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EVOLUTION OF THE 2200

In 1972 the first 2200 series computer was introduced. Since that time, the 2200 (and now the CS/386) has continued to develop and expand to meet the needs of small business.

Initially the 2200 series of computers were sold mainly to universities, scientific and technical problem solving users. But it became evident that the small business marketplace was also a viable and potentially important market. There were lots of small businesses wanting assistance in performing accounting functions, inventory control and payroll. People in the early 1970s were beginning to realize that computers could provide this assistance. In addition, software vendors working in the small business market were looking for more powerful and convenient routines for business programming, such as better SORT and SEARCH capabilities. These routines contained within our BASIC language, made programming much easier and made the 2200 attractive to software developers.

The first 2200s used tape 80KB cassettes with accesses of 10 to 15 seconds. In 1973, 250KB floppy diskettes and up to 5MB fixed/removable hard disk drives were introduced. In 1974, fixed/removable disk storage capabilities increased to 20MB. Versus seconds for a cassette, diskette or disk storage, could be accessed in a fraction of a second. Cassette based systems could only address 20% to 30% of the small business market. Diskette and disk drives opened brand new 2200 markets and by the mid 1970s the shift to the commercial marketplace was almost complete.

The 2200 was proving itself a leader in small business systems. There were several reasons for this leadership position. The first was the price/performance ratio. The early 2200 series (2200A, 2200B, 2200C, 2200S and 2200T) were price well below competition. The 2200 line even had the first Personal Computer System, the PCS. The PCS was a combination CPU, CRT and two 96KB mini-diskettes. The second reason was the 2200's excellent interactive capability. The third was the BASIC language. It was easy to program and extensions to BASIC made sorting and searching much easier. A fourth reason was the 2200 was memory-efficient. Unlike competition, the 2200 had a separate user memory area and control memory. User memory had very little overhead and could be accessed quickly.

One of the most significant steps in the evolution of the 2200 was the first multi-user system. A multi-user system could be created by multiplexing a disk from 2 to 4 CPUs. The CPUs shared common disk storage, often used programs and data files. However, this was not the final answer. What was needed was faster CPUs and a single CPU that could handle multiple users.

The next step of the multi-user evolution came in two stages. The first was the announcement of the VP in 1976. The performance of the VP was 8 to 12 times faster than a 2200T and 4 to 30 times faster than the competition at that time. The second was the introduction of the MVP, Wang's first multi-user computer system in 1977. In its early stage the MVP supported 256K of user memory and 12 terminals. In its later stages, 512K and 13 users, and 2 to 4 CPUs could multiplex 1 to 2 disk drives. A later prepackaged version called the LVP, incorporated a built-in diskette and a fixed Winchester of up to 32MBs to become even more price competitive.

The MVP and LVP opened new markets to Wang Laboratories. With the concurrent development of newer and faster interactive terminals as the 2336 series and larger and faster storage devices as the 2280 80MB fixed/removable disk drive,

sales into the medium and large size accounts commenced. Sales for the MVP models alone reached \$100 million in the first year, an impressive number in the late 1970s.

After the announcement of the initial MVP and the LVP models, model changes were limited to size of memory and the number of I/O slots available, e.g., the MVPC and LVPC models, and new peripherals. The next major innovation in the 2200 product cycle was not until April of 1985 with the announcement of the MICROVP. The MICROVP, the replacement for all 2200 CPUs, was the first 2200 system to incorporate VLSI technology. The VLSI chip based MICROVP contained only one printed circuit board (replacing 7 to 9 boards) and was available in two memory configurations, e.g., the MICROVP-1 (128KB) and the MICROVP-2 (512KB). The MICROVP CPU was 10% faster than the previous 2200 CPUs. However, the real excitement to this announcement was because of VLSI technology, monthly maintenance was reduced up to 70%.

In March of 1987, we announced the CS and the DS. The CS-2 (128KB) through CS-80 (8MB), the replacement for the 2200 and MICROVP CPUs, is built on the base of the VLSI MICROVP and has been repackaged and redesigned into an attractive VS appearance CPU cabinet. The VLSI chip based CS contains only one printed circuit board. All models have 32KB of control memory, nine I/O slots, supports 16 users per CPU, up to 16 CPUs can multiplex 1 to 3 disk drives and can utilize existing 2200/MICROVP option boards, peripherals and communication controllers. Complete hardware and software compatibility with existing 2200 and MICROVP systems is provided.

RAMdisk is available on all models. RAMDISK allows a portion of user memory (up to 7MB) to be used as a high-speed disk and all of the BASIC-2 statements can be used with RAMDISK. Since user memory is used to emulate disk storage and there is no physical disk address, RAMDISK access is considerably faster than access to an actual disk.

The new DS Data Storage Cabinet introduces a unique concept of data storage to existing 2200/MICROVP users and flexibility to new users of CS systems. The cabinet is ordered separately and a 320KB or 1.2MB half-height removable diskette, 10MB removable winchester disk drive, a 45MB tape streamer, and 20, 32, 64MB or 140MB fixed winchesters can be inserted into the cabinet, in order to customize the end-user's storage requirements. In addition, the DS provides 1,024 sectors (256KB) of cache memory compared to seven sectors on the 2280. Up to 990 sectors (256 bytes/sector) of the cache memory can also be allocated to RAMDISK. Once the RAMDISK is established, it is accessed as a normal disk platter and supports all disk commands. RAMDISK can be used to store frequently accessed data and provide a high-speed CPU to CPU communications path.

In December of 1988, we announced a new low-cost workstation and two new CS CPUs. The new workstation, the 2536DW, is a new design, low-cost workstation for the CS/2200 product line. The two new CPUs are the CS-D and CS-N series of CPUs, designed to replace the current CS series of CPUs. The CS-D has the ability to support up to three internal storage devices. The CS-N, utilizes the current DS (data storage cabinet) and directly replaces the current CS.

On May 15, 1989, Wang Laboratories announced a unique milestone in the history of computer manufactures and systems. Wang Laboratories now has the unique distinction of being the only manufacturer to take maturing computer architecture (CS/2200) and move it to a standard industry (INTEL 80386) platform. The new INTEL 80386 CPUs are the CS/386-D and CS/386-N series of CPUs, designed to replace the current CS-10D through CS-80D and CS-10N through CS-80N VLSI series of CPUs.

The CS/386 series of computers with its brand new supporting peripherals and the ability to integrate with our VS and PC product lines, have dramatically changed since the early days of the 2200A through 2200T. The 2200 marketplace which was 80-90% technical is now 95% commercial. Over 73,000 2200/MICROVP/CS systems have been sold worldwide and thousands of applications are available. 60,000 are the older models, all prime prospects for the latest Wang technology. Which is the main reason why the new CS/DS series is doing so well.

Perhaps the most important lesson we have learned from the evolution of the 2200 product line is the need to respond to market demand. The 2200 was and still is a very fine small business computer geared to solving DP problems. It is targeted at a certain segment of the market and there still is no one piece of multi-user, BASIC-2 compatible gear, in its price range, ready to take its place in the small business marketplace. There are products that will replace segments but not all. For these reasons, we will continue to develop and enhance the product line until there is a better Wang answer.

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UNDERSTANDING HOW A CS CPU WORKS

BASIC Interpreter

CPUs house either an interpreter or a compiler. The CS/2200 systems are interpretative systems. Although it is difficult to compare a compiler and interpreter, a few general differences may be stated.

A compiler translates the source code of an entire program to machine language and then stores the object code for use in the application. An interpreter only maintains source code in the system and translates and executes one program statement at a time when the program is used. The interpreter does not wait until the entire program has been read and compiled. For the programmer, the interpreter can provide almost immediate syntactical analysis. If errors have been made in the code, they can be discovered at once. The more conventional layers of software including assemblers, linkage editors, compilers and loaders are eliminated.

The interpreter is also very interactive and provides fast feedback. The immediate feedback and diagnostic aids in interpreters makes program development easier and more effective than compilers. The design of the CS and its efficient BASIC-2 interpreter, overcomes the traditional problems other interpreters have, including the need for larger memory. For example, the CS is not a pure direct execution machine, since the source code is preprocessed into a form more memory conservative and more efficiently interpreted. Our BASIC-2 is an extension of BASIC with I/O and data handling language extensions.

Memory

In the CS you have control and user memory. Both are RAM (Random Access Memory).

Control Memory

Control memory (32KB of 24-bit words) is for the operating system (OS) and language interpreter. The microprogram in control memory directs the execution of the CPU and coordinates communication with the I/O processors. The I/O bus regulates the flow of information to and from the processor. I/O, independent from the CPU, permits the overlap of CPU and I/O processing. The BASIC-2 interpreter is contained in control memory as is the BOOTSTRAP program. BOOTSTRAP reads system software from disk into control memory at power on.

User Memory

User memory (128KB to 8MB) is for application programs and RAMdisk. Application programs are stored in a highly compressed atomized form in order to conserve memory space. A CS can have up to 16 memory banks. In bank one, there is a 3KB OS bank overhead and the option of having either a 5KB universal global partition or a 61KB partition. All other banks have an 8KB overhead for the maximum of a 56KB bank. Each bank may be divided into partitions, with each partition capable of running a separate program. User memory can be divided into a maximum of 16 partitions. Therefore, the larger your memory, the larger your partition size. The largest system you can have for program is a 1MB system. With 1MB, you can have 1 61KB partition and 15 56KB partitions. All memory above 1MB, must be assigned to RAMdisk.

The number of partitions in a system and their size, are established in a process call partition generation. Each partition is assigned one terminal but may be reassigned to another terminal as needed. The CPU allocates intervals of processing time (30 milliseconds) to each partition in turn, in a "round-robin" fashion or "time slicing". Thus the program in a partition executes for a brief time before the CPU services the next partition. This creates the illusion of simultaneous execution of several programs at the same time, which is the concept of multi-programming.

Universal Global

The Universal Global partition is a special type of partition that allows sharing of data and programs by several different partitions. Each regular partition runs its own programs and is independent of the other partitions. However, any partition can use the Universal Global partition. You can also have a global partition within a bank that can be shared by other partitions within that bank. The sharing of data and common routines is another example of the efficient use of CS memory.

Foreground/Background

The CS also has the capability to run jobs in foreground and background. If an operator is inputting information through a terminal, this job is said to be in foreground. The job(s) running in partitions assigned to a terminal but not presently attached to it, are running in the background. Thus, you need not have 16 terminals in order to run 16 tasks.

24, 16 Or 8 bit?

The question most frequently asked by a prospective new user is "Is your system an 8, 16 or 32 bit machine?" The answer most given by Wang people is the 2200 is an 8-bit machine. The truth is the CS is a pseudo 16-bit processor using a 3-bus architecture for interconnecting a bank of general purpose, status, and I/O 8-bit registers and the ALU (Arithmetic Logic Unit). A microinstruction can address these registers as double, single or half registers for performing 16, 8 or 4-bit operations. The extensive microinstruction set (Control Memory), consisting of 24-bit words, provides decimal and binary arithmetic.

In comparison to a 16-bit PC, the CS performs two 8-bit I/Os in a single instruction versus several instructions on a PC to do 16-bits. In a single CPU cycle (600 nsec.), a 24-bit microinstruction can be fetched, 16-bits of data memory can be fetched, and a 16-bit operation can be performed. Therefore, because we have an 8-bit I/O but we can perform 2 fetches (16-bits) in a single instruction, are we an 8-bit or 16-bit system? What about the 24-bit microinstruction? It could be considered a 40-bit system, e.g., $24 + 16 = 40$ -bits.

Summary

CPUs vary in several ways, including speed, memory capacity, user-control memory design, storage capacity, peripheral offerings and the number of I/O slots. Compared in its proper perspective, the new CS meets all the criteria of a modern system to meet the needs of the small business marketplace.

CS/386-D, CS/386-N CPUs And The BASIC-2/386 Multi-user Operating System,
Release 1.0.

HIGHLIGHTS

- . Supports all BASIC-2 statements making the new CS/386 CPUs software compatible with all existing 2200, MICROVP and CS software.
- . Hardware compatible with all MICROVP and CS peripherals, I/O controllers and CS/DS options.
- . The CS/386 CPU is on an average of 200% faster than a CS CPU
- . A Partition can now be a maximum of 8MB versus 61KB on a VLSI CPU.
- . All memory can be allocated to program versus 1MB on a VLSI CPU.
- . Because of the large partition size, program overlays can be eliminated, resulting in a further performance increase.
- . Single or multiple partitions of any size can be declared a global to all other partitions, versus a single 5K global on a CS/2200.
- . A CS/386 CPU can read and write MS-DOS files on the DS-1.2.
- . Utilizes the current CS-D/N chassis.
- . CS/386 models (CS/386-D, CS/386-N), are available with 1MB to 8MB of main memory. 128KB and 512KB VLSI CS-D/N models are still available.
- . Any VLSI CPU can be field upgraded to a CS/386.

PRODUCT DESCRIPTION

The CS/386 CPUs, available in the CS-D and CS-N chassis, are designated the CS/386-D and CS/386-N. These CPUs use an INTEL 80386-16 32-bit high performance microprocessor chip as their processor. The new CPU board organizes memory as banks of 36 bits consisting of 32 bits of data and 4 bits of parity. In this design we use eight 32KB SRAM chips and four 64KB SRAM chips to access 256KB system memory. For user memory, 1MB is four 256KB 9 bit SIMMs, 2MB is 8 256KB 9 bit SIMMs, 4MB is 4 1MB 9 bit SIMM and 8MB is 8 1MB 9 bit SIMMs. The CPU has its own real time clock, a feature previously available only through the 2236MXE.

The CS/386-D is available with either 1MB (CS/386-10D), 2MB (CS/386-20D), 4MB (CS/386-40D) or 8MB (CS/386-80D) of main memory. The CS/386-D uses the chassis of the CS-D and supports an external DPU and three internal storage devices. The DPU can support either a 320KB or 1.2MB diskette, a 45MB tape streamer, one fixed Winchester and 1,024 sectors of cache. The Winchesters supported are a 20MB, 32MB, 64MB and a 140MB that can either be formatted as 14 10MB platters (140MB) or 7 16MB platters (112MB). The diskette and tape streamer are visible and easily accessible in order to insert and remove media. The fixed Winchester is inside the cabinet but a disk activity light (located below the power on indicator light), is provided on the front of the CPU panel. The CS/386-D replaces the CS-10D through CS-80D.

Unlike the DPU contained in the DS, the DPU for the CS/386-D is an external board that is inserted into I/O slot 9, the same as an I/O controller. The DPU also contains a system printer port. Hence, no I/O slots are lost as the DPU occupies an I/O slot the same as a 22C11 (dual printer/disk) controller) would occupy if using an external DS.

The DPU has the same functionality as the DPU in the DS with the exception that it only supports three storage devices instead of six. 1,024 sectors of cache are included with the ability to allocate up to 990 sectors (256 bytes/sector) of the cache memory to RAMDISK. Once the RAMDISK is established, it is accessed as a normal disk platter and supports all disk commands. RAMDISK can be used to store frequently accessed data and provide a high-speed CPU to CPU communications path.

The fixed Winchester can be multiplexed by up to 16 CPUs using a combination of 2275MUX and 2275MUXE controllers, the same as a DS. The only difference is instead of a DS being cable connected to the disk port on a 2275MUX, the DPU is cable connected to the 2275MUX. Three CPUs can be cable connected to the 2275MUX. Additional CPUs can be multiplexed to the fixed disk storage unit by adding up to three model 2275 MUXEs (MUX Extenders). Each 2275MUXE supports four CPUs. These boards are placed next to the 2275MUX and are connected to the 2275MUX by a ribbon cable. Participating CPUs must each have a 22C80 controller. CPUs multiplexing the fixed Winchester can be any type of CS/2200 CPU that supports a 22C80 board. These CPUs can be CS/386-Ds or CS-Ds with their own local storage. Up to two external DSs can be added to a CS/386-D via 22C11 disk/printer controllers. In addition, the end-user has the option of removing the storage devices from the CS/386-D and having them inserted into a DS if the need arises to replace the internal storage with a DS. The DPU is then removed and replaced by a 22C11 disk controller.

The CS/386-N is a CS/386-D without a DPU board and panels covering the slots where the diskette and tape streamer would go. The CS/386-N is available with either 1MB (CS/386-10N), 2MB (CS/386-20N), 4MB (CS/386-40N) or 8MB (CS/386-80N) of main memory. The CS/386-N replaces the CS-10N through CS-80N. As the previous CS-10N through CS-80N, an external DS is required for storage. CS/386-N models are field upgradable to a CS/386-D.

Both 386 models have 256KB of control memory, nine I/O slots, supports 16 users/partitions, and (with the exception of their own memory upgrades) can utilize existing CS-N to CS-D upgrades (UJ-6047), option boards, peripherals and communication controllers. Complete hardware and software compatibility with existing CS/MICROVP/2200 systems is provided.

As the recommended minimum memory configuration for a CS/386 CPU is 1MB, the CS-2D/N (128KB) and CS-5D/N (512KB) models will remain in the product line. End-users wanting to buy a VLSI CPU with greater than 512KB of memory, would order a CS-5D or CS-5N and a memory upgrade UJ. For example, to end up with 4MB, you would order a 512KB CS-D/N and UJ-5071.

Field Upgrades

Any VLSI CPU can be field upgraded to a 386 CPU by replacing the VLSI CPU board with a CS/386 CPU board and the new 386 operating system (BASIC-2/386 Operating System Release 1.0). VLSI CPUs include the MVP-128/512, MICROVP-/2 and all CS, CS-D and CS-N models. The following are the available CPU field upgrades:

<u>MODEL</u>	<u>DESCRIPTION</u>	<u>MEMORY</u>
UJ-6048	VLSI To 386 CPU	1MB
UJ-6049	VLSI To 386 CPU	2MB
UJ-6050	VLSI To 386 CPU	4MB
UJ-6051	VLSI To 386 CPU	8MB

Additional memory can be added to existing CS/386 CPU boards. The following are the available memory upgrades:

<u>MODEL</u>	<u>DESCRIPTION</u>
UJ-6052	1MB to 2MB 386 CPU Board
UJ-6053	1MB to 4MB 386 CPU Board
UJ-6054	1MB to 8MB 386 CPU Board
UJ-6055	2MB to 4MB 386 CPU Board
UJ-6056	2MB to 8MB 386 CPU Board
UJ-6057	4MB to 8MB 386 CPU Board

NOTE: To upgrade a CS/386-N to a CS/386-D, use UJ-6047.

Release 1.0 Of The BASIC-2/386 Multi-user Operating System

Concurrent with the announcement of the CS-D/N CPUs, Release 1.0 of the Multi-user BASIC-2/386 Operating System (OS) is also announced. 1.0 has the following additional enhancements (because of the 80386 chip) over Release 3.3 of the 2200/VLSI BASIC-2 Multi-user OS:

- . On a VLSI CPU only 1MB can be assigned to program, any additional memory can only be used for RAMdisk. The maximum partition size is 61K for partition 1 and 56K for all other partitions, for a maximum of one 61K and fifteen 56K partitions. On an 8MB CS/386 CPU, a partition could be as large as 8MB and all memory can be allocated to program. You can configure one 8MB partition, eight 1MB partitions, sixteen 500K partitions, or any combinations of partitions and RAMdisk, of any size, for a total of 8MB.
- . Any partition or multiple partitions can be declared a universal global to all other partitions on the CS/386. On a VLSI/2200 CPU you are limited to a single 5K universal global. The universal global partition is a special type of partition that allows sharing of data and programs by several different partitions. Each regular partition runs its own programs and is independent of the other partitions. However, any partition can use the Universal Global partition. On a VLSI/2200 CPU you can also have a global partition within a bank that can be shared by other partitions within that bank. This feature is not supported, nor needed on a 386 CPU due to the large global size available and the ability to have multiple globals.
- . The introduction of six new commands that allows a BASIC-2 program to read and write MS-DOS files from an MS-DOS diskette in the DS-1.2. These commands are:
 - . DATA LOAD AC OPEN - Open an existing MS-DOS file
 - . DATA SAVE AC OPEN - Create a new MS-DOS file
 - . DATA LOAD AC - Read an MS-DOS file
 - . DATA SAVE AC - Write an MS-DOS file
 - . DATA SAVE AC END - Update file size and close
 - . DATA SAVE AC CLOSE - Close an MS-DOS file

CS/386 GOALS

- . To improve CPU performance by 200 to 300% for CPU intensive operations.
- . For the 386 CPU to be able to handle 16 users at the same level of performance that we currently can handle 8.
- . To provide an upgrade path for existing VLSI CPU users by replacing their VLSI CPU board.
- . To provide a "stepping stone" product that will address the traditional weakness of the CS/2200 product line, e.g., partition size, number of partitions, efficient filing systems, improved I/O performance, etc.
- . To create a Wang CS/2200 "look-a-like" that will continue to touch, smell and feel like a 2200 but have a "state of the art" modern image in the small business marketplace.
- . To provide a transition path for 2200/CS users to modern technology.

The CS/386 CPU board and CPU addresses three markets:

1. Existing VLSI CPU users (6,000+ CPUs) who can be updated by replacing their current CPU board and operating system.
2. Existing 2200 CPU users who have not yet updated to a VLSI CPU (estimated at 30,000+ CPUs).
3. New users who would not buy a CS/2200 unless it had the latest technology.

Existing VLSI and 2200 users will update for the following reasons:

1. The 386 CPU will provide a 200% increase in CPU throughput
2. Partition sizes are now unlimited.
3. Global partition sizes are unlimited.
4. We will be able to read and write MS-DOS files.
5. We will support all the features of WANG BASIC-2.

New users will buy the product as:

1. It is 386 technology.
2. We can integrate BASIC-2 and MS-DOS.
3. Thousands of existing BASIC-2 applications will run "as is".

2200 MODEL STATISTICS

The following chart gives general product specifications for most of the 2200 models shipped since 1972. Maximums are expressed in practical installable limits.

<u>FEATURE</u>	<u>A/B/C</u>		<u>T/S</u>	<u>PCS</u>	<u>VP</u>	<u>SVP</u>	<u>LVP</u>	<u>LVPC</u>	<u>MVP</u>	<u>MVPC</u>	<u>MICROVP</u>	<u>CS</u>
	<u>WCS</u>								<u>(VLSI CPUs)</u>			
Memory	4-16K		32K	32K	16K- 128K	32K- 256K	32K- 512K	64K- 512K	32K- 512K	64K- 8MB	128K-	128K
I/O Slots	6	3/6	-	9	1-3	3	7	9	7	9		9
Users	1	1	1	1	1-3	8	13	13	13	16		16
Tasks	1	1	1	1	16	16	16	16	16	16		16
BASIC	X	X	X	-	-	-	-	-	-	-		-
BASIC-2	-	-	-	X	X	X	X	X	X	X	X	X
Control Memory	PROM	PROM	16K	32K	32K	32K	32K	32K	32K	32K		32K
Field Upgrade	No	No	No	To MVP	No	To LVPC	No	To MVPC	No	Mem. Only		Mem. Only
Internal Tape Storage	80K	-	-	-	-	-	-	-	-	-		45M
Internal Diskette Storage	No	No	96K	No	1.2M	1.2M	1.2M	No	No	No		1.2M
Internal Disk Storage	No	No	No	No	2MB To 16MB	2MB To 16MB	2MB To 32MB	No	No	No		20M To 140M
External Storage	-	2260	-	2260	-	2260	2260	2260	2260	2260		2260
	-	2270	-	2270	-	2270	2270	2270	2270	2270		2270
	-	2280	-	2280	-	2280	2280	2280	2280	2280		2280
	-		-	2275	-	2275	2275	2275	2275	2275		2275
			-	DS	-	DS	DS	DS	DS	DS		DS
TC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
RAMdisk (CPU)	No	No	No	No	No	No	No	No	No	No	Yes	Yes

NOTE: 2260 disk drives provided for up to 20MB, the 2270 or 2270A (IBM compatible) is a 250KB diskette, the 2280 was 80MB and the 2275 provided up to 60MB of storage. 2200Ts were generally sold as dual or triple diskette systems or a diskette and a hard disk. The VP, MVP(C), LVP(C), MICROVP and the CS CPUs can support 3 disk storage devices. 6 2280s could be supported, as a single DPU can support 2 2280s each and each DPU is treated as a single storage device. A single DS can have up to 316MB of fixed disk storage. The CS-D supports 3 internal storage devices.

Previous 2200 Storage Devices

<u>Device</u>	<u>Type</u>	<u>Storage Capacity</u>	<u>Compatible With</u>	<u>DS Equivalent</u>	<u>Comments</u>
2270A-1	Diskette	250KB	VP, MVP, MICROVP CS	DS-320	Can be MUXed
2270A-2	Dual Diskette	500KB	VP, MVP, MICROVP CS	DS-1.2	Can be MUXed
2270A-3	Triple Diskette	750KB	VP, MVP, MICROVP CS	DS-1.2	Can be MUXed
2260C-1/4	Fixed/ Removable Disk	1.25MB Fix. 1.25MB Remv.	VP, MVP, MICROVP CS	DS-20 + DS-10R or DS-TS	-
2260C-1/2	Fixed/ Removable Disk	2.5MB Fix. 2.5MB Remv.	VP, MVP, MICROVP CS	DS-20 + DS-10R or DS-TS	-
2260C	Fixed/ Removable Disk	5.0MB Fix. 5.0MB Remv.	VP, MVP, MICROVP CS	DS-20 + DS-10R or DS-TS	-
2260C-2 Dual 2260Cs	Fixed/ Removable Disk	10.0MB Fix. 10.0MB Remv.	VP, MVP, MICROVP CS	DS-20 + DS-10R or DS-TS	-
2260BC-1/4	Fixed/ Removable Disk	1.25MB Fix. 1.25MB Remv.	VP, MVP, MICROVP CS	DS-20 + DS-10R or DS-TS	Can be MUXed
2260BC-1/2	Fixed/ Removable Disk	2.5MB Fix. 2.5MB Remv.	VP, MVP, MICROVP CS	DS-20 + DS-10R or DS-TS	Can be MUXed
2260BC	Fixed/ Removable Disk	5.0MB Fix. 5.0MB Remv.	VP, MVP, MICROVP CS	DS-20 + DS-10R or DS-TS	Can be MUXed
2260BC-2 Dual 2260BCs	Fixed/ Removable Disk	10.0MB Fix. 10.0MB Remv.	VP, MVP, MICROVP CS	DS-20 + DS-10R or DS-TS	Can be MUXed
2280-1 Includes DPU	Fixed/ Removable Disk	13.4MB Fix. 13.4MB Remv.	VP, MVP, LVP MICROVP, CS	DS-32 + DS-10R or DS-TS	Can be MUXed
2280-2 Includes DPU	Fixed/ Removable Disk	13.4MB Fix. 40.4MB Remv.	VP, MVP, LVP MICROVP, CS	DS-64 + DS-TS	Can be MUXed
2280-3(A) Includes DPU	Fixed/ Removable Disk	13.4MB Fix. 67.3MB Remv.	VP, MVP, LVP MICROVP, CS	DS-64 + DS-TS	Can be MUXed

<u>Device</u>	<u>Type</u>	<u>Storage Capacity</u>	<u>Compatible With</u>	<u>DS Equivalent</u>	<u>Comments</u>
2280N-1 Excludes DPU	Fixed/ Removable Disk	13.4MB Fix. 13.4MB Remv.	VP, MVP, LVP MICROVP, CS	Add 2nd DS-32	Can be MUXed
2280N-2 Excludes DPU	Fixed/ Removable Disk	13.4MB Fix. 40.4MB Remv.	VP, MVP, LVP MICROVP, CS	Add 2nd DS-64	Can be MUXed
2280N-3(A) Excludes DPU	Fixed/ Removable Disk	13.4MB Fix. 67.3MB Remv.	VP, MVP, LVP MICROVP, CS	Add 2nd DS-64	Can be MUXed
2275-10	Diskette Disk	320KB 10MB	VP, MVP, MICROVP CS	DS-320 DS-20	Can be MUXed
2275-20	Disk Disk	10MB 10MB	VP, MVP, MICROVP CS	DS-320 DS-20	Can be MUXed
2275-30	Diskette Disk	320KB 30MB	VP, MVP, MICROVP CS	DS-320 DS-32	Can be MUXed
2275-60	Disk Disk	30MB 30MB	VP, MVP, MICROVP CS	DS-320 DS-64	Can be MUXed
2230MXA-1	MUX	Supports 4 CPUs	2200, VP, MVP	2275MUX	Uses 2260BC 2230MXB-1
2280MUX	MUX	Supports 4 CPUs	VP, MVP, MICROVP CS	2275MUX	Uses 2280 22C80
2275MUX +	MUX	Supports 4 CPUs	MVP, MICROVP CS	N/A	Uses 2280
2275MUXE	MUX Extender	Supports 4 Additional CPUs/MUXE			2275 DS 22C80
2229	Tape	14MB	VP, MVP, MICROVP CS	DS-TS	-

Note: DS configurations must always include a DS-320 or DS-1.2 diskette drive. Although the LVP(C) has the same characteristics as the MVP, the LVP(C) is not always included in the compatible column due to its own internal diskette and disk storage. Actual LVP(C) installations may include external drives. 2275 drives can only be multiplexed by using a 2275MUX. The 2280 came with a DPU (22C14) that supported 2, 2280s; for example, a 2280-3A and a 2280N-3A. As a DPU was not needed for the second 2280, 2280N models did not include a DPU. You may encounter 2280MUX installations where more than 4 CPUs are supported via a special product called the 2280MUXE (MUX extender).

Obsolete Peripheral Compatibility Chart

The following obsolete 2200 peripheral compatibility chart should be used as a guide when upgrading a customer to a new CS system. The purpose of this chart is to answer any questions a potential CS user may have in reference to whether or not an existing peripheral can be used on a CS. All peripherals listed are obsolete and are no longer available for sale:

<u>PERIPHERALS</u>		<u>PREVIOUS 2200 CPUs</u>											<u>NEW</u>
<u>MODEL</u>	<u>DESCRIPTION</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>S</u>	<u>T</u>	<u>PCS</u>	<u>VP</u>	<u>SVP</u>	<u>MVP</u>	<u>LVP</u>	<u>CS</u>	
2200WS CRT/CPU	Workstation and processor. Up to 3 can MUX disk with main CPU with 2230MXA	N	Y	Y	Y	Y	N	Y	N	N	N	N	
2201 Output Writer	Modified IBM Selectric	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	
2201L Output Writer	Modified IBM Selectric II	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
2202 Plotting Output	Modified IBM Selectric II that plots	N	Y	Y	Y	Y	N	N	N	N	N	N	
2203 Paper Tape Reader	Reads Punched Paper Tape at 30cps	N	Y	Y	Y	Y	N	Y	N	N	N	N	
2209 Tape Drive	9 Track Tape Drive 800bpi	N	N	Y	N	Y	N	Y	N	N	N	N	
2210A CRT/ Keyboard/ Mini-Disk.	64X16 CRT with Keyboard, 1 or 2 Mini-Diskette(s)	N	Y	Y	Y	Y	N	Y	N	N	N	N	
2210B CRT/ Keyboard/ Mini-Disk.	80X24 CRT with Keyboard, 1 or 2 Mini-Diskette(s)	N	Y	Y	Y	Y	N	Y	N	N	N	N	
2211M Printer MUX	Printer MUX for 4 printers or plotters except the 2232	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
2212 Analog Plotter	Flatbed Plotter	N	Y	Y	Y	Y	N	Y	N	N	N	N	
2214 Card Reader	Reads mark-sense cards	N	Y	Y	N	Y	N	N	N	N	N	N	

PERIPHERALS		PREVIOUS 2200 CPUs										NEW
MODEL	DESCRIPTION	A	B	C	S	T	PCS	VP	SVP	MVP	LVP	CS
2231W-6 Printer	70cps letter quality	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2232A Plotter	Flatbed Plotter 31X48" bed	N	Y	Y	Y	Y	N	Y	N	Y	Y	Y
2232B Plotter	Flatbed Plotter 31X48" bed improved 2232A	N	Y	Y	Y	Y	N	Y	N	Y	Y	Y
2233 Printer	100-120cps 132/158 Character	N	N	N	N	N	N	Y	Y	Y	Y	Y
2236D	DP Workstation	N	N	N	Y	N	N	Y	Y	Y	Y	Y
2236DE	DP Workstation	N	N	N	N	Y	N	Y	Y	Y	Y	Y
2236DW	WP Workstation	N	N	N	N	Y	N	Y	Y	Y	Y	Y
2236MXD	4 Port Terminal Processor	N	N	N	N	N	N	N	N	Y	Y	Y
2241 Printer	Thermal Printer 30cps	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2242 Diskette	Dual Diskette Drive 250KB each	Y	Y	Y	Y	N	N	Y	N	N	N	N
2243 Diskette	Triple Diskette Drive 250KB each	Y	Y	Y	Y	N	N	Y	N	N	N	N
2244A Diskette	Mark-sense card reader 300/minute	N	Y	Y	Y	Y	N	Y	N	N	N	N
2244B Diskette	Mark-sense card reader 300/minute	N	Y	Y	Y	Y	N	Y	N	Y	Y	Y
2245 Printer	80cps Dot Matrix Printer	N	N	N	N	N	N	Y	Y	Y	Y	Y
2250 Controller	8-bit parallel I/O Controller	N	N	Y	Y	Y	Y	Y	N	N	N	N
2251 Printer	Compact Printer 40 Character line	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2252A Controller	Scanning input BCD Controller	Y	Y	Y	Y	Y	N	Y	N	N	N	N
2254 Controller	IEEE I/O Controller	N	Y	Y	Y	Y	Y	Y	N	N	N	N
2260 Disk	Fixed/Remov. 1.25 to 20MB	Y	Y	Y	Y	Y	N	Y	N	N	N	N

PERIPHERALS		PREVIOUS 2200 CPUs										NEW
MODEL	DESCRIPTION	A	B	C	S	T	PCS	VP	SVP	MVP	LVP	CS
2260B Disk	Fixed/Remov. 1.25 to 20MB	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y
2260BC Disk	Fixed/Remov. 1.25 to 20MB Multiplexible with 2230MXA/B	N	N	N	N	Y	N	Y	N	Y	Y	Y
2260C Disk	Fixed/Remov. 1.25 to 20MB	N	N	N	N	Y	N	Y	N	Y	Y	Y
2261 Printer	Dual head 330cps Printer	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2262 Digitizer	X-Y Digitizer Input Device	Y	Y	Y	Y	N	N	N	N	N	N	N
2263-1 Printer	400lpm Chain Printer	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2263-2 Printer	600lpm Chain Printer	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2263-3 Printer	430lpm Chain Printer with 96 Character	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2270-1 Diskette	Single Diskette 250KB	Y	Y	Y	Y	Y	N	Y	N	N	N	N
2270-2 Diskette	Dual Diskette 500KB	Y	Y	Y	Y	Y	N	Y	N	N	N	N
2270-3 Diskette	Triple Diskette 750KB	Y	Y	Y	Y	Y	N	Y	N	N	N	N
2271 Printer	Modified IBM Selectric	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2271P Printer	Modified IBM Selectric that plots	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2272-1 Plotter	Drum Plotter Single pen	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2272-2 Plotter	Drum Plotter Triple pen	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2275-20 Disk	Dual 10MB Disk Drive	N	N	N	N	N	N	Y	N	Y	Y	Y

PERIPHERALS		PREVIOUS 2200 CPUs										NEW
MODEL	DESCRIPTION	A	B	C	S	T	PCS	VP	SVP	MVP	LVP	CS
2275-60 Disk	Dual 30MB Disk Drive	N	N	N	N	N	N	Y	N	Y	Y	Y
2280-1 Disk	13.4MB Fixed 13.4MB Remv. with DPU	N	N	N	N	N	N	Y	N	Y	Y	Y
2280-2 Disk	13.4MB Fixed 40.2MB Remv. with DPU	N	N	N	N	N	N	Y	N	Y	Y	Y
2280-3(A) Disk	13.4MB Fixed 67.0MB Remv. with DPU	N	N	N	N	N	N	Y	N	Y	Y	Y
2280N-1 Disk	13.4MB Fixed 13.4MB Remv. without DPU	N	N	N	N	N	N	Y	N	Y	Y	Y
2280N-2 Disk	13.4MB Fixed 40.2MB Remv. without DPU	N	N	N	N	N	N	Y	N	Y	Y	Y
2280N-3(A) Disk	13.4MB Fixed 67.0MB Remv. without DPU	N	N	N	N	N	N	Y	N	Y	Y	Y
2281 Printer	40cps Daisy Wheel	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2281P Printer	40cps Daisy Wheel that plots	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2282 CRT	Graphic CRT No Keyboard, needs 2231W-3 printer	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
22C14 Controller (DPU)	Data Processing Unit for the 2280 disk drive Supports 2 drives per DPU	N	N	N	N	N	N	Y	N	Y	Y	Y
22C03 Controller	Diskette/Disk Controller	N	N	N	N	N	N	Y	N	Y	Y	Y
2326DW	WP Workstation Expanded Keyboard	N	N	N	N	N	N	Y	Y	Y	Y	Y
2336DE	DP Workstation	N	N	N	N	N	N	Y	Y	Y	Y	Y

PERIPHERALS		PREVIOUS 2200 CPUs										NEW
MODEL	DESCRIPTION	A	B	C	S	T	PCS	VP	SVP	MVP	LVP	CS
2336DW	WP Workstation	N	N	N	N	N	N	Y	Y	Y	Y	Y
DW22/20 Printer	20cps Daisy Wheel	N	N	N	N	N	N	Y	Y	Y	Y	Y

Note: A yes in the PCS column may mean that the peripheral may only work on a PCSII and require a special option board. Some peripherals on a 2200S may also require a special option board. A yes for the CS is also a yes for a MICROVP. Peripherals listed in the current Pricing Manual will work on a CS. Examples - 2209A Tape Drive, 2270A diskette drive, 2227C TC controller, etc..

Current Peripheral/Controller Compatibility Chart

The following current CS peripheral compatibility chart should be used as a guide when upgrading or configuring a new CS system. The purpose of this chart is to answer any questions a potential CS user may have in reference to how current peripherals are attached to a CS. All peripherals listed are contained in the Pricing Manual:

<u>PERIPHERALS</u>	<u>MODEL</u>	<u>CONTROLLER NEEDED</u>	<u>DESCRIPTION</u>	<u>COMMENTS</u>
2200-PM017 Printer	400cps Printer	22C11, 22C02 or 22C32		Dot-matrix printer Needs OS 3.1
2200-PM018 Printer	60cps Daisy Wheel	22C11, 22C02 or 22C32		Letter quality printer Needs OS 3.1
2209A Tape Drive	9 Track Tape Drive, 1600bpi	2209A Tape Controller		Controller Included with 2209A
2229 Tape Drive	4 Track, 6400bpi 14MB Tape Cart.	2229 Tape Controller		Controller included with 2229. Start/stop device
2235 Printer	180/222cps	22C11, 22C02, 22C32		Dot-matrix printer
2270A-1 Diskette	Single Diskette 250KB	22C11, 22C32		IBM 3741 format compatible
2270A-2 Diskette	Dual Diskette 500KB	22C11, 22C32		IBM 3741 format compatible
2270A-3 Diskette	Triple Diskette 750KB	22C11, 22C32		IBM 3741 format compatible
2273-1 Printer	2501pm band printer	22C11, 22C02 or 22C32		Low-speed line printer
2273-2 Printer	6001pm band printer	22C11, 22C02 or 22C32		High-speed line printer
2275-10 Disk	320KB Diskette 10MB Disk Drive	22C11, 22C32 or 2275MUX		
2275-30 Disk	320KB Diskette 30MB Disk Drive	22C11, 22C32 or 2275MUX		
2281W Printer	30cps Daisy Wheel	22C11, 22C02 or 22C32		Printer/plotter
2426DW CRT	WP Workstation Expanded keyboard	2236MXE or 22C32		Needs country kit
2436DE CRT	DP Workstation	2236MXE or 22C32		Needs country kit

PERIPHERALS		CONTROLLER NEEDED	COMMENTS
	MODEL	DESCRIPTION	
2436DW CRT	WP Workstation	2236MXE or 22C32	Needs country kit
2436WP CRT/CPU	DP/WP 512KB Workstation/CPU	2236MXE or 22C32	Needs country kit Includes 1 diskette
2436WP-1 CRT/CPU	DP/WP 512KB Workstation/CPU	2236MXE or 22C32	Needs country kit Includes 2nd diskette and PM-015 Printer
2436WP-2 CRT/CPU	DP/WP 512KB Workstation/CPU	2236MXE or 22C32	Needs country kit Includes 1 diskette, 1 10MB disk and PM-015 Printer
2536DW CRT	WP Workstation	2236MXE or 22C32	Needs country kit
DM50/300 Printer	9 Pin Dot-Matrix printer. 50cps letter quality, 300cps draft	22C11, 22C32	Needs OS 3.1
DS	Data Storage Cabinet	22C11, 22C32 or 2275MUX	Empty cabinet. Disks ordered separately. See Pricing Manual
LDP8-DSK Laser	8 page/minute Laser printer	22C11, 22C32	Needs OS 3.1
LDP15-DSK Laser	15 page/minute Laser printer	22C11, 22C32	Needs OS 3.1
WOA-PM-015 Printer	40cps Daisy Wheel	N/A	Only used as a local printer on a 2436WP workstation

Note: All printers, except the PM-015, can be used as either system printers (connected to the CPU) or local workstation printers. The PM-015 can only be used a local printer for the 2436WP workstation. Most printers require a country kit (see the Pricing Manual) and the OS must contain the printer driver. OS 3.1 has all the latest printer drivers.

Current Controller Chart

The following current CS controller chart should be used as a guide when upgrading or configuring a new CS system. The purpose of this chart is to answer any questions a potential CS user may have in reference to what is the function of the most popular current controllers. All controllers listed are contained in the Pricing Manual. Refer to the Pricing Manual for special purpose TC controllers:

<u>CONTROLLER</u>	<u>FUNCTION</u>	<u>COMMENTS</u>
2236MXE Terminal Processor	Connects 4 workstations. A CS will support 4 2236MXEs	Workstations can be local or remote
2258-X 2200/VS LCO	2200/CS to VS local communications option. Allows CS terminals to logon to the VS, use VS disk as VDISK or store 2200 data in VS format	Order -3 if your 2200 diskette drive is a 2270, -5 for a LVP diskette or -9 for a 2275 or DS diskette
2275MUX	Disk Multiplexing unit. Allows 4 CPUs to share one disk. DS plugs into 2275MUX	Used for the DS, 2280 and 2275 disk drives
2275MUXE	Multiplexer Extender. Each extender accepts 4 CPUs. Up to 3 MUXEs may be used	Must be used with a 2275MUX. Connects to the MUX via a ribbon cable
22C02 Printer Controller	Single printer/plotter	Generally used for 2nd printer
22C11 Dual Controller	Single printer/single disk	Will accept either a disk or diskette
22C32 Triple Controller	Single printer/single disk/ single workstation	Most commonly used in single workstation installations
22C80 Disk MUX Controller	Controller for CPU that is multiplexing the disk on CPU #1. CPU #1 is where the 2275MUX resides	One is needed for each CPU connected to a 2275MUX or MUXE

Note: Each controller takes one I/O slot. You may not have more than nine controllers in a single CS. Of the nine, you may only use 4 2236MXEs or 3 disk controllers maximum, as the CS will only support a maximum of 16 workstations and 3 disk devices. The DS, no matter how many drives are in a single cabinet, is counted as one device. No controller is needed for a printer connected to a 2436/26, 2536 workstation.

2200 MODEL STATISTICS

The following chart gives general product specifications for most of the 2200 models shipped since 1972. Maximums are expressed in practical installable limits.

<u>FEATURE</u>	<u>A/B/C</u>	<u>T/S</u> <u>WCS</u>	<u>PCS</u>	<u>VP</u>	<u>SVP</u>	<u>LVP</u>	<u>LVPC</u>	<u>MVP</u>	<u>MVPC</u>	<u>MICROVP</u>	<u>CS</u> <u>CS-D</u>	<u>CS</u> <u>386</u>
Memory	4-16K	32K	32K	16K- 128K	32K- 128K	32K- 256K	64K- 512K	32K- 256K	64K- 512K	128K- 512K	128K 8MB	1MB 8MB
I/O Slots	6	3/6	-	9	1-3	3	7	9	7	9	9	9
Users	1	1	1	1	1-3	8	13	13	13	16	16	16
Tasks	1	1	1	1	16	16	16	16	16	16	16	16
BASIC	X	X	X	-	-	-	-	-	-	-	-	-
BASIC-2	-	-	-	X	X	X	X	X	X	X	X	X
Control Memory	PROM	PROM	16K	32K	32K	32K	32K	32K	32K	32K	32K	256K
Field Upgrade	No	No	No	To MVP	No	To LVPC	No	To MVPC	No	To CS/386	To CS/386	-
Internal Tape Storage			80K	-	-	-	-	-	-	-	-	45M 150M
Internal Diskette Storage	No	No	96K	No	1.2M	1.2M	1.2M	No	No	No	1.2M	1.2M
Internal Disk Storage	No	No	No	No	2MB To 16MB	2MB To 16MB	2MB To 32MB	No	No	No	20M To 140M	20M To 140M
External Storage	-	2260	-	2260	-	2260	2260	2260	2260	2260	2260	2260
	-	2270	-	2270	-	2270	2270	2270	2270	2270	2270	2270
	-	2280	-	2280	-	2280	2280	2280	2280	2280	2280	2280
	-			2275	-	2275	2275	2275	2275	2275	2275	2275
	-			DS	-	DS	DS	DS	DS	DS	DS	DS
TC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RAMdisk (CPU)	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes

NOTE: 2260 disk drives provided for up to 20MB, the 2270 or 2270A (IBM compatible) is a 250KB diskette, the 2280 was 80MB and the 2275 provided up to 60MB of storage. 2200Ts were generally sold as dual or triple diskette systems or a diskette and a hard disk. The VP, MVP(C), LVP(C), MICROVP and the CS CPUs can support 3 disk storage devices. 6 2280s could be supported, as a single DPU can support 2 2280s each and each DPU is treated as a single storage device. A single DS can have up to 316MB of fixed disk storage. The CS-D and CS/386-D support 3 internal storage devices.