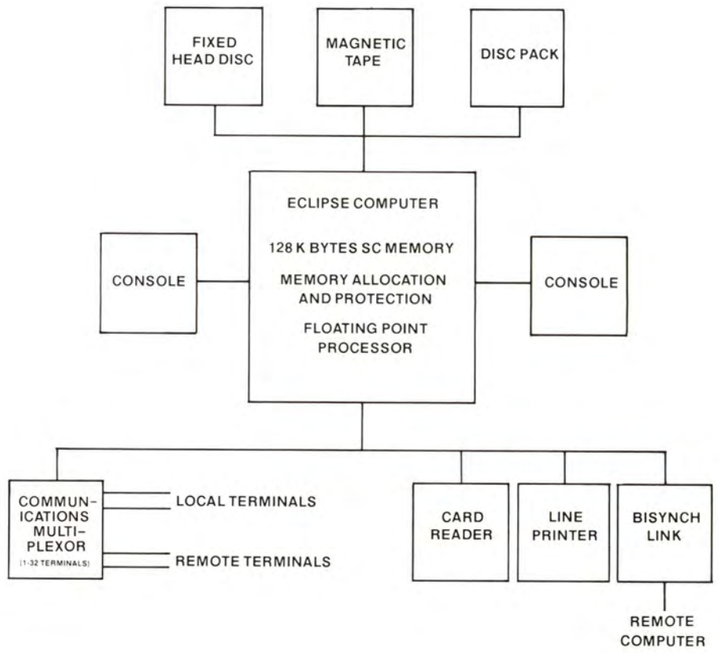
- Concurrent timesharing and Batch, or timesharing and RJE
- Up to 32 local or remote timeshared terminals
- 128K bytes of fast semiconductor memory
- High-speed Floating Point Processor
- Fast-access fixed head disc for program swapping
- Large-capacity disc pack for program and data storage
- Industry-compatible magnetic tape for economical system back-up

This typical ECLIPSE computer system is a high-speed computational facility that supports a dual operations environment. One dual operations partition provides an interactive Extended BASIC capability for up to 32 users. The second partition concurrently supports a Batch stream or a remote intelligent data terminal capability (IBM 2780 emulator).

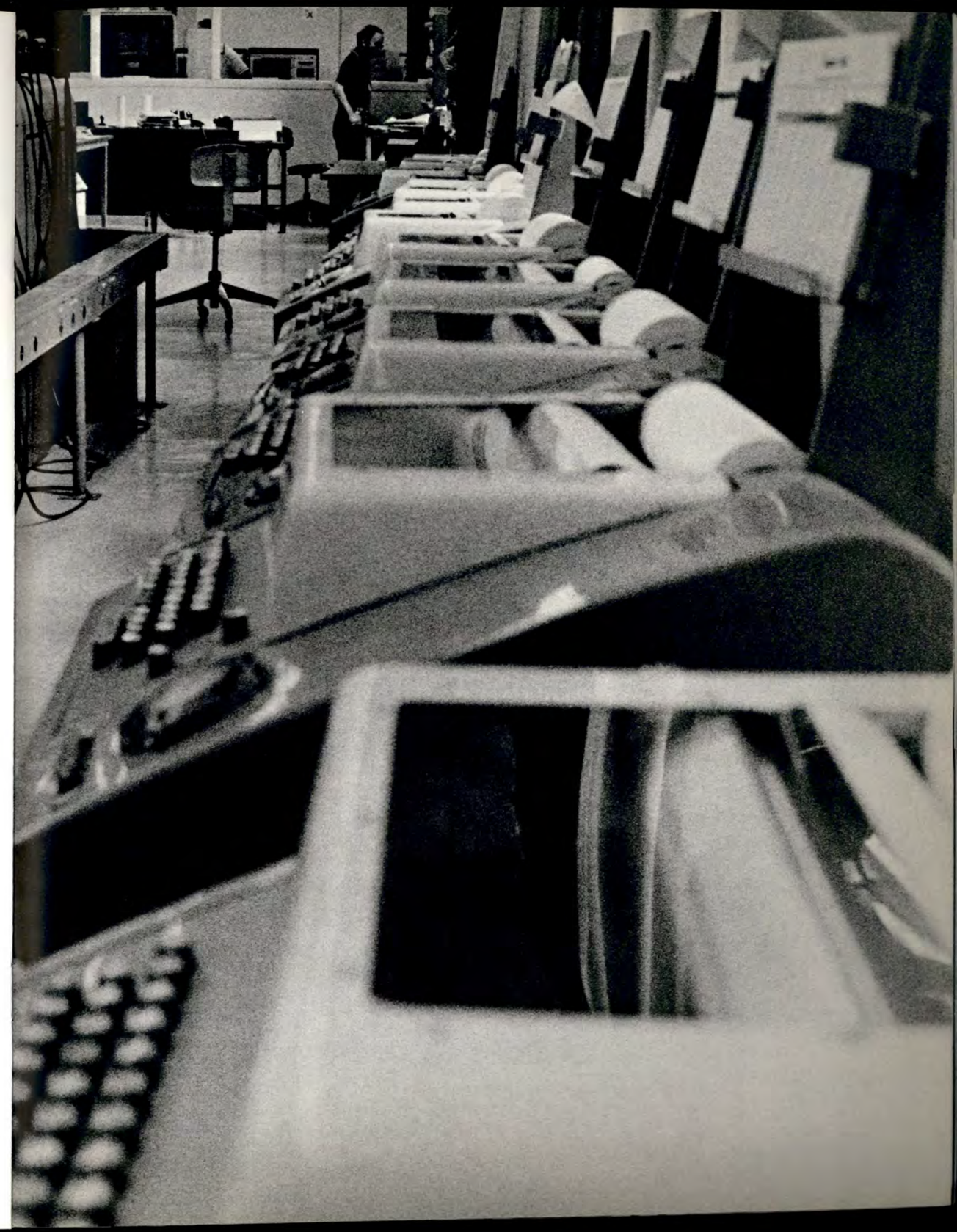
This dual operations capability is ideal for users who need a substantial stand-alone computational system *and* remote host computer access. The latter is often necessary for very large computational tasks, or access to remote data bases. Typical users include local campuses in a statewide college network, engineering departments in large manufacturing companies, or commercial timesharing service suppliers.

High-speed semiconductor memory, fast Floating Point Processor, and fast-access swapping disc all enhance system performance. Memory Allocation and Protection assures system integrity by providing hardware protection between the two user environments and the operating system.

The entire system operates under the Mapped Real-time Disc Operating System. This assures file compatibility between interactive BASIC users, and Batch users operating in Fortran 5, Fortran IV, Algol, or assembly language.



High-speed timeshared computation uses ECLIPSE fast semiconductor memory, Floating Point Processor, and 32-terminal capacity.



CONFIGURATIONS

REDUNDANT COMMUNICATIONS DUAL PROCESSOR ECLIPSE COMPUTER SYSTEM

- Redundant computers for high system availability
- Shared discs for complete system back-up
- Two computers for high throughput during peak loads
- Communications processing and interactive computation
- Reliable core memories with Error Checking and Correction for data integrity
- Direct channel interface to IBM 360/370

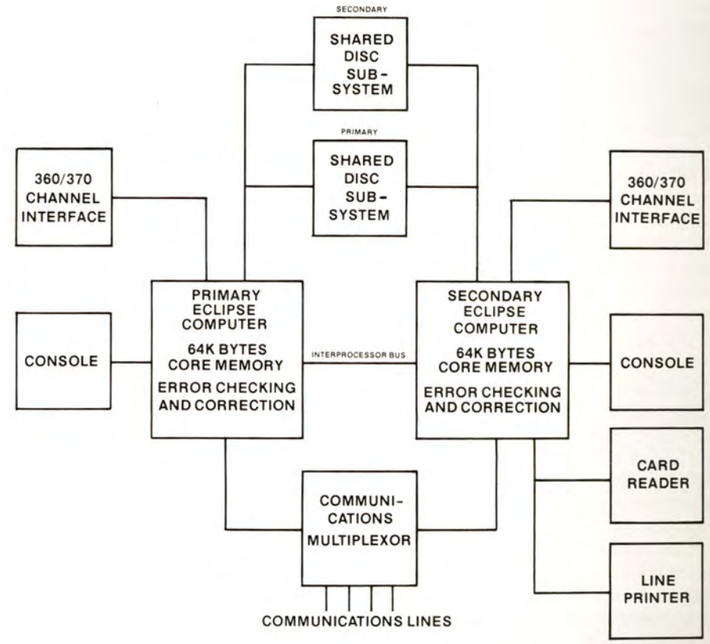
This typical dual processing system provides front end communications processing that relieves the host computer of time-consuming terminal handling. Because a large number of terminals is involved, uninterrupted system operation is highly important. High availability is achieved by two separate computers that share common storage.

One computer normally handles the front end communications operations. A second is available either for peak load communications traffic or for independent operations like interactive computations. The two are connected through an Interprocessor Bus that lets one processor monitor the other.

In case the communications processor requires maintenance, the computation processor is immediately available to take over front end processing. A Multiline Asynchronous Multiplexor Adapter switches communications lines from one computer to another, under program control. There is complete data base back-up as well, through a shared disc subsystem. Error Checking and Correction adds to high system availability, by detecting and *correcting* all single-bit main memory errors.

This unique dual computer facility is fully supported under Data General's Real-time Disc Operating System. The RDOS advanced directory/partitioning system provides disc file integrity even in a multi-user, dual computer environment.

Data communications uses redundant ECLIPSE computers for high system availability and Error Checking and Correction for data integrity.



CONFIGURATIONS

REAL-TIME SIMULATION
MULTIPROCESSOR ECLIPSE COMPUTER NETWORK

- Extremely high real-time computation capability
- Functional distribution of computers for easy expansion
- Fail soft capability

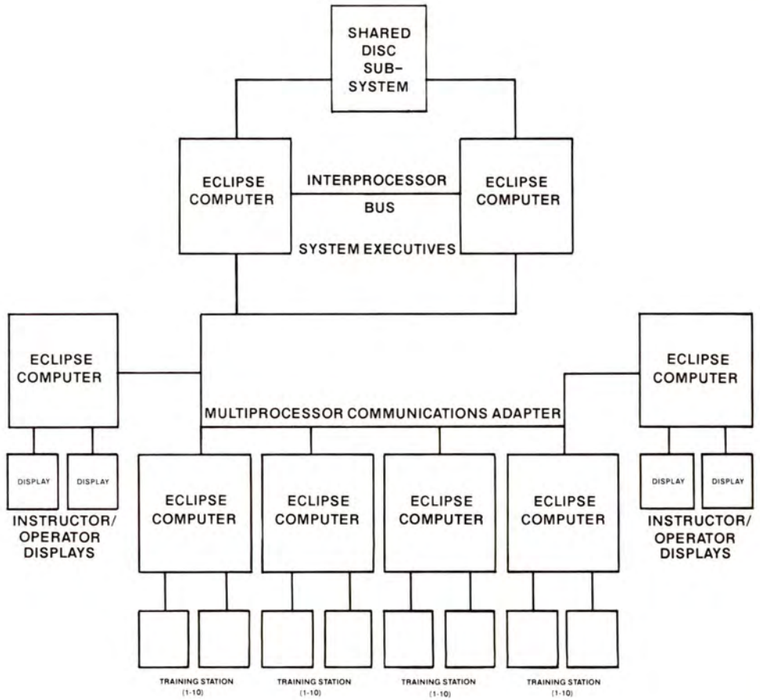
This ECLIPSE computer network is a real-time, high-performance simulation system with redundancy for high system availability.

In this example, eight communicating computers operate a training simulation system. The eight computers together manage a real-time computation load no single computer could handle alone.

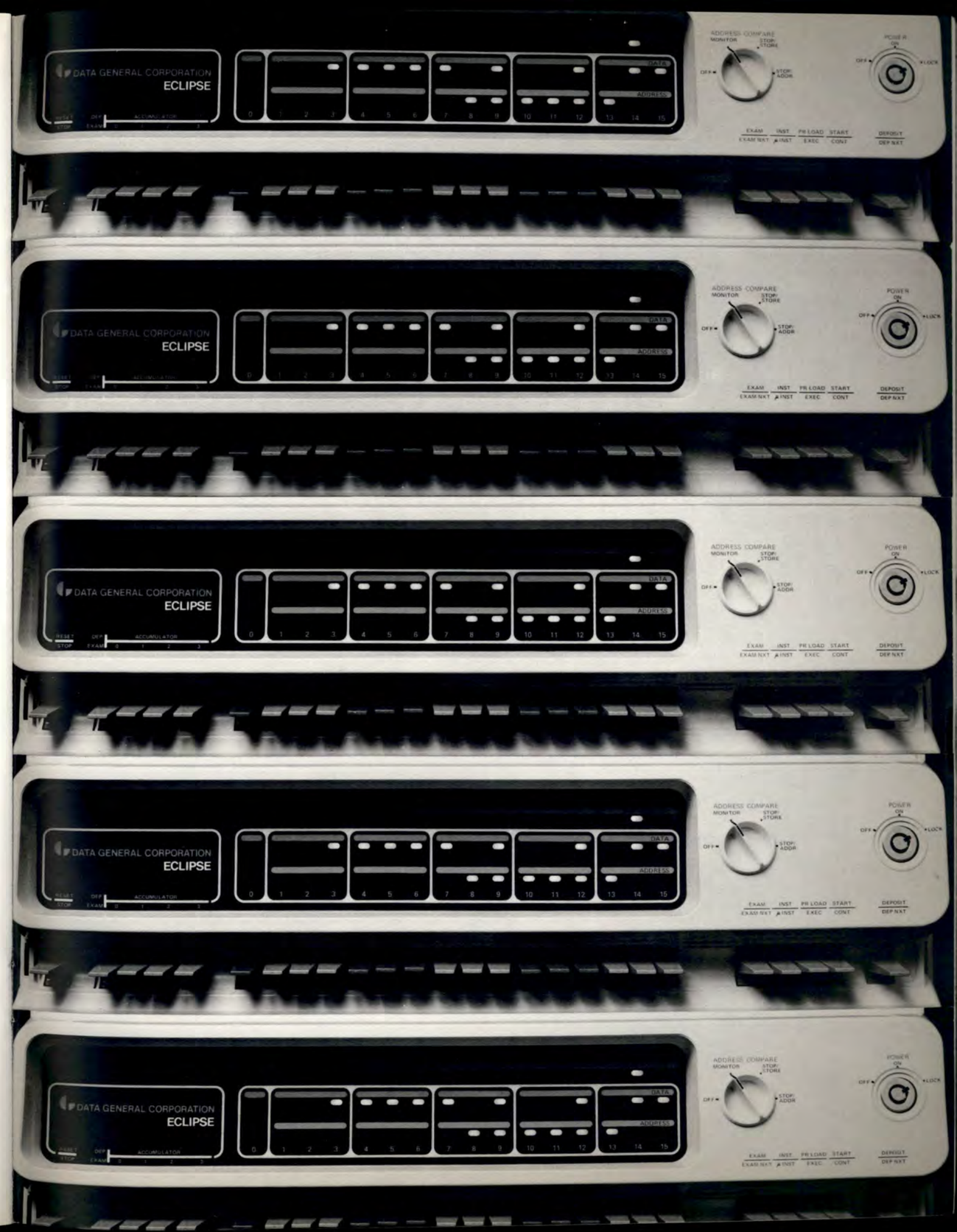
Four computers run 40 simulation stations. At each station, student pilots work model aircraft controls in response to graphic displays. The system performs all the complex, real-time computations that operate these displays and let stations simulate aircraft performance, fuel consumption, radio communication and navigation system operations on different aircraft. All stations can simulate the same mission, or two missions can be divided among them.

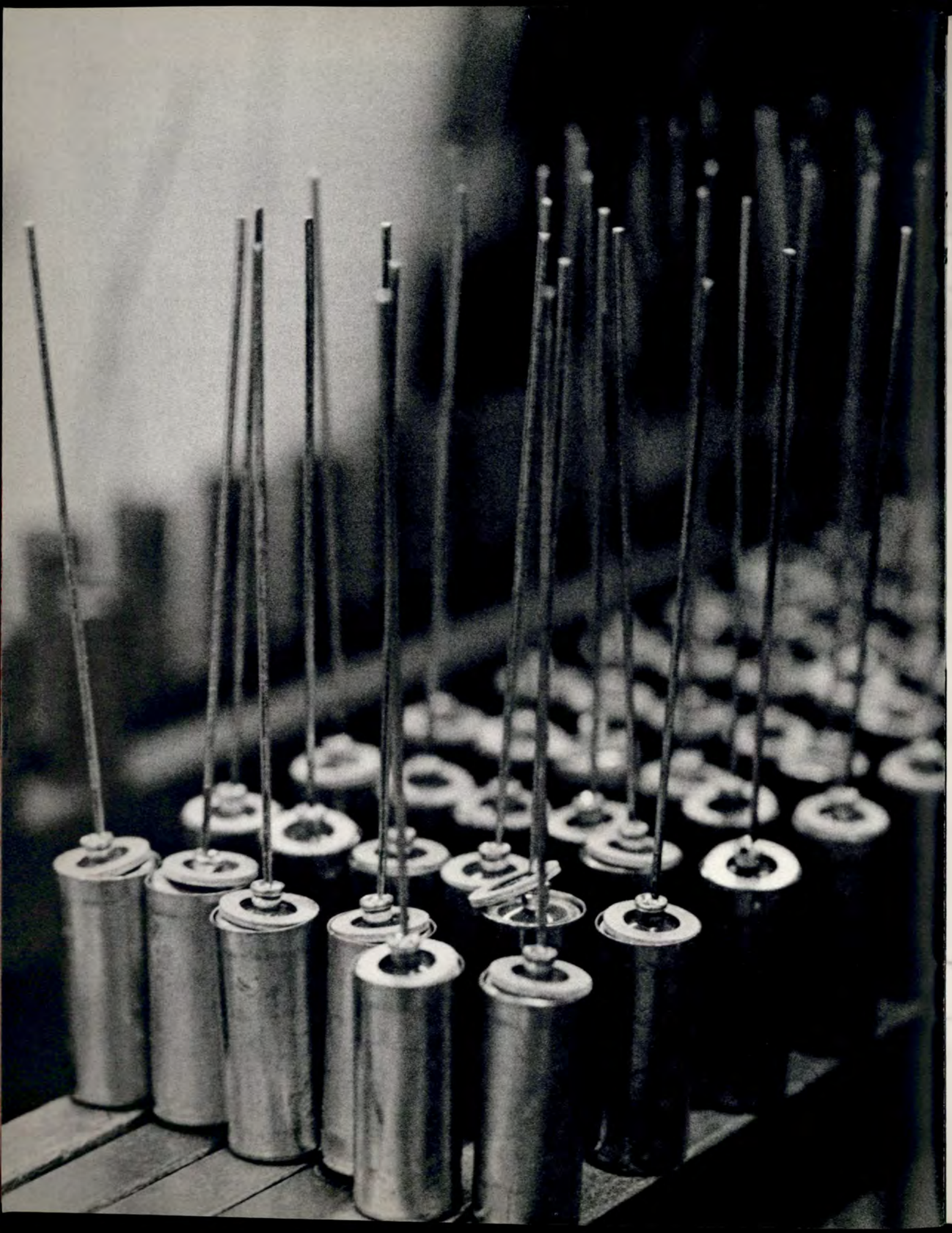
Two additional computers each control multiple visual displays that let instructors monitor individual student progress at any time. The remaining two computers are redundant system executives that share common disc storage and communicate through an Interprocessor Bus. If one computer in the pair requires maintenance, the second immediately assumes the executive function, and gives high system availability. Because the system computers are functionally distributed, system expansion is easy. And because multiple computers handle each function, users get a "fail soft" capability.

All computers in the network communicate through an RTOS/RDOS-supported Multiprocessor Communications Adapter that gives each computer access to any other in the system. The MCA is directly connected to each computer's I/O bus. It transfers data through high-speed data channels at up to 1,000,000 bytes per second. The MCA, and multiprocessor computing networks, are highly suitable for applications where large amounts of real-time data must be handled.



Multiprocessor ECLIPSE systems handle real-time computation loads no single computer could.





CONFIGURATIONS

ON-LINE PROCESS CONTROL DISTRIBUTED ECLIPSE COMPUTER NETWORK

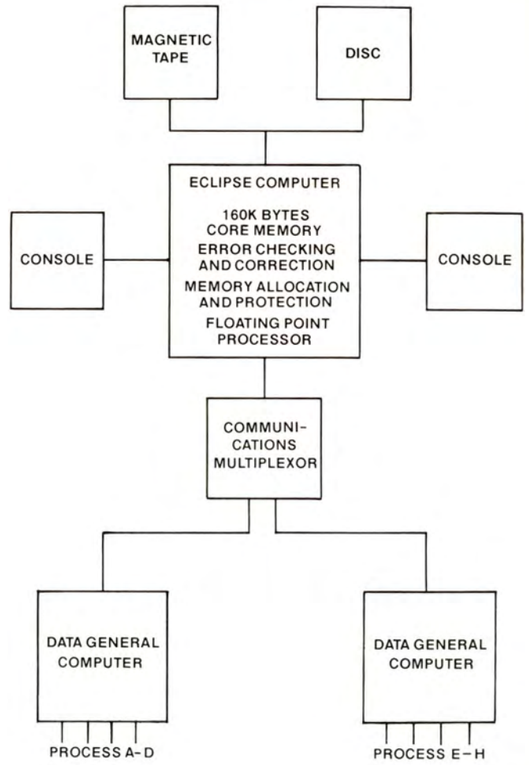
- Computing power at the operation
- System implementation in stages
- Reduced installation costs
- High system availability

This distributed computing system provides unified control of operations that occur at different levels in a company's hierarchy. At the same time, it allows on-line system implementation in easy stages. The entire distributed computing system is fully software-supported.

At the lowest computing levels, small, dedicated Data General computers support operations like furnace temperature control, or materials thickness monitoring. These dedicated computers can be any Data General model. They give individual operations all the computer power needed to control and respond to critical real-time events. They enhance overall system availability, since single-computer failure cannot disrupt the entire plant operation. And they can each be brought on-line individually.

A large dual operations ECLIPSE computer coordinates and controls overall system operations. One dual operations partition communicates with the dedicated computers. It gathers data from each process and responds with control information that optimizes overall plant operation. Since each process has its own local computer, only summarized information is transmitted, and communications facilities are kept to a minimum.

The second dual operations partition allows simultaneous program development for new applications, Batch computation, or management report generation. This distributed computing approach is highly valid for real-time process control applications. It is equally valid for any transaction-oriented, geographically deployed application.



Operations from process control to management information systems are handled by an ECLIPSE distributed computing system.

CUSTOMER SUPPORT

Data General believes that strong customer support is as important as the careful design and manufacture of its systems. That's why the Data General support organization is a worldwide network offering services ranging from system maintenance to in-depth system instruction. This comprehensive support organization lets users apply ECLIPSE to their applications.

SERVICE

Data General services all its products worldwide. On-call service is available on-site. Factory and depot service are regionally located.

On-call service contracts provide preventive maintenance and high priority remedial maintenance on-site, for a single monthly charge. On-site service is also available on a straight time-and-materials basis. Both types of field service are carried out by a highly trained service staff that has established a reputation for timely, efficient service. That record has been built on the combination of professional personnel and modular, easily serviced products.

Under a factory service contract, equipment returned to any repair depot is rapidly repaired for a monthly charge. Depot service is also done at reduced rates on a straight time-and-materials basis. Both types of service let qualified factory service personnel back-up users' technicians during critical periods.

SALES/APPLICATIONS ENGINEERS

Data General maintains a worldwide staff of sales and applications engineers. Sales engineers help users select and configure their systems. Highly qualified applications engineers are local software/hardware specialists that help users understand and apply their system to applications.

SOFTWARE SERVICES

Two software services give users the latest ECLIPSE software revisions. A Software Subscription Service provides automatic and timely updates of software and software documentation. The Service is available for a nominal annual subscription charge. A Summary of Available Software is available for ECLIPSE users not needing automatic software revisions. The Summary lists all current software and is available free of charge.

TRAINING

Data General training courses develop user operating and programming capabilities. Courses are 2-10 days long, and are repeated at frequent intervals at the Southboro, Massachusetts and El Segundo, California training centers. Courses are also offered at selected field locations.

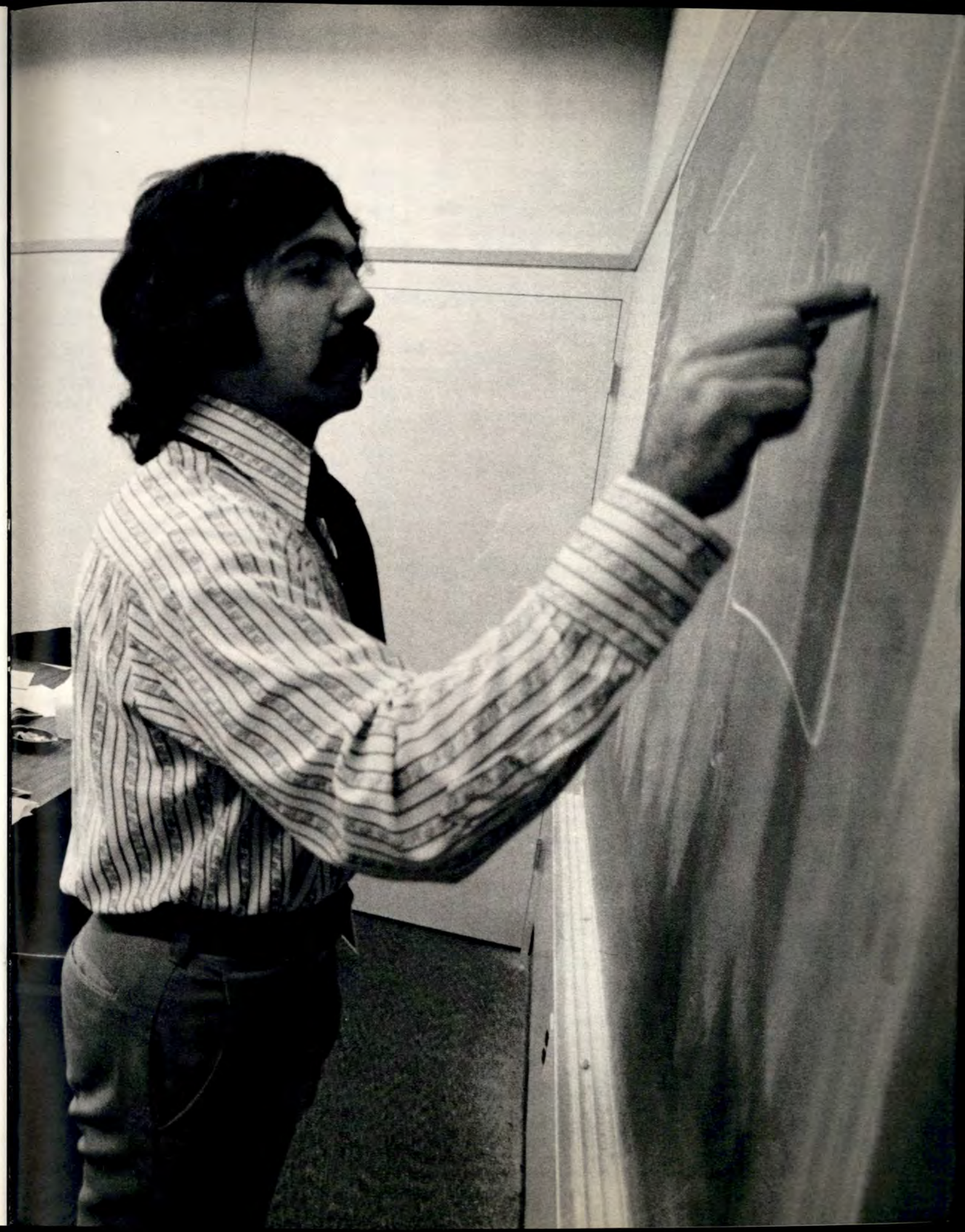
ECLIPSE computer hardware courses cover memory and central processor unit operations, logic and flow analysis, instruction repertoire, and operating procedures. Software courses range from fundamentals of programming to real-time operating systems. Additional training is available on peripherals, options, and controllers. Data General also offers custom on-site courses tailored to meet specific customer requirements.

CUSTOM PRODUCTS

An experienced technical Custom Products Group will quote on the design and fabrication of many special ECLIPSE computer interfaces.

USER'S GROUP

Data General's User's Group lets users exchange current systems and application information. The Group maintains a library of user-written programs, sponsors regional and national information meetings, and periodically publishes a newsletter. Membership in the group is free of charge with an ECLIPSE computer system purchase.



Data General's worldwide customer support includes training, service, sales/application engineering, custom products and User's Group.

ECLIPSE COMPUTER INSTRUCTION SET

FIXED POINT ARITHMETIC INSTRUCTIONS

Add	ADD
Add Immediate	ADI
Add Word Immediate	ADDI
Compare Limits	CLM
Complement	COM
Decimal Add	DAD
Decrement and Skip if Zero	DSZ
Decimal Subtract	DSB
Exchange Accumulators	XCH
Extended Decrement and Skip if Zero	EDSZ
Extended Increment and Skip if Zero	EISZ
Extended Load Accumulator	ELDA
Extended Store Accumulator	ESTA
Halve	HLV
Increment	INC
Increment and Skip if Zero	ISZ
Load Accumulator	LDA
Move	MOV
Negate	NEG
Sign Extend and Divide	DIVX
Signed Divide	DIVS
Signed Multiply	MULS
Skip if ACS>ACD	SGT
Skip if ACS≥ACD	SGE
Skip if Bit Non-Zero	SNB
Store Accumulator	STA
Subtract	SUB
Subtract Immediate	SBI
Unsigned Divide	DIV
Unsigned Multiply	MUL

LOGICAL INSTRUCTIONS

Add Complement	ADC
AND	AND
AND Immediate	ANDI
AND with Complemented Source	ANC
Exclusive OR	XOR
Exclusive OR Immediate	XORI
Inclusive OR	IOR
Inclusive OR Immediate	ORI

SHIFT INSTRUCTIONS

Double Hex Shift Left	DHXL
Double Hex Shift Right	DHXR
Double Logical Shift	DLSH
Hex Shift Left	HXL
Hex Shift Right	HXR
Logical Shift	LSH

BIT MANIPULATION INSTRUCTIONS

Count Bits	COB
Locate and Reset Lead Bit	LRB
Locate Lead Bit	LOB
Set Bit to One	BTO
Set Bit to Zero	BTZ
Skip on Zero Bit	SZB
Skip on Zero Bit and Set to One	SZBO

BYTE INSTRUCTIONS

Load Byte	LDB
Store Byte	STB

DATA MOVEMENT INSTRUCTIONS

Block Add and Move	BAM
Block Move	BLM

STACK INSTRUCTIONS

Modify Stack Pointer	MSP
Pop Block	POPB
Pop Multiple Accumulators	POP
Pop PC and Jump	POPJ
Push and Jump	PSHJ
Push Multiple Accumulators	PSH
Push Return Address	PSHR
Restore	RSTR
Return	RTN
Save	SAVE

FLOATING POINT INSTRUCTIONS

Absolute Value	FAB
Add Double (FPAC)	FAD
Add Double (Memory)	FAMD
Add Single (FPAC)	FAS
Add Single (Memory)	FAMS
Clear Errors	FCLE
Compare Floating Point	FCMP
Divide Double (FPAC)	FDD
Divide Double (Memory)	FDMD
Divide Single (FPAC)	FDS
Divide Single (Memory)	FDMS
Fix to AC	FFAS
Fix to Memory	FFMD
Float from AC	FLAS
Float from Memory	FLMD
Halve	FHLV
Load Double	FLDD
Load Exponen.	FEXP
Load Single	FLDS
Load Status	FLST
Move Floating Point	FMOV
Multiply Double (FPAC)	FMD
Multiply Double (Memory)	FMMD
Multiply Single (FPAC)	FMS
Multiply Single (Memory)	FMMS
Negate	FNEG
No Skip	FNS
Normalize	FNOM
Pop Floating Point State	FPOP
Push Floating Point State	FPSH
Read High Word	FRH
Scale	FSCAL
Skip Always	FSA
Skip=0	FSEQ
Skip≥0	FSGE
Skip>0	FSGT
Skip≤0	FSLE
Skip<0	FSLT
Skip≠0	FSNE
Skip On No DVZ	FSND
Skip On No Error	FSNER
Skip On No MOF	FSNM
Skip On No OVF	FSNO
Skip On No OVF and No DVZ	FSNOD
Skip On No UNF	FSNU
Skip On No UNF and No DVZ	FSNUD
Skip On No UNF and No OVF	FSNUO
Store Double	FSTD
Store Single	FSTS
Store Status	FSST
Subtract Double (FPAC)	FSD
Subtract Double (Memory)	FSMD
Subtract Single (FPAC)	FSS
Subtract Single (Memory)	FSMS
Trap Disable	FTD
Trap Enable	FTE

SPECIAL INSTRUCTIONS

Dispatch	DSPA
Enter WCS	XOP1
Execute	XCT
Extended Jump	EJMP
Extended Jump to Subroutine	EJSR
Extended Load Effective Address	ELEF
Extended Operation	XOP
Jump	JMP
Jump to Subroutine	JSR
Load Effective Address	LEF
Load MAP	LMP
System Call	SCL

I/O INSTRUCTIONS

Data in A	DIA
Data in B	DIB
Data in C	DIC
Data Out A	DOA
Data Out B	DOB
Data Out C	DOC
I/O Skip	SKP
No I/O Transfer	NIO

CPU INSTRUCTIONS

Halt	HALT
Interrupt Acknowledge	INTA
Interrupt Disable	INTDS
Interrupt Enable	INTEN
I/O Reset	IORST
Mask Out	MSKO
Read Switches	READS
Vector	VCT

☐ Please send sales engineer.

Please send me more information ON ECLIPSE:
- ☐ Memory Allocation and Protection
- ☐ Floating Point Processor
- ☐ Cache Memory
- ☐ Error Checking and Correction
- ☐ Computer model specifications
- ☐ Other _____

ON DATA GENERAL:
- ☐ Software
- ☐ Peripheral Equipment
- ☐ Customer Support
- ☐ Annual Report

Please add me to your mailing list (answer all 3 items below).

1. I am interested in Data General computers:
   - ☐ to use in systems we design for our own use.
   - ☐ to use in systems we design for resale.
   - ☐ because Data General computers are used in systems we buy from vendors.
2. My application is:
   - ☐ Instrumentation or Process Control
   - ☐ Computation
   - ☐ Data Processing
   - ☐ Data Communications
   - ☐ Education
   - ☐ Medical
   - ☐ Other (specify) _____
3. I already use Data General equipment.
   - ☐ Yes ☐ No

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