Four-Phase System IV Series

MANAGEMENT SUMMARY

Four-Phase Systems, Inc., was one of the earliest proponents of distributed data processing systems wherein small to medium-sized processors with sufficient mass storage performed data entry, data/text editing, and file management. They also transmitted/received information via batch and/or on-line inquiry within the distributed processing network. In addition to relieving the host of some of its processing burden, the distributed processing approach encouraged the industry move toward true interactive data management.

Within this definition of distributed data processing, the Series IV family of intelligent terminals neatly satisfies the requirements. From 1 to 32 terminals can be controlled by a small general-purpose computer designed and built by Four-Phase utilizing MOS/LSI circuits. The display/keyboard units can be used to enter/generate data in batch mode as well as interactive mode within the same system. The ability to attach a variety of mass storage devices to a Four-Phase processor not only satisfies the needs of batch data entry, but also enables the maintenance of data files with a moderate volume of transactions. Character printers attachable to each station permit the production of hard copy during data entry or word processing operations. Line printers permit the production of reports generated by on-line systems within the Four-Phase network or by the remote host processor.

Four-Phase supplies, on a bundled basis, all of the software necessary to operate the Series IV as a distributed data processor. Programs are provided to perform data entry, data editing, on-line inquiry access, screen display formatting, word processing, printing, file maintenance, communications line control, and necessary utilities. An ▷

> The expanding Four-Phase product line now includes eight systems ranging from the IV/30, a single-station data entry system priced at $25,000, to the top-of-the-line IV/90, which supports up to 32 display stations and is priced at $175,865. In between are the IV/40, IV/50, IV/55, IV/60, IV/65, and IV/70 systems, with models for 3270 simulation, transaction processing, word processing, network processing, on-line source inquiry, remote batch, and data entry at prices ranging from $19,500 to $138,315.

CHARACTERISTICS

MANUFACTURER: Four-Phase Systems, Inc., 10700 North De Anza Blvd., Cupertino, California 95014. Telephone (408) 255-0900.

Four-Phase Systems is a 2800-employee manufacturer and marketer of intelligent terminals, remote batch systems, shared-processor word processing systems, shared-logic entry systems, and distributed processing network systems. The company was founded in 1969.

MODELS: System IV/30; IV/40; IV/50; IV/55; IV/60; IV/65; IV/70; and IV/90.

DATE ANNOUNCED: IV/40—March 1973; IV/50—June 1976; IV/60 and IV/65—April 1979; IV/70—September 1970; IV/30 and IV/55—December 1976; IV/90—June 1977.

DATE OF FIRST DELIVERY: IV/40—July 1973; IV/50—4th quarter 1976; IV/70—February 1972; IV/30 and IV/55—December 1976; IV/90—July 1977; IV/60 and IV/65—June 1979.
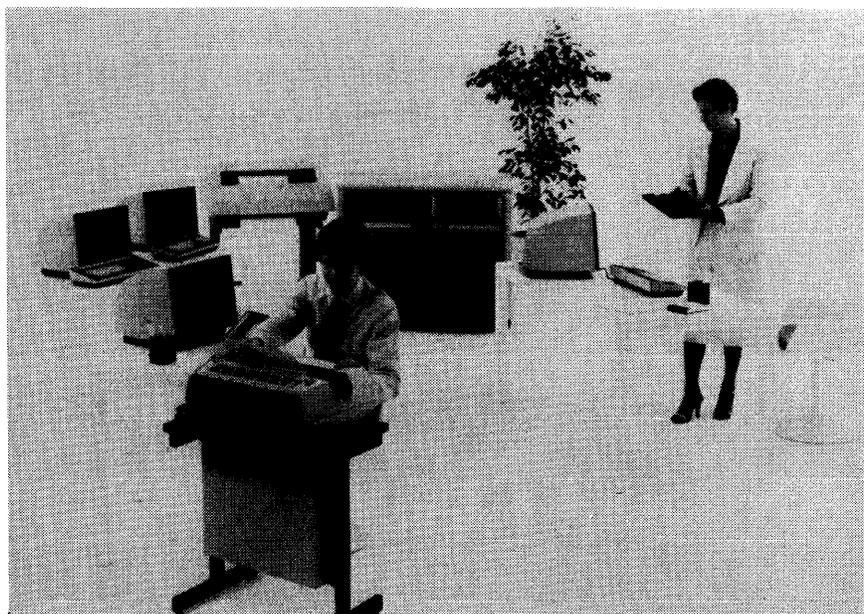
Four-Phase's new System IV/60 features high processing speeds and total compatibility with existing Four-Phase software including the new Multifunction Executive. Positioned as a mid-range processor, a IV/60 with 192K bytes of main memory can support up to 24 1920-character video terminals, up to 22.5 megabytes of disk storage, and a variety of printers.

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▷ operating system, a multifunction executive, compilers, and assemblers are offered.

DATA IV is a software application package that transforms the System IV/70 or IV/40 into a multi-station key/disk data preparation system with a remote batch capability. Data is keyed into a displayed format via a "fill-in-the-blanks" technique. Entered data is edited, validated, and intermediately stored in a disk file. Record batches can then be written on tape, transferred directly to a computer, or transmitted via a data communications link.

In June 1977, the firm announced a major software package, VISION, that incorporates in one package all of the distributed data processing functions the System IV is capable of performing. Four-Phase also provides the Disc Operating System, the Interrupt Disc Operating System, a COBOL compiler with extensions for operating in a video display environment, an RPG compiler, and two assemblers.

The COBOL compiler and the operating system permit the System IV to process data entry files in a stand-alone mode. System IV/70 COBOL, a comprehensive subset of ANSI COBOL, includes terminal-oriented video extensions that enable users to generate COBOL programs for both interactive and batch applications. An Assembler and Video Display Library provide additional user programming flexibility. Sophisticated users have departed from the standard applications package and have programmed the Four-Phase systems in COBOL to handle stand-alone applications such as order entry, packing list printing, order file update, and invoice printing.

The heart of the System IV is the company's own small general-purpose computer. This processor shows the result of a strong background in chip technology. The computer boasts total MOS/LSI construction, including its semiconductor memory. The architecture of the 24-bit processor embodies eight 24-bit registers used for control, address manipulation, and arithmetic operations, a priority interrupt system with 8 levels (and 64 sublevels for each of the 8 levels), 8 I/O channels that can operate in a multiplexer or burst mode, and single-level indirect addressing. The system architecture uses an advanced method of special data handling for CRT networks that simplifies terminal programming and reduces processing loads on the CPU.

The instruction repertoire provided with the System IV is truly impressive, even though the six decimal instructions are an extra-cost option. You want floating-point multiplication and division? You've got it, not to mention fixed-point multiplication and division, list processing, character manipulation, comprehensive branch instructions, etc. They're all there.

Starting with the IV/70, which was introduced in 1970, the Four-Phase product line has grown to a total of eight systems that span a broad range of applications and work- ▷ load volumes.

▶ **NUMBER DELIVERED TO DATE:** Over 10,000 systems (all models), representing over 80,000 display units.

DATA FORMATS

BASIC UNIT: 24-bit word.

FIXED-POINT OPERANDS: One, two, or three words. Each word can hold three eight-bit bytes. Fixed-point numbers are stored as signed 23-bit integers.

FLOATING-POINT OPERANDS: Standard single-precision floating-point operands consist of a signed 23-bit exponent and a signed 23-bit fraction. Standard extended double-precision floating-point operands have a signed 23-bit exponent and a signed 46-bit fraction.

INSTRUCTIONS: Each 24-bit instruction word is divided into a 6-bit operation code, a 3-bit modifier field, and a 15-bit operand.

The modifier field is used (when required) to specify indexing and indirect addressing. There are three basic types of instructions in the Four-Phase processor: memory-reference types, non-memory-reference types, and decimal option instructions. Memory reference instructions are either address-modifiable or non-address-modifiable. In non-address-modifiable instructions, the operand is the final or effective address (15 bits) and can directly reference up to 32,768 words without indexing or indirect addressing. For address-modifiable instructions, the operand is modified by indexing, indirect addressing, or both (indexing is done before indirect addressing).

Non-memory-reference instructions permit the operand field to be used for specification of other than address information, e.g., source/destination registers, byte control, or count/shift field.

The optional decimal instructions, available in several models such as the IV/40, IV/50, and IV/70, operate from a memory source location to a destination location. The move/compare decimal instructions have a six-bit operation code, a three-bit operation code extension, four bits for source-field-start-byte and destination-field-start-byte identifiers, and an eight-bit length field. Other decimal instructions are similar but have two five-bit length fields instead of the single length field.

INTERNAL CODE: ASCII.

MAIN STORAGE

STORAGE TYPE: MOS/LSI semiconductor memory.

CYCLE TIME: 2.0 microseconds per word in all systems except Systems IV/60, /65, and /90, where the cycle time is 400 nanoseconds.

CAPACITY: The IV/30, IV/55, and some older IV/40's have a fixed capacity of 8192 24-bit words. The currently active IV/40 models, the IV/50, and the IV/70 all come with 8192 words, expandable to 32,768 words in increments of 8192 words. The Systems IV/60 and IV/65 have 65,536 words. The IV/90 has a minimum of 32,768 words and a maximum of 131,072 words.

CHECKING: One parity bit per 24-bit word is standard.

STORAGE PROTECTION: None.

RESERVED STORAGE: Eight words are reserved for interrupts, arithmetic trap, and supervisory trap. Enough memory must be reserved to accommodate the total display screen capacity used on the system. For example, if a screen ▶

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION & SPEED	MANUFACTURER
MAGNETIC TAPE		
8501	Subsystem; includes tape drive and controller for up to 4 drives; 9-track, 800-bpi, 10.5-inch reels, 12.5 ips; 8511-01 is 1st add-on, 8511-02 is 2nd and 3rd add-on drives; 10 KBS	Wangco Mod. 10
8502	Subsystem; includes tape drive and controller for up to 4 drives; 9-track, 800-bpi, 8.5-inch reels, 12.5 ips; 8512-01 is 1st add-on, 8512-02 is 2nd and 3rd add-on drives; 10 KBS	Wangco Mod. 8
8503	Subsystem; includes tape drive and controller for up to 2 drives; 9-track, 1600-bpi, 8.5-inch reels, 37.5 ips; 8513-01 is add-on drive; 60 KBS	Wangco Mod. 8
8504	Subsystem; includes tape drive and controller; 9-track, 1600-bpi, 10.5-inch reels, 37.5 ips; 60 KBS	Wangco Mod. 10
8507	Subsystem; includes tape drive and controller; 7-track, 556/800 bpi, 8.5-inch reels, 12.5 ips; 6.95/10 KBS	Wangco Mod. 8
PRINTERS		
8122	132 positions at 10 characters per inch, 96 ASCII character set on type-wheel, servo-driven movement of 48 increments per inch vertical and 60 per inch horizontal, up to 15-inch paper; 45 cps	Diablo
8125	Desk-top serial printer; 132 positions at 10 characters per inch, 88-character set on a metal print wheel, 40 cps, otherwise same as 8122	Diablo
8126	Desk-top serial printer; 132 positions at 10 characters per inch, 96-character set on a plastic print wheel, 55 cps, otherwise same as 8122	Diablo
8135	Subsystem; includes serial printer and controller; switch-selectable for 80/132 positions 64-character set, 7 x 9 dot matrix, up to 9.375-inch paper, 2-channel VFU; 100/165 cps	Centronics
8145	Matrix line printer; 132 positions at 10 characters per inch, 96-character set, 6 or 8 lines per inch, 8-channel paper tape vertical format control unit, oscillating comb mechanism, up to 6-part 14⅞"-wide continuous forms, 120 lpm	Tally
8148	Subsystem; includes drum printer and controller; 132 positions at 10 characters per inch, 4 to 16.75-inch paper, 6 or 8 lines per inch, 64-character set, 12-channel VFU; 300 lpm	Dataproducts 2230
8149	Subsystem; includes chain printer and controller, 132 positions at 10 characters per inch, 4 to 16.75-inch paper, 6 or 8 lines per inch, 64-character set, 12-channel VFU; 600 lpm	Data Printer
8149-96	Subsystem; includes chain printer and controller, designed for word processing, 96-character upper/lower case set, 132 positions, 6 or 8 lines per inch, 12-channel VFU, up to 16.75-inch paper; 430 lpm	Data Printer
8154	Same as 8149, but 1000 lpm	Data Printer
PUNCHED CARD		
8001	Subsystem; includes reader and controller; 80-column, 550-card hopper/stacker; 80108 system load switch, requires 8011 controller on each system; 300 cpm	Documation M200
8003	Subsystem; includes reader and controller; 80-column, 1000-card hopper/stacker; 600 cpm	Documation M600L
TERMINALS		
—	CRT display/keyboard; 480 characters, 12 lines by 40 characters, 120 ASCII character set, 7 x 9 dot matrix; up to 395K bytes/second	Four-Phase
7100A	CRT display/keyboard; 288 or 576 or 1152 characters, 6 or 12 or 24 lines by 48 characters, 120 ASCII character set, 7 x 9 dot matrix; up to 395K bytes/second	Four-Phase
7101A	CRT display/keyboard; 480 or 960 characters, 6 or 12 lines by 80 characters, 120 ASCII character set, 7 x 9 dot matrix; up to 395K bytes/second	Four-Phase
7111A	CRT display/keyboard; 1920 characters, 24 lines by 80 characters, 120 ASCII character set, 7 x 9 dot matrix; up to 395K bytes/second	Four-Phase
5115A	Same as 7111A, but restricted to use with Models IV/50, /65, and /90	Four-Phase

▷ Systems IV/30 and IV/55 are intended for use in locations requiring only one or two data entry/data display stations. Such stations are typically limited to the data entry and report printing functions, leaving all data processing functions to the remotely located host computer.

Systems IV/40, IV/50, IV/60, IV/65, IV/70, and IV/90 are used when multiple, high-volume data entry stations are needed and can perform independent data processing functions or not, depending upon the user's requirements. ▷

▶ has a capacity of 1152 characters, then 384 words must be reserved for it. A 16-terminal system will therefore require about 6K 24-bit words to be reserved for storage of display data.

CENTRAL PROCESSOR

GENERAL: The model identification of Series IV processors defines the memory type and size and the types of disk units each processor can support. Each processor is an all-LSI design oriented toward video terminal support. Data is dis- ▶

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▷ The IV/60, IV/65, IV/70, and the IV/90 can be equipped with sufficient resources and software to make them in effect small computer systems.

The Four-Phase CRT display units are separate from their keyboards and can be located up to 2000 feet from the computer. There are several display models, which provide display arrangements ranging from 288 to 1920 characters per screen.

The legibility of information displayed by the Four-Phase systems is superior to that of many displays now on the market as a result of a more detailed character array. Cursor manipulation is extremely flexible and is a function of the provided display software, which can be tailored to the user's needs. Extensive editing is also provided, along with the capability to "roll and scroll" the displayed text up or down to present additional data stored in the main memory.

The System IV/40 and IV/70's variety of I/O devices and communications capabilities allow them to be configured to suit the needs of many applications. Some of these, suggested by Four-Phase, include text composition and editing, credit authorization, order and inventory management, and customer account service.

ForeWord, a shared-logic word processing system supporting up to twenty-four 1920-character video displays, sixteen printers, and four disk drives, is now available. The system provides on-line storage capacity ranging from 400 to 100,000 pages of text.

Other specific stand-alone applications are not supported; the application programs must be produced and implemented by the user.

Four-Phase systems are sold through a direct sales force of 132 marketing personnel located in 48 offices throughout the U.S. Internationally, Four-Phase markets through a combination of wholly owned subsidiaries and independent distributors. The marketing team is backed up by 105 office personnel and over 180 systems engineers and managers.

Field service is offered from a combination of Four-Phase offices and third-party service companies. Most of the service is performed by Four-Phase.

USER REACTION

Detailed below are the responses to Datapro's 1979 survey of minicomputer users from 14 Four-Phase customers with a total of 174 installed systems. The sample included 88 IV/40 systems, 15 IV/50 systems, 52 IV/70 systems, and 19 IV/90 systems. One user, a retailer, accounted for 86 of the IV/40's, 8 of the IV/50's, and 8 of the IV/90's. The only other user with more than one type of system had a IV/40 and a IV/70, both of which had been obtained via a third-party lease. All other systems were on rental from the manufacturer. The average system had been in- ▷

▶ played on CRT screens directly from refresh areas of the parallel-accessed LSI memory. This technique eliminates the need for separate buffer areas in each terminal. Provided in the processor are a multilevel priority interrupt system, a memory that is addressable either directly or through single-level indirect addressing, and, in the larger processors, a memory mapping capability.

Operation of the Four-Phase systems is directed from the individual video terminals under control of the operating software. The video terminals are similar in concept and design to conventional CRT terminals and include an extensive set of cursor and edit controls, function controls, and an adding-machine capability. Cursor controls, which provide a wraparound capability, can move the cursor right, left, up, down, to the initial line and character position of the screen (home), and to the initial character position of the next line (return). Roll controls roll the displayed text up or down, line by line. Insert and delete controls insert or delete a character or a line in or from the displayed text.

Screen and line erase are also provided. The Tab control produces any of three codes as the result of shifted, unshifted, or control shift operation. Under program control, these cursor and edit controls can be assigned to virtually any display function. A set of 13 function controls can be programmed to implement application-dependent operations to extend the system's range of usefulness. The adding-machine capability provides separate numeric and function controls for high-volume numeric operations.

All processors feature hardware multiply/divide, byte manipulation, and a real-time clock as standard equipment.

CONTROL STORAGE: The read-only memory (ROM) is composed of at least 1024 48-bit words. The microcode contained in the ROM is utilized by the Microprogram Command Generator for instruction execution.

REGISTERS: There are eight programmer-addressable registers, each 24 bits in length. R0 and R1 are read-only registers and supply the constants "0" and "1" respectively. RP is the program register; bits 0 through 5 hold and display the status bits for stop, machine malfunction, and condition codes, while bits 9 through 23 function as the program counter. RA is the accumulator, and RB is the extended accumulator. RB can also be used as a program scratch-pad. X1, X2, and X3 are all index registers. X2 also serves as a link register when subroutines are utilized.

ADDRESSING: Some instructions are address-modifiable, and others are not. In non-address-modifiable instructions, the operand is the final or effective address (15 bits) and can directly reference up to 32,768 words without indexing or indirect addressing. For address-modifiable instructions, the operand is modified by indexing, indirect addressing, or both. Indexing is done before indirect addressing. The Systems IV/60, IV/65, and IV/90 utilize mapped memory. In addressing mapped memory, the high order five bits of the logical address plus six bits from a "window" register form an eleven-bit address to the mapper. The output of the mapper, combined with the remaining ten bits of the logical address, forms an 18-bit actual address. The actual address selects the appropriate block of RAM, the page within the block, and the three-byte word within the page.

INSTRUCTION REPERTOIRE: 126 major instructions, consisting of 6 optional decimal commands, 12 word/character manipulation, 5 list processing, 17 load/store, 11 fixed-point, 4 comparison, 8 shift accumulator, 19 branch/skip, 12 register-to-register, 6 logical, 7 control, 4 interrupt, and 6 I/O instructions.

INSTRUCTION TIMINGS: The following table represents instruction timings for full-word (24-bit) fixed-point operands, in microseconds, except where noted. ▶

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stalled for about three years and had about 62K bytes of memory, from 25 to 30 megabytes of disk storage, and one tape drive. Programming, primarily in COBOL and DATA IV, was overwhelmingly by in-house personnel. Business data processing and data communications were the most frequently mentioned applications.

The table below summarizes the responses to Datapro's 1979 survey.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	7	5	2	0	3.4.
Reliability of mainframe	7	5	2	0	3.4
Reliability of peripherals	4	8	1	1	3.1
Maintenance service:					
Responsiveness	4	7	1	2	2.9
Effectiveness	2	7	5	0	2.8
Technical support	4	5	4	0	3.0
Manufacturer's software:					
Operating system	3	6	4	1	2.8
Compilers and assemblers	3	6	5	0	2.9
Applications programs	2	5	4	1	2.7
Ease of programming	4	6	3	0	3.1
Ease of conversion	4	3	5	0	2.9
Overall satisfaction	4	6	4	0	3.0

*Weighted Average on a scale of 4.0 for Excellent.

Aspects of the System IV which these users praised included the data entry package; the price, performance, dependability, flexibility, ease of use, and growth potential of the systems; the easy-to-format screens; and COBOL with multi-key ISAM. On the negative side, two users criticized the operating system, and other critical comments involved the technical support, disk failures, back-up procedures ("take too long and are too cumbersome"), and batch processing requirements.

There are no major changes in the users' opinions of Four-Phase Systems and its products between Datapro's 1979 survey and previous surveys. Ease of use and reliability are the continuing strong points of Four-Phase hardware.□

IV/30, /40, /50, /55, /70:

Load/Store	12.0
Add/Subtract	16.0
Multiply/Divide	144/132
Compare and Branch	28.0

IV/60, /65, /90:

Character Move	8.6 + 1.5/byte
Character Compare	7.2 + 1.5/byte
Multiple Word Move	1.7 + 2.1/word
Decimal Add/Subtract	1.7 + 1.7/byte
Binary Add/Subtract	1.9

INTERRUPTS: Eight programmable priority hardware interrupts are provided with 64 chained-unit addresses within a level, each of which is connected to a different I/O channel.

PHYSICAL SPECIFICATIONS: The System IV processors are not all the same size, but they are all at least 10.5 inches high, 19 inches wide, and 22.6 inches deep. They can be housed in a cabinet 53 inches high, 22.5 inches wide, and 30 inches deep. The processors operate within a temperature range of 52 to 104 degrees F. Optimum operating range for a system with magnetic media in the configuration is 60 to 90 degrees F. Humidity may range from 20 to 80 percent, noncondensing.

Adaptability to various standard voltages is dependent on the processor model. Amperage drawn is between 6.5 and 7.7, and the processors dissipate between 1700 and 2600 BTU's of heat per hour. Normal office levels of air conditioning are sufficient for all systems. A non-static conductive floor covering is recommended.

INPUT/OUTPUT CONTROL

I/O BUS: The computer I/O structure provides eight I/O channels, each of which can recognize up to 64 addressable devices. All I/O data transfers are performed directly under program control following initiation via an interrupt. Block data transfers take place under CPU control at up to 395,000 bytes/second, and under control of the interrupt system at up to 41,600 bytes/second. Control and status information is transferred in a single word, with concurrent operation of multiple channels and multiple devices within channels up to system bandwidth limitations.

For CRT I/O, a special method is used for writing to terminal displays. The solid-state memory employed in Four-Phase CPU's simultaneously refreshes all terminal screens while providing processor storage. Data located in dedicated refresh areas is automatically displayed and can be manipulated directly by the CPU without time-consuming transfers between separate refresh and processor memories. This enables terminal screens to be updated at memory transfer speeds with no I/O overhead. The technique also reduces terminal circuitry and consequently allows expansion of the CRT network for a relatively low per-unit terminal cost. Shared use of the processing unit's logic enables all keyboard functions to be custom-programmed to suit the application.

CONFIGURATION RULES

System IV/30 supports up to two display/keyboard units (one unit replaceable with a printer) and a cartridge disk drive with 2.5-megabyte capacity.

System IV/40 supports up to 16 display/keyboard units; up to 16 55-cps printers or 2 line printers; a diskette drive with a 354K-byte capacity or a cartridge disk drive with a capacity of 2.5 million bytes; and a 300-cpm or 600-cpm card reader.

System IV/50 supports up to 24 display/keyboard units; up to 24 55-cps printers or 2 line printers; a cartridge disk drive with a 2.5-megabyte capacity; a diskette drive with 354K-byte capacity; up to four disk drives with 67.5-megabyte capacity each; and a 300- or 600-cpm card reader.

System IV/55 supports up to two display/keyboard units (one unit replaceable with a printer) and a diskette drive with a 354K-byte capacity. The IV/55 functions as an IBM 3270 display terminal to a remotely attached host. A switch on the unit loads the 3270 Simulator Program from the diskette.

System IV/60 supports up to 16 display/keyboard units; up to 16 55-cps printers or 2 line printers; has 192K bytes of memory and from 5 million to 22.5 million bytes of disk storage.

System IV/65 supports up to 24 display/keyboard units; up to 24 55-cps printers or 2 line printers; has 192K bytes

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▶ of memory and from 5 million to 22.5 million bytes of disk storage.

System IV/70 supports up to 32 display/keyboard units; up to 32 55-cps printers or 2 line printers; a cartridge disk drive with 2.5-megabyte capacity; a diskette drive with 354K-byte capacity; up to four disk drives with a capacity of either 67.5 megabytes or 50 megabytes each; a 300- or 600-cpm card reader; and up to four magnetic tape drives.

System IV/90 supports up to 32 display/keyboard units; up to 32 55-cps printers or 2 line printers; a cartridge disk drive with 2.5-megabyte capacity; a diskette drive with 354K-byte capacity; up to four disk drives with a capacity of either 67.5 megabytes or 50 megabytes each; a 300- or 600-cpm card reader; up to four magnetic tape drives; and memory expandable to 384K bytes.

MASS STORAGE

8230 REMOVABLE CARTRIDGE DISK SYSTEM: Uses a removable cartridge, similar to the IBM 2315 cartridge, with a capacity of 2.5 million bytes. One 8231 disk drive may be used with the IV/40 system, and up to four may be used with the IV/70 system in conjunction with the 8230 controller. The disk is organized in 200 active tracks per side, with eight 768-byte sectors per track. There are two tracks per cylinder and three reserve tracks per surface. The access mechanism carries two heads, one for each disk surface, which results in a cylinder capacity of just over 12K bytes. The average head positioning time is 70 milliseconds, average rotational delay is 20 milliseconds, and data transfer rate is 184K bytes per second.

8240 REMOVABLE PACK DISK SYSTEM: Consists of an 8240 controller and up to four 8241 disk drives. This subsystem is not supported by the System IV/40. The 8241 uses an IBM 2316-type pack providing a storage capacity of 50 million bytes. The packs are recorded in double-density fashion. Each disk surface carries 400 active tracks. The access mechanism links a head for each surface, yielding a cylinder capacity of just over 120K bytes. Data is stored with 768 bytes per sector, 8 sectors per track, and 20 tracks per cylinder. There are six reserve cylinders. Only one-half of a cylinder can be transferred in one operation. Average head positioning time is 29 milliseconds, average rotational delay is 12.5 milliseconds, and data transfer rate is 312K bytes per second.

8250 DISKETTE SYSTEM: Uses a diskette or "floppy" disk cartridge. Both the IV/40 and the IV/70 systems can support one 8250 drive. Data is recorded on one surface only, in 64 tracks of four 1146-byte sectors each. Total capacity of the diskette is 354K bytes. Arm movement time is 10 milliseconds per track plus 10 milliseconds head settling time; average rotational delay is 80 milliseconds. Rotational speed is 375 rpm. Data transfer rate is 31K bytes per second. The controller supports only one drive.

8260 PACK DISK DRIVE: Uses a removable disk pack with a storage capacity of 67.5 million bytes. A maximum of four 8260 drives can be used on the IV/70 system, but the 8260 is not supported by the IV/40 system. Average head positioning time is 29 milliseconds, average rotational delay is 12.5 milliseconds, and data transfer rate is 250K bytes per second. The 8260 contains an integral controller employing the NP/80 16-bit processor. Add-on drives to the 8260 are assigned the number 8261.

8270 FIXED MEDIA DISK DRIVE: Provides a capacity of 10 million bytes. The fixed media has 1600 active tracks with 8 768-byte sectors per track. The data transfer rate is 195K bytes per second. Maximum average seek time is 65 milliseconds, and average latency is 20 milliseconds.

INPUT/OUTPUT UNITS

The primary I/O devices are CRT display/keyboard terminals. See the Peripherals/Terminals table for descriptions of these display units as well as the other peripheral devices. Features common to all CRT display terminals appear below.

DISPLAY/KEYBOARD UNITS: The keystations used in the Four-Phase systems contain a video display and keyboard with optional Dual Intensity and Audible Alarm features. Each display has a character set of 120 ASCII symbols, including upper and lower case alphabetics, numerics, and special symbols. Characters are generated by a 7-by-9 dot matrix.

Any of six cursor symbols is available. User-selected cursor parameters allow the cursor to blink or remain steady and to be destructive or nondestructive. Cursor controls, which provide a wraparound capability, can move the cursor right, left, up, down, to the initial line and character position of the screen (home), and to the initial character position of the next line (return). Roll controls roll the displayed text up or down, line by line. Insert and delete controls insert or delete a character or a line in or from the displayed text.

Screen and line erase are also provided. The Tab control produces any of three codes as the result of shifted, unshifted, or control shift operation. Under program control, these cursor and edit controls can be assigned to virtually any display function. A set of 13 function controls can be programmed to implement application-dependent operations to extend the system's range of usefulness. The adding-machine capability provides separate numeric and function controls for high-volume numeric operations.

Messages can be highlighted for attention or blanked for security when using the Variable Intensity feature, which permits characters to be displayed at normal or high intensities or blanked (not displayed). Control is provided by non-displayed attribute characters, which can be interspersed within the data stream.

The Audible Alarm feature alerts the operator to special conditions such as errors or end of line.

COMMUNICATIONS CONTROL

8411/4411 ASYNCHRONOUS DATA SET CONTROLLER: Provides a single-line interface for half- or full-duplex communications at 110, 150, 300, 600, 1200, 1800 or 2400 bps. Any 9- to 11-bit code is accommodated. The controller features automatic answer capability and supports Bell System type 103A, 201A, 201B, 202C and 202D modems or equivalents, or devices with an EIA RS-232C interface.

8436/4436 BINARY SYNCHRONOUS DATA SET CONTROLLER: This buffered controller provides a single-line interface for half- or full-duplex Bell System 201A, 201B, or equivalent EIA RS-232C modems operating at up to 9600 bps. Any 7- or 8-bit code is accommodated.

8437 INTELLIGENT COMMUNICATIONS CONTROLLER: Designed for use with the System IV/90, the controller contains a 16K-byte processor. The 8437 supports both the Bisync and SDLC protocols.

COMMUNICATIONS SOFTWARE: On-line inquiry is provided through direct emulation of IBM display systems plus the ability to add local processing through COBOL programming. On-line inquiry and retrieval is also provided within Four-Phase's VISION system.

The *IBM 2260 Simulator* provides all functions of an IBM 2260/2848 Display System through software emulation. This package provides for operation in either local or remote ▶

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➤ environments and supports all screen sizes. Features include Supervisory Mode, in which a display unit, acting as a supervisory station, can communicate directly with other display units connected to the same Series IV, and Media Conversion, which supports data transcription operations such as card-to-tape, card-to-printer, and tape-to-printer.

The *IBM 3270 Simulator* provides all the functions of an IBM 3270 Information Display System through software emulation. This package provides for operation in either local or remote environments and supports 480- or 1920-character display units. It includes support for options such as Variable Intensity and Audible Alarm. Format Storage capability enables selected formats to be displayed instantly from local memory, so there is no waiting for prompts. A Store-and-Forward Mode feature enables operators to key in data even during periods when the communications line or central mainframe is down. When on-line operation resumes, the locally stored records are then transmitted. The 3270 Simulator also contains facilities test features that can be used to pinpoint problems in the communications equipment, log line traffic, display format attribute types, write memory checkpoints to screen or disk, and accumulate error statistics.

Programmable 3270 Simulator allows 3270 users to add local processing capabilities to an existing 3270 network. The package provides all the capabilities of the 3270 Simulator system plus COBOL programming. Editing and validation capabilities, including range checks, algebraic relationships, interfield dependencies, conditional logic, and table comparison, can be programmed into the system to enable local handling of data. Entries may be validated against local files, and filed data can be integrated with keyed data for transmission or with received data for displaying or printing. The COBOL-programmed routines to perform these functions can be added to the system without having to modify existing 3270 application programs, systems software, or network configuration. COBOL routines can be invoked when data is transmitted or received, when the TAB or Program Function keys are pressed, or when entries in designated fields are completed. The subroutines can then access local disks, printers, and displays on the central CPU before returning control to the operator. COBOL processing is performed in the background and can support multiple tasks at multiple displays with concurrent key entry and printing.

BATCH COMMUNICATIONS: All major Four-Phase software packages provide the ability to transmit and receive data in a batch mode. The batch communication protocols in the various packages are: DATA IV, Version 1 (2780/3780); DATA IV, Version 2/3 (2780/3780/HASP/3770); VISION (2780/3780/HASP); ForeWord (2780/3780); and PWS (2780/3780/HASP). In addition, two remote job entry packages are available.

RBS with 2780/3780 is a Remote Batch System that provides a full complement of IBM 2780/3780 features including point-to-point and multipoint operation as well as transparency, auto-answer, line turnaround, space compression, and spanned record transmission. Peripherals supported include 300- and 600-cpm card readers, printers from 300 to 1000 lines per minute in speed, and a diskette or cartridge disk system for program loading. While jobs are running, the video control console displays system status, error messages, line performance statistics, and prompts. A disk spooling capability enables a job to be read in from a card reader, another job to be written out from disk to a printer, and a third job to be transmitted or received simultaneously. Reports can be transmitted to unattended RBS systems at night without concern for forms changing or device availability, and the spooled data can be printed the next day while other operations are being performed. During transmission, the host CPU creates separate disk files on the

remote system for each job. Reports can be generated and local system files updated using user-programmed software.

RBS with HASP is compatible with the IBM 360/20 HASP workstation used as a remote batch terminal. The package is offered with the System IV/40 and supports 300- to 600-cpm card reader, multiple 300- to 1000-lpm printers, 1920-character video display and operator keyboard, and diskette for diagnostics. The display and operator keyboard serve as an operator's console and display system status and communication status. The software provides the line discipline to simulate a multi-leaving HASP workstation.

SOFTWARE

Four-Phase provides generalized software designed for primary distributed processing activities: data entry, word processing, program development, on-line inquiry and retrieval, batch communications, and report generation. Further, all of these functions can operate simultaneously on one system under software control of the Multifunction Executive. (See the preceding paragraphs for a discussion of communications software.)

Operation of a System IV is directed from the individual display terminals under control of the operating software. Four-Phase provides, at no additional charge, software packages, including DATA IV, VISION, and ForeWord, to perform specific functions. Depending upon the package, the user either modifies the package with parameter settings or includes the package as part of his self-developed package. The more significant packages are discussed below. Any package will operate on any system with sufficient resources.

System IV configurations with sufficient resources can compile and test programs for operation on any System IV. Software for System IV configurations without these resources can be compiled on any IBM System/360 or 370 operating under OS or DOS that has a minimum of 65K bytes of memory. When using a System IV for compilation, a minimum of 48K bytes, a cartridge disk or a disk drive, a card reader, and a printer are required.

OPERATING SYSTEMS: The new Multifunction Executive is available for multiple program execution. In addition, Four-Phase offers NPOS, IDOS, and DOS operating systems for program development and single-program execution.

Multifunction Executive (MFE/IV) enables multiple Four-Phase software packages to operate concurrently and independently on a System IV/60, /65, or /90. These packages include DATA IV, VISION, ForeWord, PWS, and COBOL, making the following distributed processing functions available with a single processor: data entry, word processing, program development, on-line inquiry and retrieval, batch communications, local processing, and report generation. A single station can switch from one function to another easily. MFE/IV supports up to 24 1920-character screens, 270 million bytes of disk storage, and up to 384K bytes of memory.

NPOS (NP/80 Operating System) is a modular operating system which coordinates the services of the NP/80 peripheral processor. The primary function of NPOS is to service I/O requests for large mass storage devices as well as to enable the operation of multiple Series IV processors. Virtual disk capability and buffer pooling is also provided.

IDOS is a disk-oriented operating system oriented toward executing programs which IDOS provides for the cataloging and updating of source, relocatable, absolute files and command run parameter strings (job streams). The latter permits a single entry from the console to initiate sequential opera- ➤

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▶ tion of a series of programs. The Code Assembler and Relocatable Loader, COBOL with DISAM, the Sort Package, and the System Relocatable Library are among the programs provided with IDOS. Two types of disk files are available under IDOS and DOS: contiguous (chained) and sequential (linked files).

IDOS Utilities is also provided and includes a sort/merge, symbolic editor, relocatable loader, and various media conversion programs. The symbolic editor allows for insertion, deletion, replacement, and inter-record corrections of symbolic text. Media conversion programs include card-to-tape, tape-to-printer, and memory save/restore on disk or magnetic tape.

DOS is also available for custom software systems development and execution. It is a disk-resident system with a flexible Job Control Language through which the user can structure the assembly, loading, and execution of programs.

LANGUAGES: For program development Four-Phase offers PWS and three versions of COBOL.

PWS (Programmer Workstation) is a display-based remote job entry station package that helps large programming shops develop and maintain programs for IBM 360's and 370's. Programmers at 16 terminals can key in and edit simultaneously on 1920-character keyboard/display stations. At the beginning of each programming project, the source code files are retrieved from the mainframe. From this time on, files are stored locally on disk for convenient access at each programming session. After a program has been edited, it is placed in a queue to be transmitted to the IBM host for compilation and execution. When the mainframe is ready for the job, PWS transmits the source code files using 2780, 3780, or HASP multi-leaving protocol. After the program has been executed, the mainframe sends the compiled listings back to the workstation line printer.

COBOL is offered in both ANSI COBOL '68 and COBOL '74 versions, with extensions provided for screen handling. Programmers can define screen formats in the Data Division and accept keyboard data in the Procedure Division. The screen areas can be manipulated like any working storage area; thus, the programmer can read and write data to operator displays without using I/O instructions. This allows for dynamic manipulation of screen displays without imposing overhead on the processor or the channel. COBOL and Assembly language subroutines can be executed on-line and can be overlaid to conserve memory. Multi-tasking allows different activities to be supported at different displays simultaneously. Data management facilities are provided for accessing of up to 270 million bytes of local disk storage. Serial and direct files are processed using the Sequential Access and Random Access features of ANSI COBOL. A third access method, DISAM, provides multi-indexed files that may be referenced by a primary key and up to 10 secondary keys. Files created or maintained in on-line operations can also be processed in batch mode using COBOL, RPG, sort/merge, and an extensive selection of utilities.

COBOL with 2780/3780 is a package which combines ANSI COBOL for local processing with concurrent batch communications using IBM 2780/3780 protocol. Displays are supported for entry, inquiry, processing, and printing. Data is transmitted and received using IBM 2780/3780 protocol in an attended or unattended mode. A Series IV CPU can communicate with any system using IBM 2780/3780 discipline, including other Series IV's using RBS or COBOL with 2780/3780, and with IBM System/3's, 360's and 370's. This package contains standard ANSI COBOL modules for Nucleus, Table Handling, and Sequential Access plus enhanced Table Handling with three levels of subscripting/indexing, Random Access, and Library. Facilities for Sort and Segmentation are available through the Interrupt Disk

Operating System or the Multifunction Executive. This package also provides video extensions for interactive support of displays and keyboards.

COBOL with HASP combines COBOL for local processing with a set of subroutines that can be called for the transmission of data to or from another computer using HASP multi-leaving batch transmission protocol. The other computer can be a 360/370, another Four-Phase processor, or any other system having a bisynchronous HASP multi-leaving interface. Communications can be over leased or dial-up facilities with either attended or unattended operation. Local transaction processing is accomplished with user routines written in either assembler or COBOL.

APPLICATIONS PROGRAMS: VISION and three versions of DATA IV provide the software necessary to use the System IV as a shared-processor data entry system (key/disk). They all provide for extension data editing and manipulation, for verifying previously entered records, and for searching for specific records. The ForeWord word processing package is a shared-processor text-editing system that allows text to be entered, stored, edited, and printed.

Version 1 of DATA IV provides up to six program formats per job. Multiple jobs can be running at the same time, and formats can be shared among several jobs. Six balance accumulators are provided. Record lengths can be defined as up to 750 characters. Conventional keypunch functions are provided along with a large number of other functions, including "generate" and numeric field relationships. The generate function allows a single key to be used to trigger the output of a stored constant field based on the character keyed. Arithmetic relationships such as equal, not equal, greater than, and less than can be used to check a group of fields having an arithmetic relationship. A field can be defined as "must enter" or "must fill" to prevent a data entry operator from leaving the specified field blank.

Up to four 2.5-million-byte disk drives are supported by DATA IV Version 1 to provide a data file storage capacity of up to 80,000 80-character records. Either keypunch-style or typewriter-style keyboards are supported, but they cannot be mixed in the same system. Data can be printed from the screen or from the disk file. Data can also be transferred to tape from the disk while key entry continues. Output options supported include magnetic tape, direct connection to an IBM System/360 or an IBM System/370, and remote data communications using binary synchronous line discipline.

Version 2 of DATA IV provides all the features of Version 1 plus 24 balance accumulators, up to 15 program formats per job, audible error alarm, conditional field checking, multiple validation checks on the same field, extended table comparisons, and support for mixed keypunch and typewriter-style keyboards. Provisions for conditioned logic are included to enable adaptive data validation during key entry. Conditional branches to different editing sequences and operator prompts can be inserted at any point in a format. Single and nested statements of the form IF ... THEN ... ELSE can reference previously entered fields, accumulator values, alphanumeric constants, value sets, and arithmetic and logical combinations of these.

Version 3 of DATA IV accommodates concurrent data entry, retrieval, update, and communications functions and has ISAM-like capabilities. Support for up to 16 video displays is provided for interactive accessing of up to 1000 indexed sequential files, as well as storage capability for over 270 million bytes. Source data can be entered and validated on fully formatted screens displaying up to 1920 characters; data can be extracted from files for automatic entry; local files can be updated on-line; local reports can be produced; and batches of data can be exchanged with the host computer ▶

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for updating of central files. Reports can also be received in an unattended mode for local file updating or printing.

In the data entry mode, DATA IV Version 3 can validate operator entries against local master files containing up to 50,000 records and extract stored data for automatic entry. Data can be integrated with keyed entry on fully formatted screens. In data retrieval operations, Version 3 enables all system operators to work simultaneously with the same current information. Records up to 750 characters long are retrieved instantly by typing numeric, alphabetic, or alphanumeric key fields. Any file can be accessed by all displays simultaneously. Each display can also access multiple files simultaneously. Versions 2 and 3 support IBM-compatible bisync communications for transmission at speeds up to 9600 bps. Either dial or leased lines may be used with IBM 2780/3780, HASP, or SNA 3770 protocols. Remote Terminal is also supported by Versions 2 and 3.

VISION is a transaction-oriented distributed data processing system, combining in one package all computing capabilities needed at remote locations of widespread organizations: source data entry, on-line inquiry and retrieval, batch communications, and multistation file processing. Source data entry is accomplished through the display of full records, operator prompts, and error messages on dual-intensity, 1920-character screens. The powerful editing capabilities of DATA IV, including conditional logic, are also available with VISION. In addition, the file management capabilities of DATA IV, Version 3, are provided. In on-line operation in 3270/mode, VISION supports all IBM display commands and keyboard functions, enabling the full range of 3270 applications software to be used.

On-line inquiry can also be combined with data entry; VISION retrieves information from local and central files either under keyboard control or automatically. Inquiries may be fielded against the VISION data base using indexed sequential access. When the data is unavailable locally, VISION can continue the search automatically by inquiring against the mainframe data base using IBM 3270 protocol. Inquiry routing can be transparent to operators through easily specified format commands.

Batch communications provides a two-way path for information flow. Completed batches may be transmitted over leased or dial-up lines either at the end of the day or concurrently with data entry. Centrally generated reports may be received for printer output or spooled to disk. Batch transmission is accomplished via IBM 2780/3780 protocol. Addition of the HASP communications controller allows for IBM HASP multi-leaving protocol, which may operate concurrently with 2780/3780 and 3270.

Multistation file processing allows processing of up to eight sequential files concurrently from any display station. Data may be sorted on-line and printed in a variety of sequences with headings, totals, and text inserted. Documents such as purchase orders and invoices may be generated automatically. VISION can perform general calculations on data batches with decimal arithmetic and conditional logic. Results can be transmitted to disk, printer, screen, or tape. These operations are concurrent with data entry and communications.

ForeWord is a flexible shared-processor text editing system that allows text to be entered, stored, edited, and printed. The Series IV system can handle the editing and text manipulation functions of up to 24 video terminals. The system supports up to 8 disk drives with removable disk packs providing an on-line storage capacity ranging from 400 to 50,000 pages of text. Removable disks provide unlimited archival storage. Up to 16 terminal printers are supported. Automatic carriage return allows the operator to enter text at rough draft speeds without concern for end-of-line decisions. Text is automatically written to the disk as entry progresses. Instant recall of text and rapid scrolling and cursor movement are provided by the editing and cursor control keys conveniently located on the keyboard. Operators can store frequently used words or phrases within a special glossary and recall them with only two keystrokes. Automatic entering, discretionary hyphenation, and overstriking speed text entry. Updates and changes are easily done. Using the global search and replace command, the operator can type a correction once no matter how often it appears in text. Blocks of text can be moved or copied without retyping. ForeWord provides rapid assembly of documents from libraries of stored paragraphs with an option to include fill-in information. When ready to print, the text can be formatted to add page headings and footings, page numbers, and automatic replacement of footnotes. Margins, tabs, line spacing, page and paragraph numbering, and page headings all can be changed at will. ForeWord can also transmit and receive text from other computers with 2780/3780 line protocol.

PRICING

POLICY: Four-Phase makes its systems available on either a purchase basis or up to a 42-month lease basis. The company refused to supply Datapro with detailed pricing information for the individual components of its systems, but did provide the following prices for system configurations "representative of what Four-Phase is selling today."

SUPPORT: Maintenance is priced separately for purchased systems and included at no additional charge for leased systems. Maintenance is performed between 8 a.m. and 5 p.m., Monday through Friday. Extended Maintenance agreements are available for 12, 16, or 24 hours Monday through Friday for an additional three, five, or seven percent of the one-year lease monthly rental charge. Maintenance at other than covered hours is charged for by the hour with a three-hour portal-to-portal limit. Different rates are charged for three defined periods: Monday to Friday from 8 a.m. to 5 p.m. or 5 p.m. to 8 a.m. and Saturday, Sunday, or holidays. Most of the company's installed equipment is serviced by 440 Four-Phase personnel in 117 locations worldwide. A small portion is serviced by third-party companies from about 26 additional locations.

The maintenance rates shown in the following price list are for zone A (within 50 miles of a service center). A zone maintenance surcharge is billed for all users outside of zone A. Zone B is 51 to 100 miles; zone C, 101 to 150 miles; zone D, 151 to 200 miles; zone E, over 200 miles; and zone L, within 20 miles of specified Four-Phase service offices.■

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EQUIPMENT PRICES

	Monthly Rental*	Purchase	Monthly Maint.
SYSTEM IV/30 CONFIGURATION			
Single-station Data Entry System (Includes one 1920-character Video Display, 24K-byte processor with 2.5-megabyte disk drive, and binary synchronous communications controller)	347	25,000	140
Additional 1920-character Video Display	35	1,845	7
SYSTEM IV/40 CONFIGURATIONS			
4-Station Data Entry System (Includes 4 1152-character Video Displays, 24K-byte processor with 2.5-megabyte disk drive, and binary synchronous communications controller)	611	37,440	166
16-Station Data Entry System (Includes 16 576-character Video Displays, 74K-byte processor with 2.5-megabyte disk drive, and binary synchronous communications controller)	1,283	66,700	321
Remote Batch System (Includes 24K-byte processor with 354K-byte diskette drive, binary synchronous communications controller, one 1152-character Video Control Console, one 300-cpm card reader, and one 300-lpm printer)	777	47,350	253
16-Station IBM 3270 Display System (Includes 16 480-character Dual Intensity Video Displays, a 48K-byte processor with 354K-byte diskette drive, and a binary synchronous communications controller)	1,073	57,490	292
8-Station Transaction Processing System (Includes 8 1152-character Video Displays, 74K-byte processor with 2.5-megabyte disk drive and decimal arithmetic, a 300-lpm printer, and a binary synchronous communications controller)	1,334	69,330	349
SYSTEM IV/50 CONFIGURATION			
12-Station Transaction Processing (Includes 12 Dual Intensity Video Displays, 72K-byte processor, 2.5M-byte disk, 354K-byte diskette, a 30-cps printer, and bisync communications controller)	1,497	93,145	411
SYSTEM IV/55 CONFIGURATION			
Single-station IBM 3270 Simulator (Includes one 1920-character Dual Intensity Video Display, 24K-byte processor with 354K-byte diskette drive, and binary synchronous communications controller)	234	19,500	95
Additional 1920-character Video Display	35	1,845	7
SYSTEM IV/60 CONFIGURATION			
16-Station Transaction Processing System (Includes 16 1920-character Dual Intensity Video Displays, 192K-byte processor, 5M-byte disk, binary synchronous communications controller, and 120-lpm printer)	1,563	106,440	513
SYSTEM IV/65 CONFIGURATION			
16-Station Transaction Processing System (Includes 16 1920-character Dual Intensity Video Displays, 192K-byte processor, 12.5M-byte disk, binary synchronous communications controller, and 120-lpm printer)	2,123	141,570	755
SYSTEM IV/70 CONFIGURATIONS			
12-Station Data Entry System (Includes 12 288-character Video Displays, 24K-byte processor with 2.5-megabyte disk drive, and 9-track magnetic tape drive)	1,440	68,115	316
22-Station Data Entry System (Includes 22 288-character Video Displays, 72K-byte processor with 2.5 megabyte disk drive, and 9-track magnetic tape drive)	2,017	95,655	461
32-Station IBM 3270 Simulator (Includes 32 480-character Dual Intensity Video Displays, 48K-byte processor with 354K-byte diskette drive, and binary synchronous communications controller)	2,091	98,045	486
16-Station Transaction Processing System (Includes 16 1152-character Video Displays, 96K-byte processor with decimal arithmetic, 67.5-megabyte disk drive, and 9-track magnetic tape drive; 300-lpm printer, and binary synchronous communications controller)	2,880	138,315	717
SYSTEM IV/90 CONFIGURATION			
12-Station System (Includes 1920-character Dual Intensity Video Displays, 192K-byte processor with decimal arithmetic, two 67.5-megabyte disk drives, one 600-lpm printer, and SLDC/BSC controller)	3,387	175,865	930

*For 42-month lease; includes prime-time maintenance.