Honeywell Series Level 64

MANAGEMENT SUMMARY

The Honeywell Series 60 Level 64 product line has been an important member of the manufacturer's family of computers. In its current version, the single-processor DPS-330, Honeywell has positioned the system as both a competitor to IBM's 4331 and a key element in Honeywell's Distributed Systems Environment (DSE). The Level 64/DPS-330 supports local or remote batch processing, on-time (realtime) processing, time-sharing, and distributed processing.

The Level 64/DPS-330, introduced January 25, 1980, has evolved from a family of five individual systems to a single-processor concept with memory and performance enhancements. The Level 64/DPS-330 is capable, the same as its predecessors, of running programs from the more mature Honeywell 200/2000 systems. The level 64 was originally intended as an upgrade for users of the older systems. The Level 64/DPS-330 is made in France by CII-Honeywell Bull.

In its present form, the Level 64/DPS-330 (CPS4250) is equipped with 512K bytes of error correcting memory, and is expandable to two megabytes through two 256K-byte steps and a one-megabyte increment. Memory is built from 16K MOS chips and includes single-bit error correction and double-bit error detection. Two system performance upgrades are available which increase processor performance by 1.55 times the base system (CPF4955) or 2.3 times the base (CPF4966). Peripheral configurability increases with the two performance packages, and the 64/DPS-330 supports a wide variety of devices.

The 64/DPS-330 offers improved price/performance over its predecessor systems, the DPS-320 and DPS-350. Compared to IBM's 4331-1, Honeywell claims the basic DPS-330 has about 10 percent better performance and costs 17 percent more at the 512K-byte memory size. ▷

The latest in Honeywell's Level 64 series of processors, the 64/DPS-330, is a uniprocessor that features up to two megabytes of main memory, two performance enhancements, a wide choice of peripherals, and execution of up to 64 concurrent jobs under GCOS 64 Release 0500. The DPS-330 is comparable to the IBM 4331-1 and 4331-2, and is a key element in Honeywell's Distributed Systems Environment.

CHARACTERISTICS

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

CURRENT MODELS: Level 64/DPS-330 with three performance levels.

PRIOR MODELS: Level 64/DPS-320 and DPS-350.

DATE ANNOUNCED: January, 1980.

DATE OF FIRST DELIVERY: First quarter 1980.

NUMBER INSTALLED TO DATE: About 350 (USA); over 1,000 (outside USA). The figures represent all Level 64 models.

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 or fixed-point binary numbers and also as floating-point operands with single- (16-bit) or double- (32-bit) precision formats. ▶
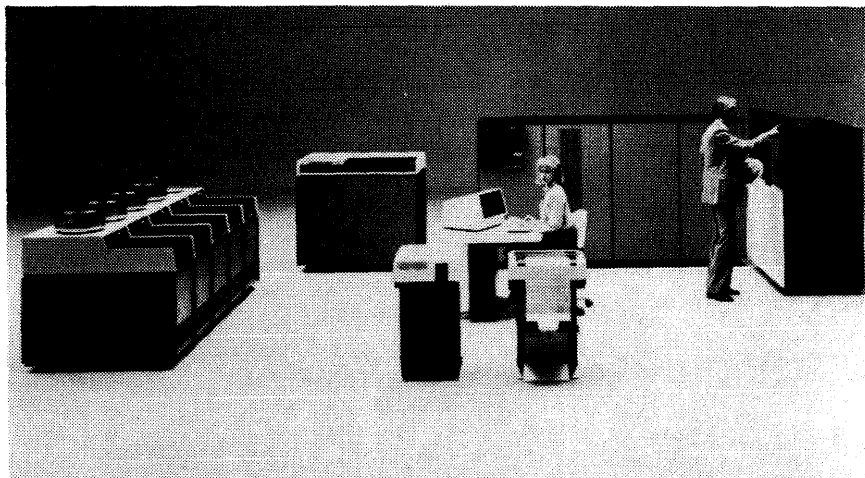
The Honeywell Level 64/DPS-330 is the current model of the Level 64 product line, and comes in one model with several memory and performance packages. It supports batch, on-line, transaction, and distributed processing environments.

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CHARACTERISTICS OF THE LEVEL 64/DPS SYSTEMS

	Level 64 DPS-320	Level 64 DPS-330	Level 64 DPS-350
CENTRAL PROCESSOR*			
Performance extension levels	2	2	1
Percent increase over base	39; 72	55; 130	25
Relative Performance	1.0 to 1.7	1.0 to 2.3	1.6 to 2.1
Cycle time (nanoseconds)	500 to 430	315	430 to 340
MAIN STORAGE (LSI MOS)			
Read cycle time, nanoseconds	1000 to 860	630	860 to 680
Write cycle time, nanoseconds	1000 to 980	770	980 to 880
Minimum capacity, bytes	512K	512K	512K
Maximum capacity, megabytes	1	2	2
Bytes fetched per cycle	4	4	4
CONTROL MEMORY (Bipolar)			
Access time, nanoseconds	175 to 155	100	155 to 140
Capacity, bytes	40K to 64K	40K to 64K	40K to 64K
Bytes fetched per cycle	4	4	4
CONFIGURATION			
Mass storage processors (max.)	1 to 2	3	2 to 3
Disk drives (max.)	8 to 16	24	16 to 24
Magnetic tape processors (max.)	1 to 2	16	2
Magnetic tape drives (max.)	8 to 16	2	16
Unit record processors (max.)	1 to 2	2	2
Unit record devices (max.)	5 to 8	12	8
Communications controllers (max.)	1 to 2	3	2 to 3
Communications lines (max.)	14 to 28	45	28 to 42
DATANET 8 Front End Network Processors (max.)	N/A	2	2
Communications lines supported by DATANET 8 (max.)	N/A	256	256

*DPS-320 has base model plus two performance upgrades; DPS-350 has one upgrade; DPS-330 has two upgrades. The DPS-320 and -350 are included for comparison.

▷ transition from the IBM System/3 to the Level 64/DPS. The Level 64 GCOS Basic Operating System is provided under a standard no-separate-charge license. All other system software is licensed at a monthly fee.

Series 200/2000 system programs run in program mode under GCOS Level 64 and, according to Honeywell, execute more efficiently and provide greatly enhanced throughput over the original systems.

RELIABILITY/MAINTAINABILITY

Honeywell has implemented its Remote Maintenance System (RMS/64) in the Level 64/DPS-330 CPU. RMS/64 permits field engineering personnel to diagnose hardware, firmware, software, and operational (human) problems from a remote support center concurrently with user production. One major benefit that users can derive from RMS/64 is the diagnosis of software problems and implementation of repairs by vendor personnel without the need for site visits or taking the system down for maintenance.

Reliability and maintainability is also carried on in the Level 64/DPS-330 CPUs through five largely independent features that provide troubleshooting information. Parity is checked on every access to storage, whether mass storage or control storage. Further, parity is checked whenever data is transferred between any two system functional units. Main memory is error-correcting ▷

▶ PROCESSOR MODES: There are two modes of processor operation, master and slave. The master mode, used only by GCOS, allows unrestricted access to all of main memory, permits initiation of I/O operations, and permits setting of control registers. The slave mode is used by user programs and also by GCOS when appropriate. In the slave mode, all storage references are relative to the base address register's contents and are restricted to assigned boundaries, program execution times are limited by the timer registers, and input/output and certain control operations cannot be executed.

CONSOLE: The Level 64/DPS-330 console provides a console display (CRT), a keyboard, a system operator panel, and one tape cassette handler. A 120-cps printer (CSF4104) is optional.

The keyboard is solid state and includes upper and lower case alphabetic characters, digits, 32 special graphics, and control keys for the printer and console display. The console printer has 80 positions per line and 6 lines per inch. It can produce an original and up to five copies. The CRT console display has a 12-inch diagonal screen, producing 24 lines of 64 characters each. The operator control panel includes power switches, check indicator, and basic operator/system controls. The keyboard and display are mounted on a free-standing pedestal.

COMPATIBILITY FEATURES: The Level 64/DPS-330 processors can be equipped with optional compatibility features that enable them to execute programs written for Honeywell Series 200/2000 Mod 1 or Series 100 systems.

CONTROL STORE: Consists of both bipolar read-only memory (ROM) and firmware routines located in main memory. Routines from either source are executed by the ▶

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OS/2000 executives. The average number of workstations was 11, and ranged from none to 150. COBOL was used exclusively by all except for one user who ran both COBOL and FORTRAN. Main memory sizes ranged from 64K bytes to one megabyte. The majority of users expected to add more data communications facilities in 1980/81. By more than two to one the Level 64 users said they would recommend the system to another user.

	Excellent	Good	Fair	Poor	1980 WA*
Ease of Operation	7	17	3	0	3.1
Reliability of mainframe	6	19	1	0	3.2
Reliability of peripherals	4	15	6	1	2.8
Responsiveness of maintenance service	4	15	6	0	2.9
Effectiveness of maintenance service	1	11	13	0	2.5
Technical support:					
Trouble-shooting	3	10	12	1	2.6
Education	2	8	8	5	2.3
Documentation	1	7	9	8	2.0
Operating system	10	13	4	0	3.2
Compilers and assemblers	8	16	3	0	3.2
Applications programs	2	11	2	2	2.8
Ease of programming	5	19	3	0	3.1
Ease of conversion	5	9	9	2	2.7
Overall satisfaction	3	17	4	1	2.9

*Weighted Average on a scale of 4.0 for Excellent.

Datapro contacted several Level 64 users for their comments. Our first user was a New England manufacturing firm that has been using a Level 64 Model 40 for almost four years. It was upgraded from a Level 64 Model 20, and currently is a completely on-line system. The DP manager told us the system runs very well, and he has no immediate plans for changing it. He has one megabyte of main memory and feels the system can handle most anything his firm needs.

Our second interview was with a midwest chemical manufacturing company with Honeywell systems in several of their locations. The DP manager told us the main office Level 64 Model 50 is a "super" machine, with consistent 98+ percent uptime running in batch mode. The CPU and disk drives are "very dependable," and the conversion from OS/2000 to GCOS operating systems had resulted in a 4 to 1 improvement in throughput. His system converted very smoothly from OS/2000 to native mode. Another Level 64 in the Southeast is also a very good performer, and communicates regularly with a Level 6 minicomputer in the headquarters. They have several Level 6s in field offices, and plan to increase communications activities with them in the near future.

A food manufacturing firm in the northeast has been using its Level 64/DPS-330 for about a year, and was one of the first users of the system. The company's spokesman told Datapro that the conversion from the previous H-2020 was rather long, and the DPS-330 has somewhat more downtime than he would prefer. He attributed the downtime to peripherals more so than the CPU. His overall throughput with GCOS has increased by 40 ▷

processor (IMSP), one integrated unit record processor (IURP), two I/O channels, one integrated communications controller (ICC) that can handle up to 15 lines, and a console with a console display.

Main memory can be expanded from 512K bytes to two megabytes in two 256K increments (CMM4180) and one 1 megabyte increment (CMM4100).

A wide range of peripheral flexibility is available on the Level 64/DPS-330, using both integrated and free-standing peripheral controllers. The maximum number of devices supported on the DPS-330 is shown on the system characteristics chart.

MASS STORAGE

MSU0421, MSS0420 MASS STORAGE UNITS: The MSU0421 system provides 100 megabytes of unformatted storage on a single Honeywell 4050 disk pack. The MSS0420 includes two MSU0421 drives in one packaged system for a total of 200 megabytes. The average rotational delay is 8.3 milliseconds and the data transfer rate is 806,000 bytes per second.

MSU0402/0452 MASS STORAGE UNITS: Both drives use Winchester technology and provide 100 megabytes (MSU0402) and 200 megabytes (MSU0452) of unformatted storage using a Honeywell 4451 disk pack. The average rotational delay is 8.3 milliseconds and the data transfer rate is 806,000 bytes per second. The MSU0402 can be field upgraded to the MSU0452.

MASS STORAGE PROCESSORS: One MSP is included with the basic level 64/DPS-330, and provides system control and fault detection. Two additional free-standing units (MSP4400) can be attached. Each processor supports up to eight disk drives, for a total of 24 drives per system.

INPUT/OUTPUT UNITS

MTP4200/4300 MAGNETIC TAPE PROCESSORS: Provide magnetic tape substytem control and fault detection. Up to two MTPs can be connected to a level 64/DPS-330 system in the following configurations: either two MTP4200s or one MTP4200 and one MTP4300. The MTP4200 supports the MTU0210/0211/0410/0500 tape units. The MTP4300 supports the MTU0410/0500 tape drives. Both MTPs can support up to eight drives each.

MTU0210/0211 MAGNETIC TAPE UNITS: These units are employed in clusters on Level 64/DPS-330 systems. A cluster consists of one MTU0210 primary drive and one to three MTU0211 secondary drives. The MTU0210/0211 drives are 37.5-ips units and are offered in three configurations that can be intermixed in the same subsystem: 9-track, 1600 bpi; 60,000 bytes/sec.; 9-track, 800/1600 bpi, 30,000/60,000 bytes/sec.; and 7-track, 200/556/800 bpi, 7,500/20,850/30,000 bytes/sec. Rewind speed for the MTU0210/0211 is 225 inches per second. Read-after-write electronics is standard.

MTU0410 MAGNETIC TAPE UNITS: These units are stand-alone 75-ips tape drives. The MTU0410 drives are available in five configurations: 9-track, 1600 bpi, 120,000 bytes/sec.; 9-track, 800/1600 bpi, 60,000/120,000 bytes/sec.; 7-track, 200/556 bpi, 11,250/31,275/45,000 bytes/sec.; 7-track 556/800 bpi, 31,275/45,000 bytes/sec.; and 7-track, 200/556/800 bpi, 11,250/31,275/45,000 bytes/sec. Rewind speed for the MTU410 is 450 inches per second. Read-after-write electronics is standard.

MTU0500 MAGNETIC TAPE UNITS: These are stand-alone 125-ips tape drives for Level 64/DPS-330 systems. They can be used in dual-access applications. The MTU0500 ▶

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microprogrammed URP4300 controls all activities over the communications lines. Five different types of terminal protocols are supported; TTY (DCF4301), Honeywell VIP (DCF4302), BSC (DCF4303), BSC with transparency (DCF4304), and IBM 3270 (DCF4308).

Communications lines can be either asynchronous (DCA4310) or synchronous (DCA4320). A polling extension (DCF4340) is available for synchronous lines with more than four terminals connected.

DISTRIBUTED SYSTEMS ENVIRONMENT

The Level 64/DPS-330 is an integral part of Honeywell's Distributed Systems Environment (DSE), which places computer power where it is most needed. Typically the DPS-330 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 Level 64/DPS-330 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 256K bytes of memory, expandable to 512K; 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 level 64/DPS-330 operating under GCOS 64. Up to two DATANET 8 processors can be configured with a DPS-330 system.

SOFTWARE

LEVEL 64 GCOS: The present version of Level 64 GCOS is Release 0400, which features enhanced multiprogramming capabilities, extension of the universal file access system (UFAS), improved program development capabilities, and enhanced communications capabilities.

Up to 31 concurrent jobs can run under Release 0400. The newest update to GCOS 64, Release 0500, can support up to 64 concurrent jobs. It is currently being delivered to selected customers, but these restrictions are to be lifted in the second quarter of 1981. In conjunction with multiple concurrent jobs, Release 0400 provides CPU dispatching automatic control (DCAC). DCAC allows the user up to three options to control the performance level of a given job or set of jobs so that throughput may be better balanced.

Release 0500 of GCOS 64 will add these additional features: 1) use of RPG for writing Transaction Driven System (TDS) transactions, 2) increased number of Level 6 systems as remote batch stations, 3) interactive execution of language processors and user programs under IOF (interactive operations facilities), 4) new tabling and indentation facilities for source language maintenance, 5) Multi Logic Data Store (MLDS), a data access method compatible with the Level 62 and IBM System/3, 6) improved system security, 7) improved interactive facilities via Immediate Step Activation, and 8) facilities to improve system use by non-technical personnel.

GCOS Level 64 supports any combination of batch, interactive, or service activities, such as multiple output-writers. Each program can be divided into job steps, each

with its own separate set of segment tables. The maximum number of job steps in the system is 256, effectively providing the nucleus of a virtual-memory system with multiple virtual spaces.

GCOS Level 64, like GCOS Level 62, uses segment-relative addressing to optimize the use of main memory. All programs in a Level 64 system are executed as fully relocatable segments. Level 64 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.

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 relocates the segments already in memory to collect all available space into one continuous area. As a last resort, GCOS may remove the least active segment in main memory to make room for a new segment. The removed segment is only written back to the backing store if it has been changed while in memory. Instruction coding is re-entrant and is never modified. Therefore, these segments never have to be rewritten and can be overlaid. Swapping and moving of the segments is invisible to the programmer, who has apparent access to a memory capacity equal to the size of the backing store.

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

Level 64 integrity features include error logging, file security, and recovery routines. Whenever the firmware of the Level 64 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 Level 64 also includes a variety of file security aids. A save/restore utility is available for taking security copies of files, and both copies and saved generations of a file can be included in the system catalog.

GCOS includes a journal function to speed file recovery. The journal is used to save all the updates to a file since the last security copy was taken. The journal, 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 possiblity of a system failure, GCOS Level 64 provides a fast recovery facility in rerun support. Rerun support allows processing to be restarted immediately, either at the beginning of the job step or at the last checkpoint. The restart procedure includes automatic repositioning of the ▶

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Activation (SCP1605). It also calls in the static linker and user object programs, and is available with Release 0500.

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

Data Communications Software

The GCOS data communications software, together with the Level 64/DPS-330 communications hardware and firmware, handle networks of up to 45 lines, with up to 32 terminals per line. A network can include switched, private, and direct-connect lines, as well as a variety of terminal types. Level 64/DPS-330 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 programming techniques.

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

The Level 64 Remote Batch Facility (RBF) enables remote job entry from a Distributed System Satellite (DSS) to a Level 64/DPS-330 (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 Level 64/DPS-330 host can support up to 15 DSS systems acting as RBF terminals, each on a separate line and on a concurrent basis. The DSS can be either a Level 6 or, more recently, a DPS 6 minicomputer.

The File Transfer Facility (FTF) enables exchange of Level 64 and DSS sequential disk files. The FTF uses two software components; FTF/6 on the Level 64/DPS-330, and FTF 64/DSS on the DSS. It will be available with GCOS 64 Release 0500.

The Distributed Network Supervisor (DNS) is the communications software designed for use in the DATA-NET 8 Front-End Network Processor (FNP) as well as other Distributed Systems Architecture (DSA) elements. DNS, along with the DATANET 8, Level 64/DPS, and a host package called Front-End Network Processor Support (FNPS), controls the overall communications network. It provides the following functions:

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

Data Base Management Software

Data Management IV (DM-IV) is a fully operational on-line, integrated data management system. Data extraction and updating from data bases with various file organizations and data structures can be directly performed by non-data processing professionals.

DM-IV is CODASYL-oriented and includes common data definition languages for describing schema and subschema views of integrated and/or indexed data files. The system offers several end-user services including the capability to satisfy unanticipated information requirements.

The new DM-IV module enhances the Level 64/DPS-330 systems communications capabilities by combining the strengths of the TDS/64 Transaction-Driven System and the I-D-S-II data base management system. DM-IV offers transaction processing users protected concurrent access to the data base and UFAS files. DM-IV provides for the consolidation and simplification of multiple and repetitive tasks such as organizing file systems and communications programs. The module also provides for the building of a multi-faceted environment within a single system. A Level 64 system with the DM-IV module in GCOS/64 can support a communications network of 42 lines with up to 32 terminals per line. The network can include switched and private lines as well as a mixture of terminal types. For more information on DM-IV, see Report 70E-480-01.

Integrated Data Store (I-D-S/II) is an enhanced version of I-D-S, a data base management system originally developed by GE. I-D-S/II was released in November 1975, and marks the beginning of an evolution of I-D-S toward conformance with the recommendations of the CODASYL Data Base Task Group. I-D-S/II is fully integrated with Honeywell's COBOL-74 compiler, and user interfaces are also implemented for FORTRAN. I-D-S/II is described in detail in Report 70E-480-01.

The Query Driven System (QDS) is a terminal-oriented file inquiry update and report writing system for the Level 64. QDS contains the interactive, report, and assistance modes of use. 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 Level 64 GCOS BFAS indexed sequential and sequential file organizations and UFAS indexed and sequential organizations.

Programming Languages

Level 64 COBOL (SCL1601), a superset of Level 62 COBOL, is a full implementation of the standard ANSI specification X3.23-1974, and adds report writer, automatic segmentation, and data communications enhancements.

The COBOL Data Communications Extension (SCL1603) is an optional extension to the basic COBOL ANS 74 ▶

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Honeywell; the Technical Assistance Center, located in Newton, Massachusetts, which coordinates all activities; a Logistics Inventory Data System, for rapid location of parts; Service Account and Field Engineering representatives; an Alert system to notify FE management of special problems; Remote Access Program software for trouble-shooting; a systems optimization and monitoring program to evaluate and measure system performance; a network analysis program to solve communications network problems; and automatic software updating.■

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Lease* 1-Year	Lease* 3-Year	Lease* 5-Year
PROCESSORS						
CPS4250	Level 64/DPS-330 Central System; includes CPU with 512K bytes of main memory, integrated mass storage processor, integrated unit record processor, integrated 15-line communications controller, and console with printer	$79,675	$226	$2,603	$2,424	$2,155
PROCESSOR OPTIONS						
CPF4955	Power Upgrade; 1.5xDPS-330	35,730	81	1,105	1,026	910
CPF4966	Power Upgrade; 2.3xDPS-330	47,640	108	1,473	1,370	1,212
CPF4111	Scientific instruction set	10,850	29	350	325	288
CPF4118	I/O channels 3, 6, 8, 9, 11 or 12	8,873	28	288	269	239
CPF4119	4th I/O Channel	8,873	28	288	269	239
CPF4120	5th I/O Channel	8,873	28	288	269	239
CPF4122	10th I/O Channel	8,873	28	288	269	239
CPF4301	Expansion Unit (cabinet 3)	13,808	47	453	422	376
CPF4302	Power Supply for CPF4301	8,778	30	288	268	239
CSF4104	Console Printer	7,750	70	233	225	213
CSF4106	Stand-Up Positioning for console printer	NC	NC	NC	NC	NC
CSF4102	Pedestal for CSF4104; low for sitting	200	—	—	—	—
CSF4103	Pedestal for CSF4104; high for standing	200	—	—	—	—
CPF4114	Series 100	9,400	28	304	284	251
CPF4115	Series 200/200	9,400	28	304	284	251
CPF4117	DOS (RPQ)	19,650	117	693	649	583
MEMORY						
CMM4108	256K-byte Memory Module; includes addressing	7,500	13	250	214	193
CMM4100	One megabyte Memory Module; includes addressing	30,000	51	1,002	856	770
CMC4100	Memory Control Expansion	5,000	12	159	148	132
MASS STORAGE						
MSA4100	Addressing for two disks; required for each two disks beyond first and second; for integrated mass storage processor	8,000	22	259	242	214
MSF4101	Series 200/2000 Mode; for integrated mass storage processor (MSP)	2,352	6	76	71	63
MSP4400	Additional MSP	28,686	136	996	931	835
MSP4401	Series 200/2000 Mode; for MSP 4100	2,352	6	76	71	63
MSF4410	Manual Switch for MSP4400	9,518	26	309	288	256
MSF4102	Mass Storage Expanded Capability	53	NC	1	1	1
MSA4400	Addressing for two disks; required for each two disks beyond first and second; for MSP4400	8,000	20	259	242	214
MSU0402	100-megabyte Mass Storage Drive, field upgradable	20,805	113	752	687	655
MSS0420	Mass Storage Subsystem; consists of two 100-megabyte disk drives	27,000	155	1,030	964	866
MSU0421	100-megabyte Mass Storage Drive	14,600	95	569	533	480
MSU0452	200-megabyte Mass Storage Drive	30,650	113	937	862	815
MSF0002	Dual Access Feature; for the MSU0420/0421	2,070	15	81	74	70
MSF0006	Dual Access Feature; for the MSU0402/0452	2,070	13	75	68	65

*Includes maintenance.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Lease* 1-Year	Lease* 3-Year	Lease* 5-Year
PRINTERS (Continued)						
URA4913	Addressing for PRU1600	8,250	21	199	194	181
PRU1600	Belt Printer, 1600 lpm, 136 positions	64,940	538	2,482	2,334	2,112
PRF0022	24 additional print positions for PRU1200 and PRU1600	2,610	15	93	87	78
PRB0703	Belt for PRU0640/0840/1200/1600; 64 characters, OCR-B font (Series 200/2000)	2,460	90	151	140	134
PRB0500	Series 100 Belt, 63 characters, OCR-B font	2,460	90	151	140	134
PRB0600	94-character upper/lower case belt; OCR-B font	2,567	90	165	160	151
PRB0549	63-character alphanumeric belt; OCR-A font	2,460	90	151	140	134
PRB0524	63-character numeric Belt; OCR-A font	2,460	90	151	140	134
PRB0501	63-character EBCDIC Belt	2,460	90	151	140	134
PRB0513	63-character ASCII Belt	2,460	90	151	140	134
PUNCHED CARD EQUIPMENT						
URA4314	Addressing for CRU0301/0501/1050	3,465	12	113	105	93
CRU0401	Card Reader, 300 cpm	9,513	71	352	319	204
CRU0501	Card Reader, 500 cpm	18,110	104	507	460	438
CRF0006	IBM Mode Mark Sense Option for CRU0301/0501	4,520	38	168	156	142
CRF0007	HIS Mode Mark Sense Option for CRU0301/0501	4,520	38	168	156	142
CRF0030	Pedestal for CRU0301/0501	184	—	—	—	—
CRU1050	Card Reader, 1050 cpm	25,290	185	891	799	766
CRF0003	51 Column Read Feature	2,079	5	67	62	55
CRF0005	IBM and HIS Mode Mark Sense Feature	7,787	48	237	217	205
URA4315	Addressing for PCU0120	6,878	23	226	210	187
PCU0120	Card Punch, 100 cpm	19,078	116	700	635	589
URA4316	Addressing for CCU0400	7,088	26	244	228	202
CCU0400	Read/Punch, 400/100 cpm	28,185	190	846	828	804
COMMUNICATIONS						
DCF4301	Terminal Support Type 1 (TTY)	53	NC	1	1	1
DCF4302	Terminal Support Type 2 (VIP)	53	NC	1	1	1
DCF4303	Terminal Support Type 3 (BSC)	53	NC	1	1	1
DCF4304	Terminal Support Type 4 (BSC) (w/Transparency)	945	4	31	29	26
DCF4308	Terminal Support Type 8 (3270)	1,665	8	58	54	48
DCF4340	Polling Extension (Up to 32 Terminals)	546	1	17	16	15
DCF4330	Performance Expansion	4,284	8	136	126	111
DCA4310	Async. Line Attachment	2,310	4	73	67	60
DCA4320	Sync. Line Attachment	2,385	5	90	83	74
DCC4300	Additional Data Communications Controller	13,650	35	442	411	365
DCU8010	DATANET 8 Front-End Network Processor	29,000	135	1,012	946	846
TERMINALS						
TWU1001	Asynchronous 30-cps Serial Matrix Printer with keyboard; 64-character buffer, 300 cps	2,470	29	126	95	87
TWU1003	With selectable transmission speeds of 110, 220 or 300 bps	2,850	40	152	116	207
TWU1005	Asynchronous 120-cps Serial Matrix Printer with keyboard; 1000-character buffer, 1200 bps	3,600	51	193	147	134
PRU1001	Asynchronous 30-cps Serial Matrix Printer without keyboard; 64-character buffer, 300 bps	2,260	28	117	88	81
PRU1003	With selectable transmission speeds of 110, 200, or 300 bps	2,640	39	143	109	101
PRU1005	Asynchronous 120-cps Serial Matrix Printer without keyboard; 1000-character buffer, 1200 bps	3,390	50	183	140	129

*Includes maintenance.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	1-year Lease*	5-year Lease*	7-year Lease*
PROCESSOR OPTIONS (Continued)						
URP4901	Second Unit Record Processor	17,400	47	402	366	311
CSF4902	30-cps Printer Console	7,750	61	218	199	168
CSF4907	30-cps Printer	7,750	61	218	199	168
CSF4914	Console Display	5,150	25	132	120	102
PSU4902	Peripheral Switch Unit	10,658	20	259	232	198
PSF4900	Additional Peripheral Switch Unit	2,625	3	64	57	49
CPF4951	Channel Qualifier, Levels 1 and 4	—	—	—	—	—
CPF4952	Levels 2 and 3	—	—	—	—	—
CPF4933	Level 5	—	—	—	—	—
For CPS4924 and CPS4953						
CPF4940#	Performance Extension for CPS4924	18,000	48	552	444	370
CPF4954#	Additional Performance Extension for CPS4924	18,000	48	552	444	370
CPF4964	Performance Extension for CPS4953	18,000	48	552	444	370
CPF4901	Scientific Instruction Set	10,850	26	248	226	192
CSF4914	Console Display	5,150	25	132	120	102
CPA4935	Addressing for Two I/O Channels	1,850	1	39	35	30
CPF4943	I/O Expansion Unit	13,150	43	312	284	241
CPF4938	I/O Channel	8,450	25	199	181	154
URP4901	Second Unit Record Processor	17,400	47	402	366	311
PSU4902	Peripheral Switch Unit	10,658	20	259	232	198
PSF4900	Additional Peripheral Switch Unit	2,625	3	64	57	49
All Processors						
CPF4924	DM100 Standard Performance Level Program Mode	9,400	26	220	201	170
CPE4901	PM200, Basic Performance Level Program Mode for CPS4924	9,400	24	216	197	167
CPE4902	PM200, Intermediate Performance Level Program Mode for CPS4924	10,250	26	235	214	182
CPE4903	PM200, Basic Performance Level Program Mode for CPS4953	9,400	24	216	197	167
CPE4904	PM200, Intermediate Performance Level Program Mode for CPS4953	10,250	26	235	214	182
MEMORY						
CMM4961	64K-byte Memory Increment	2,305	4	68	55	46
CMM4971	128K-byte Memory Increment	3,690	5	110	88	74
CMM4980	256K-byte Memory Increment	5,920	7	177	142	119
CMA4961	Memory Addressing, 64K	615	2	19	15	13
CMA4971	Memory Addressing, 128K	980	3	30	24	20
CMA4980	Memory Addressing, 256K	1,580	4	47	38	29
CMU4990	Memory Expansion Unit; for over one megabyte	5,000	10	149	120	100
MASS STORAGE						
MSP4901	Second Mass Storage Processor	11,600	61	301	273	232
MSP4902	Third Mass Storage Processor	13,950	72	360	326	277
MSA4900	Addressing for Disks 1 and 2	8,000	23	189	172	147
MSA4901	For Disks 3 and 4	8,000	23	189	172	147
MSA4902	For Disks 5 and 6	8,250	24	196	178	152
MSA4903	For Disks 7 and 8	8,550	24	202	183	156
MSA4904	For Disks 9 and 10	8,750	26	208	188	161
MSA4905	For Disks 11 and 12	9,000	28	214	195	165
MSA4906	For Disks 13 and 14	9,300	28	219	200	170
MSA4907	For Disks 15 and 16	9,500	29	226	205	174
MSA4908	For Disks 17 and 18	9,750	30	231	211	179
MSA4909	For Disks 19 and 20	10,050	30	238	216	183
MSA4910	For Disks 21 and 22	10,300	31	243	221	188
MSA4911	For Disks 23 and 24	10,500	32	250	227	194
MSU0310	29.2-megabyte Mass Storage Drive	13,040	75	410	389	331
MSU0350	70-megabyte Mass Storage Drive	13,500	83	457	396	337
MSU0400	100-megabyte Mass Storage Drive	16,500	122	616	522	444
MSK0354	Field Upgrade of MSU0400 to 100 megabytes	8,400	30	163	143	121

*Lease prices include maintenance.
#These items have a monthly support charge as follows: CPF4940, $78 and CPF4954, $121.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	1-year Lease*	5-year Lease*	7-year Lease*
MAGNETIC TAPE EQUIPMENT (Continued)						
MTU0500	Magnetic Tape Unit, 125 ips	17,441	91	591	513	435
MTF0011	9 track, 1600 bpi option	3,213	23	115	99	84
MTF0012	9 track, 800/1600 bpi option	4,137	39	145	127	108
MTF0013	7 track, 200/556/800 bpi option	6,300	63	251	215	181
MTF0015	7 track, 200/566 bpi option	3,213	23	115	99	84
MTF0016	7 track, 55/800 bpi option	3,213	23	115	99	84
MTF0018	Cartridge Load Capability	735	2	22	19	15
PRINTERS						
For CPS4900 and CPS4901						
URA4909	Addressing for PRU0456/0657/0857/1107	5,360	17	152	138	117
PRU0457	Drum Printer, 450 lpm, 132 positions	19,810	219	646	583	521
PRU0657	Drum Printer, 650 lpm, 132 positions	26,455	229	809	730	652
PRU0857	Drum Printer, 850 lpm, 132 positions	30,444	267	939	846	757
PRU1107	Drum Printer, 1100 lpm, 132 positions	34,910	328	1,124	1,011	906
PRK0476	Field Upgrade of PRU0457 to PRU0657	6,645	10	156	140	125
PRK0478	Field Upgrade of PRU0457 to PRU0857	10,634	45	279	251	225
PRK0471	Field Upgrade of PRU0457 to PRU1107	15,100	104	455	408	367
PRK0678	Field Upgrade of PRU0657 to PRU0857	3,989	35	124	111	100
PRK0671	Field Upgrade of PRU0657 to PRU1107	8,455	94	300	268	242
PRK0871	Field Upgrade of PRU0857 to PRU1107	4,466	59	176	157	142
For CPS4924 and CPS4953						
URA4908	Addressing for PRU0658/0858/1108	4,000	15	133	107	89
PRU0658	Drum Printer, 650 lpm, 132 positions	20,000	214	747	600	500
PRU0858	Drum Printer, 850 lpm, 132 positions	26,000	249	970	780	650
PRU1108	Drum Printer, 1100 lpm, 132 positions	30,000	307	1,119	900	750
For all processors						
URA4911	Addressing for PRU0640/0840	8,250	18	186	169	143
PRU0640	Belt Printer, 600 lpm, 120 positions	33,663	268	1,122	974	906
PRU0840	Belt Printer, 800 lpm, 120 positions	39,606	287	1,312	1,141	1,060
PRF0020	16 Additional Print Positions for PRU0640 and PRU0840	1,460	9	45	39	33
PRK0640	Field Upgrade of PRU0640 to PRU0840	5,660	18	159	139	129
URA4912	Addressing for PRU1200	8,250	18	186	169	143
PRU1200	Belt Printer, 1200 lpm, 136 positions	44,420	386	1,698	1,463	1,360
URA4913	Addressing for PRU1600	8,250	18	186	169	143
PRU1600	Belt Printer, 1600 lpm, 136 positions	64,940	538	2,482	2,112	1,959
PRF0020	24 additional print positions for PRU1200 and PRU1600	2,610	15	93	78	71
PKK1216	Field Upgrade of PRU1200 to PRU1600	20,520	144	706	616	570
PRB0703	Belt for PRU0640/0840/1200/1600; 64 characters, OCR-B font (Series 200/2000)	2,460	59	111	103	96
PRB0500	Series 100 Belt, 63 characters, OCR-B font	2,460	59	120	103	96
PRB0600	94-character upper/lower case belt; OCR-B font	2,567	58	134	120	110
PRB0549	63-character alphanumeric belt; OCR-A font	2,460	59	120	103	96
PRB0524	63-character numeric Belt; OCR-A font	2,460	59	120	103	96
PRB0501	63-character EBCDIC Belt	2,460	59	111	103	96
PRB0513	63-character ASCII Belt	2,460	59	120	103	96
PUNCHED CARD EQUIPMENT						
URA4914	Addressing for CRU0301/0501	3,300	11	79	72	61
CRU0301	Card Reader, 300 cpm	9,513	55	313	270	229
CRU0501	Card Reader, 500 cpm	16,643	90	507	438	372
CRF0006	IBM Mode Mark Sense Option for CRU0301/0501	4,520	33	168	142	120
CRF0007	HIS Mode Mark Sense Option for CRU0301/0501	4,305	33	168	142	120
CRF0030	Pedestal for CRU0301/0501	175	—	—	—	—
URA4915	Addressing for CRU1050	6,100	13	138	125	106
CRU1050	Card Reader, 1050 cpm	24,318	161	825	709	672
CRF0003	51 Column Read Feature	2,079	5	67	55	50
CRF0005	IBM and HIS Mode Mark Sense Feature	7,787	42	237	205	192
URA4916	Addressing for PCU0120	6,550	21	155	141	120
PCU0120	Card Punch, 100 cpm	18,344	95	618	534	499
URA4917	Addressing for CCU0400	6,750	22	161	146	124
CCU0400	Read/Punch, 400/100 cpm	27,101	150	746	709	602

*Lease prices include maintenance.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	1-year Lease*	5-year Lease*	7-year Lease*
TERMINALS* (Continued)**						
7726R	MIL STD 188C Interface; includes 7722R and 7715R; requires 7720R or 7728R	600	10	—	25	22
7728R	Factory Installed 9600 bps Transmission Feature	—	—	—	—	—
7729R	30-cps/120-cps Adaptor; includes 7715R; requires 7720R or 7728R	550	8	—	21	19
7703A	Multistation Interface Unit for direct connect	2,420	20	—	91	87
7703B	Multistation Interface Unit for connection using modem or modem bypass unit	2,420	20	—	91	87
7760-60	Master Control Unit; includes diskette drive and interface terminal controller, communications controller, program loader, program media	16,800	57	—	427	406
7761-60	Auxiliary Control Unit; includes datapath Interface, (7767), terminal controller, and program loader; requires 7760-60 with 7767	11,200	81	—	285	271
7731	Display Adapter, 24x80; includes ASCII video generator and storage for 1920 characters	1,200	4	—	31	30
7732	Display Adapter, 12x80; includes ASCII video generator and storage for 960 characters	1,200	4	—	31	30
7734	RO Printer Adapter; includes 1920-character print buffer and logic	1,360	4	—	34	32
7767	Datapath Interface; requires 7760-60	960	7	—	25	24
7768	Direct Timing Source; requires 7760-60	240	1	—	6	6
7741-60	Additional Diskette Device; requires 7760-60	2,166	17	—	57	54
7707-60	Display Monitor Unit; requires 7731 or 7732	1,350	8	—	32	31
7707-61	Operator Indicator Feature	95	2	—	5	4
7707-62	Keylock Option for Keyboard	57	2	—	4	4
7707-64	Keyboard, includes numeric pad; requires 7707-60	400	7	—	15	14

SOFTWARE PRICES

		Monthly License Fee	Software Products Support Service
Current System Software*			
SCC7001	PREFORMS—Batch Mode; for users with SCS1100	$26	—
SCC7002	PREFORMS—Transactional Mode; for users with SCS1100	53	—
SCD1015	MLDS—Multiple Logic Data Store; for users with SCS1100	56	—
SCP1005	Immediate Step Activation; for users with SCS1100	110	—
SCP1006	Interactive Program Checkout Facility; for users with SCS1100	73	—
SCU1015	File Transfer Facility/6 (FTF/6); for users with SCS1100	43	—
SCS1300	GCOS—Basic Operating System	NC	**
SCS1301	GCOS—Basic System Extension	187	61
SCS1302	GCOS—Access System Extension	142	40
SCC1603	TDS/64 Standard Processor	272	128
SCC6102	Host File Transceiver for Level 6	11	6
SCC1671	PREFORMS—Batch Mode	19	7
SCC1672	PREFORMS—Transactional Mode	39	14
SCD1607	Series 200/2000 File Access System—HFAS	NC	10
SCD1611	Integrated Data Store (IDS-II)—Entry	275	19
SCD1612	Data Management-IV (DM-IV)—Entry	547	150
SCD1615	MLDS—Multiple Logic Data Store	38	18
SCJ1601	Remote Batch Facility/6 (RBF/6)	22	6
SCL1601	COBOL ANS 74	89	11
SCL1603	COBOL—74 Data Communications Extensions	94	12
SCL1606	FORTRAN	79	8
SCL1607	Mathematical Library	103	16
SCL1608	COBOL Report Writer	36	5
SCL1611	RPG	119	6
SCL1614	Interactive BASIC	150	6
SCM1610	Series 100 Integrated Program Mode	NC	15
SCM1620	Series 200/2000 Integrated Program Mode	NC	15
SCP1601	Interactive Library Maintenance	83	27
SCP1602	Interactive Text Editor	55	18
SCP1605	Immediate Step Activation	83	27
SCP1606	Interactive Program Checkout Facility	55	18
SCU1603	SORT/MERGE	67	12
SCU1604	Data Base Administrator Aids Set	74	5
SCU1606	HFAS File Maintenance Utility Set	7	5

*Most modules are available immediately; SCP1605, SCP1606, SCU1615, SCD1615, SCS1300 Console dialogue journalization and diskette support, SCS1302 MLDS support in utilities, SCL1611 transaction code, and SCJ1601 increased number of stations, will be available with GCOS Release 500.

**Fee based on power of CPU.