WANG

Model 2280/2280N
Disk Drive User Manual

Model 2280/2280N Disk Drive User Manual

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HOW TO USE THIS MANUAL

This manual provides information concerning the operation of the Model 2280/2280N series disk drives. It is intended to be used in conjunction with the Wang BASIC-2 Disk Reference Manual.

Chapter 1 discusses the concept of information storage and retrieval on the disk, including an overview of the disk hardware and the principles of disk operation. Chapter 2 provides specific operational data, including power-on and formatting procedures. Disk drive specifications and maintenance information are collected in the appendices.

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CHAPTER 1
GENERAL INFORMATION

1.1 INTRODUCTION

The Model 2280/2280N series of Fixed/Removable Disk Drives is specifically designed for the customer who has large data storage requirements. Each of the Model 2280/2280N series of disk drives contains approximately 13.4 megabytes of removable storage and up to 67.0 megabytes of fixed storage, depending upon the model designation. Three versions of the Model 2280/2280N are available: the 2280-1 (2280N-1), the 2280-2 (2280N-2), and the 2280-3 (2280N-3), with total storage capacities of approximately 26.8, 53.6, and 80.4 megabytes respectively.

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. One DPU is included in the price of a 2280 disk unit. A Model 2280N disk drive, identical to a Model 2280 in all other respects, is shipped without a DPU and is intended for use as the second drive on a DPU. Up to three 2280 DPU's, with a maximum of two drives each, may be attached to a 2200 system (the 2200T, PCS-II, PCS-III, and WCS-15 excluded).

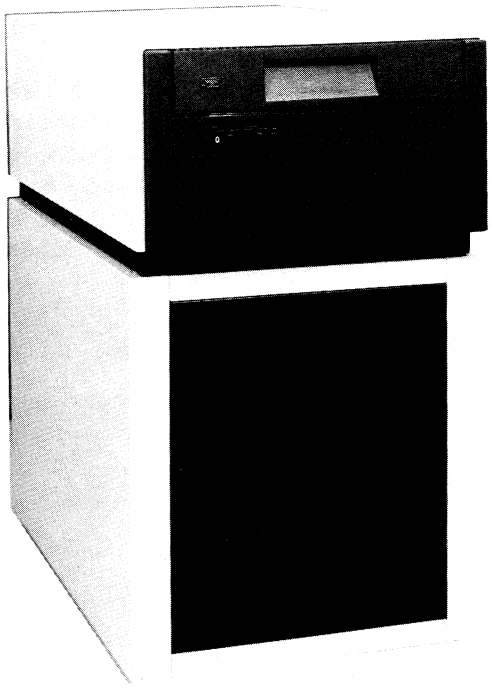

Figure 1-1. Model 2280/2280N Disk Drive

In a standard configuration (see Figure 2-1), one Model 2280 disk drive is connected to the DPU. The DPU is attached to the 2200 Series Central Processing Unit (CPU) via a standard Model 22C03 disk controller. In a dual system configuration (see Figure 2-2), a 2280N disk drive is cabled to the 2280 disk drive, and its output lead is connected to the DPU. Both disk units may thereby be controlled by the same DPU.

The Model 2280/2280N Disk Drives contain up to four disk platters mounted horizontally on a single drive shaft. The platters are mounted one above the other, somewhat as phonograph records are stacked on a record changer (see Figure 1-2). The top disk platter is housed in a cartridge which can be removed from the disk unit and replaced; it is therefore referred to as the removable disk platter. Because it is contained in a sealed, cartridge-like casing to protect it from damage when it is removed from the disk unit, the removable platter is also sometimes referred to as a disk cartridge. The other three disk platters are positioned below the removable platter on the shaft. As an integral part of the disk unit, they cannot be removed, and are therefore called the fixed disk platters. The shaft itself is coupled to a drive motor which spins the disk platters at a constant speed of 3600 rpm.

Information is recorded on, or read from, the surface of a disk platter via the read/write head. The read/write heads are attached to a comb-type access assembly consisting of four access arms (see Figure 1-3). The read/write head is fixed in position and cannot move independently of the access arm.

When a disk statement or command is executed from the system CPU, the access assembly moves the read/write heads in and out over the surface of the disk platters as they rotate. A read/write head can then record (write) information on a surface of a disk platter or retrieve (read) information from a platter as the platter rotates past the head's position.

The fixed platters can contain up to five recording surfaces with one track servo surface; the removable platter contains one surface which is a recording surface and one which is a track servo surface. A servo surface contains prerecorded information that is used by the drive electronics to position the read/write heads to the desired track. (The number of recording surfaces accessible in each Model 2280/2280N disk unit is shown in the following table.)

Recording Surfaces on the Model 2280/2280N

Model	Number of Recording Surfaces
2280-1 or 2280N-1	1 Removable, 1 Fixed
2280-2 or 2280N-2	1 Removable, 3 Fixed
2280-3 or 2280N-3	1 Removable, 5 Fixed

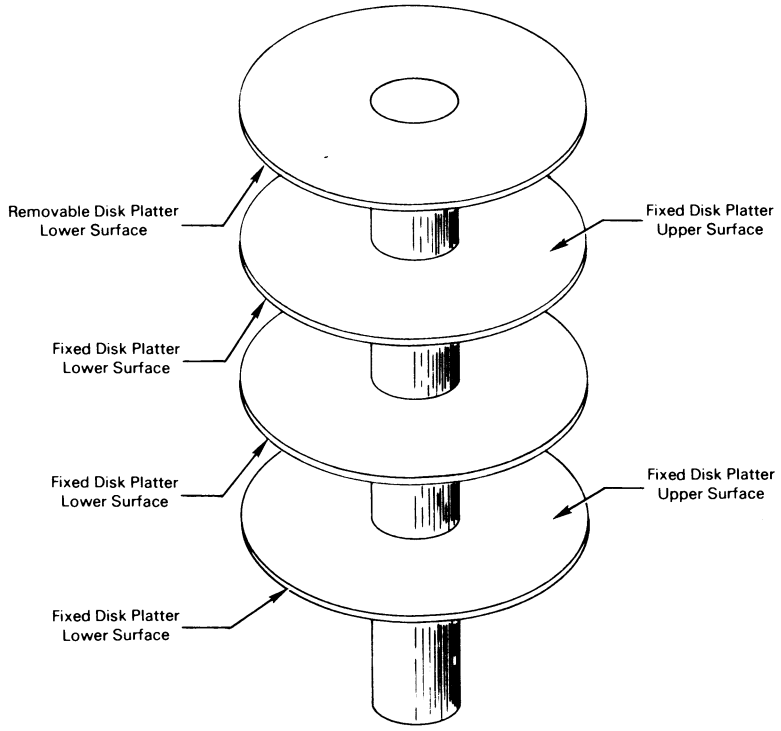

Figure 1-2. Model 2280/2280N Disk Drive Fixed and Removable Platters

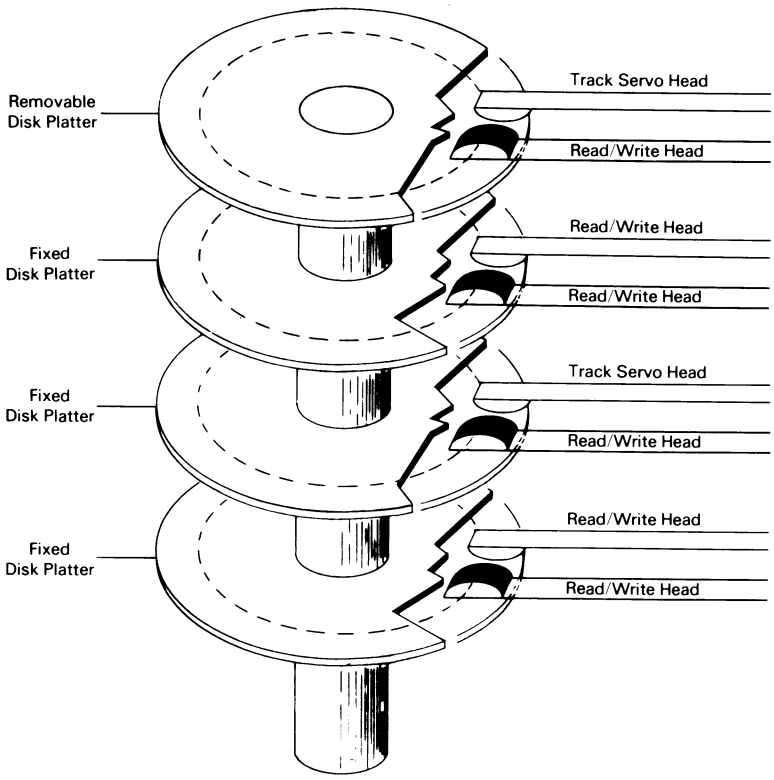

Figure 1-3. Model 2280/2280N Disk Unit Read/Write Heads

1.2 THE DISK PROCESSING UNIT

The Disk Processing Unit, included in the price of all 2280 disk drives, is an intelligent controller/processor enabling two Model 2280/2280N drives to operate quickly and efficiently. When attached to a standard 2200 disk controller, this self-contained unit controls data transfer between the disk platters and the 2200 system CPU. The DPU can thereby handle multi-sector data buffering, and control read/write, format, copy and verify operations. The DPU also performs extensive error checking and correction.

By off-loading responsibility for the above tasks from the CPU to the DPU, overall system performance has been significantly improved. For example, the COPY function without the DPU requires approximately five minutes. With the DPU, this time has been reduced to two minutes. Likewise, the DPU allows a VERIFY operation to be completed in approximately 25 seconds for a 13.4 megabyte disk.

The 2280/2280N disk drive unit can also be given multiplexing capability with the addition of an optional Model 2280MUX. Using a "star" type configuration, up to three VP or MVP CPU's an be individually connected to a 2280 DPU. Each CPU may be separated by a maximum of 1000 feet (304.8 m) from the 2280 DPU, thus allowing for multiple MVP's or VP's to share over 160 megabytes of random access storage.

1.3 RANDOM ACCESS DATA STORAGE

The disk drive provides a high volume of random access program and data storage from which data and programs may be rapidly accessed. Each storage location on the disk has a unique identification tag or address which can be directly accessed by the system. Thus, unlike sequential-access storage devices (such as magnetic tape drives, punched tape, and card readers), the disk does not have to read sequentially through a file in order to locate a desired item of information. Instead, the disk can skip over all intervening records and directly access a specified location for data storage or retrieval. Hence, random-access devices are also referred to as direct-access devices.

Random access capability is very valuable when interrogating or updating a large file, since in many cases, the records are not accessed in sequential order. Even in sequential-processing operations, however, the disk is usually as fast or faster than most other external storage devices.

1.4 THE DISK PLATTER

The storage medium of all disk units is the disk platter. A disk platter is a thin, flat, rigid circular plate. It is coated on one or both sides with a magnetic material, usually iron oxide, and except that it has no apparent grooves, closely resembles a phonograph record. The magnetic iron oxide on each recording surface is arranged in concentric tracks. Information is stored on a track in the form of magnetized spots of iron oxide, much the same way it is stored on magnetic tape (see Figure 1-4). Refer to Appendix B, Disk Platter Maintenance Information, for a complete discussion of handling and storage considerations for disk platters.

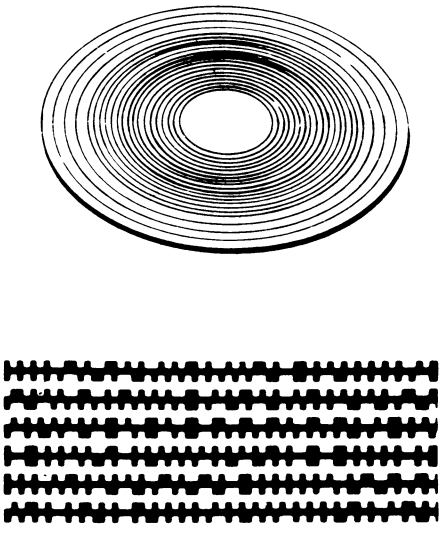

Figure 1-4. Concentric Tracks on a Disk Platter with Enlarged View of Several Tracks Showing How Information Is Stored

1.5 SECTORS ON THE DISK PLATTER

In general, it is desirable to be able to store and retrieve information in units smaller than an entire track. For this reason, each track is divided into a number of discrete segments called sectors. A sector is the smallest discrete unit of storage on the disk and has a fixed storage capacity of 256 bytes. Each sector carries its own sector address, and can be directly accessed by the system. On a Model 2280/2280N disk platter, each track is divided into 64 sectors.

In addition to the 256 bytes in each sector reserved for data storage, the disk processing unit records several bytes of control information, including sector address and an error correcting code (ECC). The sector address is, of course, needed to enable the system to uniquely identify and access each sector. The ECC is used by the system to monitor the integrity of data stored in the sector and to correct certain types of data recording errors. All system control information is created, interpreted and maintained solely by the disk controller and is completely transparent and inaccessible to the user.

1.6 TRACK AND SECTOR NUMBERING ON THE DISK PLATTER

Track numbering is sequential on each recording surface, starting with the outermost track which is designated as track #0, and ending with the innermost track designated as track #822. A total of 823 tracks are numbered independently on each disk surface. Sectors are also numbered independently on each track and on each surface.

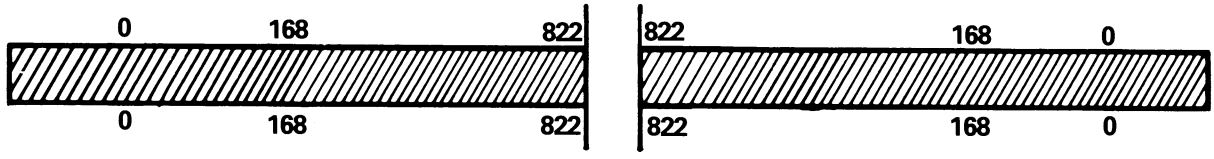

Figure 1-5. Cross-section of a Disk Platter Showing Track Numbering on the Upper and Lower Surface

Track #	Sector #
0	0 - 63
1	64 - 127
2	128 - 191
.	.
.	.
.	.
821	52,544 - 52,607
822	Not user accessible. Used for alternate sectors. (See Section 2.6.)

Figure 1-6. Sector Numbering on a Model 2280-1/2280N-1 Disk Surface

1.7 DISK ACCESS TIME

When the disk platter is formatted, the sectors are numbered sequentially; therefore, when information is read from or written on the disk, the sector arrangement is sequential. Although it is useful for the programmer to understand how sectors are arranged within tracks and how the tracks are identified, the system itself does not recognize tracks as independent entities. All absolute addressing of data stored on the disk is done in terms of sector addresses. When presented with a sector address, the system automatically moves to the track which contains that sector. The use of sector addresses minimizes access time for disk operations.

In order to retrieve a piece of information from the disk, the system must determine on which disk platter the information is stored and in which sector(s) on that platter the information is contained. The access arm must then move the read/write head to the appropriate track and access the appropriate sector.

There are, therefore, two distinct physical operations which must be carried out in order to access any particular sector on a disk platter:

1. The access assembly must move in or out to position the read/write head over the appropriate track on the appropriate platter. This operation is called the track access.

2. The read/write head must wait for the appropriate sector in the track to rotate beneath it as the platter revolves. This wait is known as the disk latency period.

The time required to perform the first of these operations is called the track access time. The time required to perform the second operation is called the disk latency time. The track access time is determined by the number of tracks which must be traversed by the access arm. The average track access time therefore increases somewhat with the size of the disk configuration. The disk latency time, on the other hand, is determined solely by the rotational speed of the disk unit. The time required for each operation must be included in the total time required to access a sector on a disk platter. Appendix A provides timing information on the Model 2280/2280N.

1.8 ADDRESSING THE MODEL 2280/2280N

Each Model 2280/2280N contains one removable platter and a fixed storage area which is divided into 1, 3 or 5 "logical" platters or recording surfaces. For consistency with other 2200 disk units, "logical" platters or surfaces are simply referred to as platters.

In a program, the user refers to each platter on the Model 2280/2280N with a unique device address of the form /Dup, where "D" is the device type, "u" specifies the disk unit and "p" specifies the platter. Alternatively, for compatibility with other 2200 disk units, device types 3 and B can be used to address the 1st fixed platter and the removable platter, respectively.

Each 2280/2280N unit or pair of units is connected to a DPU which is, in turn, connected to a standard 2200 disk controller. The controller can be set to address 10, 20 or 30. The tables below specify the device addresses used for each controller setting.

If disk controller is set to address 10,

Platter	1st Disk Unit	2nd Disk Unit
removable	/D10 (or /B10)	/D50 (or /B50)
1st fixed	/D11 (or /310)	/D51 (or /350)
2nd "	/D12	/D52
3rd "	/D13	/D53
4th "	/D14	/D54
5th "	/D15	/D55

If disk controller is set to address 20,

Platter	1st Disk Unit	2nd Disk Unit
removable	/D20 (or /B20)	/D60 (or /B60)
1st fixed	/D21 (or /320)	/D61 (or /361)
2nd "	/D22	/D62
3rd "	/D23	/D63
4th "	/D24	/D64
5th "	/D25	/D65

If disk controller is set to address 30,

Platter	1st Disk Unit	2nd Disk Unit
removable	/D30 (or /B30)	/D70 (or /B70)
1st fixed	/D31 (or /330)	/D71 (or /370)
2nd "	/D32	/D72
3rd "	/D33	/D73
4th "	/D34	/D74
5th "	/D35	/D75

CHAPTER 2
MOUNTING AND FORMATTING INSTRUCTIONS

2.1 UNPACKING AND INSPECTION

Because the disk unit is a sensitive device, it is packed using special techniques to protect it from damage in shipping. It should be unpacked and inspected only by a qualified Wang Service Representative. Failure to follow this procedure voids the Wang equipment warranty.

2.2 INSTALLATION

The Wang Service Representative will inspect the disk drive for possible shipping damage, connect it into the system, and turn it on to verify proper operation.

The following installation procedure should be observed for the disk unit:

1. Plug the DPU into the disk controller on the 2200 CPU chassis.

2. Plug the 2280 disk drive connector cables into the DPU. After attaching the cables, secure them with lock clips or screws at the DPU connection.

3. A subsequent 2280N disk drive cables to the first drive and to the DPU.

4. Plug the DPU power cord into a grounded (three-hole) wall outlet. Input power requirements for the DPU are 115 VAC, 2 amps, 50/60 Hz $\pm$ 1 cps (or 220 VAC, 2 amps, 50/60 Hz $\pm$ 1 cps, by special request). As the DPU is usually installed within the disk drive cabinet stand, it is recommended that the DPU power cord be plugged into a switch-controlled outlet to facilitate powering on and off.

5. Plug the disk drive power cord into a grounded (three-hole) wall outlet. Input power requirements for the disk are 115 VAC, 9 amps, 50/60 Hz $\pm$ 1 cps (or 220 VAC, 5 amps, 50/60 Hz $\pm$ 1 cps, by special request).

6. Plug the system power cord and the electrical power cords of all other peripherals into grounded wall sockets.

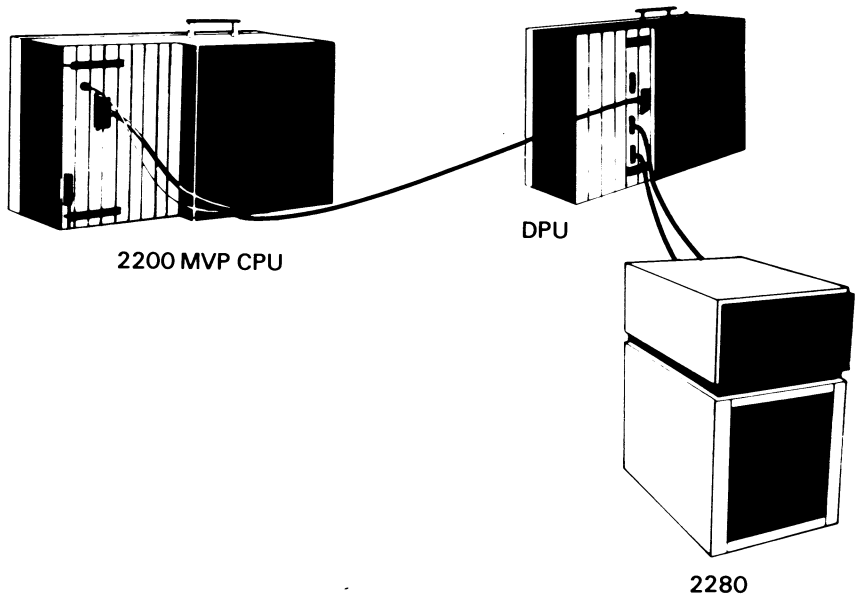

Figure 2-1. Model 2280 System Configuration

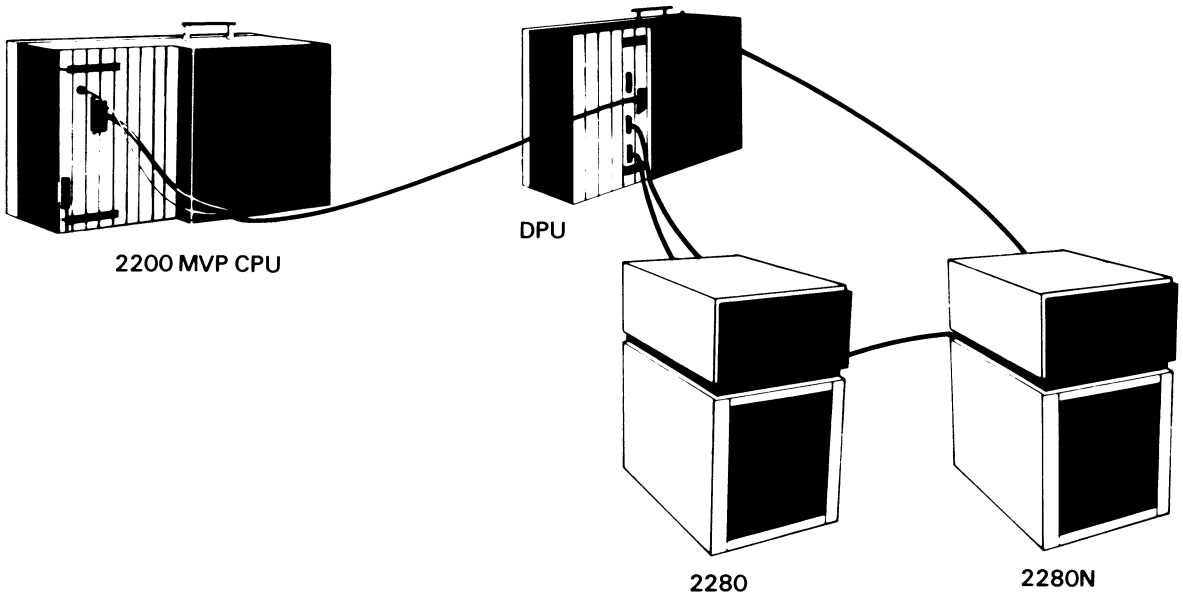

Figure 2-2. Model 2280/2280N Dual System Configuration

Note: If a Model 2280 disk drive is already installed in the system, it can be field-upgraded to a dual drive system by the purchase and installation of a 2280N drive.

2.3 MODEL 2280/2280N OPERATING PROCEDURES

Power On Procedure

1. Switch on the DPU power.

2. Be sure that the disk START/STOP switch is in the STOP position. (Never power ON or OFF in the START mode.) Note: Each drive in the dual drive configuration has its own START/STOP switch.

3. Switch ON power for all peripherals, including the disk. On a dual drive, both the master drive and the slave drive have a power switch.

4. Switch ON the main power switch of the CPU. This Master Initializes the system.

5. Turn the START/STOP switch to the START position. The READY indicator begins blinking while the disk is accelerating, and remains constantly illuminated when the unit is up to speed and the heads are loaded (after about 60 seconds).

6. The disk is now ready to be used or formatted.

> NOTE
>
> The disk unit(s) should always be switched off before powering down the DPU.

Controls and Indicators

The power switch is located on the rear of the Model 2280/2280N. Switches and indicators on the control panel are described as follows:

Control or Indicator	Function
START/STOP Switch	A dual-action switch which energizes the spindle motor of the disk drive and puts the disk in operating mode provided the following conditions are met: 1. The disk drive power switch is ON. 2. The disk cartridge loading door is closed and latched. 3. The FAULT indicator light is OFF.

START Indicator	When the START/STOP switch is in the START position, the START indicator illuminates, and extinguishes when the switch is in the STOP position.
READY Indicator	The READY indicator illuminates continuously whenever the unit is up to speed, heads are loaded, and the FAULT indicator light is OFF (indicating there are no faults within the unit that require manual intervention). The READY light blinks throughout the spindle start and stop procedure.
FAULT Indicator	This indicator illuminates when a disk hardware error (fault) exists.
WRITE PROTECT CART Switch	This switch, when depressed, disables writing to the removable disk platter, protecting the platter from accidental over-writing.
WRITE PROTECT FIXED Switch	This switch, when depressed, disables writing to the fixed disk platters.

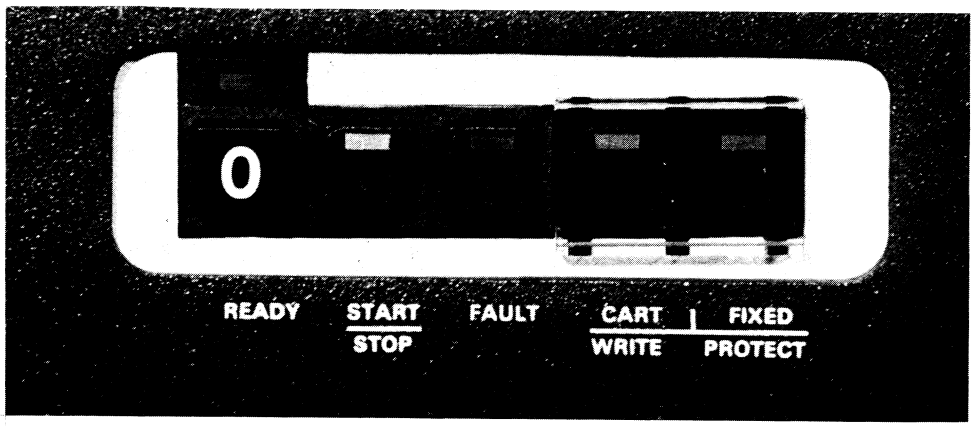

Figure 2-3. The Model 2280/2280N Control Panel

2.4 LOADING AND UNLOADING THE REMOVABLE DISK PLATTER

The Model 2280/2280N disk storage area contains a removable disk platter and a fixed disk portion. The fixed disk portion is installed at the factory and cannot be removed from the disk unit. The removable disk platter, as its name indicates, can be taken out and replaced by the operator. The following instructions explain how to change the removable disk platter (disk cartridge).

Disk Cartridge Removal

Step 1. When the READY indicator is illuminated, depress the START/STOP switch and wait about 30 seconds for the indicator to extinguish (the spindle motor has shut off). (While the READY indicator is illuminated, the disk cartridge cannot be removed.)

Step 2. After the READY indicator ceases blinking and extinguishes, open the disk cartridge access door by pulling back the door handle, and pressing in on the door release lever inside the handle.

Figure 2-4. Opening the Access Door

Figure 2-5. Removing the Disk Cartridge

Step 3. With a slight upward pressure on the cartridge handle, pull the cartridge out of the receiver.

Step 4. Turn the dust cover over and set the disk cartridge into it. (The arrow on the cartridge must be aligned with the arrow on the dust cover). Press the cartridge near the handle to lock the dust cover onto the disk cartridge. Both cover and cartridge can be carried as a unit by lifting the handle again without touching the cover release button.

Step 5. Whenever a disk cartridge is removed from the disk unit, a replacement cartridge should immediately be loaded in its place. See Figure 2-8.

Step 6. Close the access door.

> NOTE
>
> The disk cartridge must be in the same environment as the 2280/2280N Disk Drive two hours prior to its installation in the drive.

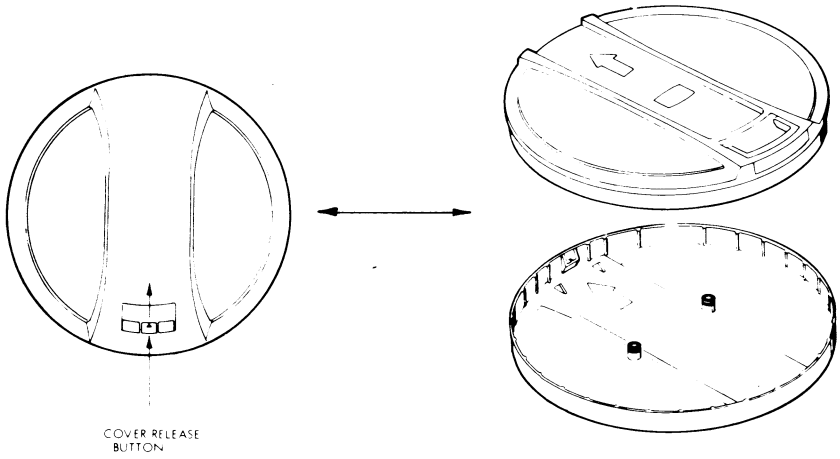

Figure 2-6. Locking the Cartridge onto the Dust Cover

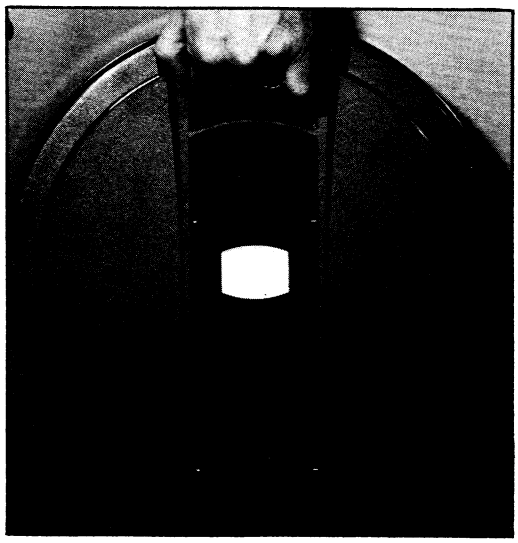

Figure 2-7. Carrying a Sealed Cartridge.

Loading a New Disk Cartridge

Step 1. Make certain that the disk power is ON, and the START/STOP switch is set to STOP (START indicator extinguished). A disk cartridge cannot be loaded while the disk is in the START mode.

Step 2. Disengage the dust cover from the disk cartridge by simply pushing the cover release button toward the center of the cover. Set the cover aside, storing it with its hollow side down to prevent dust collection.

Step 3. Slide the disk cartridge into the receiver track with a slight upward pressure on the cartridge handle; be sure that the head opening is toward the rear of the unit.

> CAUTION
>
> Do not apply downward pressure on the cartridge while loading (refer to Figure 2-9). The cartridge will not seat properly and damage may result to the disk.

Step 4. Push the cartridge rearward until it stops.

Step 5. Close the cartridge access door. The cartridge slides into place on the spindle automatically as the access door is closed.

Step 6. Set the START/STOP switch to the START position to apply power to the spindle motor.

> NOTE
>
> If the spindle motor does not rotate, the disk cartridge access door may not be completely closed, the cartridge may not be properly seated on the spindle chuck, or the cartridge receiver/base may not be all the way down the lower chassis.

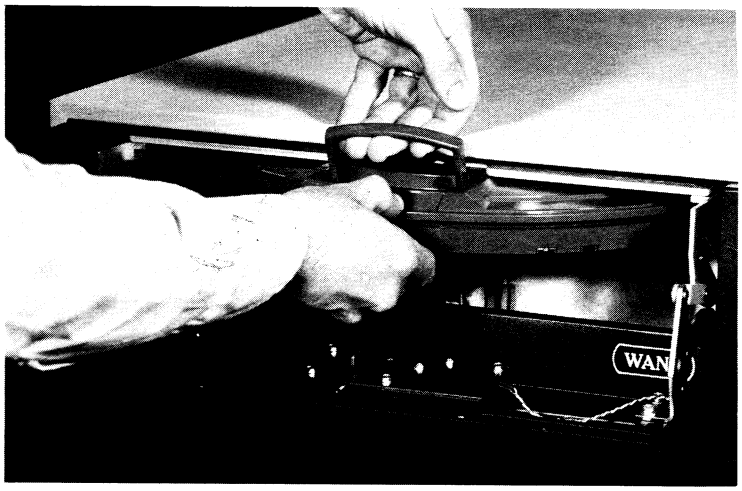

Figure 2-8. Loading the Disk Cartridge

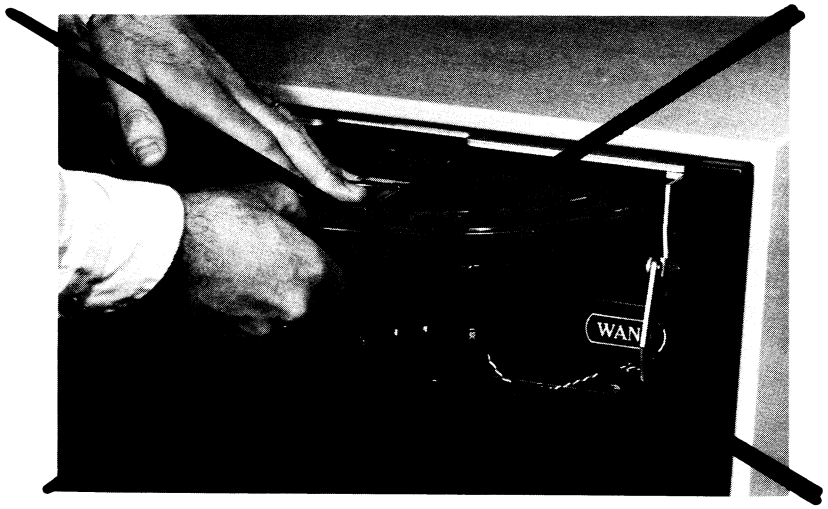

Figure 2-9. The Wrong Way to Load the Disk Cartridge

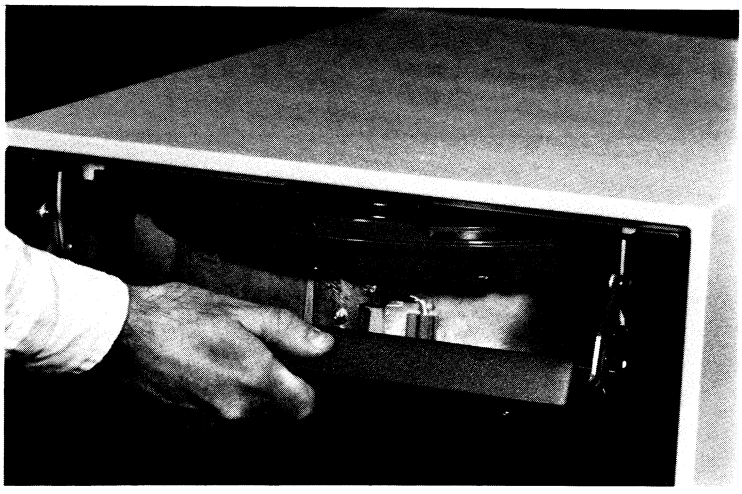

Figure 2-10. Closing the Access Door

2.5 HANDLING AND STORAGE OF THE REMOVABLE DISK PLATTER (DISK CARTRIDGE)

Refer to Appendix B, Disk Platter Maintenance Information, for a complete discussion of the handling and storage of disk platters.

2.6 MODEL 2280/2280N FORMATTING INSTRUCTIONS

Before either the removable disk platter or any of the fixed platters can initially be accessed and used, it must be formatted by the disk processing unit. Formatting involves assigning a unique address to each sector on the disk platter, along with certain control information which helps the system maintain the disk and check the validity of information written to and from it. Zeros are then written into the remaining area of each sector. Formatting also certifies the platter and assigns alternate sectors to those sectors that do not meet certification specifications.

Formatting is a software function on the Model 2280/2280N. To format a platter on the Model 2280/2280N, the user need only instruct the disk controller to begin formatting by issuing a $FORMAT DISK statement. The formatting processes are then performed automatically by the disk processing unit. When all sectors on the platter are formatted, the platter is ready for storage of programs and data.

With each Model 2280/2280N disk drive, Wang provides a utility program which can be used to format the disk platters. This utility requests the operator to identify the platter which is to be formatted, and then it automatically initiates the format operations. In general, users will find it convenient to use the Wang-supplied utility for platter formatting. The disk format utility is available on the both 2200VP and the 2200MVP System platter.

In order, however, to permit a programmer to develop a customized formatting routine, the $FORMAT DISK statement used to perform the formatting operation is described as follows:

> NOTE
>
> Before beginning the format procedure, press RESET on the keyboard to initialize the drive and controller. READY is displayed on the CRT. Check also that the READY indicator on the disk unit is illuminated. The disk must be in START mode prior to initiating the formatting procedure. The removable and each of the fixed platters in a disk unit must be formatted individually.

$ FORMAT DISK

General Form:

$ FORMAT DISK platter [file # / disk-address]

Purpose:

The $FORMAT DISK statement issues a command to the disk processing unit to format the specified disk platter. This statement can only be used with Wang disk units that support formatting under software control (e.g., Models 2260C, 2260BC, and 2280/2280N). Formatting on certain 2200 disks (e.g., Model 2270A) is initiated by pressing the format button located on the disk unit.

CAUTION

Formatting a disk platter overwrites all data previously stored on the platter. To prevent the accidental formatting of the wrong disk platter, it is recommended that the Wang supplied format utility be used.

The $FORMAT DISK statement is available in 2200VP BASIC-2 Release 1.9, 2200MVP BASIC-2 Release 1.7, and subsequent releases.

Examples of valid syntax:

```
10 $FORMAT DISK T/310
20 $FORMAT DISK T/D11
30 $FORMAT DISK R#2
```

2.7 ERROR CORRECTING CODE (ECC)

As was mentioned in Section 1.5, the Error Correction Code is written on a sector along with data for data integrity purposes. This means that if a sector develops a "bad spot" or hole, the data (up to 12 bits) in that hole will be reconstructed by the ECC on a read operation. This takes approximately 12 seconds. If the hole is larger than 12 bits an error (I96) will occur. Error correction is not done on a VERIFY operation. Thus, an occasional VERIFY will indicate the integrity of a platter and a possible indication of reformatting the platter. (A FORMAT operation assigns an alternate sector for a sector that has a hole.)

APPENDIX A
MODEL 2280/2280N SPECIFICATIONS

USER STORAGE CAPACITY

DISK MODEL	SECTORS PER SURFACE	TOTAL SECTORS	BYTES PER SURFACE	TOTAL BYTES
2280-1/2280N-1	52,608	105,216	13,467,648	26,935,296
2280-2/2280N-2	52,608	210,432	13,467,648	53,870,592
2280-3/2280N-3	52,608	315,648	13,467,648	80,805,888

LEGAL SECTOR ADDRESSES

DISK MODEL	SECTORS PER SURFACE	LOWEST LEGAL ADDRESS	HIGHEST LEGAL ADDRESS
All configurations	52,608	000	52,607

PERFORMANCE

Rotation Speed
All configurations . . . . . 3600 rpm

Seek Time (position head to track)
Track to Track . . . . . 6.00 ms
Average . . . . . 30.00 ms
Maximum . . . . . 55.00 ms

Latency Time (platter rotation to sector on track)
Average (one-half revolution @ 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 (entire disk platter)
Approximately 2 minutes per logical platter (13.4 megabytes)

GENERAL SPECIFICATIONS FOR 2280N DRIVE

Size (with 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 (78.75 kg)

Power Requirements

115 VAC ± 10%, 60 Hz + 1 cps
230 VAC ± 10%, 50 Hz + 1 cps
250 watts (standing)
1900 watts (start-up)
950 watts (running)

Cabling

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

Operating Environment

Temperature

60 to 80 F (15 to 26 C)

Relative Humidity

40% to 60%, noncondensing

Heat Output

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

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 (18.0 kg)

Power Requirements (independent of disk drive)

115 VAC ± 10%, 60 Hz ± 1 cps
230 VAC ± 10%, 50 Hz ± 1 cps
150 watts

Fuses

3.0 A (SB) @ 115V
1.5 A (SB) @ 230V

Heat Output

Minimal

APPENDIX B
DISK PLATTER MAINTENANCE INFORMATION

In order to maintain the high quality of the Model 2280/2280N disk platters, it is important that proper care be observed in their handling and storage. This Appendix lists several recommended procedures for the operation, handling, and storage of the disk cartridge, proper attention to which will ensure its continued dependable and efficient performance.

1. General Handling Precautions

The following general precautions apply:

a) Place cover on each cartridge not installed in the disk drive to prevent unnecessary dust buildup and protect the recording surface.

b) Clean the covers and cartridge cases periodically with a clean, lint-free cloth to remove any buildup of dust.

c) Replace cracked, worn, distorted, or otherwise damaged covers so that they will provide maximum protection to the platter.

d) Keep food, beverages, tobacco, and smoking accessories off the disk unit, and away from the disk platters to prevent unnecessary contamination.

e) Clean the equipment room daily using a vacuum cleaner or damp mop. Avoid raising dust with cleaning implements such as brooms or feather dusters. Do not use steel wool pads to clean the area proximate to the disk drive.

f) Do not expose the disk cartridge to intense magnetic fields such as those generated by high-current bus bars, cables, and welding transformers. A field intensity of more than 50 gauss may cause loss of information.

g) Do not store the cartridge in direct sunlight, and avoid temperature or humidity extremes as this may deteriorate the recording surface.

h) If you drop a disk cartridge, have it inspected by a Wang Service Representative before attempting to use it on a disk drive.

i) Do not touch or attempt to clean the recording surface. It is very sensitive; any abrasion may cause a loss of data stored on it.

j) Keep an accurate service record on the disk drive. The equipment should be serviced according to the recommended service schedule.

2. Carrying

The disk platters can be carried flat or sideways. To carry the cartridge flat, simply grasp the cartridge handle. To carry a cartridge sideways, place your fingers in the recessed handle compartment, with your thumb gripping the beveled edge on the bottom cover.

3. Labeling

Disk platters should be marked for identification with a felt tip pen on an adhesive label. Wang recommends that the top surface of the disk cartridge be used as the labeling surface. You may want to duplicate the label on the outside of the bottom cover to facilitate identification. However, you should refer to the label on the top surface of the cartridge for positive identification of information contained on the cartridge.

Use the following labeling precautions:

a) Use only good quality adhesive labels. Inferior labels may work loose while the cartridge is loaded, and cause severe damage to the read/write heads or the disk surface, or leave a sticky residue which traps dust and dirt.

b) Mark the label with a pen before putting it on the platter. Do not use pencil.

c) Remove old labels completely. To alter a label, replace it; never use an eraser.

4. Operating Environment

Disk platters that are in frequent use should be stored in the equipment room or in a similar environment. Platters that have not been stored in the machine room should be conditioned to machine room temperature for two hours prior to use. The conditioning time is necessary to ensure accurate track registration, data recording, and data retrieval.

The recommended operating environment is defined by the following parameters:

Temperature: 60 to 80 F (15 to 26 C)
Relative Humidity: 40% to 60%, noncondensing

5. Storage

A disk cartridge, locked in its bottom cover, form adequate short term storage containers. Unless platters are to be stored for a long period of time, no further protection is required. Cartridges may be stacked on top of each other (no more than five high) or stored on their sides. Clean, dust-free cabinets made of metal or other fire resistant material are recommended for long-term storage of disk platters.

If disk platters are to be stored for a long period, they should be repacked in their original shipping containers before storing. This protects the covers from excessive dust and/or dirt accumulation.

6. High Security Storage

Store platters containing vitally important data or duplicate master records in a cabinet or storeroom that provides protection against catastrophic damage. The cabinet or storeroom should be insulated to prevent the internal temperature from rising above 150 F (66 C) in case of fire.

7. Storage Environment

a) For short term requirements, the platter can be stored in the equipment room or similar environment.

b) Long term storage:

Temperature:	-40 to 150 F	(-40 to 66 C)
Relative Humidity:	8% to 80%	

If stored under other than real operating conditions, condition the cartridge to the machine room environment for two hours prior to use.

8. Shipping and Receiving

Disk cartridges are protected in transit by packaging assemblies designed to withstand normal shipping abuse. Upon receiving a cartridge, examine the shipping container for possible shipping damage. If you find any, have a Wang Service Representative inspect the platter prior to using it in a disk drive. This will eliminate the possibility of damaging the drive or the cartridge further.

APPENDIX C
EQUIPMENT GUARANTEE AND PREVENTIVE MAINTENANCE INFORMATION

GUARANTEE

The equipment is guaranteed from defects in materials and workmanship for a period of ninety days (one year for State and Federal Governments).

MAINTENANCE

It is recommended that equipment be serviced semi-annually. Wang Laboratories offers a Maintenance Agreement which automatically ensures proper servicing. If no Maintenance Agreement is purchased, all servicing must be requested by the customer. A Maintenance Agreement protects your investment and offers the following benefits:

Preventive Maintenance:

Semi-annually, the equipment is inspected for worn parts, lubricated, cleaned, and updated with engineering changes, if any. Preventive maintenance minimizes "downtime" repairs before they are necessary.

Fixed Annual Cost:

When you buy a Maintenance Agreement, you issue only one purchase order for service for an entire year and receive one annual billing, or more frequent billing, if desired.

Further information regarding a Maintenance Agreement can be obtained from your local Wang Sales/Service Office.

NOTE

Wang Laboratories, Inc. neither honors maintenance agreements for, nor guarantees, any equipment modified by the user. Damage to equipment incurred as a result of such modification becomes the financial responsibility of the user.

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To help us to provide you with the best manuals possible, please make your comments and suggestions concerning this publication on the form below. Then detach, fold, tape closed and mail to us. All comments and suggestions become the property of Wang Laboratories, Inc. For a reply, be sure to include your name and address. Your cooperation is appreciated.

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