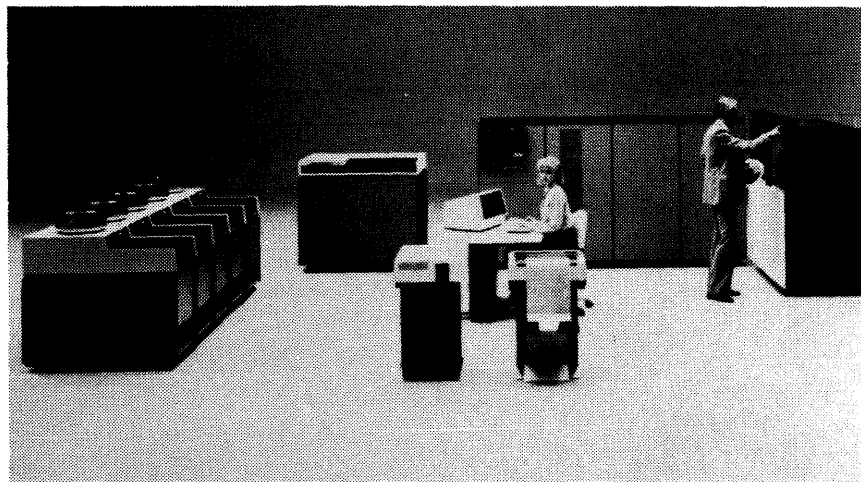# Honeywell Series 60 Level 64

MANAGEMENT SUMMARY

The Honeywell Series 60 Level 64 systems are well-liked by their users, according to the early returns of Datapro's 1982 survey of computer users. With an impressive overall satisfaction rating of 3.40, the Level 64 certainly ranks as one of Honeywell's most popular computer products. The current version of the Level 64, the 64/DPS-330, is a single-processor system that supports local or remote batch processing, on-line (realtime) processing, time-sharing, and distributed processing. Although the Level 64 product line has been superseded by the newer DPS 7 Series (Report 70C-480-09), its users will continue to receive support from Honeywell.

The Level 64/DPS-330 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 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.

The Level 64/DPS-330 (CPS4251) is equipped with 512K bytes of error correcting memory, and is expandable to three megabytes through two 256K-byte steps and two one-megabyte increments. 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. ▷

Honeywell's Level 64 family of mid-range systems has earned its reputation as a solid, dependable product line, ever since its introduction in 1977. The Level 64 has been replaced by the new DPS 7 Series, although existing Level 64 systems will still be supported by Honeywell.

MODELS: Level 64/DPS-330.
CONFIGURATION: The Level 64/DPS-330 is a single processor with from 512K bytes to 3,072K bytes of memory and 2 to 12 I/O channels.
COMPETITION: Burroughs B 2900; Digital Equipment DECSYSTEM-20; IBM 4331; NCR V-8455-II; Univac System 80, Series 90, and 1100/60 Series.
PRICE: The purchase price for the basic Level 64/DPS-330 processor with 512K bytes of memory is $90,830.

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. The systems are no longer actively marketed to new customers.

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. ▶

The Honeywell Level 64/DPS-330 supports batch, on-line, transaction, and distributed processing environments. The system comes in one model with several memory and performance enhancements. The Level 64 uses the proven GCOS 64 operating system and supports a wide assortment of peripherals.

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 further update is planned.

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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	3	3	3
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.

▷ interactive program checkout facility for interactive program debugging from a terminal; PREFORMS, for creating, modifying and storing format for the VIP7700 and VIP7760 Visual Display Terminals; Multiple Logic Data Store (MLDS), an indexed access method for transition from the IBM System/3 to the Level 64/DPS; System Behavior Reporter (SBR), which dynamically monitors, records, and analyzes the use of system resources; General Access Control (GAC), for control during simultaneous access to the same file from concurrent jobs; System Access Rights (SAR), which extends the data security provided by the GCOS 64 Catalog system; Query, a means for interaction with BFAS (basic file access system), UFAS (universal file access system), and I-D-S/II files; and Interactive Resource Monitor (IRM), which provides memory management for time-sharing among IOF (interactive operations facility) users.

In addition, two special software packages are available: Query Driven System (QDS), a query and report facility for BFAS and UFAS files; and Data Entry/64 (DE/64), an on-line data entry and collection system.

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. ▷

▶ system performance 1.55 times that of the base CPU. It can support up to three megabytes of main memory and is a prerequisite for the second performance module (CPF4966), which provides 2.3 times the base processor's power.

ASSOCIATIVE MEMORY: In the Level 64/DPS-330 CPU, an associative memory stores the eight most recently used segment descriptors and their associated segment numbers. This feature increases CPU performance by reducing the time required to calculate effective addresses.

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 a 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 ▶

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▷ network. Honeywell's DATANET 8 communications processor, which manages all operations activities in a DSA network, can be added to a Level 64/DPS-330. Additional remote processors, such as Honeywell's DPS 6 minicomputer, round out the framework of the DSE.

USER REACTION

Datapro received 25 responses from Level 64 users in the early returns of its 1982 computer survey. There were responses from four older non-DPS systems, six DPS-320s, five DPS-330s, and ten unnamed Level 64 systems. The average system was installed for just about four years, and ranged from one year to about seven years. Fifteen users purchased their systems, and ten were renting their Level 64 systems. The most frequently noted applications were financial, payroll/personnel, and order processing/inventory control. GCOS was used in all systems. Cobol was used exclusively by all except for two users who ran both Cobol and RPG. Main memory sizes ranged from 512K bytes to two megabytes. The majority of users expected to add more data communications facilities in 1982.

When asked if they felt their systems performed as expected, 22 said "yes," one said "no," and two were undecided. Of this same group, 21 said they would recommend the system to another user, one said he would not, and three had not decided. A summary of user reactions is provided in the following table.

	Excellent	Good	Fair	Poor	1982 WA*
Ease of operation	10	15	0	0	3.40
Reliability of mainframe	13	10	1	1	3.40
Reliability of peripherals	9	14	2	0	3.28
Responsiveness of maintenance service	15	6	4	0	3.44
Effectiveness of maintenance service	13	11	0	0	3.44
Technical support:					
Trouble-shooting	5	15	4	1	2.96
Education	3	12	9	1	2.68
Documentation	2	13	8	2	2.60
Operating system	13	11	1	0	3.48
Compilers and assemblers	15	9	1	0	3.56
Applications programs	2	6	6	4	2.33
Ease of programming	12	12	1	0	3.44
Ease of conversion	9	12	2	0	3.30
Overall satisfaction	11	13	0	1	3.40

*Weighted Average on a scale of 4.0 for Excellent.

Judging from these impressive ratings, it appears Honeywell's Level 64 is indeed satisfying its users' needs. In light of the recently announced DPS 7 Series, it's interesting to note that about four out of five users have no plans to replace their Level 64s with another system in 1982. To find out just how well Honeywell is doing its job, Datapro telephoned several Level 64 users for their comments.

We first called on the DP manager of a southeastern textile manufacturer, who told us his Level 64/DPS-330 ▷

▶ SIMULTANEOUS OPERATIONS: The Level 64/DPS-330 peripheral processing subsystems can operate asynchronously with the central processor, as well as with each other. Each subsystem operates under control of a microprogrammed peripheral processor. Each peripheral processor contains its own arithmetic and logic unit, read/write memory, and read-only memory and is attached to the central system through a high-speed channel.

CONFIGURATION RULES

The basic Level 64/DPS-330 system includes the CPU and 512K bytes of MOS memory, one integrated mass storage processor (IMSP), one integrted 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 three megabytes in two 256K increments (CMM4180) and two one-megabyte increments (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 characterstics chart.

MASS STORAGE

MSU0421, MSS0420 MASS STORAGE UNITS: The MSU0421 system provides 100 megabytes of unformatted storage on a single Honeywell 4050 disk pack. These units are used on CPS4250 only. 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

MTP 4200/4300 MAGNETIC TAPE PROCESSORS: Provide magnetic tape subsystem 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 MUT0210/0211 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. ▶

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► COMMUNICATIONS CONTROL

The Level 64/DPS-330 includes an integrated communications controller (ICC) that supports up to 15 lines. Two additional controllers (DCC4300) can be connected to a URP4300, providing 30 additional communications lines. The second controller requires CPU performance module CPF4955; the third controller requires CPF4966. The 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 processor 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 most widely used 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 in general release and is installed at over 100 sites. In conjunction with multiple concurrent jobs, Release 0400 provides CPU dispatching automatic control (CDAC). CDAC 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 adds 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, 8) System Behavior Reporter (SBR), which monitors the use of system resources, 9) General Access Control (GAC), that provides control during simultaneous accesses to the same file from concurrently executing programs, 10) System Access Rights (SAR), which extends the data security features of the GCOS 64 Catalog system, 11) Query, a facility that provides access to and manipulation of BFAS, UFAS, and I-D-S/II files, 12) Interactive Resource Monitor (IRM), which provides memory management for time-sharing among IOF users, and 13) 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. ►

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► 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 DATANET 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 without 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. 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 language processor that provides language and functions representing Level 1 support of the Communications Module of the 1974 Cobol ANS Standard.

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

Level 64 Fortran (SCL1606) meets the ANSI standard for Fortran IV and to a large extent meets the ANSI-1977 standards. It contains routines for many mathematical calculations plus run-time packages to handle Fortran functions such as STOP and PAUSE and dynamic error diagnostics.

Level 64 Basic (SCL1614) is an incremental compiler, checking syntax and generating object code at the input of each instruction. Under Level 64 GCOS, Basic programs can be developed and executed in either batch or interactive mode, although their primary orientation is toward interactive use. The Honeywell implementation is designed to meet and exceed the ANSI standard for Basic.

Conversion Aids

Level 64 GCOS includes an extensive set of programs and file conversion routines, including program translators and file translators for older Honeywell equipment. ►

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Lease* 1-Year	Lease* 3-Year	Lease* 5-Year
➤ PROCESSOR OPTIONS						
CPF4955	Power Upgrade; 1.5xDPS-330	35,730	81	1,193	1,108	983
CPF4966	Power Upgrade 2.3xDPS-330	47,640	108	1,591	1,480	1,309
CPF4111	Scientific instruction set	10,850	29	378	351	311
CPF4118	I/O channels 3, 6, 8, 9, 11 or 12	8,873	28	311	291	258
CPF4119	4th I/O Channel	8,873	28	311	291	258
CPF4120	5th I/O Channel	8,873	28	311	291	258
CPF4122	10th I/O Channel	8,873	28	311	291	258
CPF4301	Expansion Unit (cabinet 3)	13,808	47	489	456	406
CPF4302	Power Supply for CPF4301	8,778	30	311	289	258
CSF4104	Console Printer	7,750	70	337	318	287
CSF4106	Stand-Up Positioning for console table	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	328	307	271
CPF4115	Series 200/200	9,400	28	328	307	271
CPF4117	DOS (RPQ)	19,650	117	748	701	630
MEMORY						
CMM4108	256K-byte Memory Module; includes addressing	7,500	13	270	231	208
CMM4100	One megabyte Memory Module; includes addressing	30,000	51	1,082	924	832
CMC4100	Memory Control Expansion	5,000	12	172	160	141
MASS STORAGE						
MSA4100	Addressing for two disks; required for each two disks beyond first and second; for integrated mass storage processor	8,000	22	280	261	231
MSF4101	Series 200/2000 Mode; for integrated mass storage processor (MSP)	2,352	6	82	77	68
MSP4400	Additional MSP	28,686	136	1,076	1,005	902
MSF4401	Series 200/2000 Mode; for MSP 4400	2,352	6	82	77	68
MSF4410	Manual Switch for MSP4400	9,518	26	334	311	276
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	280	261	231
MSU0402	100-megabyte Mass Storage Drive, field upgradable	20,805	113	880	824	757
MSS0420	Mass Storage Subsystem; consists of two 100-megabyte disk drives	27,000	155	1,112	1,041	935
MSU0421	100-megabyte Mass Storage Drive	15,184	100	615	576	518
MSU0452	200-megabyte Mass Storage Drive	30,650	113	1,012	931	880
MSF0002	Dual Access Feature; for the MSU0420/0421	2,153	16	94	85	81
MSF0006	Dual Access Feature; for the MSU0402/0452	2,070	13	89	83	76
DISKETTE STORAGE						
URA4321	Addressing for Diskette Drive	1,584	8	59	54	49
DDU4040	Single Diskette Drive	1,700	21	76	70	65
DDU4041	Dual Diskette Drive	2,800	33	126	117	106
DDF4052	Pedestal for Diskette Drives; low for sitting	184	2	9	8	6
DDF4053	Pedestal for Diskette Drives; high for standing	184	2	9	8	6 ➤

*Includes maintenance.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Lease* 1-Year	Lease* 3-Year	Lease* 5-Year
▶ PRINTERS (Continued)						
PRB0600	94-character upper/lower case belt; OCR-B font	2,567	90	—	—	—
PRB0549	63-character alphanumeric belt; OCR-A font	2,460	90	—	—	—
PRB0524	63-character numeric Belt; OCR-A font	2,460	90	—	—	—
PRB0501	63-character EBCDIC Belt	2,460	90	—	—	—
PRB0513	63-character ASCII Belt	2,460	90	—	—	—
PUNCHED CARD EQUIPMENT						
URA4314	Addressing for CRU0301/0501/1050	3,465	12	122	113	100
CRU0301	Card Reader, 300 cpm	9,513	78	380	345	328
CRU0501	Card Reader, 500 cpm	19,500	114	684	638	568
CRF0006	IBM Mode Mark Sense Option for CRU0301/0501	4,520	42	181	168	153
CRF0007	HIS Mode Mark Sense Option for CRU0301/0501	4,520	42	181	168	153
CRF0030	Pedestal for CRU0301/0501	184	—	—	—	—
CRU1050	Card Reader, 1050 cpm	26,555	224	1,136	1,066	961
CRF0003	51 Column Read Feature	2,079	6	75	69	62
CRF0005	IBM and HIS Mode Mark Sense Feature	7,787	53	256	234	221
URA4315	Addressing for PCU0120	6,878	23	244	227	202
PCU0120	Card Punch, 100 cpm	20,032	147	816	741	687
URA4316	Addressing for CCU0400	7,088	26	264	246	218
CCU0400	Read/Punch, 400/100 cpm	28,185	219	914	894	868
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	37	33	29
DCF4308	Terminal Support Type 8 (3270)	1,665	8	66	62	55
DCF4340	Polling Extension (Up to 32 Terminals)	546	1	19	18	16
DCF4330	Performance Expansion	4,284	8	147	136	120
DCA4310	Async. Line Attachment	2,310	4	79	72	65
DCA4320	Sync. Line Attachment	2,385	5	97	90	80
DCC4300	Additional Data Communications Controller	13,650	35	477	444	394
DCU8010	DATANET 8 Front-End Network Processor	29,000	135	1,040	971	868
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
TWU1901	Synchronous 120-cps Serial Matrix Printer with keyboard; 960-character buffer, selectable speeds of 1200, 2400, or 4800 bps	4,500	66	243	186	172
PRU1901	Without keyboard	4,000	64	221	170	158
VIP7100	Asynchronous CRT; 960 characters, 63-character set	1,500	23	82	64	59
VIP7105	With 95-character set	1,600	24	87	67	62
VIP7200	Asynchronous CRT; 1920 characters, 64-character set	1,980	28	105	80	75 ▶