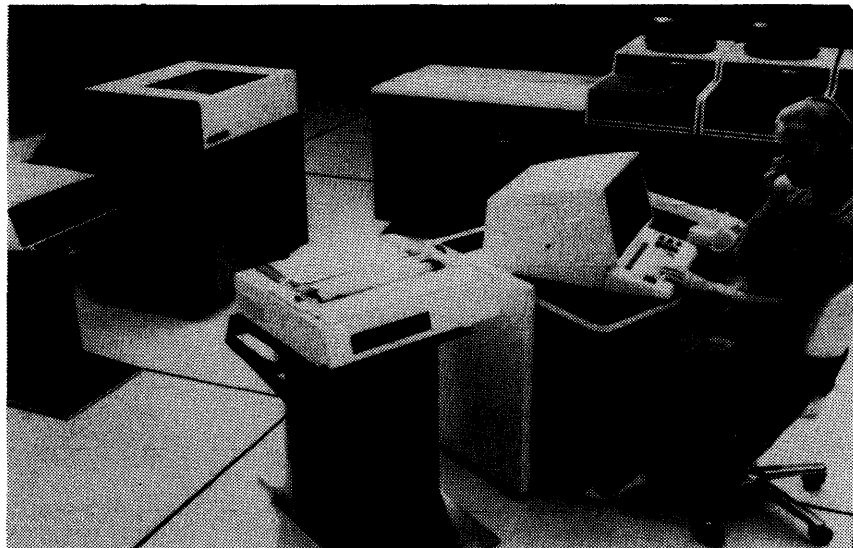# Honeywell DPS 7 Series

MANAGEMENT SUMMARY

The DPS 7 Series hardware and software is just another example of the importance Honeywell places on standardizing and providing upward mobility for their users. Flexibility in configuring and accomodating a wide range of applications is possible with the DPS 7 systems. Because change is so much a part of the distributed processing environment these systems are designed with change in mind.

Introduced in the United States as a medium-range product line, the DPS 7 Series is based on a similar product developed by Cii Honeywell Bull in France. U.S. users first took delivery of their systems in 1982.

Priced competitively, these systems afford new users a wide range of equipment to select from, and a powerful operating system. For its own users, Honeywell has positioned the DPS 7 to provide an upward-compatible growth path for Level 62, Level 64, and Series 200/2000 users. The use of current mode logic (CML) technology and an improved packaging technique called micropackaging is said to double the DPS 7's performance over the current Level 64/DPS-330 while reducing the space it requires to one-third. Now that the Level 64 systems are no longer actively marketed (although still supported) by Honeywell, the DPS 7 appears destined to fill the gap between the firm's DPS 6 family of 16- and 32-bit systems and its large-scale DPS 8 processors, a niche traditionally occupied by the Level 64. Honeywell has made certain that the transition from Levels 62 and 64 and Series 200/2000 to the DPS 7 is as easy as possible. Level 64 applications can move directly to the DPS 7 without modification. Level 62 and Series 200/2000 users have several transition aids available to make the change easier. ▷

The Honeywell DPS 7 Series have been designed primarily to serve as either host processors or remote satellite processors in a distributed processing environment. Positioned as a medium-range family, these systems offer upward mobility within the family, and to Level 62 and Level 64 users. Throughout the DPS 7 line, system upgrades can be performed onsite, without central processor swap-outs or major disruption of operations. The DPS 7 Series also offers users a wide variety of input/output configurations. Up to 271 communications lines can be supported.

MODELS: DPS 7/35, 7/45, 7/55 and 7/65.
CONFIGURATION: The DPS 7 systems can have from one to four megabytes of memory, up to 20.8 billion bytes of disk storage, and up to 16 tape drives, 10 unit record devices, and up to 271 communications lines.
COMPETITION: Burroughs B 2900, B 3900, and B 5900; Digital Equipment DECSYSTEM-20; IBM 4331-11 through 4341-1; NCR V-8455 Group II, and V-8555 Group II through V-8595 Group II; Univac System 80, Series 90, and 1100/60 Series.
PRICE: Purchase prices range from $94,200 for the DPS 7/35 central processor subsystem to $256,700 for the DPS 7/65.

CHARACTERISTICS

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

A typical small DPS 7 configuration includes the operator console and printer plus (left to right) a diskette drive, high-speed line printer, the DPS 7/35 central processor, and three disk drives. The DPS 7 has from one to four megabytes of memory, and supports a wide variety of peripheral devices.

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▷ PROCESSORS AND PERIPHERALS

The four DPS 7 models, the DPS 7/35, 7/45, 7/55, and 7/65 feature a single central processor with substantial use of microcoding to implement system functions. Performance is said to be comparable to IBM's 4331-11 up through its 4341-1. The two smaller systems have a central processor cycle time of 330 nanoseconds while the DPS 7/55 and the top-end DPS 7/65 have a 140-nanosecond cycle time. Main memory sizes range from one to two megabytes in the DPS 7/35, one to four megabytes in the DPS 7/45, and two to four megabytes in the DPS 7/55 and 7/65. The memory read and write cycle times are 355 nanoseconds and 290 nanoseconds, respectively. The systems can have from two to eight high-speed channels, depending on the model. Each model, except for the DPS 7/65, can be field upgraded to the power level and capacity of the next higher system.

DPS 7 systems are networks of specialized processors that operate simultaneously, and are composed of seven processing elements, a control store, and a processor bus. This processing "system" is connected with the central bus, which also services main memory and the input/output processors. Major system functions such as task management, addressing, and data protection are implemented in firmware, providing a further performance boost. Peripheral devices are connected to the I/O processors, which have their own control stores, logic units, and main memories. Each peripheral subsystem (processor and devices) is then connected to the CPU via a high-speed I/O channel. This distributed architecture enables various subsystems to operate simultaneously, without tying up the main processor.

A wide variety of I/O configurations is possible with the DPS 7. Each processor has an integrated Service and Unit Record Processor (SURP) that can handle five unit record devices (with an option for five more on an additional URP) and an optional communications module that provides 15 communications lines. Up to 20.8 billion bytes of on-line storage can be configured using separate mass storage processors and three different disk subsystems, including a new 1.2-billion byte dual-spindle unit, the MSU0555. As many as 16 tape drives can be connected to the DPS 7. The DATANET 8 front-end processor can be used with the DPS 7 to develop distributed networks that conform to Honeywell's Distributed Systems Architecture (DSA). Up to 256 communications lines can be connected this way. Details on the various DPS 7 I/O processors and peripheral subsystems are summarized in the Characteristics section of this report.

SOFTWARE

The DPS 7 operates under the Level 64 General Comprehensive Operating Supervisor (GCOS). GCOS 64 is a virtual memory, multi-tasking operating system, and is implemented in hardware, firmware, and software in all DPS 7 models. Parts of it reside in the memories of the input/output processors, enabling these controllers to function independently of the central processor. GCOS ▷

▶ CURRENT MODELS: DPS 7/35, 7/45, 7/55, and 7/65.

DATE ANNOUNCED: October 14, 1981.

DATE OF FIRST DELIVERY: DPS 7/45, 7/55, and 7/65—1st quarter 1982; DPS 7/35—3rd quarter 1982.

DATA FORMATS

BASIC UNIT: 8-bit byte plus one parity bit. The data paths are four bytes (32 bits) wide.

Data can be interpreted as binary, decimal, hexadecimal, or alphanumeric. Data bits are interpreted in groups of four (packed or unpacked decimal data) or eight (alphanumeric EBCDIC), or in strings of between 16 and 64 (binary digits). The strings can be interpreted as signed for fixed-point binary numbers and also as floating-point operands with single- (16-bit) or double- (32-bit) precision formats.

INTERNAL CODE: EBCDIC.

MAIN STORAGE

Memory is organized into consecutively numbered byte locations. Four-byte blocks are always accessed regardless of operand size. Halfword (16-bit) operands must begin on even-numbered byte locations, and full-word (32-bit) and double word (64-bit) operands must begin on byte locations divisible by four.

TYPE: 16-bit MOS chips. Current Mode Logic (CML), a fast, low power, low heat technology is used. CML has a propagation time of one nanosecond per logic port. In addition, the DPS 7 uses a multilayer micropackaging technique that allows 10,000 to 15,000 functions per board.

CAPACITY: See Table 1.

CYCLE TIME: See Table 1.

CHECKING: Each item of data stored in memory units, and control store is accompanied by a Hamming code (seven bits for every 4 data bytes) which permits the correction of single-bit errors and the detection of double-bit errors. Data paths, and particularly, the bus, perform parity checks to ensure data integrity. All registers and calculation circuits include a key check.

STORAGE PROTECTION: The DPS 7 protects every segment individually with an automatic system of rings and protection levels. This protection system, implemented by hardware and firmware, protects segments on the basis of the information they contain rather than their physical location.

The main processor, while executing a process, may be at one of four levels of privilege, called "rings." Rings are numbered from zero to three, with zero being the most privileged. A ring number is allocated to each segment when it is created and, when the process is entered, the main processor adopts this ring number. Each segment is allocated three protection levels, one for each possible use: read, write, or execute. Each level can be anywhere within the range of zero to three. At every reference to an address in a segment, the protection level for the relevant type of use is checked against the current ring number of the main processor. Access is only allowed under the following conditions: for read and write access, the ring number is less than or equal to the protection level; for execute access, the ring number is within the range between the write and execute protection levels. At linking time, the programmer specifies protection levels; this feature controls access to process segments from other active programs. ▶

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TABLE 1. CHARACTERISTICS OF THE DPS 7 SYSTEMS

	DPS 7/35	DPS 7/45	DPS 7/55	DPS 7/65	Level 64 DPS-330
CENTRAL PROCESSOR*					
Performance extension levels	3	2	1	—	2
Percent increase over base	40, 95, 190	41, 109	49	—	55; 130
Relative Performance	1.00	1.40	1.95	2.90	0.70-1.50
Cycle time (nanoseconds)	330	330	140	140	315
MAIN STORAGE (LSI MOS)					
Read cycle time, nanoseconds	355	355	355	355	630
Write cycle time, nanoseconds	290	290	290	290	770
Minimum capacity, bytes	1024K	1024K	2048K	2048K	512K
Maximum capacity, bytes	2048K	4096K	4096K	4096K	3072K
Bytes fetched per cycle	4	4	4	4	4
CONFIGURATION					
I/O channels available	3	3-6	3-6	4-8	2-12
Mass storage processors (max.)	1	2	3	4	3
Disk drives (max.)	9	18	27	36	24
Magnetic tape processors (max.)	1	1	2	2	2
Magnetic tape drives (max.)	8	8	16	16	16
Unit record processors (max.)	1	1	2	2	2
Unit record devices (max.)	5	5	10	10	12
Communications controllers (max.)	1	1	1	1	3
Communications lines (max.)	15	15	15	15	45
DATANET 8 Front End Network Processors (max.)	0	1	1	2	2
Communications lines supported by DATANET 8 (max.)	0	128	128	256	256

*DPS-330 has base model plus two performance upgrades, and is included for comparison.

schedules the execution of activities, the multiprogramming of job steps, and the concurrent execution of tasks within activities. No reprogramming is necessary when migrating from the Level 64 to the DPS 7. Level 62 users have several transition tools available and the DPS 7/55 and 7/65 can run Series 200/2000 emulation under control of GCOS 64. All applications currently available for the Level 64 can run unchanged on the DPS 7.

Highlights of GCOS 64 include virtual memory techniques for support of up to 64 jobs; immediate step activation, designed to provide for the interactive execution of Cobol, Fortran and RPG language processors, the linker and user object programs; an interactive program checkout facility for interactive program debugging from a terminal; the Forms Management Utility for interactively creating, modifying and storing screen formats to ease development of transactional applications; a comprehensive Query language facility; and multiple logic data store (MLDS), an indexed access method for transition from the IBM System/3 to the DPS 7. The GCOS 64 Basic Operating System is provided under a standard no-separate-charge license. All other system software is licensed at a monthly fee.

RELIABILITY/MAINTAINABILITY

Honeywell has implemented its Remote Support Facility (RSF) in the DPS 7 systems. RSF permits field engineering personnel to diagnose hardware, firmware, software, and operational (human) problems from the

CENTRAL PROCESSORS

The four DPS 7 processor complexes are microprogrammed units built around a multiprocessor configuration involving the CPU, peripheral processors, and network processor. The workload is distributed among these three elements to provide simultaneous processing and data transfer. Current mode logic (CML) technology is used extensively in CPU and input/output controller logic circuits and is said to provide faster gate speeds and less power consumption than comparable emitter-coupled logic (ECL) or transistor-transistor logic (TTL) circuits.

DPS 7 central processors are in turn composed of seven sub-units, a control store, and a high-speed processor bus. This processing "system" is connected to the central bus, which also services main memory and the input/output processors. Peripheral devices are connected to the I/O processors, which have their own control stores and main memories, which in turn are connected to the CPU via high-speed channels. This distributed architecture enables various subsystems to operate simultaneously, without tying up the main processor.

The seven components in the CPU include:

- Pilot machine (PIM): The PIM retrieves microinstruction sequences from the control store and routes them to the appropriate sub-units. Microprograms are composed of two or more 32-bit words, each protected by 4 parity bits.

- Address Calculation Machine (ACM): The ACM handles all address translations, includes the base registers and an associative memory that stores up to 8 segment addresses, and also handles data protection by checking rings under GCOS.

- Data and Instruction Management Machine (DIM): The DIM provides the interface between the main memory and

▷Honeywell Remote Technical Assistance Center concurrently with user production.

Parity is checked on every access to storage, whether mass storage or control storage. Further, parity is checked whenever data is tranferred between any two system functional units. Main memory is error-correcting and detecting (EDAC) memory that appends a 6-bit error-correcting code to each 4-byte word. This code permits automatic correction of single-bit errors and flags multiple-bit errors after retrying the access. All failing operations are retried up to eight times in order to continue processing.

The DPS 7 service and unit record processor (SURP) also functions as a system diagnostic processor. If a failure is detected in either the central processor or a peripheral subsystem, diagnostic routines are loaded into the SURP read/write memory, enabling it to perform system tests and report results locally on the system console and remotely to Honeywell field engineering support specialists through RSF.

DISTRIBUTED SYSTEM ENVIRONMENT

The DPS 7 systems have been designed to play a key role in Honeywell's Distributed Systems Environment (DSE), where computer power is either centralized or distributed to remote locations as needed by the individual organization. The layered data communication framework which manages the operation of these networks is called the Distributed Systems Architecture (DSA). The various DPS 7 systems are targeted either as host processors or remote satellite processors in a larger network. Honeywell's DATANET 8 communications processor, which controls all activities in a DSA network, can be added to any DPS 7 system except the model 7/35. Additional remote processors, such as Honeywell's DPS 6 minicomputer, round out the implementation of the DSE.

USER REACTION

Datapro's 1982 Annual Computer System User Survey was conducted first quarter 1982, the same time period for initial deliveries of the DPS 7/45, 7/55 and 7/65; and prior to delivery of the DPS 7/35 in the third quarter. For this reason, no user reactions to the DPS 7 Series are available.□

▶ the other processor sub-units and includes a 32-byte lookahead feature that allows it to begin interpreting another instruction while a previous instruction is still being executed.

● **Arithmetic and Logic Machine (ALM): The ALM includes the data registers and executes fixed-point, decimal, and logic operations.**

● **Scientific Calculation Machine (SCM): The SCM executes floating-point operations.**

● **Timer: Using the main clock as a reference, the timer transmits a master frequency along the processor bus and also provides various types of information, such as real time, elapsed time, and process time.**

● **Maintenance Interface Machine (MIM): The MIM provides the interface between the main processor and the service processor for system initialization and testing.**

CONTROL STORAGE: Control store contains firmware held in 32-bit words. Each word contains up to five instructions to be executed by the seven sub-units during a single cycle. The sequencing of firmware instructions is controlled by the Pilot machine. Up to five micro-instructions can be executed simultaneously by the sub-units.

The control store of the main processor is implemented in firmware and normally contains 12K words (but can have up to 24K words) enabling the execution of the Series 200/2000 instruction set.

Firmware is also used in the DPS 7 to perform functions traditionally performed by software. These include task management, procedure calls, data protection, etc.

The main processor is capable of recognizing and controlling a task, a unit of a program more significant than a single instruction. A task is a sequence of interdependent instructions. A program can comprise a number of tasks, each able to execute in parallel with the others (multitasking). This parallel execution of tasks requires a dispatching mechanism. On traditional machines, this mechanism required software intervention. On the DPS 7, it is a built-in firmware function of the main processor.

The DPS 7 uses firmware-controlled semaphores to interpret external events such as physical input/output termination, peripheral interrupts, operator interrupts and messages from terminals. Using semaphores, it also synchronizes the execution of competing processes, passes messages between processes, and controls competing demands for system services.

A semaphore is a group of words containing a counter and a pointer to an associated queue. When the semaphore counter is negative, all the resources associated with it are busy and processes are awaiting completion. When the counter is positive, all processes are satisfied and resources are free. When the counter is zero, all resources are busy but no processes are waiting. This mechanism can be used in any situation involving processes waiting for the completion of any operation.

REGISTERS: The DPS 7 systems use 8 32-bit Base Registers for internal address computation, 16 32-bit General Registers for data handling and indexing, 4 64-bit Scientific Registers for floating point data handling, 1 32-bit Stack Register pointing to the stack associated with the running process, and 1 28-bit Boundary Address Register holding the lowest absolute main memory address accessible by software.

ADDRESSING: Running under GCOS, the relative addressing mechanism is based on segmentation and its aim is to make optimum use of memory space. Each program running under GCOS 64 on the DPS 7 is executed as a collection of fully relocatable segments. A segment may reside in different places. As a program is being executed, its constituent segments may be moved around memory to make room for other programs, and, at a given point in time, some of its segments may even be temporarily removed from memory and placed on disk.

To avoid having to split a frequently-used routine between two segments, segments can vary in size. Machine instructions used in the GCOS 64 environment refer to segment-relative addresses, without reference to the physical location of the referenced operand. The absolute address is calculated as the instruction is executed using a segment descriptor and a displacement within the segment. High-speed registers assist in address development. ▶

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INSTRUCTION REPERTOIRE: The DPS 7 instruction repertoire consists of 221 instructions, including operations for address computations, and arithmetic instructions for performing fixed and floating point decimal and binary operations on packed or unpacked data. Operands can be binary, fixed- or floating-point, or decimal in packed or unpacked format; bytes; byte strings; or bit strings. In addition, the microcode of Models 7/55 and 7/65 can include the Series 200/2000 "Program Mode" option, and execute the Series 200/2000 instruction set.

INTERRUPTS: There are no interrupts as such. Any hardware or software event is handled through semaphores, combined with a masking feature used when high priority events occur.

CONSOLE: The DPS 7 console includes a console display (CRT), a keyboard, and a system operator panel. A pedestal mounted diskette unit with a capacity of 492.5K bytes is also provided. A 120-cps printer (CSF4104) is required.

PHYSICAL SPECIFICATIONS: The DPS 7 processors requires operating conditions of 50 to 100 degrees F. with a noncondensing relative humidity of 10 to 90 percent. The power source must be 208 volts, two-phase ± 10 percent of the rated voltage, with a frequency tolerance of 60 Hz±0.05 Hz and with a harmonic content within acceptable limits. The CPU cabinet set measures 47.3 inches wide, 33.5 inches deep, and 32.3 inches high, and weighs 550 pounds. Heat output is 17,000 BTU/hour.

INPUT/OUTPUT CONTROL

I/O CHANNELS: High-speed channels are provided with each DPS 7 processor. Channel throughput is rated at 1.25 million bytes per second. The DPS 7/35 has three channels; the DPS 7/45 and 7/55 have three channels expandable to six; and the DPS 7/65 has four channels expandable to eight. A basic DPS 7 consists of a single central processor, a mass storage processor, and an integrated service and unit record processor.

The DPS 7 systems support four types of peripheral processors: unit record, mass storage, tape, and network. The integrated unit record processor supports the system console, card units, printers, diskette drives, and, optionally, a DCC4370 communications controller. Each peripheral processor in a DPS 7 system is a fully independent processor controlling the transfer of data in parallel with other peripheral processors. Each processor has its own read/write memory as well as an arithmetic and logic unit. It executes, in full independence, commands sent to it by the central processor. The first three processor types are microprogrammed and contain a special connection which allows the maintenance processor to check operation and diagnose errors. The network processor is programmed and has its own means of detecting faults.

UNIT RECORD PROCESSORS: Every DPS 7 system has one unit record processor called the Service and Unit Record Processor (SURP), which performs the following functions: unit record device and communications control, system console control, system initialization and reconfiguration, and maintenance control. The largest DPS 7 systems can handle up to 10 unit record devices using a URP4370 Unit Record Processor in addition to the SURP.

MASS STORAGE PROCESSORS: Each DPS 7 system has at least one MSP4570 Mass Storage Processor. Depending on the DPS 7 model, up to 4 MSPs can be connected controlling a total of up to 36 disk drives.

MAGNETIC TAPE PROCESSOR: Up to 2 MTP4270 Magnetic Tape Processors, connecting up to 16 tape drive units, can be supported on the DPS 7. The MTP4270 controls up to 8 7-track or 9-track tape units.

COMMUNICATIONS PROCESSOR: Up to 15 synchronous or asynchronous communications lines can be connected to the DPS 7 systems via the DCC4370 Data Communications Controller.

SIMULTANEOUS OPERATIONS: The peripheral processing subsystems operate simultaneously with the central processor. Each subsystem operates under control of a microprogrammed peripheral processor. Each peripheral processor contains its own arithmetic and logic unit, read/write memory, and read-only memory and is attached to the central system through a high speed channel. All devices and terminals attached to a unit record processor can operate concurrently. Mechanical operations on a disk or tape subsystem, such as seek and rewind, can proceed simultaneously with a data transfer on the same subsystem.

CONFIGURATION RULES

A basic DPS 7 system includes from one to four megabytes of MOS memory, expandable in one-megabyte modules (CMM4700), three to eight channels (CPF4708), a Service and Unit Record Processor (SURP), and a Remote Maintenance Adapter. Each model can connect a DCC4370 Data Communications Controller which supports up to 15 synchronous or asynchronous lines. All models except the DPS 7/35 can connect one or two DATANET 8 Front-End Network Processors for up to 256 communications lines. An additional Unit Record Processor can be attached to the DPS 7/55 and 7/65 that can connect up to five additional unit record devices. The models 7/35 and 7/45 can configure one MTP4270 Magnetic Tape and up to eight tape drives. The 7/55 and 7/65 can have two MTPs and up to 16 tapes. Disk storage is supported through one to four MSP4570 Mass Storage Processors. The maximum number of spindles on the DPS 7 systems ranges from 4 (DPS 7/35) to 36 (DPS 7/65) with a maximum on-line storage capacity of 20.8 billion bytes on the DPS 7/65.

MASS STORAGE

MASS STORAGE UNITS: See Table 2.

INPUT/OUTPUT UNITS

MTP4270 MAGNETIC TAPE PROCESSOR: This processor handles 9-track tape with a recording density of 800 or 1600 bpi, 7-track tape with densities of 200, 556, or 800 bpi, and can simultaneously control up to 8 tape units.

MAGNETIC TAPE UNITS: See Table 3.

UNIT RECORD PROCESSOR: This integrated controller has five device ports plus a port dedicated to the console. A second processor, the URP4370, can be added, providing five more device ports. Each peripheral device connects to a device port via an addressing attachment. When the DCC4370 Data Communications controller is attached, only four ports are available for unit record devices.

PRINTERS: See Table 3.

CARD EQUIPMENT: See Table 3.

DDF4051 AND DDU4055/4056 DISKETTE DRIVES: These diskette drives are connected to the CPU via the Service and Unit Record Processor or an additional Unit Record Processor. One diskette drive unit can be connected to each Unit Record Processor. The DDF4051 is always connected to the SURP and must be specified with the initial system order. The diskette is organized into 77 tracks with 26 sectors per ▶

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TABLE 2. MASS STORAGE

Subsystems	MSU0402	MSU0452	MSU0555
Cabinets per subsystem	1	1	1
Disk packs/HDAs per cabinet	1 removable	1 removable	2 fixed
Capacity, megabytes	100	200	1200 [1]
Tracks/segments per drive unit	NA	NA	NA
Average access time, milliseconds	25	25	25
Average rotational delay	8.3 ms	8.3 ms	8.3 ms
Data transfer rate, bytes/second	806,000	806,000	1065K
Controller model	MSP4570 [2]	MSP4570 [2]	MSP4570 [2]

(1) Per drive (formatted 8-bit bytes)
(2) Mass Storage Processor

track and 128 bytes per sector. Only 74 of the tracks are used for data. Total data capacity per DDF4051 diskette is 492,544 bytes. Rotational speed is 360 revolutions per minute, and the transfer rate is 32.2 kilobytes per second. The 4055 is a single-drive unit, providing 492,544 bytes of storage, and the 4056 is a dual-drive unit with a capcity of 985,088 bytes.

TERMINALS: The Level DPS 7 supports a wide variety of data terminals. Teleprinter terminals include the PRU1001/1003/1005 printers and associated TWU1001/1003/1005 keyboard units. These units operate at asynchronous line speeds of 110, 200, 300, or 1,200 bps, depending on the model. The synchronous PRU1901/TWU1901 keyboard/printer unit is designed for speeds up to 4,800 bps. Honeywell offers several choices of video display terminals (CRTs): the VIP7100/7105/7200/7205 for asynchronous speeds up to 9600 bps; VIP7700R/7705R for synchronous speeds up to 4800 bps; VTS 7710/7740, VIP 7814 for synchronous speeds up to 9600 bps; and the VIP7804 for synchronous speeds up to 19,200 bps.

COMMUNICATIONS CONTROL

The DPS 7 can support an integrated data communications controller (DCC4370) that connects up to 15 synchronous (DCA4372) or asynchronous (DCA4371) lines at speeds up to 19.2K bps. Five different types of terminal protocols are supported; TTY (DCF4301), Honeywell VIP (DCF4302), BSC (DCF4303), BSC with transparency (DCF4304), and IBM 3270 (DCF4308). A polling extension (DCF4340) is available for synchronous lines with more than four terminals connected.

DISTRIBUTED SYSTEMS ENVIRONMENT

The DPS 7 is an integral part of Honeywell's Distributed Systems Environment (DSE), which places computer power where it is most needed. Typically the DPS 7 functions either as a host or a satellite processor within a network. The layered approach in developing a communications network that utilizes the inherent processing power in the DPS 7 is called the Distributed Systems Architecture (DSA). DSA provides the following: 1) access to public and value-added data networks, 2) application program independence from areas such as network configuration and terminal characteristics, 3) standardized user interfaces to the network, and 4) centralized or distributed control functions, independent of the processing functions. A number of specialized software packages are part of DSA, as well as a Front-End Network Processor (FNP), the DATANET 8.

DATANET 8 FRONT-END NETWORK PROCESSOR: This system (DCU8010) was designed specifically for DSE/DSA networks, and has 512K bytes of memory, expandable to 1536K; and up to 16 Channel Interface Bases, each of which supports up to 8 communications lines. All system components are connected to a Megabus, a high-speed data transfer link. The DATANET 8 is designed to handle DSE/DSA communications for a DPS 7 operating under GCOS 64. Up to two DATANET 8 processors can be configured with a DPS 7 system.

SOFTWARE

The DPS 7 operates under GCOS 64, the same monitor used on the Level 64/DPS-330, which supports batch, transaction, and distributed processing environments in addition to interactive timesharing. Components of GCOS 64 are virtually identical on both the DPS 7 and Level 64/DPS systems, therefore, Level 64 users can migrate to the DPS 7 with no reprogramming or modifications required. The DPS 7/55 and 7/65 can also run Series 200/2000 emulation simultaneously with GCOS 64. Level 62 users have several transition tools available, including file transcription facilities and an automated transition assist when migrating from the Level 62 Transaction Processing System to the DPS 7 Transaction Driven System. All applications developed by Honeywell for the Level 64/DPS can run unchanged on the DPS 7.

The current update to GCOS 64, Release 0500, can support up to 64 concurrent jobs, comprised of a mix of batch, transactional, and timesharing activities. Release 0500 adds these additional features: 1) use of RPG for writing Transaction Driven System (TDS) transactions, 2) increased number of Level 6 or DPS 6 systems as remote batch stations, 3) interactive execution of language processors and user programs under IOF (interactive operations facilities), 4) a new query and update facility for I-D-S/II data bases (QUERY/64), 5) new tabling and indentation facilities for source language maintenance, 6) Multi Logic Data Store (MLDS), a data access method compatible with the Level 62 and IBM System/3, 7) improved system security, 8) improved interactive facilities via Immediate Step Activation, 9) additional facilities to improve system use by non-technical personnel, such as user prompts and screen management tools, 10) support for Honeywell's Distributed Systems Architecture (DSA), and 11) support for "loosely coupled" DPS 7 systems for dynamic disk volume/file-sharing.

GCOS 64 supports any combination of batch, interactive, or service activities, such as multiple output-writers. Each program can be divided into job steps, each with its own separate set of segment tables. The maximum number of job steps known to the system is 256, effectively providing the nucleus of a virtual memory system with multiple virtual spaces.

GCOS 64 is a virtual memory system that uses segment-relative addressing to optimize the use of main memory. All ►

Honeywell DPS 7 Series

TABLE 3. INPUT/OUTPUT UNITS

Magnetic Tape Units	Number of Tracks	Recording Density, Bits/Inch	Encoding	Tape Speed, Inches/Sec.	Transfer Rate, Bytes/Sec.
MTU0400/0500	9	800/1600	NRZI/PE	75 or 125	160,000/200,000
MTU0400/0500	9	1600	PE	75 or 125	200,000
MTU0400/0500	7	556/800	NRZI	75 or 125	52, 125/75,000
MTU0400/0500	7	200/556/800	NRZI	75 or 125	18,750/52,125/75,000
MTU0630	9	800/1600	NRZI/PE	125	100,000/200,000

Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
PRU0615	600 lpm	136	10	6 or 8	3.0 to 15.0 width
PRU0906	900 lpm	136	10	6 or 8	4 to 19 width
PRU1205	1200 lpm	136	10	6 or 8	4 to 19 width
PRU1600	1600 lpm	136 (optional 160 positions)	10	6 or 8	4 to 22 width

Card Equipment	Columns	Speed, Cards/Min.	Input Hopper Capacity	Output Stacker Capacity	Options
CRU0301 reader	80	300	1000	1000	Mark-sense facility for Hon. or IBM modes
CRU0501 reader	80	500	1000	1000	Mark-sense facility for Hon. or IBM modes
CRU1050 reader	80	1050	3000	2500	51-column reading mark-sense facility for Hon. or IBM modes
PCU0120 punch	80	100 to 400	1600	1600	
CCU0401 reader/ punch	80 80	600 100 to 400	1600 1600	1600 1600	

programs in a DPS 7 system are executed as fully relocatable segments. DPS 7 machine instructions refer to segment-relative addresses, without regard to the physical location of the referenced operands. A segment may reside anywhere in memory, and at different times may reside in different places. The addressing mechanisms are incorporated in system hardware and firmware, thus ensuring minimum overhead and maximum data integrity.

With GCOS, the segments of a program are defined by the compilers, and optionally, under the control of the programmer. Segments are variable in length, permitting segmentation to follow the logic of the program and ensuring that distinct elements, such as iterative loops, are not split between segments.

When a program is executed, it is first loaded into backing store on disk. GCOS automatically handles the allocation of main memory to the segments as they are referenced. Whenever a new segment is needed, GCOS searches main memory for a large enough space to load the segment. If there is no space large enough, GCOS will attempt to eliminate other segments in memory to create the needed space. The search begins with the least-used non-alterable segment, with the removal of a segment necessary only if it has been changed

while in memory. This is applicable only to data segments. As a last resort, GCOS will relocate segments already in memory to produce one contiguous memory space large enough to hold the called segment. Instruction coding is re-entrant and is never modified. Therefore, these segments never have to be rewritten and can be overlaid. Swapping and moving of the segments is invisible to the programmer, who has apparent access to a memory capacity equal to the size of the backing store.

GCOS 64 protects each segment by an automatic system of rings and protection levels, similar to the large-scale Multics operating system. This protection system is implemented in the hardware/firmware of the DPS 7 systems, so it applies equally to GCOS software and to the user's own programs.

DPS 7 integrity features include error logging, file security, and recovery routines. Whenever the firmware of the DPS 7 system discovers an error, it notifies the appropriate routine. This notification takes place whether the firmware recovered the error or not, so that GCOS is always aware of the state of the system. The routines diagnose the error and update an error accounting area in memory. Error accounting information is used to keep track of the state of all system components and to update a permanent accounting file. This ▶

permanent file eases routine maintenance of the system; extensive error accounting information allows failing components to be identified and replaced before they cause problems.

GCOS 64 also includes a variety of file security aids. A save/restore utility is available for taking security copies of files, and both copies and saved generations of a file can be included in the system catalog.

GCOS includes before and after journal functions to speed file recovery. The journals are used to save all the updates to a file since the last security copy was taken. The journals, together with the catalog and the restore utility, provide all the information needed to rebuild a damaged file to its correct state.

To reduce the possibility of a system failure, GCOS 64 provides a fast recovery facility in rerun support. Rerun support allows processing to be restarted immediately, either at the beginning of the job step or at the last checkpoint. The restart procedure includes automatic repositioning of the user's files and the recovery of all files and queues used by the system, including the input read and output writer files. The output writer can restart printing at any specified page.

Job flow through the DPS 7 systems is controlled by GCOS job management. The input reader reads the job input while other jobs are executing and translates the job control information into an internal format to speed job processing. A job scheduler schedules the execution of the job using a system of job classes and priorities within each class. Resources are allocated at file, volume, and device levels to each job step, and deallocated when each job step is completed. Job accounting information is collected at all stages of the job's passage through the system. Job accounting information, along with the results of the job, are provided by the output writer, asynchronously with job execution.

The file management routines of GCOS handle allocation and deallocation of space for files, automatic label checking, automatic volume recognition, control of multiple concurrent accesses to files, and control of multiple copies and generation of files through the catalog. Additionally, they provide various access methods to different file organizations and also file and volume utilities to support file housekeeping.

When assigning a file, the user defines the file as either permanent or temporary. if the user wishes to retain a temporary file for several job steps, a parameter in the ASSIGN statement prevents the file space from being released until the end of the job.

To request space for a file, the user specifies the type of device, the identity of the volume, and the amount of space required. GCOS then searches the specified volume and automatically allocates any space available. Disk space need not be contiguous; GCOS can allocate space for a file using up to five separate areas on any one volume, and can spread the file over a number of volumes if required. On magnetic tape, GCOS supports any number of files on a single tape.

When a new file is created, file management automatically creates the appropriate labels, and these are subsequently checked every time the file is opened for processing. On disk, labels are stored in a special area called the volume table of contents (VTOC). On tape, the labels are created at the head and the tail of each file.

Disk files are shareable under GCOS 64. However, if file protection is required, multiple access should be used only in read mode, unless the optional General Access Control product is installed.

The main file access system of GCOS 64, the Universal File Access System (UFAS), replaces random, sequential, and indexed sequential files. UFAS satisfies all the requirements of the ANSI Mass Storage Task Group recommendatiaons for sequential, relative, and indexed access, and is independent of device characteristics, file organization, media addresses, and media formats.

Programs can access data sequentially, randomly by key, directly, or directly by relative position on the same UFAS file. The access method can change every time the file is accessed. UFAS files can be indexed or non-indexed; if indexes are used, they can be multiple-level, and records with indexes can be intermixed with records without indexes. UFAS can handle fixed-length, variable-length, and dynamically variable records, and a UFAS file can contain a mixture of different record types.

The file organization of a UFAS disk file is based on control intervals and control areas containing embedded free space, thereby eliminating the need for overflow areas. When records are inserted into a UFAS file, they can be physically located in their logical positions on the file; access time is reduced and the need for frequent reorganization removed. In addition, the physical record sizes in a UFAS file are independent of the lengths of the local records. When the file is moved from one medium to another, the physical record size can change to adapt to the new medium without affecting the file or the program using it. UFAS can access specific file items without a prior sort. A dynamic file extension facility allows extension of files as required.

GCOS also supports classical files, particularly standard IBM files, with the Basic File Access System (BFAS). BFAS includes three subsystems:

- Basic Sequential Access, which supports sequential files on disk using EBCDIC code and on tape using either EBCDIC or ASCII code. Records can be fixed, variable, or undefined.

- Basic Indexed Sequential Access, which supports indexed sequential files on disk. Files can have up to six levels of index, with the highest-level index being resident in memory. Overflow space can be reserved within the prime data areas, on separate cylinders within the file.

- Basic Direct Access, which supports access by relative record number and by complete or partial physical address to disk-based files. Basic Direct Access includes a number of established randomizing algorithms.

- A third set of access methods, the Honeywell File Access System (HFAS), gives full access from native GCOS programs to files in the format used on Series 200/2000 systems. HFAS includes all the features available with BFAS, and serves as a bridge between native and non-native user applications.

In addition to the GCOS 64 operating system (SCS1300), two mandatory additions to GCOS 64 are the GCOS Basic System Extension (SCS1301) and GCOS Access System Extension (SCS1302). The Basic System Extension module includes such elements as the input reader, output writer, text editor (batch), library maintenance (batch), and static linker. The Access System Extension includes BFAS, UFAS, IOF support, basic terminal network support (BTNS), message access method (MAM), and the virtual communications access method (VCAM).

The Forms Management Utility (SCU1611) is new with Release 0500 of GC0564. Operating in the IOF environment, it provides interactive definition of screen forms for use in transactional (i.e. TOS/64 or DM-IV) applications written in either Cobol or RPG. It also provides for saving the screen form definitions as well as for subsequent alterations. Optionally, the utility can be executed in batch mode. Screen definition for use with the following terminals is provided: ▶

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VIP7700, VIP7700R, VIP7760, VTS 7710, VTS7740, VIP7804, VIP7805, VIP7814 adn IBM 3270 (Display Station 3277, Model 2).

The Multiple Logic Data Store (MLDS) is an indexed access method which runs under GCOS 64 Release 0500. MLDS (SCD1615) provides upward compatibility for Level 62 GCOS RPG and Cobol programs that use indexed access, including secondary index and complementary records capabilities.

Interactive Operation Facilities (IOF) users who want to directly invoke the GCOS 64 Cobol-74, RPG, and Fortran processors can use the Immediate Step Activation (SCP1605). It also calls in the static linker and user object programs, and is available with Release 0500.

The Level 64 Interactive Program Checkout Facility (SCP1606) gives the IOF user the ability to interactively use the various functions of the GCOS Basic System Extension program checkout facility. It is also available with GCOS 64 Release 0500.

Data Communications Software

The GCOS data communications software, together with the DPS 7 communications hardware and firmware, handle networks of up to 15 lines, with up to 32 terminals per line through the Data Communications Controller. DPS 7/45, 7/55, and 7/65 users can also select the DATANET 8 Front-End Network Processor. Up to two can be configured, with 128 lines each. A network can include switched, private, and direct-connect lines, as well as a variety of terminal types. DPS 7 communications software is designed to conform to Honeywell's Distributed Systems Environment (DSE).

The GCOS Message Access Method handles a system of queues to provide the interface between the data communications network and the user's programs. The Message Access Method transforms the random, time-dependent environment, allowing serial or selective processing of messages by ordinary Cobol programming techniques. It provides the standard Cobol MCS environment.

The Transaction Driven System (TDS/64-Standard Processor) is a conversational system for handling a message entered by a user via a terminal, the initiation of a processing routine specific to that type of message, the processing of the message, and the response sent to the terminal. A library of mostly user-written transaction processing routines (TPRs) correspond to the various types of messages accepted by the system. TDS/64 can handle several dozen different transaction types in a single session. Time and memory space are optimized by utilizing a single copy of a TPR, even though the requests for that TPR may come from different terminals. TDS/64 provides a batch interface allowing batch programs to interface with it as though they were terminals. This facility is particularly useful in debugging the transaction system without incurring real-time constraints. TDS/64 has access to all files supported by GCOS and provides concurrent access control, journalization, and file recovery of UFAS files. Security is provided through controlled file access and authority codes. All input messages to TDS/64 are journalized to guard against information loss.

The Level 64 Remote Batch Facility (RBF) enables remote job entry from a Distributed System Satellite (DSS) to a DPS 7 system through the DCC (or optionally via a DATANET 8) with output return to a DSS. RBF consists of RBF/6, which runs under Level 64 GCOS, and RBF/64, which runs on the DSS under control of GCOS 6. RBF operates under synchronous or HDLC transmission using two- or four-wire connections in half-duplex mode up to 9600 bps. The DPS 7 host can support up to 15 DSS systems acting as RBF

terminals on a concurrent basis. The DSS can be either a Level 6 or, more recently, a DPS 6 minicomputer.

The File Transfer Facility (FTF) enables exchange of Level 64 and DSS sequential disk files. The FTF uses two software components; FTF/6 on the DPS 7, and FTF 64/DSS on the DSS. It is available with GCOS 64 Release 0500.

The Distributed Network Supervisor (DNS) is the communications software designed for use in the optional DATANET 8 Front-End Network Processor (FNP) as well as other Distributed Systems Architecture (DSA) elements. DNS, along with the DATANET 8, DPS 7, and a host package called Front-End Network Processor Support (FNPS), controls the overall communications network. It provides the following functions:

- Network monitoring
- Software loading and dumping
- System data logging
- Inline testing
- Software generation
- System order execution, called Node Administration (NAD), which is issued by the Node Operator Interface (NOI)
- A group of utilities which analyze the overall network operations

Data Base Management Software

Data Management IV (DM-IV) is a fully operational on-line, integrated data 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 is CODASYL-oriented and includes common data definition languages for describing schema and subschema views of integrated and/or indexed data files. The system offers several end-user services including the capability to satisfy unanticipated information requirements.

The new DM-IV module enhances the DPS 7 systems' communications capabilities by combining the strengths of the TDS/64 Transaction-Driven System and the I-D-S/II data base management system. DM-IV offers transaction processing users protected concurrent access to the data base and UFAS files. DM-IV provides for the consolidation and simplification of multiple and repetitive tasks such as organizing file systems and communications programs. The module also provides for the building of a multi-faceted environment within a single system. A DPS 7 system with the DM-IV module in GCOS 64 can support a communications network of 15 lines with up to 32 terminals per line; and, on the DPS 7/45, 7/55 or 7/65, larger networks via the DATANET 8 Front-End Network Processor. The network can include switched and private lines as well as a mixture of terminal types. For more information on DM-IV, see Report 70E-480-01.

Integrated Data Store (I-D-S/II) is an enhanced version of I-D-S, a data base management system originally developed by GE. I-D-S/II was released in November 1975, and marked 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.

The Query Processor (SCL1617) is an end-user-oriented subset of GCOS that aids in the selection and retrieval of information from user files and data bases. It uses a simplified language, and can access I-D-S/II integrated files, UFAS and BFAS sequential files, UFAS and MLDS indexed files, and ▶

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BFAS indexed sequential files. An Update Option (SCL1620) permits updating of data from I-D-S/II integrated files as well as from UFAS sequential or indexed files.

The Query Driven System (QDS) is a terminal-oriented file inquiry update and report writing system for the DPS 7. QDS contains the interactive, report, and assistance modes of operation. The interactive mode is a prompted message command/response mode for terminal-based file search and updating. The report mode provides a capability for file processing and report generation by means of terminal-built queries using a procedural language. The assistance mode is the sign-on mode and is used for building queries that are later executed under the report mode.

QDS supports GCOS 64 BFAS indexed sequential and sequential file organizations and UFAS indexed and sequential organizations.

Programming Languages

Cobol (SCL1601), a superset of Level 62 Cobol, is a full implementation of the standard ANSI specification X3/23-1974, and features automatic segmentation and optional data communications capabilities.

The Cobol Report Writer (SCL1608) is an option that provides the report writer module of the ANS 74 standard. The Cobol Data Communications Extension (SCL1603) is an optional extension to the basic Cobol ANS 74 language processor that provides language and functions representing Level 1 support of the Communications Module of the 1974 Cobol ANS Standard.

DPS 7 RPG (SCL1611) runs under GCOS 64, supports a high-level report generation language, produces report-oriented programs from specifications furnished by the user, which can execute either in a batch or transaction-oriented environment. It is directly compatible with Level 62 RPG, as well as most elements of IBM System/3 RPG.

DPS 7 Fortran (SCL1606) meets the ANSI standard for Fortran IV and contains routines for many mathematical calculations plus run-time packages to handle Fortran functions such as STOP and PAUSE and dynamic error diagnostics. It supports most elements of ANSI 77.

DPS 7 Basic (SCL1614) is an incremental compiler, checking syntax and generating object code at the input of each instruction. Under GCOS 64, Basic programs can be developed and executed in either batch or interactive mode.

Conversion Aids

GCOS 64 includes an extensive set of programs and file conversion routines for Level 62 and IBM equipment, as well as program translators and file translators for older Honeywell equipment, particularly the Series 100/200/2000 product line.

Remote Maintenance System/64

Consists of a remote console interface adapter and software diagnostic interface modules combined to provide an extension to the system console for field engineers. The engineers are remotely located and connected via phone lines. Remote Maintenance System/64 provides the ability to troubleshoot hardware and firmware problems as well as software bugs concurrent with user production. With this facility, key diagnostic programs that operate under GCOS 64 can be remotely executed and patching of many software difficulties can be accomplished without an on-site visit. Remote Maintenance System/64 operates only when the console operator places the system in maintenance mode and

provides documentation of all communications via the system console.

Applications Software

Honeywell provides a limited number of packages for the DPS 7. These include native mode and Series 200/2000 program mode applications. A complete listing of these products can be found in the Equipment Prices section of this report.

PRICING

EQUIPMENT: The following systems are representative of DPS 7 configurations. The quoted rental prices are for the basic one year lease and include equipment maintenance.

BASIC DPS 7/35: Includes CPU with 1024K bytes of main memory, mass storage processor, integrated service and unit record processor, integrated 8-inch diskette drive, data communications controller, integrated console control, console with CRT, support for three asynchronous communications lines, 300-cpm card reader, 600 megabytes of disk storage, and one 900-lpm printer. Purchase price is $284,211 and monthly maintenance is $1,386. The system can be leased for one year at $10,521 per month.

EXPANDED COMMUNICATIONS-ORIENTED DPS 7/55: Includes 2048K bytes of main memory, three I/O channels, 1,200 megabytes of disk storage via integrated MSP, one dual-density diskette drive (DDU4055), a tape subsystem with two 9-track, 1600 bpi tape drives, one 1200-lpm belt printer, three asynchronous and one synchronous communications lines with BSC support connected to the integrated communications controller, one DATANET 8 FNP with two Channel Interface Bases for interface to DSA network. Purchase price is $542,644, the monthly maintenance costs $2,427, and the monthly one-year lease price is $19,421.

SUPPORT: Honeywell offers six categories of support products for the DPS 7 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; for off-line peripherals, $12.00 to $32.00 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.

	Monthly Rates	Hourly Rates (4 hr. min.)
Principal or senior technical consultant	$17,431	$125
Project supervisor or technical consultant	14,230	102
Technical specialist	12,807	91
Systems analyst/senior programmer	10,672	77
Programmer	7,471	54

The GCOS 64 basic operating system is provided to DPS 7 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 7 equipment is available for purchase or for lease under a 1-year, 3-year, or 5-year term. The basic monthly lease charges 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 excluding Honeywell's published holidays. For scheduled maintenance beyond this period, the user pays an additional charge which is a fixed percentage of the basic monthly maintenance charge. As an alternative to scheduled extended maintenance, the user can obtain on-call maintenance service at standard hourly rates of $125 per man-hour.

Honeywell's Distributed Maintenance Services is a term covering a variety of field engineering services, coordinated to assure maximum availability of the system. DMS includes a Response Center headquartered in Atlanta, Georgia, for toll-free 24-hour a day contact with Honeywell; the Technical Assistance Center, located in Newton, Massachusetts, which coordinates all activities and provides remote testing and correction facilities; 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 Support Facility for remote trouble-shooting and remote software and hardware correction; and tools for easy software updating by customers.

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Lease 1-year	Monthly Lease 3-year	Monthly Lease 5-year
PROCESSORS						
CPS4935	DPS 7/35 Central Processor; includes CPU with one megabyte of main memory, integrated service and unit record processor, diskette, remote maintenance adapter, three I/O channels, and console	$ 94,200	$ 385	$3,327	$3,103	$2,767
CPS4945	DPS 7/45 Central Processor; includes CPU with one megabyte of main memory, integrated service and unit record processor, diskette, remote maintenance adapter, three I/O channels, and console	128,700	405	4,426	4,119	3,660
CPS4955	DPS 7/55 Central Processor; includes CPU with two megabytes of main memory, integrated service and unit record processor, diskette, remote maintenance adapter, three I/O channels, and console	202,400	527	6,850	6,368	5,646
CPS4965	DPS 7/65 Central Processor, includes CPU and two megabytes of main memory, integrated service and unit record processor, diskette, remote maintenance adapter, four I/O channels, and console	256,700	692	8,711	8,100	7,184
PROCESSOR OPTIONS						
CMM4700	1-megabyte Memory Module	15,700	26	518	480	424
CPF4702	Peripheral Expansion Cabinet	13,808	47	478	446	397
CDF4703	H200/2000 Emulator for CPS4965	9,400	28	322	299	266
CPF4707	I/O Channel Expansion (over 4 channels)	5,200	5	168	155	137
CPF4708	I/O Channel	4,600	2	145	135	118
CPK4971	Upgrade from 7/35 or equiv. power level to 7/45 power level	34,500	20	1,099	1,016	893
CPK4972	Upgrade from 7/45 or equiv. power level to 7/55 power level (minimum 2MB C.P. memory is required)	58,000	96	1,906	1,769	1,562
CPK4973	Upgrade from 7/55 or equiv. power level to 7/65 power level	54,300	165	1,861	1,732	1,538
CPK4977	Upgrade from 7/35 or equiv. power level to 7/55 power level (minimum 2MB C.P. memory is required)	92,500	116	3,005	2,785	2,455
CPK4978	Upgrade from 7/35 or equiv. power level to 7/65 power level (minimum 2MB C.P. memory is required)	146,800	281	4,866	4,517	3,993
CPK4979	Upgrade from 7/45 or equiv. power level to 7/65 power level (minimum 2MB C.P. memory is required)	112,300	261	3,767	3,501	3,100
CSF4104	Hardcopy Printer (mandatory)	7,750	70	312	294	266
CSF4102	Pedestal for CSF4104 (sit)	200	NC	—	—	—
CSF4103	Pedestal for CSF4104 (stand)	200	NC	—	—	—
CSF4107	Sit-Down Console Table for CPS4955 and CPS4965	1,200	NC	—	—	—
CSF4108	Stand-Up Console Table for CPS4955 and CPS4965	1,200	NC	—	—	—
CSF4112	Adjustable Console Table for CPS4935 and CPS4945	1,200	NC	—	—	—

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Lease 1-year	Monthly Lease 3-year	Monthly Lease 5-year
MASS STORAGE						
MSP4570	Single-Channel Mass Storage Processor; includes one group of 3 device addresses	32,275	90	1,098	1,021	906
MSA4570	Group of 3 Additional Device Addresses	3,075	22	118	111	100
MSF4506	Series 200/2000 Read/Write Mode	2,352	6	80	74	66
MSU0402	100-megabyte Mass Storage Unit	20,805	113	815	763	701
MSU0452	200-megabyte Mass Storage Unit	27,047	113	937	862	815
MSU0555	1200-megabyte Mass Storage Unit	52,183	197	1,827	1,703	1,517
MSF0006	Dual Access Feature; for MSU0402/0452	2,070	13	82	77	70
MSF0014	Dual Access Feature; for MSU0555	4,140	23	163	152	136
DISKETTE STORAGE						
DDF4051	Second Drive for Integrated Diskette Unit (factory option)	3,695	24	140	131	118
DDU4055	Single Diskette Drive: 492K bytes: requires pedestal	2,336	21	95	89	81
DDU4056	Dual Diskette Drive; 985K bytes; requires pedestal	3,833	32	152	144	130
DDF4052	Pedestal for DDU4055 or DDU4056; low for sitting	184	2	8	7	6
DDF4053	Pedestal for DDU4055 or DDU4056; high for standing	184	2	8	7	6
URA4342	Addressing for DDU4055 or DDU4056 (URP4370 only)	2,620	11	93	87	77
URA4343	Addressing for DDU4055 or DDU4056 (Integrated URP only)	2,620	11	93	87	77
MAGNETIC TAPE EQUIPMENT						
MTP4270	Magnetic Tape Processor, single-access; addressing for 8 devices	24,850	120	937	837	748
MTF4207	Translator Option	2,783	8	95	88	78
MTF4208	Pack/Depack Option	2,783	8	95	88	78
MTF4209	NRZI Option	3,728	22	139	130	117
MTU0400	Magnetic Unit, 75 ips	9,020	153	459	441	430
MTU0500	Magnetic Tape Unit, 125 ips	12,128	153	725	680	613
MTU0630	Magnetic Tape Unit	593	557	505	14,815	130
MTF0636	9-Track, 1600/800 bpi, 125 ips	460	435	398	9,805	155
MTF0011	9-track, 1600 bpi	2,735	29	131	119	112
MTF0012	9-track, 800/1600 bpi	4,137	65	198	187	171
MTF0013	7-track, 200/556/800 bpi	4,788	106	305	287	260
MTF0015	7-track, 200/556 bpi	2,735	38	139	126	120
MTF0016	7-track, 556/800 bpi	3,213	38	139	126	120
MTF0018	Cartridge Load	735	2	26	25	22
UNIT RECORD EQUIPMENT						
URP4370	Additional Unit Record Processor	18,270	52	623	579	514
PRINTERS						
PRU1600	Belt Printer, 1600 lpm, 136 positions	64,940	538	2,694	2,532	2,289
PRF0022	24 Additional Print Positions for PRU1600	2,610	15	96	90	80
PRU1205	Belt Printer, 1200 lpm, 136 positions	42,700	428	1,762	1,660	1,508
PRU0906	Belt Printer, 900 lpm, 136 positions	37,200	381	1,543	1,454	1,322
URA4332	Addressing for PRU0906/1205/1600	6,000	3	191	176	155
PRU0615	Band Printer, 600 lpm, 136 positions	16,500	180	696	656	598
PRM4001	Adapter for PRU0615	500	2	18	17	15
URA4331	Addressing for PRU0615	400	2	15	14	13
PRB0703	Belt for PRU0906/1205/1600, 64 characters, OCR-B font, Series 200/2000	2,460	90	—	—	—
PRB0501	63-character, EBCDIC, OCR-B font belt	2,460	90	—	—	—
PRB0500	63-character, OCR-B font belt, Series 100	2,460	90	—	—	—
PRB0513	63-character, ASCII, OCR-B font belt	2,460	90	—	—	—
PRB0524	63-character, OCR-A numeric belt	2,460	90	—	—	—
PRB0549	63-character, OCR-A alphanumeric belt	2,460	90	—	—	—
PRB0600	94-character, uppercase/lowercase belt, OCR-B font	2,567	90	—	—	—
PRB3703	Belt for PRU0906/1205, 64 characters, OCR-B font Series 200/2000	NC	NC	—	—	—
PRB3501	63-character, EBCDIC, OCR-B font belt	NC	NC	—	—	—
PRB2501	Band for PRU0615, 63 characters, EBCDIC, OCR-B font	NC	NC	—	—	—
PRB2502	63-character, OCR-B font band, Series 200/2000	NC	NC	—	—	—

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Lease 1-year	Monthly Lease 3-year	Monthly Lease 5-year
PUNCHED CARD EQUIPMENT						
CCU0400	Card Read/Punch; 600 cpm read, 100/400 cpm punch	29,594	190	1,137	1,065	956
CRU0301	Card Reader, 300 cpm	9,513	71	352	319	304
CRU0501	Card Reader, 500 cpm	19,500	104	684	638	568
CRF0006	(IBM) Mark Sense Option for CRU0301/0501	4,520	38	168	156	142
CRF0007	(HIS) Mark Sense Option for CRU0301/0501	4,520	38	168	156	142
CRF0030	Pedestal for CRU0301/0501; high for standing	184	NC	—	—	—
CRF0031	Pedestal for CRU0301/0501; low for sitting	184	NC	—	—	—
URA4334	Addressing for CRU0301/0501 or CRU1050	3,645	12	126	118	104
URA4336	Addressing for CCU0400	4,253	4	140	129	114
CRU1050	Card Reader, 1050 cpm	26,555	204	1,052	987	890
CRF0003	51-Column Option for CRU1050	2,079	5	69	64	57
CRF0005	Mark Sense (IBM/HIS) for CRU1050	7,787	48	237	217	205
PCU0120	Card Punch, 100 to 400 cpm	20,032	128	756	686	636
URA4335	Addressing for PCU0120	6,878	23	238	221	197
COMMUNICATIONS						
DCU8010	DATANET 8 Front-End Network Processor; includes 256K-byte memory, 256K-byte diskette and up to 16 lines	29,000	135	1,040	971	868
DCM8004	Additional 256K-byte Memory	7,000	70	288	271	247
DCE8002	Additional Lines, up to 64	3,000	5	98	91	80
DCE8004	Additional Lines, up to 128	5,000	10	166	154	136
DCE8005	Additional 256K-byte Diskette	1,785	18	73	69	63
DCE8007	Level 64/DPS Host Connection	8,000	65	315	295	267
DCF8007	Channel Interface Base, includes up to 8 channels (lines)	2,500	14	92	86	77
DCF8008	Console, 30 cps printer	2,520	54	132	126	117
DCF8006	Console, 120 cps printer	2,888	92	182	175	165
DCF8011	Dual Synchronous Channel, 9600 bps	1,500	8	54	51	45
DCF8012	Dual Asynchronous Channel, 9600 bps	1,000	5	36	33	30
DCF8020	HDLC Channel, 9600 bps	1,500	8	54	51	45
DCF8022	HDLC Wideband Channel, 56K bps	3,000	16	109	102	91
DCF8023	HDLC Wideband Channel (V.35), 56K bps	3,000	16	109	102	91
DCC4370	Additional Data Communications Controller	8,600	13	282	261	231
DCF4301	Terminal Support Type 1 (TTY)	53	NC	1	1	1
DCF4302	Terminal Support Type 2 (VIP)	53	NC	1	1	1
DCF4303	Terminal Support Type 3 (BSC)	53	NC	1	1	1
DCF4304	Terminal Support Type 4 (BSC), with transparency	945	4	34	31	27
DCF4308	Terminal Support Type 8 (3270)	1,665	8	61	57	51
DCA4371	Asynch. Line Attachment (up to 19.2K bps)	1,000	5	37	34	31
DCA4372	Synch. Line Attachment (up to 19.2K bps)	925	5	34	31	28
DCF4340	Polling Extension for DCA4372	546	1	18	17	15
DCF4370	Performance Expansion	4,284	8	142	131	116

		Purchase Price	Monthly Maint.	Monthly Lease 3-year
TERMINALS				
TWU1001	Asynchronous 30-cps Serial Matrix Printer with keyboard; 64-character buffer, 300 cps	2,470	29	NA
TWU1003	With selectable transmission speeds of 110, 220 or 300 bps	2,850	40	152
TWU1005	Asynchronous 120-cps Serial Matrix Printer with keyboard; 1000-character buffer, 1200 bps	3,600	51	193
PRU1001	Asynchronous 30-cps Serial Matrix Printer without keyboard; 64-character buffer, 300 bps	2,260	28	NA
PRU1003	With selectable transmission speeds of 110, 200, or 300 bps	2,640	39	143
PRU1005	Asynchronous 120-cps Serial Matrix Printer without keyboard; 1000-character buffer, bps	3,390	50	183
TWU1901	Synchronous 120-cps Serial Matrix Printer with keyboard; 9650-character buffer, selectable speeds of 1200, 2400, or 4800 bps	4,500	66	243
PRU1901	Without keyboard	4,000	64	221
VIP7100	Asynchronous CRT; 960 characters, 63-character set	1,500	23	NA
VIP7105	With 95-character set	1,600	24	NA
VIP7200	Asynchronous CRT; 1920 characters; 64-character set	1,980	28	NA
VIP7205	With 95-character set	2,100	28	NA
VIP7801	With 106-character set	3,175	32	NA
VIP7201	Asynchronous CRT; 1920 characters, 64-character set	795	20	NA
VIP7814	Synchronous CRT; 1920 characters, 63-character set	2,700	25	123
VIP7700R	Synchronous CRT; 1920 characters, 63-character set	3,990	36	180
VIP7705R	With 95-character set	3,990	36	180
VIP7804	Synchronous CRT; 1920 characters, 63-character set	3,365	33	155
VIP7805	Synchronous CRT; 95-character set	3,705	39	173

Honeywell DPS 7 Series

SOFTWARE PRICES

		Monthly License Fee	Monthly Software Support
Current System Software			
SCS1300	GCOS 64 Basic Operating System	NC	***
SCS1301	GCOS 64 Basic System Extension	200	61
SCS1302	GCOS 64 Access System Extension	165	40
SCS1601	GCOS 64 Coupled Systems Support	80	25
SCS1602	GCOS 64 Dynamic Status Display	64	17
SCS1603	GCOS 64 Multivolume Backing Store	55	15
SCS1605	GCOS 64 System Access Rights	127	35
SCS1607	GCOS 64 General Access Control	98	26
SCU1613	GCOS 64 System Behavior Reporter	165	25
SCU1616	GCOS 64 System Behavior Reporter Extension	118	18
SCU1619	GCOS 64 Transactional Context Restart Facility	55	19
SCL1601	Cobol-74	89	11
SCL1603	Cobol-74 Data Communications Extension	94	12
SCL1606	Fortran	87	8
SCL1607	Mathematical Library	113	16
SCL1608	Cobol Report Writer	40	5
SCL1611	RPG	131	6
SCL1614	Interactive Basic	165	6
SCS1606	GCOS 64 Interactive Resource Manager	149	40
SCL1617	Query Processor	220	70
SCL1620	Query Processor Update Option	80	25
SCP1601	Interactive Library Maintenance (LIBMAINT)	91	27
SCP1602	Interactive Text Editor	61	18
SCP1605	Immediate Step Activation	91	27
SCP1606	Interactive Program Checkout Facility	61	18
SCC1617	Data Entry (DE/64—VIP7700 Mode)	158	64
SCD1611	Integrated Data Store II (I-D-S/II) Entry	275	19
SCD1615	Multiple Logic Data Store (MLDS)	42	18
SCU1603	Sort/Merge	67	12
SCU1604	Data Base Administrator Aids Set (Batch Utilities)	81	5
SCU1617	Data Base Administrative Aids Extension	30	5
SCC1220	DATANET 8 Support (FNPS). Requires SCC8020 or SNC8096	15	5
SCC1603	TDS/64 Standard Processor	299	128
SCD1612	Data Management-IV (DM-IV) Entry	580	150
SCU1611	Forms Management Utility	50	10
SCC1671	PREFORMS Batch Mode	21	7
SCC1672	PREFORMS Transaction Mode	43	14
SCJ1601	Remote Batch Facility (RBF/6)	26	6
SCU1615	File Transfer Facility/6 (FTF/6)	42	5
SCU1618	GCOS 64 Distributed File Transfer	15	5
SCM1620	Series 200/2000 Integrated Program Mode	NC	15
SCD1607	Series 200/2000 File Access System (HFAS)	NC	10
SCU1606	HFAS File Maintenance Utility Set	8	5
SCU1609	Series 200/2000 Volume Utility Set	8	5
SCU1614	System/3 Sort Adapter	NC	10
SCV1600	Series 200/2000 COBOL to COBOL-74 Translator	NC	10
SCV1605	Series 200/2000 File Translator	NC	10
SCV1611	Series 100 COBOL to COBOL-74 Translator	NC	10
SCV1612	Series 100 File Translator	NC	10
SCV1614	System/3 Volume and File Translator	NC	10
SCV1616	System/3 RPG-II to GCOS 64 RPG Translator	NC	10
SCV1620	360/370 COBOL to COBOL-74 Translator	NC	10
SCV7609	System/3 COBOL to COBOL-74 Translator	NC	10
SCV7613	360 RPG to GCOS 64 RPG Translator	NC	10
SCV7614	370 RPG to GOCS 64 RPG Translator	NC	10
SCV7629	370 File and Volume Translator	NC	10
SNC8020	Distributed Network Supervisor (DNS)	490	86
SNC8021	Network Operator Interface (NOI)	10	5
SNC8022	Cross-Net Load/Dump Facility	10	5
SNC8024	DPS 7/GCOS 64 Host Connection	42	7
SNC8028	Multiple Host Connection-Homogeneous	20	8
SNC8031	High-Level Data Link Control (HDLC) Primary Network Support, (Point to Point)	82	15
SNC8033	Primary Network Private Virtual Circuit Endpoint	166	29
SNC8034	Primary Network Private Virtual Circuit Switching	170	30
SNC8037	Primary Network Connection-Telenet U.S.A.	166	29
SNC8038	Primary Network Connection-Tymnet U.S.A.	166	29
SNC8039	Primary Network Connection-Datapac Canada	166	29
SNC8056	Extended X.25 Public Network Interface Support (Greater Than 16 Virtual Circuits)	20	5
SNC8057	Asynchronous Terminal Support	NSC	NSC
SNC8058	VIP Synchronous Terminal Support	NSC	NSC
SNC8067	Telenet Asynchronous Pad Support (U.S.)	20	5
SNC8068	Tymnet Asynchronous Pad Support (U.S.)	20	5

*Available for an annual fee of $427 to both monthly license fee and initial license fee customers.
**Not available on new orders.
***Fee based on power of CPU.

Honeywell DPS 7 Series

SOFTWARE PRICES

		Monthly License Fee	Monthly Software Support
Current System Software (Continued)			
SNC8069	Datapac Asynchronous Pad Support (Canada)	20	5
SNC8096	Distributed Network Supervisor/Entry (DNS/E/7), for GCOS 64. Includes: SCC1220, SNC8020, SNC8021 and SNC8024.	396	70
Application Software—Native Mode			
ACD0001	PROFIT/64	1,068	25,636
ACD0016	Sales Order Processing (online available on RPQ basis only)	679	24,438
ACF0001	Accounts Receivable System	161	4,030
ACF0002	Accounts Payable System	161	4,030
ACF0003	General Ledger System	161	4,030
ACF0004	Payroll System	161	4,030
ACF6004	Payroll Tax Update (for ACF0004)	*	*
ACF6011	Accounts Receivable Online Module	43	1,795
ACF6012	Accounts Payable Online Module	43	1,795
ACM0010	IMS/64 Inventory Reporting Bill of Material—Extended	161**	6,689**
ACM0011	IMS/64 Material/Resource Requirements Planning	337**	13,841**
ACM0012	IMS/64 Standard Cost—Extended	83**	3,343**
ACM0020	Production Scheduling and Control (PSC/64)	311**	12,847**
ACM0060	HMS Inventory Record Management	100	5,000
ACM0061	HMS Manufacturing Data Control	500	25,000
ACM0062	HMS Material Requirement Planning	400	20,000
ACM0063	HMS Master Production Scheduling	400	20,000
ACM0064	HMS Statistical Forecasting	200	10,000
ACM0065	HMS Capacity Requirement Planning	400	20,000
ACM6011	IMS/64 Material Requirement Planning—Extended	161**	6,689**
ACM6040	IMS/64 Extended Online	146**	6,076**■

*Available for an annual fee of $427 to both monthly license fee and initial license fee customers.
**Not available on new orders.