

# Honeywell Series 60 Levels 66/DPS and 68/DPS

## MANAGEMENT SUMMARY

The Honeywell Level 66/DPS and Level 68/DPS systems are based on three major system groups, each characterized by a specific operating system. The Level 66/DPS, 66/DPS-440, and 66/DPS-520 all use the field-proven General Comprehensive Operating Supervisor, or GCOS. The Level 68/DPS uses the highly secure virtual memory Multics operating system. The Level 66/DPS/B3, 66/DPS/C3, and 66/DPS/C5 all use the CP-6 operating system, and were designed as a migratory path for Xerox-based systems users. Each system is capable of concurrently supporting batch processing, remote job entry, time-sharing, and transaction processing.

The basic Level 66/DPS and 68/DPS systems are dual-processor units, expandable to six CPUs, four system control units, and four input/output multiplexers (IOMs). Each basic system has one system control unit (SCU) and IOM with up to 35 I/O channels. Processor performance upgrades, as well as additional memory, can increase system throughput dramatically. The Level 66/DPS-440 and -520 systems each have one CPU, SCU, and IOM with 18 channels. The CP-6-based 66/DPS/B3, /C3, and /C5 all have one CPU, SCU, and IOM with 27 channels. Memory on the Level 66/DPS starts at 256K words (one megabyte) and increases to 2048K words (eight megabytes) of MOS storage. The Level 66/DPS-440 and -520 both have 256K words, expandable to 512K words on the 440 and 1024K words on the 520. The Level 68/DPS has 512K words (two megabytes) of memory, and has a maximum of 4096K words (16 megabytes) of storage. Each of the CP-6-based processors has 3072K words (12 megabytes) of memory. The B3 is expandable to 8192K words and the C3 and C5 are expandable to 16,384K words.

Honeywell's large-scale Level 66/DPS and 68/DPS systems have performance ranging from the IBM 4341-1 up through the 3033, and are designed to conform to the company's Distributed Systems Environment. The newer DPS 8 Series has effectively superseded the 66/DPS and 68/DPS product lines.

**MODELS:** Level 66/DPS with Performance Levels 1 through 5; Level 66/DPS-440, -520; Level 66/DPS/B3, /C3, and /C5; and Level 68/DPS with Performance Levels 1 through 4.

**CONFIGURATION:** Depending on model—1 to 6 CPUs, 1 to 16 megabytes of memory, and 18 to 216 channels.

**COMPETITION:** Burroughs B 5900, B 6900; IBM 4300 Series, 303X Series; NCR V-8500 II Series; Univac 1100/60, 1100/80.

**PRICE:** Base purchase prices range from \$198,338 (66/DPS-440) to \$1,409,000 (66/DPS/B and /C).

## CHARACTERISTICS

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

**CURRENT MODELS:** Level 66 Distributed Processing System (Level 66/DPS) with five performance levels;



*The large-scale Level 66/DPS (shown) and Level 68/DPS processors offer a wide range of performance as well as a choice of three operating systems. These systems have been replaced by the newer DPS 8 product line (Report 70C-480-11).*

**REFERENCE EDITION:** This is a mature product line, and no significant further developments are anticipated. Because of its importance, coverage is being continued, but no future update is planned.

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### CHARACTERISTICS OF THE LEVEL 66 AND 68 SYSTEMS

	Level 66/DPS	Level 66/DPS Models 440, 520	Level 66/DPS Models B & C (Xerox)	Level 68/DPS	DPS 8/70 (for comparison)
<b>SYSTEM CONFIGURATION</b>					
No. of central processors	2 to 6	1	1 to 6	2 to 6	1 to 6
No. of system controllers	1 to 4	1	1 to 4	1 to 4	1 to 4
No. of I/O multiplexers	1 to 4	1	1 to 4	1 to 4	1 to 4
No. of board slots	35 to 54	18	27	35 to 54	35 to 54
No. of network processors	1 to 8	1 to 2	1 to 12	1 to 4	1 to 8
Max. no. of lines	768	192	960	384	1,024
DCU6661	Yes	Yes	No	Yes	Yes
DCU6678	Yes	No	No	Yes	No
DCS6700	No	No	Yes	No	No
<b>CENTRAL PROCESSOR</b>					
Relative speed	1.0 to 6.7	0.4 to 0.7	0.8 to 6.3	1.1 to 6.7	1.7 to 8.7
No. of instructions	456 + 91 EIS	456 + 91 EIS	456 + 91 EIS	456 + 91 EIS	289 + 91 EIS
EIS instruction set	Yes	Yes	Yes	Yes	Yes
Cache memory	Yes	No	Yes	Yes	Yes
Size, bytes	8K to 32K	8K (520 only)	8K	8K	32K
Control storage for cache memory:					
Type/words per board	RAM/256 words	RAM/256 words	RAM/256 words	RAM/256 or 1024	RAM/256 words
Word size in bits	36	36	36	36	36
No. of words	2048	2048	2048	2048 or 8192	2048
Access time, nanoseconds	75	75	75	75	30
<b>MOS MAIN MEMORY</b>					
Minimum capacity, 9-bit bytes	1,048,576	1,048,576	12,582,912	2,097,152	2,097,152
Maximum capacity, 9-bit bytes	8,388,608	4,194,304	67,108,864	16,777,216	67,108,864
Cycle time, nanoseconds	750	1400(440); 750(520)	750	750	750
Access time, nanoseconds	440	440	440	440	440
Words fetched per cycle	2	2	4	2	2
<b>I/O CONTROL (PER IOM)</b>					
Channel data rates, bytes per second	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
No. of unit record devices/controller	8	8	8	8	8
No. of disk drives/controller	32	32	32	32	32
No. of magnetic tape units/controller	16	16	16	16	16

\*Maximum memory with GCOS 8, available only on DPS 8 systems. Maximum with GCOS is 8,388,608 bytes. Maximum with Multics-based DPS 8/70M and CP-6-based DPS 8/70C is 67,108,864 bytes.

➤ The System Control Unit (SCU) is the principal interface between central system components. It provides complete system interrupt control which regulates communication between components and handles memory demands on a priority basis. Memory units and Input/Output Multiplexers (IOMs) are directly connected to the SCU. All processors are equipped initially with one SCU. The Level 66/DPS, 68/DPS, and CP-6-based 66/DPS systems (except the DPS-440 and -550) can be expanded to four SCUs.

The Input/Output Multiplexer (IOM) is connected to the System Control Unit and interfaces with all system peripherals and Front-End Network Processors (FNP). The IOM transfers data between I/O devices and system memory while the processor continues to run its programs.

A fast access cache memory is provided in all systems except the DPS-440. The cache is used to hold the most recently accessed programs and instructions and is ➤

### ➤ MAIN STORAGE

**STORAGE TYPE: Metal oxide semiconductor (MOS).**

**CAPACITY: See table.**

**CYCLE TIME: See table.**

**CHECKING: A 5-bit error-correcting Hamming code is appended to each 36-bit word. Single-bit errors are corrected automatically, and multi-bit errors are detected and flagged for subsequent error-recovery routines. Odd parity is utilized throughout the processor.**

**STORAGE PROTECTION: The Level 68 systems use a 4-level ring protection scheme that is implemented in system firmware with supporting hardware registers. Each user program segment has an associated segment descriptor that is stored in tables in main memory. Within each segment descriptor are two 2-bit fields that specify the security level required by a user program to execute or write to a particular segment. Hardware also checks that data addresses generated during program execution do not exceed specified boundaries. The segment descriptors also contain two bits that override the ring protection scheme by denying execution or write access to a user program.**

Storage protection on CP-6 systems is provided at both the segment level and memory page level. Segments can be

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> GCOS includes a number of data management software products such as Data Management-IV (DM-IV), an integrated set of software modules that supports concurrent access to common, shared data bases in both conversational and procedural modes. The File Management Supervisor manages allocation of physical file space and controls system and file access. FMS is also an integral part of GCOS system security. A Unified File Access System (UFAS) interfaces between the system's physical devices and logical data management with such functions as buffer management, blocking and de-blocking, record location, error checking, and label processing. Additional programs include the DM-IV Query and Reporting Processor, which permits data base retrieval and report generation; a Text Executive Processor (TEX) for text processing, program execution, and program development; and the Time-Sharing Executive for management of time-sharing operations.

Network communications are handled by either the Network Processing Supervisor (NPS) or the General Remote Terminal Supervisor-II (GRTS-II). Both systems control remote communications activities such as time-sharing, transaction processing, remote job entry, and direct program access. NPS also offers store-and-forward message switching capabilities for larger networks.

GCOS has two maintenance packages to identify problems and minimize downtime. The Honeywell Error Analysis and Logging System (HEALS) detects problems in memory modules, runs a set of diagnostic routines, and prints the result on a summary sheet. The Total On-line Testing System (TOLTS) monitors system components, and calls in diagnostic tests on potential problems. It also has a remote testing capability for Honeywell maintenance engineers. Both systems run concurrently with normal operations and are invisible to users.

Numerous language processors are available with GCOS: Cobol-74, Fortran, Basic, DataBasic, PL/1, GMAP, GPSS, Simscript, Pascal, LISP, Algol, Jovial, and RPG-II. Languages available with Multics include PL/1, APL, Cobol-74, RPG, Fortran, Basic, and the ALM assembler. Languages for CP-6 include Cobol-74, Fortran, APL, Interactive Data Processor (IDP), RPG-II, Basic, PL-6, GMAP, TEXT, SPSS, BMDP, Pascal, SPITBOL, LISP-F3, IMSL, and SLAM.

The Multics operating system is used exclusively on the Level 68/DPS. It uses virtual memory and concurrently supports batch processing, remote job entry (RJE), time-sharing, on-line remote data entry and data base inquiry/updates, word processing, electronic mail, program development, and graphics. The virtual memory moves information between main memory and peripheral storage independently of hardware configuration and without programmer intervention. Multics provides a high level of security through a hardware-based ring structure with different levels of system access. Data base activities are handled by the Multics Relational Data Store (MRDS) and remote data base access is handled by

▶ hardware for generating 24-bit memory addresses; an associative memory for translation of virtual addresses to real memory addresses; program-addressable registers for preparing virtual-memory addresses; instructions for handling segmentation, paging hardware, and the system clock; hardware for interrupting a process in execution at any point, saving the processor status, and restoring the process at a later time; and hardware for implementing the Multics ring structure for program and data protection. The ring structure allows the creation of closed subsystems which are mutually exclusive and completely protected from each other.

The CP-6 systems have hardware to manage memory mapping in both segments and pages. This hardware includes an associative (cache) memory for translation of mapped (virtual) address to real addresses. The mapped address space can be subdivided into 512 workspaces, each of which can contain either a user program or an operating system process. Each workspace can be up to 16 million words in size, as provided by the hardware. However, the current CP-6 releases can only support a maximum one million words of addressable memory per workspace.

The Level 66/DPS, 68/DPS, and CP-6 systems provide a wide range of performance. At the low end, the 66/DPS-440 is slightly more powerful than the IBM 4341-1, and the 66/DPS-520 has performance similar to the 4341-2. The Level 66/DPS systems range from 1.2 MIPS (million instructions per second) up to 5.2 MIPS, giving performance from the 4341-2 up through the 3033 Model U. The Level 68/DPS ranges from 1.2 MIPS to about 5 MIPS, just about the same as the Level 66/DPS systems. The CP-6-based Level 66/DPS/B3 has about the same performance as the System 370/158-3, and the 66/DPS/C3 and /C5 have slightly more power than the 4341-2. CP-6 system performance can range up to 6.3 MIPS.

**CONTROL STORAGE:** See system characteristics chart.

**REGISTERS:** The Level 66/DPS and 68/DPS processors include a large number of program-accessible registers:

Register Name	Length (bits)	Quantity per Processor
Accumulator	36	1
Quotient	36	1
Accumulator-Quotient*	72	1
Exponent	8	1
Exponent-Accumulator-Quotient*	80	1
Index	18	8
Indicator	14	1
Base Address	18	1
Timer	27	1
Ring Alarm	3	1
Pointer*	42	8
Address	24	8
Procedure Pointer**#	37	1
Temporary Pointer***	42	1
Descriptor Segment Base#	51	1
Sement Descriptor Word Associative Memory*	88	16
Page Table Word Associative Memory**#	51	16
Fault*	35	1
Mode*	33	1
Cache Mode*	28	1
Control Unit (CU) History*	72	16
Operations Unit (OU) History*	72	16
Decimal Unit (DU) History*	72	16
Appending Unit (APU) History*	72	16
Configuration Switch Data*	36	5
Control Unit Data*	288	1
Decimal Unit Data*	288	1

\*This register is not a separate physical entity but is a combination of its constituent registers and/or flags.

\*\*These registers are not explicitly addressable, but are included because of their vital role in instruction and address preparation. Each is a combination of four registers located in the appending and control units.  
# Level 68 only.

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➤ The results of the Datapro user survey on the Level 66 and 68 systems are presented in the following table:

	Excellent	Good	Fair	Poor	WA*
Ease of operation	18	19	1	0	3.45
Reliability of mainframe	20	17	1	0	3.50
Reliability of peripherals	8	24	6	0	3.05
Responsiveness of maintenance service	13	17	8	0	3.13
Effectiveness of maintenance service	5	20	11	2	2.74
Technical support:					
Trouble-shooting	6	16	10	6	2.58
Education	2	16	14	5	2.41
Documentation	0	14	18	3	2.31
Operating system	20	15	1	1	3.46
Compilers and assemblers	10	22	4	1	3.11
Applications programs	1	17	6	5	2.48
Ease of programming	8	22	6	0	3.06
Ease of conversion	2	19	8	5	2.53
Overall satisfaction	6	24	7	0	2.97

\*Weighted Average on a scale of 4.0 for Excellent.

Datapro telephoned several Level 66 users around the country for additional comments. We first called on the DP director of the computer services division of a banking services firm in the northeast. The organization is using a dual-processor Level 66 with Performance Level II and 2048K words of memory. Prior to this system, the company used a Honeywell 6000 Series system. The director told us the conversion occurred over a weekend, and was "absolutely fine." About 75 percent of his operation is batch, with the remainder interactive, and the Level 66 handles it all "just super." GCOS is "terrific," and in particular drew high marks for its low appetite for memory. Data management is handled by I-D-S II, communications are managed by GRTS-I, and both are working fine, he told us. His response time generally is about 3 to 5 seconds, and overall system uptime is better than 99 percent. To help insure his system's continued performance, he installed a specialized power management system. Honeywell service received good marks, and he was very pleased with his operation in general.

Moving westward, we called on the DP manager of a diversified services organization using a Level 66/DPS-440. The System has 1024K words of memory and runs a variety of home-grown financial and industrial applications. Their uptime typically is better than 95 percent, and they are generally satisfied with their Level 66. Plans for 1982 include more disk equipment and a data base management package. Honeywell service is "pretty good," and they have no plans to change the system this year.

Our final call, moving back into the northeast, was the director of a computer services firm that specializes in disaster backup for Honeywell systems. The three 66/80 mainframes were used by another company prior to the present firm, and are "very solid" machines. The director, who has had quite a few years of experience with

➤ The Level 68/DPS operates in three modes—absolute, privileged, and nonprivileged. All processor instructions are available in the absolute mode. Certain instructions, such as those which operate I/O devices, are available only in the absolute and privileged modes. The nonprivileged mode is used by user programs. The full segmentation and paging capabilities of the CPU are used in the privileged and nonprivileged modes.

**INTERRUPTS:** In Level 66/DPS and 68/DPS systems, every external interrupt or internal fault results in the setting of a specific interrupt cell in the system controller. This causes the processor to take its next pair of instructions from a predetermined storage location in lower memory which normally results in the storage of the processor's status and a transfer to the appropriate servicing routine.

**SYSTEM CONTROL CENTER:** Three different system control centers are available for the Level 66/DPS and 68/DPS: the CSU6601, a desk-top arrangement with 120-cps printer and a 12-inch 1920-character CRT (a 23-inch remote display is optional) and keyboard; the larger CSU6004 with the same features of the CSU6601, but with an optional 23-inch remote display unit; and the CSU6005, which has two 12-inch screens in the console with an option for up to two 23-inch remote displays. The keyboard, common to all consoles, is a solid state unit with an alphanumeric keyboard consisting of 26 alphabetic, 10 numeric, and 28 special character keys. The CRT displays 1920 characters in a matrix of 80 characters per line, 24 lines per display. The printer associated with the CSU6601 operates at 120 cps, and the CSU6004/6005 unit runs at 30 cps, with a 120-cps option.

**PHYSICAL SPECIFICATIONS:** Level 66/DPS and 68/DPS systems must be located in a room with raised floor or equivalent. The room ceiling must be 8.5 feet above the raised floor, with at least 8 to 12 inches between subfloor and raised floor. Power requirements must meet these specifications: a voltage of 208, 240, 440 or 480 VAC  $\pm 10$  percent for the motor generator set; 60 Hertz nominal with 60.5 maximum and 59.4 minimum frequency; three-phase wire with a maximum phase variation of 5 percent from the nominal; the 120/208 VAC, five-wire cable with ground for peripheral equipment (voltage variation is  $\pm 10$  percent).

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

#### INPUT/OUTPUT CONTROL

**I/O CHANNELS:** The Input-Output Multiplexer (IOM) coordinates all input/output operations between the system control unit, peripheral subsystems, and Datanet 6600 Series Front-end Network Processors (FNPs) and document processors. Data transfers between peripheral devices and memory are also handled by the IOM. All peripheral device operations are controlled by processor-prepared control word lists stored in reserved IOM positions in memory or in the IOM scratchpad memory.

**SIMULTANEOUS OPERATIONS:** All IOM operations are performed asynchronously with program processing. Interface occurs only when two or more IOMs or processors attempt to access the same main storage module.

#### CONFIGURATION RULES

The Level 66/DPS basic central system (CPS6650) consists of two processors in one cabinet, a free-standing system

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## ► COMMUNICATIONS CONTROL

Honeywell's DATANET 6600 family of communications processors provides the network capabilities for Level 66/DPS and Level 68/DPS systems. The processors are free-standing units with common characteristics and differ only in memory size and communications capability. The processors are attached to the host system via the Direct Interface Adapter, and the remote devices are attached to the processor via the Channel Interface Bases. Each processor can operate with either the General Remote Terminal Supervisor-II (GRTS-II) or the Network Processing Supervisor (NPS) software systems.

**DATANET 6661 FNP:** This processor (DCU6661) has 64K bytes of memory, expandable to 512K bytes, and a maximum of 12 Channel Interface Bases. Up to four processors can be configured in a Level 68/DPS system, up to eight in Level 66/DPS systems, and a maximum of two in the DPS-440 and -520.

**DATANET 6678 FNP:** Another high-speed processor available for Level 66/DPS (except the DPS-440 and -520) and 68/DPS systems is the DATANET 6678 system (DCP6678). It has 128K bytes of memory, expandable to 512K bytes, and includes as standard a high-speed cache memory. Up to 12 Channel Interface Bases can be connected.

**LEVEL 66/DPS/B AND 66/DPS/C COMMUNICATIONS PROCESSOR (DCS6700):** The three CP-6 systems have a free-standing communications processor similar to the DATANET processors. The DCS6700 is based on a Honeywell Level 6 minicomputer (Model 6/47, DPS9566). Access to the host system is via a Direct Memory Access unit that connects to the host IOM. Data transfer rates up to 800K bytes per second are possible. Remote devices and additional communications processors are attached to the controller via a Multi-Line Communications Processor (MLC9103) each of which has a capacity of eight asynchronous or synchronous lines. The MLCP is similar in operation to the DATANET Channel Interface Base. The 66/DPS/B3 has a maximum of 80 lines using 10 MLCPs. The 66/DPS/C3 has up to 120 lines using 15 MLCPs. The 66/DPS/C5 can accommodate up to 200 lines via two communications processors and 25 MLCPs. Each DCS6700 has 256K bytes of memory, and can increase to 2048K bytes in 64K increments.

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

## SOFTWARE

The Level 66/DPS operating system is the General Comprehensive Operating Supervisor (GCOS), the Level 68/DPS uses the virtual-memory Multics operating system, and the Level 66/DPS/B3, /C3, and /C5 systems all use the CP-6 operating system. Additional details on all three systems can be found in Report 70C-480-11.

## GCOS

This integrated operating system has facilities for controlling concurrent local batch processing, on-line transaction

processing, and time-sharing. GCOS handles local and remote batch jobs in the same manner except for the input and output routines they use. User jobs can enter the system simultaneously from multiple local and remote terminals. Jobs entering the system are routed to a System Scheduler, which permits a large number of jobs (limited by available direct-access storage) to be queued in up to 50 installation-designated jobstreams. These jobs are initiated by assigned job class, by highest priority within the class, and on a first-in, first-out basis among jobs of equal priority.

All activities are executed under the supervision of the GCOS Dispatcher. The Dispatcher attempts to keep as many system components as possible in simultaneous use by continually transferring control to the highest-priority activity that can effectively utilize the processor and/or peripheral systems.

Input/output operations are performed under control of the GCOS I/O Supervisor (IOS). The IOS provides device independence by converting symbolic file names to physical device assignments at program execution time and permitting processing on disks drives of sequential files as normally stored on magnetic tape. Other functions performed by IOS include supervision of all I/O interrupts, queuing of I/O requests by peripheral subsystem, verification of user access to permanent files, and accumulation of accounting statistics on processor and peripheral utilization by each program.

Remote access is a featured capability of GCOS in each of its processing dimensions: batch, transaction processing, and time-sharing. The communications control functions are performed by the Datanet 6600 Front-End Network Processor. Any Series 66 program that can be entered at the central computer site can also be entered remotely via a batch terminal or a keyboard terminal.

**NETWORK PROCESSING SUPERVISOR:** The 66/DPS NPS controls five types of remote processing in any combination: remote job entry (RJE), transaction processing, time-sharing, message switching, and direct program access. RJE supports four standard interfaces for remote computers: the remote computer interface, remote network processor multmessage interface, BSC interface, and HDLC interface.

The information network is controlled by a combination of the Datanet 6600 Front-End Network Processor and the NPS software, and can range in size from several terminals to a comprehensive, distributed information network with multiple host processing facilities. NPS supports a wide variety of remote terminals, computers, and communications facilities.

**REMOTE TERMINAL SUPERVISOR-II (GRTS-II):** Provides a level of communications support below that of NPS while providing controls for five types of remote processing: remote job entry, transaction processing, time-sharing, message concentration, and direct program access. RJE supports the same standard interfaces as NPS. Programming subsystems supported under time-sharing are the same as for NPS except that ABACUS is not supported. GRTS-II does not support the direct program access communications-queued (DAC-queued) mode provided in NPS, nor does it support any host interface which makes use of the DAC-queued method. GRTS-II includes a Communication On-Line Test System (COLTS) and support for remote terminals and devices with speeds of 75 to 50,000 bps.

**TRANSACTION PROCESSING SYSTEM (TPS):** This facility invokes the loading and execution of the appropriate application programs for processing transactions received from remote terminals. The Transaction Processing System requires a front-end network processor and can accept transactions from various terminals. ►

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► printed, analyzed, and summarized, with summary data retained on an error summary file.

**TOTAL ON-LINE TESTING: TOLT** is a test and diagnostic system that monitors and saves all error status information, makes periodic surveillance checks of various hardware modules, and calls in specific diagnostic tests and on-line troubleshooting programs.

**MULTICS SOFTWARE**

The Level 68/DPS computer system uses Honeywell's Multics operating system. Multics is a specially designed virtual memory operating system that offers remote terminal access as the primary means of entering the system, multiprocessing with dynamic reconfiguration capabilities, and a unique hardware-based ring structure that provides security for sharing of programs and data. It also has a tree-structured hierarchy for organization of user and system storage, and the availability of multiple programming environments and user interfaces within a single system. It accommodates batch and time-sharing applications, similar to GCOS, and is written primarily in PL/1.

Information in the Multics system's virtual memory is organized in variable-length segments. Each segment can contain either programs or data or can be a directory, i.e., a catalog of related segments represented in tree structure. Segments are directly addressable by a symbolic name. The Multics hardware uses a segment descriptor to determine the absolute address of the segment and its access attributes. Any word, character, or bit within a segment can be referenced by its location within the segment. Segments can reside anywhere in main memory and can alter their size independently of other segments.

Controlled sharing of programs and data is facilitated by the Multics ring structure, a unique security scheme that is implemented as an integral part of the segmentation and paging scheme. The ring structure, in conjunction with the segment access control list, permits programs to access another owner's data base only through an owner-supplied program that specifies what data can be referenced and what operations can be performed.

Languages available to Multics users include PL/1, APL, Cobol-74, MRPG, Fortran, Basic, and the ALM assembly language. In addition, the system includes a wide variety of utility programs, including text editors, debugging aids, performance measurement tools, interuser communication facilities to permit messages to be transmitted among users, and on-line documentation of system software and user programs.

The Multics Relational Data Store (MRDS) functions as a subsystem of the Multics operating software and includes such features as a relational interface, programming language independence, data definition and program independence, query capability via LINUS, on-line access and updating, concurrent access and update controls, report generation, automatic recovery and restart, and data security maintenance.

LINUS (Logical Inquiry and Update System) is a facility for accessing data bases from a remote terminal. It uses the Multics Relational Data Store (MRDS) for data base access.

Multics provides support for a comprehensive word processing system, WORDPRO, which includes editing, error correction, and formatting tools for the on-line preparation of documents. Multics also provides an interactive graphics system, supporting both static and dynamic terminals, that permits creation and manipulation of complex graphics structures. The Multics Off-Line Page

Processing System (PPS) feature creates a system output tape that can be printed later on a Honeywell PPS. Multics also has an Electronic Mail Facility. This facility offers its users direct, on-line, person-to-person distribution of text. It handles mail ranging from brief memos to multi-volume documents and delivers that mail immediately to data terminals or on-line mailboxes. The facility operates in conjunction with WORDPRO.

Emacs (Editor Macros) is a text editing and screen management facility that features screen blocking for operator monitoring of more than one activity.

**CP-6 SOFTWARE**

The Level 66/DPS/B3, /C3, and /C5 computer systems use the CP-6 operating system, a Honeywell enhancement of the Xerox-developed CP-V operating system. CP-6 includes facilities for interactive time-sharing, on-line transaction processing, multiprogrammed local and remote batch processing. All CP-6 languages, files, data bases, and utilities are available to all users concurrently. Up to 500 time-sharing users can use CP-6 concurrently for activities which include program development, compilation, execution, and debugging; file maintenance; and text creation and editing.

Languages available under CP-6 include ANS 1977 Fortran, Cobol-74, APL, Interactive Data Processor (IDP), RPG-II, Basic, PL-6, GMAP (Macro Assembly Program), and TEXT. These languages can generate reentrant code where desired. Regardless of the compiler being used, debugging is performed symbolically using a centralized debugger with simple, user-oriented commands. CP-6 also includes a Sort/Merge utility and support for the I-D-S/II DBMS.

**APPLICATION PROGRAMS AND UTILITIES**

Honeywell offers a large array of utility routines and application programs for the Level 66/DPS and 68/DPS systems, a list of which can be found in the Pricing section of this report.

**PRICING**

**EQUIPMENT:** The following systems are representative of two possible Level 66/DPS configurations.

**TYPICAL LEVEL 66/DPS-520 SYSTEM:** Consists of a CPS6643 central processor with 256K words (one megabyte) of main memory, IOM with 18 channel slots, SCU, a CSU6601 console with 120-cps printer, one MSP0607 mass storage processor, three MSU0451 disk drive (600 megabytes), one MTP0610 tape processor with two 125-ips MTU0500 tape drives, one URP0600 unit record processor with one PRU1200 line printer (1200 lpm), a CRU0501 card reader (500 cpm), and one PCU0121 card punch (100-400 cpm). The purchase price is \$732,845, monthly maintenance is \$3,809, and the three-year lease price per month is \$24,575.

**TYPICAL LARGE SCALE LEVEL 66/DPS SYSTEM:** Includes a CPS6650 central system with two central processors, 1024K words (four megabytes) of main memory, performance level 3, one SCU, one IOM with 35 channel slots, 2 system consoles each with a 120-cps printer, one MSP-0609 mass storage processor, four MSU0500 disk drives (2.5 gigabytes), four MSU0451 disk drives (800 megabytes), one MTP0610 tape processor, eight MTU0610 200-ips tape drives, one URP0600 unit record processor, two PRU1600 line printers (1600 lpm), one CRU1050 card reader (1050 cpm), and one Datanet 6661 FNP with four Channel Interface Bases. The purchase price is \$2,838,673, the monthly maintenance is \$12,337, and the three-year lease price per month is \$108,078.

**SUPPORT:** Honeywell offers six categories of support products for level 66/DPS and 68/DPS systems. These ►

Honeywell Series 60 Levels 66/DPS and 68/DPS

EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Rental (1-Year lease)*</u>	<u>Rental (3-Year lease)**</u>
<b>▶ LEVEL 68/DPS SYSTEM</b>					
CPS8802	Level 68/DPS Central System basic performance level; includes two central processors, free-standing control unit, free-standing IOM with 35 channel function slots, central processor and IOM addressing, 512K words of main memory, IMP, console device, direct interface adapter, and IOM channel	1,259,000	4,124	46,873	38,707**
CPK8004	Level 68/DPS performance addition; basic level 1 to level 2	512,000	1,914	13,044	11,734**
CPK8008	Level 68/DPS performance addition; level 2 to level 3	573,000	1,167	15,774	14,197**
CPK8012	Level 68/DPS performance addition; Level 3 to level 4	555,000	572	12,236	11,012**
CPK8016	Additional Performance Module for level 4	474,000	572	10,472	9,422**
CPK8017	Additional Performance Module for level 4; requires CPK8016	474,000	572	10,472	9,422**
CPU8803	Additional Central Processor for CPS8802	516,089	2,211	21,567	17,929**
<b>PROCESSOR OPTIONS</b>					
MXC6004	Free-standing system controller; memory not included; controls up to 1,048,576 words of memory; includes all CPU and IOM port addressing; for Level 66/DPS and Level 68/DPS	57,788	116	1,841	1,785
MXU6002	Free-standing IOM with 35 channel function slots for Level 66/DPS and Level 68/DPS; includes one SCU port and one IOM port	175,055	319	4,132	4,011
MXF6005	IOM Expansion from 35 to 54 channel function slots (Free-standing IOM); for CPS6420, CPS6620, CPS6820, L66/DPS, L68/DPS	53,855	108	1,297	1,272
CPF6650	Basic BCD Option for Level 66/DPS (CPS6650)	120,000	565	5,778	5,260
CPF6651	BCD Option for Level 66/DPS Companion Processor (CPK6666)	67,500	323	3,182	2,921
CSU6601	System Console; includes keyboard, 120-cps printer, and 12-inch CRT	10,390	95	429	394
TTF0200	Pedestal for CSU6601 Printer	175	—	—	7
CSF6601	Console Table for CSU6601	415	—	—	—
DKF7201	Pedestal for Keyboard/Display	175	—	—	—
CSU6602	Auxiliary Console; includes keyboard and 120-cps printer	7,728	69	310	291
CSF6602	Auxiliary Keyboard/Display Attachment Feature	3,596	32	151	137
CSF6603	Additional Keyboard/Display; 12 inches; prerequisite is CSF6602	3,082	32	169	153
CSF6604	Large Screen Monitor, 23 inches, and Monitor Drive Option; includes up to 50 feet of cable	2,358	16	157	141
CSF6605	Ceiling Mount for Large Screen Monitor	194	—	—	—
CSF6606	Extended Systems Control Feature; provides for the addition of a remote console and for switching of master auxiliary and remote consoles for backup; prerequisite is CSF6601 and CSF6602	578	5	23	21
MGS6001	Motor Generator and Control Unit; 31.1 KVA, 60 Hz, 208/440 VAC input	17,750	65	416	403
MGS6002	Motor Generator and Control Unit; 62.6 KVA, 60 Hz, 440/480 VAC input	21,000	78	500	484
MGS6003	Motor Generator and Control Unit; 62.6 KVA, 50 Hz, 380 VAC input	22,150	81	526	512
MGS6004	Motor Generator and Control Unit; 62.6 KVA, 60 Hz, 208 VAC input	21,000	78	500	484
<b>For CPS6723, CPS6730, CPS6750</b>					
PSS6700	Control Unit Power Battery Back-Up	12,000	45	—	2,383**
DCE6700	Initial Synchronous Line Option	10,855	92	—	408**
DCE6701	Data Communications Expansion Option	192,206	439	—	6,664**
DCE6702	Data Communications Expansion Module	104,398	256	—	3,573**
DCS6700	Data Communications System; includes 256K bytes of memory, direct interface adapter, and slots for multi-line communications processors (MLCP)	61,626	525	—	2,321**
<b>MEMORY OPTIONS</b>					
CMM6021/22	128K words of main memory; max. of two; for CPS6650 only; up to 512K words	30,000	74	2,135	2,114
CMM6013/14	256K words of main memory; max. of two; of CPS6650 and CPS8802; up to 1024K words	50,000	157	4,355	4,313
CMM6023/24	256K words of main memory; max. of two; for CPS6650 only; up to 1536K words	50,000	140	4,269	4,229
CMM6025/26	256K words of main memory; max. of two; for CPS6650 only; up to 2048K words	50,000	140	4,269	4,229
CMM6015/16	512K words of main memory; max. of two; for CPS6650 and CPS8802; from 1024K to 2048K words	100,000	294	8,539	8,463
CMM6017/18	512K words of main memory; max. of two; for CPS8802 only; up to 3072K words	100,000	210	8,539	7,752**
CMM6019/20	512K words of main memory; max. of two; for CPS8802 only; up to 4096K words	100,000	210	8,539	7,752**

\*Lease prices include maintenance  
\*\*Five-Year lease prices

## Honeywell Series 60 Levels 66/DPS and 68/DPS

	Purchase Price	Monthly Maint.	Rental (1-Year lease)*	Rental (3-Year lease)*
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## ► MAGNETIC TAPE EQUIPMENT (Continued)

MTA1142	Magnetic Tape Addressing for MTU0400/0410/0500/0600 and MTU0610; addresses four devices; one or two required for each MTP0610/MTF1141	221	—	6	6
MTF1115	Series 2000 to Level 66 tape compatibility feature; one required for each MTP0610/MTF1141	2,410	6	81	75
MTF1145	ASCII Code Translator; one required for each MTP0610/MTF1141	945	—	32	29
MTF1146	EBCDIC Code Translator; one required for each MTP0610/MTF1141	945	—	32	29
MTF1147	EBCDIC/ASCII Code Translator; one required for each MTP0610/MTF1141	945	—	32	29
MTF1148	7-Track, 556/800 bpi capability; one required for each MTP0610/MTF1141; prerequisite MTF1149	1,827	3	60	55
MTF1149	9-Track NRZI, 800 bpi capability; one required for each MTP0610/MTF1141	536	15	90	82
MTF1150	9-Track GCR, 6250 bpi capability; one required for each MTP0610/MTF1141	11,666	23	387	359

## Features for the MTU0630:

MTF0634	9-track, 800/1600 bpi, 75 ips	4,725	138	286	274
MTF0635	9-track, 1600/6250 bpi; 75 ips	7,110	120	342	325
MTF0636	9-track, 800/1600 bpi, 125 ips	9,805	155	460	435
MTF0637	9-track, 1600/6250 bpi, 125 ips	10,330	137	460	435

## UNIT RECORD PROCESSORS &amp; FEATURES

URP0600	Unit Record Processor, free-standing; includes basic 4-port adapter and IOM channel	26,585	40	870	829
URP0601	Integrated Unit Record Processor; used with CP-6 systems; includes basic 4-port adapter and IOM channel	20,540	32	691	671
URP0602	Integrated Unit Record Processor for use with free-standing IOM; includes basic 4-port adapter and IOM channel; limits IOM capacity to 35 channel function slots	20,540	32	691	671
URP8001	Unit Record Processor; for up to two PRU0901/1201 Printers and two Card Units	6,500	6	209	194
URP8002	Unit Record Processor; for up to two Card Units	4,000	3	128	118
URP8003	Unit Record Processor; for up to two PRU0901/1201 Printers	4,000	3	128	118
URF0040	Unit Record Addressing Expansion for URP0600/0601/0602; required if more than four devices used or if drum and belt printers are mixed; accommodates three additional devices	983	2	32	30
URF0041	Dual Switched Channel; includes IOM channel; maximum of one	8,898	15	292	271
URA0050	Addressing capability for PCU0120/0121 and CCU0401; one required for each device	4,253	4	140	129
URA0052	Addressing capability for CRU1050; one required for each device	7,569	43	279	261
URA0053	Addressing capability for PRU1100; one required for each device	1,701	13	66	62
URA0054	Addressing capability for PRU1200; one required for each device	7,167	18	244	224
URA0055	Addressing capability for PRU1600; one required for each device	7,167	18	244	224
URA0056	Addressing capability for CRU0501; one required for each device	265	—	8	7

## LINE PRINTERS

PRU0901	Printer (900 lpm)	37,200	381	1,666	1,570
PRU1100	Printer (1100 lpm)	36,820	402	1,636	1,541
PRU1200	Printer (1200 lpm)	44,420	386	2,095	1,968
PRU1201	Printer (1200 lpm)	42,700	428	1,903	1,793
PRU1600	Printer (1600 lpm)	64,940	538	2,910	2,735
PRF0022	24 Additional Print Positions for PRU1200 or PRU1600	2,610	15	104	97
PRK1216	Retrofit Kit Upgrade for PRU1200 to PRU1600	20,520	152	832	825
PRK0901	Upgrade Kit for PRU0901 to PRU1201	6,000	47	253	238

## PUNCHED CARD EQUIPMENT

CRU0501	Card Reader (500 cpm)	19,500	114	684	638
CRU1050	Card Reader (1050 cpm)	26,555	224	1,136	1,066
PCU0121	Card Punch (100-400 cpm)	20,032	147	900	777
PCU0300	Card Punch (300 cpm)	40,544	501	1,868	1,761
CCU0401	Card Reader/Punch (100-400 cpm)	29,594	219	1,278	1,150
CRF0003	51-Column Read Feature (80-col.) for CRU1050	2,079	6	75	69
CRF0005	Mark Sense Option for CRU1050	7,416	40	198	171
CCK0401	Retrofit Kit; upgrades PCU0121 to PCU0401	9,562	76	328	373

## DOCUMENT HANDLER SUBSYSTEMS

DHP0700	Document Handler Processor for DHU0800/DHU1600 Series; include IOM	116,000	407	3,444	3,335
DHP0701	Document Handler Processor for DHU0803/0814 and DHU1600 Series; includes IOM channel	58,600	197	1,836	1,677
DHU0803	Document Reader/Sorter; 3 pockets; 830 dpm	32,240	350	993	971
DHU0814	Document Reader/Sorter; 14 pockets; 830 dpm	50,877	462	2,284	2,142



## Honeywell Series 60 Levels 66/DPS and 68/DPS

## SOFTWARE PRICES

		Monthly License	Paid-Up License
<b>► Series 60 Level 66/DPS</b>			
SEC6002	Host File Transceiver for Level 6	\$ 16	—
SEC6003	GRTS-II HDLC Support	144	—
SEC6004	NPS Basic System (Release DP1)	1,239	—
SEC6005	NPS HDLC Support (DP1/NT2)	144	—
SED6002	Standard Integrated Data Store/II (I-D-S/II)	672	—
SED6004	Interactive I-D-S/II	110	—
SED6005	GCOS Data Management-IV (DM-IV) Basic System	1,416	—
SED6006	GCOS Data Management-IV (DM-IV) Transaction Processor	1,815	—
SED6007	GCOS Data Management-IV (DM-IV) Query and Reporting Processor	501	—
SED6008	GCOS Data Management-IV (DM-IV) Procedural Language Processor Option for Query & Reporting Processor	355	—
SED6009	GCOS Data Management-IV (DM-IV) Comprehensive Package	3,551	—
SED6010	GCOS Data Management-IV (DM-IV) Co-existence I-D-S Option for Transaction Processing (TDS) and Query & Reporting Processor (MDQS/IV)	731	—
SEL6009	I-D-S/II Cobol-74 Subschema Translator	147	—
SEL6010	Cobol-74 Compiler for Series 6000	212	—
SEL6015	Host-Resident Program Development System for Level 6	557	—
SEL6016	Host-Resident Advanced Fortran System for Level 6	294	—
SEL6017	Host-Resident Cobol for Level 6	294	—
SEL6018	TEX	404	—
SEL6019	TEX Library I	41	—
SEL6102	Extended Fortran Compiler	417	—
SES6001	GRTS-II Basic System	336	—
SEU6006	Resource Collection and Plot (RECAP)	281	—
SEU6101	File Generation	55	—
SEV6101	I-D-S/II Fortran Subschema Translator	147	—
SFL6001	Cobol-74	294	—
SFL6002	PL/1	348	—
SFP6002	Management Data Query System/II (MDQS/II)	760	—
SFP6004	Management Data Query System/IV (MDQS/IV)	1,326	—
SFS6001	Transaction Driven System (TDS)	1,906	—
<b>Series 60 Level 66/DPS New Version of GCOS</b>			
SEU6210	Utility/Maintenance Facility	453	\$ 97
SEU6206	Capsul	240	28
SFC6201	GCOS/FNP-8 Processor Support Option	139	28
SES6201	GRTS-II Basic System	273	44
SEC6203	GRTS-II HDLC Support Option	129	11
SEC6204	NPS Basic System (Release NT2/DP1 or later)	974	209
SEC6205	NPS HDLC Support (Release NT2/DP1)	129	11
SEU6201	File Generation Facility	48	5
SEV6201	I-D-S/II Fortran Subschema Translator	133	11
SED6205	GCOS Data Management-IV (DM-IV) Basic System	1,134	196
SED6206	GCOS Data Management-IV (DM-IV) Transaction Processor	1,543	186
SED6207	GCOS Data Management-IV (DM-IV) Query & Reporting Processor	417	66
SED6208	GCOS Data Management-IV (DM-IV) Procedural Language Processor Option for Query & Reporting System	292	50
SED6209	GCOS Data Management-IV (DM-IV) Comprehensive Package	2,972	413
SED6210	GCOS Data Management-IV (DM-IV) Coexistent Option for Transaction Processing (TDS) and Query & Reporting Processor (MDQS/IV)	606	99
SFL6201	Cobol-74 Compiler & Runtime Facility	262	26
SER6200	Cobol-74 Runtime Facility	86	9
SEL6202	Fortran Compiler & Runtime Facility	354	50
SER6201	Fortran Runtime Facility	122	16
SFL6202	PL/1 Compiler & Runtime Facility	285	50
SER6202	PL/1 Runtime Facility	77	11
SEU6207	Batch Debug Support System	44	6
SEL6204	RPG-II Facility	133	5
SEC6202	Host File Transceiver Facility for L6	16	6
SEL6215	Host Resident Program Development Facility for L6	445	88
SEL6216	Host Resident Advanced Fortran Facility for L6	237	46
SEL6217	Host Resident Cobol Facility for L6	237	46
SEC6210	Multicopy Time-sharing Option	557	110
SEP6201	Time-sharing Facility	792	148
SEU6209	TSS Electronic Mail Option	167	33
SEU6208	TSS Sort Interface Option	70	11
SEL6203	TSS Basic Language Option	202	38

## Honeywell Series 60 Levels 66/DPS and 68/DPS

## SOFTWARE PRICES

		Monthly License	Paid-Up License
<b>Series 60 Level 68/DPS (Continued)</b>			
SGU6112	Artwork Tools	50	—
SGU6115	Limited Service System (LSS) Tools	100	—
SGU6116	ABBREV Processor	100	—
SGU6117	Search Rule Tools	100	—
SGU6118	Command Processor Tools	100	—
SGU6120	Event Management Facility	100	—
SGU6121	Command File Processor	200	—
SGU6122	System Information Tools	50	—
SGU6123	Active Function Library	50	—
<b>Special Software, Level 66/DPS</b>			
SEJ6001	Transaction Processing Executive II (TPE-II)	1,761	56,008
SEL6012	LISP/66	—	3,825
SEL6013	Pascal	—	8,609
SEL6014	Compiler B	—	5,739
SEP6001	TDS/TSS Load Generator System	347	—
SEU6001	HONEYEDIT	—	4,304
SEU6003	System Resource Monitor	—	5,566
SEU6004	Tape Testing System	—	767
SEU6005	Mass Storage Utility	—	1,079
SED6001	Level 66 Total Central	1,921	61,330*
<b>Applications Software, Level 66/DPS</b>			
AEB6001	DES Document Entry Subsystem	325	14,666
AEB6002	CHECS Proof & Transit Subsystem (PTS)	406	10,207
AEB6003	BISNET	891	21,354
AEB6004	CHECS	729	24,873
AEB6005	CHECS On-line Balancing & Item Correction	44	1,714
AED0001	Sales Order Processing System	1,003	25,889
AEF6001	SCRIBE Student Scheduling	236	11,725
AEF6002	SCRIBE Grade Reporting & Attendance	155	7,036
AEF0001	Accounts Receivable System	239	7,207
AEF0002	Accounts Payable System	239	7,207
AEF0003	General Ledger System	239	7,207
AEF0004	Payroll System	239	7,207
AEF6001	Accounts Receivable (System F)	—	5,215
AEH6001	Hospital Computer Sharing System/66, Patient Accounting (HCSS/66/PAC)	—	20,294
AEH6002	HCSS/66 Financial/Accounting (HCSS/66/FAC)	—	9,614
AEH6003	HCSS/66 Payroll/Personnel	—	5,341
AEH6004	HCSS/66 Inventory Reporting	—	2,137
AEH6005	HCSS/66 Accounts Payable	—	1,425
AEH6006	HCSS/66 Bad Debt	—	1,425
AEH6007	Medical Records/Audit	—	1,140
AEH6008	HCSS/66 Preventive Maintenance	—	926
AEH6009	HCSS/66 Property Ledger	—	926
AEH6010	HCSS/66 Cost Allocation	—	713
AEH6011	HCSS/66 Comprehensive Package	—	43,935
AEL6011	A Programming Language (APL/66 Level II)	—	40,492
AEM0003	Production Scheduling & Control	675	30,539
AES0005	General Purpose Simulator System (GPSS)	293	13,342
AES0010	Concordance Generator Program (Concordance)	391	11,351
AES0012	Coordinate Geometry (COGO)	274	11,953
AES0013	Automatic Scheduling with Time Resource Allocation (ASTRA II)	155	6,402
AES0015	MPS/66—Basic System	499	20,576
AES0016	MPS/66—Mixed Integer Feature	603	24,816
AES0017	MPS/66—Generalized Upper Bound	831	34,213
AES0004	MPS/66—Common File Management System	831	34,213
AES0019	Time-sharing Application	140	6,146
AES0020	SIMSCRIPT	129	5,633
AES0021	Biomedical Statistical Library (BMD)	—	2,071
AES0022	PMCS/66 Network Processor	445	18,691
AES0023	PMCS/66 Resource Scheduler	397	16,612
AES0024	Individualized Mathematics Instruction IMI/66	—	3,595
AES6009	Automated Dynamic Analyzer (ADA)	116	7,386
AFB6001	Customer Profile Module	1,065	33,275
AFB6002	Administrative & Controls Module	484	16,940

\*For SEJ6001 or SED6001, an annual software maintenance fee of \$1,925 or \$1,821, respectively, is invoiced one year after delivery. An upgrade to SED6001 from Total 4H costs \$21,000, and from Total Central, \$15,750.