Honeywell DPS 88 Series

MANAGEMENT SUMMARY

Honeywell Information Systems has expanded its new top-of-the-line, high-performance mainframe series with the introduction of four new processors. These include two entry level models, the single-processor DPS 88/41 and the dual-processor 88/42, and two fully redundant systems, the DPS 88/42T and 88/82T. The DPS 88/82T processor was available when it was announced in November 1984, while the other three new processor models were scheduled for delivery during the first quarter of this year. These new products bring the total number of processors within the Distributed Processing System 88 (DPS 88) to six.

Honeywell launched its DPS 88 Series three years ago with the introduction of the single-processor 88/81 and the dual-processor 88/82. Since then, more than 40 processors have been installed worldwide. By the fourth quarter of 1985, Honeywell also hopes to make good on long-awaited plans to market the NEC S-1000, a processor manufactured by Nippon Electric Company of Tokyo. Under the terms of the agreement with NEC, the Honeywell-compatible mainframe will be marketed under the Honeywell nameplate and will become Honeywell's most powerful mainframe product. Earlier plans to develop three- and four-processor models with greater power than Honeywell's most powerful existing processors have been scrapped.

The four new models and the promise of even more powerful processors in the near future should help Honeywell address the large-scale processing needs of a wider range of customers. All the models are field upgradable and readily permit Honeywell customers to migrate to a more powerful system as needs and processing requirements demand. This reflects a long-range Honeywell product policy aimed at protecting the investments of its existing users.

The highest performance computer systems in the Honeywell line, the DPS 88 models offer a wide range of processing power, and are part of Honeywell's Distributed Systems Architecture (DSA) approach to networking.

MODELS: DPS 88/41, DPS 88/42, DPS 88/42T, DPS 88/81, DPS 88/82, and DPS 88/82T.
CONFIGURATION: 1 or 2 CPUs, 16 to 128 megabytes of main memory, 1 or 2 I/O Transfer Units, and 62 to 252 I/O channels.
COMPETITION: Amdahl 580 series, IBM 308X series, NAS AS/9000 series, Sperry 1100/90 series, and Burroughs B 7900.
PRICE: From $1,850,000 to $4,800,000.

CHARACTERISTICS

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

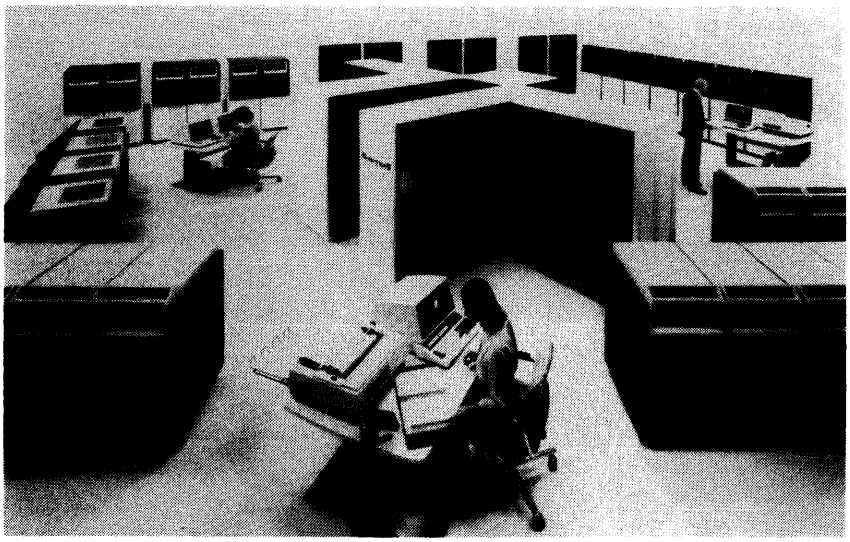
MODELS: DPS 88/41, DPS 88/42, DPS 88/42T, DPS 88/81 and DPS 88/82, DPS 88/82T.

DATE ANNOUNCED: See Table 1.

DATE OF FIRST DELIVERY: See Table 1.

DATA FORMATS

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



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

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TABLE 1. SYSTEM COMPARISON

	DPS 88/81	DPS 88/82	DPS 88/82T
SYSTEM CHARACTERISTICS			
Date announced	October 1982	October 1982	November 1984
Date first delivered	Fourth Qtr. 1983	Fourth Qtr. 1983	November 1984
Field upgradable to	—	—	—
Relative performance	6.5	11.7	11.7
Number of Processors	1	2	2
Cycle time, nanoseconds	—	—	—
Word size, bits	36	36	36
Operating systems	GCOS 8	GCOS 8	GCOS 8
MAIN MEMORY			
Type	64KB MOS	64KB MOS	64KB MOS
Minimum capacity, bytes	16M	16M	32M
Maximum capacity, bytes	64M	128M	128M
Increment size	16M bytes	16M bytes	16M bytes
Cycle time, nanoseconds	—	—	—
BUFFER STORAGE			
Minimum capacity	—	—	—
Maximum capacity	64KB	128KB	128KB
Increment size	—	—	—
INPUT/OUTPUT CONTROL			
Number of channels:			
Byte multiplexer	—	—	—
Block multiplexer	—	—	—
Word	—	—	—
Other	64-128	64-128	128-256

There are no major technical differences among the six models announced to date. The few apparent differences relate to processing capacity and performance. The 88/40 Series is positioned to fill the performance gap between the 8/70, the top processor within the Honeywell DPS 8 Series, and the DPS 88/81. The DPS 88/41 has more than twice the processing power of the DPS 8/70 and the 88/42 is said to be approximately five times as powerful. The entire DPS 88 processor line is eight times as powerful as the DPS 8/70.

The two fully redundant processors, the 88/42T and 88/82T, come with two of each of the central processing components that compose a typical DPS 88 Series system. These processors are especially suited for large highly interactive environments where downtime of even the shortest duration can be extremely costly.

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

Both the DPS 88/80 Series and the DPS 88/40 Series use the same hardware design features. All the processors incorporate an advanced evolution of current mode logic (CML) technology and liquid-cooled micropackaging into all central system components. By contrast, the larger systems within the DPS 8 Series use MSI Schottky TTL

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.

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TABLE 1. SYSTEM COMPARISON

	DPS 88/41	DPS 88/42	DPS 88/42T
SYSTEM CHARACTERISTICS			
Date announced	November 1984	November 1984	November 1984
Date first delivered	First Qtr. 1985	First Qtr. 1985	First Qtr. 1985
Field upgradable to	DPS 88/42 or DPS 88/81	DPS 88/82	DPS 88/82T
Relative performance	4.1	7.8	7.8
Number of Processors	1	2	2
Cycle time, nanoseconds	—	—	—
Word size, bits	36	36	36
Operating systems	GCOS 8	GCOS 8	GCOS 8
MAIN MEMORY			
Type	64K MOS	64K MOS	64K MOS
Minimum capacity, bytes	16M	16M	32M
Maximum capacity, bytes	64M	128M	128M
Increment size	16M bytes	16M bytes	16M bytes
Cycle time, nanoseconds	—	—	—
BUFFER STORAGE			
Minimum capacity	—	—	—
Maximum capacity	32KB	64KB	64KB
Increment size	—	—	—
INPUT/OUTPUT CONTROL			
Number of channels:			
Byte multiplexer	—	—	—
Block multiplexer	—	—	—
Word	—	—	—
Other	64-128	64-128	128-256

logic and air-cooling techniques. About 25 percent of the system logic in the DPS 88 Series is dedicated to ensuring system availability and integrity.

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

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

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

A single main memory unit comes with a minimum of 16 megabytes, expandable to 64 megabytes in 16-megabyte

MAIN STORAGE

STORAGE TYPE: Metallic oxide semiconductor (MOS).

CAPACITY: See Table 1.

CYCLE TIME: See Table 1.

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.

STORAGE PROTECTION: The DPS 88 has read, write, and execute permission bits in the Segment Descriptor. The Page Table Word (PTW) contains a write permit bit. Hardware also checks that data addresses generated during program execution do not exceed specified boundaries.

CENTRAL PROCESSORS

The DPS 88 Central System hardware consists of 11 components:

- **Central Processing Unit (CPU)**
- **Central Interface Unit (CIU)**
- **Main Memory Unit (MMU)**
- **Input/Output Transfer Unit (IOX)**
- **Channel Adapter Unit (CAU)**
- **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 Transfer Unit.

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increments. The dual processor DPS 88/42, 88/42T, 88/82, and 88/88T configured with two main memory units can contain up to 128 megabytes of main memory.

The DPS 88 Series operates only under the GCOS 8 operating system, the latest version of which is Software Release 2300. 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 support of the Network Processing Supervisor (NPS), the General Remote Terminal System (GRTS II), and the Distributed Network Supervisor (DNS) communication software that runs on existing Honeywell communications equipment.

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

Under GCOS 8, numerous programs can run concurrently (multiprogramming), and more than one processor can operate at a time (multiprocessing). All processing dimensions access data stored in common file structure. Through centralized file storage, up-to-date information is made readily available.

COMPETITIVE POSITION

Honeywell reported DPS 88 processors can outperform comparable IBM 308X processors in the on-line mode by a two-to-one ratio. But when Honeywell gauged relative performance for batch-mode processing, the results against comparable IBM processors were more competitive.

Honeywell DPS 88/41 is a large-scale single-processor system with approximately two-thirds the processing power of Honeywell full-scale DPS 88 mainframes. It competes with the IBM 3083 and the Sperry 1100/71. The DPS 88/42, also rated at two-thirds the processing power of Honeywell's bigger processors, is a dual-processor system that competes with the Sperry 1100/70 and the NCR 8645 and 8655. The DPS 88/81 is a large-scale, single-processor system designed to compete with the IBM 3081 and Sperry 1100/91. The dual-processor DPS 88/82 competes with the IBM 3084 and Sperry 1100/92.

Using Honeywell relative-performance ratios based only on batch processing performance, Honeywell marketing analysts produced the following results: DPS 88/41 came out just ahead of the IBM 3083 CX and the 3083 EX; DPS 88/42 and 88/42T models were placed just slightly ahead of the IBM 3083 JX; DPS 88/81 outperformed the IBM 3083 BX; and the DPS 88/82 and 88/82T models outperformed the IBM 3081 GX but were less powerful than the IBM 3081 KX.

ADVANTAGES AND RESTRICTIONS

The ability to perform on-line processing with high system throughput is the major advantage of the DPS 88 Series.

The Input/Output Transfer Unit, coupled with the Channel Adapter Unit, supplies the interface between the network or peripheral subsystems and a Central Interface Unit.

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

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

- **The DPS 88/80 Series processors use two separate high-speed cache memories, the instruction cache (I-cache) and the operand cache (O-cache), each providing 32K bytes of storage. The I-cache stores blocks of unmodified 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 88/40 Series models, unlike the DPS 88/80 Series models, use a single high-speed cache memory providing 32K bytes of storage rather than two separate caches. The single cache stores both instructions and operands.**
- **An instruction unit that queues instructions and performs a five-step instruction preparation and execution process. Each stage of the pipeline operates concurrently to decode instructions and generate memory addresses.**
- **Five specialized execution units that are designed to optimize actual execution. The central execution unit handles the execution of most of the Transfer Control instructions and other instructions that alter the processor states, and maintains the address registers and performs housekeeping functions. The basic operations unit performs binary fixed-point operations, Boolean operations, fixed-point comparisons, register loads, and shift operations. The virtual memory and security unit performs most instructions unique to virtual memory management. The binary floating-point unit (for multiply and divide) executes fixed-point multiply and divide instructions and all binary floating-point or hexadecimal floating-point instructions. The decimal and character unit executes those instructions involving decimal arithmetic and character manipulation.**

The Central Interface Unit (CIU) acts as a traffic controller for information passing between the CPU, MMU, and IOX. 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 Transfer Unit.**
- **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.**

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Processing performance is enhanced with the use of the five-stage pipeline architecture, which allows up to five instructions to be processed simultaneously.

Another advantage centers around high system availability. This is especially true for the four dual-processor models, the DPS 88/82, DPS 88/42, DPS 88/42T, and DPS 88/82T. The DPS 88/42T and DPS 88/82T, in particular, can be configured with full redundancy to provide backup in the event of failures.

In addition to augmenting the choices for users requiring very large systems, the DPS 88 meets the expansion needs of those presently using smaller Honeywell systems. 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.

To further augument 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 more than double the capacity of competing systems. But Honeywell cannot make that boast anymore, since at least two vendors—IBM and Amdahl—began offering 128 megabytes for some of their processor models.

In mass storage capability, the IBM 3380 disk drive with 2520 megabytes per unit surpasses the 1101 megabytes per disk unit of the Honeywell MSU0501.

Honeywell's GCOS 8 operating system provides for concurrent operation, supporting large numbers of simultaneous users with good response and serving heavy transaction processing needs. The DPS 88 with GCOS 8 supports up to 511 concurrent processes, 477 of which are available to applications.

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 recompilation is not required.

USER REACTION

More than 40 processors have been installed worldwide since Honeywell introduced the model line three years ago. Datapro, however, did not receive a list of users in advance of press time to conduct an adequate user survey. □

The Input/Output Transfer Unit (IOX), acting in conjunction with the Channel Adapter Unit (CAU), handles the data transfers between main memory and communications lines, peripheral devices, and the System Support Facility, with transfer rates up to 48 million bytes per second. The IOX 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 Transfer Unit and issuing a channel connect command to initiate processing by the IOX. Once initiated, the IOX and the CAU handle the input/output operations independently of central processing. Consequently, by offloading this input/output traffic from the CPU, the IOX helps reduce system overhead and increases the number of actual transactions processed. A basic IOX has 62 logical channels and can be expanded to 126 logical channels.

The Channel Adapter Unit is a sophisticated high-speed unit that features a data throughput rate in excess of 20 million bytes per second. The CAU can contain two channel buses (circuit paths over which data is transmitted) for connection to the IOX. The first bus possesses 31 channel function slots, while the second bus provides an additional 33 (using a channel function slot and bus expansion). The function slots are designed for connection to front-end processors, peripherals, and the System Support Facility. Two channel types are available: the Peripheral Subsystem Interface (PSI) and the Direct Interface (DI). The PSI channels are used to attach mass storage, magnetic tape, and unit record subsystems; the DI channels are used to connect FNPs and SSFs. Both channel types allow multiple logical channels to be assigned to one physical channel.

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

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

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

- **A mass controller, providing microprogrammed support of two removable media drives.**
- **A multiple-device controller, providing microprocessor control of the SSF flexible disk drive.**
- **A specialized interface, allowing direct access to DPS 88**

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TABLE 2. MASS STORAGE

Subsystems	MSU0451	MSU0500	MSU0501
Cabinets per subsystem	16	8-15	8-15
Disk packs/HDAs per cabinet	1	2	2
Capacity	156	626	1101
Tracks/segments per drive unit	815	1630 (per surface)	1686 (per surface)
Average seek time, msec.	30	25	25
Average access time, msec.	—	—	—
Average rotational delay, msec.	8.3	8.3	8.3
Data transfer rate	716	1065	1065
Controller model	MSP0611/0612	MSP0611/0612	MSP0611/0612
Comments	removable	fixed	fixed

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.
- Off-line retrieval of older messages.
- Optional hardcopy messages.

ADDRESSING: 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.

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

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

PROCESSOR MODES: The central processor has four modes of operation: master mode, privileged master mode, slave mode, and hypermode. The first three modes are standard, while the hypermode is the operating mode used to share CPU resources when diagnosing the health of the system. The privileged master mode permits unrestricted access to all memory, permits the initiation of data transfer operations through the Input/Output Transfer Unit, 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.

PHYSICAL SPECIFICATIONS: DPS 88 systems must be located in a room with a raised floor or any arrangement providing at least 12 inches of space beneath the equipment. The room ceiling must be 8 feet above the floor. Power requirements must meet these specifications: 208, 240, 440, or 480 VAC ±10 percent for the motor generator set; 60 Hz nominal frequency ±0.5 Hz; three-phase wire with a maximum phase variation of 5 percent from the nominal; and 120/208 VAC, five-wire cable with ground for peripheral equipment (voltage variation is ±10 percent).

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

CONFIGURATION RULES

The DPS 88 family consists of six models: the DPS 40/41, DPS 40/42, DPS 40/42T, DPS 88/81, DPS 88/82, and the

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TABLE 3. INPUT/OUTPUT UNITS

Magnetic Tape Units	Number of Tracks	Recording Density, Bits/Inch	Encoding	Tape Speed Inches/Sec.	Transfer Rate, Bytes/Sec.
MTU0500	7	556/800	NRZI	125	52K/75K
MTU0500	9	556/800/ 1600	NRZI/ NRZI/ PE	125	70K/100K/200K
MTU0610	9	800/ 1600/ 6250	NRZI/ PE/ GCR	200	100K/200K/1250K
MTU0630[1]	9	800/ 1600/ 6250	NRZI/ PE/ GCR	75 or 125	60-100K/120-200K/ 468.7-7781.2K

Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
PRU1200	1200 lpm	136 or 160	10	6 or 8	4 in. to 22 in. width x 3 in. to 22 in. length
PRU1600	1600 lpm	136 or 160	10	6 or 8	4 in. to 22 in. width x 3 in. to 22 in. length

DPS 88/82T. The DPS 88/41 central system includes: a Central Processing Unit (CPU); a System Support Unit (SSU); a Central Interface Unit (CIU), a Main Memory Unit (MMU) with 16 megabyte memory; an Input/Output Processor (IOX) with 64 logical channels; a Channel Adaptor Unit (CAU) with 33 channel function slots; a System Support Facility (SSF); a system console and table with pod; a maintenance console and table; a Thermal Exchange Pump (TEP), and Thermal Exchange Air (TEA), an option used when a source of chilled water is not available to the TEA.

The DPS 88/42 central processing system includes: two CPUs; two SSUs; two TEPs; one CIU; one MMU with 16 megabyte memory; one IOX with 64 logical channels; one CAU with 33 channel functions; one SSF; one system console and table with pod; one maintenance console and table, and optional TEA.

The basic DPS 88/81 central system includes: a CPU, a CIU, a MMU with 16 megabytes of memory, an IOX with 64 logical channels, a CAU with 33 channel function slots, a SSF; a maintenance console and table, a system console with table and pod, a SSU, a TEP, and optional TEA unit.

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

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

The basic system can be expanded to 64 megabytes of memory in 16-megabyte increments. Processors configured with two MMUs can be expanded from a minimum 32 megabytes to 128 megabytes. The IOX can be expanded from 64 to 128 logical channels. Systems configued with two IOXs can have up to 256 logical channels. A CAU with 33 channel function slots can be expanded to 64. Up to two CAUs with a total of 128 channel function slots can be attached to each IOX. Up to six system consoles can be configured with each SSF and up to eight 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.

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

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

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

MASS STORAGE

Disk storage subsystems available for the DPS 88 are listed in Table 2.

INPUT/OUTPUT UNITS

For magnetic tape subsystems, and printers available for the DPS 88, please refer to Table 3.

UNIT RECORD SUBSYSTEM: A user may select as part of a DPS 88 system, a unit record subsystem, which consists

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of the URP0600 unit record processor and up to eight unit record devices. These devices can include card readers, a card punch, a reader/punch, and printers. Multiple unit record subsystems can be configured. The UPR0600 unit record processor is a freestanding, microprogrammed controller that connects the Channel Adapter Unit (CAU) to the unit record devices. Microcoded programs directing the URP0600 help to maximize the overall use of the peripheral devices and decrease costly turnaround.

COMMUNICATIONS CONTROL

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

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

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

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

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

The base Datanet 8 includes 512K bytes of memory (expandable to 1536K) and a 512K-byte diskette (a second 512K diskette is optional). It can accommodate from 16 to 128 communication lines. The DPS 88 Host connection (DCE8006) and either the 30-cps Console (DCF8008) or the 120-cps Console (DCF8006) are required additions.

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

- Dual Asynchronous Channel Package, EIA RS-422-C, to 9600 bps each (DCF8009)
- Dual Bisynchronous Channel Package, EIA RS-232-C, to 9600 bps (DCF8018)
- Dual Asynchronous Channel Package, MIL-188-C, to 9600 bps (DCF8015)
- Single Synchronous Channel Package, MIL-188-C, to 9600 bps (DCF8014)
- Single Synchronous HDLC Channel Package, MIL-188-C, to 9600 bps (DCF8017)
- Single Synchronous HDLC Wideband Channel Package, MIL-188-C, to 56K bps (DCF8016)
- Channel Interface Base (DCF8007); accommodates up to four Channel Interface Options
- Dual Synchronous EIA RS-232-C Channel, to 9600 bps (DCF8011)
- Dual Asynchronous EIA RS-232-C Channel, to 9600 bps (DCH8012)
- Single HDLC EIA RS-232-C Channel, to 9600 bps (DCF8020)
- Single HDLC Wideband Channel, to 56K bps (DCF8022)
- Single HDLC Wideband Channel, CCITT-V.25, to 56K bps (DCF8023)
- Direct Connect Capability (DCF8024) for one Asynchronous or one Synchronous Line, to 9600 bps
- Universal Modem By-Pass (DCF8026), Synchronous to 20.8K bps or Asynchronous to 1800 bps
- Two Asynchronous Current Loop Ports, to 9600 bps (DCF8036)

SOFTWARE

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.

GCOS 8 is user-defined and user-oriented, 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.

GCOS 8 is a flexible operating system that features hardware transparency, meaning that the user has no need to know the particular architecture of the system, its hardware, I/O devices, or processor types. All processors can access all of memory and can execute any program. GCOS 8 can address up to 128 megabytes of real memory. Up to 477 user

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programs of up to one megabyte each can be executed concurrently. GCOS 8 can use up to 128 megabytes of memory for time-sharing. It provides high throughput by efficient and rapid scheduling of all activities, which reduces operator intervention.

MEMORY MANAGEMENT: 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. GCOS 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.

DIMENSIONS: GCOS 8 is a virtual operating system, with multiprogramming, multiprocessing, and flexible job entry capabilities. GCOS 8 also has file protection and file sharing, testing and diagnostics, communications, time-sharing, 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.

SYSTEM SECURITY: GCOS 8 provides security of hardware and software in several ways. It 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.

NETWORKING AND COMMUNICATIONS SOFTWARE

DISTRIBUTED NETWORK SUPERVISOR (DNS): DNS has been designed specifically for use in the Datanet 8 Front-End 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.

NETWORK PROCESSING SUPERVISOR: The DPS 88 and NPS 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.

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.

TRANSACTION PROCESSING SYSTEM (TPS): This facility invokes the loading and execution of the appropriate application programs for processing transactions received

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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): 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.

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

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

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. Interactive Integrated Data Store/II (I-D-S/II) provides the ability to interactively update and retrieve information from an I-D-S/II data base. 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.

LANGUAGES

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

The Cobol-74 compiler provides the functional modules specified for ANS Cobol-74, including the Debug, Sort/Merge, and Report Writer facilities. All modules are implemented at the highest level (Level 2) defined in the ANSI X3.23-1974 standard.

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.

Both Fortran-66 and Fortran-77 operate in the batch and time-sharing environments. Fortran-66 is a full implementation of Fortran IV and the 1966 ANSI standard with extensions. Fortran-77 complies with the 1978 ANSI standard and MIL-STD-1753 (Department of Defense supplement to 1978 ANSI standard), plus numerous extensions. Fortran-77 extensions include code optimization, a DO WHILE plus optional loop incrementation statement, full subscript range checking, passed argument type verification, DOUBLE precision COMPLEX data type and extrinsics, upper- lowercase ASCII character intrinsics, graphics character set, the INCLUDE statement, binary/octal/hexadecimal constants, and bit processing and intrinsics. Other Fortran-77 extensions are pretty printer (reformatting of source code), upper/lower case source code, optional flagging of undeclared variables/called functions and subroutines/intrinsics, optional flagging of implicit type conversions, and subdivision of compile time error messages into seven categories. Interactive and batch symbolic debugging of source programs through the Debug Support System (DSS) is available to the Fortran-77 user. There is also a compatibility mode which allows compilation of Fortran-66 programs without source modification. Both Fortran-77 and Fortran-66 processors compile programs in local, remote job entry, or time-sharing environments and ensure compatibility between source programs developed in one environment and used in another. Executable programs that have been developed in one environment may be run in another. Data Manipulation Lan-

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guage (DML) verbs for accessing DM-IV and I-D-S/II data bases are available in the Fortran-77 and Fortran-66 processors.

PL/1 is a block-structured language that allows both internal and external names. This feature facilitates the development and maintenance of modular PL/1 programs. All procedures are recursive and sharable. PL/1 utilizes the full ASCII character set defined in American National Standards Institute standard X3.4-1968.

Basic is a one-pass conversational compiler that operates under the GCOS 8 Time-Sharing System. It implements the Basic language as defined by the ANSI minimal Basic standard plus several Honeywell extensions.

DataBasic is a version of Basic employing the I-D-S/I file management system. DataBasic is supported by both time-sharing and batch component subsystems.

APL Level II is a superset version of the APL programming language. APL is an interactive system for use with large-scale Honeywell computers.

The Pascal compiler runs under TSS and provides these extensions to standard Pascal: constant-valued expressions may be used wherever a constant is legal in Standard Pascal, and are evaluated at compile time; files may be opened dynamically; and extended file handling is available.

Lisp is an interpreter/compiler system designed to assist in the symbolic computations common to language translation, theorem proving, symbolic mathematics, and artificial intelligence. It is a compatible superset of Lisp 1.5.

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.

Compiler "B" is a high-level language which operates in the batch or time-sharing mode. It is used for systems programming and for teaching compiler programming and design.

"C" is a general-purpose programming language featuring economy of expression, modern control flow and data structures, strong data typing, and a set of language operators. Its lack of restrictions and its generality make it more convenient to use for many tasks, including realtime applications, than the more powerful languages. "C" is useful for writing operating systems and for writing numerical, text-processing, and data base programs.

RPG II is Honeywell's implementation of the IBM-developed report program generator, and is very similar to the IBM System/3 version of the language. RPG II supports UFAS sequential, relative, and indexed sequential files, all compatible with Cobol-74.

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.

DATA MANAGEMENT

Honeywell offers a number of software packages in this category, including Data Management-IV, File Management Supervisor, Indexed Sequential Processor, Unified File Access System, Integrated Data Store I and II, Management Data Query System, TOTAL Central, and Common Files Facility.

The latest Honeywell data management, transaction processing, query and reporting, batch and interactive data base capabilities are provided by Data Management-IV (DM-IV). 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 data base management system. Data extraction and updating from data bases 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, the Transaction Processor, the Query and Reporting Processor, and the Procedural Language Processor. It also supports batch and time-sharing programs. DM-IV is described in detail in Report 70E-480-01.

The DM-IV Data Manager administers the creation of the physical and logical structures of the data base and controls the creation of the application-specific views of that data base which are used in processing. It further serves as the interface between the data base and the various DM-IV processors that access the data base and perform operations upon it.

The DM-IV Transaction Processor (TP) provides the facility for rapid, efficient, on-line data base 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, Data Base 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 Data Base Manager controls all data base activities for on-line files assigned to TP. The executive software also provides for dynamic allocation and deallocation of data base 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 data base after an application program abort to the complete reconstruction of a destroyed data base.

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.

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The DM-IV Query and Reporting Processor (QRP) provides the user with several different subsystems which act to access the defined data base 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 data base 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 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 QRP end-user facilities, the user need not be concerned with the data base structure or access methods.

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) data base. 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 data base 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 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 data base 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 date 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 data base.

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 Integrated Data Store (I-D-S/I and I-D-S/II) systems are enhanced versions of I-D-S, a data base management system originally developed by GE. I-D-S/II is based on the CODASYL Data Base Facility specifications. I-D-S/II is fully integrated with Honeywell's Cobol-74 compiler, and user interfaces are also implemented for Fortran.

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 data based retrieval and report generation system, and MDQS/IV, a system that offers all MDQS/II capabilities plus data base 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.

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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 data base, 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.

APPLICATION PROGRAMS AND UTILITIES

Honeywell offers the following utility routines and application programs for the DPS 88 systems.

Utilities

- HONEYEDIT
- TEXT Editor
- Text Executive Processor (TEX)
- Slave Program Activity Monitor (SPM)
- Time-sharing Debug/Trace (TSD/T)
- Collection and Plot of System Usage Levels (CAPSUL)
- Data Dictionary IDS I
- Mass Storage Utility
- Tape Testing
- Peripherals Resource Monitor
- Time-Sharing Dump Analysis
- Load Generator System-II
- SOLOMAN (Source & Library On-Line Manager)

Banking Applications

- Check Handling Executive Control Systems (CHECS)
- Document Entry Subsystem
- Proof and Transit Subsystem
- FUNDS System Administrative and Control Module
- FUNDS System Customer Profile Module
- FUNDS System Savings Account Module
- FUNDS System Loan Account Module
- FUNDS System General Ledger Module

Manufacturing Applications

- Honeywell Manufacturing System (HMS)
- Inventory Record Management Module
- Manufacturing Data Control Module
- Material Requirements Planning Module
- Master Production Scheduling Module
- Statistical Forecasting Module
- Capacity Requirements Planning Module
- Automatically Programmed Tools (APT)

Distribution Applications

- PROFIT (Inventory Control)
- Point-of-Sale System

Management Science Application Programs

- Mathematical Programming System (MPS)
- BMDP Statistical Programs
- SPSS Statistical Package
- IMSL Math/Statistics Library
- Project Management and Control System (PMCS)
- GPSS Simulation System
- Numerically Integrated Elements for Systems Analysis—(NISA) (Structural Analysis)
- Polo Finite (Structural Analysis)
- Coordinate Geometry (COGO)
- Concordance Generator Program

Financial Management Systems

- General Ledger
- Accounts Payable
- Accounts Receivable
- Payroll

MSA/Honeywell Applications

- Financial—General Ledger, Fixed Assets
- Cash Management—Accounts Receivable, Accounts Payable, Inventory and Purchasing
- Human Resources—Payroll, Personnel

Health Care Applications

- HHS (Honeywell Hospital System) Foundation System—Patient Profile/Master Index, Admission/Discharge/Transfer, Patient Accounting
- Fiscal/Administrative System—General Ledger/Responsibility Reporting, Accounts Payable, Property Ledger, Preventive Maintenance, Cost Allocation, Medical Records

Miscellaneous Application Programs

- Individualized Mathematics Instruction/66 (IMS/66)
- SCRIBE/66 Scheduling System
- ROLIN (Rapid On-Line Information Network)
- Employment Security Application Packages

Education Support

- Large Systems Marketing Education Support

PRICING

EQUIPMENT: The following configurations are representative of the six basic DPS 88 systems currently available from Honeywell. Models with expanded power are planned for introduction to the DPS 88 family at a later date.

A basic DPS 88/41 central system includes a central processing unit, a system support unit, a central interface unit, a

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main memory unit with 16 megabytes of memory, an input/output processor with 64 logical channels, a channel adapter unit with 33 channel function slots, a system support facility, a system console and table with pod, a maintenance console and table, and a thermal exchange pump. The basic central system has a purchace price of $1,850,000 and a monthly lease of $64,750 on a four-year plan.

A basic DPS 88/42 includes the same components at DPS 88/41 plus an additional central processing unit, system support unit and thermal exchange pump. The basic central system has a purchase price of $2,950,000 and a monthly lease of $103,250 on a four-year lease plan.

A basic DPS 88/81 central system includes a central processing unit, a central interface unit, a 16-million-byte main memory unit, an input/output transfer unit with 64 logical channels, a channel adapter unit with 33 channel function slots, a system support facility, a system console with table and pod, a maintenance console, a support unit, and a thermal exchange pump. This basic central system has a purchase price of $2,850,000. On a four-year agreement, the monthly lease is $91,200.

A basic DPS 88/82 central system includes the same components as DPS 88/81, plus an additional central processing unit, system support unit, and thermal exchange pump. This basic central system has a purchase price of $4,050,000 and a monthly lease of $141,100 on a four-year agreement.

The two fully redundant systems, the DPS 88/42T and DPS 88/82T, come with two of each central system component and also include 32 megabytes of main memory. The basic DPS 88/42T central system has a purchase price of $3,700,000, and a monthly lease of $129,500 on a four-year agreement. The DPS 88/82T has a purchase price of $4,800,000 and a monthly lease of $172,800 on a four-year agreement.

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

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

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

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

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

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

Education 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.

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

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

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EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	4-Year Lease ($)	SPSS ($)
PROCESSORS						
CPS8841	DPS 88/41 Central Processor System with 16MB Memory	1,850,000	4,000	82,400	64,750	1,110
CPS8842	DPS 88/42 Central Processor System with 16MB Memory	2,950,000	4,800	131,400	103,250	1,580
CPS8846	DPS 88/42T Fully-Redundant Processing System with a minimum 32MB Memory	3,700,000	6,400	164,800	129,500	1,580
CPS8884	DPS 88/81 Central Processor System with 16MB Memory	2,850,000	5,950	116,500	91,200	1,290
CPS8885	DPS 88/82 Central Processor System with 16MB Memory	4,050,000	7,050	179,500	141,100	1,870
CPS8886	DPS 88/82T Fully-Redundant Central Processing System with minimum 32MB Memory	4,800,000	8,650	218,400	172,800	1,870
PROCESSOR OPTIONS						
CPK8884	Central System Upgrade CPS8884 to CPS8885	1,200,000	1,100	63,000	49,900	580
MXC8800	Additional CIU and MMU for CPS8885 (no memory included)	300,000	500	12,000	10,000	—
CMM8816	Additional 16MB Memory Module	260,000	650	13,900	11,100	—
MXU8800	Additional IOX with 62 Logical Channels and CAU with 31 Channel Function Slots (for CPS8885 only)	250,000	500	10,000	8,100	—
MXF8804	IOX Logical Channel Expansion (62 to 126). Max. of one per IOX	6,000	NC	240	200	—
MXF8800	Additional CAU with 31 Channel Function Slots (max. of 1 per IOX)	150,000	150	5,400	4,300	—
MXF8810	CAU expansion from 31 to 64 Channel Function Slots	100,000	95	4,000	3,300	—
CPF8802	Additional System Support Facility (SSF). For CPS8885 only. Includes system console with large screen monitor interface, 15" CRT and Keyboard, and Console Table and Control Pod, Maintenance Console, 12" CRT and Keyboard, and Pedestal	75,000	150	3,000	2,500	—
	Consoles and Features					
CSU8801	Additional System Console with 15" CRT and Keyboard for 2nd, 4th, and 6th System Console per SSF	3,640	36	130	110	—
CSU8802	Additional System Console with 15" CRT and Keyboard for 3rd and 5th System Console per SSF	4,640	42	166	140	—
CSF8803	Large Screen Monitor Interface Feature for CSU8801/8802/Factory installed only.	400	—	16	13	—
CSF8804	System Console Table (No control pod) for CSU8801/8802	550	—	—	—	—
CSF8801	100-cps Printer for System Console	3,390	50	121	103	—
CSF8802	100-cps Printer for Maintenance Console	2,950	33	105	90	—
CSF8805	23" Large Screen Monitor	2,358	16	157	135	—
CSF8806	Ceiling Mount for CSF8805	195	—	—	—	—
TTF0200	Printer Pedestal	175	NC	NA	4	—
	Power and Cooling					
PSS8800	Memory System UPS Feature	3,800	3	150	125	—
MGS8801	Motor Generator and Control, 3 Sec. Ridethrough, 62.5KVA, 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	—
	Peripheral and Network Processors Attachment Features†					
MXF8801	Exchange of Disk or Tape Processor Attachment Feature	2,500	—	—	—	—
MXF8802	Exchange of Unit Record Processor Attachment Feature	2,500	—	—	—	—
MXF8803	Exchange of Previously Installed Host Connection for a DCE 8015 for Use on DPS 88 CAU Systems Only	1,500	—	—	—	—
MASS STORAGE						
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	12	123	103	
MSU0402	Removable-Disk Mass Storage Unit, 100M bytes; requires MSF0007	20,805	122	950	818	
MSU0451	Removable Disk Mass Storage Unit, 200M bytes; requires MSF007	27,047	113	1,140	950	
MSK4025	Upgrade Kit from MSU0402 to MSU0451	6,242	—	312	271	
MSF0006	Dual Access Feature for MSU0402/0451	2,070	13	89	76	
MSF0007	Remote Position Sensing Option for MSU0402/0451	2,025	13	87	76	

**Includes equipment maintenance.*
†For use with previously installed peripheral processors which are being attached to a DPS 88 system. These features are not needed when ordering new peripheral processors for a DPS 88 system.
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		Purchase Price ($)	Monthly Maint. ($)	1-Year Lease ($)	4-Year Lease ($)	SPSS ($)
MASS STORAGE (Continued)						
MSF1141	Device Adapter for MSU0402/MSU0451 for MSP0612 only; Cannot be used with MSF1142	6,000	—	187	152	
MSU0500	Dual Fixed Disk Mass Storage Unit, 940 megabytes; includes disk and RPS	38,850	172	1,386	1,154	
MSU0501	Dual Fixed Disk Mass Storage Unit; 1101 megabytes, includes disk and RPS	49,650	197	1,747	1,452	
MSK0501	Upgrade kit; MSU0500 to MSU0501	10,800	25	361	297	
MSF0011	Dual Access Feature for MSU0500	4,140	23	163	136	
MSA1140	Unit Addressing for MSU04xx Units (Max 4) for MSP0611 only	3,500	16	156	130	
MSA1141	Unit Addressing for MSU05xx Units (Max 2) for MSP0611 only	3,500	16	219	180	
MSA1142	Unit Addressing for MSU04xx Units; one per four MSUs	4,500	18	146	122	
MSA1143	Unit Addressing for MSU05xx Devices; one per two MSUs	4,500	18	215	177	
MSF0500	Spare Head Disk Assembly for MSU0500	12,340	—	—	—	
MSF0501	Spare Head Disk Assembly for MSU0501	15,808	—	—	—	
MSF1140	Device Adapter for MSU04xx Devices on MSP0611 only	3,500	—	109	89	
MSF1141	Device Adapter for configuring MSU04xx Devices (max 16) to MSP0612 only	6,000	—	187	152	
MSF1142	Unit expansion for configuring MSU05xx devices (Max 7) to MSP0612	4,000	—	125	105	
MSF1143	Non-Simultaneous (Switched) DATANET Channel for MSP0611,0612	8,237	15	283	233	
MSF1144	Non-Simultaneous (Switched) IOM Channel for MSP0611,0612	8,237	15	283	233	
MSF1150	Second Non-Simultaneous (Switched) DATANET Channel for MSP0611,0612	8,237	15	283	233	
MAGNETIC TAPE EQUIPMENT						
MTP0611	Magnetic Tape Processor for MTU500/0610/0630 (Max 8); requires MTF1159 and/or MTF1160	29,400	162	1,080	905	
MTU0500	Magnetic Tape Unit	12,128	159	725	613	
MTU0610	Magnetic Tape Unit	21,000	146	801	677	
MTU0630	Magnetic Tape Unit	14,815	130	593	505	
Features for the MTU0500						
MTU0500	Magnetic Tape Unit	12,128	159	725	613	
MTF0018	Cartridge Load Capability (factory-installed only) for MTU0400/MTU0500	735	2	28	24	
MTF0540	75 ips 9-Track 556/800/1600 bpi for MTU0500	1,029	110	138	132	
MTF0541	75 ips 7-Track 556/800 bpi for MTU0500	1,029	110	138	132	
MTF0542	125 ips 9-Track 800/1600 bpi for MTU0500. Includes Cartridge Load.	4,872	70	218	189	
MTF0543	125 ips 7-track 556/800 bpi for MTU0500. Includes Cartridge Load.	5,523	112	324	279	
Features for the MTU0630						
MTF0634	75 ips, PE/NRZI feature	4,725	138	286	257	
MTF0635	75 ips, PE/GCR feature	7,110	120	342	300	
MTF0636	125 ips, PE/NRZI feature	9,805	155	460	398	
MTF0637	125 ips, PE/GCR feature	10,330	137	460	398	
MTK0630	Performance upgrade MTF0634 to MTF0635	2,385	—	75	60	
MTK0631	Performance upgrade MTF0636 to MTF0637	1,700	—	55	45	
MTK0632	Performance upgrade MTF0634 to MTF0636	5,080	17	175	145	
MTK0633	Performance upgrade MTF0635 to MTF0637	3,220	17	120	100	
MTK0634	High Altitude Adapter	240	—	8	6	
MTA1152	Magnetic Tape Addressing for MTU0500/0610/0630; addresses up to four devices	800	—	25	20	
MTF1125	Series 200/2000 to Level 66 tape compatibility feature (one required for each MTP0611/MTF1151)	2,410	6	81	66	
MTF1152	Switched Channel; includes IOM channel (one required for each MTP0611/MTF1151)	6,174	7	199	163	
MTF1151	Dual Simultaneous Channel; adds 2nd channel to MTP0611; allows up to 16 Magnetic Tape Units; includes IOM channel	36,028	105	1,230	1,016	
MTF1155	ASCII Code Translator (one required for each MTP0611/MTF1151/MTP8001/MFP8001)	945	—	30	24	
MTF1156	EBCDIC Code Translator (one required for each MTP0611/MTF1151/MTP8001/MFP8001)	945	—	30	24	
PSS8001	Capacitor Ridethrough Option for MSP0611/0612/8002 and MTP0611	3,120	12	123	103	
MTF1157	EBCDIC/ASCII Code Translator (one required for each MTP0611/MTF1151/MTP8001/MFP8001)	945	—	30	24	
MTF1158	7-Track (556/800 bpi) Capability; (one required for each MTP0611/MTF1151/MTP8001/MFP8001) prerequisite is MTF1159	1,827	3	60	49	
MTF1159	9-Track NRZI/PE (800/1600 bpi) Capability; one MTF1159 and/or MTF1160 required for each MTP0611/MTF1151/MTP8001/MFP8001	536	15	31	28	
MTF1160	9-Track PE/GCR (1600/6250 bpi) Capability; one MTF1159 and/or MTF1160 required for each MTP0611/MTF1151/MTP8001/MFP8001	6,166	62	254	217	

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		Purchase Price ($)	Monthly Maint. ($)	1-Year Lease* ($)	5-Year Lease* ($)
LINE PRINTERS					
PRU1200	Belt Printer (1200 lpm); 136 print positions, belt not included	44,420	401	2,263	1,921
PRU1600	Belt Printer (1600 lpm); 136 print positions, belt not included	64,940	538	2,910	2,472
PUNCH CARD EQUIPMENT					
CRU0501	Card Reader (500 cpm); requires URA0056	19,500	119	684	568
CRU1050	Card Reader (1050 cpm); requires URA0052	26,555	224	1,136	961
CCU0401	Card Reader/Punch (400/100400 cpm); requires URA0050	29,594	219	1,228	1,032
CRF0003	51-Column Card Feature for CRU1050	2,079	6	75	62
PCU0121	Card Punch (100-400 cpm); requires URA0050	20,032	153	900	698
UNIT RECORD EQUIPMENT & FEATURES					
	Unit Record Processor and Punch Card Unit Features				
URP0600	Freestanding Unit Record Processor; accommodates four devices	26,585	42	940	791
URF0040	Unit Record Addressing Expansion for URP0600; required if more than four devices are used or if drum and belt printers are mixed; accommodates three additional devices	983	2	35	28
URA0050	Addressing for PCU0120/0121 and CCU0401; one required for each device	4,253	4	151	123
URA0052	Addressing Capability for CRU1050; one required for each device	7,569	45	301	257
URA0056	Addressing Capability for CRU0501; one required for each device	265	—	9	6
CCK0401	Retrofit Kit upgrades PCU0121 to CCU0401	9,562	79	328	334
CRF0030	Pedestal for CRU0501	184	—	—	—
	Line Printer Features				
URP8004	Embedded Unit Record Processor (max 2) for PRU1200/1600 Printers	4,000	3	128	104
URA0054	Addressing for PRU1200; one required for each device	7,167	19	264	220
URA0055	Addressing for PRU1600; one required for each device	7,167	19	264	220
PRK1216	Retrofit Kit Upgrade for PRU1200 to PRU1600	20,520	121	647	551
PRF0022	24 Additional Print Positions (136 to 160) for PRU1200/1600	2,610	16	112	93
PRB0500	Standard Print Belt with 63-character OCR-B Font for PRU1200/1600	2,460	90	179	164
PRB0513	ASCII Print Belt with 63 printable characters for PRU1200/1600	2,460	90	179	164
PRB0524	OCR A/B Print Belt with 63 printable characters for PRU1200/1600	2,460	90	179	164
PRB0549	OCR-A Alphanumeric Print Belt with 63 printable characters for PRU1200/1600	2,460	90	179	164
PRB0532	Puerto Rico Print Belt with 63 printable characters, 407 Font, for PRU1200/1600	2,460	94	179	164
PRB0600	ASCII Belt; uppercase/lowercase with 94 printable characters for PRU1200/1600	2,567	90	184	166
DATANET 6661 FRONT-END NETWORK PROCESSOR					
DCU6661	Processor; includes 64K bytes of memory, system support controller, direct interface adapter; up to 12 channel interface bases	36,605	261	1,990	1,669
OPTIONS FOR DATANET 6661 PROCESSOR					
DCF6607	Channel Interface Base	1,651	9	70	58
DCF6611	Dual Synchronous Channel Package, EIA-RS-232-C	1,450	7	60	50
DCF6612	Dual Asynchronous Channel Package, EIA-RS-232-C	590	4	26	23
DCF6613	Automatic Call Unit, Dual Channel	1,180	4	46	39
DCF6614	MIL STD 188C Synchronous Channel	1,501	8	63	53
DCF6618	Dual Binary Synchronous Channel Package	1,450	7	60	50
DCF6619	Broadband Channel	3,056	12	125	104
DCF6620	HDLC Voice-Grade Channel	2,573	11	106	89
DCF6621	Bisynchronous Broadband Channel	3,056	12	125	104
DCF6624	Direct Connect Capability, asynchronous	350	1	13	11
DCF6625	Direct Connect Capability, synchronous	480	1	17	15
DCF6627	Broadband Channel, CCITT V.35 to 72K bps	3,430	12	139	114
DCF6927	Universal Modem Bypass; synchronous to 19.2K bps or asynchronous to 1800 bps	415	11	30	24
DCF6610	20 ma Current Loop-Dual Channel Package	1,180	4	46	39
DCF6615	MIL-STD 188C Asynchronous Dual Channel	1,501	8	63	53
DCF6616	MIL-STD 188C Broadband Channel to 72K bps	1,501	8	63	53
DCF6617	MIL-STD 188C HDLC Channel	2,573	11	106	89
DCF6622	HDLC Broadband Channel to 72K bps	3,056	12	125	104
DCF6623	HDLC Channel, CCITT-V.35 to 72K bps	3,430	12	139	114

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Honeywell DPS 88 Series

		Purchase Price ($)	Monthly Maint. ($)	1-Year Lease* ($)	5-Year Lease* ($)
DATANET 8 FRONT-END NETWORK PROCESSOR					
DCU8010	Processor; includes 512K bytes of memory, system support controller, 512K bytes diskette drive, up to 16 channel interface bases	29,000	135	1,123	937
OPTIONS FOR DATANET 8 PROCESSOR					
DCE8003	Processor Power Module Enhancement	7,400	40	293	245
DCE8002	Communications Line Expansion from 16 to 64 lines	3,000	5	106	86
DCE8004	Communications Line Expansion from 64 to 128 lines; requires DEC8002/8003	5,000	10	179	147
DCP8010	Extended Processor Performance Enhancement; requires DCE8003 and DCE8004	18,500	86	644	554
DCE8005	Additional 512K diskette unit	1,785	18	79	68
DCE8015	DATANET 8 Host Connection for DPS 88 CAU Systems	8,000	65	339	288
DCE8006	DPS 8 Host Connection; maximum of four	8,000	65	339	288
DCF8007	Channel Interface Base; maximum of 16	2,500	14	99	83
DCF8001	100 cps console for DCU8010 and DCU8011	2,065	40	105	92
DCF8008	30 cps console for DCU8010	2,520	54	143	126
DCF8006	120 cps console for DCU8010	2,888	92	197	178
DCF8009	Dual Asynchronous Channel; EIA RS-422-A to 9600 bps each	1,000	7	41	35
DCF8011	Dual Synchronous Channel; EIA RS-232-C; to 9600 bps	1,500	8	58	49
DCF8012	Dual Asynchronous Channel; EIA RS-232-C; to 9600 bps	1,000	5	39	32
DCF8014	Single Synchronous Channel; MIL-188-C;to 9600 bps	1,000	6	40	33
DCF8015	Dual Asynchronous Channel; MIL-188-C; to 9600 bps	1,000	7	41	35
DCF8016	Single Synchronous HDLC Wideband Channel; MIL-188-C; to 56K bps	1,995	15	83	70
DCF8017	Single Synchronous HDLC Channel Package; MIL-188-C; to 9600 bps	2,500	12	99	82
DCF8018	Dual Bi-Synchronous HDLC Channel Package; EIA RS-232-C; to 9600 bps	1,500	7	58	49
DCF8019	Cross-Net Load/Dump Feature	1,000	6	40	33
DCF8020	Single Synchronous HDLC EIA RS-232-C Channel; to 9600 bps	1,500	8	58	49
DCF8022	Single Synchronous HDLC Wideband Channel; to 56K bps	3,000	16	118	98
DCF8023	Single Synchronous HDLC Wideband Channel; CCITT V.35; to 56K bps	3,000	16	118	98
DCF8024	Direct Connect Capability, asynchronous or synchronous; to 9600 bps	350	2	14	12
DCF8026	Universal Modem Bypass; synchronous to 19.2K bps or asynchronous to 1800 bps	415	2	16	13
DCF8036	Dual Asynchronous Current Loop Channel; to 9600 bps	1,000	6	41	35
DCM8005	Additional 512K bytes of memory (512-1024KB) for DCU8010 only	6,000	21	622	534
DCM8008	Additional 512K bytes of memory (1024-1536KB) for DCU8010 only; requires DCE8002 and DCM8005	6,000	21	622	534

**Includes equipment maintenance.*
†For use with previously installed peripheral processors which are being attached to a DPS 88 system. These features are not needed when ordering new peripheral processors for a DPS 88 system.
NC—No charge.
NA—Not available.

Honeywell DPS 88 Series

SOFTWARE PRICES

		Monthly License Fee ($)	Optional Support Charge ($)
GCOS 8 SYSTEM			
SVD8001	DM-IV Fortran Subschema Translator Option	120	10
SVS8002	DM-IV TP Facility	1,389	167
SVP8003	DM-IV QRP Option	375	59
SVP8004	DM-IV PLP Option	263	45
SVS8003	DM-IV TP Comprehensive Facility	2,755	286
SVL8000	Cobol-74 Compiler & Runtime Facility	262	26
SVL8001	Fortran Compiler & Runtime Facility	354	50
SVL8002	PL/1 Compiler & Runtime Facility	285	50
SVR8002	PL/1 Runtime Facility	77	11
SVL8003	RPG-II Facility	133	.5
SVU8002	Sort/Merge Facility	107	17
SVC8006	Host File Transceiver Facility for L6	16	6
SVE8020	Multicopy Timesharing Option	557	110
SVS8005	TSS Facility	84	22
SVE8019	TSS Administration Option	118	16
SVR8000	Cobol-74 Runtime Facility	86	9
SVE8008	TSS File Management Option	112	11
SVE8009	TSS Advanced Application Support Option	167	33
SVE8010	TSS Media Input Option	55	11
SVL8007	TSS Basic Language Option	202	38
SVE8011	TSS Cobol-74 Option	55	11
SVE8012	TSS Fortran Option	55	11
SVE8013	TSS Text Processing Option (TEX)	320	66
SVR8003	TSS Text Processing (TEX) Library Option	36	5
SVE8014	TSS Editing Option (EDIT)	101	22
SVE8015	TSS Document Formatting Option	51	11
SVE8016	TSS Electronic Mail Option	167	33
SVE8017	TSS Sort Interface Option	70	11
SVD8004	TSS Data Basic	139	22
SVE8018	TSS DM-IV Option	82	14
SVD8002	I-D-S/I Facility	1,041	110
SVL8008	Cobol-68 Compiler & Runtime	306	39
SVP8006	MDQS/II Facility	612	117
SVP8007	MDQS/IV Facility	1,058	212
SVS8006	TDS Facility	1,601	210
SVS8007	TPE Facility	561	55
SVD8005	I-D-S/I Data Query Option	167	33
SVD8003	Indexed Sequential Processing Facility	28	6
SVU8003	DM-IV TP Forms Option	250	50
SVS8000	GCOS 8 Operating System EXEC	NC	NC
SVP8000	System Maintenance Facility	87	44
SVU8000	Systems Utilities Facility	52	5
SVP8001	Software Management Facility	79	13
SVP8002	System Performance Analysis Facility	281	25
SVC8004	Extended FNP Support Facility	139	28
SVC8000	GRTS-II Facility	273	44
SVC8001	GRTS-II HDLC Support Option	129	11
SVC8002	NPS Facility	974	209
SVC8003	NPS HDLC Support Option	129	11
SVE8000	FMS Catalog Cache Facility	69	13
SVE8001	FMS Test Access Mode Facility	70	8
SVE8002	Password Encryption Facility	58	5
SVU8001	File Generation Facility	49	5
SVJ8000	Parametric JCL	36	5
SVD8000	DM-IV Standard Facility	1,041	183
SVE8022	TSF Fortran-77 option	55	11
SNU0471	PPS Utilities	27	—
SNU0472	PPS Offline	NC	NC
SNU0473	PPS Online	NC	NC
SVU8012	File Management System Utilities	316	45
SVC8048	GRTS-I Facility	450	110
SVL8010	Fortran-77 Compiler & Runtime Facility	213	15
SVR8004	Fortran-77 Runtime Facility	63	5
SVL8011	Fortran-77 Hex Option	NC	NC
SVL8012	Fortran-66 Compatibility Option for Fortran-77	NC	NC
SVP8008	Debug Support Option	104	20
SVP8009	Cobol-74 Debug Support Option	190	27
SVP8010	Fortran-77 Debug Support Option	229	10
SVD8006	Data Dictionary/Batch	281	35

NA—Not available.
NSC—No separate charge.

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		Monthly License Fee ($)	Optional Support Charge ($)
GCOS 8 SYSTEM (Continued)			
SVD8007	Data Dictionary/Online	125	15
SVD8024	DDE Basic System	1,373	226
SVD8028	DDE Comprehensive Package for TDS	3,575	506
SVD8031	DDE Comprehensive Package for TPE	3,360	474
SVD8033	DDE System Management Facility for TDS	1,484	244
SVD8034	DDE System Management Facility for TPE	1,385	228
SVH8000	Personal Computing Facility	170	30
SVE8032	Software Disk Cache Buffer for DPS88	2,000	100
SVH8001	PDQ Example Query (EQ)	350	40
SVH8002	PDQ Interactive Query (IQ)	270	30
SVH8003	PDQ Comprehensive Report Examination & Display Option (CREDO)	210	25
SVL8013	Cobol-74 Relational Query (RQ)	90	10
SPECIAL SYSTEMS SOFTWARE			
SVL8015	C Programming Language	340	800
SVL8016	C Programming Language Cross Compiler	70	160
SVP8013	Transaction Application Test System (TATS)	500	1,620
SVP8014	Softool Cobol Programming Environment	1,400	8,375
SVP8015	Softool Change & Config. Control	1,500	7,500
SVP8016	Complete Softool	2,500	15,500
SVP8017	Transaction Screen Mgmt. System (TSM)	980	1,920
SVP8018	System-80 Automatic Cobol Program Generator	780	1,840
SVP8019	System-80 Cobol Report Generator	480	1,000
SVU8016	MPCD Disk I/O Performance Analyzer	NA	100
SVU8019	BUSINESS-GRAF	NA	2,700
SVU8020	GRAFMASTER	NA	1,650
SVU8021	Scientific/Engineering Option	NA	1,575
DISTRIBUTED NETWORK SUPERVISOR (DNS) SOFTWARE			
SNC8020	Distributed Network Supervisor	490	86
SNC8021	Network Operator Interface (NOI)	10	5
SNC8022	Cross-Net Load/Dump Facility	10	5
SNC8023	Accommodation Mode, Host Conn. (DPS8)	42	7
SNC8024	Host Connection (DPS 7)	42	7
SNC8028	Multiple Host Connection	20	8
SNC8031	HDLC Primary Network Support	82	15
SNC8033	Primary Network Private Virtual Circuit (Endpoint)	166	29
SNC8034	Primary Network Private Virtual Circuit (Switching)	170	30
SNC8035	TRANSPAC Connection (France) Limited	166	29
SNC8036	TRANSPAC Conn. (France) Extended	20	5
SNC8037	TELENET Connection (USA)	166	29
SNC8038	TYMNET Connection (USA)	166	29
SNC8039	DATAPAC Connection (Canada)	166	29
SNC8040	DDX-P Connection (Japan)	166	29
SNC8041	AUSTPAC Connection (Australia)	166	29
SNC8044	EDWP Connection (Switzerland)	166	29
SNC8045	DN-1 Connection (Netherlands)	166	29
SNC8046	EURONET Conn. (European Economic Community)	166	29
SNC8047	DATEX-P Conn. (West Germany) X.25	166	29
SNC8052	PSS Connection (United Kingdom)	166	29
SNC8053	NPDN Conn. (Scandanavia) X.21 Basic	166	29
SNC8054	NPDN Conn. (Scandanavia) X.21 Ext.	20	5
SNC8056	Extended X.25 Public Network (Greater than 16 Virtual Circuits)	20	5
SNC8057	Asynchronous Terminal Support	NSC	—
SNC8058	VIP Synchronous Terminal Support	NSC	—
SNC8060	Interactive Bisync (3270) Terminal Support	76	14
SNC8061	Remote Batch Bisync (2780) Terminal Support	52	9
SNC8062	Remote Computer Interface Terminal Support	20	5
SNC8065	TRANSPAC Async. Pad Support (France)	20	5
SNC8067	TELENET Async. Pad Support (USA)	20	5
SNC8068	TYMNET Async. Pad Support (USA)	20	5
SNC8069	DATAPAC Async. Pad Support (Canada)	20	5
SNC8070	DDX-P Async. Pad Support (Japan)	20	5
SNC8071	AUSTPAC Async. Pad Support (Australia)	20	5
SNC8072	PSS Async. Pad Support (United King.)	20	5
SNC8073	Logical HDLC	85	15
SNC8074	EDWP Async. Pad Support (Switzerland)	20	5
SNC8075	DN-1 Async. Pad Support (Netherlands)	20	5

NA—Not available.
NSC—No separate charge.

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	DISTRIBUTED NETWORK SUPERVISOR (DNS) SOFTWARE (Continued)	Monthly License Fee ($)	Optional Support Charge ($)
SNC8076	EURONET Async. Pad Support (European Economic Community)	20	5
SNC8077	DATEX-P Async. Pad Support (West Germany)	20	5
SNC8090	GCOS Administration	136	24
SNC8091	GCOS 8 Administration (8MIN)	136	24
SNC8093	Log File Formatter (GCOS/GCOS 8)	NSC	—
SNC8094	DPS 8 Host to Host File Transfer	15	5
SNC8095	DNS for DPS 8/20 to 8/49	396	70
SNC8096	DNS for DPS 7 (Entry Level)	396	70
SCC1220	GCOS 64 FNP Support	15	5
SCU1618	GCOS 64 Distributed File Transfer	15	5

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