2200

MODEL 2260BC FIXED/REMOVABLE DISK DRIVE

PRODUCT DATA SHEET

- Storage Capacity Expandable to 20 Megabytes
- Multiplexing Capabilities
- Fixed and Removable Platters Combined in One Drive
- BASIC/BASIC-2 Disk Commands
- Supports 2200 Series Utilities
- Platters Formatted Under Program Control

INTRODUCTION

The Wang Model 2260BC Fixed/Removable Disk Drives provide fast, reliable, direct-access storage for Wang 2200 Series systems (except for the PCS-II/IIA, PCS-III/IIIA, SVP, WCS-15, and 2200WS) at an economically attractive cost, even for smaller scale users. The largest disk unit provides five million bytes of fixed disk storage and five million bytes of removable disk storage for an on-line total of 10 million bytes. Twenty million bytes of on-line storage are available in a special configuration which consists of two Model 2260BC disk units daisy-chained together. Removable disk platters make the off-line storage capacity virtually unlimited because they are easy to unload, store, and replace.

The 2200BC disk models can also be multiplexed. Multiplexing allows up to four independent systems to share a single disk unit, thereby providing an effective means for optimally utilizing the disk unit while minimizing the per-user cost. The participating systems may share a common data base or each system may have a specified portion of the total on-line storage reserved for dedicated use. Disk operations for the multiplexed systems are integrated in such a manner that all the systems have virtually concurrent access to the disk. The Model 2260BC Disk Drive must be attached to the Model 22C13 Disk Controller. If the unit is to be multiplexed, the multiplexer controllers are used in addition to the Model 22C13 Controller.

PHYSICAL CHARACTERISTICS

The Model 2260BC Disk Drive holds two disk platters, one fixed and one removable. Each disk platter has two recording surfaces which are divided into a number of concentric circular recording tracks. Every track is, in turn, subdivided into 24 *sectors*. A sector is the smallest addressable unit on the disk and can store 256 bytes of program text or data information. The sectors on each platter are sequentially numbered and individual sectors can be directly addressed.

STORAGE CAPACITY

The smallest Model 2260BC Disk Drive, the Model 2260BC1/4, provides approximately 1.25 million bytes of fixed disk storage and 1.25 million bytes of removable disk storage for a total storage capacity of 2.5 million

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bytes. This model can be economically expanded to a larger capacity as the user's processing demands increase. The storage capacity of each 2260BC series disk drive is listed in the specifications.

Available storage in bytes does not easily translate to the amount of real data stored. Storage efficiency is determined by a number of factors, including the type of data stored and the method of storage. For example, a full-precision number (13 digits) requires nine bytes of disk storage. The 2200 System, however, will allow the user to store each number in as few as 2 bytes, if 13-digit accuracy is not needed. For purposes of general illustration, the Model 2260BC can store about 1,100,000 full-precision (13-digit) numbers, or about 590,000 16-character alphanumeric values.

SPEED

In any external storage device, a necessary adjunct to capacity is speed. The capability to store large quantities of data is meaningless if the data cannot be retrieved with speed and efficiency. The Model 2260C series offers rapid data access in both sequential and random access modes.

The procedure for accessing a particular sector on the disk has two components: a track access and a disk latency period. Only when the appropriate sector has been accessed can the actual transfer of data between the system and the disk take place. The total time required to read or write information on the disk must therefore include the track seek time and disk latency period.

Track Seek Time

The track seek time is the time required to position the disk read/write head to a specified track on the disk platter. The average seek time is the time required to position the disk read/write head over half the tracks on the disk platter. The average track seek time for the Model 2260BC and Model 2260BC-2 is 40 msec (.04 sec). The Model 2260BC1/4 and 2260BC1/2 average track seek times are somewhat faster.

Disk Latency Time

Once it is positioned over the appropriate track, the read/write head must wait for the desired sector in that track to rotate to its position. This wait is called the disk latency period. The average disk latency time is the time required for a sector one-half track away from the read/write head to rotate to the read/write head. Since the platter makes one complete revolution in 25 milliseconds, the average latency time is one-half this time, or 12.5 msec (.0125 sec).

PLATTER COMPATIBILITY

The removable platters of all 2260 series disk units are interchangeable. Platters can be read from, written to, and formatted when mounted in any 2260 series disk unit which has a capacity as large as or larger than that of the drive which created the platter. Therefore, it is never necessary to modify the disk data base when adding additional disk units to a system.

AUTOMATIC FILE MAINTENANCE

Files can be maintained on disk in one (or both) of two modes: Automatic File Catalog mode, and Absolute Sector Addressing mode. The instructions in both of these modes are included in the BASIC and BASIC-2 languages and do not require an additional software package.

Automatic File Cataloging

This mode includes 16 BASIC statements, which provide rapid, easy access to cataloged files on the disk. Catalog mode permits the user to save and load program and data files by name, without concern for where or how the files are actually stored on the disk. The system automatically keeps track of the size and location of each file. The BASIC instructions available in Catalog mode are as follows.

SCRATCH DISK — Used to create a catalog on a specified disk platter. The catalog consists of two parts: a Catalog Index and a Catalog Area.

MOVE END — Used to alter the size of the catalog after it has been created with SCRATCH DISK.

LIST DC — Enables the operator to list the names and locations of all cataloged programs and data files on a disk.

SAVE DC — Used to name and save BASIC programs on the disk. Additional parameters in the BASIC-2 instruction allow the program to be "scrambled", and spaces and REM statements to be deleted when saved on disk.

LOAD DC — When executed as a command, this statement is used to load a named program from the disk into memory. When executed in a program, LOAD DC can be used to chain or overlay programs from disk.

DATASAVE DC OPEN — Used to name and open a new data file on the disk. On systems supporting Wang BASIC, as many as seven cataloged files may be open simultaneously. On systems supporting BASIC-2, a

maximum of 16 files can be open simultaneously. On 2200MVP-based systems, up to 16 files can be open at the same time for each partition.

DATALOAD DC OPEN — Used to reopen an existing data file on disk. The file is referenced by name.

DATASAVE DC — Used to store a data record in a currently open file on disk. Multiple-sector records are written automatically.

DATALOAD DC — Used to read data from a currently open file on disk. Multiple-sector records are read automatically.

DATASAVE DC CLOSE — Used to close one or all currently open files on disk.

DSKIP and DBACKSPACE — Enables the programmer to skip forward and backward over data records within a cataloged data file.

SCRATCH — Used to scratch program or data files which are no longer needed. The disk space occupied by a scratched file can be reused for a new file.

MOVE — Used to copy the entire catalog (the Catalog Index as well as the Catalog Area), from one platter to another. MOVE automatically deletes all scratched files from the catalog. The BASIC-2 instruction also allows the transfer of files between separate disk units and permits additional sectors to be reserved in the new file.

VERIFY — Performs special validity checks on specified sectors to ensure that the data stored in them is correct. VERIFY is normally used following a MOVE or COPY to ensure that information has been copied accurately.

LIMITS — Enables the programmer to examine the beginning, end, and current sector addresses of a specified file, as well as the total number of sectors used in the file. The BASIC-2 instruction also allows return of the type and status of the file.

Absolute Sector Addressing

This mode consists of eight BASIC statements allowing the programmer to address specific sectors on the disk directly, thus enabling the design of a personal disk operating system. Two of the eight Absolute Sector Addressing mode instructions are special statements that can be used to read or write one sector (256 bytes) of unformatted data. These special statements enable the programmer to write personal control information in individual sectors. The BASIC instructions available in Absolute Sector Addressing mode are listed and explained as follows.

SAVE DA — Used to store programs on disk in Absolute Sector Address mode. The starting sector location at which the program will be stored must be specified. Additional parameters in the BASIC-2 instruction allow the program to be "scrambled" and spaces and REM statements to be deleted when it is saved on disk.

LOAD DA — When executed as a command, is used to load programs from disk into memory. When executed within a program, LOAD DA can be used to chain or overlay programs from disk. In either case, the starting sector address of the program must be specified.

DATASAVE DA — Used to save data records on the disk. The sector address in which record storage will begin must be specified. Multiple-sector records are written automatically.

DATALOAD DA — Used to read data records stored on disk. An address must be specified in the same way as with DATASAVE DA. Multiple-sector records are read automatically.

DATASAVE BA — Special statement that writes one sector (256 bytes) of unformatted data in a specified sector on disk. (Both DATASAVE DC and DATASAVE DA automatically insert special formatting information in each record; this information is not automatically inserted by DATASAVE BA.)

DATALOAD BA — Special statement that reads one sector (256 bytes) of unformatted data from a specified sector on disk.

COPY — Used to copy the content of a specified range of sectors from one platter to the corresponding sectors on another platter. Additional parameters in the BASIC-2 instruction allow files to be copied between separate disk units, and permit a different starting sector to be specified for the destination platter.

RELIABILITY

To increase the reliability of the disk unit, two different checks are made on every sector of information on the disk. A cyclic redundancy check (CRC) and longitudinal redundancy check (LRC) are performed automatically by

the system on the data in each sector when it is read from or written to the disk. If an LRC error is detected, the system returns an error message at once; if a CRC error is detected, the system automatically rereads and rechecks the erroneous sector four times before signalling an error. In addition to the two checks performed automatically by the system, an optional read-after-write verification test can be specified by the programmer simply by including a special parameter in the appropriate BASIC instruction.

AUTOMATIC SECTOR FORMATTING

New disk platters are formatted automatically under program control. The formatting procedure involves verifying all sectors on the disk platter and assigning each a unique sector address. Each sector is formatted into three basic sections: a two-byte sector address, three bytes reserved for error checking and control information, and 256 bytes available for user's data. The sector address and error control information are transparent to the user's software, and are used by the system for data identificaton and verification.

AVAILABLE DISK UTILITIES

The complete line of Wang 2200-series disk drives is supported by a variety of disk utility programs. Although new utilities are always being developed, the following utilities are currently available.

IDEAS/HIKAM — A series of utilities which can be used to easily create application programs, data files, screen formats, and complex reports.

KFAM (Keyed File Access Method) — A sophisticated file maintenance system providing the user with rapid, direct access to individual records in a cataloged file.

Disk Sort — Sorts records in a cataloged disk file.

Compression — Reads source programs stored on disk and compresses them. The resulting compressed program can be saved back onto the disk.

Decompress — Copies a catalogued program file, automatically breaking up all multistatement lines and assigning each statement a unique line number.

List and Cross-Reference — Source of compressed programs stored on disk and read into memory, decompressed, and cross-referenced. The decompressed and cross-referenced programs can then be listed on a printer or displayed on the CRT screen.

Copy/Verify — Copies cataloged disk files from disk to disk, verifying copied files. Extra sectors can be added to copied files.

Sort Disk Catalog — Prints a Catalog Index sorted either alphabetically by file name or numerically by sector address.

Disk Programming Aids — A collection of utility routines which performs functions such as search catalog index for file name, open and close cataloged disk files, and translate files from one character code to another.

Disk Dump Utility — Generates a list of hex codes for a program or data file stored on disk.

MODEL 2260BC DISK DRIVE SPECIFICATIONS

Size
Height ..... 36.0 in. (91.4 cm)
Width ..... 20.5 in. (52.0 cm)
Depth ..... 32.0 in. (81.6 cm)

Weight
176 lb (78 kg)

Power Requirements
115 or 230 VAC ± 10%
50 or 60 Hz ± 1 Hz
800 watts start-up
325 watts running

Heat Output
1050 Btu/hr

Cabling
One 8-ft (2.5 m) cable to power source
One 10-ft (3.0 m) cable to disk controller board in CPU

Operating Environment
Temperature
50°F to 95°F (10°C to 35°C)
Relative Humidity
35% to 65% noncondensing (recommended)
20% to 80% noncondensing (allowable)

Rotation Speed
2400 rpm

Seek Time (Position Head to Track)
Minimum (one-track) ..... 7.5 msec
Average (across one-half available tracks)
Model 2260BC 1/4 ..... 20.0 msec
Model 2260BC 1/2 ..... 28.0 msec
Model 2260BC ..... 40.0 msec
Model 2260BC-2 ..... 40.0 msec

Latency Time
Average (one-half revolution) ..... 12.5 msec

Move/Copy Time
Approximately 10 minutes for an entire 5-megabyte platter

Data Rate
2.5 megabits/second

Track Density
200 tracks per inch (tpi)

DISK PLATTER STORAGE SPECIFICATIONS

Disk Unit	Sectors per Platter	Total Sectors	Bytes per Platter	Total Bytes
Model 2260BC1/4	4,800	9,600	1,228,800	2,457,600
Model 2260BC1/2	9,600	19,200	2,457,600	4,915,200
Model 2260BC	19,584	39,168	5,013,504	10,027,008
Model 2260BC-2*	19,584	78,336	5,015,504	20,054,016

* Consists of two Model 2260BC Disk Drives daisy-chained together.

ORDERING SPECIFICATIONS

The disk drive unit must be available in four configurations providing 2.5, 5, 10, or 20 megabytes of online storage; total storage should be divided equally between fixed and removable platters. The disk drive unit must be capable of storing and retrieving both program and data information.

The platters must be interchangeably addressable. It must be possible to read or write multisector arguments, and to use entire arrays as arguments. The disk unit must also provide the capability to produce backup copies of all or part of each disk platter.

The system must provide an easy-to-use disk file management system, as well as a number of statements enabling the programmer to design a custom file management system. A single system must be capable of being multiplexed to a maximum of four separate 2200 CPUs (except for PCS-II/IIA, PCS-III/IIA, SVP, WCS-15, and 2200WS).

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