

Data General Nova 3 Series

MANAGEMENT SUMMARY

The Nova 3 series of computers, introduced in October 1975, continued the trend established by earlier versions of the Nova line and proved to be a successful product for Data General. The recent introduction of the Nova 4 (Report M11-304-151) obviously marks the beginning of the end of the Nova 3 series, but Data General will continue to manufacture and market the line for several years because of its OEM commitments.

Preceding the Nova 3 were the Nova 2/4 and 2/10, the Nova 800 Jumbo, 820, 830, and 840, and the Nova 1200, 1200 Jumbo, 1210, and 1220, all of which were retired from active marketing in 1976.

There had been some speculation that the Eclipse series computers, introduced in October 1974 (Report M11-304-201), would signal the end of the popular Nova line and perhaps also a major marketing shift toward the end user. As it turned out, the Eclipse line is marketed primarily for specific scientific and commercial applications, while the solidly established Nova line prospers and maintains its primarily OEM orientation.

The Nova 3's are available in the 4-slot Model 3/4 and the 12-slot Models 3/12 and 3/D. All of these models are built around the same processor, but the Nova 3/12

Although the very popular Nova 3 line of 16-bit minicomputers is being superseded by Data General's Nova 4 Series, the Nova 3 will continue to be available. The currently active Nova 3 line consists of the four-slot Model 3/4 and the twelve-slot Models 3/12 and 3/D. Memory protection is standard on the 3/D.

CHARACTERISTICS

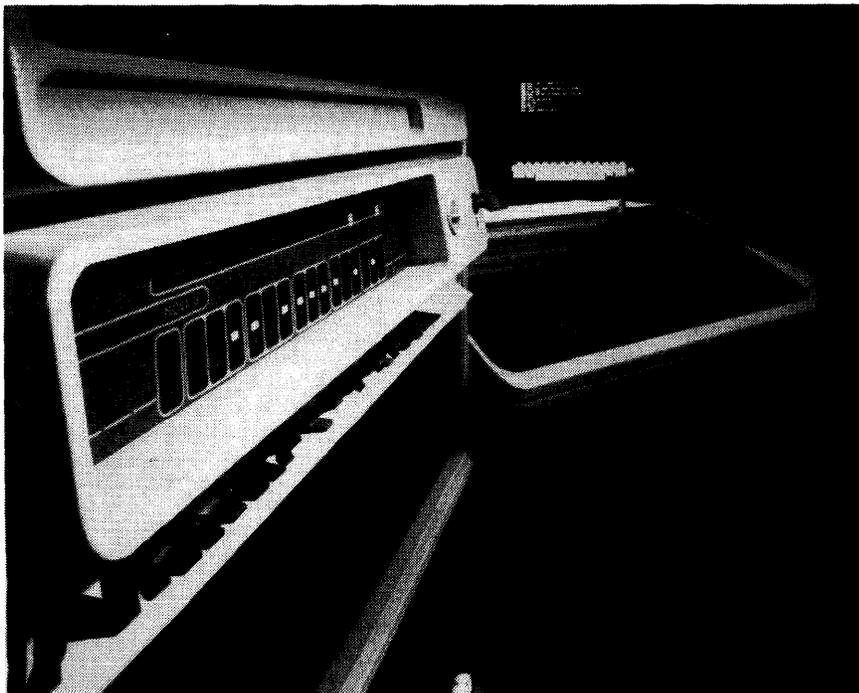
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Data General is a leading manufacturer of minicomputers, peripherals, and associated equipment. The company maintains sales offices in most major North American cities and in South America, Europe, and Australia. Manufacturing operations are located in Southboro, Massachusetts; Westbrook, Maine; Portsmouth, New Hampshire; and Sunnyvale, California. Assembly operations are also performed in Hong Kong and in Thailand.

MODELS: Nova 3/4, 3/12, and 3/D.

DATE ANNOUNCED: Nova 3/4 and Nova 3/12, October 1975; Nova 3/D, August 1976.

DATE OF FIRST DELIVERY: Nova 3/4 and Nova 3/12, April 1976; Nova 3/D, November 1976.



Newest NOVA 3 family member is the NOVA 3/D, featuring high-density semiconductor memories and memory mapping and protection for running unrelated programs simultaneously. The NOVA 3/D supports up to 128K 16-bit words of MOS or core main memory. MOS memory is available with or without parity, and comes in 32K, 16K, 8K, and 4K increments; core memory comes in 16K and 8K increments.

REFERENCE EDITION: This is a mature product line and no significant further developments are anticipated. Because of its importance, coverage is being continued, but no future update is planned.

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SUMMARY OF NOVA 3 MODELS

	Nova 3/4	Nova 3/12	Nova 3/D
Announced	10/75	10/75	8/76
First Delivery	4/76	4/76	11/76
Basic Purchase Price	\$3,700 (8KW)	\$4,700 (8KW)	\$12,000 (32KW)
Available Chassis Slots	2	10	8

➤ and 3/D can be enhanced with extra features such as 128K words of memory and memory mapping. Additionally, the Nova 3/D can be enhanced with memory protection. With the addition of memory mapping and memory protection, a Nova 3/12 becomes a Nova 3/D.

The memory management and protection unit (MMPU) of the Nova 3/D provides address validity protection, thus preventing users from addressing areas outside the assigned user space. This feature, coupled with the mapped version of RDOS, allows foreground and background processing, with each partition having a hardware fence to guarantee its own integrity.

The Nova 3 processor has the same architecture as older Novas plus one important extra: stack hardware similar to that used in the Eclipse processor. A Trap instruction has also been added. But the Nova 3's are *not* the same as, or even scaled-down versions of, the Eclipse CPU. The Eclipse is microprogrammable, while the Nova 3 is not.

The stack capabilities were added to the Nova 3 to improve its performance in real-time applications, using Nova operating systems such as RDOS. This operating system uses software-implemented queues (stacks) for real-time control, and implementing the basic stack function in the Nova 3 hardware substantially reduces operating system overhead.

Nearly overshadowing the Nova 3 introduction in October 1975 was Data General's concurrent announcement of 700-nanosecond semiconductor memories for the new systems, manufactured by DG itself and based on 4K dynamic MOS RAM chips from its Sunnyvale, California, plant. Data General has manufactured its own peripherals and core memories for some time, and has also been manufacturing TTL components in Sunnyvale. Just in case, however, a compatible (but not second-sourced) semiconductor memory, which uses MOS chips supplied by Texas Instruments, is also offered.

In all, three different memories are available with the Nova 3's: the 700-nanosecond semiconductor memory, an 800-nanosecond core memory, and a 1000-nanosecond core memory. All are intermixable in a single computer. The MOS memory is available in 8K, 16K, or 32K increments; the 800-nanosecond core memory in 8K increments; and the 1000-nanosecond memory in 16K increments. A parity option is available with the MOS memory only.

➤ **NUMBER INSTALLED TO DATE:** Data General claims that substantially more than 40,000 Nova systems of all models have been installed since their introduction in 1968.

DATA FORMATS

Same as Nova 4; see Report M11-304-151.

MAIN STORAGE

TYPE: Core and 4K-chip MOS RAM; the chip employs N-channel, silicon-gate technology. NMOS requires 64 refresh cycles every 2.4 milliseconds.

CYCLE TIME: Please refer to the following table.

Memory Type

	Core	Core	NMOS
Module size, words	8K	16K	All
Cycle time, nanoseconds	800	1000	700
Access time, nanoseconds	400	500	400

CAPACITY: 4096 to 32,768 words for the Nova 3/4; 4096 to 131,072 words for the Nova 3/12 with MMU (memory management unit); and 32,768 words to 131,072 words for the Nova 3/D with MMPU (memory management and protection unit). Available memory increments include 8K- and 16K-word core modules and 8K, 16K, and 32K NMOS modules. Modules of different sizes and types can be intermixed in the same processor in Nova 3/12 and 3/D systems.

CHECKING: Parity is optional on the Nova 3. If implemented, one parity bit is associated with each 16-bit word of parity memory. Core memory is available without parity only. NMOS is available with or without parity. Both parity and non-parity memories can be mixed in the same processor. The parity bit is added by the parity controller to each 16-bit word written into parity memory and checked when read by the same controller. The parity controller ignores access to non-parity memory.

Parity may be either even or odd, the choice being under program control.

STORAGE PROTECTION: A memory management and protection unit (MMPU) is available on the Nova 3/D for expanding the memory capacity to 128K words, protecting memory, and restricting physical-level I/O device access from user programs. The MMPU divides main memory into 1K-word pages, and can protect individual pages through software support under the Real-Time Disk Operating System (RDOS).

In addition to the storage protection, the Nova MMPU also provides three other forms of system protection: I/O protection, validity protection, and runaway defer protection. I/O protection prevents the use of any specified I/O device; any instruction attempting to address the protected device causes a system interrupt. Validity protection is used in

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION	MANUFACTURER
MAGNETIC TAPE EQUIPMENT		
6020	Transport and controller; industry-compatible, 7-track, NRZI, 10.5-inch reels, 75 ips, 556/800 bpi, vacuum columns, 8 drives per controller, 42/60 KBS	Data General
6021	Transport and controller; industry-compatible, 9-track, NRZI, 10.5-inch reels, 75 ips, 800 bpi, vacuum columns, 8 drives per controller, 60 KBS	Data General
6022	Transport; industry-compatible, 7-track, 75 ips, NRZI, 10.5-inch reels, 556/800 bpi, vacuum columns, 42/60 KBS	Data General
6023	Transport; industry-compatible, 9-track, 75 ips, NRZI, 10.5-inch reels, 800 bpi, vacuum columns, 60 KBS	Data General
6026	Transport and controller; industry compatible, 9-track, NRZI, 10.5-inch reels, 75 ips, 800/1600 bpi, vacuum columns, 8 drives per controller; 60/120 KBS	Data General
6026-A	Transport; industry-compatible, 9-track, NRZI, 10.5-inch reels, 75 ips, 800/1600 bpi, vacuum columns, 60/120 KBS	Data General
6027	Transport and controller; industry-compatible, 9-track, NRZI, 10.5-inch reels, 75 ips, 800 bpi, vacuum columns, 8 drives per controller	Data General
LINE PRINTERS		
4215	Drum; 136 positions, 64 ASCII character set, 10 characters per inch, 6 or 8 lines per inch, 4- to 16.8-inch paper, 12-channel VFU, 600 lpm	Dataproducts
4216	Drum; 136 positions, 64 ASCII character set, 10 characters per inch, 6 or 8 lines per inch, 4- to 16.8-inch paper, 12-channel VFU, 436 lpm	Dataproducts
4218	Drum; 136 positions, 64 ASCII character set, 10 characters per inch, 6 or 8 lines per inch, 4- to 16.8-inch paper, 12-channel VFU, 300 lpm	Dataproducts
4219	Drum; 136 positions, 96 ASCII character set, 10 characters per inch, 6 or 8 lines per inch, 4- to 16.8-inch paper, 12-channel VFU, 240 lpm	Dataproducts
4244	Band; 136 positions, 64 ASCII character set, 10 characters per inch, 6 or 8 lines per inch, 4 to 16.8-inch paper, 12-channel VFU, 900 lpm	Dataproducts
4245	Band; 136 positions, 96 ASCII character set, 10 characters per inch, 4- to 16.8-inch paper, 12-channel VFU, 600 lpm	Dataproducts
6086/8	Serial LP2, 7 x 9 matrix, 132 positions, 96 ASCII character set, 10 characters per inch, 6 or 8 lines per inch, 180 cps	Data General
6087/9	Serial LP2, 7 x 9 matrix, 132 positions, 96 ASCII character set, condensed or expanded/condensed printing, 6 or 8 lines per inch, 180 cps	Data General
CARD EQUIPMENT		
4016D/I	Reader; 80-column, punched card (4016D) or mark sense (4016I), 550-card hopper and stacker, 12-bit parallel; 285 cpm	Documation M200
4016E/J	Reader; 80-column, punched card (4016E) or mark sense (4016J), 1000-card hopper and stacker, 12-bit parallel; 400 cpm	Documation
4016F	Reader; 80-column, punched card, 1000-card hopper and stacker, 12-bit parallel; 600 cpm	Documation
4016G	Reader; 80-column, punched card, 1000-card hopper and stacker, 12-bit parallel; 1000 cpm	Documation
PAPER TAPE EQUIPMENT		
6013	Reader; fanfold tape, 8 channel; 400 cps	Data General
4012A/B	Punch; fanfold tape, 8-channel; 63.3 cps	Teletype
TERMINALS		
6040, 6041, 6042, 6043	Terminal printer; 5 x 7 dot matrix, inclined right 10 degrees, 132 positions, 96 character set (128 opt.), 10 characters per inch, 6 lines per inch, 40-character buffer 4- to 15-inch forms; receive only (6041 & 6043); standard typewriter keyboard (6040 & 6042); RS-232C, 20-ma current loop interfaces; 60 or 30 cps (6040 & 6041); 10, 15, or 30 cps; (6042 & 6043)	Data General
6052	CRT display/keyboard, 1920 characters, 24 lines by 80 characters, 64 ASCII character set, 5 x 7 dot matrix, detachable teletype style keyboard, 8 fn. keys, 11 key data entry pad, EIA or 20-ma current loop interface, full duplex, Dasher attachment, up to 19.6K bps (sync.)	Data General
6053	Same as 6052 except 96 ASCII character set, 5 x 8 dot matrix, detachable typewriter style keyboard, 11 fn. keys, and other features such as direct cursor positioning and programmable intensity	Data General
PLOTTER		
4017E	Plotter, 11-inch 2-fold paper, drum-type, 120-foot X-axis, 0.005-inch (4017E), 0.010-inch (4017E-A), 0.10-mm (4017E-B), or 0.25-mm (4017E-C) step size, 300 steps per second	Houston Instruments

➤ When the original Nova minicomputer—forerunner of a family that at one time included 11 active models—was introduced in September 1968, it was based on a 16-bit word length at a time when most manufacturers were ➤

➤ conjunction with memory mapping and can be extended to any 1024-word page in memory by mapping it to page 127; this indicates that the page is protected and, if addressed by any means, causes a system interrupt. Runaway defer protection prevents infinite indirect loops by counting the number ➤

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▷ busily developing 12-bit machines (e.g., DEC's PDP-8 family). Less than a year later, Data General introduced the Supernova, a machine with more than three times the speed of the original Nova and with unusually strong processing capabilities for a minicomputer of that day.

The Models 3/12 and 3/D mark the top of the Nova 3 line with the largest main memory capacities among the Nova 3's and with processor speeds suitable for the most demanding applications in the minicomputer arena. Dual-processor, shared-disk Nova 840 and Nova 2/10 configurations, announced in early 1974, have been largely supplanted by comparable systems employing the Nova 3/12 and 3/D.

Although processor options and configuration rules are not the same among various members of the Nova family, all employ the same basic 16-bit architecture, with four accumulators for computational use (two of which can be used for index registers), an I/O Bus, either a standard or high-speed Direct Memory Access (DMA) data channel, common 15-inch-square PC board packaging design, and strong communications capabilities. The actual number of devices that can be configured with any Nova system depends upon the number of available plug-in circuit board "slots" in the chassis. Only the Nova 3/12 and 3/D can have both core main memory and semiconductor RAM.

The Nova family of minicomputers is heavily used in control/monitoring systems, industrial testing, data acquisition/analysis, and various other scientific and educational applications. More recently, Novas have been appearing in general business or accounting applications, including multi-user, CRT-based systems. The majority of Nova users are either OEM buyers building systems for resale or end users building their own control systems or small business systems. The Nova 3/D, with multiprogramming capability, high-level language processors, and high performance, is strongly entrenched in the sophisticated end-user market.

The Nova 3/4 is priced competitively with several microcomputers, but offers better price/performance characteristics plus the availability of high-level languages and fully developed Nova software. The Nova 3/12, with its 128K-word memory capacity and memory mapping option, is intended for use in real-time applications such as front-ends, store-and-forward applications, and process control systems. The 3/12 has been in use as a communications front-end processor since April 1975, serving as the heart of DG's DCU/50 Data Control Unit, a user-programmable communications controller that operates in parallel with a central processor and permits a throughput of up to 48K characters per second. The Nova 3/D is almost identical to the Nova 3/12, but offers memory protection.

Competition for the Nova 3 line comes from a large number of other manufacturers. Nearly every mini maker has at least one model that competes with one or more members of the Nova family. DEC's PDP-11 family

▶ of consecutive times a particular address is referenced through a defer (indirect) cycle; if addressed 17 times consecutively, a system interrupt is generated.

The memory management unit (MMU) for the Nova 3/12 functions similarly to the MMPU, but without the validity protection feature.

Both the MMU and MMPU can hold two program maps and two data channel maps at the same time. Each map consists of 32 1K pages. Although both data channel maps can be enabled at the same time, only one program map may be enabled.

RESERVED STORAGE: Certain low-end memory locations are reserved for use during interrupt servicing, MMPU protection processing, stack fault processing, and power failure. Sixteen locations are reserved for increment and decrement registers.

CENTRAL PROCESSORS

GENERAL: The original Nova family utilized a single basic design, with the processor, memory modules, and communications/peripheral interfaces each contained on one or more 15-inch-square boards. These boards plug into slots in the Nova chassis, with its distinctive backplane wiring and power supply.

The Nova 3 series is mounted on the same 15-inch-square boards, but the architecture is an enhanced version of the earlier Novas featuring stack capabilities (similar to those found in the Eclipse processors) and removable power supplies. The Nova 3/4 is housed in a 4-slot chassis, and both the Nova 3/12 and 3/D are housed in a 12-slot chassis.

Processor options for all Nova 3 models include power monitor/auto restart, hardware multiply/divide, and a real-time clock. The latter attaches and operates like a peripheral device. In addition, the Nova 3/12 and 3/D have a memory allocation/protection option. All Nova 3's also have an automatic program load option.

The power-fail recovery system employs a battery that can maintain 32K words of NMOS memory for up to two hours. Recharge time from the fully depleted state is 24 hours during normal CPU operation. One to two milliseconds are provided for the execution of a save routine during a power failure.

CONTROL STORAGE: None.

REGISTERS: All Nova 3 processors have four 16-bit accumulators and a 15-bit program counter. Two accumulators can be used for address indexing. The Nova 3 computers also have a last-in/first-out (LIFO) push-down stack implemented in any 256 consecutive memory locations and two additional hardware registers, the stack pointer and the frame pointer. The stack pointer identifies the first memory location designated as the stack, and the frame pointer marks intra-stack boundaries to permit several "register saves" to be accumulated in the stack.

The MMPU and MMU dual program maps are each composed of 32 registers, each register controlling a 1K word space. The same is true for the 64 data channel map registers.

Beyond these hardware registers, Nova processors also have 16 reserved memory locations which function as auto-increment or auto-decrement registers when addressed indirectly.

ADDRESSING MODES: All Nova processors have six addressing modes: direct (256 words), indirect (multi-level), indexed, indexed-indirect (pre-indexing), program-relative, and program relative-indirect.

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▷ competes fully across the line, the Nova 3/4 competing with the PDP-11/03, 11/04, and 11/05, and the 3/12 directed against the PDP-11/35 and some 11/45 systems.

The Nova 3 series features three operating systems—DOS, RTOS, and RDOS/Mapped RDOS. DOS, the Disk Operating System, is diskette-based, while RTOS, the Real-Time Operating System, is memory-based. Both DOS and RTOS are compatible subsets of RDOS, the Real-Time Disk Operating System, which is hard disk-based. Four high-level languages are available for the Nova Series: COBOL, Extended BASIC, FORTRAN IV, and FORTRAN 5. An extended assembler, macro assembler, symbolic debugger, communications package, and a library of utilities—sort/merge, plotting routines, commercial subroutines, and text editor—are also available.

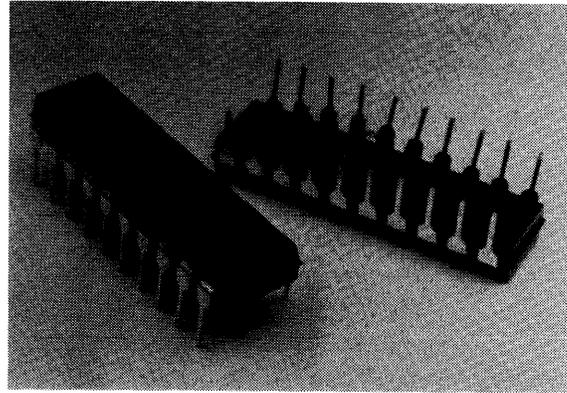
In the area of data communications, Data General provides RJE80, the Remote Job Entry Control Program, and CAM, the Communications Access Manager. RJE80 allows for remote job entry and communications between Nova processors and IBM 360/370 systems (in IBM 2780/3780 Mode), or between Nova processors and other Data General computers. CAM supports all types of communications and is designed to work with such hardware units as the DCU/50 Data Control Unit and various asynchronous and synchronous multiplexers.

Data General provides its own maintenance and field support service through about 93 field service centers distributed worldwide, which employ approximately 515 service personnel. Five depot locations—Framingham, Massachusetts; El Segundo, California; Toronto, Canada; Frankfurt, Germany; and London, England—provide comprehensive repair facilities.

With the growing popularity of small business computer systems, many turnkey systems vendors now offer custom solutions to business problems based on Nova series minicomputers.

USER REACTION

Detailed below are the responses to Datapro's late 1978 survey of minicomputer users from 17 Nova 3 customers with a total of 20 installed systems. The sample included 7 Nova 3/4 systems, 4 Nova 3/D's, and 9 Nova 3/12's. Six of the systems had been leased from third parties; all others had been purchased outright. Fourteen of the users were performing business data processing on their systems; other applications listed included data communications, scientific/engineering computing, data base management, text processing, and real-time control. The system in longest use had been installed in September 1976; the newest was installed in September 1978. The average system had been installed for slightly less than two years and had a little more than 100K bytes of memory, 106 million bytes of disk storage, and one tape unit. The most popular programming language in use was BASIC, while others mentioned were FORTRAN, ▷



Data General's 4K, 20-pin RAM used in Nova 3 semiconductor memories is an N-channel, dynamic MOS chip built with silicon-gate architecture. After fabrication in the company's Sunnyvale, California, facility, the chips are shipped to the company's Hong Kong subsidiary for wire-bonding and packaging. Completed 4K RAM's are returned to Sunnyvale for testing, then shipped to Data General's main computer manufacturing plant in Southboro, Massachusetts, for installation in Nova processors.

▶ When the MMPU or MMU is implemented, the 15-bit logical address coming from the CPU or data channel is translated to a 17-bit physical address. Memory access cycle time is unchanged.

The mapping information needed to service a CPU or data channel request is given to the address translation hardware by the operating system through I/O instructions that reference the address translation hardware. This information is transmitted before the supervisor enables either the user map or the data channel map.

All addresses can be mapped, including those acquired from DMA controllers.

INSTRUCTION REPERTOIRE: All Novas have the same basic complement of 4 Jump and Modify Memory instructions, 2 Move Data instructions, 7 stack processing instructions, 16 I/O instructions, and 8 arithmetic and logic instructions. (There are 256 variations on each of the arithmetic and logic instructions.) Hardware multiply/divide instructions are available as options.

The floating-point processor option adds 31 I/O-format instructions to the basic set; this option is not available for the Nova 3/4.

The MMPU adds 10 I/O-format instructions to the Nova 3/D, and the MMU adds 5 I/O-format instructions to the Nova 3 series.

INSTRUCTION TIMINGS: The timings shown in the accompanying table are for full-word, fixed-point operands, in microseconds, and apply to all of the Nova 3 models.

	700-nsec. NMOS*	800-nsec. Core*	1000-nsec. Core*
Load/Store	1.15	1.45	1.75
Add/Subtract	0.7	0.8	0.95
Multiply/Divide	5.8/6.5	5.9/6.6	6.0/6.8
Compare & Branch	1.7	1.9	1.9

*Average of minimum and maximum values.

INTERRUPTS: A 16-level programmed priority interrupt facility is used to recognize interrupts for I/O operations. ▶

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▷ COBOL, and Algol. Programming was almost exclusively done by in-house personnel.

The ratings assigned by users responding to the survey are summarized in the following table.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	8	8	0	0	3.5
Reliability of mainframe	9	5	1	1	3.4
Reliability of peripherals	4	10	1	1	3.1
Maintenance service:					
Responsiveness	5	5	2	2	2.9
Effectiveness	5	6	3	0	3.1
Technical support	4	2	5	3	2.5
Manufacturer's software:					
Operating system	5	5	1	1	3.2
Compilers and assemblers	4	6	0	1	3.2
Applications programs	1	3	0	0	3.3
Ease of programming	4	4	6	0	2.9
Ease of conversion	2	1	4	0	2.7
Overall satisfaction	5	7	2	1	3.1

*Weighted Average on a scale of 4.0 for Excellent.

The principal strengths of the Nova 3's were described as "Ease of use; "Operating system makes programming easy; Operable with clerical personnel; Easy to interface; Price/performance; Easy to learn and use; and Good O/S." However, the users were less enthusiastic about Data General's technical support and maintenance service, saying that "Vendor support/compilers are bad and Quality of maintenance leaves much to be desired;" some users criticized the "Lack of vendor technical support; Third party technical support; and Response time." Comments such as these have plagued mini-computer makers for years and can generally be attributed to less than adequate coverage and not enough trained support personnel. According to Data General, the company has been aware of the situation and has already taken steps to rectify it, primarily by increasing the scope and size of the company's Support Services organization.

It is appropriate to repeat here what we have said before: Data General's primary marketing direction for the Nova line is toward the OEM market. These users are usually able to solve their own technical problems and often supply service from their own in-house facilities. End users usually expect more support and services from manufacturers and are frequently disappointed by "OEM-level" support. However, Nova users are generally well pleased with the reliability, software, and price/performance of their systems.□

▶ Each I/O device is wired to one of 16 bus positions and is either authorized or denied authorization to interrupt particular service routines by an Interrupt Disable Mask Bit that corresponds to the bus position of the device.

PROCESSOR MODES: The Nova 3/D recognizes either a supervisor or user mode of program execution for use with the memory allocation and protection options. The executive program runs in the supervisor mode and can write-protect portions of each user's memory area. With this option and operating in user mode, no user can write in a protected area, use more than 16 levels of indirect addressing, or issue I/O instructions.

The Nova 3/D provides four memory maps: two program maps and two data channel maps. All addresses can be mapped, including those acquired from DMA controllers.

PHYSICAL SPECIFICATIONS: All Nova processors are housed in either 5.25-inch or 10.5-inch high chassis which are 19 inches wide and approximately 23 inches deep. Weights vary from 40 to 130 pounds fully loaded. The expansion chassis weighs 130 pounds fully loaded. The Nova 3/4 requires either 115 volts at 60 Hertz or 110, 220, or 240 volts at 50 Hertz. The Nova 3/12 and 3/D require either 115, 110, 220, or 240 volts at 50 or 60 Hertz. All units are usable internationally. Recommended operating environment for Nova computer systems is between 68 and 86 degrees F., but temperatures between 32 and 130 degrees can be tolerated. A humidity range up to 90 percent noncondensing can be tolerated. Nova 3's can operate effectively at an altitude of up to 10,000 feet. Air conditioning above normal office levels is not required. Power consumption ranges between 175 and 725 watts.

INPUT/OUTPUT CONTROL

INPUT/OUTPUT CHANNELS: An I/O bus and a Direct Memory Access (DMA) channel are standard on all Novas. Various high-speed options are available. The DMA data channel provides a multiplexer-like capability and can be seized by any device through a data channel request to handle 16-bit data transfers to and from main memory. The DMA channel can be used to increment the contents of storage locations by "1." DMA data rates for all of the Nova 3 models are summarized in the accompanying table.

	700-nsec. NMOS*	800-nsec. Core*	1000-nsec. Core*
Standard in	625K	588K	556K
Standard out	526K	500K	476K
High-speed in	1100K	1000K	909K
High-speed out	1000K	909K	833K
Autoincrement in	455K	432K	397K
Autodecrement out	833K	691K	635K

*Words per second

SIMULTANEOUS OPERATIONS: Memory overlapping is provided on all the Nova 3 series models.

CONFIGURATION RULES: Up to 62 peripheral devices can be attached to the I/O bus. The actual number of devices that can be attached to a particular Nova depends upon the available slots in the basic chassis and any available chassis extensions. The expansion chassis provides an additional 12 slots and mounts above the computer chassis. All processors occupy one slot. Any size memory module also occupies one slot. The price list at the end of this report states the number of slots remaining after the processor and memory requirements for each particular configuration are satisfied. The multiply/divide feature and parity option share the same board as the MMU and MPU; this combined board requires one slot. The MMU and MPU, when both are installed, become the MMPU. The floating-point option requires two slots.

In general, all peripheral I/O interface subassemblies/controllers require one slot. These include applicable units for reel-to-reel magnetic tape drives, cassette drives, printers, punched card equipment, paper tape units, terminals, plotters, and disk units. Also requiring one slot each are the I/O interface subassembly for the real-time clock, the bus control card, various communications controllers, and the DCU/50 Data Control Unit. The programmable interface to an IBM 360/370 requires two slots.

Other available chassis provide additional slot space for special purposes. These include the I/O Bus Switch Chassis, ▶

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► which provides 14 I/O slots, and the communications chassis, which furnishes 16 slots for line interface cards.

MASS STORAGE

All Data General disk subsystems can be accessed by two controllers to allow dual-processor, shared-disk systems. Dual-processor configurations are fully software-supported.

The following is a list of the currently supported mass storage units offered by Data General for use with the Nova 3 series. For details on these units, please refer to the Nova 4 report (M11-304-151).

- 4057 Moving Head Disk Subsystem,
- 6063/6064 Fixed-Head DG/Disk Subsystem,
- 6060/6061/6067 DG/Disk Storage Subsystems,
- 6045/46/47/48 Cartridge Disk Subsystem,
- 6070 Cartridge Disk Subsystem, and
- 6030 Floppy Disk Subsystem.

INPUT/OUTPUT UNITS

See Peripherals/Terminals table.

Data General is also an OEM peripherals supplier. Its OEM products are covered in Section M13 in Volume 3. Data General also provides a broad array of data acquisition, process control, and analog/digital I/O equipment.

COMMUNICATIONS CONTROL

Communications control on the Nova 3 is handled by the DG/CS communications Subsystem, a modular hardware and software system. This same subsystem is used on the Nova 4. The following is a list of the communications hardware currently available for the Nova 3. For details on these units please refer to the Nova 4 report (M11-304-151).

- DCU/50 Data Control Unit,
- DCU/200 Data Control Unit,
- 4263/4264 SLM-2 Synchronous Line Multiplexer,
- 4255/4256 ALM-8 Asynchronous Line Multiplexer,
- 4257/4258 ALM-16 Asynchronous Line Multiplexer,
- 4010 Asynchronous Line Controller,
- 4023 Asynchronous Single-Line Controller,
- 4025 IBM 360/370 Programmable Interface,
- 4061 Asynchronous Multiplexer, and
- 4026 Multiprocessor Communications Adapter.

SOFTWARE

OPERATING SYSTEMS: Four operating systems are available for use with Nova 3 computer systems, including the Real-Time Disk Operating System (RDOS), Mapped RDOS, Real-Time Operating System (RTOS), and the Disk Operating System, RDOS works on any Data General mini-computer with at least 16K words of main memory, a teletypewriter and a disk; Mapped RDOS is available on the

Nova 3/D to support two-partition multiprogramming with 32K-word user program areas and an operating system area of up to 32K words; RTOS is an upward-compatible subset of RDOS that runs on a minimum configuration of 8K words of memory and a real-time clock; and DOS is a diskette-based system that is also an upward-compatible subset of RDOS and supports up to 32K words of main memory. For details on these operating systems refer to the Nova 4 report (M11-304-151).

LANGUAGES: High-level language compilers are available for use on Nova 3 computers including Extended FORTRAN 5, Real-Time FORTRAN IV, Extended BASIC DOS BASIC, BUSINESS BASIC and Extended ALGOL. In addition, the Nova 3 supports an Extended Assembler, and a Macro Assembler. For details on these language products please refer to the Nova 4 report (M11-304-151).

COMMUNICATIONS: Communications software available for the Nova 3 systems includes the Communications Access Manager (CAM) and the Remote Job Entry Control Program (RJE80). For details on these products see the Nova 4 report (M11-304-151).

UTILITIES: A library of utility programs for the Nova systems include the FORTRAN Commercial Subroutine Package, a superset of IBM's CSP for data and format conversion and extended-precision integer arithmetic. Also included are a batch job control supervisor for executing stacked jobs; a real-time I/O system to support A-D and D-A interfaces and RDOS sort/merge; a text editor for 1 to 20 users; a symbolic debugger; Dataplot, a set of FORTRAN-callable routines for line drawing and axis rotation on digital plotters; and three editing programs—the Macro Editor, the Library File Editor (LFE), and the Octal Editor (OEDIT).

Utilizing simple command string input, the *Macro Editor* edits paper tape input to produce updated paper tape output. The user may define command strings in a special macro register. The command string may then be executed repeatedly by specifying the macro register name in subsequent command strings. A common application for the Macro Editor is the modification of program source tapes in preparation for a new assembly.

LFE allows the user to analyze the contents of a given library file, to merge and update libraries, and to create his own library files.

OEDIT permits the user to examine and modify, in octal, locations on a disc file. A common use of OEDIT is in making simple changes to executable saved files.

APPLICATIONS: No separate applications packages have been announced for the Nova systems to date. Other software consists of about 20 mathematical routines, more than 24 CPU and peripheral device diagnostics, and a variety of language processor libraries, format conversion routines, etc.

PRICING

POLICY: Data General offers the Nova series on a purchase-only basis, with two types of separately priced maintenance agreements: the On-Call Service contract and the Depot Service contract, which involves return of faulty equipment to a designated repair location. In either case, all parts and labor are included at no additional cost.

Normal prime-time on-call contract service hours are 9 a.m. to 5 p.m. Charges quoted in the price list are applicable to customers within 100 miles of a service center. Additional but uniform monthly charges are in effect beyond 100 miles ►

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► of a Data General service center. These charges are \$150 for customers between 100 and 300 miles from the center and \$225 for customers beyond 300 miles.

Under a Depot Service contract, any portion of a system may be covered, the minimum contract being \$75. The customer assumes all transportation and insurance costs. For non-contract on-site service, the hourly maintenance rates are \$40 for prime time and \$48 for all other times. A three-hour minimum applies. Depot service hourly labor charges are \$30 for prime time and \$48 for all other times.

Data General software is licensed and bundled so that it is included without additional charge on a system with sufficient hardware to operate it. For other configurations that include non-Data General equipment, the software is available for a license fee ranging from \$5 for object versions of various language processors to \$1,000 for full source listings of the FORTRAN or ALGOL library systems. One day on-site consulting service, including RDOS system generation, is billable at \$300 plus transportation costs from the nearest office, except for systems costing over \$30,000 with a high-speed input device, where the service is free.

The Data General Software Subscription Service provides automatic updates and documentation for Data General software at a price ranging from \$50 to \$350 per software product and for \$75 per product on any order totalling \$1,000 or more.

The Hardware Subscription Service provides automatic updates, additions, and notification of new documentation on all Data General Hardware for a fixed yearly fee. It is available to any owner of Data General equipment. This includes owners who have purchased their equipment through another vendor. Initial subscriptions include updates for one year. Prices are as follows: Nova processors, \$980; peripherals, \$920; and communications and I/O, \$920. Additional log books for any of the above topics are \$500 each without updates. Yearly renewal rates are \$480 for Nova processors, \$420 for peripherals, and \$420 for communications and I/O. A 40 percent discount applies for additional updates beyond the first to the same type of log book, ordered at the same time and deliverable to the same address.

Data General provides training courses for customers at its Westboro, Massachusetts, headquarters, at its Western Training Center in El Segundo, California, and at its United Kingdom Training Center in Greenford, Middlesex, England. Two training credits are given for each system purchased (end user) or two training credits per purchase agreement (OEM). One training credit entitles a customer to approximately one man-week of training. Schedules for training courses can be obtained at any Data General field office.

Courses currently being offered include: Introduction to Small Computers, 3 days, \$175; Introduction to Assembly Language Programming, 10 days, \$625; Assembly language Program Implementation, 5 days, \$325; FORTRAN Program Implementation, 5 days, \$325; RTOS, 5 days, \$325; RDOS Assembly, 5 days, \$325; RDOS FORTRAN, 5 days, \$325; RDOS Systems Programming, 5 days, \$375; Real-Time FORTRAN for Industrial Control, 3 days, \$225; Small Computer Hardware Fundamentals, 5 days, \$300; Nova Multiply/Divide Option, 2 days, \$150; Floating Point Unit Option, 3 days, \$225; Basic I/O Interfacing, 2 days, \$150; Magnetic Tape, 3 days, \$275; Data General Cassette, 2 days, \$175; Moving-Head Disk, 3 days, \$275; Line Printer, 2 days, \$175; and Card Reader, 2 days, \$175.

On-site training is available when necessary. Costs involve \$600 per day (with a three-day minimum) for instructional charges including the instructor's daily expenses, instructor's travel expenses, \$100 per weekend for subsistence when incurred, and a per-student charge for actual documentation used.

The Data General Users' Group provides a forum for interchange of programs. The programs are available for a fee to cover reproduction and distribution costs.

Prices shown in the Equipment Prices list are for single-unit quantities. Standard OEM three-to-five quantity discounts of 19 percent apply. Discounts of about 40 percent are available for quantities of 200 or more units.

EQUIPMENT: The following system purchase prices include all required control units, adapters, and cables.

SMALL NOVA 3/12 BATCH CONFIGURATION: Includes Nova 3/12 with 32K words of 700-nanosecond NMOS memory, multiply/divide, auto program load, 30-cps Dasher control terminal, diskette subsystem, card reader, 300-lpm printer, 10-megabyte disk drive, and cabinet. Purchase price is \$41,750.

DUAL NOVA 3/12 SYSTEM: Includes two Nova 3/12 computers, each with 32K words of core memory, multiply/divide, auto program load, power monitor, real-time clock, and interprocessor bus. System also includes a 60-cps Dasher console terminal, a DG CRT terminal, 10-megabyte disk drive, diskette subsystem, 300-lpm printer, and cabinet. Purchase price is \$52,290.

MAPPED FOREGROUND/BACKGROUND NOVA 3/D SYSTEM: Includes Nova 3/D with 80K words of core memory, power monitor, auto program load, memory management and protection unit, multiply/divide, real-time clock, 10-megabyte disk subsystem, magnetic tape drive, 60-cps Dasher terminal, DG CRT terminal, 300-lpm printer, and cabinet. Purchase price is \$59,790. ■

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
PROCESSORS			
Nova 3 processors include four accumulators, I/O system with programmed data transfer, 16-level programmed priority interrupt, extended hardware stack facility, direct memory access channel, external I/O bus connector terminator, programmer's console with lock, power supply, and chassis with slide mounts for 19-inch rack.			
Nova 3/4 Processor:			
8604-F	With 8,192 words of 800-nsec. core memory and 2 slots available	\$3,700	\$ 50
8605-G	With 16,384 words of 800-nsec. MOS memory and 2 slots available	4,400	56
8606-G	With 16,384 words of 800-nsec. MOS parity memory, 8536 parity control, 8533 option subassembly, and 1 slot available	6,100	54
8604-G	With 16,384 words of 1000-nsec. core memory and 2 slots available	5,200	60
8605-H	With 32,768 words of 700-nsec. MOS memory and 2 slots available	6,500	84
8606-H	With 32,768 words of 700-nsec. MOS parity memory, 8536 parity control, 8533 option subassembly, and 2 slots available	8,800	78
Nova 3/12 Processor:			
8607-F	With 8,192 words of 800-nsec. core memory and 10 slots available	4,700	56
8608-G	With 16,384 words of 700-nsec. MOS memory and 10 slots available	5,400	62
8609-G	With 16,384 words of 700-nsec. MOS parity memory, 8536 parity control, 8533 option subassembly, and 9 slots available	6,200	60
8607-G	With 16,384 words of 1000-nsec. core memory and 10 slots available	6,200	66
8609-H	With 32,768 words of 700-nsec. MOS parity memory, 8536 parity control, 8533 option subassembly, and 9 slots available	8,000	98
8607-H	With 32,768 words of 1000-nsec. core memory and 9 slots available	8,700	110
8608-H	With 32,768 words of 700-nsec. MOS memory and 10 slots available	6,700	102
All of the following Nova 3/D configurations include the 8535 memory management unit, 8533 option subassembly, 8530 automatic program load, and 8531 power monitor/automatic restart. All MOS memory includes 8532 battery backup, and MOS parity memory includes 8536 parity control. The Nova 3/D also includes the 8538 memory protection unit as standard.			
Nova 3/D computers:			
8578	With 32,768 words of 1000-nsec. core memory and 8 available slots	12,000	135
8579	With 49,152 words of 1000-nsec. core memory and 7 available slots	14,500	160
8580	With 65,536 words of 1000-nsec. core memory and 6 available slots	17,000	185
8581	With 81,920 words of 1000-nsec. core memory and 5 available slots	19,500	205
8582	With 98,304 words of 1000-nsec. core memory and 4 available slots	22,000	225
8583	With 131,072 words of 1000-nsec. core memory and 2 available slots	27,000	265
8584	With 32,768 words of 700-nsec. MOS parity memory and 9 available slots	14,400	125
8585	With 49,152 words of 700-nsec. MOS parity memory and 8 available slots	17,600	155
8586	With 65,536 words of 700-nsec. MOS parity memory and 8 available slots	20,800	175
8587	With 81,920 words of 700-nsec. MOS parity memory and 7 available slots	24,000	200
8588	With 98,304 words of 700-nsec. MOS parity memory and 7 available slots	27,200	215
8589	With 131,072 words of 700-nsec. MOS parity memory and 6 available slots	33,600	245
8590	With 32,768 words of 700-nsec. MOS memory and 9 available slots	12,300	153
8591-K	With 65,536 words of 700-nsec. MOS memory and 8 available slots	14,000	193
8591-M	With 98,304 words of 700-nsec. MOS memory and 7 available slots	16,500	233
8591-N	With 131,072 words of 700-nsec. MOS memory and 6 available slots	19,000	267
PROCESSOR OPTIONS			
8530	Automatic Program Load; for devices as specified in programmer's console switches	400	2
8531	Power Monitor/Auto-Restart; causes program interrupt when power fails and automatic restart when power is restored	400	1
8532	Battery Backup for MOS memory during power failure	500	10
8533	Nova 3 computer option subassembly; required by 8534, 8535, and 8536	200	2
8534	Multiply/Divide; multiplies two 16-bit numbers to produce a 32-bit product; divides a 32-bit dividend by a 16-bit divisor to produce a quotient and remainder	1,400	12
8535	Memory Management Unit; provides for Nova 3/12 memory expansion to 131,072 words, core or MOS or mixed memory modules, and two data channel operation address spaces	2,800	28
8536	Parity control option; parity generation and checking for MOS and interrupt generation on error condition in MOS parity memory modules	500	5
8537	Nova 3/12 or Nova 3/D expansion chassis; adds 12 I/O subassembly slots and includes I/O bus connector	2,000	20
8538	Memory Protection Unit (MPU) for Nova 3/12	1,000	10
8539	Floating Point Unit for Nova 3/12 or Nova 3/D	4,000	36
MEMORY (for field installation)			
8540	8,192-word, 700-nsec. MOS	1,500	28
8541	With parity option	2,100	26
8542	8,192-word, 800-nsec. core	2,000	32
8543	16,384-word, 700-nsec. MOS	1,800	40
8544	With parity option	2,400	38

Data General Nova 3 Series

EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>
8545	16,384-word, 1000-nsec. core	3,500	44
8546	32,768-word, 700-nsec. MOS, with parity	3,600	62
8547	Without parity	3,000	68
MASS STORAGE			
6060	DG/Disk Storage Subsystem; includes 12.5-megabyte pack disk drive and controller for up to four 50-, 96-, and/or 190-megabyte drives; one 3336-type disk pack is included	25,800	220
6060A	Add on 96-megabyte disk pack drive	20,800	160
6061	DG Disk Storage Subsystem; includes 190-megabyte disk pack drive and controller for up to four 96- and/or 190-megabyte drives, one 3336-11 type disk pack is included	31,000	220
6061A	Add on 190 megabyte disk drive	26,000	160
6062	Dual Port for 6060, 6061; includes controller	6,000	50
6067	DG/Disk Storage Subsystem; includes 50-megabyte pack disk drive and controller for up to four drives, and one 3330-11 disk pack	21,800	190
6067A	Add on 50-megabyte disk drive	14,800	140
6099	DG/Disk, storage subsystem; includes 12.5-megabyte pack disk drive and controller	5,100	41
6045	DG 10-megabyte Cartridge Disk Subsystem; includes one cartridge disk drive with 5 megabytes each of fixed and removable disk storage, controller four four drives and one certified disk cartridge	10,100	120
6046	DG 20-megabyte Cartridge Disk Subsystem; consists of a 6045 system with two drives and two certified disk cartridges	18,250	200
6047	DG 30-megabyte Cartridge Disk Subsystem; consists of a 6045 system with three drives and three certified disk cartridges	26,400	280
6048	DG 40-megabyte Cartridge Disk Subsystem; consists of a 6045 system with four drives and four certified disk cartridges	34,550	360
6050	Add-on 10-megabyte cartridge disk drive for 6045 or 6047 subsystem; includes power supply and one certified disk cartridge	9,000	80
6050F	Add-on 10-megabyte cartridge disk drive for an existing floppy disk subsystem; includes power supply and one certified disk cartridge	9,600	115
6051	Dual port option for 6045, 6046, 6047, or 6048 subsystem; includes controller	4,500	50
6070	DG 20-megabyte cartridge disk subsystem; includes one cartridge disk drive with 10 megabytes each of fixed and removable disk storage, controller for four drives, and six disk cartridges	13,500	140
6070-B	Same as 6070 except 2 disk drives	21,500	230
6070-C	Same as 6070 except 3 disk drives	29,500	320
6070-D	Same as 6070 except 4 disk drives	37,500	410
6070-A	Add-on removable 20-megabyte cartridge disk drive for 6070, 6070-B, or 6070-C	10,300	90
6070-E	Dual port option for 6070, 6070-B, 6070-C, and 6070-D	4,500	50
6063	DG fixed-head disk storage subsystem; includes 1-megabyte pack disk drive and controller for up to four 1- and/or 2-megabyte drives	9,900	90
6063-A	Add-on 1-megabyte disk pack	7,900	80
6064	Same as 6063 except 2-megabyte drive	13,900	125
6064-A	Same as 6063-A except 2-megabyte drive	11,900	115
6066	Four-megabyte subsystem, consists of 6064 and 6064-A	23,800	240
6030	Dual diskette subsystem including two drives with power supply and control for up to four drives	3,900	45
6030-A	Add-on dual diskette drives with chassis and power supply; for single or dual diskette subsystems	3,400	40
6030-B	Add-on dual diskette drives with chassis and power supply; for addition to a 10-megabyte cartridge disk subsystem	3,400	40
6031	Single diskette subsystem including drive with power supply and control for up to four drives	2,900	40
6031-A	Add-on single diskette drive with chassis and power supply; for single or dual diskette subsystems	2,400	35
6031-B	Add-on single diskette drive with chassis and power supply; for addition to a 10-megabyte cartridge disk subsystem	2,400	35
MAGNETIC TAPE EQUIPMENT			
6020	Magnetic tape subsystem; includes 7-track, 75-ips tape transport, switch-selectable at 556 or 800 bpi, and control for up to eight drives	9,900	90
6022	Add-on magnetic tape transport; 7-track, 75 ips, switch-selectable at 556 or 800 bpi	6,700	65
6021	Magnetic tape subsystem; includes 9-track, 75-ips tape transport, switch-selectable at 556 or 800 bpi, and control for up to eight drives	9,900	90
6023	Add-on magnetic tape transport; 9-track, 75 ips, switch-selectable at 556 or 800 bpi	6,700	65

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
MAGNETIC TAPE EQUIPMENT (Continued)			
6026	Magnetic tape subsystem; includes 9-track, 75-ips tape transport, switch-selectable at 800 or 1600 bpi, and control for up to 8 transports	14,500	115
6026-A	Add-on magnetic tape transport for use in a 6026 or 6027 magnetic tape subsystem	10,300	85
6027	Same as 6026 except 800 bpi only	10,900	100
LINE PRINTERS/PLOTTERS			
4215	Line Printer Subsystem, includes 600-lpm, 136-column, 64-char.-set printer and controller	18,000	110
4216	Line Printer Subsystem, includes 436-lpm, 136-column, 96-char.-set printer and controller	19,900	115
4218	Line Printer Subsystem, includes 300-lpm, 136-column, 64-char.-set printer and controller	12,500	85
4219	Line Printer Subsystem, includes 240-lpm, 136-column, 96-char.-set printer and controller	14,400	90
4217	Programmable Interval Timer for 4215, 4216, 4218, or 4219 subsystem	900	6
4244	Line Printer Subsystem, includes 900-lpm, 136-column, 64-char.-set, 6/8-line-per-inch printer and controller	25,500	174
4245	Same as 4244 except 660 lpm, 96-char. set	27,000	181
4014	I/O interface subassembly, must be ordered with incremental plotter control and/or line printer control	200	4
4017	Incremental plotter control for all 4017 Series plotters	1,500	10
4017E	Incremental plotter with Z-fold paper; 11-inch paper; 300 steps per second; step size 0.005 inch (4017E), 0.01 inch (4017E-A), 0.10 mm (4017E-B), or 0.25 mm (4017E-C)	5,000	100
6086	Dasher LP2 Serial 7x9 matrix printer; 64-character set; 180 cps; bidirectional; logic-seeking; up to 132 characters per line; 6/8 lines per inch	3,950	45
6087	Same as 6086, except with condensed and expanded/condensed printing	4,050	46
6088	Same as 6086, except data channel subsystem with data channel controller	4,650	51
6089	Same as 6088, except with condensed and expanded/condensed printing	4,800	52
PAPER TAPE EQUIPMENT			
4007	I/O interface subassembly; must be ordered with paper tape reader control (4011) and/or paper tape punch control (4012)	200	4
4011	Paper tape reader control for 6013 reader	850	9
4012	Paper tape punch control for 4012A punch	700	8
4012A	High-speed paper tape punch; 63.3 cps, fanfold, 8-channel paper tape	2,400	12
4012B	Same as 4012A but for use with 4013 remote-operation modification	2,400	12
4013	Remote-operation modification to punch; allows power turn-on/turn-off under program control	300	3
6013	High-speed paper tape reader; 400 cps, fanfold, 8-channel tape	1,150	12
PUNCHED CARD EQUIPMENT			
4036	I/O interface subassembly, must be ordered with card reader control (4016)	200	4
4016D	Medium-speed punched card reader, 285 cpm	2,900	40
4016E	Medium-speed punched card reader, 400 cpm	3,900	55
4016F	High-speed punched card reader, 600 cpm	4,100	80
4016G	High-speed punched card reader, 1000 cpm	5,000	80
4016I	Medium-speed mark sense card reader, 285 cpm	4,100	40
4016J	Medium-speed mark sense card reader, 400 cpm	6,000	55
TERMINALS			
6040	Dasher terminal printer, 60 cps, KSR	2,650	28
6041	Dasher terminal printer, 60 cps, RO	2,450	26
6042	Dasher terminal printer; 30 cps, KSR	2,400	25
6043	Dasher terminal printer, 30 cps, RO	2,200	23
6052	CRT; 24 lines by 80 characters, 5 x 7 dot matrix, 64-char. set; to 19.6K bps	1,990	20
6053	CRT; 24 lines by 80 characters, 5 x 8 dot matrix, 96-char. set, additional features such as blink and underscore; to 19.6K bps	2,290	20
6054	Printer interface for 6052 or 6053 CRT terminals; to 1200 bps	400	5
6055	Printer subsystem for 6052 or 6053; consists of 6054 interface and 6041 Dasher RO terminal	2,500	30
6083-A	Dasher display subsystem, typewriter-style keyboard, 9600 bps	3,090	26
6084-A	Same as 6083-A except "foreground" console	2,690	23
6085-A	Same as 6083-A except teletype-style keyboard	2,790	26
COMMUNICATIONS—ASYNCHRONOUS			
4007	I/O interface subassembly. Must be ordered with 4010 asynchronous line controller	200	4

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EQUIPMENT PRICES

COMMUNICATIONS—ASYNCHRONOUS (Continued)		Purchase Price	Monthly Maint.
4010	Asynchronous line controller for Models 33 ASR and KSR, 35 ASR and KSR, 6012, etc.	150	3
4023	EIA voltage I/O interface for Model 37 ASR and 37 KSR teletypewriters, 6012 video display, and Bell System 103 data set or equivalent when manual answer only is used; 150 bps	50	2
4029	EIA voltage interface for Bell System 202 data set or equivalent (1200 bps), or 103 data set or equivalent (150 bps)	200	2
4075	I/O interface subassembly; for 4077 TTY, I/O interface	150	2
4077	Teletypewriter I/O interface; same as 4010 except uses same interface subassembly as 4076 cassette controller	150	1
4078	EIA-type interface; same as 4023 except for use with 4077 interface	50	—
4061	Four-line subsystem of 64-line maximum asynchronous multiplexer with hardware character assembly, disassembly, and buffering; full-duplex operation with transmission characteristics and line speed selectable by jumpers; programmed I/O interface, provided for use with 4050 or 4083 junction panels	1,500	13
COMMUNICATIONS SUBSYSTEMS			
4250	Data control unit (DCU/50); provides data channel interface to any DG computer	3,000	36
4251	4-slot communications chassis for any Nova; 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	47
4255	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	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	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	500	4
4300	Sensor I/O subsystem with 16-card chassis	2,200	16
REAL-TIME CLOCKS			
4007	I/O interface subassembly; must be ordered with real-time clock (4088)	200	4
4008	Real-time clock; four frequencies selectable under program control; line frequency, 10Hz, 100Hz, or 1000Hz	400	4
4075	I/O interface subassembly; must be ordered with real-time clock (4079)	200	2
4079	Real-time clock; same as 4008 except uses same I/O interface subassembly as cassette controller (4076)	400	3
4065	I/O interface subassembly; must be ordered with programmable interval timer (4068); options 4067 and 4068 cannot both be on the same board	200	2
4068	Programmable interval timer; provides a crystal-controlled oscillator with jumper-selectable frequencies (10K Hz, 40K Hz, 80K Hz, 160K Hz, external) plus a 16-bit counting register which may be loaded and read under program control	600	6
GENERAL-PURPOSE INTERFACE			
4040	General-purpose interface board	450	—
4190	With 4192 I/O external connector	650	—
4041	Registers for 4040 or 4190; 16-bit input and 16-bit output	100	—
4042	Data channel connection	300	—
4192	General-purpose I/O external connector	300	—
CABINETS AND HARDWARE			
1012K	Cabinet; 70.5 inches high; provides 56 inches of rack space; includes blower	950	—
1012L	Cabinet; two-bay version of 1012K	1,900	—
1012M	Cabinet; 3-bay version of 1012K	2,850	—
1012N	Cabinet; half-bay version of 1012K; provides 19.25 inches of rack space	725	—
1012P	Cabinet; same as 1012K with power	950	—
4116	Blower for 1012 cabinets	150	—
1079A	Cabinet; 72.25 inches high; includes refrigeration unit; 1750 watts head load	2,900	30
1079B	Cabinet; same as 1079A except with air-to-air heat load	1,950	15

Data General Nova 3 Series

SOFTWARE PRICES

	Purchase Price	
	<u>Initial</u>	<u>Subsequent</u>
OPERATING SYSTEMS		
RTOS	100	NC
Mapped RTOS	750	NC
RDOS	NC	NC
DOS	300	NC
LANGUAGES		
RDOS COBOL	7,000	5,000
DOS BASIC	1,000	NC
RDOS Business BASIC	4,000	1,800
DOS Business BASIC	1,600	550
FORTRAN 5	NC	NC
COMMUNICATIONS		
RJE80	1,250	1,000
HASP II	1,500	1,250
CAM	100	NC