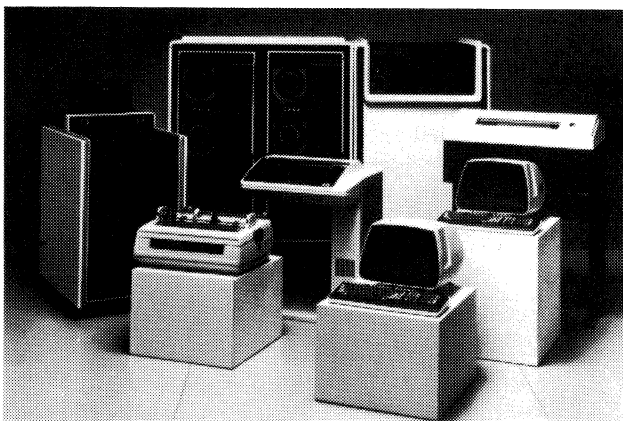# Data General MicroNova, Nova, and Eclipse Communications Capabilities

MANAGEMENT SUMMARY

Communications capabilities for Data General's computers have undergone continual enhancement since the first Novas were announced in 1975. Presently, Data General offers a wide range of communications products, both hardware and software, that can support the MicroNova, Nova, and Eclipse in an even wider range of communications applications.

Data General's strategy in the data communication's market is two-pronged. First, Data General has had for some time, and plans to continue to maintain, a policy of peaceful coexistence with IBM. Unlike other mini- and microcomputer vendors who are currently offering plug-replacements for specific IBM products, such as the 270X or 370X front-ends or various members of the 3270 terminal line, Data General offers value-added systems that include IBM compatibility as only one of many capabilities. For example, all IBM-oriented Data General offerings, both IBM terminal emulation packages and DG-to-IBM hardware interfaces, operate concurrently with other DG processing functions; the DG system need not be dedicated solely to the IBM application.

Second, for DG-to-DG communications, Data General has elected to conform to internationally-recognized interfaces, protocols, and network structure standards, such as the HDLC protocol and the X.25 packet-switching technique, rather than developing proprietary communications methodologies. As international standards become more accepted, and DG feels that they will, DG's data communications capabilities will be in pace with those standards, so that no future conversions of its existing user base will be necessary. ▷

The top-of-the-line Eclipse MV/8000, a 32-bit "supermini," is fully compatible with Data General's 16-bit Eclipse systems, and applications can be transferred between the two types of systems without rewrite. The MV/8000 can operate under either the AOS or AOS/VS operating system and supports the full range of Data General's data communications offerings.

A description of the wide assortment of data communications support provided by Data General for its MicroNova, Nova, and Eclipse product lines. Products range from single-line interface hardware and terminal emulation software, through multi-line communications subsystems, to sophisticated long-haul and local networking schemes.

The Nova or Eclipse can be configured to support up to 256 asynchronous communications lines or 32 synchronous communications lines in a wide variety of combinations; the MicroNova can support up to 16 asynchronous or 4 synchronous lines. Depending on the model and configuration, these systems can serve as a gateway to X.25 public data networks, can share resources with other DG computers using Data General's Xodiac Network Management System, can communicate with an IBM host in batch or interactive BSC modes, and can participate in an IBM SNA network as a P.U. Type 2 device.

For the OEM or large end user, Data General computers can be configured as communications processors, network processors, remote concentrators, terminal controllers, and other customized communications systems.

Data General has delivered over 100,000 computers to date. Prices range from under $1,000 for a basic MicroNova board computer to over $500,000 for a fully-featured Eclipse MV/8000.

CHARACTERISTICS

VENDOR: Data General Corporation, 4400 Computer Drive, Westboro, Massachusetts 01580. Telephone (617) 366-8911.

DATE OF ANNOUNCEMENT (currently active models):

1975—Nova 3/4 & 3/12;
1976—Nova 3/D;
1978—MicroNova MBC/1; Nova 4/C, 4/S, & 4/X; Eclipse S/250, C/150, C/350, & M/600;
1979—MicroNova MP/100 & MP/200; Eclipse S/140;
1980—MicroNova MBC/2 & MBC/3; Eclipse MV/8000;
1981—MV/6000; MPT/80, MPT/83, MPT/87, MPT/100.

DATE OF FIRST DELIVERY (currently active models):

1976—Nova 3/4, 3/12, & 3/D;
1978—MicroNova MBC/1; Eclipse M/600; ►

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TABLE 1. DATA GENERAL PROCESSOR CHARACTERISTICS

Product Family	Model	Operating Systems Supported	Main Memory Capacity (bytes)	Maximum Number of Terminals Connectable*	Date First Delivered	Approx. Processor Price Range
MicroNova	MP/100	MP/OS, RTOS, DOS	4K to 128K	18	1979	$700 to $18,000
	MP/200	MP/OS, RTOS, DOS	4K to 64K	18	1979	
	MBC/1	MP/OS	1K to 64K**	18	1978	
	MBC/2	MP/OS	8K to 40K**	18	1980	
	MBC/3	MP/OS	32K to 64K**	18	1980	
	MPT/80, /83, /87, & /100	MP/OS	60K to 64K	1	1981	$4,100 to $5,350
	Enterprise 1000	Enterprise/OS	64K	1	1981	$7,195
Nova 3	3/4	RTOS, DOS, RDOS	16K to 64K	16	1976	$3,700 to $19,000
	3/12	RTOS, DOS, RDOS	16K to 256K	16	1976	
	3/D	RTOS, DOS, RDOS	64K to 256K	16	1976	
Nova 4	4/C	MP/OS, RTOS, DOS, RDOS	32K to 64K	16	1979	$2,900 to $30,000
	4/S	MP/OS, RTOS, DOS, RDOS	32K to 64K	16	1979	
	4/X	RTOS, DOS, RDOS	128K to 256K	16	1979	
Eclipse (16-bit)	AP/130	RTOS, RDOS, AOS	64K to 128K	16	1981	$28,500 to $129,000
	S/140	RTOS, RDOS, AOS	128K to 1024K	16	1980	
	S/250	RTOS, RDOS, AOS	64K to 2048K	16	1979	
	C/150	RTOS, RDOS, AOS	256K to 1024K	16	1979	$17,300 to $204,000
	C/350	RDOS, AOS	512K to 2048K	24	1979	
	M/600	AOS	512K to 2048K	64	1978	
Eclipse (32-bit)	MV/6000	AOS, AOS/VS	1024K to 2048K	64	1981	$150,000 to $300,000
	MV/8000	AOS, AOS/VS	1024K to 4096K	128	1980	$150,000 to $500,000

*Direct Connection only; additional terminals are connectable through one or more Data Control Units (DCUs). Maximum number of terminals per system including DCUs is 256. DCU is not supported by MicroNova.
**Including memory added using separate-board options.

▷ In terms of specific data communications products, Data General emphasizes four major areas of capability:

- Basic tools, which are aimed mostly at OEMs and sophisticated end users, and can be used to build customized communications systems. These include board-level hardware components—interfaces, multiplexors, and front-end processors—as well as low-level communications software packages like DG/SDLC, which provides a general-purpose SDLC protocol emulator.

- Batch file transfer facilities, including RJE80, which is a 2780/3780 emulator, and HASP II, which emulates an IBM 360/20 HASP Multi-leaving Workstation.

- Interactive data transfer facilities for both IBM BSC and SNA/SDLC environments. Data General's RCX70 package provides emulation of an IBM 3271 (BSC) terminal controller and 3277 displays; its DG/SNA and SNA/3270 software provides emulation of an IBM 3274 or 3276 (P.U. Type 2) controller and 3278 displays.

- Networking capabilities for both DG-to-DG computer resource sharing using DG's Xodiac Network Management System, and DG-to-IBM networking via the DG/SNA software product.

Using the basic set of communication's tools, a Data General computer can be configured as a front-end processor, network processor, remote concentrator, terminal controller or other customized communications system. As a communications processor, the DG system ▷

▶ 1979—MicroNova MP/100 & MP/200; Nova 4/C, 4/S, & 4/X; Eclipse S/250, C/150, & C/350;
1980—MicroNova MBC/2 & MBC/3; Eclipse S/140 & MV/8000;
1981—Eclipse MV/6000; MPT/80, MPT/83, MPT/87, MPT/100.

NUMBER DELIVERED TO DATE: Over 100,000 (all models).

SERVICED BY: Data General Corporation.

CONFIGURATION

This section summarizes the various approaches and methodologies offered by Data General to support data communications. Both the hardware and software modules of each subsystem have been described under each subsystem heading, so that a perspective may be gained on which components are applicable to what subsystems, and how they work together to form the subsystem.

The section is broken down into three categories: MicroNova Communications, Nova and Eclipse Communications, and Communications Hardware from the Special Systems Group. Within each category, a brief summary of the basic product offerings is given, followed by a detailed description of supported communications capabilities.

MicroNova Communications

The MicroNova is a family of microcomputers designed for instrumentation, data acquisition and control, data communications, and smaller data processing applications. The MicroNova is currently offered in ten models:

- **MBC/1, MBC/2, and MBC/3, three single-board computers.**

- **MP/100, which comes in both boxed component models and fully-packaged configurations.** ▶

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▷ can offload a host from networking operations or be entirely host-independent, and depending on the sophistication of user-written software, can perform such tasks as polling, addressing, protocol handling, store-and-forward message switching, error checking, buffering, queueing, and other related networking tasks, as well as acting as a back-up system in the event of host failure. As a remote concentrator or terminal controller, the DG system can manage its own network of locally attached and remote terminals, multiplexing messages from the terminals and transmitting them over high-speed facilities to a host, handling format/code/protocol conversion, and performing related DG-to-host tasks. A down-line load capability allows the host to initialize the DG systems upon its entering the host's network, or in the event of DG system failure.

Virtually any MicroNova, Nova, or Eclipse can support batch-oriented file transfer. Interactive-type data communications are supported under RCX70 or SNA/3270 for AOS- and AOS/VS-based systems. Interactive 3270/BSC-type communications for RDOS- and MP/OS-based systems are provided under a separate package similar to RCX70 and available through the Systems Division; no interactive SNA-compatible product is currently supported.

Xodiac networking capabilities are operative in an AOS- or AOS/VS-based environment and involve point-to-point, peer-to-peer communications between two or more Eclipse systems for the purpose of exchanging data, sharing resources, and controlling processes running on remote systems with transparency to end users and applications programs. Xodiac was first announced in November of 1979 and first commercially delivered in February 1980.

DG/SNA is the highest-level package in a set of three SNA oriented modules (the other two are DG/SDLC and SNA/3270 as described above). DG/SNA provides functions equivalent to IBM's SNA transmission control, data flow control, and path control layers, and essentially allows DG computers and peripherals to communicate with one another in native DG mode while simultaneously interfacing with IBM host applications through DG/SNA. Additional SNA-oriented presentation services modules are expected to be announced in the near future.

Data General also provides some limited capabilities for local networking. The most sophisticated of these is a cable-bus-type networking scheme that supports up to 15 local computers in a ring or star configuration. Hardware components supporting this type of networking include a Multiprocessor Communications Adapter (one per system) and, for star networks, a Special Systems Group product, the Radial Multiprocessor Communications System. An MCA-based local network provides a high-speed I/O bus structure. Data is transmitted and received using a frequency division multiplexing technique in which each system on the bus is assigned a specific ▷

▶● MP/200, which is offered as a board-level computer, in boxed models, and in fully-packaged configurations.

● MPT/80, 83, and 87, Data General's line of intelligent workstations.

● MPT/100, a technical desktop computer.

● Enterprise 1000, a commercial desktop computer.

The MicroNova operates under any of three operating systems:

● Real Time Operating System (RTOS), a single-user, high-speed, memory resident, general purpose, multitasking operating system for time-critical or memory-size critical applications. RTOS is a run-time system only; programs may be developed on a DOS-based MicroNova, or RDOS- or DOS-based Nova or Eclipse.

● Disk Operating System (DOS), a subset of RDOS used on the Nova and Eclipse. DOS is upward-compatible with RTOS and is designed for use in systems that support both program development and multi-tasking processing.

● MP/OS Operating System, a single-user, multitasking, disk-based, real-time operating system. MP/OS is a subset of and compatible with the Eclipse's AOS operating system. MP/OS includes a set of utilities for program development, or programs may be developed for an MP/OS-based MicroNova on an AOS-based Eclipse.

Maximum main memory capacity for the MicroNova is 128K bytes.

Peripheral devices, including local and remote terminals, can be connected to the MicroNova via the I/O bus or the DMA channel. The MicroNova can address up to 61 peripherals on its I/O bus, including local and remote devices. The DMA channel provides a multiplexor-like capability and can be seized by any device through a data channel request to transfer data blocks directly into and out of main memory. The actual number of devices that it is practical to configure with a MicroNova depends on the number of available slots in the chassis, the method of attachment (i.e., via I/O bus or via DMA channel), and any limitations imposed by the software being used. Data General recommends 18 as the maximum number of terminals connected directly to the MicroNova via the I/O bus. Up to 16 asynchronous lines or up to 4 synchronmous lines can be configured with the General Purpose Communications Controller, which attaches to the system via the DMA channel.

Data communications capabilities include:

● *The MicroNova Communications Subsystem,* a modular hardware/software package for multi-terminal environments that operates under the control of Data General's Communications Access Manager (CAM) software in RDOS- and DOS-based systems. A similar capability is provided by MSCP for MP/OS systems. CAM and MSCP provide interfacing between user-written applications and appropriate communications boards. The main hardware modules in MCS are the General-Purpose Communications Controller (#4225-S), and the Asynchronous/Synchronous Line Multiplexor (#4336—for MP/OS-based systems only). Both support asynchronous and synchronous connections.

● *The Xodiac Network Management System,* Data General's X.25-compatible networking scheme. The MicroNova supports Xodiac's RDOS X.25 package, which permits it to communicate directly with another similarly equipped Data General computer via a public ▶

frequency slot. The aggregate data rate can be up to 1M bps. Although this approach to local networking provides none of the intelligent data handling capabilities of Ethernet and other commercial cable-driven networking schemes, it provides a simple solution to local interprocessor communications requirements. Data General has the question of whether to offer a more sophisticated local networking capability under study, but no such product is currently announced.

Although Data General has gradually changed its market posture from selling strictly to OEMs and sophisticated end users to also participating in the end-user market, its computers remain highly popular with system builders. Frequently, specialized communications software which is not available directly from Data General to end users, and fully-configured turnkey systems based on Data General hardware, can be acquired through an OEM. For example, Data Communications Corporation (Memphis, TN) currently offers a front-end communications processor based on an Eclipse S/250 and DCC software, which is being marketed as turnkey solution to interfacing custom user networks that include Data General and other vendor systems. Users are encouraged to contact Data General for more detailed information on OEM vendors and their offerings.

Data General also offers the services of its Special Systems Group (formerly known as the Custom Products Group) to those customers with special requirements. The charter of this group is to design products on an RPQ basis for OEMs, system builders, and large end users; once developed, the products are made available to subsequent customers. Again, users are encouraged to contact Data General for more detailed information on these special products.□

X.25 data network, a switched or leased communications line, or a local MCA connection. However, RDOS X.25 provides no end-user capabilities at this time.

- *Batch terminal emulation* via Data General's RJE80 and HASP-II programs. RJE80 provides emulation of IBM's 2780/3780 remote job entry terminals, and HASP-II provides emulation of IBM's 360/20 HASP Multi-Leaving Workstation.

- *Interactive terminal emulation* is provided for RDOS and MP/OS-based systems through a package available from DG's Systems Division. The package supports up to 16 terminals in 3270/BSC emulation mode.

    RDOS X.25, RJE80, HASP-II, and the 3270/BSC Systems Division product operate under CAM or MSCP using a synchronous line attached to the General-Purpose Communications Controller or the Asynchronous/Synchronous Line Multiplexor.

- *General-purpose data communications* supported by user-written software. Hardware interfaces are provided by the single-line Asynchronous Interface Board (#4207-S), the multi-line General-Purpose Communications Controller (#4225-S), and (for MP/OS-based systems only) the Asynchronous/Synchronous Line Multiplexor (#4336-S and 4336A-S).

Additional details on CAM, Xodiac, and the terminal emulation packages described above can be found in the "Nova and Eclipse Communications" section of this report. Characteristics of the MicroNova's communications hardware components are shown in Table 2.

Nova and Eclipse Communications

The Nova and the Eclipse represent the middle and the upper end of Data General's line. The Nova is currently being offered in two series, each containing three models:

- **Nova 3**, the older of the two series, which currently contains three active models, Nova 3/4, 3/12, and 3/D. This highly successful product line is mature, and being kept alive primarily because of Data General's OEM commitments.

- **Nova 4**, which currently consists of three models, 4/C, 4/S, and 4/X. The Nova 4 contains a faster processor, provides improved reliability and maintenance features, and yields a better price/performance than the Nova 3.

The Eclipse, Data General's top-of-the-line, currently consists of four series, containing a total of seven models:

- A scientifically-oriented series, represented by Models AP/130, S/140 and S/250. These systems are designed for scientific computation, instrumentation and control, image and seismic data processing, computer-aided design, and similar applications in scientific, laboratory, industrial, and data communications environments.

- A commercially-oriented series, consisting of the C/150 and C/350. These models are intended primarily for distributed processing environments, and can be used in functions ranging from a dedicated remote terminal controller to a full-blown multi-function network processor or distributed processing node.

- A multi-programming commercially-oriented series, containing only one model, the M/600. The M/600 represents the top of Data General's 16-bit minicomputer line and is designed for sophisticated multi-terminal environments.

- The "superminis," Models MV/6000 and MV/8000. These two 32-bit computers provide better throughput, more precise computation, and higher performance than the 16-bit lines, and in many ways, compare to and sometimes surpass the power and versatility of lower-end mainframes.

The operating systems used by the Nova and Eclipse fall into two distinct families: RDOS-compatible operating systems and AOS-compatible operating systems.

RDOS-compatible operating systems include RTOS, DOS, and RDOS. RTOS and RDOS can be used on either the Nova or the Eclipse. DOS is supported on the Nova (and MicroNova) only, but is a subset of and compatible with RDOS running on an Eclipse or another Nova. RTOS and DOS are briefly described under "MicroNova Communications." RDOS (Real-time Disk Operating System) is a higher-powered disk-based multi-tasking, operating system for program development and multitasking program execution; it is not supported by the MicroNova.

RTOS and RDOS come in both "mapped" and "unmapped" versions for the Nova and Eclipse. The mapped versions provide for limited (two-partition) multiprogramming. They also support optional Memory Allocation and Protection (MAP) hardware features, which provide user programs and data channels with extended access to main memory through a scheme involving the use of address extension tables and ▶

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logical-to-physical address translation. Protection features include the use of privileged instruction, I/O device protection, and main memory write and validity protection.

The operating systems designed to run in an AOS environment are: Advanced Operating System (AOS), which is supported on both the 16-bit and 32-bit Eclipse models; Advanced Operating System/Virtual Storage (AOS/VS), which is supported only by the 32-bit Eclipse models; and MP/OS, which runs only on a Nova 4 (or MicroNova) but is a subset of and compatible with AOS and AOS/VS. AOS and AOS/VS support full-scale multiprogramming, and are designed for use in environments in which multi-terminal interactive timesharing, multiple batch processing, and event-driven, real-time activities occur simultaneously. The Virtual Storage feature of AOS/VS adds the capability to manage logical addressing of the MV/6000 and MV/8000's main memory on a demand paging basis. MP/OS is briefly described under "MicroNova Communications."

Maximum main memory capacity for the Nova systems is 64K bytes for the smaller Nova 3/4, 4/C, and 4S, and 256K bytes for the Nova 3/12, 3/D, and 4/X.

Maximum main memory capacity for the Eclipse systems is 128K bytes for the AP/130, 1M bytes for the S/140 and C/150; 2M bytes for the S/250, C/350, M/600, and MV/6000; and 4M bytes for the MV/8000.

Like the MicroNova, peripherals can be connected to the Nova and Eclipse via both the I/O bus and the DMA channel. And as with the MicroNova, the actual number of devices that can be supported by a given Nova or Eclipse system depends on the available slots in the chassis (and any chassis extensions), the method of attachment, and software limitations. The recommended maximum number of terminals connected directly to the system via the I/O bus is 16 for the Nova 3, Nova 4, and Eclipse AP/130, S/140, S/250,

and C/150; 24 for the C/350; 64 for the M/600 and MV/6000; and 128 for the MV/8000.

Data communications support is provided under the following packages and capabilities:

- The Data General Communications Subsystem,

- The Xodiac Network Management System,

- The DG/SNA software modules,

- Terminal emulators for batch or interactive IBM BSC-type applications, and

- Local interprocessor communications hardware.

The Data General Communications Subsystem (DG/CS) is a general-purpose modular, hardware/software subsystem designed to offload the host of communications handling tasks in multi-terminal environments. DG/CS can be considered a fundmental building block in the communications support of the Nova and Eclipse, in that it provides basic line interfacing and multiplexing for many of the more sophisticated capabilities.

As with the MicroNova Communications Subsystem, DG/CS operates under the Communications Access Manager (CAM) software package under RTOS and RDOS. DG/CS is supported directly under AOS and indirectly by agents under AOS/VS.

CAM handles all types of communications interfacing connected to the system directly via the ULM-5 or indirectly via the DCU/50 or DCU/200 Data Control Unit, and provides support for Teletype compatibility, IBM BSC line discipline, and other user-defined protocols. Any mix of asynchronous or synchronous lines can be configured.

TABLE 2. MICRONOVA COMMUNICATIONS INTERFACE BOARDS

	Asynchronous Interface Board	General-Purpose Communications Controller	Asynchronous/ Synchronous Line Multiplexor
Component identification #	4207-S	4225-S	4336-S (sync./async.); 4336A-S (async. only)
Supported by— MicroNova model(s) Operating system(s) Comm. software package(s)	Any RTOS, DOS, MP/OS CAM	Any RTOS, DOS, MP/OS CAM, MSCP, RDOS X.25, RJE80, HASP-II	Any MP/OS MSCP
Number of slots required	1	1 for #4225-S, plus 1 for each #4226-S/#4227-S	1
Maximum number configurable per system	See comments	1	3
Connects to system via	I/O bus	DMA channel	DMA channel
Number of lines supported	1	Any combination up to 4 sync. or 16 async.	4 async./sync. lines in any combination
Maximum line speed supported	19,200 bps	9600 bps (async. or sync.)	19,200 bps (async. or sync.)
Interfacing supported	RS-232-C, 20 mA current loop	RS-232-C; 20 mA current loop (async. only); V.24 (sync. only)	RS-232-C, CCITT V.24
Integral modem provided	No	Yes	Yes
Comments	Total of 61 devices can be addressed on I/O bus	Supports up to four #4226-S Single-Line Sync. Line Controllers and/or #4227-S Four-Line Async. Line Multiplexors in any combination	Synchronous line compatible with IBM BSC protocol

INA—Information not available

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▶ Multidrop lines are supported through polling and selection sequences. Modem control support for auto answer and auto disconnect is a standard feature.

CAM also provides a queue for I/O completions that permits a single user task to control several asynchronous lines. It also features a FORTRAN interface, permitting communications I/O to be integrated into FORTRAN applications programs. A CAM network generation submodule, CGEN, lets users interactively select parameters in the CAM software to describe the network's hardware components and operating characteristics.

The DG/CS hardware is supported directly under AOS and indirectly by agents under AOS/VS. This includes support for all CAM-type functions, for the DCU/50 and the DCU/200, for IBM BSC and SDLC, and for bit- and byte-oriented HDLC, LAP, and LAP-B. The AOS system generator allows the user to interactively select parameters to describe the network's hardware components and operating characteristics. The AOS/VS system generator allows the user to select parameters describing the network and to make those parameters available to various agents.

Hardware-wise, DG/CS components include multiple line multiplexors and interfaces, one or more DCU/50 or DCU/200 Data Control Units, and a Dual Access Controller. These components may be housed in the main system chassis and/or one or more communications chassis. The maximum number of lines per system supported under DG/CS is 256 asynchronous lines or 32 synchronous lines. A single DCU/200 can handle up to 128 lines, but it is more typical to find multiple DCUs, each configured with less than its maximum number of lines, in large systems.

Under DG/CS, local and remote terminals and computers may be connected to the system via multi-line interfaces/multiplexors. These multi-line multiplexors and interfaces are provided in a wide assortment, but they can basically be divided into two types: those that communicate with the system through an I/O channel, and those that communicate through a DMA channel.

The only multiplexor/interface in the first category is the Universal Line Multiplexor (ULM-5). The ULM-5 is designed to handle multiplexing and interfacing in small configurations, and can handle up to 8 asynchronous lines and 1 synchronous line.

The second category contains: the Asynchronous Line Multiplexor (ALM-8), Asynchronous Modem Interface (AMI-8), Direct-Connection Asynchronous Line Multiplexor (ALM-16), Direct-Connection Asynchronous Terminal Interface (ATI-16), Character Synchronous Interface (CSI-2), Character Synchronous Line Multiplexor (SLM-2), Bit Synchronous Interface (BSI), and Bit Synchronous Line Multiplexor (BLM). Each of these interfaces and multiplexors can be attached directly to a DMA channel, or be connected to the DMA channel indirectly through a DCU/50 or DCU/200 front-end processor.

For more details on the communications interfaces supported under DG/CS, see Table 3.

The DCU/50 and DCU/200 are two single-board computers, either of which can act as a dedicated front-end processor for a Nova or Eclipse host. Either model can be configured with any Nova or Eclipse operating under RDOS, RTOS, AOS, or AOS/VS operating systems. Physically, the DCU/200 consists of a processing unit, a computer interface, 4K words (8K bytes) of local memory, access to an additional 28K words (56K bytes) of main host memory, and a real-time clock. It occupies one memory or I/O slot in the main system's chassis, is connected directly to

the host's DMA channel, and is attached by internal and external cables to one to four communications chassis in which the line interface boards are resident.

Each DCU/200 can handle up to 128 lines. It can handle any mix of asynchronous or synchronous lines operating in half- or full-duplex mode, any mix of line speeds (up to 56K bps), any mix of code levels, and multiple character-oriented or bit-oriented line disciplines (e.g., ASCII/teletypewriter or IBM BSC or SDLC protocols). Lines can be individually defined using parameterized tables that are a part of the DCU/200's computer access facilities. Some limitations and restrictions of configurations are imposed by AOS or AOS/VS software packages, as more and more protocol overhead is off-loaded from the host into the DCU front-end.

The DCU/50 has essentially the same capabilities as the DCU/200, except that it contains only 1K words of local memory, and has a faster memory cycle time (300 nanoseconds versus 400 nanoseconds).

The DCU performs line-oriented tasks (such as converting line signals from serial to parallel, and vice versa); controls multiplexor activities under the direction of Data General-supplied internal software drivers; processes message-oriented computer requests by performing code translation, control-character processing, error checking, buffer maintenance, and other character-level activities; and interfaces with the DMA channel, all concurrently. As a computer, the DCU is fully programmable using Data General-supplied software such as CAM and terminal emulation packages, or using user-written programs.

DG/CS components also include a Dual Access Controller, which allows two Nova or Eclipse processors to share a common set of up to 15 DG/CS ALM-8, ALM-16, or SLM-2 line modules. The line module set must be operating under the control of a single DCU/200 on each of the two systems, and may consist of any mix of asynchronous and synchronous lines housed in up to four communications chassis. No software support is provided by DG for the Dual Access Controller.

The components of the Dual Access Controller include: an arbiter and switch, which work together to make all logical connections, route I/O instructions between the systems, and resolve any simultaneous requests for service; a CRC error checking scheme; a full-duplex, high-speed interprocessor communications bus; dual watchdog timers that monitor all DCU/200 and host operations; and a control panel that contains various controls and indicators.

The Dual Access Controller may operate independently or in conjunction with an I/O Bus Switch and/or Interprocessor Bus (see "Local Interprocessor Communications"). Whatever the means of interconnection, the interconnected processors can act either in "hot-standby" mode in which one system remains in immediate readiness to act as back-up to the other, or in "cold standby," in which each processor normally runs independently, but can act as a back-up to the other where needed.

The *Xodiac Network Management System* permits Data General Systems to be interconnected for the purpose of exchanging data and/or sharing resources. All communications occur on a peer-to-peer basis, and no one system need be designated as dominant. Connections are supported on a point-to-point basis and may be made via traditional circuit-switched or dedicated communications lines, local intercomputer links (using the Multiprocessor Communications Adapter), or X.25 public data network facilities. Data General currently provides compatibility with the Telenet and Tymnet networks in the U.S., Datapac in Canada, PSS in England, and Transpac in France, and is committed to gaining certification on all X.25-based networks. ▶

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▶ All connections, whether through public or private facilities, utilize CCITT's X.25-based packet-switching methodology and the international-standard HDLC protocol. Data rates are supported at up to 56K bps full-duplex over long-haul circuit-switched and leased line facilities, up to 19,200 bps over public packet-switched data networks, and up to 1M bps over local connections.

Data General takes a "building block" approach to networking. The first level of building blocks provides physical and logical interface and connection services and supports Xodiac Layers 1, 2, and 3. The second level of building blocks adds user-oriented networking capabilities and supports Xodiac Layer 4. Any AOS- or AOS/VS Eclipse may operate at either level of capability. RTOS/RDOS-based Eclipses, and all Novas and MicroNovas, are limited to Layer 1, 2, and 3 capabilities only.

The two levels are implemented by two sets of software packages: Layers 1, 2, and 3 can be provided by either RDOS X.25 or AOS X.25, depending on the computer's basic operating environment; Layer 4 is supported by a modular set of software "agents," each of which accomplishes specific user-oriented networking operations.

RDOS X.25 and AOS X.25 provide the capability for a system to maintain logical connections with other similarly equipped Data General systems by emulating an X.25 Data Terminal Equipment (DTE) device. RDOS X.25 and AOS X.25 are compatible, so that virtually any system (MicroNova, Nova, or Eclipse) running under either package can communicate with any other. Connections may be made via a public data network, in which case the Data General system operates in the capacity of a "gateway," via point-to-point circuit-switched or dedicated communications links, or via local connection.

Each Xodiac layer provides a specific level of control. Layer 1, the Physical Interface Layer, supports the X.21 bis (RS-232-C and RS-449) physical interface for intersystem links. Layer 2, the Link Control Layer, supports both character-oriented and bit-oriented HDLC protocols in the form of software drivers. Layer 3, the Connection Layer, establishes and maintains logical host-to-host connections, handles message packetization/depacketization, multiplexes/de-multiplexes messages across network connections, controls end-to-end data flow, and performs error recovery. Both permanent virtual circuits and switched virtual circuits are supported, and multiple virtual circuits can be mapped onto a single path. Both the Link Access Procedure (LAP) and the Link Access Procedure—Balanced Mode (LAP-B) are also supported in both bit and byte forms.

RDOS X.25- and AOS X.25-based systems can form a basic communications network without the necessity of implementing Xodiac Layer 4. However, user-written programs must accomplish all interfacing between the network and end applications if the Xodiac agents are not used.

Layer 4, the Functional Layer, provides a set of user-oriented remote resource access functions by which AOS- and AOS/VS-based Eclipse system users can: log onto remote AOS and AOS/VS EXECs and control remote AOS and AOS/VS processes; access and transfer data resident on another Data General mini- or microcomputer; access and use terminals, programs, and other resources resident at a remote system; and access remote INFOS II and DG/DBMS databases.

These capabilities are accomplished by a series of "agents," which are logical extensions of operating system functions that interact on behalf of users so as to make the network operations involved in completing the user's request totally transparent to that user. Five software packages providing

these agents have been released so far (note that not all are supported as yet under AOS/VS):

- **Virtual Terminal Agent (VTA)**, which comes in AOS and AOS/VS versions and allows terminals physically attached to one system (generally as a console) to appear to be logically connected to and to control processes on another system in the Xodiac Network. Processes can be AOS EXEC, AOS Command Language Interpreter (CLI), or end user application processes.

- **Resource Management Agent (RMA)**, which comes in an AOS and AOS/VS versions and allows users to access remote resources, such as files, devices, or processes, on another system.

- **File Transfer Agent (FTA)**, which comes in AOS and AOS/VS versions and lets users move files from one system to another, with data compression and restart/recovery services provided by FTA.

- **Remote INFOS II Agent (RIA)**, which currently comes in an AOS version only and provides transparent access to Data General's INFOS II file management software on remote Eclipse computers, allowing users to take advantage of INFOS II commands and language interfaces to access INFOS II files resident on remote Eclipse systems.

- **Remote Database Agent (RDA)**, which currently comes in an AOS version only and permits transparent access to DG/DBMS database management software commands, interfaces, and files on remote Eclipse systems.

Xodiac agents can be implemented only on AOS- and AOS/VS-based Eclipse systems with at least 512K bytes (AOS-based systems) or 1 megabyte (AOS/VS-based systems) of main memory.

Network management and control is provided in two modules that are embedded in the AOS X.25 and RDOS X.25 packages. These two modules are:

- **Network Generation (NETGEN)**, which is a utility that creates and modifies network-related directories that contain files and programs used to configure and bring up the network. NETGEN software is interactive and prompts the operator in question-and-answer mode. Based on the operator's responses, NETGEN establishes or updates the specified files and programs used by Xodiac network software.

- **Network Operator Process (NETOP)**, which is used to control all Xodiac network processors and operations, such as initializing the network or an individual node, enabling and disabling of network links, determining the number and status of virtual circuits, and controlling the packet-tracing facility. NETOP also produces reports and logs on network exceptions, conditions, and usage, including status of virtual circuits, number of remote users, and link errors, in response to interactive commands given by the network operator.

In terms of physical interfacing, Xodiac uses the same hardware as other communications capabilities. Users have a choice of configuring local connections via an MCA, or long-haul connections using a DCU plus any of the synchronous interface boards (SLM, BLM, CSI, or BSI).

Data General's *DG/SNA software modules* consist of three software products that work together to allow AOS-and AOS/VS-based Eclipse systems to operate as distributed processing nodes in an IBM SNA network: DG/SDLC, DG/SNA, and SNA/3270. An Eclipse system running under DG's SNA modules appears to the host as an SNA ▶

Data General MicroNova, Nova, and
Eclipse Communications Capabilities

TABLE 3. NOVA AND ECLIPSE COMMUNICATIONS INTERFACE BOARDS

	Attachable via I/O bus	Interfaces attachable to DMA channel, directly or via a DCU		
	Universal Line Multiplexor (ULM-5)	Asynchronous Line Multiplexor (ALM-8)	Asynchronous Modem Interface (AMI-8)	Direct-Connection Asynchronous Line Multiplexor (ALM-16)
Component identification #	4241, 4242, 4243	4255, 4256	4340	4257, 4258
Supported by— Nova/Eclipse model(s)	**	Any	Nova 4; Eclipse S/140 & MV/8000	Any
Operating System(s)	Any	Any	Any	Any
Comm. software package(s)	CAM, RDOS X.25, RJE80, HASP-II, RCX70, MSCP, Xodiac	CAM	CAM	CAM
Number of slots required	1 for basic ULM-5, plus 1 for 4241-A Add-on ULM-5	1	1	1
Maximum number configurable per system	Std. system software supports two ULM-5s per system*	128 lines per DCU	112 lines per DCU	128 lines per DCU
Connects to system via	I/O bus	DMA channels, directly or via DCU	DMA channels, directly or via DCU	DMA channel, directly or via DCU
Number of lines supported	#4241—4 or 8 async.; #4242—1 sync.; #4243—4 or 8 async. plus 1 sync.	#4255—8; #4256—4	8	#4257—16; #4258—8
Maximum line speed supported	9600 bps (async. or sync.)	9600 bps	19,200 bps	9600 bps
Interfacing supported	RS-232-C, V.24, 20 mA current loop	RS-232-C, V.24	RS-232-C, V.24	RS-232-C, V.24, 20 mA current loop (any mix in sets of four)
Integral modem provided	Yes	Yes	Yes	No
Comments	#4241-A Add-on required to expand #4241 or #4243 to a maximum of 8 async. lines	4255 is 8-line version of ALM-8, 4256 is 4-line version		For use with local or dedicated lines; supports up to four #4260 Four-line 20 mA Current Loop Interfaces or #4261 Four-line RS-232-C/V.24 Interfaces in any combination

*A total of 62 devices can physically be addressed on the I/O bus; actual practical support limits depend on the number of slots available, software limitations, etc.
**Current models supporting ULM-5: 4241—any Eclipse except M/600; 4242—any Nova or Eclipse; 4243—any Nova, any Eclipse except M/600.

▶ Physical Unit Type 2 (P.U. Type 2). Depending on the Eclipse model, either the Bit Synchronous Interface (BSI) or the Bit Synchronous Line Multiplexor (BLM) provides the physical interface to the IBM host system.

DG/SNA is the primary module in the set and corresponds to the transmission control, data flow control, and path control layers of SNA. It provides emulation of a 3274- or 3276-type terminal controller for up to 16 concurrent users. It also includes interactive network generation and control capabilities, a HELP facility, and a TRACE function, which can be used together to manage and coordinate the activities between the Data General terminals and the IBM host. Multiple copies of DG/SNA can run concurrently, so that more than 16 terminal users can be accommodated.

The companion DG/SDLC module, runs on the DCU/200 front-end board and provides the SDLC protocol that corresponds to SNA's link layer. (The DG/SDLC module can also stand alone in systems that need a general-purpose

SDLC interface to implement user-written SNA-compatible networking applications.)

The third member of the set, SNA/3270, is DG's first product offering that corresponds to SNA's presentation services layer, and provides for emulation of IBM 3278 display terminals and 3286 and 3289 printers operating at up to 9600 bps. Additional presentation services modules are expected to be forthcoming from DG in the near future.

The DG/SNA modules run concurrently with other applications software, allowing a user to interface simultaneously with local processes and the IBM host, and a terminal to be switched between native Dasher mode and IBM emulation mode as called for by the application.

BSC terminal emulation packages for the Nova and Eclipse, include RJE80, HASP-II, and RCX70. They may run concurrently with each other and with Xodiac networking software; however, generally, specific communications lines ▶

Data General MicroNova, Nova, and
Eclipse Communications Capabilities

TABLE 3. NOVA AND ECLIPSE COMMUNICATIONS INTERFACE BOARDS (Continued)

	Interfaces attachable to DMA channel, directly or via a DCU (Continued)				
	Direct-Connection Asynchronous Terminal Interface (ATI-16)	**Character Synchronous Interface (CSI-2)**	**Character Synchronous Line Multiplexor (SLM-2)**	**Bit Synchronous Interface (BSI)**	**Bit Synchronous Line Multiplexor (BLM)**
Component identification #	4342	4345, 4346	4263, 4264	4348, 4349	4248, 4249
Supported by— Nova/Eclipse model(s)	Nova 4; Eclipse S/140 & MV/8000	Nova 4; Eclipse S/140 & MV/8000	Any	Nova 4; Eclipse S/140, MV/6000 & MV/8000	Nova 4, any Eclipse
Operating system(s)	Any	Any	Any	AOS, AOS/VS	AOS, AOS/VS
Comm. software package(s)	CAM	CAM, RDOS X.25, RJE80, HASP-II, RCX70, Xodiac	CAM, SYNCP, RDOS X.25, RJE80, HASP-II, RCX70, Xodiac	DG/SNA, AOS X.25, Xodiac	DG/SNA, AOS X.25, Xodiac
Number of slots required	1	1	1	1	1
Maximum number configurable per system	128 lines via DCU	32 lines per DCU (2 lines at 56K bps)	32 lines per DCU (2 lines at 56K bps)	16 lines per DCU	16 lines per DCU
Connects to system via	DMA channel, directly or via DCU	DMA channel, directly or via DCU	DMA channel, directly or via DCU	DMA channel, directly or via DCU	DMA channel, directly or via DCU
Number of lines supported	16	#4345—2; #4346—1	#4263—2, #4264—1	#4348—1; #4349—4	#4248—1; #4349—4
Maximum line speed supported	19,200 bps	9600 bps; 56K bps optional (requires DCU/200)	9600 bps; 56K bps optional (requires DCU/200)	DG/SNA—9600 bps; X.25—19,200 bps	DG/SNA—9600 bps; X.25—19,200 bps
Interfacing supported	20 mA current, RS-232-C (any mix in sets of four)	RS-232-C, V.24; 23 mA current loop optional	RS-232-C, V.24; 23 mA current loop and V.34 (Bell 303) optional	RS-232-C, RS-449, V.35	RS-232-C, RS-449, V.35
Integral modem provided	No	Yes	Yes	Yes	Yes
Comments	For use with local or dedicated lines only; supports up to four #4344 Four-line 20 mA Current Loop Interfaces and/or #4261 Four-line RS-232-C/V.24 Interfaces in any combination	Compatible with IBM BSC protocol	CRC generator/checker optional; compatible with IBM BSC protocol	Compatible with IBM SDLC and X.25 HDLC protocols	Compatible with IBM SDLC and X.25 HDLC protocols

▶ must be separately dedicated to each function. Multiple copies of the same package may also run concurrently, so that a larger number of terminals that prescribed by the single package can be supported.

RJE80 and HASP-II, like their MicroNova product counterparts, provide for emulation of the IBM 2780/3780 remote job entry terminals and the 360/20 HASP Multi-leaving Workstation, respectively. Versions of RJE80 and HASP-II are available for RTOS/RDOS/DOS-based, AOS-based, and AOS/VS-based systems. All versions of HASP-II, and the AOS and AOS/VS versions of RJE80, include all CAM functions; RTOS/RDOS/DOS-based RJE80 requires that CAM be ordered separately under a no-charge license. Enhanced versions of both packages, called IC/RJE80 and IC/HASP-II, provide extended capabilities for Eclipse systems running in conjunction with local interactive COBOL applications.

RCX70 (Remote Cluster 70) is a 3270/BSC emulator that provides control for communications between up to 16 Dasher terminals and an IBM host. All CAM functions are built-in. The terminals may be connected to the DG system locally or by switched or leased lines, and may operate at speeds up to 9600 bps. RCX70 runs only on AOS- and AOS/VS-based Eclipse systems. An equivalent 3270/BSC-type product is available through the Systems Division for RDOS- and MP/OS-based systems.

Either the Character Synchronous Interface (CSI-2) or the Synchronous Line Multiplexor (SLM-2) can provide physical interfacing for these character-oriented protocol emulators.

Local interprocessor communications can be used to interconnect Nova and Eclipse systems in a local resource-sharing or local networking scheme. Any of three vehicles are available to accomplish this: the I/O Bus Switch, the Interprocessor Bus, and the Multiprocessor Communications Adapter.

The I/O Bus Switch (#8080), the simplest form of interconnection, allows control of low-speed peripherals and communications lines to be transferred back and forth between two systems. Primarily used to switch (either manually or under program control) critical peripherals to a back-up computer when the primary computer must be brought down for maintenance, the I/O Bus Switch physically consists of two PC boards (one for each of the connected systems), connecting cables, and a chassis that can accommodate up to 14 device and/or line controllers. The I/O Bus Switch is supported by all Data General computers and peripherals, and is frequently used in dual-processor/shared-disk configurations in conjunction with an Interprocessor Bus link. ▶

Data General MicroNova, Nova, and Eclipse Communications Capabilities

▶ The Interprocessor Bus (#4240) is used to interconnect two processor systems so that they may operate in a dual-processor/shared-disk mode. The Interprocessor Bus capability can be supported by any RDOS-based Nova and by a RDOS-based Eclipse S/140, S/250, C/150, or C/350. One #4240 PC board is required on each of the two systems being interconnected. The systems are connected via a single cable and may be up to 25 feet apart. The Interprocessor Bus logically consists of: a 16-bit, half-duplex, buffered communications path that is used to control access to the shared-disk files; a 16-bit full-duplex, interrupt-driven communications path that transfers status information and data between the computers under program control; and dual interval timers that detect computer malfunctions and call for back-up computer control.

The Multiprocessor Communications Adapter (#4206), which provides the most sophisticated of Data General's local interprocessor capabilities, allows RTOS- or RDOS-based Nova and Eclipse and AOS- and AOS/VS-based Eclipse computers to be interconnected via cable in a ring configuration. Each processor requires an MCA, which transfers data blocks from the DMA channel of its computer to the DMA channel of the next system in the ring. Each MCA supports simultaneously data transmission and reception, and can handle multiple messages concurrently.

A choice of two data rates is supported by the MCA, and determines the maximum communications bus cable length and maximum number of processors in the ring: in rings operating at "normal" speed (625K bytes per second), the cable bus can be up to 150 feet in length and the maximum number of processors is 15; in rings operating at "high" speed (1M bytes per second), the maximum cable length is limited to 40 feet and the maximum number of processors is 4. Multiple rings can be created and interlocked to form larger local networks.

Applications involving heavy-volume computations, heavy-traffic data communications, and real-time process control can use the MCA local networking scheme for load balancing, system redundancy, or system expansion. In addition to these local processing tasks, appropriately configured MCA-based rings can participate a Xodiac Network Management System.

Communications Hardware from the Special Systems Group

In response to the wide variety of communications needs of Data General's customers, the company has for quite some time supported a Special Systems Group (previously known as the Custom Products Group) to develop hardware components that satisfy special user requirements. Once developed, these products are made available to subsequent customers. Among the data communications products currently offered through the Special Systems Group are:

- High Speed Synchronous Communication Controller (#5015MA), which is available in two versions, one that supports data transfer rates up to 230.4K bps and one that supports data transfer rates up to 1.54M bps. This controller provides a single synchronous data link between a Nova or Eclipse and a local or remote high-speed communications subsystem.

- Synchronous Down Line Loader (#5895) and Asynchronous Down Line Loader (#5895A), which are receive-only communications boards that reside in a remote Data General computer and permit that computer to be down line loaded in an unattended environment. These two downline loaders can share a line with any synchronous or asynchronous DG line adapter, respectively.

- Communication Switch (#5777G), which provides eight data channels by which to manually switch serial peripheral devices or communications lines (line-by-line or on a bulk basis) between two Data General computers. The switch's channels interface to standard DG communications line multiplexors and interfaces, and require no special software drivers.

- T-Bar Switches, of which three types are available: Manual, Bulk Line, and Automatic. These cross-over and cross-swapping switches may be used, for example, for peripheral sharing between two processors, or communications line switching (individual or bulk) between two multiplexors.

- Radial Multiprocessor Communications System (#5899), a local bus networking scheme by which up to 15 DG computers can be interconnected in a radial multiprocessor configuration. The RMCS can be added to a local network environment utilizing Multiprocessor Communications Adapters to convert the network topology from a ring configuration to a star (radial) configuration.

- Bell 801-C compatible Auto Call Units, which come in several models to support one line or up to four lines and interface with various DG computers.

- IEEE Bus Interfaces (#5280AR, 5702RI, and 5700U), which provide controllers for various devices designed to meet the IEEE-488-1975 interface standard.

In addition to these already-specified products, the Special Systems Group can provide other communications hardware designed to custom specifications.

PRICING

Like the Data General processors themselves, DG communications hardware components are available from Data General on a purchase-only basis. Dollar-volume and unit-volume hardware discounts are available.

Hardware support services include prime-time or multi-shift on-call maintenance service contracts, priority response agreements, separate terminal maintenance agreements, short term contracts, assigned on-site field engineers, and repair service at designated Data General Field Engineering Depots.

Software prices are provided separately for the initial year's use, and subsequent renewals. The initial license fee includes comprehensive software support and software subscription services. Subsequent license fees include no support services, which are available separately for renewal customers. Custom software consulting services are also available on a time-and-expenses basis.

Training can be provided by on-site trainers, by self-study courses, or by any of 6 Data General Education Centers located throughout the U.S. ▶

Data General MicroNova, Nova, and Eclipse Communications Capabilities

		Purchase	Monthly Maintenance
MicroNova Communications Hardware			
4207-S	Asynchronous Interface Board	$ 285	$ 5
4225-S	General-Purpose Communications Controller	385	4
4226-S	Single-line Synchronous Line Controller; attaches to 4225-S	440	6
4227-S	Four-line Asynchronous Line Multiplexor; attaches to 4225-S	550	8
4228-S	CRC Generator and Checker Option; for 4225-S	275	4
4336-S	Asynchronous/Synchronous Line Multiplexor	825	8
4336A-S	Asynchronous/Synchronous Line Multiplexor; with support for async. lines only	660	7
Nova and Eclipse Communications Hardware			
4250	DCU/50 Data Control Unit	3,300	50
4254	DCU/200 Data Control Unit	4,290	40
4007	Asynchronous Terminal Interface; requires 4008 and 4010 and paper-tape controls	220	5
4008	Real-time clock option for 4007	440	5
4010	Asynchronous Line Controller for 4007	165	4
4023	RS-232-C Interface for 4010	55	3
4029	Modem Control for 4023	220	3
4075	Asynchronous Terminal Interface; requires 4079 and 4077 and cassette tape control	220	3
4079	Real-time clock for 4075	440	4
4077	Asynchronous Line Controller for 4075	165	2
4078	RS-232-C Interface for 4077	55	NC
4074	Synchronous Line Controller	1,650	16
4241	Universal Line Multiplexor (ULM-5); async. only	1,540	16
4241-A	ULM-5 Asynchronous Add-on	1,540	16
4242	Universal Line Multiplexor (ULM-5); sync. only	1,540	16
4243	Universal Line Multiplexor (ULM-5); async./sync.	2,970	30
4255	Asynchronous Line Multiplexor (ALM-8); 8 lines	2,310	18
4256	Asynchronous Line Multiplexor (ALM-8); 4 lines	1,440	18
4340	Asynchronous Modem Interface	2,640	18
4257	Direct-Connection Asynchronous Line Multiplexor (ALM-16); 16 lines	2,310	22
4258	Direct-Connection Asynchronous Line Multiplexor (ALM-16); 8 lines	1,510	22
4260	Four-line 20 mA Current Loop Interface for 4257 or 4258	190	3
4261	Four-line RS-232-C/V.24 Interface for 4257 or 4258	190	3
4342	Direct-Connection Asynchronous Terminal Interface (ATI-16)	2,775	22
4344	Four-line 20 mA Current Loop Interface for 4342	190	3
4261	Four-line RS-232-C/V.24 Interface for 4342	190	3
4345	Character Synchronous Interface (CSI-2); 2 lines	2,640	14
4346	Character Synchronous Interface (CSI-1); 1 line	1,760	14
4347	Single-line 23 mA Current Loop Interface option for 4345 or 4346	220	3
4263	Character Synchronous Line Multiplexor (SLM-2); 2 lines	1,735	14
4264	Character Synchronous Line Multiplexor (SLM-2); 1 line	1,155	14
4265	Single-line 23 mA Current Loop Interface option for 4264	230	3
4266	CRC Generation and Checker option for 4264	580	5
4348	Bit Synchronous Interface (BSI); 1 line	1,900	14
4349	Bit Synchronous Interface (BSI); 2 lines	4,500	14
4248	Bit Synchronous Line Multiplexor (BLM); 1 line	1,900	14
4249	Bit Synchronous Line Multiplexor (BLM); 4 lines	4,500	14
8080	I/O Bus Switch	4,950	59
8081	Bus Control Card; one per system required to connect to 8080	1,870	22
4240	Interprocessor Bus Unit	2,090	19
4206	Multiprocessor Communications Adapter	2,310	19
4232	Dual Access Controller	2,890	33
4251	Four-slot Communications Chassis	2,090	24
4253	Four-slot Expansion Communications Chassis	1,650	16
Special Systems Group Communications Hardware			
5015MA	High-Speed Synchronous Communications Controller	2,775	30
5895	Synchronous Down Line Loader	1,980	29
5895A	Asynchronous Down Line Loader	1,980	29
5777G	Communication Switch	3,350	59
5899	Radial Multiprocessor Communications System	4,700	59

NC—No charge.
*Includes Comprehensive Software Support and Subscription Services.
**Depending on media used for distribution.

Data General MicroNova, Nova, and
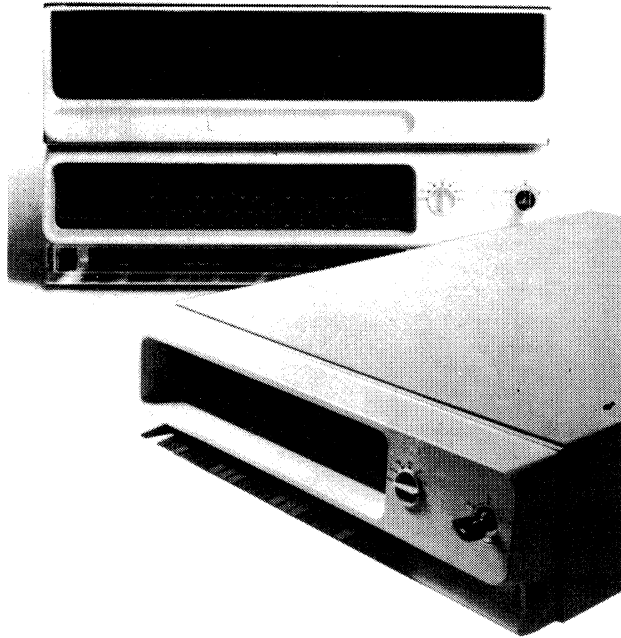# Eclipse Communications Capabilities

		Annual License Fee		Comprehensive Annual Software Subscription Service
		Initial Year*	Subsequent Years	
MicroNova Communications Software				
3460	Communications Access Manager (CAM)	$ 105	NC	$ 53
3601	RJE80	1,313	$1,050	158
3725	HASP-II	1,575	1,313	158
3813	RDOS X.25	1,050	630	420 to 473**
Nova Communications Software				
3460	Communications Access Manager (CAM)	105	NC	53
3601	RJE80	1,313	1,050	158
3725	HASP-II	1,575	1,313	158
3745	IC/HASP-II; for Nova 3; used in interactive COBOL environments	2,783 to 3,623**	2,625	158
3832	IC/HASP-II; for Nova 4; used in interactive COBOL environments	2,783 to 3,623**	2,625	158 to 998**
3813	RDOS X.25	1,050	630	420 to 473**
Eclipse Communications Software				
3501	Communications Access Manager (CAM)	NC	NC	53
3599	RJE80	1,313	1,050	158
3756	IC/RJE80; used in interactive COBOL environments	2,258 to 3,098**	2,100	158 to 998
3365	HASP-II	1,575	1,313	158
3755	IC/HASP-II; used in interactive COBOL environments	2,783	2,625	158 to 998**
3813	RDOS X.25	1,050	630	420 to 473**
3726	AOS RJE80	1,838	1,575	210
3727	AOS HASP-II	2,100	1,838	210
3801	AOS RCX70	5,775	5,250	315
3827	AOS X.25	1,890	1,155	210 to 420**
3828	AOX Xodiac; includes VTA, RMA, and FTA	7,500	3,250	550
3975	AOS RIA	1,575	1,050	315
3976	AOS RDA	1,575	1,050	315
3995	AOS DG/SNA	8,000	5,000	400
3996	AOS DG/SDLC	2,000	1,500	400
3997	AOS SNA/3270	2,000	1,500	400
3924	AOS/VS RJE80	1,838	1,575	210
3923	AOS/VS HASP-II	2,100	1,838	210
3925	AOS/VS RCX70	5,775	5,250	315
3991	AOS/VS Xodiac; includes VTA, RMA, and FTA	7,500	4,000	550
3992	AOS/VS DG/SNA	8,000	5,000	400
3993	AOS/VS DG/SDLC	2,000	1,500	400
3994	AOS/VS SNA/3270	2,000	1,500	400

NC—No charge.
*Includes Comprehensive Software Support and Subscription Services.
**Depending on media used for distribution.■

Data General Nova and Eclipse Communications Capabilities

Pictured above are two popular models of the Data General Nova 3 family. Both the four-slot Model 3/4 (foreground) and the 12-slot Model 3/12 (background) may be configured as remote communications concentrators, as stand-alone or distributed processors, or as front-end communications processors.

MANAGEMENT SUMMARY

Evolution of Data General's Nova and Eclipse minicomputer line has been under way since 1970 and 1975, respectively. Almost every year since their introduction, Data General has discontinued older models and added new ones which featured improved performance and functionality. Today, Data General is actively marketing about a half dozen models of each and boasts an estimated 60,000 processors in use.

Communications capabilities for the Nova and Eclipse have undergone continued enhancement over the years. Presently, Data General offers a wide range of communications products, both hardware and software, which support the Nova and Eclipse in an even wider range of communications applications.

Data General has maintained an OEM-oriented marketing posture, and several OEM's resell Data General systems with specialized communications software which is not available directly from Data General to end users. For example, Monchik-Weber Associates (NY, NY) markets a combination Nova/Eclipse system with specialized IBM 370 front end capabilities. Gamma Technology (Palo Alto, CA) markets Data General systems with specialized software that includes IBM 3270 protocol emulation. Users are encouraged to contact Data General for more detailed information on OEM vendors. ▷

A set of communications features which support the Data General Nova and Eclipse minicomputers. As communications processors, either may be employed as a channel-attached front end or remote concentrator to an IBM 360/370 host. Numerous other configurations are also supported.

IBM 2780/3780 and/or HASP II workstation emulation can be implemented on any model. A single Nova or Eclipse can be configured to support up to 256 communications lines with a communications throughput of up to 40,000 characters per second. Lines may be a mix of half- or full-duplex, asynchronous or synchronous, leased or switched. Asynchronous transmission is supported at up to 19.2K bps; synchronous to 56K bps. Standard communications options include BSC and X.25 protocol support.

A communications subsystem for a single Eclipse, which includes a DCU/200, CAM and X.25 software, hardware multiplexers, and interfaces for two 56K bps synchronous lines and 24 asynchronous lines, can be purchased for $14,700. Maintenance on this subsystem costs $122 per month.

CHARACTERISTICS

VENDOR: Data General Corporation, Route 9, Westboro, Massachusetts 01772. Telephone (617) 366-8911.

DATE OF ANNOUNCEMENT: (Current Actively-Marketed Models) 1975—Nova 3/12, 3/4, 3D; Micronova; Eclipse S/230; 1976—Nova 3/D; Eclipse S/230, C/330; 1977—CS Systems; Eclipse S/130; 1978—Nova 4/S, 4/X, 4/C; Eclipse M/600, S/250, C/350, C/150.

DATE OF FIRST DELIVERY: 1976—Nova 3/12, 3/4, 3D; Micronova; Eclipse S/230, C/330; 1977—Eclipse S/130; 1978—Eclipse M/600; CS Systems; 1979—Nova 4/S, 4/X, 4/C; Eclipse C/150, S/250, C/350.

NUMBER DELIVERED TO DATE: 60,000 (All models, estimated).

SERVICED BY: Data General Corporation.

CONFIGURATION

For the most part, the same communications subsystems can be implemented on any of the current, actively-marketed models of the Nova and Eclipse. There are, however, some notable exceptions.

The Micronova, for example, is capable of supporting the same type of communications as the Nova and Eclipse, but to a lesser degree. Capacity is limited to 16 asynchronous and four synchronous lines, and the maximum supported speed of any single line is 9600 bps. The Micronova does not ▶

Data General Nova and
Eclipse Communications Capabilities

▷ Data General has focussed communications development of the Nova and Eclipse towards IBM compatibility, although communications as stand-alone processors, or with other Data General systems, is also supported. A Nova or Eclipse may be employed as a channel-attached front end, data concentrator or distributed processor to an IBM 360/370 host.

A Nova or Eclipse front end offers enhanced functionality over a dedicated IBM 370X front end. With a Data General front end, the network operation stays completely independent of the host, permitting it to be dedicated to applications processing. If the host fails, the Nova or Eclipse can keep the network operational and handle essential processing services until the host is reinstated. It may, depending on the degree of user-written software sophistication, log messages onto disk and even handle data base management for the host, in addition to performing typically front-end functions such as polling, addressing, message routing, code conversion, protocol handling, error checking, buffering and queuing. The user will tailor the Data General processor to perform the functions required in his specific environment. It may be desirable, for example, to utilize this front end for concurrent RJE or timesharing applications, or perhaps for off-line program development and upgrading.

As a remote concentrator, the Nova and Eclipse can multiplex messages and send them to the host either in periodic high-speed bursts, or store them until polled. The concentrator may perform code and protocol handling, sending all data to the host in a single host-compatible format. It would likewise take the host's output and reconvert it into the format required by each respective terminal. Data General concentrators may be redundant, and if the on-line one fails, a backup unit may automatically assume full control of lines and processing. Downline loading from the host in the event of remote concentrator failure is also supported.

Virtually any Nova or Eclipse can support RJE batch input (IBM 2780/3780 terminal emulation) or perform as a HASP II Multileaving station to an IBM host. Bisynchronous link protocol is fully supported.

Numerous Nova and Eclipse communications configurations are supported as stand-alone systems, or in a network with other Data General processors. Up to 256 communications lines may be terminated by a single processor, and may be a mixture of half- and full-duplex, synchronous and asynchronous, and of variable codes, speeds and protocols. Special hardware components permit two processors to share a common data base and mass storage. Also, processors may be joined together by high-speed local links. Up to 15 processors can be grouped up to 150 feet apart in this manner. Communications hardware and software is modular in nature, and permits easy flexibility and expansion. In most cases, additional line handling capability can be added to Data General multiplexers with no change to existing software.

Data General is regularly in the news with announcements of new communications products for its Nova and ▷

▶ support the Data Control Units (DCU/50 or DCU/200) that are supported by the Nova and Eclipse. The hardware and software components which handle communications on the Micronova are slightly different than, and may be considered compatible subsets of, their counterparts on the Nova and Eclipse.

Micronova Communications Subsystem

The Micronova handles communications via Data General's Micronova Communications Subsystem. It includes a Micronova version of the Communications Access Manager (CAM) software which is program-compatible with the Nova and Eclipse CAM, and is supported in the Micronova by either the DOS or RTOS operating systems. The hardware components which comprise the Micronova Communications Subsystem are:

MODEL 4225 COMMUNICATIONS ADAPTER: Occupies one chassis slot in either the 9- or 18-slot Micronova chassis, and controls up to four asynchronous or synchronous controllers.

MODEL 4227 ASYNCHRONOUS LINE MULTIPLEXER: Controls up to four asynchronous communications lines. Each line can be configured for RS-232C or 20-ma current loop operation and individually programmed for number of bits per character (5 to 8), number of stop bits (1, 1.5, or 2), line speed (50 to 9600 bps), and parity (odd, even, or none). When enabled, parity is automatically checked/generated on each line. The multiplexer supports full- and half-duplex operation. The 4227 provides full character buffering on reception and transmission, program-controlled loopback testing, and modem control with automatic answer capabilities for Bell 103, 202, and 212 Series data sets.

MODEL 4426 SYNCHRONOUS LINE CONTROLLER: Interfaces to medium-speed (9600 bps) synchronous/bisynchronous communications lines, and provides a full- and half-duplex EIA RS-232C/CCITT V.24 interface and full character buffering on reception and transmission. When coupled with the optional Model 4228 hardware CRC generator, the synchronous line controller can select either of two standard check polynomials, CRC16 or CCITT16. Both idle and sync characters, as well as character, size, parity, and loopback testing, are program-selectable. In receive mode, Model 4426 automatically synchronizes data and then strips out the sync character. Standard modem control is supplied for Bell 201, 203, 208, and 209 Series data sets. This synchronous controller also supports IBM Bisynch protocols with full transparency and is program code compatible with the SLM-2 Series synchronous multiplexer used on Data General Nova and Eclipse processors.
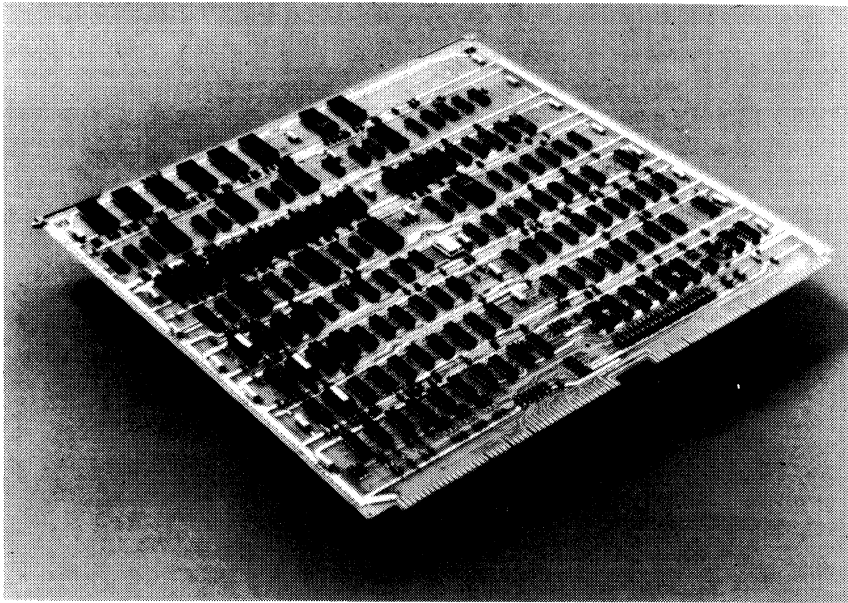
Up to four Model 4426 controllers can be configured with a single microNova minicomputer, allowing it to control a maximum of four synchronous lines. Only one CRC generator board is needed per system.

In addition to the Micronova CAM software, several other communications software packages can be implemented with the Micronova. These include the RJE80 Remote Job Entry Control Program, the IBM HASP Workstation Emulator, and the X.25 Protocol Support Package.

Commercial Systems (CS) Communications

Data General's Commercial Systems (CS/20, CS/30, CS/40 and CS/60) are also limited in their support of data communications. Although these packaged systems include standard Data General processors (CS/20 is a Micronova, CS/40 is a Nova, and so on), communications presently is limited to a single synchronous communications line. The Data General Communications Subsystem (DG/CS) is not ▶ supported.

Data General Nova and
Eclipse Communications Capabilities

The DCU/200 Data Control Unit, left, occupies one slot in the chassis of a Nova or Eclipse, and serves as a front end, offloading communications and line handling from the host processor. Up to four DCU's can be configured with a single system, and can provide throughput of up to 48,000 characters per second.

▷ Eclipse line. For example, an X.25 software package has recently been announced which will run under the DOS, RDOS and RTOS operating systems, and provide Data General processors with an interface capability to the X.25 packet-switched networks.

Data General is reportedly preparing CAM II, a new version of its standard Communications Access Manager, for release later in 1979. The new communications operating software will permit more efficient use of the DCU/200, a recently-announced processor which "front ends" a Nova or Eclipse, and permits higher communications throughput with less host overhead. Other communications enhancements to the Nova and Eclipse line can reasonably be expected in the near future, such as an X.25 capability for its AOS operating system.☐

▶ None of the Commercial Systems support the CAM software, Data Control Unit, or multi-line multiplexers. The Interactive COBOL Operating System (ICOS), which is standard to these systems does, however, support the RJE80 and HASP software packages for remote batch and job entry to a host.

Nova and Eclipse Communications

Two basic communications subsystems, and numerous variations of each, are available for communications control in all models of the Nova and Eclipse. High-volume communications systems would use the Data General Communications Subsystem (DG/CS), while low-performance systems would probably only require the Universal Line Multiplexer (ULM-5).

Either system operates under the control of the Communications Access Manager (CAM) software. CAM operates under the DOS, RDOS, Mapped RDOS and RTOS operating systems. With Eclipses running under the Advanced Operating System (AOS), CAM is not required as a separate component as its functions have been incorporated into AOS.

The DG/CS Communications Subsystem is a hardware and software system that is modular in nature. It is composed

of the ALM-16 and ALM-8 Series asynchronous multiplexers, the SLM-2 Series synchronous multiplexers, the 4251 Communications Chassis, and the DCU Data Control Unit. The CAM Communications Access Manager provides software support for teletypewriter terminals and Bisync line protocol.

Low-performance systems can utilize the ULM installed in the main chassis. Medium-performance applications use the ACM and SLM multiplexers in the 4251 chassis, which is connected directly to the host computer I/O bus. For high-performance applications, the DCU is inserted as a "peripheral processor" between the host CPU and the communications subsystem.

The DG/CS supports both full- and half-duplex operation. Line interface support is provided for EIA RS-232C/CCITT V.24, 20-ma current loop, and 23-ma current loop.

The DG/CS is supported by the AOS, RDOS, Mapped RDOS, and RTOS operating systems. Other software support includes RJE80, Data General's HASP Workstation Emulator, DCU-resident physical I/O routines, the aforementioned CAM, and an X.25 protocol support program.

DCU DATA CONTROL UNIT: Provide a dedicated communications controller consisting of a Nova processor with a local 1K (DCU/50) or 4K (DCU/200) words of memory on a single card that plugs into the host computer chassis. A DMA interface to the host allows any of the host memory to be "windowed" into the DCU address space to give the DCU access to the host processor's communications buffers without the need to interrupt the host. Communications with the various asynchronous and synchronous line multiplexers is via the DCU's I/O bus (separate from that of the host). Control of these multiplexers is in parallel with the main processor. The DCU's can be programmed for composite throughputs of several thousand characters per second over up to 256 asynchronous or synchronous lines. Programming of the DCU's can also handle unique protocols and character processing functions. Multiple DCU's can be connected to a single processor for increased communications loads. The units are normally used to perform all character-level interrupt processing, control character processing, code translation, error checking, and buffer maintenance.

The single most important function of the DCU is the off-loading from the host processor of most of the communi- ▶

Data General Nova and
Eclipse Communications Capabilities

Table 1. Interface Features and Line Multiplexer Selection; Nova/Eclipse

Line	Type of Line Interface	Timing	Data Set Supported	Interface Features for Multiplexer	No. Lines Supported per Interface Feature	Line Multiplexer
Leased Local	RS232-C CCITT V.24, DG-6053 Video Display	Asynchronous	Bell 103 (manual answer only)	Requires RS232-C Compatible #4261	4	ALM-16
	Teletype, DG-6053 Video Display	Asynchronous	33KSR, 35KSR	Requires Loop Interface #4260	4	ALM-16
Switched	RS232-C, CCITT V.24	Asynchronous	Bell 103, 202	—	4 or 8	ALM-8
Leased Local	RS232-C, CCITT V.24	Synchronous	Bell 201, 203, 208, 209	—	2	SLM-2
Leased	RS232-C, CCITT V.24	Synchronous	Bell 201, 203, 208, 209	—	1	ULM-5
Leased or Switched	RS232-C, CCITT V.24	Asynchronous	Bell 103, 202	—	4	ULM-5
Leased Local	213mA Current Loop	Synchronous	Bell 303	Requires Loop Interface #4265	1	SLM-2

cations processing overhead. For example, an Eclipse S/230 without a DCU would typically require 65 percent of its processing power to handle a data transmission rate of 10,000 characters per second. At 14,000 cps, about 84 percent would be required, and at 16,000 cps, no other processing could be performed. With the implementation of a DCU/50, the same processor's overhead required to handle 10,000 cps is reduced from 65 percent to 10 percent.

Up to four DCU's can be added to one host for an aggregate traffic volume of about 40,000 cps, with only about 40 percent of the main processor's time being devoted to communications overhead.

Software support generally permits the addition of a DCU to an already existing system without affecting the applications programs. Regeneration of CAM and, if present, RJE80, HASP or X.25 software is all that is required, except when implemented on an AOS Eclipse system, where the entire system needs to be regenerated.

The DCU occupies one of the processor's I/O slots, and is cable-connected to a separate communications chassis which houses the line multiplexers. Model 4251 is a four-slot chassis which is used for all Eclipse models, and Nova models 2, 3, 4, 1210, 1220, and 820. Model 4252 is a four-slot chassis used with Nova models 800, 830, 840, and 1200. Model 4253 refers to the second and subsequent chassis, which are cable-connected to the first. Each of the chassis supports up to four multiplexer cards, and multiple chassis can be configured to support up to 256 communications lines per system.

When the DCU is handling synchronous lines, a CRC generator/checker must be included; one per DCU regardless of the number of synchronous lines. The Model 4266 CRC Generator/Checker Feature permits use of either the CRC-16 or CCITT-16 polynomials for cyclic redundancy checking.

It should be noted that a DCU is not required for implementation of a DG/CS communications subsystem. However, for Data General systems where considerable communications activity is planned, the DCU will alleviate the host processor of most of its communications overhead, and enhance the capability to do other processing without adding additional main memory. Without a DCU, the line handling capacity for any single processor is reduced from 256 to 128.

4263/4264 SLM-2 SYNCHRONOUS LINE MULTIPLEXER:
Provides one or two lines with speeds of up to 9600 bps as a stand-alone unit or up to 56,000 bps in conjunction with a DCU and an optional high-speed interface for Bell 303 Series modems. Line operation may be either full- or half-duplex. Full character buffering is offered.

Programmable line characteristics include parity type (even, odd, or none); 6-, 7-, or 8-bit code level; SYN (synchronous) and DLE (delete) characters; transmitter/receiver on or off; and either CRC-16 or CCITT-16 cyclic redundancy check (CRC) polynomials, if the optional CRC Generator/Checker is installed. The internal clock is jumper-selectable to one of eight frequencies from 300 bps to 56,000 bps. Modem control is offered for Bell 201, 203, 208, 209, and 303 or equivalent data sets. Modem control signals include carrier detect, data set ready, ring indicator, request to send, data terminals ready, and clear to send. The RS-232C/CCITT V.24 interface is standard, while an interface for a Bell 303 is optional.

Up to 32 synchronous lines can be supported with the DCU/50 using the 4263 dual-line SLM-2. Off-line error detection and diagnostics are a standard feature.

4255/4256 ALM-8 ASYNCHRONOUS LINE MULTIPLEXER:
Offers a line speed of 5 to 19.2K bps on a program-selectable basis. The 4255 offers eight lines, while the 4256 offers four. Full-character buffering is standard. Line operation may be full- or half-duplex. Full modem control, including automatic answer capabilities for Bell 103, 202, or equivalent data sets, is standard. Modem control signals include carrier detect, ring indicator, data set ready, request to send, data terminal ready, and clear to send.

Programmable line characteristics include parity type (odd, even, or none); 5-, 6-, 7-, or 8-bit code level; 1 or 2 stop bits; and the aforementioned line speed. Diagnostics and error detection on an off-line basis are standard. Up to 128 asynchronous lines can be supported with a DCU and 4255. The EIA RS-232C/CCITT V.24 interface is standard.

4257/4258 ALM-16 ASYNCHRONOUS LINE MUTLIPLEXER:
Provides a line speed of 5 to 19.2K bps on a program-selectable basis. The 4257 handles 16 lines, while the 4258 handles 8. Full-character buffering is standard. Line operation may be full- or half-duplex. Programmable line characteristics include parity type (odd, even, or none); 5-, 6-, 7-, or 8-bit code level; 1 or 2 stop bits; and the aforementioned line speed. Diagnostics and error detection on an off-line basis are standard. Up to 256 asynchronous lines can be supported with a DCU and any combination of the 4257 or 4258. Interfacing is by the 4260 4-line, 20-ma current loop module or the 4261 4-line, EIA RS-232C/CCITT V.24 module. Both modules can be intermixed on the same ALM-

Data General Nova and
Eclipse Communications Capabilities

Table 2. Line Multiplexer Capacity Options; Nova/Eclipse

Line Multiplexer	Feature #	No. of Lines Supported	Timing	Speed	Remarks
ALM-16	4257	16	Asynchronous	Up to 19.2K bps	Local connections
	4258	8	Asynchronous	Up to 19.2K bps	Local connections
ALM-8	4255	8	Asynchronous	Up to 19.2K bps	Full modem control
	4256	4	Asynchronous	Up to 19.2K bps	Full modem control
SLM-2	4263	2	Synchronous	Up to 56K bps	Full modem control
	4264	1	Synchronous	Up to 56K bps	Full modem control
ULM-5	4241	4	Asynchronous	Up to 19.2K bps	Full modem control
	4242	1	Synchronous	Up to 9600 bps	Full modem control
	4243	5	4-Asynchronous	Up to 19.2K bps	Full modem control
			1-Synchronous	Up to 9600 bps	Full modem control

Note: All lines supported either half- or full-duplex.

▶ 16 board. Interfacing is also available to a Bell 103 data set for manual answer-only operations.

The 424X ULM-5 UNIVERSAL LINE MULTIPLEXER: Provides a low-performance alternative to the DG/CS and DCU system. The ULM-5, like the DCU/50 or DCU/200 occupies one slot in the Nova or Eclipse chassis and is cable-attached to the main processor I/O bus.

There are three models of the ULM-5; the Model 4241 handles up to four asynchronous lines only; the Model 4242 handles a single synchronous line only; and the Model 4243, which incorporates both the 4241 and 4242 on to a single board.

Asynchronous lines supported by the ULM-5 may be half- or full-duplex at up to 9600 bps. Character size is program-selectable at 5, 6, 7, or 8 bits, as well as the number of stop bits. Line interfaces may be either RS-232C/V.24 or Current Loop. Full modem control for Bell 103, 113, 202, 212 or equivalent modems is provided.

The synchronous line controller also supports either half- or full-duplex operation at up to 9600 bps. Character size is program-selectable at 6, 7, or 8 bits. An internal clock permits jumper selectable line speed. Controller includes full modem control for Bell 201, 203, 208, 209 or equivalent modems.

The ULM-5 is supported under CAM operating with DOS, RDOS and RTOS, and under AOS. The ULM-5 also supports Data General's RJE80 and HASP emulation packages.

Data General markets several special-function communications hardware components for its Nova and Eclipse line. Among these are the IBM Channel Interface, the Multiprocessor Communications Adapter, and the Dual-Access Controller.

IBM channel attachment is achieved with the 4025 IBM 360/370 PROGRAMMABLE INTERFACE which attaches to an IBM selector or byte-multiplexer channel, and can simulate the IBM 3705, 2700 series, etc. Operates in multiplexed or burst mode at up to 150,000 bytes per second. A 4025 IBM Software Driver is provided for I/O programming. The 4025 can operate with RDOS or RTOS in a real-time environment. On-line and off-line diagnostics are provided. The interface occupies two chassis slots.

The interface operates under user-written software, and can simulate any IBM peripheral or control device. It responds automatically to IBM channel sequences unless there is a command requiring a response from the Nova or Eclipse, in which case the 4025 generates an interrupt to the Nova or Eclipse. The mode of data transfer to the IBM host is predefined in the user-written software.

The 4206 MULTIPROCESSOR COMMUNICATIONS ADAPTER: Permits attachment of up to 15 systems through their DMA data channels to a common communications

bus, which has a bandwidth of 500K words per second. Typical data transfer rates are 140K to 250K words per second.

A 4206 MCA is required for each processor that is connected in the local multiprocessor network. It occupies one slot in the Nova or Eclipse chassis, and can support data transfer in one of two modes; normal and high-speed. The normal mode bus supports transfer of up to 625K bytes per second, can link up to 15 Nova or Eclipse processors, and can be up to 150 feet long. The high-speed bus supports data transfer of up to one megabyte per second, but can only link four processors and cannot exceed 40 feet in length. The 4206 MCA operates under control of either the RDOS or RTOS operating systems.
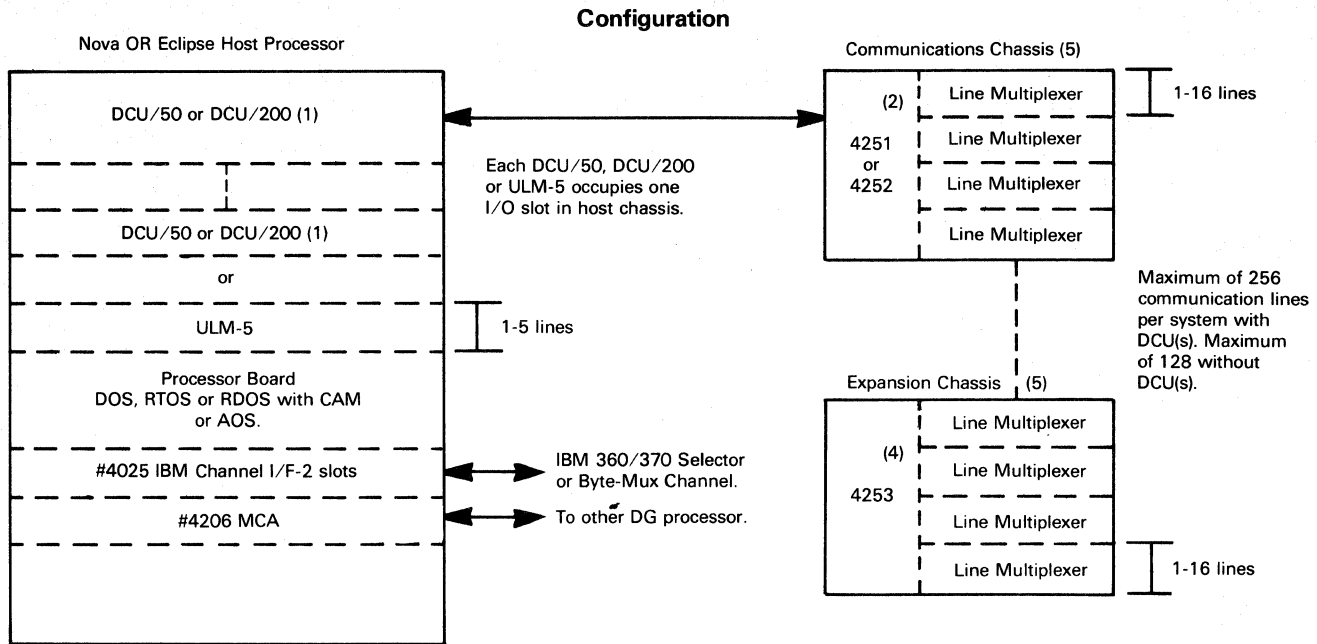
The 4232 DUAL-ACCESS CONTROLLER: Permits two DCU's to share up to 15 ALM's and SLM's. It contains a cross interrupt facility, watchdog timers, audio and visual alarms, CRC calculator, control panel, and a full-duplex interprocessor communication channel. Any mix of ALM's and SLM's can be assigned to either processor. Bank switching can be automatic or manual. The 4232 occupies the first slot in the 4251 communications chassis. A dual-access controller supports several major functions; such as backup redundancy for Data General processors performing communications line handling, or even for processors to share a common data base or other resources. One of the two processors may be disengaged from line handling to perform other tasks such as program development.

COMMUNICATIONS SOFTWARE

COMMUNICATIONS ACCESS MANAGER (CAM): Supports all types of communications, with or without a DCU Data Control Unit. SLM-2, ALM-8, ALM-16, and ULM-5 are supported under CAM, as well as the DCU's. CAM is modular and can be generated by the Communications System Generation Program (COMGEN) to include only those program segments required for each individual system. It operates under DOS, RTOS, RDOS, or mapped RDOS, and, since it uses the operating system's runtime-defined interrupt service, it may reside on disk and be brought into main memory from disk only as needed. This frees large segments of memory in a real-time communications system for other processing tasks. Portions of CAM also reside in the memory of a DCU, if it is present, further reducing main memory overhead. With AOS, a version of CAM is incorporated into the operating system, providing the same degree of communications functionality.

CAM software can support both standard and special user-defined protocols, including Bisync (BSC) and an asynchronous terminal line procedure. Synchronous and asynchronous protocols can be intermixed. Multi-drop lines are supported through polling and selection sequences. Modem control support for auto answer/auto disconnect is a standard feature. CAM provides a queue for I/O completions that permits a single user task to control several asynchronous lines. ▶

Data General Nova and
Eclipse Communications Capabilities

Configuration

Nova OR Eclipse Host Processor

Communications Chassis (5)

DCU/50 or DCU/200 (1)

DCU/50 or DCU/200 (1)

or

ULM-5

Processor Board
DOS, RTOS or RDOS with CAM
or AOS.

#4025 IBM Channel I/F-2 slots

#4206 MCA

Each DCU/50, DCU/200
or ULM-5 occupies one
I/O slot in host chassis.

1-5 lines

IBM 360/370 Selector
or Byte-Mux Channel.

To other DG processor.

(2)

4251
or
4252

Line Multiplexer

Line Multiplexer

Line Multiplexer

Line Multiplexer

1-16 lines

Maximum of 256
communication lines
per system with
DCU(s). Maximum
of 128 without
DCU(s).

Expansion Chassis (5)

(4)

4253

Line Multiplexer

Line Multiplexer

Line Multiplexer

Line Multiplexer

1-16 lines

(1) DCU/50 has use of 32K 16-bit words of memory; 1K of its own memory and 31K of host memory. DCU/200 has use of 32K 16-bit words of memory; 4K of its own memory and 28K of host memory. Host memory access by DCU is via DMA. Up to four DCU's can be configured in a single system.

(2) Communication Chassis #4251 is used with host Eclipse and Nova 2, 3, 4, 1210, and 820; #4252 is used with host Nova 800, 830, 840, and 1200. The communication chassis supports four Line Multiplexers.

(3) Choice of three Line Multiplexers: ALM-16, ALM-8, SLM-2. See Table 2 for number of lines supported. See Table 1 for additional features required with ALM-16.

(4) Expansion communications chassis supports four Line Multiplexers; maximum of three expansion chassis per Communication Chassis.

(5) Chassis are normally mounted in processor cabinet.

CAM also features a FORTRAN IV, FORTRAN 5, or COBOL interface, permitting communications I/O in FORTRAN or COBOL programs.

CAM operates on any Data General processor with 32K bytes of main memory, a real-time clock, and a communications chassis which includes at least one SLM-2, ALM-8, ALM-16, or ULM-5.

Data General has indicated that a new version of CAM, CAM II, will be released later in 1979. Among other enhanced features, it will reportedly make more use of the DCU/200's increased memory (8K bytes) in further off-loading communications overhead from the host Nova or Eclipse.

REMOTE JOB ENTRY CONTROL PROGRAM (RJE80): Allows for remote job entry and communications between Data General processors and IBM 360/370 systems, or between other Data General computers. Support is provided for four types of RJE systems:

• Point-to-point communications between a Nova or Eclipse emulating an IBM 2780/2780 and an IBM 360/370 host.

• Point-to-point communications between two Data General systems running RJE80.

• Multi-drop Data General systems emulating IBM 3780 slave terminals, communicating with an IBM 360/370 host.

• Multi-drop Data General Systems emulating IBM 3780 slave terminals, communicating with a Nova or Eclipse master system also running RJE80.

RJE80 running under mapped RDOS also allows a user to run one application in either the foreground or background mode while RJE80 runs independently in either mode.

RJE80 is supported by RTOS, RDOS, mapped RDOS, and AOS, as well as CAM. Features include horizontal and vertical printer format control; error detection on transmission and reception; and disc, tape, or card transmission to remote systems. Transmission between host systems may be to unattended RJE80 systems, and because of device-independent I/O capabilities, any combination of I/O devices can be utilized without additional software.

Under RTOS, RJE80 requires a 32K-byte Nova or Eclipse with a card reader, line printer, console terminal, real-time clock, 4251 or 4252 communications chassis, and an SLM-2 Synchronous Line Multiplexer.

Under RDOS, RJE80 requires a 48K-byte processor with 512K bytes of disc storage, a line printer, a console terminal, a real-time clock, a 4251 or 4252 communications chassis, and an SLM-2 Synchronous Line Multiplexer. RJE80 can handle line speeds up to 9600 bps with the SLM-2 or up to 56K bps with the DCU/50 Data Communications Unit and SLM-2 combination. Any modem of the Bell 201, 203, 208, 209, or 303 type, or equivalent, can be utilized.

The capabilities of both RJE80 and HASP II are also ▶

Data General Nova and
Eclipse Communications Capabilities

> supported under AOS, with the exception that local file transfers such as tape-to-disk, card-to-disk, and diskette-to-printer are directed by operating system commands rather than as part of either emulator.

IBM HASP II WORKSTATION EMULATOR: Lets a Nova or Eclipse system emulate an IBM HASP remote job entry workstation. The program operates under RTOS, RDOS/Mapped RDOS, or AOS. Its multileaving capability can include up to seven input and seven output data streams. Efficiency of data transmission is achieved by interleaving and data compression. The emulator supports both disc and tape storage. Hardware requirements under RTOS include a 32K-byte Eclipse or Nova with card reader or magnetic tape drive, line printer, and a real-time clock. Under RDOS, 48K bytes of memory are required plus a fixed- or moving-head disc, line printer, and real-time clock.

X.25 PROTOCOL SUPPORT PACKAGE: Permits a Nova or Eclipse to support the X.25 packet-switched network protocol. The package enables Data General processors to communicate directly or over public packet-switched networks such as Telenet, Tymnet or Canada's Datapac. The protocol package presently runs under only the RDOS operating system, but future announcements could reason-

ably be expected to include the X.25 capability for AOS, and possible RTOS. The package operates with other communications software and utilizes the HDLC protocol standard and synchronous communications. This protocol is applied to transmissions received and transmitted to and from the processor.

A library of communications software is available for operation under RDOS, Mapped RDOS, or RTOS. The library includes a Binary Synchronous Communications package callable from FORTRAN programs device-independent drivers for single- and multi-line synchronous and asynchronous adapters with full modem control, and device-independent drivers for intercomputer communications, particularly multiprocessor Data General configurations and direct channel interfacing to an IBM 360 or 370 system.

PRICING

Like the Nova and Eclipse processors, the communications hardware components are available on a purchase-only basis. An On-Call Service maintenance contract is available.

It should be noted that the CAM software is a separately-priced component for Nova systems, but is included in the price of the basic operating software with Eclipse systems.

HARDWARE PRICES

		Purchase Price	Monthly On-Call Service
COMMUNICATIONS SUBSYSTEMS; NOVA AND ECLIPSE			
4250	DCU/50 data control unit; 1K controller and data channel interface to any DG computer	$3,000	$ 36
4251	4-slot communications chassis; includes power supply, terminator card, and cable	1,800	22
4253	Add-on 4-slot communications chassis for 4251	1,400	14
4254	DCU/200 data control unit; 4K controller and data channel interface	3,900	36
4255	ALM-8, 8-line asynchronous multiplexer, programmable, includes full modem controls, for 4251 systems	2,000	16
4256	Same as 4255, except for 4 lines	1,250	16
4257	ALM-16, 16-line asynchronous multiplexer; programmable, does not include modem controls, for 4251 systems	2,000	20
4258	Same as 4257, except for 8 lines	1,300	20
4260	4-line current-loop interface for 4257 or 4258 multiplexer; for TTY or 6012 display interface	160	2
4261	4-line EIA interface for 4257 or 4258 multiplexer; RS-232C or CCITT V.24 compatible; for 6012 displays or Bell 103 or equivalent modems (with manual answer only)	160	2
4263	SLM-2, 2-line synchronous line multiplexer; programmable, for 4251 systems; includes full modem controls	1,500	12
4264	Same as 4263, except for 1 line only	1,000	12
4265	Current-loop interface for 4263 or 4264; for Bell 303 or equivalent modems	200	2
4266	CRC generator/checker for 4263 or 4264; one per DCU	500	4
4232	Dual computer access controller for 4250/4251	2,500	25
4241	ULM-5 4-line asynchronous line controller; universal, for use with Bell 103, 113, 202, 212 modems or equivalent	1,400	14
4242	ULM-5 single-line synchronous controller for use with Bell 201, 203, 208, 209 modems or equivalent	1,400	14
4243	ULM-5 combined 4241 and 4242	2,700	27
INTER-COMPUTER INTERFACES			
4206	Multiprocessor communications adapter, up to 15 Nova or Eclipse central processors can be interconnected	2,100	17
4075	Programmable IBM channel adapter; takes two chassis slots	7,500	225
MICRONOVA			
4225	Communications adapter card; 1 chassis slot	350	4
4226	Synchronous, single-line controller	400	5
4227	4-line asynchronous controller	500	7
4228	CRC generator/checker for 4226	250	4
COMMERCIAL SYSTEMS			
9127	Synchronous Line Interface for Bell 202-type modem and license to use Interactive COBOL/RJE80 software; for CS/40 and CS/60 systems	2,500	15
9163	Same, except with license for HASP II; CS/40 and CS/60 systems	2,500	15
9178	Synchronous Line Interface for Bell 202-type modem and license to use Interactive COBOL/RJE80 software; for CS/20 systems	1,000	NC

Data General Nova and
Eclipse Communications Capabilities

SOFTWARE PRICES

		Purchase Price	
		Initial	Subsequent
	COMMUNICATIONS SOFTWARE		
3599/3601	RJE80; All Nova and Eclipse (except AOS)	1,250	1,000
3725/3365	HASP II; All Nova and Eclipse (except AOS)	1,500	1,250
3726	RJE80; For AOS Eclipse	1,750	1,500
3727	HASP II; For AOS Eclipse	2,000	1,750
3460	CAM; For Nova and Micronova*	100	NC
3813	X.25 Software; For DOS, RDOS or RTOS	1,000	600

*CAM for Eclipse included with basic operating software.■