Honeywell DPS 88 Series

MANAGEMENT SUMMARY

UPDATE: *Honeywell's announcement of an entirely en-hanced DPS 88 line took a back seat late last year to rumors of Honeywell plans to get out of computer production. At press time, Honeywell was reportedly talking to Groupe Bull of France and NEC of Japan about plans to merge its computer operation with its long-time partners. Details of the proposed merger and the role Honeywell would continue to play in a new corporate entity were not available at this writing. While such plans were the talk of Wall Street and industry analysts, Honeywell spokespersons would only say that the firm was involved in negotiations with Bull and NEC. As the corporate storm raged around Honeywell, this long-time industry player was beginning shipments of a new generation of DPS 88 large-scale mainframes. The six new processors replace the existing six DPS 88 products. The latest DPS 88 versions feature larger main memory capaci-ties, 256K-bit memory chips, and the GCOS 8 Performance Enhancement Facility, bundled software products that were formerly offered as options. Included in the software pack-age is the Rapid Access Data System (RADS), a facility for improving I/O throughput. Additionally, new Datanet com-munications gear is also available for Honeywell's entire medium- to large-scale mainframe line. The enhanced DPS 88 Series is now positioned against the top-end IBM 3090 mainframe line. Honeywell claims the new DPS 88 systems incorporating price/performance improvements are now competitive with the 3090 Series in mixed work load environments.*

The new models come in configurations identical to the previous DPS 88 offerings. The three lower end models are part of the DPS 88/860 Series and the three upper end models are part of the DPS 88/890 Series. The 860 models include the DPS 88/861, a single processor; the DPS 88/862, a dual processor; and the DPS 88/862T, a fully redun-dant system. The DPS 890 models include the DPS 88/891, ▷

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

MODELS: DPS 88/861, DPS 88/862, DPS 88/862T, DPS 88/891, DPS 88/892, and DPS 88/892T.
CONFIGURATION: 1 or 2 CPUs, 32 to 128 megabytes of main memory, 1 or 2 I/O pro-cessors, and 64 to 256 logical I/O channels.
COMPETITION: Amdahl 580 Series, Bur-roughs B 7900, CDC Cyber 180, IBM 3090 Series, NAS AS/9000 Series, and Sperry 1100/90 Series.
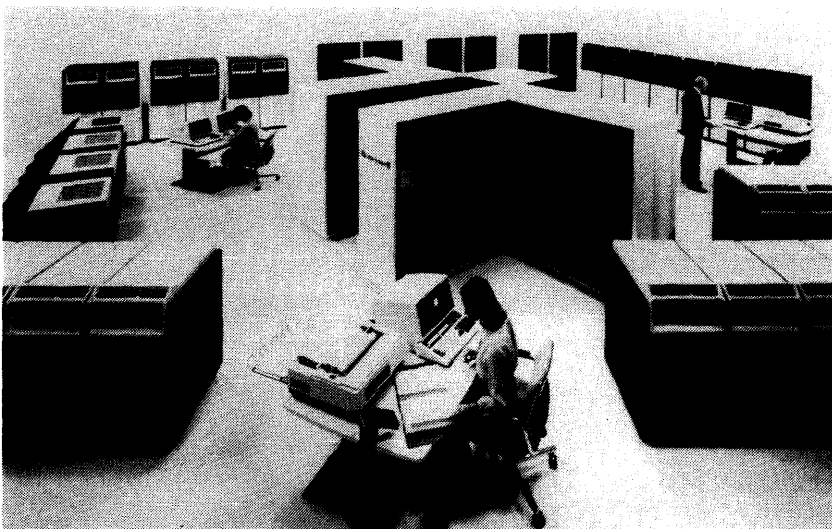PRICE: From $1,740,000 to $4,510,000.

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 88/861, DPS 88/862, DPS 88/862T, DPS 88/891 and DPS 88/892, DPS 88/892T.

DATA FORMATS

BASIC UNIT: nine-bit bytes organized functionally to pro-cess 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 88/892T shown here is a dual-processor system that can be configured with 128 megabytes of main memory and 256 logical channels. As a networking/commu-nications-oriented system operat-ing within the Honeywell Distributed Systems Environment, the DPS 88/892T can support as many as 320 satellite processors in a variety of network structures.

Honeywell DPS 88 Series

a single processor; the DPS 88/892, a dual processor; and the DPS 88/892T, a fully redundant system.

Each model comes with double the starting memory capacity of the previous models. Both single- and dual-processor models come with 32 megabytes of main memory. The two fully redundant models come with 64 megabytes of memory. Similar to the previous DPS 88 versions, memory on all the models can be increased to a maximum of 128 megabytes. Channel capacity for the series continues to range from 64 to 256 channels.

In addition to new, denser 256K-bit memory chips and related hardware, Honeywell has improved system performance through the use of new software features. Products incorporated in the GCOS Performance Enhancement Facility are said to make more efficient use of DPS 88 pipelining, a feature that makes it possible to handle multiple instructions at various execution stages in a single CPU cycle.

The Rapid Access Data System (RADS) facility improves system throughput for I/O-bound environments. It's similar in function to IBM's Expanded Storage feature, offered as an option on IBM 3090 systems. RADS improves throughput by minimizing accesses to disk storage devices and by taking advantage of faster main memory. When a business application calls for information stored on disk, instead of fetching an item at a time, RADS will pull a larger body of data from the disk and store the data in main memory. When the application calls for additional information, the system will first search the RADS area of main memory before making another trip back to the disk. Most of the information an application needs will more than likely be accessible in main memory under this arrangement. According to Honeywell estimates, the RADS feature has improved throughput efficiency by up to 60 percent. The RADS feature runs under GCOS 8 Release 2500, the newest version of Honeywell's primary operating system, first shipped in 1986.

New peripheral hardware now available for the DPS 88 includes three recently introduced Datanet 8 communications processors. These are the Datanet 8/10, which supports up to 31 data communications ports; the 8/20, which supports up to 127 ports; and the 8/30, which supports up to 255 ports.

Honeywell launched its DPS 88 Series in 1982 with the introduction of the single-processor DPS 88/81 and the dual-processor DPS 88/82. The processor line was expanded in 1984 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. With the September introduction of the DPS 88/860 and 88/890 models, these earlier models have been phased out and are no longer marketed. The promise of a four-processor model was fulfilled with the announcement of the new DPS 90 Series, a processor line based on the Nippon Electric Company (NEC) S-1000 processor. NEC is supplying the Honeywell-compatible processor line under

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 memory 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.

Honeywell DPS 88 Series

TABLE 1. SYSTEM COMPARISON

MODEL	DPS 88/861	DPS 88/862	DSP 88/862T	DPS 88/891	DPS 88/892	DPS 88/892T
SYSTEM CHARACTERISTICS						
Date announced	September 1986	September 1986	September 1986	September 1986	September 1986	September 1986
Date first delivered	Fourth Quarter 1986	Fourth Quarter 1986	Fourth Quarter 1986	Fourth Quarter 1986	Fourth Quarter 1986	Fourth Quarter 1986
Field upgradable to	DPS 88/862 or DPS 88/891	DPS 88/862T or DPS 88/892	DPS 88/892T	DPS 88/892	—	—
Relative performance	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
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	256K-bit MOS	256K-bit MOS	256K-bit MOS	256K-bit MOS	256K-bit MOS	256K-bit MOS
Minimum capacity, bytes	32MB	32MB	64MB	32MB	32MB	64MB
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

▷ the terms of a partnership agreement between the Japanese computer maker 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 making major changes to applications 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 swap out. 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 88/860 Series and the more powerful DPS 88/890 Series involve main memory and high-speed cache memory performance. The DPS 88/890 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 88/860 Series, on the other hand, uses a single 32K-byte cache for both instructions and operands. Main memory uses 256K-bit Random Access Memory (RAM) chips mounted on 4M-byte capacity MOS boards.

The DPS 88/890 Series consists of the higher performance models of the DPS 88 systems family. The DPS 88/860 Series uses the same architecture and technology as the DPS 88/890 Series but with a design approach that provides approximately two-thirds the power of the corresponding DPS 88/890 models.

The two fully redundant systems, the DPS 88/862T and DPS 88/892T, come with two of each of the central processing components that compose a typical DPS 88 Series system. These systems are especially suited for large, highly ▷

▶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 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 coupled with the Channel Bus Unit (CBU), 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 ▶

Honeywell DPS 88 Series

▷ interactive environments where downtime of even the shortest duration can be extremely costly.

Both the DPS 88/890 Series and the DPS 88/860 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 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 systems 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.

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 supports the full GCOS III file system and job control language. GCOS 8 continues to support the Network Processing Supervisor (NPS), the General Remote Terminal System (GRTS II), and the Distributed Network Supervisor (DNS), communications 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

After years of reverses and disappointments in the computer business, 1986 will go down as a year of reckoning for Honeywell Information Systems. At press time, Honeywell was in negotiations with NEC and Bull. Honeywell watchers believed the firm was trying to work out plans to consolidate its computer business by forming joint partnerships with NEC and Bull. As part of this new worldwide alliance, industry analysts believed Bull and NEC would continue to manufacture systems, while Honeywell would assume a strictly sales and marketing role. Since Honeywell ▷

▷ phase. The design increases the system performance by allowing as many as five instructions to be in process simultaneously.

The DPS 88/890 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 instructions 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 88/860 Series models, unlike the DPS 88/890 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.

DPS 88 Systems also include:

- 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 Bus Unit (CBU), handles the data trans- ▶

Honeywell DPS 88 Series

▷ remained mum on the subject at press time, proposed merger plans could not be officially confirmed.

For most industry observers, the rumored merger plans make sense. According to International Data Corporation (IDC), a market research firm, Honeywell's share of world-wide unit shipments of large- and medium-scale systems by a U.S. vendor was down to an all-time low of 4.1 percent. IDC estimates the value of its worldwide computer shipments in 1985 was less than two percent. IDC reports further that among U.S. vendors, Honeywell's share of the worldwide installed base of large- and medium-scale systems was 10.7 percent. According to *The Wall Street Journal*, Honeywell's computer operation earned $200 million in 1985 on sales of $1.9 billion, placing it well back in the pack among mainframe and computer vendors in general. Ironically, when Honeywell absorbed General Electric's computer division during the early 1970s, a new Honeywell Information Systems became the No. 2 computer company for a time behind IBM.

Now let's take a look at the bright side. A merger of Honeywell, Bull, and NEC operations would create a $7.50 billion company and make the new corporate entity the third largest computer company behind IBM and the Burroughs/Sperry alliance, at least according to *Datamation* estimates appearing in *The Wall Street Journal*. The merger of the three would complete a natural fit, since all three have been sharing technology for years and already jointly market compatible systems. A pooling of resources would help the three achieve certain economies of scale, particularly in the expensive research and development area. Honeywell currently markets the DPS 90 top-end system, a processor line based on NEC processor technology, and the DPS 7 medium-size processor line, systems manufactured by Bull.

Systems that Honeywell manufactures are the DPS 8 and DPS 88, products the vendor considers large-scale mainframe systems. With the announcement of enhanced DPS 88 mainframes in September 1986, the line has undergone a long overdue modernization. According to Honeywell, performance improvements and related hardware enhancements, such as the addition of 256K-bit memory chips, make the line competitive with the IBM 3090 in mixed work load environments involving on-line processing and batch processing. Prior to the enhancements, the DPS 88 systems were positioned to compete against the IBM 308X Series, a processor line whose days may be numbered.

In conjunction with the hardware/software enhancements, Honeywell also lowered purchase prices. An entry-level DPS 88/861 now sells for $1,740,000, compared with $1,850,000 for the DPS 88/41, the previous entry-level offering. The top-end DPS 88/892T, a dual-redundant system, sells for $4,510,000, compared with $4,800,000 for the DPS 88/82T, the previous top-end offering. One- and four-year lease rates remain unchanged from the previous models. ▷

▶ fers 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/Output Processor and issuing a channel connect command to initiate processing by the IOP. Once initiated, the IOP and the CBU 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 Bus Unit (CBU) is a sophisticated high-speed unit with data throughput rates in excess of 20 megabytes per second. The CBU can contain two channel buses (paths over which data is transmitted) for connections to the IOP. The CBU supports the connection of the I/O subsystems that comply with the Federal Information Processing Standard (FIPS). The CBU has an expansion option that doubles the 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 ▶

Honeywell DPS 88 Series

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

In a price comparison with IBM, a basic IBM 3090 Model 150 with 32 megabytes of memory sells for $1,300,000. With the addition of required hardware components, it sells for $1,664,880. In comparison, a Honeywell entry-level system, the DPS 88/861, which includes required components and features 32 megabytes of memory, sells for $1,740,000. The basic IBM 3090 Model 200 dyadic system with 64 megabytes of memory sells for $4,100,000. The addition of required hardware components brings the price up to $4,573,840. Honeywell's top-end, dual-redundant system, which includes two of each hardware component and 64 megabytes of memory sells for $4,510,000.

An obvious difference between the 3090 and DPS 88 is maximum configuration size. Honeywell users who want to migrate to a four-processor system comparable to the IBM 3090 Model 400 will have to bypass the DPS 88 line and move to the larger DPS 90 Series, which features a top-end, four-processor model. The largest system within the DPS 88 line, the DPS 88/892, and a fully redundant version of the same top-end model, feature a maximum of two central processors. DPS 8 users ready to move to a larger Honeywell system can migrate to either the DPS 88 or the DPS 90 line.

Generally, in head-to-head performance comparisons with IBM, Honeywell MIPS (millions of instructions per second) 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 maintains that its DPS 88 systems have performance levels in the interactive processing work loads that are competitive with the IBM 3090 models.

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 88/860 and DPS 88/890 Series.

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.

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.

Honeywell DPS 88 Series

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
PRU0903	900 lpm	136	10	6 or 8	4-to-19 width x 3-to-11 length
PRU1203	1200 lpm	136	10	6 or 8	4-to-19 width x 3-to-11 length
PRU1600	1600 lpm	136 or 160	10	6 or 8	4-to-22 width x 3-to-22 length

▷ 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 operating under 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 recently introduced 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 capacity was 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. Not to be outdone, IBM plug-compatible vendors, NAS and Amdahl, have even announced top-end systems that can be configured with up to 512 megabytes of main memory.

With the introduction of the MSU3380 disk unit, purchased on an OEM basis from IBM, Honeywell now offers 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. ▷

▶ • 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 more than 300 instructions and exceeds the instruction complement of the DPS 8 which is more than 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 88/862T and DPS 88/892T come with two of each central system component. ▶

Honeywell DPS 88 Series

▷ 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

Two Honeywell DPS 88 users who responded to Datapro's 1986 survey of general-purpose computer users both installed DPS 88/41 models. A Southern manufacturing firm installed the single-processor system in November 1985, while a Western insurance firm installed a similar system in December 1985. Both firms use the systems for accounting/billing, order processing/inventory, and payroll/personnel. Additionally, the insurance firm uses the system for insurance and mathematics/statistical applications. The manufacturing firm uses the system for engineering/scientific, manufacturing, and purchasing applications.

Both user systems have a memory capacity ranging between 16 and 32 megabytes and both have deployed more than 60 local terminals and more than 60 remote terminals.

In a point-by-point rating of the two systems, the manufacturing firm gave its system somewhat higher marks in most of Datapro's fourteen ratings categories than the insurance firm.

The insurance firm gave the system good marks for ease of operation and system reliability, while peripheral reliability was rated fair. The other user rated system operation as good, system reliability as excellent, and peripheral reliability as fair. In areas of manufacturer's maintenance service, technical support, manufacturer's software, and overall satisfaction, the manufacturing firm rated almost everything as good. A major exception was Honeywell applications software, which the firm rated as fair. The data processing manager for the firm said Honeywell does not supply enough packaged software particularly in the accounting area. On the hardware side of the coin, this same user said he was pleased with Honeywell's remote maintenance and troubleshooting capabilities delivered via a phone hookup.

The insurance firm, on the other hand, seemed more critical of Honeywell's technical support. Troubleshooting, education, and documentation were all given a fair rating. Honeywell applications software was also rated fair. Both ▷

▶ 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 eight feet above the floor. Power requirements must meet these specifications: 208, 240, 440, or 480 VAC ±10 percent for the motor-generator set; 60 Hz nominal frequency ±0.5 Hz; three-phase 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 88/861, DPS 88/862, DPS 88/862T, DPS 88/891, DPS 88/892, and the DPS 88/892T. The DPS 88/861 central system includes a Central Processing Unit (CPU); a System Support Unit (SSU); a Central Interface Unit (CIU); a Main Memory Unit (MMU) with 32 megabytes of memory; an Input/Output Processor (IOP) with 64 logical channels; a Channel Bus 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 88/862 central processing system includes two CPUs; two SSUs; two TEPs; one CIU; one MMU with 32 megabytes of memory; one IOP with 64 logical channels; one CBU; one SSF; one system console and table with pod; one maintenance console and table; and optional TEA.

The basic DPS 88/891 central system includes a CPU, a CIU, a MMU with 32 megabytes of main memory, an IOP with 64 logical channels, a 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 88/892 includes two CPUs; two SSUs; two TEPs; one CIU; one MMU with 32 megabytes of memory; one IOP with 64 logical channels; one CBU; one SSF; one system console and table with pod; and one maintenance console and table; and optional TEA.

The DPS 88/862T and the DPS 88/892T are fully redundant system containing two of each central system component. These systems also include a minimum 64 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 64 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 CBU can be expanded to twice its basic channel capacity. Up to two CBUs can be attached to each IOP. Up to six system consoles can be configured with each SSF and 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. ▶

Honeywell DPS 88 Series

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

users said their systems did what they expected them to do and both said they would recommend their systems to other users. □

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 CBU and the IOP. FNPs connect to the CBU 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 CBU with the IOP for access from peripheral subsystems. Each CBU can transfer data at a rate of up to 24 million bytes per second.

MASS STORAGE

Please refer to Table 2 for information about mass storage devices.

INPUT/OUTPUT UNITS

Please refer to Table 3 for information about magnetic tape and printer products.

TERMINALS

Please refer to Table 4 for information about terminals.

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 Bus Unit (CBU) 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

The DATANET 8 Series of network processors are designed for use in data communications networks conforming to Honeywell's Distributed Systems Architecture (DSA), and operate under the control of the Distributed Network Supervisor (DNS) software executive. These processors manage data communications traffic for Honeywell DPS 8, DPS 88, or DPS 90 large systems operating under GCOS 8 or GCOS, or DPS 7 and DPS 7E medium systems operating under GCOS 7.

Features common to all network processors in the DATANET 8 Series include:

• Capability to interconnect systems using private networks that use High-Level Data Link Control data communications links

• Capability to connect to PDNs, VANs, and to most types of standard digital or analog, leased or switched data communications lines

• Capability to attach terminal devices

• System Control Facility for remote maintenance

• Console access for network management functions

• Integrated 5¼-inch diskette drive for executive software maintenance functions

In addition, all DATANET 8 Series processors require a visual display console.

Physical connections between DATANET 8 Series network processors and central systems are made through network processor channel options which include Peripheral Subsys-

Honeywell DPS 88 Series

▶ tem Interface (PSI) or Direct Interface Adapter (DIA) channels. The options are determined by the central system. The network processor provides support for one to four connections to large systems, or two connections to medium systems.

The DATANET 8 processor series includes the *DATANET 8/10, 8/20,* and *8/30.* All three network processors are expandable from a basic to maximum configuration and use the same executive software, Distributed Network Supervisor.

DATANET 8/10 is a single processor system which provides support for a maximum of 31 data communications lines. The basic system includes one megabyte of central memory expandable to a maximum of two megabytes. A 5¼-inch diskette drive for executive software support is also included with the basic system. A second 5¼-inch diskette drive is optionally available. A console visual display terminal is required with each DATANET 8/10. In addition, a hardcopy printer may be required.

Three RS-232-C asynchronous data communications ports are included with each 8/10. Data communications interface adaptors and line interface module options make it possible to expand data communications ports to a maximum of 31 lines. These options accommodate line characteristics such as data transmission speed, asynchronous/synchronous operation, and physical interfaces such as RS-232-C.

DATANET 8/20 is a single processor system with cache memory and one megabyte of central memory. To increase 8/20 performance, users may add a second processor and its associated cache memory. Central memory may be expanded to two megabytes by adding a one megabyte memory option. A basic system also includes a 5¼-inch diskette drive for executive software support. A second 5¼-inch diskette drive is optionally available. A console visual display terminal is required with each 8/20, and a hardcopy console printer may be required. Three RS-232-C asynchronous data communications ports are included with each DATANET 8/20. The basic system provides support for up to 31 data communications ports, expandable to 127 ports with power and line expansion module options. Expansion of individual data communications ports is accomplished by ordering various communications interface adaptors and line interface module options. These options accommodate line characteristics such as data transmission speed, asynchronous/synchronous operation, and physical interfaces such as RS-232-C.

DATANET 8/30 is a single-processor system with cache memory and two megabytes of central memory. To increase 8/30 performance, users may add a second processor and its associated cache memory. Central memory may be expanded to four megabytes by adding a two-megabyte memory option. A 5¼-inch diskette drive is included for executive software support, while a second 5¼-inch diskette drive is optionally available. A console visual display terminal is required with each 8/30 and a console hardcopy printer may be required. Three RS-232-C asynchronous data communications ports are included with each 8/30. The basic system provides support for 159 data communications ports expandable to 255 ports with a line expansion module option. Data communications interface adaptors and line interface module options make it possible to expand individual data communications ports. These options specify line characteristics such as maximum speed, asynchronous/synchronous operation and physical interfaces such as RS-232-C.

DATANET 8/10, 8/20, and 8/30 processors are fully upward compatible with each other and prior DATANET 8 DSA product offerings. These network processors can coexist with pre-DSA products making it possible for a user to migrate to a DSA network environment and retain pre-DSA network products.

Line options common to all three DATANET models include:

- Multiline Communications Controller-16 (DCF8052). It accommodates up to four Communications Interface Adaptors.

- RS-232-C Asynchronous/Character Synchronous Integrated Communications Interface Adaptor (DCF8073). The adaptor has four RS-232-C communications ports, includes four 50-foot cables (DCE to DTE) for device attachment, and has a maximum data transfer rate per port to 19.2K bps.

- RS-232-C Bit Synchronous HDLC Integrated Communications Interface Adaptor (DCF8049) The adaptor has two RS-232-C communications ports, includes two 50-foot cables (DCE to DTE) for device attachment, and has a maximum data transfer rate per port to 19.2K bps.

- Low/Medium Speed Asynchronous/Character Synchronous Communications Interface Adaptor (DCF8053). This adaptor is a nonintegrated adaptor which requires a minimum of one line interface module. It will accommodate up to four line interface modules. Maximum data transmission rate per line interface module is 19.2K bps.

The following line interface modules are allowed with DCF8053:

- RS232-C/V.24 Asynchronous/Character Synchronous Line Interface Module (DCF8055). This module has one RS-232-C/V.24 data communications port, includes one 50-foot cable (DCE to DTE) for device attachment, and has a maximum data transmission speed to 19.2K bps.

- MIL-188-C Asynchronous/Character Synchronous Line Interface Module (DCF8059). This module has one MIL-188-C data communications port, includes one 50-foot cable (DCE to DTE) for device attachment, and has a maximum transmission speed to 19.2K bps.

- Medium/High Speed Character Synchronous/Bit Synchronous Communications Interface Adaptor (DCF8061). This option is a nonintegrated adaptor capable of supporting one medium speed (to 19.2K bps) or one high speed (to 64K bps) data communications line via one of the following Line Interface Modules.

The following Line Interface Modules are allowed with DCF8061:

- RS-232-C/V.24 Bit Synchronous HDLC Line Interface Module (DCF8062). This module has one RS-232-C/V.24 data communications port, includes one 50-foot cable (DCE to DTE) for device attachment, and has a maximum data transmission rate to 19.2K bps.

- X.21 Bit Synchronous HDLC Line Interface Module (DCF8064). This module has one X.21 data communications port, includes one 50-foot cable (DCE to DTE) for device attachment, and has a maximum data transmission rate to 64K bps.

MIL-188-C Bit Synchronous HDLC/Character Synchronous Line Interface Module (DCF8067). This module has one X.21 data communications port, includes one 50-foot cable (DCE to DTE) for device attachment, and has a maximum data transmission rate to 64K bps.

- V.35 Bit Synchronous HDLC/Character Synchronous Line Interface Module (DCF8069). This module has one ▶

Honeywell DPS 88 Series

➤ V.35 data communications port, includes one 50-foot cable (DCE to DTE) for device attachment, and has a maximum data transmission rate to 64K bps.

• Bell 301/303 Bit Synchronous/Character Synchronous Line Interface Module (DCF8071). This module has one Bell 301/303 data communications port, includes one 50-foot cable (DCE to DTE) for device attachment, and has a maximum data transmission rate to 64K bps.

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.

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 256 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 256 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, RPG II,* and *C.*

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. ▶

Honeywell DPS 88 Series

▶ 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 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 (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.

Honeywell DPS 88 Series

▶ 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 number 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. Certain peripheral equipment is available under one-year, three-year, and five-year leases. Basic monthly rentals entitle users 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. DPS 88 systems come with a 12-month warrenty on all central system components.

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. ▶

Honeywell DPS 88 Series

	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.

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

SMALL CONFIGURATION:

Honeywell single processor DPS 88/861 features 32 megabytes of main 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 Buffer Unit with 33 function slots, one System Support Facility, one system console, and one maintenance console.	$1,740,000
VIP7815 60 Display Units	185,700
DCU8110 One 8/10 Datanet Network Processor; up to 31 ports	23,900
DCF8002 One VDT Communications Console	795
DCE8109 One DPS 88 Network Processor Channel Connection	8,000
MGS8801 One Motor-Generator and Control	38,000
MGF8801 One Power Sequencer	4,000
MSP3880 One Mass Storage Processor	74,270
MSU3380 Two Mass Storage Unit/Controllers	177,600
MSU3382 Six Mass Storage Slave Units	386,700
MTS8205 One Magnetic Tape Subsystem; includes MTU8205	55,350

MTF8200 One 1 x 8 Switch for magnetic tape subsystem	No charge
MTU8208 Seven Magnetic Tape Units; 200 ips, 1600/6250 bpi	154,700
PRU1600 Two 1600-lpm Belt Printers	129,880
URP8402 One Embedded Unit Record Processor	4,000
TOTAL PURCHASE PRICE:	**$2,974,895**

MEDIUM CONFIGURATION:

Honeywell single processor DPS 88/891 features 32 megabytes of main memory, plus 32 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.	$3,165,000
MGS8801 One Motor-Generator and Control	38,000
MGF8801 One Power Sequencer	4,000
VIP7815 60 Display Units	185,700
DCU8110 One Datanet 8/10 Network Processor; up to 31 ports	23,900
DCF8002 One VDT Communications Console	795
DCE8109 One DPS 88 Network Processor Channel Connection	8,000
MSP3880 Two Mass Storage Processors	148,540
MSU3380 Four Mass 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 8 Switch	6,130
MTU8208 Fourteen Magnetic Tape Units; 200 ips, 1600/6250 bpi	309,400
PRU1600 Two 1600-lpm Belt Printers	129,880
URP8402 Embedded Unit Record Processors	4,000
TOTAL PURCHASE PRICE:	**$6,072,015**

LARGE CONFIGURATION:

Honeywell dual redundant DPS 88/892T featuring 64 megabytes of main memory, plus 64 megabytes of additional memory, two System Support Units, two Thermal Exchange Pumps, two Central Interface Units, two Main Memory Units, two Input/Output Processors with 128 logical channels, two Channel Buffer Units with 66	$5,490,000

Honeywell DPS 88 Series

➤ function slots, two System
Support Facilities, two
system consoles, and two
maintenance consoles

MGS8801 One Motor- Generator and Control	38,000	
MGF8801 One Power Sequencer	4,000	
VIP7815 90 Display Units	278,550	
DCU8130 one 8/30 Datanet Network Processor; 159 ports	80,000	
DCF8002 VDT Communications Console	795	
DCE8109 DPS 88 Network Processor Channel Connection	8,000	
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; includes MTU8205	110,700
MTF8201 2 x 8 Switch	6,130
MTU8208 Fourteen Magnetic Tape Units; 200 ips, 1600/6250 bpi	309,400
PRU1600 Two 1600-lpm Belt Printers	129,880
URP8402 Embedded Unit Record Processor	4,000
TOTAL PURCHASE PRICE:	**$7,736,595**

EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	4-Year Lease ($)	SPSS ($)
PROCESSORS						
CPS8867	DPS 88/861 Central Processor System with 32MB Memory	1,740,000	3,600	82,400	64,750	1,221
CPS8868	DPS 88/862 Central Processor System with 32MB Memory	2,775,000	4,320	131,400	103,250	1,738
CPS8869	DPS 88/862T Fully Redundant Processing System with 64MB Memory	3,475,000	5,760	164,800	129,500	1,738
CPS8891	DPS 88/891 Central Processor System with 32MB Memory	2,675,000	5,355	116,500	91,200	1,419
CPS8892	DPS 88/892 Central Processor System with 32MB Memory	3,810,000	6,345	179,500	141,100	2,057
CPS8893	DPS 88/892T Fully Redundant Central Processing System with 64MB Memory	4,510,000	7,785	218,400	172,800	2,057
SYSTEM UPGRADES						
CPK8841	CPS8867 (DPS 88/861) to CPS8868 (DPS 88/862)	1,035,000	720	49,000	38,500	470
CPK8842	CPS8868 (DPS 88/862) to CPS8892 (DPS 88/892) or CPS8869 (DPS 88/862T) to CPS8893 (DPS 88/892T)	1,035,000	2,025	48,100	37,850	290
CPK8843	CPS8867 (DPS 88/861) to CPS8891 (DPS 88/891)	935,000	1,755	34,100	26,450	180
CPK8884	CPS8891 (DPS 88/891) to CPS8892 (DPS 88/892)	1,135,000	990	63,000	49,900	580
PROCESSOR OPTIONS						
MXC8800	Additional CIU and MMU for CPS8868 and CPS8892; no memory included	282,000	450	12,000	10,000	—
CMM8816	Additional 16MB Memory Module	245,000	585	13,900	11,100	—
MXU8801	Additional IOP with 64 Logical Channels and CBU; for CPS8868 and CPS8892	250,000	450	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	188,000	135	5,400	4,300	—
MXF8811	CBU Expansion	94,000	86	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	135	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; 100 cps	1,225	50	121	103	—
CSF8802	Printer for Maintenance Console; 100 cps	1,225	33	105	90	—
CSF8805	23" Large Screen Monitor	2,358	16	157	135	—
CSF8806	Ceiling Mount for CSF8805	195	—	—	—	—
CSF8301	Printer Pedestal for CSF8801/8802	395	NC	NA	NA	—
	Power and Cooling:					
MGS8801	Motor Generator and Control; 3 sec. ridethrough, 62.5 kVA, 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	—

NC—No charge.
NA—Not available.

Honeywell DPS 88 Series

PROCESSOR OPTIONS (Continued)

Peripheral and Network Processors Attachment Features:

		Pur-chase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	4-Year Lease ($)	SPSS ($)
MXF8020	General Purpose Adapter for disk	18,500	15	850	700	—
MXF8021	General Purpose Adapter for 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 Datanet 8, page printing system, DPS 88 SSF, or document handler processor channel connection feature; 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	6,000	—	—	—	—

NC—No charge.
NA—Not available.

		Pur-chase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	4-Year Lease ($)
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, unformatted; requires MSF007	18,500	122	1,140	*950
MSF0006	Dual Access Feature for MSU0451	2,070	14	89	*76
MSF0007	Rotational Position Sensing Option for MSU0451	500	14	87	*76
MSU0500	Dual Fixed Disk Mass Storage Unit, 612 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 MSU0501/0500	4,140	23	163	*136
MSA1140	Unit Addressing for up to four MSU04xx Units for MSP0611/0612	3,500	16	156	*130
MSA1141	Unit Addressing for up to two MSU05xx Units for MSP0611/0612	3,500	16	219	*180
MSA1142	Dual Addressing for up to four MSU04xx Units	4,500	18	146	*122
MSA1143	Dual Addressing for up to two 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	Single channel device adapter for MSU04xx devices on MSP0611/0612	3,500	—	109	*89
MSF1141	Device Adapter for configuring MSU04xx devices (max 16) to MSP0612	6,000	—	187	*152
MSF1142	Unit expansion for configuring additional MSU05xx devices (max 7) to MSP0612	4,000	—	125	*105
MSF1143	Nonsimultaneous (Switched) Datanet Channel for MSP0611/0612	8,237	15	283	*233
MSF1144	Nonsimultaneous (Switched) IOM Channel for MSP0611/0612	8,237	15	283	*233
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 8 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.

Honeywell DPS 88 Series

		Pur-chase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	4-Year Lease ($)
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, requires speed/density feature	21,000	175	801	*677
MTU0630	Magnetic Tape Unit	14,815	130	593	*505
Features for the MTU0610:					
MTF0607	800/1600 bpi, 200 ips feature	6,090	75	300	*260
MTF0608	1600/6250 bpi, 200 ips 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, PE/NRZI feature	4,725	140	286	*257
MTF0635	75 ips, PE/GCR feature	7,110	120	342	*300
MTF0636	125 ips, PE/NRZI feature	9,805	158	460	*398
MTF0637	125 ips, PE/GCR feature	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 belt printer; 900 lpm	34,975	421	2,065	*1,720
PRU1203	High-speed belt printer; 1200 lpm	38,275	468	2,340	*1,920
PRU1600	High-speed Belt Printer; 1600 lpm, 136 print positions	64,940	538	2,910	*2,472
PRU0903/1203 Options:					
PRB3213	64-character Uppercase ASCII Print Belt, optimized	NC	NC	NC	NC
PRB3300	96-character Upper/Lowercase ASCII Print Belt, optimized	NC	NC	NC	NC
PRB3500	64-character Series 400/600/6000/L66 Print Belt	NC	NC	NC	NC
PRB3501	64-character Standard IBM Print Belt	NC	NC	NC	NC
PRB3513	64 character Uppercase ASCII Print Belt	NC	NC	NC	NC
PRB3524	64-chacacter OCR-A Numeric Print Belt	NC	NC	NC	NC
PRB3549	64-character OCR-A Alphanumeric Print Belt	NC	NC	NC	NC
PRB3600	96-character Upper/Lowercase ASCII Print Belt	NC	NC	NC	NC
PRB3703	64-character Series 200/2000 Print Belt	NC	NC	NC	NC
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	NC	NC	NC
PRU1600 Options:					
PRB0500	63-character OCR-B Print Belt	2,460	90	179	*164
PRB0524	63 character OCR A/B Print Belt	2,460	90	179	*164
PRB0532	63-character Puerto Rico Print Belt	2,460	94	179	*164
PRB0549	63-character OCR-A Alphanumeric Print Belt	2,460	90	179	*164
PRB0600	94-character 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	129	694	*578
Unit Record Equipment and Features:					
URP8400	Embedded Unit Record Processor for CBU systems; supports up to 2 CRU0501 card units	4,000	3	128	118
URP8401	Embedded Unit Record Processor for CBU systems; supports up to 2 PRU0903/1203 printers	4,000	3	128	118
URP8402	Embedded Unit Record Processor for CBU systems; supports up to 2 PRU1200/1600 printers	4,000	3	128	118
URP0600	Freestanding Unit Record Processor; supports up to 4 devices	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
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

		Pur-chase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	3-Year Lease ($)
TERMINALS					
VIP7201	Asynchronous, Multipurpose Keyboard Display Terminal	795	20	—	—
VIP7202	Asynchronous, Multipurpose Keyboard Display Terminal with 25-foot RS-422-A cable and pin adapter	830	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	—	—
VIP7305	Multifunctional Keyboard Display Terminal with RS-422-A interface and 25-foot cable; includes optional RS-232-C interface	1,900	NA	—	—
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	—	—
VIP7311	Standard Keyboard Display Terminal with 20-mA current loop interface and 50-foot cable	1,900	20	—	—
VIP7313	Word Processing Keyboard Display Terminal with 20-mA current loop interface and 50-foot cable	1,900	20	—	—
VIP7315	Multifunctional Keyboard Display Terminal with current loop interface and 50-foot cable	1,900	16	—	—
VIP7317	Data Entry Keyboard Display Terminal with 20-mA current loop interface and 50-foot cable	1,900	20	—	—
VIP7381	Standard Keyboard Display Terminal with RS-422-A cable and pin adapter	1,900	20	—	—
VIP7383	Word Processing Display Terminal with RS-422-A cable and pin adapter	1,900	20	—	—
VIP7385	Multifunctional Display Terminal with RS-422-A cable and pin adapter	1,900	16	—	—
VIP7387	Data Entry Display Terminal with RS-422-A cable and pin adapter	1,900	20	—	—
VIP7813	Asynchronous 12-inch Keyboard Display Terminal with low profile multifunctional keyboard; includes 72-line scroll feature, buffered printer adapter and 25-foot RS-232-C cable	2,350	25	—	—
VIP7814	Synchronous/Asynchronous Keyboard Display Terminal with 12-inch diagonal CRT, 1920-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	—
VIP7816	Synchronous/Asynchronous Multiple Mode Terminal with 12-inch CRT, green phosphor, high profile keyboard, 25-foot RS-232-C cable; includes VIP7800 and VIP7700 modes	2,800	25	121	—
VIP7817	Synchronous/Asynchronous Multiple Mode Terminal with 15-inch CRT, green phosphor, high-profile keyboard, 25-foot RS-232-C cable; includes VIP7800 and VIP7700 modes	3,350	30	145	—
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	—	—
VIP7824	Synchronous/Asynchronous, low profile multifunctional keyboard, 12-inch diagonal CRT, 1920-character display positions, RS-232-C and RS-422-A interface and 25-foot cable	2,700	25	123	—
VIP7825	Synchronous/Asynchronous, low-profile, multifunctional keyboard, 15-inch CRT, phosphor green, 72-line scroll and buffered printer adapters, RS-232-C and RS-422-A interface, and 25-foot cable	3,095	30	138	—
VIP7826	Synchronous/Asynchronous Multiple Mode Terminal with 12-inch CRT, green phosphor, low profile multifunctional keyboard, RS-232-C and RS-422-A interface, and 25-foot RS-422-A cable; includes VIP7800 and VIP7700 modes	2,800	25	121	—
VIP7827	Synchronous/Asynchronous Multiple Mode Terminal with 15-inch CRT, green phosphor, low-profile multifunctional keyboard, 25-foot RS-422-A cable; includes VIP7800 and VIP7700 modes	3,350	30	145	—

		Pur-chase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	5-Year Lease ($)
DATANET 8 SERIES NETWORK PROCESSORS AND OPTIONS					
DCU8110	DATANET 8/10 Network Processor system with 1MB of memory expandable to 2MB; supports a maximum of 31 data communications ports and includes 3 RS-232-C/V.24 asynchronous/character synchronous ports	23,900	130	1,195	795
DCU8120	DATANET 8/20 Network Processor system with cache memory, 1MB of memory expandable to 2MB. System is upgradable to dual-processor system with dual-cache memory; supports 31 data communications ports extendable to 127 ports, and includes 3 RS-232-C/V.24 asynchronous/char. synchronous ports	38,000	215	1,900	1,275
DCU8130	DATANET 8/30 Network Processor system with cache memory and 2MB of memory expandable to 4MB. System is upgradable to dual-processor system with dual- cache memory; supports 159 data comm. ports expandable to 255 ports, and includes 3 RS-232-C/V.24 asynchronous/char. synchronous ports	80,000	350	4,000	2,675

NC—No charge.
NA—Not available.

Honeywell DPS 88 Series

DATANET OPTIONS		Pur-chase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	5-Year Lease ($)
	OPTIONS FOR THE DATANET 8/10 ONLY:				
DCM8110	One-megabyte Memory Expansion Module	7,000	50	350	230
DCE8105	Multiple Network Processor Channel Connection Adapter for DATANET 8/10 and medium systems only; required for DATANET 8/10 to support multiple Network Processor Channel Connections (NPCC)to DPS 7 or DPS 7/E Systems (max. 2). A second NPCC connection, DCE8103 or DCE8104 must be ordered with this adapter.	25	NA	2	1
	OPTIONS FOR DATANET 8/20 ONLY:				
DCP8120	Extended Performance Option; includes second processor and associated cache memory	14,000	115	700	475
DCM8120	One-megabyte Memory Expansion Module	7,000	50	350	235
DCE8121	First Line Expansion Module; provides support for up to 32 additional data com-munications ports (max. 63 ports per DATANET 8/20)	2,500	5	125	85
DCE8122	Second Line Expansion Module; provides support for up to 64 additional data communications ports (max. 127 ports per DATANET 8/20); requires DCM8120 and DCE8121	5,000	10	250	170
	OPTIONS FOR DATANET 8/30 ONLY:				
DCP8130	Extended Performance Option; includes second processor and associated cache memory	27,000	220	1,350	900
DCM8130	Two-megabyte Memory Expansion Module	14,000	100	700	470
DCE8131	Line Expansion Module; provides support for up to 96 additional data communica-tions ports (max. 255 ports per DATANET 8/30); requires DCM8130	7,500	15	375	250
	OPTIONS FOR DATANET 8/10, 8/20, AND 8/30:				
DCF8002	Visual Display Terminal Console, 24-by-80 character screen; one required for each DATANET 8/10, 8/20, or 8/30	795	20	40	30
DCF8003	Hard Copy Console Receive Only Printer (100 cps); one required for each system that uses DATANET 8, 8/10, 8/20, or 8/30 Network Processors	1,195	22	60	40
DCF8004	Console Table for Console Components	750	NA	40	25
DCF8005	Second 5¼-inch Diskette Drive	800	16	40	25
DCE8103	Network Processor Channel Connection to DPS 7 Systems	8,000	65	339	288
DCE8104	Network Processor Channel Connection to DPS 7/E System	8,000	65	339	288
DCE8107	Network Processor Channel Connection to Level 66 DPS System	8,000	65	339	288
DCE8106	Network Processor Channel Connection to DPS 8 with Input/Output Multiplexer	8,000	65	339	288
DCE8109	Network Processor Channel Connection to DPS 88 System with Channel Adapter Unit	8,000	65	339	288
DCE8111	Network Processor Channel Connection to DPS 90 System with Input/Output Processor	8,000	65	339	288
DCF8052	Multiline Communications Controller-16 (MLC-16) accommodates up to four Com-munications Interface Adapters; maximum of 16 data communications ports per MLC-16	2,700	15	135	90
	LOW- AND MEDIUM-SPEED OPTIONS:				
DCF8073	RS-232-C Asynchronous/Character Synchronous Integrated Communications In-terface Adapter with four RS-232-C data communications ports; includes four 50-ft. cables. Maximum port speed is 19.2K bps.	2,000	16	100	70
DCF8049	RS-232-C Bit Synchronous HDLC Integrated Communications Interface Adapter with two RS-232-C data communications ports; includes two 50-ft. cables. Max-imum port speed is 19.2K bps.	3,200	26	160	110
DCF8053	Low- and Medium-Speed Asynchronous/Character Synchronous Communications Interface Adapter; accommodates up to four Line Interface Module Connections; any combination of DCF8055 and DCF8059 is allowed	1,000	7	50	35
DCF8055	RS-232-C/V.24 Asynchronous/Character Synchronous Line Interface Module with one RS-232-C/V.24 data communications port; includes one 50-ft. cable. Maxi-mum port speed is 19.2K bps	275	3	15	10
DCF8059	Mil-188-C Asynchronous/Character Synchronous Line Interface Module with one Mil-188-C data communications port; includes one 50-ft. cable. Maximum port speed is 19.2K bps	275	3	15	10
	MEDIUM- AND HIGH-SPEED OPTIONS:				
DCF8061	Medium- and High-Speed Character Synchronous or Bit Synchronous Communica-tions Interface Adapter accommodates one Line Interface Module Connection (DCF8062, DCF8064, DCF8067, DCF8069, or DCF8071)	2,200	16	110	75

NC—No charge.
NA—Not available.

Honeywell DPS 88 Series

	DATANET OPTIONS (Continued)	Pur-chase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	5-Year Lease ($)
	MEDIUM-SPEED OPTIONS FOR DCF8061				
DCF8062	RS-232-C/V.24 Bit Synchronous (HDLC) Line Interface Module with one RS-232-C/V.24 data communications port; includes one 50-ft. cable. Maximum port speed is 19.2K bps.	275	3	15	10
	HIGH-SPEED OPTIONS FOR DCF8061				
DCF8064	X.21 Bit Synchronous (HDLC) Line Interface Module with one X.21 data communications port; includes one 50-ft. cable. Maximum port speed is 64K bps	450	3	25	15
DCF8067	Mil-188-C Bit Synchronous (HDLC)/Character Synchronous Line Interface Module with one Mil-188-C data communications port; includes one 50-ft. cable; Maximum port speed is 64K bps.	450	3	25	15
DCF8069	V.35 Bit Synchronous (HDLC) Character Synchronous Line Interface Module with one V.35 data communications port; includes one 50-ft. cable; Maximum port speed is 64K bps.	450	3	25	15
DCF8071	Bell 301/303 Bit Synchronous (HDLC)/Character Synchronous Line Interface Module with one Bell 301/303 data communications port; includes one 50-ft. cable; Maximum port speed is 64K bps.	450	3	25	15
	OTHER OPTIONS FOR DATANET 8, 8/10, 8/20, AND 8/30:				
DCF8024	Direct Connect Capability for one Asynchronous or Character Synchronous Line with RS-232-C Physical Interface	350	2	14	12
DCF8026	Universal Modem Bypass; character synchronous to 19.2K bps. RS-232-C physical interface	415	2	16	13

NC—No charge.
NA—Not available.

SOFTWARE PRICES

		Monthly License Fee ($)	Expanded Support Charge ($)	Initial License Fee ($)	Annual Basic Support ($)
GCOS 8 SYSTEM					
	Operating System Executives:				
SVS8028	GCOS 8 Operating System Executive	1,000	(1)	—	—
SVS8028M	License Origination Fee for SVS8028; $3,000	—	—	—	—
SVS8030	GCOS 8 Basic System	NSC	(1)	—	—
	Operating System Extensions:				
SVE8040	Console Journal	154	11	—	—
SVJ8000	Parametric JCL	40	6	—	—
SVP8000	System Maintenance	96	48	—	—
SVP8001	Software Management	87	14	—	—
SVP8002	System Performance Analysis	309	28	—	—
SVS8014	Six Processor Spt	68	13	—	—
SVP8082	Composition System Maintenance Facility:; DPS 88 and DPS 90	800	180	—	—
	Operating Systems Utilities:				
SNU0471	PPS Utilities	29	5	—	—
SNU0472	PPS Off-line	NSC	—	—	—
SNU0473	PSS On-line	NSC	—	—	—
SVU8000	System Utilities	57	6	—	—
SVU8001	File Generation Facility	55	5	—	—
SVU8002	Sort/Merge Facility	118	19	—	—
SVU8012	File Management System Utility	348	50	—	—
SVU8018	VIDEO	25	5	—	—
SVU8025	Comp System Utility Facility	185	30	—	—
SVU8026	UTL8	175	25	—	—

(1) Charge varies relative to hardware central power.
NA—Not available.
NSC—No separate charge.
NC—No charge.

Honeywell DPS 88 Series

GCOS 8 SYSTEM (Continued)

		Monthly License Fee ($)	Expanded Support Charge ($)	Initial License Fee ($)	Annual Basic Support ($)
	System Administration:				
SVD8006	DD/DS Basic Facility	309	39	—	—
SVD8007	DD/DS On-line	138	17	—	—
SVP8012	PARS	319	33	—	—
SVU8016	Mass Store I/O Analyzer	—	—	2,500	100
SVU8017	CAPSUL	296	33	—	—
SVU8022	FACTS	—	—	14,500	2,175
SVU8023	SARA	—	—	14,800	2,720
SVU8024	TRS	—	—	6,950	1,045
	Time Sharing Facilities:				
SVE8008	TSS File Management	124	12	—	—
SVE8009	TSS Adv. Application Support	184	36	—	—
SVE8010	TSS Media Input	61	12	—	—
SVE8013	TEX	358	71	—	—
SVE8014	TSS Editing	111	24	—	—
SVE8015	TSS Document Format	56	12	—	—
SVE8016	TSS Electronic Mail	187	36	—	—
SVE8017	TSS Sort Intrfc	78	12	—	—
SVE8018	TSS DM-IV	90	15	—	—
SVE8019	TSS Administration	130	18	—	—
SVE8020	Multicopy TSS Support	613	121	—	—
SVS8005	TSS Facility	92	24	—	—
	Languages and Compilers:				
SEL6012	LISP	—	—	3,825	—
SEL6013	PASCAL	—	—	5,739	—
SEL6014	Compiler B	—	—	8,609	—
SVD8004	TSS Databasic	156	24	—	—
SVE8011	TSS Cobal-74	61	12	—	—
SVE8012	TSS Fortran-66	56	12	—	—
SVE8022	TSS Fortran-77	61	12	—	—
SVL8000	Cobol-74 C & R Facility	290	29	—	—
SVL8001	Fortran-66 Compiler	390	55	—	—
SVL8002	PL/1 C & R Facility	314	55	—	—
SVL8003	RPG-II Facility	149	5	—	—
SVL8007	TSS Basic	222	40	—	—
SVL8008	Cobol-68 Compiler	337	43	—	—
SVL8010	Fortran-77 C & R Facility	235	17	—	—
SVL8011	Fortran-77 Hex Exp.	NSC	—	—	—
SVL8012	Fortran-66 Compatibility	NSC	—	—	—
SVL8013	Cobol-74 RQ	99	11	—	—
SVL8015	C Programming Language	340	—	8,000	800
SVL8016	Fortran-77 ESV C & R	465	35	—	—
SVR8000	Cobol-74 Rntm Facility	95	10	—	—
SVR8002	PL/1 Rntm Facility	86	12	—	—
SVR8004	Fortran-77 Rntm Facility	71	5	—	—
SVR8005	Fortran-77 ESV Rntm	140	15	—	—
	Data Management Facilities:				
SVD8000	DM-IV Standard Facility	1,145	201	—	—
SVD8001	DM-IV Fortran Sub Tr.	132	11	—	—
SVD8002	I-D-S/I Facility	1,166	119	—	—
SVD8003	Index Sequential Processing Facility	31	7	—	—
SVD8011	Multicopy DM-IV/TP Conc.	330	33	—	—
	End-User Facilities:				
AFF0001	Management Support Center; annual license fee, $72,500	—	—	150,000	15,000
SNM7800	PC7800 Emulator	—	—	295	—
SNM7803	PC7800 for Macintosh	—	—	295	—
SVD8005	I-D-S/I DQ	187	36	—	—
SVE8023	Forum 8	180	33	—	—
SVE8041	EDIT 8	275	—	7,000	840
SVH8000	PCF	190	32	—	—
SVH8001	EQ	385	44	—	—
SVH8002	IQ	297	33	—	—
SVH8003	Credo	231	28	—	—
SVH8004	Texto	—	—	35,000	3,500

(1) Charge varies relative to hardware central power.
NA—Not available.
NSC—No separate charge.
NC—No charge.

Honeywell DPS 88 Series

GCOS 8 SYSTEM (Continued)

		Monthly License Fee ($)	Expanded Support Charge ($)	Initial License Fee ($)	Annual Basic Support ($)
SVH8005	Texto Logotel	—	—	13,200	1,320
SVP8003	DM-IV QRP	413	65	—	—
SVP8004	DM-IV PLP	289	50	—	—
SVP8006	MDQS/II	673	129	—	—
SVP8007	MDQS/IV	1,164	233	—	—
SVP8020	Syntax-Directed Edit	225	25	—	—
SVU8020	Grafmaster	—	1,650	11,000	—
SVU8027	Solution Center Menu	200	24	—	—
	Programmer Productivity Facilities:				
SVH8006	Magna 8	—	—	120,000	14,400
SVP8008	Debug Support System	116	22	—	—
SVP8009	Cobol-74 Debug Support	205	30	—	—
SVP8010	Fortran-77 Debug Support	250	11	—	—
SVP8014	Softool Cobol	1,400	—	33,500	8,375
SVP8015	Softool CCC	1,500	—	30,000	7,500
SVP8016	Complete Softool	2,500	—	60,000	15,000
SVP8018	System-80 Cobol	780	—	18,400	1,840
SVP8021	Auditec	—	—	18,000	2,700
SVP8022	System-80 DM-IV Optional	500	—	12,000	1,800
SVP8023	System-80 Cobol with DM-IV Optional	1,280	—	30,400	3,640
SVU8019	Business-Graf	—	2,700	19,000	—
SVU8021	Scientific/Engineer	—	1,575	10,500	—
SVU8050	UW Tools	500	—	10,500	1,050
	Transaction Processing:				
SVD8015	CTP	300	30	—	—
SVE8033	DM-IV/TP ELQ	275	55	—	—
SVP8013	TATS	500	—	10,800	1,620
SVP8017	TSM	980	—	24,000	1,920
SVS8002	DM-IV/TP Facility	1,530	185	—	—
SVS8006	TDS	1,761	231	—	—
SVS8007	TPE-II	617	61	—	—
SVS8017	TP8	2,000	227	—	—
SVU8003	DM-IV/TP Forms Facility	311	59	—	—
	Special Packages:				
SVD8024	DDE Basic System	1,708	271	—	—
SVD8028	DDE Comp for TDS	3,933	557	—	—
SVD8031	DDE Comp for TPE	3,696	521	—	—
SVD8033	DDE Management Facility for TDS	1,632	268	—	—
SVD8034	DDE Management Facility for TPE	1,525	251	—	—
SVS8003	DM-IV/TP Comp Facility	3,031	425	—	—
SVS8009	DM-IV/TP System Management Facility	1,096	225	—	—
	Other Software:				
SVS8012	GCOS 8 SR2000 P	39	—	—	—
SVS8013	GCOS 8 SR2000 SER DB	33	—	—	—
SVS8015	GCOS 8 SR2300 P	50	—	—	—
SVS8016	GCOS 8 SR2300 SER DB	40	—	—	—
SVS8019	GCOS 8 SR2500 P	60	—	—	—
SVS8020	GCOS 8 SR2500 SER DB	50	—	—	—

(1) Charge varies relative to hardware central power.
NA—Not available.
NSC—No separate charge.
NC—No charge.

SOFTWARE PRICES

DATANET 8 Distributed Network Supervisor Software

		Monthly License Fee ($)	Optional Monthly Support Charge ($)
SNC8120	Distributed Network Supervisor	560	99
SNC8121	Network Operator Interface	11	5
SNC8123	Host Connect Support for DPS 8, 88, and 90	60	11
SNC8131	HDLC Data Link Control point to point	95	18
SNC8122	Value Added Network Support, X.25, PAD, PBX, and LAN	185	33
SNC8126	Primary Network Support, X.21	185	33
SNC8127	Interactive Binary Synchronous Terminal Support (3270)	90	17

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

Honeywell DPS 88 Series

		Monthly License Fee ($)	Optional Monthly Support Charge ($)
DATANET 8 Distributed Network Supervisor Software (Continued)			
SNC8128	Remote Batch Binary Synchronous (2780/3780) Workstation Support	80	14
SNC8129	Remote Computer Interface (RCI) Terminal Support	50	9
SNC8130	Logical High-Level Data Link Control	125	22
SNC8190	Host Administrative Facilities	155	28
SNC8193	Network Administration Facility	35	6
SVC8051	Unified File Transfer 8	200	72
SNC8195	Distributed Network Supervisor/Entry GCOS 3/GCOS 8	450	80
SNC8197	Remote Switch/Concentrator	375	66
SNC8118	Eight-Inch Diskette Software Updates for DN8	10	NC
SCC3209	Remote Batch Facility/6 (RBF/6)	32	6
SCC3210	Distributed Job Processing	67	14

NA—Not available.
NSC—No separate charge.
NC—No charge. ∎