Honeywell DPS 88 Series

MANAGEMENT SUMMARY

Honeywell Information Systems has had a policy for a long time of taking into account the needs of their existing users, whenever they plan new products. This is again evident in their latest announcement of a new family of computer systems—the Distributed Processing System 88 (DPS 88). Only two models, the DPS 88/81 and the DPS 88/82, are announced to date; but it is certain this family will see additional new members before too long. Support for their customer base is a policy that undoubtedly will hold appeal for others outside the Honeywell base, who also have a growing investment in software. Initial orders for the DPS 88/81 and DPS 88/82 systems are expected to come from those users who require additional processing power, flexibility and security; and a variety of software aids and migration tools are being made available to them.

The new family is 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.

The DPS 88 incorporates an advanced evolution of current mode logic (CML) technology and liquid-cooled micropackaging in all central system components. About 25 percent of the system logic is dedicated to ensuring system availability and integrity. Other new features of the DPS 88 include the use of 64K-bit MOS memory chips and a 64-kilobyte cache memory (double the size of the DPS 8/70 cache).

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 ▷

Honeywell's top of the line, the DPS 88 family, offers a wide range of processing power, and is part of Honeywell's Distributed Systems Architecture (DSA) approach to networking.

MODELS: DPS 88/81 and DPS 88/82.
COMPETITION: Amdahl 580 series, IBM 308X series, NAS AS/9000 series, and Sperry Univac 1100/90 series.
PRICE: A single-processor DPS 88/81 central system has a purchase price of $2,850,000; and the dual-processor basic DPS 88/82 central system has a purchase price of $4,050,000.
SCHEDULED DELIVERY: Models DPS 88/81 and DPS 88/82 will be delivered in the fourth quarter of 1983.

CHARACTERISTICS

MANUFACTURER: Honeywell Information Systems, 200 Smith Street, Waltham, MA 02154. Telephone (617) 895-6000.

MODELS: DPS 88/81 and DPS 88/82.

DATE ANNOUNCED: October 1982.

DATE OF FIRST DELIVERY: Fourth quarter 1983 for both models.

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 four-bit groups; six-bit, nine-bit, and 18-bit groups; and 72-bit double precision groups. ▶
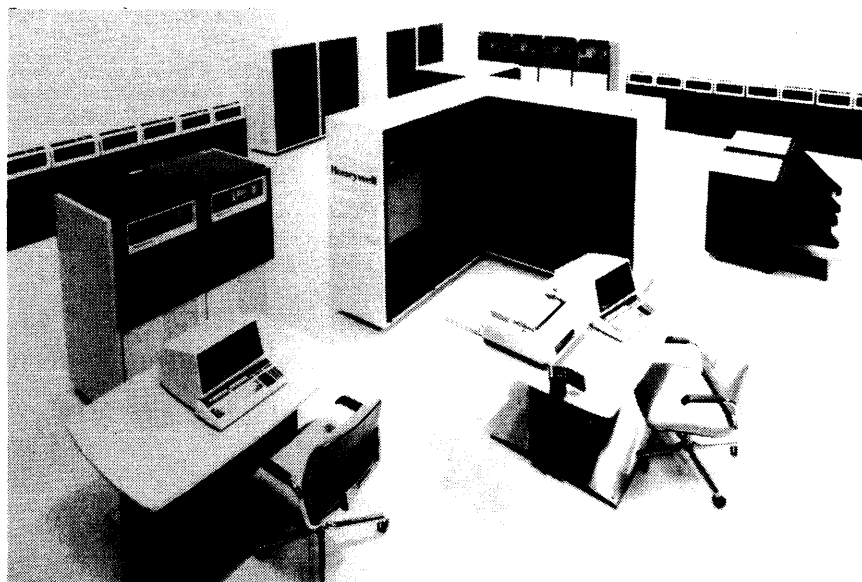
Honeywell's new DPS 88 family was developed in response to large users' increasing need for more processing power. Shown is the DPS 88/81 with up to 64 million bytes of main memory and 64 channel function slots. Automatic monitoring of system components and built-in fault and validation tests help ensure utility-grade reliability, availability, and data integrity.

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process simultaneously; four-way memory interlacing to increase the effective access rate to main memory; native fault testing that can identify logic faults down to the micropackage level, and a system support facility which is a dedicated stand-alone minicomputer that handles all faults, interrupts, test diagnostics and system management.

This new system can support up to 320 satellite processors, over 2,000 timesharing users and over one trillion bytes of mass storage. The DPS Model 88/81 is said to have from three-and-a-half to four-and-a-half times the processing power of the company's previously most powerful single processor system, DPS 8/70. The DPS 88/82, according to Honeywell, is from six to eight times as powerful. Maximum input/output throughput capacity is approximately 12 times the throughput of the DPS 8/70.

The new family operates only under the GCOS 8 operating system to which new enhancements are being added. To Honeywell users of GCOS III, the GCOS 8 operating system offers object-level compatibility, and it supports the full GCOS III job control language. GCOS 8 continues support of Network Processing Supervisor (NPS), General Remote Terminal System (GRTS II), and Distributed Network Supervisor (DNS) communication software that runs on existing Honeywell communications equipment.

Programs that have used system privileges will require some adjustments. 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). Up to 511 different programs can be assigned for processing simultaneously; 477 of these may be user programs. All processing dimensions access data stored in common file structure. Through centralized file storage, up-to-date information is made readily available.

The Honeywell DPS 88/81 is a large-scale single processor system designed to compete with the Amdahl 5860, IBM 3083 Model Group J, National Advanced Systems AS/9050, and Sperry Univac 1100/91. The Honeywell DPS 88/82 is a dual processor system with 16 to 128 megabytes of main memory which is double the capacity of its competitors. The DPS 88/82 will be competing with the Amdahl 5870 and 5880, IBM 3081 Model Group K, National Advanced Systems AS/9070, and Sperry Univac 1100/92.

Competing with Amdahl 580 series, IBM 308X series, NAS AS/900 and Sperry Univac 1100/90 series, the DPS 88 expands the arena for users with requirements for very large systems. In the case of their own users, Honeywell ▷

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 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 of indirect pointer for operands 1, 2, and 3, respectively.

INTERNAL CODE: 9-bit ASCII code is standard.

MAIN STORAGE

STORAGE TYPE: Metallic oxide semiconductor (MOS).

CAPACITY: See Table 1

CYCLE TIME: See Table 1

CHECKING: A 5-bit error-correcting Hamming code is appended to each 36-bit word. 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 systems use a 4-level ring protection scheme that is implemented in system firmware with supporting hardware registers. Each user program segment has an associated segment descriptor that is stored in tables in main memory. Within each segment descriptor are two 2-bit fields that specify the security level required by a user program to execute or write to a particular segment. Hardware also checks that data addresses generated during program execution do not exceed specified boundaries. The segment descriptors also contain two bits that override the ring protection scheme by denying execution or write access to a user program.

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)

▶

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TABLE 1. CHARACTERISTICS OF DPS 88 SYSTEMS

PROCESSOR	DPS 88/81	DPS 88/82
SYSTEM COMPONENTS		
Central Processing Unit (CPU)	1	2
Central Interface Unit (CIU)	1	1 or 2
Main Memory Unit (MMU)	1	1 or 2
Input/Output Transfer Unit (IOX)	1	1 or 2
IOX Logical Channels	62-126	62-252
Channel Adapter Unit (CAU)	1 or 2	1-4
Channel function slots	31-128	31-256
System Support Facility (SSF)	1	1 or 2
Maintenance Consoles	1	1 or 2
System Consoles	1-6	1-12
System Support Unit (SSU)	1	2
Thermal Exchange Pump (TEP)	1	2
Thermal Exchange Air Unit (TEA) (an option only when a chilled water supply is not available to the TEP)	(2)	(4)
No. of network processors	0 to 8	0 to 16
DATANET 8	Yes	Yes
DATANET 6661	Yes	Yes
Central Processor		
Cache memory	Yes	Yes
Size—operand cache	32KB	32KB
Size—instruction cache	32KB	32KB
No. of instructions	351	351
Word size in bits	36	36
No. of words	2048	2048
Main Memory		
No. of units	1	2
Minimum capacity per unit	16Mbyte	16Mbyte
Maximum capacity per unit	64Mbyte	64Mbyte
Cycle time, nanoseconds	750	750
Access time, nanoseconds	225	225
Words fetched per cycle	8	8
Channel Adapter Unit transfer rate	20Mbyte	20Mbyte
Input/Output Transfer Unit (IOX)	·48Mbyte	48Mbyte
Storage Devices for peripheral processor		
No. of unit record devices	1-8	1-8
No. of disk drives	1-32	1-32
No. of magnetic tape units	1-16	1-16

▷ estimates the volume of data that these users must process is experiencing a 20 to 40 percent compound annual growth. With users spreading their resources geographically more and more, even greater pressure is exerted on computer manufacturers, such as Honeywell, to furnish secure and "fail-safe" distributive processing networks.□

▶ • 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.

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 free-standing dedicated maintenance processor with special hardware and software that manages the diagnostic and resource management. The system consoles and maintenance consoles are connected to and controlled by the System Support Facility. System Consoles may also be connected to front-end network processors.

The new architecture employed in the DPS 88 microprogrammed central processor is a five-stage pipeline design. The design increases the system performance by allowing as many as five instructions to be in process simultaneously. The central processor consists of:

• Two separate high speed cache memories, each providing 32K bytes of storage, the instruction cache (I-cache) and the operand cache (O-cache). The I-cache stores blocks of unmodified instructions and indirect words, while the O-cache stores blocks of operands 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.

• An instruction unit that queues instructions and performs a five-step instruction preparation and execution process. Each stage of the pipeline works on its own to decode instructions and generate memory addresses.

• Five specialized execution units that are designed to optimize the process by which the system components accomplish a particular function. 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 ▶

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

• Bringing the central processor 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 startup and restart through reconfiguration tasks.

The *Input/Output Transfer Unit* acting in conjunction with the Channel Adapter Unit 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 Input/Output Transfer Unit 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 the IOX. Once initiated, the IOX and 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 System Support Facility. Two channel types are available: the Peripheral Subsystem Interface (PSI) and the Direct Interface (DI). The Peripheral Subsystem Interface (PSI) channels are used to attach mass storage, magnetic tape, and unit record subsystems; the Direct Interface (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 stand-alone computer that logically connects to all central system components. Acting as the system monitor, the SSF checks processing and hardware operation and diagnoses malfunctions online. The SSF functions as the hypervisor with a set of hardware logic and software that supports the central system resource sharing, as well as protection mechanisms between the operating system and the functional test system. On the software side SSF performs the following functions:

• Initializes blocks of memory in the Main Memory Unit for use by the operating system or test software.
• Loads a separate copy of executable processor instructions (hyperswitchers) 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 input/output channels allocated to the operating system, using configuration information provided by the system administrator.
• Cooperates in system restart following a shutdown.

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

• A mass controller, providing microprogrammed support of two removable media drives.
• A multiple-device controller, providing microprocessor control of the SSF flexible disk drive.
• A specialized interface, allowing direct access to DPS 88 system components via a logic interface within the system support unit.
• A multiline communications processor, permitting microprocessor control of system consoles and alternate 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, although it can be used as an alternate system initialization device if the mass storage controller is inoperative.
• 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 can be configured on each SSF.

The *System Support Unit (SSU)* is attached to the CPU, 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 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.

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TABLE 2. MASS STORAGE

	MSU0402	MSU0451	MSU0500	MSU0501
Maximum units per dual-or-single channel MSP0603	16 or 32	16 or 32	0 or 8	0 or 8
Maximum units per single-channel MSP0607/ MSP0611	16	16	8	8
Maximum units per module for dual-channel MSP0609/MSP0612	32	32	15	15
Mixed combinations of units	0-16	0-16	0-15	0-15
Capacity:				
Formatted characters (millions)	117	235	940	1651
Formatted 9-bit bytes (millions)	78	156	626	1101
Tracks/recording surface	411	815	1630	1686
Peak/effective transfer rate (thousands):				
Characters per sec.	1074/922	1074/922	1597/922	1597/1474
9-bit bytes per second	716/614	716/614	1065/614	1065/983
Average access time (milliseconds)	25	30	25	25
Average latency	8.3	8.3	8.3	8.3
Media	Removable	Removable	Fixed	Fixed

▶ The *System Consoles* are modular free-standing units; models CSU8801 and CSU8802 offer features to help simplify system interaction and increase processing throughput. The CSU8801 model with 15 inch monitor/keyboard can be configured as the second, fourth, and sixth system console per SSF. The CSU8802 model with 15 inch monitor/keyboard can be configured as the third and fifth system console per SSF. Both system consoles offer the DPS 88 operators the following capabilities:

- Online recall of recent messages.
- Offline retrieval of older messages.
- Optional hardcopy messages.

CONTROL STORAGE: See table 1 on DPS 88 system characteristics.

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 351 instructions and exceeds the instruction complement of the DPS 8 which is 289 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 diagnose 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 (IOX), 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 raised floor or equivalent. The room ceiling must be 8.5 feet above the raised floor, with at least 8 to 12 inches between subfloor and raised floor. Power requirements must meet these specifications: a voltage of 208, 240, 440, or 480 VAC ± 10 percent for the motor generator set; 60 Hertz nominal with 60.5 maximum and 59.4 minimum frequency; 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 F. 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 F. or the relative humidity more than ± 5 percent.

CONFIGURATION RULES

The DPS 88 Family consists of two models: the DPS 88/81 and DPS 88/82. The basic DPS 88/81 central system includes a Central Processing Unit (CPU), a Central Interface Unit (CIU), a Main Memory Unit (MMU) with 16 megabytes of main memory, an Input/Output Transfer Unit (IOX) with 62 logical channels, a Channel Adapter Unit (CAU) with 31 channel function slots, a System Support Facility (SSF) and Maintenance Console, a Central System Console, a System Support Unit (SSU), a Thermal Exchange Pump (TEP), and Two Thermal Exchange Air (TEA) units, an option used when a chilled water supply is not available to the TEP. 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. (Thousands)
MTU0500	7	556/800	NRZI	125	52/75
MTU0500	9	556/800/1600	NRZI/NRZI/PE	125	70/100/200
MTU0610	9	800/1600/6250	NRZI/PE/GCR	200	100/200/1250
MTU0630[1]	9	800/1600/6250	NRZI/PE/GCR	75 or 125	60-100/120-200/ 468.7-7781.2

(1) Speeds dependent upon features used.

▶ basic system may be expanded to 64 megabytes of memory in 16 megabyte increments. The IOX may be expanded from 62 to 126 logical channels. An additional CAU with 31 channel function slots may be added and up to five more system consoles may be added to the DPS 88/81. As processing needs increase, the DPS 88/81 can be field upgraded to the DPS 88/82.

The maximum DPS 88/82 consists of two Central Processing Units (CPUs), two Central Interface Units (CIUs), two Main Memory Units (MMUs) with 128 megabytes of main memory, two Input/Output Transfer Units (IOXs) with 252 logical channels, four Channel Adapter Units (CAUs) with 256 channel function slots, two System Support Facilities (SSFs) and two Maintenance Consoles, twelve System Consoles, two System Support Units (SSUs), two Thermal Exchange Pumps (TEPs), and four Thermal Exchange Air (TEA) units.

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 DPS 88:

- Front-end Network Processors
- Terminals
- Peripheral Processors
- Disk and Tape units
- Card readers and Punches
- Online and Offline Printers

DPS 88 Peripheral subsystems communicate with the central system through the Channel Adapter Unit and Input/Output Transfer Unit. 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

A DPS 88 mass storage subsystem is comprised of a free-standing Mass Storage Processor (MSP) and up to 32 disk units (MSU). The single/dual channel MSP0603, the single channel MSP0609/MSP0612 can be configured. Multiple mass storage subsystems are permitted on the DPS 88.

Capacity: See Table 2

Timing: See Table 2

INPUT/OUTPUT UNITS

MAGNETIC TAPE: The Honeywell DPS 88 system utilizes a magnetic tape subsystem comprised of a magnetic tape processor (MTP) and up to 16 magnetic tape units (MTU).

The single or dual channel MTP0610 or MTP0611 can be configured. Provision has been made for multiple magnetic tape subsystems to be utilized.

Magnetic Tape Characteristics: See Table 3.

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

CARD EQUIPMENT: The DPS 88 System has four card equipment models available. Two readers, CRU0501 and CRU1050; card punch PCU0121 and a reader/punch CCU0401. The CRU0501, CRU1050, and CCU0401 use a photoelectric/column by column/serial reading technique. Operator-convenient features on all models include a large input hopper and output stacker, a color-coded display panel and push-button control.

Card Equipment Characteristics: See Table 4

PRINTERS: There are two line printers offered, the PRU1200 and PRU1600. Both are 136-character belt devices that operate at 1200 lpm and 1600 lpm respectively. Among the features available with these printers are several character sets, ability to handle single-part or multi-part originals, clearly visible indicators of low paper, paper out-of-stock, buffer overflow and feeder error. A print belt provides for smearless printing and precise character alignment. There is a choice of four printer belts.

Printer Characteristics: See Table 5

PAGE PRINTING AND PAGE PROCESSING SUBSYSTEMS: Two systems, which can be used to complement the DPS 88 environment, are the Page Printing System (PPS) and the Page Processing System (PPS II). The Page Printing System operates offline under control of a pre-programmed DPS 6 computer, reading print-image magnetic tape and converting into printed output. Fixed information, such as letterheads, logos, column headings etc. can be formed. Expanded character sets are available to handle letter-writing applications and to allow simple forms to be designed without the use of forms cylinders. PPS also supports competitive-vendor ATS textwriting systems.

The more powerful system is the PPS II. This Page Processing System is capable of online, remote or offline operation. With the addition of a front-end processor ▶

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TABLE 4. CARD EQUIPMENT

Card Equipment	Columns	Speed, Cards/Min.	Input Hopper Capacity	Output Stacker Capacity	Options
CRU0501 card reader	80	500	1000	1000	
CRU1050 card reader	80	1050	3000	2500	51-column reading (CRF0003)
PCU0121 card punch	80	100-400	1200	1300	
CCU0401 reader/ punch	80 80	400 100-400	1200 1200	1300 1300	

coupler, data is transmitted online directly from the Honeywell host to PPS II via a high speed channel. This data is processed and sorted on the PPS II disk, and then passed to the nonimpact printer. If a multiline communications processor and a communications-Pac Broadband Adapter are attached to the PPS II, print data can be received from the host via communications lines. Remote operation is then identical to online operation. Offline, the system reads seven- or nine-track magnetic tape from the host and transfers data to the nonimpact printer.

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 solid-state, 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 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 co-exist 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 2048K), a 512K-byte diskette (a second 512K diskette is optional), and can accommodate from 16 up 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 two, eight, or sixteen DCF8007 Channel Interface Bases (CIB) depending on the line configuration. Each CIB supports up to four Channel Interfaces, each of which 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-232C Channel to 9600 bps (DCF8011).
- Dual Asynchronous EIA RS-232C Channel to 9600 bps (DCH8012).
- Single HDLC EIA RS-232C 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 9,600 bps; FDX only (DCF8036).

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TABLE 5. PRINTERS

Printers	Printing Speed (lpm)[1]	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Chars./Inch	Form Size (fanfold)
PRU1200	1200	136 or 160	10	6 or 8	4 in. to 22 in. width x 3 in. to 22 in. length
PRU1600	1600	136 or 160	10	6 or 8	4 in. to 22 in. width x 3 in. to 220 in. length

(1) Based on a 48-character set.

► SOFTWARE

The Honeywell GCOS 8 (General Comprehensive Operating Supervisor 8) is the only operating system utilized by the DPS 88/81 and DPS 88/82 models. Introduced in 1979 with the DPS 8 systems, GCOS 8 is a product of evolution with a genesis dating back to the early 1960's. GCOS 8 is a multi-processing, multi-programming, 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 users with GCOS can be upgraded to GCOS 8, and user programs which have been running under GCOS will run unchanged under GCOS 8.

GCOS 8 is a user-defined, user-oriented, communications-related operating system with multidimensional, multipro-gramming, and multiprocessing 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 each can execute any program. GCOS 8 can address up to 128 megabytes of real memory and up to 8 trillion bytes of virtual memory. Up to 477 user programs of up to 1 megabyte each can be executed concurrently. Approximately 1600-2400 time-sharing users can operate simultaneously, and GCOS 8 can use up to 128 megabytes of memory for this activity. 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 multi-level 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.

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. ►

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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.

DISTRIBUTED NETWORK SUPERVISOR (DNS): DNS has been designed specifically for use in the DATANET 8 Front-End Processor, and is part of a new 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 satellite to host support for DM-IV Transaction Processing. 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 7100/7200/7200S/ 7700/7700R/7800 and VTS7740. Also supported is the Distributed System Satellite (DSS), a hardware/software system that allows a DPS 6 or Level 6 system to function as a satellite processor and to communicate with a DPS 88 host in a DSA network.

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 50,000 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 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 teletype-writer 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 ▶

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▶ Report provides reports on the accumulated utilization of the time-sharing system resources. Personal Computing Facility is now available under time-sharing offering "spread sheet 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 on Level 2 except Report Writer and Inter-program Communication, which are implemented on Level 1.

Time-Sharing Fortran is a full implementation of ANSI Fortran IV with extensions. Fortran-77 is a full implementation of the 1978 ANSI standard, and supports the Fortran IV language essentially unmodified. Fortran IV extensions include nonstandard returns from subroutines; optional code optimization; multiple entry points; switch test subroutines; memory-to-memory conversion; seven array dimensions; character type; generalized expressions as subscripts; extended TYPE, PARAMETER, and IMPLICIT statements; list-directed and direct-access I/O; mixed-mode arithmetic; quoted character constants; and Boolean functions. Both Fortran processors compile programs in local, remote job entry, or time-sharing mode and ensures compatibility between source programs developed in one environment and used in another. Data Manipulation Language (DML) verbs for accessing DM-IV and I-D-S/II databases are available.

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 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.

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 is the evolution of 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. ▶

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▶ 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.

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 non-computer-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 File Management Supervisor (FMS) provides powerful file management capabilities, including multi-level 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 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 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 oeprations. 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 ANS Cobol-74, and file integrity protection for normal and abort processing.

Integrated Data Store (I-D-S/I and I-D-S/II) are enhanced versions of I-D-S, a data base management system originally developed by GE. I-D-S/II marks the beginning of an evolution of I-D-S toward conformance with the recommendations of the CODASYL Data Base Task Group. I-D-S/II is fully integrated with Honeywell's Cobol-74 compiler, and user interfaces are also implemented for Fortran. I-D-S/II is described in detail in Report 70E-480-01.

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.

TOTAL Central is a widely used proprietary data base management system that uses data set relationships to establish a network structure among records in different data files in an integrated and nonredundant manner. TOTAL Central's network structure provides the ability to directly interrelate a data record with up to 2500 other data record types in the data base.

The TOTAL Central system design supports data dependence; only the data elements used by a program need be described for that program. New data elements and records may be added to the data base without affecting existing programs. The TOTAL system is described in detail in Report 70E-132-01a.

The Common Files Facility 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 systems(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.

ELAN: The Honeywell Error Logging and Analysis system is a software system that works in conjunction with TOLT, GCOS, 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.

TOTAL ON-LINE TESTING: TOLT is a test and diagnostic system that runs under GCOS. Its objective is to improve the ▶

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► system's reliability and availability through the use techniques. TOLT monitors and saves all error status information, makes periodic surveillance checks of various hardware modules, and calls in specific diagnostic tests and on-line troubleshooting programs.

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 Mangement 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 Applications

- General Ledger
- Accounts Payable
- Accounts Receivable
- Payroll

Miscellaneous Application Programs

- Individualized Mathematics Instruction/66 (IMS/66)
- SCRIBE/66 Scheduling System
- HCSS/66 (Hospital Computer Sharing 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 two 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 88/81 central system includes a central processing unit, a central interface unit, a 16 million-byte main memory unit, an input/output transfer unit with 62 logical channels, a channel adapter unit, 31 channel function slots, a system support facility, a system console/table/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, except it has two central processing units, two system support units, and two thermal exchange pumps. This basic central system has a purchase price of $4,050,000 and a monthly lease of $141,100 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	8,718

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. ►

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► Education services include standard courses, advanced professional training, multi-media 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. Multi-media 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 1-year, or 4-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 full service coverage (24 hours, 7 days per week) the additional charge is 48% of the base maintenance charge.

Honeywell's Distributed Maintenance Services provides users with remote testing and diagnostic facilities. Headquartered in Phoenix, Arizona, DMS Includes a Response Center for toll-free 24-hour a day contact with Honeywell; the Technical Assistance Center, which coordinates all activities; a Logistics Inventory Data System, for rapid location of parts; Service Account and Field Engineering representatives; an Alert system to notify FE management of special problems; Remote Access Program software for trouble-shooting; a systems optimization and monitoring program to evaluate and measure system performance; a network analysis program to solve communications network problems; and automatic software updating.

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	1-Year Lease	4-Year Lease	SPSS
PROCESSORS						
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
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 Memroy Module	400,000	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	103	130	110	—
CSU8802	Additional System Console with 15" CRT and Keyboard for 3rd and 5th System Console per SSF	4,640	36	166	140	—
CSF8803	Large Screen Monitor Interface Feature for CSU8801/8802/Factory installed only.	400	NC	16	13	—
CSF8804	System Console Table (No control pod) for CSU8801/8802	550	NC	NA	NA	—
CSF8801	120 cps Printer for System Console	3,390	50	121	103	—
CSF8802	120 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	NC	NA	NA	—
TIF0200	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. Ride-Through, 62.5VA, 60Hz, 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 (DPS 88 Systems only)	2,500	NC	NA	NA	—
MXF8802	Exchange of Unit Record Processor Attachment Feature (DPS 88 Systems only)	2,500	NC	NA	NA	—
MXF8803	Exchange of Network Processor Attachment Feature (DPS 88 Systems only)	1,500	NC	NA	NA	—

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*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.

Honeywell DPS 88 Series

EQUIPMENT PRICES

	Purchase Price	Monthly Maint.	1-Year Lease*	4-Year Lease*
MASS STORAGE				
MSU0402	Removable-Disk Mass Storage Unit, 100M bytes	$20,805	$113	$880	$757
MSU0451	Disk Mass Storage Unit, 200M bytes; requires MXF6002 IOM data rate expansion and includes rotational position sensing	27,047	113	1,140	950
MXF6002	IOM Data Rate Expansion Unit	23,720	47	621	552
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
MSF1023	Device Adapter for MSU0402/MSU0451	11,475	32	423	366
MSU0500	Dual Fixed Disk Mass Storage Unit, 940 million characters; includes disk and RPS	38,850	172	1,386	1,154
MSU0501	Dual Spindle Fixed Disk Drive; 1.1 billion bytes	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
MSF1024	Device Adapter for MSU0500	20,000	30	750	648
MSF1034	Drive Expansion for MSU0500; required for more than 8 MSU0500s	12,690	14	335	308
MSF1037	Device Adapter for MSU0500	—	—	—	—

MASS STORAGE

	Purchase Price	Monthly Maint.	1-Year Lease*	4-Year Lease*
MSA1140	Unit Addressing for MSU04xx Units (Max 4)	4,100	16	156	130
MSA1141	Unit Addressing for MSU05xx Units (Max 4)	6,000	16	219	180
MSA1142	Unit Addressing for MSU04xx Units (Max 4)	4,100	18	146	122
MSA1143	Unit Addressing for MSU05xx Devices (Max 8)	6,300	18	215	177
MSF0500	Spare Head Disk Assembly	12,340	—	—	—
MSF0501	Spare Head Disk Assembly	15,808	—	—	—
MSF1140	Control Adapter for MSU04xx Devices (Max 1)	3,500	—	109	89
MSF1141	Control Adapter for MSU04xx Devices (Max 1). Required for configuring MSU0402/0451	6,000	—	187	152
MSF1142	Unit expansion for additional MSU05xx (Max 1)	4,000	—	125	105
MSF1143	First Switched Channel Feature to FNP (Max 1). Required for NPS software in FNP	8,237	15	283	233
MSF1144	Switched Channel Feature to Central System	8,237	15	283	233
MSF1150	Second Switched Channel Feature to FNP (Max 1)	8,237	15	283	233

MAGNETIC TAPE EQUIPMENT

	Purchase Price	Monthly Maint.	1-Year Lease*	4-Year Lease*
MTP0611	Magnetic Tape Processor; DPS 8 (1x8); includes IOM channel; for MTU0400/0411/0412/0500/0610	29,400	162	1,080	905
MTU0500	Magnetic Tape Unit (125 ips)	17,441	153	725	613
MTU0610	Magnetic Tape Unit (200 ips)	21,000	146	801	677
MTU0630	Magnetic Tape Unit (75 or 125 ips)	14,815	130	593	505
Features for the MTU0500:					
MTF0011	Nine-track, 1600 bpi	3,060	21	94	81
MTF0012	Nine-track, 800/1600 bpi	4,137	65	198	171
MTF0013	Seven-track, 200/556/800 bpi, NRZI	6,300	106	305	260
MTF0015	Seven-track, 200/556 bpi	3,060	21	94	81
MTF0016	Seven-track, 556/800 bpi, NRZI	3,213	38	139	120
MTF0017	Nine-track, 200/556/800/1600 bpi	6,300	106	305	260
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 MTU0400/0410/0500/0600/0610/0630; 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	114	95

*Includes equipment maintenance.

Honeywell DPS 88 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	1-Year Lease*	4-Year Lease*
► MAGNETIC TAPE EQUIPMENT (Continued)					
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
PUNCHED CARD/PRINTER EQUIPMENT					
URF0040	Unit Record Addressing Expansion for URP0600/0601/0602 and URP8000; required if more than four devices used or if drum and belt printers are mixed; accommodates four additional devices	983	2	32	26
URA0050	Addressing capability for PCU0120/0121 and CCU0401; one required for each device	4,253	4	140	114
URA0052	Addressing capability for CRU1050; one required for each device	7,569	43	279	238
URA0054	Addressing capability for PRU1200; one required for each device	7,167	18	224	204
URA0055	Addressing capability for PRU1600; one required for each device	7,167	18	224	204
URA0056	Addressing capability for CRU0501; one required for each device	265	NC	8	6
UNIT RECORD PROCESSORS & FEATURES					
URP0600	Unit Record Processor, free-standing, includes basic 4-port adapter and IOM channel	26,585	40	870	732
URF0040	Unit Record Addressing capability; 4 additional port attachments; expands URP to maximum of 8 ports; also required if printer types are mixed in one subsystem (PRU1200 and PRU1600 are considered one type in this definition)	983	2	32	26
LINE PRINTERS					
PRU1200	Printer (1200 lpm)	44,420	386	2,045	1,779
PRU1600	Printer (1600 lpm)	64,940	538	2,910	2,472
PRF0022	24 Additional Print Positions for PRU1600	2,610	15	104	86
PUNCHED CARD EQUIPMENT					
CRU0501	Card Reader (500 cpm)	19,500	114	684	568
CRU1050	Card Reader (1050 cpm)	26,555	224	1,136	961
CCU0401	Card Reader/Punch (100-400 cpm)	29,594	219	1,228	1,032
CRF0003	51-Column Read Feature (80-col.) for CRU1050	2,079	6	75	62
CRF0005	Mark Sense Option for CRU1050	7,416	40	198	171
URA0050	Addressing capability for PCU0121 and PCU0401	4,253	4	140	114
URA0052	Addressing capability for CRU1050	7,569	43	279	238
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					
DCF6609	Channel Interface Base; accommodates all channel types except HDLC	1,501	8	52	49
DCF6611	Dual Synchronous Channel Package, EIA-RS-232-C	1,450	7	56	46
DCF6612	Dual Asynchronous Channel Package, EIA-RS-232-C	590	4	24	21
DCF6613	Automatic Call Unit, Dual Channel	1,180	4	43	36
DCF6614	MIL STD 188C Synchronous Channel	1,501	8	58	49
DCF6618	Dual Binary Synchronous Channel Package	1,450	7	56	46
DCF6619	Broadband Channel	3,056	12	116	96
DCF6620	HDLC Voice-Grade Channel	2,573	11	98	82
DCF6621	Bisynchronous Broadband Channel	3,056	12	116	96
DCF6624	Direct Connect Capability, asynchronous	350	1	12	10
DCF6625	Direct Connect Capability, synchronous	480	1	16	14
DCF6627	Broadband Channel, CCITT V.35 to 50,000 bps	3,430	12	129	106
DCF6927	Universal Modem Bypass, Synchronous to Asynchronous; to 20.8K bps	415	11	28	22
DCF6607	Channel Interface Base	1,651	9	65	54
DCF6610	20mA Current Loop-Dual Channel Package	1,180	4	43	36
DCF6615	MIL-STD 188C Asynchronous Dual Channel	1,501	8	58	49 ►

Honeywell DPS 88 Series

EQUIPMENT PRICES

	Purchase Price	Monthly Maint.	1-Year Lease*	4-Year Lease*
OPTIONS FOR DATANET 6661 PROCESSOR (Continued)				
DCF6616 MIL-STD 188C Broadband Channel	1,501	8	58	49
DCF6617 MIL-STD 188C HDLC Channel	2,573	11	98	82
DCF6622 HDLC Broadband Channel	3,056	12	116	96
DCF6623 HDLC Channel, CCITT-V.35	3,430	12	129	106
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	1,040	868
OPTIONS FOR DATANET 8 PROCESSOR				
DCM8004 Additional 256K bytes of memory	7,000	70	288	247
DCE8003 Processor Power Module Enhancement	20,200	110	740	620
DCE8002 Communications Line Expansion from 16 to 64 lines	3,000	5	98	80
DCE8004 Communications Line Expansion from 64 to 128 lines; requires DCE8002/8003	5,000	10	166	136
DCE8005 Additional 512K diskette unit	1,785	18	73	63
DCE8006 DPS 88 Host Connection; maximum of four	8,000	65	314	267
DCF8007 Channel Interface Base; maximum of 16	2,500	14	92	77
DCF8008 30 cps console for DCU8010	2,520	54	132	117
DCF8006 120 cps console for DCU8010	2,888	92	182	165
DCF8011 Dual Synchronous Channel; EIA RS-232-C; to 9600 bps	1,500	8	54	45
DCF8012 Dual Asynchronous Channel; EIA RS-232-C; to 960 bps	1,000	5	36	30
DCF8020 HDLC EIA RS-232-C Channel; to 19,200 bps	1,500	8	54	45
DCF8022 HDLC Wideband Channel; to 56K bps	3,000	16	109	91
DCF8023 HDLC Wideband Channel; CCITT V.35; to 56K bps	3,000	16	109	91
DCF8024 Direct Connect Capability, asynchronous or synchronous; to 9600 bps	350	2	13	11
DCF8026 Universal Modem By-Pass, asynchronous or synchronous; to 20.8K bps	415	2	15	12

SOFTWARE PRICES

GCOS 8 SYSTEM		Monthly License Fee	Optional Support Service
SVD8001	DM-IV Fortran Subschema Translator Option	133	11
SVS8002	DM-IV TP Facility	1,543	186
SVP8003	DM-IV QRP Option	417	66
SVP8004	DM-IV PLP Option	292	50
SVS8003	DM-IV TP Comprehensive Facility	3,061	429
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
SVL8004	Host Resident Program Development Facility for L6	445	88
SVL8005	Host Resident Advanced Fortran Facility for L6	237	46
SVL8006	Host Resident Cobol Facility for L6	237	46
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	91	15
SVD8002	I-D-S/I Facility	1,041	110
SVL8008	Cobol-88 Compiler & Runtime	306	39
SVP8006	MDQS/II Facility	612	117
SVP8007	MDQS/IV Facility	1,058	212

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SOFTWARE PRICES

GCOS 8 SYSTEM (Continued)		Monthly License Fee	Optional Support Service
SVS8006	TDS Facility	1,601	210
SVS8007	TPE Facility	561	55
SVD8005	I-D-S/I Data Query Option	167	33
SVV8000	Coexistence IDS/II Facility	NC*	NC*
SVV8001	Coexistent IDS/II DB Converter	NC*	NC*
SVD8003	Indexed Sequential Processing Facility	28	6
SVS8009	DM-IV TP System Management Facility	996	203
SVU8003	DM-IV TP Forms Option	278	55
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	1,157	203
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	312	39
SVD8007	Data Dictionary/Online	139	17
SVD8024	DDE Basic System	1,525	251
SVD8028	DDE Comprehensive Package for TDS	3,972	562
SVD8031	DDE Comprehensive package for TPE	3,733	527
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

*Licensed for use without separate charge to a user who has acquired his central system from Honeywell.
**Charge varies relative to Hardware Central System Power (see Hardware Price Catalog for Charges). ■