Honeywell DPS 88 Series

MANAGEMENT SUMMARY

UPDATE: *The DPS 88 Series, formerly the most powerful processor family in the Honeywell line-up, has been overshadowed somewhat with the March 1985 announcement of the new top-of-the-line DPS 90 Series. Despite this development, the DPS 88 line continues to play a role within the Honeywell large-scale mainframe lineup. During the first quarter of this year, for instance, Honeywell is scheduled to deliver new disk and tape peripherals and related hardware components for the DPS 88. The latest release of the GCOS 8 operating system, Release 2500, which will support the new disk and tape subsystems, is scheduled to be delivered by the second quarter of this year.*

GCOS 8 Release 2500 is now the newest version of Honeywell's primary operating system. The latest GCOS release features a new transaction processing facility called TP-8. TP-8 is said to make more efficient use of central system resources, memory, message management, and fault tolerance.

New peripherals announced for the DPS 88 Series are the MSP3880 mass storage processor and MSU3380 disk unit, and the MTS8200 Magnetic Tape Subsystem. The new MSP3880 mass storage processor, purchased from IBM Corporation on an OEM basis, supports up to 32 mass storage units using optional dual, switch, or dual simultaneous connections. Peak transfer rate is three megabytes per second. The MSU3380 disk unit has a total formatted capacity of 1.8 gigabytes. The new MTS8200 Magnetic Tape Subsystem, purchased on an OEM basis from Storage Technology, consists of a single-channel controller and tape drive. Seven additional drives can be added to the controller/tape unit. The tape subsystem supports 800, 1600, and 6250 bpi tapes. A subsystem can be expanded to support two controllers and 16 tape drives. The tape and disk systems also meet Federal Information Processing

The Honeywell DPS 88 is a large-scale processor line positioned between the DPS 8 medium- to large-scale processor line and the DPS 90, Honeywell's new top-end processor line. The DPS 88 model line is part of Honeywell's Distributed Systems Architecture (DSA) approach to networking.

MODELS: DPS 88/41, DPS 88/42, DPS 88/42T, DPS 88/81, DPS 88/82, and DPS 88/82T.
CONFIGURATION: 1 or 2 CPUs, 16 to 128 megabytes of main memory, 1 or 2 I/O Processors, and 64 to 256 Logical I/O channels.
COMPETITION: Amdahl 580 Series, Burroughs B 7900, CDC Cyber 180, IBM 308X Series, NAS AS/9000 Series, and Sperry 1100/90 Series.
PRICE: From $1,850,000 to $4,800,000.

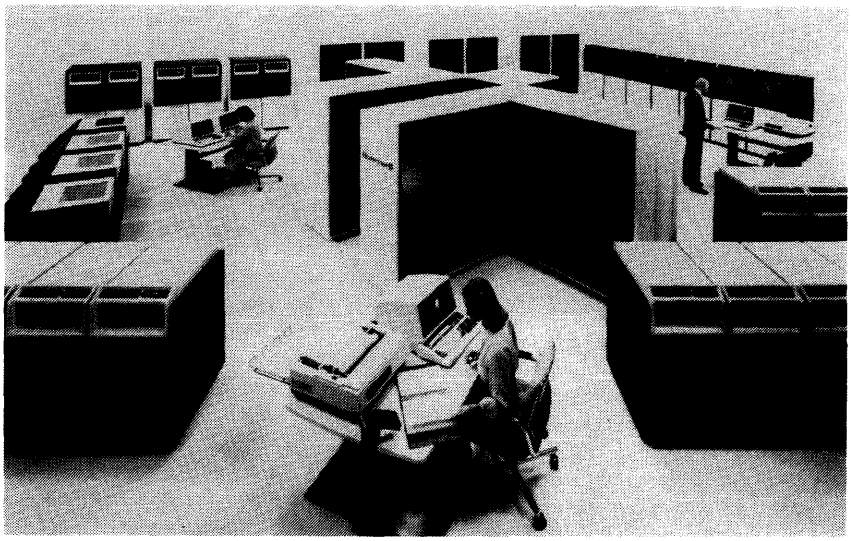
CHARACTERISTICS

MANUFACTURER: Honeywell Information Systems, 200 Smith Street, Waltham, MA 02154. Telephone (617) 895-6000. In Canada: Honeywell Ltd., 155 Gordon Baker Road, Willowdale, Ontario, Canada. Telephone (416) 499-6111.

MODELS: DPS 88/41, DPS 88/42, DPS 88/42T, DPS 88/81 and DPS 88/82, DPS 88/82T.

DATA FORMATS

BASIC UNIT: 9-bit bytes organized functionally to process 36-bit (word) groupings of information. Special features are also included for ease in manipulating 4-bit groups; 6-bit, 9-bit, and 18-bit groups; and 72-bit double-precision groups.



The DPS 88/82 shown here is a dual-processor system that can be configured with 128 megabytes of main memory and 256 logical channels. As a networking/communications-oriented system operating within the Honeywell Distributed Systems Environment, the DPS 88/82 can support as many as 320 satellite processors in a variety of network structures.

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TABLE 1. SYSTEM COMPARISON

MODEL	DPS 88/41	DPS 88/42	DSP 88/42T	DPS 88/81	DPS 88/82	DPS 88/82T
SYSTEM CHARACTERISTICS						
Date announced	November 1984	November 1984	November 1984	October 1982	October 1982	November 1984
Date first delivered	Third Quarter 1985	Third Quarter 1985	Third Quarter 1985	Fourth Quarter 1983	Fourth Quarter 1983	November 1984
Field upgradable to	DPS 88/42 or DPS 88/81	DPS 88/42T or DPS 88/82	DPS 88/82T	DPS 88/82	—	—
Relative performance	4.1	7.8	7.8	6.5	11.7	11.7
Number of processors	1	2	2	1	2	2
Cycle time, nanoseconds	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Word size, bits	36	36	36	36	36	36
Operating systems	GCOS 8	GCOS 8	GCOS 8	GCOS 8	GCOS 8	GCOS 8
MAIN MEMORY						
Type	64K-bit MOS	64K-bit MOS	64K-bit MOS	64K-bit MOS	64K-bit MOS	64K-bit MOS
Minimum capacity, bytes	16MB	16MB	32MB	16MB	16MB	32MB
Maximum capacity, bytes	64MB	128MB	128MB	64MB	128MB	128MB
Increment size	16MB	16MB	16MB	16MB	16MB	16MB
Cycle time, nanoseconds	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
BUFFER STORAGE						
Minimum capacity	32KB	64KB	64KB	64KB	128KB	128KB
Maximum capacity	32KB	64KB	64KB	64KB	128KB	128KB
Increment size	—	—	—	—	—	—
INPUT/OUTPUT CONTROL						
Number of channels:						
Byte multiplexer	—	—	—	—	—	—
Block multiplexer	—	—	—	—	—	—
Word	—	—	—	—	—	—
Other	64-128	64-128	128-256	64-128	64-128	128-256

Standards (FIPS) and can be attached to the Honeywell Input/Output Processor through the use of a new option, a FIPS-compliant Channel Bus Unit.

Honeywell launched its DPS 88 Series three years ago with the introduction of the single-processor DPS 88/81 and the dual-processor DPS 88/82. The processor line was expanded a year ago with the introduction of two entry-level models, the single-processor DPS 88/41, and the dual-processor DPS 88/42, in addition to a fully redundant system, the DPS 88/42T. The latest introductions brought the total number of processors within the Distributed Processing System 88 (DPS 88) to six. The largest processor in the series features two processors and up to 128 megabytes of memory. The promise of a four-processor model was fulfilled with the announcement of the new DPS 90 Series, a long-awaited processor line based on the NEC S-1000 processor. Nippon Electric Company of Japan is supplying the Honeywell-compatible processor line under the terms of a partnership agreement between NEC and Honeywell.

DPS 8 users who have outgrown the capabilities of this medium to large-scale processor line can upgrade directly to the DPS 88 line or the DPS 90 line without having to make major changes to application software. The choice of which large-scale processor line to upgrade to depends, of course, on capacity planning needs. An upgrade from a DPS 8/70, the most powerful processor within the DPS 8 line, to the DPS 88 or DPS 90 line would involve a processor swapout. Processors within each series can be field upgraded to progressively more powerful processors.

The six processors within the DPS 88 Series are all technically similar. Key differences between the DPS 88/40 Series and the more powerful DPS 88/80 Series involve main memory and high-speed cache memory performance. The

FIXED-POINT OPERANDS: Binary fixed-point numbers are represented with 18-bit half word, 36-bit single word, and 72-bit double-precision operands.

Decimal numbers used directly in hardware arithmetic commands are expressed as decimal digits in either the four-bit or nine-bit character format. They are expressed as unsigned numbers or as signed numbers using a separate sign character.

Alphanumeric data is represented by nine-bit, six-bit, or four-bit characters. A machine word contains either four, six, or eight characters, respectively.

FLOATING-POINT OPERANDS: There are two floating-point formats—binary and hexadecimal. Binary floating-point numbers are represented with 36-bit single-word and 72-bit double-word precision. In both operands, 0 represents the sign of the exponent, bits 1 to 7 the exponent, and bit 8 the sign of the fraction. The rest of the operand starting with bit 9 represents the rest of the fraction. Hexadecimal has an exponent of 16. The reason for two floating-point formats is to expand the exponent range of the floating-point operand.

INSTRUCTIONS: All basic instructions use one 36-bit word. The processor performs operations using 6-, 9-, 18-, 36-, and 72-bit operands. All single-word instructions use bits 0 through 17 for the address field, bits 18 through 27 for the op code, bit 28 as the interrupt inhibit bit, bit 29 as the address register bit, and bits 30 through 35 as the instruction address modifier. Multiword instructions use bits 0 through 17 for various functions as required, bits 18 through 27 as the op code, bit 28 as the interrupt inhibit bit, and bits 29 through 36 as the operand descriptor 1 modification field. Words 2, 3, and 4 contain the operand descriptor or indirect pointer for operands 1, 2, and 3, respectively.

INTERNAL CODE: 9-bit ASCII code is standard.

MAIN MEMORY

The Main Memory Unit (MMU) on Honeywell processors uses memory interlacing techniques to allow simultaneous access to memory boards. This improves access time and enhances performance. Board groups are contained in mem-

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DPS 88/80 Series uses two high-speed caches, a 32K-byte instruction cache and a 32K-byte operand cache. Taken together, the twin-cache memory is double the size of the DPS 8/70 cache. The DPS 88/40 Series, on the other hand, uses a single 32K-byte cache for both instructions and operands. All the processors employ 64K-bit MOS memory chips.

Main memory uses two interlaced arrays with at least 16 memory boards within each array. Both arrays have their own power and are interconnected in two-way interlacing for the DPS 88/40 series and four-way interlacing for the DPS 88/80 series, allowing simultaneous access to up to 32 bytes.

Honeywell introduced the DPS 88/40 Series last year to fill the performance gap between the DPS 8/70, the top processor within the Honeywell DPS 8 Series, and the DPS 88/81. The DPS 88/41 has more than twice the processing power of the DPS 8/70 and the DPS 88/42 is said to be approximately five times as powerful. The two fully redundant processors, the DPS 88/42T and DPS 88/82T, come with two of each of the central processing components that compose a typical DPS 88 Series system. These processors are especially suited for large highly interactive environments where downtime of even the shortest duration can be extremely costly.

The DPS 88 Series processors are a part of Honeywell's Distributed Systems Architecture (DSA) approach to networking. As hosts in communications networks, the DPS 88 systems are consistent with national and international standards for digital networks. They are suitable for users who require a high degree of processing power, flexibility, and security. A variety of software aids and migration tools are available to assist users.

Both the DPS 88/80 Series and the DPS 88/40 Series use the same hardware design features. All the processors incorporate an advanced evolution of current mode logic (CML) technology and liquid-cooled micropackaging into all central system components. By contrast, the larger systems within the DPS 8 Series use MSI Schottky TTL logic and air-cooling techniques. About 25 percent of the system logic in the DPS 88 Series is dedicated to ensuring system availability and integrity.

The DPS 88 also incorporates such advanced and sophisticated system technology features as store-into-cache policy for improved performance, a five-stage instruction pipeline that permits five instructions to be in process simultaneously, fault testing that can identify logic faults down to the micropackage level, and a system support facility which is a dedicated standalone minicomputer that handles all faults, interrupts, tests and diagnostics, and system management.

The DPS 88 Series operates only under the GCOS 8 operating system, the latest version of which is Software Release 2500. To Honeywell users of GCOS III, the GCOS 8 operating system offers object-level compatibility and

ory arrays, each with its own power supply to insure availability. An MMU can contain up to two arrays.

STORAGE TYPE: Metallic oxide semiconductor (MOS).

CAPACITY: See Table 1.

CYCLE TIME: Information not supplied by vendor.

CHECKING: An 8-bit error-correcting Hamming code is appended to each 72-bit word pair. Single-bit errors are corrected automatically, and multiple-bit errors are detected and flagged for subsequent error recovery routines. Odd parity is utilized throughout the processor.

RESERVE STORAGE: Memory contains segment descriptors, a page table, and an associative memory. Segment descriptors indicate which working space a segment resides in, the size and base address of the segment, and access privileges allowed to the segment. The page table describes the physical location of each page of a working space. The associative memory is a kind of cache memory that provides fast access to page addresses. To implement storage protection, the DPS 88 uses read, write, and execute permission bits in the Segment Descriptor. The Page Table Word (PTW) contains a write permit bit. Hardware also checks that data addresses generated during program execution do not exceed specified boundaries.

CENTRAL PROCESSORS

The DPS 88 Central System hardware consists of 11 components:

- **Central Processing Unit (CPU)**
- **Central Interface Unit (CIU)**
- **Main Memory Unit (MMU)**
- **Input/Output Processor (IOP)**
- **Channel Adapter Unit (CAU) or Channel Bus Unit (CBU)**
- **System Support Facility (SSF)**
- **System Support Unit (SSU)**
- **Thermal Exchange Pump (TEP)**
- **Thermal Exchange Air (TEA)**
- **Central System Console**
- **Maintenance Console**

All processing is performed by the Central Processing Unit, with the Central Interface Unit supervising the transfer of information between the CPU, the Main Memory Unit and the Input/Output Processor.

The Input/Output Processor or Channel Bus Unit (CBU), coupled with the Channel Adapter Unit, supplies the interface between the network or peripheral subsystems and a Central Interface Unit.

The System Support Facility is a freestanding, dedicated maintenance processor that performs diagnostic functions and supports resource management. The system consoles and maintenance consoles are connected to and controlled by the SSF. System Consoles may also be connected to Front-end Network Processors (FNPs).

The architecture employed in the DPS 88 CPU is a five-stage execution pipeline design augmented by a pipeline instruction prefetch stage and a pipeline instruction wrap-up phase. The design increases the system performance by allowing as many as five instructions to be in process simultaneously. The central processor consists of:

- **The DPS 88/80 Series processors use two separate high-speed cache memories, the instruction cache (I-cache) and the operand cache (O-cache), each providing 32K bytes of storage. The I-cache stores blocks of unmodified instruc-**

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supports the full GCOS III file system and job control language. GCOS 8 continues support of the Network Processing Supervisor (NPS), the General Remote Terminal System (GRTS II), and the Distributed Network Supervisor (DNS) communication software that runs on existing Honeywell communications equipment.

Programs that have used system privileges will require changes. A special migration tool developed for the DPS 88 is the Common Files Facility, which allows GCOS III and GCOS 8 to share disk files via a mass storage processor. Level 66 or DPS 8 users can run their current systems simultaneously with the DPS 88 at a schedule consistent with their needs.

COMPETITIVE POSITION

Early last year, Honeywell, IBM, Burroughs, and NAS all introduced a new class of top-end mainframes to satisfy the needs of *Fortune 500* companies outgrowing the capabilities of existing general-purpose mainframes. These new top-end products include the Honeywell DPS 90, the IBM 3090, the Burroughs A 15, and the NAS Alliance Series. The mass introductions of this new class of top-end mainframes has created another class of mainframes from these same vendors called "former top-end mainframes." Such former top-end mainframes pushed, by default, into this Number-2 spot include IBM's 308X Series, the Burroughs B 7900, the NAS 9000 Series, and the subject of this article, Honeywell DPS 88, a processor line that competes with these competing models.

Succumbing to the status of a former top-end processor is not necessarily detrimental. Much depends on whether the products in a mainframe lineup continue to use up-to-date technology and continue to address clear markets. When applying these two conditions to the DPS 88 line, it's not entirely clear whether the processor line is meeting these criteria. Both the DPS 88 line and the new DPS 90 line, for instance, feature single and dual processors. However, the DPS 90 Series, unlike the DPS 88, uses 256K-bit chips rather than the 64K-bit chips used within the DPS 88 line, and by Honeywell's own estimation, the DPS 90/91 delivers 30 to 70 percent greater performance than the single processor DPS 88/81. Furthermore, the DPS 90 features a maximum four-processor configuration, while the DPS 88 features a maximum two-processor configuration. DPS 8 users ready to move to a larger Honeywell system can migrate to the DPS 88 or the DPS 90 line. Just the same, the DPS 90 with its faster performance and maximum four-processor migration path would appear to be the clear price/performance choice.

The DPS 88 is positioned against the IBM 308X Series, a processor line that may be doomed with the delivery of the new 3090 Series. With the announcement of the new 3090 models, many IBM customers decided to wait for first deliveries of the new top-end line rather than purchase existing 308X processors using older technology. Sales of 308X have indeed languished. To stimulate sales, IBM announced price cuts for 308X processors by the end of second quarter 1985.

tions and indirect words, while the O-cache stores blocks of operands and modified instructions, and modified indirect words. By using cache memory in this manner, the instructions and data are effectively separated, and all store operations are directed to the O-cache, thereby reducing main memory traffic. The DPS 88/40 Series models, unlike the DPS 88/80 Series models, use a single high-speed cache memory providing 32K bytes of storage rather than two separate caches. The single cache stores both instructions and operands.

- **An instruction unit that queues instructions and performs a five-step instruction preparation and execution process. Each stage of the pipeline operates concurrently to decode instructions and generate memory addresses.**
- **Five specialized execution units that are designed to optimize actual execution. The central execution unit handles the execution of most of the Transfer Control instructions and other instructions that alter the processor states, and maintains the address registers and performs housekeeping functions. The basic operations unit performs binary fixed-point operations, Boolean operations, fixed-point comparisons, register loads, and shift operations. The virtual memory and security unit performs most instructions unique to virtual memory management. The binary floating-point unit (for multiply and divide) executes fixed-point multiply and divide instructions and all binary floating-point or hexadecimal floating-point instructions. The decimal and character unit executes those instructions involving decimal arithmetic and character manipulation.**

The Central Interface Unit (CIU) acts as a traffic controller for information passing between the CPU, MMU, and IOP. The CIU, as all other central system components, comes with an independent power supply that helps enhance system availability. The functions performed by the CIU are:

- **Bringing the central system to an orderly halt when a critical error is detected.**
- **Supporting communications between central system units through connect, interrupt, and similar steering procedures.**
- **Resolving memory access conflicts between system components.**
- **Directing all accesses to memory by the Central Processing Unit and the Input/Output Processor.**
- **Switching all control signals, addresses, and data into and out of main memory.**
- **Providing the control tasks for main memory, including error detection and correction (EDAC) to help minimize data errors.**
- **Supporting system start-up and restart through reconfiguration tasks.**
- **Initiating memory refresh cycles.**

The Input/Output Processor (IOP), acting in conjunction with the Channel Adapter Unit (CAU) or Channel Bus Unit (CBU), handles the data transfers between main memory and communications lines, peripheral devices, and the System Support Facility, with transfer rates up to 48 million bytes per second. The IOP is designed to:

- **Accommodate the Input/Output data transfer demands involved in systems that run numerous programs concurrently (multiprogramming) and that operate more than one processor at a time (multiprocessing).**
- **Provide the high disk access rates needed in data base-oriented systems.**
- **Serve the heavy transaction processing needs of large organizations.**

The CPU does not handle input or output directly; it is responsible for obtaining control segments (portions of a program) that describe the I/O operations to be performed, storing them in a memory mailbox area for the Input/

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An IBM dual-processor 3081 KX with 64 megabytes of memory, a 128 kilobyte cache memory and 16 channels sells for $3,210,000. A dual DPS 88/82 with 64 megabytes of main memory, 128 kilobytes of cache memory and 64 logical channels sells for $4,830,000. CW Communications rates the 3081 KX at 16.3 MIPS (millions of instructions per second) and rates the DPS 80/82 at 13 MIPS.

The IBM four-processor 3084 QX with 128 megabytes of main memory, 256 kilobytes of cache memory, and 16 channels sells for $6,020,000. A Honeywell dual-processor DPS 80/82 with 128 megabytes of memory, 128 kilobytes of cache memory, and 64 logical channels sells for $5,870,000. CW Communications rates the 3084 QX at 29.1 MIPS compared to 13 MIPS for the DPS 80/82. The IBM processors feature a CPU cycle time of 24 nanoseconds, while Honeywell declines to reveal cycle times.

Generally, in head-to-head comparisons with IBM, Honeywell MIPS ratings tend to be smaller. Honeywell, as well as other mainframe vendors, has been backing away from MIPS and cycle time comparisons, contending that such comparisons are not a true indicator of processor performance since application mix and processor architectures can vary so much. Honeywell strengths have long focused around transaction processing while IBM has built a reputation on batch processing performance. Honeywell has long maintained its DPS 88 processors can outperform comparable IBM 308X processors in the on-line mode by a two-to-one ratio. Batch performance between the two model lines tends to be more competitive.

ADVANTAGES AND RESTRICTIONS

Transaction processing continues to be a major plus for the DPS 88 line. System architecture and processor configurations help support this capability. Processing performance is enhanced with the use of the five-stage pipeline architecture, which allows up to five instructions to be processed simultaneously. To insure a high degree of availability, Honeywell offers dual and full tandem versions within the DPS 40 and DPS 80.

Furthermore, the GCOS operating system itself with all its enhancements continues to maintain a high reputation among on-line system users. The operating system supports large numbers of simultaneous users and is suited for heavy transaction processing environments. The DPS 88 with GCOS 8 supports up to 511 concurrent processes, 477 of which are available to applications. In order to meet the large-volume processing needs of large-scale system users, the DPS 88 processors were designed to support 2,000 timesharing users and 320 satellite processors.

Honeywell claims its new TP-8 transaction processing product delivers a substantial performance boost compared with previously available Honeywell transaction processors.

To further augment the processing capacity of large-volume users DPS 88 systems can be outfitted with 128 megabytes of memory. For a time this maximum memory

Output Processor and issuing a channel connect command to initiate processing by the IOP. Once initiated, the IOP and the CAU handle the input/output operations independently of central processing. Consequently, by offloading this input/output traffic from the CPU, the IOP helps reduce system overhead and increases the number of actual transactions processed. A basic IOP has 64 logical channels and can be expanded to 128 logical channels.

The Channel Adapter Unit (CAU) and the Channel Bus Unit (CBU) are sophisticated high-speed units with data throughput rates in excess of 20 megabytes per second. The CAU and CBU can contain two channel buses (current paths over which data is transmitted) for connections to the IOP. Each bus contains 33 channel function slots. The CBU supports the connection of the I/O subsystems that comply with the Federal Information Processing Standard (FIPS). Both the CAU and the CBU have expansion options that double their channel capacity. All channel types allow multiple logical channels to be assigned to one physical channel.

The System Support Facility (SSF) is a small standalone computer that logically connects to all central system components. Acting as the system monitor, the SSF initializes the system, checks processing and hardware operation, and diagnoses malfunctions on line. The SSF supports the central system resource sharing and the protection mechanisms between the operating system and the functional test system. On the software side, the SSF performs the following functions:

- **Initializes the central system.**
- **Initializes blocks of memory in the Main Memory Unit for use by the operating system or test software.**
- **Loads control stores for each CPU.**
- **Loads and maintains hyperpage tables in the CPUs and IOXs to control memory isolation for the operating system or test software, and to provide contiguous memory addressing.**
- **Communicates with the CPU concerning shared processor utilization.**
- **Initializes CPU information on the I/O channels allocated to the operating system, using configuration information provided by the system administrator.**
- **Cooperates in system restart following a shutdown.**
- **Responds to central system alarms and coordinates instruction retry.**

The SSF hardware consists of a mainframe with a control panel and peripherals. The mainframe includes a Central Processing Unit, 512K words of EDAC-protected MOS memory, and several interface units:

- **A mass controller, providing microprogrammed support of two removable media drives.**
- **A multiple-device controller, providing microprocessor control of the SSF flexible disk drive.**
- **A specialized interface, allowing direct access to DPS 88 system components via a logic interface within the system support unit.**
- **A multiline communications processor, permitting microprocessor control of system consoles and alternate remote Technical Assistance Center (TAC) interconnection path.**
- **A maintenance interface, supporting the maintenance console, the SSF itself, an optional hardcopy audit trail, and the TAC connection through a customer-supplied modem.**

The SSF peripherals include:

- **An integrated diskette unit primarily used for saving files.**
- **Two high-speed random-access digital data storage devices, providing main mass storage for the SSF. The storage capacity of each device is 67 megabytes formatted.**
- **Up to six system consoles per SSF.**

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capacity was generally the largest main memory available in a commercial, general purpose processor. However, with the introduction of the Honeywell DPS 90, and several competing products, 256-megabyte maximum memories are becoming the norm.

With the introduction of the MSU3380 disk unit, purchased on an OEM basis from IBM, Honeywell will begin offering its customers larger disk capacities. The MSU3380 has a total formatted capacity of 1.8 gigabytes compared to the previous top-of-the-line Honeywell disk unit, the MSU0501, which has a total capacity of 1.1 gigabytes.

Another area of consideration involves channel capacity. Interestingly, the DPS 88 features a maximum channel capacity of 256 logical channels, while the new top-end DPS 90 family features a maximum channel capacity of 64. The difference apparently stems from the fact that the DPS 90 is a repackaged version of the existing NEC S-1000 processor line which features that many channels. The DPS 88 line, on the other hand, is a home-grown Honeywell product.

A final area of consideration involves system cooling. The DPS 88 uses a Thermal Exchange Pump to circulate liquid coolant to processor CML circuitry, while the DPS 90 uses air cooling. When a chilled water supply is not available to DPS 88 users, they must purchase a $30,000 Thermal Exchange Air Unit.

For DPS 8 systems already running with GCOS 8, upgrading to a DPS 88 would require a change of hardware, but software would remain the same. Since identical compilers are run on both the DPS 8 and DPS 88, and since they generate the same object code for both, there is no need to recompile programs to a five-stage pipeline architecture when going from a DPS 8 to a DPS 88. Recompiling Fortran-66 programs with the Fortran-77 compiler may improve performance in object execution, but this recompiling is not required.

USER REACTION

Datapro obtained user reaction from two *Fortune 500* size, high-technology firms. One firm installed a two-processor DPS 88/82T a year ago, while the other installed a single-processor DPS 88/81. The high-end DPS 88/82T replaced a six-processor DPS 8/70 system that had been operating at full capacity. The DPS 88/81 replaced a five-processor DPS 8/70 configuration.

The firm with the DPS 88/82T runs a mix of applications involving scientific/engineering, business, transaction processing, and timesharing. The firm also runs applications on IBM 3082 and 4381 mainframes. This two-vendor arrangement gives computer personnel a rare opportunity to evaluate the pluses and minuses of two distinct mainframe lines. In the opinion of a DP professional who agreed to evaluate his DPS 88 for Datapro, the Honeywell system appears to have more to offer. He gives Honeywell high marks for the GCOS 8 operating system, which he believes had the attributes of a good interactive operating system

The System Support Unit (SSU) is attached to the CPU, and helps the SSF monitor performance and maintain service. Acting as a liaison between the SSF and all other central system components, the SSU makes possible initialization and testing of circuitry, examination of hardware for alarm conditions, and collection of power and cooling information. The SSU provides the power-entry controls for the central system power supply and houses the system clock.

The Thermal Exchange Pump (TEP) circulates liquid coolant to each DPS 88 component that incorporates CML circuitry, and dissipates the heat through four closed cooling loops into the customer's chilled water system. This system allows for lower, more controlled operating temperatures.

If the user cannot provide a chilled water supply, the TEP passes the heat to optional Thermal Exchange Air Units (TEA), which dissipate it into the room air.

The System Consoles (CSU8801 and CSU8802) are modular freestanding keyboard/display units. Both models offer features to help simplify system interaction and increase processing throughput. The CSU8801 can be configured as the second, fourth, and sixth system console per SSF, while the CSU8802 can be configured as the third and fifth system console per SSF. Both system consoles offer the DPS 88 operators the following capabilities:

- **On-line recall of recent messages.**
- **Off-line retrieval of older messages.**
- **Optional hardcopy messages.**

The DPS 88 uses virtual memory which provides the processor with a directly addressable virtual space of 2^{43} bytes. It also includes the capability of translating the virtual address to a real memory address. Two different addressing modes are provided: absolute and paging. In the absolute addressing mode a virtual address is generated, but is not mapped to a real address. The paging mode maps the virtual memory address to a real memory address.

The DPS 88 processor models have a comprehensive instruction set for performing data movement, binary arithmetic, shifting, logic, and control operations. The instruction set includes arithmetic facilities for performing variable-length fixed- and floating-point decimal arithmetic, and bit and byte string manipulation for processing bytes, BCD characters, packed decimal data, and bit strings.

The basic instruction set of the DPS 88 contains over 300 instructions and exceeds the instruction complement of the DPS 8 which is over 280 instructions.

The central processor has three modes of operation: master mode, privileged master mode, slave mode. The privileged master mode permits unrestricted access to all memory, permits the initiation of data transfer operations through the Input/Output Processor, and the setting of control registers. Master mode allows access to certain authorized portions of memory, while the slave mode is utilized by the operating system, when appropriate, and for execution of all user programs. These modes provide operating control and security in a multiprogramming environment.

SPECIAL FEATURES: The DPS 88 line features fully redundant configurations to maintain fault-tolerance within organizations running critical applications. The fully redundant DPS 88/42T and DPS 88/82T come with two of each central system component.

PHYSICAL SPECIFICATIONS: DPS 88 systems must be located in a room with a raised floor or any arrangement providing at least 12 inches of space beneath the equipment. The room ceiling must be 8 feet above the floor. Power requirements must meet these specifications: 208, 240, 440,

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TABLE 2. MASS STORAGE

MODEL	MSU0451	MSU0500	MSU0501	MSU3380	MSU3382
Cabinets per subsystem	16	8-15	8-15	8	8
Disk packs/HDAs per cabinet	1	2	2	2	2
Capacity	157MB	626MB	1.1GB	802MB/1.8GB	802MB/1.8GB
Tracks/segments per drive unit	815	1630 per surface	1686 per surface	13,275	13,275
Average seek time, msec.	30	25	25	15	15
Average access time, msec.	38.3	33.3	33.3	23.3	23.3
Average rotational delay, msec.	8.3	8.3	8.3	8.3	8.3
Data transfer rate	716K bps	1065K bps	1065K bps	3M bps	3M bps
Controller model	MSP0611/0612	MSP0611/0612	MSP0611/0612	MSP3880/3884	MSP3880/3884
Comments	Removable	Fixed	Fixed	Fixed	Fixed

long before IBM's popular Virtual Machine operating system. He said GCOS had VM qualities as far back as the late 1960s. He called GCOS a flexible operating system that's easy to install.

Besides the operating system, the spokesperson gave the DPS 88/82T highest marks for reliability and ease of operation. Additionally, he said maintenance services and technical support are also excellent.

He was not as pleased with Honeywell's MSU501 disk drive, however. He said he has experienced drive reliability problems. He added, the reliability problems may be magnified by the sheer size of his magnetic disk operation and may not be a true indication of basic reliability. His shop operates 100 MSU501 spindles, he explained. Some of the MSU501 problems may be resolved when his firm takes delivery in July of the new MSU3380 drives Honeywell is purchasing on an OEM basis from IBM. The spokesperson, who has also had experience with IBM drives, said the IBM products have also been known to have occasional reliability problems.

The DPS 88/81 user said the new single processor has higher processor performance than his old five-processor system, while also occupying much less floor space. He said ease of mainframe operation was excellent, and rated mainframe and peripheral reliability as good. He gave Honeywell top grades for maintenance service and good grades for technical support. He called GCOS 8 an excellent operating system and characterized available compilers and application software as good.

Reliability in the disk area was again a particular concern. He said he is looking forward to taking delivery on the new MSU3380 disk drives in June. He said his past experience with IBM drives has been positive. Working in a multivendor shop that also employs IBM equipment, he said the IBM peripherals register few data errors.

Another major area of concern centers around migration to the new TP-8 transaction processor product. His computer center has remained a beta test site for TP-8 for some time, as personnel continue to try to work some of the bugs out of TP-8. Despite the problems, he said Honeywell support has been excellent. He believes when the product is finally debugged, the benefits will more than pay for the current aggravation.

Spokespersons from both sites also noted they have had problems with Honeywell equipment delivery delays.

or 480 VAC ±10 percent for the motor generator set; 60 Hz nominal frequency ±0.5 Hz; three-phase wire with a maximum phase variation of 5 percent from the nominal; and 120/208 VAC, five-wire cable with ground for peripheral equipment (voltage variation is ±10 percent).

A design temperature between 68 and 78 degrees Fahrenheit with a relative humidity between 40 and 60 percent noncondensing is permissible, although a temperature of 73 degrees with a relative humidity of 50 percent is recommended. Once a temperature and relative humidity are selected, the temperature should not fluctuate more than ±2 degrees Fahrenheit or the relative humidity more than ±5 percent.

CONFIGURATION RULES

The DPS 88 family consists of six models: the DPS 40/41, DPS 40/42, DPS 40/42T, DPS 88/81, DPS 88/82, and the DPS 88/82T. The DPS 88/41 central system includes a Central Processing Unit (CPU); a System Support Unit (SSU); a Central Interface Unit (CIU); a Main Memory Unit (MMU) with 16 megabyte memory; an Input/Output Processor (IOP) with 64 logical channels; a Channel Adaptor Unit (CAU) or Channel Buss Unit (CBU); a System Support Facility (SSF); a system console and table with pod; a maintenance console and table; a Thermal Exchange Pump (TEP); and Thermal Exchange Air (TEA), an option used when a source of chilled water is not available to the TEA.

The DPS 88/42 central processing system includes two CPUs; two SSUs; two TEPs; one CIU; one MMU with 16 megabyte memory; one IOP with 64 logical channels; one CAU or CBU; one SSF; one system console and table with pod; one maintenance console and table; and optional TEA.

The basic DPS 88/81 central system includes a CPU, a CIU, a MMU with 16 megabytes of memory, an IOP with 64 logical channels, a CAU or CBU; a SSF; a maintenance console and table, a system console with table and pod, a SSU, a TEP, and optional TEA unit.

The DPS 88/82 includes two CPUs; two SSUs; two TEPs; one CIU; one MMU with 16 megabyte memory; one IOX with 64 logical channels; one CAU with 33 function slots; one SSF; one system console and table with pod; and one maintenance console and table; and optional TEA.

The DPS 88/42T and the DPS 88/88T are fully redundant system containing two of each central system component. These systems also include a minimum 32 megabytes of main memory.

The basic system can be expanded to 64 megabytes of memory in 16-megabyte increments. Processors configured with two MMUs can be expanded from a minimum 32 megabytes to 128 megabytes. The IOP can be expanded from 64 to 128 logical channels. Systems configured with two IOPs can have up to 256 logical channels. A CAU or CBU can be expanded to twice its basic channel capacity. Up to two CAUs or CBUs can be attached to each IOP. Up to six system consoles can be configured with each SSF and

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TABLE 3. INPUT/OUTPUT UNITS

Magnetic Tape Units	Number of Tracks	Recording Density, Bits/Inch	Encoding	Tape Speed Inches/Sec.	Transfer Rate, Bytes/Sec.
MTU0500	7	556/800	NRZI	125	52K/75K
MTU0500	9	556/800/ 1600	NRZI/ NRZI/ PE	125	70K/100K/200K
MTU0610	9	800/ 1600/ 6250	NRZI/ PE/ GCR	200	100K/200K/1250K
MTU0630	9	800/ 1600/ 6250	NRZI/ PE/ GCR	75 or 125	60-100K/120-200K/ 468.7-781.2K
MTU8205/6/8	9	800/ 1600/ 6250	—	125 or 200	100-160K/200- 320K/781.2-1250K
Printers	**Printing Speed**	**Print Positions**	**Horizontal Spacing, Chars./Inch**	**Vertical Spacing, Lines/Inch**	**Form Size, Inches**
PRU1600	1600 lpm	136 or 160	10	6 or 8	4 in. to 22 in. width x 3 in. to 22 in. length

A final area of immediate concern involves processing capacity. After little more than a year in place, the DPS 88/82T is operating at near rated capacity. Depending on application mix, however, the spokesperson said he believes the DPS 88/82T probably has three times the rated Honeywell capacity. The DPS 88/81 user, meanwhile, is not as worried about capacity limitations. He said his shop is moving towards less centralized processing involving the installation of medium-scale Honeywell processors. He said his processing load will probably hold steady for a while and then drop as other smaller processors are deployed. □

additional system consoles may be attached to a network processor. In all, the DPS 88 system can support up to sixteen system consoles, of which fifteen can be connected via the network processors. All processor models within the DPS 88 Series can be field upgraded to a larger system as processing needs increase.

INPUT/OUTPUT CONTROL

The DPS 88 supports most peripherals that are used on the DPS 8 system. The following types of peripheral devices can be logically connected to the DPS 88:

- **Front-end Network Processors (FNPs)**
- **Terminals**
- **Peripheral Processors**
- **Disk and Tape Units**
- **Card Readers and Punches**
- **On-line and Off-line Printers**

DPS 88 peripheral subsystems communicate with the central system through the CAU or CBU and the IOP. FNPs connect to the CAU directly via individual channels. Mass storage, tape, and unit record devices are linked to the channel by way of peripheral processors. Up to two interfaces (buses) connect each CAU or CBU with the IOP for access from peripheral subsystems. Each CAU or CBU can transfer data at a rate of more than 20 million bytes per second.

MASS STORAGE

(Covered in Table 2.)

INPUT/OUTPUT UNITS

(Covered in Table 3.)

TERMINALS

(Covered in Table 4.)

As part of a DPS 88 system, a user may select a unit record subsystem consisting of the URP0600 unit record processor and up to eight unit record devices. These devices can include card readers, a card punch, a reader/punch, and printers. Multiple unit record subsystems can be configured. The UPR0600 unit record processor is a freestanding, microprogrammed controller that connects the Channel Adapter Unit (CAU) to the unit record devices. Microcoded programs directing the URP0600 help to maximize the overall use of the peripheral devices and decrease costly turnaround. The URP8400/1/2 are embedded unit record processors for the CBU. Each URP can control up to two card or printer devices.

COMMUNICATIONS

DATANET 6661 NETWORK PROCESSOR: This processor provides large-volume network communications capabilities for DPS 88 systems. The Datanet 6661 incorporates an independently programmable computer with an instruction repertoire of 98 single-address instructions. The CPU in the Datanet 6661 is a solidstate, interrupt-driven 18-bit unit operating asynchronously under firmware control. The DCU6661 comes standard with 64K bytes of memory and is expandable to 512K bytes. The DCP6661 has two performance enhancement packages rated at 47 and 82 percent. Multiple Network Processors can be configured.

A high-speed cache memory is optional in the DCU6661, which provides an execution rate of up to 1,000,000 instructions per second given the appropriate configuration and optimum instruction mix.

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TABLE 4. TERMINALS

MODEL	VIP 7814	VIP 7815-7817 and 7824-7827	VIP 7823/7831	VIP 7201	VIP 7301/ 7303/7307	VIP 7305
DISPLAY PARAMETERS						
Max. chars./screen	2000	2000	2000	1920	2000	2000
Screen size (lines x chars.)	24 x 80	24 x 80	24 x 80	24 x 80	25 x 80	25 x 80
Symbol formation	7 x 9 dot matrix	7 x 8 upper/ 7 x 9 lower	7 x 8 dot matrix/ 7 x 9 lower	7 x 11 dot matrix	7 x 9 dot matrix	7 x 8 upper/ 7 x 9 lower
Character phosphor	P31 green std.	P31 green	P31 green	P31 green std.	P31 green std.	P31 green std.
Total colors/no. simult. displayed	—	—	—	—	—	—
KEYBOARD PARAMETERS						
Style	Typewriter	Typewriter	Typewriter	Typewriter	Typewriter	Typewriter
Character/code set	128 ASCII	128 ASCII	128 ASCII	128 ASCII	128 ASCII	128 ASCII
Detachable	Std.	Std.	Std.	Std.	Std.	Std.
Program function keys	12 std.	12 std.	12 dual std.	7 std.	12 std.	12 dual std.
OTHER FEATURES						
Buffer capacity	3 pages	3 pages	3 pages	1 page	1 page	1 page
Tilt/swivel	Tilt opt.	Tilt opt.	Tilt opt.	Tilt opt.	No	Tilt opt.
Graphics capability	—	Std.	Std.	—	—	Std.
TERMINAL INTERFACE	RS-232-C	RS-232-C or RS-442A	RS-232-C or RS-422A	RS-232-C or RS-442A	RS-232-C, RS-422A, 20 ma, or MIL-188-C	RS-232-C or RS-422

The Network Processor input/output multiplexer (IOM) performs all operations required for the transfer of data between I/O devices and the FNP memory. A data transfer rate of up to 2,000,000 bytes per second is possible. The IOM is connected to the I/O bus, to which various devices are attached. These units are the System Support Controller for the console and network processor diskette; the Direct Interface Adapter, which connects to the host; and the Peripheral Interface Adapter (optional) for access to the host's mass storage processor, when required. The remaining I/O connections are for the Channel Interface Bases, through which the network devices enter the system.

The Channel Interface Base (CIB) provides the line interfacing arrangements necessary to accommodate terminals with various data transfer rates, bit orders, bits per character, information codes, character sets, message formats, and communications control procedures. Terminals in the low-, medium-, and high-speed ranges can be supported, with a maximum of 72,000 bps possible. In addition, synchronous, bisynchronous, and asynchronous transmissions and any combination of half- and full-duplex modes are supported. Each Channel Interface Base can handle up to eight communications lines, in various configurations. The DCU6661 can accommodate up to 12 CIBs.

DATANET 8 NETWORK PROCESSOR: This system is designed for use in communication networks conforming to the Distributed Systems Architecture (DSA) and operates under the control of the Distributed Network Supervisor (DNS) and GCOS 8. The Datanet 8 (DCU8010) is not compatible with the Datanet 6661, but can coexist with it on the same system. A maximum of four DPS 88 host connections can be configured enabling the Datanet 8 to be shared by four DPS 88 host systems.

The base Datanet 8 includes 512K bytes of memory (expandable to 1536K) and a 512K-byte diskette (a second 512K diskette is optional). It can accommodate from 16 to 128 communication lines. The DPS 88 Host connection (DCE8015) is a required addition.

The Datanet 8 can be configured with 2, 8, or 16 DCF8007 Channel Interface Bases (CIB) depending on the line configuration. Each CIB supports up to four channel interfaces, each of which in turn supports either one or two communication lines, depending on the specific type of Channel Interface chosen. The following options are available on Datanet 8 systems and can be field-installed:

- **Dual Asynchronous Channel Package, EIA RS-422-C, to 9600 bps each (DCF8009)**
- **Dual Bisynchronous Channel Package, EIA RS-232-C, to 9600 bps (DCF8018)**
- **Dual Asynchronous Channel Package, MIL-188-C, to 9600 bps (DCF8015)**
- **Single Synchronous Channel Package, MIL-188-C, to 9600 bps (DCF8014)**
- **Single Synchronous HDLC Channel Package, MIL-188-C, to 9600 bps (DCF8017)**
- **Single Synchronous HDLC Wideband Channel Package, MIL-188-C, to 56K bps (DCF8016)**
- **Channel Interface Base (DCF8007); accommodates up to four Channel Interface Options**
- **Dual Synchronous EIA RS-232-C Channel, to 9600 bps (DCF8011)**
- **Dual Asynchronous EIA RS-232-C Channel, to 9600 bps (DCF8012)**
- **Single HDLC EIA RS-232-C Channel, to 9600 bps (DCF8020)**
- **Single HDLC Wideband Channel, to 56K bps (DCF8022)**
- **Single HDLC Wideband Channel, V.35, to 56K bps (DCF8023)**
- **Direct Connect Capability (DCF8024) for one Asynchronous or one Synchronous Line, to 9600 bps**
- **Universal Modem Bypass (DCF8026), Synchronous to 20.8K bps or Asynchronous to 1800 bps**
- **Two Asynchronous Current Loop Channels, to 9600 bps (DCF8036)**

SOFTWARE

OPERATING SYSTEM: The Honeywell *GCOS 8 (General Comprehensive Operating Supervisor 8)* is the only operating system utilized by the DPS 88/88 processor line. Introduced in 1979 with the DPS 8 systems, GCOS 8 is a product with a genesis dating back to the early 1960s. GCOS 8 is a multiprocessing, multiprogramming, communications-oriented operating system that supports distributed systems requirements. Honeywell's objective is to keep the operating system dynamic by a series of planned releases which capitalize on new technology while preserving the user's investment in software. Honeywell's direction for distributed systems is toward the eventual linking of an organization's entire complex of physically separate data processing systems into a single logical network system regardless of physical boundaries.

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According to Honeywell, current GCOS users can upgrade to GCOS 8, and user programs (with few exceptions) that have been running under GCOS will run unchanged under GCOS 8. The latest GCOS 8 release offered for all Honeywell large-scale processor lines from the DPS 8 and DPS 88 to the top-end DPS 90 is GCOS 8 Release 2500. Migration to the new release from Release 2300 the former GCOS 8 version can be accomplished without the need to recompile application software. The newest release supports an enhanced transaction processing facility, TP-8, and new large-scale disk and tape subsystems.

GCOS 8 is user-defined and user-oriented virtual operating system, with multidimensional capabilities. It is a batch system, a time-sharing system, and a transaction processing system. GCOS 8 balances the use of system resources, and gives multiple options for customizing the system for each user's needs. GCOS 8 concurrently supports 1) batch processing, 2) remote job entry (RJE), 3) interactive remote job entry (IRJE), 4) time-sharing, 5) transaction processing, 6) direct program access, 7) on-line test and diagnostics, 8) on-line program test and development, and 9) electronic mail.

Additionally, the operating system features multiprogramming, multiprocessing, and flexible job entry capabilities. GCOS 8 also has file protection and file sharing, testing and diagnostics, communications, timesharing, data management facilities, language processors, diagnostic and system protection facilities, and various system utilities. Batch, time-sharing, transaction processing, and other activities can be individually tailored and dynamically varied throughout the day. Peripherals are allocated before memory so that processing is not delayed by operator or mechanical delays.

GCOS 8 is a flexible operating system that features hardware transparency, meaning that the user has no need to know the particular architecture of the system, its hardware, I/O devices, or processor types. All processors can access all of memory and can execute any program. GCOS 8 can address up to 128 megabytes of real memory. Up to 477 user programs of up to one megabyte each can be executed concurrently. GCOS 8 can use up to 128 megabytes of memory for time-sharing. It provides high throughput by efficient and rapid scheduling of all activities, which reduces operator intervention.

GCOS 8 memory management is flexible. The system architecture with GCOS 8 provides dynamic memory management, descriptor-controlled access, and shared access to both data and procedures. Each of these functions is based on a hardware-protected memory segment. The memory segment is defined by a segment descriptor that contains the logical address of the beginning of the segment, the size of the segment, and the permissions that control its use.

Dynamic memory management permits programmers to develop software as if there were an unlimited logical memory. The available physical memory, on the other hand, depends on the system configuration and the workload.

GCOS 8 controls the physical organization of up to four million pages of real storage with each page consisting of 4096 bytes. CGOS 8 can use as many as 477 separate working spaces (out of 512 total working spaces) at any time for memory allocation and control.

Any available page of main memory can be used for any page-sized block of logical memory. Although pages may be located anywhere in memory, they can be accessed as if they were physically contiguous. With memory access, segment descriptors and page table words translate the virtual address to a main memory address.

Hardware and software system security is provided in several ways. The operating system will abort an activity if an illegal operation is received. The File Management Supervisor provides a common file system for all DPS 88 operating dimensions as well as protective and restorative functions to ensure file integrity. Access to files is controlled through several levels. Files are grouped in a hierarchical order by user name, access restrictions, and resource control. File names are qualified by comparing them to the user names under which they are cataloged. Passwords may be required as an additional form of user identification. Access to files is under the originator's discretion and control. Each user can have a multilevel hierarchical subcatalog structure, with the ability to assign access controls and passwords at each subcatalog level. Another safeguard is a hardware implementation that controls access to sets of memory segments called domains. This structure protects programs and files from intentional access by unauthorized personnel and unintentional access during debugging procedures.

PROGRAMMING LANGUAGES: The language processors available for use on the DPS 88 systems under GCOS 8 are *Cobol-74, Cobol-68, Fortran-66, Fortran-77, PL/1, GMAP, GPSS, Basic, data Basic, Simscript, Pascal, Compiler "B," Lisp, APL,* and *RPG II.*

Syntax Directed Editor (SDE) is a productivity tool designed to support the creation or modification of Cobol-74 programs. SDE reduces the amount of code that a programmer must enter and immediately checks for format and syntax errors.

System-80 is designed to reduce the time and effort of coding, maintenance, and documentation normally associated with Cobol program development. It includes several functional programs and associated files that interact with the user to acquire needed information about files, fields, screen formats, and validations and edits.

Softool is a set of software tools designed for cost-effective management, development, and maintenance of application software. The Softool Development Environment Product Set offered by Honeywell consists of the Cobol Programming Environment (Cobol-74) and the Change and Configuration Control.

Simscript provides the user with a simulation-oriented language that permits the translation of complex mathematical and logical models into meaningful simulation sequences. It is an event-oriented language with a timing routine that allows the analysis of activities in a controlled sequence in simulated time.

The General-Purpose Simulator System (GPSS) is a simplified, simulation-oriented language that establishes mathematical models in order to provide results for further analysis.

The General Macro Assembler Program (GMAP) enables the programmer to code either in an open-ended macro language or directly in machine-oriented symbolic instructions.

The *Debug Support System (DSS)* supports batch or on-line debugging of user programs, and can trace programs, display memory contents, and modify memory locations. Object-level debug can be performed with any language. Symbolic debug is supported by Cobol-74, Fortran-77, and PL/1.

DATABASE MANAGEMENT: The *DM-IV Data Manager* component of *Data Management-IV* handles the database management functions on Honeywell mainframes. Data Manager, also referred to as *Integrated Data Store/II (I-D-S/II)*, administers the creation of the physical and logical structures of the database and controls the creation of the application-specific views of that database which are used in processing. It further serves as the interface between

the database and the various DM-IV processors that access the database and perform operations upon it.

The I-D-S/I and I-D-S/II systems are enhanced versions of I-D-S, a database management system originally developed by GE. I-D-S/II is based on the CODASYL DataBase Facility specifications. I-D-S/II is fully integrated with Honeywell's Cobol-74 compiler, and user interfaces are also implemented for Fortran.

Relational Access Manager, which allows interface to many standard file types, adds a relational access to nonrelational databases. The facility accomplishes this without restructuring data files or programs. The facility is a user-friendly facility that lets nontechnical and technical users access data through a simple command structure.

DATA MANAGEMENT: Data Management on Honeywell systems are handled through Data Management-IV (DM-IV), a product containing a collection of facilities to handle database management, transaction processing, querying and report processing in addition to providing batch and interactive database capabilties. (Database management capabilities are detailed in the Database Management section above.) Additionally, Honeywell is now offering a new transaction processor product called *TP-8*. Other facilities included under data management include the *Data/Dictionary/Directory System (DD/DS), File Management Supervisor, Indexed Sequential Processor, Unified File Access System (UFAS), Management Data Query System, TOTAL Central,* and *Common Files Facility (CFF).*

DM-IV has evolved from earlier software systems such as *Integrated Data Store-I, Transaction Processing System, Transaction Driven System* and *Management Query System.* DM-IV is a fully operational on-line, integrated database management system. Data extraction and updating from databases with various file organizations and data structures can be directly performed by non-data processing professionals. DM-IV consists of the following functional modules: the Data Manager, (described in the Database Management section), the *Transaction Processor, the Query and Reporting Processor,* and the *Procedural Language Processor.* It also supports batch and timesharing programs.

The DM-IV Transaction Processor (TP) provides the facility for rapid, efficient, on-line database processing. It is most effectively used in applications where the end user has little or no knowledge of the operating system or storage structure, or data processing in general. Its internal design is optimized for high-volume transaction processing where extremely fast response and fast, automatic restart/recovery are required. The TP system includes both on-line software components for processing the actual transaction and a wide variety of support software products for program testing, library updating, and TP system generation. Within DM-IV/TP, there are five major functional components: Transaction Manager, Database Manager, Integrity Manager, Message Manager, and Executive Manager.

The Executive Manager schedules and coordinates all Transaction Processor activities. It manages the allocation of system resources for transaction processing.

The Transaction Manager controls and coordinates all activities during the processing of a transaction. It initiates each transaction control task which TP processes and controls the communication between application routines.

The Database Manager controls all database activities for on-line files assigned to TP. The executive software also provides for dynamic allocation and deallocation of database files to TP for uninterrupted continuous operation.

The Integrity Manager provides for fast, automatic recovery and restart after any type of application or system failure. This includes everything from rollback of the database after an application program abort to the complete reconstruction of a destroyed database.

The Message Manager is the executive software component that actually handles the communication interface with the terminal network supported by the Front-End Network Processor (FNP). The Message Manager provides both the physical and logical interface to the on-line network of terminals and handles the acceptance and delivery of input and output messages.

TP-8, a new transaction processing facility under GCOS 8 Release 2500, is said to enhance productivity within organizations with heavy transaction processing workloads. The product can be a growth path for DM-IV/TP users who need increased transaction processing performance and functionality, according to Honeywell. TP-8 is compatible with DM-IV/TP and the *Transaction Processing Executive (TPE-II)* (described in the Data Communications section), while also offering several improvements. Using the product, users can tailor transaction processing applications to specific needs. Applications can be implemented through routines and programs written in several languages including Cobol 74 or Fortran. While in execution, each routine or program is processed independently and can access the range of facilities available in GCOS 8.

The Data Dictionary/Directory System (DD/DS) is a comprehensive set of software modules that can implement a centralized data dictionary/directory. Data is entered into the dictionary database via either batch or interactive operations. The DD/DS supports up to 19 entity-types such as fields, records, files, programs, procedures, jobs, schemas, reports, etc. Multiple versions and status of each entity-type, alias names, narrative, and attributes unique to the entity type are also supported.

Several report generation facilities are available to the DD/DS user. The reporting system extracts information from the data dictionary and presents it to the user in various formats. Included is an extensive cross-reference (where used) reporting capability for all entity-type occurrences and an Impact Analysis Report which analyzes and reports the effect of change to an entity-type occurrence. A complete set of utilities is provided to assist in the maintenance of the data dictionary system and its database.

The *DM-IV Query and Reporting Processor (QRP)* provides the user with several different subsystems which act to access the defined database and its structure and to generate reports on the results of the requested access. The DM-IV QRP end-user facilities provide access to the database by noncomputer-oriented personnel. Within QRP, simple, straight-line procedures may be written to explicitly retrieve the desired data and process exception conditions such as no data qualifier and end of retrieval conditions.

The *Personal Computing Facility (PCF)* is a screen-oriented, interactive system that provides a user-friendly application environment. A person without knowledge of conventional computer programming can use PCF to create any type of VDU or CRT form as a basis for interactive problem solving.

Example Query (EQ) is an end-user facility consisting of an easy-to-learn language and support program. EQ aids application-oriented users in the queuing of data through the Relational Access Manager, which is included. User interface is through CRT devices (VIP7800), and alternatives to CRT display include printed output and file output. The interactive language facilities are designed for fast and

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simple formulation of requests which provide answers to application questions. The language has minimal syntax which is easily constructed into graphic representation of user processing requests.

Interactive Query (IQ) is an end-user facility that allows users to interface in nonforms mode with any type of terminal. Included with IQ is the Relational Access Manager, which allows interface to many standard file types.

The *Comprehensive Report Examination/Display Option (CREDO)* is an optional Personal Data Query (PDQ) facility that can format report data generated through the EQ and IQ facilities into refined, individualized reports. CREDO reports are defined, created, examined, and distributed according to user-specified or system-default options.

The *Transaction Application Test System (TATS)* is a software tool that provides an interactive time-sharing environment for writing, compiling, testing, and debugging Transaction Processing Routines (TPRs) using a DM-IV (IDS-II) database. TATS also provides a TPR program skeleton generator, and forms mode support is currently provided for the DM-IV TP Forms Option (TPFO). The TATS package can also be used to interactively verify database updates and to integrate completed TPRs into the production system.

The *Transaction Screen Management System (TSM)* is a set of tools designed to enhance the development of application programs in a DM-IV TP environment. This system enables the developer to design, develop, test, and implement screen formats for application systems. Little or no knowledge of the communications network or the DM-IV TP operating environment is required.

The File Management Supervisor (FMS) provides powerful file management capabilities, including multilevel user catalogs, file sharing, and access control. The system employs a hierarchical, "tree-structured" design. A System Master Catalog lists the various user Master Catalogs, and each user may in turn define one or more levels of subcatalogs. Users may permit general sharing of their files or specify individual users who may access them on either a read/write or read-only basis. Password access control can be imposed at any or all levels of the file structure. Security is also provided by the optional logging of file access attempts and by a time-sharing command allowing a user to encrypt his or her file using a predefined algorithm.

The Indexed-Sequential Processor (ISP) supports the widely used indexed-sequential file organization and access method, which permits mass storage files to be accessed in either random or sequential fashion. For each logical file, ISP maintains a data file and an independent key file, which serves as an index. The key file can be placed on a faster random-access device to speed up the access process.

The Unified File Access System (UFAS) provides automatic management for file processing, including record location and automatic blocking and deblocking. File organizations supported include sequential, relative, indexed, and integrated files. UFAS also includes facilities for error checking and initiation of error processing as defined by ANSI Cobol-74, and file integrity protection for normal and abort processing.

The Management Data Query System (MDQS) is a data management system that permits interrogation of sequential, indexed sequential, or I-D-S/I file organizations. MDQS operates as a subsystem to GCOS in both batch and time-sharing environments, and is available in two versions: MDQS/II, a database retrieval and report generation system, and MDQS/IV, a system that offers all MDQS/II capabilities plus database creation and maintenance features.

The Common Files Facility (CFF) controls the sharing of user program and data files between GCOS III and GCOS 8 as well as between GCOS 8 hosts without requiring manual partitioning of data or mass storage devices. The CFF allows a Level 66 or DPS 8 system(s) and a DPS 88 system(s) to share disk files on a single common group of disk drives.

CFF allows up to four computer systems, in any mix, to share common disk drives. Concurrent access to files is controlled by lock bytes in the mass storage processor that supervises disk drive operation. Locking occurs at the single file level, which ensures that only one computer system in the cluster can update a file at one time. CFF clusters can also exist within communications networks based on Honeywell's Distributed Systems Architecture.

The Honeywell *Error Logging and Analysis (ELAN)* system is a software system that works in conjunction with the SSF and *System Maintainability/Availability Software (SMAS)*, GCOS 8, and the DPS 88 fault recovery hardware. The Instruction Retry feature attempts to recover from transient errors such as incompleted operations, parity errors, and illegal procedures. The proper Error Analysis and Logging module is called in when a processor or memory module error is detected. After analysis and logging, either the faulted instruction is retried or normal GCOS 8 fault processing procedures continue. The Error Reporting Program is initiated when a hardware error occurs, when the error log becomes half full, or at operator request. Error record is printed, analyzed, and summarized, with summary data retained on an error summary file. ELAN is a key element of the remote diagnostic and testing facilities.

The System Maintainability/Availability Software (SMAS) includes the SMAS Executive which provides control functions for the System Support Facility (SSF) and the SSF Test Programs. The SMAS Executive functions include system administration, GCOS 8 interface, mainframe error recovery, memory error management, access security control to maintenance facilities (including isolation of the SSF when it requires maintenance), mainframe memory dumping via the SSF, debug support, and test program management. SSF test programs include the Functional Test System (FTS) which tests the mainframe and the peripherals on line, the Native Fault Tests (NFT) which allow the SSF to directly test mainframe logic elements, and the Mainframe Panel Function (MPF) which permits display and modification of mainframe internal register contents by the SSF Maintenance Console. The other SSF Test Programs are the Utility Programs which update the SSF system files and database, boot peripheral controllers, display hardware logic interconnect data, and transfer data from SSF disk to tape. The SSF and SMAS function with the Hypervisor, which is a set of hardware and software that supports central system resource sharing as well as protection mechanisms between GCOS 8 and the FTS. This capability allows maintenance functions to proceed concurrently with normal system production.

DATA COMMUNICATIONS: *Distributed Network Supervisor (DNS)* has been designed specifically for use in the Datanet 8 Processor, and is part of a set of communication software products based on Honeywell's Distributed Systems Architecture (DSA). DNS supports up to four DPS 88 Host connections enabling one Datanet 8 to serve multiple hosts.

DNS operates in the Datanet 8 in conjunction with a DPS 88 host running the GCOS 8 or GCOS operating system to provide support for transaction processing, distributed transaction processing, distributed terminal concentration, time-sharing, remote job entry, direct program access, and networks made up of DPS 88s, DPS 8s, DPS 7s, and DPS 6s in any combination. DNS supports private networks, Public Data Networks (PDNs) and Value Added Networks

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(VANs), including X.25 packet switched and X.21 circuit switched networks.

The administrative functions distributed throughout the various systems that make up the DSA network include network monitoring, cross-network software loading, dumping, data logging for statistics, billing and maintenance, in-line tests, and software generation.

DNS supports a variety of terminals such as the Honeywell TWU/PRU 1003, 1005, and 1901, VIP 7100/7200/7201/7700/7700R/7800, and VTS7710. Also supported is the DPS 6-DSA software package that allows a DPS 6 or Level 6 system to function as a distributed processor and to communicate with a DPS 88 host in a DSA network.

The *Network Processing Supervisor* and the DPS 88 support five types of remote processing in any combination: remote job entry (RJE), transaction processing, time-sharing, message switching, and direct program access. RJE is supported by four standard interfaces for remote computers: remote computer interface, remote network processor multimessage interface, BSC interface, and HDLC interface.

The information network is controlled by a combination of the Datanet 6600 Front-End Network Processor and the NPS software, and can range in size from several terminals to a comprehensive, distributed information network with multiple host processing facilities.

NPS supports a wide variety of remote terminals, computers, and communications facilities, such as the Honeywell TWU/PRU 1003 and 1005, Teletype Models 28/33/35/37/38, GE TermiNet 300/1200, Hazeltine 2000, IBM 2741 and 2780, and Honeywell VIP 765/776/786, VIP 7100/7200, VIP 7700/7700R/7760/7800, RNP 702/707, and RNP 6/DPS 6 minicomputers. NPS also provides customization and parameterization facilities to facilitate implementation of additional terminal types and network protocols into the system, journalization of message traffic on mass storage, restart/recovery capability, supervisory control through one or more Network Control Supervisory Stations, statistical recording and reporting, and a high level of line/terminal control through parameterization.

The *Remote Terminal Supervisor II (GRTS-II)* provides controls for five types of remote processing: remote job entry, transaction processing, time-sharing, message concentration, and direct program access. RJE supports the same standard interfaces as NPS. Programming subsystems supported under time-sharing are the same as for NPS. GRTS-II does not support the direct program access communications-queued (DAC-queued) mode provided in NPS, nor does it support any host interface which makes use of the DAC-queued method.

GRTS-II includes a *Communication On-Line Test System (COLTS)* and support for remote terminals and devices with speeds from 75 to 56,000 bps. GRTS-II may coexist with NPS or DNS, each residing and executing in a different network processor. Host-to-host file transmission is supported through the Data Link System.

The *Transaction Processing System (TPS)* invokes the loading and execution of the appropriate application programs for processing transactions received from remote terminals. The Transaction Processing System requires a front-end network processor and can accept transactions from various terminals.

TPS is modular in design and consists of the *Transaction Processing Executive (TPE),* user-written *Transaction Processing Applications Programs,* the *Transaction Input Interface* at each remote terminal, and the *Interslave Communication (INTERCOM) Facility.* Transaction Processing Applications Programs (TPAPs) can be written in any language processor supported by GCOS 8 including Cobol, Fortran, or GMAP, and are stored in the GCOS file system for activation as required.

The *Transaction Input Interface* provides simplified procedures for entering transactions from either teletypewriter or keyboard/display consoles. The INTERCOM facility permits data to be exchanged between the Transaction Processing Executive and applications programs through direct buffer-to-buffer transfers. The Transaction Processing Executive operates as a privileged slave program under the GCOS 8 operating system and is activated by an operator command.

Transaction Driven System (TDS) is designed for high-volume, on-line transaction processing. TDS differs substantially in internal architecture from the GCOS Transaction Processing System (TPS), but it complements TPS by giving a total DPS 88 transaction processing capability. The TDS internal design is optimized for high-volume transaction processing where extremely fast response and fast, automatic restart/recovery are required.

The TDS Executive program executes under GCOS 8 much like the Time-Sharing System Executive. It is an executive operating under GCOS 8 with the major responsibilities of scheduling and coordination of all TDS activities and tasks. TDS manages the allocation of system resources for transaction processing and handles all communications between TDS and GCOS 8.

The DPS 88 *Time-Sharing System (TSS),* in connection with a Datanet front-end processor, provides time-sharing computing services to multiple users at remote terminals. The system resources allocated to time-sharing can be dynamically varied under operator control. The time-sharing executive, operating as a slave activity under GCOS 8, suballocates storage and dispatches the processor to the programs of individual time-sharing users. Time-sharing on GCOS 8 utilizes the GCOS 8 memory architecture to permit any desired amount of system memory to be allocated to time-sharing. A single copy of TSS can support up to 600 users, assuming enough memory, I/O, and communications facilities are provided. In multiple-processor systems, the time-sharing users' programs can simultaneously use as many processors as desired by the site. A separately priced Multicopy Support Option allows from two to four copies of the time-sharing executive to run on one DPS 88 system, thereby increasing the number of users that can be supported.

DPS 88 GCOS Time-sharing users have a choice of six major programming languages: Cobol-74, Extended Basic, Pascal, Time-Sharing Fortran-66, Fortran-77, and APL. Time-sharing users can communicate directly with batch-mode facilities, permitting the development and testing of programs, data entry, control of batch program execution, and manipulation of results from remote terminals.

Interactive Integrated Data Store/II (I-D-S/II) provides the ability to interactively update and retrieve information from an I-D-S/II database. Access is a conversational file management system for creating, deleting, and maintaining catalogs and files and for assigning passwords and accessing criteria. The *FDUMP* facility can be used for inspection and maintenance of permanent files. The *LODT* routine permits execution of experimental user subsystems, including trace analysis and debugging of user programs from remote terminals. The *Time-Sharing Activity Report* provides reports on the accumulated utilization of the time-sharing system resources. *Personal Computing Facility* is now available under time-sharing offering spreadsheet capability.

PROGRAM DEVELOPMENT: Honeywell offers a num-

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ber of products that can be put to use as program development tools. These include the *Text Executive Processor, (TEX),* DM-IV Procedural Language Processor (PLP), the Transaction Application Test System (TATS), the Transaction Screen Management System (TSM), the DM-IV Query and Reporting Processor (QRP), and the Personal Computing Facility (PCF). TEX and PLP are described in the following paragraph while these other products were described in other parts of the Software section.

The *Text Editor* permits terminal users to create a body of text, edit it, save it, and print it in a specified format. *TEX* is an interpretive language that integrates the capabilities of the Text Editor with text processing, providing additional verbs and subroutine calls. The optional DM-IV Procedural Language Processor (PLP) is an extension of QRP which provides a high-level, procedure-oriented language for use by application and system programmers. When using the Query and Reporting Processor end-user facilities, the user need not be concerned with the database structure or access methods.

UTILITIES: System utilities include a *Sort/Merge Facility,* the *File Generation Facility, FMS Utilities, Visual Information Display for Efficient Operation, Comprehensive System Utilities Facility,* and *System Utility 8, General Loader, Bulk Media Conversion,* and *Source and Object Library Editor.*

OTHER SOFTWARE: Honeywell offers application programs for the DPS 88 systems that address Finance, Management Sciences, Manufacturing, Health Care, and Banking. A rundown of some of the packages for each area follows.

Financial applications include Accounts Receivable, Accounts Payable, General Ledger, and Payroll systems. Other packages include Payroll Tax Update, Accounts Receivable On-line, General Ledger On-line, Honeywell Cashflow Management System, Honeywell Financial & Corporate Planning System, HFCS Hierarchical Consolidation Option, HFCS Risk Analysis Option, and HFCS Graphics Option.

Management packages include TEX Application & Demonstration Library, MPS Common File Management System, General Purpose Simulator System, Concordance Generator Program, Coordinate Geometry, MPS Basic System, MPS Mixed Integer Feature, MPS Generalized Upper Bound, Time Sharing Application, Simscript, PMCS Network Processor, PMCS Resource Scheduler, PMCS Interactive Input Processor, and PMCS Interactive On-line Reporting Processor. Others include Slave Program Activity Monitor/II, APT Postprocessors, types A & B, APT Automatically Programmed Tools, Applications Services Library, and Interactive Mathematical Programming System.

Manufacturing packages include APT Automatically Programmed Tools, HMS Inventory Record Management, HMS Manufacturing Data Control, HMS Material Requirement Planning, HMS Master Production Scheduling, HMS Statistical Forecasting, HMS Capacity Requirements Planning, and HMS Purchased Material Control. Products packaged under the Anvil-4000 name include Basic System, Extended Geometry, Drafting, Numerical Control, Analysis, and Complete Package.

Health Care packages include HHS Foundation System, HHS General Ledger/Responsibility Reporting, HHS Preventive Maintenance, HHS Property Ledger, HHS Accounts Payable, HHS Cost Allocation, and HHS Medical Records.

Banking packages include DES Document Entry Subsystem, CHECS Proof & Transit Subsystem, CHECS, and CHECS On-line Balancing and Item Correction.

PRICING & SUPPORT

POLICY: DPS 88 equipment is available for purchase or for rental under a one-year or four-year lease. The basic monthly rentals entitle the user to unlimited central processor usage per month with on-call remedial maintenance between the hours of 8 a.m. and 6 p.m. on Mondays through Fridays. For maintenance beyond this period, the user pays an additional charge which is a fixed percentage of the base maintenance charge. For scheduled extended maintenance service (24 hours, 7 days per week), the additional charge is 40 percent of the base maintenance charge.

Honeywell's TotalCare Program provides support services for hardware and software. These services include Basic and Extended Hardware Maintenance Site Preparation, Installation, On-site Dedicated Maintenance, Basic and Expanded Software Support, On-site Software Support, and Software Installation. Remote testing and diagnostic facilities include the National Response Center for toll-free 24-hour-a-day contact with Honeywell, the Technical Assistance Center (which provides remote support), the Logistics Inventory Data System for rapid location of parts, and the ELAN software system for troubleshooting.

SUPPORT: Honeywell offers six categories of support products for DPS 88 systems. These products include data services, system engineering, software, education, publications, and supplies.

Data services consist of machine time for predelivery production and checkout, and for overload/peakload situations. Processor time costs approximately $110.00 per hour, minimum, depending on the amount of memory. Charges for on-line peripherals vary from $4.00 to $12.80 per hour; for off-line peripherals, $10.90 to $29.10 per hour.

System engineering falls into one of five billable support categories, as described in the following table. Field engineering managers are responsible for the degree of skill required to perform the job.

	Hourly Rates ($)	Monthly Rates ($)
Principal or senior technical consultant	138	19,174
Project supervisor or technical consultant	112	15,653
Technical specialist	100	14,088
Systems analyst/senior programmer	85	11,739
Programmer	59	8,218

Hourly charges are for a four-hour minimum. The monthly rates do not include supplies.

The GCOS 8 operating system executive (OSE) is provided to DPS 88 users at no additional cost. All other facilities, such as job management, file systems, conversion aids, language processors, utilities, applications packages, communications software, system maintenance, and system performance analysis are separately priced.

EDUCATION: Education services include standard courses, advanced professional training, multimedia self-instruction courses so that customers can self-train as often as needed, site surveys to determine educational requirements, on-site classes, and clustered on-site classes to accommodate a group of users from an area. Prices vary from $126 per student per day for standard courses to $165 per student daily for the most sophisticated programs. Multimedia self-instruction courses can be purchased for prices ranging from $18 to $995.

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TYPICAL CONFIGURATIONS: Sample configurations for the DPS 88 Series are shown below. Complete equipment and software prices follow these configurations.

SMALL CONFIGURATION:

Honeywell dual processor DPS 88/42 features 16 megabytes of main memory, two System Support Units, two Thermal Exchange Pumps, one Central Interface Unit, one Main Memory Unit, one Input/Output Processor with 64 logical channels, one Channel Adapter Unit or Channel Buffer Unit with 33 function slots, one System Support Facility, one system console, and one maintenance console.	$2,950,000
VIP7815 60 Display Units	185,700
DCE8010 One Network Processor	29,000
DCE8007 Two Channel Interface Bases	5,000
DCF8001 One Communications Console	2,065
MGS8801 One Motor-Generator and Control	38,000
MGF8801 One Power Sequencer	4,000
MSP3880 One Mass Storage Processor	74,270
MSU3380 Two Storage Unit/Controllers	177,600
MSU3382 Six Mass Storage Slave Units	386,700
MTS8205 Magnetic Tape Subsystem; includes MTU8205	55,350
MTF8200 1 x 8 Switch for magnetic tape subsystem	No charge
MTU8208 Seven Magnetic Tape Units; 200 ips, 1600/6250 bpi	154,700
PRU1600 Two 1325-lpm Belt Printers	129,880
URP8401 Embedded Unit Record Processor	4,000
TOTAL PURCHASE PRICE:	$4,196,265

MEDIUM CONFIGURATION:

Honeywell single processor DPS 88/81 features 16 megabytes of main memory, plus 48 additional megabytes of memory, one System Support Unit, one Thermal Exchange Pump, one Central Interface Unit, one Main Memory Unit, one Input/Output Processor with 64 logical channels, one Channel Adapter Unit or Channel Buffer Unit with 33 function slots, one System Support Facility, one system console, and one maintenance console.	$2,850,000
MGS8801 One Motor-Generator and Control	38,000
MGF8801 One Power Sequencer	4,000
VIP7815 60 Display Units	185,700
DCE8010 One Network Processor	29,000
DCE8007 Eight Channel Interface Bases	20,000
DCF8001 One Communications Console	2,065
DCE8015 Datanet 8 Host Connection	8,000
DCE8002 Communication Line Expansion; 16 to 64 lines	3,000
MSP3880 Two Mass Storage Processors	148,540
MSU3380 Four Storage Unit/Controllers	355,200
MSU3382 Twelve Mass Storage Slave Units	773,400
MTS8205 Two Magnetic Tape Subsystems; include MTU8205	110,700
MTF8201 2 x 16 Switch	6,130
MTU8208 Fourteen Magnetic Tape Units; 200 ips, 1600/6250 bpi	309,400
PRU1600 Two 1325-lpm Belt Printers	129,880
URP8401 Embedded Unit Record Processors	4,000
TOTAL PURCHASE PRICE:	$5,757,015

LARGE CONFIGURATION:

Honeywell dual processor DPS 88/82 featuring 16 megabytes of main memory, plus 112 megabytes of additional memory, two System Support Units, two Thermal Exchange Pumps, one Central Interface Unit, one Main Memory Unit, One Input/Output Processor with 64 logical channels, one Channel Adapter Unit or Channel Buffer Unit with 33 function slots, one System Support Facility, one system console, and one maintenance console	$4,050,000
MXC8800 Additional Central Interface Unit and Main Memory Unit	300,000
CMM8816 Seven additional 16-megabyte Memory Modules for a total of 128 megabytes of main memory	1,820,000
MXU8801 Additional Input/Output Processor with 64 Logical Channels	250,000
MXF8804 Two IOP Logical Channel Expansions; 128 to 256 Channels	12,000
MXF8800 Two Additional Channel Adapter Units	350,000
CPF8802 Additional System Support Facility	75,000
MGS8801 One Motor-Generator and Control	38,000
MGF8801 One Power Sequencer	4,000
VIP7815 90 Display Units	278,550
DCE8010 One Network Processor	29,000
DCE8007 Sixteen Channel Interface Bases	40,000
DCF8001 One Communications Console	2,065
DCE8015 Datanet 8 Host Connection	8,000
DCE8002 Communication Line Expansion; 16 to 64 lines	3,000

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DCE8004 Communication Line Expansion; 64 to 128 lines	5,000	MTF8201 2 x 16 Switch	6,130
MSP3880 Two Mass Storage Processors	148,540	MTU8208 Fourteen Magnetic Tape Units; 200 ips, 1600/6250 bpi	309,400
MSU3380 Four Storage Unit/Controllers	355,200	PRU1600 Two 1325-lpm Belt Printers	129,880
MSU3382 Twelve Mass Storage Slave Units	773,400	URP8401 Embedded Unit Record Processor	4,000
MTS8205 Two Magnetic Tape Subsystems; includes MTU8205	110,700	TOTAL PURCHASE PRICE:	$9,101,865

EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	4-Year Lease ($)	SPSS ($)
PROCESSORS						
CPS8841	DPS 88/41 Central Processor System with 16MB Memory	1,850,000	4,000	82,400	64,750	1,110
CPS8842	DPS 88/42 Central Processor System with 16MB Memory	2,950,000	4,800	131,400	103,250	1,580
CPS8846	DPS 88/42T Fully Redundant Processing System with a minimum 16MB Memory	3,700,000	6,400	164,800	129,500	1,580
CPS8884	DPS 88/81 Central Processor System with 16MB Memory	2,850,000	5,950	116,500	91,200	1,290
CPS8885	DPS 88/82 Central Processor System with 16MB Memory	4,050,000	7,050	179,500	141,100	1,870
CPS8886	DPS 88/82T Fully Redundant Central Processing System with minimum 16MB Memory	4,800,000	8,650	218,400	172,800	1,870
SYSTEM UPGRADES						
CPK8841	CPS8841 (DPS 88/41) to CPS8842 (DPS 88/42)	1,100,000	800	49,000	38,500	470
CPK8842	CPS8842 (DPS 88/42) to CPS8885 (DPS 88/82) or CPS8846 (DPS 88/42T) to CPS8886 (DPS 88/82T)	1,150,000	2,250	48,100	37,850	290
CPK8843	CPS8841 (DPS 88/41) to CPS8884 (DPS 88/81)	1,000,000	1,950	34,100	26,450	180
CPK8884	CPS8884 (DPS 88/81) to CPS8885 (DPS 88/82)	1,200,000	1,100	63,000	49,900	580
PROCESSOR OPTIONS						
MXC8800	Additional CIU and MMU for CPS8842 and CPS8885; no memory included	300,000	500	12,000	10,000	—
CMM8816	Additional 16MB Memory Module	260,000	650	13,900	11,100	—
MXU8801	Additional IOP with 64 Logical Channels and CAB; for CPS8842 and CPS8885	250,000	500	10,000	8,100	—
MXF8804	IOP Logical Channel Expansion (64 to 128). Max. of one per IOP	6,000	—	240	200	—
MXF8805	Additional Channel Bus Unit (CBU); max of one per IOP	200,000	150	5,400	4,300	—
MXF8811	CBU Expansion	100,000	95	4,000	3,300	—
MXF8800	Additional CAU; max. of 1 per IOP	150,000	150	5,400	4,300	—
MXF8810	CAU expansion	100,000	95	4,000	3,300	—
CPF8802	Additional System Support Facility (SSF). For CPS8842 and CPS8885 only. Includes system console with large screen monitor interface, 15" CRT and keyboard, Console Table and Control Pod, Maintenance Console, 12" CRT and Keyboard, Table, and two Modem switches	75,000	150	3,000	2,500	—
	Consoles and Features:					
CSU8801	Additional System Console with 15" CRT and Keyboard for 2nd, 4th, and 6th System Console per SSF	3,095	36	130	110	—
CSU8802	Additional System Console with 15" CRT and Keyboard for 3rd and 5th System Console per SSF	4,095	42	166	140	—
CSF8803	Large Screen Monitor Interface Feature for CSU8801/8802	400	—	16	13	—
CSF8804	System Console Table for CSU8801/8802	550	—	—	—	—
CSF8801	Printer for System Console	1,225	50	121	103	—
CSF8802	Printer for Maintenance Console	1,225	33	105	90	—
CSF8805	Large Screen Monitor	2,358	16	157	135	—
CSF8806	Ceiling Mount for CSF8805	395	—	—	—	—
CSF8301	Printer Pedestal	395	NC	NA	4	—
	Power and Cooling:					
MGS8801	Motor Generator and Control; 3 sec. ridethrough, 62.5k VA, 60 Hz, 208/240 or 440/480 VAC Input	38,000	70	1,280	1,025	—
MGF8801	Power Sequencer for use with MG	4,000	2	135	110	—
MGF8802	Power Sequencer for use with Full System UPS	4,000	2	135	110	—
CPF8801	Thermal Exchange Air Unit. One option required for each TEP when customer cannot provide chilled water source for TEP.	30,000	50	1,200	1,000	—

**Five-year lease*
NC—No charge.
NA—Not available.

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		Purchase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	4-Year Lease ($)	SPSS ($)
	Peripheral and Network Processors Attachment Features:					
MXF8020	General Purpose Adapter Disk	18,500	15	850	700	—
MXF8021	General Purpose Adapter Tape	18,500	15	850	700	—
MXF8407	Exchange of Disk or Magnetic Tape Processor Attachment Feature; IOM/CAU to IOP/CBU system	3,000	—	—	—	—
MXF8408	Exchange of Unit Record Processor Attachment Feature; IOM/CAU to IOP/CBU	3,000	—	—	—	—
MXF8409	Exchange of Previously Installed Host Connection for a DCE8017 DN 8 Network Processor; IOM/CAU to IOP/CBU	3,000	—	—	—	—
MXF8412	Exchange of DN6600 Network Processor Attachment Feature; IOM/CAU to IOP/CBU	3,000	—	—	—	—
MXF8414	Hyperchannel Attachment Feature for IOP/CBU Systems	14,000	111	1,111	745	—
MXF8415	Exchange of Hyperchannel Attachment Feature from IOM/CAU to IOP/CBU Systems	4,000	—	—	—	—
MXF8801	Exchange of High-Speed Disk or Tape Processor Attachment Feature	2,500	—	—	—	—
MXF8802	Exchange of Standard-Speed Peripheral Processor Attachment Feature	2,500	—	—	—	—
MXF8803	Exchange of Network Processor or Page Printing System Attachment Feature	1,500	—	—	—	—
MXF8815	Exchange of Hyperchannel attachment feature from IOM/CAU to IOP/CBU systems	4,000	—	—	—	—
MASS STORAGE						
MSP3880	Mass Storage Processor; includes two storage directors and two channels for DPS 88 Channel Bus Unit connection	74,270	200	4,400	3,745	—
MSP3884	Mass Storage Processor; includes two storage directors and four channels for DPS 88 Channel Bus Unit connection	88,270	224	5230	4,450	—
MSP0611	Freestanding Single-Channel Mass Storage Processor	50,000	123	1,819	1,498	—
MSP0612	Freestanding Dual Channel Mass Storage Processor	64,375	168	2,120	1,748	—
MSK0612	Upgrade Kit, MSP0611 to an MSP0612	23,000	60	856	706	—
PSS8001	Capacitor Ridethrough Option for MSP0611, 0612	3,120	13	123	103	—
	Mass Storage Units:					
MSU3380	Head of String Mass Storage Unit; includes four actuators	88,800	295	4,780	4,070	—
MSU3382	Mass Storage Slave Unit; includes four actuators	64,450	215	3,470	2,960	—
MSU0451	Removable Disk Mass Storage Unit, 200M bytes; requires MSF007	27,047	113	1,140	950	—
MSF0006	Dual Access Feature for MSU0451	2,070	14	89	*76	—
MSF0007	Remote Position Sensing Option for MSU0451	2,025	14	87	*76	—
MSU0500	Dual Fixed Disk Mass Storage Unit, 940 megabytes	38,850	172	1,386	*1,154	—
MSU0501	Dual Fixed Disk Mass Storage Unit; 1101 megabytes	49,650	197	1,747	*1,452	—
MSK0501	Upgrade kit; MSU0500 to MSU0501	10,800	25	361	*297	—
MSF0011	Dual Access Feature for MSU0501	4,140	23	163	*136	—
MSA1140	Unit Addressing for MSU04xx Units for MSP0611 only	3,500	16	156	130	—
MSA1141	Unit Addressing for MSU05xx Units for MSP0611 only	3,500	16	219	*180	—
MSA1142	Unit Addressing for MSU04xx Units	4,500	18	146	*122	—
MSA1143	Unit Addressing for MSU05xx Devices	4,500	18	215	*177	—
MSF0500	Spare Head Disk Assembly for MSU0500	12,340	—	—	—	—
MSF0501	Spare Head Disk Assembly for MSU0501	15,808	—	—	—	—
MSF1140	Device Adapter for MSU04xx Devices on MSP0611 only	3,500	—	109	*89	—
MSF1141	Device Adapter for configuring MSU04xx Devices (max 16) to MSP0612 only	6,000	—	187	*152	—
MSF1142	Unit expansion for configuring MSU05xx devices (max 7) to MSP0612	4,000	—	125	*105	—
MSF1143	Nonsimultaneous (Switched) DATANET Channel for MSP0611/0612	8,237	15	283	*33	—
MSF1144	Nonsimultaneous (Switched) IOM Channel for MSP0611/0612	8,237	15	283	*33	—
MSF1150	Second Nonsimultaneous (Switched) DATANET Channel for MSP0611/0612	8,237	15	283	*233	—
MAGNETIC TAPE EQUIPMENT						
MTS8205	Magnetic Tape Subsystem; includes tape processor, one MTU8205 tape unit, and one IOP/CBU channel	55,350	526	2,913	2,516	—
MTS8206	Magnetic Tape Subsystem; includes tape processor, one MTU8206 tape unit, and one IOP/CBU channel	52,700	549	2,774	2,395	—
MTS8208	Magnetic Tape Subsystem; includes tape processor, one MTU8208 tape unit, and one IOP/CBU channel	54,650	613	2,876	2,484	—
MTF8200	Magnetic Tape Subsystem 1 x 8 Switch; either this feature or MTF8201 required for each MTS82xx	NC	NC	NC	NC	—
MTF8201	Magnetic Tape Subsystem 2 x 16 Switch	6,130	14	323	279	—
MTF8202	Magnetic Tape Subsystem Switched Channel; includes IOP or CBU channel	8,000	12	421	364	—
MTP0611	Magnetic Tape Processor for MTU500/0610/0630	29,400	178	1,080	*905	—

**Five-year lease*
NC—No charge.
NA—Not available.

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		Purchase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	4-Year Lease ($)	SPSS ($)
Magnetic Tape Units:						
MTU8205	Magnetic Tape Unit; 125 ips, 800/1600 bpi	19,725	338	1,038	897	—
MTU8206	Magnetic Tape Unit; 125 ips, 1600/6250 bpi	20,150	363	1,061	916	—
MTU8208	Magnetic Tape Unit; 200 ips, 1600/6250 bpi	22,100	427	1,163	1,005	—
MTU0610	Magnetic Tape Unit; includes cartridge load	21,000	175	801	*677	—
MTU0630	Magnetic Tape Unit	14,815	130	593	*505	—
Features for the MTU0610:						
MTF0607	800/1600 bpi feature	6,090	75	300	*260	—
MTF0608	1600/6250 bpi feature	13,319	115	511	*432	—
MTK0678	Upgrade Kit; MTF0607 to MTF0608 performance	10,784	48	211	*172	—
Features for the MTU0630:						
MTF0634	75 ips, 800/1600 bpi	4,725	140	286	*257	—
MTF0635	75 ips, 1600/6250 bpi	7,110	120	342	*300	—
MTF0636	125 ips, 800/1600 bpi	9,805	158	460	*398	—
MTF0637	125 ips, 1600/6250 bpi	10,330	150	460	*398	—
MTK0630	Performance upgrade MTF0634 to MTF0635	2,385	20	75	*60	—
MTK0631	Performance upgrade MTF0636 to MTF0637	1,700	25	55	*45	—
MTK0632	Performance upgrade MTF0634 to MTF0636	5,080	20	175	*145	—
MTK0633	Performance upgrade MTF0635 to MTF0637	3,220	20	120	*100	—
MTK0634	High Altitude Adapter	240	—	8	*6	—
LINE PRINTERS						
PRU0903	High-speed printer; 900 lpm	34,975	421	2,065	*1,720	—
PRU1203	High-speed printer; 1200 lpm	38,275	468	2,340	*1,920	—
PRU1600	High-speed Belt Printer; 1325 lpm	64,940	538	2,910	*2,472	—
PRU0903/1203 Options:						
PRB3213	Uppercase ASCII, optimized	—	—	—	—	—
PRB3300	Upper/Lowercase ASCII, optimized	—	—	—	—	—
PRB3500	Series 400/600/6000/L66	—	—	—	—	—
PRB3501	Standard IBM	—	—	—	—	—
PRB3513	Uppercase ASCII	—	—	—	—	—
PRB3524	OCR-A Numeric	—	—	—	—	—
PRB3549	OCR-A Alphanumeric	—	—	—	—	—
PRB3600	Upper/Lowercase ASCII	—	—	—	—	—
PRB3703	Series 200/2000	—	—	—	—	—
PRK0903	Upgrade PRU903 to PRU1203	5,000	50	300	*225	—
PRK0907	Exchange of PDSI to DAI interface for 0903.1203; includes control panel	3,000	—	—	—	—
PRU1600 Options:						
PRB0500	OCR-B Print Belt	2,460	90	179	*164	—
PRB0524	OCR A/B Print Belt	2,460	90	179	*164	—
PRB0532	Puerto Rico Print Belt	2,460	94	179	*164	—
PRB0549	OCR-A Alphanumeric Print Belt	2,460	90	179	*164	—
PRB0600	ASCII Belt; upper-/lowercase	2,567	90	184	*166	—
PRF0022	24 Additional Print Positions; 136 to 160	2,610	16	112	*93	—
PUNCH CARD EQUIPMENT						
CRU0501	Card Reader (500 cpm); requires URA0056	19,500	119	684	568	—
PCU0121	Card Punch (100-400 cpm); requires URA0050	20,032	153	900	698	—
Unit Record Equipment and Features:						
URP8400	Embedded Unit Record Processor for IOP/CBU system; supports up to 2 CRU0501 or PCU0121 card units	4,000	3	128	118	—
URP8401	Embedded Unit Record Processor for IOP/CBU system; supports up to 2 PRU0903/1203 printers	4,000	3	128	118	—
URP8402	Embedded Unit Record Processor for IOP/CBU system; supports up to 2 PRU1600 printers	4,000	3	128	118	—
URP0600	Freestanding Unit Record Processor	26,585	42	940	*791	—
URF0040	Unit Record Addressing Expansion for URP0600	983	2	35	*28	—
URF0041	Dual Switched Channel for URP0600	8,898	16	315	*259	—
URA0050	Addressing for PCU0121	4,253	4	151	*123	—
URA0055	Addressing Capability for PRU1600	7,167	19	264	*220	—
URA0056	Addressing Capability for CRU0501; one required for each device	265	—	9	6	—
CRF0030	Pedestal for CRU0501	184	—	—	—	—

**Five-year lease*
NC—No charge.
NA—Not available.

Honeywell DPS 88 Series

		Purchase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	4-Year Lease ($)	SPSS ($)
TERMINALS						
VIP7201	Asynchronous, Multipurpose Keyboard Display Terminal	795	20	—	—	—
VIP7301	Standard Keyboard Display Terminal with RS-422-A interface and 25-foot cable; includes optional RS-232-C interface	1,900	20	—	—	—
VIP7303	Word Processing Keyboard Display Terminal with RS-422-A interface and 25-foot cable; includes optional RS-232-C interface	1,900	20	—	—	—
VIP7307	Data Entry Keyboard Display Terminal with RS-422-A interface and 25-foot cable; includes optional RS-232-C interface	1,900	20	—	—	—
VIP7305	Multifunction Keyboard Display Terminal with RS-232-C/RS-422-A interface and 25-foot cable	1,900	20	—	—	—
VIP7814	Synchronous/Asynchronous Keyboard Display Terminal with 12-inch diagonal CRT, 1,920-character display positions	2,700	25	—	123	—
VIP7815	Synchronous/Asynchronous Keyboard Display Terminal with 15-inch CRT green phosphor, RS-232-C, and RS-422-A interfaces	3,095	30	—	138	—
VIP7823	Asynchronous Keyboard Display Terminal with Multifunction Keyboard; includes a 72-line scroll feature, buffered print adapter, and 25-foot RS-422-A cable	2,350	25	—	—	—
DATANET 6661 FRONT-END NETWORK PROCESSOR						
DCU6661	Processor; includes 64K bytes of memory, system support controller, direct interface adapter; up to 12 channel interface bases	36,605	261	1,990	*1,669	—
DATANET 6661 Options:						
DCF6661	Performance and Line Enhancement	13,209	113	700	*578	—
DCE6662	Cache Memory Performance Enhancement	29,840	65	1,365	*1,120	—
DCE6663	Communication Line Expansion; maximum 96 Lines	3,546	—	149	*139	—
DCM6605	Memory Increment from 64K bytes to 128K bytes	8,400	218	589	522	—
DCM6606	Memory Increment from 128K bytes to 256K bytes	10,920	109	693	*624	—
DCM6607	Memory Increment from 256K bytes to 512K bytes	21,840	218	1,387	1,248	—
DCF6607	Channel Interface Base	1,651	9	70	*58	—
DCF6611	Dual Synchronous Channel Package, to 9600 bps	1,450	7	60	*50	—
DCF6612	Dual Asynchronous Channel Package, to 9600 bps	590	4	26	*23	—
DCF6613	Automatic Call Unit, Dual Channel	1,180	4	46	*39	—
DCF6614	MIL STD 188C Synchronous Channel, to 9600 bps	1,501	8	63	*53	—
DCF6618	Dual Binary Synchronous Channel Package, to 9600 bps	1,450	7	60	*50	—
DCF6619	Broadband Channel, to 72K bps	3,056	12	125	*104	—
DCF6620	HDLC Voice-Grade Channel; to 9600 bps	2,573	11	106	*89	—
DCF6621	Bisynchronous Broadband Single Channel; to 72K bps	3,056	12	125	*104	—
DCF6626	Direct Connect Capability	350	2	15	*13	—
DCF6627	Broadband Channel, CCITT V.35 to 72K bps	3,430	12	139	*114	—
DCF6927	Universal Modem Bypass	415	11	30	*24	—
DCF6610	Dual Channel Package, to 9600 bps	1,180	4	46	*39	—
DCF6615	Asynchronous Dual Channel, to 9600 bps	1,501	8	63	*53	—
DCF6616	MIL-STD 188C Broadband Channel to 72K bps	1,501	8	63	*53	—
DCF6617	MIL-STD 188C HDLC Channel	2,573	11	106	*89	—
DCF6622	HDLC Broadband Channel to 72K bps	3,056	12	125	*104	—
DCF6623	HDLC Channel, CCITT-V.35 to 72K bps	3,430	12	139	*114	—
DATANET 8 FRONT-END NETWORK PROCESSOR						
DCU8010	Processor; includes 512K bytes of memory, system support controller, 512K bytes diskette drive, up to 16 channel interface bases	29,000	135	1,123	*937	—
DATANET 8 Options:						
DCE8003	Processor Power Module Enhancement	7,400	40	293	*245	—
DCE8002	Communications Line Expansion from 16 to 64 lines	3,000	5	106	*86	—
DCE8004	Communications Line Expansion from 64 to 128 lines; requires DEC8002/8003	5,000	10	179	*147	—
DCP8010	Extended Processor Performance Enhancement	18,500	86	644	*554	—
DCE8005	Additional 512K-byte diskette unit	1,785	18	79	*68	—
DCE8015	Datanet 8 Host Connection for DPS 88 CAU Systems	8,000	65	339	*288	—
DCF8007	Channel Interface Base	2,500	14	99	*83	—
DCF8001	Communications Console; 100 cps	2,065	40	105	*92	—

**Five-year lease*
NC—No charge.
NA—Not available.

Honeywell DPS 88 Series

		Purchase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	4-Year Lease ($)	SPSS ($)
DCF8009	Dual Asynchronous Channel; EIA RS-422-A; to 9600 bps each	1,000	7	41	*35	—
DCF8011	Dual Synchronous Channel; EIA RS-232-C; to 9600 bps	1,500	8	58	*49	—
DCF8012	Dual Asynchronous Channel; EIA RS-232-C; to 9600 bps	1,000	5	39	*32	—
DCF8014	Single Synchronous Channel; MIL-188-C; to 9600 bps	1,000	6	40	*33	—
DCF8015	Dual Asynchronous Channel; MIL-188-C; to 9600 bps	1,000	7	41	*35	—
DCF8016	Single Synchronous HDLC Wideband Channel; MIL-188-C; to 56K bps	1,995	15	83	*70	—
DCF8017	Single Synchronous HDLC Channel Package; MIL-188-C; to 9600 bps	2,500	12	99	*82	—
DCF8018	Dual Bisynchronous HDLC Channel Package; EIA RS-232-C; to 9600 bps	1,500	7	58	*49	—
DCF8019	Cross-Net Load/Dump Feature	1,000	6	40	*33	—
DCF8020	Single Synchronous HDLC EIA RS-232-C Channel; to 9600 bps	1,500	8	58	*49	—
DCF8022	Single Synchronous HDLC Wideband Channel; to 56K bps	3,000	16	118	*98	—
DCF8023	Single Synchronous HDLC Wideband Channel; CCITT V.35; to 56K bps	3,000	16	118	*98	—
DCF8024	Direct Connect Capability; to 9600 bps	350	2	14	*12	—
DCF8026	Universal Modem Bypass	415	2	16	*13	—
DCF8036	Dual Asynchronous Current Loop Channel; to 9600 bps	1,000	6	41	*35	—
DCM8005	Additional 512K bytes of memory; 512-1024KB	6,000	21	622	*534	—
DCM8008	Additional 512K bytes of memory; 1024-1536KB	6,000	21	622	*534	—

**Five-year lease*
NC—No charge.
NA—Not available.

SOFTWARE PRICES

		Monthly License Fee ($)	Optional Support Charge ($)
GCOS 8 SYSTEM			
SVS8000	GCOS 8 Operating System EXEC	NSC	—
SVP8000	System Maintenance Facility	87	44
SVP8001	Software Management Facility	79	13
SVP8002	System Performance Analysis Facility	281	25
SVE8000	FMS Catalog Cache Facility	69	13
SVE8001	FMS Test Access Mode Facility	70	8
SVE8002	Password Encryption Facility	58	5
SVJ8000	Parametric JCL	36	5
Utilities:			
SNU0471	PPS Utilities	25	—
SNU0472	PPS Off-line	NSC	—
SNU0473	PPS On-line	NSC	—
SVU8012	File Management System Utilities	316	45
SVU8000	Systems Utilities Facility	52	5
SVU8001	File Generation Facility	49	5
SVU8002	Sort/Merge Facility	107	17
Data Management:			
SVD8000	DM-IV Standard Facility	1,041	183
SVD8001	DM-IV Fortran Subschema Translator Option	120	10
SVD8002	I-D-S/I Facility	1,041	110
SVD8003	Indexed Sequential Processing Facility	28	6
SVD8006	Data Dictionary/Batch	281	35
SVD8007	Data Dictionary/Online	125	15
Languages and Compilers:			
SVL8000	Cobol-74 Compiler & Runtime Facility	262	26
SVL8001	Fortran Compiler & Runtime Facility	354	50
SVL8002	PL/1 Compiler & Runtime Facility	285	50
SVR8002	PL/1 Runtime Facility	77	11
SVL8003	RPG-II Facility	133	5
SVL8010	Fortran-77 Compiler & Runtime Facility	213	15
SVL8011	Fortran-77 Hex Option	NC	NC
SVL8012	Fortran-66 Compatibility Option for Fortran-77	NC	NC
SVL8013	Cobol-74 Relational Query (RQ)	90	10

NA—Not available.
NSC—No separate charge.

Honeywell DPS 88 Series

		Monthly License Fee ($)	Optional Support Charge ($)
SVR8000	Cobol-74 Runtime Facility	86	9
SVR8004	Fortran-77 Runtime Facility	63	5
SVP8008	Debug Support Option	104	20
SVP8009	Cobol-74 Debug Support Option	190	27
SVP8010	Fortran-77 Debug Support Option	229	10
SVL8008	Cobol-68 Compiler & Runtime	306	39
Transaction Processing:			
SVS8006	TDS Facility	1,601	210
SVS8007	TPE Facility	561	55
SVS8002	DM-IV TP Facility	1,389	167
SVU8003	DM-IV TP Forms Option	250	50
Time-Sharing:			
SVE8020	Multicopy Times-sharing Option	557	110
SVS8005	TSS Facility	84	22
SVE8019	TSS Administration Option	118	16
SVE8008	TSS File Management Option	112	11
SVE8009	TSS Advanced Application Support Option	167	33
SVE8010	TSS Media Input Option	55	11
SVL8007	TSS Basic Language Option	202	38
SVE8011	TSS Cobol-74 Option	55	11
SVE8012	TSS Fortran Option	55	11
SVE8013	TSS Text Processing Option (TEX)	320	66
SVE8014	TSS Editing Option (EDIT)	101	22
SVE8015	TSS Document Formatting Option	51	11
SVE8016	TSS Electronic Mail Option	167	33
SVE8017	TSS Sort Interface Option	70	11
SVE8022	TSS Fortran-77 option	55	11
SVD8004	TSS Data Basic	139	22
SVE8018	TSS DM-IV Option	82	14
Communications Software:			
SVC8000	GRTS-II Facility	273	44
SVC8001	GRTS-II HDLC Support Option	129	11
SVC8002	NPS Facility	974	209
SVC8003	NPS HDLC Support Option	129	11
SVC8006	Host File Transceiver Facility for L6	16	6
SVC8004	Extended FNP Support Facility	139	28
SVC8048	GRTS-I Facility	450	110
Query and End-User Facilities:			
SVD8005	I-D-S/I Data Query Option	167	33
SVP8003	DM-IV QRP Option	375	59
SVH8000	Personal Computing Facility	170	30
SVP8004	DM-IV PLP Option	263	45
SVH8001	PDQ Example Query (EQ)	350	40
SVH8002	PDQ Interactive Query (IQ)	270	30
SVH8003	PDQ Comprehensive Report Examination & Display Option (CREDO)	210	25
SVP8006	MDQS/II Facility	612	117
SVP8007	MDQS/IV Facility	1,058	212
Other:			
SVS8003	DM-IV TP Comprehensive Facility	2,755	286
SVR8003	TSS Text Processing (TEX) Library Option	36	5
SVD8024	DDE Basic System	1,373	226
SVD8028	DDE Comprehensive Package for TDS	3,575	506
SVD8031	DDE Comprehensive Package for TPE	3,360	474
SVD8033	DDE System Management Facility for TDS	1,484	244
SVD8034	DDE System Management Facility for TPE	1,385	228

SPECIAL SYSTEMS SOFTWARE

SVL8015	C Programming Language	340	800
SVL8016	C Programming Language Cross Compiler	70	160
SVP8013	Transaction Application Test System (TATS)	500	1,620
SVP8014	Softool Cobol Programming Environment	1,400	8,375
SVP8015	Softool Change & Config. Control	1,500	7,500

NA—Not available.
NSC—No separate charge.

Honeywell DPS 88 Series

		Monthly License Fee ($)	Optional Support Charge ($)
SVP8016	Complete Softool	2,500	15,500
SVP8017	Transaction Screen Mgmt. System (TSM)	980	1,920
SVP8018	System-80 Automatic Cobol Program Generator	780	1,840
SVP8019	System-80 Cobol Report Generator	480	1,000
SVU8016	MPCD Disk I/O Performance Analyzer	NA	100
SVU8019	BUSINESS-GRAF	NA	2,700
SVU8020	GRAFMASTER	NA	1,650
SVU8021	Scientific/Engineering Option	NA	1,575
	DISTRIBUTED NETWORK SUPERVISOR (DNS) SOFTWARE		
SNC8020	Distributed Network Supervisor	490	86
SNC8021	Network Operator Interface (NOI)	10	5
SNC8022	Cross-Net Load/Dump Facility	10	5
SNC8023	Accommodation Mode, Host Conn. (DPS 8)	42	7
SNC8024	Host Connection (DPS 7)	42	7
SNC8028	Multiple Host Connection	20	8
SNC8031	HDLC Primary Network Support	82	15
SNC8033	Primary Network Private Virtual Circuit (Endpoint)	166	29
SNC8034	Primary Network Private Virtual Circuit (Switching)	170	30
SNC8035	TRANSPAC Connection (France) Limited	166	29
SNC8036	TRANSPAC Conn. (France) Extended	20	5
SNC8037	TELENET Connection (USA)	166	29
SNC8038	TYMNET Connection (USA)	166	29
SNC8039	DATAPAC Connection (Canada)	166	29
SNC8040	DDX-P Connection (Japan)	166	29
SNC8041	AUSTPAC Connection (Australia)	166	29
SNC8044	EDWP Connection (Switzerland)	166	29
SNC8045	DN-1 Connection (Netherlands)	166	29
SNC8046	EURONET Conn. (European Economic Community)	166	29
SNC8047	DATEX-P Conn. (West Germany) X.25	166	29
SNC8052	PSS Connection (United Kingdom)	166	29
SNC8053	NPDN Conn. (Scandanavia) X.21 Basic	166	29
SNC8054	NPDN Conn. (Scandanavia) X.21 Ext.	20	5
SNC8056	Extended X.25 Public Network (Greater than 16 Virtual Circuits)	20	5
SNC8057	Asynchronous Terminal Support	NSC	—
SNC8058	VIP Synchronous Terminal Support	NSC	—
SNC8060	Interactive Bisync (3270) Terminal Support	76	14
SNC8061	Remote Batch Bisync (2780) Terminal Support	52	9
SNC8062	Remote Computer Interface Terminal Support	20	5
SNC8065	TRANSPAC Async Pad Support (France)	20	5
SNC8067	TELENET Async Pad Support (USA)	20	5
SNC8068	TYMNET Async Pad Support (USA)	20	5
SNC8069	DATAPAC Async Pad Support (Canada)	20	5
SNC8070	DDX-P Async Pad Support (Japan)	20	5
SNC8071	AUSTPAC Async Pad Support (Australia)	20	5
SNC8072	PSS Async Pad Support (United King.)	20	5
SNC8073	Logical HDLC	85	15
SNC8074	EDWP Async Pad Support (Switzerland)	20	5
SNC8075	DN-1 Async Pad Support (Netherlands)	20	5
SNC8076	EURONET Async Pad Support (European Economic Community)	20	5
SNC8077	DATEX-P Async Pad Support (West Germany)	20	5
SNC8090	GCOS Administration	136	24
SNC8091	GCOS 8 Administration (8MIN)	136	24
SNC8093	Log File Formatter (GCOS/GCOS 8)	NSC	—
SNC8094	DPS 8 Host to Host File Transfer	15	5
SNC8095	DNS for DPS 8/20 to 8/49	396	70
SNC8096	DNS for DPS 7 (Entry Level)	396	70
SCC1220	GCOS 64 FNP Support	15	5
SCU1618	GCOS 64 Distributed File Transfer	15	5

NA—Not available.
NSC—No separate charge. ■