

Honeywell DPS 7 Series

MANAGEMENT SUMMARY

UPDATE: *As part of ongoing plans to modernize the DPS 7 line of medium-size computer systems, Honeywell planned to include GCOS 7, the latest version of the Honeywell standard operating system, with all new processor shipments beginning in August or September 1985. GCOS 7 replaces the previous standard DPS 7 operating system, GCOS 64. After August 1985, Honeywell will continue to offer GCOS 64 with new model shipments, but only if a customer specifically requests it. Although Honeywell plans to shift product emphasis to GCOS 7, the vendor will continue to support systems using the older operating system.*

In addition to the new operating system, Honeywell also expanded the maximum storage capacities of all the processors, and introduced new mass storage and magnetic tape peripherals. Earlier this year, Honeywell brought out a two-megabyte memory expansion module that now makes use of the new 256K-bit MOS memory technology. Systems configured with four to six megabytes of main memory can add the two-megabyte module. Depending on the model, maximum main memory can range from four to eight megabytes. All new shipments of DPS 7E processors are also outfitted with the 256K-bit chips.

On the hardware side, Honeywell added a new 900-megabyte mass storage subsystem, the MSS4979, a magnetic tape processor, the MTP4475, and a 9-track, 1600/6250 bpi magnetic tape unit, the MTU0537. Additionally, Honeywell lowered the price of certain mass storage devices.

The new operating system, memory options and peripherals are the latest additions to the four-model DPS 7 computer family introduced in the United States in 1981. The DPS 7 Series is based on a similar product developed in France by Groupe Bull (formerly Cii Honeywell Bull). In 1984, as part of a major product overhaul, Honeywell announced and began delivering revised versions of the

The Honeywell DPS 7 Series systems 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 a growth path for Level 62 and Level 64 users. Throughout the DPS 7 line, system upgrades can be performed on-site without central processor swap-outs or major disruption of operations.

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

CONFIGURATION: From 1 to 8 megabytes of memory and up to 21 billion bytes of disk storage, 20 tape drives, 10 unit record devices, and 268 communications lines.

COMPETITION: Burroughs B 2900 and B 3900; IBM System/38 and 4300 Series; NCR V-8500 Series; and Sperry System 80.

PRICE: Purchase prices range from \$85,200 for the DPS 7/35E central processor subsystem to \$215,700 for the DPS 7/65E.

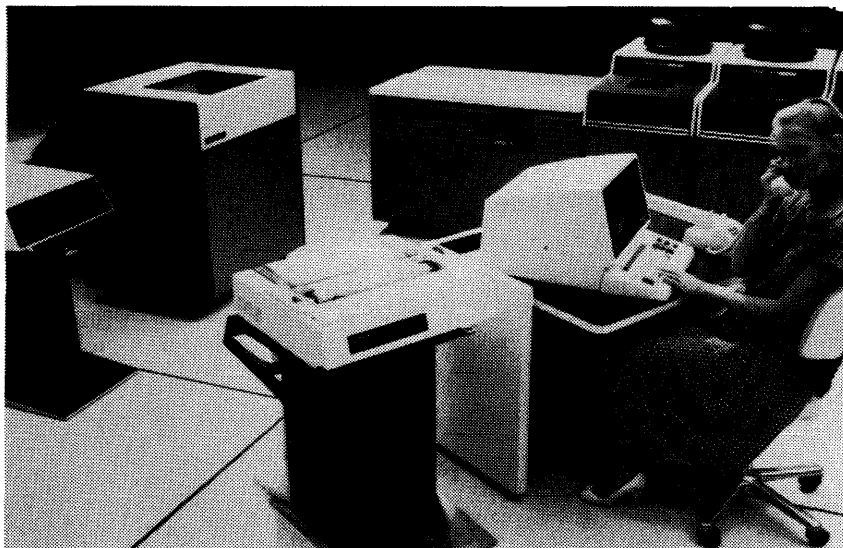
CHARACTERISTICS

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

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

DATE ANNOUNCED: DPS 7/35E—June 1983; DPS 7/45E, 7/55E, and 7/65E—November 1983.

DATE OF FIRST DELIVERY: Original models—January 1982; "E" models—December 1983.



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

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▷ DPS 7 and changed its model designations to DPS 7/35E, 7/45E, 7/55E, and 7/65E. The "E" models are nearly identical in functionality and appearance to the earlier DPS 7 models. In 1984, it became possible to directly attach selected Level 62 mass storage units to assist Level 62 users in their migration to the DPS 7. Also added was a new tape adapter with two new tape units.

The biggest enhancement to the processor line this year, of course, is GCOS 7. Unlike GCOS 64, GCOS 7 is a menu-driven operating system with built-in user-friendly features such as prompts and Help facilities. It's designed for users throughout an organization whose level of computer training and experience can vary. According to Honeywell, the menu features will make inexperienced computer users productive in a short time while more experienced users can bypass some of the user-friendly features to achieve even greater productivity. GCOS 7 is a multitasking, virtual storage operating system that supports interactive and batch processing in centralized and distributed environments.

The four DPS 7 models feature a single central processor with substantial use of microcoding to implement system functions. The two smaller systems have a central processor cycle time of 330 nanoseconds while the DPS 7/55E and the top-end DPS 7/65E have a 140-nanosecond cycle time. With the introduction of new memory expansion options, main memory sizes can now range from one to four megabytes in the DPS 7/35E, one to six megabytes in the DPS 7/45E, and two to eight megabytes in the DPS 7/55E and 7/65E. 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 can be field upgraded to the power level and capacity of any of the higher models.

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 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 two optional communications modules that provide six communications lines each. Up to 21 billion bytes of on-line storage can be configured using separate mass storage processors and three different disk subsystems, including a 1.2-billion-byte dual-spindle unit, the MSU0555. As many

▶ 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. Half-word (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: 64K-bits or 256K-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 micro-packaging 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 in control store is accompanied by a Hamming code (seven bits for every four 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.

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

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TABLE 1. SYSTEM COMPARISON

MODEL	DPS 7/35E	DPS 7/45E	DPS 7/55E	DPS 7/65E
SYSTEM CHARACTERISTICS				
Date announced	June 1983	April 1984	April 1984	April 1984
Date first delivered	Fourth Quarter 1983	April 1984	April 1984	April 1984
Field upgradable to	7/45E, 55E, 65E	7/55E, 65E	7/65E	—
Relative performance	1.00	1.40	1.95	2.90
Number of processors	1	1	1	1
Cycle time, nanoseconds	330	330	140	140
Word size, bits	32	32	32	32
Operating systems	GCOS 7, GCOS, GCOS-ES	GCOS7, GCOS, GCOS-ES	GCOS 7, GCOS	GCOS 7, GCOS
MAIN MEMORY				
Type	64K-bit or 256K-bit MOS	64K-bit or 256K-bit MOS	64K-bit or 256K-bit MOS	64K-bit or 256K-bit MOS
Minimum capacity, bytes	1MB	1MB	2MB	2MB
Maximum capacity, bytes	4MB	6MB	8MB	8MB
Increment size	1 or 2MB	1 or 2MB	1 or 2MB	1 or 2MB
Cycle time, nanoseconds	355 read, 290 write	355 read, 290 write	355 read, 290 write	355 read, 290 write
BUFFER STORAGE				
Minimum capacity	Not applicable	Not applicable	Not applicable	Not applicable
Maximum capacity	Not applicable	Not applicable	Not applicable	Not applicable
Increment size	—	—	—	—
INPUT/OUTPUT CONTROL				
Number of channels:				
Byte multiplexer	—	—	—	—
Block multiplexer	—	—	—	—
Word	—	—	—	—
Other	2-4	4-6	4-6	4-8

as 16 tape drives can be connected to the DPS 7 via magnetic tape processors. From one to four additional tape units can be attached using a new tape adapter. 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.

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 communications 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. The 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.

COMPETITIVE POSITION

The DPS 7 competes against the IBM System/38 and 4300 Series, the Burroughs B 2900 and B 3900, the NCR V 8500 Series, and the Sperry System 80. With some notable exceptions, most product lines within the medium-size mainframe arena have remained fairly stable. The biggest changes have occurred within the IBM 4300 line and within Burroughs medium-size systems. Last year, IBM withdrew older 4321 and 4331 systems, took the 4341 out of active production, and expanded the entry-level 4361 processor family with new models and enhancements. Burroughs, meanwhile, announced plans to phase out its

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 subunits, 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 subunits. Microprograms are composed of two or more 32-bit words, each protected by four parity bits.
- **Address Calculation Machine (ACM):** The ACM handles all address translations, includes the base registers and an associative memory that stores up to eight 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 the other processor 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.

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▶ older mid-range models, such as the B 2900 and B 3900 and replace them with the new V Series models. Most of the DPS 7 mid-range competition continues to use 64K-bit memory chips, except for Burroughs' new V Series models which employ 256K-bit memory chips. It should be noted, however, that the first installments of the new V series feature larger main memory capacities and are positioned above the DPS 7 line.

The DPS 7 Series features between one and eight megabytes of main memory, 64K-bit or 256K-bit memory chips (depending on the age of the model and when it was shipped) and sells for between \$85,200 and \$215,000. The newer IBM 4361 Model Group 3 systems feature two to four megabytes of main memory and sell for between \$56,500 and \$71,500. The Sperry System 80 features 524 kilobyte to four-megabyte main memories and sells for between \$66,082 to \$123,900. Both the Sperry System 80 and the Honeywell DPS 7 are specifically designed for distributive processing applications and offer a range of I/O configurations.

ADVANTAGES AND RESTRICTIONS

Within the last couple years Honeywell has been refashioning its medium-size processor line and increasing its appeal. This year's big change comes with the delivery of a new GCOS operating system. GCOS 7, the new user-friendly system, is in many ways a response to the more flexible role computer systems are playing in many organizations. The greater use of transaction processing lets more users with varying levels of experience access the central computer system. Menus, prompts, and Help facilities let nondata processing professionals become familiar with the components and capabilities of the operating system more quickly. Of course, the use of such user-friendly features also increases the amount of memory space the operating system must occupy. In this regard, GCOS 7 is no exception. How much additional memory to accommodate the new operating system will be required depends on existing memory size, job mix, and applications. Highly interactive environments making use of the additional user-friendly features will probably have to add some additional memory.

The switch to GCOS 7 from GCOS 64 Release 0501 should be easy to accomplish, at least according to Honeywell. GCOS 7 is fully compatible with GCOS 64, making it possible for users of the current release of GCOS 64 to migrate to GCOS 7 without any conversion.

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 reportedly doubles the DPS 7's performance over the earlier Level 64/DPS-330 while reducing the space it requires to one third. The DPS 7 fills 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 the transition from Levels 62 and 64 and Series 200/2000 to the DPS 7 as easy as possible. Level ▶

- ▶ • **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 subunits during a single cycle. The sequencing of firmware instructions is controlled by the Pilot machine. Up to five microinstructions can be executed simultaneously by the subunits.

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 eight 32-bit Base Registers for internal address computation, sixteen 32-bit General Registers for data handling and indexing, four 64-bit Scientific Registers for floating-point data handling, one 32-bit Stack Register pointing to the stack associated with the running process, and one 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 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 instruc- ▶

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▷ 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.

USER REACTION

The 21 DPS 7 users who responded to the 1985 Datapro survey of general purpose computers have many traits in common. Most of the 21 respondents converted to the DPS 7 from either a Honeywell Level 62 or 64 System within the last two years. The majority purchased rather than leased their systems. Of the 21, eight have DPS 7/45s, three have DPS 7/35s, two have DPS 7/55s, two have DPS 7/35Es, one has a DPS 7/45E, and one has a DPS 7/65. The largest single industry represented among the 21 were businesses involved in retailing or wholesaling (7). Other major industry sectors included manufacturing (3), transportation (2), government (2), health care and medical (1), and insurance (1). Most of the users put their DPS 7s to work on traditional bread-and-butter business applications. These include, in order of rank, accounting and billing, payroll and personnel, order processing and inventory control, sales and distribution, and purchasing. A healthy number also use the DPS 7 for manufacturing applications.

Of these 21 respondents, five said they use a database management system, while five also said they planned to install one this year. Ten said they have no such plans. The five using a database management system use either Honeywell's IDS or DM IV packages. Of the nine who said they use a communications monitor, five said they use Honeywell's TDS. Six said they do not use a monitor and the rest said they have no plans to install one this year.

The users' ratings of the DPS 7 systems, summarized in the table below, are generally higher in most categories than rating results tabulated in last year's user survey. The DPS 7 overall satisfaction rating increased from the 3.09 weighted average recorded last year to 3.33. The DPS 7 also shows improvements in maintenance and technical support. Overall ratings in this category, however, show that Honeywell and most competing vendors continue to fall well short of user expectations. Another category that usually draws a low rating among most vendors is vendor-supplied application programs. The DPS 7 was rated at 2.44 in this category, virtually the same as the rating reported for this category last year. A particular Honeywell sore spot may be ease of conversion. The score in this category dropped from the 3.09 recorded last year to 2.95 scored in 1985.

Overall, DPS 7 users were generally pleased with their systems. An official with a Florida-based publishing company had only good things to say about his DPS 7/35E, installed in October 1984. The firm, which uses the Honeywell system for direct-mail and directory publishing applications, migrated from a Honeywell Level 62 system. "Our previous experience with the Level 62 was great. We've been with Honeywell six or seven years now, and they've never let us down." A Wisconsin photo-finishing company uses a DPS 7/35E for accounting, billing, and

▷ tions used in the GCOS 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.

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 7/55E and 7/65E 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 require operating conditions of 68 to 78 degrees Fahrenheit, with a noncondensing relative humidity of 45 to 55 percent. The power source must be two-phase, 208 volts \pm 10 percent at 60 Hz \pm 0.05 Hz. The CPU cabinet set measures 54.3 inches wide, 33.5 inches deep, and 33.5 inches high, and weighs 838 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 7/35E has two channels expandable to four; the DPS 7/45E and 7/55E have four channels expandable to six; and the DPS 7/65E 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 DCC4270 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 SURP also supports a Magnetic Tape Adapter (MTA4370) with up to four tapes. The largest DPS 7 systems can handle up to 10 unit record devices using a URP4375 Unit Record Processor in addition to the SURP.

MASS STORAGE PROCESSORS: Each DPS 7 system has at least one MSP4575 or MSP4270 Mass Storage

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TABLE 2. MASS STORAGE

MODEL	MSU0390	MSU0402	MSU0452	MSU0555	MSS4979
Cabinets per subsystem	1	1	1	1	3
Disk packs/HDAs per cabinet	1	1	1	2	3
Capacity	300MB	100MB	200MB	1200MB per drive	900MB
Tracks/segments per drive unit	Not specified	Not specified	Not specified	Not specified	Not specified
Average seek time, msec.	25	25	25	25	25
Average access time, msec.	33.3	33.3	33.3	33.3	33.3
Average rotational delay, msec.	8.3	8.3	8.3	8.3	8.3
Data transfer rate	1,200,000 bytes/sec.	806,000 bytes/sec.	806,000 bytes/sec.	1,065,000 bytes/sec.	1,200,000 bytes/sec.
Controller model	MSP4270	MSP4575	MSP4575	MSP4575	Includes mass storage processor
Comments	Removable	Removable	Removable	Fixed	Removable

other business applications. The firm's DP manager was particularly pleased with a Honeywell communications monitor. "The TDS communications monitor works super," he said. Three DPS 7 users interviewed also said they would probably migrate to GCOS 7, Honeywell's latest enhancement of the DPS 7 standard operating system. But for one DPS 7/35 user, at least, the new operating system will increase system overhead. If GCOS 7 is installed, the DP manager of a Michigan-based manufacturing firm said he will probably have to add another megabyte of main memory and at least another disk drive to accommodate GCOS 7 and his existing applications.

The users' ratings are summarized in the following table.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	9	10	0	0	3.47
Reliability of mainframe	12	4	2	1	3.42
Reliability of peripherals	7	11	0	1	3.26
Maintenance service:					
Responsiveness	8	10	3	0	3.24
Effectiveness	4	14	3	0	3.05
Technical support:					
Troubleshooting	4	15	1	1	3.05
Education	0	16	4	1	2.71
Documentation	1	14	5	1	2.71
Manufacturers software:					
Operating system	10	10	1	0	3.43
Compiler & assemblers	9	12	0	0	3.43
Application programs	0	8	7	1	2.44
Ease of programming	5	14	2	0	3.14
Ease of conversion	5	8	6	0	2.95
Overall satisfaction	8	12	1	0	3.33

*Weighted Average on a scale of 4.0 for Excellent.

All 21 of the survey respondents said the DPS 7 systems did what they were expected to do. Seventeen respondents said they would recommend the DPS 7 systems to other users, one respondent would not recommend the system, and three said they were undecided. □

Processor or one MSS4979 Mass Storage Subsystem. 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 two MTP4275 Magnetic Tape Processors, connecting up to 16 tape drive units, can be supported on the DPS 7. The MTP4275 controls up to eight 7-track or 9-track tape units.

COMMUNICATIONS PROCESSOR: Up to 12 synchronous or asynchronous communications lines can be connect-

ed to the DPS 7 systems via two DCC4270 Data Communications Controllers.

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 eight megabytes of MOS memory, expandable in one-megabyte modules (CMM4701). Those systems operating at the four-megabyte level can add memory in two-megabyte increments (CMM4721). Also included are two to eight channels, a Service and Unit Record Processor (SURP), and a Remote Maintenance Adapter. Each model can connect up to two DCC4270 Data Communications Controllers which support up to 12 synchronous or asynchronous lines. All models except the DPS 7/35E 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 7/55E and 7/65E that can connect up to five additional unit record devices. The models 7/35E and 7/45E can configure one MTP4275 Magnetic Tape Processor (MTP) and up to eight tape drives. The 7/55E and 7/65E can have two MTPs and up to 16 tapes. Disk storage is supported through one to four MSP4575 or MSP4270 Mass Storage Processors, or one to four MSS4979 Mass Storage Subsystems. The maximum number of spindles on the DPS 7 systems ranges from 17 (DPS 7/35E) to 36 (DPS 7/65E) with a maximum on-line storage capacity of 20.8 billion bytes on the DPS 7/65E.

MASS STORAGE

MASS STORAGE UNITS: See Table 2.

INPUT/OUTPUT UNITS

MTP4275 MAGNETIC TAPE PROCESSOR: This processor handles nine-track tape with a recording density of 800 or 1600 bpi, seven-track tape with densities of 200, 556, or 800 bpi, and can simultaneously control up to eight tape units.

MTP4475 Magnetic Tape Processor: This processor handles nine-track tape with a recording density of 1600 or 6250 bpi, and can control up to eight tape units.

MTA4370 MAGNETIC TAPE ADAPTER: This adapter allows the attachment of from one to four nine-track tapes with a density of 1600 bpi. ▶

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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.
MTU0320/0420 MTU0500	9 7 or 9	1600 556/800/ 1600	PE NRZI/ PE	45 or 75 125	72,000/120,000 70,000/100,000/ 200,000
MTU0537	9	1600/ 6250	GCR	125	781,000
Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
PRU0615 PRU0906 PRU1205 PRU1600	600 lpm 900 lpm 1200 lpm 1600 lpm	136 136 136 136 std.; 160 opt.	10 10 10 10	6 or 8 6 or 8 6 or 8 6 or 8	3 to 15 wide 4 to 19 wide 4 to 19 wide 4 to 22 wide

► **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 URP4375, can be added, providing five more device ports. Each peripheral device connects to a device port via an addressing attachment.

PRINTERS: See Table 3.

CARD EQUIPMENT: See price list.

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 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 capacity of 985,088 bytes. The DDU4055 and DDU4056 are mutually exclusive with the MTA4370.

TERMINALS: Please refer to Table 3 and the terminal section of the price list.

COMMUNICATIONS CONTROL

The DPS 7 can support two integrated data communications controllers (DCC4270) that connect up to 12 synchronous or asynchronous line attachments (DCA4270) 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. Up to two DATANET 8 processors can be configured with a DPS 7 system.

SOFTWARE

DPS 7 can now operate under one of three available operating systems: GCOS 7, GCOS 64, or GCOS Entry System (GCOS-ES). GCOS 7 is the newest version of the standard Honeywell operating system. It's a virtual storage, multipurpose operating system containing features for both experienced and inexperienced operators.

GCOS, (formerly GCOS 64) was the primary DPS 7 operating system before the introduction of GCOS 7. It's the same monitor used on the Level 64/DPS-330, which supports batch, transaction, and distributed processing environments in addition to interactive timesharing. This older version of GCOS will eventually be phased out.

GCOS-ES, the third system, is an entry-level operating system for DPS 7/35E and DPS 7/45E users. GCOS-ES is a subset of the previous GCOS version and is fully compatible with it.

GCOS 7 OPERATING SYSTEM

GCOS 7 is a menu-driven system that incorporates user-friendly features to guide inexperienced or untrained users through its many components. To enhanced productivity, more experienced users can bypass some user-friendly features. GCOS 7 supports centralized, distributive, interactive and, batch processing, and offers a database management system. Similar to the previous operating system version,

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TABLE 4. TERMINALS

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

► GCOS 7 can execute up to 64 concurrent activities. This latest version of the GCOS operating system is compatible with the previous operating system. Users operating under the latest release of the previous GCOS can migrate to GCOS 7 with minimal transition requirements, according to Honeywell. GCOS 7 also includes transition products to help users migrate from certain IBM source-code programs. These include Cobol programs written for IBM 360/370 systems, System 3 Cobol and IBM 370 and System/3 RPG II.

Honeywell divides operating system functions into three parts: production system, information system and development system. The production system component includes database management and transaction processing features. Information functions involve utilities for retrieving and processing data and text. Development system functions include such tools as a data dictionary and menus to speed up program development time. Basic components of GCOS 7 include multitasking, virtual memory, diagnostics, resource allocation, CPU dispatching, and load balancing. Other major components include language compilers and networking products. Communications support is provided through Distributed Systems Architecture (DSA) networking software.

GCOS 7 is built around a large set of menus, prompts, Help text, and an interactive command language. Menus display functions for selection, the prompts provide brief descriptions of parameter entries, and the Help text supplies detailed explanations on request. Another related feature is the GCOS Command Language (GCL). This interactive command language lets users define and create command sequences. GCL includes the functions of Job Control Language and Operator Control Language.

CENTRAL SYSTEM FUNCTIONS: GCOS 7 uses virtual storage memory management techniques. To put main memory to most efficient use, system code, user code and data segments can be relocated automatically. A combination of hardware, firmware, and software all work in concert to achieve this efficiency. To establish CPU execution priorities, GCOS 7 uses four dispatching algorithms:

- Event-driven CPU-time by class;
- Slicing CPU-time within a class;
- Limiting CPU-time within a class; and
- Optimizing CPU and I/O-bound jobs in adjacent classes.

Resource allocation under GCOS 7 is flexible. Operators can mount tape and disk volumes on any available device. The operating system automatically recognizes the device

and makes the mounted volume available to the executing job.

A job management system under GCOS 7 sets up priorities and determines when each job will be executed. A job scheduler uses a system of job classes and priorities to determine when each job will be executed. The system provides up to 16 user classes, eight levels of scheduling priorities, and 10 levels of execution priorities.

As jobs flow through the system, job accounting information is collected at all stages. The system tracks job names, times, dates, memory and segment activity, and I/O activity. Such information can be edited for printing or used for billing or system analysis programs.

A GCOS 7 facility called the Catalog contains information about files, projects, and users. The Catalog enhances system security by controlling access to various files. The facility is part of a built-in data integrity and protection system. The Catalog contains information about data accessible to users and the programs they can run. To help ensure that work submitted to GCOS 7 will not be lost, system journals contain copies of records before and after processing.

Data integrity and recovery are maintained through a number of facilities provided for these purposes. These include the File Salvage Facility, which ensures that file status and file control information is correct following an incident. The Before-Journal Facility restores file contents in case of hardware, software, program, or TDS transaction failure. The Checkpoint/Restart Facility establishes a program restart point. Used in conjunction with the Before-Journal Facility, the utility repositions files and starts jobs at the last restart point. The After-Journal Facility records file updates as they occur, making it possible to recover files in case of volume destruction. Deferred Updating delays updating files until a unit of processing is completed successfully.

To assist in error detection and correction, GCOS 7 maintains a permanent log. When an error is detected and corrected, if possible, the permanent log is updated. Operators and service personnel can use the log for routine maintenance procedures and to monitor the status and error history of all system components. To pinpoint and correct errors, the log can be accessed by service personnel locally and remotely.

Besides system security, integrity and recovery features, other facilities available system-wide include spooling-sorting-merging functions, code-forms-data management functions, system management facilities, networking and transition tools. ►

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► **Spooling functions** are handled by the GCOS 7 Output Writer. This function, automatically handles printed and punched output production, unit record resource sharing among competing activities, and the restarting or repositioning after an incident, all without the need for user intervention. Sorting and merging functions sequence tape and disk files through various methods.

Code management is handled through Library Maintenance and Text Editing facilities. Using this feature, libraries containing source, executable, binary and shareable code for system and user functions can be created, managed, and deleted. These facilities can be used in batch or interactive environments, and are supported by menus, prompts, and Help text.

Forms management is handled through the Forms Management Utility. This feature simplifies forms creation, storage, and maintenance in transactional and interactive environments. Programmers can generate the forms by entering commands into the forms-generation utility.

Volume and file management are supported by a variety of utilities that can operate in batch or interactive modes. They are also supported by menus, prompts, and Help text. At the volume level, utilities are available for preparing volumes, checking volume integrity, duplicating volumes, printing blocks of a volume, listing volume content and saving or restoring volumes. Similar functions are also available at the file level. Additional file level functions include the ability to create a file, compare two files, reorganize an indexed file, sort and load secondary indexes, process file groups and allocate or deallocate file space.

File access methods available under GCOS 7 are Unified File Access System (UFAS), Basic File Access System (BFAS), and Multiple Logic Data Store (MLDS). UFAS, the main file access facility under GCOS 7, offers a single alternative to random, sequential, and indexed sequential files. With UFAS, users need not be concerned with the physical characteristics of file media. UFAS permits all record insertions to be handled totally within the main body of the file structure. This results in predictable performance over the life of the file, reducing the need for periodic performance-related file reorganization. UFAS also supports secondary indexing capabilities for indexed sequential files.

BFAS, an IBM 360/370-compatible file system, allows interaction between IBM and Honeywell GCOS 7 environments.

MLDS supports the methods and structures used on Honeywell Level 62 and IBM System/3 environments.

Products designed to improve programmer productivity include Interactive Development Facility (IDF), Interactive Program Checkout Facility (IPCF), Full Screen Editor (FSE), and Data Dictionary. IDF creates environments for fashioning forms personally tailored to the needs and experience of users, including the creation of personal user commands. IPCF capabilities include stopping on an address, displaying or modifying the contents of one or more variables, and modifying a program's processing sequence. FSE, a text editor, is a menu-driven facility that contains an extensive HELP system. The product permits the formatted entry of Cobol and RPG II programs. The product complements the line/context editor by providing easy, full-screen creation and maintenance of library members. Data Dictionary simplifies the standardizing of terminology and helps eliminate redundancy. To help improve program development, the facility provides programmers with a complete picture of applications as they pass through different stages of development.

SYSTEM MANAGEMENT: Four products under this category manage and control disk-space distribution and provide monitors for hardware and software resources. These include the Multiple Backing Store, a facility that distributes disk-stored virtual memory over up to seven disk volumes. This helps to better distribute storage load and optimize performance under heavy disk-load conditions.

General Access Control, another management tool, provides for protected access to the same files simultaneously from concurrently executing jobs operating in batch, remote batch, transactional, and interactive environments.

System Behavior Reporter, a third management tool, monitors and reports on the behavior of allocated hardware and software resources. Coupled Systems Support allows disk space to be shared dynamically by two GCOS 7 systems. File and database access between the two systems can be partially or fully shared. The two systems sharing disk files can be different configurations operating at different levels of power.

Data Communications Software

Communications and networking configurations are available through the Data Communications Controller and the Datanet 8 front-end network processor. At the software level, GCOS 7 provides for a number of operating system facilities. These include the Transaction Driven System (TDS), Basic Terminal Network Support, Front-end Network Processor Support (FNPS), Virtual Communications Access Method (VCAM), Message Access Method (MAN), File Transfer Facility/6 (FTF/6), Remote Batch Facility/6 (RBF/6), Distributed Job Processing (DJP), and Distributed File Transfer (DFT).

Transaction Driven System (TDS) is a transactional monitor that allows users to communicate with the operating system through terminals and access data immediately. TDS controls user access to the I-D-S/II database management system and to UFAS or MLDS files, and maintains file integrity and recovery through the journals facility. Transactions can be written in Cobol or RPG II. Additionally, a special interface allows the linking of batch programs to TDS as though they were terminals.

The Basic Terminal Network Support (BTNS) module works in conjunction with the Data Communications Controller. BTNS manages the physical operation of networks, allocates communications resources, transmits messages among terminal and program queues and monitors network activity of the communications controller.

Front-end Network Processor Support (FNPS) works with the Datanet 8 front-end processor and its resident Distributed Network Supervisor software to perform several operations. A major FNPS function is the managing of Datanet 8 interaction with GCOS 7. FNPS handles Datanet 8 requests, performs I/O channel control, executes buffer management and checks Datanet 8 operations. It also controls administrative functions, statistics collection, and journalization, and software loading and generation.

Virtual Communications Access Method (VCAM) establishes logical connections between GCOS 7 communications-based applications and the communications network.

Message Access Method queues and dequeues the messages passing between the communications network and Cobol communications programs.

File Transfer Facility/6 is used to exchange files between a DPS 7 and DPS 6/microSystem 6/Level 6 systems. Transferred files must be organized sequentially with fixed-length records. ►

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► Remote Batch Facility/6 (RBF/6) is used to accept job requests from a DPS 6/microSystem 6/Level 6 system for execution on DPS 7. RBF/6 delivers the resulting output to the requestor, or to another DPS 6-based system.

Distributed Job Processing (DJP) establishes communications between DPS 7 systems through DSA networks. DJP permits remote batch job entry, message routing between systems, and the chaining or initiating of remotely submitted jobs automatically. The facility also monitors submitted jobs and receives generated output.

Distributed File Transfer (DFT) is used to transfer information between two DPS 7 systems through a DSA primary network. Data transfers can be initiated through a job command or operator command.

Database Management Software

Under GCOS 7, Honeywell offers several products for master file updating, job scheduling, and the enhancing of batch/transaction processing throughput. These include the TDS transaction processing system, the I-D-S/II database management system, and Data Management 7 (DM7). DM7 combines TDS, Data Base Manager (DBM), Query, an inquiry processor, and Data Base Reorganizer (DBREORG) in a single product. TDS was described in the Data Communications section.

I-D-S/II, the GCOS 7 database manager, performs many functions in both batch and interactive environments. The facility includes an integrated manager, a utility for creating, administering, monitoring, maintaining, and validating the database, a dialogue capability. The database can be accessed directly using Cobol verbs interactively.

Transactional Context Restart Facility (TCRF) is used to restart transactional applications on a backup system. The facility restarts TDS jobs in a short time without interrupting backup system operation.

Query is a user-friendly, end-user oriented facility for handling information requests from various data organizations including UFAS, I-D-S/II, BFAS, and MLDS. With assistance from a Help facility and special formatting capabilities, the facility allows access to given file records, access to fields from a record, and also allows the rearranging or combining of fields.

Programming Languages

Cobol language processor, an implementation of the 1974 ANSI specification, provides access to other languages such as Fortran, access to TDS and communications through Cobol verbs, and access to I-D-S/II databases through standard CODASYL language elements.

Basic language processor implements ANSI 78 standards. The processor has functions specific to GCOS 7. These include interactive debugging and execution, operating commands for using programs written in Basic and for user help. Also available for Basic users is a mathematical library.

RPG II language processor is compatible with other common industry implementations. It supports all GCOS file organizations and the creation of RPG II programs to be executed under control of the TDS.

Fortran language processor supports data access methods and file organizations for the Unified File Access System and Basic File Access System. The Fortran processor uses the scientific instruction set and provides for quadruple precision, complex double precision, manipulation of character data types, and arrays of up to seven dimensions.

Other languages supported include PL/1, Pascal, and APL.

GCOS OPERATING SYSTEM

Components of GCOS are virtually identical on both the DPS 7 and Level 64/DPS systems. This allows Level 64 users to migrate to the DPS 7 with no reprogramming or modifications required. The DPS 7/55E and 7/65E can also run Series 200/2000 emulation simultaneously with GCOS. 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.

GCOS Release 0500, can support up to 64 concurrent jobs, consisting 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 nontechnical 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 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 is a virtual memory system that uses segment-relative addressing to optimize the use of main memory. All 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 nonalterable 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 reentrant and is never modified. Therefore, these segments never have to be rewritten and can be overlaid. Swapping ►

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► 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 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 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 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. 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, 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 recommendations 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 nonindexed; 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.

Another 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, ►

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► and serves as a bridge between native and nonnative user applications.

In addition to the GCOS operating system (SCS1300), two mandatory additions to GCOS 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 GCOS. Operating in the IOF environment, it provides interactive definition of screen forms for use in transactional (i.e., TDS 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: VIP7700, VIP7700R, VIP7760, VTS 7710, VTS7740, VIP7804, VIP7805, VIP7814, and IBM 3270 (Display Station 3277, Model 2).

The Multiple Logic Data Store (MLDS) is an indexed access method which runs under GCOS 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 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 GCOS 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 Release 0500.

Data Communications Software

The GCOS data communications software, together with the DPS 7 communications hardware and firmware, handle networks of up to 12 lines, with up to 32 terminals per line through the Data Communications Controller. DPS 7/45E, 7/55E, and 7/65E 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) 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) corresponds to the various types of messages accepted by the system. TDS 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 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 realtime constraints. TDS 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 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 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 Release 0500.

The Distributed Network Supervisor (DNS) is the communications software designed for use in the 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 persons who are not 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 DM-IV module enhances the DPS 7 systems' communications capabilities by combining the strengths of the TDS 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

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► 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 multifaceted environment within a single system. A DPS 7 system with the DM-IV module in GCOS can support a communications network of 12 lines with up to 32 terminals per line; and, on the DPS 7/45E, 7/55E, or 7/65E, 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.

Data Management 7 (DM 7) is an on-line, integrated data management system which includes all the tools necessary to develop, use, and administer an on-line transactional data base system. DM 7 (SCD1617) is a packaging of several complementary GCOS system software products which encompass the following system facilities:

- I-D-S/II (Integrated Data Store/II) provides the facilities to describe, access, and maintain an integrated data base.
- Data Base Administrator Aids provide the administrative tools needed for examining, maintaining, designing, and continually improving the efficiency of an I-D-S/II data base. The Aids can be executed in an interactive or batch environment.
- TDS (Transaction Driven System), which is described above, handles on-line transactional processing.
- The Forms Management Utility enables data terminal screen forms to be easily defined for use in the TDS environment using Cobol or RPG. Screen forms can be generated for use with the following terminals: VIP7814, VIP7804/5, VIP7700/R, VIP7760, VTS7710, VTS7740, and IBM3270.
- The Query Processor component of DM 7 provides an information retrieval facility for end users. The information can be displayed at a terminal or in a simple formatted report.

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.

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 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 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 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, supports a high-level report generation language, and produces report-oriented programs from specifications furnished by the user. DPS 7 RPG 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, Basic programs can be developed and executed in either batch or interactive mode.

Conversion Aids

GCOS 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 concurrently with user production. With this facility, key diagnostic programs that operate under GCOS 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.

GCOS-ENTRY SYSTEM

GCOS-Entry System (GCOS-ES) is an entry-level version of the GCOS operating system intended for use on the DPS 7/35E and 7/45E. The operating system is functionally equivalent to the older version of the GCOS operating system, but is priced lower. When it was first introduced in 1983, Honeywell called the package a first step for new DPS 7 users expecting only gradual growth into the full DPS 7 GCOS environment. GCOS-ES includes facilities for database management, transaction processing, screen forms management, query processing and report generation. Major components include DM 7-ES integrated database system, an implementation of I-D-S/II, TDS, a transaction processor monitor, the Forms Management Utility, and the Query Processor, an information retrieval facility. ►

Honeywell DPS 7 Series

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 7/35E: Includes CPU with one megabyte of main memory, mass storage processor, integrated service and unit record processor, integrated 8-inch diskette drive, a 300 megabyte mass storage unit, a magnetic tape processor, a 1600 bpi, 75 ips tape drive, a unit record processor, a 900 lpm printer, a 300 cpm card reader, a Datanet 8 front-end network processor, and a channel interface base. The purchase price is \$273,003, the monthly maintenance is \$1,422 and the monthly one-year lease price is \$11,384.

EXPANDED COMMUNICATIONS-ORIENTED DPS 7/55E: Includes two megabytes of main memory, four I/O channels, integrated service and unit record processor, a dual-density disk drive, a mass-storage processor, a 1,200 megabyte mass storage processor, a magnetic tape processor, two nine-track, 1600/800 bpi tape unit, a unit record processor, a 1600 lpm belt printer, a 1050 cpm card reader, a Datanet 8 front-end processor and two channel interface bases. The purchase price is \$441,503, the monthly maintenance is \$2,008 and the monthly one-year lease price is \$18,395.

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.

The GCOS 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.

Education services include standard courses, advanced professional training, multimedia self-instruction courses so that customers can self-train as often as needed, site surveys to determine educational requirements, on-site classes, and clustered on-site classes to accommodate a group of users from an area.

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

CONTRACT TERMS: DPS 7 equipment is available for purchase or for lease under a one-year, three-year, or five-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 \$159 per working 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 troubleshooting and remote software and hardware correction; and tools for easy software updating by customers.

EQUIPMENT PRICES

		Monthly Charges				
		Purchase Price (\$)	Monthly Maint. (\$)	1-Year Lease (\$)	3-Year Lease (\$)	5-Year Lease (\$)
PROCESSORS						
CPS4937	DPS 7/35E Central Processor; includes CPU with one megabyte of main memory, integrated service and unit record processor, diskette, remote maintenance adapter, two I/O channels, and console	85,200	208	3,593	3,351	2,988
CPS4947	DPS 7/45E Central Processor; includes CPU with one megabyte of main memory, integrated service and unit record processor, diskette, remote maintenance adapter, four I/O channels, and console	107,700	210	4,780	4,449	3,953
CPS4957	DPS 7/55E Central Processor; includes CPU with two megabytes of main memory, integrated service and unit record processor, diskette, remote maintenance adapter, four I/O channels, and console	158,800	364	7,398	6,877	6,098
CPS4967	DPS 7/65E Central Processor; includes CPU with two megabytes of main memory, integrated service and unit record processor, diskette, remote maintenance adapter, four I/O channels, and console	215,700	562	9,408	8,748	7,759

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		Monthly Charges				
		Purchase Price (\$)	Monthly Maint. (\$)	1-Year Lease (\$)	3-Year Lease (\$)	5-Year Lease (\$)
PROCESSOR OPTIONS						
CMM4701	One-megabyte Memory Module	10,000	26	559	518	458
CMM4721	Two-megabyte Memory Module	15,000	52	843	783	692
CPF4712	Peripheral Expansion Cabinet	13,808	47	516	482	429
CPF4713	H200/2000 Emulator for CPS4957/CPS4967	9,400	28	348	323	287
CPF4707	I/O Channel Expansion (for more than four channels)	5,200	5	181	167	148
CPF4710	Two I/O Channels	9,200	4	290	270	236
CPK4981	Upgrade from 7/35E or equiv. power level to 7/45E power level	13,300	2	897	828	729
CPK4982	Upgrade from 7/45E or equiv. power level to 7/55E power level (minimum 2MB C.P. memory is required)	41,100	128	2,059	1,910	1,687
CPK4983	Upgrade from 7/55E or equiv. power level to 7/65E power level	56,900	198	2,010	1,871	1,661
CPK4987	Upgrade from 7/35E or equiv. power level to 7/55E power level (minimum 2MB C.P. memory is required)	54,400	126	2,956	2,738	2,416
CPK4988	Upgrade from 7/35E or equiv. power level to 7/65E power level (minimum 2MB C.P. memory is required)	111,300	324	4,966	4,609	4,077
CPK4989	Upgrade from 7/45E or equiv. power level to 7/65E power level (minimum 2MB C.P. memory is required)	98,000	326	4,069	3,781	3,348
CSF4104	Hardcopy Printer; 120 cps (mandatory)	4,100	70	364	343	310
CSF4102	Pedestal for CSF4104 (sit)	200	—	—	—	—
CSF4103	Pedestal for CSF4104 (stand)	200	—	—	—	—
MASS STORAGE						
MSP4575	Single-Channel Mass Storage Processor; includes one group of 3 device addresses	24,363	90	1,098	1,021	906
MSA4575	Group of 3 Additional Device Addresses	3,075	22	18	111	100
MSF4506	Series 200/2000 Read/Write Mode	2,352	6	80	74	66
MSU0402	100-megabyte Mass Storage Unit	20,805	122	750	890	815
MSU0452	200-megabyte Mass Storage Unit	12,000	113	1,012	931	880
MSU0555	1200-megabyte Mass Storage Unit	46,284	197	1,827	1,703	1,517
MSF0006	Dual Access Feature; for MSU0402/0452	2,070	13	89	83	76
MSF0014	Dual Access Feature; for MSU0555	4,140	23	176	164	147
MSP4270	Single-Channel Mass Storage Processor; includes eight device addresses for MSU0390	21,560	90	1,098	1,021	906
MSS4979	900-megabyte Mass Storage Subsystem; includes addressing for eight devices	60,000	597	4,812	4,144	3,855
MSU0390	300-megabyte Mass Storage Unit	25,000	204	1,238	1,041	983
MSK4026	Upgrades MSU0402 from 100 to 200 megabytes	1,000	—	62	61	62
DISKETTE STORAGE						
DDF4051	Second Drive for Integrated Diskette Unit (factory option)	3,695	24	140	131	118
DDU4055	Single Diskette Drive; 492KB; requires pedestal	2,336	21	95	89	81
DDU4056	Dual Diskette Drive; 985KB; requires pedestal	3,833	32	152	144	130
DDF4052	Pedestal for DDU4055 or DDU4056; low for sitting	184	2	10	9	6
DDF4053	Pedestal for DDU4055 or DDU4056; high for standing	184	2	10	9	6
MAGNETIC TAPE EQUIPMENT						
MTP4275	Magnetic Tape Processor, single-access; addressing for eight devices	24,850	120	896	837	748
MTP4475	PE/GCR Magnetic Tape Processor; addressing for eight MTU0537 units	36,200	265	1,295	1,209	1,080
MTF4207	Translator Option	2,783	9	111	103	91
MTF4208	Pack/Depack Option	2,783	9	111	103	91
MTF4209	NRZI Option	3,728	24	162	151	136
MTA4370	Magnetic Tape Adapter on SURP (for MSU0320/0420)	5,500	43	215	202	182
MTU0320	Magnetic Tape Unit; 1600 bpi, 45 ips	15,100	120	592	556	502
MTU0420	Magnetic Tape Unit; 1600 bpi, 75 ips	16,895	140	668	627	567
MTU0421	Magnetic Tape Unit; 45 ips, 1600 bpi	16,895	140	668	627	567
MTU0500	Magnetic Tape Unit; 125 ips	12,128	159	725	680	613
MTU0537	Magnetic Tape Unit; 125 ips, 1600/6250 bpi	24,900	367	1,144	1,085	996
MTU0630	Magnetic Tape Unit	14,815	130	593	557	505
MTF0636	9-Track, 1600/800 bpi, 125 ips (for MTU0630)	9,805	155	460	435	398
UNIT RECORD EQUIPMENT						
URP4375	Unit Record Processor and Cabinet	18,270	52	623	579	514
URA4351	Addressing for Printer PRU0615	400	2	15	14	13
URA4352	Addressing for Printers PRU0906/1205/1600	5,000	3	191	176	155
URA4354	Addressing for Card Readers CRU0301/0501/1050	3,645	12	126	118	104
URA4355	Addressing for Card Punch PCU0120	6,878	23	238	221	197
URA4356	Addressing for Card Reader/Punch CCU0400	7,088	28	285	266	235
URA4362	Addressing for Diskette Units DDU4055/4056 on URP4375	2,620	12	100	94	83
URA4363	Addressing for Diskette Units DDU4055/4056 on SURP	2,620	12	100	94	83

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Monthly Charges

		Purchase Price (\$)	Monthly Maint. (\$)	1-Year Lease (\$)	3-Year Lease (\$)	5-Year Lease (\$)
PRINTERS						
PRU1600	Belt Printer, 1600 lpm, 136 positions	64,940	538	2,910	2,735	2,472
PRF0022	24 Additional Print Positions for PRU1600	2,610	16	112	105	93
PRU1205	Belt Printer, 1200 lpm, 136 positions	34,500	428	1,903	1,793	1,629
PRU0906	Belt Printer, 900 lpm, 136 positions	29,500	381	1,666	1,570	1,428
PRU0615	Band Printer, 600 lpm, 136 positions	14,585	180	752	708	646
PRM4006	Adapter for PRU0615	500	2	18	17	15
Belts for PRU1600:						
PRB0703	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	—	—	—
Belts for the PRU0906/1205:						
PRB3703	Belt for PRU0906/1205; 64 characters, OCR-B font, Series 200/2000	NC	—	—	—	—
PRB3501	63-character, EBCDIC, OCR-B font belt	NC	—	—	—	—
Bands for PRU0615:						
PRB2501	63 characters, EBCDIC, OCR-B font	NC	—	—	—	—
PRB2502	63-character, OCR-B font band, Series 200/2000	NC	—	—	—	—
PUNCHED CARD EQUIPMENT						
CCU0400	Card Read/Punch; 600 cpm read, 100/400 cpm punch	28,185	219	914	894	868
CRU0301	Card Reader, 300 cpm	9,513	78	380	345	328
CRU0501	Card Reader, 500 cpm	19,500	119	684	638	568
CRF0006	IBM Mark Sense Option for CRU0301/0501	4,520	45	181	168	153
CRF0007	HIS Mark Sense Option for CRU0301/0501	4,520	45	181	168	153
CRF0030	Pedestal for CRU0301/0501; high for standing	184	—	—	—	—
CRF0031	Pedestal for CRU0301/0501; low for sitting	184	—	—	—	—
CRU1050	Card Reader, 1050 cpm	26,555	224	1,136	1,066	961
CRF0003	51-Column Option for CRU1050	2,079	6	75	69	62
CRF005	Mark Sense (IBM/HIS) for CRU1050	7,787	57	256	234	221
PCU0120	Card Punch, 120 cpm	20,032	153	816	741	687
TERMINALS						
VIP7201	Asynchronous, Multi-purpose Keyboard Display Terminal	795	20	—	—	—
VIP7301	Standard Keyboard Display Terminal with RS-422-A interface and 25-foot cable; includes optional RS-232-C interface	1,900	20	—	—	—
VIP7303	Word Processing Keyboard Display Terminal with RS-422-A interface and 25-foot cable; includes optional RS-232-C interface	1,900	20	—	—	—
VIP7307	Data Entry Keyboard Display Terminal with RS-422-A interface and 25-foot cable; includes optional RS-232-C interface	1,900	20	—	—	—
VIP7305	Multi-function Keyboard Display Terminal with RS-232-C/RS-422-A interface and 25-foot cable	1,900	20	—	—	—
VIP7814	Synchronous/Asynchronous Keyboard Display Terminal with 12-inch diagonal CRT, 1,920-character display positions	2,700	25	—	123	—
VIP7815	Synchronous/Asynchronous Keyboard Display Terminal with 15-inch CRT green phosphor, RS-232-C and RS-422-A interfaces	3,095	30	—	138	—
VIP7823	Asynchronous Keyboard Display Terminal with Multi-function Keyboard; includes a 72-line scroll feature, buffered print adapter and 25-foot RS-422-A cable	2,350	25	—	—	—
COMMUNICATIONS						
DCU8010	DATANET 8 Front-End Network Processor; includes 512KB memory, 256KB diskette, and up to 16 lines	29,000	135	1,123	1,049	937
DCM8005	Additional 512KB Memory	6,000	21	622	585	534
DCM8008	Additional 512KB Memory; requires DCM8005 and DCE8002	6,000	21	622	585	534
DCE8003	Processor Power Module Enhancement; requires DCE8002	7,400	40	293	274	245
DCE8002	Additional Lines, up to 64	3,000	5	106	98	86
DCE8004	Additional Lines, up to 128	5,000	10	179	166	147
DCE8005	Additional 256KB Diskette; one maximum	1,785	18	79	75	68
DCE8007	Level 64/DPS Host Connection	8,000	65	339	319	288
DCE8008	DPS 7 Host Connection; four maximum	8,000	65	339	319	288
DCF8007	Channel Interface Base, includes up to 8 channels (lines); 16 maximum	2,500	14	99	93	83

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		Monthly Charges				
		Purchase Price (\$)	Monthly Maint. (\$)	1-Year Lease (\$)	3-Year Lease (\$)	5-Year Lease (\$)
COMMUNICATIONS (Continued)						
DCF8001	Console, 100-cps printer	2,065	40	105	100	92
DCF8009	Dual Asynchronous Channel, RS-422-A; 9600 bps	1,000	7	41	38	35
DCF8011	Dual Synchronous Channel; RS-232-C; 9600 bps	1,500	8	58	55	49
DCF8012	Dual Asynchronous Channel; RS-232-C; 9600 bps	1,000	5	39	36	32
DCF8014	Single Synchronous Channel; MIL-188-C; 9600 bps	1,000	6	40	37	33
DCF8015	Dual Asynchronous Channel; MIL-188-C; 9600 bps	1,000	7	41	38	35
DCF8016	Single Synchronous HDLC Wideband Channel; MIL-188-C; 56K bps	1,995	15	83	79	70
DCF8017	Single Synchronous HDLC Channel; MIL-188-C; 9600 bps	2,500	12	99	91	82
DCF8018	Dual Bisynchronous Channel; RS-232-C; 9600 bps	1,500	7	58	54	49
DCF8020	HDLC Channel, 19.2K bps	1,500	8	58	55	49
DCF8022	HDLC Wideband Channel, 56K bps	3,000	16	118	110	98
DCF8023	HDLC Wideband Channel (V.35), 56K bps	3,000	16	118	110	98
DCF8024	Direct Connect Capability; for use with RS-232-C channels only	350	2	14	13	12
DCF8026	Universal Modem Bypass; synchronous to 19.2K bps or asynchronous to 1800 bps	415	2	16	15	13
DCC4270	Additional Data Communications Controller	7,100	11	233	216	191
DCC4271	Data Communications Controller for up to four HDLC lines	4,700	11	158	147	130
DCF4301	Firmware for TTY Procedure	53	—	1	1	1
DCF4302	Firmware for VIP Procedure	53	—	1	1	1
DCF4303	Firmware for BSC Procedure	53	—	1	1	1
DCF4304	For for BSC with transparency	945	4	40	36	31
DCF4307	Firmware for HDLC Procedure	53	NC	1	1	1
DCF4308	Firmware for IBM 3270 Procedure	1,665	9	71	67	59
DCA4270	Synchronous/Asynchronous Line Attachment (up to 19.2K bps)	1,000	5	37	34	31
DCF4340	Polling Extension for DCA	546	1	21	19	17
DCF4370	Performance Expansion; 100K bps	4,284	8	142	131	116

SOFTWARE PRICES

		Monthly License Fee (\$)	Monthly Software Support (\$)
GCOS 7 OPERATING SYSTEM			
System software and options:			
SCS3000	GCOS 7 System Support	(1) NC	—
SCS3221	System Supervisory Functions	1,121	220
SCS3210	Coupled Systems Support	85	27
SCS3212	General Access Control	104	28
SCC3206	File Transfer Facility/6 (FTF/6)	51	5
SCC3209	Remote Batch Facility/6 (RBF/6)	32	6
SCC3207	DSA File Transfer	15	5
SCC3210	Distributed Job Processing	67	14
SCC3200	Transaction Driven System (TDS)	315	138
SCD3200	Data Base Manager (DBM)	471	31
SCD3208	Data Management 7 (DM7)	883	195
SCD3205	Data Base Reorganize	37	5
SCD3201	Multiple Logic Data Store (MLDS)	51	19
SCU3204	Transactional Context Restart Facility (TCRF)	55	15
SCL3206	Basic	201	23
SCL3209	Query	285	85
SCL3210	Query Update	98	27
SCF3200	Wordpro	173	57
SCU3203	Interactive Development Facility (IDF)	84	13
SCP3200	Full Screen Editor (FSE)	70	13
SCP3202	Interactive Program Checkout Facility (IPCF)	65	19
SCD3202	Data Dictionary	298	54
SCL3200	Cobol	230	35
SCL3201	Fortran 77	244	26
SCL3202	RPG II	65	9
SCL3204	PL/I	RPO	RPO
SCL3205	Pascal	RPO	RPO

(1) NC—no separate charge. Licensed for use without separate charge to users who have acquired their central processors/systems from Honeywell.

(2) Fee based on power of CPU.

(3) Software support provided with basic license.

RPO—call to request price quote.

Honeywell DPS 7 Series

	Monthly License Fee (\$)	Monthly Software Support (\$)
GCOS 7 OPERATING SYSTEM (Continued)		
SCV3001	370 Cobol Translator	NC 11
SCV3002	System/3 Cobol Translator	NC 11
SCV3005	RPGTRANS	NC 11
SCV3006	PACK/FILTRANS	NC 11
SCV3010	System/3 Sort Adapter	NC 11
SCL3207	APL	RPO RPO
SCF3201	APL Graphic Interface	RPO RPO
GCOS 64 OPERATING SYSTEM		
System software and options:		
SCS1300	GCOS64 Basic Operating System	(1) NC (2)
SCS1301	GCOS 64 Basic System Extension	244 66
SCS1302	GCOS 64 Access System Extension	201 43
SCS1601	GCOS 64 Coupled Systems Support	85 27
SCS1602	GCOS 64 Dynamic Status Display	68 18
SCS1603	GCOS 64 Multivolume Backing Store	58 16
SCS1605	GCOS 64 System Access Rights	135 38
SCS1607	GCOS 64 General Access Control	104 28
SCU1613	GCOS 64 System Behavior Reporter	175 27
SCU1616	GCOS 64 System Behavior Reporter Extension	125 19
SCS1310	DPS 7 GCOS Entry System	1,150 (2)
SCU1619	Transactional Context Restart Facility (TCRF)	55 15
SCL1601	Cobol-74	108 12
SCL1603	Cobol-74 Data Communications Extension	114 13
SCL1606	Fortran	106 9
SCL1607	Mathematical Library	138 17
SCL1608	Cobol Report Writer	49 5
SCL1611	RPG	65 9
SCL1614	Interactive Basic	201 6
SCS1606	GCOS 64 Interactive Resource Manager	158 43
SCL1617	Query Processor	185 55
SCL1620	Query Processor Update Option	98 27
SCL1623	Query Report Mode Option	100 30
SCP1601	Interactive Library Maintenance (LIBMAINT)	96 29
SCP1602	Interactive Text Editor	65 19
SCP1605	Immediate Step Activation	96 29
SCP1606	Interactive Program Checkout Facility	65 19
SCP7601	GCOS 64 Menu Driven Facility	65 10
SCC1617	Data Entry (DE/64—VIP7700 Mode)	167 69
SCD1611	Integrated Data Store II (I-D-S/II) Entry	335 21
SCD1615	Multiple Logic Data Store (MLDS)	51 19
SCU1603	Sort/Merge	71 13
SCU1604	Data Base Administrator Aids Set (Batch Utilities)	99 5
SCU1617	Data Base Administrative Aids Extension	37 5
SCU7604	Storage Analysis for UFAS Indexed Files	25 —
SCC1220	GCOS 64 Front-End Network Processor Support (FNPS). Requires SCC8020 and SNC 8024	15 5
SCC1603	TDS/64 Standard Processor	365 138
SCD1612	Data Management-IV (DM-IV) Entry	707 162
SCU1619	Transactional Context Restart Facility (TCRF)	55 15
SCU1611	Forms Management Utility	50 10
SCC1671	Preforms Batch Mode	25 8
SCC1672	Preforms Transaction Mode	52 15
SCJ1601	Remote Batch Facility/6 (RBF/6)	32 6
SCU1615	File Transfer Facility/6 (FTF/6)	51 5
SCU1618	GCOS 64 Distributed File Transfer (DFT). Requires SCC1220 for each DN8	15 5
SCM1620	Series 200/2000 Integrated Program Mode	(1) NC 16
SCD1607	Series 200/2000 File Access System (HFAS)	(1) NC 11
SCU1606	HFAS File Maintenance Utility Set	10 5
SCU1609	Series 200/2000 Volume Utility Set	10 5
SCU1614	System/3 Sort Adapter	(1) NC 11
SCV1600	Series 200/2000 Cobol to Cobol-74 Translator	(1) NC 11
SCV1605	Series 200/2000 File Translator	(1) NC 11
SCV1611	Series 100 Cobol to Cobol-74 Translator	(1) NC 11
SCV1612	Series 100 File Translator	(1) NC 11
SCV1614	System/3 Volume and File Translator	(1) NC 11
SCV1616	System/3 RPG-II to GCOS 64 RPG Translator	(1) NC 11
SCV1620	360/370 Cobol to Cobol-74 Translator	(1) NC 11
SCV7609	System/3 Cobol to Cobol-74 Translator	(1) NC 11

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(2) Fee based on power of CPU.

(3) Software support provided with basic license.

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Honeywell DPS 7 Series

		Monthly License Fee (\$)	Monthly Software Support (\$)
GCOS 64 OPERATING SYSTEM (Continued)			
SCV7613	360 RPG to GCOS 64 RPG Translator	(1) NC	11
SCV7614	370 RPG to GCOS 64 RPG Translator	(1) NC	11
SCV7629	370 File and Volume Translator	(1) NC	11
SCC6902	Query Driven System (QDS)	(3) 506	—
SNC8020	Distributed Network Supervisor (DNS)	490	86
SNC8021	Network Operator Interface (NOI). Requires SNC8020	10	5
SNC8022	Cross-Net Load/Dump Facility. Requires SNC8020 and SNC8031	10	5
SNC8024	DPS 7/GCOS 64 Host Connection. Requires SNC8020	42	7
SNC8028	Multiple Host Connection—Homogenous. Requires SNC8024	20	8
SNC8031	High-Level Data Link Control (HDLC) Primary Network Support (Point to Point). Requires SNC8020 or SNC8096	82	15
SNC8033	Primary Network Private Virtual Circuit Endpoint. Requires SNC8031	166	29
SNC8034	Primary Network Private Virtual Circuit Switching. Requires SNC8031	170	30
SNC8035	Primary Network Connection—Transpac/Limited (France); Maximum of 16 Virtual Circuits. Requires SNC8031	166	29
SNC8036	Primary Network Connection—Transpac/Extended (France); Greater than 16 Virtual Circuits. Requires SNC8035	20	5
SNC8037	Primary Network Connection—Telenet U.S.A. Requires SNC8031	166	29
SNC8038	Primary Network Connection—Tymnet U.S.A. Requires SNC8031	166	29
SNC8039	Primary Network Connection—Datapac Canada. Requires SNC8031	166	29
SNC8040	Primary Network Connection—DDX-P Japan. Requires SNC8031	166	29
SNC8041	Primary Network Connection—AUSTPAC Australia. Requires SNC8031	166	29
SNC8044	Primary Network Connection—EDWP Switzerland. Requires SNC8031	166	29
SNC8045	Primary Network Connection—DN-1 The Netherlands. Requires SNC8031	166	29
SNC8046	Primary Network Connection—EURONET European Economic Community. Requires SNC8031	166	29
SNC8047	Primary Network Connection—DATEX-P West Germany. Requires SNC8031	166	29
SNC8052	Primary Network Connection—PSS United Kingdom. Requires SNC8031	166	29
SNC8053	Primary Network Connection—NPDN(X.21) Basic, Scandinavia. Requires SNC8031	166	29
SNC8054	Primary Network Connection—NPDN(X.21) Extended, Scandinavia. Requires SNC8053	20	5
SNC8056	Extended X.25 Public Network Interface Support (Greater than 16 Virtual Circuits). Requires SNC8037, SNC8038, SNC8039, SNC8040, SNC8041, or SNC8052	20	5
SNC8057	Asynchronous Terminal Support. Requires SNC8020	(1) NC	—
SNC8058	VIP Synchronous Terminal Support. Requires SNC8020	(1) NC	—
SNC8067	Telenet Asynchronous Pad Support (U.S.). Requires SNC8037	20	5
SNC8068	Tymnet Asynchronous Pad Support (U.S.). Requires SNC8038	20	5
SNC8069	Datapac Asynchronous Pad (Canada). Requires SNC8039	20	5
SNC8065	TRANSPAC Asynchronous Pad Support (France). Requires SNC8035 or 8036	20	5
SNC8070	DDX-P Asynchronous Pad Support (Japan). Requires SNC8040	20	5
SNC8071	AUSTPAC Asynchronous Pad Support (Australia). Requires SNC8041	20	5
SNC8072	PPS Asynchronous Pad Support (United Kingdom). Requires SNC8052	20	5
SNC8074	EDWP Asynchronous Pad Support (Switzerland). Requires SNC8044	20	5
SNC8075	DN-1 Asynchronous Pad Support (Netherlands). Requires SNC8045	20	5
SNC8076	EURONET Asynchronous Pad Support (European Economic Community). Requires SNC8046	20	5
SNC8077	DATEX-P Asynchronous Pad Support (West Germany). Requires SNC8047 or 8036	20	5
SNC8096	Distributed Network Supervisor/Entry (DNS/E/7) for single-host networks only	396	70

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