

Concurrent Computer Corporation Supermini Systems

MANAGEMENT SUMMARY

UPDATE: A number of significant changes have taken place since we last updated our report. For starters, the Concurrent Computer Corporation was formed by Perkin-Elmer to assume the activities and assets of Perkin-Elmer's Data Systems Group. Concurrent has also made some major changes to its Series 3200 product line; the product line has been expanded to include five new processors: the 3203, 3230XP, 3230MPS, 3260MPS, and 3280MPS. In addition, Concurrent has also introduced the Xelos Family (XF) Unix-based systems. Also announced as part of the XF product line was the 3200-CP, an intelligent front-end processor.

According to Perkin-Elmer, Concurrent Computer Corporation was formed to provide a clearer path for future growth in the computer field. Concurrent assumes the activities and assets of Perkin-Elmer's Data Systems Group. Initially, Perkin-Elmer will own approximately 99 percent of Concurrent Computer; Concurrent's management owns the remaining one percent.

Quite a number of changes have occurred within Concurrent's Series 3200 superminicomputer product line. New systems announced for the product line include the 3203, 3230XP, 3230MPS, 3260MPS, and 3280MPS. ➤

Concurrent Computer Corporation, formerly Perkin-Elmer Corporation Data Systems Group, provides two major product lines: the Series 3200 and the Xelos Family (XF) systems. The Series 3200 parallel processing systems are designed for the engineering/scientific marketplace. The XF systems, designed for the commercial market, are Unix-based systems which range from a single-user desktop supermicro to a multiuser supermini parallel processing system. (Only the XF supermini systems will be discussed in this report.)

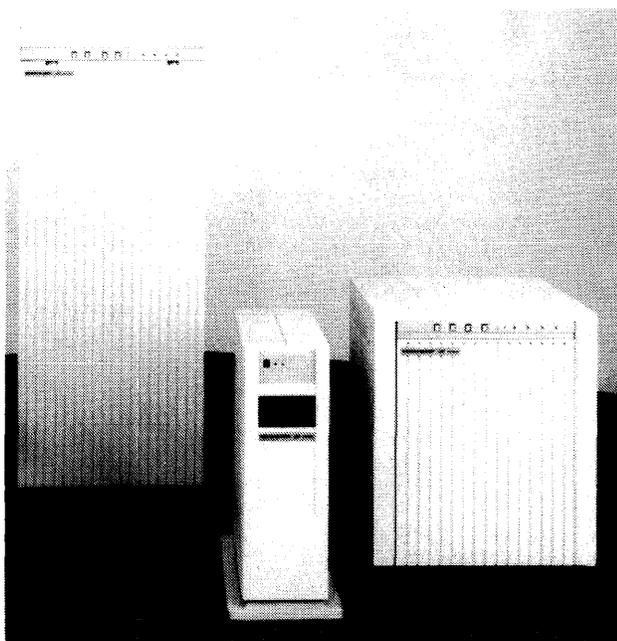
MODELS: 3203, 3205, 3210, 3210/A (OEM only), 3230XP, 3230MPS, 3250XP, 3260MPS, 3280MPS, XF/400, XF/600, and XF/610.

MEMORY: 512KB to 16MB.

DISK CAPACITY: 51MB to 576GB.

WORKSTATIONS: Up to 512.

PRICE: Processor prices range from \$12,950 to \$415,000.



The XF/610, XF/400, and XF/600 superminis (shown left to right in the photo) make their debut as members of Concurrent's new Xelos Family (XF). The Xelos Family systems are based on modified Series 3200 processors and run AT&T's Unix System V, Release 2. The XF products support up to 16MB of memory, up to 2.4GB of disk storage, and a maximum of 64 communications ports.

CHARACTERISTICS

MANUFACTURER: Concurrent Computer Corporation, 2 Crescent Place, Oceanport, New Jersey 07757. Telephone (201) 870-4500.

CANADIAN ADDRESS: Concurrent Computer Corporation, 6486 Viscount Road, Mississauga, Ontario Canada L4V 1H3. Telephone (416) 677-8990.

DATA FORMATS

BASIC FORMAT: 32-bit word.

FIXED-POINT OPERANDS: 16-bit halfwords, 32-bit fullwords, and 64-bit doublewords. In each format, the zero bit is the sign bit, and the remaining 15, 31, or 63 bits represent the magnitude. Each group of four bits represents one hexadecimal digit.

FLOATING-POINT OPERANDS: 32-bit fullwords (single-precision operands) or 64-bit doublewords (double-precision operands). A floating-point number includes a single-bit sign (zero bit), a 7-bit exponent (bits 1-7) in excess-64 notation, and a fraction field consisting of six hexadecimal digits for single-precision operands or 14 hexadecimal digits for double-precision operands.

INSTRUCTIONS: Instructions can be 16, 32, 48, 64, 80, or 96 bits in length, depending upon instruction type. There are eight instruction formats, seven of which have an 8-bit operation code and a 4-bit general register operand indicator. The eighth format is essentially a pair of back-to-back instructions which can address two strings of data in memory and perform memory-to-memory operations.

The eight formats are Register-to-Register (RR), Short Format (SF), Register-and-Immediate-Storage, and three Register-and-Indexed-Storage instructions, including RX1, ➤

Concurrent Computer Corporation Supermini Systems

CHART A. SYSTEM COMPARISON

MODEL	3203	3205	3210	3230XP	3230MPS
SYSTEM CHARACTERISTICS					
Date of introduction	February 1985	May 1983	September 1981	August 1985	August 1985
Date of first delivery	May 1985	December 1983	September 1981	October 1985	October 1985
Operating system	OS/32, Xelos				
Upgradable from	Not applicable	3203	3205	Any 3200 system	3230XP
Upgradable to	Any 3200 system				
MIPS	0.4	0.4	0.6	1.0	1.9 to 5.0
Relative performance*	0.7	0.7	1.0	2.0	3.8 to 12.0
MEMORY					
Minimum capacity, bytes	512K	1M	1M	1M	2M
Maximum capacity, bytes	4M	4M	16M	16M	16M
Type	MOS	MOS	MOS	MOS	MOS
Cache memory	None	None	None	4KB	4KB + 4KB per APU/IOP
Cycle time, nanoseconds	400	400	500	500	500
Bytes fetched per cycle	4	4	4	4	4
INPUT/OUTPUT CONTROL					
Number of channels	1	1	4	16	16
High-speed buses	1	1	1	1	1
Low-speed buses	1	1	1	1	1
MINIMUM DISK STORAGE					
	51MB	51MB	51MB	51MB	51MB
MAXIMUM DISK STORAGE					
	170MB	1.2GB	72GB	144GB	288GB
NUMBER OF WORKSTATIONS					
	16	16	64	128	128
COMMUNICATIONS PROTOCOLS					
	SDLC, HDLC, ADCCP, BSC, SNA, X.25, X.29, Ethernet	SDLC, HDLC, ADCCP, BSC, SNA, X.25, X.29, Ethernet	SDLC, HDLC, ADCCP, BSC, SNA, X.25, X.29, Ethernet	SDLC, HDLC, ADCCP, BSC, SNA, X.25, X.29, Ethernet	SDLC, HDLC, ADCCP, BSC, SNA, X.25, X.29, Ethernet

*Represents single precision Whetstone performance running Fortran VII Z

➤ The entry-level 3203, based on the older 3205 processor, is designed for the multiuser environment in commercial, technical, and industrial applications. The basic 3203 comprises 512KB of memory, eight communications ports provided by the Multiperipheral Controller (MPC), a parallel printer port also provided by the MPC, a 5¼-inch Winchester disk with either a 51MB or an 85MB capacity, a 60MB streaming cartridge tape drive for backup, and a single, desk-high cabinet and power supply/fan package. Options include eight additional communications ports (for a total of 16), on-board memory expansion to 4MB, an additional 51MB or 85MB disk (for a maximum of 170MB), an Ethernet Data Link Controller (EDLC), and a Universal Logic Interface (ULI).

The 3230XP, a mid-range uniprocessor, is based on a multibank memory system with a Shared Global Memory Bus. The 3230XP supports from 1MB to 16MB of main memory, from 51MB to 144GB of disk storage, and up to 128 workstations. The 3230XP also supports up to two Direct Memory Access (DMA) channels.

The 3230XP, which acts as the 3230MPS host and is field-upgradable to the 3230MPS, includes a 4KB cache memory, 32-bit Writable Control Store, power fail/auto restart, and an MPC board. The MPC has an 8KB Loader Storage Unit (LSU), universal clock with watchdog timer, parallel printer interface, eight data communications ports (async or sync), and a high-speed data handler.

The 3230MPS Multiprocessor System is a high-performance, tightly-coupled system designed to provide transparent parallel processing. (A parallel processor permits single instructions to act on groups of data simultaneously or applies multiple processors to the execution of a single program.) The 3230MPS is based on the 3230XP Processor and supports up to five attached processors dedicated to ➤

➤ **RX2, and RX3; the eighth format, Register and Indexed Storage/Register and Indexed Storage (RXX), appears to be a pair of adjacent RX instructions but is actually only one instruction.**

The 3280 CPU utilizes a four-stage instruction pipeline designed to increase performance by overlapping the execution of four consecutive instructions. Model 3280 performs the following four steps to execute a typical instruction: Instruction Fetch, Address Calculation, Operand Fetch, and Execution. The 3280 is the only Series 3200 system to allow all four stages to operate simultaneously on four separate instructions. Instructions are passed from stage to stage through the pipeline.

The Floating-Point Processor (FPP) on 3200 Series and Xelos Family (XF) computers provides 48 single- and double-precision floating-point instructions. It also contains eight 32-bit single-precision registers and eight 64-bit double-precision registers. Twelve instructions are available to transfer data between the single- and double-precision registers for mixed-mode calculations. High floating-point accuracy is achieved via R-Star rounding. This rounding technique provides more accurate results over extended calculations as opposed to conventional rounding.

INTERNAL CODE: ASCII is standard. With the auto-driver channel (a standard feature), facilities are provided for automatic character translation and for the computation of cyclic redundancy checksums and longitudinal redundancy checksums for communications applications.

MAIN STORAGE

TYPE: MOS.

CYCLE TIME: 400 nanoseconds for the 3203, 3205, XF/600, and XF/610; 500 nanoseconds for all other models.

CAPACITY: Memory capacity ranges from 512KB to 16MB. See Chart A for memory sizes of specific models.

The Shared Memory System allows 3210, 3230XP, 3230MPS, 3250XP, and 3280 users to build multiprocessor systems for applications requiring high availability or high ➤

Concurrent Computer Corporation Supermini Systems

CHART A. SYSTEM COMPARISON (Continued)

MODEL	3250XP	3260XP	3260MPS	3280XP	3280MPS
SYSTEM CHARACTERISTICS					
Date of introduction	July 1983	February 1985	February 1985	September 1985	September 1985
Date of first delivery	July 1983	February 1985	February 1985	November 1985	November 1985
Operating system	OS/32, Xelos				
Upgradable from	Any 3200 system	Any 3200 system	3260XP	Any 3200 system	3280XP
Upgradable to	Any 3200 system	Any 3200 system	Any 3200 system	3280MPS	Not applicable
MIPS	1.3	1.3	1.9 to 7.2	4	4 to 22
Relative performance*	2.0	3.0	5.0 to 21.0	12.0	12.0 to 65.0
MEMORY					
Minimum capacity, bytes	2M	2M	2M	2M	2M
Maximum capacity, bytes	16M	16M	16M	16M	16M
Type	MOS	MOS	MOS	MOS	MOS
Cache memory	8KB	8KB	8KB + 4KB per APU/IOP	16KB	16KB + 16KB per APU/IOP
Cycle time, nanoseconds	500	500	500	500	500
Bytes fetched per cycle	16	16	16	16	16
INPUT/OUTPUT CONTROL					
Number of channels	32	32	32	32	32
High-speed buses	4	4	4	4	4
Low-speed buses	1	1	1	1	1
MINIMUM DISK STORAGE					
	51MB	51MB	51MB	51MB	51MB
MAXIMUM DISK STORAGE					
	576GB	576GB	576GB	576GB	576GB
NUMBER OF WORKSTATIONS					
	256	256	256	512	512
COMMUNICATIONS PROTOCOLS					
	SDLC, HDLC, ADCCP, BSC, SNA, X.25, X.29, Ethernet	SDLC, HDLC, ADCCP, BSC, SNA, X.25, X.29, Ethernet	SDLC, HDLC, ADCCP, BSC, SNA, X.25, X.29, Ethernet	SDLC, HDLC, ADCCP, BSC, SNA, X.25, X.29, Ethernet	SDLC, HDLC, ADCCP, BSC, SNA, X.25, X.29, Ethernet

CHART A. SYSTEM COMPARISON (Continued)

MODEL	XF/400	XF/600	XF/610
SYSTEM CHARACTERISTICS			
Date of introduction	September 1985	September 1985	September 1985
Date of first delivery	September 1985	September 1985	September 1985
Operating system	Xelos	Xelos	Xelos
Upgradable from	XF/300	XF/400	XF/600
Upgradable to	XF/600	XF/610	—
MIPS	—	—	—
Relative performance*	—	—	—
MEMORY			
Minimum capacity, bytes	2M	2M	4M
Maximum capacity, bytes	4M	16M	16M
Type	MOS	MOS	MOS
Cache memory	None	1KB	1KB
Cycle time, nanoseconds	400	500	500
Bytes fetched per cycle	—	—	—
INPUT/OUTPUT CONTROL			
Number of channels	—	—	—
High-speed buses	—	—	—
Low-speed buses	—	—	—
MINIMUM DISK STORAGE			
	51MB	51MB	51MB
MAXIMUM DISK STORAGE			
	170MB	2.4GB	2.4GB
NUMBER OF WORKSTATIONS			
	8	24	32
COMMUNICATIONS PROTOCOLS			
	2780/3780, 3270, X.25, Ethernet, SNA, HASP	2780/3780, 3270, X.25, Ethernet, SNA, HASP	2780/3780, 3270, X.25, Ethernet, SNA, HASP

*Represents single precision Whetstone performance running Fortran VII Z.

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

➤ either I/O or computation. The processors can be any combination of Auxiliary Processing Units (APUs), Input/Output Processors (IOPs), and dual functionality units (APU/IOPs), which have the features of both the APU and IOP but take on the role of one or the other according to the operating system environment.

The tightly coupled architecture of the 3230MPS allows each processor equal access to all memory for sharing data and programs. The design of the 3230MPS is asymmetric, with each processor tailored to the function it performs. ➤

➤ system throughput. Designed around a central Shared Memory bus, the Shared Memory System can comprise one to four shared memory banks. Up to 16 ports are available for interfacing processors and Direct Memory Access (DMA) buses into the Shared Memory bus. Each processor in a multiprocessor configuration can share common memory space while retaining private access to its local memory for unique instructions and data. Depending upon its maximum memory capacity, each Series 3200 processor has direct access to as many as 16 million bytes of shared and local memory. The Shared Memory System can achieve a maximum throughput of 64M bytes per second in a fully expanded configuration using four-way interleaved banks of shared memory. ➤

Concurrent Computer Corporation Supermini Systems

CHART B. MASS STORAGE

MODEL	M60-100 MSM 300	M60-102 MSM 80	M60-020 CDD-50	M46-770 CDD-32	M46-772 CDD-64
Type	Removable Pack	Removable Pack	Cartridge	Cartridge	Cartridge
Controller model	IDC	IDC	IDC	IDC	IDC
Drives per subsystem/controller	4	4	4	4	4
Formatted capacity per drive, megabytes	256	67	40	27	54
Number of usable surfaces	19	5	4	2	4
Number of sectors or tracks per surface	823 tracks/surface	823 tracks/surface	624 tracks/surface	823 tracks/surface	823 tracks/surface
Bytes per sector or track	16,384/track	16,384/track	15,872/track	16,384/track	16,384/track
Average seek time	30 ms	30 ms	35 ms	30 ms	30 ms
Average rotational/relay time	8.3 ms	8.3 ms	8.55 ms	8.3 ms	8.3 ms
Average access time	38.3 ms	38.3 ms	43.55 ms	38.3 ms	38.3 ms
Data transfer rate	1.2MB/sec.	1.2MB/sec.	1.2MB/sec.	1.2MB/sec.	1.2MB/sec.
Supported by system models	All	All	All	All	All

▷ The 3230MPS supports from 2MB to 16MB of main memory, 4KB of cache memory plus 4KB of cache memory per APU/IOP, from 51MB to 288GB of disk storage, and up to 128 workstations.

Concurrent's 3260MPS Multiprocessor System is also a tightly coupled multiprocessor computer designed to provide transparent parallel processing. The 3260MPS is based on the 3250XP Processor and supports up to nine attached processors focused on I/O or computation. Like the 3230MPS, the 3260MPS supports any combination of APUs, IOPs, and APU/IOPs. Cross-coupling allows the 3260MPS to share memory with other 3260 or 3250XP computers.

The 3260MPS supports from 2MB to 16MB of main memory, 8KB of cache memory with an additional 4KB per APU/IOP, from 51MB to 576GB of disk storage, and up to 256 workstations.

With the introduction of the 3280MPS, Concurrent has publicly acknowledged its long-term commitment to a parallel processing architecture. The 3280MPS is a multiprocessor system which reportedly delivers almost six times the performance of Digital Equipment Corporation's VAX 8600 by providing from 4 to 22 MIPS.

Code-named the "Cruncher," this new top-of-the-line Model in the 3200 Series is Concurrent's highest performance superminicomputer system to date. The tightly coupled and asymmetric 3280MPS is based on a single 3280 CPU and can support five additional attached processors designed for I/O or computation. The 3280MPS can also support any combination of attached IOPs, APUs or APU/IOPs, depending on the specific application requirements. Each processor has equal access to all memory for sharing data and programs, reportedly eliminating the need to transfer data from one processor along special high-speed communications links, as in loosely coupled or clustered designs.

Designed for engineering/scientific functions, general-purpose computing, realtime transaction data processing, data communications, and software development, the 3280 processor performs at 4 MIPS, while a fully configured six-processor system reportedly performs at 22 MIPS. In addition, a Whetstone benchmark test performed using Concurrent's Fortran optimizing compiler showed a per-▷

▶ A single bank of Shared Memory can comprise between 512KB and 16MB of MOS storage. A system can be constructed to contain one, two, or four banks. (The architecture of Series 3200 systems requires that no processor physically address more than 16M bytes of combined local and Shared Memory.)

All Shared Memory banks and all available Shared Memory ports interconnect through the Shared Memory bus. This bus consists of two unidirectional, asynchronous, 32-bit buses. One bus is used for transferring addresses and writing memory data; the other is used exclusively for reading memory data. All read/write operations can be performed on as many as four full-words at a time. The Shared Memory bus resolves all contention among Shared Memory ports.

The Shared Memory System is housed in one cabinet, which can be physically located up to 30 feet from the processors by interconnecting cables. A Shared Memory System consists of three major components:

- One or more CPU-Shared Memory links.
- One or more DMA-Shared Memory links.
- One to four Shared Memory banks.

The processor-Shared Memory link on each processor provides a direct path from the CPU to shared memory. The 3250XP and 3260MPS processor-Shared Memory link consists of two components: Shared Cache (SCACHE) and Shared Memory Interface (SMI). SCACHE is an 8KB, four-way set associative cache dedicated for use by the CPU in accessing Shared Memory. This high-speed local storage is identical in architecture to cache used on the CPU for accessing main or local memory. SCACHE is equipped with invalidation logic to ensure the accuracy of the information it contains. SMI provides the interface to the Shared Memory bus for the CPU-Shared Memory link. The SMI is contained in the Series 3200 Shared Memory cabinet, and is connected to the processor and the SCACHE through a 12.2-meter (40-foot) cable. Each link of a model 3250XP or 3200MPS CPU to the Series 3200 Shared Memory System through SCACHE and SMI requires one Shared Memory port.

The 3230XP and 3230MPS Shared Memory link comprises a 3230 Shared Bank Controller (SBC) and a Shared Memory Bus Interface (SMBI). The SBC interface contains 4K bytes of direct-mapped cache dedicated for use by the CPU in accessing Shared Memory. The SMBI provides the interface to the Shared Memory bus for the 3230 Shared Memory link. The SMBI is located in the Shared Memory cabinet, and is connected to the processor and the SBC through a 12.2-meter cable.

The 3210 Shared Memory link is composed of an SBC that provides the interface from the CPU to the Shared Memory System and an SMBI that provides the interface to the ▶

Concurrent Computer Corporation Supermini Systems

CHART B. MASS STORAGE (Continued)

MODEL	M46-774 CDD-96	M60-120 MSM 300F	M60-124 MSM 600F	M60-128 MSM 1200F	M46-691 MSM 80F
Type	Cartridge	Winchester	Winchester	Winchester	Winchester
Controller model	IDC	IDC	IDC	IDC	IDC
Drives per subsystem/controller	4	4	2	1	4
Formatted capacity per drive, megabytes	80.9	268	536	1GB	67
Number of usable surfaces	6	8	16	32	5
Number of sectors or tracks per surface	823 tracks/surface	1024 tracks/surface	1024 tracks/surface	1024 tracks/surface	823 tracks/surface
Bytes per sector or track	16,384/track	16,384/track	16,384/track	16,384/track	16,384/track
Average seek time	30 ms	30 ms	30 ms	30 ms	30 ms
Average rotational/relay time	8.3 ms	8.3 ms	8.3 ms	8.3 ms	8.3 ms
Average access time	38.3 ms	38.3 ms	38.3 ms	38.3 ms	38.3 ms
Data transfer rate	1.2MB/sec.	1.2MB/sec.	1.2MB/sec.	1.2MB/sec.	1.2MB/sec.
Supported by system models	All	All	All	All	All

CHART B. MASS STORAGE (Continued)

MODEL	M60-180 MSM 825F	M60-315 SCSI-51D	M60-317 SCSI-85D
Type	Winchester	Winchester	Winchester
Controller model	IDC	ST 506	ST 506
Drives per subsystem/controller	4	2	2
Formatted capacity per drive, megabytes	646	40.33	66.79
Number of usable surfaces	16	5	7
Number of sectors or tracks per surface	1024 tracks	987 tracks	1166 tracks
Bytes per sector or track	39,424/track	8,192/track	8,192/track
Average seek time	16 ms	30 ms	30 ms
Average rotational/relay time	13.9 ms	8.3 ms	8.3 ms
Average access time	29.9 ms	38.33 ms	38.33 ms
Data transfer rate	1.815MB/sec.	625KB/sec.	625KB/sec.
Supported by system models	All	All	All

▷ performance increase of up to 65 million Whetstone instructions per second.

The optional multifunction attached processors have all the necessary features for each function—that is, CPU, APU, or IOP—but take on a designated role according to the direction of the OS/32 realtime, multitasking operating system and Control/Diagnostic System environment.

The parallel processing architecture of the 3280MPS includes a four-stage instruction pipeline said to increase performance by overlapping the execution of four consecutive instructions; two 8KB cache memories with two-way associative organization; an integral 64-bit floating-point processor; and an arithmetic/logic unit and 64-bit parallel multiplier array. Minimum memory capacity for the 3280MPS is 2MB, expandable to 16MB. Also included are a high-performance synchronous system bus (S-Bus); advanced Shottkey logic; and the Control/Diagnostic System (CDS), which allows users to control all functions through the system console for any 3280MPS configuration. According to Concurrent, CDS is also designed to increase system reliability by constantly monitoring processor, memory, power supplies, cabinet temperature and other functions, in addition to simplifying system configuration.

Although the 3280MPS marks the beginning of a new processor architecture for the Series 3200 family, it is fully I/O- and software-compatible with existing members of the product line. However, none of the systems in the 3200 product line can be upgraded to the 3280MPS.

Also announced was a new family of Unix-based systems, the Xelos Family (XF), which provides a selection of supermicro- and superminicomputer systems. The Xelos ▷

▶ Shared Memory bus. The 3210 Shared Memory link does not employ cache.

The DMA-Shared Memory link allows a 3250XP, 3260MPS, or 3280 DMA bus to be connected to the Shared Memory System. Each DMA bus (to a maximum of four per processor) requires a separate DMA-Shared Memory link. This link allows peripheral devices connected to the DMA bus to access either local memory or the interconnected Shared Memory.

The DMA-Shared Memory link consists of a Shared Direct Memory Access Interface (SDMAI) and a Shared Memory Access Interface (SMAI). The SDMAI interfaces to a single 3250XP DMA bus and provides peripheral devices on the bus with an access path to Shared Memory. The SMAI connects the SDMAI to the Shared Memory bus. The SMAI resides in the Series 3200 Shared Memory cabinet, and is connected to the SDMAI by a 12.2-meter (40-foot) cable.

Each DMA-Shared Memory link requires one port on the Shared Memory bus, and each DMA bus on a 3250XP or 3260MPS with Shared Memory access must have a separate DMA-Shared Memory link. Four Shared Memory ports are required to connect four DMA buses into a Shared Memory System.

A Series 3200 Shared Memory bank consists of a Shared Local Memory Controller (SLMC) and up to eight memory storage modules. An SLMC interfaces to a Shared Memory bus through which it interconnects to all other Shared Memory banks in the system and to all interfaces to processors and DMA buses. A minimum, single-bank Shared Memory configuration requires the following: one SLMC; one 512KB memory module; one Series 3200 Shared Memory cabinet (including cabinet, chassis, and power system); and appropriate CPU-Shared Memory links. A fully expanded 16MB, four-bank Shared Memory System includes the following components: four SLMCs; eight 2MB memory modules; a Series 3200 Shared Memory Cabinet; a Memory Expansion chassis for inclusion in the Shared Memory cabinet; and appropriate CPU-Shared Memory links. ▶

Concurrent Computer Corporation Supermini Systems

CHART C. WORKSTATIONS

MODEL	M60-240	M60-160
DISPLAY PARAMETERS		
Max. chars./screen	1,920	1,920
Buffer capacity	1KB	1.4KB
Screen size (lines x chars.)	24 x 80	24 x 80
Tilt/swivel screen	Standard	Standard
Symbol formation	7 x 10 dot matrix	7 x 9 dot matrix
Character phosphor	Green or amber	Green or amber
Total colors/no. simult. displayed	None	None
KEYBOARD PARAMETERS		
Style	Typewriter	Typewriter
Character/code set	128 ASCII	128 ASCII
Detachable	Yes	Yes
Program function keys	16	4
TERMINAL INTERFACE		
	RS-232	RS-232

➤ Family includes the following models: the XF/200, XF/210, and XF/300 supermicros; the XF/400 mid-range supermini; and the XF/600 and XF/610 superminis. This report will provide coverage on the XF/400, XF/600, and XF/610 systems only.

The XF/400, XF/600, and XF/610 are based on modified Series 3200 computers. The XF/400 is based on the 3203, the XF/600 on the 3210, and the XF/610 on the 3210 with a Direct Memory Access I/O Subsystem (DIOS). The XF systems include the Xelos operating system, which is based on AT&T's Unix System V, Release 2, with Berkley extensions.

The XF/400 supports from 2MB to 4MB of dynamic RAM memory. Eight communications ports are standard; eight more are optionally available. Also supported are a maximum of 134MB of disk storage and a 60MB streaming tape drive. The XF/400 is object code-compatible with XF/600 and XF/610 systems, and source code-compatible with all Xelos Family systems.

The XF/600 and XF/610 processors support up to 16MB of main memory, 1KB of direct-mapped cache memory, and up to 64 communications ports. Fixed and removable disk subsystems ranging from 51MB to 2.4GB are also supported. For enhanced system throughput, the XF/610 features an intelligent I/O handler for "blocked terminal output" applications, freeing the main processor to perform more computation and support more users.

Designed for the business or laboratory environment, the XF/600 can be configured in either a 30-inch or a 56-inch high cabinet; the XF/610 is configured in a 56-inch cabinet.

Also introduced as part of the Xelos Family product line was the 3200-CP communications processor, which combines parallel processing, networking capabilities, and Xelos functionality. The 3200-CP is an intelligent front-end processor that enables XF/600 and XF/610 systems to interface to SNA, bisync, X.25, and IEEE 802.3 (Ethernet) networking environments.

The Xelos Family systems support the C, Fortran 77, Assembler, RM/Cobol, and Unibol programming languages. Communications protocols supported include 2780/3780, 3270, X.25, HASP, Ethernet, and SNA.

➤ **CHECKING:** A modified 7-bit Hamming code is appended to each 32-bit word. All single-bit errors are corrected, and all double- and most multiple-bit errors are detected. Error detection and correction are standard on all models. An optional memory error logger identifies the memory module reporting a fault and indicates the location of the faulty memory chip.

STORAGE PROTECTION: Each task operates in a segmented logical address space of up to one megabyte. There are four types of program segments: Pure, Impure, Reentrant Library, and Task Common.

The segmentation of programs into Pure and Impure segments allows programs to be shared for efficient multiaccess or multithreading. The Pure segment of such a program contains the static, unchanging code of the program. The Impure segment contains the dynamic work space of the program plus any impure code, such as overlays. Regardless of the number of times such a program is required for concurrent use, only one copy of the Pure segment is loaded into memory by the operating system, while an Impure segment is loaded each time it is needed. The operating system ensures the integrity of a Pure segment by using the MAC (Memory Access Controller) access protection facility to allow read-only access to Pure segments.

Reentrant Library segments, also composed of pure code, contain commonly required reentrant subroutines, such as the Fortran Run-Time Library. Task Common segments are shareable data areas accessible to any number of tasks. Access to Task Common segments is achieved symbolically in Fortran or Assembler programs. The linkages are resolved by the Task Establisher, which is also used to request Read/Write or Read-Only access to Task Common. The relocation, protection, and MAC or MAT fault interrupt programmed into the MAC and the MAT can be enabled or disabled under program control.

Each task must contain one Impure segment and may contain a maximum of 16 segments in any combination of the following: one Pure segment, up to 15 Reentrant Library segments, and/or up to 15 Task Common segments. Each segment has a minimum size of 256M bytes and a maximum of one megabyte in increments of 256M bytes, limited only by the amount of memory available. The logical addresses in the user program are automatically translated and relocated into physical addresses by the Memory Address Translator (MAT) in all models, which also apply access protection according to the type of program segment being addressed.

RESERVED STORAGE: The 3200 and XF processors reserve approximately 2,300 bytes in low memory for the single-precision floating-point register save area, power fail save area pointer, various program status words (PSWs), bootstrap loader and device definition table, system pointers, the basic and expanded interrupt service pointers, and

Concurrent Computer Corporation Supermini Systems

CHART D. PRINTERS

MODEL	M46-300	M46-302	M46-304	M60-200
Type	Line	Line	Line	Line
Speed	300 lpm	300 lpm	300 lpm	300 lpm
Bidirectional printing	Not applicable	Not applicable	Not applicable	Not applicable
Paper size	3" to 16"	3" to 16"	3" to 16"	Up to 16" wide
Character formation	Band	Band	Band	Full
Horizontal character spacing (char./inch)	10	10	10	10/12
Vertical line spacing (char./inch)	6/8	6/8	6/8	6/8
Character set	64/96 USASCII	64/96 USASCII	64/96 USASCII	96 ASCII
Controller/Interface	8-bit parallel	8-bit parallel	8-bit parallel	RS-232-C
No. of printers per controller/interface	1	1	1	1
Printer dimensions, in. (h x w x d)	15 x 30 x 25	15 x 30 x 25	15 x 30 x 25	8.66 x 24.8 x 16.34
Graphics capability	No	No	No	No

CHART D. PRINTERS (Continued)

MODEL	M60-210	M60-250	M60-285
Type	Serial	Line	Matrix
Speed	25 cps	1200 lpm	150/200 cps
Bidirectional printing	Yes	Not applicable	Not applicable
Paper size	3.5" - 16.7" wide 3" - 17" long	3.5" - 18.75"	5" - 14.875" wide
Character formation	Full	Band	24x 9 overlapping dot matrix
Horizontal character spacing (char./inch)	10/12/15	10	10/12/16.8
Vertical line spacing (char./inch)	6/8	6/8	6/8
Character set	96 ASCII	64/96 USASCII	96 ASCII
Controller/Interface	RS-232-C	8-bit parallel	RS-232-C
No. of printers per controller/interface	1	1	1
Printer dimensions, in. (h x w x d)	5.12 x 21.66 x 12.99	49 x 35.5 x 38.5	9.1 x 21.6 x 12.4
Graphics capability	No	No	Yes
Comments			

➤ In addition to the new systems, Concurrent continues to market three other models in the Series 3200: the 3205, 3210, and 3250XP.

The Model 3205 processing unit is contained in an eight-slot chassis. The single-board 3205 processor features up to 1MB of memory and a floating point; a second board allows for maximum support of 4MB of memory. An MPC contains the most commonly used peripheral items, including clocks, a boot loader, eight asynchronous or synchronous communications lines, and a parallel line printer interface. The 3205 implements a two-bus structure; the Multiplexor bus interfaces medium-speed devices like printers, consoles, and card readers, while the Selector Channel bus supports secondary storage devices like disks and magnetic tapes. Up to 1.2GB of disk storage are available on the 3205, and up to 16 workstations can be attached.

The Model 3210 can address up to 16MB of main memory and support up to 64 users. An integrated dual cartridge and fixed-disk secondary storage system is standard with the 3210; total disk storage is expandable to 28GB. Options available for the 3210 include a floating-point processor providing 48 single- and double-precision floating-point instructions, and a custom DMA interface for up to 63 synchronous or asynchronous devices.

The Model 3250XP supports 256 workstations and 576GB of disk storage. The basic 3250XP is a single-processor system with 2MB of integral memory; memory can be

➤ supervisor call location counters. In addition, certain locations are reserved for use by the MAC/MAT. The basic interrupt service pointer table utilizes 512K bytes. The expanded interrupt service pointer tables employ 1,536 bytes.

Additionally, a System Q (system queue), a special circular list with an automatic pointer in memory locations 128 to 131, is built into the 3200 architecture. In the event of any change in the program status word, the System Q list location pointed to is checked for any new additions. A new entry becomes the new PSW, providing hardware CPU dispatching.

CACHE MEMORY: Refer to Chart A for specific cache memory sizes for the Series 3200 and Xelos Family systems.

CENTRAL PROCESSOR

GENERAL: All processors are Schottky TTL (Transistor/Transistor Logic), MSI and LSI (Medium Scale Integration/Large Scale Integration). The Models 3203, 3205, 3210, 3230XP, and 3250XP are one-board (3205), five-board (3210, 3230MPS, and 3280), eight-board (3250XP) processors, and nine-board (3260MPS) with hardware multiply/divide. These processors feature direct addressability of up to four million bytes of main memory on the 3203, 3205 and 3210, and 16 million bytes on the 3230, 3250XP, and 3260MPS. Information was not available for the 3280.

The XF/400, XF/600, and XF/610 are based on modified Series 3200 computers. The XF/400 is based on the 3203, the XF/600 on the 3210, and the XF/610 on the 3210 with the Direct Memory Access I/O Subsystem (DIOS).

The 3230MPS and 3250XP are tightly coupled asymmetrical multiprocessor systems that communicate through a

Concurrent Computer Corporation Supermini Systems

CHART E. MAGNETIC TAPE EQUIPMENT

MODEL	M46-760	M46-762	M46-750	M46-754
TYPE	Reel-to-Reel	Reel-to-Reel	Reel-to-Reel	Reel-to-Reel
FORMAT	9	9	9	9
Number of tracks				
Recording density, bits per inch	800	1600	800	800/1600
Recording mode	NRZI	PE	NRZI	NRZI/PE
CHARACTERISTICS				
Controller model	M46-767	M46-766	M46-758	M46-759
Drives per controller	4	4	4	4
Storage capacity, bytes	15M	23M	15M	15/23M
Tape speed, inches per second	45	45	75	75
Data transfer rate, units per second	36KB	72KB	60KB	60/120KB
Streaming technology	No	No	No	No
Start/stop mode; speed	45 ips	45 ips	75 ips	75 ips
Switch selectable	No	No	No	No

CHART E. MAGNETIC TAPE EQUIPMENT (Continued)

MODEL	M60-010	M60-314	M37-600	M60-040
TYPE	Reel-to-Reel	Streaming	Streaming	Reel-to-Reel
FORMAT	9	9	6	9
Number of tracks				
Recording density, bits per inch	800/1600/6250	8000	6400	1600
Recording mode		Serpentine	Serpentine	PE
CHARACTERISTICS				
Controller model	HPTD	Included	Included	Included
Drives per controller	4	1	1	2
Storage capacity, bytes	15/23/62M	60M	17.2M	Variable
Tape speed, inches per second	125	90	78	100
Data transfer rate, units per second	100/200/781	87KB	62.5KB	160KB
Streaming technology	No	Yes	Yes	Yes
Start/stop mode; speed	125 ips	NA	NA	NA
Switch selectable	No	No	No	No

▷ expanded to 16 megabytes. The 3250XP can be used as a standalone system and can be upgraded to a 3260MPS through the addition of APUs. (The upgrade is accomplished through the addition of a 3250XP Power-Pak with a single APU; the Power-Pak includes global memory interface, floating-point processor, Writable Control Store, two RTSMs (Real-Time Support Modules) which synchronize the operation of all processing units, an RTSM chassis, cables, power supply, and battery backup.) Additional APUs can be added as the user's needs dictate.

On the software side, Concurrent supports the OS/32 and the Xelos operating systems for Series 3200 systems. The Xelos Family systems support only the Xelos operating system. OS/32 is a realtime, multitasking, multiprogramming monitor. Features of OS/32 include 255 levels of task priority and virtual memory support.

As mentioned previously, the Xelos operating system is based on AT&T's Unix System V, Release 2, with several enhancements. Xelos has the same basic structure as System V; it consists of a central kernel responsible for system management, a shell that interprets user requests, and a library of utilities. Xelos provides a hierarchical file system, which provides users with the capability to create, maintain, access, and protect files. The Xelos operating system also supports Documenter's Workbench, a set of text processing tools; The Menu Maker, a program designed to create menus to simplify and customize the operation of Xelos-based application systems; and the Administrative

▶ single global memory system. The CPU manages system resources—scheduling of auxiliary processing units (APUs), memory management, input/output, and fault handling—while remaining available for user tasks. The APUs perform compute-intensive tasks; task scheduling is accomplished through microprogramming. An APU executes user program code simultaneously with the CPU and other APUs. The processing operations of all units on the 3200MPS are synchronized and coordinated through the Real-Time Support Module (RTSM). The RTSM serves as an interprocessor communications link, allowing for APU and task control, timing and performance monitoring of APU tasks, and programmable signal generation. The global memory system of the 3200MPS permits the CPU and APUs to directly access up to 16 megabytes of memory. The global memory system can be two-way or four-way interleaved.

The 3260MPS multiprocessor, tightly coupled system is based on the 3250XP processor and supports up to nine attached processors which can be dedicated to either I/O or computation. Any mix of APUs and Input Output Processors (IOSs) can be configured, depending on the specific application requirements.

The 3280MPS is Concurrent's highest performing 32-bit superminicomputer. Tightly coupled and asymmetric, the 3280MPS is based on a 3280 CPU and supports up to five attached processors dedicated to I/O or computation. The tightly coupled design of the 3280MPS gives each processor equal access to all memory so that data and programs can be shared. The asymmetric functionality allows each processor to perform a unique primary function; for example, the CPU controls the multiprocessing environment while APUs perform user computational tasks and IOPs handle physical I/O processing.

Concurrent Computer Corporation Supermini Systems

▷ Environment, a menu-driven package designed to ease the administration of a system running Xelos.

The Resilient System combines redundant Series 3200 supermini hardware with software designed to sense and recover from system failures. Implemented in a dual-processor configuration with switched peripherals, the Resilient System can be installed as a field upgrade to existing Series 3200 compilers. Any combination of Series 3200 systems running Concurrent's proprietary OS/32 operating system can be used in a resilient configuration; the only requisite is that each system be able to support the environment it will be called upon to recover.

The Unify relational database management system is offered for Series 3200 and Xelos Family systems under license from the Unify Corporation. Unify is designed to operate in a Unix environment, and provides the user with a number of features, including interactive data entry, ad hoc queries, batch and interactive database updates, and system builder tools.

Concurrent's Pennet software for network communications allows Series 3200 superminis to communicate with other Concurrent systems in geographically dispersed or locally clustered network configurations using private lines or packet switched networks. Pennet Plus provides all the packet switching and leased-line networking capabilities of Pennet, and also supports the Ethernet protocol for local area networking. Pennet Plus uses the IEEE 802.3 (Ethernet Version 2) standard for local connection between Series 3200 superminis.

Concurrent's Pengates communications software consists of five protocol emulation products that provide gateways from Concurrent Pennet Plus networks to SNA-based and IBM-compatible systems. The SNA/3270 Emulator allows interactive terminals, printers, or application programs on Series 3200 superminis to emulate the capabilities of IBM 3270 terminals. The SNA/RJE Emulator lets Series 3200 superminis emulate RJE workstations. The BSC/3270 Emulator provides the same facilities as the SNA/3270 Emulator over bisynchronous lines. The BSC/Hasp Emulator allows a Series 3200 computer to emulate the operation of an IBM multileaving Hasp RJE workstation. The 2780/3780 Emulator permits Concurrent superminis to function as IBM 2780 or 3780 remote job entry workstations.

COMPETITIVE POSITION

The Concurrent Series 3200 systems compete with a number of superminicomputers designed for the engineering/scientific marketplace. However, Concurrent has cited Digital Equipment Corporation as the chief competitor for all of its product offerings.

Concurrent Computer believes that parallel processing is the systems architecture of the future. According to Concurrent, parallel processing is the most cost-effective method of providing the most computing power in the shortest time span; parallel processing "crunches" data ▷

▶ **CONTROL STORAGE:** The 3200 Series and XF processors run under control of a 60-nanosecond (50 ns on the 3200MPS) bipolar ROM fixed control store of 2,048 32-bit words. The control store works with a 260-nanosecond microinstruction processor with a repertoire of 60 instructions. The microinstruction processor uses only 32-bit words, not half-words, bytes, or bits. Microcode in the 3200 CPU recognizes 257 operation codes: 253 standard instruction operation codes plus four that permit the user to employ the Writable Control Store. Forty-seven operation codes each are recognized, respectively, by control store on the CPU for use in the optional single- and double-precision floating-point hardware features.

The Writable Control Store (WCS) feature provides users with 2048 words of dynamically alterable high-speed control store memory (4K words on the 3280), organized as an extension to the 2048 words of fixed read-only control store. Each 32-bit word in writable or fixed control store represents one machine-level microinstruction. Four instructions support this feature: Enter Control Store (ECS), a nonprivileged instruction that can be located anywhere within a user-level routine to call a WCS routine; Branch to Control Store (BDCS), a privileged instruction to transfer processor control to WCS; Write Control Store (WDCS), a privileged instruction that transfers a data buffer from main memory to WCS; and Read Control Store (RDCS), a privileged instruction that transfers a data buffer from WCS to main memory.

The ECS instruction transfers control to one of 16 different locations in WCS to initiate one of 16 different microcoded functions. Control is returned to the fixed ROM upon completion of the function.

The Loader Storage Unit (LSU) automatically loads the operating system, OS/32, from a secondary storage device such as a disk or magnetic tape. This load operation can occur after a power fail sequence, or upon operator intervention for Initial Program Load (IPL). The Series 3200 bootstrap loader also performs additional processor tests before the operating system is loaded, further assuring the user of a fully operational system.

REGISTERS: The 3200 Series minicomputers have 128 32-bit general registers in eight sets of 16. Four dedicated sets (numbered 0, 1, 2, and 3) handle the four external interrupt levels. The remaining four sets (numbered 4, 5, 6, and 15) are allocated by the operating system as necessary. There are also eight optional single-precision floating-point registers, each 32 bits wide and identified by the even numbers zero through 14, and eight optional double-precision floating-point registers, each 64 bits wide and identified by the even numbers zero through 14. The single-precision and double-precision registers are separate. Floating-point operations must always specify even-numbered registers.

With the Memory Access Controller, 16 32-bit hardware segmentation registers are provided to allow segmentation, relocation, and memory protection of user programs and data.

ADDRESSING: Three addressing modes are available: direct, indexed, and relative. Depending on the format of the instruction, operand addresses can be indexed by one or two index registers or can directly address any part of main storage. Fifteen of the sixteen 32-bit registers in any of the general sets in use can be used as index registers. Instructions in the RX2 format automatically place the second operand relative to the program location counter. The RX3 format permits double-indexing to an absolute address up to the full memory capacity of a system.

Indirect addressing is not available. Memory is byte-addressable. ▶

Concurrent Computer Corporation Supermini Systems

▷ with uniprocessors working in unison, and delivers the highest MIP per-dollar ratio.

Concurrent firmly believes that their Series 3200 parallel processing systems provide an effective solution for their users by interconnecting multiple processors to execute different portions of the same overall task.

Other advantages of parallel processing are its ability to support the addition of processing hardware without reprogramming or other costly downtime or adjustment, and its inherent fault tolerance which prevents catastrophic failure through limited system degradation.

Concurrent clearly sees Digital Equipment Corporation's VAX 8600, which is not a parallel processing system, as the main competitor for the top-of-the-line 3280MPS, and regards the 8600 as a more expensive alternative. In addition, the company also views smaller parallel processing vendors such as Areté, Elxsi, and Sequent as competition. Statistics from International Data Corporation (IDC) show that Concurrent holds a leadership role in parallel processing, having shipped 60 percent of parallel processing systems shipped to date. Sequent claims 15 percent of the market, while Areté and Elxsi both claim 10 percent; "other" vendors claim a mere 5 percent of the market.

When comparing the 3280MPS to Digital's VAX 8600, we find that the VAX 8600 and Concurrent's 3280MPS each support up to 512 workstations. Main memory supported on the VAX 8600 is double that supported on the 3280MPS (32MB versus 16MB). However, the 3280MPS's support of 576GB of disk storage is far greater than the 8600's support of 164GB. MIPS ratings for the two systems range from 4.45 to 30 MIPS for the VAX 8600 and from 4 to 22 MIPS for a fully configured 3280MPS system. Concurrent claims that the 3280MPS performance expansion price per MIPS sets a performance edge over the VAX 8600. The Concurrent 3280MPS is priced at \$30,000 per MIPS, whereas Digital's 8600 VAX Cluster has a price tag of approximately \$85,000 per MIPS.

On the low end of the Series 3200 product line, Concurrent sees the 3203 as being most competitive with Digital Equipment Corporation's MicroVAX II. However, a comparison with the MicroVAX II proves that Digital's offering is much larger than the 3203. For instance, maximum memory support on the 3203 is 4MB; the MicroVAX II supports 9MB. Disk storage capacity supported is a maximum of 170MB on the 3203; the MicroVAX II surpasses that figure with its 1.8GB maximum capacity. In addition, the MicroVAX II supports more than twice the number of workstations (33 as compared to 16 on the 3203).

Other typical competition for the Series 3200 can be found from Data General's Eclipse MV/Family, Harris' H Series, and Prime's 50 Series.

Within the Unix arena, Concurrent sees the XF/400 competing against NCR's Tower XP and AT&T's 3B2300, although both competitive systems are considered super-micros. Competition for the XF/600 can be found from ▷

▶ **INTERRUPTS:** The 3200s have four separate priority lines with 1,024 levels. Each level is automatically vectored and has automatic device identification. The average interrupt response time is given by the vendor as 5.9 microseconds with a 2-microsecond latency. There is a 25-microsecond time-out on all microprocessor operations to the I/O system to insure against any failing I/O device's locking out the processor.

The four separate priority (external interrupt attention) lines automatically activate different general register stacks. All interrupts are through the multiplexor bus, even final device interrupts on the selector channels. The external interrupt attention lines feed into the dedicated register sets 0 to 3. These register sets are then utilized to determine which interrupt lines are enabled. The architecture of the 3200s could handle 15 attention lines to match the inherent ability of the architecture to handle 16 sets of general registers, but at present the user's general registers (4, 5, 6, and 15) have no strapable external interrupt attention line options available, and the second eight sets of registers are not implemented.

The OS/32 operating system employs what Concurrent calls "task-handled traps" to support interrupts. This amounts to a choice of whether an interrupt caused by a task-connected event will be processed by the task or by the operating system. For example, in a divide overflow the task handles the overflow rather than have the operating system "flush" the program for a simple data error. OS/32 places this trap and others at the user level.

OPERATING ENVIRONMENT: The processors and all memory can fit within a single upright cabinet that is 56 inches high and which can house two additional 7-inch chassis for I/O expansion. (The XF/400, XF/600, and 3203 are available with a 30-inch cabinet.) The CPU chassis of the 3205 is 7 inches high and 17 inches deep, with 8 slots; it can fit into a 19-inch EIA cabinet 30 inches high. The CPU chassis on other models is 14 inches high and 17 inches deep and has 16 slots.

The cabinets are cooled by forced air. Power requirements are 180V to 230VRMS (brownout protection), 47 to 63 Hz, 13 amp. The 3205 is available at 90 V to 132 VRMS, 58 to 62 Hz. An optional power subsystem is also available; it also requires 90 to 132 VRMS AC voltage and frequency of 47 to 63 Hz.

The processors require an operating environment of from 32 to 122 degrees Fahrenheit at 50 to 90 percent noncondensing humidity to operate; storage conditions can be more severe. The processor is subjected to vibration testing prior to shipment.

INPUT/OUTPUT CONTROL

Models 3203, 3205, 3210, and 3230 all have two communications buses. Models 3202, 3205, and XF/400 have one multiplexor bus and a Selector Channel bus. Models XF/600, XF/610, 3210 and 3230 models have a multiplexor bus and one Extended Direct Memory Access (EDMA) bus with seven channels. Models 3250XP and 3260MPS have a multiplexor bus and from one to four Direct Memory Access (DMA) buses.

The 3260MPS also supports a Global Memory Bus (GMB) which functions as the major communications port to memory by providing two independent 32-bit paths: read and write. The GMB supports quadword operations designed to increase the data bandwidth of the system. The 3280 supports the S-Bus, which is very similar to the 3260MPS's GMB.

The multiplexor buses (human/machine interface) service slow- to medium-speed devices such as printers, consoles, ▶

Concurrent Computer Corporation Supermini Systems

➤ AT&T's 3B5, Digital Equipment Corporation's VAX 11/750, and NCR's Tower 32. The XF/610 is aimed at Digital Equipment's VAX 11/780, AT&T's 3B5, and Pyramid Technology's 90X systems.

ADVANTAGES AND RESTRICTIONS

Concurrent Computer Corporation's product offerings range from supermicros to multiprocessing superminicomputers. Their compatibility, combined with Concurrent's commitment to supporting industry standards such as Unix, provides users with a distinct expansion path, while protecting their initial hardware and software investments.

With Xelos, an AT&T System V-compatible operating system, the 3200 Series and Xelos Family systems can utilize the increasing number of third-party packages currently available for use with System V. Concurrent is keeping good company, in that System V is the Unix version of choice for Burroughs, Data General, Harris, NCR, and, of course, AT&T. With the support of such major vendors, System V has a growing base of third-party vendor software.

One advantage Concurrent has given its Series 3200 systems is a measure of fault tolerance through the Resilient System. The benefits of a highly reliable system are obvious—the system is always available for use, the integrity of the data stored is assured, and the costs associated with downtime and repairs are greatly decreased. Concurrent is one of the first vendors of general-purpose systems to integrate fault tolerance into an existing product line. Many industry analysts believe that, within as few as ten years, providing some type of fault tolerance will be like providing an operating system—it will be viewed as an integral part of any system. In recognizing this trend, Concurrent is positioning itself to remain a presence in the minicomputer industry for some time to come.

To reinforce what was mentioned in the Competitive Position, Concurrent Computer believes that parallel processing is the systems architecture of the future. Concurrent fully intends to continue to support its proprietary OS/32 operating system and maintain its strong position within the scientific processing market. In fact, Concurrent has made a major thrust in the development of its parallel processing systems, firmly believing that this architecture will provide its OS/32 (and Xelos users) with the most computing power possible.

At first glance, there appears to be an overlap in the size of the systems in Concurrent's product line. Models 3203 and 3205 both support up to 4MB of memory. The 3210 and 3230XP each support a minimum of 1MB of main memory, with a maximum of 16MB supported. Likewise, Models 3230MPS, 3250XP, 3260MPS, and the 3280 all support a minimum of 2MB of main memory and a maximum of 16MB. Models 3203 and 3205 each support 16 workstations; Models 3230XP and 3230MPS both support 128 workstations; and the 3250XP and 3260MPS each support up to 256. There is also some overlapping in disk storage capacities; Models 3250XP, 3260MPS, and 3280 all sup- ➤

➤ and card readers, while the Selector Channel bus, the EDMA bus, and the DMA bus serve as connections for high-speed secondary storage devices, such as disks and tapes.

The multiplexor bus channel supports up to 1,023 devices, divided among four priority levels. The user can assign device priorities. Data transfers over the multiplexor bus are accomplished in two ways: a byte or a half-word is transferred between a multiplexor bus device and memory under control of an I/O instruction or multiplexed blocks of data are transferred between a multiplexor bus device and memory. The transfer of blocks of data is accomplished by the Auto Driver Channel, which is driven by the fixed control store. The channel performs automatic character translation and computes cyclic redundancy checksums (CRC) and longitudinal redundancy checksums (LRC) used in communications devices. Throughput on the multiplexor bus is between 334KB and 400KB per second.

The Selector Channel bus supports data transfers to and from memory. The selector channel is programmed using multiplexor bus commands. When the channel is activated, the processor is free to continue processing. The selector channel initiates and terminates data transfers. The selector channel can support five device controllers and transfers bytes or half-words to or from the memory. Selector channel controllers typically support four devices.

The selector channel transfers data to or from memory through a cycle-stealing operation. Once initiated, the selector channel functions in a completely autonomous fashion, with one controller or device actively transferring data at any one time. Upon termination of data block transfer, the selector channel interrupts the processor to signal the completion of activity. The processor then returns the selector channel to an idle mode. When idle, the Selector Channel bus is connected to the multiplexor bus and functions as a bus buffer.

The Selector Channel bus is integrated on the 3203, 3205, and XF/400; it may be added to other Series 3200 models.

The EDMA bus found on the 3210, XF/600, and XF/610 supports four high-speed ports to and from memory; the EDMA bus on the 3230 supports eight high-speed ports. Each port is controlled by a selector channel, which initiates and terminates data transfers. Each selector channel can support 16 device controllers. Each selector channel can transfer either individual 16-bit half-words or burst groups of two to fourteen half-words to or from memory. In burst mode, a selector channel can transfer 5.71 million bytes per second when writing to memory and eight million bytes per second when reading from memory. The selector channels are programmed using the multiplexor bus; once a channel has been activated, the processor is free. A special logic interface is available for implementing custom-designed interfaces.

Each DMA bus supports eight high-speed ports to and from memory (up to four DMA buses are available on the 3250). Each port is controlled by a selector channel that initiates, controls, and terminates data transfers. As in the other models, the selector channel is programmed through the multiplexor bus; once the channel is activated, the processor is free to continue processing. Each DMA bus has a burst transfer rate of 10M bytes per second.

The *Intelligent Disk Controller* (IDC) provides a high-performance interface between Concurrent's 32-bit superminis and its high-speed disk storage products. It can support and control up to four disk drives of different types and capacities. The disk types are transparent to the user. The IDC has been designed to operate through the selector channel on the Series 3200 and Xelos Family DMA, EDMA, and Selector Channel buses. The IDC transfers ➤

Concurrent Computer Corporation Supermini Systems

► port a maximum disk storage capacity of 576GB. This overlap can be explained, at least in part, by the company's commitment to total upgradability. That is to say, the overlapping systems form a smooth upward compatibility path from one system to another. While the move from one system to another may not increase memory, it will, in most cases, result in higher performance and greater disk capacity.

An important factor to consider is that none of the systems in the 3200 product line can presently be upgraded to the new 3280. However, although the 3280 marks the beginning of a new processor architecture for the Series 3200 family, it is fully I/O- and software-compatible with existing members of the product line.

USER REACTION

Responses to Datapro's 1985 Computer Users' Survey included returns from 24 users of the Concurrent Computer (Perkin-Elmer) Series 3200 systems. The Xelos Family systems had not been announced until after the survey had been conducted and are too new to conduct accurate user interviews. Therefore, the User Reaction concentrates on the Series 3200 systems. However, the survey does include some Series 3200 models that are no longer marketed. Of the users surveyed, 21 had purchased their systems, 2 rented or leased from the manufacturer, and 1 leased from a third party. The average length of installation for the systems was 9.8 months.

A variety of industries were represented in the survey; however, represented most often were the education (29 percent) and engineering/scientific (21 percent) industries. Principal applications included accounting/billing (38 percent); education/scheduling/administration, engineering/scientific, mathematics/statistics, and order processing/inventory, each cited by 29 percent of the respondents.

Total disk storage averaged between 50 megabytes and 1.2 gigabytes. The number of local workstations in use averaged between 6 and 15. In addition, 13 of the respondents used between 1 and 60 remote workstations.

Of the users surveyed, nine used a data base management system; only one other user planned to implement one. Four users employed integrated office automation functions and another three planned to integrate them. The programming languages used most often on the Series 3200 systems included Cobol (nine users) and Fortran (seven users). When asked if they had a disaster recovery plan, eleven users responded that they did and another three indicated that they planned to implement one. In addition, seven users indicated that they had established an information center at their site, and one other planned to implement one.

Most applications software programming was achieved by in-house personnel (21 users). Other methods of obtaining applications software were accomplished through an independent supplier (11 users), and contract programming ►

► data to the selector channel at up to 2.6M bytes per second. Data buffers on the IDC provide transparent management of the data flow between each disk drive and the processor bus. In addition, the IDC automatically provides error checking and correcting for data error bursts of up to 11 bits per sector.

The IDC also supports and controls all overlapped seeks. The IDC uses a microprocessor-based control system that provides on-board diagnostics which pretest the controller before the disk subsystem is activated. These diagnostics test most control functions, data paths, and ROM/RAM integrity.

CONFIGURATION RULES

GENERAL: The basic 3203 system includes 512KB of on-board main memory, eight communications ports provided by the Multi-Peripheral Controller (MPC), a parallel printer port, either a 51MB or 85MB 5¼-inch Winchester disk, and a 60MB ¼-inch streaming cartridge tape drive.

The basic 3205 Processor includes a Model 3205 CPU board, MPC, a system control panel, and an eight-slot CPU chassis. The CPU Board contains 1MB of memory, floating-point instruction capability, and a DMA port. The MPC includes an 8KB Loader Storage Unit, universal clock, a watchdog timer, a line printer interface, High Speed Data Handling capabilities, and eight data communications ports.

A Model 3205 System includes the basic 3205 Processor plus a CDD 50 Disk Subsystem (25MB fixed and 25MB removable cartridge storage media), power supply, and 30-inch cabinet. The 3205 is expandable to 4MB of memory. Battery backup is optional.

A 3210 base system configuration includes the 3210 CPU, 1MB of MOS memory with ECC, 32MB cartridge disk drive (16MB fixed/16MB removable), disk controller, memory management hardware, memory error logger, loader storage unit with boot loader, universal clock, Model 550B Video Display Unit (VDU) as a system console, two-line communications multiplexor, 3200 selector channel, power supply, three-inch high low-profile cabinet with AC distribution panel and integral controller, system console, and battery backup memory retention system.

The basic 3230XP includes the 3231XP Processor, a 56-inch cabinet housing the CPU and 8-slot I/O expansion chassis, 1MB of MOS memory with single-bit error correction and double-bit error detection, error logger and memory scrubber circuits, memory address translation circuits, system console terminal, power fail/auto restart, battery backup, 300 amp P5 power subsystem, MPC board with Loader Storage Unit, universal clock, parallel printer interface, and eight data communications ports (async or sync).

The 3230MPS is based on the 3230XP Processor and is available in four configurations. All four configurations include a 56-inch cabinet housing the CPU, power supplies, and four chassis (the CPU, Shared Memory, Local Memory Bus, and I/O); a 56-inch cabinet containing APUs or IOPs (depending on the configuration) and power supplies; 2MB or 4MB memory with single-bit error correction and double-bit error detection; memory scrubber and error logger circuits; Writable Control Stores; Floating-Point Processors; Direct Memory Access (DMA) channels; Loader Storage Unit (LSU), including bootstrap loader universal clock; battery backup; bus switch control panel for IOP configurations; and a system control panel.

The 3250XP is available in two models. The basic 3252XP Processor contains two banks of 2MB memory and has two DMA buses. The 3254XP Processor has 4MB of memory organized into four banks and four DMA buses. Both are ►

Concurrent Computer Corporation Supermini Systems

➤ (8 users). Only 7 users used packaged programs from Concurrent (Perkin-Elmer).

Concurrent Computer Series 3200 users rated their systems as shown in the table below.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	4	17	2	1	3.0
Reliability of system	15	8	1	0	3.6
Reliability of peripherals	8	11	4	1	3.0
Maintenance service:					
Responsiveness	7	13	1	0	3.3
Effectiveness	5	11	4	1	3.0
Technical support:					
Troubleshooting	3	11	6	1	2.8
Education	6	5	9	1	2.8
Documentation	0	11	10	1	2.4
Manufacturers software:					
Operating system	5	12	3	2	2.9
Compiler & assemblers	6	10	5	1	3.0
Application programs	0	9	7	2	2.4
Ease of programming	7	11	5	0	3.1
Ease of conversion	6	12	5	0	3.0
Overall satisfaction	5	14	3	1	3.0

*Weighted Average on a scale of 4.0 for Excellent.

For the most part, Concurrent users were generally pleased with their Series 3200 computers. Of the users surveyed, 21 said that their computers did what was expected and 21 would recommend the Concurrent systems to another user.

Users' plans for the forthcoming year included expansions to present hardware (13 users), the acquisition of additional software from the manufacturer (11 users), proprietary software from other suppliers (9 users), and expansions to data communications facilities (8 users).

To further qualify our findings in the survey, Datapro was able to conduct telephone interviews with three Concurrent users to obtain their opinions concerning their Series 3200 systems. The first user contacted was the DP manager for a retail firm located on the West Coast. This site utilized the Concurrent system for a variety of accounting, purchasing, and sales-related applications. Initially, the system delivered was too small to accommodate the processing requirements of this retail firm. However, the staff at Concurrent worked very closely with the company's DP staff to quickly resolve the problem. Once the problem was taken care of, it was smooth sailing for this DP department. To date, they have no major complaints, and are quite pleased with the Concurrent system. In fact, the firm plans to expand the system during the year.

The second user contacted was the office manager for a construction firm in the Southeast. This user was not happy with the Concurrent 3220 system the firm had installed. To begin with, the firm had trouble with the system since the time it had been delivered; the delivery was behind schedule. Secondly, the system was much too large for the company's accounting and payroll applications requirements. Thirdly, the staff had trouble training to use the system and the company had problems keeping up with vendor changes made to the hardware and software. The

➤ housed in 56-inch cabinets with power supplies, battery backup, System Control Panel, and I/O expansion chassis. The processor includes 8KB of four way set associative cache, Writable Control Store, Loader Storage Unit, universal clock, watchdog timer, and two data communications ports.

The 3260MPS is based on the 3250XP Processor and supports up to nine attached processors. All four basic configurations of the 3260 system include a 56-inch cabinet housing the CPU, power supplies, and four chassis (the CPU, Global Memory, Local Memory Bus, and I/O); a 56-inch cabinet containing APUs or IOPs (depending on the configuration) and power supplies; 2MB or 4MB memory with single-bit error correction and double-bit error detection; memory scrubber and error logger circuits; Writable Control Stores; Floating-Point Processors; Direct Memory Access (DMA) channels; Loader Storage Unit (LSU), including bootstrap loader universal clock; battery backup; bus switch control panel for IOP configurations; two-line communications multiplexor (system console); and a system control panel.

With up to five attached processors, the 3280MPS offers up to 21 possible configurations. The five basic building block configurations of the 3280MPS system are packaged in a single 72-inch cabinet with power supply and AC distribution panels. All five configurations include a 72-inch cabinet housing the CPU, power supply, S-Bus, DMI, memory, and I/O; 2MB or 4MB composite memory modules with integrated controllers and single-bit error correction and double-bit error detection, memory scrubber, and error logger circuits; 4K words of Writable Control Store; multiperipheral controller; battery backup; and a system console.

The XF/400, based on the 3203 processor, comprises a processor with an integral DMA channel, an integral single/double precision floating-point unit, 2MB of memory expandable to 4MB, a MPC configured for eight RS-232-C ports and a parallel printer port, a Small Computer System Interface (SCSI) peripheral subsystem which supports a ¼-inch cartridge tape drive, either a 51MB or 85MB fixed disk, and the Xelos operating system.

The XF/600, based on the 3210 processor, is available in either a 30-inch or a 56-inch cabinet. The XF/600 includes a processor with 1KB of cache, 2MB of memory expandable to 16MB, and a SMA Selector Channel Bus (SELCH). Support for 16 ports is included, based on an MPC and an 8-line communications Mux. Also included is a 16-user Xelos operating license.

The XF/610, based on the 3210 with DIOS, is available in a 56-inch cabinet which includes a processor with 1KB of cache, 4MB of memory expandable to 16MB, a SELCH, support for 32 ports (expandable to 64 ports), and a 32-user Xelos license.

WORKSTATIONS: System terminals and CRTs are multiplexor bus-supported devices. See Input/Output Control for details on bus configurability.

DISK STORAGE: Disks are DMA or EDMA bus-supported devices. See Input/Output Control for details on bus configurability.

MAGNETIC TAPE: Magnetic tape units are DMA or EDMA bus-supported devices. See Input/Output Control for details on configurability.

PRINTERS: Line printers and card readers are Multiplexor bus-supported devices. See Input/Output Control for details on configurability.

Concurrent Computer Corporation Supermini Systems

➤ solution for this company was to install three IBM PC XT's to replace the Concurrent system. In fact, the company was in its final phase out stage when we spoke to the office manager.

The third user we spoke to was the chief engineer at a Midwestern educational institution. Two 3220s, the systems used to perform engineering, scientific, and mathematical applications at this institution, were converted from an older Digital Equipment Corporation PDP-9. Although basically very pleased with the systems' performance, the user was somewhat displeased with the difficulty the institution experienced when trying to keep up with and implement vendor changes to the system. Some of the problems were resolved by hiring a third-party vendor to make some modifications. Productivity rose after the modifications were made and the engineering department is now very pleased with its Concurrent computers. □

➤ MASS STORAGE

For information on available mass storage devices for Concurrent 3200 Systems, refer to Chart B.

INPUT/OUTPUT UNITS

For information on available workstations refer to Chart C. For information on available printers refer to Chart D. For information on available magnetic tape equipment refer to Chart E.

COMMUNICATIONS CONTROL

GENERAL: *The Multi-Peripheral Controller (MPC)* uses microprocessor technology to implement the most commonly used input/output functions on a single card. The MPC supports eight RS-232 full-duplex communication lines. These lines support asynchronous, synchronous, SDLC, HDLC, or Bisync operations. Line speeds are from 50 to 19.2K baud in any mode. Full modem support is offered on all lines.

The MPC also has a Data Handling Assist used primarily for data communications applications. Two instructions, Process Byte and Process Byte Register, are used to calculate a cumulative checksum based on an old checksum and a new data byte. The check can be used for Bisync or SDLC protocols.

MPC also supports a Loader Storage Unit (LSU) that automatically loads the OS/32 operating system from a secondary storage device. Other features of the MPC include: a universal clock that incorporates a programmable precision interval clock and an AC line-frequency-derived clock; a watchdog timer that interrupts the processor if deadlocked and forces a system reload through the LSU; a parallel line printer port capable of supporting line printers with parallel interfaces from 120 cps to 1200 lpm; and a self-test feature that causes the MPC to test itself for board integrity upon power-up.

The Intelligent Peripheral Controller (IPC), available on the 3203 and XF/400 processors, is a full-function controller which interfaces the 3203 and XF/400 systems to the Small Computer System Interface (SCSI). The IPC utilizes an MC68000 microprocessor to execute processor commands autonomously. It provides the following: SCSI bus support for a variety of disk and tape devices from one controller,

multitasking controller which supports CPU commands and DMA access, up to 128KB RAM for outboard peripheral handling, online formatting of disk drives and offline back-up, and system integrity through a self-test feature.

Direct Memory Access I/O Subsystem (DIOS): The DIOS is a high-performance, intelligent communications controller for the Concurrent Series 3200. The DIOS provides DMA facilities between main memory and multiple I/O devices, allowing data transfers to take place with no processor intervention. The DIOS supports up to 63 two-wire or 31 four-wire communications devices. For asynchronous devices, the DIOS supports both the two-line and eight-line communications multiplexors as well as Concurrent's earlier PALS and PASLA equipment. For character-synchronous or bit-synchronous devices, the DIOS supports the Single Line Synchronous Adapter, the Quad Synchronous Adapter, and the 201/301 Data Set Adapter (character-synchronous only).

The DIOS is fully supported under Concurrent's 32-bit operating system, OS/32, and provides a peak throughput of 100,000 characters per second, data rates up to 56 kilobaud per line, and hardware Cyclic Redundancy Check (CRC) generation and checking. DIOS comes with built-in comprehensive diagnostic testing hardware.

The DIOS microcode contains special routines to support selected communications protocols. For asynchronous devices the DIOS microcode routines enable an entire terminal screen (maximum of 1,920 characters) in Concurrent's Reliance software environment to be transferred between the terminal and the processor. For synchronous devices the DIOS microcode routines support Bisync protocol. Special character-handling routines process the many control characters of the Bisync protocol in a manner fully compatible with the OS/32 Bisync line driver. This enables higher level software, such as Concurrent's 2780/3780 Emulation, HASP/32, 3270 Emulation, and 3270 Support packages, to use DIOS hardware without modification.

For bit-synchronous devices the DIOS microcode routines provide full support for the continuous frame transfer capabilities of the Zero Bit Insertion/Deletion versions of the Quad Synchronous Adapter and Single Line Synchronous Adapter. Using OS/32's chained or queued buffer techniques, processor intervention is required only once per frame or buffer. The DIOS handles all device status checking and frame check sequence generation/validation. When used in conjunction with Concurrent's ZDLC Channel Terminal Manager software package, the DIOS provides a support package for all three industry standard bit-oriented protocols: SDLC, HDLC, and ADCCP.

The Quad Synchronous Adapter (QSA) is a communications interface for Concurrent's Series 3200 computer systems and standard synchronous communication lines. QSA, constructed on one 15-inch board, contains all of the serializing, deserializing, and character buffering necessary to accommodate four synchronous lines. QSA is available in two versions—M47-002 accommodates traditional binary synchronous protocol or other similar character-oriented protocols, and M47-003 accommodates both the bit-stuffing features required by SDLC, ADCCP, or HDLC, as well as binary synchronous and other character-oriented protocols. Each line can operate individually in either half-duplex or full-duplex mode.

The transmission rate of the QSA is established by the particular modem, which must supply the clock signals. QSA is unaffected by the transmission rate as long as the rate does not exceed the upper limit of the unit—1.6M baud or 200,000 characters per second. During binary synchronous transmission, data is transmitted bit-serially. "Bit-stuffing" or Zero Bit Insertion/Deletion (ZBID) mode is required to support implemented bit-oriented protocols. ➤

Concurrent Computer Corporation Supermini Systems

► The *Single Line Synchronous Adapter (SSA)* is a data communications interface for Concurrent's 3200 family of computer systems. The SSA provides a telecommunications interface between the computer and the data set (modem) used with common carrier-switched or leased facilities.

The SSA is a double-buffered communications interface and controller for Bell Series 200 synchronous modems or equivalent. The SSA supports both half-duplex (two-wire) and full-duplex (four-wire) operations. The SSA is available in two versions; M47-106 accommodates the traditional binary synchronous protocol or other similar character-oriented protocols, and M47-107 accommodates both the traditional binary synchronous protocols and the Zero Bit Insertion/Deletion (ZBID) and flag insertion/deletion required for such bit-oriented protocols as SDLC, HDLC, and ADCCP.

During binary synchronous transmission (or any similar character-oriented protocol), data is transmitted in a bit-serial fashion. The sync character is program-selectable.

For bit-oriented protocols, the SSA is ordered with ZBID capability. The ZBID function can be enabled or disabled under program control.

The *Communications Multiplexor (Comm Mux)* provides an interface between the standard multiplexor bus and 103/202-type modems over switched or leased facilities. Local terminals requiring RS-232 or current loop connection can also be accommodated. The Comm Mux is available in two versions: the M47-104 two-line Comm Mux, and the M47-105 eight-line Comm Mux. The eight-line Comm Mux is the same as the two-line Comm Mux, except that the eight-line Comm Mux provides eight asynchronous communications lines with RS-232-C interface only. All eight lines are individually programmable.

The *Ethernet Data Link Controller* provides processor-to-processor communication over a 10M bps coaxial cable. The EDLCs are compatible with Ethernet Version 2 and the IEEE-802.3 draft specification for Carrier Sense Multiple Access with Collision Detection (CSMA/CD) on local area networks that carry baseband serial communications.

The *Ethernet Terminal Server* connects asynchronous RS-232-C compatible devices to the Ethernet local area network. In addition to terminals, the Terminal Server can also interface to minicomputer ports, modems, serial printers, microcomputers and other devices that are RS-232-C-compatible. The Terminal Server contains eight EIA RS-232-C asynchronous ports. Up to four units may be cascaded together so that they share a common transceiver unit connection on Ethernet.

The *3200-CP* communications processor combines parallel processing, networking capabilities, and Xelos functionality. The 3200-CP is an intelligent front-end processor that enables XF/600 and XF/610 systems to interface to SNA, bisync, X.25, and IEEE 802.3 (Ethernet) networking environments. Up to four serial synchronous lines are supported on the 3200-CP to provide DMA communications between the host Xelos Family member and IBM and non-IBM systems.

SOFTWARE

OPERATING SYSTEM: Along with the 32-bit OS/32 and OS/32MTM operating systems, Concurrent offers the Xelos version of the Unix operating system for its 32-bit computers. The Xelos Family systems operate under the Xelos operating system.

OS/32 is a realtime, multitasking, multiprogramming monitor with up to 255 levels of task priority, concurrent batch background processing, and reentrant I/O handlers. OS/32

also controls memory through memory segmentation and relocation via the Memory Access Controller. File management consists of file protection at the file and task levels, named files and devices, system calls for file manipulation, file-oriented console commands, and two file structures. These structures are indexed and contiguous.

As in any multiprogramming system, OS/32 has traps for privileged instructions. OS/32 features task-handled traps, which allow a task to be either external event or time-driven, and also provide for intertask communications.

Tasks can be one of three types: foreground, user/executive, and background. Task scheduling priorities are user-defined. Events affecting priority are operator requests, hardware interrupts, intertask communications/activations, and time-related events including time of day, elapsed time-out, and periodical events.

OS/32 also features a virtual task manager, through which multiple user tasks consisting of up to 16M bytes of code and data can execute in a minimum of 128K bytes of user task memory. The virtual memory system does not require any special user programming; each user has access to 16M bytes of logical address space that are automatically paged between disk and the user's working set.

Selection of virtual memory is optional, and occurs when a program is passed through the operating system's linkage editor; the user can select how much real memory is allocated for the execution of the virtual task.

The virtual memory capability of the OS/32 operating system permits users to employ a range of memory management methods, including process roll-in/roll-out and tree-structured transparent overlays. Roll-in/roll-out permits realtime system builders to keep noncritical tasks on secondary storage when those tasks are not needed. The tree-structured transparent overlay scheme enables highly structured applications to control the swapping of program segments between disk and memory. In addition, virtual demand paging allows the general user to fit a large program into a smaller physical space without regard for program structure.

In Concurrent's fault-tolerant Resilient System, OS/32 combines with a *Reconfiguration Monitor* to ensure resiliency. The Reconfiguration Monitor runs as a continuous task under OS/32. The Resilient System requires dual Series 3200 processors and redundant hardware; the Reconfiguration Monitor runs in both processors, allowing each to monitor the other for correct responses. Each system can run independently, with separate applications. When a failure occurs, the unaffected system takes control of those programs, environments, and peripheral devices required for total operation. The Reconfiguration Monitor accepts operator commands to reconfigure the system for maintenance with minimal impact on the production environment.

A *Mirror Disk* option is also available for use with OS/32 in the Resilient System. The Mirror Disk capability permits creation of complete dual images for all user files and critical transactions; the two sets of images are stored on separate disk units. If one disk fails, the system will detect the failure, alert the system operator, and automatically switch to the remaining unit. When the failed unit has been restored, the operator can use system-provided utilities to guide the rate at which the restored drive will reach full synchronization.

OS/32 requires a 512K byte Series 3200 processor with operator console panel, power fail/auto restart option, memory access controller, teletypewriter, Carousel, or CRT on a current loop interface for use as an operator command console, universal clock, and magnetic media (which may be 9-track magnetic tape or disk). ►

Concurrent Computer Corporation Supermini Systems

► **OS/32 Multi-Terminal Monitor (OS/32MTM)** provides a general-purpose programming environment for up to 64 interactive terminal users on Concurrent 32-bit computer systems. The full program development facilities of the OS/32 operating system are available to each interactive terminal user, including the OS command set, the command substitution system, the language processors, and the service utility programs; the virtual memory capability of OS/32 is also available. The capacity and throughput of the system are maximized by the provision of background batch processing and an I/O spooler. OS/32MTM allows individual users to operate autonomously, with complete privacy from all other users of the system. In particular, each user can create disk files inaccessible to any other user. MTM also allows cooperating users to define group files accessible to any group member. A comprehensive job accounting facility is provided by OS/32 and MTM to report system utilization statistics such as CPU, memory, and I/O utilization by individual account number, by account groups, and in summary for the entire system. Reports can be generated for any specified report period because archival files are created and maintained in accordance with operator commands. In addition, the sign-on time or CPU time for individual accounts can be limited to preassigned maximums.

Xelos is a multiuser, multitasking operating system based on AT&T's Unix System V, Release 5.2. With Xelos, each user has control over background processes and can switch between various interactive environments. Each process can use all available physical memory; address translation and protection between processes are performed in hardware.

The user interface to Xelos is provided by a system shell and interactive command interpreter. Both the standard AT&T Unix system shell and the C shell from the University of California at Berkeley are provided with Xelos. The interpreter provides control structures, variables, and passed parameters for program implementation.

Xelos has a hierarchical file system which enables users to logically organize files in directories and subdirectories. File access protection is assigned on a file or directory basis by the owner. The file system also manages multiple concurrent access to files, enabling users to share common data files.

A number of system administration tools are provided with Xelos. These include MenuMaker, a utility designed to enable the user to create menus to drive applications, System Administrator's Menus to allow easy configuration and maintenance of a Xelos system, Accounting Utilities that can monitor, report and charge fees for system resource use, and a system activity monitor to provide information such as CPU utilization, peripheral I/O, and file system activity.

DATA BASE MANAGEMENT SYSTEMS: Concurrent offers the Unify relational data base management system, under license from the Unify Corporation, for use with the Xelos operating system. In addition, the *Reliance* database management system is designed to implement transaction processing on any of Concurrent's 32-bit minicomputers running the OS/32 operating system and includes the Integrated Transaction Controller (ITC), Data Management System/32 (DMS/32), Relational Query Language (RQL/32), and Cobol.

The *Unify* relational data base management system provides full-screen, interactive data entry facilities. Ad hoc query capability is provided by Sequel 2, a relational query language based on IBM's standard structured query language. The Enter facility provides query-by-form capability for users who do not have a detailed knowledge of the database.

Unify provides fourth-generation nonprocedural development tools, allowing a user to develop applications with little

or no conventional programming. Unify also provides a number of system building tools, including language interfaces and subroutine modules. Designed for ease of use, Unify provides a menu-oriented user interface and relational access. The RPT report writer provided with Unify allows a user to develop database reports.

The *Reliance* system supports up to nine application programs running in parallel and maintains system performance at user terminals under extremely heavy transaction volume. The Integrated Transaction Controller (ITC) controls and monitors application programs and libraries, provides complete application facilities for system building, and enables the user to interactively create and modify screen formats while handling data validation and screen format control automatically.

DMS/32 provides central data base-oriented file and data management and maintains file directories. DMS/32 is designed specifically for an online transaction processing environment. DMS/32 provides multikeyed data update and retrieval from multiple user files in a single data base and manages realtime concurrent data access by maintaining data base integrity through automatic online recovery features, record and file locking, and means for rapid restoration of the data base in case of a system failure. Among the features of DMS/32 are an unlimited number of secondary keys; random and sequential access; data access by full, approximate, and generic keys; multiple files with multiple extents; control of concurrent access; on-line rollback of failed transactions; automatic recovery from any system failure; central control of the data base; and access through Cobol, RPG II, and Concurrent's Common Assembler Language Macros.

RQL/32 is the query and report writing component of Concurrent's *Reliance* transaction processing system. RQL/32 allows authorized personnel to interactively retrieve data or print reports on an as-needed basis. The compiler is nonprocedural, which means that the user needs no knowledge of programming to retrieve data or produce reports. Guided by automatic prompting and a Help facility, the user enters query and report specifications via the *Reliance Plus* "fill-in-the-blanks" screen forms.

RQL/32 performs functions that are ordinarily performed by custom-written application programs. RQL/32 responses can be displayed at the user's terminal or queries can be optionally saved for later use, with or without modification. Detailed printed reports can be obtained for selected information, eliminating the need for numerous programs dedicated to report writing. Complete data independence is provided between the format of the report and the payout of the file. Interactive queries and report specifications can be saved for later use.

Cobol is the commercial language included with the *Reliance* system for applications programming. Cobol data and media formats are compatible with industry standards.

Reliance Plus is a transaction-oriented data base management system for use on Concurrent's 32-bit superminis. It contains all the facilities needed to build and execute a variety of applications, such as those found in the banking, manufacturing, and distribution industries. The integrated components of *Reliance PLUS* include a data dictionary; the DMS/32 relational data base management system; an Integrated Transaction Controller (ITC); the RQL/32 relational query language; and an industry standard Cobol compiler.

The data dictionary provides the data description language that allows the user to define and control the use of data throughout the application environment. The dictionary has a set of query and report specifications that can be customized to suit specific needs through the relational query capabilities of *Reliance PLUS*. ►

Concurrent Computer Corporation Supermini Systems

► Application programs may be written in either ANSI '74 Cobol or ANSI '77 Fortran, which are extended to include the Reliance Plus Data Manipulation language statements. Transaction development is accomplished through the ITC screen definition facility. Screen forms can be designed by the application user, with no programming knowledge needed. Moreover, screen forms and applications can be added or modified while Reliance Plus is in use without impacting the production environment. The DMS/32 component of Reliance PLUS provides indexed file organization in which records are referenced by either one unique primary key or multiple nonunique secondary keys. The RQL/32 component allows parameter substitution when a saved query is run. The information contained in a saved query includes the relationship of multiple data base files; fields to be displayed or printed; qualifying criteria for record selection; and, for printed reports, actual format specifications. Parameter substitution eliminates the need for continual modification of saved queries.

Reliance PLUS also includes: a sample application that provides a "walk-through" of an on-line data base management system; a demonstration package; a Reliance Resource Monitor; and a system design guide.

Also available for use in the Reliance Plus environment is a separate product, the *Reliance Update System/32 (RUS/32)*. RUS/32 is a nonprocedural file entry and update facility that accesses the same data base as Reliance PLUS applications written in high-level languages like Cobol and Fortran. RUS/32 allows authorized personnel to interactively create, modify, or delete records on an as-needed basis. Guided by prompts and an information facility, users enter RUS/32 specifications through "fill-in-the-blank" screen forms.

Another separate product for use in the Reliance Plus environment is *Reporter/32*. This facility allows users to produce sophisticated reports quickly without programming. Reporter/32 specifications are entered via "fill-in-the-blank" screen forms with automatic prompting that uses default values wherever possible. On-line help and information facilities are available to guide users in making a request.

Reliance PLUS can also be used with Concurrent's fault-tolerant Resilient System to enhance recovery and database management.

LANGUAGES: Concurrent's program development languages for the Series 3200 systems include the Common Assembly Language (CAL) and CAL Macro, Fortran VII Z, ANSI '77 Fortran VII, ANSI Standard Cobol, RM/Cobol, Basic II, Coral 66, Sibol, C, and RPG II.

The C, Fortran 77, and Assembler languages are standard with the XF systems. Optionally supported languages are RM/Cobol and Unibol.

COMMUNICATIONS: Capabilities offered by communications software for the 3200 Series and XF systems include telecommunications support for modems; interfaces with SNA-based networks and other IBM-compatible systems; and wide area and local area networking.

The *Integrated Telecommunications Access Method (ITAM/32)* facility is provided as an OS/32 component. For synchronous lines, a Bell 201-type Data Set Adapter or Quad Synchronous Adapter is supported. Bell 103-type modems are supported at up to 300 bits per second. For asynchronous lines, either single- or multiline controllers are supported. Bell 201-, 208-, and 209-type modems are supported at 2400, 4800, and 9600 bits per second, respectively. Dataphone Digital Service (DDS), Data Service Units (DSUs) are supported to 9600 bits per second.

Pengates, a set of communications products, permit Series 3200 superminis to interface with SNA-base networks and other IBM-compatible systems. These products allow users to access IBM systems' data bases and application programs for interactive and batch jobs. Pengates products include SNA/3270 Emulator, SNA/RJE Emulator, BSC/3270 Emulator, BSC/Hasp Emulator, and 2780/3780 Emulator.

The SNA/3270 Emulator enables interactive terminals, printers, or application programs on a series 3200 supermini to emulate the capabilities of IBM 3270 terminals. The emulator provides Logical Unit Type 1, 2, and 3 support, making a Series 3200 supermini look like a 3270 cluster controller. The emulator furnishes both an application program (virtual terminal) interface and hardware emulation of 3270 series terminals and 3280 series printers by Concurrent terminals and printers. In virtual terminal mode, application programs running on a Series 3200 system can interact with the IBM host as if they were 3270s; screens can be sent back and forth, and applications and data bases on the host can be accessed. All details of the interface are handled by the emulator. In hardware emulation mode, Concurrent editing terminals can be used like 3270 series terminals connected to the host. The integration of those two emulation modes with the transaction processing and database management capabilities of the Reliance PLUS system permits Series 3200 users to develop local transaction processing applications that parallel those existing in the host; the local application can decide whether to process the transactions itself and update the host later or to pass the transactions on to the host as they are entered.

The SNA/RJE Emulator makes a Concurrent Series 3200 minicomputer appear to an SNA/SDLC network as a Logical Unit Type 1 3776 RJE workstation. The SNA/RJE Emulator provides both a program interface and emulation of hardware, including the workstation operator's controls. The emulator provides real or virtual emulation of an RJE workstation. In real emulation, a Concurrent Spooler is used for buffering. In virtual emulation, the emulator allows application programs direct access to the datastream. Any user signed on to the local Concurrent Multi-Terminal Monitor (MTM) time-sharing facility can route RJE job streams to the host through standard MTM commands. The RJE workstation operator's controls can be simulated by a user-supplied monitor program, by the local system operator through the system console terminal, or by anyone at any system terminal.

The other three emulators in the Pengates series supply bisynchronous communications. The BSC/3270 Emulator provides facilities identical to those offered by SNA/3270, but over bisynchronous lines. The BSC/Hasp Emulator permits a Concurrent computer to emulate the operations of an IBM multileaving Hasp RJE workstation. The 2780/3780 Emulator allows Concurrent systems to emulate IBM 2780 or 3780 remote job entry terminals.

The *Pennet* system allows Concurrent superminis to communicate with other Concurrent systems in geographically dispersed network configurations using private lines or packet switched networks. Pennet facilities are based on International Telegraph and Telephone Consultative Committee (CCITT) X.25 standards for computer-to-computer communication through packet switched data networks. Pennet complements Concurrent's 2780/3780 RJE Emulator, Hasp/32 Emulator, and 3270 Emulator.

Pennet permits both indirect and alternate routing. In indirect routing, systems not directly connected can communicate indirectly through an intermediate system. In alternate routing, alternative routes can be established between systems for dynamic runtime selection to balance line usage. ►

Concurrent Computer Corporation Supermini Systems

► In addition to X.25 packet switching capabilities, Pennet provides other networking services. The Interactive Terminal Facility allows terminals attached to one Concurrent system to log into or sign on to Reliance transaction processing or MTM time-sharing environments in a second Concurrent system; the terminals can function as if they were directly attached to the second system. The connection is accomplished without a long-distance communications link; messages to and from several terminals are concentrated in the local computer and multiplexed over a single synchronous communication link in the network.

Pennet's File Transfer Facility allows files of any length to be copied from one system to another system on the network. Users can perform data collection in remote systems and transfer files for processing when necessary; application software maintenance can be performed on a local system and the programs and other database information transferred across the network interactively or in batch mode. Pennet's Programming Interface facility provides an interface to the OSI (Open System Interconnect) transport layer, allowing users to implement their own applications.

Pennet's Network Printing Facility permits programs running under the OS/32 or OS/32MTM operating systems, or in the transaction processing environment, to output reports, memoranda, and operating data to printers physically connected to other Concurrent systems in a network. Network printing operations are transparent to the application program.

Pennet provides a command set that lets the user monitor the status of the network either automatically or upon request. In addition, the Network Control Facility performs the following functions: provides commands that let operators ascertain the status of individual communications lines; maintains a log of significant events occurring during network operations; and allows removal of communications lines from the network for maintenance and error analysis.

Pennet also provides X.29 terminal access, allowing remote terminals to dial in to a Pennet network over a public packet switched network.

Pennet Plus is an enhancement that provides all wide area networking capabilities of Pennet and also supports the Ethernet protocol for local area networking. Pennet Plus provides a transparent bridge between Ethernet and X.25 network connections on Concurrent Series 3200 systems; any system on the LAN can use all facilities of the X.25 global networking system. Pennet Plus is structured to permit future incorporation of other local area networks.

The architecture of Pennet Plus is based on the International Standards Organization's Reference Model for Open System Interconnect (ISO-OSI). ISO-OSI provides a seven-layer model for structuring total data processing systems distributed across multiple systems.

For local area networking, Pennet Plus uses the IEEE 802.3 (Ethernet Version 2) standard for local connection; this standard permits resource sharing among a large number of local Series 3200 systems. All systems communicate with one another over a single cable. Maximum distance between stations is 2,500 meters. Available bandwidth is 10 megabits per second. Each Concurrent system interfaces to the Ethernet local area network through an Ethernet Data Link Controller (EDLC), and may be up to 50 meters from the IEEE/802.3 Ethernet cable.

For access without local intelligence, Pennet Plus supports remote asynchronous terminals in accordance with the CCITT X.29 standard protocol. Such terminals interface to a packet switched service through a Packet Assembler-Disassembler provided by the service.

Pennet Plus provides utility programs to define and control the distributed network. A network administrator specifies connections in the network, alternative routes to be used within the network, and control parameters for indirect routes. Traffic is automatically balanced over multiple equally preferred routes.

UTILITIES: Seven major OS utilities are available: OS/32 Edit, OS/32 Aids, OS/32 Text, OS/32 Copy, OS/32 Patch, Sort/Merge II, and Medit. Utilities available for Xelos include the Documenter's Workbench.

OS/32 Edit is a line-oriented text editor for ASCII and binary characters; it also provides facilities for character and column manipulation. A string search and replacement capability is also provided. OS Edit can be used for interactive editing and batch-stream job editing, and has file manipulation capabilities. Text is read into an edit buffer in memory that is at least 1K byte in size; it can be made larger by operator request. OS Edit is included at no charge with each operating system.

OS/32 Aids (Automatic Interactive Debugging System) has breakpoint, snapshot, and trace facilities, and also a memory call or register monitor feature. It operates in interactive or batch mode. It is included gratis with the OS/32 operating system.

OS/32 Text is a document preparation facility which can be used on all Concurrent 32-bit processors. Entry can be from a terminal or a keyboard printer. OS Text provides for the creation, maintenance, storage, and printing of documents and permits the documents to be modified, appended, updated, and merged. Existing text can be stored on disk or tape, and stored text (or files) can be assigned "private", "accessible to a defined group", or "open" levels of priority. Text 1 provides all the facilities of OS Text, while Text 2 is a subset which includes all capabilities except text entry and editing. OS Text operates as a segmented task under OS/32.

OS/32 Copy provides for the copying of any file.

OS/32 Patch facilitates the entry of program patches.

The OS library also includes OS/32 source updater, disk integrity check, disk initialize, disk pump, and disk compress routines.

In *Sort/Merge II*, Sort arranges multiple input files into one file in mixed ascending or descending, user-specified key sequences. Merge produces a sorted file from multiple input files presorted in identical key sequences. Sort/Merge II features multiple input files; ANSI and IBM standard labeling and blocking conventions; computational, display, packed, decimal, and floating-point key fields; user exit for special handling of duplicate keys at output time; dynamic error correction and recovery mechanisms; automatic multivolume and interfile prompting; interactive and batch command input modes; and automatic scratch file allocation.

Medit is a realtime full-screen editor for Series 3200 computers running under OS/32. Results are immediately displayed as the operator enters and manipulates text. There are no explicit formatting commands to enter into the body of the text.

The Xelos operating system provides *Documenter's Workbench* software which allows the user to create more complex displays through preprocessor utilities. The utilities work with Documenter's Workbench text formatters to format simple graphics, mathematical equations, and complex tables. Some utilities include programs for editing and formatting text, setting mathematical equations in type, slide and overhead preparation, and phototypesetting. ►

Concurrent Computer Corporation Supermini Systems

► **OFFICE AUTOMATION:** *Network Electronic Mail (NEM/32)* permits Reliance database management system users on Pennet Plus distributed networks to send mail to other users on the network. NEM/32 allows mail receipt confirmation, private tray storage, multiple-addressed mail, and broadcast facilities.

The Xelos Family systems support *VisiWord* and *Final-Word* word processing software.

APPLICATIONS: Application programs for Concurrent systems are generally available through the Concurrent users' group, Interchange. Programs from Interchange are nominal in cost. For information, write Concurrent's headquarters. There are similar groups outside the U.S. as well.

In addition to the packages listed in the Software Price section, Concurrent offers about 50 diagnostic/test programs at \$50 to \$260 each.

PRICING

POLICY: Concurrent offers its systems on a purchase-only basis, with customer service provided. Field installations are performed by Customer Service on a fixed-price basis. Since system configurations and customers' locations vary, rates are provided on a quotation basis only. Customer Service must be contacted for a formal quotation on all such installations. A minimum installation charge of \$200 plus the travel charge is applicable. Installation consists of functional and operational testing, and system performance as demonstrated by Concurrent's applicable test programs. This service must be ordered prior to shipment of the equipment. A full on-site service warranty applies for 90 days from installation date.

Software is separately priced.

Discounts of 10 to 38 percent are provided in quantity orders of up to 100 systems; additional discounts are available for larger orders.

SUPPORT: The Concurrent Customer Service Division is organized to provide comprehensive maintenance service. The field force is supported by a staff of service specialists at Concurrent's national headquarters in Neptune, New Jersey, and at support depots in Flanders, New Jersey, and Garden Grove, California. Customer engineers are located in major cities throughout the United States to provide service on a local level. Each service office is stocked with spare parts, tools, and special test equipment to facilitate repairs.

Maintenance service can be obtained in one of the following ways: on a contract basis, with fixed monthly charges to

cover the normal business week up to, and including, 24 hours a day, seven days a week at most locations; on a full-time, on-site basis; through a depot and fixed-rate exchange service, which provides users with repairs and exchange parts at predetermined rates; or on a per-request basis, which provides service at hourly rates.

Both hardware and software subscription services are offered by Concurrent at \$200 per year. The hardware service entitles a Concurrent user to receive product improvement notices, general information bulletins, and preventive maintenance procedures. The software service brings a user regular software bulletins describing new Concurrent software, software defects, and patches or alternatives associated with defects. Revisions to previously purchased software are available at reduced rates.

TRAINING: Training is offered on both software and hardware topics in a number of courses. For information regarding course content, location, and prerequisites, contact the Technical Training Center in Neptune, New Jersey, (201) 988-0400. Information regarding on-site training courses is also available.

TYPICAL CONFIGURATIONS: The following are sample Concurrent system configurations.

MODEL 3205:

M33-704—3205 system; 1MB memory;	\$27,950
50-MB cartridge disk subsystem	
M46-300—300 lpm band printer	9,000
Two M60-160 6100 VDU workstations	995
TOTAL PURCHASE PRICE:	\$37,945

MODEL 3280MPS:

M33-604—3200MPS system; CPU with 4MB	\$310,000
memory; four APUs	
M60-128—MSM1200F 1-GB storage system	71,000
M60-010—HPTD125 mag tape subsystem	49,500
Three M60-016 HPTD125E mag tape	69,000
expansion transports	
M60-250—1200 lpm band printer	29,990
Six M60-200 55 lpm line printers	20,970
Five M47-105 Eight-line Comm Mux	13,200
Forty M60-240 6312 VDU workstations	55,000
TOTAL PURCHASE PRICE:	\$618,660

Concurrent Computer Corporation Supermini Systems

EQUIPMENT PRICES

		Purchase Price (\$)	Monthly Maint. (\$)
MPS SYSTEMS			
MPS Systems include a 32-bit CPU, a 32-bit Auxiliary Processing Unit (APU), and documentation. The CPU includes: memory; a two-line Communications Multiplexor (Comm Mux); Loader Storage Unit (LSU); universal clock; eight-slot I/O chassis; cabinet; 300 amp P5 current; and 150 amp P5U current. The APU includes: cables; terminators; 300 amp P5 current; and an AC distribution panel.			
M33-600	3200MPS system with 2MB of memory in two banks and one APU; one DMA bus	185,000	1,240
M33-602	Same as M33-600 except contains 4MB of memory in 2 banks	198,000	1,300
M33-604	3200MPS Performance System includes M33-600 system; memory bank expansion to four banks for 4MB of memory; additional Auxiliary Processor cabinet with 300 amp P5 current; four Auxiliary Processing Units (APU).	310,000	2,374

3280MPS PROCESSORS

3280MPS Systems include a 32-bit CPU, and up to five attached processors. All processors include a 32-bit CPU with 16KB cache memory, 4K words, WCS, and Integrated Floating-Point Processing capability. The CPU includes 72-inch system cabinet, I/O chassis with up to 20 slots, a Direct Memory Interface, a Multi-Peripheral Controller, a VDU, battery backup, AC distribution panel, control/diagnostics system, cables, and terminators.

M37-200	3281XP processor with 2MB main memory, 1 DMI, and a 20-slot I/O chassis	250,000	1,250
M37-202	3282XP processor with 4MB main memory 2 DMIs, and a 20-slot I/O chassis	265,000	1,325
M37-204	3284XP processor with 8MB main memory, 4 DMIs, and a 20-slot I/O chassis	295,000	1,475
M37-208	3284XP processor with 16MB main memory, 4 DMIs, and a 20-slot I/O chassis	325,000	1,625
M37-210	3282-10 processor with 4MB main memory, 2 DMIs and a 16-slot I/O chassis	385,000	1,925
M37-212	3284-10 processor with 8MB main memory, 4 DMIs, and a 16-slot I/O chassis	415,000	2,075
M37-206	3284XP processor with 8MB main memory, 2 DMIs, and a 20-slot I/O chassis	285,000	1,425

3260MPS PROCESSORS

3260MPS Systems include a 32-bit CPU, and up to nine attached processors. All processors include a 32-bit CPU with cache memory, WCS, and a Floating-Point Processor. The CPU includes a 2-line Comm Mux, Loader Storage Unit, a VDU, clock, and subchannel controller. The CPU cabinet contains an 8-slot I/O chassis, AC distribution panel, and necessary cables and terminators.

M37-101	3262-10 processor with 2MB main memory in 2 banks	185,000	1,240
M37-020	3264-10 processor with 4MB main memory in 4 banks, and one APU	219,000	1,555
M37-022	3264-01 processor with 4MB main memory in 4 banks, and one IOP	219,000	1,555

3250XP PROCESSORS

M33-412	3251XP processor with 1MB MOS memory in 1 bank	125,000	763
M33-400	3252XP processor with 2MB MOS memory in 2 banks	150,000	817
M33-402	3252XP processor with 4MB MOS memory in 2 banks	163,000	861
M33-404	3254XP processor with 4MB MOS memory in 4 banks	184,500	1,134

3230MPS PROCESSORS

3230MPS Systems include a 3230XP CPU and up to five attached processors. The CPUs have 4KB of cache memory, 4K Writable Control Store, power-fail/auto restart, battery backup, multiperipheral controller board, 8KB LSU, clock, parallel printer interface, eight comm prots, and a high-speed data handler. The 3230MPS is housed in two 56-inch high cabinets containing a processor chassis, shared memory bus chassis, local memory bus chassis, an 8-slot I/O chassis, power system with battery backup, and a power distribution panel.

M37-110	3232-10 processor with 2MB main memory in 2 banks, 1 Auxiliary Processing Unit (APU)	125,000	1,044
M37-112	3232-10 processor with 4MB main memory in 2 banks, 1 APU	135,000	1,104
M37-118	3232-10 processor with 2MB main memory in 2 banks, 1 Input/Output Processor (IOP)	125,000	1,044
M37-120	3232-10 processor with 4MB main memory in 2 banks, 1 IOP	135,000	1,104
M37-130	3234-10 processor with 4MB main memory in 4 banks, 1 APU	156,000	1,200
M37-132	3234-10 processor with 8MB main memory in 4 banks, 1 APU	166,000	1,320
M37-136	3234-10 processor with 4MB main memory in 4 banks, 1 IOP	156,000	1,200
M37-138	3234-10 processor with 8MB main memory in 4 banks, 1 IOP	166,000	1,320

3230XP PROCESSORS

3230XP Systems are mid-range processors which may be upgraded to a high-performance 3230MPS multiprocessor system by adding the appropriate 3230XP Power Pak.

M33-900	3231XP processor with 1 MB main memory in 1 bank	85,000	411
M33-902	3231XP processor with 2MB main memory in 1 bank	90,000	441
M33-910	3232XP processor with 2MB main memory in 2 banks	94,000	489
M33-912	3232XP processor with 4MB main memory in 2 banks	104,000	549
M33-918	3234XP processor with 4MB main memory in 4 banks	112,000	645
M33-920	3234XP processor with 4MB main memory in 4 banks	122,000	765

CSQ—Requires special Customer Service quotation.

NA—Not applicable.

NC—No charge.

Concurrent Computer Corporation Supermini Systems

		Purchase Price (\$)	Monthly Maint. (\$)
3210 PROCESSORS			
M32-154	3210 processor to Shared Memory Interconnect	6,000	75
M33-570	3210 processor with 512KB MOS memory; 32MB CDD disk	47,000	CSQ
M33-550	Same as M33-570 with 1MB of memory and MSM300 disk in place of the CDD disk	72,500	CSQ
M33-552	Same as M33-570 with 1MB of memory and MSM80 disk in place of the CDD disk	57,250	CSQ
M33-554	Same as M33-570 with 1MB of memory and MSM80F disk in place of the CDD disk	51,250	CSQ
M32-502	64MB in place of 32MB CDD disk for M32-500	5,500	CSQ
M32-504	96MB in place of 32MB CDD disk for M32-500	11,000	CSQ
M32-549	2MB memory in place of 1MB memory for M32-500	6,000	CSQ
M32-508	Nonfloating-point back panel in place of standard back panel on M32-502	NC	NA

3210/A PROCESSORS

M32-527	3210/A CPU with 1MB memory in place of 512KB memory	30,000	137
M32-528	3210/A CPU with 2MB memory in place of 512KB memory	37,000	167
M32-529	Substitution of nonfloating-point back panel (not field-installable; must be ordered with processor)	NC	NA

3205 SYSTEMS

3205 Systems include: 3205 CPU with memory; 50MB fixed/removable disk subsystem (25MB fixed, 25MB removable); Multi-Peripheral Controller (MPC) board with 8KB Loader Storage Unit (LSU), universal clock, line printer interface, and eight synchronous/asynchronous communication ports; 75 amp master power supply; Model 6100 VDU; 30-inch beige cabinet; and documentation.

M33-704	3205 System with 1MB memory	27,950	295
M33-706	3205 System with 1MB memory	27,950	295
M33-708	3205 System with 2MB memory	32,850	340
M33-710	3205 System with 2MB memory	32,850	340
M33-712	3205 System with 3MB memory	36,950	370
M33-714	3205 System with 3MB memory	36,950	370
M33-716	3205 System with 4MB memory	40,950	400
M33-718	3205 System with 4MB memory	40,950	400

3205 PROCESSORS

3205 processors include: 3205 CPU with memory, eight-slot chassis, and system control panel; MPC board with 8KB LSU, universal clock, line printer interface, and eight synchronous/asynchronous communications ports.

M33-732	3205 processor with 1MB memory	12,950	135
M33-734	3205 processor with 2MB memory	17,850	180
M33-736	3205 processor with 3MB memory	21,950	210
M33-738	3205 processor with 4MB memory	25,950	240

3203 PROCESSORS

3203 systems include a CPU board with 0.5MB of memory, a Multi-Peripheral Controller board, and Intelligent Peripheral Controller board, a 51MB Winchester disk, and a ¼-inch streaming cartridge tape. The basic system is housed in a floor-standing, slimline cabinet.

M33-800	3203 processor with 0.5MB main memory and 51MB of disk storage	16,600	125
M33-802	3203 processor with 0.5MB main memory and 85MB of disk storage	17,990	145
M33-804	3203 processor with 1MB main memory and 51MB of disk storage	18,990	142
M33-806	3203 processor with 1MB main memory and 85MB of disk storage	20,990	162
M33-808	3203 processor with 2MB main memory and 51MB of disk storage	23,890	187
M33-810	3203 processor with 2MB main memory and 85MB of disk storage	25,890	207
M33-812	3202 processor with 4MB main memory and 51MB of disk storage	31,990	247
M33-814	3203 processor with 4MB main memory and 85MB of disk storage	33,990	267

XELOS FAMILY SYSTEMS

XF/400

XF/400 systems include a CPU with an integral DMA channel, and an integral single/double precision floating-point unit, 2MB of memory, an MPC configured for 8 RS-232-C ports and a parallel printer port, an SCSI peripheral subsystem, and the Xelos operating system.

M37-630	XF/400 processor with 2MB main memory and 51MB of disk storage	21,995	—
M37-631	XF/400 processor with 2MB main memory and 85MB of disk storage	23,995	—
M37-632	XF/400 processor with 4MB main memory and 51MB of disk storage	30,095	—
M37-633	XF/400 processor with 4MB main memory and 85MB of disk storage	32,095	—

CSQ—Requires special Customer Service quotation.

NA—Not applicable.

NC—No charge.

Concurrent Computer Corporation Supermini Systems

Purchase Price (\$)	Monthly Maint. (\$)
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XF/600

XF/600 systems include a CPU with 1KB cache memory and main memory available in a choice of 30-inch or 56-inch cabinet, a SELCH, an MPC and an 8-line comm mux, and the Xelos operating system.

M37-640	XF/600 processor with 2MB main memory, 1KB cache memory, and the Xelos operating system	27,000	—
M37-642	XF/600 processor with 4MB main memory, 1KB cache memory, and the Xelos operating system	37,000	—
M37-643	XF/600 processor with 8MB main memory, 1KB cache memory, and the Xelos operating system	48,000	—

XF/610

XF/610 systems include a CPU with 1KB cache memory and main memory, a 56-inch cabinet, a SELCH, an MPC (8 ports), a DIOS supporting three 8-line comm mux's (24 ports), and the Xelos operating system.

M37-650	XF/610 processor with 4MB main memory, 1KB cache memory, and the Xelos operating system	45,000	—
M37-651	XF/610 processor with 8MB main memory, 1KB cache memory, and the Xelos operating system	56,000	—

XELOS FAMILY PROCESSOR OPTIONS

M37-694	2MB to 4MB memory expansion for the XF/400; field-installable only	11,000	60
M33-821	Expansion to the SCSI disk subsystem for the XF/400; includes a 40MB drive and cables	2,820	45
M33-822	Expansion to the SCSI disk subsystem for the XF/400; includes a 67MB drive and cables	4,700	65
M33-823	Expansion MPC for the XF/400 30-inch cabinet; includes 8 RS-232-C interfaces and a Centronics-type printer interface	2,750	20
M37-690	1MB memory storage module for XF/600 and XF/610	7,000	30
M37-691	2MB memory storage module for XF/600 and XF/610	13,000	60
M37-692	4MB memory storage module for XF/600 and XF/610	23,000	120
M37-693	8MB memory storage module for XF/600 and XF/610	34,000	240
M37-695	Floating Point Processor for XF/600 and XF/610	5,600	42
M37-696	Battery backup for XF/600 and XF/610	1,500	25
M48-055	I/O Switch for for XF and Series 3200 systems except the 3203 and XF/400; allows a common system I/O to be shared between processors; includes boards and interconnecting 25-foot cable.	2,000	32

PROCESSOR OPTIONS

M32-710	Memory bank expansion; requires 3250XP CPU	5,000	42
M32-721	Floating-point processor; requires 3250 CPU	9,500	63
M32-722	High-speed data handling adapter; requires 3250XP CPU	1,100	11
M32-720	DMA bus option; requires 3250XP CPU	5,750	21
M49-140	I/O expansion cabinet with AC distribution panel; requires 3250XP CPU	4,025	NA
M49-143	I/O expansion chassis; requires 3250XP CPU	1,840	NA
M49-145	Power control and P5 module	5,750	42
M49-146	P5 expansion module	2,875	21
M32-004	Floating-point hardware; requires 3230	6,160	42
M32-005	High-speed data handling; requires 3230	1,210	11
M32-010	3200 selector channel; requires any 3200	2,000	20
M32-103	I/O expansion chassis and cables; requires 3230	1,840	NA
M32-104	150 Amp MOS expansion power supply; +5 VDC; requires 3230 or I/O expansion chassis	2,875	21
M32-105	56-inch I/O expansion cabinet, beige, without power; requires 3230	1,265	NA
M32-106	56-inch I/O expansion cabinet, beige, with power; requires 3230	9,775	42
M49-107	56-inch cabinet, beige, without power; requires any 3200	1,265	NA
M32-509	Floating-point processor; requires 3210 or 3210/A CPU	5,600	42
M32-540	Master power supply; requires 3210, 3210/A and I/O expansion	2,950	16
M32-541	Slave power supply; requires 3210, 3210/A or I/O expansion	1,850	16
M32-513	8-slot I/O expansion chassis for 30-inch expansion cabinet; requires 3210, 3210/A and I/O expansions	1,840	NA
M32-514	8-slot I/O expansion chassis for 56-inch expansion cabinet; requires 3210, 3210/A and I/O expansions	1,840	NA
M32-515	I/O expansion cabinet; requires 3210	6,325	16
M32-517	Single disk expansion cabinet; requires 3210	2,300	NA
M32-519	Single disk and expansion cabinet; requires 3210	7,245	16
M32-521	Dual disk expansion cabinet; requires 3210	2,300	NA
M33-564	Battery backup (use with M32-540 master supply; requires 3210/A)	1,500	25
M32-560	8KB loader storage unit with boot loader; requires 3210/A	1,100	11
M32-561	Cooling fan assembly; requires 3210/A	300	NA
M32-563	Test aid, for 3210/A	1,438	NA
M32-565	3210/A 30-inch system cabinet without front doors, cooling or power	3,220	NA
M32-567	Front door for 30-inch cabinet with CDD disk drive cutout	230	NA
M32-568	Front door for 30-inch cabinet with dual CDD disk drive cutout	230	NA
M32-569	Full front door for 30-inch cabinet	230	NA
M32-570	3210/A 56-inch system cabinet without front doors, cooling or power; requires 3210/A or I/O expansions	4,025	NA
M32-572	I/O interface panel for 56-inch cabinet	110	NA
M32-750	4K words 3230 WCS	5,000	40
M32-751	Same as M32-750 with software on 1600 cpi mag tape	5,000	40
M32-752	Same as M32-750 with software on 10MB disk	5,300	40

CSQ—Requires special Customer Service quotation.

NA—Not applicable.

NC—No charge.

Concurrent Computer Corporation Supermini Systems

PROCESSOR OPTIONS (Continued)		Purchase Price (\$)	Monthly Maint. (\$)
M32-753	Same as M32-750 with software on 16MB disk, IDC controller	5,300	40
M32-754	Same as M32-750 with software on 16MB disk, MSM controller	5,300	40
M32-755	4K WCS upgrade for 3230 CPU-A board	1,500	40
M33-408	3250 Power-Pak. Converts a 3250XP processor to a 3200MPS system	44,800	CSQ
M33-410	Field conversion option for 3250	17,758	NA
M33-420	3MB MOS memory with ECC	18,000	90
M33-421	4MB MOS memory with ECC	23,000	120
M33-422	6MB MOS memory with ECC	29,000	180
M33-423	8MB MOS memory with ECC	34,000	240
M33-424	10MB MOS memory with ECC	37,000	300
M33-425	12MB MOS memory with ECC	40,000	360
M33-608	Expansion APU for 3200MPS systems	42,000	CSQ
M33-610	APU expansion cabinet for 3200MPS systems; 300 amp P5 current; houses up to three APU and two I/O chassis	11,000	CSQ
M33-612	I/O expansion cabinet for 3200MPS; houses up to five I/O chassis; 150 amp P5 current and AC distribution panel	8,500	CSQ
M33-614	MPS Memory Link; allows a 3200MPS system to address another MPS or a 3200 Shared Memory System	10,000	CSQ
M33-616	DMA bus expansion; provides additional DMA bus for an MPS system; includes DMAI, 8-slot I/O chassis	5,750	CSQ
M33-618	Two-bank memory expansion. Expands a 3200MP system from two banks to four banks. (Does not include storage modules.)	10,000	CSQ
M33-620	I/O Expansion Chassis for 3200MPS system	1,600	CSQ
M33-622	Power down option for APU on 3200MPS; includes M33-612 I/O expansion cabinet	8,500	CSQ
M33-624	P5 expansion module for 3200MPS I/O expansion cabinets; 150 amp	2,500	CSQ
M33-632	High Speed Data Handling Adaptor for 3200MPS	1,100	CSQ
M33-760	75A master power supply for 3205	2,950	16
M33-761	75A master power supply for 3205	2,950	16
M33-762	75A expansion power supply for 3205	1,750	16
M33-764	Battery backup for 3205	1,000	25
M33-766	Cooling fan assembly for 3205	300	NC
M33-768	I/O expansion chassis for 3205	2,000	NC
M33-770	CPU or I/O Mounting Rails for 3205	60	NA
M33-772	3205 Documentation set for Processor and MPC. Includes maintenance and operation	100	NA
M33-776	30" CPU or peripheral expansion cabinet. 115 V 60 Hz	1,100	NC
M33-778	30" CPU or peripheral expansion cabinet. 208 V 60 Hz	1,100	NC
M33-788	3205 Processor system integration	1,000	NA
MEMORY EXPANSION			
M32-162	1MB memory	7,000	30
M32-163	2MB memory	13,000	60
M32-151	Shared Memory DMA	6,000	48
M32-711	1MB MOS memory with ECC; requires 3250 CPU	7,000	30
M32-712	2MB MOS memory with ECC; requires 3250	13,000	60
M32-710	Memory bank expansion; requires 3250	5,000	42
M32-279	512KB MOS memory expansion with ECC; requires 3230 CPU	5,000	60
M32-280	1MB MOS memory expansion with ECC; requires 3230	7,000	30
M32-281	2MB MOS memory expansion with ECC; requires 3230	13,000	60
M32-278	Enhancement for 4MB 3230s to address up to 16MB MOS memory	5,000	NC
M32-000	256KB MOS memory expansion with ECC; requires any 3200	9,200	CSQ
M32-510	512KB MOS memory expansion with ECC; requires 3210 or 3210/A	5,000	CSQ
M32-511	1MB MOS memory expansion with ECC; requires 3210 or 3210/A	7,000	30
M32-512	2MB MOS memory expansion with ECC; requires 3210 or 3210/A	13,000	60
M32-157	Shared Local Memory	3,000	48
M33-626	1MB MOS memory with ECC; requires 3200MPS	7,000	CSQ
M33-628	2MB MOS memory with ECC; requires 3200MPS	13,000	CSQ
M33-752	3205 memory expansion from 1MB to 2MB	6,000	45
M33-754	3205 memory expansion from 2MB to 3MB	5,500	30
M33-756	3205 memory expansion from 3MB to 4MB	5,500	30
MULTIPROCESSOR OPTIONS			
M48-055	I/O switch	2,000	32
M48-058	I/O switch extension cable, 25 feet	300	NC
M48-018	Manual control panel; 1 bus, up to 6 processors	300	3
M48-019	Manual control panel; up to 3 buses, 2 processors each bus	300	3
M48-063	IOS switch panel; up to 3 buses, 2 processors each bus	600	3
M48-064	IOS switch panel; 1 bus, up to 6 processors	500	3
M48-001	8-line interrupt module	1,100	8

CSQ—Requires special Customer Service quotation.
NA—Not applicable.
NC—No charge.

Concurrent Computer Corporation Supermini Systems

		Purchase Price (\$)	Monthly Maint. (\$)
MASS STORAGE			
M46-742	Intelligent Disk Controller (minimum order, 5)	4,500	25
M46-770	Model CDD32, 32MB disk system	16,500	115
M46-772	Model CDD64, 64MB disk system	21,500	130
M46-774	Model CDD96, 96MB disk system	26,500	145
M46-776	Disk pack	250	NA
M46-790	Model CDD32, 32MB disk expansion	12,500	90
M46-792	Model CDD64, 64MB disk expansion	17,500	105
M46-794	Model CDD96, 96MB disk expansion	22,500	120
M60-100	MSM300, 300MB disk with IDC controller	37,000	260
M60-102	MSM80, 80MB disk with IDC controller	23,500	185
M60-104	MSM80F disk with IDC controller	15,200	105
M60-106	MSM80F/HPT disk with IDC controller	22,500	136
M60-108	MSM300 IDC expansion disk	31,000	235
M60-110	MSM80E IDC expansion disk	17,500	160
M60-112	MSM80FE IDC expansion disk	13,000	80
M60-114	MSM80FE/HPT IDC expansion disk	20,300	111
M60-116	80MB disk pack	515	NA
M60-117	300MB disk pack	1,185	NA
M60-120	MSM300F disk subsystem; 268MB drive and controller; 60 Hz	17,500	125
M60-122	MSM300FE expansion disk drive; 268MB drive only; 60 Hz	15,500	100
M60-124	MSM600F disk subsystem; 536MB; two 268MB drives and controller; 60 Hz	39,000	225
M60-126	MSM600FE expansion disk drives; two 268MB drives only; 60 Hz	34,000	200
M60-128	MSM1200F disk subsystem; four 268MB drives and controller; 60 Hz	71,000	425
M46-604	MSM300 disk system; 300MB drive and controller, 60 Hz	37,000	294
M46-605	MSM300E disk expansion drive; 300MB drive only, 60 Hz	31,000	229
M46-600	MSM80 disk system; 80MB drive and controller, 60 Hz	23,500	197
M46-601	MSM80E disk expansion drive; 80MB drive only, 60 Hz	17,500	132
M46-690	MSM disk controller	11,000	65
M46-691	MSM80F disk system, 60 Hz	15,200	118
M46-693	MSM80F/HPT disk system, 60 Hz	22,500	149
M46-695	MSM80FE disk expansion, 60 Hz	13,000	53
M46-697	MSM80FE/HPT disk expansion, 60 Hz	20,300	84
M46-622	MSM80E dual port option, factory installed	2,000	21
M46-624	MSM300E dual port option, factory installed	2,500	27
M46-626	MSM80E dual port option, field installed	2,700	21
M46-628	MSM300E dual port option, field installed	3,200	27
M46-699	MSM80F/HPT dual port option	1,800	27
M46-609	80MB formatted pack	549	NA
M46-610	300MB formatted pack	1,225	NA
M46-730	Model CDD32, 32MB disk subsystem for 3210 processors and packaged systems	16,500	152
M46-732	Model CDD32, expansion drive for 3210	12,500	90
M46-734	Model CDD64, 64MB disk subsystem for 3210	21,500	167
M46-736	Model CDD64, expansion drive for 3210	17,500	105
M46-738	Model CDD96, 96MB disk subsystem for 3210	26,500	182
M46-740	Model CDD96, expansion drive for 3210	22,500	120
M46-743	Removable cartridge disk pack for 3210	260	NA
MAGNETIC TAPE			
M46-750	Mag tape; 9-track, 800 cpi, 75 ips	10,500	155
M46-752	Mag tape expansion; 9-track, 800 cpi	10,000	130
M46-754	Mag tape; 9-track, 800/1600 cpi, 75 ips	19,100	175
M46-756	Mag tape expansion; 9-track, 800/1600 bpi	11,200	130
M46-758	Controller; 800 cpi, 75 ips	2,750	25
M46-759	Controller; 800/1600 cpi	2,530	25
M46-760	Tape transport; 9-track, 800 cpi	6,100	120
M46-762	Tape transport; 9-track, 1600 cpi	10,600	115
M46-764	Expansion transport; 9-track, 1600 cpi	6,600	100
M46-766	Controller; 1600 cpi, 45 ips	2,530	25
M46-767	Controller; 800 cpi, 45 ips	2,750	25
M60-010	HPTD 125 mag tape subsystem; 800/1600/6250 bpi; 125 ips; tape auto load and power window; supports three additional expansion transports	49,500	390
M60-012	HPTD 125 mag tape subsystem; 800/1600/6250 bpi; high speed, 125 ips; gapless mode support with 1K buffer, tape auto load and power window; supports three additional expansion transports	51,500	390
M60-015	HPTD mag tape controller; 800/1600/6250 bpi; 125 ips	13,750	30
M60-016	HPTD 125E expansion transport; 800/1600/6250 bpi; 125 ips	23,000	225
TERMINALS			
M60-160	6100 VDU, green phosphor CRT, 115 VAC, 60 Hz	950	15
M60-162	Same as M60-160, but amber CRT	950	15
M60-240	6312 VDU with full editing capabilities, 115 V, 60 Hz	1,375	18
M60-241	Same as M60-240, but amber CRT	1,375	18

CSQ—Requires special Customer Service quotation.

NA—Not applicable.

NC—No charge.

Concurrent Computer Corporation Supermini Systems

		Purchase Price (\$)	Monthly Maint. (\$)
PRINTERS			
M46-233	CP printer interface and cable	990	11
M46-300	LP300 line printer, 90-132 VAC, 60 Hz	9,000	111
M46-302	LP300 line printer, 180-250 VAC, 60 Hz	9,000	111
M46-304	LP600 line printer, 90-132 VAC, 60 Hz	15,000	151
M46-306	LP600 line printer, 180-250 VAC, 60 Hz	15,000	151
M46-309	LP printer pedestal and paper shelf	500	NC
M46-310	LP printer acoustical cabinet	1,000	NC
M46-312	LP300 USAC II 64-character set	750	NA
M46-313	LP300 USAC II 96-character set	750	NA
M46-319	LP600 USAC II 64-character set	750	NA
M46-320	LP600 USAC II 96-character set	750	NA
M60-200	LQP-55 letter quality printer	3,495	50
M60-210	LQP-25 letter quality printer	1,295	25
M60-285	Model PR-210 color dot matrix line printer	2,750	45
M60-250	LP1200 line printer	29,990	290
M60-254	LP1200 USASCII 64-character set	750	NA
M60-255	LP1200 USASCII 96-character set	750	NA
CARD EQUIPMENT			
M46-235	400-1000 cpm card reader interface	1,210	11
M46-234	Hollerith to ASCII conversion	484	NC
M46-238	400 cpm card reader, 60 Hz	7,000	65
COMMUNICATIONS EQUIPMENT			
M47-160	Ethernet Data Link Controller	3,700	35
M47-163	Ethernet local area network coaxial cable, 25 meters	440	NA
M47-180	Ethernet terminal server host end package	5,500	50
M47-183	Ethernet terminal server end package host end	4,800	50
M47-184	Ethernet terminal server expansion package, terminal end	4,500	50
M47-014	DMA I/O subsystem (DIOS)	7,040	53
M47-015	DMA I/O subsystem (DIOS) with zero bit	8,690	63
M47-106	Single line synchronous adapter	1,650	16
M47-107	Single line synchronous adapter with zero bit	1,980	16
M47-108	Cable SSA Bell 200 or equivalent 25 feet	187	NA
M47-002	QUAD synchronous adapter	2,310	32
M47-003	QUAD synchronous adapter with zero bit	3,520	42
M47-004	Line conditioning module (LCM)	990	21
M47-005	Line conditioning module (7.5-inch)	770	11
M47-104	2-line communications multiplexor	990	16
M47-105	8-line communications multiplexor	2,640	32
M47-110	Current loop communications multiplexor	2,420	32
M47-016	Bell 801 auto calling unit interface	1,760	11
SYSTEMS MODULES			
M48-062	Universal clock module	990	8
M48-001	8-line interrupt module	1,100	8
M48-002	General-purpose interface board	770	NA
M48-060	Subchannel controller	1,210	6
M48-065	Universal DMA interface	770	NA
M32-110	8KB loader storage unit with Series 3200 bootstrap loader	1,100	11
INPUT/OUTPUT			
M48-400	Contact closure module	525	6
M48-500	Relay driver module	525	6
M48-450	Digital I/O module	700	11
M48-612	Digital I/O cable assembly	120	NA
M48-353	D/A output system module	1,050	21
M48-354	D/A system with scope control	1,150	32
M48-355	D/A system 4-channel	1,850	42
M48-214	A/D input module, 33KHz	1,600	32
M48-215	A/D input module, 75KHz	3,100	42
M48-212	A/D input module, 20KHz	2,900	32
M48-213	A/D input module, 40KHz	3,200	42
M48-207	A/D module expansion multiplexor	400	21
M48-216	A/D programmable gain option	630	16
M48-217	Programmable gain/dual LL amplifiers	1,150	16
M48-606	Analog termination panel	460	NC

CSQ—Requires special Customer Service quotation.

NA—Not applicable.

NC—No charge.

Concurrent Computer Corporation Supermini Systems



		Purchase Price (\$)	Monthly Maint. (\$)
CABINETS AND CHASSIS			
M32-156	Shared Memory System Cabinet	15,000	42
M49-115	Single pedestal, beige, without power	400	—
M49-118	Double pedestal, beige, 115 VAC	800	—
M49-119	Double pedestal, beige, 230 VAC	800	—
M49-107	56-inch cabinet, beige, without power	1,265	NC
M32-420	I/O expansion cabinet with power	12,397	CSQ
M32-105	56-inch I/O expansion cabinet, beige, without power	1,265	NC
M32-106	56-inch I/O expansion cabinet, beige, with power	9,775	42
M49-140	I/O expansion cabinet with AC distribution panel; requires 3250 CPU	4,025	NC
M49-143	I/O expansion chassis; requires 3250	1,840	NC
M32-515	I/O expansion cabinet	6,325	16
M32-517	Single disk expansion cabinet	2,300	NC
M32-519	Single disk and I/O expansion cabinet	7,245	16
M32-521	Dual disk expansion cabinet	2,300	NC
M32-565	3210/A 30-inch system cabinet without front doors, cooling or power	2,800	—
M32-570	3210/A 56-inch system cabinet without front doors, cooling or power	3,500	—
M32-572	I/O interface panel for 56-inch cabinet	100	—
M32-159	Memory Expansion Chassis	3,000	NA

CSQ—Requires special Customer Service quotation.
 NA—Not applicable.
 NC—No charge.

SOFTWARE PRICES

GROUP I

For 3203 and 3205 systems. All prices include documentation package and are subject to Concurrent licensing agreements.

	Purchase Price (\$)
OS/32	1,800
OS/32 MTM	300
OS/32 Text	550
Xelos, 8 user (tape)	1,500
Xelos, 8 user (disk)	2,100
Pascal	3,400
Reliance Plus	3,000
Reliance	2,800
Reliance Plus DBMS option	500
Reliance Update System (RUS/32)	800
Cobol	1,400
DMS/32	2,000
Pennet	2,300
Reporter/32	1,000
Sibol	1,250
RM/Cobol Development System	1,495
RM/Cobol Runtime System	750
Medit	800
OS/32 C Compiler	2,800
Unify Development System	2,995
Unify Runtime System	1,495
BSC/3270 Emulation	1,400
BSC/3270 Support	1,400
NEM/32	800
SNA Base	2,800
SNA/DSX Support	1,000
SNA/HCF Support	1,600
SNA/RJE Emulation	1,000
SNA/3270 Emulation	1,600
SNA/3270 Support	1,600
The Record Keeper	1,000
VisiWord	1,750
The Final Word	1,750
Supercomp-Twenty	2,000



Concurrent Computer Corporation Supermini Systems

GROUP II	Purchase Price (\$)
For 3210, 3210/A, and 3230 systems. All prices include documentation package and are subject to Concurrent licensing agreements.	
OS/32	4,400
OS/32 MTM	2,000
OS/32 Text	825
Xelos, 16 user (tape)	5,000
Xelos, 16 user (disk)	5,600
Pascal	4,600
Reliance Plus	15,000
Reliance	13,000
Reliance Plus DBMS option	2,000
Reliance Update System (RUS/32)	2,000
Cobol	3,975
DMS/32	6,000
Pennet Plus	4,700
Reporter/32	3,000
Sibol	5,000
RM/Cobol Development System	2,495
RM/Cobol Runtime System	1,295
Medit	1,100
OS/32 C Compiler	5,200
Unify Development System	6,995
Unify Runtime System	3,495
BSC/3270 Emulation	2,600
BSC/3270 Support	2,600
NEM/32	2,000
SNA Base	5,200
SNA/DSX Support	1,600
SNA/HCF Support	3,000
SNA/RJE Emulation	1,600
SNA/3270 Emulation	3,000
SNA/3270 Support	3,000
The Record Keeper	1,500
VisiWord	3,200
The Final Word	3,400
Supercomp-Twenty	3,800

GROUP III

For 3250, 3250XP, and 3200MPS systems. All prices include documentation package and are subject to Perkin-Elmer licensing agreements.

OS/32	6,400
OS/32 MTM	3,000
OS/32 Text	1,100
Xelos, 16 user (tape)	7,500
Xelos, 16 user (disk)	8,100
Pascal	5,775
Reliance Plus	24,000
Reliance	20,000
Reliance Plus DBMS option	4,000
Reliance Update System (RUS/32)	4,000
Cobol	5,300
DMS/32	10,000
Pennet Plus	5,000
Reporter/32	7,000
Sibol	7,500
RM/Cobol Development System	4,995
RM/Cobol Runtime System	2,495
Medit	1,400
OS/32 C Compiler	7,000
Unify Development System	14,995
Unify Runtime System	7,495
BSC/3270 Emulation	4,000
BSC/3270 Support	4,300
NEM/32	4,000
SNA Base	8,000
SNA/DSX Support	3,000
SNA/HCF Support	4,500
SNA/RJE Emulation	3,000
SNA/3270 Emulation	4,500
SNA/3270 Support	4,500
The Record Keeper	2,000
VisiWord	4,100
The Final Word	4,300
Supercomp-Twenty	4,800

Concurrent Computer Corporation Supermini Systems

	Purchase Price (\$)
NO GROUP ASSOCIATION	
Mirror Disk	4,000
Resilient System	15,000
Sort/Merge II	1,150
MicroXelos	750
Basic II	500
Basic Plus	400
Coral 66	6,000
RPG II	2,750
Reliance Star	5,000
HASP/32	2,120
2780/3780 RJE Emulator	1,500
UPGRADES	
OS/32	
Group I to Group II	2,250
Group I to Group III	3,750
Group II to Group III	1,500
OS/32 MTM	
Group I to Group II	1,200
Group I to Group III	1,850
Group II to Group III	650
OS/32 Text	
Group I to Group II	75
Group I to Group III	150
Group II to Group III	75
Pascal	
Group I to Group II	800
Group I to Group III	1,600
Group II to Group III	800
Reliance Plus	
Group I to Group II	8,000
Group I to Group III	13,400
Group II to Group III	5,400
Reliance	
Group I to Group II	5,876
Group I to Group III	9,876
Group II to Group III	4,000
Reliance Update System (RUS/32). Documentation package not included.	
Group I to Group II	900
Group I to Group III	2,100
Group II to Group III	1,200
Cobol	
Group I to Group II	975
Group I to Group III	1,500
Group II to Group III	525
DMS/32	
Group I to Group II	1,800
Group I to Group III	3,400
Group II to Group III	1,600
Pennet	
Group I to Group II	1,850
Group I to Group III	3,550
Group II to Group III	1,700
Reporter/32	
Group I to Group II	2,000
Group I to Group III	4,000
Group II to Group III	2,000
Sibol	
Group I to Group II	1,500
Group I to Group III	2,500
Group II to Group III	1,000

Concurrent Computer Corporation Supermini Systems

	Purchase Price (\$)
Medit	
Group I to Group II	100
Group I to Group III	200
Group II to Group III	100
OS/32 C Compiler	
Group I to Group II	1,280
Group I to Group III	2,480
Group II to Group III	1,200
BSC/3270 Emulation	
Group I to Group II	1,000
Group I to Group III	2,400
Group II to Group III	1,200
BSC/3270 Support	
Group I to Group II	1,000
Group I to Group III	2,400
Group II to Group III	1,200
NEM/32	
Group I to Group II	900
Group I to Group III	2,100
Group II to Group III	1,200
SNA Base	
Group I to Group II	2,000
Group I to Group III	4,000
Group II to Group III	2,000
SNA/DSX Support	
Group I to Group II	500
Group I to Group III	1,000
Group II to Group III	1,000
SNA/HCF Support	
Group I to Group II	2,000
Group I to Group III	4,000
Group II to Group III	2,000
SNA/RJE Emulation	
Group I to Group II	500
Group I to Group III	1,000
Group II to Group III	1,000
SNA/3270 Emulation	
Group I to Group II	2,000
Group I to Group III	4,000
Group II to Group III	2,000
SNA/3270 Support	
Group I to Group II	2,000
Group I to Group III	4,000
Group II to Group III	2,000

FORTRAN LANGUAGE SYSTEMS

	Initial License* (\$)	Right- of-copy License* (\$)
Universal Fortran Language System	15,000	6,000
Global Fortran Language System	10,300	3,800
Fortran VII Universal Compiler	12,000	4,650
Fortran VII Global Compiler	7,300	2,450
Fortran VII Development Compiler	3,400	1,150
Debug/32	2,000	1,000
Series 3200 FEP	1,000	350
Fortran Performance Utilities	1,000	500
Upgrade to FLS	8,500	4,000
Universal Compiler Upgrade (no documentation; subject to licensing prerequisites)	5,500	2,650
Global Compiler Upgrade (no documentation; subject to licensing prerequisites)	5,200	1,750

*Prices include documentation, except where otherwise indicated. ■