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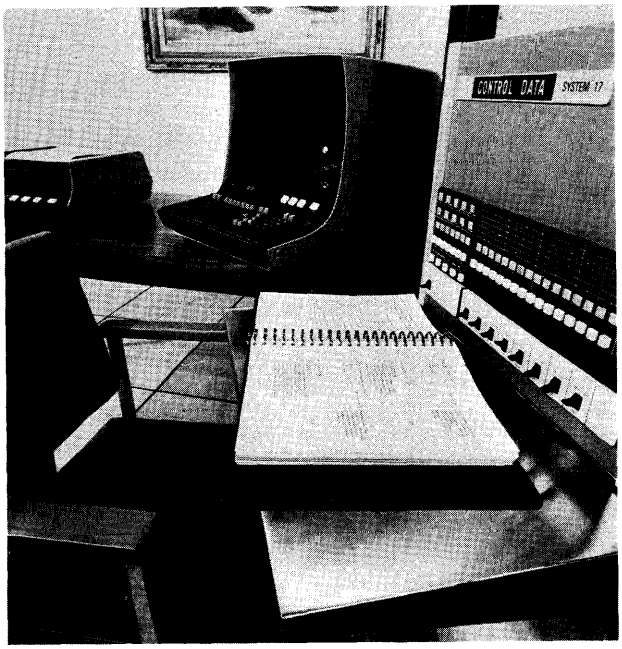
Control Data System 17 Series



The general-purpose CDC System 17 Series offers 4K to 64K 16-bit words of either 600-nanosecond or 900-nanosecond MOS memory, a wide range of CDC-built peripherals, three levels of operating system support, and dozens of major application programs. Shown here is the System 17 CPU with a CRT operator console.

The recently announced CDC System 17 Series is intended by CDC to supersede the long-lived CDC 1700's. With full program/peripheral/operator panel compatibility to the earlier systems, the 17 is a powerful minicomputer with strong worldwide support, a comprehensive range of proven software, and an excellent price-performance ratio. Basic 4K-word systems start at less than $14,000.

MANAGEMENT SUMMARY

The CDC System 17 Series was announced on July 11, 1973 as an extension and replacement for the earlier real-time oriented CDC 1700 systems originally introduced by Control Data in 1965. With more than 600 of the earlier systems installed at the time of the System 17's announcement, and three levels of CDC 1700 operating systems available, as well as dozens of major applications programs representing more than $10 million dollars worth of software development, it made very good sense for the System 17 to have the same instruction repertoire and fundamental architecture as the older 1700's. A hallmark of the System 17 is, in fact, its program, peripheral, and operator panel compatibility with the 1700's.

Both series of systems are 16-bit processors with memory ranges of 4K to 64K words, a direct memory access capability, a programmed I/O data transfer channel, 16 levels of interrupts, etc. But the System 17 offers higher memory and I/O speeds (600- or 900-nanosecond MOS instead of 1.1 or 1.5 microsecond core, up to 1.6 million words/second data transfer rate (instead of 0.9 million words/second data), newer low-cost peripherals (8 new units), and general exploitation of recent advances in memory and logic technology. In general, however, the System 17 (represented by only one model at this time) can be considered a faster, more flexible 1700 with a ▷

CHARACTERISTICS

MANUFACTURER: Control Data Corporation, P.O. Box 0, Minneapolis, Minnesota 55440. Telephone (612) 853-8100.

MODEL: System 17.

DATA FORMATS

BASIC UNIT: 16-bit word.

FIXED-POINT OPERANDS: 16 or 32 bits.

FLOATING-POINT OPERANDS: No provisions made.

INSTRUCTIONS: One-word and two-word instructions; uses the same instructions as the earlier CDC 1700.

Storage-reference instructions have a 4-bit operation code, a 4-bit address mode (for indexing/addressing), and an 8-bit operand address. Register-reference instructions have an 8-bit operation code and an 8-bit modifier or operands. Shift instructions have an 8-bit operation code, a 1-bit direction flag, two 1-bit A/Q indicators, and a 5-bit shift count. Skip instructions have a 12-bit operation code and a 4-bit skip count.

Seven addressing modes are provided, including absolute, indirect*, relative, relative-indirect*, constant, storage, and storage-indirect*.

*Multi-level in 32K Mode only.

INTERNAL CODE: ASCII.

MAIN STORAGE

STORAGE TYPE: MOS.

CYCLE TIME: 600 or 900 nanoseconds (different-speed memories cannot be mixed on the same system).

CAPACITY: 4K to 64K words of memory in 4K word increments.

CHECKING: 1 parity bit per word standard.

STORAGE PROTECTION: One memory protect bit per word is standard, and permits the implementation of a Program Protect System. This system sets (or resets) the protection bit associated with each operand and instruction contained in a given program, and causes an interrupt when unauthorized access is attempted. (This system must be employed for time sharing/multiprogramming operations.)

CENTRAL PROCESSOR

GENERAL: The full parallel System 17 processor retains ▶

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much improved cost/performance ratio (about twice that of the nearest 1700 model).

In addition to the 1700's traditional market targets (industrial control, data acquisition, communications, OCR control, key-to-disk data entry, graphic systems control, terminal network control, hospital/medical, and amusement/recreational), the System 17 processor is designed to operate in an office environment without needing preventive maintenance. Competition to the System 17 comes from Data General's 840, DEC's PDP-11/45, the Hewlett-Packard 2100's, Burroughs B 1700, Interdata's Model 80, the IBM System/7, Texas Instrument's 960A, and the Varian VDM 73. The system 17 holds its own against most of these competitors on basic price alone, but shows real strength when compared against the broad spectrum of total service. CDC, after all, is one of the giants in the computer services industry by anybody's standards, and the full support of hundreds of locations worldwide is available to service the System 17, as well as to provide custom systems engineering support. (CDC, in fact, makes available field support for a number of competitive minicomputer vendors). Furthermore, CDC manufactures its own peripherals (as well as those of many of its competitors) and is able to provide factory-trained maintenance services as necessary.

Users of 1700 systems contacted by Datapro report that they have been very well satisfied with the performance of their systems, and are looking forward either to installation of the new System 17 or to a long-term rental reduction on their installed gear (for leased systems). Thus, the satisfaction level for CDC's existing small computers is high, and current users are confident of continued good performance by CDC in the new minicomputer line. □

software compatibility with the earlier CDC 1700's and includes the CDC 1700's instruction repertoire, interrupt structure, memory protection, program protection, remote autoload, and breakpoint switch as standard features. Other standard features include hardware multiply/divide, 16 interrupts, two index registers, and a programmer's panel. Options on the System 17 are offered for either configuration expandability or for CDC 1700 peripheral compatibility. The System 17 is built with MSI and LSI TTL technology and performs one's complement arithmetic. The 900-nanosecond version is a closely similar performance substitute for the CDC 1700, while the 600 nanosecond version provides substantially higher system throughput.

REGISTERS: Two general-purpose hardware index/arithmetic registers are standard. These registers are the 16-bit Accumulator (A) register (principal arithmetic register, also serving as the data interface during I/O operations), and the auxiliary 16-bit general (Q) register (also used as an index register, and to hold the address of a peripheral device during an I/O operation).

Seven special-purpose registers are also available, including a 16-bit program counter (P), a 16-bit exchange register (X), a 16-bit memory address computation register (Y), a 16-bit interrupt mask register (M), a 16-bit instruction function register (F), a 16-bit breakpoint register (B), and a 16-bit Index register (I).

INDIRECT ADDRESSING: Yes, to multiple levels, in 32K (non-interleaved) mode only. To one level in 64K (interleaved) mode.

INSTRUCTION REPERTOIRE: 72 basic instructions, consisting of 16 decisions, 13 arithmetic, 6 shifts, 16 logical instructions, 10 transfers, 4 jumps and stops, 2 program protection instructions, 3 interrupt instructions, and 2 I/O instructions. These basic instructions can obviously be greatly expanded by means of the seven addressing modes.

INSTRUCTION TIMINGS: All times are in microseconds for full-word, fixed-point operands.

	1784-1	1784-2
Load/Store:	1.8	1.2
Add/Subtract:	1.8	1.2
Multiply/Divide:	17.4	11.6
Compare and Branch:	1.8	1.2

INTERRUPTS: One internal (parity error, program protect fault, power failure), and 15 external (I/O, etc.). Vectored priority interrupts are standard in this system.

INPUT/OUTPUT CONTROL

I/O CHANNELS: A non-buffered programmed data channel (AQ channel or Bus) is standard with the System 17. The "A" register is used to transfer data in and out of the computer, transmit function codes, and receive status bits. The "Q" register transmits the addresses of peripheral devices and the control signals. The AQ channel can handle data rates of 160K words/second (600-nanosecond system), 110K words/second (900-nanosecond system), or 50K words/second (CDC 1700 mode of operation). A Direct Storage Access Channel (DSA channel or Bus) is also a standard component that provides direct access by external devices to the System 17's main storage at rates of 1.6 million words/second (600-nanosecond system), 1.1 million words/second (900-nanosecond system), or 370K words/second (SC 1700 mode of operation). Up to eight peripheral controllers can be attached to a channel.

SIMULTANEOUS OPERATIONS: The first 32K words of memory and the second 32K words of memory (contained in the Expansion Chassis) are in two separate banks. This system architecture allows a computer memory reference in one bank to occur simultaneously with a DSA memory reference in the other bank.

CONFIGURATION RULES: Basic system has 36 slots in the chassis with pre-wired positions for the CPU and teletype control (7 slots), memory controller (2 slots), 4K to 32K words of memory (8 slots), magnetic tape controller and phase-encode option (7 slots), 1 disk controller (5 slots), plus 4 AQ positions and 3 DSA positions for connection of peripherals and channels.

Memory expansion over 32K words (to 64K) or additional peripheral interface requires a 1783-1 Expansion Chassis and a 1786-1 Memory Expansion Control (2 expander slots), a 1785-1 AQ Channel Expansion (1 slot in expander and 1 slot in basic processor), or a 1785-2 DSA Channel Expansion (1 slot in expander and 1 slot in basic processor). The free-standing, rack mountable Expansion Chassis provides 36 slot positions for 32K words (8 slots), a memory controller (2 slots), 10 AQ and 4 DSA wired positions, and 12 unwired positions for special interfaces. ➤

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION	SPEED
MAGNETIC TAPE EQUIPMENT		
608	Industry-compatible, 37.5 ips 7-track, 200/556/800 bpi (4 slots for 4 drives)	30 KCS
609	Industry-compatible, 37.5 ips, 9-track, 800 bpi (4 slots for 4 drives)	30 KBS
615-73	Industry-compatible, 37.5 ips, 7-track, 556/800 bpi (4 slots for 4 drives)	30 KCS
615-93	Industry-compatible, 37.5 ips, 9-track, 800/1600 bpi (4 slots for 4 drives)	60 KBS
LINE PRINTERS		
501	136-position, 64-character, (1"AQ" slot)	1000 lpm
1742	136-position, 64- character (1"AQ" slot)	300 lpm
1742-30	136-position, 64-character drum (1 "AQ" slot)	300 lpm
1742-120	136-position, 48-or 64-character cartridge (1 "AQ" slot)	1200 lpm
PAPER TAPE EQUIPMENT		
1721/1722	Reader, 5-8 character	400 cps
1723/1724	Punch, 5-8 character	120 cps
1771-1,-2	Reader/Punch, 5-8 character	400/150 cps
CARD EQUIPMENT		
405	Reader, 80 column (1 "AQ" slot)	1,200 cpm
430	Reader/Punch, 80-column (1 "AQ" slot)	1,000/500 cpm
1729-2	Reader, 80-column (1 "AQ" slot)	330 cpm
1729-3	Reader, 80-column (1 "AQ" slot)	300 cpm
OCR EQUIPMENT		
915	Page Reader	370 cps
936-1	Document Reader	750 cps
921-1	Document Reader	1,200 cpm
955-1	Page/Document Reader	750 cps
TERMINALS/OPERATOR CONSOLES		
1711-4	Hardcopy, KSR-33 (integrated control)	10 cps
1711-5	Hardcopy, KSR-35 (integrated control)	10 cps
1713-4	Hardcopy, ASR-33 (integrated control)	10 cps
1713-5	Hardcopy, ASR-35 (integrated control)	10 Cps
713-10	A/N CRT, 16 X 80 character (integrated control)	30 cps

MASS STORAGE

853/854 DISK SUBSYSTEM: Provides storage for 1.5 or 3.1 million words per disk drive, with an average access time of 110 milliseconds and a data transfer rate of 78K words/second via the 1733-1 Controller. Up to 8 drives of either type can be attached to the 1733-1. The 853/854 connects to the System 27 via 1785-3 and 1785-4 Channel Adapters.

856 FREE-STANDING CARTRIDGE DISK SUBSYSTEM: The single-density 856-2 drive provides storage for 2.25 million 16-bit words on one fixed and one removable disk cartridge. The double-density 856-4 drive has a total storage capacity of 4.5 million words. Up to four voice-coil-positioned drives of either density can be attached to the 1733-2 controller (5 slots) that connects in turn to the DSA channel. The 1733-2 has absolute cylinder addressing and a daisy-chain capability with seek-overlap. Each disk has 2 surfaces, 200 or 400 tracks per surface (856-2 or 856-4), 29 sectors per track, and 96 words per sector. Average head-positioning time is 35 milliseconds. Rotational speed is 2400 rpm and data transfer rate is 156K words/second.

1739 CARTRIDGE DISK SUBSYSTEM: Provides storage for 1.1 million words on each of one fixed and one removable disk cartridge with an average access time of 47 milliseconds, and a data transfer rate of 156K words/second. Each subsystem consists of a disk drive and controller as one unit, and connects to the System 17 via 1785-3 and 1785-4 Channel Adapters.

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1752 DRUM MASS STORAGE SUBSYSTEM: Provides storage for 196,608, 589,824, 1,179,698, or 1,572,864 words (Models 1 to 4) with an 8-millisecond average access time and a data transfer rate of 185K words per second. Each 1752 subsystem includes its own controller, and connects to the System 17 via the 1785-3 and 1785-4 Channel Adapters.

INPUT/OUTPUT UNITS

See Peripherals/Terminals/Table.

1750/1797 INTERFACES: Provides 15 or 8 sensor subsystem interfaces, respectively, via the 1500 Series A/D or D/A controllers. A wide variety of 1500 Series devices (more than 30) are avaialble.

Note that all earlier CDC 1700 I/O units can also be used with the Series 17 equipped with the optional CDC 1700 I/O Adapter.

COMMUNICATIONS CONTROL

Note that all communications control units connect to the System 17 via the 1785-3 and -4 Channel Adapters.

1716/1718 INTERCOMPUTER COUPLERS: Provide interface to CDC 1700 or CDC 1700/3000/6000 computers via DSA channel. The 1716 transfers up to 900K 16-bit words per second and can interface up to eight peripherals. The 1718 transfers an average of 300K 12-bit words per second and does not interface to any peripherals.

1717-1 SINGLE LINE DATA SET CONTROLLER: Provides interface for one full-duplex synchronous line at up to 40.8 KBS (8-bit characters) for interface to the Autodin network.

1747 SINGLE LINE DATA SET CONTROLLER: Provides interface for one half-duplex synchronous line (301B) at up to 60.8 KBS (12-bit characters).

358 COMMUNICATIONS TRANSCEIVER: For full or half-duplex data transmission at various rates over private line facilities: Model 358-1 at up to 9600 bps (Bell modems 103 or 202); Model 358-2 at 1200, 2400, 4800, or 9600 bps (201; Model 358-3 at 49.8 KBS or 163.2 KBS (301); Model 358-4 at 50 KBS or 200 KBS (303).

364 COMMUNICATION MULTIPLEXORS: Provide for up to eight 361 synchronous or asynchronous, half- or full-duplex Communications Adapters operating at 50 to 2,000 bps (asynchronous) or 600 to 203.4K bps (synchronous).

SOFTWARE

OPERATING SYSTEMS: The System 17 will run all earlier CDC 1700 Standard Operating Systems, including MSOS 3.0 (A303-01/08), MSOS 4.0 (A304-01), Tape Scope 2 (A402-01/13), and the Reduced Core Monitor (A401-01) using the CDC 1700 Channel Adapter. An MSOS Version 4.1 operating system that supports the System 17 peripherals is also available, with first delivery promised for the first quarter 1974.

The Mass Storage Operating System (MSOS 4) is a sophisticated real-time (plus batch) operating system that operates in 16K words of memory. Program development support is provided for a macro-assembler (Compass) and an ANS FORTRAN Compiler. A file management system, communications driver (for 364-4 and -5 Communications Multiplexor with 361-1 Communications Adapter), COSY program compression routine, system configurator, and on-line checkout support are all included.

The Reduced Core Monitor (RCM 1) is a minimum-memory system that runs in 4K words of memory with a teletype or card reader/punch to provide a real-time monitoring capability. From 6 to 16 levels of software priority can be handled with upward compatibility to MSOS. RCM is generally used as an operating system to support terminal networks, OCR, data collection stations, data concentration applications, or the System 17 functioning as a high-level I/O station.

Tape SCOPE is a magnetic-tape-oriented monitor that maintains full upward compatibility with MSOS and runs on an 8K-word system.

PROGRAMMING: Under the CDC 1700 operating systems, 4K Assembler (A 101-01/02) and Grasp (OCR Generalized Read And Simulate Program – A001-01/03) are available. Using MSOS 4, FORTRAN (with 4K- to 16K-word systems) is also supported.

APPLICATIONS: An extensive library of applications software is available, including packages for industrial control, data acquisition, hospital/medical, communications, message entry (OCR), ticket issuing (pari-mutel betting, lottery, and entertainment), and supervisory control (utilities/liquids). Cardio-test (for ECG acquisition applications) and AUTRAN (process control compiler) are also supported under MSOS. All applications programs developed for the earlier CDC 1700 will run on a suitably equipped System 17. A utility system that runs in 8K words is also available to support program development. A series of "Import" packages is available to support the System 17 as a *remote terminal for larger CDC 6000/Cyber 70 Series* computers.

PRICING

POLICY: Control Data makes the System 17 available on either a purchase or a lease basis. Lease terms are for 1 year or 3 years (cancellable after 2 years).

EQUIPMENT: The following typical approximate purchase and rental prices include controllers and adapters.

TYPICAL MSOS TERMINAL SYSTEM: Consists of System 17 with 16K words, buffered data channel, data set controller (for connection to CDC 6000 or Cyber 70), magnetic tape subsystem, card reader, disk drive, data and control terminal, printer, and teletype. Approximate purchase and 1-year monthly lease charges are $85,000 and $2,000.

936 OCR DOCUMENT READER SYSTEM: Provides DRAFT control over an OCR reader to process up to 90,000 documents per hour. Consists of a System 17 with 16K words, OCR reader/sorter, teletypewriter, and one tape drive. Approximate purchase and 1-year monthly lease charges are $140,000 and $2,500.

DUAL PROCESSOR PROCESS CONTROL: Provides AUTRAN control over two System 17's with 32K words each, a coupling data channel, disk storage module, line printer, teletypes, CRT station, card reader/punch, Data and Control Terminators, and 2 log/alarm teletypes. Approximate purchase and 1-year monthly lease charges are $140,000 and $3,600.

TYPICAL SMALL-SCALE TICKET ISSUING SYSTEM: Consists of one System 17 with 32K words, up to 100 ticket issuing machines (not included), 1 teletype, a card reader/punch, a mass storage device, line printer, and magnetic tape drive. Approximate purchase price and 1-year monthly lease charges are $82,000 and $2,000. ■

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	1-Year Lease	3-Year Lease*
CENTRAL PROCESSORS					
1784-1	Basic processor with 4K 16-bit words (900 nanoseconds), parity, memory protection, hardware multiply/divide, 16 interrupts, 2 index registers, breakpoint-switch, console, cabinet, and TTY/CRT controller	$13,500	$ 97	$ 330	$ 322
1784-2	Like 1784-1 with 600 nanosecond memory	16,500	118	355	346
MEMORY/PROCESSOR OPTIONS					
1782-1	4K 16-bit words (900 nanoseconds)	3,000	30	80	78
1782-2	4K 16-bit words (600 nanoseconds)	4,000	35	85	83
1785-3	1700 AQ Channel Adapter (for Series 1700 peripherals)	2,500	15	65	63
1785-4	1700 DSA Channel Adapter (for Series 1700 peripherals)	1,500	15	40	39
1783-1	Memory/Peripheral Expansion Chassis	4,000	8	85	83
1785-1	AQ Channel Expansion for 1783-1	1,000	10	25	24
1785-2	DSA Channel Expansion for 1783-1	1,000	10	25	24
1786-1	Memory Expansion Control (32K-64K words) for 1783-1	1,500	15	40	39
1787-1	Cabinet, 19-inch	900	0	25	24
1787-2	Mini-cabinet	775	0	20	19
10297-1	Memory-Hold Battery (preserves 64K words for 8 hours)	495	10	10	10
MASS STORAGE					
1733-1	Control for 1-8 85 3/854 Disk Drives	10,500	55	370	361
853	Disk Drive, 1.5 million words	7,500	52	315	136
854	Disk Drive, 3.1 million words	10,000	78	470	218
1733-2	856 Cartridge Disk Drive Controller for 4 drives	5,500	30	165	160
856-2	Cartridge Disk Drive, 2.2.million words	9,000	55	190	185
856-4	Cartridge Disk Drive, 4.4 million words	12,500	65	300	292
1739-1	Disk and Controller, 2.2 million words	13,500	109	500	450
1752-1	Drum and Controller, 196,608 words	52,000	170	1,980	1,940
1752-2	Drum and Controller, 589,824 words	68,000	195	2,445	2,397
1752-3	Drum and Controller, 1,179,698 words	83,000	205	2,750	2,580
1752-4	Drum and Controller, 1,572,864 words	90,000	210	3,000	2,925
MAGNETIC TAPE EQUIPMENT					
1732-1	608/609 Magnetic Tape Controller for 4 drives	8,000	49	330	250
608/609	Tape Drive, 7/9 track, 30 KCS	16,430	114	290	289
1732-2	615 Magnetic Tape controller for 4 drives	5,000	30	160	156
615-73	Tape Drive, 7-track, 30 KBC	5,500	66	165	160
615-93	Tape Drive, 9-track, 60 KBS	7,000	77	180	175
10300-1	Phase-encode, 1600 bpi feature	1,500	10	40	39
LINE PRINTERS					
1740	Control for 501	15,000	65	500	449
501	Printer, 1000 lpm	7,500	260	700	250
1742	Printer and Control, 300 lpm	14,900	195	605	445
1742-30	Printer and Control 300 lpm	17,000	195	370	360
1742-120	Printer and Control, 1200 lpm	50,000	292	1,460	1,423
CARD EQUIPMENT					
1726	Control for 405 Reader	12,720	60	190	189
405	Reader, 1200 cpm	24,910	71	370	365
1729-2	Reader and Control, 330 cpm	7,000	76	380	200
1729-3	Reader and Control, 300 cpm	6,000	76	170	162

* Cancellable after 2 years.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	1-Year Lease	3-Year Lease*
CARD EQUIPMENT (Continued)					
1728	Control for 430	$ 9,010	$ 38	$ 225	$ 223
430	Reader/Punch, 500/100 cpm	19,080	119	355	346
PAPER TAPE EQUIPMENT					
1721	Reader and Control, 400 cps	1,000	27	115	30
1722	Reader and Control, 400 cps (with reels)	3,880	38	170	125
1723	Punch and Control, 120 cps	1,400	27	140	45
1724	Punch and Control, 120 cps (with reels)	4,263	38	180	130
1777-1	Reader/Punch and Control, 400/150 cps	7,500	81	235	234
1777-2	Reader/Punch and Control, 400/150 cps (with punch check)	8,000	87	250	245
OCR EQUIPMENT					
1735	Control for 915	10,050	31	335	332
915	Reader, 370 cps	50,425	486	1,365	1,300
936-1	Reader and Control, 750 cps (document)	105,180	1,103	1,799	0
8019-1	Control for 921-1	2,250	27	75	71
921-1	Reader, 1200 dpm	28,500	300	920	874
955-1	Reader and Control, 750 cps (page and document)	115,350	770	2,510	2,435
COMMUNICATIONS EQUIPMENT					
358-1	Transceiver, 9600 bps (Asynch.)	1,010	17	16	16
358-2	Transceiver, 9600 bps (Synch.)	1,855	22	32	32
358-3	Transceiver, 163.2K bps (Synch.)	3,180	33	61	60
358-4	Transceiver, 200K bps (Synch.)	3,290	33	66	66
1717-1	Synchronous Line Controller (FDX)	26,500	125	505	495
1747	Synchronous Line Controller (HDX)	17,490	65	375	370
1748-2	Controller for 364-1-2	16,115	76	375	370
364-1	Communication Multiplexor	6,500	20	170	167
364-4	Communication Multiplexor	6,950	20	180	177
361-1	Communication Adapter (Asynch.)	920	7	24	24
361-2,3	Communication Adapter (Asynch.)	460	4	12	12
361-4	Communication Adapter (Asynch.)	1,930	9	50	49
361-5,-6	Communication Adapter (Synch.)	2,100	15	55	55
1750	A/D Interface (15)	9,540	44	250	245
1797	A/D Interface (8)	9,010	54	210	207
1716	Intercomputer Coupler	18,250	65	670	520
1718	Intercomputer Coupler	8,550	22	300	235
TERMINALS/OPERATOR CONSOLES					
1711-4	Teletype 33 KSR	1,400	30	35	3
1711-5	Teletype 35 KSR	3,000	38	70	68
1713-4	Teletype 33 ASR	1,600	35	45	44
1713-5	Teletype 35 ASR	4,800	45	110	105
713-10	CRT, 8 X 80 char., 30 cps	1,995	15	60	59
711-100	16 X 80 Expander for 713-10	320	10	10	10
713-120	Non Impact Printer for 713-10	2,600	22	85	83

SOFTWARE

		Initial Fee	Monthly Charge
A 303-06	AUTRAN 1 under MSOS 3	2,500	300
A 303-08	CARDIOTEST II, 1 under MSOS 3	1,000	100
A 304-01	MSOS 4 (includes system configurator, system checkout, COSY, Macro Assembler, and file manager)	500	100
A 401-0	Reduced Core Operating System	275	0

* Cancellable after 2 years.