

PRODUCT DATA SHEET

The Model 2280/2280N Fixed/Removable Disk Drive introduces Wang's new generation of cost-effective, large capacity disk storage units for Wang 2200 systems (the 2200T, PCS-II, PCS-III, and WCS-15 excluded). The Model 2280/2280N provides a single 13.4-megabyte removable platter, and between 13.4 and 67.0 megabytes of fixed storage, all within the same drive unit. This arrangement offers the advantages of both fixed-only units and removable-only units without the drawbacks of drives offering only one type of storage. To speed processing and provide extensive error correction, the disk units are controlled by an intelligent Disk Processing Unit (DPU), which can support two drives.

The DPU is included in the price of the Model 2280; the Model 2280N, identical to the Model 2280 in all other respects, is shipped without the DPU and can be used only as the second drive on a DPU. The following descriptions apply alike to the Model 2280 and Model 2280N versions of the Fixed/Removable Disk Drive.

The Model 2280 is available in three versions — Model 2280-1, Model 2280-2, and Model 2280-3; each version offers excellent storage capacity and backup capability. The largest disk unit, the Model 2280-3, provides approximately 67.0 million bytes of fixed disk storage and 13.4 million bytes of removable disk storage, for a total of 80.4 million bytes on-line. In each model, the important function of data file backup is accomplished reliably and rapidly (13.4 megabytes within two minutes) without the necessity of employing a second fixed drive, magnetic tape, or a complement of floppy disks. The removable disk platters make the off-line storage capacity virtually unlimited because they are easy to unload and store, and are less susceptible to destruction from operator or program errors, or hardware malfunctions.

PHYSICAL CHARACTERISTICS

The Model 2280 is a free-standing unit ideally suited for integration into the office environment. The disk drive is enclosed in a functional cabinet featuring a hinged front door for the loading and removal of the disk cartridge. The cabinet accommodates one removable disk platter and the fixed storage section.

2200

MODEL 2280/2280N FIXED/REMOVABLE DISK DRIVE

- High-Speed Fixed/Removable Disk Drive
- Up to 80.4 Million Bytes of Storage per Disk Unit
- Up to Six Individual Addressed Platters per Disk Unit
- Intelligent Disk Processing Unit
- Up to Six Drives per 2200 VP/MVP System



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STORAGE CAPACITY

Each Model 2280 contains approximately 13.4 megabytes of removable storage and up to 67.0 megabytes of fixed storage. The total amount of fixed storage available to the user is dependent on the model designation. The Model 2280-1 has a fixed storage capacity of 13.4 megabytes, the Model 2280-2 has 40.4 megabytes, and the Model 2280-3 has 67.0 megabytes. The system divides the fixed storage portion into logical platters, each with 13.4 megabytes of storage capacity. Each logical platter has a unique device address in the 2200 system (i.e., D10, D11, D12, etc.).

The recording surface of a logical platter is divided into 82 concentric recording tracks for user storage, and every track is subdivided into 64 sectors. A sector is the smallest addressable unit on the disk and can store 256 bytes of information (program text or data). The sectors on each platter are sequentially numbered, and individual sectors can be directly addressed. One track on the recording surface is reserved by the system to enable error correction, and is not available for user storage.

Available storage in bytes does not easily translate to the amount of actual data which can be 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. If 13-digit accuracy is not needed, however, 2200 Series products will allow the user to store each number in as few as two bytes. For purposes of general illustration, the Model 2280-3 (80.4 megabytes) can store about nine million full-precision numbers, or over five million 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 of little value if the data cannot be retrieved with speed and efficiency. The Model 2280 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 seek time 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 both the time for the track seek and the disk latency period.

- **Track Seek Time** — The average track seek time is the time required to position the disk read/write head over half the tracks on the disk platter. The average seek time for the Model 2280 series is 30 milliseconds.
- **Disk Latency Period** — Once it is positioned over the appropriate track, the read/write head must wait for the desired sector in that track to reach its position. This wait is called the disk latency period. The average 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 16.67 milliseconds, the average latency time for the Model 2280 series is one-half this time, or 8.33 milliseconds.

DISK PROCESSING UNIT

The Disk Processing Unit (DPU) is an intelligent controller/processor enabling two Model 2280 drives to operate quickly and efficiently when the DPU is attached to a standard 2200 disk controller. This self-contained unit performs data buffering and error checking, as well as coordinating data transfer between the disk platters and the Central Processing Unit (CPU). Up to three DPUs may be attached to a 2200 system, with a maximum of two drives each, for a total of six drives. One DPU is included with each Model 2280 drive; if an additional drive is desired for that DPU, a Model 2280N should be ordered. With the maximum configuration of Model 2280/2280N drives and DPUs, up to 484 million bytes of on-line storage are available to the 2200 user.

PLATTER COMPATIBILITY

The removable platters of all Model 2280 series disk units are interchangeable. Therefore, it is never necessary to modify the disk data base when adding disk units to a system.

MULTIPLEXING CAPABILITIES

An optional Model 2280 MUX "star" type multiplexer is available. When installed directly into a 2280 DPU and connected to a Model 22C80 controller installed in each participating CPU's I/O bus, the multiplexer board permits any combination of two or three 2200VP or 2200MVP CPUs to share a Model 2280 disk drive or combination of 2280/2280N disk drives. Disk time is then allocated to multiple systems in a manner which enables all systems to have virtually concurrent access to the disk.

AUTOMATIC FILE MAINTENANCE

Files can be maintained on disk in one (or both) of two modes: Automatic File Cataloging mode and Absolute Sector Addressing mode. The instructions in both of these modes are included in the Wang BASIC-2 language, 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 itself automatically keeps track of the size and location of each file. The BASIC instructions available in Catalog mode are as follows.
 - SCRATCH DISK is 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 is used to alter the size of the catalog area after it has been created with SCRATCH DISK without altering the catalog index.
 - LIST DC enables the operator to list the names and locations of all cataloged programs and data files on a disk.
 - SAVE DC is 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, 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 the disk.
 - DATASAVE DC OPEN is used to name and open a new data file on the disk. A maximum of 16 files can be open at the same time. On 2200MVP-based systems, up to 16 files can be open simultaneously for each partition.
 - DATALOAD DC OPEN is used to reopen an existing data file on disk. The file is referenced by name.
- DATASAVE DC is used to store a data record in a currently open file on disk. Multiple-sector records are written automatically.
- DATALOAD DC is used to read data from a currently open file on disk. Multiple-sector records are read automatically.
- DATASAVE DC CLOSE is used to close one or all currently open files on disk.
- DSKIP and DBACKSPACE enable the programmer to skip forward and backward over data records within a cataloged data file.
- SCRATCH is 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 after a MOVE operation.
- MOVE is used to copy the entire catalog (the Catalog Index as well as the Catalog Area) from one platter to another. Executing a 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.
- Absolute Sector Addressing — This mode consists of eight BASIC statements which permit 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-2 instructions available in Absolute Sector Addressing mode are listed and explained as follows.

- SAVE DA is used to store programs on disk in Absolute Sector Addressing 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 saved on disk.
- LOAD DA (command) is used to load programs from disk into memory. The starting sector address of the program must be specified.
- LOAD DA (statement) is used within a program to chain or overlay programs from disk. The starting sector address of the program must be specified.
- DATASAVE DA is 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 is used to read data records stored on disk. The sector address in which the record begins must be specified. Multiple-sector records are read automatically.
- DATASAVE BA is a 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 is a statement that reads one sector (256 bytes) of unformatted data from a specified sector on disk.
- COPY is used to copy the content of a specified range of sectors from one platter to the corresponding parameters 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, an error correcting code (ECC) is recorded with each sector.

Errors in the transfer of data between the CPU and the disk unit are detected by a longitudinal redundancy check (LRC). In addition to these two functions performed automatically by the system, an optional read-after-write 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 using a prescribed instruction sequence. 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 employed by the system for data identification and verification.

AVAILABLE DISK UTILITIES

Wang supports its complete line of 2200 Series disk drives with a variety of disk utility programs. Although new utilities are always being developed, the following utilities are available at present.

- KFAM (Keyed File Access Method) — A sophisticated file maintenance system providing the user with rapid, direct access to keyed records in a large-scale cataloged file.
- Disk Sort — Sorts records in a cataloged disk file.
- 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 perform functions such as searching the catalog index for a file name, opening and closing cataloged disk files, and translating files from one character code to another.
- Disk Dump Utility — Generates a list of hex codes for a program or data files stored on disk.

MODEL 2280N DISK DRIVE SPECIFICATIONS

Size (including cabinet stand)

Height	36.0 in. (91.4 cm)
Width	20.4 in. (51.8 cm)
Depth	32.6 in. (82.8 cm)

Weight

175 lb (77.1 kg)

User Storage Capacity

	Model 2280-1/ 2280N-1	Model 2280-2/ 2280N-2	Model 2280-3/ 2280N-3
Sectors per Surface	52,608	52,608	52,608
Total Sectors	105,216	210,432	315,648
Bytes per Surface	13,467,648	13,467,648	13,467,648
Total Bytes	26,935,296	53,870,592	80,805,888

Power Requirements

115 or 230 VAC \pm 10%
 50 or 60 Hz \pm 1.0 Hz
 250 watts (standing)
 1900 watts (start-up)
 950 watts (running)

Heat Output

1050 Btu/hr (standing); 2150 Btu/hr (running)

Cabling

5 ft (1.5 m) cable to the disk controller board in DPU.
 8 ft (2.5 m) to power source.

Operating Environment

60° to 80°F (15° to 26°C)
 40% to 60% relative humidity

PERFORMANCE

Rotation Speed

3600 rpm \pm 3.5%

Seek Time (position head to track)

Track-to-Track	6 ms
Average	30 ms
Maximum	55 ms

Latency Time

Average (one-half revolution at 3600 rpm) 8.33 ms

Average Sequential Read Time (per sector)

4.6 ms

Average Sequential Write Time (per sector)

3.6 ms

Average Random Read/Write Time (per sector)

42.0 ms

Move/Copy Time

Approximately 2 minutes per logical platter (13.4 megabytes)

DPU SPECIFICATIONS

Size (outside cabinet stand)

Height	13.8 in. (35.05 cm)
Width	21.0 in. (53.36 cm)
Depth	8.5 in. (21.59 cm)

Weight

40 lb (18 kg)

Power Requirements (independent of disk drive)

Voltage	115 VAC \pm 10%, 60 Hz \pm 1 cps 230 VAC \pm 10%, 50 Hz \pm 1 cps
Power	150 watts
Fuses	3.0 ASB @ 115V 1.5 ASB @ 230V

Heat Output

Minimal

ORDERING SPECIFICATIONS

A disk drive unit capable of storing and retrieving information for a Wang 2200 Series operations (the 2200T, PCS-II, PCS-III, and WCS-15 excluded). The unit must be available in three separate configurations providing 26.9, 53.6, and 80.4 megabytes of on-line storage, respectively.

The logical platters must be individually addressable. It must be possible to read or write multisector arguments of any length on disk, 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. The disk unit must be compatible with other I/O and storage devices in the system.

Standard Warranty Applies

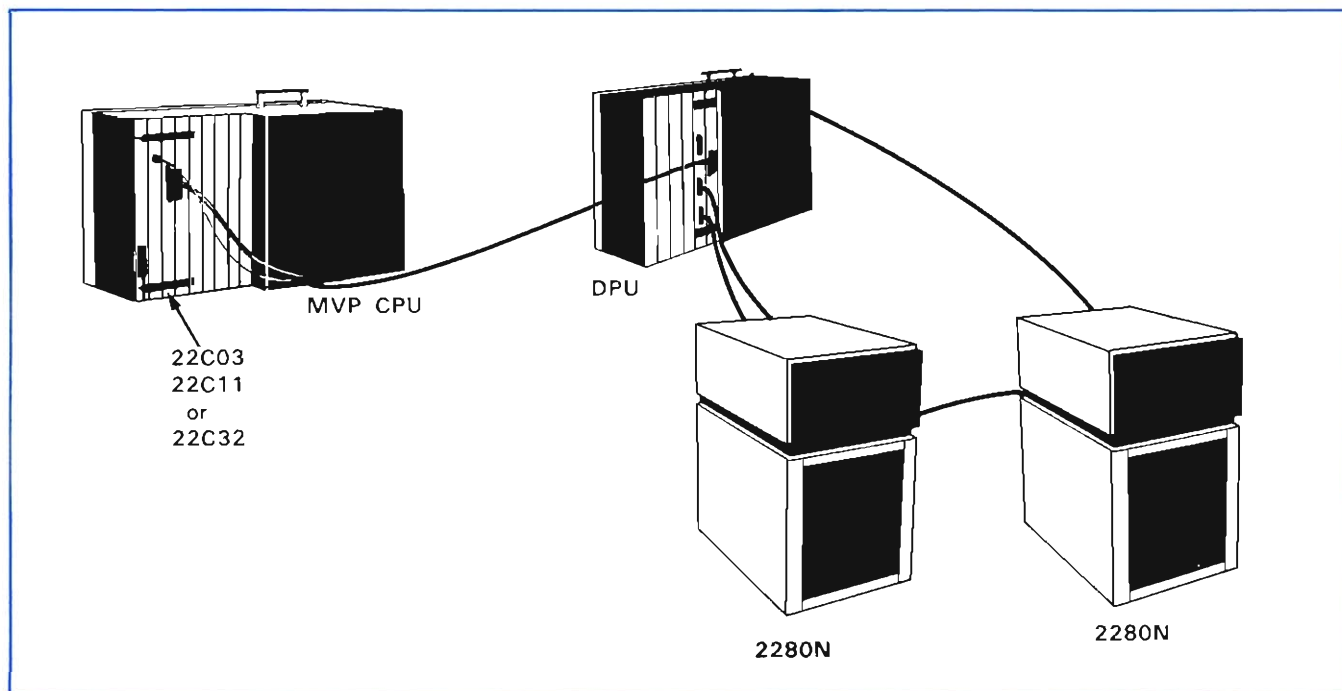


Figure 1. Typical 2280 Dual System Configuration (using MVP).

Wang Laboratories reserves the right to change specifications without prior notice



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