Bull HN Information Systems, Inc.
DPS 6

CHARACTERISTICS

EDITOR'S NOTE: On January 31, 1989, Honeywell Bull Inc. changed its name to Bull HN Information Systems Inc. to reflect the 65.1 percent ownership of the U.S.-based company by Groupe Bull of Paris. The "H" refers to the 19.9 percent interest held by Honeywell Inc. of the U.S., and the "N" reflects the 15 percent interest held by NEC Corporation of Japan. The information which follows is being reissued, using the new name, as a service to our subscribers.

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Since the introduction of the DPS 6 Plus Series—an extension of the DPS 6 Series—the DPS 6 Series has lost its strategic importance in Bull HN's approach to entry-level and mid-range workgroup, departmental, and enterprise-wide computing. Bull HN's marketing and product strategies focus primarily on the DPS 6 Plus system product line. Because of the significant installed base of DPS 6 low-end and mid-range systems, however, we continue to present system characteristics and the last available CPU prices.

DATA FORMATS

BASIC UNIT: 16-bit word—microSystem 6/10, DPS 6/22, DPS 6/40, DPS 6/42, DPS 6/42-1, DPS 6/45, DPS 6/45-1, DPS 6/70, DPS 6/70-1, DPS 6/75, 6/75-1, and DPS 6/78-1; 32-bit word—DPS 6/85, 6/85-1, DPS 6/95, 6/95-1, 6/95-2, 6/98-1, and 6/98-2.

FIXED-POINT OPERAND: Signed 15-bit single-precision or signed 31-bit double-precision operands. Byte and bit operands are also possible. In both single- and double-precision operands, the high-order bit of the first word is the sign bit. Signed data is always in twos complement notation.

FLOATING-POINT OPERAND: Single-precision operands include a seven-bit exponent and a 24-bit fraction plus the sign of the fraction. Double-precision operands have a 56-bit fraction formed by adding 32 bits to the single-precision format. In both single- and double-precision formats, the seven most significant bits of the first word form the exponent expressed in excess—64 notation. Following the exponent is the one-bit fraction sign field and the fraction.

All DPS 6 systems from the 6/40 through the 6/98-2 perform floating-point arithmetic by using either the Scientific Instruction Processor (SIP) or software simulation. Software simulation of the scientific instruction set is accomplished via two trap handlers: the floating-point simulator and the scientific branch simulator.

Formats for SIP and floating-point software simulation are the same.

INSTRUCTIONS: DPS 6 instructions are predominantly 16 to 48 bits in length, depending on the addressing mode employed. A three-word format is used for double-precision, immediate-operand instructions. All instructions, except generic types, have a one-bit control field (bit 0), a three-bit register designator (bits 1 through 3), and a four- or five-bit op code (bits 4 through 7 or 8). The use of the remaining seven or eight bits varies with the type of instruction.

A commercial instruction set is standard on all DPS 6 processors and includes 30 instructions for numeric, alphanumeric, edit, and branch operations. Decimal (both four-bit packed and eight-bit string), alphanumeric, and binary ➤

Although the DPS 6 Series is no longer strategic to Bull HN, the company is keeping the DPS 6 systems and system upgrade options available to DPS 6 customers who do not care to migrate to the newer DPS 6 Plus line—a line of DPS 6-compatible computers that offers improved price/performance.

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CHART A. SYSTEM COMPARISON

MODEL	microSystem 6/10	DPS 6/22	DPS 6/40	DPS 6/42 & 6/42-1	DPS 6/45 & 6/45-1
SYSTEM CHARACTERISTICS					
Date of introduction	April 1983	November 1984	July 1983	March 1985 (6/42); January 1986 (6/42-1)	September 1983 (6/45); January 1986 (6/45-1)
Date of first delivery	June 1983	January 1985	June 1983	June 1985 (6/42); April 1986 (6/42-1)	November 1983 (6/45); April 1986 (6/45-1)
Operating system	GCOS 6, UCOS III	GCOS 6, UCOS III	GCOS 6, UCOS III	GCOS 6, UCOS III	GCOS 6, UCOS III
Upgradable from	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Upgradable to	Not applicable	Not applicable	Not applicable	Not applicable	6/75, 6/85, & 6/95 models
MIPS	—	—	0.4	0.4	0.4
Relative performance (based on a rating of the 6/40 at 1.0)	0.4	0.8	1.0	1.0	—
MEMORY					
Minimum capacity, bytes	128K	512K	512K	1M (6/42); 2M (6/42-1)	512K (6/45); 2M (6/45-1)
Maximum capacity, bytes	1M	1.7M	1M	2M (6/42); 4M (6/42-1)	1M (6/45); 4M (6/45-1)
Type	MOS	MOS	MOS	MOS	MOS
Cache memory	None	None	None	None	None
Cycle time, nanoseconds	—	—	—	300	300
Bytes fetched per cycle	2	2	2	2	2
INPUT/OUTPUT CONTROL					
Number of channels	4 (max.)	4 (max.)	4 (max.)	4 (max.)	4 (max.)
High-speed buses	—	1	1	1	1
Low-speed buses	—	—	None	—	None
MINIMUM DISK STORAGE	15MB	28MB	40MB	40MB	40MB
MAXIMUM DISK STORAGE	56MB	136MB	1.6GB	1.6GB	1.6GB
NUMBER OF WORKSTATIONS	2	10	28	32	32
COMMUNICATIONS PROTOCOLS	DSA, RNP, VIP, PVE, TTY, XNS, X.25, HASP, BSC, SDLC, HDLC, LU6.2, SNA	DSA, RNP, VIP, PVE, TTY, XNS, X.25, HASP, BSC, SDLC, HDLC, LU6.2, SNA	DSA, RNP, VIP, PVE, TTY, XNS, X.25, HASP, BSC, SDLC, HDLC, LU6.2, SNA	DSA, RNP, VIP, PVE, TTY, XNS, X.25, HASP, BSC, SDLC, HDLC, LU6.2, SNA	DSA, RNP, VIP, PVE, TTY, XNS, X.25, HASP, BSC, SDLC, HDLC, LU6.2, SNA
PURCHASE PRICE (for basic configuration)	$3,995	$17,000	$27,000	$19,300 for 6/42; $24,300 for 6/42-1	$20,000 for 6/45; $27,000 for 6/45-1

Note: a dash (—) in a column indicates that the information is unavailable from the vendor.

data can be processed with mixed data types in the same operation. The maximum length of decimal operands is 31 digits, while alphanumeric operands can be up to 255 characters in length.

Generic instructions consist of an eight-bit op code (eight zeroes) and an eight-bit function code.

The optional Scientific Instruction Processor adds two types of instructions to the basic instruction set. Both of these types, the floating-point arithmetic instructions and the scientific branch instructions, are 16 to 32 bits in length, depending on the addressing mode utilized.

INTERNAL CODE: ASCII.

MAIN STORAGE

TYPE: 64K- and 256K-chip MOS RAM; the memory chips employ N-channel silicon-gate technology.

CYCLE TIME: 300 nanoseconds (ns) per word.

CAPACITY: Memory ranges from 128K to 16M bytes. See Chart A for memory sizes for particular models.

CHECKING: Error Detection and Correction (EDAC) memories are standard with all DPS 6 processors. EDAC memories use a six-bit Hamming code to detect and correct all internally caused single-bit errors and to detect all double-bit errors. With EDAC memory, address parity accompanies the most significant eight bits on the address bus. When memory detects an error on these bits, it does not respond; the result is a bus timeout. Each device controller/communications processor on the Megabus checks parity on information received from the Megabus and indicates an error by setting a parity error status bit.

STORAGE PROTECTION: DPS 6/40 through 6/98-2 systems incorporate memory management functions. The 6/40, 6/42, 6/42-1, 6/45, 6/45-1, 6/70, 6/70-1, 6/75, 6/75-1, and 6/78-1 incorporate the Memory Management Unit (MMU) on the central processor board. The 6/85, 6/85-1, 6/95, 6/95-1, and 6/98-1 support a separate board to provide the memory management functions of the allocation and assignment of memory among several users. The system divides the first 128K bytes of memory into sixteen 8K-byte segments for both short- and long-form addresses on a modular-256K basis, and the remaining memory into fifteen 64K-byte segments using long-form addresses. Virtual addresses in each segment are then automatically relocated to physical segments, each of which has its own read-write-execute protection level.

Protection is based on a 6-bit portion of a 32-bit descriptor employing 2 bits for read, 2 bits for write, and 2 bits for execute protection. Four levels of protection are available, allowing read, write, or execute access only if priority is greater than or equal to current priority. A hardware context save/restore facility automatically loads a new descriptor map at context switching time from an area reserved for this purpose. The unit also provides base relocation and descriptor validation.

RESERVED STORAGE: The first 256 locations are reserved for use by hardware. Among the 256 locations are four locations used by the realtime clock and watchdog timer, four locations for interrupt mask storage, 92 locations for 46 trap vectors, and 128 locations for 64 interrupt

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CHART A. SYSTEM COMPARISON (Continued)

MODEL	DPS 6/70 & 6/70-1	DPS 6/75 & 6/75-1	DPS 6/78-1	DPS 6/85 & 6/85-1	DPS 6/95, 6/95-1, & 6/95-2	6/98-1 & 6/98-2
SYSTEM CHARACTERISTICS						
Date of introduction	July 1985 (6/70); January 1986 (6/70-1)	September 1983 (6/75); January 1986 (6/75-1)	January 1986	March 1985 (6/85); January 1986 (6/85-1)	September 1983 (6/95); January 1986 (6/95-1 & -2)	January 1986
Date of first delivery	September 1985 (6/70); April 1986 (6/70-1)	November 1983 (6/75); January 1986 (6/75-1)	April 1986	May 1985 (6/85); April 1986 (6/85-1)	November 1983-(6/95); April 1986 (6/95-1 & -2)	April 1986
Operating system	GCOS 6, UCOS III	GCOS 6, UCOS III	GCOS 6, UCOS III	GCOS 6, UCOS III	GCOS 6, UCOS III	GCOS 6, UCOS III
Upgradable from	Not applicable	6/45 models	6/45 & 6/75 models	6/45, 6/75, & 6/78 models	6/45, 6/75, 6/78, & 6/85 models	6/45, 6/75, 6/78, 6/85, & 6/95 models
Upgradable to	Not applicable	6/78, 6/85, 6/95, & 6/98 models	6/85, 6/95, & 6/98 models	6/95 & 6/98 models	6/98	Not applicable
MIPS	—	0.56	—	—	1.8	—
Relative performance (based on a rating of the 6/40 at 1.0)	1.7	1.7	1.7	3.0	4.5	—
MEMORY						
Minimum capacity, bytes	2M	1M (6/75); 2M (6/75-1)	4M	2M (6/85); 4M (6/85-1)	2M (6/95); 4M (6/95-1 & -2)	2M (6/98-2); 4M (6/98-1)
Maximum capacity, bytes	2M (6/70); 8M (6/70-1)	2M (6/75); 8M (6/75-1)	8M	4M (6/85); 8M (6/85-1)	16M	16M
Type	MOS	MOS	NMOS	MOS	MOS	NMOS
Cache memory	8KB	8KB	8KB	8KB	8KB	8KB
Cycle time, nanoseconds	300	300	300	300	300	300
Bytes fetched per cycle	2	2	2	2	4	4
INPUT/OUTPUT CONTROL						
Number of channels	5 (max.)	12 (max.)	12 (max.)	—	24 (max.)	24 (max.)
High-speed buses	1	1	1	1	1	1
Low-speed buses	—	None	None	—	None	None
MINIMUM DISK STORAGE	40MB	40MB	40MB	40MB	40MB	40MB
MAXIMUM DISK STORAGE	1.6GB	1.6GB	1.6GB	3.3GB	6.6GB	6.6GB
NUMBER OF WORKSTATIONS	32	96	96	64	160	160
COMMUNICATIONS PROTOCOLS	DSA, RNP, VIP, PVE, TTY, XNS, X.25, HASP, BSC, SDLC, HDLC, LU6.2, SNA	DSA, RNP, VIP, PVE, TTY, XNS, X.25, HASP, BSC, SDLC, HDLC, LU6.2, SNA	DSA, RNP, VIP, PVE, TTY, XNS, X.25, HASP, BSC, SDLC, HDLC, LU6.2, SNA	DSA, RNP, VIP, PVE, TTY, XNS, X.25, HASP, BSC, SDLC, HDLC, LU6.2, SNA	DSA, RNP, VIP, PVE, TTY, XNS, X.25, HASP, BSC, SDLC, HDLC, LU6.2, SNA	DSA, RNP, VIP, PVE, TTY, XNS, X.25, HASP, BSC, SDLC, HDLC, LU6.2, SNA
PURCHASE PRICE (for basic configuration)	$30,500 for 6/70 and 6/70-1	$35,000 for 6/75 and 6/75-1	$52,000	$57,000 for 6/85; $62,000 for 6/85-1	$80,000 for 6/95; $86,000 for 6/95-1; $126,000 for 6/95-2	$98,000 for 6/98-1; $138,000 for 6/98-2
COMMENTS					The 6/95-2 is a dual-processor system.	The 6/98-2 is a dual-processor system.

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vectors, each of which points to a specific interrupt save area with its starting address of the interrupt subroutine and register storage area. The remainder of the locations are reserved for present and future system software usage.

Traps are caused by events such as overflows, parity errors, addressing nonexistent resources, or executing a scientific instruction if the SIP is not installed. A trap can occur at any priority level, and several can be nested at the same level. A trap could be entered at one level, that level interrupted during the execution of the trap routine, and then the same trap routine reentered in the new level.

Each type of trap has its own trap vector containing a pointer to the trap-handler procedure. Also utilized is a pointer to the next available trap save area. The latter is pooled, and pointers to the next available area are automatically adjusted by firmware. When a trap occurs, some, but not all, register contents are automatically stored in the trap save area.

CACHE MEMORY: The following DPS 6 models contain a cache memory: 6/70, 6/70-1, 6/75, 6/75-1, 6/78, 6/78-1, 6/85, 6/85-1, 6/95, 6/95-1, 6/95-2, 6/98-1, and 6/98-2.

CENTRAL PROCESSORS

GENERAL: The central processor for the microSystem 6/10 and DPS 6/22 is the Micro 6, which is a firmware-controlled, 16-bit microcomputer compatible with the DPS 6 instruction set. Bull HN's Large Scale Integrated (LSI) 6 microprocessor, with bidirectional architecture, controls the input/output operations and provides full functional compatibility with DPS 6 peripheral subsystems.

The Personal Computing Option, available for the 6/10, includes a 16-bit Intel 8086 processor. The processor provides for up to 64 priority levels.

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The DPS 6/22 has an LSI 6 microprocessor that includes a Commercial Instruction Processor (CIP) and a Scientific Instruction Processor (SIP) and executes the DPS 6 instruction set.

In the DPS 6/40, 6/42, 6/42-1, 6/45, and 6/45-1, the commercial instruction set is embedded in the CIP. The CIP is contained on the single-board processor. A System Control Facility (SCF) is also integrated into the processor board. The 6/40 and 6/42 models have a five-slot Megabus structure; the 6/45 models have a nine-slot Megabus. All of these models support the optional SIP.

The DPS 6/70, 6/70-1, 6/75, 6/75-1, and 6/78-1 processors are three-board modules that include the CPU with the MMU, the CIP, and an 8K-byte cache memory board. The 6/70, 6/70-1, 6/75, 6/75-1, and 6/78-1 offer as an adjunct a fourth board containing the System Control Facility. The 6/70 provides a 10-slot Megabus chassis, and three additional slots are available for expansion. The 6/75 and 6/78-1 have a 20-slot Megabus architecture. The 6/70, 6/75, and 6/78-1 models support the optional SIP.

The DPS 6/75, 6/75-1, 6/78-1, 6/95, and 6/98 models contain a disk cache processor. The disk cache provides for memory speed access to the most frequently requested disk-resident data.

The 32-bit DPS 6/85, 6/95, and 6/98 processors utilize a separate subsystem chassis with 32-bit high-speed data paths to integrate the boards and their respective functions. The board complement for the 32-bit processors is expanded to support increased system throughput. The central processor comprises two distinct circuit boards, as does the cache/memory management unit. The CIP and the SIP are both included as standard features, and each processor is made up of two boards. An Extended Megabus Connector completes the board complement of the 32-bit processors. The 6/85 models feature a 14-slot expanded Megabus, and the 6/95 and 6/98 models feature a 30-slot expanded Megabus.

A separate board contains the system control facility, which allows the CP register and main memory contents to be entered and displayed. It can control, in a step-by-step fashion, the system initialization sequence by single-stepping a program, and by stopping and starting program execution. The SCF permits remote operation of the system for diagnosis of hardware and software problems and for operator training and application updates.

The memory save and auto restart unit is an optional feature that ensures data retention for two memory controller boards for a two-hour period. Support circuit power runs are separated to minimize standby power drain. Electronics within the optional unit maintains the battery charge, retains memory contents when the system is manually powered down, regulates outputs, and indicates holdup failures. Power failures generate an interrupt with the auto restart feature. Following power failures, operations are automatically resumed, starting at memory location zero. Up to 1.5 milliseconds (ms) are allowed for the user program interrupt handler.

The 6/95-2 and 6/98-2 are similar to the 6/95-1 and 6/98-1, but are dual processing systems, containing two sets of tightly coupled 90E processors.

A full commercial instruction set is available on all DPS 6 models except the 6/22, which is missing two instructions. Those models with a separate Commercial Instruction Processor feature increased system throughput; the CIP incorporates hardware and firmware optimized for character string and decimal data manipulation.

The Scientific Instruction Processor is constructed around an LSI 40-pin chip and 17 four-bit slice bipolar microprocessors. The SIP is integrated on the 6/22. A single-board SIP is used for the DPS 6/40, /42, /42-1, /45, /45-1, /70, /70-1, /75, /75-1, and /78-1; a two-board unit is used for the DPS 6/85, /85-1, /95, /95-1, /95-2, /98-1, and /98-2. The SIP features mixed-precision arithmetic, mixed-mode arithmetic, automatic normalization, rounding and truncation of results under software control, and support of maskable traps. Data integrity checks can be performed for hardware, data, or program. The SIP on the 32-bit models supports standard Fortran math functions via single instructions.

Both 32-bit, single-precision, floating-point operands with an accuracy of six hex characters and 64-bit double-precision floating-point operands with an accuracy of 14 hex characters can be handled by the SIP, as well as single-word and double-word integer operands. Mixed-mode arithmetic is possible.

Upon decoding a scientific instruction and resolution of address syllable and memory management, the CPU sends the command and the operand memory address (if required) to the SIP, and goes on to the next instruction. The SIP gets the operand from memory under direct memory access (DMA) control and overlaps processing with the CPU processing. For the 16-bit systems, the SIP includes "double-fetch" logic and gets operands from memory two words at a time using the interleaved memory included in the system. The 32-bit machines retrieve 32 bits in a single fetch.

CONTROL STORAGE: Each of the DPS 6 central processors, CIPs, and SIPs provides control storage and microprogram capabilities. The 6/40, /42, /42-1, /45, and /45-1 provide 1,024 microinstructions, 80 bits in length, with a 210-nanosecond microcycle time. The 6/70, /70-1, /75, /75-1, and /78-1 include 1,024 microinstructions, 64 bits long, with a 170-nanosecond microcycle time. The 6/85, /85-1, /95, /95-1, and /98-1 include 2,048 microinstructions, 96 bits in length, with a 100-nanosecond microcycle time.

REGISTERS: The DPS 6/70, /70-1, /75, /75-1, and /78-1 offer 22 basic registers plus six optional registers. The 6/85, /85-1, /95, /95-1, and /98-1 incorporate 35 registers, including six registers for the Scientific Instruction Processor.

The basic 22 registers are seven 16-bit data registers; seven 20-bit address registers; 20-bit program counter; 16-bit status register; 16-bit indicator register; 20-bit remote descriptor base register; and four 8-bit mode registers. Three of the seven accumulators can be used for address indexing.

The data registers are 16 bits in length on all models, to preserve the integrity of arithmetic and logical operations. The base registers on all DPS 6 models are 20 bits in length, allowing them to directly address 2M bytes of memory. Depending on the model, the amount of addressable memory may be more than, the same as, or less than installed physical memory.

In the DPS 6, the base registers are used to address memory to the word level. The 6/85, /85-1, /95, /95-1, and /98-1 have seven 32-bit registers in the standard complement. Also included is the 20-bit stack address register.

If the SIP is installed, the standard register complement is increased by three 64-bit scientific accumulators, two 8-bit SIP mode registers, and an 8-bit SIP indicator register.

ADDRESSING: The DPS 6 models have 18 addressing modes in addition to register addressing: direct; indirect;

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indexed; indirect indexed; immediate (half-, one-, and two-word operands); base register direct; base register indexed address; base register indirect address; base register indirect address postindexed; base register predecremented (push addressing); base register postincremented (pop addressing); base register auto indexed; predecremented (push indexed); and base register auto indexed postincremented (pop indexed). All the previous addressing modes are for one-word instructions; the following are for two-word instructions in short address form or three-word instructions in long address form: program relative direct; program relative indirect; base register relative direct; and base register relative indirect. Several other modes are included for commercial instructions and for the more unified aspects of the 6/85 and 6/95 32-bit processor.

INTERRUPTS: The DPS 6 models have a single vectored party line interrupt system with up to 64 priority levels. Each interrupting device transmits a unique identifier to the CPU that causes control transfer through a vector table. The vector table entry points to the Interrupt Save Area (ISA), a memory block of at least six entries and as many as 43 entries.

The DPS 6 processors also have provisions for 46 trap vectors, for use with hardware enhancements and internally detected conditions such as nonrecoverable memory errors, program errors, unimplemented instructions, privileged operations violations, or program trace operations. The SIP adds traps for such conditions as reference to unavailable resources, exponent overflow, exponent underflow, and precision errors. Trap vectors are stored in reserved memory locations and point directly to the trap-handler routines.

OPERATING ENVIRONMENT: The microSystem 6/10 consists of the system unit (or enclosure), monitor, and keyboard. The 6/10 desktop system enclosure measures 6.0 inches (15.2 cm.) high by 20.5 inches (53.3 cm.) wide by 7.0 inches (17.8 cm.) deep, and weighs 45 pounds (20.3 kg.). A floor system enclosure is 26.0 inches (66.0 cm.) high, 15.0 inches (38.1 cm.) wide, 18.8 inches (47.6 cm.) deep, and weighs 124 pounds (55.8 kg.).

The DPS 6/22 processor unit is a small box measuring 30.0 inches (76.2 cm.) in height, 28.6 inches (72.6 cm.) in width, and 28.9 inches (73.4 cm.) in depth. The minimum weight is 274 pounds (123.3 kg.), maximum weight is 359 pounds (161.6 kg.).

The 6/40, 6/42, and 6/70 models are 30.0 inches (76.2 cm.) high, 20.7 inches (52.4 cm.) wide, and 34.8 inches (88.3 cm.) deep; they weigh 330 pounds (148.5 kg.) each. The 6/45 models stand 61.5 inches (156.2 cm.) tall, 20.7 inches (52.4 cm.) wide, and 34.8 inches (88.3 cm.) deep; the 6/45 weighs 500 pounds (226.8 kg.). The 6/75, 6/78, and 6/85 models are 61.5 inches (156.2 cm.) high, 27.0 inches (68.6 cm.) wide, and 36.1 inches (91.7 cm.) deep, and weigh 500 pounds (227 kg.) each. The top-of-the-line 6/95 and 6/98 models are a double-wide cabinet configuration at 61.5 inches (156.2 cm.) high, 51.0 inches (129.5 cm.) wide, and 36.1 inches (91.7 cm.) deep. The 6/95 and 6/98 models each weigh 970 pounds (440 kg.).

For power, the microSystem 6/10 and DPS 6/22 require 120 V AC (+10 percent, −15 percent), 60 Hz (±0.5 percent). The 6/40 and 6/42 models require 120 V AC (+10 percent, −15 percent), single-phase, 60 Hz, 15 amp. The 6/45 models require 240 V AC (+10 percent, −15 percent), 2-phase, 60 Hz, 30 amp. The 6/70 models require 120 V AC (+10 percent, −15 percent), single-phase, 60 Hz, 30 amp. The 6/75 models require 240 V AC, 2-phase, 60 Hz (±1 Hz). The 6/78, 6/85, 6/95, and 6/98 models require 120 to 208 V AC, 3-phase, 60 Hz (±1 Hz).

Maximum power consumption per model is as follows: microSystem 6/10—0.5 KW (with hard disk); 6/22—0.85 kVA; 6/40—1.2 kVA (includes two disk units); 6/42—0.84 kVA; 6/45—1.33 kVA; 6/70—0.84 kVA; 6/75 and 6/78—3.29 kVA; 6/85—4.60 kVA; and 6/95 and 6/98—5.98 kVA.

The operating environment for all DPS 6 models is 50 to 100 degrees Fahrenheit (16 to 32 degrees Celsius) at 10 to 90 percent relative humidity, noncondensing. The maximum heat generation per model is as follows: microSystem 6/10—1700 Btu per hour (includes hard disk); 6/22—1850 Btu per hour; 6/40—2963 Btu per hour (includes two disk units); 6/42—2295 Btu per hour; 6/45—3620 Btu per hour; 6/70—2295 Btu per hour; 6/75 and 6/78—9010 Btu per hour; 6/85—12,000 Btu per hour; and 6/95 and 6/98—16,382 Btu per hour. DPS 6 models require air-conditioning of some type.

INPUT/OUTPUT CONTROL

The LSI 6 processor, a standard feature with both the 6/10 and 6/22, has a bidirectional architecture that controls the I/O operations.

The 6/40, /42, /45, /70, /75, /78, /85, /95, and /98 models feature the Megabus, an asynchronous high-speed bus implemented as a printed circuit backplane to which all system components are connected and through which all interdevice communications occur. The Megabus has an addressing range of over 16M bytes and supports data rates up to 6M bytes per second. All I/O controllers are microprocessor-based and transfer all data directly to or from the 1,024 independent channels of the Megabus. Currently, the following controllers are available for the Megabus: cartridge disk/mass storage and fixed disk controllers for up to four disk drives each; magnetic tape controller, for up to four tape drives; multiple device controller, for I/O devices such as card readers, printers, diskettes, and a document handler; and multiline communications processors.

CONFIGURATION RULES

GENERAL: Configuration parameters for the DPS 6 models range from 128K bytes of RAM, 15M bytes of disk storage, and one workstation with the microSystem 6/10 to 16M bytes of RAM, 6.6G bytes of disk storage, 160 terminals, 4 tape drives, and up to 8 line printers on the DPS 6/98 models.

The DPS 6/22 includes the LSI 6 microprocessor CPU board with memory controller, Commercial Instruction Processor, and Scientific Instruction Processor and supports from 512K bytes to 1.7M bytes of main memory and five workstation ports. It is available in two different configurations; one comes with a 40M-byte (20M-byte fixed, 20M-byte removable) cartridge disk drive, and the other comes with a 28M-byte or 68M-byte fixed disk drive. Each of these configurations can also support an additional disk drive, making the maximum auxiliary storage capacity 136M-byte.

One chassis slot is available for one of the following options: a second five-port workstation/printer controller, an asynchronous/synchronous dual-line communications controller, or a single-line HDLC/SDLC communications controller. A two-slot expansion chassis is available. A single quarter-inch streaming tape unit is mounted on the front of the DPS 6/22 cabinet.

The DPS 6/40 is a microprocessor-based minicomputer that accommodates up to 28 workstations. The system ar-

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chitecture is based on a five-slot Megabus chassis that contains three standard boards; two slots are reserved for options. The single-board processor module includes the Micro 6 chip, a CIP, a Memory Management Unit (MMU), an SCF for remote diagnosis of system problems, and 512K bytes of memory (expandable to 1M bytes). The second board contains the MLC-16 communications controller. The disk controller is included on the third board. A single disk controller supports one 650K-byte diskette and one or two 40M-byte hard disks. Among the options that may be added through the remaining two slots are a second Multiline Communications Controller (MLC-16); a Multiple Device Controller (MDC-III); a second Cartridge Disk Controller; a Mass Storage Controller; a Magnetic Tape Controller; a Document Handler Controller; and an SIP.

The DPS 6/42 16-bit system is based on the Model 40 processor with a standard 1M bytes of Error Detection and Correction (EDAC) memory standard, expandable to 2M bytes. A five-slot Megabus chassis is standard. Other features of the DPS 6/42 include a CIP, an MLC-16 that supports up to 16 workstation/communications ports, a High Speed Disk Controller (HSDC), and a 5.25-inch 640K-byte diskette. Two additional Megabus slots are available for expansion either at the time of initial order or in the field. Maximum fixed disk capacity is 1.6G bytes. Up to 32 users can be supported on the system.

The DPS 6/42-1 differs from the DPS 6/42 in that it offers more physical memory. The DPS 6/42 comes with 2M bytes of memory. Up to 4M bytes of memory can be configured on the system.

The DPS 6/45 architecture is based on a nine-slot Megabus chassis containing three standard boards, a fourth board for a user-selected mass storage subsystem, and five slots reserved for option boards. The 6/45 integrates, on a single board, the Micro 6 processor, up to 2M bytes of memory, a CIP, an MMU, and an SCF for remote system support. The 6/45 also includes an MDC-III with a 650K-byte diskette and an MLC-16. The system can be configured with up to eight disk storage devices. Options for system expansion include a second MLC-16 and an SIP.

The DPS 6/45-1 is almost identical to the DPS 6/45 in configurability. However, the DPS 6/45 supports more memory. It accommodates 2M bytes to 8M bytes of memory.

The DPS 6/70 16-bit system offers 2M bytes of EDAC memory, an SCF, 8K bytes of cache memory, an MMU, a CIP, an MLC-16 that supports up to 16 workstation/communications ports, an HSDC supporting fixed disk storage of up to 1.6G bytes, and a 650K-byte diskette. The system offers a 10-slot Megabus; three additional Megabus slots are available for expansion either at the time of initial order or in the field. The DPS 6/70 can be expanded to support up to 32 workstation/communications ports.

The DPS 6/70-1 differs from the DPS 6/70 in that it offers more physical memory. The DPS 6/70 comes with 2M bytes of memory. It can accommodate up to 8M bytes of memory.

The DPS 6/75 is based on a 20-slot Megabus chassis containing seven standard boards, an eighth board for the user-selected mass storage subsystem, and 12 slots for option boards. The processor module comprises four boards and provides 1M bytes of memory, expandable to 2M bytes. Like the 6/45, the 6/75 contains an MMU, an SCF, an MDC-III, an MLC-16, and a user-specified mass storage subsystem. The 6/75 also offers 8K bytes of cache memory, as well as a faster CIP and a Disk Cache Processor. The number of communications lines on the 6/75 can be expanded to 96; disk storage capacity is expandable to 1.6G bytes.

The DPS 6/75-1 is similar to the DPS 6/75. However, it offers greater memory capacities. The DPS 6/75-1 supports up to 8M bytes of memory.

The basic DPS 6/78-1 system includes the 70E processor with 4M bytes of error detection and correction (EDAC) system memory, expandable to 8M bytes; a disk cache processor which uses 2M bytes of the 4M bytes as disk cache buffer memory; the System Control Facility (SCF); the Commercial Instruction Processor (CIP); the Multiline Communications Controller (MLC-16) with four RS-422-A workstation/communications/serial printer ports; a Multiple Device Controller with a diskette adapter; and a 5.25-inch, 650K-byte diskette. Twelve additional Megabus slots are available for expansion. One slot is required for a user-specified storage subsystem. The DPS 6/78-1 can support up to 96 workstation, communications, or serial printer ports; as many as 92 can be modem-connected communications lines. Configured with a Mass Storage Controller (MSC-16) the system can support a combination of up to four 67M-byte and 256M-byte mass storage units or 80M-byte cartridge module disks; or if configured with a High-Speed Disk Controller (HSDC), the system can support two disk controllers with each controller supporting a combination of up to four 132M-byte and 413M-byte fixed disk units.

The DPS 6/85's and DPS/85-1's Central Subsystem (CSS) consists of three standard processors. The Central Processor includes both 16- and 32-bit data registers and the capability to directly address 16M bytes of main memory. The CIP provides increased performance of Cobol-generated programs, and the SIP provides floating-point arithmetic capability. Main memory on the DPS 6/85 is expandable from the standard 2M bytes to a maximum of 4M bytes; on the DPS 6/85-1, expandable to 8M bytes from the standard 2M bytes. The basic DPS 6/85 or DPS 6/85-1 also includes an MDC-III with diskette adapter and panel-mounted an 5.25-inch, 650K-byte diskette. Over 3G bytes of disk storage can be supported on either the DPS 6/85 and DPS 6/85-1. Also, the DPS 6/85 is field upgradable to the DPS 6/95 or 6/98 models; the DPS 6/85-1 is upgradable to the DPS 6/95-1.

The DPS 6/95 is built around a 32-bit processor and is based on a 30-slot Megabus chassis, plus a Central Subsystem Assembly. Six Megabus slots contain standard boards. The Central Subsystem includes 8K bytes of cache memory, a Central Processor (CP), a CIP, an SIP, and a Disk Cache Processor. Main memory on the DPS 6/95 is expandable from the standard 2M bytes to a maximum of 16M bytes. The 6/95 can be configured with a 32-bit Mass Storage Controller (MSC-32) that simultaneously supports up to three disks in seek mode while reading/writing on the fourth. Up to four MSC-32s can be configured in a 6/95 system. Maximum on-line storage capacity is 6.6G bytes.

The DPS 6/95-1 differs from the DPS 6/95 in that comes packaged with 4M bytes of memory. The DPS 6/95-2 differs from the DPS 6/95-1 in that it contains two processing subsystems.

The DPS 6/98-1 features the Model 90E processing subsystem. The Central Subsystem (CSS) includes three standard processors: a Central Processor, a CIP, and a SIP, which are all linked together through 32-bit data paths. The basic DPS 6/98-1 also includes a Multiple Device Controller with diskette adapter and panel-mounted 5.25-inch, 650K-byte diskette. The DPS 6/98-1 can be configured to support up to 160 workstation, communications, or serial printer ports. As many as 156 can be modem-

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connected communications lines. The system supports 4M bytes of main memory, expandable to 16M bytes; a Disk Cache Processor which uses 2M bytes of the 4M bytes of memory as the disk cache buffer; and up to 6.6G bytes of disk storage.

The DPS 6/98-2 is similar to the DPS 6/98-1. It differs from the DPS 6/98-1 in that it contains two Model 90E processing subsystems.

WORKSTATIONS: The workstation maximums given for the DPS 6 systems (see Chart A) are configuration sensitive. Processing load varies the number of terminals able to be used at any one time. Workstation ports are equivalent to communications ports. The MLC-16 Communications Controller, an integral feature of the 6/40, /42, /45, /70, /75, /78, /85, /95, and /98 systems, supports up to 16 devices.

DISK STORAGE: The microSystem 6/10 supports one or two 650K-byte diskettes and up to 56M bytes of hard disk storage. The 6/22 can be configured with a 40M-byte (20M-byte fixed, 20M-byte removable) cartridge disk drive, or with a 28M-byte or 68M-byte fixed disk drive. Each of the 6/22 configurations can support an additional disk drive for a total capacity of 80M bytes or 136M bytes, respectively. All models from the 6/40 through the 6/98-2 support a 650K-byte diskette drive, plus additional disk devices with capacities of 40M bytes, 67M bytes, 80M bytes, 132M bytes, 256M bytes, or 413M bytes. The 6/40 through 6/78-1 models support a total of 1.6G bytes; the 6/85s support 3.3G bytes; and the 6/95 and 6/98 models each support 6.6G bytes.

Disk caching is standard on the DPS 6/78, 6/95, and 6/98 systems. The 6/78 can support up to 6M bytes of cache buffer memory, which can be added in increments of 2M bytes. The 6/95 can support up to 14M bytes of disk cache buffer memory; 2M bytes of system main memory must be allocated on the 6/95 for the disk cache buffer.

MAGNETIC TAPE UNITS: The 6/10 and 6/22 can support one control panel-mounted cartridge tape unit. The 6/40 and 6/42 support up to two magnetic tape drives. The 6/45, 6/75, 6/70, 6/78, 6/85, 6/95, and 6/98 models support up to four magnetic tape units. These units are available with a variety of feature choices, such as single- or dual-density, 45 or 75 ips, and NRZI, PE, or GCR recording mode. All systems (except the 6/10 and 6/22) support a tabletop cartridge tape unit.

PRINTERS: A variety of dot matrix (100 to 400 cps), letter-quality (35 to 55 cps), and line (300 to 1,200 lpm) printers may be configured on DPS 6 systems. As many as eight printers can be configured on the DPS 95 models.

OTHER PERIPHERALS: Bull HN provides two 500-card-per-minute (cpm) card readers and three document handlers as additional I/O options. The document reader, if configured, takes up four of the eight available ports.

COMMUNICATIONS CONTROL

GENERAL: The microSystem 6/10 supports asynchronous communications options that permit interfacing with Bull HN RNP or DSA networks, or IBM BSC or SNA networks. The asynchronous port, a standard feature, enables the 6/10 to communicate with asynchronous devices and with various on-line public data base services.

The DPS 6/22 dual-line communications controller supports asynchronous and synchronous (switch selectable) communications lines. Both RS-232-C and RS-366 (Autocall) ports are supported. A Network Controller Board supports single-line HDLC/SDLC and a second Workstation/Printer Controller Board supports five RS-422-A ports.

On the DPS 6/40 through 6/98 models, communications control is handled through the *MLC-16 Communications Controller.*

The MLC-16 Communications Controller connects up to 16 workstation/communications/serial printer ports on DPS 6/40, 6/42, 6/45, 6/70, 6/75, 6/85, and 6/95 systems. The MLC-16 permits such communications options as support of RS-422 workstations or serial printers up to 4,000 feet away; support of a wide variety of medium-speed lines—synchronous or asynchronous; RS-232-C, RS-422-A, current-loop, MIL-STD 188-C, and Autodial interfaces; medium- and broadband support of HDLC/SDLC; and broadband synchronous line support.

The MLC-16 supports up to four communications adapters, with four lines on each adapter. Available adapters include:

- A four-line workstation adapter (RS-422) with integrated line interface units (up to 19,200 bps).
- A four-line synchronous/asynchronous RS-232-C adapter with integrated line interface units (up to 9600 bps).
- A four-line synchronous/asynchronous communications adapter for support of medium-speed (synchronous or asynchronous) lines; the user can choose among eight types of line interface units per port.
- Single-line, medium-speed HDLC/SDLC adapters.
- Single-line, broadband synchronous/HDLC/SDLC adapters.

One MLC-16 is standard with each system; others may be added. The standard MLC-16 on each system includes one 4-line RS-422-A adapter supporting four workstation/serial printer ports. The DPS 6/40 can support one additional MLC-16 with up to three 4-line adapters. The 6/42, 6/45, and 6/70 models can support one additional MLC-16 with four 4-line adapters, for a maximum of 16 additional ports. The DPS 6/75 models can support five additional MLC-16s, each with a maximum of four 4-line adapters. The 6/85 models can support three additional MLC-16s with four 4-line adapters each. The 6/95 and 6/98 models can handle up to seven additional MLC-16s, each with a maximum of four 4-line adapters.

Bull HN's hardware and software *Local Area Network (LAN)* is an Ethernet-compatible LAN that provides communications and gateway and network control servers to link the company's large- and small-scale computer systems and terminals. Three models of communications servers can connect equipment from other vendors to a baseband Bull HN LAN. Two gateway servers interconnect Bull HN LANs and allow integration of long-distance communications devices. Each server can be independent—that is, no central controller is required—or up to 40 communications servers may be down-line loaded via a network control server.

The *Communications Server/1 (CS/1)* directs communications and compensates for speed variations between devices and computers on a Bull HN LAN. Up to 32 device connections can be made through one CS/1. Asynchronous and synchronous terminals, workstations, terminal printers, and modems can be attached to the CS/1. The CS/1 models are available with diskette or without disk (see Network Control Server/150).

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The *Communications Server/1-X.25 (CS/1-X.25)*, like CS/1, directs communications and compensates for speed variations. It also multiplexes asynchronous terminal traffic, translates high-level protocols, and permits file transfers between compatible information processors. The CS/1-X.25 can accommodate up to 48 concurrent sessions.

The *Communications Server/100 (CS/100)*, a series of eight different models, is similar functionally to the CS/1 and will support from four to 14 device connections. The CS/100 models are available with diskette drives or without disk (see Network Control Server/150).

The *Network Control Server/150* may down-line load up to 40 of its "client" communications servers, CS/1s or CS/100s. The NCS/150 is required for the diskless communications servers and optional for communications servers with diskettes. The NCS/150 also provides centralized administration and control.

Gateway Server/1 permits integration with distant or isolated resources by connecting the Bull HN LAN to X.25 Value Added Networks and Public Data Networks. The GS/1 supports X.29 pad functions of those networks. It can use the networks to link with resources on similarly attached Bull HN LANs.

The second gateway is the *Gateway Server/3*, which can link up to 15 geographically isolated Bull HN LANs by connecting GS/3 devices to a variety of dedicated communications media.

Bull HN's LAN products are compatible with Ethernet Version 2.0 and the IEEE 802.3 electrical specifications and support the Xerox Network System (XNS) protocols.

SOFTWARE

OPERATING SYSTEM: Bull HN offers a choice of two operating systems for the DPS 6 systems—GCOS 6 MOD 400 or UCOS III.

DPS 6 GCOS 6 MOD 400 is disk based and provides program and task management facilities, multiprogram control, I/O communications support, file and data management, utilities, and support for a range of hardware configurations. It also supports a hierarchical file system and 64 vectored priority levels and automatically recognizes interrupts.

GCOS 6 MOD 400 contains several significant capabilities for system availability, including a power resumption facility that uses the memory save and auto restart option to resume the memory image and reactivate system operation; a file recovery function that saves record images before they are updated in order to provide file integrity in the event of system or program failure; and a checkpoint restart procedure to provide a file recovery and program restart capability.

Monitor services supported by GCOS 6 MOD 400 are called using the Monitor Control Language (MCL). MCL instructions are generated by compilers and can also be coded in assembly language macroinstructions. The monitor services include task, trap, memory, file, basic communications, and clock management; a loader; standard I/O functions and input/output drivers; and a scientific instruction simulator based on traps.

UCOS III, derived directly from AT&T UNIX System III, provides UNIX commands and system features and adds Bull HN extensions compatible with Bull HN microSystem 6/10 and DPS 6 product line. UCOS III is a general-purpose, multiuser, multitasking interpretive system designed for software development, document processing, and communications applications. It comprises the following components:

- Kernel—providing the executive file system and basic (TTY) communications necessary to support the UCOS III multitasking programming environment.
- Shell Processor—including the UNIX System III command processor (the Bourne shell). The shell interprets user commands and provides pipe/filter capabilities in support of stored command programs.
- C Compiler and Assembler—including a full C language compiler and run-time support environment.
- UNIX-to-UNIX Communication—providing the intersystem networking facility.
- Source Code Control System (SCCS)—providing the source maintenance capability and offering full source revision and delta update control.
- Text Processing—providing the ASCII version of the UNIX Writers Workbench word processing and report writing capability.
- Commands—providing the majority of UNIX System III commands and utilities along with new commands and shell scripts from Bull HN.

DATA BASE MANAGEMENT SYSTEM: *Info 6* is a conversational data file management system operating as an on-line application under GCOS 6 MOD 400. Info 6 provides a complete data entry, update, and query language and a report writing system with computational capabilities.

Oracle, developed by Oracle Corporation, is a relational data base management system with data presented in tabular form. Oracle uses Structured Query Language (SQL), which is designed to operate on tables and possesses sophisticated query capabilities. Additional features of Oracle include a data dictionary; a report program facility; a host language interface that allows CALL or SQL statements to be embedded in Cobol, Fortran, and C programming languages; an interactive application facility; and data load facilities.

Total Central is a general-purpose data base management system supported by GCOS 6 MOD 400. Total Central can manage an unlimited number of data sets on an "integrated, nonredundant" basis and allows association of each of those data sets with other data sets, to form an integrated data base.

Data Management 6 Integrated Data Store/II (DM6 I-D-S/II) comprises the DM6 Transaction Processor (DM6 TP), DM6 I-D-S/II data base manager, and DM6 Interactive Query Facility (DM6 IQF).

The DM6 TP is a multitasking software subsystem designed for high-volume transaction processing environments. The DM6 TP subsystem provides concurrent processing of diverse types of transactions entered on-line from users' terminals. It is designed to run concurrently with users engaged in nontransaction processing operations. Transactions can also be entered in batch mode through multiple batch streams with or without interactive transactions. DM6 TP employs a high-level, Cobol-like generation language to describe transactions and the transaction processing environment.

The system is a standard implementation of the recommendations and specifications of the Conference on Data Sys-

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tems Languages (Codasyl). It supports hierarchical (multilevel) or network data structures, or a combination of the two. Up to 4.29 billion records can be implemented. Integrity is ensured through GCOS system journalization, automatic recovery, and restart capabilities; system-maintained relationship pointers; and a concurrency control scheme.

Bull HN's *Transaction Processing System 6 (TPS 6)* provides realtime transaction processing with data management facilities. TPS 6 provides for both data recording and file inquiry. All data is automatically validated, the data is processed and output, and the files are then updated. TPS 6 runs as an application under GCOS 6 MOD 400. It can be multiprogrammed with other applications. Performance monitoring allows the user to determine appropriate changes to programs and resource allocation in order to optimize TPS 6. TPS 6 includes a transaction processing language called Screenwrite. This high-level language is used, as is Cobol, for application programming and can be executed interactively with visual display terminals or in a batch environment.

The *Transaction Control Language Facility (TCLF)* allows multiple users, each operating in his/her own environment, to execute transactional applications concurrently. A transactional application program is composed of three interactive components: a screen form, a program (usually written in Cobol), and a transaction descriptor. The descriptor is written in Transaction Control Language and links the screen form and program. A combination of transaction descriptors and form descriptors allows data to be edited without an application program present. TCLF runs under GCOS 6 MOD 400. It is also compatible with the Transaction Control Language, which forms the primary application interface with the older MOD 200 and permits application transferability between the two systems.

LANGUAGES: Program development languages, plus a macro-preprocessor that allows development of macros in any higher-level language, are available for the DPS 6 processors. The program development languages are Advanced Fortran; intermediate and advanced Cobol; RPG II; Basic, available either as an Interpreter or Interpreter/compiler; Assembler and Advanced Assembler; C; Ada; and Pascal.

COMMUNICATIONS: The DPS 6 systems support a variety of communications software products.

Distributed Systems Architecture DPS 6 (DSA6) is a set of networking products providing communications functions among all levels of Bull HN systems, from micros through large-scale computers, while providing DP and office automation services to distributed departments and end users. DSA6 consists of the following components:

- Transport Facility (DSA-TF)—provides communications protocols and basic network management tools.
- Network Terminal Manager (DSA-NTM)—enables a DPS 6 to function as a terminal concentrator. DSA-NTM concentrates terminal traffic onto one communications line to access other DPS 6 systems, as well as DPS 6 Plus, DPS 7, DPS 8, DPS 88, and DPS 90 applications.
- Unified File Transfer (DSA-UFT)—moves disk-resident program files, data files, and dumps between DPS systems.
- Remote File Facility (DSA-RFF)—exchanges files with large systems operating under GCOS III or GCOS 8.
- Remote Batch Facility (DSA-RBF)—permits a DSA 6 node to be used for job submission and output delivery from a DPS 8 system via the network.
- Application Interface Facility (DSA-AIF)—allows users to write Cobol programs incorporating communications within a DSA 6 network.

The *Remote Network Processor DPS 6 (RNP6)* is a collection of networking facilities enabling a DPS 6 system to communicate with Bull HN's large-scale systems or other DPS 6 systems. The facilities include basic transport, remote concentration, remote batch, file transfer, and application transport interface. All of these functions can be provided with communications links to other RNP6 or GRTS-II, NPS, or DNS Front-End network processors. The links can be dial-up or leased, full- or half-duplex, and they can operate at speeds up to 56K bps.

Polled VIP Emulation (PVE) allows the minicomputer to emulate a Bull HN synchronous VIP terminal. Facilities offered under PVE include file transfer, remote batch, and interactive entry.

Systems Network Architecture DPS 6 (SNA6) is a set of software products that emulate most operations of standard IBM devices, permitting DPS 6 systems to interface with SNA distributed networks. SNA6 includes the following components: Transport Facility (SNA-TF), Interactive Terminal Facility (SNA-ITF), Remote Job Entry (SNA-RJE), Application Interface Facility (SNA-AIF), File Transfer Facility (SNA-FTF), and Remote Operator Facility (SNA-ROF).

Binary Synchronous Communications DPS 6 (BSC6) consists of a set of software products that emulate the majority of standard functions of several common IBM BSC communications devices. The facilities are designed to operate with standard IBM host software. Both SNA6 and BSC6 products can coexist in the same DPS6 system as part of an overall migration strategy. BSC includes the following components: BSC Transport Facility (BSC-TF), BSC 2780/3780 Workstation Facility (BSC-WF), HASP Multileaving Facility (BSC-MF), and BSC Programmable Facility/3271 (BSC-PF).

DSA/SNA Gateway 6 (GW6) connects Bull HN and IBM networks and provides internetworking capabilities for users in both environments. The DPS 6 acts as the internetwork bridge between the Bull HN network using DSA and the IBM network using SNA.

Bull HN provides a variety of emulators to integrate end-user workstations and micros into an overall distributed system. Through the appropriate emulator, a workstation can take on the personality of the terminal required to access a specific computer and its applications. The available emulators include the following:

- GCOS 6 MOD 400-based Emulators—allow Bull HN networking products and IBM interconnect software executing under GCOS 6 MOD 400 to provide emulation capabilities for asynchronous terminals and workstations.
- microSystem 6/10 Asynchronous Emulators—allow VIP 7305, TTY, microSystem VIP, PC 7300, and PC 7800 emulation.
- microSystem 6/10 Standalone Emulators—permit VIP 7804 and VIP 7705 emulation.
- microSystem 6/10 Bridge Facility—permits conversion of MOD400 files into MS-DOS files and vice versa.

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- microSystem PC Asynchronous Emulators—allow the microSystem PC and IBM's PC XT to operate as asynchronous VIP 7300 and/or VIP 7800 terminals.

Docu-Link enables the DPS 6 computers to share documents and data files with IBM systems running Distributed Office Support System (DISOSS) software.

UTILITIES: GCOS 6 MOD 400 utilities support peripheral I/O, debugging aids, program patch, copy/compare, print, dump/edit, file dump, data transcription, file formatting, sort/merge, and file maintenance functions. The GCOS 6 Sort/Merge can be called by any of the operating systems or compilers. It includes 16 sort key fields and user processing of input and output records capability.

GCOS 6 MOD 400 utilities support program development in GCOS Cobol and Basic. The volume preparation utility formats and labels disk packs and creates disk bootstrap records. The file utility allows files to be created, deleted, or renamed. Copy moves files and entire volumes either from disk to another disk or a printer, or from a card reader to a disk. Compare matches files and volumes and prints any discrepancies. The print utility prints sequential files, and the file dump prints program files by logical or physical record in both numeric and hexadecimal form. List prints all file entries or a subset within a directory showing file type, attributes, and size. A text editor and linker complete the list of program development aids. An interactive debugging aid, a memory dump editor, a patching facility, and file modification programs are also included. MOD 400 also provides the User Productivity Facility (UPF), a menu- and HELP-driven utility that permits users with minimal knowledge of data processing to create their own menus, forms, and prompt messages.

Test and Verification programs form an integral part of the Bull HN maintenance strategy. These programs consist of automatically executed processor and memory tests that are permanently resident in ROM and a family of free-standing routines. These programs consist of eight central subsystem tests for the central processor, memory, Scientific Instruction Processor, power failure detection, and realtime clock/watchdog timer; seven I/O subsystem tests for the console, card reader, printer, diskette, general-purpose DMA interface, cartridge disk, and magnetic tape units; and three communications subsystem tests.

System-80 Cobol Program Generator is a programmer productivity tool that generates complete Cobol programs using a hierarchy of menus, fill-in-the-blank attribute screens, prompts, and explanation screens. The software utilizes data dictionaries and program generators to produce complete, compilation-ready Cobol programs. The program can help write applications that enable data entry, data query, file copy, reporting, and file maintenance and updating.

PRO-IV is a fourth-generation application generator for business applications. It guides developers step by step through a series of fill-in-the-blank screens.

OFFICE AUTOMATION: Bull HN offers *Plus* office processing capabilities with *ONE Plus*, which includes the following systems:

ONExchange Document Library allows users of desktop workstations (terminals and PCs) to store and retrieve a variety of text and data files in a secure and organized fashion. The system consists of library services, print services, and distribution services.

ONEmail Electronic Mail provides a method of sending and receiving text, compound documents, DP files, and messages over communications lines.

ONEtime Time Management provides planning and scheduling tools for individual and departmental time management.

ONEtext Document Processing allows the user to enter text, format, revise, and print documents. It includes a spelling verifier/corrector, calculator, file management system, optical character reader (OCR) support, and a system administrator.

ONEtext Plus is an advanced document processing facility that automatically generates tables of contents and indexes and numbers paragraphs.

ONEbase Departmental Information Base works in concert with Oracle to allow the extraction and formatting of data.

ONEcalc Electronic Spreadsheet is a three-dimensional calculation and forecasting tool.

ONElist List Processing provides an optional office-level data base.

ONEdocument Compound Document allows a document to be previewed, assuring that the compound document is formatted in a satisfactory manner.

ONEdial Asynchronous Communications Information Retrieval Facility provides access to public data networks such as Tymnet and Telenet and commercial data bases such as The Source and Dow Jones.

ONElink DISOSS Services provides ONE Plus users with access to DISOSS services.

Document Transfer allows users to store and move files to and from either a Bull HN or an IBM host system.

APPLICATIONS: Bull HN's *Minicomputer Business Applications (MCBA)* products include interactive application modules: customer order processing, accounts receivable, inventory management, bill of materials, general ledger, accounts payable, payroll, purchase order, and mailing list generation. All MCBA applications are written in Cobol and run under the GCOS 6 MOD 400 operating system. MCBA is supported by the 6/22 through 6/98-2 models.

Bull HN also offers software for the sales and distribution, factory management, manufacturing, retail, health care, educational, and banking and finance areas.

In addition, Bull HN offers the DPS 6-based videotex system, InfoNow, which provides both hardware and software. The system consists of a dedicated central processor for data storage and processing of dial-in requests; end-user terminals for remote access over telephone networks; information provider workstations that allow information providers to design and load information pages into the system; and a system administrator terminal for logging on users, requesting statistics, backing up files, and performing other administrative functions.

PRICING

POLICY: Bull HN offers the DPS 6 computers for purchase only. The list prices for basic system configurations appear at the end of this report.

SUPPORT: Bull HN provides maintenance and field support for the DPS 6 line through its TotalCare program, a flexible service program that integrates on-site service, remote assistance, and self-help.

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One TotalCare service offering, the Customer Assisted Maintenance Program (CAMP), provides a low-cost alternative to traditional on-site service through Customer Replaceable Units (CRUs), which permit users to repair equipment themselves. DPS peripherals using CRUs are the VIP 7300 family of workstations and the PRU 9619 and PRU 9620 belt printers. Customers who elect CAMP dispatch service can receive parts from the nearest stocking location within four to eight hours.

TotalCare also includes a four-hour response time on hardware service calls, with an option for accelerated, two-hour response at customer request. There are no distance surcharges on service calls.

The DPS 6/22 through the 6/98-2 systems include the System Control Facility (SCF) as a standard internal component. This facility enables Bull HN's Technical Assistance Center (TAC) to dial in to a user site and assume direct operation of the system to diagnose hardware and software problems. A 300 bps modem and modem cable are supplied free of charge for RSF service. Through SCF, the user can also bring up a remote DPS 6 site for problem diagnosis, operator error detection, and operation assistance.

Another facility, the Remote Support Update Facility (RSUF), allows DPS 6/22 through 6/98-2 system users to perform remote updates on application programs and to receive Bull HN software patches from remote sources.

TRAINING: Bull HN offers users both on-site training and classroom instruction at customer education centers. Through the Education Account Management Service, Bull HN assists DPS 6 users in structuring training programs that address the needs of their organizations. Entry-level and operations training are offered, along with training in programming, transaction processing, data base management, and networking.

EQUIPMENT PRICES

		Purchase Price ($)	Annual Maint. ($)
COMPUTER SYSTEMS			
CPX9816	microSystem 6/10 with 128KB memory, single 650KB diskette, 2 async ports, display monitor, keyboard, power supply, and desktop enclosure	3,995	595
CPX9818	microSystem 6/10 with 640KB RAM memory, 15MB hard disk, 650KB diskette unit, 2 async ports, monochrome monitor, keyboard, and desktop system enclosure	6,995	800
CPX9871	microSystem 6/10 with 1MB RAM memory, 15MB fixed disk, 650KB diskette, monochrome monitor, keyboard, 2 async ports, and desktop system enclosure	7,995	850
CPX9873	microSystem 6/10 with 1MB RAM memory, 15MB fixed disk, 650KB diskette, color monitor with color graphics option board, keyboard, 2 async ports, printer port, and desktop system enclosure	10,595	960
CPX9874	microSystem 6/10 with 640KB memory, 28MB fixed disk, one 650KB diskette, 2 async ports, keyboard, monochrome monitor, power supply, and floor enclosure	9,995	850
CPX9875	microSystem 6/10 with 1MB memory, 28MB fixed disk, one 650KB diskette, 2 async ports, keyboard, monochrome monitor, power supply, and floor enclosure	10,995	900
CPX9877	microSystem 6/10 with 1MB memory, 28MB fixed disk, one 650KB diskette unit, 2 async ports, keyboard, color monitor with color graphics option board, power supply, and floor enclosure	13,595	1,010
CPX9112	DPS 6/22 with 512KB memory, CIP, SIP, 40MB (20MB fixed, 20MB removable) cartridge disk, one 5¼-inch 650KB diskette, five RS-422-A workstation ports, and one expansion slot	17,000	1,450
CPX9113	DPS 6/22 with 512KB memory, CIP, SIP, 28MB fixed disk, one 5¼-inch 650KB diskette, five RS-422-A workstation ports, and one expansion slot	12,995	650
CPX9840	DPS 6/40 with 512KB of memory; 40-megabyte cartridge disk, four workstation ports, 2 empty Megabus slots, 30-inch cabinet	27,000	1,700
CPX9866	DPS 6/42 with CIP, MMU, SCF, 1MB memory, HSDC, 5¼-inch 650KB diskette, MLC-16 communications controller with four RS-422-A ports, two empty Megabus slots, 30-inch cabinet	19,300	1,425
CPX9841	DPS 6/45 with 512KB of memory, MDC-III controller with integrated 650KB diskette, four workstation ports, MLC-16 communications controller, CIP, 60-inch cabinet	20,000	1,200
CPX9870	DPS 6/70 with 2MB memory, cache memory, CIP, MMU, SCF, MLC-16 with 4 RS-232-A ports, 650K-byte diskette, disk controller	30,500	2,100
CPX9861	DPS 6/75 with cache memory, CIP, 1MB memory, MDC-III with integrated 650KB diskette, four workstation ports, MLC-16 communications controller, and 60-inch cabinet	35,000	3,500
CPX9886	DPS 6/85 in 60-inch cabinet; contains 32-bit CSS with 32-bit processor, cache/memory management unit, CIP, SIP, 32-bit memory controller with 2MB double-density memory, SCF, MDC-III, MLC-16 communications controller with four RS-422-A ports	57,000	1,000
CPX9891	DPS 6/95 with cache memory, commercial and scientific instruction processors, 2MB memory, MDC-III with integrated 650K-byte diskette, four workstation ports, MLC-16 communications controller, and two 60-inch cabinets	80,000	6,200
DPS 6 DASH SERIES COMPUTER SYSTEMS			
CPX9742	DPS 6/42-1 with 2MB EDAC memory, MMU, high-speed disk controller, 2 option slots, and 30-inch cabinet	24,300	1,625
CPX9745	DPS 6/45-1 with 2MB EDAC memory, MMU, multiple device controller, 6 option slots, and 60-inch cabinet	27,500	1,650
CPX9770	DPS 6/70-1 with 2MB EDAC memory, EMMU, cache, high-speed disk controller, 6 option slots, and 60-inch cabinet	30,500	2,100
CPX9775	DPS 6/75-1 with 2MB EDAC memory, EMMU, cache, multiple device controller, 13 option slots, and 60-inch cabinet	36,000	2,800
CPX9778	DPS 6/78-1 with 4MB EDAC memory, EMMU, cache memory, disk control processor with 2MB disk cache buffer, multiple device controller, 12 option slots, and 60-inch cabinet	52,000	3,800
CPX9785	DPS 6/85-1 with 4MB EDAC memory, EMMU, cache, SIP, multiple device controller, 9 option slots, and 60-inch cabinet	62,000	4,850

NA—Not applicable.

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		Purchase Price ($)	Annual Maint. ($)
CPX9795	DPS 6/95-1 with 4MB EDAC memory, EMMU, cache, SIP, multiple device controller, 22 option slots, and two 60-inch cabinets	86,000	5,700
CPX9798	DPS 6/98-1 with 4MB EDAC memory, cache, EMMU, SIP, disk cache processor with 2MB disk cache buffer, multiple device controller, 21 option slots, and two 60-inch cabinets	98,000	6,050
CPX9796	DPS 6/95-2 Dual Processor with 4MB EDAC memory, a cache memory, SIP, multiple device controller, 22 option slots, and two 60-inch cabinets	126,000	7,120
CPX9799	DPS 6/98-2 Dual Processor with 2MB EDAC memory, EMMU, cache, SIP, disk processor with 2MB cache buffer, multiple device controller, 21 option slots, and two 60-inch cabinets	138,000	7,470
FIELD SYSTEM UPGRADES			
CPX9002	Performance accelerator upgrade kit for CPX9102 to CPX9112 includes SIP, CIP, new memory controller with 512KB memory (256KB additional memory), basic electronics cage to accept 512KB modules (1.75MB max), and faster CPU	4,500	NA
CPK9001	Field retrofit, CIP for current CPX9102 model	375	NA
CPX9800	Upgrade kit for microSystem 6/10—includes 384KB RAM, second diskette unit, MOD 400 Operating System and Utilities	1,895	160
CPK9850	DPS 6/45 with 512KB to DPS 6/75 with 1MB	21,600	2,300
CPK9851	DPS 6/45 with 1MB to DPS 6/75 with 1MB	19,850	2,050
CPK9852	DPS 6/45 with 2MB to DPS 6/75 with 2MB	24,350	2,050
CPK9853	DPS 6/45 with 512KB to DPS 6/75 with 2MB	67,400	4,667
CPK9854	DPS 6/45 with 1MB to DPS 6/75 with 2MB	65,650	4,417
CPK9855	DPS 6/45 with 2MB to DPS 6/75 with 2MB	61,150	3,917
CPK9856	DPS 6/75 with 1MB to DPS 6/95 with 2MB	56,850	2,367
CPK9857	DPS 6/75 with 1.5MB to DPS 6/95 with 2MB	54,350	2,117
CPK9858	DPS 6/75 with 2MB to DPS 6/95 with 2MB	52,350	1,867
CPK9859	Upgrade adder for systems without SIP	1,500	333
DPS 6 DASH SERIES SYSTEM UPGRADES			
CPK9701	DPS 6/45-1 with 4MB to DPS 6/7501 with 2MB	14,000	450
CPK9702	DPS 6/45-1 with 4MB to DPS 6/85-1 with 4MB	41,500	2,500
CPK9703	DPS 6/45-1 with 4MB to DPS 6/95-1 with 4MB	63,400	3,350
CPF9701	2MB price increment required for DPS 6/45-1 systems with 2MB memory upgrading to DPS 6/75-1, 85-1, or 95-1	4,000	700
CPK9704	DPS 6/75-1 to DPS 6/78-1 (memory is retained; DPS 6/78-1 must have at least 4MB)	12,000	350
CPK9705	DPS 6/75-1 with 8MB to DPS 6/85-1 with 4MB	35,200	NC
CPK9706	DPS 6/75-1 with 8MB to DPS 6/95-1 with 4MB	57,100	800
CPF9702	2MB price increment required for DPS 6/75-1 systems with less than 8MB upgrading to DPS 6/85-1 or 95-1; order one if 6MB, two if 4MB, or three if 2MB	4,000	700
CPK9707	DPS 6/78-1 with 8MB (total main and disk cache memory) to DPS 6/98-1 with 4MB	57,100	850
CPF9703	2MB price increments required for DPS 6/78-1 systems with less than 8MB upgrading to DPS 6/98-1; order one if 6MB, two if 4MB systems	4,000	700
CPK9708	DPS 6/85-1 to DPS 6/95-1 (memory is retained; order additional CMM9791 or CMC9791 as required)	30,300	850
CPK9709	DPS 6/95-1 to DPS 6/98-1 or DPS 6/95-2 to 6/98-2 (memory is retained; order additional CMM9791 or CMC9791 as required)	16,000	350
CPK9710	DPS 6/95-1 to 6/95-2 or 6/98-1 to 6/98-2 (memory is retained; order additional CMM9791 or CMC9791 as required)	42,000	1,420
CPK9859	Price adder for systems without scientific instruction processor (SIP) upgrading to systems with SIP	1,500	333

NA—Not applicable. ■