Formation 4000 Information System

MANAGEMENT SUMMARY

Formation's first "off-the-shelf" product, the Formation 4000 Information System, was introduced in March 1980. It is a complete and powerful minicomputer system consisting of processor, controllers, and peripherals. The Formation 4000 offers IBM System/370 program compatibility via a unique "Program Equivalent" (PE) architecture. The Formation 4000 is a 32-bit minicomputer that uses microprocessors to emulate the IBM 370 channels and controllers. The peripherals and their controllers are minicomputer devices. The hardware is quite different from IBM's hardware; however, to the software it appears equivalent.

The Formation 4000 is designed for ultra-high reliability. The system provides a separate System Control Processor that runs diagnostics on all modules, checking their condition each time the system is started and monitoring them while the system is running. Another key to the reliability is the unique redundancy capablity. The user has a choice of duplicating any one module or all the modules of the system (full redundancy). These added modules enhance the performance of the system. If a failure occurs, the system will shut down, automatically reconfigure itself, and start running with minimal degradation. Formation also provides a complete remote diagnostics feature for hardware and software maintenance from a central control location. Other features of the Formation 4000 designed to provide dependability are the use of solid-state error-correcting memory, sealed disk "Winchester" technology, low power components, and extensive use of LSI circuitry. ▷

The Formation 4000 is a powerful 32-bit minicomputer system that offers IBM System/370 compatibility. The F4000 system performance is approximately that of the IBM 4331. Formation is marketing the F4000 to knowledgeable users as a distributed data processing stand-alone system, and an OEM system. The first F4000 system is scheduled for delivery in August 1980.
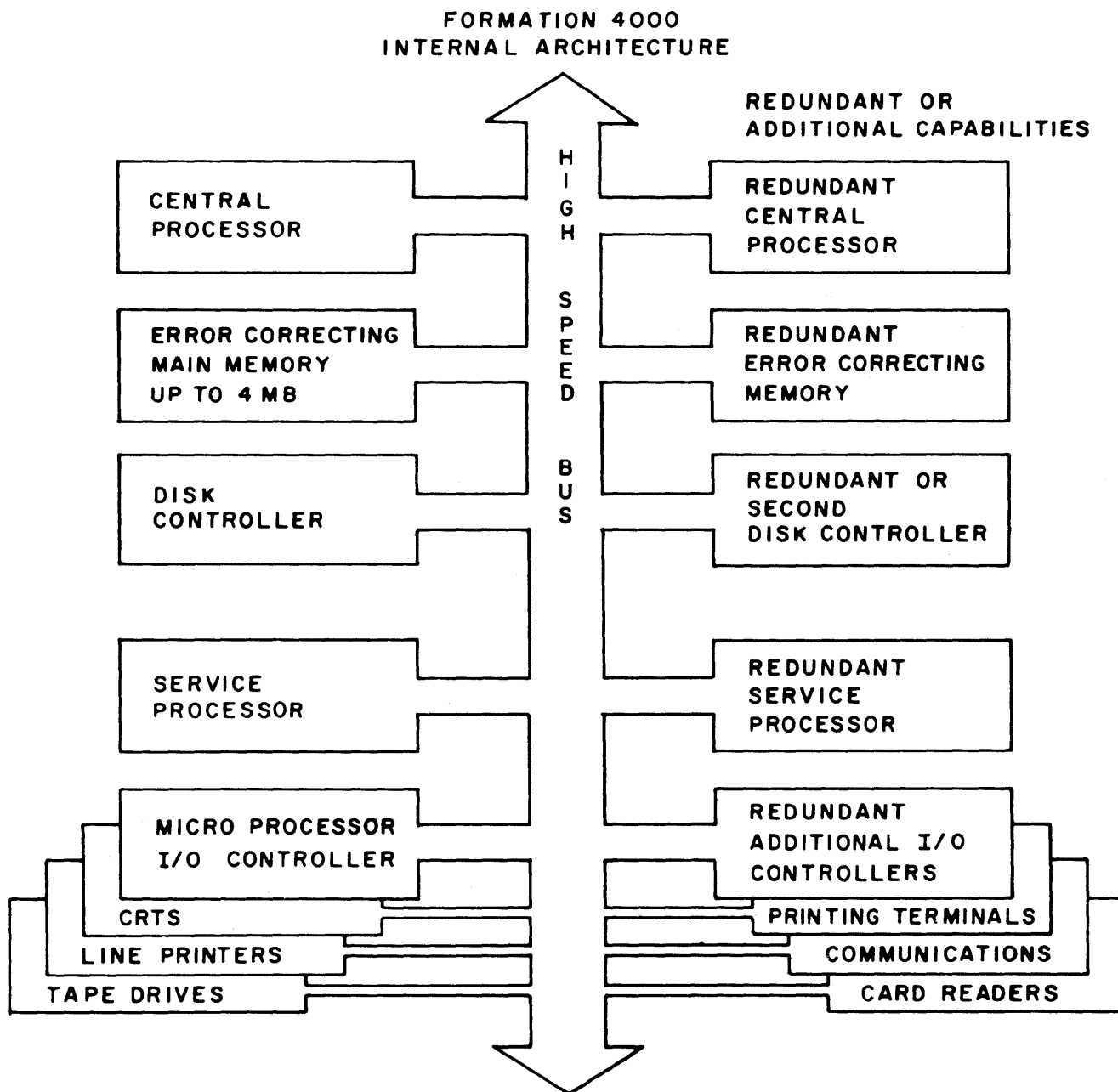
CHARACTERISTICS

MANUFACTURER: Formation Incorporated, 823 East Gate Drive, Mt. Laurel, N.J. 08054. Telephone: (609) 234-5020.

Formation, Inc. is a technology company founded in 1970 to provide consulting services in the information processing industry. Formation's principal business has been the design and manufacturing of enhanced peripheral products such as tape and disk drive subsystems, memory expansion systems, and CORDNET, a dedicated on-line data management and communications systems. Formation's first "off-the-shelf" product, the Formation 4000 Information System, was announced in March 1980. The F4000 system is a complete system consisting of processor, controllers, and peripherals with a unique redundancy capability designed into the system. The Formation 4000 system offers "Program Equivalent" (PE) architecture, which uses microprocessors to emulate the IBM 370 channels and controllers. Consequently, although the hardware is quite different from its IBM counterpart, it appears to the software to be equivalent. Therefore, the software runs as if it were on an IBM System 370, and no changes are required to any system control programs or application programs. ▶

The Formation 4000 Information System offers performance capabilities equivalent to the IBM System/370. The Formation 4000 shown has a central processor with 512K bytes of memory, a System Control Processor, a 1-megabyte floppy disk, a disk controller with two 70-megabyte disk drives, a magnetic tape controller with one magnetic tape drive (not shown), a unit record processor with a 300-lpm printer, and three CRT terminals. This system is priced at $118,900 with a monthly maintenance fee of $790.

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FORMATION 4000
INTERNAL ARCHITECTURE

REDUNDANT OR
ADDITIONAL CAPABILITIES

CENTRAL PROCESSOR	REDUNDANT CENTRAL PROCESSOR
ERROR CORRECTING MAIN MEMORY UP TO 4 MB	REDUNDANT ERROR CORRECTING MEMORY
DISK CONTROLLER	REDUNDANT OR SECOND DISK CONTROLLER
SERVICE PROCESSOR	REDUNDANT SERVICE PROCESSOR
MICRO PROCESSOR I/O CONTROLLER	REDUNDANT ADDITIONAL I/O CONTROLLERS

HIGH SPEED BUS

CRTS
LINE PRINTERS
TAPE DRIVES

PRINTING TERMINALS
COMMUNICATIONS
CARD READERS

▷ **MODELS**

The Formation 4000 system is available in three packaged models: the F4000/100, F4000/200, and F4000/300. The entry level F4000/100 package is equipped with central processor, 256K bytes of memory, a shared disk controller, a system control processor, a 1-megabyte floppy disk, and a 300-bps modem and is priced at $42,500. The Model F4000/200 consists of a central processor, 256K bytes of memory, a separate disk controller, a system control processor, a 1-megabyte floppy disk, and a 300-bps modem and can be purchased for $54,400. The F4000/300 packaged model offers the user system redundancy. The F4000/300 package contains two central processors/shared disk controllers, a megabyte of memory (512K bytes of memory for each CPU), a system control ▷

► **MODELS:** Formation's 4000 Information System at present consists of three models: an entry level F4000-100, a more powerful F4000-200, and the model F4000-300 that provides full hardware redundancy. All three models are capable of running IBM DOS/VS, OS/VS1, and VM 370 operating systems.

DATE ANNOUNCED: March 1980.

DATE OF FIRST DELIVERY: August 1980.

DATA FORMATS

BASIC FORMATS: 8-bit byte. Each byte can represent 1 alphanumeric character, 2 BCD digits, or 8 binary bits. Two consecutive bytes form a "halfword" of 16 bits, while 4 consecutive bytes form a 32-bit "word". ►

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> processor, a 1-megabyte floppy disk, and a 300-bps modem. The F4000/300 can be purchased for $88,000.

Each of the three models may be expanded by adding:

- Central Processor

- Memory modules of 256K bytes or 1 megabyte.

- Integrated Disk Controller

- 1-megabyte Floppy Disk

- 70-megabyte Disk Drives

- Integrated Magnetic Tape Controller

- 72K-byte Magnetic Tape Drives (1600 bpi)

- System Control Processor

- Unit Record Processor

- Card Reader (300 cpm)

- Character Printer (180 cps)

- Line Printer (300 or 600 lpm)

- Local Communications Processor

- CRT Terminals

MEMORY CAPACITY

The Formation 4000 supports up to two memory controllers, each of which can accommodate up to four memory arrays of the same size. The F4000 offers memory arrays in two sizes: 256K bytes or 1 megabyte. The maximum memory capacity for the F4000 is 8 megabytes.

Allowable configurations with one controller:

System Capacity:	256KB	512KB	768KB	1MB	2MB	3MB	4MB
Array:							
256KB	1	2	3	4			
1MB				1	2	3	4

Allowable configurations with two controllers:
(identical capacities required in each controller)

System Capacity:	1MB	2MB	4MB	8MB
Array:				
256KB	4	8		
1MB		2	4	8

INPUT/OUTPUT CONTROL

There are no hardware channels in the Formation 4000; however, via the Program Equivalent feature the system appears to have 4 IBM 370 channels. Channel 0 is a Byte Multiplexer and Channels 1, 2, and 3 appear as Block Multiplexer Channels to the software. The Input/Output is accomplished through intelligent controllers that interface minicomputer peripherals to the system central bus. ▷

> **FIXED-POINT OPERANDS:** Can range from 1 to 16 bytes (1 to 31 digits plus sign) in decimal mode; 1 halfword (16 bits) or 1 word (32 bits) in binary mode.

FLOATING-POINT OPERANDS: 1 word, consisting of 24-bit fraction and 7-bit hexadecimal exponent, in "short" format; 2 words, consisting of 56-bit fraction and 7-bit hexadecimal exponent, in "long" format; or 4 words in extended "precision" format.

INSTRUCTIONS: 2, 4, or 6 bytes in length, specifying 0, 1, or 2 memory addresses, respectively.

INTERNAL CODE: EBCDIC (Extended Binary-Coded Decimal Interchange Code).

MAIN STORAGE

TYPE: MOS; 16K bits per chip and 64K bits per chip.

CAPACITY: Memory is available in either 256K or 1-million-byte increments. A memory controller supports four increments of the same type, such as four 256K increments (1 million bytes) or four increments of 1 million bytes for a total of 4 million bytes per memory controller. The F4000 supports two memory controllers; however, both controllers must have the same capacity.

CYCLE TIME: Memory cycle time is 800 nanoseconds. Memory refresh is required every 2 milliseconds. This normally occurs during idle F bus times, but memory can demand bus access to refresh if adequate cycles are unavailable.

CHECKING: Parity is checked on all read and write operations between the memory and the central processor. When data is stored, a 7-bit error-correcting code is substituted for the byte parity bits. When data is retrieved, single-bit errors are detected and corrected automatically, and most multiple-bit errors are detected and signaled so appropriate action can be taken.

STORAGE PROTECTION: The Store and Fetch Protection feature which guards against inadvertent overwriting and/or unauthorized reading of data, is equivalent to the standard feature on the IBM 370 models.

SYSTEM OVERVIEW

The F4000 system is made up of highly microcoded modules which emulate the IBM 370/138 processor and controllers. The controllers interface minicomputer-type peripherals directly to a central bus (F-Bus). This unique approach eliminates the hardware channels, but allows all system and application software to function as if the channels and multiplexers were included.

The system consists of a 32-bit central processor, memory, system control processor, disk controller, I/O controllers, and peripherals. The components are integrated into a powerful minicomputer system that emulates all the functions of an IBM 370/138 System.

CENTRAL PROCESSOR

The F4000 uses a 2901-type bit sliced microprocessor to emulate all the standard features of the IBM 370/138 including: virtual storage capability by dynamic address translation, System/370 Universal Instruction Set, store and fetch storage protection, byte-oriented operands, clock comparator and CPU timers, time-of-day clock, interval timer, control registers, machine check handling, channel command retry, channel indirect addressing, expanded precision floating point, console audible alarm, console file, ▶

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▷ The F4000 system may have two disk controllers (F4830); each controller supports up to four 70-megabyte disk drives. The F4000 supports two tape controllers (F4803), and up to four 72K-byte magnetic tape drives may be attached to each controller. The unit record processor supports one line printer and/or one card reader. The F4000 can support two unit record processors and up to eight integrated local communications processors (LCP). Each LCP (F4272) has four ports to which CRT's or printer terminals may be attached.

FORMATION 4000 CONFIGURABILITY

Max. Quantity	Description of Feature	IBM equivalent
8 MB	Memory increments: 256KB, 512KB, 1MB, 2MB, 4MB, 8MB	
8	70MB fixed disks	3340
35*	CRT terminals	3277
35*	180-cps character printers	3203
2	1.2MB floppy disk	3540 and 3740
2	300- & 600-lpm line printers	3203
8	1600-bpi, 45-ips tape drives	3420
2	300-cpm card readers	3504

*Total for both devices.

SOFTWARE

Although the hardware is quite different from IBM hardware, Formation via Program Equivalent (PE) architecture has made the F4000 system look to the software as if it were a System/370. A major advantage of the F4000 is that it accommodates the IBM DOS/VS, OS/VS1, and VM operating systems. The microcoded VM assists are included on all F4000 models. Applications programs that run on an IBM System/370 Models 115 through 138 should run on the Formation 4000 without modifications.

Formation has developed a Transaction Management System (TMS) for the F4000 that runs under the IBM VM operating systems. TMS is a data base management and transaction processing system.

TMS features are:

● VM/370 environment

● A complete data base management system

● Automatic start-up (operator-less execution)

● Report handling

● Security management

● Automated backup and restore of software

● Menu selection for transactions ▷

▶ external control mode, program event recording, and virtual machine assist.

The central processor control store consists of 8K words of 64 bits. The standard version utilizes ROM memory for control store with an additional 1K capacity of writable area for diagnostics and updates. Optionally, an 8K-word writable control store (WCS) module is available. When WCS is used, microcode is loaded automatically from the system floppy disk immediately upon completion of the automatic self test.

The same electronic modules are used for the central processor and integrated disk controller. In the minimum configuration (F4000-100), the central processor and disk controller functions share the same electronics. A maximum of four central processor and/or disk controller modules is supported. Only one module may be designated as the CPU and two modules as disk controllers for any configuration; however, for redundancy purposes the modules may be redesignated at IPL time as long as the maximum configuration is not exceeded.

All modules on the system including the central processor, disk controller, memory, service processor and I/O processors are interconnected via a common 4-byte-wide (F bus) connection.

SUPPORT PROCESSOR

A separate electronics module set within the system cabinet is designated the System Control Processor (SCP). The SCP is designed to run diagnostics on all system modules prior to each IPL of the system. Only those modules that pass these diagnostics are enabled to the "active" state on the F-bus. Multiple configurations can be stored on the system floppy disk (connected to the SCP).

The SCP also monitors the state of the F-bus and can detect most system failures. If a failure occurs, the system can automatically be halted and IPL'ed following another diagnostic test by the SCP.

All diagnostic detected errors as well as I/O and memory errors, including soft errors, are recorded on the system floppy disk by the SCP and are available for review via either the local or remote console.

The SCP provides for four terminal I/O ports. The first is dedicated to the local console position and the second to a modem for remote support. The system comes standard with a 300-bps asynchronous modem which can be used for remote hardware and software support. An optional 1200-bps modem is available. Since the system contains no control panel other than an on/off key and power and status lights, all the operator panel functions are handled via menu driven screens on the CRT console or remote console. Initiation of remote console support requires operator intervention, and all operations are duplicated on the local console.

Two additional I/O terminal ports are available on the SCP and can be used for local support of CRT terminals and/or printers in the same manner as if attached to the Local Communications Processor. The SCP also provides the support of an optional customer accessible floppy disk for program or data storage. This floppy is accessible to 370 level software.

CONTROL STORAGE

The F4000 provides for either firmware or optional writable control storage. The control store consists of one 8K-word by 64-bit module for the central processor function and a second 8K-word by 64-bit module for the disk controller ▶

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▷ • Query language

• Business Programming Language (BPL)

The Transaction Management System will run on either a Formation 4000 system or an IBM 370 system.

COMPETITION

The Formation 4000 systems are being marketed as distributed data processing systems, stand-alone systems, and OEM systems. The Formation 4000 systems are designed to compete with IBM System 370 Models 115 through 138, and the IBM 4331. It also competes in performance with the IBM System/38, IBM 8100 System, Wang VS System, and Hewlett-Packard's 3000 Series. The first shipments of the Formation 4000 systems are planned for August 1980.□

▶ function. Both modules must be present for shared operation.

The standard ROM control store uses 8K ROM chips organized in an 8K by 64-bit configuration. In addition to the ROM storage there is 1K by 64 bits of WCS used for diagnostic and update purposes.

The optional writable control storage uses 4K by 1, MOS static rams (70 nanosecond access) organized in the 8K by 64-bit configuration.

INPUT/OUTPUT CONTROL

I/O CHANNELS: The F4000 system appears to have four IBM 370 Channels. Channel 0 is a Byte Multiplexer and Channels 1, 2, and 3 appear as Block Multiplexer Channels. These channels appear to the software as their IBM counterparts; however, there are no hardware channels in the F4000. The F4000 is therefore "program equivalent" not "plug-compatible". I/O is performed through intelligent integrated controllers that interface minicomputer peripherals to the system F-bus. The system's aggregate I/O data rate is that of the F-bus, 5 megabytes/second.

CONTROLLERS: All controllers for the F4000 are integrated and plug into the backplane of the F4000. The controllers (except the disk controller) are Z80-based and microcoded to appear to the software as the equivalent IBM controllers.

INTEGRATED DISK CONTROLLER—F4830: Utilizes the same electronics assemblies as the central processor and by the addition of increased control store can function as a shared disk controller/central processor. A maximum of two disk controllers per system are supported, each capable of supporting up to four 70-megabyte disk drives. The controller appears to the software as a 3830 attached to a Block Multiplexer channel supporting 3348-70 data modules. Rotational Position Sensing (RPS) is supported as a standard feature. Separate central processor and disk controller electronics are standard on the F4000-200 model. A separate disk controller can be added to the F4000-100 model via the expansion backplane.

INTEGRATED MAGNETIC TAPE CONTROLLER—F4803: The magnetic tape controller is integrated and plugs into the standard backplane. Each controller is Z80-based and contains the controlling and formatting electronics to interface up to four 72K-byte magnetic tape drives. The controller appears as an IBM 3803 controller attached to a Block Multiplexer channel supporting 3420 tape drives. The F4000 supports up to two F4803 magnetic tape controllers.

INTEGRATED UNIT RECORD PROCESSOR—F4821: The Unit Record Processor supports one line printer and/or one card reader and plugs into the standard system backplane. The F4000 supports up to two Unit Record Processors. The Unit Record Processor is Z80-based and contains the control and channel electronics so that the printer and card reader appear as a 3203 printer and 3504 card reader attached directly to integrated attachment features.

INTEGRATED LOCAL COMMUNICATIONS PROCESSOR—F4272: The integrated local communications processor (LCP) plugs into the standard system backplane. Each LCP supports 4 ports which can be used to directly attach Formation's F4277 terminals and/or F4203-1 printers. A maximum of eight LCP's is supported; 3 LCP's plug into the standard system backplane and 2 more can be plugged into the F4603 expansion backplane. Terminals appear to the system as local 3277's connected to a 3272 controller through a Byte Multiplexer Channel. Printers appear as 3203 printers connected through a Byte Multiplexer attached to Channel 0. Terminals and printers may be remotely located up to 3000 feet via RS-422 hard wire connections.

INPUT/OUTPUT UNITS

MASS STORAGE F4340 DISK DRIVE: The F4340 Disk Drive is a 70-megabyte "Winchester" disk drive. The heads and magnetic disk media are sealed and are nonremovable with a closed-loop air filtration system. The average head positioning time is 32 milliseconds and the data transfer rate is 1.2 million bytes/second. The disk appears to the system as an IBM 3340. The 4340 includes a cabinet that supports up to two drives. The F4340 may be mounted in the disk cabinet as a second drive or in the bottom of the F4420 tape cabinet. A total of eight F4340 disk drives are supported.

Each F4340 may be ordered with an optional "dual port" configuration. Only one port may be active for any system configuration; however, configurations may be changed automatically under the control of the system control processor each time the system is IPL'ed. The disk drives may be mounted up to 100 feet from the controller.

MAGNETIC TAPE DRIVE—F4420: The F4420 Magnetic Tape Drive is a 1600-bpi, 72K-bits-per-second drive with a tape speed of 45 inches per second. It is mounted in a separate tape cabinet.

Up to four F4420's may be connected to the Integrated Tape Controller (F4803). The drives are connected in a daisy chain configuration up to 20 feet from the controller.

The F4420 is a tension arm drive capable of handling 2400-foot reels; it employs 1600-bpi phase-encoded recording standards. The tape drive appears to the software as an IBM 3420 connected to a 3803 Controller.

There is space available in the bottom of the tape cabinet for mounting an F4340 disk drive to reduce the number of cabinets required for a system configuration.

TERMINALS—F4277: The F4277 CRT terminal is a 25-line by 80-character display that includes a keyboard as a standard feature. Twenty-four lines are available for the user and one line is dedicated for system status. Normal and high-intensity display modes are supported.

The F4277 terminal keyboard has a 10-key numeric pad and 12 Program Function keys in addition to a standard typewriter keyboard. ▶

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▶ The F4277 supports all IBM 3277-2 standard features and appears to the software as a 3277 connected to a 3274 controller. The F4277 may be hardwire connected to the Local Communication Processor or System Control Processor up to 3000 feet using an RS-422 included as a standard feature.

PRINTERS: Three printer models are available: the F4203-1 Character Printer, F4203-3 Line Printer, and F4203-6 Line Printer.

The F4203-1 Character Printer is a 132-column, 64-character, 180-character-per-second dot matrix printer. It has a tractor feed and supports both 6 and 10 characters-per-inch spacing. Paper widths of up to 15 inches and 6-part forms are supported.

The F4203-1 is intended to handle the printing requirements of distant CRT terminals or system print needs where relatively low print volume exists. The terminal emulates most of the features of an IBM 3203 line printer offering more compatibility than the usual 3286 or 3287 and appears to the software as a direct connected 3203. The F4203-1 may be hardwire connected to the Local Communication Processor or System Control Processor up to 3000 feet using an RS-422 interface included as a standard feature.

The F4203-3 and -6 line printers provide for 300- and 600-line-per-minute output, respectively. Both printers are the same except for their speed. The printers are band printers with standard 64-character sets capable of handling character spacing of 10 or 15 characters per inch, 6 or 8 lines per inch, paper widths of 3 to 16 inches, and up to 6-part forms. The printers emulate an IBM 3203 line printer and appear to the software as direct connected 3203's. The 4203-3 or -6 printers are connected to the Unit Record Processor via a 25-foot cable; an optional 100 foot cable is also available. A sound-absorbing acoustic cabinet is also available as an option to replace the standard printer stand.

SOFTWARE

Formation offers complete functional compatibility with IBM 360/370 software. Operating systems supported include DOS/VS, OS/VS1, or VM/370. These operating systems execute without modification on the F4000.

Programs written to run on an IBM System/370 using DOS/VS, OS/VS1, or VM/370 System Control programs and utilizing the available peripherals should run on the F4000 provided there is no time-dependent code.

The Formation Transaction Management System (TMS) extends the capabilities of VM/370. Formation has used IBM's VM/370 (release 5.0) and CMS as a base to build its own system level software. Seeking to address on-line data base-oriented transaction processing applications, Formation has created a set of software tools named the Transaction Management System (TMS). TMS is made up of a group of subsystems and monitors. The monitors execute in their own virtual machines and, like the nucleus of an operating system, are always present. The subsystems are software tools that can be invoked by the transaction programs at run time or can be used to define structures and screens ahead of the application execution.

A Business Programming Language (BPL) is a language subsystem that is used to do all application work under TMS. BPL is very similar to PL/1. Special syntax has been added to handle screens, the data base, and report generation. At present, the BPL runs the source code through a translator to create a PL/1 source program; then the PL/1 compiles the program. BPL programs are developed under CMS, and a predefined EXEC handles the subsequent processing. Formation plans to develop a BPL compiler in the future.

DATA BASE MANAGEMENT: Formation has defined its own data base structure and manager. The structure is defined by a Data Description Language (DDL).

DDL is a set of declarations created by CMS and processed by a DDL translator under CMS. The language allows for the definition of fields, groups of fields, records, and keys (primary and alternate); and relationships amongst fields belonging to different records in different files.

The structure allows for one parent-multiple children as well as one child-multiple parent kind of linkages. Multiple levels of parent-child relationships can exist. It is possible to retrieve a parent record based on a known child. The construction of the data base is a network model.

Retrieval is possible on a multitude of criteria, such as sequential, keyed, and relational (those based on complex relationships). The relational retrieval gives the data base a unique feature. Selection expressions involving non-keyed fields are also supported.

Security is definable to the field level. Retrievals and updates are possible by fields, thus providing data independence for applications programs.

Transaction logging is done by the DB manager to make recovery from a catastrophic failure as simple as possible (re-entry of on-line transactions should not be needed). Total back-up and restoration of data sets is also provided. Audit trails are maintained and are available for subsequent examination and reporting.

DATA BASE MONITOR: TMS manages all its stored, disk-based data as part of one data base. The entire data base is under control of a single process—the Data Base Monitor.

The monitor is resident in its own virtual machine. It receives requests from the application programs and manages all disk activity. The monitor interfaces with CP (Control Program—part of VM/370) to create and manipulate disk files. The access method used is VSAM. The monitor will reference the run-time tables created by the DDL translator. Security is checked at run time to the field level. The monitor prevents any inconsistencies that could be created by concurrent updates of the same record.

The monitor acts similarly to prevent situations generally known as the "deadly embrace" wherein programs "lock" one set of resources and wait on each other to release the other set.

This monitor and its virtual machine are always present in the TMS environment.

TERMINAL MONITOR: Since TMS is intended for an on-line environment, it is assumed that all interfaces to the external world are via terminals being used by the end user.

All terminals are managed by the Terminal Monitor. The terminal monitor displays menus, and the user selects additional menus or transaction screens. The screens provide an easy-to-use environment to enter data, inquiries, requests for reports, and other specific actions.

Corresponding to each transaction is an applications processing program. The terminal monitor provides a consistent interface between the user and the applications program. ▶

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Menus and screens are defined using the screen definition language of BPL. The translation then creates the tables that the terminal monitor and application programs need at run time.

A key feature of the terminal monitor is its security management. The user defines, using a separate utility program, a matrix of terminals, menus, and transactions. This enables the terminal monitor to bring up on a given terminal a particular menu screen, thus limiting that terminal to a specific set of transactions.

On the other hand, a terminal may be given the freedom to accept any user, and from then on the user's ID defines the scope of his activities.

Furthermore, all attempted security violations are logged and can be analyzed for further action.

The Terminal Monitor supports Formation's terminals, which have a number of pre-defined keys that can be very helpful to the inexperienced user. For example, the "HELP" key will cause the display of helpful text, the "TRANS" key enables the user to branch out in the middle of a data entry operation to execute an inquiry, and the "BROWSE" key enables the user to review prior screens and data.

There are eight such keys. Each key performs a helpful function and then returns the user to the point at which the key was first invoked.

APPLICATIONS MONITOR: Each application program runs under the supervision of the Applications Monitor. Each execution of an applications program causes a new virtual machine to be created with a copy of the monitor and the program.

The monitor manages the communications between the program and terminals and between the program and data base.

Since the terminal and data base management are defined in their own monitors, the interfaces that application programs have to meet are uniform and consistent, leaving the programmers free to concentrate on the application.

Automated Operator: In keeping with its philosophy of catering to non-DP personnel, an automated operator is planned that will perform routine functions such as IPL upon power-on. This should eliminate the need for full-time operators.

PLANNED ENHANCEMENTS: Formation has planned enhancements to TMS that are expected to be introduced in the near future. The more significant ones are discussed below.

Query: An interactive report generating language is planned that will make it easy for users to obtain ad-hoc reports. The commands for a specific report could be stored in procedures that could be invoked with a single command. Query will not bypass any of the security features of TMS. Query will work directly with the data base rather than with a massive data load that needs frequent refreshing.

What-If: It will be possible for users to obtain a copy of the data base for the sole purpose of playing "what-if" games. If a particular interaction is satisfactory to the user, the actual data base can then be updated.

Multilingual: Formation plans on providing multilingual support for TMS. Starting out with EPL, the support will be expanded to COBOL, BAL, etc.

PRICING

MAINTENANCE: The normal maintenance period is 8 a.m. through 5 p.m., Monday through Friday, excluding nationally recognized holidays. An extended maintenance period plan is available.

EXTENDED MAINTENANCE PERIOD CHARGES

	8 Hrs.	12 Hrs.	16 Hrs.	20 Hrs.	24 Hrs.
Mon-Fri (excluding national holidays)	BMMC*	30%	35%	40%	45%
All Saturdays in month	10%	12%	14%	16%	18%
All Sundays and holidays in month	10%	12%	14%	16%	18%

*BMMC—Basic Monthly Maintenance Charge.

The Formation maintenance plan provides for up to two hours of on-site work; outside periods of coverage are at a fixed rate. Work beyond two hours will be billed at the following rates:

HOURLY RATES

Monday-Friday during normal maintenance period, except holidays	$60.00 per Hour
Monday-Saturday outside normal maintenance period, except holidays	$70.00 per Hour
Sundays and holidays	$80.00 per Hour■

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EQUIPMENT PRICES

PACKAGED SYSTEMS Model no.	Description	Purchase Price	Basic Monthly Maintenance Charge
F/4000-100	CPU with 256K bytes of memory, shared disk controller, System Control Processor with floppy disk & 300-bps modem mounted in a single cabinet with a 26-slot backplane	$42,500	$185
F/4000-200	CPU with 256K bytes of memory, separate disk controller, System Control Processor with floppy disk & 300-bps modem mounted in a single cabinet with both a 26-slot and 8-slot backplane	54,500	215
F/4000-300	2 CPU/Shared Disk Controllers with 512K bytes of memory for each CPU, one System Control Processor with floppy disk and 300-bps modem mounted in 2 adjacent cabinets	88,000	405

PROCESSOR OPTIONS

F/4100	Central Processor	12,000	40
F/4103	System Control Processor	6,500	50

ADD-ON MEMORY

F/4502-1	256K-byte Memory Modules	5,000	35

MASS STORAGE

F/4830	Integrated Disk Controller	15,000	50
F/4348	70-megabyte Disk Drive	13,000	80
F/4540	1-megabyte Floppy Disk Drive	1,500	35

MAGNETIC TAPE UNITS

F/4803	Integrated Magnetic Tape Controller	7,500	40
F/4420	72K-byte Magnetic Tape Drive	9,000	68

PRINTERS AND CARD READER

F/4516	Unit Record Processor	2,500	12
F/4203-1	180-cps Character Printer	3,400	58
F/4203-3	300-lpm Line Printer	9,000	185
F/4203-6	600-lpm Line Printer	12,000	215
F/4504	300-cpm Card Reader	6,000	58

TERMINALS

F/4503	Local Communications Processor	2,500	12
F/4277	CRT Terminal with Keyboard	2,400	25

SOFTWARE PRICES

Transaction Management System	12,000